

The Benefits of Woodland

Unlocking the Potential of the Scottish Uplands

Part I – Overview

Dr Helen Armstrong (Broomhill Ecology)
and
Forest Policy Group

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Summary

The Scottish uplands are widely celebrated for their wild quality, but they have long been regarded as inherently un-productive due to poor soils, high rainfall and climatic exposure. Received wisdom suggests they are only suitable for the production of hardy sheep, grouse, red deer and exotic conifers. There are, however, other options that we believe should be more widely considered. Many of these moorlands could support mixed woodland. Unlocking of this woodland potential can be achieved in many upland areas simply by reducing grazing pressure from sheep and deer and limiting the practice of muirburn. Implementing these two measures alone can result in the rapid natural growth of a diverse woodland and shrub cover. Such a change in land cover has benefits for soils, water quality and flow, fisheries, carbon capture, shelter and forage for domestic stock, fuelwood and timber, biodiversity, game animals and birds, and resilience to both climate change and pests and diseases. These improved outputs and ecosystem services would be of value both locally and nationally.

Introduction [1,2,4,5]

The uplands cover around 70% of Scotland's land area. Many people think that the familiar treeless landscapes of the uplands are an entirely natural phenomenon. This is not the case. Certainly, where geology, topography and climate have resulted in soils that are nutrient poor and waterlogged, the resulting blanket bog is never likely to support more than a few, stunted trees. Although economically unproductive, these areas are valuable for their large stores of carbon and their specialist wildlife. Elsewhere, however, large areas of grass and heather moor could be supporting woodland, were it not suppressed by grazing and burning. Although open moorland landscapes have their admirers and their values, the presence of mixed woodland in the landscape can provide many benefits, as described below.

Soil productivity [2,3]

Without trees and shrubs, the soils of Scotland's upland areas are generally wet, acidic and low in plant nutrients. In most areas the under-lying rocks yield little in the way of soil nutrients when they break down. Additionally, the abundant rainfall washes soil nutrients out of the soil. Short vegetation, with its shallow roots, presents little resistance to the movement of water into, and through, the soil, so nutrients are easily dissolved and taken on into streams, rivers and eventually, the sea. The soil is left poorer in nutrients, more acidic and un-productive. Where the iron content is high the dissolved iron is deposited further down the soil profile and can form a hard layer of iron oxide (an iron 'pan') which impedes drainage, making the soil permanently wet as well as nutrient poor. In the most extreme cases, this results in complete water-logging, inhibiting the decomposition of dead plant material which builds up as peat. Most of Scotland's upland soils have been subject to this sort of leaching for hundreds, or in some cases thousands, of years since woodland cover first started to decline. Muirburn for grouse moor management, or to provide young plant growth for sheep to eat, exacerbates the loss of soil nutrients.

Fortunately, this process can be reversed. Trees have deep roots that can bring nutrients up from the lower levels of the soil. They can sometimes even break through an iron pan. Deciduous trees and shrubs, when they lose their leaves in autumn, return those nutrients

to the woodland floor. Their leaves decompose easily and produce a nutrient-rich compost that fertilises and improves the soil. Scots pine woodland with a mix of other tree species and an open canopy can achieve the same effect. However, soil acidity is increased by the thick mat of needles that builds up under dense plantations of conifers.

Soil erosion [4, 5]

Rain falling on short grassy or heathy vegetation, especially if it has been recently burned or is heavily grazed, runs rapidly over the surface, often dislodging soil particles and carrying them into the nearest stream. By contrast, rain falling on wooded ground infiltrates more slowly into the soil. Much of the water is held in this organic-matter-rich, 'spongy' soil until it is brought back up through the roots of trees and other plants. The rest of the rainwater moves through the soil too slowly to dislodge soil particles.

Landslips [6]

Landslips occur on steep slopes, particularly after prolonged heavy rainfall when the soil is saturated with water. They create scars on the hillside and block roads in their path. The bare scars are then susceptible to erosion. Tree roots provide a framework for the soil, helping to stabilise it. A cover of trees and shrubs on steep slopes therefore reduces the incidence of landslips, such as occur regularly on the A83.

Siltation and flooding [7]

Soil particles that are washed off the land are taken into streams. The particles are deposited as silt on the bed of slow running parts of streams or rivers (see Fisheries, below) or on the bed of lochs or reservoirs. By reducing the amount of soil washing off the land, a cover of trees and shrubs can prolong the life of reservoirs.

Compared to short vegetation, trees and shrubs have a high surface area of leaves and branches so they 'catch' more of the rain in their canopy, from which it evaporates back into the atmosphere. More water is also drawn up from their deep roots and transpired from their leaves. The higher water holding capacity of the soil under trees and shrubs means that any water remaining in the soil is released slowly into watercourses. In treeless river catchments the water runs off more quickly, increasing the chance of flooding downstream. By slowing down the flow of water into streams, a cover of trees and shrubs can reduce flood risk.

Fisheries [7, 11]

Salmon and trout need to lay their eggs in the well-aerated gravel beds of small upland streams, free of silt. The young fish need cool water which has high oxygen levels. They also feed on invertebrates which in turn feed on algae or water plants requiring a supply of nutrients. All of these factors are improved when deciduous trees or shrubs clothe the banks of streams. The trees and shrubs reduce siltation, cast shade, and provide a supply of leaves that are easily decomposed. Streamside trees also help to maintain the riffle-and-pool structure of the stream bed, providing both young and adult fish with suitable areas for feeding, resting and escaping predators.

Carbon sequestration [8]

Much more carbon is stored in the vegetation and soils of woodland than in those of open ground. Developing woodland cover in the uplands increases the amount of carbon stored from quite early on in the process. The exception may be where soils with a peat depth of more than about 50 cm are ploughed or otherwise disturbed prior to planting. This is likely to dry out the soil allowing it to oxidise, releasing carbon dioxide. This does not occur where woodland expansion is by natural regeneration and there is no soil disturbance. Some carbon is lost from peat soils due to the drying effect of the trees as they grow and this is greater on soils with deep peat. This is likely to be more than compensated for, however, by the growth of the trees and other woody species. On deep peats, trees will not grow well without prior drainage so any natural regeneration is likely to result in only scattered, stunted trees that have little effect on its hydrology or carbon storage. This kind of 'bog woodland' is currently a scarce habitat in Scotland.

Shelter and forage for domestic stock and deer [9]

The poor quality of forage available on the open hill, together with the lack of shelter from the often harsh weather conditions, means that only less productive sheep and cattle breeds can be grazed in the uplands. Trees and shrubs provide shelter and, by improving the soils, foster more nutritious pasture plants. Grazing stock do better on meadows set within a matrix of woodland and shrub cover or within open woodland, as is the norm in many other European countries, than they do on the open hill. Red deer, too, are more productive when they live in woodland, producing more calves and growing larger than in the exposed conditions of the open hill.

Fuelwood and timber [10]

Mixed woodland with a high proportion of broadleaved trees can be managed for a range of timber products including fencing and saw logs, fuelwood, pulpwood and chipwood. Broadleaved trees can produce quality timber if managed appropriately and can be economically viable despite growth rates being generally lower than those of conifers. Demand for fuelwood, a renewable energy source, is currently growing and is likely to increase further. A woodland varying in open-ness, as well as in the mix of tree species, can yield these products sustainably without the need for clear-felling with its associated impacts on soils, run-off, erosion and biodiversity. This approach is used in many other European countries.

Biodiversity [2, 11, 14]

Open upland grasslands and heathlands, whilst having specialist species, are relatively low in rarer species compared to open deciduous woodland and shrub habitats. A mixed landscape of patches of open areas set within a matrix of woodland and shrubby vegetation provides a wide range of habitats that support a diverse flora and fauna. Additionally, allowing trees and shrubs to colonise the uplands would create habitat types that have almost entirely disappeared from Scotland due to human impacts: montane shrub, treeline woodland and bog woodland. Rare species such as black grouse, capercaillie and wild cat would benefit. Taller vegetation would also provide more cover and food for small mammals and birds, supporting in turn more predatory species. Golden eagles, once thought to need large areas of open land over which to hunt, are now known to do well in landscapes composed of a mosaic of wooded and open habitats. The biodiversity associated with existing conifer

mono-cultures can also be enhanced by making them more natural by diversifying the tree species, felling only small patches at a time and leaving some stands to become older than the normal felling age of around 45 years.

Game animals and birds [12]

With a general increase in biodiversity comes the potential to hunt a wider variety of game species such as black grouse, capercaillie and wood cock. Red grouse would thrive in montane scrub areas as they do in Norway (where they are called willow grouse). A woodland landscape provides more shelter and forage than does the open hill so woodland-living red deer are bigger and produce more calves per hind. The maximum sustainable yield of venison is therefore greater and trophy hunters can shoot larger stags. With more woodland cover, deer would have a larger area in which to shelter and forage in winter, their impact would be more spread out and the density of deer compatible with allowing young trees to escape from browsing would be higher. Nevertheless, in the absence of large predators, continued hunting would be essential to ensure successful woodland regeneration.

Non-timber forest products [13]

Heavy grazing by sheep and deer over most of the Scottish uplands severely reduces the production of berries from plants such as blaeberry, cranberry and cloudberry. Neither heavily grazed woodlands nor closed canopy, coniferous forests have the understorey of small trees and shrubs such as hazel, willow, rowan, elder, dog rose, raspberry and bramble that produce edible nuts, berries and stems for woven crafts. Fungi, many of which are edible, proliferate in mixed woodland and can be harvested by those who are suitably trained. Mixed landscapes with a high proportion of open, mixed woodlands are thought to be best for such products. An increase in the extent of this type of landscape would make it possible for more people to enjoy the health and wellbeing benefits of harvesting these items - a popular activity in many other European countries. It may also allow commercial businesses to develop, though these would have to be carefully regulated to ensure sustainable use.

Resilience to climate change [14]

Predictions of the impact of climate change on Scotland come with a high degree of uncertainty as to both their nature and timing. In an uncertain world, fostering diversity is the best approach to ensuring resilience. A diverse ecosystem with a wide range of structures, habitat types, species and outputs stands the best chance of withstanding whatever changes occur since, if some species or habitats decline, others can expand to take their place. A diverse ecosystem providing diverse outputs is therefore likely to be both ecologically and economically more stable, whatever happens to the climate.

Resilience to diseases and pests [15]

A mixed landscape of open habitats set within a matrix of species-rich wooded and shrubby habitats also offers high resilience to the effects of pests and diseases. Mono-cultures of one species, such as Sitka spruce, grouse, sheep or red deer, are susceptible to catastrophic declines in productivity if affected by pests or diseases that are newly introduced or that proliferate as a result of climate change. By contrast, the productivity of a multiple-output, diverse system is less vulnerable to a decline in any one species. Additionally, where

individuals of any one species are more spread out, species-specific pests and diseases are less likely to spread and cause severe damage.

Achieving the transition [16, 17]

Conditions over much of the Scottish uplands are suitable for trees and shrubs to grow. Grazing and burning suppress natural regeneration over much of this area. Releasing this regeneration requires three actions: a large reduction in the number of deer, a reduction in the number of sheep (beyond that which has occurred since the change in the subsidy system in 2008) and a large reduction in the area of land that is burned. In much of the uplands, these actions alone would result in spontaneous natural regeneration of woodland and shrubs, as has been demonstrated in pioneering projects at Abernethy, Creag Meagaidh, Glen Affric and Glen Feshie. South west Norway also provides a good example of a region, similar in climate and soils, where this has occurred. Planting or ground preparation would only be needed in areas that are distant from a seed source, such as at Carrifran in the Scottish Borders, or where the ground vegetation is too dense or the soils too poor. A gradual re-structuring of existing conifer plantations to make them more akin to natural woodlands would also help to bring about the benefits listed above. Reducing deer numbers would have additional public benefits including reduced tick densities, a probable reduction in the incidence of Lyme disease and fewer deer-vehicle collisions.

Conclusion

Over much of the uplands, the current land use regime, dominated by mono-cultures of sheep, deer, grouse and exotic conifers, is maintaining, and even exacerbating, the low productivity of the land. A landscape with an increased cover of mixed woodland, in mosaic with open areas, would provide richer, more productive and more stable ecosystems. These, in turn, would provide an array of increased outputs and services that would be of major benefit to both private and public interests. The relevance, importance and value of each of the benefits of woodland described above will differ according to local circumstances. The potential of woodland to provide these benefits should be more widely considered, however, in both the development of national land use policy and in local land management decision making.