Uplandia: making better policy in complex upland systems

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Policy Context

Uplands are a key priority for Defra and Natural England, given their importance for climate change mitigation, biodiversity, drinking water provision, flood risk mitigation, agriculture, recreation and culture. Uplands feature prominently in Defra's 25 year plan and peatlands (many of which are in the English uplands) are being targeted for restoration in the Nature for Climate Fund and forthcoming England Peat Strategy (to be delivered by Natural England), as part of the UK's plans to reach net zero emissions for the land use sector. Linked to this, legislation is now being brought forward to prevent the burning of heather and other vegetation on protected blanket bog habitats. However, little is known about how the cessation of burning (and possible replacement with mechanical cutting) might influence wildfire risk, especially in sites that are not in favourable condition, if these changes in management are not accompanied by restoration measures.

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The Policy Challenge

Uplands are complex social-ecological systems, and policy interventions designed to deliver net zero and biodiversity targets may have unintended effects on other parts of the system, which could inadvertently undermine these and other policy goals. Existing policy appraisal methods based on evidence synthesis are able to show how specific policy interventions (e.g. peatland restoration) are likely to influence specific outcomes (e.g. GHG emissions). However, these methods are not able to explain how different interventions may interact when combined, or predict how multiple outcomes may trade-off with each other, to produce unexpected outcomes. Interpreting conflicting evidence and addressing low strength of evidence with high uncertainty can also limit attempts to inform policy directly.

An evidence-based solution

Systems models enable evidence syntheses to be integrated with each other, alongside other sources of evidence including, for example, computational models and qualitative data. By representing key system components and their linkages, simple Logic Maps or more sophisticated Bayesian Networks enable policy analysts to see how new evidence or different assumptions about contested relationships is likely to influence the outcomes of a policy intervention. By making the complexity of the systems and the decision-makers assumptions explicit, these methods enable more transparent decision-making under conditions of uncertainty.

Our Approach

This project developed a Bayesian Belief Network for English uplands, representing key system components and relationships on the basis of the best available evidence. Given the policy relevance of managed and wild fire, a rapid evidence synthesis was conducted to assess factors influencing the behaviour of peatland users and managers in relation to wildfire, which informed a wildfire sub-model. By considering four scenarios (below), it was possible to consider how changes in the availability of public funding and/or carbon finance might alter the overall utility of uplands and provision of specific ecosystem services.

The Policy scenarios

Public funding for upland management is expected to change significantly as the UK constructs post-Brexit policies. If this leads to a reduction in public funding, this might trigger the abandonment of some uplands or more intensive management where outputs can be produced for the market. Alternatively, ecosystem markets such as the Peatland Code, and emerging instruments (such as Landscape Enterprise Networks or a proposed UK Farm Soil Carbon Code for non-peat uplands), might provide substantial new revenue streams, retaining overall funding levels at or above levels experienced prior to EU-exit.

Key findings from the Uplandia model

- There is a trade-off between maximising productivity and provision of ecosystem services notably climate regulation, flood protection, water quality and biodiversity. This trade-off is robust and resilient to changes in individual interventions and habitat extent or condition. If levels of funding post-Brexit were to trigger more intensive management in some locations for products that have a sufficiently strong market demand, these private goods could come at a significance cost in terms of reduced public goods from these uplands.
- Maximising climate regulation, flood protection and water quality are generally consistent with maximising biodiversity, but spatial and taxonomic heterogeneity, and difficulties valuing biodiversity make trade-offs difficult to predict. To ensure biodiversity is not compromised by future upland policy and regulation, a precautionary approach will be needed, piloting and evaluating interventions in a range of upland contexts before integrating them into a national framework.
- The model allows resilience of specific services or habitats to be explored. For example increasing cover and condition of blanket bog habitats results in a 75% probability of maintaining or increasing climate regulation, flood protection and biodiversity in the context of predicted climate change. In contrast, if cover and condition of this habitat were to decline, there would only be a 57% to 67% probability of maintaining or increasing these services.
- Wildfire reduction potential is decreased under a payment for ecosystem services scenario compared to a maximising productivity scenario largely as a result of changes in fuel type related to habitat extent and connectivity of habitat.

- Sensitivity analysis suggests that wildfire reduction potential could best be retained or enhanced by reducing fire ignition risk, highlighting the importance of effective behavioural change interventions (see findings from the wildfire evidence synthesis below).
- It also indicates that direct interventions to reduce habitat connectivity and fuel load such as mechanical cutting may have an important role to play. Note, that there is considerable uncertainty about how mechanical cutting should be implemented to reduce landscape-scale connectivity; small scale fire-breaks may not be effective.
- The model also indicates that rewetting is also likely to be effective in maintaining wildfire reduction potential in the long-term, as it leads to changes in fuel type, as well as having beneficial effects on other services, notably climate regulation, flood protection, water provisioning and biodiversity.

Key findings from the wildfire evidence synthesis

A rapid evidence assessment [ongoing] identifies factors influencing the behaviour of peatland users and managers, in relation to wildfire (this report summarises interim findings, which will be finalised in April 2021). Social science research relating to wildfire management in UK peatlands (either related to fuel management or ignition behaviours) was limited, so evidence was considered from comparable international peatlands and where potentially relevant, from the wider literature on behaviours related to forest fires in Europe and the USA. In these cases, the difference in environmental context makes it difficult to infer the relevance of findings to a UK peatland context. Despite these evidence gaps and uncertainties, a number of policy-relevant themes can be identified at this stage:

- Based on a global review of prescribed burning practices, there is evidence that the development of **stringent 'command and control' policies and increased regulation of traditional, self-organised fire-based land management systems can have potentially negative impacts for managing wildfire risk. Instead, evidence from prescribed burning in Europe and wildfire management in US forest systems, suggest that flexible policy and planning approaches (and regular review), including regional policy adaptation, can increase the ownership, uptake and sustained application of wildfire mitigation measures, and so reduce wildfire risk.** In European and international contexts, the continuation of traditional land use systems has been identified as important to the retention of sustainable prescribed burning practices over the long-term.Spatial planning including land management plans which incorporate fire risk planning offer potential for enhancing hazard awareness and mitigating wildfire risk. Grazing programmes have been used effectively for managing fuel breaks in some land use contexts (with appropriate incentives and monitoring), and could be explored in the UK context.
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- The integration of local knowledge and use of trusted local information sources is important to **frame wildfire mitigation messages** for rural communities who are more likely to adopt these where are perceived to align with existing community identity, norms and culture (compared to suburban and rural-urban fringe communities who may be more receptive to more top-

down approaches). For example, public and stakeholder support for a wildfire early warning system in a UK protected area was dependent on the extent to which implementation enabled shared understandings of fire hazards and incorporated pre-existing stakeholder values and dynamics.

- The development of **place specific, collaborative, community wildfire programs** can have positive effects for mitigating wildfire risk at community and landscape levels. These may include, for example, collaborative development of land management plans and training. While the literature emphasizes the need for skills and knowledge to be place-specific, **national training standards and certification** has also been associated with increased uptake of mitigation measures and adoption of best practice. With effective facilitation, community programs may enable resource-pooling and planned collaborative responses to wildfire. This may increase the likelihood of a rapid response to wildfire, and by building a common sense of purpose linked to shared values, may enhance uptake of mitigation measures. In addition, there is also evidence that wildfire preparedness may be greater in more cohesive and connected communities, as community members inform and support decision-making by individual land managers.
- **Public attitudes towards fuel management can affect land manager behaviours relating to burning practices.** Negative public perceptions of prescribed burning was one factor responsible for a decline in this practice in Irish hill farms, and there is evidence from Europe and the USA that effective communication can change public perceptions of the benefits and impacts of prescribed burning.
- Public outreach that: **i) involves citizens (i.e. is interactive/ participative); ii) occurs at all stages (before, during, after fires); iii) uses consistent messaging; iv) employs a tailored placed-based approach for high risk areas; and v) takes a partnership building approach** between agencies and communities, can increase acceptance of the need for fire management and mitigation measures among members of the public and land managers. While the

literature emphasised consistency over time, it also identified the idea of 'teachable moments' immediately after fires timing, during which risk reduction messages may be particularly effective.

- **Police involvement in wildfire awareness campaigns and youth initiatives (and prioritisation of wildfire a**s an issue at local levels by police forces) offers potential for increasing the impact of outreach programmes and reducing wildfire risk. Targeted training courses with young people in high-risk areas of Wales led to a 46% decrease in call outs recorded by the fire service, and a programme involving the police in Dorset led to a 60% decrease in heathland fires in the region.

Behaviours and interventions relating to wildfire ignition (accidental and intentional) identified from the rapid evidence assessment:

Behaviour category	Specific Manager/ User Behaviours	Interventions
Wildfire ignition - accidental	Loss of control of prescribed burns (fire spread)	**Promotion of best practice** (intensity, timing etc.) and sufficient available staff/support and equipment
	Accidental ignition from other user groups (camping, barbecues)	**Public education/engagement on fire risk awareness** responsible fire behaviour/fire risks from accidental ignition (fire risk campaigns etc.
Wildfire ignition - intentional	Arson/intentional fire starting	**Public wildfire education** (on wildfire arson and risks from intentional fire setting) - youth education programmes on wildfire risk/risk awareness
		Targeted education (specific groups) and local awareness and engagement programmes on wildfire risk awareness
		Police involvement in wildfire mitigation strategies and awareness programmes
		Limiting access to high risk areas (visitor management)

Find out more

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