Forest Research

MAXIMISING BIODIVERSITY

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BPG

NOTE 9

Best Practice Guidance for Land Regeneration

Introduction

Biodiversity refers to the biological diversity of an area and can be defined as 'the variety of plants and animals found on earth, and the place in which they live'. It reflects the variety of species that exist on global, national, regional and local scales.

The significance of biodiversity is widely publicised, but is often thought of in terms of very specific and vulnerable areas at a global level. For example, the rain forests of South America, as these affect our food, clothing, medicine, overall environment and moral conscience, while the biodiversity of a reclaimed or urban area is often overlooked as these sites appear to offer little habitat range or significance. However, brownfield sites often offer a vast resource of rare and protected species (Figure 1) and many have been designated as Sites of Special Scientific Interest (SSSIs) for their nature conservation value (DoE, 1996). Species diversity can also be enhanced by careful habitat placement, creation and management.

Overall, recent research has shown that biodiversity is being lost. During the 20th century the United Kingdom lost over one hundred species of flora and fauna, and many more have been significantly reduced in number or habitat range. Reduction in biodiversity is often a result of a decrease in natural habitats, both in the land area they occupy and their variety. Habitat loss and fragmentation impact on the species diversity in the following ways:

- Populations are moved into smaller and smaller areas which, ultimately, are unable to support them.
- Populations become fragmented so that they become isolated into populations that are too small to be self-sustaining.
- Areas of habitats are so small that the 'core area' decreases to such an extent that they are influenced by negative edge effects.
- Intensive management and a decline in traditional management methods have led to fewer older trees and less deadwood (www.woodlandtrust.org.uk).

Reclaimed and brownfield land provides a valuable resource for counteracting some of these effects by creating new habitats that are sympathetic to surrounding areas, while recognising areas of existing wildlife interest. Woodland establishment is often crucial to the success of any attempt to increase biodiversity as a large proportion of the United Kingdom's native wildlife lives in forests and woodlands. By increasing the biodiversity value of a site, the area can become a valued recreational and educational resource, in addition to improving the local environment and providing a more sustainable habitat for the future.

Figure 1 Common spotted orchids are among the plants often found growing on mine waste.

Quantifying existing biodiversity resources

It should not always be assumed that because a site comprises brownfield or restored land it has no ecological value. Many brownfield sites offer habitats that are suited to species that are unusual in that region; for example, orchids are often found thriving on the acidic soils produced by mine waste (Figure 1). Prior to any decisions being made regarding the ecological enhancement of a site, the existing species and potential for species need to be assessed. Initially, a desk-based survey can highlight information that may already be available locally, for example from the local records centre and local interest groups. Following this a habitat survey should be carried out by an experienced ecologist. A number of methods exist for carrying out ecological surveys, including an Extended Phase I Habitat Survey as set out in *Guidelines for baseline ecological assessment* (Institute for Environmental Impact Assessment, 1995). This survey will characterise the site in terms of the habitats and vegetation, including their abundance, age and condition. It will also provide an indication of the species that may inhabit or visit the site if no physical evidence is observed (e.g. tracks). If the survey for determining the presence of protected or valuable species is inconclusive or the presence of a particular species is suspected a more detailed or targeted ecological survey may be recommended.

During the assessment of the ecology present at a site, the following should be considered:

- Are there any protected habitats or species present at the site or surrounding it? Statutory legislation exists to safeguard protected habitats and species which needs to be considered in the planning stages of woodland establishment.
- Are there any rare species present at the site or surrounding it? This may include species that are not rare on a national scale, but might be locally.

If the answer to either of these questions is yes:

- What specific characteristics of the site must be retained/enhanced to maintain or encourage migration of populations?
- What habitats and species are or were found in the areas surrounding the site? The proposed woodland establishment should complement the local environment by appropriate landscape design and vegetation species selection.

The current ecological value of the site and its surrounding area will be the primary deciding factor on what actions need to be taken in increasing its biodiversity, in conjunction with the Local Biodiversity Action Plan (LBAP) for that area. If the habitat survey indicates that any areas currently support or have the potential to support rare or unusual species then the site should be managed to ensure these species are encouraged. The following provide guidance on effective management of such habitats or species:

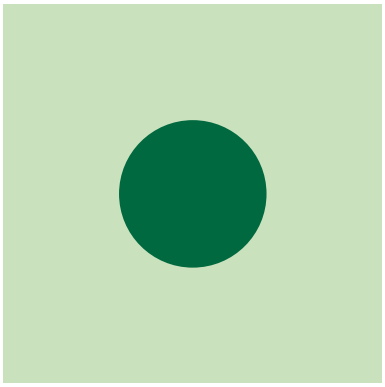
- Broad Habitat Statements (Jackson, 2000): these give summary descriptions of the general habitats found in the UK as well as current issues affecting these habitat types and broad policies to counteract them.
- Priority Habitat Action Plans: provide more detailed descriptions for specific habitats; they also give current issues affecting these habitat types and broad policies to counteract them.
- Action Plans for the specified 'at risk' species that have been identified within the UK, including any legislation relating to their protection.
- LBAPs highlight the priorities for specific regions to ensure that the needs of these areas are met and that they contribute to national targets.

Further information can be found on the Joint Nature Conservation Committee (JNCC) website.

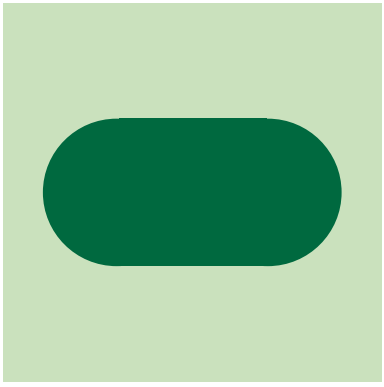
Planning to maximise biodiversity

The following general rules, demonstrated in Figure 2, can be applied to increase the overall biodiversity of an area. They may not all be suitable for every site, particularly if the habitat survey has highlighted any protected or unusual habitats or species.

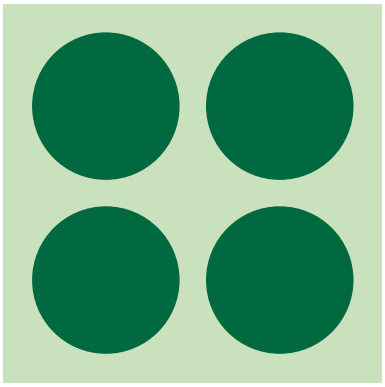
Figure 2 Habitat size and shape to promote biodiversity (after Diamond, 1975).



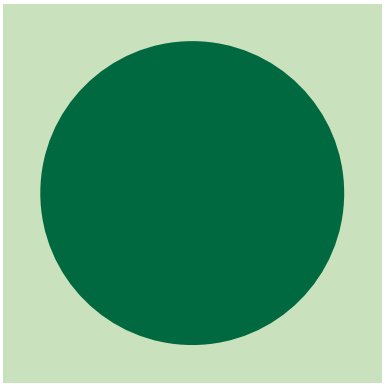
(a) A small habitat with a small core area can negatively impact on population viability.



(b) Long thin habitats reduce core area and increase the negative edge effects.



(c) Several small habitats with interacting populations are preferable to one small habitat.



(d) A large habitat is preferable to a small or fragmented habitat.

Habitat location When establishing greenspace on contaminated and brownfield land the primary objective should be to counteract habitat loss and fragmentation by creating or enhancing habitats that are representative of semi-natural or natural habitats in the surrounding region. The biodiversity of an area will only be significantly improved, and this improvement sustained, if habitats are created or managed to improve the ecological function of the wider landscape (Watts *et al.*, 2005).

Habitat shape The shape of habitat areas should be designed so that the size of the core area is maximised, therefore reducing negative edge impacts. The more exposed boundaries that exist increase the influence of surrounding areas; this could include physical damage, air pollution or invasion by other species. However, long thin habitats may be suitable, for example along riparian zones or adjacent to established habitats that may enhance the site diversity.

Habitat size Habitat areas should be large rather than small. The island biogeographical theories suggest that larger habitat islands can support a larger number of species than smaller ones.

Habitat linkages Habitat design should complement habitats surrounding the site to provide linkages both within and off site. This is particularly important if the developer wishes to encourage species to move into a new greenspace from existing woodland or greenspace areas. For example, ancient woodland is often likely to contain a rich variety of species that may be encouraged to move into a new area, reducing fragmentation and increasing the sustainability of the population (Spellerberg, 1995). However, landscape function is an important consideration and sites should be developed to ensure that the interactions within and between sites are appropriate to encourage the desired habitat or species.

Habitat types Vegetation species should be varied within an area. Monoculture vegetation provides little biodiversity. The selected species mix can be planted in clumps of single species types, or in mixed clumps; the size of clump and distances between clumps can also be varied (Rodwell and Patterson, 1995). However, it may be more beneficial to create or manage habitats that have less biodiversity if those habitats are rare or ecologically important to a region. Again, when choosing which species to plant on a site the surrounding ecology should be taken into consideration.

Habitat management The encouragement of ground vegetation will also provide habitats for a wide range of species. This can be achieved by minimising herbicide applications and, where possible, weeding by hand of undesirable species, and planting a mix of coniferous and broadleaved species as conifers reduce the pH of the soil. Any such encouragement of ground vegetation should be made without compromising tree growth or establishment. Species diversity is often considered to be higher in areas where soils have a low nutrient status, so fertiliser applications should be kept to a minimum. Further information on fertiliser use can be found in BPG Note 7: *Fertiliser application in land regeneration.*

Forest Research has a suite of Biological and Environmental Evaluation Tools for Landscape Ecology (BEETLE). These tools aim to provide a means of assessing existing and predicting future landscape structure and function within a region, enabling the user to ensure that any new habitat creation or management will reduce fragmentation. Further information on the development and application of landscape ecology tools is available at www.forestry.gov.uk/fr/landscapeecology

In order to monitor the success of any management programme or vegetation establishment on a site a Phase I Habitat Survey should be completed periodically. This will ensure that the site management is having the desired effect on habitat development and species enhancement. It will also highlight any changes that may need to be made to the existing management plan to enhance species response or encompass new priorities.

Most brownfield and contaminated sites used for greenspace establishment will have several end-users. These may include educational, community or local interest groups and individual members of the public in addition to the wildlife inhabitants of the site. With careful consideration of each user's requirements and appropriate planning, these sites can offer a multifunctional resource encompassing ecological, social, archaeological and environmental benefits.

References

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Watts, K., Humphrey, J.W., Griffiths, M., Quine, C. and Ray, D. 2005. *Evaluating biodiversity in fragmented landscapes: Principles.* Forestry Commission Information Note 73. Forestry Commission, Edinburgh.

Useful links

www.forestry.gov.uk/fr/landscapeecology

www.jncc.defra.gov.uk

www.woodlandtrust.org.uk

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