

NATIVE WOODLAND DEVELOPMENT IN THE NORTH YORK MOORS AND HOWARDIAN HILLS

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Summary

This report reviews the options for expanding native woodland in the North York Moors and Howardian Hills. Its objective is to help Forest Enterprise, in partnership with the North York Moors National Park, Howardian Hills Area of Outstanding Natural Beauty, English Nature and the Royal Forestry Society (representing private owners), to develop a unified approach to this expansion. The combined areas are already well-forested by national standards – 21% of the land area is forested – but much of this forest – some 68% - is mainly stocked with introduced conifers, and in several districts the woods are sparsely scattered and poorly linked.

The review is based on the concept of the Forest Habitat Network. This recognises that forest habitats have been reduced by millennia of clearance to small, isolated fragments, within which native wildlife is vulnerable to loss of diversity, and forest managers are hampered by several factors, from the absence of economies of scale to the need to preserve particular stands for landscape and wildlife. Restoration of an interlinked network of forest habitats would simultaneously make wildlife populations more resilient and reduce constraints on forestry operations.

The report covers (i) forest pattern, (ii) forest management, (iii) treatment of trees outside forested land, (iv) linkages between woodland and (v) the role of non-woodland habitats within a forest habitat network. In sequence it:

- **Outlines the policy framework for forest expansion and management (Chapter 1).**
- **Describes the North York Moors and the Howardian Hills, and how the present forest cover has developed (Chapter 2).**
- **Summarises the Forest Habitat Network concept (Chapter 3).**
- **Quantifies land types, and especially forest types (Chapter 4).**
- **Considers several ecological issues relating to forest expansion and management (Chapter 5).**
- **Evaluates the present forest pattern and condition against Forest Habitat Network norms (Chapter 6).**
- **Recommends particular measures for native woodland expansion, related to historic woodland types, and the need to fill gaps in the**

present network of forest habitats (Chapter 7), and identifies priorities (Chapter 8).

3. FOREST HABITAT NETWORKS

This chapter summarises the main features of Forest Habitat Networks as they relate to British conditions (FHN). For a more detailed statement, see **Peterken (2000, 2002)**.

3.1. Forest Habitat Networks (FHN) in general.

The basic idea behind a FHN is simple enough. Forest habitats and their associated species naturally covered the landscape, but have been reduced by clearance and fragmented into isolated wooded remnants in a matrix of unwooded land. Fragmentation can be reversed by re-creating at least some of the lost habitats, and ensuring that the resulting pattern achieves good links between the components. This is 'defragmentation' or, more euphoniously, 'restoring a forest habitat network'.

The assumptions underlying a FHN are threefold:

1. that ecological isolation is severe and limiting for wildlife.
2. that, if more woodland were created and a network were to be generated, populations would expand, ranges would adjust to changing circumstances, and biodiversity would be more resilient.
3. that this expansion and greater resilience would be a 'good thing'.

3.2. The relationship between forested land and the rest of the landscape.

FIG 3.1 summarises some the properties of a hypothetical landscape in which woodland is distributed randomly. By reading from left (no woodland) to right (wholly wooded), we can read how the landscape changes as new woodland is added randomly to this landscape. The key points are:

- that new woodland added to a landscape that is 30% wooded or more will almost invariably lie close to existing woodland, i.e., that ecological isolation is minimised if woodland can be increased to at least 30% of the land area, provided it is reasonably well distributed.
- that edge habitats are maximised at about 50% woodland cover, and remain substantial within the range 20-80% cover.

- that from about 60% cover upwards, woods tend to form the habitat matrix, within which other habitats take the form of islands.
- that interior conditions, i.e., woodland free from edge effects, develop only at 70-80% cover and above. Woods free of edge effects have to be designed into the network at lower cover.

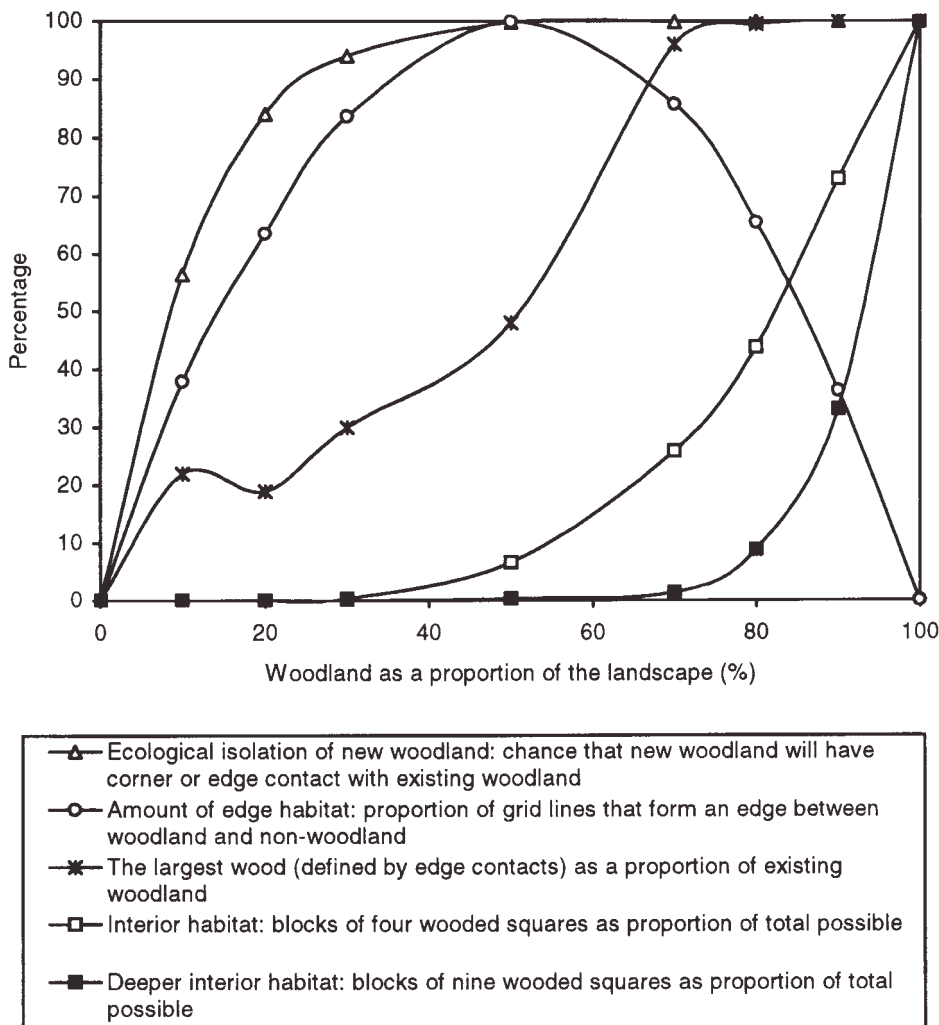


FIG.3.1. Changes in some spatial properties in relation to woodland as a proportion of the landscape in a model grid of 10 x 10 squares. Modified from Peterken (2000).

Perhaps the most useful point to emerge is the first, which gives rise to the “30% rule”. If woodland is reasonably well distributed through a landscape, ecological isolation will be minimised when woodland covers 30% or more of the ground. This applies to any patch type. Thus, for example, if mature stands occupy 30% or more of a contiguous forest area, and are reasonably well distributed, then the species that depend on mature stands should experience minimal ecological isolation, should be able to move through

the whole forest area, and should exist as a single inter-connected population rather than separate more-or-less isolated sub-populations.

FIG 3.1. can also be used to characterise the main features of forest elements in a landscape at different ranges of woodland cover:

- Forest cover close to 100%. Natural conditions. Forests would naturally cover the great majority of the north temperate landscape, save for small permanent openings on high ground, large rocky outcrops, large mires and major rivers, and temporary openings where forest had recently been severely disturbed by, say, storms. Non-forest habitats were therefore isolated or temporary, and forested (i.e., tree-covered) habitats formed the matrix. Although forested ground was spatially and temporally continuous, some internal isolation would be felt by species dependent on particular site conditions or stand age. Likewise, although the forest presented no barriers to movement of species in any direction, internal networks operated along drainage corridors and topographical alignments. Recently, **Vera (2000)** has suggested that natural temperate forests of Europe were more open, almost park-like, but pollen evidence indicates that open woodland was largely limited to the more extreme site types, such as floodplains, montane land and base-poor, dry soils (**Svenning 2002**).
- Forest cover between 60% and 100%. This is a single forest punctuated by clearings, which represents the first stage of forest fragmentation. It differs from natural conditions in possessing much more edge habitat and much less forest interior habitat. All forested land is well-connected, though barriers to species movement may arise if clearance is particularly associated with internal networks, i.e. along watercourses. Almost all new woodland that springs up on cleared ground would not be isolated, i.e. it would be connected to existing forest, and rapidly colonised by forest species.
- Forest cover between 30% and 60%. The forest comprises a dense array of separate patches of various sizes and shapes. Edge habitats are maximal, but forest interior habitats are much reduced and survive mainly in the cores of the largest patches. Movement of species within patches is generally not restricted, except for species that naturally depended on internal networks, notably stream corridors. Movement across the landscape involves crossing non-forested land, though the gaps (and the risks) are small. Most new woodland added to this landscape will be close to existing woodland and will tend to extend and link existing patches of forest.
- Forest cover between 5 per cent and 30 per cent: Landscape containing a scatter of separate woods with few large woods. Edge habitats decline as cover falls below 30 per cent and forest interior habitats are either absent or reduced to tiny areas within the largest patches. Movement of species across the landscape depends on crossing non-forest land. Any new woodland added to this landscape may be isolated from existing patches and thus not readily colonised by forest species. If new woodland develops mainly as marginal expansion of existing

woodland, colonisation by woodland species should be rapid, but movement across the landscape will remain limited.

- Forest cover below 5 per cent: Landscape containing a sparse scatter of generally small woods. Isolation is substantial, edge habitats are limited, interior habitats are absent or extremely limited, and movement of species across the landscape requires long traverses of unwooded land. New woodland is most likely to be isolated from existing woodland

When this model is applied to real landscapes, certain complications inevitably arise. Forest cover can easily be computed, but only after the boundary of the area being considered has been drawn. In fact, forest cover as a proportion of the total is partly determined by where the boundary is placed. Thus, if a poorly wooded district is excluded, the proportion increases. This implies that the 30% rule should be used flexibly, always defining and justifying the boundaries. It can be applied in a 'nested' fashion to a large area, or to any part of a larger area.

3.3. Woodland size and separation

Although the objective of a network is to minimise isolation, any realistic pattern will still include individual woods. The issues are: how large should these be, and what separations can be tolerated?

Several lines of evidence suggest that a threshold of about 30ha is significant. This size of woodland tends to be sufficient for the most exacting woodland birds, that tend to avoid smaller woods for nesting. In woods of this size and larger, the flora of open space habitats within the woodland achieves its maximum proportion of about 55% of the total woodland flora, probably because it is rare for woods of this size to remain unmanaged, or ever to lack open spaces somewhere within their borders. This size is also regarded by continental ecologists as the smallest within which all growth stages of a natural forest are likely to be maintained in non-intervention reserves.

A second threshold exists at much smaller sizes. Very small woods tend to lack open space habitats, but above a certain area access tracks and rides are almost always included in the design. In lowland districts with generally compact woods, this threshold lies at about 3ha, but in the North York Moors, where many woods are elongated, it may be larger. Between these two thresholds, i.e., from about 3ha to about 30ha, there is an increasing probability that a wood will contain rides and other permanent open spaces, and an increasing probability that recent forestry operations will have generated felling coupes and sections of unshaded ride.

Acceptable separations between woods are determined by the colonising capacity of woodland species, which is a continuous variable. And also determined by the land use in the matrix. Even poor colonists may be able to jump separations of 200m if semi-natural vegetation occupies the land between, but may be unable to jump gaps of 100m if the intervening land is cultivated. The only general rule is: the closer the better.

3.4. Habitat range within a FHN.

It is easy to equate 'forest' with 'land covered by trees'. However, managed forests generally contain 5-10% of permanent open space (e.g., rides, loading bays), and in a 'normal' forest a proportion of the wooded ground is in felling coupes and restocks. In natural woodland, there were certainly openings around rivers, tall cliffs and the wetter mires, and there is a possibility that large herbivores maintained semi-permanent glades and tracts of open woodland, or wood-pasture (**Vera 2000**). Medieval forests, including the Forest of Pickering, were patchworks of wooded and open semi-natural habitats.

There is much to be said for adopting the medieval pattern as the basic concept of 'forest' in a FHN, i.e., accepting that the forest should be a patchwork of various habitats within a generally wooded matrix. This is especially important in districts where the rest of the landscape is intensively farmed, i.e., where semi-natural grassland, marshes, etc. have been largely eliminated by arable cultivation. In such districts, which include the Howardian Hills and some peripheral parts of the North York Moors, forests represent the best or only opportunity to maintain examples of semi-natural grassland, etc. This is why open space habitats generally should be a major factor in assessing woodland sizes (see section 3.3).

3.5. The significance of ancient woodland within a FHN.

With the emphasis in network development on new woodland and woodland restoration, it is easy to lose sight of the importance of ancient woodland. These are the woods that harbour populations of woodland species that we hope will expand into a restored FHN. Many of these species are rare or localised, and a high proportion are poor colonists. Three important implications emerge:

- All remaining ancient woods should be retained as the sources for repopulating a FHN.
- Those ancient woods that are not currently in an ideal condition should be restored to maximise their contribution to a FHN.
- New woodland should be created as expansions of existing woods, not as new isolated patches.

3.6. Links within a forest network.

Forested links on a landscape scale can take the form of closed woodland or open woodland (wood-pasture and well-treed farmland). Clearly, such links vary in their acceptability to different species: what is a link for one species may still be a barrier for others. Internal barriers arise where, for example, a wooded link crosses a zone of dry soils, which would be a barrier for species requiring wet ground.

The pattern of links can take several forms. The most obvious would be narrow corridors of woodland between otherwise discrete woods. Very large woods are also

links, since they inevitably provide contiguous woodland between distant sites. In high-relief landscapes, woods often take a strongly linear form along valley sides, as is conspicuously the case in the Tabular Hills of the NYM.

The most effective links are probably those associated with watercourses. Riparian woodland is often a complex mosaic of different woodland types on irregular terrain, within which there are far fewer internal barriers than in wooded corridors that cut across the main topographical lines. Watercourses are in any case the natural focus of species movement in a landscape. The best links are probably wooded riparian corridors encased in a matrix of well-treed pasture or meadow. In such corridors, the woodland should cover at least 30% of the ground (see 3.2). Care must be taken to ensure that species of open habitats are not eliminated by excessive shade from trees, i.e., that patches of semi-natural grassland are retained.

Hedges and green lanes also function as a small-scale network of forest habitats, but their effectiveness as refuges outside woodland and as corridors for the movement of woodland species varies from species to species. They seem to facilitate the movement of inherently mobile species, but rarely help the saproxylics and slow-colonising vascular plants. They may be more significant for semi-natural grassland species: a green lane with good hedges is often well-stocked with such species, and thus links open space habitats within woodland.

3.7. FHNs and forest management

FHNs are not just about the pattern of green on the map. Many species are strongly associated with one component of a forest, or one stage of growth. If their particular conditions are not available throughout the network, their populations will still remain isolated.

As a broad generalisation, the specialist species that would limit the performance of a habitat network are the 'saproxylic' species, those that depend on dead wood, large trees and generally on conditions at the end of a forest rotation. These not only require time for their conditions to develop from scratch, but many are extremely poor colonisers of newly available habitat. Species in the other specialist group – those dependent on open spaces and young growth – tend to be good colonists.

A FHN must therefore not only provide a sufficient total forest cover and good linkages between individual woods, but it must also sustain the provision of mature habitats.

This can be achieved by:

- maintaining a full range of age classes within each large wood or group of woods. This implies sustained forest management.

- implementing silvicultural systems that incorporate maturity, e.g., long rotations, two-storied high forest, coppice-with-standards, ‘permanent’ retention of some mature trees and groups.

3.8. Limitations on the restoration of a FHN.

The development of new woodland takes time. Native trees take several decades to grow to mature height, and stands take even longer (150 years at least) to qualify as ‘old-growth’, i.e. stands with a wide range of tree ages, including very large and decaying trees. Woodland species colonise at different rates, but some are very slow to colonise, even from nearby woodland. Furthermore, new woodland on fertilised ground, e.g., former arable, is generally occupied by rampant plants, such as nettle, bramble, ivy, that resist and retard colonisation by less vigorous species. Restoring a FHN by adding new woodland is therefore a matter of decades, at least, and centuries before it can be complete.

There is also another kind of limitation. There are many other demands for land, and little prospect that we could allow 30% of Britain to become wooded. This leads to a requirement for efficiency, in the sense that maximum connectedness must be achieved within a FHN with the minimum amount of newly forested land.

Yet another limitation comes from the need to protect unwooded habitats and landscapes as well as woodland. To some extent this is met by recognising the ‘medieval’ definition of ‘forest’, but care must nevertheless be taken to avoid loss of scarce grassland, heathland, etc. and associated species by over-enthusiastic native woodland expansion.

3.9. The significance of the matrix.

The matrix is the land outside the habitat network. As far as the species in the network are concerned, it may be hostile, benign, or anything in between. Movement of the species in a network will be facilitated by a benign matrix, but inhibited by a hostile matrix. Accordingly, there is an incentive to ensure that the matrix is as benign as possible.

Applying this to a FHN in the North York Moors and Howardian Hills, the matrix is the farmland, plus the residential and industrial ground. The most hostile matrix for forest species is intensively used farmland, where most of the ground is drained, arable or leys predominate, fertilisers and herbicides are liberally used, and where watercourses have been ditched and hedges and boundary trees occur at low density. The performance of a FHN would be improved if the development of forest habitats were accompanied by a measure of habitat restoration in farmland.

3.10. The benefits of a restored FHN.

The case for restoring a FHN has been built primarily on nature conservation objectives, but the benefits are not confined to nature conservation. Successfully implemented, a FHN would safeguard ancient woods and other habitats, and generate larger and more resilient forest wildlife populations. 'Resilience' in this instance means both the capacity to respond to changes in conditions, and increased genetic interaction between sub-populations.

Other benefits, in no particular order of importance, include:

- Increased production of timber and wood products, including native hardwoods, in the enlarged forest area, and an even flow of produce.
- More shelter from trees and shrubs in farmland.
- Improved water quality (and fishing) by using forest habitats as buffers between cultivated land and watercourses.
- Landscape improvement where trees are accepted as desirable features.
- Opportunities for long-distance recreational routes within forest habitats.
- Greater freedom for forest managers, because species will be more resilient in the face of localised changes in condition brought about by silvicultural interventions.
- Reduced need for special designations, e.g, SSSI, for the same reason.

A FHN has multiple benefits, but it is based on ecological principles. It should make the landscape generally more 'sustainable'.