



Research Information Note

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Review of the impacts of heather and grassland burning in the uplands on soils, hydrology and biodiversity

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Introduction

Regular burning of moorland habitats, to stimulate new growth of grasses and heather *Calluna vulgaris* for livestock or for red grouse, has shaped the open landscape typical of much of upland England. Peatlands, notably blanket bog and wet heath have also been regularly burnt to promote the growth of heather, commonly in tandem with drainage by 'gripping'.

Burning alters the vegetation composition, pattern, physical structure and age structure of plants and can affect soil structure and hydrology. Burning of moorland does not however necessarily damage upland vegetation and soils. The impacts of fire are dependent upon the intensity, frequency and scale of the burns, the type of vegetation burnt and underlying soils. Too frequent fires, intense fires, fires covering large areas and burning of sensitive areas and burning at certain times of year, however, can all be environmentally damaging.

While much of the uplands are recognised to be of high importance, in a recently published report on the condition of Sites of Special Scientific Interest (SSSIs) in England (English Nature 2003), moor burning is the second most common cause (by area) of 'unfavourable condition' on SSSIs.

To achieve challenging government targets to attain favourable condition on SSSIs, it is important that English Nature provides the most accurate advice to land managers and advisors on the impact of burning, and good burning practice. This includes the identification of areas that may be extremely sensitive to burning, and should not be burnt.

What was done

To enable English Nature to provide such advice a comprehensive review of current knowledge was commissioned to assess the impact of heather and grass burning practices on upland soils, hydrology, vegetation communities, plants and fauna.

Specifically the review covered impacts of burning on:

- vegetation communities with reference to changes in plant communities and increases and decrease in cover of key species and structure of communities
- individual plant species including both higher and lower plants especially lichens and bryophytes
- birds including the impact of spring burning on nesting attempts
- invertebrates including speed of recolonisation
- mammals, reptiles and amphibians – impact on populations
- soils including peat formation and carbon dynamics, soil structure, moisture and composition, soil fauna
- hydrology including changes to run-off and peat hydrology
- priorities for further research

Results and conclusions

Most of the research on managed burning in Britain has been carried out on Scottish grouse moors, in particular studies on moorland burning histories, fire characteristics and impacts on heather *Calluna vulgaris*, and heathland communities. Many of these research studies date back to the 1960's and 1970's.

Carefully controlled prescribed management burns in appropriate habitats and conditions:

- Can arrest succession processes.
- Can maintain habitats of high conservation importance such as dry dwarf shrub heaths.
- May also help to maintain low nutrient conditions.
- Through the burning of small patchworks of *Calluna* can also increase vegetation structural diversity and species-richness in plants, invertebrates and birds of *Calluna* dominated dry heathland habitats (although probably not on peatlands as these habitats have higher inherent levels of diversity).

However, the impacts of fires on soils, hydrology and biodiversity are complex and vary according to a number of interrelated factors. Characteristics of the fires are especially important, such as their frequency, temperature, ground surface intensity, residency time and size. These characteristics in turn depend on a range of factors including: fuel type and structure, width of fire, slope, wind and moisture levels in the vegetation and soil, and burning method. Impacts also depend on soil and habitat conditions at the time of burning (which partly reflect the cumulative impacts of burning), season, weather conditions and interactions with grazing and other management practices.

Fires can have significant detrimental impacts, including:

- Ignition, combustion and loss of peat and humus layers by hot fires in dry conditions.
- Increased rates of run-off and erosion, particularly after hot fires and where large or old stands of *Calluna* are burnt, and on steep slopes.
- Reduction in peat accumulation, even under well controlled prescribed burns, and potentially emission of carbon dioxide and other greenhouse gases from carbon stores in peat if these ignite or dry out as a result of hot burns.
- Reduction of structural and species diversity and vegetation composition changes if carried out too frequently or over large areas.

- Post-fire establishment of invasive species such as bracken *Pteridium aquilinum*, for example where old *Calluna* stands are burnt.
- Destruction and long-term exclusion of fire sensitive and slow colonising species.
- Removal of cover for ground-nesting wildlife and destruction of birds nests and clutches during spring burning periods.

This review also concludes that further research is required on many aspects of burning management in the English uplands. Key research needs include better descriptions of burning practices in each upland area and habitat type; examination of the advantages and disadvantages of extending the burning season into September and shortening the spring burning period; assessments of the impacts of fire on nutrient cycling and budgets; run-off and erosion rates (and in turn their impacts on water courses); bird nesting and the biodiversity of bogs and acid grasslands.

English Nature's viewpoint

Regular burning, whether part of grouse moor management or as part of livestock production, has shaped the open landscape typical of much of upland England. English Nature recognises the value of sympathetic burning regimes in certain habitats, notably dry heath, but also recognises that other habitats, notably peatlands (blanket bog and wet heath) can be severely damaged by inappropriate burning.

Like all land management practices English Nature promotes an environmentally sustainable approach to burning management. However, there will be some ground on which we believe burning should not be undertaken because of damage or potential damage.

Selected references

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