

Steep ground harvesting and landslide prevention: the A82 project

Photo courtesy of Forestry and Land Scotland

The A82 is a major road in Scotland running for 270 km from Glasgow to Inverness via Fort William. Sections of the A82 between Glen Coe and Inverness are bordered by forests on steep slopes, which were planted by the Forestry Commission in the 1920s and 1930s for timber production before this became a major transport route. These stands are now mature and consequently have an increased risk of windthrow, which on steep slopes can increase the risk of landslides and rockfall, presenting a significant risk of damage and disruption to the road. The changing climate further increases these risks. A Transport Scotland report in 2008 identified 19 sections of the A82 as being at a high risk from landslides. The large scale, large tree size, steep slopes, difficult terrain and proximity to the road make forestry and engineering operations complex and expensive, but necessary, to mitigate the potential risk to public safety, the costs and risks of emergency repairs and the significant disruption to the community and economy.

Management objectives

Forestry and Land Scotland's Steep Ground Management Programme was formed in 2009, and the A82 project began in 2011 to reduce the risk of windthrow and stabilise the slopes adjacent to the road to minimise or prevent landslides. Management objectives include replacing mature conifers with slow growing broadleaved species that can better stabilise the slope and increase resilience, and creating a well-connected broadleaf woodland corridor to provide significant biodiversity benefits.

Risks and opportunities

Main climate change risks

Climate change projections include more frequent and severe storms and winter rainfall, which will increase the risk of windthrow and landslides on steep slopes. Additional climate risks that need to be considered include drought on free-draining slopes, wildfire and pest and disease.

Vulnerabilities

Many of the older conifer stands along the A82 are increasingly vulnerable to windthrow and subsequent landslides. Some large trees now weigh up to 10 tonnes, increasing the difficulty of harvesting them on the steep slopes.



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

Identifying and selecting measures

The primary adaptation measures are to remove the large conifer trees adjacent to the road and develop a continuous cover of broadleaf woodland to improve tree and slope stability, with less need for extensive management interventions in future. The **ForestGALES** decision support tool is used to assess the wind risk to the forest and the impact of management actions on surrounding trees. The **Ecological Site Classification decision support tool** (ESC) can be used to identify a list of appropriate species to cope with future climate change projections. The selected species should have potential to stabilise the slope, as well as reducing wind, fire and tree health risk, and should ideally be a mix of native broadleaves.

Skyline winch extracting timber on a steep slope at Glen Righ.



Chainsaw operator in Glen Righ.



Further information on the
A82 project

Further information on
ForestGALES

Implementing adaptation measures

Small-scale trials were carried out in 2007–8, felling test areas of conifers and using skyline winches to extract timber. Works were then upscaled and operations were carried out adjacent to the A82. Approximately two major projects are scheduled per year and the entire project is likely to take up to 20 years to complete. The cost of the felling and engineering works is around £1 million per year. Harvesting optimises the timber value to be cost-effective.

Works are carried out according to best practice, following sustainable management principles and compliance with UK Forestry Standard and UK Woodland Assurance Standard Guidelines, including specialist workforce training and health and safety measures. Steep ground harvesting requires specialist equipment and techniques, including skyline winches to pull timber up or down to a road, and skilled chainsaw operators. Some trees need to be hauled 600 m uphill to the nearest forest road. This requires an assessment of existing, and potentially the building of new, forest infrastructure, and the selection of machinery and skilled operators appropriate for the site.

Operations can increase the risk of rock and debris falls, so to protect the public, traffic, road and utilities, geotechnical measures such as rock catch fences, nets, anchors and gabions are used to secure the slope and then the rocks are safely removed. Temporary catch fences are also erected prior to felling, using suitable trees as fence posts. Even with protective measures, traffic control is needed to

ensure public safety. Forest planning and replanting of the harvested sites is carried out by the regional team.

Protective measures, such as rock catch fences and traffic controls are installed to protect people, traffic, roads and utilities.



Photo courtesy of Forestry and Land Scotland

Monitoring and assessment

The areas of forest at the highest risk along the A82 are monitored, and the prioritising and planning of the next phases of work is carried out by the project team. During the operations, inspection and maintenance of protective measures are carried out by a specialist team and the ongoing management and monitoring of cleared forest sites is carried out by regional staff. Monitoring is expensive but essential and the partnership approach helps to spread this load.

Lessons learnt

There is an emphasis on learning by doing to develop skills as the project progresses in complexity. Collaboration is a strength of the project, with partners learning and working well together. The project partners include Transport Scotland, BEAR Scotland, Highland Council and Police Scotland. Close co-operation between these agencies is essential to manage road safety and ensure coordination with hard engineering projects. Research partnerships can play an essential part in adaptive management by sharing results with partners who will use findings to inform management.

Intended future outcomes

The forest management intention for the A82 corridor is to provide a contiguous, primarily mixed broadleaf protective forest that supports slope stability and requires less hard engineering, providing long-term resilience. A key objective is to increase the levels of specialist knowledge, resources and expertise with regard to working on difficult terrain in the forestry sector.

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