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Hedgerows and their management for carbon storage

Why is this of interest to the NFU and its members?

This briefing, condensed from a number of sources, provides background information that contributes to the NFU's aim to enable enhanced hedgerow management as a contribution towards on-farm carbon storage, under "Pillar 2" of our Net Zero 2040 goal. Hedgerows have only modest potential to store carbon compared with other measures, but they are an easy 'win-win' that may be implemented in the short term. A large majority of British farms already have hedgerows of one kind or another marking their field boundaries, offering opportunities for enhancement or enlargement through changes to management, restoration and gapping-up of neglected hedgerows, and planting of new hedgerows, shelter belts and windbreaks.

Background

According to Smith and Westaway (2019), hedges, windbreaks or shelterbelts and riparian buffers are all examples of 'agroforestry' type systems already prevalent in the British landscape. In some agricultural landscapes, these features comprise the most important semi-natural 'woodland edge' habitat, supporting biodiversity locally as well as offering wildlife corridors between larger patches of woodland. Hedgerow trees (emergent from a hedgerow or adjoining it) may add further diversity to both habitat and landscape. Hedgerows of all kinds may also provide pollination services and improved pest control to adjacent fields, and some may act as barriers to spray drift when crop protection products are applied, as well as filtering out airborne particulate matter or capturing diffuse water pollution.

Warmer air and soil temperatures in the lee of a hedge (up to 30 times its height) can enhance crop growth, although there are trade-offs with shade and water competition reducing yield closer to the hedge boundary. Hedges can also benefit the productivity of livestock, for which both summer shade and winter shelter may be important. Soil erosion may be reduced and water infiltration improved by the presence of hedges. Where hedges across slopes capture eroding soil, there may be an increase in soil organic carbon for up to 60 metres uphill.

Hedgerows do require active management in order to thrive and to continue to provide these multiple functions, and the recommended management of hedgerow components is likely to vary for specific environmental outcomes according to location. In addition to periodic cutting to maintain their shape and limit encroachment into neighbouring fields or rights of way, hedges and related features require rejuvenation at longer intervals to maintain their structure and function, e.g. by laying, coppicing, pollarding or restocking.

Definition of a hedgerow

A simple definition of a hedge is a line of woody or shrubby vegetation which is subject to management that alters its natural shape. However, hedges usually also contain herbaceous growth around their base and many contain mature trees. They may be set on banks and can have ditches along one or both sides. British hedgerows typically contain hawthorn, blackthorn and other shrubby species, plus ramblers like bramble and rose, with occasional larger trees such as ash and maple, occasionally pollarded for woodfuel. Species make-up may also reflect the hedge's original purpose - to divide land, denote land ownership and limit the movement of farmed animals.

The presence and extent of hedgerows, and their management and typical shape varies with farm type and region; in some parts of Britain hedgerows and similar linear features may account of 10-15% of land area. Arable farmers tend to trim their hedges after crop harvest in early autumn, when access to the field margins is easier, whilst grassland farmers tend to trim hedges earlier in the season. Regional characteristics include having rounded hedge tops so that snowfall will slide off, or growing hedges especially tall and thin to shelter horticultural crops such as hops, ornamentals or flower bulbs. In Devon and Cornwall, hedges are often found on top of earth banks, and those banks may be faced with stone. Fencing may be incorporated on one or both sides to control browsing of the hedge by livestock.

Hedges are regulated in a number of ways:

- Under [cross compliance regulations](#) in England, hedges and trees can only be cut between 1 September and the end of February, although coppicing and hedgelaying is permitted up to 30 April. Further regulations apply to [hedgerows funded under the Countryside Stewardship scheme](#).
- In addition, some hedgerows over 20 metres in length, or which join other hedgerows, alongside certain categories of land, are offered protection against removal under the Hedgerow Regulations 1997.

Hedgerow statistics

Figures for the total extent of British hedgerows may be expressed as length or area, and estimates vary. There are about 550,000 km of hedgerows in England (or 82,500 hectares, assuming an average width of 1.5m), of which about one-third have been managed under agri-environment schemes. Across the whole of the UK, these figures rise to around 800,000 km (120,000 ha), of which 52% is managed and 48% unmanaged.

Estimates of the carbon stock of UK hedgerows (based upon above-ground biomass) range between about 15 tonnes of carbon per hectare (tC/ha) for short hedges (1.5m height) and 30-40 tC/ha for tall hedges (2.7m), with an similar amount of carbon in below-ground biomass. If a crude average value (above plus below ground) is 40 tC/ha, then the present total for UK hedgerows is about 4.8 million tonnes of carbon.

Assessment of hedgerow condition and general management

Some hedgerows on UK farmland are in relatively poor condition, due to either under-management or over-frequent flail trimming. The Hedgeline partnership and PTES¹ recognise 10 or 12 stages of hedgerow condition, which may be grouped into four basic categories: overtrimmed, dense/well-managed, rejuvenated and overgrown (see Figure 1 below). Although originally developed around biodiversity, this kind of hierarchical classification may be suitable in future for monitoring, reporting and verification (MRV) of carbon storage in hedgerows.

¹ People's Trust for Endangered Species (www.ptes.org)

Hedgeline suggest maintaining a hedge between a 'healthy trimmed' and a 'healthy tall' state, neither overtrimmed nor overgrown. Sympathetic trimming to thicken a hedge may entail varying the cutting height to encourage new growth points. Flail cutting is good for mulching hedge trimmings but circular saw heads are better for long-term reshaping or where brash is to be collected (e.g. for wood fuel – see below).

To achieve a healthy hedge condition, Hedgeline recommend:

- keeping the hedge thick and dense
- cutting at the right time (late winter), and not too often
- encouraging native shrubs and a dense grassy understorey
- allowing both large and small trees to emerge
- linking to other hedges and wildlife habitats

Sources of support for hedgerow establishment and management

- Farmers and land managers can apply for a [Hedgerows and Boundaries Grant](#) under the current Defra [Countryside Stewardship](#) scheme, for management as well as new planting. See further [information on NFUonline here](#).
- The Woodland Trust [MOREhedges scheme](#) funds up to 75% of the cost of 100-250 metres of new hedgerow with trees every 6 metres

Management for wood fuel

Although hedges which are allowed to grow larger will build up carbon stocks both above and below ground, total carbon gains may be higher when hedges are managed by coppicing for wood fuel which substitutes for fossil heating fuels such as oil, coal and LPG. In some parts of France, hedgerows are a significant source of fuel, accounting for about 11% of domestic firewood consumption. Periodic hedgelaying can also produce some fuelwood, but coppicing yields more stems of a useful diameter – although it results in a different kind of hedge structure. Smith and Westaway (2019) recommend that no more than 50% of the hedges on one farm should be managed by coppicing, with no more than 5% coppiced in any one year. Willow, hazel, alder and ash all respond well to coppicing. Pollarding is an alternative technique, more common in France – this involves cutting back higher up the main stem, and can yield wood fuel of a convenient diameter from emergent hedgerow trees.

Trials in Devon have demonstrated that hedges can indeed be managed to produce good quality wood fuel, and a technical guide was published in 2015 by the Organic Research Centre TWECOM project. However, a felling licence from the Forestry Commission is a requirement if cutting stems over 15 cm diameter (measured at 1.3m above ground level) or single tree stems over 8 cm diameter, where more than 5 m³ of timber is being removed in any calendar quarter.

It is most important to match the wood-fired heating system (boiler capability and fuel handling) to the quality of wood fuel. Wood chip from hedgerows is likely to be more variable in particle size and ash/mineral content than wood fuel derived from forest and woodland management.

Design of new hedge planting

Where possible, hedges should be planted along existing boundaries or to join up existing hedges and areas of habitat. For a stock-proof barrier, a staggered double row spaced about 40 cm apart of blackthorn, hawthorn and hazel every 15-25 cm is suitable, but other species may be included to support greater biodiversity, and willow or sycamore may be preferred if the aim is to harvest woodchip

for fuel or animal bedding. Taller whips for hedgerow trees may be spaced about every 6-10m along the hedge.

Windbreaks

The location of new windbreaks should be a function of wind direction, topography, farm practice and desired outcomes, with around 40% permeability ideal to avoid turbulence downwind. The best design may be a length around 10-12 times the desired height, with one or more lines of trees in the centre and shrubs on either side that can be trimmed. Small islands of trees upwind of access gaps can help avoid any wind tunnel effects. Fast-growing species (poplar, elder, birch) can enable other longer-lived species like oak to establish. Windbreaks are likely to need thinning after 15-20 years, and may also be harvested and replanted in the longer term, starting with the leeward side in order to maintain shelter.

Riparian planting

Buffer strips alongside rivers and streams may be designed to reduce diffuse pollution, to manage stream flow, and/or to create cooling shade as adaptation to climate change. Of between 5m and 30m width, riparian buffers should ideally have only a modest slope to promote infiltration (7 to 13 degrees maximum is a typical recommendation). Establishment may be by planting or natural regeneration, minimising the use of machinery, and environmental consent may be required in the case of planting. The eventual tree canopy should leave around 50% of the stream surface open to sunlight. Longer term management may be limited to minimal intervention in sensitive environments.

Hedgerow trees

To safeguard emerging hedgerow trees, mark them with tape or coloured rags, as a warning to hedge-cutting contractors to avoid them. In some cases, it may be more convenient to plant saplings at appropriate locations alongside a hedge. Both large trees and smaller fruiting trees such as crab-apple will add diversity. Mature hedgerow trees may offer particularly good habitat for hole-nesting birds, and some standing dead wood should be retained as insect habitat that will attract both birds and bats.

Proposed NFU 'net zero' workstream on hedgerow carbon storage

Under "Pillar 2" of our net zero 2040 goal, the NFU aims to develop a "Growing Larger Hedgerows" proposal with wide stakeholder backing to put to Defra for support under the Environmental Land Management Scheme (ELMS). This should cover enhanced hedge management, restoration and new planting of hedges and shelterbelts, linked to farmer reward payments for public goods based upon an actual or 'shadow' carbon price. Policy measures to enhance carbon storage need to avoid conflict with management for other environmental objectives (biodiversity, diffuse pollution), but "layering" of payments for different outcomes may be a possibility under ELMS.

Further reading

Smith, J. and S. Westaway (2019) Hedges, windbreaks and riparian buffers. Ch 5, in *The Agroforestry Handbook*, Soil Association, Bristol. pp 77-93.

Hedgelinek (a national partnership of hedgerow stakeholders which offers extensive information, management advice and links to additional resources on its web site):

<http://www.hedgelinek.org.uk/index.php?page=23>

http://www.hedgelinek.org.uk/cms/cms_content/files/30_complete_good_hedge_management_guide_leaflet.pdf

People’s Trust for Endangered Species (PTES - charity supporting and hosting the *Great British Hedgerow Survey*, source of Figure 1 below):

<https://hedgerowsurvey.ptes.org/hedge-management-cycle>

<https://hedgerowsurvey.ptes.org/hedge-structures>

The CFE (Championing the Farmed Environment) partnership offers guidance and links to other resources:

<http://www.cfeonline.org.uk/environmental-management/wildlife/maximise-the-value-of-your-field-boundaries/>

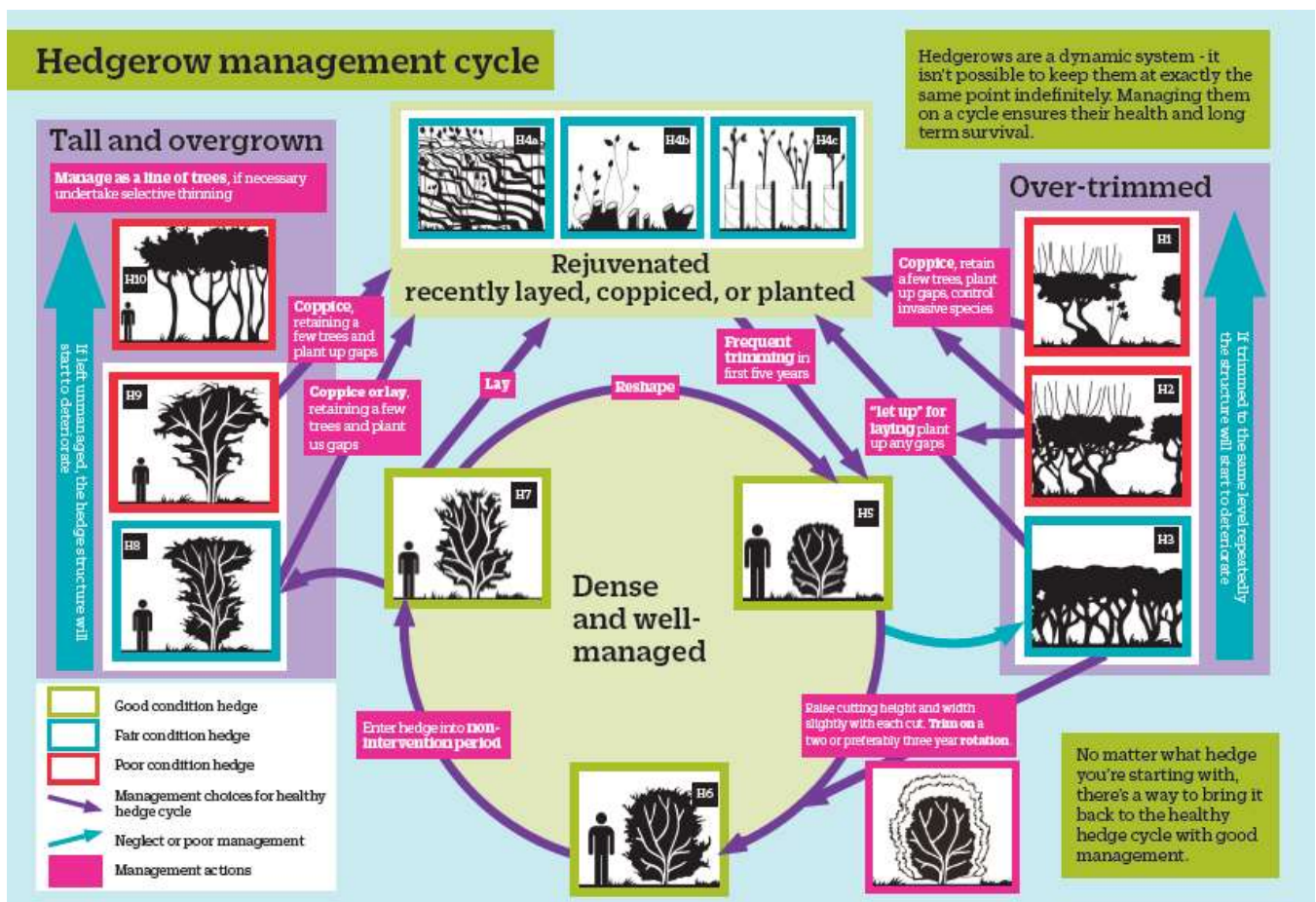


Figure 1. Hedgerow management cycle (courtesy of PTES). See also key to hedgerow condition at <https://hedgerowsurvey.ptes.org/hedge-structures>