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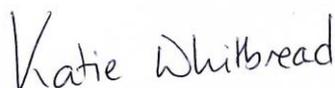
Mark Wrightham,
Scottish Natural Heritage,
Great Glen House,
Leachkin Road,
Inverness
IV3 8NW

Dear Mark,

Thank you for your request for responses in regard to the proposed development of a vision for the uplands under the second land use strategy. In consideration of the questions provided in your email, I have prepared the attached contributions on behalf of the British Geological Survey.

The British Geological Survey (BGS), a part of the Natural Environment Research Council (NERC), is a world-leading geological survey organisation, focussing on public and national good science for government, and research to understand earth and environmental processes. As a public sector organisation BGS is responsible for advising the UK government on all aspects of geoscience as well as providing impartial geological advice to industry, academia and the public. BGS is not a statutory body, but has an interest in collecting and preserving geoscientific data and information making them available to a wide range of users and communities via the National Geoscience Data Centre (NGDC).

Yours Sincerely,



Dr Katie Whitbread
Geologist
For BGS Scotland
The Lyell Centre
British Geological Survey

Question 1: Definition of the uplands

From a geological perspective, upland regions, considered as broad areas characterised generally by high relief and relatively steep topography, are commonly distinct from low-lying areas due to characteristic differences in the nature of their rocks and sediments, and by the range and intensity of landscape processes that occur within them.

In Scotland, there are classic examples of geological control of the landscape which have historically defined uplands. At the largest scale, the upland terrains of the Highlands and Southern Uplands are separated from the lowlands of the Central Belt (geologically known as the Midland Valley) by major, terrain-bounding faults.

The rugged terrain of upland areas, coinciding with typically high levels and intensity of precipitation particularly in western Scotland, condition land systems with high potential for erosion and transport of sediment through landslides, surface wash and stream flow. These processes give rise to the unstable slopes, thin soils, and bedrock-floored or rough boulder-strewn streams typical of the Scottish uplands.

In this regard, any definition of “uplands” should account for their dynamic nature: the definition should recognise that upland ecological systems and the cultural and social context of these landscapes are responses to the dynamic character of the upland land system.

Care should also be taken to ensure that any definition of the uplands also accommodates the fact that hydrological systems typically connect upland and lowland areas; rivers are typically sourced in upland headwaters and pass through lowlands in their lower reaches.

Finally, the term “uplands” is implicitly associated with altitude. If the latter criterion is used solely to define uplands, areas at low elevations and/or of low relief in otherwise 'upland' areas that may also be considered to be marginal land because they share many characteristics of higher altitude or higher relief areas, could be wrongly excluded from consideration. Such an exclusion would neglect the coherence in the dynamics of these landscape systems as discussed above; such coherence requires an holistic approach to their management which recognises continuity and connectedness in the landscape. Examples of marginal land of low relief and low elevation which share many characteristics with their adjacent uplands are common in the Northwest Highlands and the Hebrides.

Question 2: Benefits of the uplands

Scotland's uplands play an important role in buffering run-off and mitigating flooding in downstream areas. This is due to flow impedance by thick vegetation, infiltration in thick, peaty organic soils and porous unconsolidated superficial sediments, and attenuation of flow through meandering streams, lakes and reservoirs. In addition, the uplands provide for significant sources of fresh water and hydropower generation thanks to the generally high precipitation and typically steep river gradients.

Organic soils, peat bogs, native upland woodlands and appropriate upland forestry are important for carbon sequestration as well as providing important ecological functions.

Scotland's uplands form important components of the nation's rich and diverse geological heritage. Many of the geological features of the upland landscape have been at the heart of fundamental advances in geological science over more than two centuries (e.g. Hutton's unconformities, the intrusive nature of igneous rocks, the NW Highland controversy). The varied geology and spectacular exposures of the Scottish uplands continue to underpin geological education and training at all levels, attract geo- and landscape tourists, and provide a natural laboratory for ongoing scientific research.

The significance of Scotland's uplands for geoscience education, and geoheritage and landscape tourism is exemplified by the important role played by the National Parks and particularly the Geoparks of Lochaber and the Northwest Highlands in engaging students, tourists as well as local communities.

Question 3: Prevention/reduction of climate change impacts

Effective stewardship and management strategies could enhance the flood buffering capacity of the uplands, with increased flood protection for lowland areas and agricultural land. Mitigation of the effects of bog bursts and shallow slope failures and improvements in the stability of upland organic soils, particularly in peatlands, may also increase potential for carbon sequestration in upland areas.

Land-use management strategies designed to mitigate risks to vulnerable infrastructure from slope instability may help to counteract an increased risks of slope failure events triggered by increased rainfall and higher rainfall intensity associated with climate change.

Question 4: Key choices an upland vision should address

The conceptual basis for an upland vision on which choices of management strategy and planning policy are based, should not be centred around a static view of the properties of an upland landscape, but acknowledge the dynamic nature of these systems. The vision should consider how the effective *functioning* of upland land systems can support the multiple benefits these landscapes provide when properly and holistically managed.

Question 7: Involvement of stakeholders

The research community (academia and publically-funded research institutes) form an important stakeholder group that may provide valuable information and understanding that can inform the development of a vision and strategy for managing upland landscapes.

We consider that the key to effective decision making lies in understanding the functioning of upland land systems. Particular knowledge needed to support the assessment of multiple benefits and strategic land use planning includes understanding of the links between geological processes, ecological stability and biodiversity, soil processes and carbon cycling in the uplands.

Reflecting the significance of the required knowledge base, BGS Scotland are developing research capability in the functioning of catchment sediment systems and working with partners in environmental management and academia to assess how these systems support ecosystems, sustain soils and condition carbon cycling.



Developing a research network to encourage collaboration between groups would help to build a coordinated approach and develop the knowledge needed to support effective management of the uplands. In Scotland, a research network of geomorphologists focused on Mountain Rivers and comprising researchers from the Universities of Edinburgh and Glasgow, the British Geological Survey and other institutions has already been established. Opportunities for harnessing the knowledge, expertise and tools of this group should be explored to help develop relevant research in Scotland to underpin the upland vision.

Dr Katie Whitbread
For BGS Scotland
12 October 2016