

**MONTANE
SCRUB
ACTION
GROUP**



Scrubbers' Bulletin 11



Cover photo:

Willow seeds dehiscing: *Salix myrsinifolia*, Ben Lawers NNR
(Photo by David Mardon)

Scrubbers' Bulletin no. 11

The Bulletin of the **Montane Scrub Action Group (MSAG)**:
a partnership of individuals supported by their organisations.

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Welcome to issue number 11 of the Scrubbers' Bulletin,

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We are most grateful to the authors and photographers for their contributions to this issue – it's a bumper one! Many thanks, all – and we're always keen to receive articles and images for future editions. Please contact phil.baarda@snh.gov.uk or diana.gilbert2@btinternet.com for more information and submission details.

Earlier issues of the Bulletin may be read at <http://www.mountainwoodlands.org/publications.asp>



Island on Loch nan Eun, Dundreggan.
(Photo by Alan Watson Featherstone)



Craigellachie NNR, overlooking Aviemore. (Photo by Phil Baarda)

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Update from the Chair

Diana Gilbert

At the start of 2015, the situation regarding Montane Scrub in the UK is definitely more optimistic than it was ten years ago, specifically with regard to its profile within upland land use, and in terms of provision for its management and the number of projects proposed that include measures to expand the existing resource. When considering the condition of the remaining populations, particularly of montane willows, the story is perhaps less clear.

All sub-arctic willow scrub included as a feature of interest on a designated site was assessed as in unfavourable condition in SNH's most recent site condition monitoring surveys. And there has been only very limited activity to care for populations of montane willows off designated sites. But alongside this story there is again cause for optimism: the Species Action Framework oversaw the beefing up of the vulnerable woolly willow populations, action that has to be commended and the success of this is being monitored. In addition a number of NGOs (National Trust for Scotland, Borders Forest Trust, Trees for Life) have all taken direct action to either expand existing or establish new populations of willows, dwarf birch and/or juniper. Private estates, such as Gaick in Strath Spey, have also invested in the establishment of new populations of montane scrub species, in this case dwarf birch. Last summer, Forest Enterprise Scotland (FES) commissioned a number of field surveys of mountain areas known to have, or likely to have montane scrub and so has expanded its knowledge of the populations within the National Forest Estate. There is now internal discussion about how FES might act on the information it has gathered for the benefit of the montane scrub in its care. The Cairngorm National Park Authority has also embarked on an ambitious project to expand the montane scrub cover within the National Park by 100%, *ie* to double it!

The Montane Scrub Action Group (MSAG) is as ever moving forward. In response to the potential increased activity on the ground we have set

ourselves the task of developing Best Practise guides in relation to the different aspects of montane scrub management, including the establishment of new populations. Throughout 2015 we hope to develop guidance covering the following topics:

- the conservation of genetic diversity
- the nursery production of young montane scrub plants for scrub establishment schemes, or existing population enhancement
- the planting process; site preparation, protection and aftercare
- monitoring success
- recording wild montane scrub populations

We also hope this year to set in train the updating of and better access to the montane scrub dataset. The aim is to provide open access to the records, initially as a map based resource. In order to maintain the integrity of the dataset it will not be editable but we expect to be able to accept new data and add it to the set on a relatively regular basis. We are very keen to keep the dataset evolving, there are still many records that date back to the 1970s and '80s, and even some from the 1950s which really do need clarifying and we will be delighted to receive new data from anyone taking the time to gather data.

Finally, I am becoming aware that there are a growing number of people who are interested in the MSAG and would like to have some involvement. So another task we will take on this year is to investigate how wide that interest is and whether there is a need for us to look at our format and function and review whether it needs to be changed. I would welcome any comments that you may have on this (to diana.gilbert2@btinternet.com).

Diana Gilbert, PhD, is an Upland ecologist with 30 years' experience working in the Highlands focussing on upland vegetation, particularly montane scrub, treelines and upland woodland. She initiated the MSAG in 1996. If not on the side of a crag somewhere can be found enjoying the arts, in the garden or kitchen.

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Propagation of *Salix lapponum* and *Salix lanata*

Jill Hodge

Given the difficulty of collecting viable seed from montane willows in remote locations with difficult access, Trees for Life has been doing some work to investigate producing seed in the nursery from cuttings collected from plants in wild populations.

Cuttings of *Salix lapponum* were first taken from 4 plants at one site in Gleann na Ciche on 23 November 2010. 30 plants were produced from these cuttings and planted out into stockbeds in spring 2012 at our nursery in Glen Moriston. Further cuttings from these original cuttings were taken during April, June and August 2012 to produce a further 65 plants, some of which were also planted into the stockbeds. Much labelling is needed to keep track of all the cuttings and which plants they originate from – we now have a stockbed of over 60 plants, all originating from the four wild plants we collected from. Since then we have found out that only one of the wild plants was female, and only 6 plants in our stockbed are confirmed as female!

Male and female plants flowered in the stockbeds in 2013 and seed was collected on 6 June, from which 90 plants were produced. Seed was collected again on 20 May 2014 and 110 plants produced. All seedlings appear to be *S. lapponum*, with no obvious hybrids occurring.

In 2013, we collected a further seven cuttings from five female plants at the same site in Gleann na Ciche to add to the stockbed, but no flowering has occurred as yet. At this time, seed was collected from the *S. lapponum* as well as *S. myrsinifolia* in Gleann na Ciche, but no seedlings were produced. The seed was possibly not quite ready, but given the remote location and difficult access, we were not able to go back and collect further seed at a later date from this site.



Willows growing in beds on the nursery in 2014 showing *Salix lanata* on the right and *Salix lapponum* on the left. (Photo by Jill Hodge)

We still need to go back and collect cuttings from many other locations in Gleann na Ciche, so that we have much wider genetic base, from which we can hopefully produce seed on the nursery in the future.

In May 2012, we collected cuttings of *S. lanata* from 5 remnant plants at a site near Glen Moriston, in the hope of producing seed in the nursery in the same way as *S. lapponum*. We appear to have cuttings from one original male plant in the stockbed, and although flowering occurred in 2014, so far no seed has been produced as the male plants flowered several weeks after the female plants this year.

We are still learning about getting stock beds set up correctly, but we are aiming to continue producing *S. lapponum* seedlings and hopefully other willow species in the future as well.

Jill Hodge is Dundreggan project co-ordinator at Trees for Life. Her work includes managing the tree nursery and organising tree planting on Trees for Life's Dundreggan estate in Glen Moriston.

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Transplanting *Betula nana* on Ben Wyvis

Nikki Dayton

Betula nana is a red data book species of least concern and is listed as scarce in the British guide by Stewart and Pearman (1993). In the latest British flora, published in 2002, *B. nana* was recorded from 74 10km tetrads during the recording period 1987-99, 54 tetrads less than in previous years. The losses were mainly from the south and west of the range.

As part of the ecological mitigation work being undertaken by Quadrat Scotland Ltd for the Wyvis Estate hydro development, an area of the proposed pipe route was identified that crossed through an extensive stand of this species. It was located entirely between two burns and some of the trees were of an unusually large size and spread. Dr Diana Gilbert was asked to survey and assess this population and it was agreed that they were of high significance, both for the size and density of the trees and at one location in the site, for a mixed population of *B. nana*, *Salix* spp. and downy birch *B. pubescens*; an unusual association (for the UK), reminiscent of the plant's habits in Scandinavia.

The developers, although trying to mitigate any ecological damage as much as possible, were unable to move the line of the proposed feeder pipeline from the nominated route due to engineering constraints. It was decided to try to transplant individual *B. nana* trees in order to reduce the number that would be damaged or destroyed.

In the first trial during November 2011, it proved very difficult to dig up the plants by hand, due to their extensive root and mycorrhizal systems that ran deep and extended well beyond the area of the clumps. We managed to extract three plants (or most of them) and replanted them in an area well away from the proposed construction zone. These survived reasonably well but were obviously stressed by their translocation after the first season.

Following the results of this attempt, a further trial was made to move the trees, including some of the larger trees affected, by using a digger. It was possible to pick up a much larger mass of substrate this way, extending at least 1m beyond each clump and 70cm-1m deep, using a wide digger bucket.



Left: *Betula nana* bush, taken in March one year after the transplant. Right: *B. nana* bush, taken in May one year after the transplant. (Photos by Nikki Dayton)

Each clump was draped over peat substrate close to their initial location, as far as possible putting the plants on a moderate (c. 10 degree slope) to ensure adequate drainage. Much of the work was through recent pine plantation so the transplanted trees were often draped over the side of the forestry ditches. In the end about thirty plants of varying sizes were moved in this way, some more than 1m high and c. 2m diameter.

The trees were checked for leaf growth and height throughout their first spring/summer after the transplant and appeared to be growing normally. They were checked again in the spring following and were found to all be doing well; it was hard to tell the transplanted trees from those left *in situ* and the rate of new growth was commensurate. So far, none of the transplanted trees have been lost although one of those from the first trial is partly dead, which seems mainly to be due to the root damage sustained by the hand-dig method of transplantation. The success of the latter method was, I think,

largely down to the care and expertise of the digger driver who followed the ecologist's onsite instructions with a high degree of sympathy with the objective.

Nikki Dayton is the director of Quadrat Scotland Ltd - an ecological consultancy since 1992 specialising in Scottish Upland habitats and species. This work was carried out as part of our Ecology Clerk of Works role with the Ben Wyvis hydro schemes

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***Salix herbacea* records in Scotland 2014**

Peter and Sylvia Woodhead

A survey for the detailed presence of *Salix herbacea*, dwarf willow, on Cumbrian fell tops developed from a Cumbria Wildlife Trust (CWT) Upland Juniper project, which followed concerns that juniper bushes in Cumbria were dying and not regenerating. It was felt that previous records did not provide enough data to aid conservation and to guide replanting schemes. A project officer was appointed, a survey form drawn up and a team of around a dozen volunteers were trained, to survey and replant juniper. The juniper survey was designed to map the distribution of juniper on the Lakeland Fells, both of *J.c. communis* and *J.c. nana*, and to assess the current state of the stands on a subjective scale of performance. 58% of the juniper sites in Cumbria were found to be in decline. This information was used to inform individual, hand planting of juniper seedlings in precisely selected localities. By March 2014 CWT volunteers had individually hand planted 6400 junipers at eight different sites, each of which had a management plan. Further details of the Uplands for Juniper Project can be obtained from CWT (www.cumbriawildlifetrust.org.uk).

Literature about dwarf willow suggests that this tiny tundra species has already become extinct in England and Wales from the Peak District and Snowdonia, and may be declining in the Lake District. However standard botanical recording of the presence of dwarf willow, by hectad or by kilometre squares, does not provide sufficient detail to be able to identify stands and thereby to judge its health and status. Use of GPS now means that 10 figure grid references can be generated for individual location and extent of the willow.

Over the 2012-14 seasons, CWT volunteers have continued to survey for the presence of dwarf willow on Wainwright¹ summits in Cumbria. Willow has been found on over 70 Wainwrights, in two types of microhabitat, 'carpet' and 'crevice', from 975m on Scafell Pike down to 535m on Buckbarrow, an outlying fell in west Cumbria. Carpet habitats occur on exposed summit ridges, where stony terrain and very short vegetation does not out-compete the dwarf willow. Crevices are narrow cracks, mostly vertical, where dwarf willow can survive relatively free from grazing by sheep. CWT and the Cumbria Biological Records Centre at Tullie House in Carlisle hold the full detailed findings (www.cbdc.org.uk).

While on holiday in Ullapool, May-June 2014, focussing on the twin objectives of Golden Wedding celebrations and the North West Scotland GeoPark, dwarf willow was encountered in four localities, namely: Cul Mor, up to 780m; Ben Stack SE and summit ridges; on low hills above Sandwood Bay; and on the clifftop at Cape Wrath, all of which appear to be new Scottish records. The Cape Wrath record is being claimed as the lowest, at 130m, and most northerly dwarf willow occurrence on the Scottish mainland. Using the CWT system, which was originally set up to plot dwarf juniper stands, the following is a summary of the records of our Scottish dwarf willow finds. The CWT record sheet requires: date; grid reference; location; male or female; altitude; areal extent; number of plants; presence of sawfly galls; and a brief habitat description. This differs slightly from the Montane Scrub Action Group (MSAG) forms, which were unavailable to us at the time.

¹ The 'Wainwrights' are the 214 fells (hills and mountains) described in A. Wainwright's seven-volume *Pictorial Guide to the Lakeland Fells* (1955–66).

Note, that while on holiday we did not have access to the spread-sheet of Scottish willow records, nor to the MSAG Willow Scrub Recording Card, although this card does not list *Salix herbacea*. We could not substantiate MSAG records from 1999 onwards, on Knockan Cliff, Canisp and other records. Canisp SE ridge, 28 May 2014, was a nil return.

Can any conclusions about differences between dwarf willow occurrence in Cumbria and Scotland be drawn from only four records, given that the Scottish willow finds were by happenstance, not as the result of a planned survey? The leaf size of Scottish willows appears to be slightly larger, on average, than in Cumbria, but the tree still has a prostrate growth form and occurs in quite discrete patches, limited to certain habitats, and absent from other sites, which otherwise appeared to be suitable. It was found in snow bed habitats, as per the literature, yet no willow has been found in snow bed habitats in Cumbria, as these are generally too wet.

It is important to continue to monitor dwarf willow occurrences, for base line distribution data, and to attempt to measure parameters that will indicate the health of the dwarf willow. In Cumbria, for the 2015 season, volunteers will continue to survey 'gaps' in dwarf willow occurrence, while also seeking signs of whether the dwarf willow is disappearing from Cumbrian fells. While the dwarf willow is so low-growing that it does not make any impact on landscape, evidence is accumulating that it may have, by virtue of its occurrence over the last 10-15,000 years in Cumbria, a wider community of potentially mycorrhizal fungi and parasitic insects associated with it. The *Eupontania herbacea* sawfly is endemic to dwarf willow, laying eggs on the leaves, which develop as red galls from which the flies emerge. It is not known if this weakens the plant. Sawfly galls are quite widespread on Cumbrian dwarf willow, whereas in 2014, sawfly galls were seen in Scotland only on Ben Stack at around 510m. However, the association is certainly ripe for further investigation.

There is some evidence of sheep grazing on dwarf willow, as bitten leaves or presence of sheep wool, which may have negative implications for the survival of this iconic species in Cumbria. CWT would be very pleased to liaise with MSAG to further research into the occurrence and performance of this species, which it is suspected may be a 'canary on the fells' for Cumbrian upland vegetation in the face of present and future climate change.



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They live in south Cumbria.

Cul Mor 27 May 2014. 2 sites- (2 photos)

1. Meallan Diomhain (NC 171117) At 595-598m, on a snow bed habitat below the col on a block field of small sized pieces of Cambrian quartzite, a shedding site, north facing, was a patch of 'carpet' dwarf willow covering over 40sqm, together with *Loiseleuria*. The willow had very small leaves, less than 10mm width. Male and female flowers were developing. No willow sawfly galls present.



Dwarf willow on Cul Mor at 580m, 27 May 2014. Insert: close up at same location. (Photos SW)

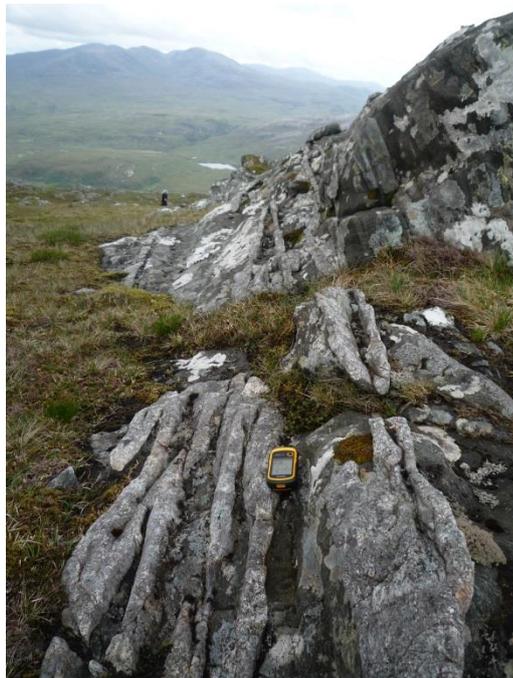
2. Creag nan Calman (NC 160115) At 771-780m, on Torridonian Sandstone, above the col between the twin summits, on worn path areas was a patch of 'carpet' dwarf willow about 25sqm, again with very small leaves, and no sawfly galls.



Dwarf willow on Torridonian sandstone, Cul Mor 27 May 2014. (Photo SW)

Ben Stack 3 June 2014. 2 localities

1. Leathad na Stioma (NC 278942) 510-513m, on the SE ridge, dwarf willow was found in both crevice and carpet habitats, adjacent to the path, about 5° slope, with very small leaves. Sawfly galls present.



Dwarf willow in crevices on Ben Stack, around 510m. (Photo SW)

2. Summit ridge (NC 269942) at 715-721m, dwarf willow was widespread in turf over 125sqm, among a range of different stones and boulders, of both Torridonian Sandstone and Cambrian quartzite. No sawfly galls.



Dwarf willow on Ben Stack summit 3 June 2014. (Photos by SW)

Above Sandwood Bay 2 June 2014

(NC 221964) At 135m, on Druim na Buainn, about 35sqm of willow was found on the sides and top of a small cliff of Torridonian Sandstone, in both horizontal and vertical cracks, with vigorous growth of leaves of up to 25x21mm. No sawfly galls.



Dwarf willow near Sandwood Bay, 2 June 2014. (Photo SW)

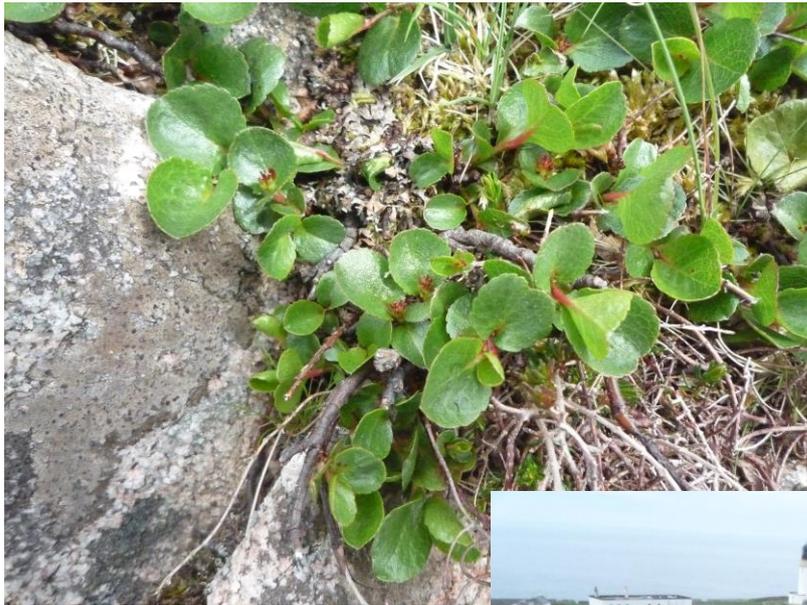


Vigorous dwarf willow growth at 135m, Druim na Buainn. (Photo PW)

Cape Wrath 31 May 2014

(NC 226975) At 130m, over 255sqm of willow was found adjacent to the track to the former signal station, on a north facing slope, in rock crevices in Lewisian Gneiss, and carpet of turf in *Calluna*, *Eriophorum*, *Festuca*, at about 5% cover. Woody stems were visible. No sawfly galls.

Cape Wrath – the most northerly dwarf willow on mainland Scotland. (Photo SW)



Healthy dwarf willow at
Cape Wrath. (Photo SW)

Assessments of montane willow scrub and dwarf juniper heath for the Red List of European Habitats project

Ben and Alison Averis

The Red List of European Habitats project is assessing changes in the extent and quality of over 500 Red List terrestrial, freshwater and marine habitats in the European Union together with Switzerland, Norway, Iceland and neighbouring seas. It is funded by the European Commission, and the UK assessments, made by various people including ourselves, are co-ordinated by Professor John Rodwell. The Red List habitats are defined using a modification of the European Union Nature Information System (EUNIS) classification.

We are making assessments of ten Red List habitats in the UK, two of which are of interest to *Scrubbers' Bulletin* readers: these are the habitats which in the UK consist of (1) montane willow scrub (NVC W20 *Salix lapponum-Luzula sylvatica* scrub) and (2) dwarf juniper heath (NVC H15 *Calluna-Juniperus* heath).

For each habitat the information being gathered is for extent (past and present), habitat condition, trends in extent/condition and pressures contributing to habitat loss or degradation. The information is short and summarized, and is entered into a spreadsheet (one row per habitat), which sounds quite simple but some data such as accurate area measurements can be hard or even impossible to obtain from currently available sources. However, we have obtained useful data on these two habitats. Approximate extents are 0.12 km² of montane willow scrub and 8 km² of dwarf juniper heath. The main pressures on willow scrub are grazing, airborne nitrogen pollution and fragmentation; reduced snow cover and associated increased exposure to wind and frost might also affect some montane willow plants. It is good that some significant and previously unknown patches of this habitat have been found in recent years. Montane willow scrub is also increasing in extent as a result of willow-planting in the last couple of decades. The main

pressures on dwarf juniper heath are grazing, airborne nitrogen pollution and burning. This type of heath appears to have been reasonably stable in extent and condition in recent decades.

Our work will be completed shortly after this issue of the *Scrubbers' Bulletin* goes to press; the Red List of European Habitats project as a whole will continue until June 2016.

We are very grateful to Diana Gilbert, Sally Johnson, Richard Marriott, Graham Sullivan and Dan Watson for their help in providing useful information for our assessments of montane willow scrub and dwarf juniper heath.

Ben and Alison Averis are botanists living in East Lothian and specialising in botanical survey, monitoring, teaching and writing. Most of their work is in northern and western Britain. Their website is www.benandalisonaveris.co.uk

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Mountain woodlands in Scotland found to support a treasure trove of fungal diversity

Emily Hesling and Andy Taylor

A four year PhD research project completed in 2013 has uncovered an astonishing level of fungal diversity growing in Scotland's montane woodlands. The research focused on 'ectomycorrhizal' (ECM) fungi, which form symbiotic relationships with most montane woody plant species. ECM fungi extract nutrients and water from soil and pass them onto the plants in exchange for sugars derived from photosynthesis. This association is likely to be particularly critical in the climatically harsh, nutrient-poor montane environment. This relationship is obligate, neither the host plant nor the complex associated community of ECM fungi will survive without the presence of the other. Two hundred and fifty seven species of fungi were recorded during the project, bringing the total number of ECM fungi recorded in mountain woodlands in Scotland up to 348. Thirty-four species new to the UK were recorded, and at least 28 species new to science were also uncovered, including what is expected to be a high number of endemic species. This most likely represents the highest degree of novel macro-organisms encountered in a terrestrial habitat in recent UK history, and emphasises the importance of montane woodlands as reservoirs of biodiversity.



The 'alpine brittlegill'
Russula nana, growing
with dwarf birch in Glen Muick.
(Photo by Andy Taylor)

Research of lowland ECM fungi associated with trees has established that ECM fungi species have varied distributions, from individual soil horizons to geographical scales, and have diverse niche requirements. We are now starting to establish baseline information on the biogeography and ecology of montane ECM fungi in Scotland, which may provide insight into how to manage restoration projects with the fungal kingdom in mind.

Although many fungi species commonly found in the lowlands do occur in sub-alpine and alpine habitats with hosts such as dwarf birch and dwarf willow, at least 90 named ECM species only occur in arctic-alpine habitats in the UK. Montane scrub therefore represents the only habitat for these species nationally, and the only habitat internationally for the subset of species considered endemic.

Communities of ECM fungi are significantly different between host plant species at host genus level. This means that communities associated with dwarf birch, dwarf willow and bearberry all differ significantly, however communities cannot be distinguished between common and alpine bearberry, and are unlikely to differ between willow species (except due to differences in habitats occupied by host species). Dwarf willow appears to support the highest diversity of ECM fungi when compared with dwarf birch and the bearberry species studied, and perhaps unsurprisingly given its altitudinal distribution, dwarf willow supports the highest number of ECM fungi which are only found in alpine habitats.



A new species of web cap (*Cortinarius* Sect. *Dermocybe*) growing with common bearberry in the alpine heaths of the Invereshie-Inchriach NNR. (Photo by Emily Hesling)



A honey scented species of web-cap (*Cortinarius* Sect. *Defibulati*) growing on the cliff top heaths of the Isle of Hoy with common and alpine bearberry. (Photo by Emily Hesling)



Cortinarius floccopus a new record for the UK, growing with common bearberry.
(Photo by Emily Hesling)

With dwarf birch in Glen Muick, the only extensive population remaining on mineral soil in Scotland, the diversity of ECM fungi encountered was far higher than that recorded with the plant growing in blanket bogs elsewhere. This is likely to reflect the fact that ECM fungi are aerobes which struggle in waterlogged conditions. Given the obligate nature of the ectomycorrhizal relationship for survival under natural conditions, this suggests that the NVC habitat M19ci (*Calluna vulgaris*-*Eriophorum vaginatum* blanket mire, *Vaccinium vitis-idaea* sub community, *Betula nana* variant) where dwarf birch is usually found in Scotland, is unlikely to be an optimum habitat for the species. This supports the view dwarf birch persists in blanket bogs having been lost from dryer habitats where susceptibility to burning and over-grazing is higher.

Over the 23 sites studies across the Scottish Highlands, ECM communities varied significantly in a northwest to southeast gradient and also in response to the oceanicity of a habitat. For instance, some of the new species discovered occur only across sites in the far northwest and on the island of Hoy, whilst others are only found in the central and eastern highlands. This leads to questions about ECM fungi species' ability to disperse between what are now highly fragmented populations of host plants in the UK's mountains, and whether they will be capable of colonising newly planted restoration schemes where mycorrhizal inoculum in the soil has long since vanished with the loss of host plant populations.

With the loss of Scots pine from most of its sub-alpine and Krummholz range in Scotland, it has been presumed that much of the associated biodiversity of these mountain woodlands was lost in tandem, leaving comparatively biotically poor heaths. In a detailed study of common bearberry in heaths spanning the sub-alpine to alpine zone in the Invereshie-Inchriach National Nature Reserve, we found a staggering 126 species of ECM fungi associated with the host. Many of these species were previously considered to be species that only associated with pine, such as the velvet bolete *Suillus variegatus* and a very rare fungus *Hydnum gracilipes*. This diversity was found to be higher than that recorded on the roots of pines in the ancient Caledonian pinewoods of Rothiemurchus in an associated study. Furthermore, communities of ECM fungi were found to vary significantly with altitude within the bearberry heaths, with some fungi appearing to have alpine distributions, and others preferring altitudes in proximity to the existing altitudinally suppressed tree-line. Essentially the persistence of bearberry in these managed heaths has acted as a fungal refuge, preserving a fingerprint of the mycorrhizal fungi suited to different altitudes which are likely to have associated with pine prior to deforestation. It has long been noted by foresters that bearberry is a good indicator of sites suitable for tree planting, and although a causal link has not yet been established, the presence of ECM fungi ready to colonise pine seedlings is likely to facilitate their establishment.

An analysis of soil samples taken from a long term experiment in Deeside found that ECM fungi diversity associated with common bearberry was significantly reduced by warming using small greenhouses, was significantly increased by addition of nitrogen fertilisation, and that there were significant shifts in the ECM community composition in response to burning of the heath seven years prior to sampling. These results demonstrate that the effects of muirburn, nitrogen pollution and climate change are not limited to those observed above ground, and are likely to have large impacts on ECM fungal communities, which are intrinsic ecological components of montane woodlands.

The PhD project was conducted at the James Hutton Institute and University of Aberdeen, supported by funding from NERC and SNH. The full thesis is held in the library of the University of Aberdeen, papers covering topics discussed above and others are in preparation for publication.

Emily Hesling is an ecological consultant specialising in upland vegetation and fungi, currently working on renewable projects in the north of Scotland for Nevis Environmental, based in Inverness. She is specifically interested in arctic-alpine ecology and furthering her skills in field identification of upland fungi.

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Andy Taylor is a fungal ecologist specialising in the roles of symbiotic fungi in ecosystem functioning. He has a particular interest in how communities of ectomycorrhizal fungi are structured and in how anthropogenic impacts affect this structure and species functions. He utilises both traditional and molecular tools for species identifications.

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The Gleann a'Chlachain Mountain Woodland

John P. Holland

This short article gives an update on the development of the mountain woodland at the SRUC Hill and Mountain Research Centre, near Crianlarich, since 2009 (see [Scrubbers' Bulletin 8](#) (pages 8-13) for more details on the planting and establishment of this woodland).

Three blocks of woodland were established in Gleann a'Chlachain in the late 1990s as part of a hill sheep and native woodland project; a 43 ha block along the Allt Gleann a'Chlachain gorge (220-380m); a 36 ha block on the north-west facing flank of Ben Challum (360-610m); and a 181 ha block in the main bowl of Gleann a'Chlachain (390-600m).

The trees that were planted in the lower section of the gorge woodland have established well and many are now over 2.0m tall, whereas those higher up the gorge (above 270 m) have been slower to establish and many remain less than 1.0m tall. Monitoring of the Allt Gleann a'Chlachain gorge woodland in May 2012 found that the mean number of live trees and shrubs per hectare over the whole site (including areas that were originally planned to be scattered trees or unplanted) was 1288. The mean height of the trees was 1.28m. Thirty seven percent of the monitored trees were Birch and 32% were Rowan. The gorge woodland WGS was finally approved by FCS in November 2012.

Within the gorge woodland the population of Scotch Argus butterflies (*Erebia aethiops*) has continued to increase and they have now expanded into the other woodland blocks higher up the glen. Species such as Wild Angelica (*Angelica sylvestris*), Devil's-bit Scabious (*Succisa pratensis*) and Bog Myrtle (*Myrica gale*) have increased. Whinchat, Stonechat, Cuckoo, Willow Warbler, Tree Pipit, Twite, Bullfinch, Mistle Thrush, Wren, Robin and Black Grouse all now use this woodland. There is a footpath through the gorge woodland that can be accessed from the Strathfillan Wigwams site at Auchtertyre.



The Allt Gleann a'Chlachain Gorge woodland looking north east towards Ben Challum (2014). (Photo by John Holland)



The Allt Gleann a'Chlachain Gorge woodland looking south west towards Beinn Dubhchraig (2014). (Photo by John Holland)



The Allt Gleann a'Chlachain Gorge woodland (2014). (Photo by John Holland)

Monitoring of the main Gleann a'Chlachain woodland block was carried out in spring 2013. Three hundred and six plots (each 0.01ha in size) were surveyed. A total of 2156 live trees were recorded of which 53% were Birch. 81.4% of the surveyed plots contained trees, and 26.1% of the plots contained 11 or more trees. The mean number of live trees and shrubs per hectare over the whole site (including areas that were unplanted) was 705. The mean height of the monitored trees was 0.69m. Mean tree height was negatively correlated to altitude. Trees planted on the east-facing slope of the glen were on average taller than those planted on the west-facing slope of the glen, and this was the case for all species. Although many of the trees were less than 50cm tall, most of them appear to have established successfully, having a low, prostrate, bushy growth form, which has developed in response to the environmental and biological conditions. This 'scrubby, mountain woodland' growth form is entirely appropriate and expected at the altitudes involved. The active deer management that has been carried out on the site has been largely successful with only 1.5% of the monitored trees showing signs of recent browsing damage.



The woodland on the flank of Ben Challum (2014). (Photo by John Holland)



The woodland on the flank of Ben Challum (2014). (Photo by John Holland)



Looking towards the main Gleann a'Chlachain woodland and the Cam Chreag at the head of the glen. (Photo by John Holland)

Following the monitoring of the woodland in spring 2013, a mutually acceptable agreement for the signing-off of the WGS was reached with FCS in August 2013.

Within the two upper enclosures the dwarf shrub heath and *Molinia caerulea* dominated grassland, with tall herb species, has continued to develop. Lesser Twayblades (*Listera cordata*) have been observed growing under heather, a species not previously recorded on the farm. Numerous, large patches of Wood Anemone (*Anemone nemorosa*) have developed on well drained slopes producing a spectacular floral display in April and May.



Abundant *Anemone nemorosa* within the woodland enclosure (May 2013). (Photo by John Holland)

Large Heath butterflies have been recorded within the main woodland along with Small Heath, Green Veined White, Northern Eggar moths, Emperor moths, Golden-ringed Dragonflies and Common Hawker Dragonflies. Black Grouse, Stonechat, Whinchat, Wren, Meadow Pipit, Willow Warbler, Merlin, Raven, Golden Eagle and Short-eared Owl have all been recorded within the main woodland block. During the winter Gleann a'Chlachain is visited by flocks of Snow Buntings, Fieldfares and Redwings, as well as small numbers of Reed Bunting and Bullfinch. Field Voles are abundant within the un-grazed woodland blocks and other animals present include Mountain Hare, Badger, Stoat, Red Fox, Common Frog and Common Lizard.

We are now beginning to see that our vision of a mountain woodland of low growing trees and shrubs with extensive open areas is beginning to develop, creating a diverse and species-rich habitat.

Dr John Holland is an upland ecologist based at the SRUC Hill and Mountain Research Centre at Kirkton & Auchtertyre Farms near Criarlarich in Perthshire. He has been involved in the management and monitoring of the mountain woodland since it was planted. His main research interests are mountain ecology, grazing, ecosystem services and greenhouse gas emissions from hill farms.

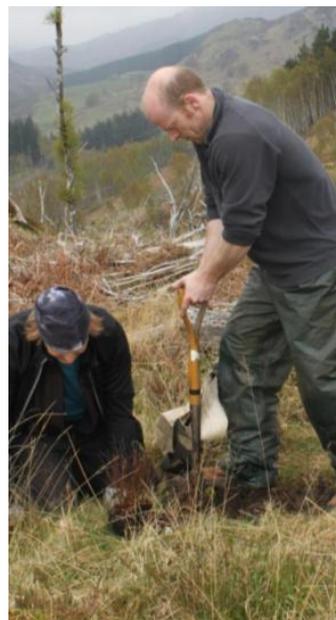
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Mountain Woodland Project update

Billy Bodles

The Mountain Woodland Project has been working hard over the last year, running numerous educational activities and promotional events, not to mention being involved through our partners in the planting of nearly 400,000 upland native broadleaf trees. Our education events have been transformed through a partnership with the Alladale Wilderness Reserve, we've created a 'home base' within the reserve that has enable us to bring 125 young people out into the upland environment. Through scrub planting days and practical conservation activities the young people have gained a new level of knowledge of the world that surrounds them, locally and globally. This programme will be continued in 2015 and we hope to expand it to other areas of Scotland. We've also been focusing on creating closer links to The Conservation Volunteers (TCV) and through this working relationship we've held 8 planting days, planting approximately 1200, juniper, dwarf birch aspen and tea-leaved willow. We are continuing this relationship through the creation of a small scale project specific tree nursery, looking at growing scrub trees for future planting days on our partner sites. As part of the nursery we have erected a new poly tunnel that will enable us to provide better protection for the seedlings in the early stages of development.



(Photos by Billy Bodles)

We've also got a scrub protection trial planned for spring 2015 at Caen Lochan, in partnership with SNH. We'll be putting out some herbivore exclusion cages on individual *Salix lanata* plants, in order to gauge the changes occurring due to decreased grazing levels. The cages will be of a variety of sizes and will exclude deer only or deer and hare in combination.

The past year has seen some dramatic changes to our project partner sites, some have had to drop out and others have joined up. The closing of the relevant areas of the SRDP funding programme meant that a lot of the original site partners were unable to continue with the project. This has left the project in a state of financial flux and we've been unable to carry out as much work as we would have liked. There is now a light at the end of the tunnel and we are able to see new partners coming on board and bringing with them a new optimism and focus on mountain woodlands.

2015 will see us working hard towards our goal of 500,000 mountain woodland trees planted through the project, we will be creating a series of survey events through the summer, reviewing old records of montane scrub, enabling us to feedback on changes to the populations.

But, whatever we do during 2015, you can be sure that whilst we do our best to make it fun and enjoyable, there is a very serious take home message about the benefits of the wonderful plants and animals that survive in the montane scrub zone.

Dr William Bodles is project manager of the Mountain Woodland Project led by Highland Birchwoods. A keen ecologist Billy has worked in the mountain woodland/upland ecology field for 12 years.

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Trees for Life Update

Mick Drury

In autumn 2014, we erected a new 3.5 ha enclosure for the restoration of dwarf birch *Betula nana* on our Dundreggan Estate in Glen Moriston. Experimental work here is being planned to encourage regeneration, eg through heather cutting or ground scarification. It's curious that viable seed is produced but very few seedlings are noticed. Meanwhile, in April 2014, we had a 50% success rate striking eared willow *Salix aurita* cuttings within the neighbouring enclosure, fenced since 2010. Visits to two earlier enclosures, which Trees for Life (TfL) erected on neighbouring estates in 1997 and 2001, showed little change in the growth and vigour of the dwarf birch; it's not clear how much this is due to sub-optimum mire habitat and/or possible browsing by hares. What growth there is tends to be lateral, due to exposure or centuries of browsing pressure, or both.

The question of optimum habitat for dwarf birch was addressed through a student project undertaken by Chris Brown from Plymouth University. The study found a series of significant factors influencing the success of the species including aspect, dominant vegetation communities and altitude. He concluded that south facing slopes, *Calluna vulgaris* dominated habitats and lower less exposed altitudes would provide the best opportunities for re-establishment projects.

Another research project, by Anthony Taylor from the Scottish Wildlife Trust, visited higher elevation lochan islands to assess vegetation differences when compared to adjacent 'mainland' areas. It was surprising that some deer browsing impacts were evident on all of these; however, on the largest and least disturbed of the islands, at 500m asl, he found the richest flora of the study. Here a low canopy of windswept downy birch *B. pubescens* and rowan *Sorbus aucuparia* grows in a band around the fringe of the island. There's a large spreading juniper *Juniperus communis*, a good number of eared willow,

some dwarf birch, a few tea-leaved willow *S. phyllicifolia*, and downy willow *S. lapponum*. A vivid snapshot of what the landscape might be like without the land management practices of recent centuries.



Island on Loch nan Eun. (Photo by Alan Watson Featherstone)

Work at the tree nursery continued with propagation of around 5000 dwarf birch plants, some of these being planted at Dundreggan. New nursery stock beds have been planted up with seven different species of willow of various provenances, for the production of cutting material for propagation, and also, we hope, to produce seed. (See *Jill's article*; page 7.)

Mick Drury is Field Projects Co-ordinator for the charity Trees for Life. The TfL mission is the restoration of native forest in the Highlands, the ancient Caledonian Forest.

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Survey of montane willows on the national forest estate

Richard Thompson

Records of montane willows have been accruing on the national forest estate (land managed by Forest Enterprise Scotland) in recent years as we begin to learn more about the un-afforested areas under our management. Due to their conservation status and vulnerability to various threats, we were keen to learn more about the state of these populations and determine appropriate management actions to safeguard and enhance them. In 2014, we commissioned a survey to confirm old records, assess condition and threats, make new records and propose recommendations for management. The aim was to get an overview rather than establish a detailed baseline for future monitoring. Diana Gilbert and Andy Scobie surveyed sites in Glen Affric, the Clunes hills, Glen Orchy and Glen Creran. Billy Bodles and Chris Kerr surveyed two sites in Highland Perthshire, 5 sites in the Trossachs and 8 sites in the north of the Cowal peninsular.

Dark-leaved and tea-leaved willows were included in the scope of this survey although it is acknowledged that these species are less restricted to higher altitudes. Least willow was not always recorded (and not included in results below) as it is known to be more ubiquitous at higher elevation and less susceptible to threats such as over-grazing and rock fall.

Galloway was not re-assessed as a detailed survey has been carried out here in recent years under the Action for Mountain Woodlands project (*ie* the precursor to the current Mountain Woodland project).

Modelling potential sites

As well as confirming old records, we agreed within the MSAG that it would be good to try some simple GIS modelling to predict sites suitable for montane willows without existing records. I undertook this using the following parameters: bedrock associated with existing populations (derived from the British Geological Survey 1:625K map); altitude between 500 and 700m asl,

aspect NE to NW. I then selected all polygons with suitable micro-topography (*ie* crags) as evident on the 1:10,000 O.S. map. This “wing and a prayer” approach delivered mixed results (see below) and refinements to the model are planned to improve predictability.

Survey methodology

This was developed by Diana Gilbert and allowed a quick assessment of each bush/collection of bushes as well as surrounding vegetation, the topographical context, type of damage, factors affecting expansion and management recommendations. A population was defined as more than 10 bushes. Due to various constraints, it was not possible to assess most of the sites whilst they were flowering so bush sex was not determined in many cases. Additionally, no roped access was used so bushes could only be recorded from safe vantage points and some on more severe terrain may have been missed.

Results

Old records were not always rediscovered. This appeared to be largely a combination of initial misidentification and low resolution grid references. This illustrated how difficult it is to monitor the fate of populations without using the method described by Richard Marriott ([Scrubbers' Bulletin 7](#) pages 11-16) or a similar approach that more precisely records and relocates bushes in relation to micro-topography.

Table 1 presents a summary of the number of records (patches or individuals) made during these surveys, including those on modelled sites. Table 2 shows results for the modelled sites and illustrates that montane willows were found on only 2 out of 8 sites. However, this included 4 new populations of downy willow. Of the six sites with no recorded willows, 3 contained suitable ground to establish new populations of montane willows if grazing levels can be reduced. Refinement of the model is planned for future surveying (*ie* using the BGS 1:50K map and restricting to sites with substantial crags).

Table 1 Summary of records of montane willows on the NFE

Willow species	Records	Populations (>10 bushes)
Woolly	5	2
Downy	121	28
Dark-leaved/tea-leaved	46	8
Whortle-leaved	5	2
Tea-leaved x creeping	9	0
Mountain	1	0
Downy x eared	1	0

NB these results do not include montane willow populations in Galloway

Table 2 Modelled populations

Willow species	No. of sites	No. of records	No. populations
Downy	1	26	4
Dark-leaved/tea-leaved	1	5	0
None	6	0	0

Glean na Ciche

This site is located to the west of Glen Affric and the east of Kintail. It is without doubt the most significant location for montane willows on the NFE. A number of surveys had been carried out here previously but the extent of the downy willow populations in particular had not been realised before. We now know that at least 18 populations of downy willow exist here (54 separate records were made). A new population of woolly willow was also discovered. During 2015, we will work with others to determine the best course of management to safeguard this site.



Female downy willow. (Photo by Diana Gilbert)

Threats and recommended management

Excessive impact from deer and in one case, feral goats, was a threat to most of the willow populations assessed. Some of the southern sites are also leased for sheep grazing. We will look at ways to reduce these impacts – whether through culling, fencing or stock removal, on sites prioritised by these surveys.

Surveyors suggested the use of exclosures and, in some cases, planting to protect and expand functionally extinct remnants and where there were indications that there is an imbalance of male and female plants. These recommendations will be carefully considered with local staff to assess the practicality of fencing. We will also determine the best source of planting material through discussions with MSAG members and others.

Sitka spruce regeneration was also a potential future threat at a number of sites. Again, these will be prioritised to remove regeneration from around montane willows and other rare plants.

Conclusions

This survey has provided really useful information that will direct where we focus our restoration effort. Suitable ground currently without montane willows has also been identified and this offers opportunities for us to create substantial new areas of montane scrub in the future when resources allow.

Richard Thompson is Native Woodland Ecologist for Forest Enterprise Scotland. He was previously with Forest Research as their Upland Native Woodland project leader. Richard is working with local staff in a number of Scottish locations to develop montane scrub and treeline woodland projects.

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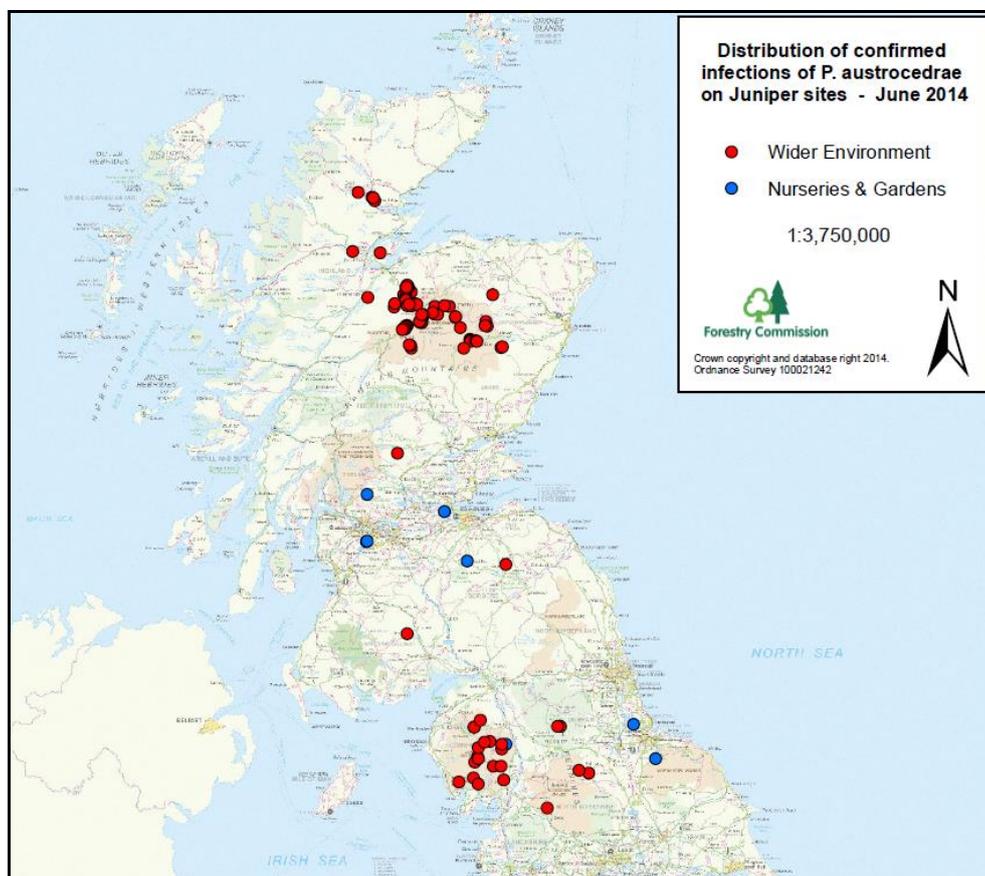


Juniper and *Phytophthora austrocedri* – an update on status and advice on planting to reduce the risk of further spread of the disease

Kate Holl and Sarah Green

In the last [Scrubber's Bulletin](#) (pages 5-8) an informative piece by Sarah Green (Forest Research) brought us up to date with the unfolding situation regarding juniper and *Phytophthora austrocedri* the disease which is rapidly emerging as a growing threat to juniper across the country.

Over the last 2 years, severe decline of upland native juniper (*Juniperus communis*) has been investigated at numerous sites in northern Britain. The widespread distribution of the pathogen across northern Britain (see map below) and the extensive nature of the dieback observed at some of the sites, including the presence of many long-dead trees, indicate that *P. austrocedri* may in fact have been present in the country for some time. At the majority of infected sites the disease appears to be causing extensive mortality of the juniper.



As was explained in Green *et al.* (2014), *Phytophthoras* are microscopic and generally live in roots, soil or water. Many *Phytophthoras* also produce resting spores called chlamydospores that are very resilient, enabling the pathogen to survive in plant residues and soils for years once it has become established on a site. This unfortunately makes the disease particularly difficult to control in the natural environment.

The pathogen's main mode of spread is almost certainly via zoospores in water, and poorly drained sites with wet soils are most at risk of the disease establishing if introduced. Thus the cool, wet climatic conditions prevalent in many parts of Britain could be very suitable for *P. austrocedri*. More recent work (Sarah Green, personal communication) seems to be indicating that the disease does not favour warmer temperatures – there is yet no evidence that *P. austrocedri* has established in other warmer European countries, thus warmer summer climates may be a limiting factor for the pathogen.

Green *et al.* (2014) have now shown that that *P. austrocedri* is a primary pathogen of juniper, and occurs on this host across a range of geographically disparate sites in northern England and Scotland.

It is not clear whether *P. austrocedri* is capable of true aerial dispersal and further work is planned to determine this. It is known that inoculum can be splashed upwards from the soil during heavy rain. Such splash dispersal from soil to aerial plant parts is a major means of dispersal for a number of soil-inhabiting *Phytophthora* species.

The majority of infected sites in Britain contain, to varying degrees, areas of standing or moving water, for example wet flushes, mire, streams and seepages. Dieback of juniper was found to occur predominantly within these wet areas. This is not surprising because *Phytophthora* species disseminate via free-swimming zoospores and the presence of watercourses and/or waterlogged soil conditions provide favourable conditions for disease spread.

In addition to the field outbreaks in Britain reported here, over the last few years, DNA of *P. austrocedri* has been identified in a small number of diseased juniper plants located in nurseries or private gardens in England and Wales. A thorough investigation of nursery juniper planting material is now required in order to determine the risk of spread of the disease through planting out of nursery sourced material.

Until a clearer position can be established with regard to planting into the wider environment in Scotland, [the juniper planting guidance](#) on the Forestry Commission's website should be followed. In general, planting out of nursery sourced juniper is not being recommended other than in areas where juniper is scattered and impoverished with little or no recent regeneration and where sustained and significant conservation action is required.

Because symptoms are hard to detect and take some time to develop, it is hard to be sure that juniper plants are not infected when they are received from nurseries.

Therefore, where practical, it is advised that juniper nursery stock is kept for a whole growing season before planting out, to see if symptoms develop. This will minimise the risk of introducing a problem, and will also help to increase our understanding of the disease.

There is a risk of the disease being spread to new areas via footwear / tools and vehicle tyres. For this reason, when visiting land with juniper, it is advised that you undertake basic biosecurity measures. Ideally, before entering and upon leaving land with juniper, footwear should be disinfected using Propellar disinfectant or Cleankill Sanitising Spray. If this is not possible, you should at least ensure that footwear is clean and free of mud, to minimise the risk of transfer of spores. More details on good biosecurity practice is provided in the Forestry Commission's Biosecurity Guidance

[http://www.forestry.gov.uk/pdf/FC_Biosecurity_Guidance.pdf/\\$file/FC_Biosecurity_Guidance.pdf](http://www.forestry.gov.uk/pdf/FC_Biosecurity_Guidance.pdf/$file/FC_Biosecurity_Guidance.pdf)

Reference

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[DOI:10.1111/ppa.12253.]

Kate Holl is a Woodland Advisor with Scottish Natural Heritage. Most of her work is focussed on understanding and helping deliver favourable woodland condition - including co-ordinating SNH's response to the impacts of *Phytophthora austrocedri* on Juniper. Kate is based in Silvan House, Edinburgh and may be contacted at kate.holl@snh.gov.uk



Dr Sarah Green is a forest pathologist based at Forest Research's Northern Research Station in Scotland. Her main interests are distribution, detection, biology and evolutionary processes of forest pathogens, with a particular recent focus on emerging *Phytophthora* diseases, including *P. austrocedri*, and their transmission in soil.

