

## Using native flora for quarry restoration

This technical note is one of a series produced by *Flora locale* to encourage good practice in the use and collection of native flora. While designed for use within Britain or Ireland, the principles followed (e.g. sourcing flora from within country or from more local ecologically distinctive zones) are relevant elsewhere.

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## 1 Introduction

Surface quarrying is an ancient activity – as old as people have existed in Britain.

Until relatively recently, old quarry sites were not deliberately “restored”, but many quickly became invisible as wild plants naturally colonised the landscape scars. Examples can be found all over the Britain and Ireland. In Derbyshire, former lead workings support a great diversity of wild plants including species which have become specially adapted to the contaminated soil. Near Peterborough, old gravel workings have developed a varied terrestrial and aquatic flora, and support one of the UK’s largest populations of Great Crested Newt.

However, as quarries have increased in size, and the scars ever-bigger, restoring them has become a major landscape industry. The main issue for biodiversity, and for *Flora locale*, is to ensure that when restoring quarry workings of any size, native flora is specified and sourced from appropriate locations, and that natural regeneration is encouraged wherever practicable.



### Key references on habitat restoration

Grahame White and Jo Gilbert (Eds). 2003. RSPB. *Habitat creation handbook for the minerals industry*. ISBN 1 901930 37 8. £24.99 from RSPB, order from 01767 680551.

*Go Native! Planting for biodiversity*. Guidelines published by *Flora locale* and available on the website in 2005.

Gilbert, Oliver and Anderson, Penny. 1998. *Habitat Creation and Repair*. Pub: Oxford University Press. ISBN 0 19 854966 0.

Oxford, M. 2000. *Developing naturally: A handbook for incorporating the natural environment into planning and development*. Association of Local Government Ecologists. £31.25 from Mike Oxford, PO Box 1164, Pensford, Bristol BS39 4YB.

*Cost Effective Landscape: Learning from Nature. Landscape Design and Management Policy. A Roads, Bridges and Traffic in the Countryside Initiative*. (pub. The Scottish Office. 1998. Available @ £15 from the Stationery Office. ISBN 0 7480 5863 X.)

## 2 Sourcing native flora

Native plants and seed used in the countryside should be of appropriate origin and from the same region if possible. Local origin stock should be used if the quarry site is adjacent to a Site of Special Scientific Interest or in an ecologically sensitive zone, such as an island, coastal locality or national park. Purchased material should be obtained from suppliers who are able to source-identify their stock. Further guidance is available in *Go Native! Planting for biodiversity* and on *Flora locale's* website.

If seed or plants are to be collected, sufficient time and funding should be allocated for this approach. Collections should take place over a period of successive years and may be used to establish stock in cultivation or to establish directly on site. Following this approach will require careful planning, good coordination and one or more specialist contractors.

Seed collectors should follow *Flora locale's* Code of Practice. Permission will be required from landowners and will also be required from the government nature conservation agency if the site is a Site of Special Scientific Interest.

## 3 Assessing what to do: the design stage

Outline proposals for restoration are often designed many years before the quarry is started, and will probably accompany a mineral company's planning application for quarrying. At this point it is essential that the landscaping team includes a qualified ecologist with a good knowledge of native flora. The ecologist must:

- put into context the site in relation to its geographical and ecological setting
- identify the potential for incorporating biodiversity into the restoration specification, taking into account other factors (such as land tenure, after-use, soils, geology and final site contours)
- specify principles and detail for using and sourcing native flora (including promoting natural regeneration) – see *Go Native! Planting for biodiversity*.

### Key points

- Quarries are usually in the countryside
- Garden plants and horticultural varieties of trees, shrubs, aquatic plants and other flowers should not be planted in the countryside
- Quarry restoration provides major opportunities to restore native flora and to improve an area wild plants and other wildlife.



At Greenham and Crookham Commons (Berkshire), ponds dug in bare gravel less than 10 years ago, have quickly become colonised by a diverse mix of plants, including stoneworts.

## 4 Natural regeneration

Natural regeneration will not always be an acceptable approach, but can work spectacularly well on gravel workings and where open water will be left. It can work well on many other sites, but may be considered unacceptable if the ground is likely to remain bare or only sparsely vegetated for a considerable time.

Some aquatic plants and those found along water margins will arrive of their own accord, while using nursery-grown stock can bring a risk of introducing plants of non-native origin, garden varieties and invasive non-native species.

Scrub willows (especially Grey Willow) will often readily colonise aquatic margins from wind-blown seed.

## 5 Creating new floristically diverse grasslands

The objectives for new grasslands must be decided at an early stage, as these will dictate the species and methods to be used. In determining objectives, the means for managing grasslands, and resources required, must be considered.

### Grassland types

- Acid grasslands
- Neutral grasslands: hay meadows, wet grasslands
- Calcareous grasslands

### A summary of grassland management options

- *Floristically diverse swards*: mowing for hay with aftermath grazing OR mowing only (allow flowering to mid-summer, mow and remove the arisings; to achieve a short sward at the end of the growing season and to the beginning of the next, further mowing may be needed)
- *Wet grasslands for breeding birds* (lapwing, etc): manage as extensive pasture with stock grazing and winter flooding
- *Species-poor tall grasslands* for small mammals and Barn Owl: mow areas in rotation once a year (cuttings may need to be removed occasionally but not every year).

If the desire is to create a species-rich grassland and grazing is not an option, a mowing regime will be required that may involve two or more cuts in a year. Grass cuttings are very bulky, so disposal will need to be on site unless hay can be made and taken or sold by a local farmer. The eventual site tenure (who will own it or rent it) will finally determine what options will be realistic and achievable with the likely resources available. Natural regeneration could be an option where there is an adjacent seed source, but will be slow. It can be speeded up by collecting seed or hay from existing grasslands and spreading this on the site to be restored.

Tall undesirable weeds such as Ragwort, Clustered Dock, Creeping Thistle, Mugwort and Spear Thistle are likely to be the biggest challenge to a successful wild flower grassland scheme on former quarry sites. Weed seeds are nearly always in topsoil, and will thrive unless measures are taken before sowing to reduce the seed bank.

The use of nutrient-rich topsoil should be avoided, and subsoil sourced from on site used in preference wherever possible. It is inadvisable to import topsoil as more often than not it will originate from building sites and may have a seedbank of invasive non-native weeds that will become difficult to remove if they become established.

If weed-free subsoil is used, this can be sown with a wild flower and grass seed mix after preparing a level seedbed. However, if any topsoil is used other methods of grassland establishment should be considered. The method chosen will need to be carefully assessed by the restoration manager – and will vary from site to site.



### Ground preparation and sowing options

The seedbed should be prepared (levelled, rolled), and seed in the soil allowed to germinate in the autumn. Seedlings should be repeatedly sprayed with a total kill herbicide to reduce the weed burden prior to sowing with a suitable wild flower and grass seed mix the following autumn. The soil surface should not be disturbed, to prevent further weed seeds from coming to the surface.

An alternative approach is to sow with several fine-leaved grass species, such as Crested Dog's-tail (*Cynosurus cristatus*), Red Fescue (*Festuca rubra*) and Common Bent (*Agrostis capillaris*) and leave the introduction of wild flowers until year 2 or year 3. This gives time to eradicate undesirable tall weeds which may regenerate from the seed bank. The grass should be kept quite short by regular mowing. This will encourage grass growth and reduce any early infestation by unwanted weeds. A broad-leaved weedkiller can be applied to the sward in Years 2 and again in 3 (if needed) to eradicate all broad-leaved plants, after which wild flowers can be introduced.

In the autumn of Year 2 or 3, wild flowers can be introduced by sowing seed into undisturbed weedkilled patches. (All sowings should take place without surface disturbance or cultivation, so as to prevent weed seeds from being brought to the surface.)

Alternatively, the area can be sown very cheaply with Perennial Rye-grass (do not include clover), mown to prevent any tall weeds from flowering throughout the year, and the whole site weedkilled and sown in Year 3 without disturbing the soil.

### Sources of wild flower and grass seed

All wild flower seed used in Britain should be of British native origin and obtained from growers who can source-identify their stock. *Flora locale's* guidance on sourcing should be followed (refer to *Go Native! Planting for Biodiversity*).

Some amenity varieties of fine-leaved grasses are cheap and for the most part appropriate for large-scale quarry restoration away from ecologically sensitive areas. Suitable species are Crested Dog's-tail, Common Bent, Chewings Fescue and non-tillering Red Fescues (*Festuca rubra*).

#### Case study: Greenham Common, Berkshire

The concrete runways were removed in the early 1990s, and the aggregate recycled, leaving large areas of bare gravel. The rest of the common is species-rich grassland and lowland heath, so seed from these areas was mechanically harvested and strewn over the bare gravel to assist regeneration. Additional areas, levelled by infilling in the 1950s, have been quarried and



the gravel recycled. These areas have been left to regenerate naturally. Cattle have been reintroduced to graze the common and are helping in the process of spreading seeds and establishing soil. No aquatic plants have been introduced, but the ponds have already been colonised by stonewort, rush, reedmace and other aquatic plants such as Water Plantain. Unfortunately the highly invasive New Zealand Pigmyweed (*Crassula helmsii*) has also arrived.





Foreground: grassland created using locally collected seed at a Dorset limestone quarry. Photo: Barbara Smith.

The use of wild-harvested seed mixtures or green hay from native grasslands will be appropriate for projects that aim to re-create new native grasslands and in ecologically sensitive zones. Such projects are vital to achieving local biodiversity action plans; quarry restoration can make a major contribution to reaching targets in these plans.

The choice of species used, whether grasses or wild flowers) should be specified by a qualified ecologist with a good knowledge of native plant communities. Different species will be appropriate for different soils, substrates, locations and target grassland types.

### Key references for grassland creation

See *Flora locale's* website: [www.floralocale.org](http://www.floralocale.org) for lots of guidance notes on grassland creation and seed harvesting including a comprehensive list of references. Click on "library". Under "options" select listings for grasslands. See the interactive map of local projects for Barbara Smith's case study of restoring limestone grassland to a Dorset quarry.

## 6 Woodland and scrub establishment

The development of scrub communities, as well as woodland, should be considered as scrub habitats are valuable for birds and insects. Dog Rose, Elder, Hawthorn, Blackthorn and Grey Willow are among some of the species that can be readily established.

Options for woodland and scrub establishment are:

- Natural regeneration
- Assisted regeneration (e.g. collecting and sowing seed and planting cuttings)
- Planting.

Natural regeneration can be a long process and, for many quarry companies, will not be an acceptable approach. Alternatively, assisted regeneration is relatively cheap and likely to provide a more natural woodland or scrub habitat than one that is established by planting trees.

Seed can be contract-collected from known locations, over a succession of years, and sown into prepared weed-free ground as it becomes available (do not use topsoil, which will bring with it undesirable weeds).

A nurse crop of grass can be used to reduce weed infestation, while Broom (*Cytisus scoparius*) has also been successfully used.

In all cases, whether seed or plants are to be used, they should be of known origin (e.g. from a specified British Forestry Commission Seed Zone).



If planting is the preferred option, this should be designed with the final habitat objective in mind. For schemes that aim to create a good habitat for wildlife, regimented plantings should be avoided. (This landscaping scheme on a restored quarry site is particularly unimaginative.)





Grey Willow (*Salix cinerea*) is easy to grow from cuttings. This species is fast-growing and an excellent small tree for insect life. As a scrub habitat it should be maintained by periodic coppicing.

Planted trees and shrubs must be protected from rabbits, livestock and deer either by perimeter fencing or with appropriate tree guards or spiral shelters.

Young woodlands, where the tree canopy has closed (10-15 years after planting), can be undersown with woodland wild flowers. Plug plants could also be introduced.

#### Key references for woodland establishment and tree planting

BTCV. *Tree planting and aftercare, a practical handbook*. ISBN 0 946752 25 7. Tel: 01302 572200 to order (includes guidance on establishing a tree nursery). *Creating woodland naturally*. Information note on [www.floralocale.org](http://www.floralocale.org)

Conservation Volunteers Northern Ireland. *Our trees: A guide to growing Northern Ireland's native trees from seed*. £5 from CVNI, 159 Ravenhill Road, Belfast BT6 0BP, tel: 02890 645169

*Enhancement of woodland amenity field layers in Milton Keynes*. Information note by Joanna Francis on [www.floralocale.org](http://www.floralocale.org)

Forestry Commission voluntary certification scheme for native trees and shrubs: [www.forestry.gov.uk/forestry/infd-5kylpk](http://www.forestry.gov.uk/forestry/infd-5kylpk)

Forestry Commission Local Seed Zones map: [www.forestry.gov.uk/website/pdf.nsf/pdf/provmap.pdf/\\$FILE/provmap.pdfs](http://www.forestry.gov.uk/website/pdf.nsf/pdf/provmap.pdf/$FILE/provmap.pdfs) and shrubs: [www.forestry.gov.uk/forestry/infd-5kylpk](http://www.forestry.gov.uk/forestry/infd-5kylpk)

Gwynedd Council/Countryside Council for Wales. 1998. *Growing native trees from seed. A guide to growing native broad-leaved trees and shrubs from seed*. ISBN 1 86169 061 4. CCC 157. Tel: 01248 385500 to order (free).

Herbert, R., Samuel, S. & Patterson G. 2000. *Using local stock for planting native trees and shrubs*. Forestry Commission practice note 8. (Download from the FC's website, [www.forestry.gov.uk](http://www.forestry.gov.uk)). ISSN 1460-3810.

National Urban Forestry Unit: see [www.nufu.org.uk](http://www.nufu.org.uk) for information notes on tree planting and tree seeding.

Rodwell, J. & Patterson, R. *Creating New Native Woodlands*. 1995. A useful booklet published by the Forestry Commission (available from the Stationery Office). ISBN 0 11 710320 9.

The Committee for Plant Supply and Establishment. 2002. *Specifying seed sources for trees for large scale amenity and forestry planting. Recommendations for best practice*. Published on behalf of the Joint Council for Landscape Industries. Download from [www.l-i.org.uk](http://www.l-i.org.uk). (This specification should be used to ensure the correct supply of British origin planting stock.)

The Tree Council. 2000. *The good seed guide: all you need to know about growing trees from seed*. £3.50 from The Tree Council, 51 Catherine Place, London SW1E 6DY. See also [www.treecouncil.org.uk](http://www.treecouncil.org.uk) for lots of information on British native trees.

The Tree Council. See [www.treecouncil.org.uk](http://www.treecouncil.org.uk) for a Seed gathering chart for some British native trees and lots of information on tree planting.

[www.british-trees.com/guide/home.htm](http://www.british-trees.com/guide/home.htm) – information on propagating and growing native trees



## 7 Wetlands

Plants for wetlands should be very carefully sourced from known locations, whether seeds, rhizomes or vegetative shoots. Reed (*Phragmites communis*) is easily propagated from cuttings, and large reedbeds can be rapidly established by planting out seedlings. Many other aquatic plants regenerate vegetatively and can be established by planting rhizomes or rooted stolons. Examples include Yellow Flag (*Iris pseudacorus*) and Water Mint (*Mentha aquatica*). Many other species will arrive of their own accord.

### Types of aquatic plants

- **Marginal species**, which often have their rootstock and foliage submerged for only part of the year – these species may also flourish in shallow permanent water (e.g. Yellow *Iris/Iris pseudacorus*).
- **Emergent species** of shallow water (e.g. Arrowhead/*Sagittaria sagittifolia*). These species are rooted on the bed or sloping edge of the water body.
- **Rooted plants of deeper water**, which have leaves that are submerged and floating (and which are usually different in shape and form) – examples include water lilies, water crowfoots and pondweeds.
- **Free-floating species** that are not anchored to the bed of the pond or river (e.g. Frogbit/*Hydrocharis morsus-ranae*). This group includes plants that have (a) only floating leaves; (b) both floating and submerged leaves; (c) submerged leaves only

Purchased plants should be obtained from nurseries that specialise in growing native species and who can source identify their stock. However, purchasing plants can pose a risk of introducing unwanted non-native and potentially invasive species. General aquarists and garden centres will also sell cultivated varieties which are unsuitable for countryside projects.

### Assisting natural colonisation of water margins

In areas where there is no source of Grey Willow (*Salix cinerea*) seed, colonisation can be speeded up by spreading twigs containing mature female catkins along the water margin and in low-lying damp areas. The twigs should be collected just before the fertilised catkins break open and shed their seed. A similar approach can be used to introduce seed of Common Alder (*Alnus glutinosa*), and in dryer areas, to introduce seed of Sallow (*Salix caprea*).

Similarly, the arrival of marginal wild flowers could be assisted by picking stems containing mature seed pods of some common waterside wild flowers, and spreading the picked stems along the water margin. Examples of species that can be established this way include Ragged Robin (*Lynchnis flos-cuculi*), Purple Loosetrife (*Lythrum salicaria*), Valerian (*Valeriana officinalis*) and Meadowsweet (*Filipendula vulgaris*). Local seed sources might include ditches, canal and riverbanks. These species grow on land which is damp in summer and autumn, but which is often below water in winter or spring.

*Flora locale's* Code of Practice should be followed.

### Key references on wetland creation

Reed propagation (Information note on Flora locale's website).

RSPB habitat guides (Order from 01767 680551):

*The Wet Grassland Guide*. 1997. Bensted *et al.*

*Reedbed Management for Commercial and Wildlife Interests*. 1995. Hawke & Jose.

*Habitat creation handbook for the minerals industry*. 2003. Grahame White and Jo Gilbert (Eds).



Reed (*Phragmites communis*).  
Photo: Sue Everett.



## 8 Heathland

It may be possible to create heathland habitats on dry sand and gravel workings. Heather seed should be sourced from an existing heathland in the locality and can be obtained by forage harvesting, by brush harvester or by cutting, collecting and baling. Collected material must be properly handled to ensure the seed remains viable. A few other species, such as Wavy Hair-grass, can also be brush harvested, while minor species will need to be hand collected. A successful scheme will require careful planning and coordination. Specialist contractors must be used.

### Key references for heathland restoration

*A practical guide to the restoration and management of Lowland Heathland.* Nigel Symes and John Day. 2003. Pub. RSPB. £19.95. (Order from 01767 680551)

Information notes from Flora locale on [www.floralocale.org](http://www.floralocale.org):

*Equipment for harvesting wild flora and heather seed; Harvesting and using heather seed*

See the interactive map on [www.floralocale.org](http://www.floralocale.org) for case study of English Nature/Imrys project restoring china clay quarries in Cornwall.

English Nature. 2004. *The upland restoration handbook*. On-line at [www.english-nature.org.uk](http://www.english-nature.org.uk)

See also back issues of *Enact* and *Conservation Land Management* (pub. British Wildlife Publishing)



Established lowland heath (Southern England). It is possible to establish heather and acid grassland on dry acidic sand and gravel workings. Photo: Sue Everett

