THE FLORA OF COLD REGIONS

(a conference held in conjunction with the 2012 AEM)

Friday, 2012 November 23
1.00 p.m. – 5:00 p.m.

Abstracts

The Montane Flora of Scotland – What is its future? Alistair Headley

The montane vascular flora of Scotland is not necessarily particularly diverse or unique in a European or global perspective, but it does have many nationally rare species. The hypothetical threats to these plants come from climatic warming, land-use changes, renewable energy infra-structure, recreational disturbance, atmospheric pollutants, erosion and increased grazing pressure from red deer and sheep.

The single population of *Diapensia lapponica* in Scotland is potentially vulnerable to climatic warming as it is situated on the summit of a single hill in western Scotland. However, as it must have survived the Holocene hypsithermal since the end of the last ice-age it must of survived temperatures that were warmer than they are today. Climatic warming impacts on *Koenigia islandica* will become evident much quicker on this only arctic annual that grows on the basalt barrens and flushes Isles of Mull and Skye. Autecological studies on this plant by Qasair Rashid showed that this plant readily cope with high temperatures (at least 45º C) for short periods, but is dependent on mobile substrates of low fertility. Increased mortality of plants is associated with drier summer months.

An attempt at re-visiting some of the quadrats taken in the Scottish Highlands by McVean & Ratcliffe showed that those quadrats on ground accessible to large herbivores had become grassier and the cover of dwarf-shrubs had decreased. In contrast quadrats in inaccessible locations appeared to have changed little, which is where many of the arctic-alpine species are to be found.

The Flora of Nepal : Mark Watson

Nepal is well known for its snow-capped mountains and alpine scenery, yet this is but part of a diverse mosaic of ecosystems found in this fascinating Himalayan country. With an immense altitude range from tropical jungles, at just 60m above sea level, to the top of Everest at 4848m, there are dramatic changes in vegetation within short distances and a huge diversity of plant species - Nepal is smaller than the UK but is thought to have some 7000 species. The diversity of habitats, rainfall patterns and isolation of mountain chains partly explains the large number of species, but this is augmented by Nepal's position at the cross-roads of several major floristic regions. Several genera display rapid speciation, linked to the geologically recent mountain building events during the Himalayan uplift. *Berberis* is one such group where new research is questioning the geological dating of the rise of the Himalayas. The different ecological patterns found in Nepal will be introduced - with emphasis on the colder regions - along with current research on exploration, documentation and production of the Flora of Nepal.

The Flora of Greenland : R.W.M. Corner

Greenland is the largest island in the world extending over 2500km from 60°N. to over 83°N. latitude where it reaches the nearest point of land to the Pole. It is considered to part of North America with an American floristic element on the west side and a European element on the east. It is dominated by its huge ice cap but has extensive areas of snow-free land on parts of the east and west coasts as well as in Peary Land to the north. The geology is complex with the oldest rocks in the world being found there. Various different geobotanical zones have been delineated for this large area by different authors and are subject to continuous alteration and fine tuning. High and low arctic is the simplest division with the high arctic boundary extending further south to 70 °N. lat. on the east coast than the west because of the influence of the cold East Greenland current which carries most of the ice south from the Arctic Ocean. The high Arctic climate has a wide temperature range with a July mean below 5°C and low precipitation compared with a July mean above 5° and a smaller temperature range with high to moderate precipitation in the low Arctic. A small sub-arctic zone exists in sheltered interior parts of the south west fjords where a low scattered forest of *Betula*, *Alnus* and *Salix* occur. The most important of plant families in Greenland are the grasses, sedges and members of the *Asteracea*e and *Brassicaceae* with 50-75 species out of a total of 513 species. The number of higher plant species falls northwards from 350 in the south to 120 in the north as conditions become more extreme. Mosses number 471 including 31 Sphagna, hepatics 135, lichens c. 950 and fungi 1600. The cryptogams make up an increasingly important part of the biomass from south to north. It is thought that almost all the higher plants colonised the country over the past 11,500 years although it is possible that some species were periglacial survivors in ice free refugia during the last glaciation. Two such species, *Draba sibirica* and *Potentilla stipularis* found far to the east in Siberia, are used to support this view The huge geographical latitudinal range of Greenland makes it an ideal area for climate change studies in relation to plant distribution.

Observations in the field described here were made in the high arctic of North East Greenland and Peary Land. The hugely impressive fjords and towering ice capped mountains are a feature of the region and together with the midnight sun and anticyclonic conditions produced by the icecap have rightly named North East Greenland the “Arctic Riviera”. There are marked differences between the climate of the more oceanic snowy fog bound coasts and the continental climate of the drier sunnier inner fjords where cryo-aridity and the effect of Föhn winds have a major effect on plant life. Precipitation falls steadily northwards from 400mm annually in the south of the region to 200mm to the north although it can be as low as 20mm annually in parts of Peary Land. Permafrost melting and snow beds are therefore important water sources. Solifluction and site aspect have major effects on the plant communities.

Greenland is a huge country which is exhilarating to visit and botanise in. It is a privilege to have been there and one gets the feeling that there is still so much more to discover botanically. There are many beautiful valleys and fjords and islands which have never been investigated in spite of the concentrated efforts of the Greenland Botanical Survey and the scientific expeditions of the past.

Acknowledgments. Geoffrey Halliday introduced me to Greenland and has been a constant source of help in the work I have carried out there. The late Commander Angus Erskine of Erskine Expeditions pioneered short visits to the high Arctic and this tradition was carried on under Kathleen and Neville Cartwright and Robert Burton of Arcturus Expeditions and I owe them much thanks as I do Bent Fredskild and Christian Bay of the Greenland Botanical Survey. Finally I would like to acknowledge the help given to me by my fellow expeditioners whose observations led me to plants which I would otherwise have missed.

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The coffee table book Det Grønne Grønland by Tyge W. Bøcher published by Rhodos in 2000: ISBN 87 7245 845 3 Although in Danish, the superb colour photographs of the scenery and flora give a real taste of Greenland and its plants.

The Flora of Antarctica and South Georgia : Jonathan Shanklin, Emeritus Fellow, British Antarctic Survey, Madingley Road, Cambridge, UK

There are only two flowering plants native to Antarctica, whilst South Georgia has 25, though there are around 40 introduced species that have persisted here. The introduction of alien species is a cause for concern, but efforts to exclude humans as a vector for their spread may obscure natural introduction of species. In the future the area of the Antarctic Peninsula and South Georgia may become more hospitable to flowering plants through the environmental changes induced through the action of ozone depleting and other greenhouse gasses. I will outline the environment of the region, and explain the effects of the ozone hole and climate change and I will offer some controversial thoughts on the actions that we should be taking.

Arctic-alpines and climate change John Birks, Department of Biology, University of Bergen, Norway & Environmental Change Research Centre, University College London, UK & School of Geography and the Environment, University of Oxford, UK

This is an extended abstract of the lecture I gave at the BSBI Conference on *The Flora of Cold Regions* held in Cambridge on 23 November 2012. The PowerPoint of my lecture can be viewed or downloaded from http://www.eecrg.uib.no/presentations.htm

Many arctic-alpine plants (namely alpine plants that primarily grow above the potential altitudinal forest-limit and arctic plants that primarily grow beyond the latitudinal forest-limit) are considered to be sensitive to climate change directly through warming or directly or indirectly through competition from tall and/or fast-growing lowland plants (Dahl 1998). In my lecture I outlined how changes in the occurrence and distribution of arctic-alpines are studied using the techniques of Quaternary palaeoecology (pollen analysis, plant macrofossil analysis, DNA analysis) (Birks, H.H. 2008). I discussed the changes in the distribution of arctic-alpines at two major climate changes: (i) the very marked climate changes at the transition from the last glacial stage to the Holocene (post-glacial) about 11,700 years ago (Birks, H.H. 2008) and (ii) the recent climate shifts at the onset of the Anthropocene at about AD 1850 due to increased human impacts on atmospheric composition, particularly rising CO_2 levels (Steffen et al. 2011). There is abundant evidence from fossil remains for local or regional extinction of arctic-alpines at the onset of the Holocene but no known global extinctions at this time in Europe or eastern North America (Birks and Willis 2008; Birks, H.H. 2008). Botanical resurveys of mountain areas originally surveyed in the 1930s (e.g. Klanderud and Birks 2003; Felde et al. 2012) in Scandinavia and the Alps show that summit floras are becoming more species-rich as montane dwarf-shrubs and grasses move up altitudinally into the lower and even the upper-alpine zones, presumably in response to climate warming. There is, however, very little evidence from botanical resurveys (about 100 such resurveys in Europe – Grytnes et al. unpublished data) for local extinction of high-altitude upper-alpine species. These findings contrast with predictions from broad-scale (50 × 50 km grids) modelling of species distributions in relation to present-day and future climate in Europe that predict a loss of about 60% of the European alpine flora by 2080 (Thuiller et al. 2009). The reason for this major discrepancy between model predictions and resurvey data is one of spatial scale (Willis and Bhagwat 2009). The most likely reason for the resilience of high-altitude species to recent climate warming is that there is very considerable local landscape heterogeneity in an alpine area (Scherrer and Körner 2011a, b). This leads to local climate heterogeneity and hence a wide range of environmental niches for arctic-alpines within a small area which in turn confers considerable biological resilience to climate change (Scherrer and Körner 2011a, b). Landscape heterogeneity and associated local climate heterogeneity are providing resilience to change just as they did in the past by providing local micro-refugia in which plants could persist locally in otherwise regionally unfavourable conditions (Birks and Willis 2008).

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