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Wildfire risks to UK landscapes

Overview

- Climate change and land use changes are altering the frequency and severity of wildfires globally. In the UK, weather conducive to wildfires is projected to occur more frequently due to climate change.
- More frequent and severe wildfires could hinder progress towards the UK's climate and biodiversity goals. There is a risk of major wildfires affecting urban communities and infrastructure in the UK.
- Almost all UK wildfires are started by humans. There is poor public awareness of wildfire risks. Improved risk communication and community engagement may reduce wildfires.
- Wildfires can present distinct challenges for Fire and Rescue Services, which are typically focused on responding to fires in buildings. Wildfire response is managed and resourced variably between services.
- The likelihood and impact of wildfires vary greatly across landscapes, and between habitat types.
- Stakeholders agree that wildfire risk should be incorporated into land management planning but disagree about the merits and drawbacks of different approaches, such as managing vegetation and rewilding.
- The Home Office is committed to scoping a Wildfire Action Plan by mid-2024. Challenges include fire hazard assessment, Fire and Rescue Service response, and managing land to mitigate wildfire risks.

Wildfires and climate change

Wildfires (Table 1) are a natural phenomenon.[a] However, climate change, demographic changes and shifts in land use are altering the global frequency and severity of wildfires,[b] with impacts on ecosystems, infrastructure and human health (Table 2).[1,13,14]

Dangerous fire weather is projected to increase in most countries under future climate change, including in the UK (Box 1).[15–19] Met Office modelling predicts twice the number of summer days with dangerous weather conditions for fire development under 2°C of warming, and a five-fold increase under 4°C of warming. Smaller increases in dangerous spring weather are also predicted.[18]

Increasing wildfires threaten global carbon stores and may drive further warming.[20–28] Researchers raise concerns that extreme wildfires, such as occurred in Australia's 'black summer' in 2019-20, could mark the beginning of a global shift towards greater fire activity.[16,28,29]

Box 1: The UK's fire regime

The UK has an oceanic climate, with year-round precipitation. Vegetation and soils usually remain wet, reducing their flammability.[18,19,30,31]

The UK's fire regime has two seasonal peaks in spring and summer. Currently, spring fire seasons tend to be more severe. Fire seasons vary annually, with the UK experiencing episodic peaks in fire activity.[32–34]

Under climate change, the UK is likely to experience milder, wetter winters that promote vegetation buildup, and hotter, drier springs/summers that increase the risk of this vegetation catching fire.[17–19,35] Climate change is projected to increase fire risk most strongly in summer. Southeast and Central England are projected to experience the greatest increase in dangerous fire weather.[18,19]

[a] Wildfires have occurred on Earth since land plants first evolved more than 400 million years ago. Some habitats are sustained by fire, and some species are considered fire-adapted.[1–3] For instance, some plants possess traits which are adaptive in fire-prone environments, such as post-fire seed release (serotiny) in North American pines and Australian *Banksia.*[4]

[b] The area of land burned globally by wildfire declined by 25% between 1998 and 2015, due mostly to agricultural intensification in tropical savannahs and grasslands.[5] However, climate change between 1979 and 2013 extended the length of Earth's fire seasons by an average of 18.7%.[6] Climate change has been strongly linked to increases in burnt area and the number of major fires affecting western North America and Australia.[7–12]

Table 1: Wildfire definitions	
Wildfire	The Forestry Commission and Scottish Fire and Rescue Service define wildfire as 'any uncontrolled vegetation fire which requires a decision or action regarding suppression'.[36] This definition is used in statistics for UK wildfire reported in this POSTnote.[37,38] Fire and Rescue Services in England use the same basic definition, but additionally require fires to meet one or more of the below National Operating Guidance criteria: • Involves a geographical area of at least one hectare • Has a sustained flame length of more than 1.5 metres • Requires a committed resource of at least 4 fire appliances • Requires resources to be committed for at least 6 hours • Presents a serious threat to life, environment, property and infrastructure.[39]
Fire intensity	The energy output of a fire.[40]
Fire severity	The amount of organic matter consumed by a fire.[40]
Fuel	The material which is burnt in a fire. In a wildfire, fuel consists of vegetation and soil organic matter. Fuel can be divided into **ground** fuels (below the soil surface), **surface** fuels (0-50cm above soil surface) and **crown** fuels (in the shrub/tree canopy). Ground and surface fuels can be connected to crown fuels by **ladder** fuels such as understory trees and shrubs. **Fine** fuels (diameter less than 6mm) dry quickly and are easily ignited.[29,36,41]
Fire weather	Weather favourable to the ignition and spread of fires, which is characterised by prolonged high temperatures, low precipitation, low humidity and high winds.[6,18,36,42]
Fire season	The periods within a year when wildfires are most likely.[36]
Fire regime	The spatial and seasonal pattern of wildfires in a region, influenced by climate and the availability of fuel.[36,43]

In 2013, wildfire was added to the UK's National Risk Register.[44] Responsibility for managing wildfire risk is devolved, and policies differ between England, Scotland, Wales and Northern Ireland.

England has 44 Fire and Rescue Services (FRS). The Home Office is the lead department for wildfire in England, responsible for the coordination of wildfire issues within Government. Defra is responsible for promoting wildfire mitigation and adaptation through land management.[45] The Welsh Government oversees 3 regional FRS in North Wales, South Wales and West & Mid Wales.[46] Scottish and Northern Irish Governments oversee singular Scottish and Northern Ireland FRS.[36,47]

The sections below describe the threats posed by wildfire to UK landscapes and habitats, and options to promote wildfire resilience. These include public communication, improved fire suppression and land management.[33,41]

Table 2: Impacts of wildfire

Biodiversity	Wildfire kills organisms that move too slowly to escape and alters post-fire habitat composition.[1,48] Changing fire regimes can alter ecosystems by promoting species that better tolerate fire, at the expense of fire-sensitive species.[1,49–51]
Carbon emissions and climate change	Global wildfires emitted 2.2 Pg C yr^{-1} between 1997 and 2016,[c] compared with an average of 30 Pg C yr^{-1} over the same period for fossil fuels and industry.[25,26,52] Wildfires have complex effects on soils, vegetation and the atmosphere which may increase or partially offset the climate impacts of wildfire greenhouse gas emissions.[16,25,48,51,53,54]
Soil and water	Wildfire removes surface vegetation and alters soil properties.[55–57] This means rainfall reaches watercourses faster in subsequent storms, exacerbating flooding.[55,56] Eroded sediment enters watercourses, reducing water quality.[55,58]
Human health	Wildfires present hazards which may injure or kill emergency responders and members of the public. Exposure to wildfire smoke can cause respiratory and cardiovascular health impacts over great distances. Wildfires can increase the prevalence of mental health conditions in impacted communities.[14,59–61]
Economic	Wildfires affect economies through capital losses, disruption to economic activity and health effects.[62,63] Economic losses from Californian wildfires totalled approximately $148.5 billion in 2018, equating to 1.5% of California's GDP.[62]

[c] Pg C yr^{-1} = Petagram of carbon per year. 1 Petagram = 1,000,000,000 tonnes.

Wildfire vulnerabilities of UK landscapes and habitats

Destructive wildfires already occur in the UK (Table 3). However, relative to more fire-prone countries, the area burned by wildfires each year is currently small.[d]

The likelihood and severity of wildfire varies between upland and lowland landscapes.

- The largest wildfires have tended to occur in upland landscapes, due to the large areas of continuous fuel available to burn in these habitats.[38] Fire suppression is more challenging in the uplands, because reporting can be slower, water supplies are scarcer and there are fewer access points for equipment.[65]

- UK wildfires occur more frequently in lowland landscapes, because almost all are ignited by accidental or deliberate human action, and the lowlands are more densely populated.[33,66]

Under extreme fire weather, wildfires can start and spread in almost all habitats. However, the drivers of wildfire risk vary between habitat types.[16,67–69]

Open landscapes

Open landscapes include heathlands, peatlands, grasslands and arable farmland. Between 2009-2021, approximately 30% of wildfires in England occurred on open landscapes, accounting for over 70% of the area burned.[37]

Stakeholder observations and scientific studies indicate that open landscapes may be particularly vulnerable to wildfires where habitats consist of continuous, fast drying grasses and shrubs.[65,70–75]

Peatlands, heathlands and semi-natural grasslands

Peatlands, heathlands and semi-natural grasslands are most extensive in the uplands.[37]

Peatlands are wetland ecosystems formed by waterlogging promoting the accumulation of partially decomposed plant matter (PN 668).[76] Peatlands hold the largest carbon stores of all terrestrial habitats in the UK. These carbon stores are threatened by wildfires.[23,33,77–79]

Where the water table is high throughout the year, peatlands are characterised by high cover of *Sphagnum* mosses.[80] According to the Joint Nature Conservation Committee's (JNCC) National Vegetation Classification,[e] high heather cover in peatlands can indicate human degradation.[83] Based on evidence from peat cores,

[d] In 2022, the European Forest Fire Information System (EFFIS) recorded 20,000 hectares burned in the UK, compared with 66,000 hectares in France, 104,000 hectares in Portugal and 307,000 hectares in Spain. EFFIS data include all fires larger than 30 hectares, including prescribed burns for vegetation management.[64]

[e] The JNCC is the public body that advises the UK Government and devolved administrations on UK-wide and international nature conservation.[81] The National Vegetation Classification is a common standard developed to systematically classify and describe the plant communities of Britain.[82]

other commentators argue that abundant heather is a natural feature of some peatland ecosystems, preceding intensive human management and drainage.[84,85]

Heathlands and semi-natural grasslands tend to be drier, occurring over shallower peat or mineral soils. Heathlands are characterised by the presence of low shrubs such as heather and gorse.[86] Semi-natural grasslands contain abundant grasses such as purple moor grass. Where vegetation is continuous, wildfire can spread readily through these fine fuels.[66,87–89]

There is evidence for human management (including by fire) of these habitats for more than 5,000 years, which has tended to promote vegetation that regenerates relatively quickly following fire.[89–93]

Agricultural landscapes

FRS highlight distinct wildfire risks in intensively managed lowland pasture and arable land uses,[94,95] which are exposed to ignitions from farm machinery.[37] However, most agricultural land is enclosed by boundary features such as hedgerows, roads and walls, which break up fuels, resulting in relatively small burn areas.[37,96,97]

Vulnerability of arable agricultural land may increase under climate change, with recent studies projecting more frequent dangerous fire weather in summer, when ignitions are highest and crops are dry awaiting harvesting.[18,19] In the summer drought of 2022, over 2,200 farm fires - including 258 combine harvester fires - cost the specialist insurer NFU Mutual £83.5 million. This could result in increased future insurance premiums if actions are not taken to mitigate risks.[98]

The protection offered by boundary features is likely to become weaker during dangerous fire weather, since hedgerows and copses may themselves ignite, and flying embers can spread fires over tracks and walls.[16,41,99,100]

Woodlands

Between 2009-2021, 14.2% of wildfires in England occurred in woodlands, but these tended to be small, accounting for only 5% of the area burned. More fires occurred in broadleaf woodland, but conifer woodland fires burned a larger area.[37]

In woodlands, fires may burn through surface fuels, or may spread into the canopy, forming a crown fire (Table 1). Crown fires burn with high intensity and are difficult to suppress.[41,74]

The Forestry Commission states that species composition and physical structure of woodlands affects their vulnerability to wildfire:

- evergreen conifers are usually more flammable than deciduous broadleaf trees [41,101]
- woodlands composed of single species of the same age tend to have higher fuel continuity and greater vulnerability to pests and disease, both of which may increase wildfire risks[41]
- closed canopy woodlands[f] are generally more fire-resistant than open habitats because they retain surface moisture in dry weather.[99,100] Young woodlands remain vulnerable to wildfire until the canopy closes, due to increased ground vegetation and reduced moisture retention[41,101]

Crown fires are currently rare in the UK, with most woodland fires spreading through ground fuels and not igniting trees.[41] Stakeholders are concerned that crown fires may occur more frequently in the UK with climate change.[103,104]

Rural-urban interface

Fire researchers and practitioners refer with particular concern to fires at the 'rural-urban interface' (RUI), which pose an immediate threat to human health and infrastructure (Table 2) and occur frequently due to increased human ignitions.[32,105–109] Between 2009-2021, 54.4% of wildfires in England were in built-up areas and gardens, accounting for 16% of the area burned.[37] This figure does not include fires in adjacent rural land, which readily spread into urban areas (Table 3).[105–107]

Researchers suggest fire behaviour may change unpredictably at the RUI due to changing fuel types and altered airflow.[110,111] Recent major fires have demonstrated the potential risks posed to population centres and infrastructure directly abutting nature areas.[105–107,110–113]

[f] In a closed canopy woodland, crowns or canopies of individual trees overlap to form a virtually continuous layer.[102]

Table 3: UK wildfire case studies

Location	Year	Habitat	Impacts
Swinley Forest, Berkshire	2011	Conifer plantation	Crown fire affecting 300 ha. Threatened major infrastructure including Broadmoor High Security Hospital; A3095 shut for five days.[33,114]
Stalybridge (Saddleworth) Moor, Greater Manchester	2018	Upland heath & peatland	Burned 18km^2 of upland heathland and peatland. Substantially degraded air quality (PN 691), exposing 4.5 million people to $PM_{2.5}$ concentrations above WHO guidelines.[33,59]
Little Marlow, Buckinghamshire	2018	Arable farmland	Crop ignited during harvest, burning 30ha and destroying industrial buildings and a house.[33,115]
Flow Country, Scottish Highlands	2019	Upland heath & peatland	Burned 55km^2 of peatland, doubling Scotland's greenhouse gas emissions over the 6 days it was alight.[116]
Wennington, East London	2022	Grassland	Started in a residential garden, spreading via adjacent grassland, with 17 houses destroyed.[117] One of multiple vegetation fires causing London Fire Brigade's 'busiest day since the Blitz'.[118]
Canford Heath, Dorset	2022	Lowland heath	Damaged 17 ha of protected lowland heath. 20 houses evacuated, but fire halted at fire break (Box 3).[103,112]

Preventing ignitions and suppressing wildfires

Preventing wildfire ignitions

Historic ignition data are considered incomplete, but available data indicate almost all UK wildfires (as defined in Table 1) are started by human action,[g] either accidental or deliberate (arson).[32,38,120]

In Natural England and Forestry Commission analyses of English wildfires, around 40% of fires were started deliberately, with fires lacking an assigned cause potentially adding to this figure. [38,121] Over 70% of 2,666 lowland wildfires analysed by Natural

[g] In other countries, lightning is responsible for a much greater proportion of wildfires,[119] but FRS have recorded only 3 incidents of lightning ignition in the UK, two of which were part of the same fire.[103]

England were started deliberately.[38] Deliberate ignitions caused most of the wildfires recorded in Scotland 2009-2020.[120]

Stakeholders and researchers suggest that improving education of the public may reduce ignitions and protect communities from wildfire.[16,66,122–125] In more fire-prone countries, investigation of ignition sources informs targeted education campaigns, and may act as a deterrent against negligent or deliberate ignitions.[121,123–126] Fire investigators at UK FRS have not historically been trained in wildfire investigation,[33,121] but work to expand future capacity has recently been initiated.[103,104]

In the South Wales Valleys, frequent wildfires have been linked to deprivation and anti-social behaviour. The 'Healthy Hillsides' project has used community outreach to educate members of the public on wildfire impacts, seeking to reduce fires on valley sides at the rural-urban interface.[127,128]

Wildfire risk assessment and recording

In more fire-prone countries including Australia, Canada and the USA, fire danger rating systems have been developed. These use weather, topography and fuel data to dynamically assess wildfire risk, communicate risk to the public and trigger restrictions on activities that might start fires.[129–131]

In the UK, fire weather is currently assessed using adapted Canadian indices, which give an indication of potential fire severity but do not fully account for the influence of different UK fuel types.[132–134] The Met Office Fire Severity Index (MOFSI) provides a publicly available assessment of fire risks. Where risk is exceptionally high, MOFSI may be used to suspend open access rights under the Countryside and Rights of Way Act (2000).[135,136]

Recent academic research has made progress towards a fire danger rating system tailored specifically to the UK's fuel types.[134,137] The researchers suggest that a hazard alert system built using a combination of fuel data from this research and existing vegetation maps and weather models could be used to create a FRS and public-facing wildfire danger rating system for the UK, similar to those used by other countries.[133,138]

Alongside risk assessment, the management of wildfires has been hampered by inconsistency in wildfire data collection by FRS (PN 603). The Incident Recording System used by FRS since 2009 is currently under review by the Home Office, with the aim of collecting more accurate and useful data on future wildfires.[32,39,108]

Suppression of wildfires

In the UK, the same fire appliances and personnel may be deployed to both structural fires and wildfires.[32] The lack of wildfire-specific equipment within some FRS has previously presented challenges, as wildfire behaviour and hazards differ from those of structural fires.[32,34,36]

The National Fire Chiefs Council provide National Operational Guidance for wildfires.[103,139] However, there are no mandatory standards for the provision of wildfire-specific training and equipment, and capacity varies between regional FRS according to their assessment of wildfire risk.[32,33] Regional FRS have invested to varying degrees in advanced training, wildfire PPE, suppression equipment and

vehicles, and wildfire-specific training programmes are in continued development.[32,140–142]

In severe wildfires, such as those associated with the July 2022 heatwaves (Table 3), resources and personnel have been shared between regional FRS. Stakeholders suggest that capacity for interagency assistance may be compromised if wildfires occur in multiple regions simultaneously, as is likely under severe fire weather.[33,140,143]

Engaging with land managers

FRS engagement with land managers can promote wildfire awareness in high-risk landscapes.[32,34] FRS can gain prior information on access points, water sources and vegetation composition, assisting suppression in the event of a fire. In many cases, land managers also have access to equipment that can be adapted for wildfire suppression. Prior communication helps FRS to integrate this equipment into emergency response.[32,33,65]

Defra has supported the development of accredited wildfire training schemes for land managers.[103,144,145] In England, upcoming changes to Defra's Environmental Land Management payment schemes will incentivise Landowner-FRS collaboration (Box 2).[145]

Box 2: Incentivising action by land managers

Although many land managers engage voluntarily in wildfire mitigation, ongoing challenges exist in promoting adaptation to wildfire amongst competing objectives. Defra's Environmental Land Management (ELM) scheme will incentivise the assessment and management of wildfire risk in England.

ELM capital payments to increase awareness of wildfire will be available under the Sustainable Farming Incentive. Managers of forestry, moorland and lowland heath will be eligible for additional funding under Countryside Stewardship to produce a more detailed wildfire management plan, that will be shared with relevant FRS. Defra will also provide funding for the creation and maintenance of firebreaks, fuel breaks and fire belts (Box 3) where identified as necessary within a manager's wildfire plan.[145]

Collaboration between stakeholders

The England and Wales Wildfire Forum, Scottish Wildfire Forum and Northern Ireland Wildfire Stakeholders Group are non-statutory bodies that bring together public, private and third-sector stakeholders. They promote knowledge exchange and good practice in wildfire management.[32,45,47]

Regional wildfire groups have also been established across much of the UK, fostering collaboration between local government, Fire and Rescue Services, land managers and other stakeholder groups.[32,45,65]

Promoting landscape wildfire resilience

Landscape management regimes could be altered to reduce ignitions, slow fire spread and enable suppression by FRS. If severe wildfires are beyond the capacity of FRS suppression,[h] altered landscape management may reduce the damage caused by wildfires to ecosystems, infrastructure and human health.[33,65,66]

Vegetation management

Vegetation may be managed using cutting, grazing and prescribed burning. Fire and rescue practitioners suggest that, without vegetation management, fuel loads rise and make suppression of wildfires more difficult.[103,104,146–148] Management can be applied across a landscape to alter the arrangement and quantity of fuel, or targeted to create fire and fuel breaks (Box 3) in specific areas.[65,149]

Vegetation management has been successful in reducing wildfire severity and allowing fire suppression in other countries.[67,68,126,150] Vegetation management interventions for wildfire mitigation in fire-prone regions (for example Australia, Western USA) tend to be conducted on a larger scale than that associated with traditional vegetation management (for example rotational burning) in the UK.[151–154]

To control regrowth, vegetation management must be conducted continuously, which may be labour or resource intensive. Studies on heathlands suggest cutting is likely to be less effective where cut material cannot be removed from the site.[89,155]

Prescribed burning

Prescribed burning can be used where land is too steep and/or rocky for cutting,[33,155] but is constrained by burning regulations including the legal burning season.[153,156,157]

There is a well-established tradition of rotational burning management (known in Scotland as 'muirburn') across many of the UK's open landscapes. This is principally conducted to promote the growth of new vegetation for grazing livestock and game, alongside biodiversity objectives such as the maintenance of heathland habitats and species.[92,154,158]

However, the evidence base for the use of prescribed burning to mitigate wildfire risk on peatlands is disputed.[84,85,155,159–162] Field studies of UK heathlands and peatlands indicate that older heather burns with greater intensity and severity.[70,75,163] Some commentators, including the Game and Wildlife Conservation Trust (GWCT),[i] argue that prescribed burning may prevent severe wildfires with greater negative impacts.[85,160,162,165]

Other commentators, including UK Government agencies and the IUCN UK PP, argue that rotational burning maintains the dominance of shrubs and grasses that are vulnerable to wildfire. They suggest that the cessation of burning (in combination

[h] Fires spreading faster than 50m per minute with a flame length of greater than 3.5m are considered extremely difficult for well-equipped and trained responders to suppress.[65]

[i] The Game and Wildlife Conservation Trust are a UK charity 'conducting conservation science to enhance the British countryside for public benefit'.[164]

with rewetting - see below) would raise the water table and reduce the abundance of shrub and grass fuels over time, lowering wildfire risk.[66,145,152,159,166] This suggestion is contested by some researchers, who argue that natural hydrological variation[j] in peatlands would limit the efficacy of rewetting in reducing shrub/grass cover.[84,85,168]

In England, The Heather and Grass etc Burning Regulations (2021) made it illegal to conduct prescribed burns on peat more than 40cm deep in protected areas (PN 668).[157] In Scotland, The Wildlife Management and Muirburn Act (2024) outlaws burning on peat soils more than 40cm deep.[169]

Both pieces of legislation allow prescribed burning (under licence) for mitigation of wildfire risk where alternative management approaches are deemed unfeasible.[157,169]

Box 3: Fire breaks, fuel breaks and fire belts

Fire breaks, fuel breaks and fire belts are linear features that split up areas of continuous fuel, slowing the spread of wildfire and allowing access for FRS suppression.[41,65] The Forestry Commission defines fire breaks as linear gaps in vegetation, and fuel breaks as gaps in vegetation where litter and organic material is also removed, leaving bare mineral soil.[41]

Fire belts are strips of woodland composed of fire-resistant tree species, intended to prevent or reduce the spread of surface and crown fires. These may be established to separate more flammable trees in woodlands, or in open habitats to break up continuous shrub and grass fuels.[41,170]

Defra and NatureScot suggest that fire and fuel breaks could be implemented around points where ignitions are likely (such as car parks, campsites) to prevent the spread of fires into larger areas of continuous vegetation.[145,171] Permanent landscape features such as waterbodies, walls and tracks can also function as fire breaks. The management of vegetation around these features may increase their efficacy in stopping or slowing the spread of wildfires.[41,96]

To protect life, property and infrastructure, Wildfire Management Zones, known in the USA and Australia as Home Ignition Zones or Asset Protection Zones respectively, can be used by designing and maintaining them in relation to the wildfire performance of the assets being protected.[172,173]

Increasing woodland resilience to wildfire

The UK Government has established a target of planting 30,000 hectares of new woodland annually from May 2024.[174] New woodlands will be threatened by wildfire, particularly during early phases of growth.[41] The establishment of new woodlands will influence the vulnerability of landscapes to wildfire depending on their location, composition and management.[41]

The UK Forestry Standard (UKFS) underpins regulation of public and private forestry in the UK (PN 636). The 2023 UKFS does not include wildfire-specific requirements,

[j] Hydrology refers to the distribution and movement of water in relation to land. The hydrology of peatlands is influenced by precipitation, vegetation, geology and topography.[167]

but guidelines recommend that fire risk should be assessed in forest management plans.[175]

Woodland creation and restocking

Forestry Commission guidance suggests increasing the resilience of plantations by incorporating fire-resistant species into planting and avoiding monocultures of single-species, even-aged trees.[41] The UKFS stipulates that no more than 65% of a forest management unit should be allocated to a single tree species. As a result, monocultures are no longer being planted in publicly managed forests (26% of UK woodlands), and are becoming less prevalent in privately managed forests.[176]

Practitioners suggest woodlands created by tree planting or natural regeneration could reduce landscape vulnerability to wildfire by breaking up areas of continuous fuel, particularly if composed of fire-resistant (usually broadleaved) tree species.[41,104] New woodlands could be sited to function as fire belts (Box 3) in open landscapes or amongst more fire-prone conifer plantations.[41,99]

However, new woodlands could also increase wildfire risks. Forestry researchers suggest that low density tree planting or regeneration might simply raise fuel load, lacking the fire-suppressive effects of a closed canopy woodland.[f,104,177] Increased ladder fuel in less dense woodlands could also increase the risk of crown fires, although the risk of high-intensity crown fires could be lower due to reduced crown fuel continuity.[178,179] Some commentators suggest that, even at low densities, trees may reduce wildfire risk by altering moisture content and temperature of vegetation in their immediate surroundings.[171,180]

Vegetation management within woodlands

In plantations and natural woodlands, understory vegetation management may reduce the risk of surface fires.[k] The removal of ladder fuels can prevent surface fires from developing into crown fires. Removal of dead wood would reduce fuel loads.[41,178]

The Forestry Commission state that these interventions should be balanced against the biodiversity value of retaining dead wood and understory vegetation according to site-specific assessments of wildfire risk.[41,182]

Restoration programmes

Rewilding

Rewilding can refer to reinstating natural processes that would have occurred in the absence of human activity (PN 537).[183] Rewilding Britain[l] argues that rewilding could reduce wildfire risk by creating mosaics of different habitats, such as wetlands and woodlands, which would slow the spread of wildfire by reducing fuel continuity.[185,186]

[k] The understory is the layer of plants found below the main canopy of a woodland.[181]

[l] Rewilding Britain is a UK charity that promotes rewilding as a means of 'protecting, restoring and regenerating species-rich mosaics of habitats'.[184]

However, fire and rescue practitioners express concerns that reduced vegetation management in rewilding schemes may increase fuel loads, increasing the risk of severe wildfires.[146,148]

Peatland rewetting

Many of the UK's peatlands have been subject to historic drainage, which has caused water tables to drop.[187,188] Rewetting refers to re-establishing a waterlogged state in peatlands by blocking up land drains and gullies, often in combination with other measures such as transplanting *Sphagnum* mosses.

According to UK government bodies and the IUCN Peatlands Programme (IUCN UK PP),[m] rewetting is likely to raise water tables, increase *Sphagnum* moss abundance and reduce the cover of continuous grasses and shrubs. As a result, they argue that rewetting could reduce the incidence, severity and carbon emissions of wildfires.[23,87,88,145,159,171,191–193]

Research on the 2019 Flow Country wildfire (Table 3) indicated that vegetation on rewetted peatlands suffered less severe burning than drier degraded peatlands.[194,195] There is some experimental evidence that, where wildfires occur, an intact moss layer may protect underlying peat soils.[196]

Other commentators debate the extent to which rewetting alone can reduce wildfire risk. They argue that blocking drains may raise the water table in some contexts, but that natural environmental variation in peatlands means rewetting is unlikely to consistently promote a shift from shrubs and grasses to *Sphagnum*-dominated vegetation. As a result, some researchers suggest supplementary vegetation management will continue to be necessary on some rewetted sites.[84,85,168,197]

Landscapes at the rural-urban interface

At the rural-urban interface, emphasis is on preventing the spread of fire from vegetation into the urban environment. To this end, fire and fuel breaks (Box 3) can be created between semi-natural habitats and buildings/infrastructure.[33,198] Fire and fuel breaks can also prevent urban fires spreading into rural vegetation (such as along roadside verges).[199]

In Dorset, the Firewise-UK programme provides guidance to communities living near fire-vulnerable heathlands. They suggest that maintenance of housing and gardens at the rural-urban interface can reduce the risk of wildfire spreading into structures. Removing trees and shrubs in close vicinity to buildings and keeping gutters clear of debris can prevent wildfires from becoming structural fires.[200]

In major wildfires in other countries, buildings have often been ignited by embers, which can travel great distances from the fire front. In these cases, vegetation management around buildings is likely to be less effective (Box 3).[198,201]

[m] The International Union for Conservation of Nature (IUCN) is an international membership union composed of government and civil society organisations.[189] The IUCN UK Peatland Programme 'exists to promote peatland restoration in the UK'.[190]

The future of wildfire policy

In England, the Home Office and cross-Government partners have committed to scoping out a Wildfire Strategy and Action Plan by mid-2024.[202] This includes incentivising assessment and management of wildfire risk under the Environmental Land Management (ELM) scheme (Box 2).[145] Other key areas that may need to be addressed are listed in Table 4.

Table 4: A summary of key challenges in addressing UK wildfire

Fire and Rescue Service capacity	FRS investment in wildfire training and equipment varies across the country according to their assessment of local wildfire risk. Climate modelling suggests increasing risks under future climate change, and changing risk distribution across the regions of the UK.[18,19] Fire and rescue practitioners suggest that further collaboration with land managers and investment in training and equipment would strengthen the capacity of FRS to respond to evolving wildfire threats.[32,65,103,149]
Fire hazard assessment	The UK currently lacks a dynamic fire hazard assessment system tailored to fuel types (PN 603). Researchers and practitioners suggest that building public-facing and FRS/land manager-oriented fire danger rating systems could reduce accidental ignitions and aid wildfire suppression.[66,103,133]
Fire investigation	UK fire investigators are not routinely trained in wildfire investigation. According to commentators, promoting wildfire expertise amongst fire investigators could improve data collection and enable targeted education campaigns, reducing negligent or deliberate ignitions.[33,103,121,123–125,193]
Land management evidence base	Stakeholders debate the likely effects of changing land management practices on wildfire risk in UK habitats, and insufficient evidence exists to establish definitive answers.[66,84,85,159,186,197] The application of international evidence is limited by the distinct composition of UK habitats.[33,66] Commentators suggest that addressing this evidence gap could inform adaptation to increasing wildfire risks.[66,85,103]

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