Natural England Review of Upland Evidence 2012

Scoping Document

June 2012

1.0 Introduction and Background

1.1 In March 2011 Defra published the Government's review of uplands policy which sets out a range of actions the Government, led by Defra, will take in partnership with others in the public, private and voluntary sectors to help secure a sustainable future for the English uplands. The actions in the Uplands Policy Review sit under four main themes:
- Supporting England's hill farmers
- Delivering public goods from upland environments (including biodiversity)
- Supporting sustainable upland communities
-Driving and monitoring change

1.2 Natural England has a specific role in helping deliver the Uplands Policy Review; in particular through our research and evidence based advice, our delivery of agri-environment schemes, and our partnership work with the hill farming and moorland management sector and rural communities to deliver a wide range of public goods and environmental benefits in the uplands. Our role in the uplands is also shaped by our broader role in the delivery of the government's Natural Environment White Paper and Biodiversity 2020 aspirations that focus on the enhancement and protection of ecosystem services and the natural environment, including improving the condition of England's SSSIs. Biodiversity 2020 targets for SSSIs are to achieve 50% in favourable condition and 95% in favourable recovering condition by 2020.

1.3 For these reasons it is important that our advice and decisions are based on sound evidence, and that our evidence processes are transparent & robust.

2.0 Issues considered in the review

2.1 The English Uplands are extensive and include a range of biotypes, species, and land management practices. It is widely recognised that they provide provisioning, regulatory, and cultural ecosystem services. As such, the uplands present a number of environmental conservation and land management challenges. It would not be possible to cover diversity of issues in a single review of evidence.

2.2 This review relates to the evidence on biodiversity and ecosystem services in the uplands, and the impact of land management activities upon them.

2.3 To make this task manageable the review of biodiversity and ecosystems evidence will focus on five issues where there is significant challenge:

- Impacts of tracks and vehicle use on soil structure and hydrology and their impacts on biodiversity.
- Feasibility of restoring degraded blanket bog including areas such as drainage, vegetation cover (peat forming species), and climate change.
- Impacts of managed burning on peatland biodiversity and ecosystem services.
- Appropriate management regimes for sustaining biodiversity in upland hay meadows.

- Determination of environmentally sustainable stocking regimes on moorland.

2.4 Clearly, there are many other upland issues where a review of the evidence would be beneficial. A record of other topics will be maintained for future reviews.

2.5 Given the geographic spread of the English uplands, where the evidence indicates significant differences in impacts spatial variation will be considered in the review conclusions.

3.0 What is excluded from the review?

3.1 Consideration of other relevant information, such as social and economic factors, are an important part of the process of developing our advice, but are not part of this review.

3.2 This review will draw evidence-based conclusions on the changes that occur to ecosystem services and biodiversity because of the interventions. Recommendations for land management advice and or practice will not be developed within this review process.

3.3 Climate scenarios are excluded from the review and a note with further details can be found at Annex 1.

4.0 Questions for Review

4.1 Impact of upland tracks

4.1.1 <u>The Issue:</u>
There are an increasing number of engineered tracks on blanket peat to enable vehicular access for a range of land management operations. Whilst these are relatively small scale linear features it might be that they change peat structure and alter the nutrient and hydrological environment affecting the ecosystem services and biodiversity of blanket peat.

4.1.2 <u>What is considered in this review?</u>
This review covers the creation of vehicle tracks across blanket peat. It is focused upon tracks that require hard engineering but will also consider the use and impact of mesh products as a less intrusive alternative to hard engineering.

4.1.3 <u>The over-arching review question is:</u>

What are the impacts of tracks upon the integrity and function of blanket peat?
Function in this instance also includes the biodiversity interest.

4.1.4 <u>The following sub-questions will be the focus of review:</u>

a) Do tracks alter the hydrological system of blanket bogs at either surface or sub-surface level?

b) Do tracks alter the structural integrity of blanket peat?

c) Do tracks lead to enhanced erosion of blanket peat?

d) Do type of vehicle and usage influence the impact of the track upon either the structural integrity or hydrology of the blanket peat?

4.1.5 Comparator: the comparators for the questions in this review are either:

i Functionality of blanket peat prior to intervention; or
ii Functionality of blanket peat where intervention has not occurred.

4.2 Burning on upland peatlands

4.2.1 The Issue:

Blanket bog and other upland peatland habitats (including springs, flushes and swamps) cover much of the English uplands. Because of a range of interventions (including grazing, drainage, burning – both managed and wildfire, afforestation and atmospheric pollution) much of our peatland habitats are in poor condition. Burning is a traditional land management tool widely practiced throughout the uplands from the south west to the north east. Burning aims to provide structural diversity and improved feeding value on heather dominated habitats for both sheep and red grouse and is considered a vital activity for both farmers and grouse moor managers. There has been much recent debate over the possible impacts of burning on a range of ecosystem services that peatlands provide but there is no overall consensus. An understanding of the interaction of burning with other activities, such as grazing, is critical. Large areas of deep peat soils are now dominated by heather and do not contain peat forming vegetation.

The definition of terms considered in the upland peat review is habitats and characteristic associated species of flora and fauna of upland peatland habitats; in particular, blanket bog (degraded forms may be non-active and dominated by heather), and also associated upland habitats on peat soils including flushes, fens and swamps and wet heath.

4.2.2 What is considered in this review?

The review covers biodiversity maintenance and restoration objectives, including the effects of burning on modified, degraded upland peatland habitats and their restoration, and effects on ecosystem services, particularly carbon and water.

4.2.3 The overarching review question is :

What are the effects of managed burning on the maintenance and restoration of upland peatland biodiversity and the provision of ecosystem services (particularly carbon and water)?

4.2.4 <u>The following sub-questions will be the focus of the review:</u>

a) What are the effects of managed burning on the maintenance and restoration of the characteristic floristic composition, structure and function of upland peatland habitats?

b) What are the effects of managed burning on the maintenance and enhancement of the characteristic fauna of upland peatlands either directly or indirectly through changes in vegetation composition and structure?

c) What are the effects of managed burning of upland peatlands on carbon sequestration and storage, either directly or indirectly through changes in vegetation composition and structure?

d) What are the effects of managed burning of upland peatlands on water quality (including colouration, release of metals and other pollutants and aquatic biodiversity) and water flow (including downstream flood risk), either directly or indirectly through changes in vegetation composition and structure?

e) How do differences in the intensity, frequency, scale, location and other characteristics of burns (including 'cool burns') affect upland peatland biodiversity and ecosystem services?

f) How does the interaction of managed burning and grazing affect upland peatland biodiversity and ecosystem services?

g) Is there a relationship between managed burning of upland peatlands and 'wildfire' (risk, hazard, intensity, extent and damage etc.)?

h) What are the extent, frequency, practice and type of managed burning (including 'cool burning') on upland peatlands (including in relation to designated sites and water catchments)?

4.2.5 There are a variety of terms associated with blanket bog, blanket peat and mires that can cause confusion in discussions about issues relating to the habitat, the peat substrate and the landscapes it occupies.

- ***Blanket mire*** – a term normally used to describe the overall peat blanket covering an upland geographic area which may include a variety of mire types – both ombrotrophic (blanket bog) and minerotrophic (fens). This term is therefore all inclusive and can cover many different morphological types such as saddle mires, ladder fens and valley mires.

- ***Blanket bog*** – a type of mire habitat 'fed' solely by atmospheric precipitation (from which it also receives nutrients) and found on blanket peat of between 0.3 – 6m deep (Lindsay 2010). There are a range of blanket bog types present in England reflecting both natural ecological variation and variations induced by man's interventions. These can be divided into two main types on the basis of whether they are 'active' or 'non-active':

    - ***Active (peat forming) –*** on blanket bogs characterised by having a two-layered peat structure, which influences the way peat is formed, carbon is fixed and

water flows. The surface layer or *acrotelm* is composed of the most recently deposited material (top 10-20cm). This layer also supports a range of peat forming plant species, especially bog mosses and cotton grasses. In this layer the water table fluctuates. The base layer, the *catotelm*, remains permanently waterlogged and anaerobic. The lack of oxygen slows decomposition to extremely low levels, and this is where peat is formed and stored. On less modified, active blanket bog there can be variation in the surface micro-topography, with hummocks, ridges, *Sphagnum* lawns, wet hollows and pools. Dwarf shrubs can be abundant on the drier areas, for example, the hummocks. Some types of active blanket bog may be degraded and may have lost both the heather and bog mosses. However they may retain cotton grasses and may still be peat forming.

- ***Dry deep peat (non-active***) – blanket peat that currently does not support peat forming vegetation and hence not accumulating peat. The *catotelm* is present, but often of a modified drier condition and structure, and may be subject to peat loss and reduction of the thickness of this layer through wind and water erosion. This type is often dominated by heather creating an appearance of 'dry heath' vegetation but on a blanket peat substrate not a mineral soil. The vegetation is often quite uniform and surface micro-topography is likely to be missing.

- ***Blanket peat*** – is the peat material accumulated by blanket bogs when they are 'active' and which blankets the landscape. The depth of peat can vary greatly with deeper peats supporting blanket bog. Shallower peats often support a wet heath vegetation.

4.2.6 Comparator: the comparators for the questions in this review are either:

i. Peatland biodiversity and other ecosystem services prior to intervention; or

ii Peatland biodiversity and other ecosystem services where the intervention has not occurred.

4.3 Hay meadow management

4.3.1 The Issue:

There are concerns over Higher Level Stewardship management prescriptions for hay meadows. Specifically, meadow prescriptions relating to inorganic fertiliser and farmyard manure application (timing, amounts, periodicity). There are also some concerns over other related management issues such as rush invasion, lime application, grazing and drainage.

4.3.2 What is considered in this review?

This review covers the management of upland hay meadows and the maintenance of biodiversity within the context of UK farm regimes.

4.3.3 The overarching review question is:

What management regime maintains the diversity of the flora and fauna of the upland hay meadow Priority Habitat?

4.3.4 The following sub-questions will be the focus of the review:

a) What types, rates of application and timing/periodicity of nutrient and lime applications maintain the floristic diversity and breeding bird populations of upland hay meadows ?

b) What management methods or approaches control rushes (Juncus spp) in upland hay meadows and maintain the floristic diversity of the meadows and ensure suitability of the hay crop as a winter feedstuff.

c) What spring grazing levels, timing of shut up/closure for hay and cutting dates maintain the floristic diversity and breeding bird populations of upland hay meadows?

4.3.5 The following will be the definition of terms considered within the hay meadow management review:

- Upland hay meadows are species-rich plant communities conforming to the National Vegetation Classification types MG3 *Anthoxanthum odoratum-Geranium sylvaticum* grassland and MG8 *Cynosurus cristatus-Caltha palustris* grassland occurring in upland areas in northern England.

- A generalised annual management cycle for upland hay meadows involves grazing during in the spring (sheep), followed by exclusion of livestock in mid May (shut-up) and hay cutting in July. This is followed by further grazing in late summer and autumn (sheep and/or cattle).
- Floristic diversity is here used include both species density or richness (number of species/unit area) and ecological diversity which is a measure of the relative abundance of species.

4.3.6 Comparator: the comparator for the questions in this review is:

Improved or semi-improved meadow grasslands often dominated by rye-grass (NVC types MG6 *Lolium perenne-Cynosurus cristatus* grassland and *MG7 Lolium perenne* leys and related grasslands) which are less diverse or species-rich.

4.4 Restoration of degraded blanket bog

4.4.1 The Issue:

Degraded blanket bog tends to become drier with a loss of peat-forming conditions and key peat-performing species. Changes to the vegetation found on the peatland occur and consequently the blanket bog is sometimes mistakenly classed as dry heathland and grassland – this results in inappropriate management that will not lead to the recovery of the degraded blanket bog. An understanding of the various causes of degradation is critical if the correct restoration measures are to be put in place.

4.4.2 What is considered in this review?

The review will consider the features of a functioning and active blanket bog; the factors that lead to the degradation of blanket bog; and the feasibility and techniques of restoring degraded blanket bog.

4.4.3 The overarching review question is:

What are the requirements for, and what interventions can restore and maintain a functioning and active blanket bog with a representative bog fauna and flora from a degraded state?

4.4.4 The following sub-questions will be the focus of review:

a) What are the hydrological, structural and floristic characteristics indicative of a functioning and active blanket bog?

b) What factors (management, atmospheric deposition and climatic) affect the hydrological, structural and floristic status and composition of blanket bog, and leads to its degradation?

c) What species of plant are peat- forming and what are their physical (hydrological and other) requirements?

d) What interventions are required to restore a degraded blanket bog to a functioning and active blanket bog system with abundant peat-forming species, and over what timescale?

e) Does the blocking of artificial drainage channels (grips)on degraded blanket bog result in a functioning and active blanket bog with abundant peat forming species and representative bog flora and fauna. If so, do all drains require to be blocked?

f) Are there are conditions where it is not feasible to completely restore a degraded blanket bog to a fully functioning bog system with its representative flora and fauna, and if so what is likely to prevent their full recovery.

g) Are there any wider environmental impacts resulting from the restoration of degraded blanket bogs?

4.4.5 Comparator: the comparators for the questions in this review are either:

i. Peatland biodiversity and other ecosystem services prior to intervention; or

ii Peatland biodiversity and other ecosystem services where the intervention has not occurred.

4.5 Moorland grazing and stocking rates

4.5.1 The Issue:

The majority of upland semi-natural vegetation is subject to grazing, or forage production. It is considered that overgrazing has an impact on upland landscapes and biodiversity, and is a key reason for unfavourable condition of SSSIs and Priority Habitats. A key element of Agri-environment and other land management schemes is establishing grazing regimes that allow recovery and sustainable management of habitats and support ecosystem service delivery.

4.5.2 What is considered in this review?

This review will consider the effects of different grazing regimes and stocking rates, including the use of different types of livestock; the impacts of tools such as shepherding and burning; and the abandonment or absence of grazing; on moorland biodiversity and ecosystem service delivery.

4.5.3 The overarching review question is:

What are the effects of grazing regimes and stocking rates on the maintenance and or restoration of moorland biodiversity and ecosystem service delivery?

4.5.4 The following sub-questions will be the focus of the review:

a) What is the effect of grazing on the delivery of moorland biodiversity and other ecosystem services, including timing, frequency and regularity of grazing as well as livestock numbers, and what are the differential effects on integrated moorland ecosystem services?

b) What methods of stocking rate calculation, or setting grazing regimes, consistently provide regimes that maintain or restore moorland biodiversity, and what are the key parameters that calculations should include?

c) What changes have taken place under recent reductions and seasonal changes in sheep grazing, and what is the significance of these changes?

d) Over what timescales can grazing-related change in plant structure and diversity be observed or expected?

e) How is 'under-grazing' defined? What are the effects of low intensity regimes, set to restore small areas of priority habitat within a moorland mosaic, on other parts of the moorland including non-target habitats such as acid grassland?

f) What factors influence spatial patterns of grazing? How effective are tools such as shepherding and burning in influencing grazing distribution, and how do they interact with stocking rates to achieve improvements in habitat condition and ecosystem services?

g) Do different types of livestock (species and breed), and combinations of livestock, affect moorland habitats differentially?

h) What are the effects of absence or abandonment of grazing on moorland biodiversity and other ecosystem services?

4.5.5 The following will be the definition of terms considered in the moorland grazing review:

- Moorland ecosystem services are the carbon sequestration and storage aspects of climate regulation and water provision, including water quality and regulation (water flows and flood prevention), in addition to biodiversity.
- Moorland biodiversity includes the priority habitats upland heathland, blanket bog, upland calcareous grassland, upland flushes, fens and swamps, calaminarian grassland (associated with heavy metal-rich mine spoil), inland rock outcrops and scree, limestone pavements and montane habitats, and associated species.
- The Natural England approach to setting sustainable moorland stocking rates involves applying a standard restoration or maintenance annual maximum rate proportionately to each main habitat type in the moorland unit, to arrive at an overall maximum annual rate. These rates are derived from typical vegetation biomass productivity and digestibility values for the habitat. The maximum annual rate is converted to a grazing regime using published Livestock Unit conversions for different livestock and breed types, and a stocking calendar agreed to take account of environmental objectives and farming operations.

4.5.6 <u>Comparator:</u> The comparators for the questions in this review are either:

i. Upland heathland communities where the heathland component is in a suppressed and fragmented state; or

ii. Graminoid dominated moorland vegetation on deep and shallow peat and mineral soils, through heavy selective grazing of dwarf shrub, herbs and favoured grasses, or avoidance of less favoured graminoids.

ANNEX 1 Note on Climate Scenarios

Blanket peat forms only under specific climatic and topographic conditions. Of key importance is a requirement for high rainfall, low evapotranspiration and flat or gently sloping land. The low-lying oceanic blanket peats such as those found in Ireland and parts of Scotland require more than 200 rain days per annum with an annual precipitation in excess of 1200 mm (O'Connell 1990). At higher altitudes as is the case with much of the blanket peat in England, a minimum of 160 rain days is required with rainfall also exceeding 1200 mm (Rodwell 1991). A reasonably good correlation has been made between the1200-1250 mm isohyet and the extent of blanket peat (Godwin 1981; O'Connell 1990).

In recent years researchers have been attempting to understand the implications of changing weather patterns upon the upland environment. Looking specifically at blanket peat, Clark *et al*. (2010) and Gallego-Sala *et al*. (2010) suggest that the environmental conditions currently found in areas of blanket peat will contract north-westwards. The degree to which these changes take place will depend upon which emission scenario is used. It should be noted that these predictions are based upon precipitation, temperature, water-deficit and evapotranspiration data and do not address the responses to changes in environmental conditions discussed by Barber (1981) and Goode (1973). These latter authors, using the peat archive, suggest that as temperature or rainfall changes, the *Sphagnum* species that prefer either drier or wetter conditions, come to dominate. Whilst a full understanding of the impact of warming on blanket peat is some way off, there is consensus based upon available evidence, that damaged peatlands are substantially less resilient to climate change than healthy ones (http://www.iucn-uk-peatlandprogramme.org/resources/188).

References

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