

LOWLAND HEATHLAND ESTABLISHMENT ON MINERAL SITES

General principles

Lowland heathland is found below 300 m altitude, on generally acidic sandy soils and clays, on which also occur botanically important valley mires. These are internationally rare and vulnerable habitats. Mineral workings with suitable soils are ideal opportunities for creation. It will take up to 20 years for the full assemblage of heathland vegetation and features to develop, but is of real conservation value from the outset, and pioneer vegetation cover can develop in 3-5 years.

Lowland heathland and mire communities vary in character across the country. It is important to create heathland appropriate to local soil and climate conditions.



Key criteria

Successful heathland establishment will depend on a number of physical criteria:

- **Low soil fertility.** Soil phosphorous (P) availability should be less than 10 mg kg⁻¹ to avoid competition from weeds.
- **Acidic soils.** Lowland heathland creation is only viable on soils with a pH of 3-5.
- Source seeds and turfs from the same vegetation communities (and close proximity where possible) as the target community. Inappropriate species or strains could permanently damage existing heathland. Check the **National Vegetation Classification** for guidance
- **Varied topography.** Create a landform that replicates the natural heathland landscape, including variations in slope and aspect as appropriate.
- **Bare and sparsely vegetated ground** should also be planned into the long-term design for the site as it is host to specialist early pioneer species of plants, invertebrates and birds.
- Wet heath can establish where **seasonal waterlogging** with base poor water occurs.
- Mire vegetation can develop where **waterlogging is permanent**.
- Establishing a **heathland mosaic** and not just heather, which may only be a relatively small part of the typical community.

It's important to establish a heathland mosaic and not just heather, which may be only a relatively small part of the typical community.

Establishment techniques

Soil preparation

Only use topsoil recovered from a heathland in good condition prior to mineral extraction, otherwise establish heathland on mineral substrates that are very low in available minerals. Do not import nutrient rich topsoil or compost.

Natural colonisation

Natural colonisation will occur on very nutrient-poor soils, where an adjacent seed source is available. Seeds blown from adjacent heathland will be very slow to establish, as ericaceous seeds are not adapted for wind blown dispersal. This is an appropriate method if plenty of time is available to establish the habitat. Weed species (birch/pine seedlings, bracken, rough grasses) need to be kept at low thresholds.

The **mosaic** of acid grassland, bare ground and developing heath that occurs in the interim will have significant wildlife benefits. **Bare and sparsely vegetated ground (Open Mosaic Habitat)** is host to specialist early pioneer

species of plants, invertebrates and birds. Bare ground habitat should therefore also be planned into the long-term design for the site.

Topsoil and turf application from a donor site

Topsoil and turf are likely to be only occasionally available because this usually causes severe disturbance to the donor area. However, donor sites that have been under-managed can be restored using turfing and or topsoil stripping as this benefits the donor site by removing accumulated organic litter.

The appropriate statutory conservation agency must be consulted before turfing or scraping on SSSIs. Archaeological authorities should also be contacted to avoid damage to historic interest on the donor site. The least damaging time to lift turfs and topsoil is likely to be late summer or autumn.

Traditionally, small turfs were routinely cut for fuel using alternate (chequerboard) spacing carried out over a long rotation.

Taking turfs to re-establish heathland vegetation

- A seed bank will exist in the upper c.10 cm of undisturbed heathland soil - in the organic horizon immediately below the fresh litter and in the top 5 cm of the mineral soil.
- Laying turfs in a block will establish a total heathland cover, and suppress competition, but scale will be limited by availability of turfs. Instead, space the turfs across the site and rely on seed from them to fill the gaps. This will provide diversity to the vegetation structure.
- Smaller turfs are easier to transport and can be spaced out so seed from them will infill the spaces between. Larger turfs are less prone to desiccation and to damage but can be difficult to transport.
- Dig turfs deep enough to avoid damage to roots (these are close to the surface). Around 10-20cm should suffice but ideally research this on site.
- Turfs need to be lifted, transported and laid before desiccation of the rootstock occurs, and taking care to exclude air pockets beneath the turfs, e.g. with light roller.
- Lift turfs in the autumn/winter, when plants are dormant and there is less risk of desiccation. Turfs should be dug in so the edges are flush with the ground surface to avoid desiccation of the rootstock.
- Where the receptor site is very infertile, the turves may be chopped and spread using the technique described below and roll to press into the soil; this will enable the material to be spread further if need be.
- Watering may be required in dry weather in the year following laying.

Using topsoil to relocate seed material from a donor area

- Remove standing vegetation to 2-5 cm prior to soil removal - fresh organic matter will heat when stored and risks killing the seed. Spread the cut material spread as an additional seed source: cut in autumn (post-flowering) and collect, using suitable machinery (double chop forage harvester or hi-tip type mower).
- Use a machine that will strip material to a determinable depth so that the organic horizon and the seed-bearing soil are taken together plus a few centimetres to ensure all seed material is gathered.
- Lift, transport and lay topsoil in one operation. If it must be stored, prevent heating which if above 50°C will kill ericaceous seeds: storage heaps should be less than 1.5 m high, on free-draining ground, preferably on geotextile sheeting. Ericaceous seeds viability is > 14 months if properly stored, but vegetative material of species such as purple moor-grass or bilberry will not survive storage.
- Spread topsoil using e.g. a manure spreader as this is quick and cost effective. Any clods can be broken up with a light harrow. Alternatively dump piles of material and spread using an excavator or similar.
- An even and complete cover of vegetation is not usually desirable for nature outcomes; it causes an even stand structure.
- Spread material more thinly to give sparser early distribution. Small gaps will infill with seeds from established plants creating a structural diversity.
- On coarse, mineral, substrates with low sand content, spreading fine, sandy, mineral subsoil would help water retention and improve soil-plant nutrient exchange.
- A nurse grass crop (e.g. *Agrostis*) can stabilise vulnerable soil and protect germinating seedlings from desiccation. It is normally only necessary in particularly exposed locations. Choose nurse species that have a

low nutrient demand (so no need for additional fertiliser), and short viability so naturally lose dominance after 3-4 years. The nurse sward should be sparse, with space for heathland species to develop.

- Sow nurse crop in spring or late summer/ early autumn, by broadcasting onto a moderate seedbed and roll-in with a Cambridge roller.
- Geotextile sheeting may be needed to stabilise steep slopes.
- Spread topsoil in late winter or early spring, when relatively dry. The first germination can happen relatively quickly and this gives a full growing season.

Litter and brash transfer

Collecting and spreading litter and/ or vegetation containing viable seed of a range of heathland plants is relatively cheap, non-destructive, and repeatable.

Cutting and spreading

- Prepare a relatively compact seedbed on the receptor site - any roughness will help shelter young plants from desiccating winds. A nurse crop should not be necessary on reasonably flat ground as the chopped brash shelters the seedlings.
- On the donor area, cut heath that is well grown but not old to ground level with cut and collect machinery e.g. a double-chop forage harvester – cutting then baling sheds many seeds and thereby reduces success.
- Cut between late September and late November when ripe seeds are in the capsules. Small amounts of topsoil are inevitably picked up, which imports heathland soil microbes and the mycorrhizal fungal associate that is thought to benefit establishment of ericaceous species.
- Transport the cut material to the receptor site and spread it immediately. Store if necessary in low piles to prevent heating.
- Spread the material with e.g. a clean manure-spreader. Tease apart any clods with a light harrow. Use a Cambridge roller to press seeds into the ground to promote better rooting.
- If desired, to establish a quick dense cover, spread material 1 cm deep. Approximately one hectare cut will provide for two hectares of spread. Spread more thinly for less dense cover and the material will go further.
- Heather germination rates are variable - some germinate within six months, others over two years –wait to assess success. Mature ericaceous shrubs produce thousands of seeds per metre square, and the new seedlings are tiny so are easy to miss!

Litter collection

The humic litter from old unmanaged heathland will contain a high number of seeds. Litter removal can be used as part of restoration work on appropriate donor sites.

- Strip litter to the mineral soil surface - regeneration of the donor site will occur from the seedbank.
- Collect material using e.g. a grading blade with a very sensitive control to scrape without digging into the mineral soil, lift into trailers, or
- loosen the litter with a light harrow, let it dry and then vacuum into a trailer
- transport and spread on the receptor site in the same way as heather cuttings

Harvesting and sowing seed from donor sites

Seed harvesting is usually done by specialist contractors. It limits the species imported, but will give good take of heather. Machines brush the seeds from the plants and collect them, with limited damage to the vegetation. Seed is usually cleaned and heat or smoke treated to increase germination. Collection is expensive, but transport and spreading costs will be relatively low because volumes are low. This of all methods will produce uniform stands of heather with low species richness.

Ericaceous seeds are extremely small and light, so a nurse crop of fine grasses may be necessary on exposed areas (see above). It is usually preferable to harvest the whole crop (see above) to provide some mulch with the seed.

Sowing commercially available seed

Unless local progeny can be guaranteed, do not buy commercial seed as this could introduce potentially genetically 'alien' heather or create a monoculture of heather, with low wildlife value.

Planting out seedlings and plants

This is labour intensive and often expensive: seedlings need to be collected or grown from seed, hardened off, transplanted and cared for to avoid drought and suppress competition. Recommend using fewer plants at relatively wide spacing; once established, these will seed into and fill gaps (manage any competition). This method could be used to introduce 'missing' species after monitoring of early regeneration.

Long-term management

Keep establishing heathland free from competing plants, and keep soil fertility low. Management must avoid introducing nutrients through incorporation of organic matter.

Options include:

- **Light spring and early summer grazing** – to control competing grasses and shrubs. Timing of introduction is not critical and can be delayed until a problem with the level of competition is identified.
- **Rabbit browsing** – helps to maintain early-successional habitat for plants, invertebrates and birds like woodlark, generating prostrate heather growth, along with open ground. Needs to be at low intensity, otherwise over-grazing will inhibit heather establishment.
- **Rabbit-proof fencing** – to prevent over-grazing if local rabbit population is high. Maintain for about five years until heath vegetation is established.
- **Mowing and removing cuttings** – to reduce grass dominance. The heather will survive in a prostrate form.
- **Herbicide** – necessary to control bracken, optional to control gorse, birch and other weeds.
 - **Asulam**, the most effective herbicide to act on bracken was removed from licence in 2011. It has been provided under emergency licence since, but the possibility remains that it may be withdrawn, if so alternative methods of bracken control must be used.
 - **Glyphosate (Roundup)** is a broad spectrum herbicide which should be spot-sprayed or wiped to avoid killing all surrounding vegetation, including heather. It may not be practical if other ground flora and fauna needs to be protected.
- **Crushing** - use a large roller to crush or break the bracken stem. NB do not undertake where ground nesting birds may be present
- **Cutting** - using a majority of different tools such as a swipe, a mower, brush-cutter or a cut-and-collect system such as a forage harvester. NB do not undertake where ground nesting birds may be present. Both techniques only knock the bracken back, and will require repeat treatment.
- Rushes may be a problem on wet heath, but are controllable by herbicide via weed-wipe or by mowing.

Relevant case studies

[Wicken North quarry case study](#)

[Sandy Heath quarry case study](#)

[Plenmeller](#)

Further reading

A Practical Guide to the Restoration and Management of Lowland Heathland. Symes, N.C. & Day, J. (2003)