



Loch Arkaig Pine Forest

**Exploring the perceived impacts of different
management interventions on woodland benefits**



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Background

Forests and woodlands are an important part of Scotland's natural heritage. Woodlands provide a range of 'benefits': they are home to a variety of flora and fauna, they store water and carbon, and provide a space for recreation and relaxation. The way a forest or woodland is managed and used affects the benefits from a forest. An area managed for timber production, for example, might create direct benefits such as timber and employment opportunities. Other benefits from that same woodland could include providing a place for recreation and for mental restoration, as well as providing natural flood management through preventing water run-off.

People have different understandings and viewpoints about the range of benefits a woodland can offer, and some people might prefer one type of benefit over another. To understand how people perceive the benefits from different woodland management systems, researchers from The James Hutton Institute are conducting research in three different parts of Scotland: in the Central Belt (North Lanarkshire), on the west coast (Argyll), and in the Highlands (Lochaber).

Loch Arkaig Pine Forest

This report presents the results of a research workshop about Loch Arkaig Pine Forest. A further workshop report is available regarding

workshop discussions relating to the Tom an Eireannaich woodland, near the community of Clunes, which is also part of the wider Loch Arkaig Pine Forest area. The Loch Arkaig Pine Forest consists of two separate woodland areas known as Glenmallie and the Gusach, an area covering over 1000ha of the south side of Loch Arkaig, near the small communities of Clunes, Achnacarry and Burnarkaig in Lochaber. The areas of Loch Arkaig Pine Forest included in this workshop were transferred to joint ownership of Woodland Trust Scotland and Arkaig Community Forest (ACF) in 2016 through the Community Asset Transfer Scheme. Both organisations work closely to manage the woodland under an agreement overseen by a joint Advisory Board. The Woodland Trust is the majority landowner, with ACF owning approx. 53ha.

Consulting local experts

To explore different perspectives about woodland management, and about the impacts of management interventions on the perceived benefits from forests, we adopted a research method called *scenario workshops*. This method presents a range of management scenarios for the woodland, which then form the basis of in-depth discussions with a small group of people with knowledge and expertise about the woodland and the surrounding area.



Scenario development

Researchers developed narratives depicting six management approaches for discussion (appendix 1), building on documents such as management plans, site surveys, and future climate predictions, and with input from colleagues at the Woodland Trust and ACF. One of the scenarios was based on the past management of the site **The Past: 1980s/1990s**, one on the site's present condition **The Present: 2021** and then four hypothetical future scenarios set in 2035. These future scenarios focus on imagined management interventions and practices: **Restoration and Revival**, broadly based on the continued implementation of the current management plan **A Diverse Hotspot** with a strong emphasis on biodiversity conservation iii) **People's Forest**, giving prominence to community engagement activities and **Natural Growth**, a scenario based on reduced budgets and resources, where only minimal management interventions are possible.

Local expert panel methodology

Eight local participants attended an introductory online session in July 2021, followed by an interactive online workshop in August 2021. Participants came from a range of backgrounds and professions, and each with knowledge and interest in Loch Arkaig Pine Forest. Participants included locally based forestry and land use experts, people engaged in community forest management and outdoor education and activity leaders.

Due to restrictions caused by the Covid-19 pandemic, the workshops were hosted online via CiscoWebex, and using an interactive whiteboard

(Miro). Participants received a workshop pack a week before the workshops which contained the six scenarios (appendix 1) and scoring worksheets. Prior to the online workshop, participants were asked to individually score how well they thought each scenario performed against eleven different woodland benefits (ecosystem service indicators) on a scale of 1-10, where 1 is low and 10 is high. Full details of the eleven indicators are listed in appendix 2.

The scores given by participants in relation

“you’ve really got to be thinking sustainability, carbon sequestration, flood control, all of these things at once... it’s not easy.”

to each indicator, and for each of the scenarios, were collated prior to the workshop and entered onto the virtual whiteboard. During the interactive workshop, participants' scores formed the basis of facilitated discussions to explore patterns and differences across the scenarios, and to identify the reasons behind participants' choices. Following these discussions, participants were given an opportunity to revise any individual indicator scores if they wished. Finally, workshop participants were invited to identify their preferred future management scenario, and to outline what their ideal future management approach would look like, explaining the reasons for their choice.

After the workshop, the researchers analysed the scores given for each of the woodland benefits across the scenarios. Comments made by participants about the rationale for their scores and discussions during the workshop were also analysed, to gather additional insight about their perspectives of management interventions and impacts on benefits from the woodlands.

Ecosystem benefits across the scenarios: results from the scoring exercise

The median values for each of the eleven ecosystem service indicators, assessed for each scenario, are illustrated in table 1. These values indicate that participants felt that **Restoration and Revival**, **A Diverse Hotspot** and **People's Forest** performed well across the indicators as whole. **Restoration and Revival** scored strongly against all the indicators, while **A Diverse Hotspot** performed strongly in indicators such as 'Natural Flood Management', 'oppression of species such as bramble and rhododendron' ('Target species B'), 'Carbon Storage' and 'Landscape Quality', but poorly for 'Timber





Extraction'. The almost exclusive focus on biodiversity conservation in **A Diverse Hotspot** meant that participants also scored it lowly for employment and learning opportunities, with criticism of the sense that the learning opportunities outlined in the scenario were for university-level education and research only and thus quite exclusive.

The lowest scoring scenarios were **The Past**

and **Natural Growth** (the low resource scenario), which performed poorly across the board, although with a recognition that there was some previous timber extraction from the woodland, and the forest structure would have created some natural flood management.

Table 1: Median scores given to each indicator for each scenario (1 is low; 10 is high). The 'median of medians' indicates the preferred scenario overall based on participant scores. See Appendix 2 for a full description of the ecosystem service indicators.

	The Past	The Present	Restoration & Revival	A Diverse Hotspot	People's Forest	Natural Growth
Employment & Income	5	6	7.5	5	9	2.5
Target Species A	4.5	6.5	8	8	6.5	4
Target Species B	2.5	7	8	9	7	1
Timber Extraction	6	7	6	1.5	8	1
Carbon Stored	5	5.5	8	9	6	2
Mental Restoration	2.5	6	8.5	7	6.5	3.5
Spirituality	3	5.5	8.5	7	7	3
Learning & Skills	2.5	6	8	5.5	8.5	2
Landscape Quality	4	5.5	9	9	7	3
Place Attachment	3	6.5	9	6.5	7.5	3
Natural Flood Management	5.5	6	8.5	8.5	7	2
Median of Medians	4	6	8	7	7	2.5



Scoring the scenarios

Figure 1 on pp 6–7 shows a summary of the scores given by participants for each of the indicators in a boxplot format. The boxplots allow us to see variation between participant scores in more detail, helping to identify commonalities and differences in response.

Some key points to highlight:

As well as receiving the highest scores overall, there was a lot of agreement between participants in the beneficial aspects of the **Restoration and Revival** scenario. The one exception to this consensus was about whether the scenario provided employment and income opportunities, with one participant commenting that there was too much emphasis on the use of volunteers rather than job creation.

The **People's Forest** scenario was also scored highly by most participants for most indicators, although views were more mixed about whether this scenario was successful in reducing invasive species such as rhododendron.

The **Diverse Hotspot** scored fairly strongly across the board, although received relatively low scores for 'Timber extraction', and 'Employment and skills', and with participants expressing mixed views about how well learning and educational opportunities would be created.

While participants considered that **Natural Growth** and **The Past** scenarios performed poorly for most indicators, there was quite a lot of variation in scores given to indicators such as 'Mental restoration', 'Spirituality' and 'Place attachment' with some participants emphasising that even a woodland with little active management can provide important opportunities for people to connect with nature.

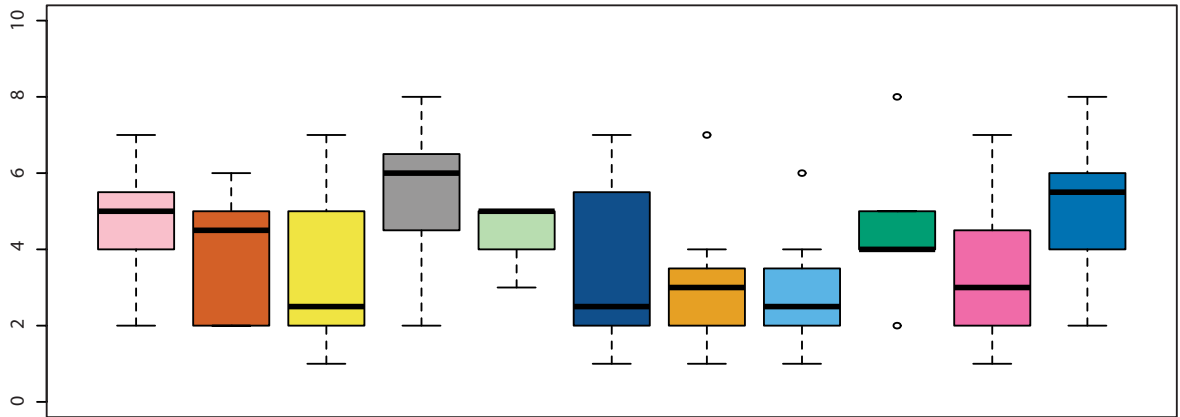
“it's important that everybody can gain access and just be there. [It's] not all about teaching and building centres and universities, but just be there.”

Figure 1: Boxplots summarising the scores for each ecosystem benefit across the six scenarios. The horizontal line in the middle of each box is the median, or middle, score. The top line of the box represents the 75th percentile (upper quartile) and the bottom line the 25th percentile (lower quartile). The lines emerging from the boxes represent the maximum and minimum scores given by participants. Points outside the lines are 'outliers' – scores that are numerically distant from the rest of the data. See Appendix 2 for a full description of the indicators.

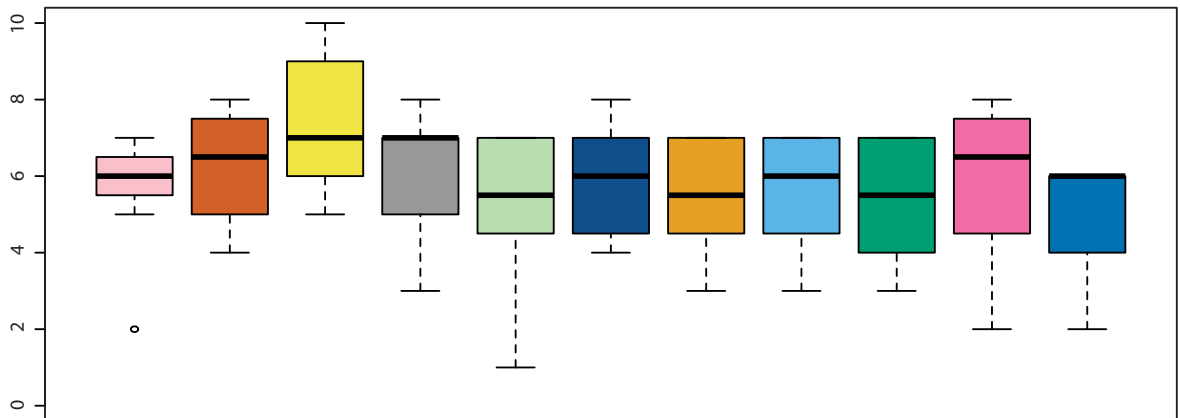
Legend

- | | | |
|--------------------------------|-----------------------------------|---|
| Employment and Income | Target Species A – Spring Flowers | Target Species B – brambles, bracken and rhododendron |
| Timber Extraction | Carbon Stored | Mental Restoration |
| Learning, Knowledge and Skills | Landscape Quality and Character | Spirituality |
| | | Place Attachment |
| | | Natural Flood Management |

The Past



The Present



Restoration Revival

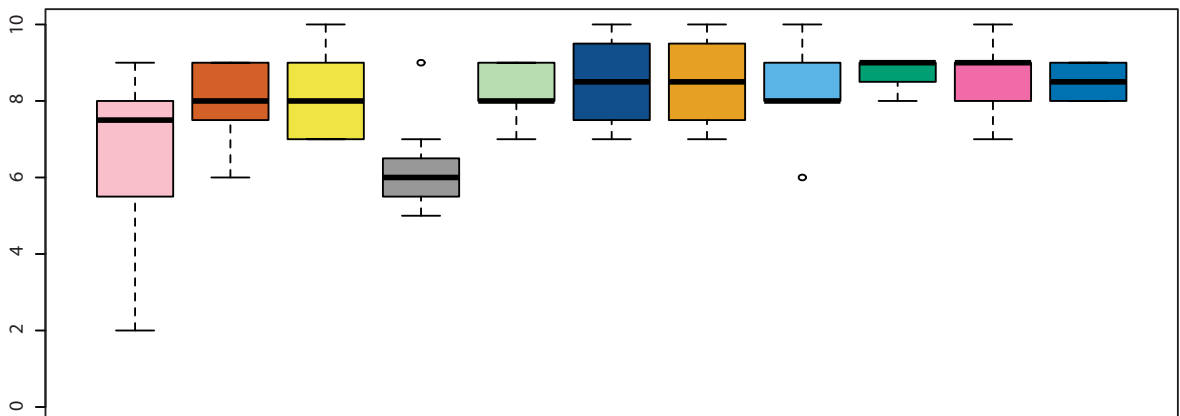
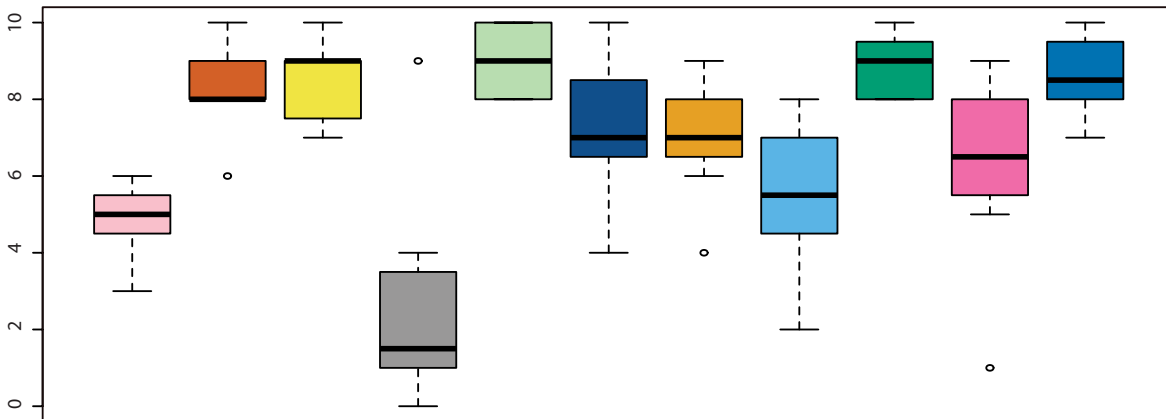


Figure 1. Continued.

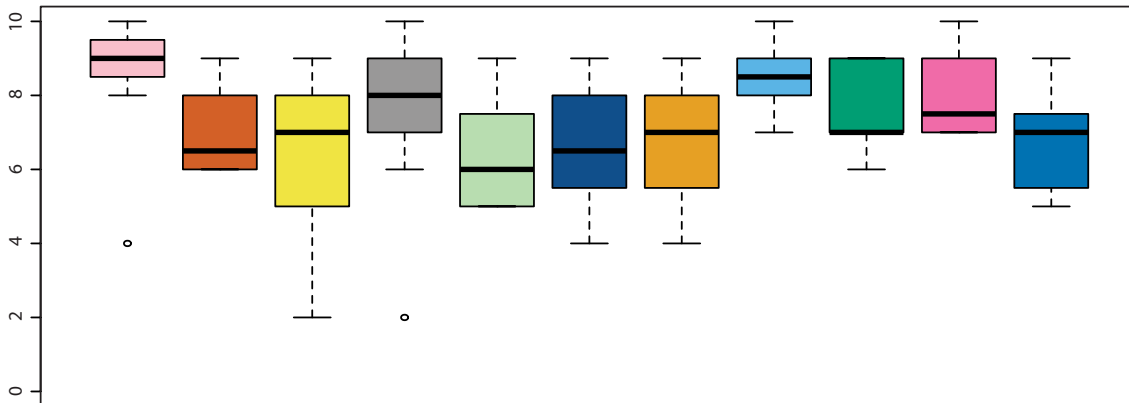
Legend

- Employment and Income
- Target Species A – Spring Flowers
- Target Species B – brambles, bracken and rhododendron
- Timber Extraction
- Carbon Stored
- Mental Restoration
- Spirituality
- Learning, Knowledge and Skills
- Landscape Quality and Character
- Place Attachment
- Natural Flood Management

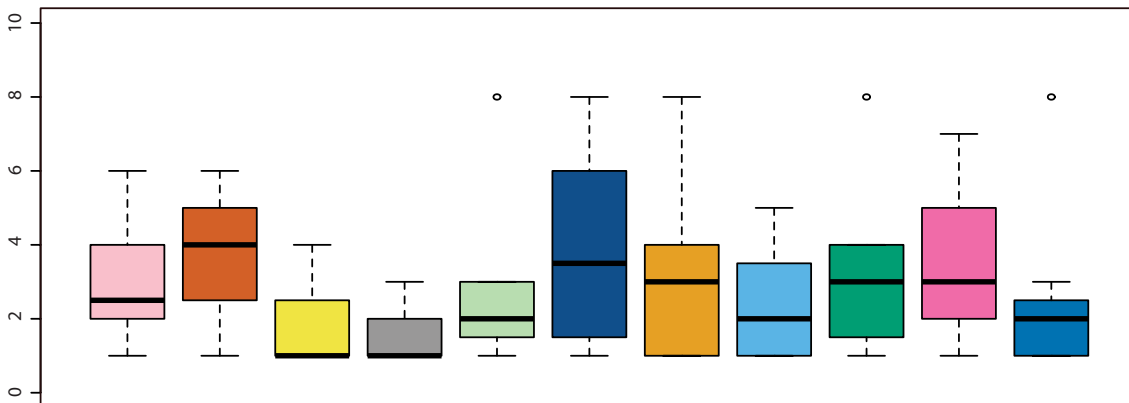
A Diverse Hotspot



People's Forest



Natural Growth



Key discussion points from group deliberation

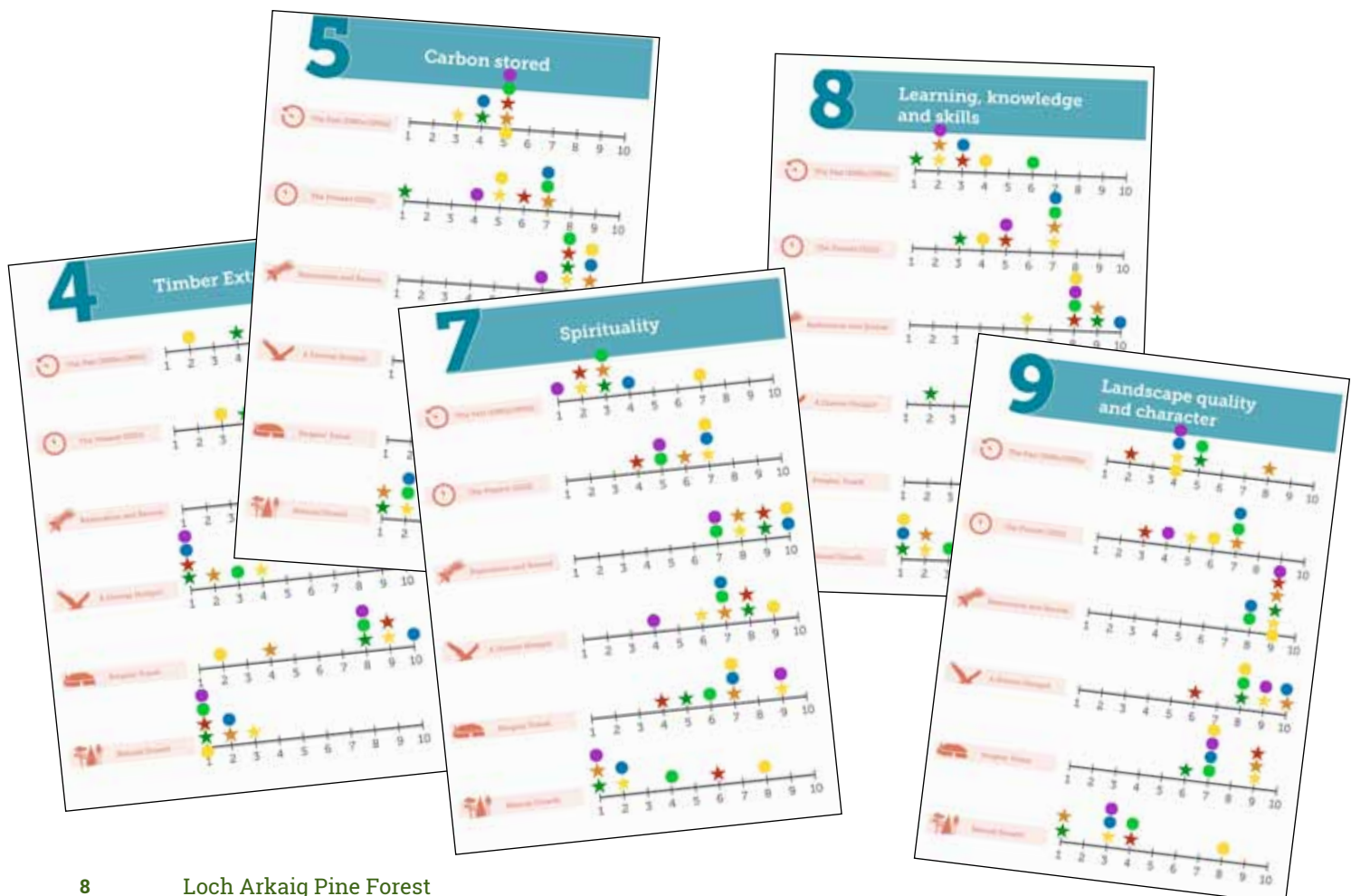
Increasing access and public engagement

Participants placed a lot of emphasis on the importance of creating opportunities for increasing public access to the woodlands. Participants were keen to support management interventions that would make the forest “*more open for all, and more available for a variety of people to access*”, while also being sensitive to fears about the impacts of potential over-tourism on the community, or risks to disturbing the sense of peace and quiet, and of the woodland as a place people can go to relax.

- The biodiversity benefits of **A Diverse Hotspot** were welcomed, although participants questioned the perceived exclusive focus on academic-level research and education represented in the scenario, preferring a more inclusive approach which would ensure a wider range of people can access the woodland.
- Participants were keen to enhance access and learning opportunities both directly and indirectly, emphasising how these issues are interrelated. Concerns were expressed about the reduced access options presented in the **Natural Growth** scenario that would result in

few learning opportunities because of there being “*no encouragement to get involved,*” and less opportunity for people to engage with the woodland overall.

- Discussion also focused on the distinctions between formal and informal learning opportunities, and the opportunities to create formal learning opportunities through engagement activities and connections with schools, while also emphasising that, as one participant said “*it’s important that everybody can gain access and just be there. [It’s] Not all about teaching and building centres and universities, but just be there.*”
- ‘Mental restoration’ and ‘Spirituality’ were considered quite personal experiences that could be fostered by engagement in the woodlands, but also hard to measure, thus resulting in some different viewpoints. Discussion of spirituality included aspects such as forest bathing, seeing “*inspiring things*”, a “*retreat for personal space*” and a place where people are going to feel “*they can just get some peace and quiet and space in somewhere green.*” One participant added “*the more natural it would seem to me to be, the more value it would have as a place that might engender spirituality.*” Others emphasised how the ability to gain a sense of spirituality and



mental wellbeing from being in the woodlands is connected to issue of access, giving lower scores in the scenarios where access was limited.

- The necessity of trade-offs in woodland management was recognised in discussion of management preferences and access. One participant highlighted the biodiversity benefits of increasing osprey numbers in the **Diverse Hotspot** scenario, and the tensions of subsequent access restrictions required to protect the ospreys; another participant felt the situation could be managed sensitively, and that the conservation benefit outweighed the access needs, given the size of the woodland area under discussion. Another example discussed was a desire from some people to increase the access and opportunities to enjoy the woodland opportunities and provide income to support jobs and forest management activities, while also recognising those in the community who value the peace and quiet and are hesitant about the impact of more visitors.

Interconnectedness

Participants emphasised how Loch Arkaig Pine Forest is both directly connected to neighbouring woodlands and, beyond that, is part of the wider mosaic of land and woodland across Lochaber and the rest of Scotland. Indeed, one participant highlighted how the sense that the Loch Arkaig Pine Forest is part of a journey rather than a destination in and of itself was something that contributed to its uniqueness.

This sense of connection did influence reflections about what woodland management interventions might be desirable or not. As one participant commented: *"It's part of a much bigger picture of what's going to happen everywhere else because there might be different areas which are obviously better for different things... it might be Loch Arkaig [is best] to be a 'Diverse Hotspot' but maybe not. Maybe it is much better as a 'People's Forest' and somewhere else would be better suited to be 'A Diverse Hotspot.'"* Discussion also highlighted how changes in management might have benefits in one area, but such changes needed to be reflected elsewhere on a national level, and raising the importance of understanding future land management across the wider local area when considering management decisions at Loch Arkaig as well.

The differences in accessibility between the two main forest blocks were also discussed, with participants indicating that the lack of access to the western area, The Gusach (which is currently only accessible by boat), meant that

"It's part of a much bigger picture of what's going to happen everywhere else because there might be different areas which are obviously better for different things..."

a sense of a *"wild feel"* about the forest could be maintained in some areas, while increasing opportunities for access elsewhere. The diversity of the Loch Arkaig Pine Forest area was also felt to be a strength, with the woodland being large enough with sufficient space for creating new paths, increasing access, and actively managing the forest in some areas while leaving *"plenty of room for having pure, natural reserve areas"* as well.

Balancing economic sustainability with other community benefits

A concern for most participants was how to ensure that the woodland could be economically sustainable, in a way that creates income to support rangers and forest officers necessary to engage in active management, and reduces the need for constantly fundraising for grants. Sustainability concerns also included recognition of the challenges of trying to manage the forest for multiple benefits. As one participant commented: *"you've really got to be thinking sustainability, carbon sequestration, flood control, all of these things at once... it's not easy."*

Some participants wanted to encourage engagement and income opportunities as part of *"some sort of dynamic, active community with lots of things going on"* while others spoke of creating and maintaining momentum for engagement and economic activity that would provide sufficient resources to support sustainable forest management that benefits nature and communities.

The role of the local community when considering the wider benefits of the forest was important: participants emphasised the importance of a sense of community, and connection with place in developing a sense of care for the woodland that would ultimately help it be managed sustainably: *"I think the main thing for me is that the people who are involved in the forest are part of it. So they're working in it, and if you're working there, you're going to become stewards of it and care for it and look after it..."*. Yet while it was felt that the sustainability of the forest could be enhanced by creating opportunities to attract visitors, participants also expressed concern about the potential negative impacts of over-tourism on the local community.

In talking about **A Diverse Hotspot**, one participant commented *"You need some income to maintain it, but it is nice to keep it natural as well..."* while another expressed the tensions between economic opportunity, and a sense of what creates a sense of attachment to place for the local community *"some people are quite nervous... because they like living in a quiet place without many people being here..."* Another participant wanted to avoid the situation whereby the forest becomes a busy attraction which is harmed by too many visitors: *"Tourists might bring money in, but... it can have a very negative impact, especially when you're talking about access roads and all the rest..."*

Preferred management interventions

Participants highlighted positive aspects of the **Diverse Hotspot** scenario in terms of promoting biodiversity but were keen to enhance opportunities within the woodlands for public engagement and education and increase the numbers of people able to visit and experience the benefits of being in the forest. The high scores given by participants to the **Restoration and Revival** scenario were reiterated in group discussions, with an emphasis on enabling people to gain access to the woodlands, with or without additional facilities or organised educational activities. As one participant commented *"it's important that everybody can gain access and just be there. Not all about teaching and building centres and universities, but just be there."*

While participants did not score the **People's Forest** scenario as highly across the board as **Restoration and Revival**, comments made during the workshop pointed to a high level of support for increasing public engagement – but avoiding the 'busy-ness' of the **People's Forest** scenario. The desire for greater public access and engagement was considered an opportunity for creating sustainable income sources to maintain

the forest and support the local community. Participants also discussed the challenges of avoiding over-tourism in an area where communities – and visitors - have a strong sense of place that is linked with its rural location.

Participants therefore took aspects from each of the **Diverse Hotspot, Restoration and Revival**, and **People's Forest** scenarios to create a vision of woodland management that leads to a healthy and biodiverse forest supported through community-led engagement that creates opportunities for access by a diverse range of people. Support was expressed for management interventions that protect sensitive species while increasing access and engagement opportunities, with a pro-active management style that also creates economic and employment opportunities for the local community.

Next steps

This workshop report is the fifth of six reports by researchers at The James Hutton Institute investigating people's perceptions of management interventions in woodlands around Scotland. The sixth report in this series relates to a workshop discussing the nearby Clunes oak woodland, which forms part of the broader Loch Arkaig Pine Forest.

We have now concluded six local expert panel workshops across Scotland. We are currently undertaking a cross-site analysis of the data to gain an in-depth overview on how different types of management interventions impact woodland goods, services, and benefits from a range of perspectives.

The other five workshop reports in this series can be found by clicking these hyper-links::

[Glen Creran Woods, Argyll](#)

[Glasdrum National Nature Reserve, Argyll](#)

[Forest Wood, Cumbernauld](#)

[Cumbernauld Glen, Cumbernauld](#)

[Clunes Oak woodland, Lochaber](#)

Loch Arkaig Pine Forest

Site description

The Loch Arkaig Pine Forest consists of two separate woodland areas known as Glenmallie and the Gusach. The forest area covers over 1000ha of the south side of Loch Arkaig, near the small communities of Clunes, Achnacarry and Burnarkaig in Lochaber. Loch Arkaig Pine Forest was acquired by the Woodland Trust and Arkaig Community Forest (ACF) in December 2016. The Woodland Trust is the majority landowner, while ACF owns roughly 53 ha, and both organisations work closely together to manage the woodland.

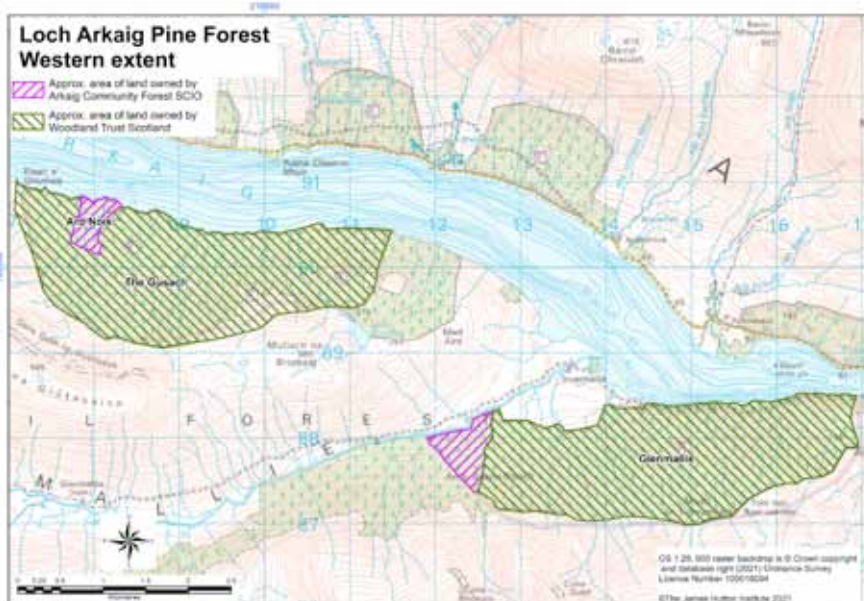
The Loch Arkaig Pine Forest is one of the 35 native pinewood sites first identified in Steven & Carlisle's 1959 book "The Native Pinewoods of Scotland" and comprises 4 of the updated total of 84 Caledonian Pinewood Inventory sites in Scotland. The forest has been described as a good example of semi-natural Caledonian pinewood (Forestry Commission Scotland, 2018) and is comprised of remnant stands of mature Scots pine, upland birchwood, and wet woodland. An estimate of around 100 hectares of the forest is considered relatively undisturbed 'Ancient Semi-natural Woodland' dominated by downy birch along with oak, ash, hazel, rowan, alder, bird cherry, holly, Scots pine and willow. There are large amounts of standing deadwood in Glenmallie and approx. 400ha of mature Sitka spruce and Lodgepole pine remain, having been planted as non-native conifers in the 1970s (Plantations on Ancient Woodland Sites (PAWS)), despite significant woodland restoration undertaken by Forestry Commission Scotland in the 1990s. The soils are mainly peats, peaty podzols, and peaty gleys, with some rocky

outcrops covered with thin mineral soils, with associated ground-flora including heather, blaeberry, crowberry, and woodland flowers.

The forest is home to charismatic fauna such as osprey, otter, pine marten, red deer, and black grouse, as well as populations of wood ants, chequered skipper butterflies, Northern Emerald dragonflies, and birds such as the crested tit and Scottish crossbill. Despite these important habitats, the woodland does not hold any conservation designations.

Although there are no marked footpaths, the Glenmallie woodland is publicly accessible, with a small car park operated by Forestry and Land Scotland at the nearby Chia-Aig falls. Beyond this point, vehicle access to Glenmallie is limited to off-road vehicles. The most remote part of the Loch Arkaig Pine Forest, the Gusach, has no road access, and no formal footpath, and is best accessed by boat across Loch Arkaig. The remains of some 18th century stone buildings are found in the Ard Nois block at the remote western end of the Gusach, although little is known about the historical or cultural significance of the settlement.

With a history of common grazings for local communities, the woodland has a long history of human involvement. It is intricately linked with Scottish history, with Bonnie Prince Charlie said to have hidden in the forest after defeat at the Battle of Culloden in 1745. From 1942-1946, the woodland was home to a commando training centre (based at Achnacarry House), and suffered a large fire in 1942, which severely damaged much of the forest.



The Past (1980s/1990s)

Loch Arkaig Pine Forest (Glenmallie, and the Gusach further west along the southern loch shore) is owned by the Forestry Commission and managed primarily for timber. Both forest blocks contain compartments of Sitka spruce, Lodgepole pine (which constitutes a significant proportion of the Gusach), and larch that were planted in the 1960s and 1970s, and trees on the better ground are maturing well following active management and thinning in the 1980s. Both Glenmallie and the Gusach are surrounded by fencing to prevent deer from entering and browsing younger trees, and any deer found within the plantation areas are controlled.

As well as large areas of commercial plantation on ancient woodland sites (PAWS) there are remnant stands of semi-natural Scots pine, upland birch, and oak. These semi-natural elements led to the forest being included in the 1994 Caledonian Pinewood Inventory as one of only 83 such remnant sites in Scotland and they contain important bryophytes such as ostrich plume moss and tree lungwort. Restoration work in 1997 has focussed on felling non-native trees to waste in areas with mature Scots pine and other valuable semi-natural features. Subsequent fencing and deer control have resulted in plenty of birch saplings and some Scots pine regeneration in these areas, diversifying the forest structure.

Elsewhere in the woodland, the compartments of commercial non-native trees (e.g., Sitka spruce, Lodgepole pine) have been left to mature and are being harvested on a planned rotation. These stands have tended to prevent a diverse understory from developing due to shading and needle litter.

The forestry activity in the wider area supports a small community, most of whom live locally at the Clunes Forestry Commission houses, and staff are based out of the workshop and office there.

Glenmallie doesn't receive many visitors, and the remote location of the Gusach means that there are no expectations of public access. The small number of visitors use the small car park at the Chia-Aig falls just east of Loch Arkaig and walk across the White Bridge to the southern shore, and sometimes on to the bothy at Invermallie. Few continue onwards to the Gusach because of the difficult ground, and this forest tends only to be accessed for management purposes.

The Present (2021)

Following the recent purchase of the two forest areas by the Woodland Trust and Arkaig Community Forest, work is now well underway to jointly manage the woodland, investing in ecological restoration under an agreement overseen by an Advisory Board.





Site boundary deer fences are being repaired and fences can be seen that have been erected to exclude deer from regeneration areas. Unproductive Sitka spruce on higher slopes is currently being felled “to waste” while extraction of mature timber is planned for the remainder of the site, which might otherwise become windthrown. Scots pine in these stands are being left as seed trees, and significant amounts of standing deadwood left as habitat. Large blocks of mainly Lodgepole pine are visible in the more remote Gusach plantation, with little birch regeneration. Concerted rhododendron control in Glenmallie means that most of this non-native species has recently been removed.

In the summer of 2020, funding was obtained to support and improve habitat connectivity across the area and restore native woodland edge, which is an important habitat for species such as black grouse, chequered skipper butterfly, dragonflies, lichens, otters, and bats. Wild boar have recently been spotted along with signs of their foraging around the base of trees. This behaviour can help plants and trees to establish, although there is some concern about causing damage to roots, so some informal monitoring is planned.

An osprey pair has nested at the site for the past few years, and the Woodland Trust have worked with Arkaig Community Forest to set up a live ‘osprey cam’ with external funding. The pair produced successfully fledged chicks in 2017 and 2019 attracting approximately 40,000 unique views, while in summer 2020, over 200,000 viewers watched the returning pair successfully fledge three young birds. The osprey cam is raising awareness and interest by the national media. The Covid pandemic and associated UK-based tourism has brought a lot of visitors to the Lochaber area during the summer and autumn of 2020, although the remoteness of Glenmallie the Gusach, and the lack of waymarked paths, means that not many made their way to the forests. However, the Woodland Trust has upgraded the small forest road without damaging mature native trees nearby, to improve access for forest management needs while still limiting the size & type of vehicles able to access the site. The Woodland Trust is communicating with the community around the timing of operations and the rationale for the management to mitigate any concerns about the impact of clear-felling.

Future scenario 1 (2035)

Targeted planting and regeneration over the past 15 years to restore this ancient Caledonian pinewood remnant has resulted in a mosaic of different habitats including large patches of established native saplings and young trees, pockets of veteran birch intermingled with veteran Scots pines, open ground, and the lower slopes along the loch shore supporting oak, birch, willow, alder, and holly. Adding to the diverse landscape is a total of 200ha of restored peatland (drains blocked and ground reprofiled) across both Glenmallie and the Gusach which was previously commercial, non-native, forestry. Due to the large non-native tree seed source, non-native saplings continue to establish and require regular removal every five years or so, which involves local conservation volunteers known as the Woodland Working Group. Beech trees are being removed and remaining invasive species (*Rhododendron ponticum* and *Gaultheria (Gaultheria shallon)*) are also monitored and managed.

The deer fence surrounding the woodland is maintained, and deer management carried out on ACF and Woodland Trust land to keep browsing pressure low and enable native regeneration. A proportion of the older ‘granny’ pines are dead or dying, but still standing with loose bark and broken limbs, creating valuable deadwood habitat for invertebrates and lichens. Alongside the considerable regeneration of birch, Scots pine, and some oak, the wood ant population is beginning to recover, assisted by a successful translocation programme.

Following consultation, a network of low impact paths has improved public access and a log roundhouse has been built by the shore at Glenmallie to provide a venue for outdoor learning and engagement activities. The bothy at Glenmallie is maintained by volunteers and used by walkers on the long-distance wilderness trail to Inverie in Knoydart. Most 12-13 year-old students in the area participate in a 3-day ‘wilderness expedition’ each year, and senior geography and history students from across Lochaber come on field trips to see the restored native woodland and historic cultural sites. These are led by volunteers from the community in conjunction with Highland Council’s outdoor education team.

The ACF and the Woodland Trust have also worked in partnership to create opportunities for local businesses and community members, including restoration work, stalking, and marketing of venison, and firewood and charcoal production from community woodlots. Although still relatively low compared to the wider Lochaber area, an increasing number of visitors

are keen to catch a glimpse of the raptors (ospreys, white-tailed eagles, and golden eagles) that nest in the woodland. Opportunities to manage and capitalise on this increased level of tourism are being considered. The wild boar population has grown, and debate continues as to whether they are friend or foe – they do cause disturbance but can also help with natural tree regeneration.

A Diverse Hotspot

Future scenario 2 (2035)

Following a lot of work to prevent non-native trees establishing and to exclude deer, restoration is visibly progressing towards semi-natural forest with a mosaic of habitat types and associated structural diversity. While commercial forest management has long ceased, some management interventions, including deer fence maintenance, continue. Such fencing will be less necessary soon, as natural processes take over. The actions taken to support the regeneration of the native woodland are seen as a beacon of success for conservation in Scotland.

Linked to this success, landscape-scale collaborative management activities with neighbouring estates are under discussion to further increase native woodland cover, assisted by mature seed trees in Gusach and Glenmallie. Over 150 hectares of peatland outwith the forest has been restored over the past fifteen years, with drain-blocking and removal of non-native conifers funded by Peatland Action. The peatland restoration provides many benefits including capturing and storing carbon. Visible progress continues to be made, contributing to a Scotland-wide push to enhance biodiversity and to help meet Scotland's climate change commitments. The mosaic of semi-natural habitats has helped with the establishment of a new black grouse lek, even though goshawk also breed in an old stand near the loch shore. Significant effort in the 2020s has seen *Rhododendron ponticum* and *Gaultheria shallon* all but been eradicated, although it is an ongoing process to monitor the woodland and spot signs of regrowth.

The wild boar first seen in the forests in the 2010s are now well-established and are considered to benefit the natural regrowth of the forest, as their disruption to the soil enables flower and tree seedlings to take hold. The translocation of woodland ant colonies from other woodlands has been successful, helped by the distribution of queen ants throughout the 1000ha site. The ants' nest mounds are now a frequent sight on the forest floor. After a period of consultation under new legislation governing reintroductions, a low-key, monitored, release of a pair of lynx to

the Gusach in 2032 has been successful. So far, they have been found to prey predominantly on roe deer within or close to wooded areas and are currently raising their first litter.

While locals enjoy the forest, access is not actively encouraged to protect biodiversity. Indeed, there are no parking or camping facilities, and engagement in relation to the wildlife is restricted to researchers and limited access for educational purposes, such as student field trips.

People's Forest

Future scenario 3 (2035)

Sitka spruce, larch, and Lodgepole pine have been retained on more accessible and productive ground, and selective felling has created structurally diverse, multi-aged, compartments. Remote operations are carried out by boat via Loch Arkaig, and on the upgraded forest access road. With timber values being high, thinning is economical. As mature stands are felled, the forest provides resources that are actively managed by local social enterprises, including a community firewood business, fencing, and value-added timber.

Alongside work to retain the remnant semi-natural pinewoods, funding has been awarded to establish an outdoor education facility near the Glenmallie access road, which has been popular with schools and universities across Scotland and beyond. An additional wilderness ecotourism experience has been created in Ard Nois, towards the western edge of the Gusach, where the existing buildings have been restored and are used by universities and colleges, including a UHI 'Cultural History' course. The facilities are popular with artists and musicians attending three-month long 'wilderness residencies' developed by ACF. The Woodland Trust now employs two additional staff, a ranger, and an education specialist, who work to support outdoor education and volunteering activity on site, and develop activities for visitors, schools, universities, and volunteers.

The osprey-cam that was first set up in the 2010s is increasingly popular, attracting hundreds of thousands of viewers each year. A new, young osprey pair have now had two successful nesting years, after the previous pair were last seen in 2032. The setup now provides a virtual reality experience where viewers can situate themselves just centimetres away from the osprey nest and are provided with automated interpretation about the birds' diet and activities. This success provides an income stream from advertisers. Links to interactive VR-hubs run by the Woodland Trust has also generated income from

subscriptions and donations, which is reinvested in additional restoration work and educational activities in the local area.

Scotland's bustling eco-tourism industry has inspired a community-owned tourist boat service which offers short trips around the loch. The boat service enables visitors to access the remote woodland to the west where artists have created a sculpture trail inspired by local stories and historical events. While some people feel that wildfowl and the osprey are being disturbed by increased visitor numbers, no impact studies have yet taken place and existing mitigation, via limits on activities at certain times, is deemed sufficient.

The existing forest road was upgraded to enable better vehicular access for forest management. Additional footpaths and mountain-bike trails established in the 2020s increased accessibility into the wood at Glenmallie and have recently been extended right through to the Gusach. These paths have been zoned to leave some areas relatively undisturbed for wildlife. Seasonal grazing with cattle was reintroduced in 2025 as part of a wider management plan help re-establish the cultural value of the woodlands as a 'forest commons' area, and this has helped diversify the forest. Deer numbers continue to be actively managed, allowing more young trees to establish, and the community feels that there is a good balance between healthy forest habitat and cultural and recreational opportunities.



Natural Growth

Future scenario 4 (2035)

Glenmallie and the Gusach forests are a patchwork of ancient semi-natural woodland remnants among areas of clear-felled commercial blocks, which were harvested or felled-to-waste under previous management. Due to the economic downturn and subsequent fall in income in the mid-2020s that followed the Covid pandemic, work to remove the final compartments of non-native conifers was abandoned, leaving some stands of overmature Sitka spruce and Lodgepole pine in each forest. There are neither funds nor volunteers available to remove the non-native saplings that are self-seeding into adjacent clear-fell areas, merging with the birch and pine regeneration that established after intensive deer control in the early 2020s. In parts of the cleared forest, erosion and land slips have meant that some soil has been lost downhill and to the loch, particularly during heavy rain, and initial efforts to restore areas of deeper peat were abandoned due to funding cuts. This means that large areas, particularly in the Gusach, are still drained and

continue to dry out and erode, forming large peat hags and erosion gullies. This all contributes to carbon being lost, rather than accumulated through the growth of healthy peat.

A small number of the remaining Lodgepole pine trees in an isolated patch of the Gusach are being impacted by *Dothistroma* needle blight. There is no evidence that neighbouring stands of mixed-age Scots pine have been infected, but the situation is being monitored when resources allow. Due to the lack of active management, Rhododendron is quickly spreading west through Glenmallie.

A lack of fence maintenance over recent years has allowed more deer to enter the woodland, and neighbouring estates continue to generate income from stalking, meaning that overall deer numbers were initially high. The resulting increased browsing pressure is preventing regeneration and leading to open areas now turning to acid grassland and heather. More recently however, increased demand for domestic meat means that venison from hind culls is now a high value food commodity and the local community has responded by running a larder and butchery at the Glenmallie road end. The wild boar population has also significantly increased, creating opportunity for culling for meat to sell. The wild boar have rooted out large swathes of bracken and rank heather, leading to some pulses of tree and understory regeneration.

Visitor numbers exploring the woodlands have reduced, as many of the paths created in the 2020s have become overgrown or blocked by uncleared windthrown trees. Wild camping continues near the loch, with a mix of local visitors and people taking a detour from travelling along the Great Glen Way. Even this small number of visitors has led to disturbance of wildlife - the ospreys have moved west up the loch to the Gusach, and signs of otter at the eastern end of the loch are less frequent. The nearby communities are in communication with the Woodland Trust about co-managing the coastal strip of woodland to create a more formal camping area, from which they would hope to generate some income.

Appendix Two - Ecosystem service indicators:

Potential benefits from Loch Arkaig Pine Forest.

These indicators are common across the different research sites in this study. Some of the indicators might be more applicable to other woodland contexts than Loch Arkaig.

	Indicator	Explanation
1	<p>Employment and Income</p> <p>Overall, how well do you think each scenario delivers with regards to employment, i.e. the number of jobs directly or indirectly linked to the site?</p>	Consider for each scenario the impact on employment for the area. Think about the impact each scenario has on the diversity of jobs available in the local area and whether these are likely to be unskilled, skilled or professional jobs.
2	<p>Target species – spring flowers</p> <p>Overall, how well do you think the scenario encourages woodland spring flowers (bluebell, wood anemone, violets etc.)?</p>	Consider for each scenario to what extent the various management interventions lead to more open, woodlands, with moderate levels of disturbance and species rich ground flora.
3	<p>Target species – brambles, bracken and rhododendron</p> <p>Overall, how well do you think the scenario suppresses species such as bramble, bracken and rhododendron?</p>	For this indicator we are interested in the impact of the scenario on species that are considered 'bad for biodiversity' as they potentially exclude others, leading to reduced species diversity. In this case, a high score indicates that these species would be kept at bay in a given scenario.
4	<p>Timber Extraction</p> <p>Overall, how do you think each scenario will affect the actual extraction of different types of wood materials (i.e. construction timber, wood fuel, wood for pulp, craft woods) from the site?</p>	This indicator refers to wood/timber materials for different uses that are extracted from the site under the different scenarios. Please consider in your answers both the availability of such materials and the extent to which it is actually taken off site.
5	<p>Carbon stored</p> <p>Overall, how do you think each scenario will affect the amount of carbon stored at the site?</p>	Please consider in your answer that all of the components of the site potentially contribute to carbon uptake and storage, e.g. trees, understory shrubs and grasses, mosses, but also the carbon in the soil itself.
6	<p>Mental restoration</p> <p>Overall, to what extent does each scenario promote people's feelings of being relaxed and restored?</p>	This indicator relates to subjective experiences that contribute to mental wellbeing. In your answer please consider how each scenario would affect users' feelings of calmness and tranquillity, stress relief and escape from daily hassles/problems, and feeling refreshed and re-energised. This includes local residents, visitors and any other people using the site.

Indicator		Explanation
7	<p>Spirituality</p> <p>Overall, how well do you think each scenario delivers on opportunities for spiritual experiences?</p>	<p>This indicator refers to how each scenario fosters a sense of encountering something sacred or bigger than oneself, and promotes a sense of wonder.</p>
8	<p>Learning, Knowledge and Skills</p> <p>Overall, how well do you think each scenario delivers on opportunities for training, education and learning?</p>	<p>Please consider the full range of potential knowledge, skills and training opportunities and all age groups – from traditional land management skills to handicrafts, to research and monitoring, to outdoor education and mountaineering skills.</p>
9	<p>Landscape quality and character</p> <p>Overall, how well do you think the scenario delivers on perceived landscape quality and character?</p>	<p>To which extent do you think people will appreciate the landscape, in terms of its visual aesthetics as well as its other features and its overall character?</p> <p>Consider how the different elements and features (natural and human made) make up the landscape in the scenario.</p>
10	<p>Place Attachment</p> <p>Overall, how well do you think each scenario supports local people/visitors in forming and/or maintaining a strong attachment to this place?</p>	<p>How might each scenario affect people's emotional connection to the site? Please consider how the changes described in the scenario would affect the emotional significance of the place for individuals, as well as extent to which users would experience feelings of belonging and being 'at home'.</p>
11	<p>Natural Flood Management</p> <p>Overall, how well do you think each scenario provides protection from flooding, e.g. through natural flood management?</p>	<p>Do any scenarios increase or decrease the risk of flooding either in the upper or lower catchment? Consider how the vegetation and soil structure in each scenario may affect the volume and speed of surface water run off or soil permeability.</p>



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