Appendix 2: Design guide

Purpose

This document is an Appendix to the Grant Manual for the England Woodland Creation Offer (EWCO), available on the Application form page. It provides further guidance on how to design your woodland effectively to provide the public benefits that EWCO supports through Additional Contributions. Your Woodland Officer will compare your proposals with this guidance and may ask or require you to adjust your EWCO application. This is to ensure your woodland design is as effective as possible in delivering public benefits, and that it therefore justifies any EWCO Additional Contributions or associated points.

Woodland design for nature recovery

Creating new native woodland

Tree species selected to create woodland for nature recovery under EWCO should aim to mimic the appropriate natural woodland community. To achieve this, it is essential to select tree species suitable for the site. We recommend that you use the Ecological Site Classification Decision Support System (ESC-DSS). This tool helps you to get an indication of the appropriate National Vegetation Classification (NVC) for the site and associated woodland tree species. The Woodland Wildlife Toolkit can help identify local species priorities and includes advice on woodland creation.

When planting, we recommend you consider innovative planting patterns to create a combination of clumps and open space to introduce variation by changing the following characteristics:

- mixture of species within clumps, distribution and size of clumps
- spacing between trees within clumps
- spacing between trees and shrubs in adjacent clumps
- distance between clumps
- size and distribution of open areas

The design of new native woodland should consider how the design will be laid out on the ground and what the practical implications are for the trees' aftercare during the establishment and maintenance phases.

Woodland design to enhance or expand red squirrel habitat

The planting of large-seeded broadleaves such as oak and beech (except for on the Isle of Wight), is strongly discouraged where it is likely to provide a corridor for greys to move into a red squirrel reserve or its buffer zone. An exception to this is the

enlargement of ancient and semi-natural woodland because this is often desirable for a range of landscape and conservation reasons. However, any such extensions should be limited to avoid:

- exceeding a 10% increase in large-seeded broadleaved woodland in the red squirrel reserve buffer zone over any ten-year period
- enhancement of potential grey squirrel incursion corridors

Table 1: Tree species and their suitability for planting for red squirrel habitat

Tree species suitable for planting for red squirrel conservation	Neutral tree species	Do not plant
Blackthorn, bird cherry, pine spp., Douglas fir, hawthorn, holly, spruce spp., wild cherry, western red cedar, yew.	Alder, aspen, birches, black poplar, Cypress spp., field maple, juniper, lime spp., rowan, sycamore, western hemlock, whitebeam, willows, wych elm.	Beech, hazel, chestnuts, oaks, walnut.

For further information see FCS Guidance Note 33: Forest operations and red squirrels: November 2006.

Woodland design for water benefits

In some circumstances, woodland creation can have a negative impact on water resources. In some parts of England, conifer's high use of water can threaten local water supplies and river flows. In some locations, reduced river flows can be detrimental to water-dependent protected sites. Where the scale and type of woodland planting suggests these might be an issue, you should seek advice from available data published online, for example the Environment Agency, local water company and Natural England, and use the advice received to inform your woodland creation proposal.

Woodland design to improve water quality

In the right locations, woodland creation can decrease diffuse pollution through reduced fertiliser and pesticide usage. It can also protect sensitive soils from:

- disturbance and erosion
- increase infiltration and reduce water runoff
- intercept sediment and chemical pollutants in run-off, reducing the delivery of pollutants to watercourses

Woodland will be located:

- within groundwater and surface water Protection Zones
- on soils at high risk of erosion or leaching chemical pollutants
- where temporary surface water collects and flows during heavy rain
- on areas receiving runoff from hard standings, on infiltration basins and on sustainable rural and urban drainage systems
- downslope of erosion or chemical pollutant sources

For maximum benefit, your proposal will:

- target pollutant sources and retention zones
- run parallel to the land contour, where the woodland is designed to intercept pollutants draining from upslope areas
- have the highest planting densities along runoff pathways
- include an open space towards the uphill edge of the woodland to enhance the trapping of fine sediment where overland flow is an issue
- have a minimum 1,100 stems per hectare, though closer spacing should be used across run-off pathways
- have a maximum of 20% open space within the woodland where fully justified, but preferably less than this
- use productive broadleaf or conifer species to provide the greatest benefits for water
- avoid larger scale planting of conifers where acidification or water resources are identified as an issue

Woodland design to reduce flood risk

Appropriately located and designed proposals can help reduce flood risk by slowing flood flows and increasing the retention and infiltration of water on the land by creating:

- woodland in the wider catchment – creating woodland here can help to:
    - reduce fertiliser and pesticide usage
    - protect sensitive soils from disturbance and erosion
    - increase infiltration and reduce water runoff
    - intercept sediment and chemical pollutants in run-off, reducing the delivery of pollutants to watercourses
- riparian woodland – creating woodland along watercourses can create a buffer between rivers and the adjacent land, reducing water temperature by providing shade and slowing flood flow water delivery to watercourses
- floodplain woodland – creating woodland here can act as a permeable partial barrier to a river when in flood, helping to slow flood flows

- cross-slope woodland – creating smaller areas (typically shelterbelts) of woodland (all types) across hill slopes can reduce rapid runoff from higher land. Trees also encourage infiltration and increase the soil's water storage capacity

For maximum benefit, your proposal will:

- involve random spacing but, if in rows, the rows will be offset and aligned perpendicular to the flow of water to slow the water flow
- have open space that will be concentrated on the higher, drier parts of the site
- have a minimum of 1,100 stems per hectare (outside riparian buffers, across the lowest lying, wettest parts of the floodplain and along the downstream of the woodland consider higher stocking densities of up to 2,500 stems per hectare to increase low level roughness and temporary flood storage)
- have up to 30% of the species mix can be made up of woody shrubs and small trees
- have a maximum of 20% open space within the woodland, but preferably less than this
- where appropriate, create riparian buffer zones following advice in this design guide into which water from appropriately designed forest drains is slowly discharged. These buffer zone must be at least as wide as the minimum UKFS buffer distance (10 or 20 metres for watercourses < or > 2 metres width respectively) to ensure forest drains can discharge at the landward edge of them without affecting watercourses
- create areas of wet woodland in naturally wet areas where appropriate within a productive forest, rather than installing new drainage
- select tree species that can survive temporary inundation and thrive in wetter conditions where it is appropriate to do so within the site
- in the flood plain create a multi-layered canopy especially, within the riparian buffer and other wet/waterlogged parts including ground vegetation and subsequent inputs of dead wood to provide hydraulic roughness
- in some instances, it may be appropriate to include other run off attenuation features (for example swales and scrapes) into the open space design of the woodland[1]
- use native broadleaves adjacent to watercourses (see UKFS Guidelines) and on lowest lying, wettest areas; use productive planting of either broadleaves or conifers elsewhere, especially on higher, drier parts of the site need to consider whether sub-soiling as a cultivation method is appropriate for the site, it may be permitted where it is required for successful tree establishment to help vertical drainage by breaking any plough or iron pan

[1] The positive benefits of these should be agreed in advance with the appropriate flood authority but remain outside the funding requirements, payments and permissions of EWCO.

- ensure any linear cultivation is cross slope and complies with UKFS Practice Guide on Managing Forestry Operations to Protect the Water Environment

For more information please see: UKFS Practice Guide on Managing Forestry Operations to Protect the Water Environment.

You should avoid creating woodland in areas:

- where flood flows are controlled or back-up by existing restrictions such as bridges and culverts, particularly where these are vulnerable to blockage
- alongside stretches of main river with engineered flood defence banks
- where the backing-up of floodwaters from physical bottlenecks could threaten local properties
- within 'washlands' which are areas of land adjacent to rivers that flood at times when river levels are high-these areas act as a natural store for water, which can help avoid flooding homes or important agricultural land

Woodland design for riparian buffers

Creating woodland along watercourses can:

- create a buffer between the water and adjacent land, intercepting and removing nutrient pollutants and sediment in run-off
- provide a barrier to pesticide spray drift
- protect riverbanks from disturbance and erosion
- slow flood flows; provide shade to reduce thermal stress to fish and other aquatic life
- provide important dispersal corridors for wildlife.

You should aim to create shade along 50% of the watercourse adjacent to your proposal. The design close to the watercourse should include 40% open space, with no more than 1,100 stems per net planted hectare. It should comprise native tree and shrub species suited to riparian woodland.

All existing field drains that discharge into a watercourse must be disconnected and re-designed to discharge appropriately into a buffer area, prior to woodland creation works beginning.

Your proposal will need to be:

- composed entirely of native tree species, excluding advancing or honorary native species, with the exception of Scots pine which we will allow up to 15% where this will preserve the presence of Scots pine in the immediate area
- the planting stock of any Scots pine must be of native provenance

- within 10 metres of the bank of a targeted watercourse
- targeted towards stretches of watercourse at risk of receiving sediment, nutrient pollutants or pesticide spray from adjacent land
- along stretches of watercourse vulnerable to bank erosion
- along watercourses lacking shade and where fish are thought to be at risk from thermal stress

Where appropriate and practicable, include the construction of large woody debris dams within the watercourse to improve channel structure and aid re-wetting of the riparian zone.

For maximum benefit, your proposal will:

- provide continuous canopy cover along the length of the riparian zone but allowing for light/dappled shade alongside the watercourse itself
- include open space towards the outer edge of the new planting to enhance the trapping of fine sediment where overland flow from adjacent land is an issue
- be at its widest and densest where overland flow discharges from the adjacent land and extend to include areas of active erosion and unstable slopes where possible
- extend right up to the edge of the watercourse where bank erosion is an issue

Woodland design for social and recreational benefits

Where the EWCO Additional Contribution for recreational access is being applied for, careful design is required to ensure that opportunities to enhance the visitor experience are maximised. To do this:

- make the most of natural features such as views, water, open space, sunny glades or crags
- decide in which areas conservation take priority over recreation
- link features and woodlands: trails and facilities can be linked across woodlands
- zone the woodland for different activities and uses. For example, special 'off-route zones and jump areas' for mountain bikers might be located away from areas where families are walking. Consider if time-zoning may also be possible to help with this
- operate an effective permission structure for events
- waymark walking routes, easy access routes, cycling routes and bridle routes to avoid accidental trespass and minimise conflict between user groups
- ensure trails and routes are well-made, wide enough, well-drained and well-marked
- where possible, develop trails that are easily accessible to a whole spectrum of users and ability

- retain some areas or routes with less intervention for local or informal use.
- make provision for dogs
- remember that diverse types of users may need different management approaches, for example family cycling and mountain biking
- remember that signage needs to be bigger if people are travelling at greater speed, for example where cyclists will be travelling downhill

Woodland design for ammonia reduction

Woodland creation can also contribute to air quality objectives by capturing ammonia emissions, which are mainly from agriculture.

Ammonia impacts biodiversity through toxicity to sensitive species, and it is the biggest contributor to nitrogen deposition in the UK. Excessive nitrogen can affect ecosystems and soil health, as well as contributing to climate change. Over 85% of Sites of Special Scientific Interest (SSSIs) in England are receiving levels of nitrogen where harm is expected and 88% of SSSIs exceed concentrations of ammonia likely to cause damage to lower plants[2]. Ammonia also reacts with other air pollutants to form fine particulates that impact on human health.

The design of shelterbelts must maximise ammonia capture by the trees and disrupt air flow, following the guidance at www.farmtreestoair.ceh.ac.uk. The ammonia captured by the trees is related to leaf area index so is greater when trees are larger and in leaf, but ammonia is also captured on branches and twigs. Air quality is also affected by the wind dispersal and air flow disruption through the trees. A proportion of evergreen tree species planted more densely (with a minimum stocking density 2,500 stems per hectare (sph) on the downwind edge of the planting (the 'backstop canopy') will enhance ammonia capture, as will increasing the depth of the shelterbelt. The main canopy should be more open (with a minimum stocking density 1,100 sph) to allow air flow into the shelterbelt. It should include species with a larger leaf area and that are fast-growing to be more effective sooner.

Your new shelterbelt or woodland should be planted downwind of the source of ammonia and, ideally, upwind of any SSSI. Your woodland creation plan will assess the effectiveness for capturing ammonia emissions from the source to reduce the impact of ammonia on sensitive habitats and species. These shelterbelts and small woodlands are to be created within 20 metres of farm buildings and slurry stores, so can also be used to screen the buildings without impeding ventilation and will have wider benefits for biodiversity and carbon capture.

[2] Nitrogen Futures | JNCC - Adviser to Government on Nature Conservation

Advice on the location, design and species mix of your proposal can be requested from your Catchment Sensitive Farming Officer in priority areas for water and air quality.