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Ecology and conservation of birds in upland and alpine habitats – concluding remarks

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While the conference benefited greatly from the perspectives provided by participants from overseas, most of the contributions were from Britain and my conclusions are therefore largely concerned with the birds, habitats and management of the British uplands. By international standards, these are not high; they are exposed to the wet and windy oceanic climate of the Atlantic seaboard of Europe; and a large part of them is managed for game-shooting in a way that is peculiarly British.

In some parts of the world there are species restricted to high altitudes, with adaptations to the challenges of the montane environment. In Europe we have a few such species and in Britain none: the birds of our uplands generally also occur in the lowlands, some further north but some even in Britain itself. Furthermore, the recent Atlas survey has shown that some species formerly regarded as upland birds are now common in the lowlands (e.g. Common Buzzard *Buteo buteo*) and some that were formerly widespread are now concentrated in the uplands (e.g. Whinchat *Saxicola rubetra*). For British ornithologists, an upland bird is simply a species that occurs in upland habitats, whether or not it is specially restricted to such places.

Species that can be considered typical of the uplands in Britain, especially waders, have recently declined more than have species characteristic of any other habitat. The same is true in other European countries in which the matter has been addressed. Much of the conference was therefore not surprisingly taken up with what determines population levels of birds in the uplands and, especially, the causes of the recent declines. While each species has been affected by changes in the upland habitat in its own particular way, some general themes emerged.

There is abundant evidence, in many sorts of animals, of latitudinal shifts in distribution that closely match what climate change would be predicted to have caused. It is not therefore surprising that climate can be identified as an important determinant of distribution of upland birds or that climate change appears to be a driver of recent changes in altitudinal distribution. The impacts of climate change may be mitigated by habitat management, such as the blocking of drains in peatlands to reduce their drying out and thus maintain cranefly (Tipulidae) numbers. Greater availability of craneflies benefits various birds but habitat management may often need to be specifically targeted at individual species. An indirect consequence of climate change on birds is through the side-effects of sustainable energy generation. We know that wind turbines kill birds and deter them from foraging in their vicinity but we need to know more, especially about long-term effects on bird populations. Navigating between the Scylla and Charybdis of nature conservation and of environmental sustainability will require great skill and we need more research to underpin policy development.

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Climate change may be responsible for the tree-line moving up hill in Norway and other parts of Europe but so may be reduced grazing pressure. Humans and our domestic animals began to modify upland habitats thousands of years ago, much of that modification, such as the removal of forests and the modification of open-ground vegetation by burning, being intensive. The effects on wildlife of changes in land use may be rapid: when the intensity of grazing by sheep in Orkney was increased, Common Vole *Microtus arvalis* numbers went down almost immediately and the Hen Harrier *Circus cyaneus* population consequently declined; subsequent reduction of sheep numbers was followed by recovery in both Vole and Harrier populations. Where upland farmland has been abandoned, scrub has developed or forests have been planted. Scrub has greater avian biodiversity than the open habitats that it replaces and is closer to the vegetation that clothed the hills before human intervention, so could be seen as good for nature conservation. On the other hand, not only does scrub and forest remove the habitat for the birds of open ground but it shelters predators, whose excursions onto the open ground may be responsible for the declines seen in many upland species. Furthermore, farmers using smaller areas may use them more intensively, which itself has effects on wildlife.

The spread of forestry and any consequent increase in the predators that forests shelter are restricted because much of the hill ground in Britain is managed for the shooting of Red Grouse *Lagopus lagopus scotica*. But this management, amazingly successful in achieving its objectives in terms of Grouse numbers, is a source of much controversy. The legal control of generalist predators such as Red Foxes *Vulpes vulpes* and crows *Corvus corone* and *C. cornix* benefits Rec Grouse and other bird species but illegal persecution, occurring to an extent that is incomprehensible to the general public, substantially reduces raptor numbers over much of the British uplands. Grouse moor management is largely a matter of encouraging Heather (Ling) *Calluna vulgaris*, superficially a conservation benefit given the international significance of British Heather; but are the Heather monocultures that cloak many hills desirable? Furthermore, the abundance of Heather is produced by regimes of burning that are often inconsistent with our international responsibilities and clearly damaging, especially on deep peat. Given that grouse-moor management produces both benefits and disbenefits for nature conservation, we need to know more about the optimal methods and intensity of such management. The side-effects of some of the management practices are simply unknown and should be researched: for example, do the anthelmintic drugs in medicated grid move up food chains to affect non-target species or get into waterways? And turning to the social sciences, we need to know how to reduce current levels of illegal persecution of raptors.

As with most land on this overcrowded planet, there are competing interests in the management of our uplands. The community needs to balance forestry, agriculture and game-shooting; it needs to decide on the desirable level of grazing of the uplands; if (as many moorland managers believe) grouse shooting is only economically viable if raptors are illegally killed, the community needs to decide whether the economic benefits justify the widespread disregard of the law and the destruction of some of our most charismatic birds. Some argue that landed proprietors should be allowed to do what they wish on their own land but, even if one brushes aside the democratic claim of the whole community to have a voice in the management of great swathes of the country, the financial support provided by the taxpayer for all these rural activities gives every citizen a rightful voice.

We need the sorts of scientific debates that this BOU conference provided to help us all understand the problems that need wise resolution.

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