4.4 How to design a new wood

4.4.1 How to design the high forest planting

What structure should you aim for?

The most valuable mature woods for wildlife are those which provide a diverse range of habitats and structure (Figure 4.7), including:

- closed-canopy woodland with a well developed ground flora; a shrub layer up to about 5 m tall; an understorey of low stature trees and immature canopy species; and a canopy layer of mature trees
- areas of open canopy and small trees/shrubs
- a well-structured shrub layer along internal and external woodland edge
- rides and glades, including a field layer of grasses, ferns and wild flowers
- mature stems with holes; standing and fallen dead and decaying wood.

Figure 4.7 Structural variation in mature woodland.

High quality ancient semi-natural woodland is not dominated by any single habitat type or structural feature; a balance between them encourages a rich woodland flora and fauna. **The key to success in designing woodland for wildlife is to understand these structural requirements, and to ensure that in new woodland, they are diverse and provide a high quality habitat.**

Is the size of the new wood important?

To some extent, biodiversity is dependent on the size of a new wood; an aspect of planning, which is often determined by non-biological constraints. Bird communities, in particular, tend to be more diverse in larger woods (Ford, 1987; Fuller, 1995; Woolhouse, 1983). Including areas of open canopy or small trees/shrubs in the design creates habitat for early successional bird species such as tree pipit, whitethroat, linnet and yellowhammer. Scrub and young trees may be retained to support birds such as common nightingale, turtle dove, whitethroat and bullfinch. These areas also contribute to the overall amount of woodland edge habitat, which is critical to the biodiversity of new woodland. Woodland of 5 ha or more will comfortably accommodate the range of structures listed above, with a reasonable balance among them, although even woods of 2–5 ha can support a valuable degree of structural diversity.

Woods smaller than 2 ha – a common sight in Kent and East Sussex – are often dismissed in the literature as too small to be of value to biodiversity conservation. Even these woods can make a positive contribution, albeit

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TOP LEFT Blue tits will nest in new woods if boxes are provided, otherwise, they will use the habitat for feeding, particularly post-fledging family parties.

TOP RIGHT The Eurasian jay is a frequent visitor to new woods.

LEFT Common nightingale habitat in new woodland at Comfort's Wood.

with a reduced range of vegetation structures. In small woods, populations of birds may be limited to just one or two pairs of a species, which will inevitably be vulnerable to events such as predation. Consequently, small woods rely on immigration of birds from one year to the next, without ever developing stable populations. The value of small woods depends on their position in the landscape; planting next to mature woodland, particularly where management has been abandoned, may add to the structural diversity of the whole, and provide areas of scrub and open space to compliment the closed canopy of the mature woodland. So, even opportunities to plant small plots of land should be given serious consideration.

What are the key factors to consider when designing the high forest?

It is impossible to design a new woodland that resembles the structure of an ancient woodland in a single step, but it is possible to enhance the processes of succession that will eventually lead to it.

For the design of high forest, five factors should be considered:

1. **Size and use** – the range of habitats and structure will be constrained for small woods < 2 ha.

2. **Areas of open space** – these are essential for light-requiring ground flora and they allow natural regeneration (or later planting) to diversify age structure.

3. **How should canopy trees be grouped?** Single species groups avoid competition and blocks of 36 trees, planted 2 m apart should ensure that at least one tree will reach the canopy or sub-canopy; variation could be introduced for example by varying group size and spacing.

4. **How should understorey trees and shrubs be grouped?** Both single species and intimate mixes should be considered; group size is less critical than for canopy trees, and may be much smaller.

5. **Planting pattern** – trees and shrubs could be planted in straight lines, sinuous rows or more randomly, whilst maintaining specified spacing; groups of trees and shrubs should be located randomly, whilst trying to avoid shrub dominance over slower growing canopy trees.

In practice, each factor may be varied, producing almost infinite possibilities within a design: examples of how this can be achieved are given for Victory Wood in Section 4.4.3. **For successful woodland creation for wildlife, adopt a simple design, which is easy to plant and manage and which provides a framework, within which natural regeneration and wildlife colonisation are enhanced.**

4.4.2 How to design a woodland edge

What structure should you be aiming for?

The woodland edge marks the boundary between high forest and 'other vegetation', (e.g. arable land, grassland, tall herb vegetation or scrub) or the internal boundary between high forest and rides or larger glades. A distinct zone of shrubs or coppiced trees included along such boundaries will be very attractive to wildlife. Plant species to include in a woodland edge mix are described in Section 4.2, where the emphasis is placed on creating:

- a structurally diverse habitat for many species of insects, foraging birds and bats
- areas of dense foliage, at different levels, for nesting birds, mammals and basking insects
- shrubs and trees that fruit for much of the year
- nectar sources for insects, to complement sources in the open ground flora.

Birds, which favour the woodland edge, include dunnock, wren, long-tailed tit, and summer visitors such as common nightingale, blackcap, garden warbler and chiffchaff. The woodland edge also provides valuable hunting areas for raptors and owls, such as sparrowhawk, barn owl and tawny owl. Many of the birds, which inhabit the edges of mature lowland woods are those which also favour the young growth of new woodlands, such as most of the woodland warblers.

LEFT **A woodland edge lacking a shrub zone is very poor for insects, birds and foraging bats.**

RIGHT **This woodland edge looks attractive because the trees have not been pruned, but it lacks structural diversity and is poor for wildlife; note the ride is frequently mown, also creating very poor habitat for wildlife.**

The rich shrub edge in this new woodland (comprising blackthorn, buckthorn, crab apple, dogwood, field maple, hawthorn, hazel and rowan) is good for wildlife.

What are the key factors to consider when designing the woodland edge?

Before attempting this design, it is helpful to study a natural woodland edge or mature area of scrub, to visualise what the planting is being designed to achieve. For the design of the woodland edge, four factors should be considered:

1. **Area of woodland edge** – decide how much of the new wood can be designated as woodland edge, considering the extent of the woodland perimeter; the desired internal ride network; and the number of glades envisaged. The width of the edge may be constant or variable (a minimum of three rows is essential). To encourage structural diversity and natural regeneration, open spaces should be incorporated into the woodland edge design.

2. **Orientation of rides** – position rides east-west if the wood is large enough to accommodate this.

3. **How will the shrubs and trees be grouped?** Planting these as intimate mixes rather than single species groups, 2 m apart, should produce structural diversity and enhance biodiversity recovery; variable rather than uniform spacing could also be considered.

4. **Planting pattern** – straight lines, sinuous rows or more random planting should be considered, reflecting the planting pattern of the high forest areas; consider the growth rates and sizes of different species, planting taller species along the inner rows.

The woodland edge is confined to a much smaller area than the high forest, but it will support a disproportionately high level of wildlife. Consequently, its design is very important, and opportunities should be taken to introduce as much structural diversity as possible.

Observing the structural diversity of a natural woodland edge, such as this one at Yocklett's Bank in Kent, can help the design process.

4.4.3 Examples of woodland design: Victory Wood

A 5 hectare compartment based on the Victory Wood planting scheme has been chosen to illustrate the process of woodland design, including areas of high forest, woodland glades, woodland edge and rides.

Design of the high forest

Key design features:

1. **Size and use** – 5 ha compartment; an ash-field maple-dog's mercury woodland created for wildlife conservation

   High forest planting area occupies 3.41 ha, of which:
   3.25 ha are occupied by trees and 0.16 ha by permanent glades

   Woodland edge planting area occupies 0.5 ha

   Rides (central and peripheral) occupy 1.09 ha.

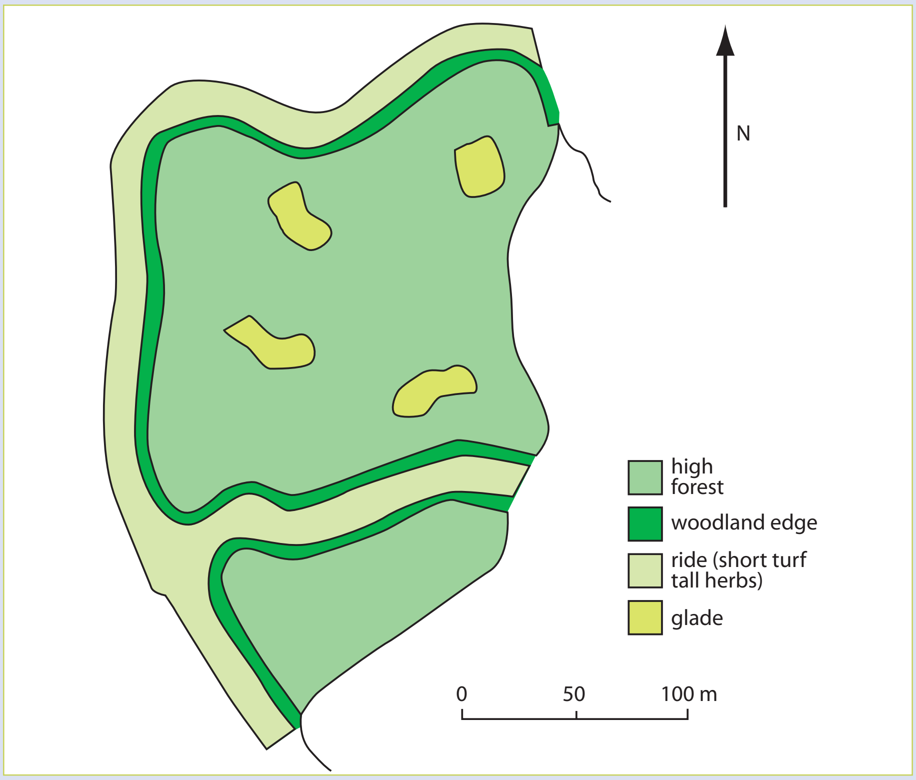


Figure 4.8 Example of a 5 ha compartment, based on the planting sceme at Victory Wood.

2. **Areas of open space** – four small glades, each of 400 m² (0.04 ha) randomly sited between groups of trees and shrubs (Figure 4.8): these will support light requiring ground flora, and will provide some structural diversity, but they will require continued management.

3. **How will canopy trees be grouped?** Single species; blocks of 36 trees to avoid competition and to ensure that at least one tree will reach the canopy or sub-canopy; birches scattered randomly; uniform 2 m spacing to encourage canopy closure.

4. **How will understorey trees and shrubs be grouped?** Mixed species groups to encourage structural diversity; blocks of 20 shrubs.

5. **Planting pattern** – to achieve a more naturalistic appearance, planting in sinuous lines, 2 m apart; planting along these lines in a staggered pattern (2 m apart); groups located randomly.

How to calculate the number of trees required

To calculate the number of trees, and the number of groups required, the following simple calculation can be performed:

Area of high forest planting = 3.25 ha

At 2 m spacing, 2,500 trees/shrubs planted per ha
Therefore, for 3.25 ha; number trees/shrubs required = 2,500 x 3.25 = 8,125

To calculate requirement for each species, multiply total number of trees/shrubs by proportion of each species;
for example, number of hornbeam trees required = 0.2 x 8,125 = 1,625

To calculate the number of groups of each species, divide the number of trees/shrubs by the group size (36 for trees, 20 for shrubs);

for example;
number of hornbeam groups = 1,625/36 = 45
number of shrub groups = 2,031/20 = 102 groups.

Canopy trees	Planting percentage	Number plants required	Approximate number of groups
Sessile oak	25	2031	56
Pedunculate oak	2.5	203	6
Hornbeam	20	1625	45
Ash	25	2031	102
Elm	2.5	203	6
Understorey shrubs – intimate mix	25	2031	102

Design of the woodland edge

This design adopts a uniform edge width, with three rows of shrubs and trees, planted 2 m apart. Three planting patterns have been devised, varying in planting density, each based on unit lengths of 50 m. The scheme described meets the criteria for new 'native' woodland by the English Woodland Grant Scheme, which allows a shrub element of up to 25% of the grant-aided area.

High density areas

Three rows of shrubs and trees planted 2 m apart; random planting with no grouping. To achieve some gradation of height; growth rates and size should be considered to determine whether species should be planted towards the inner or outer edge of the shrub zone. Consequently, plant willows, holly, crab apple, hazel, field maple and wild cherry along the inner edge.

Medium density areas

This design reduces the planting density by simply leaving 25% of planting spaces unoccupied, to provide greater structural diversity.

Low density areas

This design reduces the high density planting by leaving 50% of planting spaces unoccupied, to encourage some natural regeneration and provide greater structural diversity.

Key design features

1. **Area of woodland edge** – 10% of total area (0.5 ha); width of edge 6 m (three rows of shrubs and trees); ride width 15 m.

The unoccupied spaces in the shrub edge of this new woodland add to its structural diversity.

2. **Orientation of rides** – peripheral ride and an east-west central ride.

3. **How will the shrubs and trees be grouped?** Intimate planting mix; uniform 2 m spacing.

4. **Planting pattern** – sinuous lines, 2 m apart; planting along these lines in a staggered pattern (2 m apart); faster growing or taller species predominately along the inner edge.

Optional design features for this compartment

Here, four modifications are proposed to the design of the compartment described above. The planting scheme which results from them would be more complicated to layout, but would increase structural diversity of the high forest area, and allow a greater opportunity for natural colonisation.

- **Location of open areas** – the area and number of permanent, randomly sited glades could be increased in the high forest area from 0.16 to 0.5 ha, accounting for 10% of the total compartment area. Glades would vary in area from a minimum of 1,000 m^2, providing increased opportunities for natural regeneration, development of the light requiring ground flora; and along the internal edges, more shade tolerant ground flora.

- **Spacing of trees and shrubs within groups** – this could be varied to encourage more structural diversity: standard 2 m spacing, with occasional groups spaced at 3 m or 5 m to promote a more open and natural appearance and create opportunities for natural regeneration.

- **Species composition and size of canopy tree groups** – single species groups retained, but size varied: in addition to groups of 36 trees, occasional groups of 16 and nine trees could be included, particularly close to the woodland edge; this would increase structural diversity.

- **Area of woodland edge** – this could include deep scallops of predominately shrubs rather than tall herbs or grassland, which effectively varies the width of the woodland edge from 6 m (three rows) to 15 m (eight rows). This would provide considerable structural diversity, attractive to a wide range of woodland edge species.

4.4.4 How to design and establish the vegetation of rides and glades

What structure should you aim for?

The open spaces of rides and glades support a great diversity of wildlife, and can help to conserve the flora and fauna of another threatened and diminishing habitat, unimproved semi-natural grassland. Rides on wetter soils may support a marshy flora, whilst those on drier soils can develop a heathland flora. Rides also serve as corridors for dispersal by many species and for hunting by others. Like the woodland edge, ride vegetation needs to have some structural, as well as floral diversity. This creates a range of habitats capable of supporting a high density and variety of insects, from bare ground and short turf, through tall herbs to the woodland edge. Plants which should be included in a ride/glade mix are described in Section 4.3. For nature conservation purposes, an area of open space equivalent to 25% or more of a new wood would be valuable.

LEFT **Abundant nectar sources in the tall herb zone of a 'new woodland' ride, 15 years after planting.**

TOP RIGHT **Species-rich tall herb zone at Bentley Meadow.**

BOTTOM RIGHT **Although quite narrow, this east-west ride in Straits Enclosure, Alice Holt, is good for woodland butterflies such as silver-washed fritillary and purple emperor.**

Silver washed fritillary nectaring on thistle in Straits Enclosure, Alice Holt.

However, the biodiversity potential of rides and open spaces in woodlands planted on agricultural land in Kent and Sussex over the last 25 years or so often remains unfulfilled. In addition to poor or non-existent zones of shrubs along the woodland edge, rides may be mown repeatedly resulting in a low diversity of plants, or they may be narrow and shaded. Such rides are quite unsuitable for many woodland insects and their predators because they lack nectar sources and food plants. Even where foodplants have colonised, such as Yorkshire-fog and timothy grasses favoured by the small skipper, in the absence of abundant sources of nectar, dispersing adults are unlikely to colonise such areas. Occasional bramble patches may attract insects, but they will not sustain breeding populations through the spring and summer months.

TOP LEFT **This woodland ride is frequently mown throughout the summer, and is consequently very poor for wildlife.**

RIGHT **Common spotted-orchid has been recorded in the rides of several farm woodlands in Kent.**

Common fleabane provides an excellent source of nectar for insects in late summer.

In special circumstances, one of the management objectives of a new wood could be to provide habitat to attract rare species such as pearl-bordered fritillary or heath fritillary butterflies, although the author is unaware of any woodland creation schemes designed specifically to encourage colonisation by rare woodland specialist butterflies. However, this could be attempted in the future, providing specialist habitat design and management guidelines were devised by experts.

Heath fritillary occurs in Ellenden Wood, less than 100 m from the new woodland creation site at Victory Wood.

TOP A shady north east-south west ride in Ham Street Woods, Kent supports several woodland butterflies.

BOTTOM White admirals favour shady woodland rides, often in mature woodland, but visit sunny glades to nectar.

Butterflies illustrate very well some of the key ecological issues which underpin ride design and management. Most woodland butterflies rely on sunlit rides and glades, which must support a plentiful supply of larval foodplants, and an abundant supply of flowers for nectaring. These open spaces usually offer protection from wind, and a warmer microclimate for species which like to bask, such as comma, the fritillaries and white admiral. Wood white and ringlet are exceptions, as they prefer light shade, whilst green-veined white and speckled wood will tolerate deep shade. The adults of most species will use a range of flowers for nectaring, whilst their larvae are likely to feed on just a few species. This is particularly so for the woodland specialists such as white admiral, which feeds only on honeysuckle. Wider countryside species may also have a narrow range of foodplants, for example small tortoiseshell requires either nettle or small nettle. However, the presence of the right foodplant and an abundant supply of nectar is not always sufficient to allow a species to colonise a particular wood. The habitat and micro-climate in which the foodplant is growing is also critical for breeding to take place. Some species such as the marbled white prefer tall grassy areas, whereas others such as the small heath require short vegetation. Oates (2004) has shown that the pearl-bordered fritillary requires "plentiful leaf litter plus adequate violets without (too much) grass, plus tree/ scrub seedling and re-growth development and over good spring weather". If the grass is too long, the habitat becomes unsuitable, even with plentiful violets. This is the reason why this species is now believed to be extinct in Kent. Rides in which it bred in the last two remaining woods were allowed to become overgrown.

How to design rides

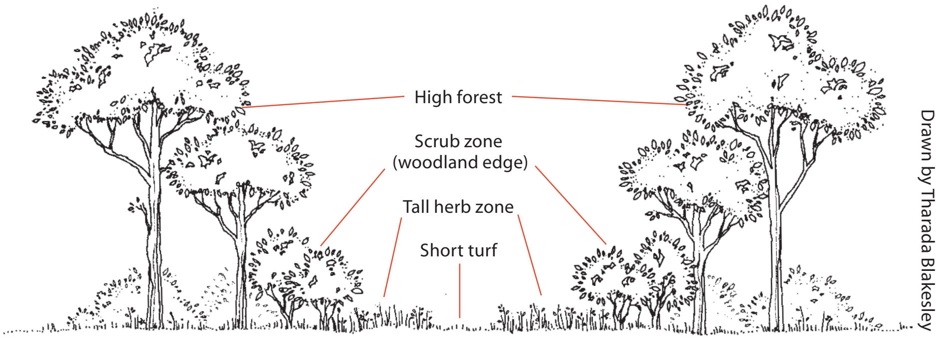
Light penetration is affected primarily by the orientation of the ride, its width and the height of the trees along the high forest edge. Within an east-west ride, the north side is sunny and warm, the south side cooler and moister. East-west rides are sunnier for longer than north-south rides during the summer months. For a detailed account of aspect and the duration of direct sunlight, refer to Ferris and Carter (2000). It is important that light reaches the central zone of short turf or bare ground, as well as the areas of taller herbs and shrubs. Rides must be sunny and warm to support nectaring insects, whilst also providing cool, shady conditions for larvae of the same species. Increasing the width of east-west rides creates more sunny areas, although there is a risk that they become wind tunnels, particularly with prevailing westerly winds. This can be alleviated by angling rides to the north or south near the edge of the wood, by scalloping and by closing off some ride sections with standard trees.

Tree height usually cannot be manipulated, unless a broad zone of shrubs is planted to grade into the high forest on the southern side. In many woodlands, both old and new, rides are often too narrow, but this can be avoided in new woodland, providing the site is large enough. **The width of rides should be approximately one, to one and a half times the height of the high forest edge. For new woodland, assume that trees will grow 20–30 m tall, so rides should not be narrower than 20 m and preferably wider than 30 m.** The width of north-south rides is not as critical, so if space is limited, they can be narrower. They are likely to support a different flora to their east-west counterparts, which is more typical of light-woodland shade; consequently they provide important habitats in their own right. Woods larger than 5 ha should easily accommodate a simple ride network, whereas those of 2–5 ha should have at least a single ride.

Ride management

The ideal ride management system for an east-west ride is a three-zone system (Warren and Fuller, 1993), modified for new woodland (Figure 4.9). Zones or strips of differing habitat are created, from a central track of short dry turf with bare areas, through tall herb swards rich in wild flowers (on neutral or calcareous soils), grasses, sedges and rushes, to the graduated scrub and coppice zone of the woodland edge. Such designs must be maintained by appropriate mowing and cutting regimes to enhance and retain biodiversity. Cuttings should be removed to avoid damage to the habitat through soil enrichment.

Figure 4.9 Profile of a three-zone ride management system.



The short turf or central zone should be approximately 2 m wide, and mown once or twice a year to create areas of short turf and to maintain access. Occasional areas of bare ground should be encouraged – particularly along south-facing woodland edges – so such areas should not be re-vegetated. Bare ground is often exposed accidentally during mowing, mimicking the results of grazing by large herbivores. In sunny positions, bare ground will warm up rapidly, and may be as much as 10°C higher than the surrounding vegetation. It supports a rich and characteristic insect fauna (Key, 2000) and is used by insects for basking, egg laying and by solitary bees and wasps for burrowing. Predatory beetles, ants, flying insects and some spiders scavenge, hunt or ambush their prey on bare ground, whilst snakes bask on it in early morning sunshine. Log piles and brash will provide similar opportunities.

Tall herbs should be mown every 4 years with a side-mounted flail, on a rotational basis, to create a mosaic of tall grasses and herbs of four different ages in the ride network, preferably in equal amounts, but certainly sufficient to maintain viable populations of insects. Some insects, such as wood white butterflies cannot tolerate this level of disturbance, but this would only be an issue in specialised circumstances. The woodland edge or scrub zone should be cut or coppiced on a rotation of 8–20 years to create a mosaic of structural diversity and different aged shrubs. If shrubs have been planted fairly close together, they should be cut more frequently. Woodland edges which have regenerated naturally may have a low density of trees and shrubs and require less frequent cutting.

The basic three-zone system can be improved by incorporating a scalloped woodland edge – particularly along south facing edges. Scallops should be up to 20 m long and 20–50 m deep, to provide bays that offer more shelter from the wind (Warren and Fuller 1993). Scalloping replaces straight woodland edges with more natural, diffuse ones. It increases the total amount of woodland edge and diversify wildlife habitats. Some scalloped areas may be coppiced, with others maintained as tall herbs or grassland. Gently curving rides also provide an alternative to long straight rides.

Although a three-zone ride network requires continuous management, it provides increased habitat diversity and attracts a rich variety of woodland flora and fauna. Therefore, where woodland is created primarily for biodiversity conservation, it should be seriously considered. Indeed, rides in any new woodland would be best designed like this, if funds and space allow.

How to establish the vegetation of rides and glades

The planting design for ground vegetation in rides is relatively straightforward compared with high forest and the woodland edge. All plant species can be introduced in a single seed mix, uniformly across the ride area.

There are five options for introducing grassland plants to agricultural land, some of which will require sward killing and cultivation in preparation:

- sowing a sward (basic mix of grasses, or a species-rich seed mix)
- spreading green hay
- oversowing and slot seeding
- planting container grown plants or plugs
- natural regeneration.

Due to the relatively small areas likely to be involved in a woodland creation scheme, each may be applicable in certain circumstances. Table 4.15 presents the main advantages and disadvantages of each method for such areas, and gives examples of where each might be employed.

Can areas be left to regenerate a sward naturally?

If semi-natural grassland, high in biodiversity occurs nearby and if soil nutrient levels are relatively low, then natural colonisation of the site is possible, given a sympathetic management regime. Such an approach might also be considered, even in the absence of adjacent areas of semi-natural grassland, provided soil fertility is low. In such cases, a diverse flora should colonise open areas within 10 years or so; the time taken for the planted trees to close canopy. An appropriate ‘natural’ grass seed mix could be sown to exclude unwanted weeds (Section 4.3.2), allowing other species to colonise. Such land may also be considered for conservation grassland as well as woodland.

In an otherwise arable landscape with no semi-natural grassland nearby, natural swards will be composed of plant species typically found in NVC grassland communities of lower botanical nature conservation value, such as rank grassland (MG1a,b), improved permanent grassland (MG6) and reseeded grassland (MG7). They may also take on the character of an open vegetation community, characteristic of field margins and fence lines. Such grassland is likely to contain a poor diversity of flora and insects, and will take a very long time to attain any significant biodiversity value. In these circumstances, consider sowing a native grass and wild flower mix.

Table 4.15 Sward establishment options for woodland open spaces, and larger grassland areas

Options	Advantages	Considerations	Suitable sites
Sowing a 'natural' grass seed mix	■ Mix of grasses can establish sward on more fertile site, followed by species-rich hay spreading or oversowing after 3 years or so ■ Control over species planted, though not over establishment ■ More cost effective for relatively small areas of woodland open space ■ Simple mix increases the chances of success ■ Seed mixes can be related to local conditions and known vegetation types (NVC)	■ Seed mix should be determined for each site, considering: objectives, management, and site characteristics ■ Provenance can be difficult to ascertain ■ Risk to genetic structure in the wider landscape if non-local seed sown adjacent to existing unmanaged natural grassland ■ Any natural colonisation of herbs from adjacent species-rich habitat slow in comparison to sowing ■ High soil fertility and/or pernicious weed problems may require repeated cultivation and spraying for 12 months or so prior to sowing	■ Land with a P Index 0–1 ideal; 2 is marginal ■ Sites which match a local seed source ■ Suitable for woodland rides where relatively small areas are sown
Sowing species-rich grassland mixes	■ More rapid establishment of a diverse sward ■ Early introduction of wild flowers to enhance value for insects and other wildlife ■ Control over species planted, though not over establishment ■ Seed mixes can be related to local conditions and known vegetation types (NVC) ■ More cost effective for relatively small areas of woodland open space	■ Mix should be formulated for each site, or an appropriate wild-harvested seed mixture used ■ Site must not be dominated by coarse grasses or pernicious weeds – if stress tolerant species are likely to be present, may need two stage process ■ If stress-tolerant species do not survive, may require repeat sowing or hay spreading after 3 years or so ■ Provenance can be difficult to ascertain ■ Risk to genetic structure in the wider landscape if non-local seed sown adjacent to existing unmanaged natural grassland ■ Some ground preparation required to open-up sward ■ May be expensive ■ Hay may need to be removed on sites with a high P-index	■ Long term pasture with higher N and low P (note these may also be considered for grassland restoration) ■ Land with a P Index 0–1 ideal; 2 is marginal ■ Particularly suitable for woodland rides where special mix is required ■ Oversowing can be done in zones along rides in existing swards
Species-rich green hay spreading	■ Richer sward likely ■ Fresh seed – high viability ■ Lower cost than seed ■ Local provenance may be easier to source ■ Local species mix	■ Sourcing hay may be difficult ■ Hay must be very fresh ■ Species introduced determined by diversity and abundance of source flora ■ No guarantee of which species will be viable in the mix ■ Site must not be dominated by coarse grasses or pernicious weeds ■ Most suitable for existing sward with little weed burden ■ Ground preparation required, and grazing or light rolling after strewing	■ Land with a P Index <2 ■ Donor site must match the restoration site closely ■ Sites previously sown with a species-poor mix, and harvested annually ■ Particularly suitable for woodland rides where small areas can be prepared
Potted seedlings or plugs	■ Plant in bare ground or sward ■ Self seed ■ Introduce targeted species to an existing botanically interesting sward e.g. butterfly foodplant or insect nectar plant ■ Introduce species difficult to propagate through seed	■ Expensive – mortality can be high ■ Requires careful planting and aftercare until established ■ Plants can be swamped by existing vegetation ■ Unsuitable for highly fertile sites ■ Provenance can be difficult to ascertain ■ Unsuitable for archaeological sites	■ Small areas ■ Long term pasture with high N and low P (note these may be considered for grassland restoration) ■ Grassland with P Index 0–2 ■ Suitable for woodland rides where a small number of target species are required ■ Planting can be done in zones along rides or in specific areas
Natural regeneration	■ Seed/hay not required ■ Species-rich swards may develop in the longer term, particularly on sites adjacent to existing unmanaged natural grassland ■ Colonisation can be accelerated through livestock movement if unmanaged natural grassland close by ■ Local provenance assured ■ Low cost option	■ Lack of seed bank in most sites ■ Requirement for low P levels eliminates a lot of agricultural land ■ Requires nearby unmanaged natural grassland ■ May take a decade or more to establish ■ Perennial weeds in existing seed bank or invading can cause problems	■ Smaller sites in close proximity to unimproved natural grasslands or reseeded areas ■ Long term pasture with higher N and low P (note these may be considered for grassland restoration) ■ Low risk from perennial weeds ■ Rapid response is not required ■ Seed bank already contains some target species ■ Evidence of colonisation by desirable species in set aside ■ Cost is an important issue ■ Archaeological interest