Information Note: Forest Planning to minimise wildfire risk in Scotland

Introduction

A wildfire is 'an uncontrolled vegetation fire which requires a decision or action regarding suppression'[1]. Wildfires can have devastating impacts for people, property, industry, infrastructure, and the environment. Wildfires in forests make up a small proportion of all incidents, and often originate outside the forest boundary, but their impacts can be disproportionately large and costly to forest owners, society and the environment.

Wildfire hazards and risks related to new and existing woodland can be reduced with good practice in forest planning. Wildfire prevention work, including good forest planning, can reduce the likelihood of wildfires occurring, small incidents escalating into large incidents, and the severity of damage and impacts if they do occur. Planning and preparation can aid fire suppression and minimise response times.

The UK Forestry Standard (UKFS) advises that managers should plan for forest resilience whilst considering the risks to the woodland, and specifically the risk from fire. Further detailed guidance is provided in Forestry Commission (2014) Practice Guide 22: [Building wildfire resilience into forest management planning](). This Information Note supports forest owners, planners, and managers in Scotland to implement this guidance in a Scottish context, to understand the wildfire risk to the forests they manage, and how to reduce this risk through good practice in forest design and planning.

Background

There are three main types of wildfires: surface fires, ground fires and crown fires. The most common is the surface fire burning surface fuels, such as heather, grass, bracken and gorse. Surface fires can burn fiercely, spread fast with long flames and at high fire intensity. Ground fires consume peat and threaten carbon stores. Smouldering peat fires are hard to extinguish and can re-kindle frequently. They are a concern in Scotland due to the large area of peat soils. Crown fires, the most dangerous type of fire, are rare in Scotland but usually occur in combination with surface fires. Trees are damaged by wildfires in three main ways: crown scorch, heating of the living cell layers near the base of the tree, and heating or burning of the roots. Fast spreading fires with long flames create the greatest hazards to people, forests, wildlife and property. Once a wildfire starts it will only stop when it either runs out of fuel or is extinguished.

The majority of forested areas in Scotland are medium-high altitude, with relatively poor soil and a surface vegetation type of grass, heather, bracken or gorse. Deep continuous surface vegetation in open areas, rides or within stands, that is dry, creates the most hazardous conditions. There can be substantial growth of these fuels as forests become established, before canopy closure, and after woods have been thinned.

Wildfire hazards are also affected by the seasonal condition of the vegetation. Dead fuel accumulates over the winter and dries out faster than live vegetation. Wildfire risk is highest during dry weather conditions especially in the late winter/spring and late summer. The highest number of wildfires occur in the late winter/spring due to the combination of dead vegetation, frosts at night, then warmer temperatures and low relative humidity during the day, that are common with high

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[1] https://forestry.gov.scot/publications/99-building-wildfire-resilience-into-forest-management-planning

pressure weather systems. Summer wildfires are driven by heatwaves and drought which dry out fuel, including soil organic layers.

Wildfire risk will increase with climate change due to higher air temperatures and lower relative humidity in spring and more frequent heatwaves and droughts in the summer. The risk of wildfire could double in a 2°C global temperature increase scenario and quadruple in a 4°C scenario[2]. The combination of higher surface fuel loads and climate change will create longer and more dangerous fire seasons in future.

Wildfire resilience measures can address potential ignitions sources, fuel load, minimise wildfire spread, protect assets, and support response. Wildfire hazards and risks should be considered when planning a new woodland, and resilience measures included in the design plan. The level of risk to existing forests should be assessed and, where possible, included in current forest management plans, although some forest design measures will need to be introduced during the restructuring phase.

Assessing Wildfire Hazards and Risks

To plan appropriate measures to reduce risk and aid response, it is important to identify values at risk, potential ignition sources, and understand how fuel load and site conditions might influence wildfire spread and impact on assets. A Wildfire Risk checklist is provided in Appendix 1.

Ignition Sources: Wildfires are a semi-natural hazard, but most are started accidentally from recreational or land management activities or deliberately. Potential ignition sources include campfires, BBQs, hot oil or particles from machinery and vehicles, or powerlines. Wildfires start more frequently in areas with high visitor numbers, near areas of socio-economic deprivation, and in areas close to public rights of way.

Fuel: Surface vegetation, surface litter, standing and fallen dead wood, organic peat soil, and canopy vegetation all act as fuel in forest wildfires. The fuel load influences fire spread and fire intensity. Ladder fuels, including tall shrubs, low tree canopies, standing trees in poor health and leaning windblown trees increase the risk of canopy fires. Fuel moisture content determines if a fire will ignite, how the fire spreads and its intensity. Fuel moisture is linked to season and weather conditions, with fine and dry vegetation burning most readily. Vegetation and tree species influence flammability, with species such as heather, grass, bracken, gorse, and young conifers all highly flammable. Mature deciduous broadleaved stand with little surface vegetation will have low flammability, while sparse stands of birch in the uplands with a more surface vegetation can be a habitat with high flammability.

Weather: Wildfires are often associated with high pressure weather systems, with higher air temperatures and lower relative humidity levels. When a wildfire occurs, it will typically spread in the direction the wind is blowing. Wind speed and direction will have a major influence on fire spread and fire intensity.

Site Topography: Site conditions influence fire behaviour. Wildfires spread faster up-hill than on flat ground or downhill. South-facing slopes are also hotter and drier than other aspects.

Land use: Land use change around a new or existing forest can influence the wildfire risk, through affecting ignition sources, fuel load, and assets. Sites should be assessed for wildfire risk when assessing suitability for woodland and neighbours should be consulted on plans. The impact that tree planting and exclusion of livestock or deer will have on site conditions and fuel load should be

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[2] www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA3-Briefing-Wildfire.pdf

considered during new woodland design and planning. Fuel load/hazard reduction to create fuel breaks should be considered.

Tree planting can lower the water table and increase the risk of ground fires on peaty soils. Restoration of afforested peatland will also impact site conditions, raising the water table and reducing the risk of damage from ground fires. However, where restoration includes felling trees to waste or leaving high volumes of brash, this will increase the fuel load.

Assets: The level of wildfire risk is influenced by who and what is vulnerable to impacts, including people, property, businesses, infrastructure, historic features, the environment, wildlife, and the trees themselves.

Response: Wildfires can spread and intensify if there is a delay in detection or response, with remote sites at greater risk of delayed detection. Limited or blocked access routes with weight restrictions and without passing places or turning circles can inhibit or delay the response of fire and rescue services. As fires often spread above the tree line, care should be taken to plan access routes to/from the open hill, with gates in deer fences in strategic locations.

Higher-Risk	Lower-Risk
Ignition Sources	
History of wildfire, wilful fire raising, or antisocial behaviour	No history of wildfire, wilful fire raising, or antisocial behaviour
High visitor numbers, recreation routes, campsites	Low visitor numbers
Fuel	
Surface fuels in young stands before canopy closure	Closed-canopy broadleaf or conifer stand
Open or thinned woodland	Closed-canopy stands
Large amounts of dry understorey or ground vegetation, especially dead vegetation after winter	Low amounts of surface vegetation
Tree health damage, die-back	Healthy trees
Tree mortality, windthrow, deadwood, or brash	Managed levels of deadwood and brash removed
High-risk (flammable) species (e.g. heather, gorse, young conifers)	Mature trees with a thick or corky bark (e.g., Scots Pine, redwoods)
Free draining soils. Organic or dry peat soils	Wetted peatland, high water table, mineral soils
Site Conditions & Land Use	
Dry climate, light, drought-prone soils	Wet climate, heavy, wet soils
Slopes, gullies, south facing slopes	Flat ground, with shaded aspect
Flammable habitats or a history of wildfire nearby	
Assets and values at risk	
Close to people, property, utilities, or infrastructure	Remote from property, utilities & infrastructure
High value ecological, historical, or business assets, including timber	No or low-value assets on site or nearby
Response	
Remote site, no on-site staff (late detection)	Owners, foresters, rangers, stalkers, or staff conducting patrols and surveillance on site (early detection) during periods of very high or extreme fire danger
Inaccessible, poor roads, low weight-limit on bridges	Good site access, good roads, hard standings
No water source nearby	Water source nearby, including helicopter dipping ponds, insurance for fire-fighting costs including helicopter response

Long term forest planning and woodland design measures to reduce wildfire risk

Wildfire resilience can be incorporated in forest management plans for existing and new woodlands as a component of sustainable forest management. This guidance is not intended to be prescriptive, forest managers and planners should consider the risks above and implement measures proportionately to the hazards identified and the level of risk for a site, in line with UK Forestry Standard guidance and developing good practice.

Measures to Reduce Fire Likelihood
In areas at high risk of fire entry or ignition:

- ✓ Design in fire breaks of a width appropriate to the adjacent vegetation, down to mineral soil and/or reduce fuel load
- ✓ Plan zones, breaks or belts with less fire-prone trees and vegetation
- ✓ Plan areas for deadwood and vegetation management
- ✓ Avoid highly flammable species

Mitigation measures to Increase Resilience
Across the woodland area:

- ✓ Plan fire breaks to create discontinuous blocks. Roads and rides, and natural features such as watercourses, rock outcrops and wetlands, can be incorporated into the design of breaks.
- ✓ Link naturally resilient features such as riparian areas to fragment high-hazard areas by removing / reducing surface vegetation and creating fuel breaks.
- ✓ Plan the timely removal of trees in poor health, wind throw, and declining or under-performing stands and brash.
- ✓ Where appropriate, consider re-wetting and restoring peatland to reduce the risk of damage from ground fires

Measures to Protect Assets
Where assets are at risk:

- ✓ Plan fire breaks around assets
- ✓ Plan where to reduce fuel load in areas of open space including rides or thinned woods with an understory
- ✓ Plan zones or belts of less fire-prone trees and vegetation, and check that there will be little surface vegetation
- ✓ Plan zones where deadwood, brash, and vegetation management is necessary
- ✓ Avoid highly flammable tree species

Planning Infrastructure to Aid Response

- ✓ Plan access roads with passing places and turning points. Plan access to open hills and through deer fences
- ✓ Ensure road and bridge weight limits support HGVs where possible
- ✓ Plan a large hard-standing area for response coordination
- ✓ Assess water resources and plan fire ponds near the top of hills if possible

Planning Forest Operations to Reduce Wildfire Risk

- ✓ Vegetation management at establishment
- ✓ Maintain fire breaks using vegetation control
- ✓ Regular & targeted swiping along rides & roads
- ✓ Control brash & deadwood in management zones
- ✓ Clear regeneration & vegetation in high-risk areas
- ✓ Manage vegetation around young woodland and in open woodland with scattered trees
- ✓ Manage the understorey in high-risk areas
- ✓ Carry out regular assessment of tree health
- ✓ Appropriate clearing & handling of diseased trees
- ✓ Clear wind throw & leaning trees

- ✓ Time operations to avoid high-risk conditions
- ✓ Maintain equipment & machinery
- ✓ Employ best practice in fuel use & storage
- ✓ Maintain clear access routes
- ✓ Consider hazards to responders, such as deer-fences, and add gates
- ✓ Prepare a Wildfire Response Plan and Fire Map
- ✓ Provide signs & information during high-risk condition

Wildfire Response Planning

Planning for the event of a wildfire can reduce response times, assist fire and rescue services, and minimise impacts during an incident. Further information on response planning can be found in FC Practice Guide 22. A key first step in response planning should be to consult both Scottish Fire and Rescue Service (SFRS) and neighbours on your wildfire plans. Working with SFRS and neighbours is a key aspect of successful fire response.

Fire Danger Intelligence:
The Scottish Wildfire Forum in conjunction with the SFRS and other agencies release fire danger information and maps when conditions are "very high" or "extreme". Each forest should develop a flexible and increasing level of activity as the risk of fire danger in their area increases. Responses should include wildfire prevention and preparedness measures. Forest managers should ensure that they have access to fire danger information and share the information with staff and contractors on the ground and with neighbours.

Fire Maps
Fire maps communicate key site information to the fire responders. Fire maps can be submitted to Scottish Fire and Rescue Services, Operations Control Centre, Macalpine Road, Dundee, DD3 8SA, where they will be held on record for use in the event of an incident and should also be shared with neighbours and local groups e.g., wildfire groups.

A fire map may include:

- ✓ Location of entry points with co-ordinates
- ✓ Location of locked gates, padlock code or details of key holders
- ✓ Site boundaries
- ✓ Access routes, vehicle suitability, access restrictions, bridge weight limits

- ✓ Location of equipment e.g., firebeaters
- ✓ Passing places, turning areas
- ✓ Hard standings
- ✓ Landscape & navigation orientation features
- ✓ Water resources & volumes

- ✓ Fuel hazards: fuel stores, pipelines, power cables
- ✓ Site hazards: deer fencing, dead ends
- ✓ Site & soil properties, including presence of organic soils, prevailing local wind direction, contours & slope direction
- ✓ Location of people: staff, visitors, assembly points
- ✓ On-site & surrounding residential & business property
- ✓ On-site & surrounding assets, utilities, infrastructure
- ✓ On-site & surrounding animals & priority habitats
- ✓ Forest blocks, forest type, age range, high-risk species
- ✓ Fire breaks, rides & natural features
- ✓ Protection areas, defendable areas, sacrificial areas

Local Wildfire Groups:
Contingency planning for wildfires is increasingly becoming part of the work of a range of organisations that work in a locality, for example Deer Management Groups. Where levels of risk are high more formalised "Wildfire Groups" may be set up. A Wildfire Group is a partnership between SFRS and the land management sector, including both public agencies and private estates, to tackle the increasing threat of damaging wildfires. Groups currently operating in Scotland are: North Grampian Wildfire Group, South Grampian Wildfire Group, Badenoch Strathspey and Nairn Wildfire Group.

Further sources of information
Forestry Commission (2014) Practice Guide: Building wildfire resilience into forest management planning
Scottish Fire and Rescue Services www.firescotland.gov.uk/media/1143735/wildfirestrategy-final01-update-gg.pdf
Scottish Wildfire Forum www.scottishwildfireforum.co.uk
FISA 803 Firefighting leaflet https://ukfisa.com/Safety/Safety-Guides/fisa-803

Appendix - Wildfire Risk Checklist

This checklist supports planners to assess the potential wildfire risk factors for a forest. Assessment may involve a site survey, map-based analysis, consideration of historic events, and current- and future-climate.

Fire Ignition Checklist (potential sources of ignition)

Does the site have:

- ☐ A history of wildfire events
- ☐ A history of fire on adjacent sites
- ☐ Flammable habitats nearby
- ☐ Camp sites, laybys, or car parks on-site/nearby
- ☐ High visitor numbers, recreation routes

Fire Hazard Checklist (fuel & site conditions)

Does the site contain:

- ☐ Open areas / rides with dense surface vegetation
- ☐ Young woodland, with surface vegetation before canopy closure
- ☐ Open or thinned woodland with scattered trees and surface vegetation
- ☐ Extensive areas of brash
- ☐ Dead or dying trees
- ☐ High risk tree species (eucalyptus, cypress, pines)
- ☐ Is the site prone to drought?
- ☐ Is the site on a slope or south facing?
- ☐ Is the soil organic or peat? Is the site drained?
- ☐ Is the site remote?

Asset Checklist (who and what is at risk)

- ☐ Are there staff or recreation users on-site?
- ☐ Are there residential or industrial areas nearby?
- ☐ Are there schools, hospitals, or communities vulnerable to smoke nearby?
- ☐ Are there infrastructure or utilities* on-site/near?
- ☐ Are there business assets+ on-site?
- ☐ Are there livestock, or game animals on site?
- ☐ Are habitats/species on site sensitive or priority?
- ☐ Is the site designated or protected?
- ☐ Does the site contain historical features?
- ☐ Is the site in scenic area or a high value landscape?
- ☐ Does the site contain significant carbon stocks?

Response Checklist

- ☐ Is the site accessible by road?
- ☐ Do roads & bridges support the weight of HGVs?
- ☐ Does the site include hard standings?
- ☐ Is the site remote from responders or equipment?
- ☐ Is the site remote from suitable water sources?
- ☐ Does the site have a fire map and response plan?
- ☐ Does the site have insurance for helicopter response?
- ☐ Does the site include risks to firefighters? dead ends, deer fencing, fuel, explosives, power lines or gas pipelines.

* gas mains, power cables, telephone lines, water supply pipes/structures, masts, wind turbines, reservoirs, roads, rail