

# Scrubbers' Bulletin - No. 5, May 2003.

## The Montane Scrub Action Group Bulletin.

Welcome to issue number 5 of the Bulletin. Many of our readers receive the Bulletin electronically. We would prefer this method of circulation, and it facilitates the use of colour illustrations, as in this issue. For future use, if you have been sent a paper copy but have an email address that we could use, please email it to me (DKM) at the address below.

If any readers are not on the circulation list but wish to be, please let us know and we can add your name to the list.

**The Montane Scrub Action Group is a partnership of the following individuals supported by their organisations:**

**Diana Gilbert**, Highland Birchwoods  
**David Mardon**, National Trust for Scotland  
**John Holland**, Scottish Agricultural College  
**Adam Powell**, Trees for Life  
**Bruce Lowe**,  
**Deborah Long**, Plantlife

**Michael Scott**, Plantlife  
**Jenny Bryce**, Scottish Natural Heritage  
**Alison Hester**, The Macaulay Institute  
**Rob Soutar**, Forest Enterprise  
**Keith Miller**, Mountaineering Council of Scotland

We are pleased to welcome Deborah Long, of Plantlife Scotland, and Jenny Bryce who has succeeded Angus Macdonald from SNH. We thank Angus for his valuable contributions over the last few years. We also welcome Keith Miller to the group, representing views of the walkers and climbers via the MC of S, and Mark Wrightham, who will deputise in Keith's absence.

Contributions for the Bulletin should be sent to: David Mardon, The National Trust for Scotland, Lynedoch, Main Street, Killin, FK21 8UW, or preferably by email to [dmardon@nts.org.uk](mailto:dmardon@nts.org.uk)

Copy may also be submitted on 3.5" floppy disc or CD, **in MS Word** please.

For other correspondence regarding the group, please contact:

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# MSAG Progress Report

This 2001 conference, and publication of the proceedings (listed below), represented the completion of Phase one of the Montane Scrub Action Group agenda, i.e., the action points agreed from the 1996 conference had been achieved. However, these outputs were primarily communications and publications and the desired increase in practical conservation of treeline woodlands and scrub largely remains to be achieved.

The future of the group was reviewed, with the result that we agreed that it should continue to have role, but a more action orientated one, to achieve practical progress. However, the 'road map' to this achievement will still require a great deal of communication. At a 'new pathfinder' meeting, four key areas of development were identified:-

- Raising public awareness,
- Raising political awareness,
- Inventory development,
- Integrating land use.

Our recent efforts are largely directed by these objectives. One specific target is the establishment of a series of 'Demonstration Projects' where action is being achieved and that can be promoted with interpretation for visitors. These will be reported in a future Bulletin.

Specific outputs since the last Bulletin have been:-

Proceedings of the one-day conference held on 26<sup>th</sup> April 2001, were published and are available from HB for cost of postage:-

**Gilbert, D. (ed.) (2002). *Montane Scrub: The Challenge above the Treeline*. Highland, Birchwoods, Munloch.**

A reprint of **MacKenzie, N.A. (2000). *Low alpine, Subalpine, & Coastal Scrub Communities in Scotland*. Highland Birchwoods, Munloch** was supported by SNH, and can also be obtained from HB for the cost of postage.

An article on scrub published in 'The Scottish Mountaineer', the newsletter of the Mountaineering Council of Scotland:

**Mardon, D. (2002). *Clothing for the hills*. *The Scottish Mountaineer*, 12, 26.**

Two talks on montane scrub were delivered at the Botanical Society for Scotland two-day symposium "**Plant conservation in Scotland**" in September 2002, and are due to be published in a forthcoming issue of the Botanical Journal of Scotland, as follows:.

**Gilbert, D. & Di Cosmo, L. (2003; in press). *Towards restoration of treeline woodland and montane scrub*. *Botanical Journal of Scotland* 55 (1),177-187.**

**Mardon, D.K. (2003; in press). *Conserving montane willow scrub on Ben Lawers NNR*. *Botanical Journal of Scotland* 55 (1), 189-203.**

"**Expanding up the hill**": a talk given by **Diana Gilbert** at "**Roots to the Summits**", the Cairngorms Campaign one-day conference to review the future for the Cairngorms Mountain woodlands in November 2002. It was notable that all speakers at this event made reference to treeline woodland or scrub, except for Robin Harper MSP, reporting on developments in the Scottish Parliament, in which scrub does not yet figure. Perhaps there is another target to be aimed for.....

# MSAG Willow Scrub Recording Card

**David Mardon**

The work of the group has led to the conclusion that many records of montane willow species made in the past have lacked the numerical detail and precision needed to assess the importance and potential viability of the population. This information is needed to plan for conservation.

To facilitate the collection of more useful data we have produced a printed card for recording in the field. It is A5 in format, printed both sides, waterproof to be usable in all weathers, but needs some support for writing, e.g. a folded OS map. Cards can be obtained from us on request ([dmardon@nts.org.uk](mailto:dmardon@nts.org.uk)) and have the return address printed on them. If you are likely to encounter montane willows, please try to help gather this information.

We are most grateful to Scottish Natural Heritage for funding the printing of the cards



Content and layout of cards are as shown below.

Montane willow scrub - site condition recording form					<b>Species</b>				1-10	11-50	51-100	101-500	Over 500	Seed seen?	Size range H x L x W & sexes seen
<b>Name of observer</b>					<i>Salix lapponum</i>										
<b>Address (postal)</b>					<i>Salix lanata</i>										
					<i>Salix myrsinites</i>										
<b>Address(e-mail)</b>					<i>Salix myrsinifolia</i>										
<b>Name of site:</b>					<i>Salix phylicifolia</i>										
Please use OS map; name of coire or hill, qualified by aspect etc					<i>Salix x tetrapla</i>										
<b>Description of site</b> (To aid relocation)					<i>Salix arbuscula</i>										
<b>Estimate of size of site:</b>		<b>Photo taken?</b>			<i>Salix reticulata</i>										
<b>Grid reference:</b>		<b>Date:</b>			<i>Salix aurita</i>										
Method used for grid ref.	Map only 1:25,000	Map only 1:50,000	Map & Romer	GPS	<i>Salix sp. not det.</i>										
Please tick box					Juniper										
					Other sp.										
Altitude at top of site (m)					<b>Plant details:</b> (see below)										
Altitude at bottom of site (m)					<b>Numbers -</b> If possible count plants, otherwise tick boxes										
Method used for altitude					<b>Size range -</b> Indicate size by approx. or actual measurement (height x length x width; L = longest diameter & W at 90° to L) e.g. 'most c. 0.5m x 0.5m; a few >1m x 1.5m x 1.5m; a few <10cm x 10cm x 10cm.										
Time spent on site: Weather visibility etc:					<b>Condition of plants -</b> Comments on signs of: Rockfall / landslip (fallen plants etc); Browsing (shredded twigs, stripped bark); Current year's growth of shoots.										
					<b>Sex of plants -</b> Counts of any plants sexed, e.g. '2m 7f'.										
<i>Details of species, numbers and condition of plants overleaf.</i>					Note of other species of interest, animal or plant, such as tall herbs or insects of the shrubs:										
Please return completed form to:		John Holland, C/o SAC, Kirkton Farm, Crianlarich, FK20 8RU													
<i>With thanks from Montane Scrub Action Group</i>															

# “Biodiversity: Taxonomy, Genetics And Ecology Of Sub-Arctic Willow Scrub”– a multidisciplinary research project

## SEERAD Willow Project

Populations of montane willows in the UK are a source of acute conservation concern. Sub-arctic willow scrub is a priority habitat type recognised in the EC Habitats Directive, *Salix lanata* is a UK Red-Data species covered by a Species Action Plan, and four other montane willow species are classified in the UK as 'Scarce' (Stewart *et al.* 1994, Wigginton 1999). The basis of their conservation status is their small population size, as well as the isolated and fragmented nature of many populations, some of which are in danger of terminal decline unless remedial action is undertaken (Mardon 1991).

Where populations are in a critically endangered state, there is often a conflict between the need to conduct a research programme to obtain data to guide conservation actions, and the need to undertake immediate active management to prevent populations going extinct. In Scotland there are several active conservation programmes underway on montane willows; these programmes have taken the initiative in acting to avoid, or reverse, local population extirpation. Recognising the desirability of obtaining parallel research data to contribute towards these conservation initiatives, a research proposal was submitted to the Scottish Executive Environment and Rural Affairs Department (SEERAD) as part of their Flexible Fund (FF) Programme in 2001. This proposal was funded, and the research commenced in 2002.

The project is a multidisciplinary one combining expertise and experience from Scottish research institutes, University departments, government agencies and non-governmental organisations.

The aims of the project are:

- To characterise the species and genetic diversity of populations of sub-arctic willow scrub
- To establish if diversity in the willow populations correlates with diversity of associated species, and if so, how
- To establish the factors limiting willow regeneration

This will provide underpinning data for conservation programmes on sub-arctic willow scrub, and also to address a broad conceptual issue, namely the relationship between species diversity, genetic diversity and ecological interactions.

The research programme can be divided into four complimentary themes: taxonomy, genetics and population biology, ecological interactions and regeneration ecology.

### *Taxonomy*

Identifying montane willows is not a simple task. High levels of developmental and environmentally induced variation, coupled with extensive inferred hybridisation, leads to difficulties assigning a given individual to a particular taxon. This in turn has implications for conservation. Firstly, an accurate assessment of the conservation status of a species requires information on its distribution and population sizes - this requires that it can be distinguished from other taxa (including morphologically similar hybrids). Secondly, when selecting material for reintroduction programmes on a given species, it is desirable that the source material is the intended taxon, rather than a morphologically similar hybrid derivative.

To try to tackle these issues and to gain some insights into the complicated taxonomy of willows, a combination of molecular and morphological studies are being undertaken. A range of populations of montane willow species has been sampled to establish a base line for the identification of parental species. The samples are currently being screened to search for species-specific DNA markers. These markers will then be examined in putative hybrid individuals and populations. This is to establish whether hybridity as inferred from morphology, is supported by molecular data (which is not subject to environmental or developmental plasticity). The programme will include scattered samples of hybrids, as well as detailed studies of a small number of focal sites in which the dynamics of hybridisation will be examined in detail. The historical role of hybridization across species ranges in Scotland will also be assessed. David Tennant, an amateur botanist with particular expertise in willow taxonomy, holds an extensive living collection of montane willows and their hybrids. This collection will also form an important component of the project's samples.

The DNA markers being used include standard approaches such as amplified fragment length polymorphism (AFLPs), and chloroplast restriction fragment length polymorphism (RFLPs), but also markers developed specifically for montane willows such as microsatellites and small nucleolar RNA gene markers.

The taxonomic part of the willow project is being carried out predominantly at the Royal Botanic Garden Edinburgh (RBGE contact: Alan Forrest; [A.Forrest@rbge.org.uk](mailto:A.Forrest@rbge.org.uk)), with marker development being undertaken at the Scottish Crop Research Institute (SCRI contact: John Brown; [jbrown@scri.ac.uk](mailto:jbrown@scri.ac.uk)).

#### *Genetics and population biology*

Establishing what constitutes a willow individual can be difficult. Asexual reproduction and plant fragmentation in an unstable habitat can lead to vegetative dispersal. This in turn impacts on the interpretation of population size estimates based on census counts. In many cases plants do not form easily definable clumps, and even where they do, the number of discrete bushes may not equate well with the number of genetically different individuals. Another population genetic issue of relevance to montane willows is the extent to which populations are differentiated from one another. It is not clear what the spatial scales of effective dispersal are, and the degree to which different sub-populations within a given massif are genetically isolated.

To establish patterns of dispersal and the spatial partitioning of genotypes and genetic diversity, a combination of genetic marker techniques and seed dispersal measures are being undertaken. DNA fingerprinting, using willow microsatellites isolated from three montane willow species, is being used to produce clonal maps of montane willows at two focal sites: Corrie Sharroch, Glen Doll and Meall Ghaordie in the Breadalbanes. In addition, estimates of population genetic structure are being obtained from all of the 13 extant populations of *S. lanata* and 10 populations each of *S. lapponum* and *S. herbacea* from across their range in Scotland. Further leaf samples of *S. lapponum* have been collected from Ben Lawers for detailed studies of gene flow. Together with direct seed trapping experiments these studies should provide insights into the reproduction, dispersal and regeneration potential of montane willow species.

The clonal mapping, population genetic and gene flow studies are predominantly being carried out at the Scottish Crop Research Institute (contact: Konstantina Stamati; [kstama@scri.sari.ac.uk](mailto:kstama@scri.sari.ac.uk)), and the seed dispersal studies carried out by the Macaulay Institute (contact: Robin Pakeman; [r.pakeman@macaulay.ac.uk](mailto:r.pakeman@macaulay.ac.uk)).

### *Ecological interactions*

Diversity in one component of an ecosystem is likely to impact on the diversity of any associated species. Thus the willow project is also evaluating to what extent the genetic, demographic and taxonomic composition of montane willow communities influences other components of sub-arctic willow scrub.

For instance, mycorrhizal fungal communities are known to play a vital role in ecosystem functioning and nutrient cycling and yet little is known about the diversity of these communities. Research has shown that surface fruiting bodies are actually poor indicators of mycorrhizal communities, and that sporocarp surveys can be misrepresentative of the total mycorrhizal fungal diversity at a given site. Assessing belowground diversity has been difficult in the past. However, recent advances in molecular genetics now allow molecular identification of mycorrhizal root tips and this opens up opportunities for assessing these communities directly. Molecular tools will also be used for identifying the pathogenic rusts that infect montane willows. Morphological identification of rusts is hampered by the need to have all five life-stages to assign it to a given species. Sequence-based identification using reference libraries is an efficient method to circumvent these identification problems. Using these molecular identification approaches, we aim to establish how mycorrhizal diversity and rust diversity relates to willow diversity.

Plant/animal interactions are also of importance to montane willows and we are assessing the extent to which willow species and population structure is correlated with diversity in associated insect communities. Using the locally abundant willow species *Salix arbuscula*, the responses to different degrees of artificial shoot removal in late winter, which mimics large herbivore browsing, are also being investigated, along with any changes in the associated insect fauna.

As an additional link between willow diversity and associated species diversity, we are investigating phytochemical diversity of willows. Willows are known to show heritable variation in phenolic glycoside composition, and these biochemical differences are hypothesised to underlie the allelochemical interactions with associated species, including the insects and fungi, being studied in other parts of the project. This information will be combined with the genetic, demographic and taxonomic data from the willows to elucidate their role as the phytochemical link between the genetics of the willows and their ecological interactions.

The mycological studies are predominantly being carried out at RBGE (contact: Jeremy Milne; [J.Milne@rbge.org.uk](mailto:J.Milne@rbge.org.uk)), the plant-insect interaction studies are being carried out at the Macaulay Institute (contact: Ros Shaw; [R.Shaw@macaulay.ac.uk](mailto:R.Shaw@macaulay.ac.uk)) and the phytochemistry studies are being carried out at the Macaulay Institute in collaboration with Riitta Julkunen-Tiitto, University of Joensuu, Finland (contact: Glenn Iason; [G.Iason@macaulay.ac.uk](mailto:G.Iason@macaulay.ac.uk)).

### *Regeneration ecology*

The final area of research is investigating the impacts of grazing on regeneration ecology. It is well documented that large mammals can have devastating effects on montane willows, and that exclosures can lead to a marked increase in the growth of adult bushes. However, the exclosure of large mammals can also lead to an increase in sward height and an associated increase in small mammal populations, which in turn may increase seed and seedling predation. The removal of large mammals can also profoundly affect the availability of microsites suitable for willow establishment.

To test this hypothesis, and to learn more about the impact of small mammals on willow regeneration, a series of experiments have been established in which the effects of small

mammals, invertebrates and other causes of seed and seedling mortality are being quantified, under a range of ecologically realistic environmental conditions. In the Creag an Lochain enclosure at Ben Lawers, an area from which large mammals have been excluded, small scale enclosure cages have been established to prevent entry of small mammals. Within these cages, the effects of reduced vegetation height and soil disturbance, both of which are features of large-herbivore grazed systems are being compared with appropriate controls. An understanding of the effects of these variables on willow establishment will help to target future conservation effort and management techniques to appropriate areas and conditions.

The regeneration ecology studies are being carried out at the Macaulay Institute (contact: Ros Shaw; [R.Shaw@macaulay.ac.uk](mailto:R.Shaw@macaulay.ac.uk)).

#### *Further details*

As the project develops, updates will be written for the 'Scrubbers Bulletin' focusing on individual components of the project. A web page describing the project's activities can be found at <http://rbg-web2.rbge.org.uk/willow>.

The willow project is coordinated by Pete Hollingsworth (RBGE; [P.Hollingsworth@rbge.org.uk](mailto:P.Hollingsworth@rbge.org.uk)) and Glenn Iason (Macaulay Institute; [G.Iason@macaulay.ac.uk](mailto:G.Iason@macaulay.ac.uk)). It involves collaboration with colleagues from the Macaulay Institute, The Royal Botanic Garden Edinburgh, the Scottish Crop Research Institute, the Scottish Agricultural College, Biomathematics and Statistics Scotland, the Universities of Edinburgh and Aberdeen, along with Chris Sydes (SNH), David Mardon (NTS) and David Tennant (willow taxonomist).

#### *References*

Mardon D.K. (1991). Conservation of montane willow scrub in Scotland. *Transactions of the Botanical Society of Edinburgh*, **45**, 427-436.

Stewart, A., Pearman, D. & Preston, C.D. (1994). *Scarce Plants in Britain*. Joint Nature Conservation Committee, Peterborough.

Wigginton, M.J. (1999). *British Red Data Books 1: Vascular Plants*. Joint Nature Conservation Committee, Peterborough.



*Salix* canopy



*Salix lanata* eaten



*Salix lapponum* galls



*Russula nana*

# Scottish Juniper Survey

Graham Sullivan ([Gsullivan01@aol.com](mailto:Gsullivan01@aol.com))

Concern over the perceived decline in extent and distribution of juniper and the condition of juniper populations has resulted in the production of a Species Action Plan. The SAP identifies information obtained through field survey as an essential precursor to setting priorities for conservation of the species. This survey, funded by SNH and carried out by Graham Sullivan, aims to provide this.

A stratified random sample of 71100km<sup>2</sup> grid squares throughout Scotland with existing records of juniper presence is being surveyed. Juniper locations are identified and mapped, and in a 1km<sup>2</sup> within the 100km<sup>2</sup> a more detailed survey which includes environmental and land use factors, juniper population strength, age and sex structures, regeneration, herbivory and disease is carried out. A similar survey has been carried out by Forest Research staff on Forest Enterprise land, and this information will be incorporated into the final project report. Although the project has not yet been completed, several interesting points emerge from preliminary analysis of some of the results.

Juniper has disappeared from some 20% of 100km<sup>2</sup> with previous records of presence. In a further 12 % of squares, juniper is found in very small populations, usually confined to habitats such as cliffs, and in such cases long-term persistence is extremely unlikely without intervention. In contrast, around one third of squares have populations consisting of hundreds or thousands of individuals, and the future of most of these populations appears to be secure assuming drastic changes in land use do not occur. In the remaining squares there are populations which seem to be under no immediate threat, but which may require some form of intervention to ensure regeneration in the longer term.

Regeneration is more common in larger populations, which also have more varied age structures than smaller populations, which is another factor favouring the persistence of larger rather than smaller populations.

Widespread browsing by mammalian herbivores has been found, while the incidence of invertebrate herbivory and fungal disease appears to be greatest in larger populations.

Full analysis of all the results from the survey will permit detailed and precise assessments and conclusions to be drawn in the final report for this project, which is scheduled for the end of February 2003. A sound basis will then exist for decisions regarding the conservation of juniper in Scotland to be made.

# Juniper and the Rural Stewardship Scheme

Gillian McKnight, SAC Conservation Services, October 2002

Juniper can exist in a range of habitats and conditions, however it has suffered from widespread overgrazing and burning, consequently it is diminishing across its range in Scotland. Juniper is principally found in lowland and upland heathlands, birchwoods and pinewoods but remnants can occur in unimproved grasslands, along the edges or in rides within forestry plantations and along burns and gullies. Juniper thrives on a range of soil types, but its high demand for light can quickly affect its survival under the shade of developing trees.

“Suppressed” juniper is commonly seen in over-grazed or frequently burned situations. Such practices, ongoing for decades, can reduce the overall quantity of juniper, minimise regeneration of new seedlings and weaken the structure of the habitat. “Under-grazed” juniper can lead to the growth of dense uniform stands of juniper to dominate in favour of grassland or heather. These stages of development can be manipulated to achieve a desired condition.

Management to benefit juniper implies initial cessation of grazing, controlled grazing, controlled burning or bracken control, but as juniper scrub can be an ideal habitat for both black grouse and pearl-bordered fritillary, management recommendations must take into account the varied requirements of associated species. Black grouse need good vegetation structure and the maintenance of open wet areas rich in cotton grass that are important feeding areas for chicks. Pearl-bordered fritillary needs bracken cover for over-winter protection and early spring warmth for emerging larvae and violets, the main larval food.

Under the Rural Stewardship Scheme payments are available through SEERAD for farmers who enter into a 5 year management plan. The whole farm must be managed under general environmental protection measures and in addition, selected areas can be entered for specific management options. Options such as “scrub management” or “moorland management plans” can be used to restrict or control grazing to encourage juniper to develop within a mosaic of grassland or moorland. The farmer receives management payments for loss of grazing and the costs of any necessary fencing required for controlling livestock grazing. Poorly positioned fences can be hazardous to black grouse and careful siting or marking of fences is crucial.

Areas of juniper on farms that have benefited from appropriate management through careful grazing are for example in Lochgilphead, where juniper is rare, on an area adjacent to a SAC, summer grazing by sheep has been restricted. In mid Loch Ness area on scattered “juniper savanna” (a mosaic of juniper over unimproved species rich grassland and open birch woodland) overall sheep grazing has been reduced through a combination of stock disposal under moorland management and management of species rich grassland. Controlled grazing, particularly by cattle, can help to keep the juniper open, maintain the varied structure of the habitat and create conditions for new seedlings to establish.

Juniper is locally common in the Cairngorms where the one of the pioneering agri-environment schemes, the Cairngorms Environmentally Sensitive Area scheme has helped to protect and regenerate juniper throughout Strathspey and Strathdon and has encouraged farmers into conservation management. Black grouse, pearl-bordered fritillary as well as associated species such as violets, birdsfoot trefoil, yellowhammer, linnets, argent and sable have also benefited.