Trees for Life

The Role of Rewilding in Wildfire Prevention and Mitigation

The devastating wildfires of Spring 2023 near Kinloch Moidart[1], Cannich[2], and Daviot[3] have prompted recent discussion around how we best manage wildfire risk and mitigate their impact in the Scottish landscape, particularly in its upland environments[4].

Following the introduction of the **Wildlife Management and Muirburn (Scotland) Bill**[5] much of the focus on wildfire risk management has been on the use of muirburn to manage fuel loads and mitigate wildfire extent, especially in heather moorland. However, Trees for Life would echo, and support evidence given to the Rural Affairs and Islands Committee at stage 1 of the bill, highlighting the **crucial role healthy and resilient ecosystems play in creating wildfire resistant and resilient landscapes**.

Rewilding[6] is the most effective way of restoring Scotland's damaged and degraded landscapes to full ecological health and functioning. This means allowing our native Caledonian Forest to naturally regenerate, expand, and recover much more of our currently denuded open uplands, as well as restoring and rewetting our carbon rich bogs and peatlands. **Trees for Life supports and delivers these actions to create more fire resistant and resilient ecosystems, helping to reduce wildfire risk, extent, and severity.**

Key points

- **In Scotland moorland poses a greater fire risk than woodland**
- **More wildfires occur on moorland than in woodland**
- **Natural & restored ecosystems like wetted peatland and native woodland are more fire resistant and resilient than degraded landscapes**
- **There is little to no evidence that supports the use of muirburn as a tool to mitigate wildfire risk, extent, or severity.**
- **Muirburn should not be conflated with other fire-based techniques used to mitigate wildfire risk (e.g., controlled burning to create linear firebreaks) or manage ongoing wildfires (e.g., tactical burning, back-burning)**
- **Rewilding provides a solution to building more fire resistant and resilient landscapes**

Wildlife Management and Muirburn (Scotland) Bill Recommendations

- **Muirburn, as currently practiced, should not be licenced for the prevention or mitigation of wildfire.**
- **Licensing muirburn for wildfire prevention or mitigation should only be considered following a review of relevant fire science literature and international best practice in the use of controlled burning for wildfire prevention and mitigation e.g., creation of fire breaks.**
- **Findings from this review should be applied to create mandatory operational guidance for Scotland and licence applications for muirburn should be submitted with full fire management plans.**

Rewilding Definition

"Rewilding means enabling nature's recovery, whilst reflecting and respecting Scotland's society and heritage, to achieve more resilient and autonomous ecosystems.

Rewilding is part of a set of terms and approaches to landscape and nature management; it differs from other approaches in seeking to enable natural processes which eventually require relatively little management by humans.

As with all landscape management, rewilding should be achieved by processes that engage and ideally benefit local communities, in line with Scotland's Land Rights and Responsibilities Statement, to support a Just Transition."

- Scottish Government Proposed Rewilding definition for Scotland's Public Sector

Fire prone landscapes

- **The Scottish uplands have become more fire prone due to the dominance of vegetation like heather and purple-moor grass, a result of historical land management practices including over-burning and over-grazing[7,8].**

- **Guidance from the Fire and Rescue Service, Forestry Commission Scotland (2014), Forest Research, and elsewhere state that broadleaved and mixed woodlands are highly resilient to wildfire and present low fire risk[8,9,10].**

- **Wildfires occurred most frequently in shrubland and grassland accounting for 88% of large wildfires, increasing to 90% in Highland local authority. In comparison, combined broadleaf and conifer woodland account for only 10% of large wildfires (7% in Highland).**

- **Nearly 20% of all wildfire incidents from 2009-2020 were recorded in Highland local authority and Highland accounts for 70% of wildfire burn area for all Scottish wildfires >1 ha since 2011.**

- **In Scotland from 2011 to the present, woodland accounts for only 2% of total area burned for wildfires with a burn area > 1 ha.**

Vegetation like heather and purple moor grass dries out very easily during prolonged warm periods, and shrubs like heather and gorse contain flammable volatile compounds and become very combustible fuel sources[8]. Having very fine stems and branches, they have a high surface area to volume ratio causing them to burn quickly and intensely.
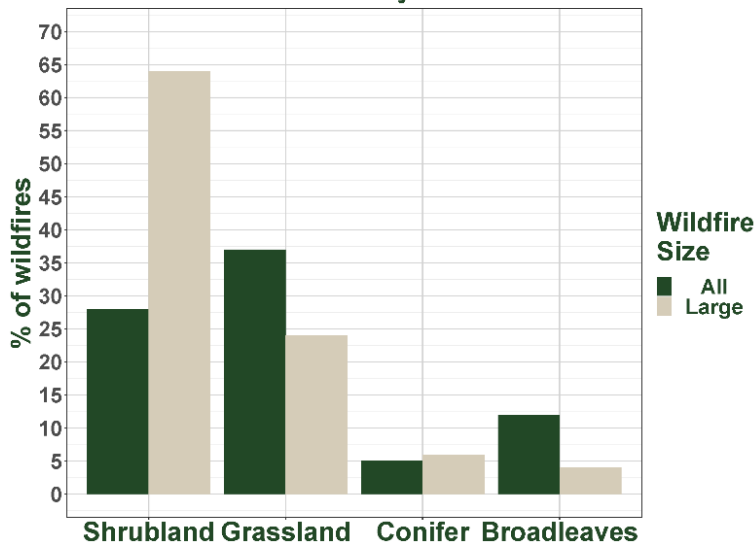
Wildfire incidents data from the Scottish Fire and Rescue Service Incident Reporting System (SFRS IRS) for the period 2009-2020 show that 28% occurred in shrubland (heather) and 37% in grassland (e.g., purple moor grass), compared with only 12% and 5% in broadleaf and conifer woodland respectively[11]. It also shows that nearly 20% of all wildfire incidents occurred in Highland local authority which is dominated by shrubland and grassland vegetation.

When large wildfires are considered, shrubland and grassland account for 64% and 24% of wildfires >1000m^2 in area, compared with broadleaves and conifers that account for only 4% and 6% large wildfires respectively.

This pattern is replicated in the Highland local authority area where shrubland and grassland account for 74% and 17% of wildfires >1000m^2 over the 2009-2020 period, compared to 7% and 4% in broadleaves and conifers respectively[11].

Additionally, nearly 20% of combined shrubland and grassland wildfires are large (>1000m^2) compared with combined broadleaf and conifer woodland where only 8% of wildfires are large in scale (Table 1.), suggesting that shrubland and grassland are more prone to more extensive wildfires.
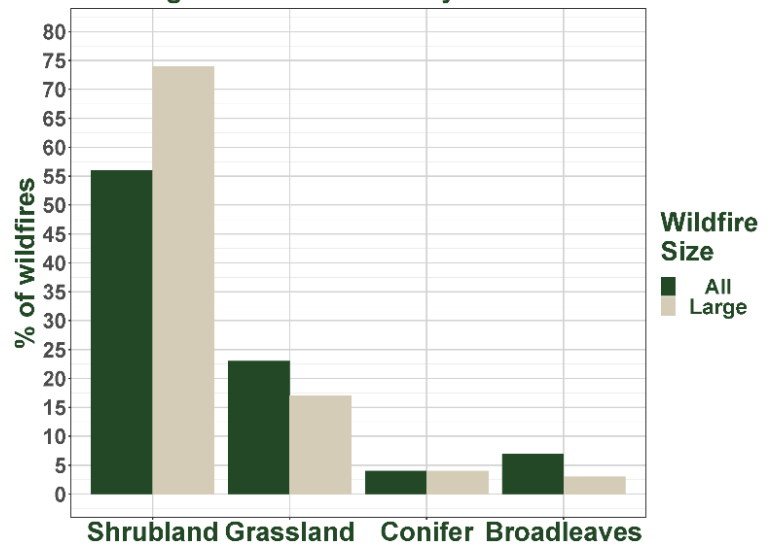
Figure 1. Wildfire statistics from SFRS IRS for all local authority areas (left) and Highland local authority area (right). Graphs display % wildfire data for all reported wildfires (green) and large wildfires (greater than 1000m² area; off-white). Shrubland (e.g., heather) and grassland (e.g., purple moor grass) combined account for nearly 4 times as many wildfires as conifer and broadleaf woodland. For large wildfires shrubland and grassland account for nearly 9 times more wildfires than broadleaf or conifer woodland. For the Highland local authority there are approximately 7 and 13 times as many wildfires and large wildfires respectively in shrubland and grassland compared with broadleaf

This is further supported by data from the European Forest Fire Information System (EFFIS). Data on wildfire burn area of wildfires with a burn area of greater than 1 hectare in Scotland from 2011 until the present shows that woodlands contribute only 2% to the total area burned. This dataset also shows that Highland local authority accounts for approximately 70% of the total area burned in Scotland since 2011, highlighting the urgent need to rewild these landscapes and restore ecosystems.

These statistics reflect guidance from Fire and Rescue Service Wildfire Operational Guidance, Forestry Commission Scotland (2014), Forest Research, and elsewhere that state broadleaf and mixed woodlands present low-risk, highly resistant and resilient habitats to wildfire[8,9,10].

20% of Scotland's land area is composed of bog and peatland, which should be incredibly resilient to wildfire, however up to 80% are degraded[12]. As a result, 35% of bog & peatland wildfires are greater than 1000m², and account for 16% of all reported *large wildfires[11]. Restoring these bogs and peatlands to their natural state by reducing artificially high numbers of deer in the landscape, reprofiling damaged areas, and blocking drains, is a key measure to building wildfire resilience in our landscapes. **These restored habitats are much wetter, making them more difficult to burn and raised water tables also result in the reduction of dominant woody surface fuels like heather.**

	All Local Authorities		Highland	
	All wildfires	**Large wildfires**	**All wildfires**	**Large wildfires**
Shrubland & Grassland	**65%** (6252)	**88%** (1170)	**79%** (1463)	**90%** (590)
Broadleaf & Conifer	**17%** (1659)	**10%** (131)	**11%** (204)	**7%** (46)

Table 1. SFRS IRS data for all wildfires and large wildfires (>1000 m²) by combined shrubland & grassland habitat, and combined broadleaf and conifer habitat for all local authorities and Highland.

Rewilded and resilient ecosystems

- **Natural regeneration and landscape-scale expansion of native woodlands is urgently needed to build wildfire resistance and resilience in our landscapes.**

- **Research has evidenced that since the end of the last ice-age bogs and peatlands were less susceptible to fire, and rewetting degraded peatlands improves fire resistance and reduces wildfire occurrence[13-17]**

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- **Restored, healthy, and functioning bog and peatland areas have recently demonstrated effective wildfire resilience and mitigation as was seen on the RSPB managed Dove Stone Nature Reserve during the 2018 Saddleworth Moor wildfire[18], and similarly in 2019 at the Forsinard Flows Nature Reserve during the flow country wildfire in Sutherland[19].**

- **Almost all UK wildfires are directly or indirectly caused by human activity, with natural ignition sources like lightning strikes extremely rare. Wildfire prevention and mitigation measures should be targeted to the highest ignition risk areas to be most effective, with a focus on nature-based solutions such as planting fire belts of low flammability broadleaf trees[8,11,20].**

Rewilding work to restore healthy, functioning bogs and peatlands has already proven to be effective against wildfires in Britain such as during the 2018 wildfire on Saddleworth moor which burned out as it reached a rewetted bog area managed by RSPB[18]. The UK's largest recorded wildfire occurred in 2019 in Sutherland's flow country, sweeping south through the landscape when it was eventually extinguished upon reaching RSPB's Forsinard Flows Nature Reserve where blanket bog has been restored[19].

Research found that restored areas and near-natural areas of blanket bog retained much more moisture ahead of the fire. This resulted in less severe burning and less vegetation loss compared with drained and degraded areas[22]. It also found that dissolved organic carbon in water samples from burned, drained, and degraded sites was significantly higher than samples from burned, near-natural sites, indicating poorer water quality from the degraded sites[23].

These examples are supported by the wider research literature. Research investigating historical wildfires over the past 10,000 years, across North America, Europe, and Patagonia, report decreased susceptibility of peatlands to burning compared with the wider landscape[16,17]. Additionally, several lines of evidence, including multispectral satellite imaging in Russian peatlands and modelling work of Canadian and northern European peatlands, support the effectiveness of restoring and rewetting degraded peatlands in reducing wildfire susceptibility and occurrence[13-15].

Caledonian Pinewoods are among our oldest and richest habitats, characterised by wild Scots pines, descended from Scotland's once-vast ancient forests, but are also made up of aspen, birch, rowan, and

willow[7]. Scotland's surviving Caledonian Pinewoods are dangerously fragmented, under threat and in poor condition. With the climate and biodiversity crises intensifying, securing healthy and resilient Caledonian Pinewoods through rewilding has never been more important. Doing so will make our future landscapes more fire resilient, a critical step given the projected increase in global wildfire weather conditions because of climate change[20,24,25].

The most effective means of expanding and restoring our Caledonian Pinewoods is through the natural regeneration of Scotland's remaining fragments. Often this will begin from a poor ecological baseline due to historical land management and transitioning to ecologically rich and fire resilient pinewoods from current heather dominated landscapes, may temporarily increase wildfire risk. These temporary, transitional risks can be well managed.

Almost all UK wildfires are caused by human activity, and ignition risk increases close to areas of high human activity, therefore targeting wildfire prevention and mitigation measures to these high-risk areas will be most effective[8,11,20]. This could include creating fire breaks adjacent to areas of high human activity e.g., near roads or popular walking areas, by strategic clearing of vegetation or planting of belts of less flammable broadleaf trees. A strategy used widely in global forestry[8] and in fire risk management at the wildland-urban interface[26].

Muirburn and wildfires

- **There is little to no evidence that supports the use of muirburn as a tool to mitigate wildfire risk, extent, or severity. Many wildfires are in fact the result of out-of-control muirburn, with figures ranging from 24-68% of all wildfires in upland areas[21].**

- **Muirburn is not equivalent to fire-based techniques used for the explicit purpose of mitigating wildfire risk or managing ongoing wildfire**

In 2022 NatureScot published a comprehensive review of literature covering environmental impacts of muirburn practice and reported there was little to no evidence supporting the view that muirburn was an important tool in mitigating wildfire risk, extent, and severity[21]. Whilst fuel load reduction is obviously a plausible mechanism to mitigate wildfire, this can apply to multiple methods, and there is poor evidence that muirburn as a practice meaningfully affects fuel load and structure to minimise the likelihood or subsequent spread of wildfire.

An important distinction should be made between muirburn, and burning practices such as prescribed or controlled burns that are used for the explicit purpose of wildfire prevention and mitigation. Where and when used, the latter are strategically designed in a manner that will actually be effective against wildfire, either through creating long, linear firebreaks, or via tactical burning to remove fuel ahead of the fire during an ongoing wildfire[20,21]. Whereas the patchwork of burning created via muirburn, the primary purpose of which is to create habitat for game birds, is unlikely to provide the most effective spatial pattern, frequency, or approach to minimise wildfire.

The same review also reports figures that suggest that the proportion of wildfires originating from managed burns ranges from 24-68% when data from the lowlands is removed. These figures would support the position in the Muirburn code published by NatureScot which states, *"Fires escaping from muirburn are a major cause of wildfire in Scotland."*. Additionally, robust evidence from the Peak district ranger reports showed that wildfires because of escaped managed burns were in the minority (24% of wildfires), they were often larger in scale, accounting for 51% of area affected by wildfire from 1976-2004[27]. Currently there is an absence of evidence investigating how widespread this damaging effect may be in other regions.

The assertion that muirburn is a necessary tool to prevent large-scale, out of control wildfires, in upland areas is unsupported. Data from Scottish National Trust properties indicate that over a period of 18 years up until 2015, only 1,463 ha of 63,316 ha (2%) were affected by wildfire[28]. No managed burning practices were implemented on these properties, demonstrating that a lack of managed burn does not result in widespread large-scale wildfire in upland environments.

Unfortunately, the current wildfire vulnerability of our landscapes and the risks associated with rewilding them to healthy, fully functioning, and resilient ecosystems is down to historical land management practices. The solutions to these problems do not lie in repeating the same mistakes that led to the current situation. These practices have successively prevented natural regeneration and restoration of our native ecosystems, instead locking them into a denuded and degraded state that present a much greater risk than restored ecosystems.

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