

# Fire Behaviour in Shrub Fuels - A Fact Sheet

## Overview

- The weather significantly affects fire behaviour within the wide range of shrub fuels found within the UK.
- Shrub fuels is a broad definition, covering many vegetation types from low lying young heather to tall gorse stands – all of which will have different rooting systems and varying flammability characteristics. UK heathland shrub fuels are characterised by being typically evergreen and adapted to long summer droughts.
- This Fact Sheet provides some background on the research work undertaken so far in this area and offers guidance on how weather and vegetation characteristics affects fire potential within shrub fuels.
- As a result, the severity of such fires and consequential impact on the underlying soils can be much greater than other types of wildfire and potentially lead to longer recovery times.



## Typical Fire Behaviour

- A variety of shrub fuels are widespread throughout the UK which differ markedly from forest and grassland fuel types.
- The most significant feature of fire within shrub fuels is their ability to rapidly turn into high intensity, fast moving fires.
- Shrub fuels often support and retain large amounts of dead fuel, elevated above the ground, which can dry rapidly. Many shrub fuels also contain volatiles and other chemicals which may be naturally flammable.
- Shrub fuels can be dense, high from the ground and well aerated, allowing the wind to quickly carry any flame front through comparatively large quantities of fuel easily.
- These combination of factors set shrub fuels apart from other fuels quite distinctively. They can produce significantly more intense fires than grass fires, and under the right conditions, can move very quickly. Fire behaviour in shrub fuels can become extreme in what may otherwise appear as fairly benign weather conditions.

## Fuel Moisture

- Fire behaviour in shrub fuels, as with any other fuel type, is heavily dependant upon the fuel moisture of the vegetation itself. This can be a complex process within shrub fuels, when often the vegetation is composed of a mix of woody and leafy components.
- All shrub fuels rely on their physiological processes and rooting systems to provide moisture to the living parts of the plants. Those rooting systems vary in depth from a few centimetres for young heather, to many tens of centimetres for taller gorse, for example. Understanding the soil moisture at the appropriate rooting depths of the shrub could provide an appreciation of the water available to the vegetation, and hence its fuel moisture content.

## The Impact of Age

- The age of the vegetation can be critical in determining fire behaviour patterns. Typically, shrub fuels become more woody and less leafy with age. They also carry a greater proportion of dying fuel parts. It is this ratio of live to dead material which can be important. Fifteen year old heather, for example, would be more aerated, carry a greater proportion of denser woody material and produce a much more intense flame than its younger counterpart.
- Older shrub fuels often carry a significant quantity of elevated fallen dead fuel, exposed to the full extent of the solar radiation from the sun in clear conditions. This fuel may therefore dry out much more quickly than the litter under its canopy.
- The shape and density of the fuel in the area can be important in determining fire behaviour. Evidence suggests that younger very dense areas of shrub fuel can exhibit slower fire spread due to lack of significant aeration from the wind. However, these slower moving fires can also be more intense as the residency time of the flame is longer in any particular area.

## Natural Flammability

- Heathland vegetation is usually susceptible to fire during periods of water stress, due to the presence of tannins, resins and essential oils in the plant, which can form a highly flammable component of the plant.
- The presence of volatiles and other chemicals within shrub fuels also means that the live part of the fuel plays an important part in the combustion process. This is in stark contrast to grass and forest

fires, where the live fuel component would have a damping effect on fire behaviour.

- Many shrub fuel species around the world are renowned for their flammability and ability to burn at very high rates of spread and extreme fire intensities.
- In many shrub fuel types, fire behaviour will switch from benign to extreme with only small changes in the fuel's characteristics. A small change in fuel moisture for example, can push the fuel to a tipping point in terms of its fire behaviour.

## Surrounding Impact

- The area surrounding the shrub fuels is important. Shrub fuels can produce significant amount of brash each year, which falls to the floor and behaves as a dead fine fuel. Moss can often also be found along the ground beneath shrub fuels. Both of these can combine to help carry a flame front more quickly under the vegetation canopy, aiding the spread of the fire.
- Shrub fuels within the UK are often found on extensive areas of peat land. This provides an additional risk for fires within these areas in drought conditions, when it is possible that the peat itself may also ignite under such intense fires.

## Future Work

- Whilst there has been significant research into shrub fuel fire behaviour in other countries, much still remains to be done, particularly within the UK where comparatively little research has been undertaken in a systematic manner.