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## Wildfire

This Science Note is one of a series of short guides covering a range of natural hazards. These guides aim to provide non-experts with a brief introduction to each hazard and to highlight key aspects that may need to be taken into account in decision-making during an emergency involving this hazard. They are not intended to be fully comprehensive, detailed analyses or to indicate what will happen on any particular occasion. Instead they will signpost issues that are likely to be important and provide links to sources of more detailed information.

### What is a Wildfire?

The term wildfire can have various definitions. In this context, wildfire refers to any unintentional, self sustaining outdoor fire which consumes significant quantities of natural vegetation as its primary fuel source. Wildfires can occur in a range of fuel types from grasslands to forested areas, each fuel type exhibiting very different patterns of fire behaviour. Two aspects of wildfire are considered here, fire severity and fire frequency. At times, extreme fire weather conditions can be relatively localized, potentially leading to isolated, extremely severe fires which are large and difficult to control. At other times, widespread elevated wildfire conditions can cause numerous fires simultaneously across much of the country, any one of which may not be particularly severe in wildfire terms, but have the collective ability to strain resources. Several factors affect wildfire behaviour. Many of these, such as the vegetation type and topography, remain relatively static over time. It is the seasonal cycle of the other sources of information which may be useful.

### Where is affected?

- The Met Office produces a Fire Severity Index (FSI) forecast for the five days ahead. These are disseminated to the public by Natural England and the Countryside Council for Wales. These forecasts indicate how severe any wildfire may be, should one occur. They do not necessarily reflect how widespread wildfires may be.
- Natural England provide maps of fire severity covering England: <http://www.naturalengland.org.uk/ourwork/access/openaccess/fireseverity.aspx>
- The Countryside Council for Wales provide maps of fire severity covering Wales: <http://www.ccg.gov.uk/enjoying-the-country/open-access-land/the-fire-severity-index.aspx>
- During conditions of elevated fire severity, the Met Office provides guidance on wildfires through the Daily Hazard Assessment, which is produced on a daily basis.



## How does Weather affect Wildfire?

Weather conditions elevating fire behaviour may be short lived or comparatively long in timescales. Dry surface conditions are generally a prerequisite for extreme fire behaviour. However, such conditions may persist for some weeks without significantly increasing the likelihood of a wildfire. With the appropriate antecedent conditions, a short period of stronger winds coupled with a drop in relative humidity can significantly raise the probability of wildfires for perhaps only a day or so. Such scenarios are common in the springtime<sup>(1)</sup>, where the relative humidity is very important as it determines the moisture content of the dead fuels. The dead fuels (such as cured grasses, brash and twigs) play an important role in springtime fires before the environment has undergone significant green- up, providing a build up of dead matter to fuel potential fires.

Drought conditions, which are more usually (though not exclusively) associated with summertime, can significantly impact on fire behavior<sup>(2)</sup>. Vegetation relies on water from its roots, and in dry conditions the water content of most vegetation types will reduce significantly. The lower the fuel moisture content of the vegetation, the more energetically it will burn, resulting in greater flame lengths and a more intense burn.

## What causes Wildfires in the UK?

People cause wildfires in the UK<sup>(3)</sup>. There is no evidence to suggest that natural causes, such as lightning ignition or spontaneous combustion, play a significant role in the initiation of wildfires in the UK, though these phenomena are evident in overseas climates. The most common causes of wildfires in the UK are:

- **Accidental fires**

These are started accidentally by a variety of means including: leaving barbecues unattended or failing to ensure they are put out properly after use; campfires growing out of control; sparks from machinery, such as steam trains. Discarded cigarettes, contrary to popular belief, are not likely to be responsible for a significant number of fires due to the highly localised and relatively low heat source they exhibit. Accidental fires are more common in highly populated outdoor areas.

- **Arson**

These are malicious fires started deliberately. There is a strong correlation between the occurrence of school holidays and wildfires. Some parts of the UK have particular problems with repetitive arson attacks. Arson is more prevalent in the urban rural fringe.

- **Prescribed burning**

These are accidental fires caused by a controlled fire (used to burn off old vegetation) which has become out of control. This occurs when land managers underestimate wildfire conditions or have insufficient resources to effectively control their planned fire. The prescribed burning season (as directed by DEFRA's Grass Burning Code<sup>(4)</sup>) lasts from October to the middle of April. Some of these fires can be very remote and difficult to reach by emergency responders.

## What are the Impacts of Wildfires?

The impacts of wildfires can be numerous. Many impacts will be very localised and personal, such as the loss of property and potentially life. Others will be more widespread due to the consequential impacts of the

loss of infrastructure. Little has been done to study the economic impact of wildfires within the UK, though limited research suggests that a single wildfire (Swinley Forest, 2011) had an economic impact in excess of £1M<sup>(5)</sup>. That was one of several hundred fires reported around the same period. The most common impacts include:

- **Loss of agricultural production/income from the land**

This may include the immediate destruction of expensive crops including timber. It will also include the loss of production for at the least the period of the cleanup operation. Grouse moors are extensively managed for grouse shooting and landowners may lose significant income from areas affected by wildfire.

- **Loss of property**

This is more relevant in areas within the urban rural fringe, but it also includes the loss of remote outbuildings in more rural areas. The impact will vary depending on the property lost, but can of course include critical national infrastructure.

- **Loss of life**

The loss of life, either to the general public or emergency responders, is rare within the UK compared to other countries.

- **Health impacts**

The composition of smoke will vary depending on the fuels consumed within the wildfire. Typically, high intensity fires produce less smoke in the form of visible particulates. Likely pollutants from a wildfire would include: hydrocarbons, carcinogens, particulate matter of varying sizes though probably including PM2.5 and PM10, carbon dioxide, carbon monoxide and sulphur dioxide, amongst others.

Concentrations are usually highest near the flame front and burnt area and pose more of a risk to emergency responders on the scene. Further afield, depending on atmospheric conditions, pollutant levels may still exceed national standards and pose a significant risk to human health<sup>(6)</sup>.

- **Transport closures**

Poor visibility and considerations to pollutant exposure may necessitate the closure of roads in the direct vicinity of a wildfire. This may be particularly problematic around major trunk roads and motorways. Dense smoke plumes can sometimes travel significant distances and may affect visibility sufficiently to temporarily cause airport closures. The risk of pollution exposure may also necessitate temporary closures of railway lines.

- **Environmental impact**

Wildfires usually impact on the local wildlife which will vary with the time of year and location. Ground nesting birds and reptiles are particularly at risk from surface fires. The longer term impact of a wildfire will depend critically on the temperature of the fire. Hotter fires can reach deeper into the decaying organic layer (duff layer) and carry the risk of fires spreading into the underlying peat where present. Peat fires can take many weeks to extinguish and if the area is desiccated, it will not recover within a lifetime. Depending on the severity of the fire shrub land areas may take years to recover.

In contrast, surface fires which do not become deep rooted, may cause little long term environmental damage and may begin to recover almost immediately. Protecting designated areas, such as Sites of



Special Scientific Interest, Special Protected Areas and Special Areas of Conservation may be of particular concern.

- **Water pollution**

Fires near watercourses and reservoirs can have a significant impact on water quality as ash and other pollutants are leached through the soil. Water companies are usually very keen to be involved in wildfire management as a result. Wildfires may lead to discolouration of water sources and in more extreme cases may lead to pollution levels exceeding water quality standards.

## **How can we reduce the Impacts and Incidence of Wildfires**

Reducing the frequency and impacts of wildfires requires consideration of general land management, wildfire planning, controlling fuel loads, and increasing fire watches in elevated conditions, assessing the initial response to wildfires and education amongst the general public and responders alike.

- **Land management**

This pre-planning aspect of wildfire reduction is critical in sensitive areas. The main aspects of management which land owners and managers should consider include: ensuring that sufficient natural or man-made fire breaks are in place; ensuring that fuel loads do not become excessive and ensuring an adequate mix of vegetation cover which are not naturally flammable at the same time of year. The perimeters of forested areas are of particular concern. If the fuel types are allowed to feather from grasses to intermediate fuels, there is an increased risk of the fire climbing the fuel ladder and initiating a forest fire.

- **Controlling Managed burns**

Land managers need to ensure that they fully understand the state of the fuels and the impact of the weather before initiating managed burns. They need to ensure that they are properly equipped and suitably staffed for the fire behaviour they expect to experience. Weather forecasts should always be consulted before initiating any burn.

- **Wildfire planning**

Many areas around the UK operate Fire Operation Groups. The groups are responsible for compiling 'Fire Plans' which provide a wealth of detail in a variety of aspects of wildfires. It would generally include: contact details of key people able to assist in a wildfire; location of equipment (such as All Terrain Vehicles and fire beaters); a list of key infrastructure or landscapes to protect as a matter of priority; location and seasonality of nearby water resources; details of tracks which are and are not suitable for fire fighting tenders. In elevated conditions, local land managers should ensure such fire plans are up to date and that fire fighting equipment is serviceable. Under exceptional conditions, land managers may also negotiate call-off contracts with helicopter companies specialising in fire suppression. Emergency responders can also plan ahead by positioning equipment where it is most likely to be required and sharing assets across regional borders.

- **Fire watches**

Some National Park managers implement fire watches during elevated conditions. This usually comprises volunteers or staff watching over large areas of land from an elevated position, such as a hilltop. Spotting a fire early on can significantly reduce the overall burn scar of any wildfire.

- **Initial response**

In elevated fire weather conditions, particularly in times of increased wind speeds or significant drops in relative humidity, emergency responders should consider a robust initial attack against wildfire. An initial dispatch of significant resources will prove more beneficial than escalating resources once the fire begins to spread.

- **Education and awareness raising**

There is no standard signage for wildfire conditions within the UK. Nonetheless, many land managers provide signs indicating the level of risk in susceptible areas. It is important that these are changed frequently in response to actual ground conditions to maintain credibility by the public. The emergency response community is cautious about advertising elevated wildfire conditions to a broad audience, for fear of encouraging arsonists to the countryside. On a local scale however, land owners and National Park managers often take the time to inform visitors of fire risk in susceptible areas.

## **Further Information (web references accessed on 15th August 2016)**

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(3) Gallani, M. (2002). Causes of UK Countryside Fires: A Literature Review. Report for Natural England, Met Office.



(4) Defra. (2007). The Heather and Grass Burning Code.

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(5) Ayles, J. (2011). Costing UK Wildfires, presented at Wildfire UK, Manchester University.

(6) Finlay, S.E., Moffat, A., Gazzard, R., Baker, D. and Murray, V. (2012). Health Impacts of Wildfires. *PLOS Currents Disasters*.