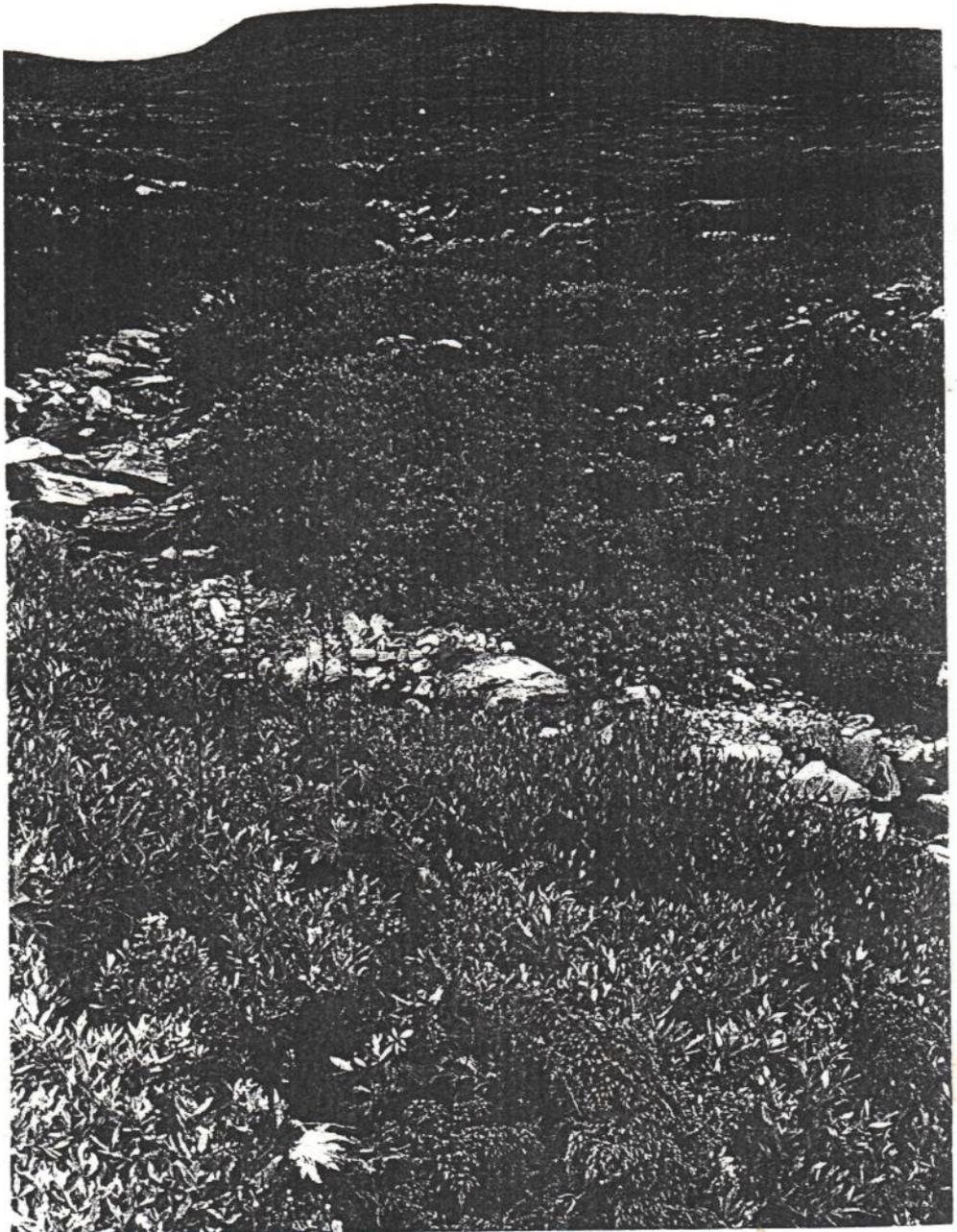


Scrubbers' Bulletin



MONTANE SCRUB ACTION GROUP

Scrubbers Bulletin - No. 1, Winter 1996/97.

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Editorial/Introduction.

Welcome to the first issue of the Bulletin. This was an agreed action point from the one day seminar 'A future for montane shrub communities' organised by Diana Gilbert at Battleby on 27th March 1996. The Bulletin is intended to be the 'mouthpiece' of the Montane Scrub Action Group (see below). It will be produced occasionally as required, with no fixed frequency or date of issue. However, it is likely to be circulated about once a year, at least initially, probably in winter. A need for more frequent issues may arise if rapid progress is made in scrub conservation. The format and content are open to suggestions and development and we are hoping for input from anyone active in the field of montane scrub. Please feel free to write to us with ideas.

The Bulletin is compiled and circulated by David Mardon, Ben Lawers NNR Office, The National Trust for Scotland, Fagus, Manse Road, KILLIN, Perthshire, FK21 8UY. (tel./fax. 01567 820988). Contributions will not be edited for content. We have included the circulation list. Please let us know of anyone who is not listed but would like to receive the bulletin.

Many thanks to all the contributors to this issue.

The Montane Shrub Action Group.

A steering group has been formed, also as an action point from the Seminar in March 1996. The steering group is an unconstituted self-appointed body, at present including:-

Michael Scott, Plantlife (Chair)
 Ian Hulbert, SAC
 Rob Soutar, FE (or Ian Forshaw, FE)
 Brian Staines, ITE

David Mardon, NTS
 Sandy Payne, SNH
 Tim Clifford, Caledonian Partnership
 Diana Gilbert, Highland Birchwoods.

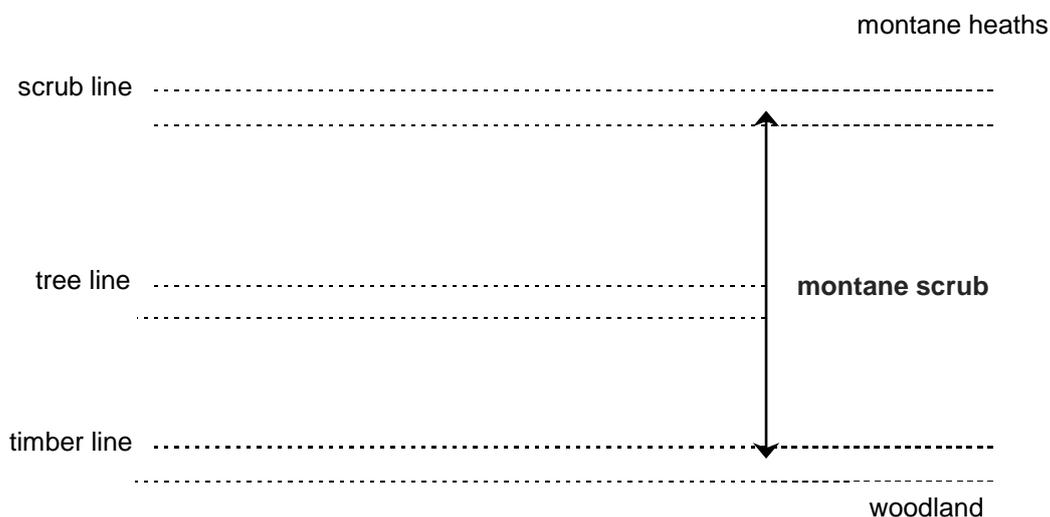
At its first meeting in November 1996, the principal objectives of the group were agreed, to develop action towards :-

1. A vision for restoration of montane scrub.
2. Promotion of that vision.
3. Production of guidance notes for restoration.
4. An inventory of site-based information.

Towards these ends, we also agreed i) to develop a description or definition of the habitat under discussion (first attempt below); ii) to produce the bulletin; iii) to produce a promotional booklet; iv) to seek wider publicity for the aims of the group.

The group exists to address a perceived need to conserve plant communities which have, until recently, been neglected by the conservation movement in terms of action or support schemes. Montane scrub is essentially transition zone vegetation between submontane woodland and montane dwarf-shrub heath, but differs from those plant communities, on which some conservation effort has concentrated, in that there is almost nothing left. The transitional characteristics, and especially the small scale and vestigial nature of surviving remnants, result in difficulties in defining the vegetation by use of British vegetation classification systems. As a first step in defining our remit, we have described the vegetation targeted by the action group as follows:-

Montane scrub communities - the zone between the timber-line* and the montane heaths, consisting of the stunted, crooked and twisted little trees in the zone of the tree-line (commonly pine, birch or rowan, rarely oak) and the shrubs which naturally or potentially grow at and above the tree line***, (willow spp., juniper and dwarf birch, rarely hazel, but excluding dwarf shrubs such as heaths, heathers or related species).**



* The altitudinal limit of tree growth in a form which produces exploitable timber.

** This will probably be mountain birch, *Betula pubescens* ssp. *tortuosa* (also called ssp. *odorata* and ssp. *carpatica*) and may include all or most of the range of this taxon in Scotland.

*** The natural altitudinal range of many of these species, eg. montane willows and juniper, extends below the tree-line where the shrubs may form a woodland understorey.

The Montane Shrub Restoration Project

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Ross-shire, IV8 8NN.

This is a phase 1 Millennium Forest for Scotland Project. It was established in reaction to a lack of concerted action to address the loss of natural high altitude tree-lines and their associated shrub communities. The project has joint financial backing from the Millennium Commission through the MFS Trust and SNH. Since its conception it has had considerable support and assistance from a number of interested parties, most notably, Alison Hester, MLURI, David Mardon, of NTS, Richard Marriott and Sandy Payne, SNH.

The first action of the project was to run a seminar in Battleby in March 1996, to both draw attention to these shrub communities, and bring together most of the people and organisations who have taken an interest in the communities and/or been involved with efforts to carry out site based restoration.

An outcome of the seminar was a clear mandate to establish an action group which would take the project forward. This has now been done and the first meeting was held in November 1996 (described above).

A major output from the seminar will be "The ecology and restoration of montane and subalpine scrub habitats in Scotland" (eds. Gilbert, Horsfield and Thompson). This publication, to be issued as one of SNH'S Review series, sets out the papers from the meeting, including expanded poster contributions and one additional paper on the invertebrate interest of montane scrub. All the papers have now been compiled and the document is currently under review. Circulation to all those who attended the seminar is expected in April 1997. Should anyone else wish for a copy they should contact Diana Gilbert at Highland Birchwoods.

The project also involves two site based actions and focussed on restoration issues. A small area at one site has been fenced in order to facilitate expansion of the willows, rowan, and possibly dwarf birch present in the area. The second site is on an estate which has increased its annual deer cull and a monitoring programme, using small enclosures as controls, will be established this spring to record the impact of reduced deer on a community of mixed willows. The opportunity to review fencing methodology at high altitude is being examined at both sites, which use electric fencing and sacrificial stock fencing to offset damage from rock fall and avalanche.

The conclusion of the project will be the production of a set of guidelines outlining good practice in restoration of montane scrub. These will be launched for discussion at a seminar for a broad spectrum of mountain interests, planned for year the 2000.

For further information about the MFS project contact Diana Gilbert.

Synopsis of B.Sc. dissertation - An investigation of *Salix lapponum* communities in different habitat locations.

John Coll formerly University of Stirling, Department of Environmental Science; 5 Ardoch Crescent
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Salix lapponum communities in the Scottish uplands are largely restricted to inaccessible ledge sites, the consensus view attributing this restricted distribution to the historical and contemporary grazing pressure.

Implementation of Council Directive 92/43/EEC (commonly known as the Habitats Directive) translated to U.K. law as the "Conservation (Natural Habitats & c.) Regulations 1994" on 30 October 1994 (SNH., 1995), commits the U.K. government and its agencies to conservation of surviving upland *Salix* spp. and the promotion of regeneration where possible. However, upland *Salix* communities are poorly understood.

This project studied *Salix lapponum* clumps at four locations in the Scottish Highlands, examining variation in:

- Biomass and density characteristics
- Within and outwith clump variation for selected soil properties
- Site shelter characteristics

Exchangeable Ca^{2-} , Mg^{2-} , pH and Effective Cation Exchange Capacity levels were significantly higher in soils beneath clumps compared to outwith. It was proposed these differences were related to leaf fall from the plants.

Site shelter and aspect measurements suggested a link between clump distribution and late lying snow. Parallel evidence from elsewhere suggesting a synchrony between *Salix* spp. life cycles and late lying snow must be considered possible.

Despite some useful and potentially valuable findings of this study, it was concluded that much further research is required if a coherent conservation and regeneration strategy is to be implemented.

REFERENCE

Coll, J. 1996. *An investigation of **Salix lapponum** communities in different habitat locations.*
University of Stirling: Dissertation submitted as part of the B.Sc. Environmental
Science with Biology degree.

Note on the monitoring of *Salix* scrub at Coire Sharroch, Caenlochan NNR.

Viv Halcrow (Seasonal Warden, Caenlochan NNR 1989) Steading Flat, Inshnach Farm, By AVIEMORE,
Inverness-shire, PH22 1QP.

One of the main work priorities of the Seasonal Warden at Caenlochan NNR is to carry out monitoring of rare Arctic/Alpine plant species. Regular monitoring of eleven RDB species and two Nationally Scarce species has been carried out since 1986; for further details of this see the report produced by Claire Geddes describing the monitoring techniques used at Caenlochan NNR and Ben Lawers NNR.

At Caenlochan NNR, the most dense and vigorous growth of *Salix* scrub is on an irrigated, shattered, north-facing rocky outcrop which affords some protection from browsing sheep and deer. The two major shrub species of interest here are *Salix lanata* and *Salix lapponum*. This colony has been described as the best example of Arctic/Alpine *Salix* scrub in Britain; indeed, though small in extent the individual bushes on closer inspection are relatively large, mature and spreading and produce good numbers of catkins.

Monitoring of the populations of *Salix lanata* and *Salix lapponum* has been carried out since 1986 and involves counting the total number of bushes and the number of male and female bushes. A sketch map is

drawn of the site and Polaroid photographs taken. A sex ratio is calculated, a ratio of 1 : 1.5 male : female being the optimum for seed production.

There are several drawbacks to the methods used:-

1. Bushes have branches which spread horizontally, under *Sphagnum* cover, making it difficult to determine the extent of individuals: counting separate bushes is not sufficiently accurate to draw numerically-based conclusions
2. Hybrids (and hybrids of hybrids?) form between the two *Salix* species
3. Many bushes produce no catkins
4. Sketch maps are of limited use when the artist changes annually
5. The quality of Polaroid photographs is usually poor
6. Trampling damage is inevitably caused at each visit due to the fragility of the substrate

Monitoring is expensive in terms of time and long-term commitment; there is little point in spending a lot of time collating inaccurate and non-comparable data. A simpler system of fixed-point photography (using a good quality camera) would provide useful non-numerical but visually-comparable information on the extent of the *Salix* colony.

On the north-east facing slopes of the coire there is a more extensive *Salix* colony which is more accessible and has suffered much heavier browsing in the past. It is expected that these plants will recover now that the entire coire is surrounded by an enclosure fence, and fixed-point photographic monitoring would provide a most interesting documentation of the development of this nationally rare Arctic/Alpine scrub type.

Footnote: At VH's suggestion, I checked with Ken Slater, Seasonal Warden 1995 & 1996, who confirmed that the method described has not been changed since 1989. DKM.

Woodland development and sheep production - an integrated system of landuse for the uplands.

Ian Hulbert, Scottish Agricultural College, Kirkton Farm, Crianlanch, FK20 8RU.

Sheep headage payments from the European Union (EU) and the UK government for hill sheep farming are likely to be modified and/or reduced and with the expansion eastwards of the EU these changes are likely to accelerate. Additionally, environmental improvements and nature conservation benefits are increasingly important policy objectives in upland areas. One response to these changes in financial support and in policy at the farm level has been to reduce inputs and sheep numbers (extensify). These moves towards extensification have been perceived to benefit the native flora in hill communities as a decline in grazing pressure is considered to result in greater vegetational diversity and perhaps even the establishment of native woodland. However, even with quite substantial reductions in sheep numbers (from 1 ewe/ha to 0.5 ewe/ha) maintained over many years, there may be very few environmental benefits. Regeneration of trees and scrub, even where there is a seed source, is unlikely to occur at these sheep stocking rates. More critically (for the fanner), a reduction in sheep numbers may have a disproportionate impact on capacity to meet fixed costs, mainly the cost of labour. Experimental work at the Scottish Agricultural College (SAC) has shown that a 30% reduction in stocking rate requires a 70% reduction in labour inputs just to maintain profitability, due to the heavy reliance of hill sheep farmers on headage payments to meet 80% of all costs. One consequence of reduced labour inputs is that the welfare of the sheep in these more extensive systems deteriorates with higher mortality among all age classes. Coupling this with the low reproductive output of extensive systems (c.60%), many questions are raised as to the long term viability of such systems. There is no escaping the fact that headage payments in the form of subsidies to upland hill sheep farmers will be reviewed and questioned in the near future and environmental objectives in hill LFAs will become even more important. Therefore, in order to survive upland farmers will have to adapt and possibly change their whole approach to sheep production.

With a few exceptions, the upland landscapes of Scotland have been deforested and degraded over the last few centuries, to such an extent that questions must be asked as to whether the land has the capacity

to sustain the range of uses to which it is subjected. A different approach is required where the land is managed in a way that equals its productive potential. In the uplands of Scotland, one solution may be the adoption of a more integrated development of land use incorporating sheep production with woodland development. It might appear a contradiction in terms to have sheep and trees together, after all considerable effort is spent usually trying to keep them apart, but the future of upland hill farming requires a radical reshaping of the present system. Too often in the past, forestry and agriculture have been seen as competing interests, but integrating both land use types will provide upland communities with a diversity of economic opportunities and provide the farmers themselves with stability in that they are not reliant on only one product - lamb. Before this can happen however, upland farmers have to see the advantages to themselves of adopting a new system of land management and changing from one that has been used for generations.

To remain profitable, commercial afforestation of upland areas requires that trees are planted at 2m spacing with approximately 2500 trees per hectare. Consequently, except during the few years after planting before canopy closure and the resulting suppression of the ground vegetation, commercial forests are incapable of being integrated with upland sheep production. However, it is possible to develop woodland that is extensive, fragmented and more diverse with fewer trees per hectare in the form of shelter belts or shelter patches or even utilise already established native woodlands. If such woodlands were developed or actively managed, sheep production at low densities could be enhanced. For example, a substantial proportion of the variation witnessed in the breeding performance and rates of growth in herbivores such as red deer and sheep can be related to the quality of the habitat in terms of its ability to provide shelter and to supply a suitable quantity of nutritious forage. It is known that even small patches of woodland can reduce wind speeds by as much as 95% which results in a reduction in the rate of convective heat loss to the surrounding air and exchange of radiation from the mammal to the cold sky. Experiments on domestic herbivores and computer modelling of wild deer, have found that their energy requirements are raised substantially in cold windy environments and that pregnant ewes exposed to cold temperatures and high winds loose body weight whereas those occupying sheltered environments do not. Very little is known on the population dynamics of sheep occupying woodlands but a lot can be- learned from studies of other wild herbivores such as red deer occupying commercial plantations. It has been shown that red deer occupying woodlands have higher rates of early growth and attain greater sizes as adults than those deer inhabiting the open hill. Furthermore, in woodland, when a hind reaches maturity she tends to breed every year, unlike'hinds on the open hill where considerable numbers fail to breed in successive years. It is possible that similar results would be obtained for sheep if they were to occupy woodland.

The economic benefits of allowing sheep to graze within woodlands are not difficult to calculate. At present in much of the uplands of Scotland, between 60 and 80 lambs are weaned for every 100 ewes. Of these, 35 have to be kept back to provide new recruits, leaving between 25 and 45 lambs to be sold. If because of increased shelter and increased nutrition within a woodland, the number of lambs weaned were increased even by 50% to between 90 and 120 lambs per 100 ewes, the number of lambs sold would be at least doubled, providing a substantial increase in the income of upland farms. Problems clearly occur practically and financially. Farmers require to be educated in the sustainable management of existing mature woodlands and in particular in the establishment of new woodlands capable of carrying sheep. At SAC's research farm at Kirkton and Auchtertyre by Crianlarich, work is currently underway to investigate how a more integrated system of land use could be developed. It is important that those working in the uplands of Scotland see the potential economic and environmental benefits of such a system that incorporates both woodland and sheep production. At the very least, hill farmers would still be present, but at best, economic opportunities would be expanded beyond that currently experienced with the added bonus that the environment would be enhanced.

The Tarmachan habitat restoration and improvement project.

D. K. Mardon, The National Trust for Scotland, Fagus, Manse Road, KILLIN, Perthshire, FK21 8LJY.

Restoration of montane scrub on Ben Lawers National Nature Reserve was begun 8 years ago (Mardon, 1990; 1997 in press). The land which has been owned by the National Trust for Scotland (NTS) since 1950 is subject to grazing rights which limit the opportunities for restoration to very small areas which can be fenced, by agreement with the farmers operating there. The two fenced sites now being restored have a total area of 30ha, only 1% of the Trust's section of the Reserve, and only a fraction of that area is potential montane scrub habitat. The Trust has also recently bought the hill ground part of the

neighbouring Morenish Farms estate, that is the south and east side of the Tarmachan ridge from the head dyke up to the watershed. Without grazing rights, it represents an exceptional opportunity to conserve some of the most interesting montane and submontane vegetation in the Highlands. A last minute hiccup with respect to restoration versus sporting rights led to the Trust buying these rights too, thereby gaining full control over deer culling.

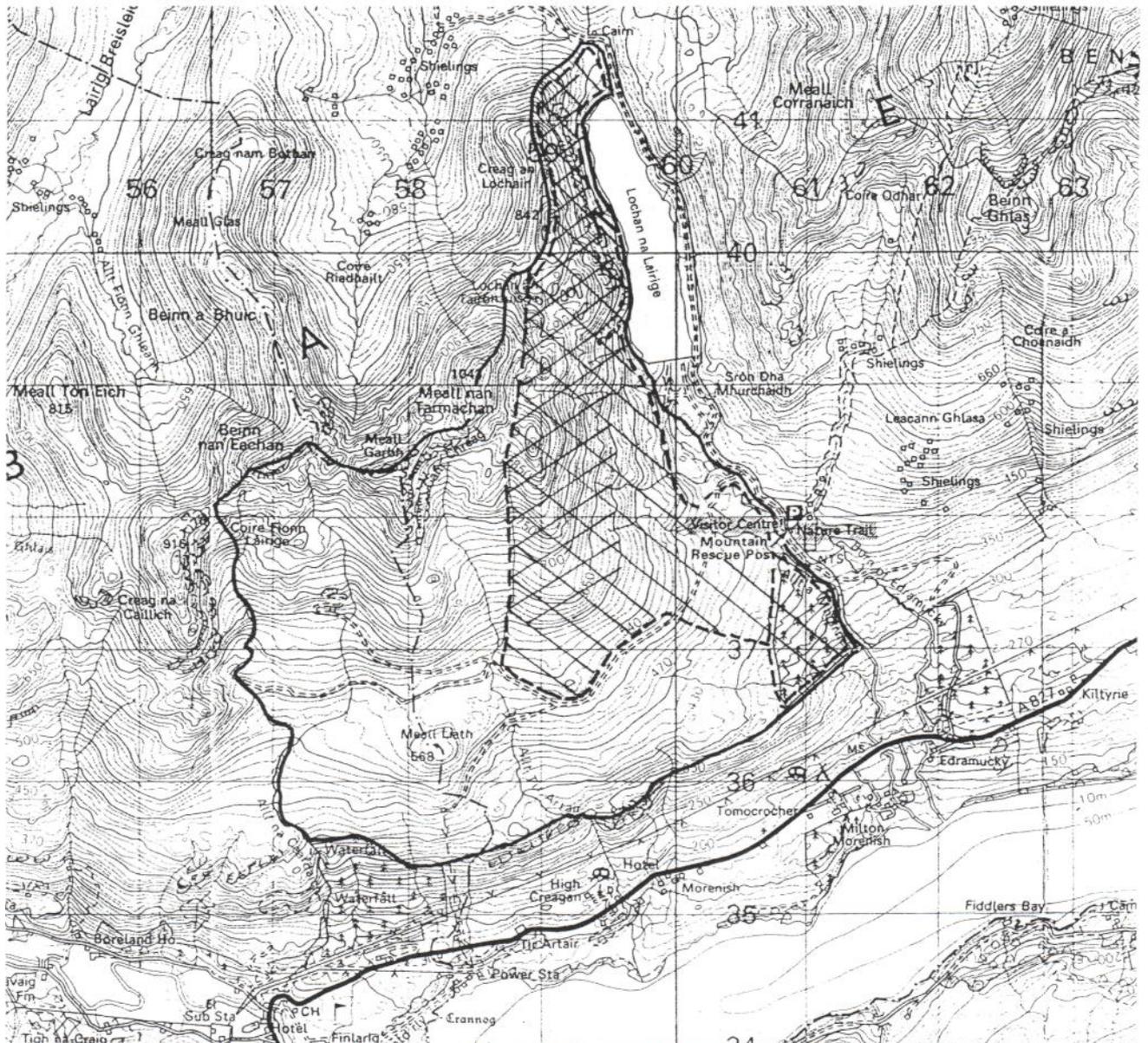
The new area includes part of the NNR, where Reserve staff have worked for many years, through Nature Reserve Agreements, to represent the interests of NCC and recently SNH. Remnants of what may be the richest or most diverse tree-line plant communities in the country, together with a selection of the famous Ben Lawers rarities, survive mostly on cliff ledges. Several species of montane shrub are present, the majority restricted to similar sites and reduced to very small numbers. The exception to this generalisation is *Salix arbuscula* which has survived quite well in procumbent form, and probably has its biggest British population on this site. At the other extreme is *Salix lapponum* with only about 18 plants, dispersed at 9 distinct locations. At several sites only lone plants survive, and the biggest cluster includes only 3 or 4 plants. *Salix myrsinifolia* is present with 100+ plants, widely dispersed, and *Salix aurita* is probably more abundant but the numbers not yet estimated. Juniper has probably become extinct there in recent years, with the recorded demise of the single known plant, although some may survive on inaccessible cliffs. A few ageing mountain birch plants, *Betula pubescens* ssp. *tortuosa* hang precariously on cliff ledges, close to their altitudinal limit. With an altitude range from 300-1,044 metres, much of the ground is below the tree-line.

The montane willow scrub and eutrophic tall herbs are both 'habitats' which must be maintained at 'favourable conservation status' if the SAC designation is confirmed. Neither of these, nor birchwood, can be considered to have 'favourable conservation status' at present. This can only be achieved by active restoration, and that is the general aim of the project.

The project concentrates on the eastern end of the Tarmachan range (see map), and aims to re-establish native trees, shrubs and tall herbs on this area, including the site of the alien conifer plantation. This will require a combination of natural regeneration and planting, and removal of the alien conifers. Experimental work with 2 small exclosures at Creag an Lochain since 1987 has shown that tall herbs can spread, without intervention beyond protection from grazing, but that we cannot expect the scarcer species of shrub or tree to do so. Even the birch trees produce negligible amounts of seed, and samples tested in 1995 had germination rates in the range 0%-6%. Although sheep are not now hefted to the ground (at least not officially) they will stray in and deer are resident on the site. The mechanism by which protection from browsing will be achieved has yet to be decided, but we hope to avoid the need for extensive fencing, especially at high altitude where huge problems are a certainty. A combination of low-level stock fencing, shepherding and culling seems the most promising option, but will depend on an increase in staffing.

Above the natural limit to tree growth, assumed to be around 600-650 metres altitude, the montane willow scrub will be the main aim of restoration. We should at least be able to reverse the trend towards extinction that seemed inevitable for some of the shrub species if intensive sheep grazing had continued. Neither the woodland nor the scrub will be dense and impenetrable as some people seem to fear, but will form a mosaic with other habitats, most of which will remain open. Indeed, the proportion of the ground which is potential montane willow habitat is extremely restricted. Many areas of heather, grassland and wet flushes and will remain free of trees or shrubs, and some of these represent other Annex 1 habitats. Another feature of this area is an excellent archaeological record and the many sites will also be maintained as open parts of the cultural landscape. The woodland and scrub that develops may never be an exact replica of what grew there at any specific time in the past, and such precise knowledge is lacking anyway. However, it should realise more of the potential biodiversity of the site under present climatic conditions. My vision of this land, when restored, will undoubtedly offer a potential experience unique within this country.

The Trust had submitted an application for MFS Phase 3 funding, but we now know that this is unlikely to provide the necessary funding. Without such resources, the project will be a challenge to test the commitment of both NTS and SNH to the conservation of montane scrub. **NB. Map - see next page.**



The Tarmachan habitat restoration and improvement project: Map.
 Continuous line: area of new acquisition; Broken line & cross hatch: area of restoration; Double cross hatch: area above tree-line, where work will concentrate on montane scrub.

***Salix lapponum* on the Helvellyn massif.**

D. K. Mardon

Downy willow *Salix lapponum* has its only known English location on the cliffs of Helvellyn (Lake District National Park Authority et al.; *Helvellyn Mountain Massif Draft Management Plan*). Only females have been recorded, restricted to the crags by grazing. The conservation of the colony is considered in the Management Plan. A fenced enclosure has been suggested, but may not be possible because of the common grazing rights. The plan includes ideas for the import of male plants from a Scottish population in order to try and establish a self-sustaining population. Staff there have had discussions with me regarding the project, and I hope we may be able to assist. Juniper is also present on cliff ledges and other areas. The information given to me by Andrew Fairey, the Helvellyn Project Officer in 1996, suggests that effective conservation of this isolated outpost of downy willow will be a challenge.

Notes on the development of reinstatement methods for H15 (*Calluna vulgaris* - *Juniperus communis* ssp. *nana* heath) at a quarry site on the Isle of Harris.

G. M. McGowan and N. G. Bayfield, Institute of Terrestrial Ecology, Hill of Brathens, Banchory, AB31 4BY.

Background

Dwarf juniper has a prostrate habit and is frequently noted draped over rocks and banks in association with heather. H15, *Calluna vulgaris*-*Juniperus communis* ssp. *nana* heath, has a very restricted distribution in Scotland. Although prostrate forms of juniper are found throughout the Central Highlands, H15 is mainly confined to the north-western seaboard. Constant species in the community are *Calluna vulgaris*, *Deschampsia flexuosa*, *Erica cinerea*, *Juniperus communis* ssp. *nana*, *Potentilla erecta*, *Scirpus cespitosus*, *Hypnum cupressiforme*, *Racomitrium lanuginosum*, *Pleurozia purpurea* and *Cladonia uncialis* (Rodwell, 1991). This ecologically significant community occupies a transitional niche between sub-alpine scrub and low-alpine dwarf shrub heath.

Both sub-species of juniper (*J. c. nana* and *J. c. communis*) are sensitive to burning and grazing pressure, and this may help explain the very patchy distribution of H15. A recent fire seems to have destroyed an H15 community near Tongue, Sutherland (Olmo, 1996). The present known communities of H15 probably represent fragments of a more widespread distribution in the past.

H15 is present at sea level at Rodel, Harris, at and around the site of a proposed super-quarry. Quarrying would create ledges and areas of spoil on which it should be feasible to create semi-natural vegetation similar to that present before the quarry development. The Institute of Terrestrial Ecology (ITE) have been looking at ways to manage and reinstate the dwarf juniper and the associated vegetation community.

Preliminary work started in 1995/96 and included:

transplanting turves of H15 (including dwarf juniper) onto areas of spoil; and growing dwarf juniper from cuttings in a cool greenhouse.

Turf transplanting trial

The aim of this trial, set up in May 1995, was to examine the survival and growth of turves, containing dwarf juniper and heather, transplanted onto a shallow layer of peat and rocks on the spoil area of trials at the quarry site. Turves were laid out in 0.75 x 0.75 m plots, either closely abutted or widely spaced, with control plots having no turves. There were four replicates of each treatment laid out in a randomised split plot design, with half the plots treated with a slow release fertiliser (Vitax Q4 5.3 : 7.5 : 10 NPK).

The following months were exceptionally dry and hot. As the experimental site was exposed and the plots were topographically isolated, the turves were not expected to survive. However, analysis in November 1995, showed remarkably good survival of both dwarf juniper and heather transplanted in the turves. Sixteen months after the trial was set up, poorest survival of dwarf juniper was in the unfertilised, widely spaced turves (31%) compared with >70% when fertilised. The closely turved treatments were equally successful with or without fertiliser (Figure 1).

By autumn 1996, there were marked differences between the fertilised and unfertilised plots (Figure 2). Fertiliser application encouraged the vigorous growth of ericoids, grasses and other wet heath components of the turves. Although dwarf juniper survival and growth remained similar to the previous year, it will be interesting to see if competition from faster growing species causes a decline in future.

Cuttings trial

Rooted cuttings could provide a useful source of dwarf juniper for transplanting in the field. Can dwarf juniper be grown from cuttings? What kind of cuttings would root most successfully? Does hormone rooting powder or fertiliser application improve the proportion of cuttings rooting? Experiments to answer these questions were set up in a cool greenhouse.

Three types of cuttings were taken: long (10cm) and woody; short (5cm) and woody; and short green cuttings. In addition, short woody cuttings were treated with either hormone rooting powder (Baby Bio Roota), slow release fertiliser (Keri spike 6 : 4 : 4 NPK) or both. The cuttings were planted in a 50/50 mixture of sharp sand and peat, three to a pot and there were eight replicates of each treatment.

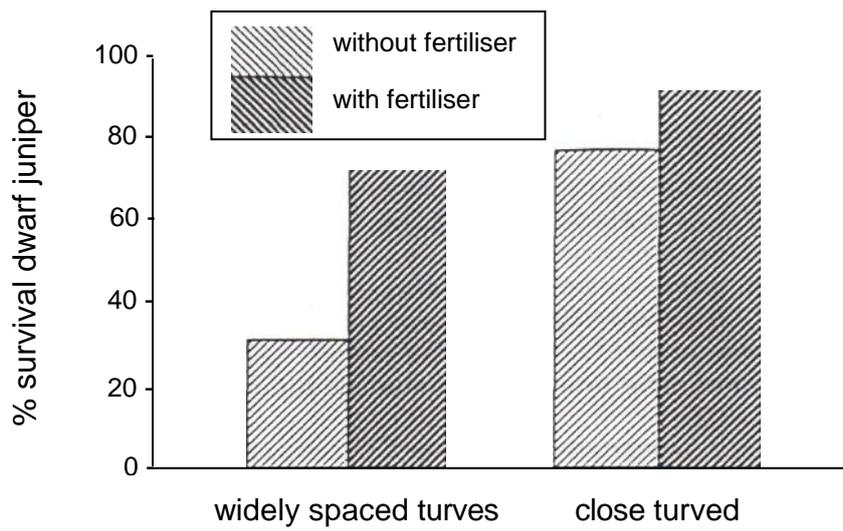


Figure 1. Mean % survival after sixteen months of dwarf juniper in H15 turves widely spaced or closely abutted, with and without fertiliser treatment, transplanted onto quarry spoil.

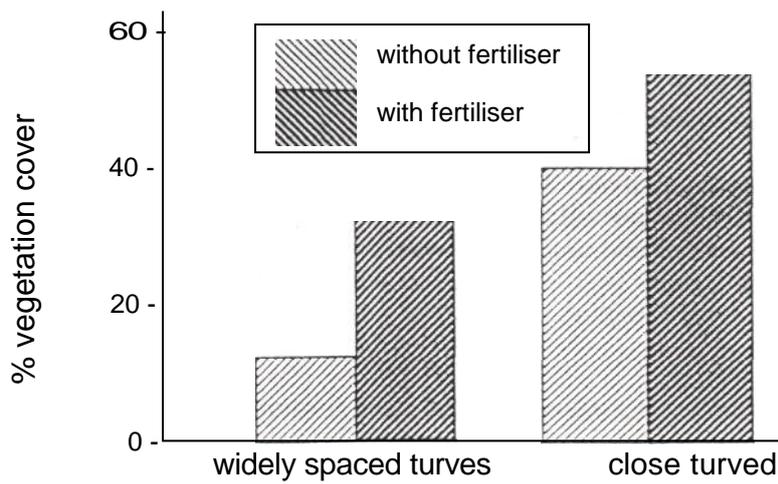


Figure 2. Mean total vegetation cover (%) after sixteen months on plots, with turves of H 15 widely spaced or closely abutted, with and without fertiliser treatment.

More than 70% of all the cuttings survived. There were no obvious advantages of either hormone rooting powder or fertiliser application.

Conclusions

Obviously our work on dwarf juniper is still in the early stages. However, the results of these initial trials are very encouraging. We hope to transplant cuttings into suitable situations in the field, and develop a spectrum of approaches to the reinstatement of heather-dwarf juniper communities. Understanding the processes involved will underpin the scientific basis of environmental remediation. For instance, post-development restoration of the quarry site could well include the reinstatement of dwarf juniper, to partially redress the balance between economic growth and environmental impact. The long-term output from the study could include guidelines for the strategic conservation planning for areas suitable for H15 in north-west Scotland, where grazing or burning could be manipulated to create suitable conditions for re-establishment.

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- Rodwell J S (1991) British plant communities. Cambridge University Press.

Montane scrub and forestry

Rob Soutar, Forest Enterprise, South Scotland, 55/57 Moffat Road, Dumfries, DG1 1NP.

There are few places in Scotland where forests are bounded by an altitudinal zone of transition from semi-natural woodland to open semi-natural habitat. Beyond the forest fence, heavy grazing by sheep and deer have largely restricted trees and taller shrubs to remote gullies, crags and boulder fields. However, it is clear from other countries and from isolated examples in Scotland that scrub could be much more prominent on the hill ground.

The creation or restoration of a mosaic of scrub habitats ranging from the treeline through to truly montane conditions could be of considerable value to nature conservation and biodiversity. Some woody species are greatly restricted in their distribution and any expansion in the range of species such as dwarf birch *Betula nana*, woolly willow *Salix lanata*, or rock whitebeam *Sorbus rupicola* would directly benefit conservation. In the wider sense, the expansion in range of any native woody species including the common birch *Betula pubescens* and willow *Salix* spp. could enhance habitat structure and benefit a wide range of wildlife including "flagship" species. For example, greenshank *Tringa nebularia* are known to favour patchworks of scrub and bog in other countries (as they did in the Cairngorms in the past). It is also true that treeline and montane scrub could enhance landscapes and that the structural features of high elevation scrub are often fascinating in both aesthetic and scientific terms.

However, it must always be borne in mind that Scotland has a rich heritage of upland habitats, guilds of moorland species and archaeological landscapes, often of international distinction. Scrub should not be encouraged on land which in an open condition has a higher value for nature conservation or archaeological heritage. Nor indeed would it be appropriate to create scrub on sites where high forest would be a preferred option. A consensus is needed in the identification of areas where the restoration of scrub would or would not be appropriate.

There may often be a case for encouraging open woodland and scrub on land which lies well below the climatic limit for tree growth (which even without the effects of global warming will often be higher than many hilltops). This need not pose a serious philosophical or management problem since most existing treeline and montane scrub habitats arise from the interactions of a number of environmental gradients of which altitude is only one (albeit very important).

It is anticipated that semi-natural treeline and montane scrub can be created utilising the interaction of climate against a carefully considered management regime with control of grazing and muirburn. The

character and level of grazing need to be clarified and we need to understand the advantages, disadvantages and risks of supplementary planting versus completely regeneration.

Open land beyond the existing treeline is often in the ownership of forestry interests who could be encouraged to extend woodland scrub. However, scrub is of little or no economic value and may be expensive to create and manage. In addition foresters would need to supplement their expertise and be assured that they know the answers to at least the basic questions - for example: Where are the best places to encourage scrub? What woody species should be encouraged? What techniques are appropriate to create and maintain the habit? How long will it take to really make a difference? How can restoration and management be funded? I contend that, on their own, foresters do not have the resources or expertise needed to create extensive and valuable areas of scrub habitat; we need partners.

I also believe that foresters will be helpful as partners when scrub is being restored on land which is not owned by forestry interests. Scrub beyond the treeline could be the most prominent part of forested landscape and any expansion of open woodland or scrubland should, in my view, be considered as part of the forest design process. Conservation organisations managing land abutting forest land will also need the co-operation of their forest neighbours if the management and ecology of forest and treeline scrub habitats are to be properly integrated.

Thus, my central point is that the creation or restoration of scrublands will require partnerships involving both the forestry and environmental communities. This can be demonstrated by a current proposal.

There is a splendid opportunity to develop treeline and montane scrub in the Ben Lomond National Memorial Park where Forest Enterprise (FE) is to gradually replace its coniferous plantations with woodlands of exclusively native species. We are in partnership with the National Trust for Scotland (NTS) who own the land above our holdings including the summit of the Ben.

The FE land and probably most of the NTS land lies well below the climatic limit for tree growth. It is also true that much of the NTS land is an upland SSSI which cannot (and should not) be replaced with woodland. However, with informed management we should be able to create and maintain a semi-natural treeline scrub at moderate as well as higher elevations. A treeline transition of varying width and structure between an extensive native woodland and an upland SSSI, would afford highly significant opportunities for the conservation of nature and biodiversity and enhance an already outstanding landscape.

Neither the FE nor NTS have the necessary resources to determine the precise management regime that is required. The character and level of grazing and other management needs to be clarified and we need to identify sources of funding to allow expansion of scrubland on this scale. FE and NTS have requested the assistance of Scottish Natural Heritage and consultant Dr. George Peterken in assisting us in developing a management specification which will be used in bids for funding.
