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Issues of plant origin

Sue Everett, *Flora locale*

Flora locale aims to 'promote and advance the conservation and enhancement of native wild plants and their associated biodiversity, with particular regard to creative conservation, ecological restoration and the conservation of genetic diversity'.

Why was Flora locale set up?
Lots of people were getting concerned that strange plants were appearing in the countryside. Lots of wild flower seed was being sown, trees and shrubs planted. It was all meant to be native species – but much of it was not native species at all. Some recent examples include *Centaurea rhenana* and Pot Marigold sown on the M1-A1 link road in Yorkshire, and the planting of *Cornus alba* and its relatives (planted instead of our native *Cornus sanguin*ea). There are many other examples.

Many plants that appeared to be native species looked quite different when compared to their truly native counterparts. Bigger leaves and flowers, larger fruits and earlier leafing are just some characters which distinguished them. The reason for this was simply that vast numbers of plants were (and still are) being introduced into the countryside, on a very large scale, but scant (if any) attention was being paid to plant origin. In fact much of the planting stock still originates far from Britain's shores.

Why is plant origin important?
To understand why, a little knowledge about plant variation and evolution is necessary. A good introduction to this is given in Ennos et al[i]. For a more serious read see Briggs and Walters[ii].

Examples of how genetic variation is expressed in plants
Morphology

- Growth form and habit e.g prostrate, upright
- Leaf or flower e.g shape size, colour

Phenology

- Flowering and leafing time (important for synchronisation with pollinators)
- Dormancy
- Germination: timing and period

Biochemistry

- E.g. Production of toxins to protect against insect attack

Survival (relates to all the above)

- Ability to survive hostile conditions e.g. drought, frost

Molecular

- There may be detectable molecular genetic differences that bear no relationship to observable physical of chemical differences – and vice versa.

Variation:

- occurs between and within populations of a species
- can be significant in some species and little in others
- allows for selection processes to continue and for adaptation to environmental change.

Many species occur as groups of individuals which differ from other populations cytologically (most commonly in chromosome number) but these differences are not reflected in obvious morphological or ecological differences.

Why are there patterns of variation?

Fitness and survival: adaptation to locality
Selection pressures include:

- Biotic (e.g. grazing, cutting, burning)
- Climatic
- Edaphic (soil dryness, wetness, nutrients, etc)

A recent research project found that there were significant differences in biomass and reproductive effort between intraspecific variants of Centaurea nigra and Lotus spp. in response to water levels – with implications for the success of grassland re-creation and the selection of seed for reintroduction projects. See Barrat et al[iii].

Agrostis curtisii (Bristle Bent) shows a positive relationship between geographic distance and genetic distance – its gene flow has not been greatly disrupted by humans. In contrast Lolium perenne (Perennial Rye-grass) shows the opposite – showing no such relationship. This species has been well "mucked about" – with cultivars having a narrow genetic diversity widely planted for agriculture. This has also affected the genetic makeup of wild populations in unimproved grasslands. Further background to this can be found in a paper by Hamilton (which can be accessed via a link on the Flora locale website).

Dactylis glomerata (Cocksfoot) is a grass showing adaptive variation. Early-flowering plants are associated with meadows cut for hay, while plants from grazed meadows produce more tillers.

Colonisation history
Genetic variation between some populations of a species may reflect its colonisation history. *Juniperus communis* is an example, having three possible routes of colonisation which are distinguished by detectable variation in populations. See Van der Merwe[iv]

Ecological history
e.g. effects of habitat fragmentation may cause genetic erosion, particularly in:

- small or long-isolated populations
- species which are "inbreeding".

These populations/species may be most at risk from:

- Environmental change
- Ill-considered introductions (e.g. by "swamping" of characters for fitness and survival to local circumstances).

… or … would they benefit from exposure to a wider gene pool?

The answer to this question is we don't know for most of the species which we are happily reintroducing into the countryside on a large scale. We really do need to find out more about them.

Introductions and translocations – new native woodland

The emphasis of many habitat Biodiversity Action Plans, agri-environment programmes and the UK Forestry Strategy is now upon ecological restoration, involving large scale plantings and sowings of native plants to "re-create" habitats, reduce habitat fragmentation and generally enhance the biodiversity value of the wider countryside. Current restoration activity, including native woodland replanting and establishment, has involved:

- **the introduction and establishment of non-native genotypes, varieties and cultivars of native species** (e.g. hybrid *Sorbus*, Common Alder *Alnus glutinosa* from Hungarian sources[1] , rye-grass cultivars)
- **the introduction and establishment of non-native species that are related to native species** (dogwoods *Cornus* spp., Spanish Bluebell *Hyanthoides hispanica*)
- **translocations of native species** (e.g. Wild Thyme from Scotland planted on arable reversion grassland in southern England).

Impacts of inappropriate introductions and translocations

Impacts related to loss of genetic variation and inappropriate introductions may be expressed by:

- reduced ability to evolve and adapt to change
- reduced reproductive fitness e.g. sterility
- loss of locally adapted distinctive variants
- loss or disruption of patterns of variation (e.g. that may relate to historical patterns of colonisation)
- impacts on associated species e.g. pollinators, competitors (introduced varieties or cultivars may be useless for associated species, e.g. corolla tube of some Red Clover varieties is to long for native bumble bees)
- failure to survive.

There is also the heritage issue – why rebuild biodiversity with poor facsimiles of our native flora? To do so, is like rebuilding a dry stone wall in the limestone area of the Peak District with Millstone Grit from the Dark Peak (but worse). Or, maybe, using breeze blocks to repair the external walls of Windsor Castle.

Woodland ground flora

Large scale introductions and translocations of woodland ground flora species have not yet begun, but there is a danger of disrupting historic patterns of genetic variation and losing information on plant colonisation history.

Research into the genetics of woodland ground flora species is needed. The results will help to shape future policy on plant sourcing, but in the meantime the precautionary principle should be applied.

Conservation organisations need to create a bottom-up relationship with plant nurseries so that commercial production can be shaped to meet genetic conservation objectives for biodiversity and to ensure sufficient quantities of local origin seed is available. For some species, such as bluebell, seed can be collected easily from local woodlands and this used when carrying out introductions in the locality.

Some broad objectives should also be set (see below) and followed by all partners in the Biodiversity Action Plan process – at the national and local level. These objectives should apply to all flora, whether it be seed, plants, wild flowers or native trees and shrubs.

[1] cone size in the non-native trees can be up to 35% larger than in native trees

Conservation objectives for species reintroductions and translocations

1. Maintain and enhance fitness, adaptiveness and long term potential for evolution among species
2. Safeguard patterns of variation that reflect a species' evolutionary history
3. Maintain and, where possible, restore genetic processes, especially gene flow and natural selection
4. Create and restore robust plant communities, habitats and landscapes that reflect local character and will deliver regional and local biodiversity objectives.

(Bullets 1-3 after Ennos et al.)

In practice this means using seeds or plants that originate and are native to a natural area or heritage zone where possible, and at the very least sourcing plants from a climatically similar region within Britain. For sites of significant nature conservation value (and those in close proximity to such areas), natural regeneration would be the preferred option. Flora locale has produced a guidance note on plant sourcing (see Table 1). Owing to the lack of scientific data on genetic variation in our native species, this guidance aims to be pragmatic, stressing the need for particular care to be taken in ecologically sensitive areas.

Finally, it also goes without saying that it is is also important to use *typical* species representative of the plant community being restored, and that are native to the area. These should reflect local abiotic conditions such as microclimate, soil type etc. Standard references include the British Plant Communities publications (pub. Cambridge University Press), as well as The Atlas of the British and Irish Flora[v] and individual county floras – which identify species native to specific localities.

Practical considerations

Some practical considerations to plant sourcing relate to the mis-match between supply and demand for native flora. Limited quantities of seed and plants are available at any one time, and large projects should plan well ahead to ensure that flora of appropriate origin will be used.

- Very specific demands for plants or seed or native origin to specific localities or in very large quantities are unlikely to be met from the 'off the shelf' supplier. In these cases, contract growing and wild seed harvesting are recommended.
- Build up a relationship with your suppliers
- Set up/join a local native flora network with other NGOs/farmers/groups carrying out habitat creation projects to increase demand for local seed. This should allow larger, more cost efficient, orders to be placed, including contract-grow. Cooperatives and local seed networks could also train local seed collectors and organise local seed collections.
- Don't plant if it means you are likely to use planting stock of inappropriate origin!

Finally, some of the messages I have given here have already been said long ago. For example, important messages from the 1995 symposium, "The role of genetics in conserving small populations" (published by JNCC) included:

- Genetic variation within species is a fundamental component of biodiversity – its conservation should feature prominently in nature conservation programmes
- Patterns of genetic variation within species differ and need to be taken into account in developing conservation strategies.

- Caution is required over the potentially negative consequences of otranslocations, particularly in relation to “genetic mixing” and disruption of long-established patterns of genetic variation.

These messages have taken a long time to get through – seven years later we are still seeing large scale inappropriate introductions and translocations, often paid for by public grant, for forestry and in agri-environment schemes, highways and landscaping projects.

Table 1: Planting with wildlife in mind. Sourcing native flora: summary note

(This and other Flora locale guidance, can be accessed via www.floralocale.org)

❀ Best option (for genetic conservation and/or greater assurance of plant survival in non "gardened" environments)

✔ Acceptable [where "local " this is only a less preferable option when supplies of local material are limited]

✖ Not usually advised – however, there may be circumstances where this approach is appropriate

Location of scheme	Advised origin for native plants or seed			
	Britain	***Climatically similar region of British Isles***	***Local area***[1]	***Use natural regeneration*** *where possible*
Formal parks and gardens	✔	❀	✖[1]	✖
Larger projects in urban and suburban areas or industrial landscapes[1]	✔	❀	✔	✖
Field-scale countryside projects within intensively farmed landscapes[1] (including new native woods, restoration of mineral workings)	✖	✔	❀	✔
Ecologically sensitive areas: e.g. offshore islands, the coastal fringe, Environmentally Sensitive Areas, biodiversity "hot-spots"	✖	✖	❀	✔
Special sites: e.g. ancient semi-natural woodlands or species-rich hedges, nature reserves and SSSIs	✖	✖	✔	❀

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[i] Ennos, R. et al. 2000. Genetic variation and the conservation of British Native Trees and Shrubs. Forestry Commission

[ii] Briggs, D. & Walters, S.M. 1997. Plant variation and evolution. Cambridge University Press.

[iii] Barrat et al. 1999. Variation in the responses of intraspecific variants of wet grassland species. Watsonia, 22: 317-328.

[iv] Van der Merwe. 2000. Spatial and temporal aspects of the genetic structure of Juniperus communis populations. Molecular Ecology, 9, 379-386.

[v] Preston, C., Pearman, D. and Dines, T. 2002. New atlas of the British and Irish Flora. Oxford University Press.