

Sustainable forest management at Kinveachy Caledonian Pinewoods

Kinveachy Forest is an ancient pinewood located in Cairngorms National Park, north of Aviemore, and is owned and managed by the Seafeld Estate. Records show that parts of the site regenerated naturally until the 1860s, after which there was a mixture of planting and natural regeneration. In total, 5326 ha are designated as a Site of Special Scientific Interest (SSSI) because of the valuable and extensive ancient pine forest and moorland habitats that provide feeding and nesting areas for protected bird species, rare invertebrates, lichens and flowering plants. Of these, 2850 ha centred around the pinewood are designated as a Special Area of Conservation (SAC) and a Special Protection Area (SPA).

Management objectives

The forests on the Seafeld and Strathspey Estate are managed to generate revenue from sport and timber; harvests from productive stands are outside the Kinveachy SSSI. The revenue supports the family, the estate, the delivery of wider public benefits and provides local employment. Sustainable forest management is an integral principle, and extensive efforts have been made to support conservation of the Kinveachy Pinewoods, and ground-nesting birds including capercaillie, as part of the long-term vision for a resilient forest.

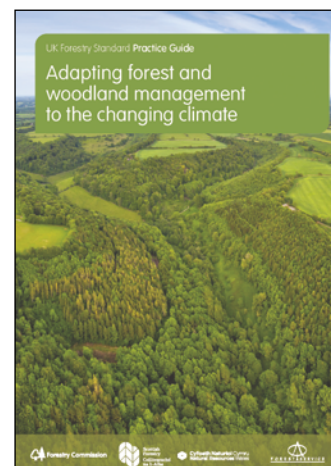
Risks and opportunities

Main climate change risks

The current climate assessed by ESC, the **Ecological Site Classification decision-support system** is 'cool, wet and moderately exposed', with future climate projections indicating warm, wet and moderately exposed by 2050. Conditions for Scots pine remain 'suitable', with a potential increase in growth rate where moisture is not limiting. The main risks include drought, fire and unpredictable weather patterns, increasing the risk of pests and pathogens.

Vulnerabilities

Annual weather patterns are already changing, with an increase in the occurrence of mild winters, which can increase the risk from pests or pathogens; severe spring droughts in 2018 and 2020 resulted in seedling mortality. Spring and summer droughts are likely to increase, and while established Scots pine is tolerant, newly planted seedlings and broadleaf species are susceptible.



Find detailed information in UKFS Practice Guide *Adapting forest and woodland management to the changing climate*.

Information on the UK Forestry Standard and supporting guidance is available at www.forestryresearch.gov.uk/ukfs

Significant felling took place during the Second World War, and further seed trees were lost in a post-war fire. Historically, high deer numbers have prevented regeneration and the mature canopy presents a risk from age-related decline, fire and windthrow. Fire risk could increase in future from hotter drier summers and increased vegetation growth during mild winters, resulting in higher fuel loads.

Tree pathogens are already present, although not extensive, with *Dothistroma* needle blight (DNB) on pine and *Phytophthora* on juniper.

Identifying and selecting measures

To support biodiversity, conservation and the resilience of this forest, the priority is to increase structural diversity by encouraging new generations of trees. To support the conservation of local genetic populations and avoid the introduction of disease, natural regeneration is the most suitable establishment method; planting Scots pine in the Caledonian Pinewoods Inventory zone is not permitted under most circumstances. Additional deer control is necessary to achieve this, which has resulted in the loss of the estate's sporting operations and income.

Regeneration of native broadleaves is being encouraged at suitable sites. Designations prevent the planting of non-native species to support conservation. Regular monitoring for pests and pathogens will continue. The estate has begun a programme of Lodgepole pine removal as a result of the presence of DNB, which causes needle loss, reduced growth and mortality in Lodgepole pine, and increases the risk to Scots pine. Fire risk will increase, so preparation and monitoring will continue.

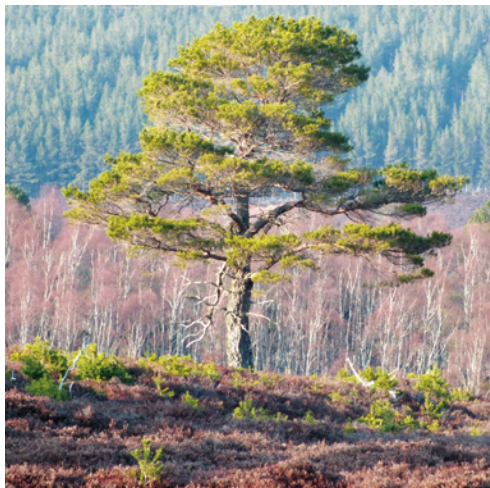
Implementing adaptation measures

High numbers of deer are a barrier to woodland regeneration, so culling is carried out to manage the herd and achieve the desired outcomes. In 2005, a 10-year Deer Control Agreement was drawn up with the Deer Commission for Scotland, Nature Scot and the estate, covering the SSSI and SAC/SPA. The target was to reduce numbers to three deer per km² over four years, from 2004 levels of 27 deer per km². The reduction targets were reached by 2007. Monitoring showed that browsing rates halved from 80 to 40% from 2006 to 2015, and that 87% of the marked Scots pine seedlings increased in height.

Funding came from a 10-year Nature Scot management agreement and a Scottish Forestry Grants Scheme (FGS) deer management application. A follow-up FGS grant application for deer and predator control (to protect black grouse and capercaillie from predators such as foxes and crows) enabled work to continue from 2016 to 2020. The estate has recently secured FGS funding to continue the regeneration and deer control from 2021 to 2025.

Game keepers are experienced at fire management through muirburn. Fire control equipment is available on-site and a local fire protection group shares resources in an incident.

Natural regeneration of Scots pine is being supported by deer control to increase structural diversity



Monitoring and assessment

Monitoring of fire, tree pests and pathogens, as well as deer populations, is ongoing. Seedling numbers and growth are measured to assess the impact of deer control and the need for new measures.

Partnerships with organisations, researchers and regulating bodies have been fundamental. Forest Research have been using pheromone traps for pine tree lappet moth monitoring for five to six years. The baseline woodland condition was established in 2005 under the Deer Control Agreement with a woodland profile survey, a tree seedling survey and a tree increment coring survey. Regular monitoring is a requirement of the SAC and SPA designations. Surveys include repeat monitoring of the health and growth of marked seedlings and habitat impact assessments. Further surveys were carried out in 2011 and 2020 to assess seedling recruitment since the start of the project.

The 2011 survey quantified the extent of regeneration of Scots pine taking place, alongside the (low) levels of broadleaf regeneration. The average stocking of seedlings and saplings across the whole survey area was 514 trees/ha, ranging from 0 to 22 300 stems per hectare, with higher recruitment on better drained mineral soils. A bryophyte ground layer was recorded in two-thirds of plots and is likely to be inhibiting regeneration. The 2020 survey recorded an 11% increase in average stocking density, comprising 76% Scots pine, 13% broadleaves and 11% juniper. This demonstrates a significant achievement over a large (400 ha) area without the use of deer fencing.

Lessons learnt

Natural regeneration of pine is taking place, albeit slowly, at a landscape scale. Despite the significant reductions in the deer population over a large area, the browsing rate was only reduced by half, highlighting the need to monitor impacts as well as population numbers. The cost of deer control is very high, and the estate has forgone hunting revenue; grant support was needed to achieve and maintain low deer population levels. Long-term public funding is needed to achieve such results without fencing.

Limited and localised broadleaf regeneration is likely due to the lack of appropriate seed trees, soil properties and preferential browsing from red deer, which are still present at low densities.

The estate is experimenting with innovative approaches, such as planting aspen and rowan within clumps of juniper to see if they can establish without protective planting tubes. A trial of rotary cultivation to break the surface mat is being carried out at two 5–10 ha sites. The locations are based on a survey to identify where intervention could aid recruitment.

There can be a trade-off between risks and benefits of adaptive practices, for example, decreasing deer numbers to allow regeneration has increased vegetation height and density, which in turn increases fire risk.

Intended future outcomes

The long-term vision is for a resilient pinewood and pockets of native broadleaves, with a diverse age structure, featuring multiple generations, and sufficient levels of natural regeneration to conserve the local genetic resource.

The pinewood will provide revenue through sport and hunting activities, with timber production primarily from other forests on the estate, and some sections of the designated site.

To achieve this, deer management will continue, building on the success of the landscape-scale deer management and regeneration. Regeneration surveys will be carried out every five years, with a target density of at least 400 stems per hectare to qualify for the forestry regeneration grant schemes.

The first claim for a 30 ha area was made in 2017, proving the success of deer control measures and natural regeneration, and over the next five years a further 400 ha could be claimable, recognising the long-term commitment to maintain and protect the emerging resource.

This case study is one of a number supporting the UKFS Practice Guide on *Adapting forest and woodland management to the changing climate*