The Provenance and Production of Scottish Broadleaved Trees©

S. Thompson
Christie Elite Nurseries, Forres, Moray IV36 3TW

Native broadleaved tree species now account for half of all the trees planted in Scotland each year. There is a preference for planting stock of local provenance. The factors determining the availability of sufficient seed are discussed. Different plant rearing systems which produce different types of planting stock are described. Each has characteristic suitabilities for the varied planting sites found throughout Scotland.

INTRODUCTION

Up until 1988, broadleaved tree species accounted for only 5% of all the trees planted in Scotland. Timber trees of large stature such as oak (*Quercus petraea* and *Q. robur*), beech (*Fagus sylvatica*), and ash (*Fraxinus excelsior*) were the preferred species. The plants used were often imported from continental Europe or, if from British nurseries, raised from seed sourced from outside the U.K. Alder (*Alnus glutinosa*), birch (*Betula pendula* and *B. pubescens*), elder (*Sambucus nigra*), rowan (*Sorbus aucuparia*), and other native species of low timber value were regarded as weeds by foresters and rigorously cleared from developing conifer woodlands. However, 1988 saw the introduction of financial grant schemes which place greater value on the conservation of native woodland, its genetic composition, its habitat diversity, its ecology, and its importance in the landscape. Timber production is not an important requirement in these new native woodlands and this is reflected in the wide choice of tree and shrub species planted (Table 1) and the low stocking density prescribed (1100 plants h^{-1}).

Scotland's Native Trees and Shrubs. Table 2 lists more than 30 species considered to be native to the Scottish Highlands. Although most occur throughout the region some, e.g., whitebeam (*Sorbus aria*), are not found in the northwest. Table 2 lists a further 12 species native to Scotland, but not found in the Highlands.

PROVENANCE AND ORIGIN

Before humans started moving plant material around, the terms provenance and origin were synonymous. This is no longer the case. "Origin" is the place where the genotype evolved in response to selection pressure such that it is adapted to that particular locality. "Provenance" is the place where a tree is growing. It can be where it has evolved, when it is described as autochtonus, i.e., truly native, but often the tree has been planted and its origin can be many, many, miles away. Having survived to reproductive age, often over several generations since plants and seeds have been imported into the U.K. for several centuries, it has been argued that seed collections from local sources, because they are tolerably adapted to the environment they are growing in, are acceptable for the creation of new native woodlands. This is not acceptable to those involved in genetic conservation but for most British

Table 1. Tree and shrub species native to Central and South Scotland.

		Seed collection zone				
Species	Common name	107	108	109	203	204
Acer campestre	Field maple	0	0	*	0	*
Cornus sanguinea	Common dogwood	0	0	*	*	*
Daphne laureola	Spurge laurel	0	0	*	*	*
Euonymus europaeus	Common spindle	0	0	*	*	*
Ligustrum vulgare	Common privet	0	0	*	*	*
Rhamnus cathartica	Common buckthorn	0	0	*	*	*
R. frangula	Purging buckthorn	0	0	*	*	*
Rosa arvensis	Field rose	0	0	*	*	*
Salix triandra	Almond willow	0	0	*	0	*
Taxus baccata	Yew	0	*	0	0	*
Tilia cordata	Small-leaved lime	0	*	0	0	*
T. platyphyllos	Large-leaved lime	0	0	*	0	*

Derived from Herbert et al. (1999)

Table 2. Tree and shrub species native to Scottish Highlands and Islands.

		Seed collection zone							
Species	Common name	101	102	103	104	105	106	201	202
Alnus glutinosa	Common alder	*	*	*	*	*	*	*	*
Betula pendula	Silver birch	*	*	*	*	*	*	*	*
B. pubescens	Downy birch	*	*	*	*	*	*	*	*
Corylus avellana	Hazel	*	*	*	*	*	*	*	*
Crataegus monogyna	Common hawthorn	*	*	*	*	*	*	*	*
Cytisus scoparius	Broom	*	*	*	*	*	*	*	*
Fraxinus excelsior	Ash	*	*	*	*	*	*	*	*
Ilex aquifolium	Holly	*	*	*	*	*	*	*	*
Juniperus communis	Juniper	*	*	*	*	*	*	*	*
Malus sylvestris	Crab apple	0	0	*	*	*	*	*	*
Pinus sylvestris	Scots pine	0	*	0	*	*	*	*	*
Populus tremula	Aspen	*	*	*	*	*	*	*	*
Prunus avium	Gean or wild cherry	0	*	*	*	*	*	*	*
P. padus	Bird cherry	*	*	*	*	*	*	*	*
P. spinosa	Sloe or blackthorn	*	*	*	*	*	*	*	*
Quercus petraea	Sessile oak	0	*	*	*	*	*	*	*
Q. robur	English or common oak	0	*	*	*	*	*	*	*

Rosa canina	Dog rose	*	*	*	*	*	*	*	*
Salix alba	White willow	0	0	*	*	*	*	*	*
S. aurita	Eared willow	*	*	*	*	*	*	*	*
S. caprea	Goat willow	*	*	*	*	*	*	*	*
S. fragilis	Crack willow	0	0	*	*	*	*	*	*
S. lapponum	Lapland willow	*	*	*	*	*	*	*	*
S. myrsinifolia	Dark-leaved willow	*	*	*	*	*	*	*	*
S. pentandra	Bay willow	0	0	*	*	*	*	*	*
S. phylicifolia	Tea-leaved willow	*	*	*	*	*	*	*	*
S. purpurea	Purple willow	0	0	*	*	*	*	*	*
S. viminalis	Common osier	*	*	*	*	*	*	*	*
Sambucus nigra	Elder	0	*	*	*	*	*	*	*
Sorbus aria	Whitebeam	0	*	0	0	*	*	*	*
S. aucuparia	Rowan or mountain ash	*	*	*	*	*	*	*	*
Ulex europaeus	Whins or gorse	*	*	*	*	*	*	*	*
Ulmus glabra	Wych elm	*	*	*	*	*	*	*	*
Viburnum opulus	Guelder rose	*	*	*	*	*	*	*	*

Derived from Herbert et al. (1999)

broadleaved species we lack the tools to differentiate between local genotypes and those from more distant parts of the natural range.

The Forestry Commission has recently produced a map which defines local seed zones (Fig. 1). This was derived from an earlier map which divided the U.K. into four parts. Although each of these parts has now been subdivided into more environmentally similar zones they could not be described as ecotypic units. Also, apart from some work on *Betula*, very little research has been done on the degree of ecotypic variation present in any of our native broadleaves. Thus, when plants of local provenance cannot be sourced, those from an adjacent seed zone are substituted. Present day nurseries must have a reliable audit trail from seed to planting stock and be able to provide customers with authentic certificates of plant provenance and origin where known.

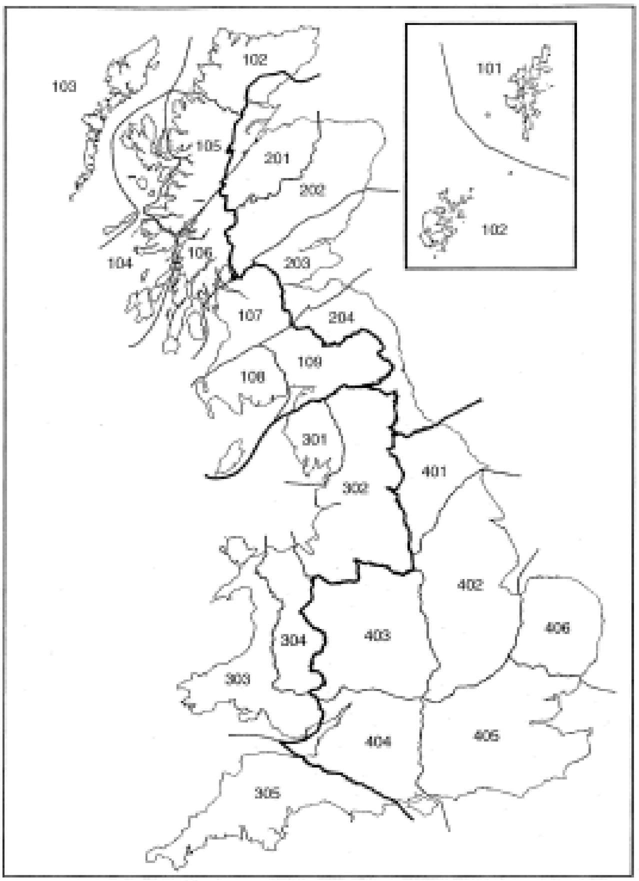

Figure 1. United Kingdom seed zones (reproduced with permission from The Forestry Commission).

COLLECTION AND MANAGEMENT OF SEED

Many of the species listed in Table 1 are at the edge of their natural range and as a result they are irregular producers of viable seed. Even birch and rowan do not produce seed every year and there may be 10 or more years between mast years of sessile oak. This has important consequences, including questions of conscience, for nurserymen and those planning to create new native woodlands, especially when using natural regeneration.

We do not have a clear understanding of the mechanisms controlling the size and frequency of good seed years. Good flower production, often related to favourable weather prior to flower development, and successful pollination are prerequisites. Frosts, hailstorms, and gales can, however, conspire to prevent successful development of the fruits. Even when the fruit is ripe and present in collectable quantities, rapacious birds, mice, or squirrels can change the position overnight.

Seed Collection. Successful and economically viable collections of seed from native broadleaves in the Highlands and Islands of Scotland are tricky, especially if you are trying to make a living from it. Good local knowledge is a prerequisite. Knowing where the seed is and when it is ready for collection is essential since locations can be remote. Repeat visits have to be made to accommodate the varying ripening schedules of our wide species range (from *Salix* in June to *Ilex* in January). Good relations with local landowners can be of great assistance — albeit at the cost of royalties for the seed collected.

Seed Storability. There is a considerable variation between species in the conditions required for successful seed storage. *Betula* seed can maintain its viability for many years if kept in refrigerated storage at low moisture content. Thus, large quantities can be collected in good years and stored for use after lean years. *Quercus*, on the other hand, is difficult to store. However, various growing practices can be used to make plants available for use over several years from a single mast year.

Seed Dormancy. This is another hurdle which has to be surmounted before the seed can be raised into planting stock. Dormancy varies from none, as in *Salix*, to "triple dormancy" in *Fraxinus*. It can also vary between seedlots and the method of seed storage can also be an important influence. Artificial methods of breaking seed dormancy are well known but they tend to be less reliable and less productive than "natures way". Often this requires the passage of several winters, and a summer in a moist environment.

PLANT PRODUCTION

Almost 90% of the planting stock used in the U.K. is field grown and bare-rooted. When the plants are dormant they can be planted from November to April, and into June if cold-stored. The remaining 10% to 15% is cell-grown or containerised. Such stock has only become readily available over the last decade. Since their root systems are undamaged by transplanting, buffered by the plug of compost, cell-grown plants (CGPs) can be planted throughout the year. However, they are most widely used in the months prior to and immediately after the field-grown planting season.

Field Grown Stock. This is the traditional method of plant production where seedlings or transplants are raised from seed. Seedbeds are undercut to improve the amount of fine roots on seedling stock but transplanting remains the best means of improving plant sturdiness and shoot : root ratio, albeit at greater cost.

Small (12/25 cm) 1u0 stock is now widely used in the establishment of new native broadleaved woodlands in the northwest Highlands. Being small, they are sheltered by the natural vegetation and with young roots, they rapidly colonise the new soil and make good height growth in their first season. Larger, older plants tend to struggle on these harsher sites but they are preferred on more sheltered, more fertile sites where weed competition can be a problem. In forestry practice, plants up to 90 cm are used but for amenity and landscaping purposes; field grown stock up to 5 m tall can be planted. As plants become taller it becomes more difficult to maintain an adequate balance between root and shoot. Larger stock frequently suffers severe planting shock, the penalty for the desire to have a high visual impact at time of planting.

Cell-Grown Plants. In the northern hemisphere this is now the normal method of plant production. U.K. production has suffered because of the greater cost of CGPs and the comparative ease of use and general effectiveness of field-grown stock in our benign climate. At present, CGPs tend to be used to raise small seedlots from scarce provenances because the yield of plants is greater than field-growing and they are available for planting more quickly. CGPs are also used on dry sites where they survive better than field-grown stock and they are also used outside the normal field grown planting season, again to ensure plant survival.

Compared to field-grown methods of plant production, CGP production is still in its infancy. I believe there is considerable scope to improve the biological potential of CGPs such that when they are planted, not only do they survive, they thrive and grow such that their greater unit cost is recouped in reduced woodland establishment costs.

FURTHER READING

Herbert, R., S. Samuel, and **G. Patterson. (1999).** Using local stock for planting native trees and shrubs. Forestry Commission Practice Note 8.