

Scottish Seed Stand Project

Appendix E. Best Practice Guidance on Seed Stand Creation and Maintenance



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Appendix E. Best Practice Guidance on Seed Stand Creation and Maintenance

This guidance has been created to provide a useful reference for parties undertaking the creation and maintenance of local provenance seed stands for montane and pioneer species. Guidance was produced by Julia Stewart and Innes Manders (both Catkin Ecology) with Sarah Watts, as part of a Woodland Trust Scotland innovation project.

1. Suitability Assessment

1.1. Identification of Demand

Before setting out to establish a seed stand, refer to the Woodland Trust Scotland database of existing stands and high-priority areas for seed stand creation (**Appendix D**). If a seed stand has already been established in the target area, contact the stand manager to identify whether there is a surplus of seed, or potential to collaborate in replicating or adding to the stand.

If a seed stand is being established for work on a particular site, it is essential to evaluate the suitability of this site for planting the species in question. Recent work suggests that montane willows are tolerant of a wider range of climatic and edaphic conditions than generally expected based on their relict distribution¹. However, the following passage from a recent review of montane willow scrub restoration summarises the risks of an overly-interventionist approach:

“Restoration should avoid large-scale rapid planting in unsuitable or marginal sites, which could create unhealthy, structurally homogenous stands with negative implications for important open-ground habitats and soil carbon-nutrient dynamics. Such action may provide a reservoir for the spread of pests and pathogens, with the potential to damage nearby naturally occurring relict sites, particularly during the era of escalating climate change.”

Watts, 2024a

To assess site suitability, see the **Habitat Map of Scotland Mountain Woodland 2023 – Wild, relict or remnant** dataset and **summary report by Watts (2024b)**, and **Mountain Woodland Project BPG3** (see **References**).

1.2. Identification of Source Site

The general principle should be to collect material from as many individuals as possible, within close proximity to the planting site. Previous guidance has proposed a general threshold of 10km; however, consideration should also be made of local climatic and geological factors. If the stand is intended to be registered on the National Register of Basic Material, then all individuals must come from at least the same region of provenance.²

Cluster maps produced from the **Habitat Map of Scotland Mountain Woodland 2023 – Wild, relict or remnant** dataset provide guidance on source sites for montane willows (Appendix B).³ For other uncommon species, such as *Salix pentandra* and *Salix purpurea*, specific records can be found by searching the BSBI database.⁴

2. Seed Stand Creation Plan

The siting and layout of a seed stand should consider:

- Accessibility
- Design for seed production
- Hybridisation
- Biosecurity
- Whether or not the stand will be registered on the National Inventory of Basic Material

¹ Watts, S. (2024a). Montane willow scrub restoration in Scotland: reviewing 30 years of progress to reestablish the altitudinal treeline. *Restoration Ecology*.

² Forestry Commission Open Data. Forestry Reproductive Materials Regions of Provenance. Available at : [Forest Reproductive Materials Regions Of Provenance | Forestry Commission Open Data website](#)

³ NatureScot (2023)

⁴ BSBI database. Available at: <https://database.bsbi.org/>

2.1. Accessibility

Unsurprisingly, seed stands are usually established in locations where they can be easily accessed, managed, and protected from herbivory. For montane species, this is almost always at lower-elevations and in more sheltered conditions, than the locations of the source populations. Although conditions at low elevation are not representative of those faced by montane willows in their natural habitat, so long as seed is collected from a sufficient number of individuals from the stand, and the stand is not replicated at low-elevation over successive generations, there is negligible risk this will have an impact on the populations' adaptation to high-altitude conditions.

2.2. Design for Seed Production

Design to maximise seed production is relatively simple: stands should be sited in a well-lit and sheltered location inside a fence to protect against browsing by large herbivores. Within the stand, plants should be given sufficient space to maximise light and flowering shoot growth – the relevant distances will vary for each species. All native *Salix* and *Betula* species regularly flower in the UK, and there is no need to stress plants to increase seed production. For dioecious taxa, males and females should be mixed throughout the stand.

2.3. Hybridisation

As a general rule, stands should be sited and designed to minimise the risk of hybridisation. Ideally, stands should be situated at least 500m from other taxa with which they could hybridise – for the species covered by this project, this means all other taxa of the same genera. The risk of hybridisation will be evaluated for any stand to be registered on the National Register of Basic Material (Section 2.5.)

However, it is important to consider that some taxa within the same genera are more likely to hybridise than others, and some also frequently hybridise in nature. For example, *Betula pubescens* x *nana* hybrids occur occasionally in the UK, however, introgression has been found to be unidirectional from *B. nana* into *B. pubescens*.⁵ *B. pendula* and *B. nana* may hybridise more readily as they are both diploid; however, hybrids do not regularly occur due to the different niches occupied by these species. Therefore, it is particularly important that *B. nana* stands established at low-elevation should not be sited near *B. pendula* populations.⁶

Montane willows frequently hybridise in remnant populations across Scotland, without any apparent loss in species diversity or hybrids becoming dominant. It is likely that the risk of hybridisation is greatest where there are biased species ratios, and it has been reported that montane willow hybrids are less vigorous than “true” individuals.⁷ For these reasons, where space is limited and stands are not intended to be registered on the National Inventory of Basic Material, or seed marketed commercially, stand managers may choose to establish stands of multiple species in relatively close proximity, provided the resulting seedlings are visually screened for hybrids.

The issue of gene flow is particularly complex when it comes to subspecies, where variation may even be clinal. Care should be taken when collecting material from *Juniperus communis* that subspecies are identified and separated – not simply prostrate versus upright individuals. Variation in upland *Betula pubescens* remains too poorly understood for stands to effectively be established for potentially rare taxa such as *B. pubescens* var *pumila* if this is indeed present in Scotland.

2.4. Biosecurity

Biosecurity risks should be assessed in the design and creation of seed stands for all species, however, the importance of this threat cannot be overstated when establishing stands for juniper. Juniper stands should be sited at least 1km away from the

⁵ Zohren, J., Wang, N., Kardailsky, I., Borrell, J. S., Joecker, A., Nichols, R. A., & Buggs, R. J. (2016). Unidirectional diploid tetraploid introgression among British birch trees with shifting ranges shown by restriction site-associated markers. *Molecular ecology*, 25(11), 2413-2426.

⁶ Borrell, J. S., Wang, N., Nichols, R. A., & Buggs, R. J. (2018). Genetic diversity maintained among fragmented populations of a tree undergoing range contraction. *Heredity*, 121(4), 304-318.

⁷ Finger, A., Rao, S., Cowie, N., MacDonell, T., Beck, A., & Denny, B. (2023). Conservation genetics of montane willow populations in Scotland—Limited natural recovery despite long-distance gene flow and high genetic diversity. *Environmental Research: Ecology*, 2(1), 015001.

nearest existing juniper population, and other susceptible *Cupressaceae* species. Great care should be taken to ensure material is not collected from populations where *Phytophthora austrocedri* is present, and the stand should be designed to enable biosecurity measures such as cleaning of footwear when entering and exiting the stand. For guidance on how to limit the risks of *Phytophthora austrocedri* see **Management of juniper populations to mitigate spread of *Phytophthora austrocedri*, Reducing *Phytophthora* risk in nurseries – key considerations** and **Juniper: Management Guidelines**.^{8,9,10,11}

2.5. Registering (or not) a Source-Identified Stand on the National Register of Basic Material

When considering the design and planning of new seed stands – a key consideration should be whether the seed stand will be registered on the National Register of Basic Material. This is an online inventory maintained by regulators of Forest Reproductive Materials.

Forest Reproductive Materials

The Forest Reproductive Material (Great Britain) Regulations provide a system of control for seed, cuttings and planting stock that is used for forestry purposes in Great Britain. This ensures that planting stock is traceable throughout the collection and production process to a registered source of Basic Material. In addition, it provides information on the genetic quality of the stock.

Forestry Commission, 2022

The regulation of seed sold for forestry reproductive purposes is only a legal requirement for controlled species – of the montane and pioneer species native to Scotland, this is effectively only *Betula pubescens*, *Populus tremula* and *Alnus glutinosa*. Registration of FRM from all other species relevant to this project are covered by the voluntary scheme.¹²

There is no requirement for seed stands to be registered: seed collected from stands can simply be registered as a source-identified collection. However, there are benefits to registering a source-identified seed stand on the National Register of Basic Material which is managed by the Forest Reproductive Materials team:

- Only seed from registered seed stands can be approved as indigenous by FRM regulations
- Information sharing on seed collection sources for seed collectors and nurseries

The FRM definition of a source-identified stand is wider than the use of “seed stand” here. Wild populations can also be registered on the National Register of Basic Material as a source-identified stand.

However, not all stands would be suitable to meet FRM standards for a source-identified stand. Registered stands must meet the following criteria:

- Source material has been collected from a single native seed zone or region of provenance¹³
- Source material has been collected from a single altitudinal band (i.e. not material from both <300m asl **and** >300m asl)
- The risk of hybridisation is low (this will be assessed on a case-by-case basis but at least 500m from potential sources of hybridisation is a good general rule).¹⁴

For guidance on how to register as a Basic Material Manager, and how to register a source-identified seed stand on the National Register of Basic Material, [see the 2022 Forestry Commission guidance](#).¹⁵

3. Collecting Material

3.1. Collection Methods

Most seed stands are likely to be established from cuttings or seed collected from remnant populations. Table D1. summarises the respective merits of these methods of collection.

⁸ Forest Research (2022)

⁹ Forest Research (2023)

¹⁰ DEFRA (2017)

¹¹ Forestry Commission Scotland (2013).

¹² Forestry Commission (2019)

¹³ Scotland is divided into two regions of provenance: Western (101-109) and Eastern (201-204).

¹⁴ Forest Reproductive Materials team (personal communication)

¹⁵ Forestry Commission (2022)

Table D1. Advantages and disadvantages of collecting material from cuttings and seed.

<u>Taxa</u>	<u>Cuttings</u>		<u>Seed</u>	
	<u>Advantages</u>	<u>Disadvantages</u>	<u>Advantages</u>	<u>Disadvantages</u>
<i>Betula nana</i>	Hybrids can be identified and avoided.	Time-consuming.	Monoecious. Seed production is reliable and large quantities can often be collected.	Plants grown on may be hybrids.
<i>Juniperus communis</i>	Material can be collected from plants which do not set seed. Material can be collected from isolated individuals. Material can be collected from individuals on crags where seed collection is not possible. Easy to spot plants in winter. An even sex ratio can be ensured. Cuttings can establish quicker and produce seed earlier than plants grown from seed.	Time-consuming. Difficult to establish cuttings.	Plants can be established more easily. Collections can take place at any time of year.	Dioecious. Long dormancy period. Upland populations seed infrequently. Collections may be low in genetic diversity if seed is repeatedly gathered from only a low number of accessible reproductive individuals
<i>Salix spp.</i>	Material can be collected from plants which do not set seed. Material can be collected from isolated individuals. Material can be collected from individuals on crags where seed collection is not possible. Genetic diversity of local population can be retained Material can be collected from multiple species in a single visit. An even sex ratio can be ensured. Cuttings can establish quicker and produce seed earlier than plants grown from seed.	Cuttings are most likely to be successful when collected during the dormant season, when locating and identifying plants is more difficult.	Collections take place in summer.	Careful monitoring and multiple site visits may be necessary. The timing of seed ripening varies for each species. Plants grown on may be hybrids. Collections should not be made from small, isolated populations. Seed for montane species is highly recalcitrant. Collections may be low in genetic diversity if seed is repeatedly gathered from only a low number of accessible reproductive individuals
<i>Sorbus rupicola</i>	Material can be collected from plants which do not set seed. May be possible to graft onto <i>Sorbus aucuparia</i> rootstock.		Apomictic so seed can be collected from isolated individuals.	Many individuals rarely produce seed.

Cuttings are usually the most effective method for establishing localised stands of most *Salix* spp. and often juniper from individuals at high-elevations. The genetic diversity of a local population can be retained through cuttings, whereas seed collection may only rely on a low number of accessible, reproductive individuals. However, stands of *Betula nana* are more likely to be established from large, reliable seed sources. Seed collection is the usual propagation method for *Sorbus rupicola*, however, Broadford Community Tree Nursery are also establishing plants through grafting onto a *Sorbus aucuparia* rootstock.

Cuttings for montane willows are most successful when collected during dormancy, before leaf buds burst, and are often gathered from the wild between February and April. Cuttings should be stored in polythene bags and planted into moist soil as soon as possible after collection.

The value of recording and mapping populations during the field season before collecting cuttings the following year cannot be overstated, particularly where multiple species are present and/or populations are small and isolated (Figure E1).

Right: JS collecting *Salix reticulata* cuttings in Glen Lochay Estate. These small individuals would be tricky to locate in winter without prior knowledge or surveying of the population.

It is important to note that landowner permission must be established when collecting cuttings or seed and it is necessary to gain NatureScot consent if relict populations are within protected areas. Strict biosecurity protocols should be adhered to when collecting plant material, particularly for juniper. For full guidance on collecting montane willow, dwarf birch and juniper cuttings and seed, see the **Mountain Woodland Project Best Practice Guidance Note 2**.



3.2. Genetic Diversity

Whether growing plants from cuttings or seed, it is important to maximise the genetic diversity of seed produced in the stand. Therefore, for most species the planted stand should consist of at least 30-50 individuals preferably originating from across multiple local populations. With dioecious species an even sex ratio should be maintained, and it could be argued that reaching the threshold of 50 plants is more important.¹⁶ There is no maximum number of individuals, and as a general principle, the more plants which can be collected from within the target area, the better.

As *Sorbus rupicola* is apomictic, there is no requirement for a minimum number of individuals. However, it is proposed here that stands could consist of around 10-20 individuals collected from multiple locations.

4. Managing a Seed Stand

4.1. Ground Preparation and Vegetation Management

Despite the calcareous requirements of montane willow species, particularly *S. myrsinites*, *S. lanata* and *S. reticulata*, most seed stands have been established without the need for base-enrichment. However, this research has found no previous projects which have successfully cultivated *S. reticulata*, the species with the highest base requirements (MWP BPG 3). The James Hutton Institute – Ripa Gar Foundation partnership at Glen Lochay Estate is experimenting with the liming of soil for cultivation of *Salix reticulata*.

Mulch mats can prove effective in controlling surrounding vegetation, which is particularly important for cultivating the slowest growing montane willows. Otherwise, cuttings or seedlings should be regularly weeded to reduce competition and allow the trees or shrubs establish. Protection from large herbivores will be required using fencing, and managing the length of surrounding vegetation will also help minimise damage from small mammals such as voles.

¹⁶ Coille Alba (2019). Establishing Seed Stands for Scottish Aspen.

A spacing of c.1m is typical for montane willow seed stands; however, wider spacing would be necessary for larger species such as *Salix myrsinifolia*.

4.2. Harvesting and Processing Seed

Although artificial pollination has been successful with *Populus tremula*, this approach is not usually required for willow seed stands, or for stands of *Betula nana*. Artificial pollination may have the potential to increase gene flow and seed production in *Sorbus rupicola*.

Guidance on collecting and processing willow seed can be found in **MWP BPG 3**. It may take several collections for each species to ensure seed is being collected from as many individuals as possible at the correct time. Collected seed should be processed and sown or sent to a nursery as soon as possible, ideally within 48 hours, as seed viability declines rapidly. Useful references for collecting seed from other native species include **Forestry Commission Practice Guide: Raising Trees and Shrubs from Seed** and **A Handbook of Scotland's Trees** (see **Key References**).

4.3. Seed Stand Database

New seed stand managers are encouraged to register the stand with Catkin Ecology who are managing the database of existing montane and pioneer seed stands across Scotland established during this project for Woodland Trust Scotland. This includes those stands which for various reasons are not included in the National Register of Basic Material. To register a stand visit catkinecology.co.uk/seedstand or contact info@catkinecology.co.uk.

5. Key References

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