

Woodland management planning at Queensberry Estate, Buccleuch

The Queensberry Estate in southwest Scotland encompasses 34 600 ha of mixed land use surrounding the 17th century Drumlanrig Castle, including gardens, agriculture and 4390 ha of mixed forestry. The estate is owned and managed by the Buccleuch family.

Management objectives

The core of the estate is managed for historical conservation, landscape aesthetics, sustainability and biodiversity. This is supported by generating revenue through timber production on the whole estate. The forest is diverse, comprising more than 40 different tree species. Of the stocked area, around 50% is Sitka spruce, 25% other conifers, including Norway spruce, Douglas fir and Scots pine, and 25% broadleaf species, including oak, beech, birch, aspen and eucalyptus. This mix becomes more complex around the castle. The forest is managed for hardwood and softwood production, from high quality timber to woodchips for renewable energy. The area of woodland is being increased, with new plantings on agricultural land amounting to more than 650 ha in the last 10 years.

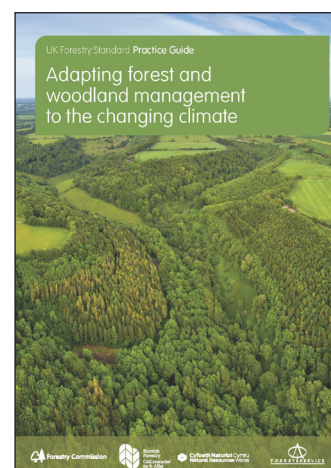
Risks and opportunities

Main climate change risks

The climate is wet and mild and is projected to remain ecologically suitable for the current tree species under future climate conditions. There is likely to be an increase in extreme weather events, including winter storms and seasonal heavy rainfall and summer drought. The wet, mild conditions increase the risk from tree pathogens, and the estate has experienced significant impacts from *Phytophthora ramorum* on larch, which occupied 17% of the whole forest but 25% of the core forest area around the castle prior to the outbreak. Around 500 ha of larch have been removed, with work continuing.

Vulnerabilities

Historical management has meant planting was mainly in areas with surface water gleys, or on slopes, or in gullies and bogs, with agriculture in prime locations, bringing an increased risk of wind damage and waterlogging. Wind risk is likely to increase with climate projections, especially in combination with wetter winter soils.



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.forestresearch.gov.uk/ukfs

The removal of larch left the surrounding stands more vulnerable to windthrow, especially mixed and small group stands. Storm Arwen in November 2021 had a devastating effect on the estate, with the loss of 40 000 tonnes of timber, taking an estimated two years to clear.

Mild winters have led to high vole populations, and the denser vegetation on former agricultural sites is a good habitat for them. These factors have contributed to increased damage to young trees, including Sitka spruce, which is not usually damaged by voles.

Changes in annual weather patterns have affected forest management operations in recent years. Thinning has been constrained to the spring on some sites to protect forest soils, as occurrences of mild, wet winters with insufficient ground frosts have increased, and wet summers have restricted thinning to sites with free-draining soils. Spring droughts in 2018 and 2020 resulted in significant seedling mortality. Planting is now paused in April and recommences in July with cell-grown stock.

Identifying and selecting measures

The forests at Queensberry are already quite species-diverse and further increasing the range of species grown is a key resilience strategy. The loss of larch as a planting choice poses a risk to diversity, but also presents an opportunity to diversify these areas at replanting.

Increasing structural diversity through continuous cover forestry (CCF) is another way to increase resilience, with suitable areas of the estate being selected for conversion through irregular group selection. As CCF requires more frequent and extensive thinning, conversion is constrained to free draining soils. It is also constrained by cost.

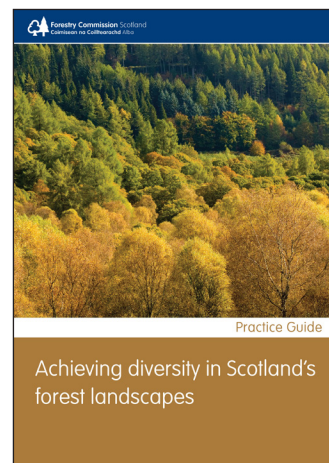
Drumlanrig Castle situated within the forests of Queensberry Estate.



Photo courtesy of Queensberry Estate

Implementing adaptation measures

Former larch stands are being replanted with a diverse range of species. The site determines the species, but is averaging 50% Norway spruce, 25% Douglas fir, 10% broadleaves and 5% minor conifers. Ridge edges and knolls are being planted with broadleaves such as beech, to maintain the landscape value created by larch in the past. Blocks of novel conifer species have been planted for the conifer



Forestry Commission
Scotland Practice Guide
*Achieving diversity
in Scotland's forest
landscapes.*

Information on
Queensberry Estate

conservation project. These stands will act as trials and potentially provide a future seed source for nurseries.

Natural regeneration is being encouraged and retained on sites being converted to CCF, with birch, oak, beech, grand fir, silver fir and western hemlock recorded and retained. Natural regeneration is encouraged through sustained intensive deer control across a large area. This further increases species diversity and adds visual benefit.

For new and established woodland, vegetation management is needed to reduce vole damage. A small trial of six Shropshire sheep to manage ground vegetation in Douglas fir stands was successful, and the sheep did not browse the trees. The trial was scaled up to 30 sheep in stands of different tree species and was successful in Sitka spruce, Norway spruce and western hemlock; the sheep did, however, browse broadleaf seedlings.

Monitoring and assessment

Regular monitoring of the estate forests is carried out to assess tree health, natural regeneration, establishment and site conditions for operations.

Lessons learnt

Larch was often intimately mixed with Sitka spruce, managed for timber production and to enhance landscape aesthetics. Large volumes of larch have now been removed from mixed plantings. Where possible, only the larch component was removed; however, on some sites both components were felled because of the high wind risk for the remaining trees. Despite this consideration, Storm Arwen caused extensive damage to the estate, and many of the trees retained after larch removal, and the surrounding stands, were lost. In these areas, neither the intimately mixed nor diverse stands provided the increased resilience that is often ascribed to them, because of the severity of this storm.

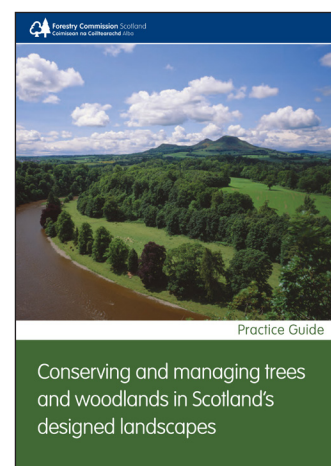
Converting stands to CCF and incorporating natural regeneration in the new canopy layer can take time. Many of the stands undergoing conversion to CCF were lost during Storm Arwen.

The changes to annual weather patterns and the subsequent impacts on forest management result in trade-offs. For example, moving planting time to autumn to avoid spring drought mortality might increase the risk of frost heave and plant washout over winter; even with projections of milder winters, occasional frost events can impact establishment.

Vegetation management for new woodland plantings continues to be important. The sparse branching habit of improved Sitka spruce, along with delayed canopy closure, resulted in an increased density of vegetation.

Intended future outcomes

The long-term vision is of a species-rich, structurally diverse forest, which continues to support the estate financially through timber production and sporting access, while providing aesthetic and recreational value and supporting biodiversity. The area of novel species will have increased and learning will be integrated into future management plans on a regular basis.



Forestry Commission
Scotland Practice Guide
*Conserving and managing
trees and woodlands
in Scotland's designed
landscapes.*

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