Scottish Forestry
Coilltearachd na h-Alba

A Routemap to Resilience for Scotland's Forests and Woodlands

Scottish Forestry is the Scottish Government agency responsible for forestry policy, support and regulation
S e Coilltearachd na h-Alba a' bhuidheann-ghnìomha aig Riaghaltas na h-Alba a tha an urra ri poileasaidh, taic agus riaghladh do choilltearachd

Scottish Government
Riaghaltas na h-Alba

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Ministerial foreword

As Scottish Government's Cabinet Secretary for Rural Affairs, Land Reform and Islands, I am acutely aware of the importance of the way we manage our land in addressing the challenges of climate change. Our vision for forestry by 2070, as set out in the Scottish Forestry Strategy is to not only create more woodlands but to ensure that,

…'our woodlands will be a more resilient adaptable resource, with greater natural capital value, that supports a strong economy, a thriving environment, and healthy and flourishing communities'.

For our woodlands and forests to fulfil their potential we need to ensure that they will survive and thrive.

Scotland, like the rest of the world, is already experiencing the impacts of climate change including greater volatility and extreme weather events. We've already seen more severe flooding due to intense rainfall and periods of droughts causing instances of water scarcity. The Climate Change Committee are clear, we must prepare now for 2 degrees centigrade of global warming and assess the risks for 4. With this in mind, early planning and preparation is always better than late response and recovery.

For forestry, this means that our trees are more vulnerable to pests and diseases, storm damage and wildfires for example - all of which are expected to increase in numbers and severity as the climate continues to change.

Yet our forests and woodlands are one of the most precious tools we have to help our society adapt to our changing climate and to reverse biodiversity loss. Our forests and woodlands provide natural means to sequester carbon, provide sustainable building products, reduce the extremes of temperature and flooding as well as providing places for us to live and work and experience the beauty of nature, boosting our health and wellbeing.

We must act if we want to continue to enjoy and benefit from our woodlands and forests. This Routemap sets the direction for us to achieve the Forestry Strategy vision and ensure that our woodlands and forests are fit for the future. It also shows early action to deliver the ambitions set out in our Scotland National Adaptation Plan (2024-2029).

I am pleased to say that this Routemap was developed with a noteworthy amount of sector input and cross-sector collaboration through the Adaptation and Resilience Steering Group, National Forestry Stakeholder Group and beyond – I very much want to thank those involved, and welcome the joint working and wide commitment to this strategic approach.

To ensure the success of this Routemap we need to continue this co-operative approach and ensure that its delivery remains a real shared endeavour, with shared learning and commitment to change. I look forward to working collaboratively across the whole sector to achieve the joint ambition in this plan.

Ro-ràdh Ministearail

Mar Rùnaire Caibineit Riaghaltas na h-Alba airson Cùisean Dùthchail, Ath-leasachadh Fearainn agus nan Eilean, tha mi gu math mothachail air cho cudromach sa tha an dòigh sa bheil sinn a' riaghladh ar fearann ann a bhith a' dèiligeadh ri dùbhlain atharrachadh na gnàth-shìde. 'S e an lèirsinn againn airson coilltearachd ro 2070, mar a chaidh mìneachadh ann an Ro-innleachd Coilltearachd na h-Alba, gum bithear a' cruthachadh fearann coillteach a bharrachd ach cuideachd gus dèanamh cinnteach

gum bi... 'na coilltean againn na ghoireas a ghabhas atharrachadh nas seasmhaiche, le barrachd luach calpa nàdarra, a bheir taic do eaconamaidh làidir, àrainneachd fàsmhor agus coimhearsnachdan fallain agus soirbheachail'. Airson ar fearann coillteach agus ar mòr-choilltean a bhith a' coileanadh an comais, feumaidh sinn dèanamh cinnteach gum mair iad beò agus gun soirbhich leotha.

Tha Alba, mar a' chòrr den t-saoghal, a' faighinn eòlas mu thràth air buaidhean atharrachadh na gnàth-shìde, a' gabhail a-steach caochlaideachd a bharrachd agus tachartasan shìde mòra. Chunnaic sinn tuiltean nas miosa mu thràth air sgàth 's uisge trom agus amannan tiormachd ag adhbharachadh gainnead uisge. Tha Comataidh Atharrachadh A' Ghnàth-shìde soilleir, feumaidh sinn ullachadh an-dràsta airson 2 puing ceud-ìre blàthachadh na cruinne, agus na cunnartan airson 4 a mheasadh. Le seo nar cuimhne, tha planadh agus ullachadh ro làimh an-còmhnaidh nas fhèarr na freagairt agus ath-bhuannachd anmoch.

Airson coilltearachd, tha seo a' ciallachadh gu bheil na craobhan againn nas so-leònte ro plàighean agus galairean, milleadh stoirmean agus teintean fiadhaich, mar eisimpleir - agus thathar an dùil gun àrdaich iad sin ann an àireamh agus buaidh, agus a' ghnàth-shìde fhathast ag atharrachadh.

Ach tha na mòr-choilltean agus fearann coillteach againn mar aon de na h-innealan as luachmhoire a th' againn gus ar comann-sòisealta a chuideachadh gus atharrachadh gu ar gnàth-shìde caochlaideach agus gus call bith-iomadachd a thionndadh air ais. Tha na mòr-choilltean agus fearann coillteach againn a' toirt seachad dòighean nàdarra airson gualain a ghlacadh, stuthan togail seasmhach a sholarachadh, teòthachd agus tuiltean a lughdachadh cho math ri bhith a' toirt àiteachan dhuinn airson a bhith a' fuireach agus ag obair agus a' faighinn eòlas air bòidhchead nàdair, a' neartachadh ar slàinte agus ar sunnd.

Feumaidh sinn obair ma tha sinn airson cumail oirnn tlachd is buannachd fhaighinn às an fhearann choillteach agus na mòr-choilltean againn. Tha am Mapa-slighe seo a' stèidheachadh an t-slighe dhuinn gus lèirsinn Ro-innleachd na Coilltearachd a choileanadh agus gus dèanamh cinnteach gu bheil am fearann coillteach agus na mòr-choilltean againn iomchaidh airson an ama ri teachd. Tha e cuideachd a' sealltainn gnìomh tràth gus na rùintean a tha air am mìneachadh nar Plana Freagarrachaidh Nàiseanta na h-Alba (2024-2029) a lìbhrigeadh.

Tha mi toilichte a ràdh gun deach am Mapa-slighe seo a leasachadh le mòran taic bhon roinn agus co-obrachadh thar-roinneil tron Bhuidheann Stiùiridh Atharrachadh agus Seasmhachd, Buidheann Luchd-ùidh Coilltearachd Nàiseanta agus nas fhaide air falbh – tha mi gu mòr airson taing a thoirt dhaibhsan a bha an sàs ann, agus tha mi a' cur fàilte air a' cho-obrachadh agus an dealas farsaing don dòigh ro-innleachdail seo.

Gus dèanamh cinnteach gum bi am Mapa-slighe seo soirbheachail, feumaidh sinn leantainn air adhart leis a' mhodh cho-obrachail seo agus dèanamh cinnteach gu bheil a lìbhrigeadh fhathast na fhìor oidhirp cho-roinnte, le ionnsachadh co-roinnte agus dealas airson atharrachadh. Tha mi a' coimhead air adhart ri bhith ag obair còmhla air feadh na roinne gus an co-mhiann sa phlana seo a choileanadh.

Mairi Gougeon MSP
Cabinet Secretary for Rural Affairs, Land Reform and Islands

Executive Summary

Building the resilience of our Forests and Woodlands is at the heart of the Scottish Forestry Strategy underpinning delivery of Sustainable Forest Management and improving the economy, environment, and wellbeing of people living in Scotland, now and in the future. Climate change means that Scotland will be wetter in winters, drier in summers, sea level rise will continue, and our weather will become more variable and unpredictable. Extremes will be more common. The impact of climate change is already being felt now both around the world and here at home.

This Routemap sets out how we can achieve more resilient forests and woodlands in Scotland and defines Scotland's priorities for action over the next ten years to deliver the three outcomes of effective planning, species choice and silviculture, and knowledge exchange. It does so by committing to 25 priority strategic and practical actions including:

- Ensuring we have a strong strategic scenario approach to risk planning down to local level, with horizon scanning, systems, tools and guidance in place to implement pre-emptive and adaptive resilience building measures.
- Enabling the underpinning role of ecosystem health, function and biodiversity at a woodland type and landscape scale, in current and future woodlands, using new technologies such as eDNA and app-based approaches.
- Development of a shortlist of future productive species following an evidence-based criteria approach including criteria such as climate suitability and risk susceptibility. Also to apply similar approach to a framework for native species and provenance choice selection.
- Ensuring seed availability and tree improvement programmes for resistance, ecosystem health, increasing productivity and carbon sequestration.
- Enabling further understanding of the economics of additional productive species, enabling processing capability and a diversity of high value products for future markets.
- Developing 'smart silviculture' for managing our future forests including harnessing the power of remote sensing, artificial intelligence and machine learning.
- Developing a range of silvicultural incentives, tools and approaches to adaptively manage a greater range of species and management types.
- Enabling effective knowledge exchange hubs, forums, demonstration sites, seminars and peer learning.

This Plan focuses on actions agreed across the forest sector, with the collaborative and inclusive development of this plan supporting a just transition and for collaborative delivery. The actions complement each other, combine to deliver the three outcomes, and also recognise the interconnected and cascading potential of climate risks, thereby aiming to ensure our approach is just as agile and adaptable.

Acknowledgments: This document was produced by Scottish Forestry led by Helen Sellars collaboratively with stakeholders and alongside a Steering Group with cross-sector representation including CONFOR representatives, Environment LINK members, Industry groups, Forest Research, NatureScot, Forestry and Land Scotland, and independent forest management experts.

Introduction

We are in a changing world. We cannot continue to do things in the same way. We know our woodlands and forests are vital to the health and wellbeing of this nation, our rural prosperity, our economy, and our environment. We also know they are under ever increasing threat from climate change. We need them to survive and prosper. Doing nothing is not an option.

In this strategic action plan we set out a routemap for building the resilience of our forests and woodlands in Scotland, working cross-sector to secure their future.

Context

The declaration of a global climate emergency by Scottish Ministers in 2019, and the government's commitment to net zero by 2045 has brought climate change to the centre of government policy.

These commitments, together with increasing examples of increased temperature, droughts and pests and diseases, as well as wildfire and storms, have heightened the need for action to improve the resilience of Scotland's woods and forests, along with the need to contribute to lowering the amount of carbon dioxide in the atmosphere.

The magnitudes of risk are already large and rapidly increasing. At the global scale, in the UN 2022 'Global Assessment Report on Disaster Risk Reduction' they warn of a scenario of 'global collapse' unless outcomes on mitigation and adaptation can be achieved. The UN urges nations to develop and implement mitigation strategies that minimise the speed and eventual level of climate change (by reducing or preventing emissions), and establish resilience strategies that allow us to cope with the climate change that does take place. **The Climate Change Committee's current advice on that is to plan for a global temperature rise of 2°C and assess the risks up to 4°C.**

Biodiversity loss is seen as part of a 'twin crisis' with climate change and provides a key underpinning role in resilience.

Biodiversity loss and ecosystem collapse is one of the top five risks in the World Economic Forum's 2020 Global Risks Report. In terms of biodiversity globally, there has been an 83% population decline across freshwater species, a 60% population decline across vertebrate species and a 41% decline of known insect species. Over 85% of wetlands (area) has been lost, 50% of the world's coral reef system, and 32% of the world's forest area has been destroyed.

Scotland's policy framework

Scotland has a mature statutory policy framework for building resilience to the impacts of climate change, which sits alongside the forestry strategy, commitments on mitigation and reaching net zero by 2045, and the biodiversity framework. These are briefly outlined below:

The Climate Change (Scotland) Act 2009 requires the preparation of strategic programmes for adaptation in response to each 5-yearly round of UK-wide Climate Change Risk Assessment (CCRA) – the evidence for which is prepared by the independent UK Climate Change Committee (CCC).

The Act also requires annual reporting and for the CCC to set out independent assessments of the progress made.

- The current UK Climate Change Risk Assessment 3 (CCRA) was published in June 2021. UK CCRA4 is due in 2026.
- Scotland's National Adaptation Plan 3 (2024 – 2029) (SNAP3) (published September 2024) is the Scottish Government's response to UK CCRA3. The plan sets out the actions that the Scottish Government will take to prepare for and build Scotland's resilience to the impacts of climate change between 2024 and 2029.
- Preparation and delivery of this routemap is a commitment in SNAP3.

Scotland's Climate Change Plan sets out the policies and proposals required in order to drive delivery in Scotland's journey to net zero. The next Climate Change Plan is due in 2025.

The Scottish Government has set out an ambitious new framework to halt biodiversity loss by 2030 and reverse it with large-scale restoration by 2045. The framework includes the Scottish Biodiversity Strategy accompanied by the first five year delivery plan and the development of the Natural Environment Bill, to establish statutory targets for nature restoration.

Scotland's Forestry Strategy (SFS) identifies climate change resilience as a key strategic driver underpinning the three pillars of sustainable forest management and sets out a vision where by 2070: 'Scotland's forests and woodlands will be a more resilient adaptable resource, with greater natural capital value, that supports a strong economy, a thriving environment, and healthy and flourishing communities.'

What is resilience: definitions

This Plan defines resilience as a framework composed of four elements as explained below and shown in **Figure 1.**

- **Resistance** – risk reducing measures. The ability of the treescape to reduce the threat or absorb the impact of a risk with no substantial change or loss.
- **Adaptation** – active change to the treescape informed by the expected impacts of climate change. Adaptation relates to driving change by increasing the extent, connectivity, diversity, composition of our woodlands and forests in order to reduce the impact of future threats.
- **Response** – taking action. When threats do occur, facilitating an effective and timely response to minimise the impacts.
- **Recovery** – moving to a previous or new stable state. Measures that enable the treescape to recover from threats and maintain economic, social and environmental benefits.

These four elements will inevitably overlap to an extent, for example during recovery to a new stable state, adaptation measures will be needed.

There is a balance needed when choosing resilience measures. For example, if more adaptive or resistance measures are used then there may be less need for response and recovery and vice versa. This will also vary nationally, with no standard requirement for each woodland or forest to employ the same measures.

The actions in this Plan are designed to cover all of these four elements.

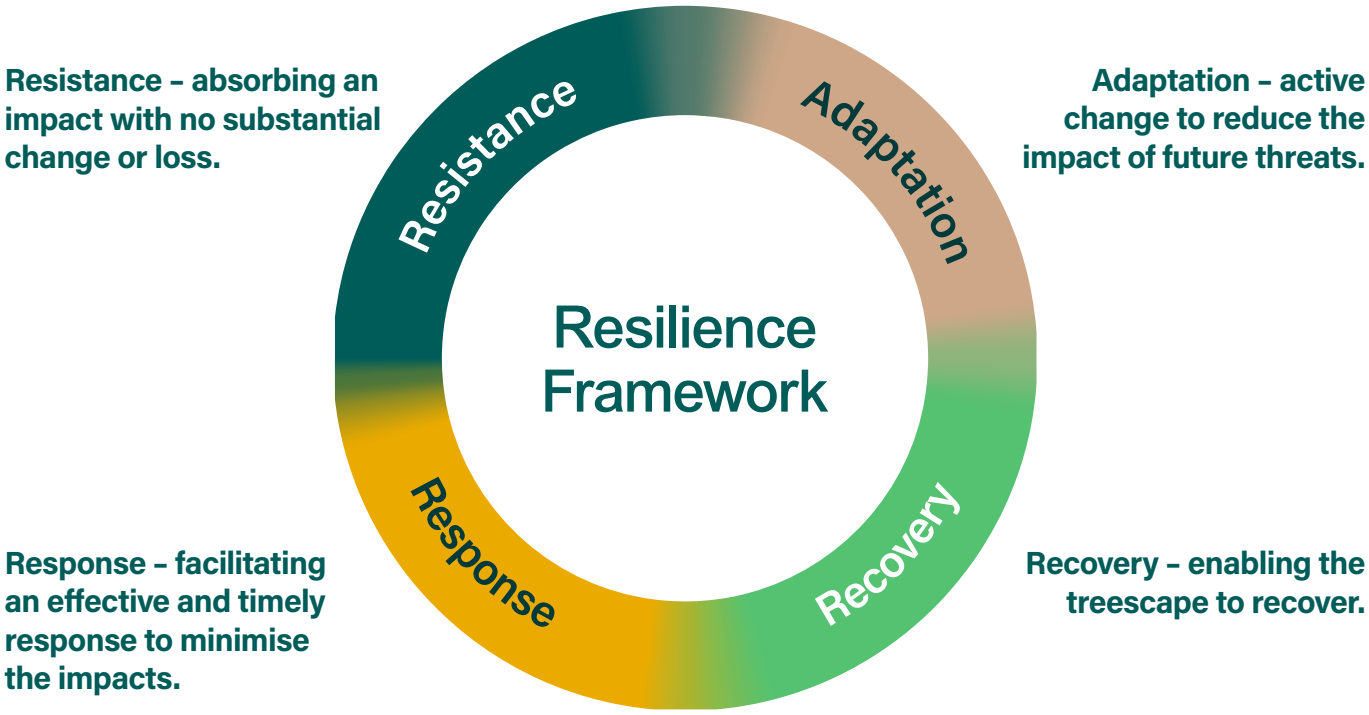


Figure 1: Resilience Framework elements

Why do we need to build the resilience of our woodlands and forests: impacts

Sustainable Forest Management (SFM) aims to use forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity and vitality, as well as their potential to fulfil, now and in the future, relevant ecological, economic and social functions at local, national and global levels, and that does not cause damage to other ecosystems. Scottish Forestry articulate how to achieve SFM through the UK Forestry Standard.

Scotland's woodland and forests as a nature-based solution provide a huge range of benefits and ecosystem services, which would be at risk if they were not resilient to a future climate. For example:

Mitigating climate change

Forests are natural carbon stores and make an essential contribution to Scotland's challenging target of net zero by 2045. Scotland's forests currently sequester 7.5 million tonnes of carbon dioxide, which is equivalent to around 14% of Scotland's greenhouse gas emissions in 2022.

The recent Scottish Forestry commissioned Forest Research publication, 'Quantifying the sustainable forestry carbon cycle', shows that in broad carbon terms, faster-growing, generally coniferous tree species sequester carbon quickly in the medium to long term (<50 years). Slower-growing broadleaf tree species can accumulate high carbon reserves, within the woodland itself, in the very long term (100+ years). Maintaining the carbon in our soils is also a key part of this cycle.

Using timber for long-term products like furniture and housing, re-using and recycling of forest products helps to ensure that the carbon sequestered is not lost back to the atmosphere. Substituting building materials that release large volumes of greenhouse gases in their production, such as concrete, plastic and steel, with wood products can also significantly help to reduce emissions. Supporting home-grown timber means we are not harvesting from unsustainably managed woodlands nor increasing carbon emissions through importation.

Ecosystem, ecological and landscape resilience

Sustainably managed woodlands, and expansion of them, improve ecosystem and ecological resilience, and provide and enhance habitats, species, ecological processes, and nature connectivity as part of wider dynamic landscapes.

Forests[1] are one of the most biodiversity rich habitats on the planet. Forests and woodlands support a diverse range of species and are rich in biodiversity; to date, researchers at Stirling University have recorded over 1,000 species associated with Scottish forests, including 172 protected species.

Increasing the biodiversity and health of all our woodland, including soils, through active maintenance, monitoring and management will increase their ability to regenerate, build resilience to the changing climate and support nature restoration.

The National Forest Inventory data on Woodland Ecological Condition (WEC) is the most comprehensive assessment we have of forest ecological condition across all our woodlands and provides a strong baseline proxy measure for biodiversity. WEC measures show the characteristics of our woodlands that are needed to increase biodiversity. It shows that woodlands

1 The terms forests and woodlands are used interchangeably in this document. They are defined as land under stands of trees with a canopy cover of at least 20%, or having the potential to achieve this, including integral open space, and including felled areas that are awaiting restocking (replanting). The minimum area is 0.1 ha and there is no minimum height.

of all types, be it productive broadleaves, conifer, native or mixed, have the potential to contribute to biodiversity gain in Scotland.

Woodlands as part of integrated land use can also help to build resilience in the wider landscape, for example by providing shelter and shade for farm and riparian wildlife, reducing soil loss and improving water quality.

Rural economy

Healthy and resilient expanded forests and woodlands help to ensure a resilient rural economy, by ensuring a sustainable timber supply for a multitude of uses such as housing and furniture.

Forestry in Scotland is worth £1.1 billion per year to the Scottish economy and supports more than 34,000 jobs from direct forest management, timber processing and supply chain activities to forest based recreation and tourism. These rural jobs support local communities and delivery of the Scottish Government Economic Strategy.

More and more farmers in Scottish agriculture are realising the benefits that trees can bring to their farming businesses, such as providing shelter for livestock, improving productivity, diversifying income streams, creating habitat for wildlife and reducing carbon footprints.

Supporting communities

Forest and woodlands benefit Scotland's people and communities in a range of ways. They deliver a wide range of public and community benefits in both rural and urban settings (where over 80% of the population lives), including mental health and well-being benefits derived from direct access and use; economic benefits through, for example, tourism, skills development and jobs, as well as environmental benefits, such as improving air quality, helping to cool urban areas, and reducing noise pollution.

Creating new woodland and sustainably managing forests and woodlands can also help communities to adapt, become more resilient to a changing climate and support a just transition through, for example, flood mitigation by slowing the water flow in areas prone to flooding. They can also help to protect transport and energy networks from flooding and landslides in turn enabling a more resilient Scotland, further supporting the economy.

What do we need to build resilience to: threats

The latest Intergovernmental Panel on Climate Change report warns that without immediate and deep emission reductions across all sectors, keeping global warming below the 1.5°C threshold will be impossible. The Climate Change Committee's advice is to adapt now to a global temperature rise of 2°C and assess the risks up to 4°C - even though it is imperative the world avoids this catastrophic scenario.

In Scotland, this is leading to a climate with hotter drier summers and warmer wetter winters, with an increase in extreme events. These locking-in changes are leading to a range of impacts and increased risks, which will intensify over coming years.

The threats to forests and woodlands are:

temperature - increased generally, and an increase in the length and severity of high temperatures.

pests and diseases - increased risk due new pests that can survive in a changing climate, and an increase in more susceptible trees due to other stressors.

frost - reduced number but changed timing, such as occasional hard frosts which are particularly damaging after bud-burst and during lamas growth.

wildfire – increased due to reduced rainfall and higher temperatures.

flooding and waterlogging – increased due to change in intensity of rainfall.

windthrow - increased storm frequency and intensity. Overall tree stability is also reduced by successive storm events, drought and saturated ground.

drought – increased due to change in distribution of rainfall.

In recent years it is becoming increasingly clear that these threats are not isolated and the compound effect on the forest resource can be significant, further adding to the need for resistance and continuous adaptation building, along with rapid and effective response and recovery strategies. For example, leaving significant areas of windblown timber will increase the risk of pest and diseases which can more easily take advantage of stressed and dying trees, and also increase the risk of wildfire by increasing the amount of fuel.

How to build resilience: measures

As has always been the case with SFM, there is a balance when creating and managing woodland, between the economic, social and environmental benefits that forests and woodland provide. The balance can be influenced at a national level through policy and incentives, but is also dependent on the land available for planting, the landowner's objectives for the site, and the individual site conditions.

This balance now needs to be achieved in the context of a climate emergency, nature crisis and increasing uncertainty. Mitigation and resilience strategies are major drivers, influencing how we implement SFM in the future and what our future forests will look like, but cannot be considered in isolation. We need a woodland to make a strong contribution to mitigation to minimise the speed and eventual level of climate change, in balance with resilience measures that allow woodlands to cope with the climate change that does take place.

Work has been progressing on this in Scotland in relation to woodlands and forests through work commissioned by Scottish Forestry on 'Strategies for building resilience', and the subsequent UKFS Practice Guide on Adaptation. The new UKFS edition 5 which outlines the governments approach to SFM, has also recently been strengthened in relation to resilience measures.

The UKFS Practice Guide: Adapting forest and woodland management to the changing climate identifies **the measures that can be employed to build resilience such as:** increasing the diversity of species, provenance, and structure at a number of scales; more use of management methods such as thinning, rotation length and natural regeneration; tree breeding for resistance; monitoring and surveillance; better planning for risk in forest design plans; and contingency planning for response and recovery to events. See Figure 2 for full list of options.

There is no one prescription for resilience, but applying a range of adaptation measures across each of the elements of the resilience framework, suitable for the site and management objectives, will significantly reduce risk. It is not about doing the same resilience measures everywhere.

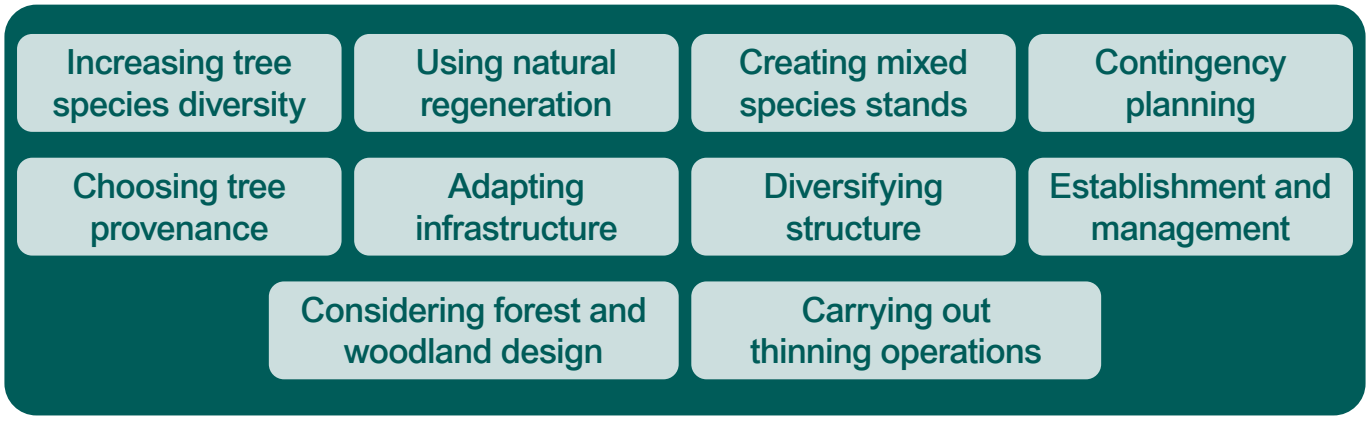
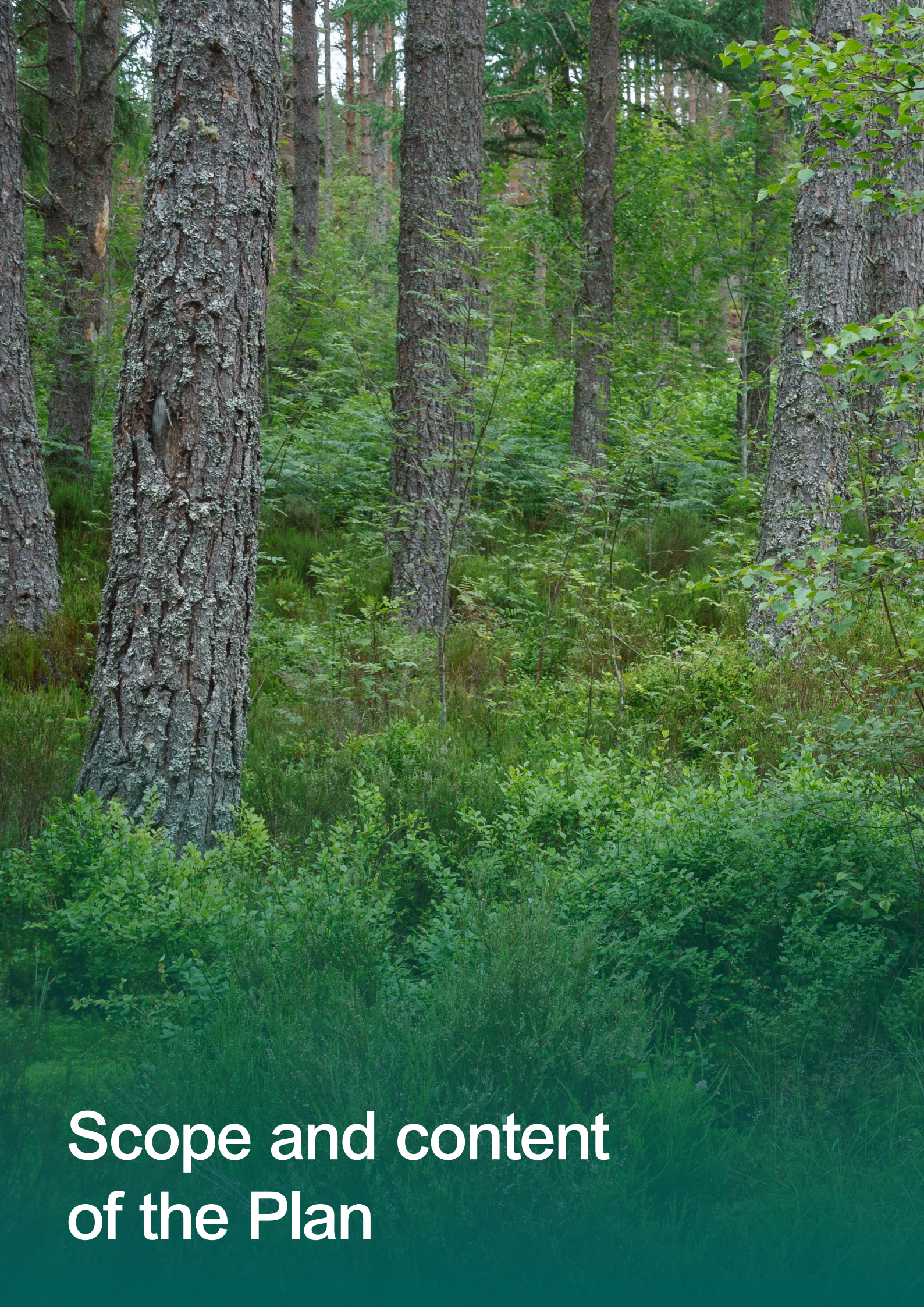


Figure 2: UKFS Practice Guide: Adapting forest and woodland management to the changing climate



Scope and content of the Plan

This plan lays the foundation to building resilience in all of our woodlands and forests.

It articulates the **priority** actions agreed by the cross-sector Adaptation and Resilience Steering Group, that need to be taken now, to achieve a resilient Forest and Woodland resource in Scotland by 2070.

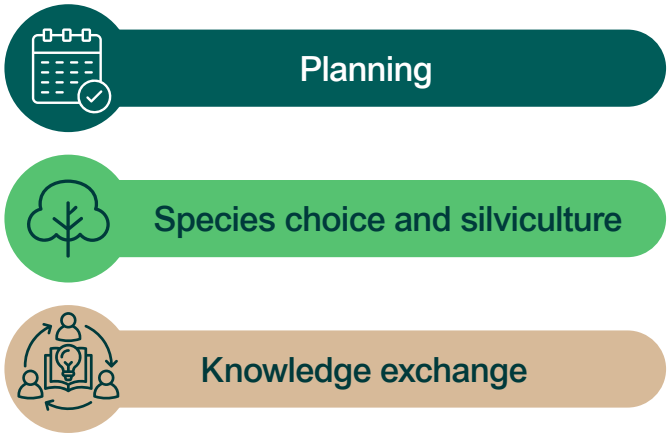
The priorities and actions cover all of the four aspects of the resist, adapt, respond and recover definition of resilience, and will help to enable and unblock the barriers around delivery of the resilience measures.

This is a strategic document to set direction, unblock major issues and barriers and enable change. Practical guidance to building resilience in a forest is a key part of a number of the Actions.

It is based on the comprehensive paper on Building Resilient Future Forests that was written by Scottish Forestry and discussed at the National Stakeholder Group (NSG) meeting in November 2022 and which can be found here.

Following that meeting Scottish Forestry (SF) established a cross-sector Adaptation and Resilience Steering Group (SG) to develop and deliver this Plan. The terms of reference and membership of the Steering Group can be found on Scottish Forestry's website: Scottish Forestry - Adaptation and Resilience Steering Group

The SG identified the following three priorities for action:



These are the initial priorities addressed in the first iteration of this plan which identifies:

- the outcomes we are looking to achieve
- the high-level actions agreed to be taken forward by this Steering Group to deliver the outcomes
- delivery partners
- timescale (to 2035)

Actions

Actions address both immediate and long-term issues. Some of the actions will have an immediate outcome, whilst others will lay the foundations for longer-term change – opening up adaptation opportunities and supporting the longer-term decision making required.

Each of the three priorities has a desired outcome, and the actions combined aim to deliver that outcome. Potential delivery partners have been identified for each of the actions in the plan. Successful delivery of the plan outcomes will depend on a cooperative approach across the sector.

Evidence is a key and underpinning aspect of this plan. Adaptation and Resilience were given high priority in both the previous and current Science and Innovation Strategies. New research and evidence gathering will also be commissioned as part of this plan.

If a barrier is being addressed elsewhere with governance, plans or actions in place then it isn't repeated here. Actions on soil resilience for example are being taken forward as part of Scottish National Adaptation Plan.

Deer management is absolutely fundamental to building the resilience of our woodland and increasing diversity, however, there is already a Strategic Deer Board with four working groups and actions in place in the Scottish Biodiversity Strategy to take this forward across all land uses.

Management of Invasive non-native species is also crucial in many of our woodlands, but again, this is addressed through the Scottish Biodiversity Strategy.

Similarly Forestry's role in helping to mitigate climate change threats such as flooding, have also not been included as they are covered in the Scottish Forestry Strategy and Implementation Plan, or wider government plans and strategies.

Timescales

The ambition and timeline for delivery of all these actions is **by 2035**. There are interdependencies between actions, and these will be identified, and a programme for delivery put in place with the Adaptation and Resilience Steering Group.

Within this timescale the plan may need to be updated with any changing context or new learning from the delivery of the plan's actions. This will enable new priority areas to be identified, thus maintaining positive momentum towards achieving more resilient forest and woodland ecosystems by 2070.

Monitoring and review

The routemap will be monitored using indicators as set out in the Scottish Forestry Strategy and Implementation Plan for monitoring Resilience. Progress, alignment with the Implementation Plan and proposed significant changes will be considered on review in 2030.


Centre Grid
Reference:
NH 49996 15567
Ancient Woodland
There is a small
woodland
There

Priorities

The Plan is set out around the three priorities of **Planning, Species Choice and Silviculture, and Knowledge Exchange.** This section introduces those areas and gives some background to the actions set out in Annex 1.

Planning

Outcome: effective planning for risk and resilience is in place at an appropriate level

Planning – case study

The Scottish wind blow contingency plan is a national level, strategic plan for dealing with catastrophic wind blow events in Scottish forests. It relates to actions that need to be taken at a national, regional and local scale.

It covers:

- information about the forest planning measures that can increase the resilience of forests to storm events
- the steps that should be taken to prepare for potentially catastrophic wind blow events
- the processes that are triggered when winds of ≥80 and ≥90 mph are forecast
- the responses that will occur after a potentially catastrophic wind blow event

The plan is reviewed on an annual basis, we intend to use the resilience framework as a tool to assist future reviews. We can also consider if similar plans are needed for each of the climate change risks to forestry through a risk assessment process looking at the level and likelihood of impact of each risk.

The key for all national and regional level plans will be to make them relevant and accessible so that they are easily used to inform and strengthen local-level plans.

Planning

Forest Planning is a key part of building resilience and can address each of the elements of the resilience framework as well as management objectives, the balance of SFM benefits, and the balance between mitigation and adaptation.

The heart of this section is 'be prepared'. It is not 'if' – it is 'when'.

Forests and woodland are long lived and can't change overnight, but the actions in this section set the direction for managed change, and to get plans in place to support efforts to resist and adapt, and strengthen the current position as much as possible, but also plan to respond and recover when a threat does occur.

By carefully considering current and future risks and making informed decisions to reduce those risks, planning affords us the greatest opportunity to manage change and ensure resources are available, and enable adaptive management.

Uncertainty and scale

There is an inherent challenge with assessing the likelihood and impact of risks over long time periods and it is difficult to know how much resilience to build into the forest. Due to this uncertainty, it is important that adaptation policies and plans have a degree of flexibility so that they can be adjusted as and when new information becomes available.

Planning at national and strategic level through to landscape and local level needs to link up to be effective. Any decisions for building resilience taken at national level will be largely implemented at local level, and need to be practical and achievable, and effectively implemented. Resilience can be built, measured and implemented at multiple scales.

Effective planning must also consider interdependencies between the forests and the infrastructure to support them. For example, planning for risk at local level can ensure operational challenges such as urgent access considerations are addressed, which may be needed more frequently in future to tackle wildfires or to remove diseased or windblown trees.

Forest planning must also be considered in the context of wider sustainable land use. There may considerable advantages to working at a landscape scale across multiple landowners, for proactive management of some pest and diseases, water resource management, enabling matrix structures of species or age diversity, or habitat connections.

Planning can help ensure active and adaptive forest management to help manage uncertainty. Adaptive forest management - the continuous development of practice by learning from outcomes - is key to delivering resilience. Research and development to enable smarter forest planning and management, such as using remote sensing, machine learning and artificial intelligence, is also a key part of this plan.

Also, ensuring active management of our forests to ensure they are in good condition and connected will considerably improve their resilience. Effective planning also responds to the constraints and opportunities of the site, for example species options may be limited on poorer sites, but resilience could still be increased, for example by diversifying forest structure.

Monitoring and surveillance

Scottish Forestry also has an extensive tree health monitoring and surveillance programme – surveying over one million hectares of trees per year. Proactive horizon scanning is undertaken to prevent pests and diseases reaching our trees, and our borders are managed to aid resistance to future pests and diseases by aiming to prevent their entry.

There are benefits to exploring new approaches that technological advancements are allowing us to use, and as well as monitoring for presence of a pest or disease, monitoring the health of our trees to identify those that maybe a risk of attack due to drought stress, for example which will help enable pre-emptive actions and reduction of risk. Regular on-site monitoring and surveillance to assess changes in woodland condition, tree health and vigour are essential for informing risk assessment and management decisions.

Timescales

A key consideration for forest planning is timescales. In contrast to other sectors, five, twenty and even fifty years are short-term planning horizons for some elements of woodland management. By the 2080s, an oak tree planted now will only be half-way through a commercial rotation, while as a component of semi-natural woodland, it would still be at a juvenile stage.

For productive Sitka spruce, the standard rotation length is more like 40 years. Both can have long lifespans if retained, and both contribute to forest ecosystems. These long timescales also mean that only about 2.7% (see Table 1 below) of the overall forest resource in Scotland is created or restocked each year, which limits the speed of change.

Planning actions

There are a number of tools already in place for effective Forest Planning; including the framework of the UKFS, however, this Plan sets the ambition to take a strategic approach by looking at potential future scenarios based on risk, and projecting potential scenarios of impact on our forest resource and industry. This scenario based approach is intended to better inform how we plan and what we plan for, and to ensure we have the right plans in place, at the right level, with associated decision support and monitoring systems, and training and resources to support implementation.

The full list of actions is shown in Annex 1.

Mode of change	Area (ha)	Percentage %
New woodland creation	18,000 by 2024/25	1.3% of overall woodland resource each year
Estimated felled area of coniferous woodland from remote sensing data (includes areas that will not be restocked due to habitat restoration and planning approvals)	19,252 hectares a year (average over the last 5 years)	1.4% of overall woodland resource each year
Management planning	Approximately 854,000 hectares of woodland are under active management through a Forest Plan.	Some opportunity to influence the long-term objectives of 85,000 hectares – about 6% the of the overall woodland resource, each year.

Table 1: Change to forest and woodland resource

Species choice and silviculture

Outcome: A greater range of species and silviculture will be employed to increase the resilience of Scotland's forests and woodlands, and forest industry.

Species Choice – case study

Understanding the productive tree species that will be suitable for the future is a critical foundation to secure a resilient forest resource and sector that maintains and enhances all the current benefits that forests and woodlands provide. Work is already underway on this key underpinning action. Scottish Forestry initiated this work by holding a workshop with 60 key industry representatives in September 2023. At this workshop we developed the list of criteria to be considered when creating a shortlist of future productive species.

Forest Research (FR) were then commissioned to use the results, and prepare an assessment framework to identify those species with the greatest potential across the range of criteria. The framework, is based on over 100 datasets which have been combined into 10 definitive criteria, with a further 12 supporting criteria developed to help sense-check the results.

The framework and data were tested at a follow up workshop in May 2024, that also explored the relative importance of each of the criteria. Each criteria in the framework can be weighted to prioritise species that perform the best against the most important categories, for example: future climate suitability.

To conclude this work FR will conduct a sensitivity analysis and quality assurance exercise on the data to refine the framework, using the results from the workshop. Results will be sense-checked to arrive at the final shortlist, which will be agreed by the Adaptation and Resilience Steering Group.

Species choice and silviculture

All our sustainably managed woodland in Scotland contributes to key Government objectives, supporting the economy and rural jobs, protecting and enhancing environmental objectives, our health and wellbeing and net zero (see section 3).

We have a successful industry primarily based mainly around a single species implemented to deliver the original Forestry Commission objective to ensure a strategic reserve of timber. Sitka Spruce proved to be the most robust and productive conifer for the Scottish climate and now it makes up 43% of the forestry area in Scotland. Native broadleaved and other broadleaved species account for 29% of the area and Scots pine an additional 13%. The total industry contributes £1.1 billion Gross Value Added (GVA) to the Scottish economy and supports over 34,000 jobs.

Sitka and Norway spruce account for 73% of all conifer timber forecast available for harvest in Scotland, with the majority from Sitka, and this figure rises to approximately 80% by 2032 through to 2046. The reliance of the industry in Scotland on a single species is a key risk. The industry is also predominantly reliant on few silvicultural systems, however a more diverse forest structure for example with great age class diversity could provide key resilience gains, especially on poorer sites with limited species options. Therefore, species choice and silviculture has been identified as a key priority for building resilience.

Climate suitability

The suitability of our climate in Scotland to specific species is changing. This means we need to review which species are most suitable for the future, and where geographically they are most suited. For example, a general increase in temperature would suggest that a greater area of Scotland would be suitable for planting key species like Sitka spruce, however when drought is factored in, the actual area reduces.

Alongside this we also need to update our knowledge and practice on silviculture and management of these additional species, along with a greater understanding of provenance choice and genetic diversity.

Pests and diseases

A key risk relating to our current species breakdown is the increasing prevalence of numerous types of pest and disease due to the changing climate. Some pests and diseases can move rapidly through landscapes, especially with large populations of a single susceptible tree species, and even more so, if those trees are stressed. Once established in the wider environment, they can be extremely difficult, or even impossible, to eradicate.

Ips typographus, for example, is a significant risk. This is a spruce bark beetle that has caused major devastation to multiple species on the continent. Higher temperatures, drought and storm damage are all risk factors that create conditions conducive to outbreaks of *Ips typographus* and other damaging bark beetles. Since 2018 multiple localised and small-scale breeding populations of *Ips typographus* have been found in south-east England, mostly on Norway spruce, and an interception of isolated beetles in traps was made for the first time in Scotland in 2023, with the first finding in GB of *Ips typographus* on Sitka spruce recently confirmed in West Sussex (2024).

Future management of this pest will involve increased surveillance, monitoring and eradication of incursions. Resistance actions, like surveillance and monitoring of susceptible populations of trees, and regular thinning to encourage root and crown development and

improve overall health and vigour. Adaptation actions, such as improved planning for restock and management to reduce the potential for trees to suffer stress, to reduce the potential area for spread, along with contingency planning for responding to wider outbreaks should they occur.

Recent examples of pests and diseases on elm, ash and larch have shown the devasting impact that losing these trees has had for our biodiversity and landscape, and highlighted the significant costs of managing the affected trees, requiring additional surveys, safety management and biosecurity measures and often with reduced timber values. Therefore, our species and silviculture actions have been designed to enable the successful establishment and diversity of management of a wider range of tree species, to spread and reduce the overall risk to the forest resource.

Species choice and silviculture actions

The key initial action to deliver this outcome is selecting a shortlist of broadleaved and conifer productive species for the future. These will be selected in liaison across the sector and based on a number of criteria, such as those suitable for a future climate and with a low-risk profile in terms of pests and diseases. The shortlist needs to have a range of species suitable for a range of silvicultural systems, forest structures, species mixtures and site types.

We aim to apply a similar approach, and also take forward key research on our native species, not to produce a shortlist, but rather to help us understand and respond to the impact of the changing climate, and understand where suitability of species and importantly provenances may change, and which are most at risk, to enable us to help our woodlands to adapt.

Follow up actions then respond to the challenge of increasing the use of alternative broadleaf and conifer species, enabling greater use of alternative silvicultural systems, more adaptive management; the ability to continually change practice based on experience. They also aim to enable 'smart' silviculture, using new technologies such as AI, machine learning and drones, to more effectively plan, monitor and manage our forests.

A key action is understanding the underpinning role of terrestrial ecosystem (including soil) health, function and biodiversity in the resilience of different forest and woodland types, and how to enable these to adapt in a changing climate. This approach will use new tools, like detection of environmental DNA metabarcoding (eDNA), which is already starting to hugely increase our understanding of forest ecosystems.

To deliver improved planting material, the plan is to prioritise and take forward tree improvement programmes, be that to build resistance to pests and diseases for ecosystem health purposes, or to increase productivity for economic and carbon purposes.

Key actions will also investigate the economics of current and future species, aiming to for example ,enable processing capability, and the development of a diversity of high value wood products for future markets. Enabling new markets could also support a higher number of undermanaged and smaller woodlands into management.

The full list of actions to deliver this outcome is show in Annex 1.

Knowledge exchange

Outcome: A range of coordinated, easily accessible resources, are available to support implementation of resilience and adaptation measures.

Knowledge exchange – case study

One of our approaches to knowledge exchange is to break down the complexity of Sustainable Forest Management in a changing climate into easily accessible and understandable webinars, based on key climate change risks that impact forestry. We began this webinar series by looking at wildfire because it has significant and long-term impacts on the forest resource and our communities.

At this webinar the Scottish Fire and Rescue Service (SFRS) explained the current and predicted future risk. Forest Research then introduced some measures that can be taken to reduce risk and increase preparedness, and the Managing Director of Cawdor Forestry shared his experience in incident response.

The question-and-answer session allowed discussion to go into further detail, helping attendees to understand their risk, and to prepare for a proportionate response that maintains forest integrity whilst reducing the risk to high value assets like people's homes. Discussions also covered some of the practicalities of responding to an incident, like who's in charge at an incident (SFRS), how to get helicopter support, and moved on to issues around recovery, starting with insurance claims.

All these sessions will be available on our website.

Knowledge exchange

Capturing and sharing the current understanding of the climate change impacts to forestry and the risk reducing measures we can take is now essential.

Our Knowledge Exchange actions are designed to help meet this challenge in the face of the time, resource, knowledge and experience issues faced by the industry, by bringing together key reliable information into a limited number of trusted and accessible locations – like the Climate Change Hub. Another driver is to simplifying complex data and make it accessible through seminars and demonstration sites, and by establishing a practitioner forum, to openly discuss applying resilience measures.

The aim of these measures is to support real and meaningful exchange at an appropriate scale, and in a timely fashion that progressively reduces risk, maintains productivity, ensures a just transition and enables rapid and effective response and recovery strategies. The measures will be targeted at those challenged with delivering change – landowners and managers.

The full list of actions is shown below in Annex 1.

Annex 1 - Priority Actions

Planning

Outcome: Effective planning for risk and resilience is in place at an appropriate level

Ref	Draft Action	Key partners	How this action will support delivery of the outcome
PL1	Consolidate, assess need and produce as required strategic plans to mitigate risk at national to local levels, and contingency plans on action to take when an event occurs.	SF/Confor	Risk assessments and strategic plans are publicly available and understood. Risk interdependencies are considered.
PL2	Use scenario planning and a range of data sources such as satellite data, to gain further understanding of risk level and impact and use to inform the sector and PL1. Make available as part of knowledge exchange.	SF/Confor	Plans are robust and applicable to a range of likely impacts.
PL3	Using new techniques such as eDNA, deliver research on understanding the underpinning role of ecosystem health, function and biodiversity on resilience, including the ability of our forest and woodland ecosystems to adapt to a changing climate.	SF/FR/FLS/ NatureScot	Improvement of management of all woodland types for biodiversity and resilience in a changing climate. Knowledge on how to help whole woodland ecosystems, including soil, adapt to expected temperature rise and climate change.
PL4	Develop practical guidance on sustainably applying the resilience measures, and using adaptive management to different forest types, and provide 'Planning for Resilience' training (link to PL1) to inform local level planning and delivery.	SF/FR/ICF	Forest planners understand and ensure climate change risks, and adaptation, resistance, response and recovery are included in forest plans, and sustainable application. Potential for wider education partnerships.
PL5	Enable forest landscape scale restoration areas, forest nature networks, and 30x30, to support adaptation and building resilience and ensure these are built into planning guidance, plans, training and incentives.	SF/ NatureScot/ FLS/ Confor	Ensure natural expansion into future climate suitable areas is supported by these initiatives.

Ref	Draft Action	Key partners	How this action will support delivery of the outcome
PL6	Review planning tools and systems and employ new technologies to ensure planners have support for species matching to site, assessing risk, and managing mixed species and structure stands. Ensure complementarity of use and link to planning guidance and training (PL4 and 5).	FR/SF	Forest planners can access simple, co-ordinated support for precision species matching to site, risk management (climate, wind, drought, flooding or tree health), managing mixed species stands, and selective product felling for example. Systems indicate high risk scenarios, and opportunities.
PL7	Building on the current horizon scanning and surveillance programme and using new technologies, ensure effective pest and disease risk and resilience surveillance and monitoring is in place, especially for novel pathogens and trees under stress, or more at risk of hosting a pest and disease outbreak.	SF/Confor/LINK	New technologies employed for horizon scanning for new pests and pathogens and to identify stressed trees, and reduction in tree vigour and health. New or increased risks are identified early, allowing for a pre-planned and timely response.
PL8	Investigate potential to enable delivery of pre-emptive management actions, to reduce risk such as pest and disease or wildfire as identified in PL1 and PL2 and link to forest planning and incentives.	SF/Confor/LINK	Pre-emptive action to reduce impacts of climate change threats and area of spread.
PL9	Use new technologies for land managers to measure and monitor woodland condition at site level for resilience, ecosystem and biodiversity assessment, and consider options for linking to natural capital incentives and forest planning.	Confor/ Naturescot/FLS / FR	Woodland condition, ecosystem health and integrity, and biodiversity is increased and monitored in all forests, including soils, underpinning resilience.
PL10	Ensure forest resilience considerations are a key part of strategic and delivery level planning for grazing management.	SF/Confor/LINK	Grazing management fundamental to delivery of the plan.

Species choice and silviculture

Outcome: A greater range of species will be successfully established and managed to increase the resilience of Scotland's forests and woodlands and forest industry.

Ref	Draft Action	Key partners	How this action will support delivery of the outcome
SP1	Develop, agree and promote an evidence-based shortlist of productive conifer and broadleaved species for Sustainable Forest Management and the maintenance of a vibrant forest industry, in single and mixed species stands and support use.	FR/SF/Confor/NS/ LINK	Enable the focus of effort and resources on a set of agreed species suitable for the predicted future climate in Scotland, and that work in mixtures and on a range of silvicultural management systems and sites.
SP2	Develop, agree, and promote an evidence-based framework for native species and provenance choice in Scotland using a similar approach to SP1. Include species that are native to Scotland, the UK, and naturalised species and support use.	FR/SF/Confor/NS/ LINK	Support decisions on native species and provenance choice considering climate projections, how the suitability of native species and provenance will change, adaptive capacity, and functional redundancy.
SP3	Update suite of guidance on management of semi-natural woodlands based on evidence and to include climate change considerations, and promote natural capital funding streams to increase management action.	SF/FR/ NatureScot/ Confor/LINK	Greater active management of native woodland for climate change, including choice of provenance and natural regeneration. Greater management of under-managed woodlands.
SP4	Identify and fill research, development and silvicultural knowledge gaps, and initiate further development of 'smart silviculture' for these future forests (PL6). Include work on growing, establishing, adaptive management, yield modelling, mixtures, thinning and managing structural diversity.	FR/SF/Confor/ Confor nursery producers group/ Tilhill/FLS/ LINK/ NS/Forestry practitioners	Reduce the risk of failure and increase the successful establishment of future species. Maximise adaptation pathways by proactive management to build resilience that responds to the site, climate and management objectives, for key species, mixtures, stand structures and silvicultural systems.

Ref	Draft Action	Key partners	How this action will support delivery of the outcome
SP5	Develop and deliver silviculture training on sustainably managing a greater range of species and mixed species stands, adaptively for resilience purposes, and applying tools and systems available (see PL6).	SF/FR/Confor/ Further Education Providers	Includes native species and stands. Reduce the risk of failure and increase the successful establishment of short list and native species, and enable greater use of tools and technology available.
SP6	Ensure Scottish co-ordination of work on Forest Genetic Resources.	SF/FRM/ Confor nursery producers group/ FLS/UK FGR group	Scotland engaged in UK-level Forest Genetic Resources Strategy.
SP7	Increase seed stand resource, seed collection, processing, storage and nursery production of preferred provenances of native and productive shortlist species and review incentives to increase supply. Improve market intelligence and mechanisms to incentivise growing.	Confor nursery producers group/ SF/FR/FLS/Seed collectors	Sufficient UK supply of required / preferred provenance for all native and productive shortlist species to support increased demand.
SP8	Create and prioritise shortlist for tree improvement, source funding, and put in place tree breeding programmes for selected conifer or broadleaf species.	Confor/Conifer breeding Coop/ FTT/FR/SF	Ensure tree breeding can contribute to resilience such as for drought, pests and diseases, productivity, timber quality, and ecosystem health and function. Include the suitability to grow in mixtures as part of the consideration.
SP9	Develop broad understanding of economics of productive shortlist conifer and broadleaved species, and review financial support mechanisms required to support use.	Confor processors group/SF/FR/	Supporting knowledge and decision making on shortlist species. Include costs of achieving a marketable plant, establishment, management rotation length, harvesting, processing, returns for timber, scale of planting required and investment.
SP10	Commission work to enable greater understanding of product range of the productive short list species, potential new products and potential future market supply and demand. Consider full range of financial mechanisms and natural capital incentives to enable development and investment.	Confor/Napier/ SF/BEST	Enable understanding of new wood products, including technical properties and potential market demand, to encourage the planting of a wider range of species and sizes, and bring more woodlands into active management.

Knowledge Exchange

Outcome: A range of coordinated, easily accessible resources are available to support implementation of resilience measures.

Ref	Draft Action	Key partners	How this action will support delivery of the outcome
KE1	Develop the FR Climate Change Hub of information 'website'.	FR/ UK nations/SF	Consolidated information on forestry related climate change issues.
KE2	Develop a series of knowledge exchange events and videos - include videos and learning from European colleagues.	SF/ICF/Confor/ FR	Practical information on climate change risks and measures is easily available.
KE3	Identify demonstration sites supported with clear site history / management information.	SF/FLS/ICF/RSFS/ FR/Lantra	Practitioners can see on-the-ground measures in action to reduce risks. Potential for wider education partnerships.
KE4	Establish a practitioner forum.	SF/FLS/FR	Practitioners can obtain impartial, practical advice on resilience measures. Potential for wider education partnerships.
KE5	Maintain co-ordination to ensure forest resilience interests are included in wider related policy development and delivery.	SF/Confor/LINK	Essential policy development and delivery is supported.