

A guide to

Harvesting woodfuel from hedges



Guidance on bringing England's hedges back into the farm business by managing them for woodfuel

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Why manage hedges for woodfuel?

Why hedges are important

Hedgerows are a prevalent feature across Western Europe, with an estimated 435,000 miles in Great Britain alone.¹ They have significant cultural and historical value and provide many functions and benefits within the landscape, including sheltering crops and livestock, supporting wildlife and linking habitats, controlling erosion and visually enhancing the landscape. Hedgerows provide a habitat similar to that of woodland edge across agricultural landscapes, providing wildlife refuges from more intensive land use and connecting areas of semi-natural habitat. Many species live in or use hedges, with more than 600 plant species, 2000 insect species, 64 bird species and 20 mammal species associated with British hedgerows.² In the UK Hedgerow Habitat Action Plan, 84 of the species associated with hedgerows are of conservation concern.³



Photo: Daria Eric

Hedges in the West Berkshire landscape

Why manage hedges for woodfuel?

Traditionally, hedges provided a variety of wood products including firewood, but as labour became more expensive and wood was replaced by fossil fuels, the practice of managing hedges for firewood was lost. Following recent rises in oil and gas costs and concerns about climate change, there is a growing interest in reviving the economic value of hedgerows through managing them once again for woodfuel, mainly through coppicing. Most English hedges are currently managed by annual flailing, a costly practice which eventually leads to degradation of the hedge without periodic rejuvenation by laying or coppicing. Likewise under-management, where the hedge is left to develop into a line of trees, also results in the loss of hedgerows. Managing hedges for woodfuel through coppicing therefore provides an opportunity to rejuvenate old hedges, restoring not only their economic role but their value to the wider landscape.

Managing hedges for woodfuel by coppicing has the potential to:

- Improve their vigour and longevity, and therefore persistence in the landscape for future generations
- Improve their value to wildlife and maintain their functions and benefits within the landscape
- Reduce hedge flailing and overall hedgerow management costs
- Provide timber, woodchips and logs, which can be used on-farm or sold
- Provide a source of local, carbon-friendly and renewable energy.

Coppicing hedgerows could save you money

Most hedges in England are managed by flailing with a tractor-mounted hedge cutter. This is often carried out annually, particularly on arable farms and roadside hedges. Managing hedges by flailing takes time and costs money every year, but earns nothing and doesn't contribute to the farm business. It may be relatively easy and a lot quicker than hedge laying or coppicing, but when carried out year-after-year to the same height, does little to improve the hedge as a wildlife habitat or erosion and runoff buffer strip.

Flailing costs 88p per metre, that's £13.20 per metre over 15 years, including diesel, machinery costs, wear and tear, depreciation, and labour costs to flail the top and sides of a 2m high hedge each year.⁴ This amounts to £8,800 to flail 6.2 miles/10km of hedge annually. Alternatively a new method of hedgerow management could be introduced - hedgerow coppicing - where suitable hedges are allowed to grow up over 10-20 years and their outgrowth kept in check through side flailing every three years, before being coppiced for woodfuel. **A total of £9.68 per metre of hedge could be saved in flailing costs over the 15 year hedge coppice cycle** if side-flailed four times over that period.¹

Front & back cover photos: Hazel and blackthorn hedge at Elm Farm being coppiced for woodfuel as part of the hedgerow harvesting machinery trials 2014.

How to manage hedges for woodfuel

Hedgelaying or coppicing?

Coppicing has been shown to yield better results in terms of economics and biomass output compared to hedgelaying. Coppicing a hedge and chipping the harvested biomass takes only one ninth of the time it takes to lay a hedge and produce logs, where as much as 70% of the biomass is either left in the hedge or burnt as brush.⁵ Both coppicing and hedgelaying stimulate dense bushy growth at the base of a hedge, however hedgelaying also provides some level of habitat continuity and creates a livestock-proof barrier. This guide only considers coppicing; for more information on harvesting timber after hedgelaying see *Hedges for Woodfuel Handbook* produced by the Devon Hedge Group (www.devon.gov.uk/hedges) and for further information on hedgelaying see the National Hedgelaying Society (www.hedgelaying.org.uk).

Woodchip or logs?

Whether you want woodchip, logs or timber from a hedge will affect how it is managed, harvested and processed. Equally, hedge type and species composition will determine the products it can produce. This guide focuses on the production of woodchip for use in woodfuel boilers.

Which hedges are suitable for coppicing?

Hedges should ideally be at least 5m and preferably 7m in height before being coppiced for woodfuel, and stems should be 10-20cm in diameter; the bigger they are the more biomass will be harvested. If a hedge is not yet ready to coppice for woodfuel, avoid top-cutting allowing stems to grow up tall. The sides of the hedge may need trimming every three years to reduce the impact on the adjacent crop or road.

Both mixed and single species hedges can be valuable for woodfuel. Most broadleaf species respond well to being coppiced; those that are especially suitable include hazel, sweet chestnut, willow, ash, sycamore, alder, birch and elm.⁶ Poplar and birch coppice well, but will regrow both from the roots with suckers and from the cut stool.⁷ Field maple and hawthorn also coppice well but are slow growing, as are oak, hornbeam and beech. These three species were all traditionally grown as coppice, but regrow less reliably especially when mature and require specialist practices, such as coppicing them at the right time of year. Wild cherry, blackthorn and aspen do not coppice well but sucker instead and are not ideal species for hedgerow coppice systems, as is also true for pure hawthorn and/or blackthorn hedges. Some species such as hazel, sweet chestnut, willow, ash, alder, and lime also respond well to layering, a technique which can be used to replant gaps.

Growth rate and length of coppice cycle will vary between species and site conditions. Fast growing species such as willow and poplar respond well to harvesting cycles of 3-5 years, while sweet chestnut, ash and hazel are well suited to a coppice rotation of 10-20 years.⁸ The slow-growing species like field maple and oak need to be managed on a

longer rotation of 20-30 years and can also be managed as standards. In summary, it is likely that you will get some regrowth from most broadleaf species, but if you have hedges which predominantly consist of species listed here as less reliable, then it is recommended that you seek further specialist advice before coppicing them.



Recently coppiced hazel stool (above) and 1.1m hazel regrowth seven months later (below).

TOP TIP Try to synchronise fence replacements with your coppice rotation. Once a hedge has been brought into a coppice rotation, replacement of the fence will likely coincide with the next coppice, the lifespan of timber fence posts being approximately 15 years. This will help to reduce the costs of fence removal and replacement.

Managing different types of hedges

Every hedge is different, but most can be grouped into four general categories based on their physical characteristics and previous management. For each hedge type, recommendations on management for woodfuel and machinery options are given below. See the Hedgerow Management Cycle available from Hedgeline (www.hedgeline.com) for a more detailed description of hedge types and general management options.

Over flailed hedge

Description: Short and gappy hedge generally less than 2m high with few healthy stems, typical of flailed arable enclosure hedges. Shrubs are often thorny species such as hawthorn and blackthorn poorly suited to woodfuel production.

Management: This hedge type is generally unsuitable for woodfuel production, especially if it is predominantly hawthorn and blackthorn. In this case the hedge could be enhanced as wildlife habitat by planting up any large gaps and relaxing the flailing regime to side flailing every three years, or allowing the hedge to get a little bigger every time. If it is a mixed species hedge comprising good coppice species, and stem density and vigour is sufficient, the hedge could be allowed to grow up for future coppicing. Coppicing should then encourage new growth and allow for gaps to be planted up, and invasive or undesirable species, such as elder, removed. If the hedge is small and thin, and you wish to rejuvenate it by coppicing, any firewood can be extracted and the brash burned.

Machinery options: Manual fell with chainsaw or tractor-mounted circular saw.



Photo: Rob Wolton



Thick shrubby hedge

Description: Thick hedge with a high density of healthy stems 2-5m high. Often a mixture of shrub species, ideal for managing for woodfuel especially if there are high proportions of fast-growing species suitable for coppicing such as hazel, sweet chestnut, willow, poplar or ash.

Management: Coppice when stems are around 10-20cm in diameter and 5-7m tall. Any gaps can be planted up soon after coppicing. The hedge material can be chipped for woodfuel or processed for firewood.

Machinery options: Assisted fell technique, manual fell with chainsaw, or circular saw (if trees are less than 5m high and 20cm in diameter on average).

Tall gappy hedge

Description: Tall and generally gappy hedge typically over 5m high, which comprises a line of small trees, often of several species as these are typically old established hedges. The shrub layer may vary from dense to thin with more usual hedgerow shrub species present such as thorn and hazel. Larger stems are likely to be 15-20cm diameter, ideal for managing for woodfuel by felling and coppicing.

Management: Coppice when stems are around 10-20cm in diameter. Any large gaps could be planted up with shrubs straight after coppicing, however newly planted trees or shrubs could struggle with competition from established hedge plants, so would need to be checked. Small gaps may be better gapped up by layering or planting a young tree. Locally appropriate or fast-growing biomass species good for woodfuel production could be planted.

Machinery option: Assisted fell technique, hydraulic tree shears or felling grapple with chainsaw bar.



Line of mature trees

Description: These hedges are lines of mature or nearly mature trees, often with little or no understorey due to shading. Trees are generally mixed broadleaf species.

Management: Where possible, retain these hedges as a line of trees and a landscape feature for as long as possible, managing on a long rotation appropriate for the species as you would in woodlands. When trees die or are felled a hedge can be replanted. If coppiced, leave one hedgerow tree every 20m or so for landscape and wildlife considerations. As these trees mature they can be thinned, to one tree every 50m, to avoid shading out coppice regrowth. The whole-tree hedge material can be chipped for woodfuel. Alternatively, cordwood can be extracted as firewood or saw timber and the remaining material chipped.

Machinery option: Assisted fell technique, hydraulic tree shears or felling grapple with chainsaw bar.

Photo: Emily Ledger, Natural England

Hedge management planning

The rotation and management of hedges should be planned on a farm or landscape scale. Start by mapping your hedges and identifying any hedges unsuitable for coppicing for woodfuel. This may be due to their historical or wildlife value or other functions such as visual screening. Assess the remaining hedges for their suitability for woodfuel in terms of size and species composition. As a general rule, no more than 50% of your hedges should be managed for woodfuel and no more than 5% of your hedges should be coppiced in any one year.⁹ It is also important to consider landscape connectivity; try to maintain or improve linkages between habitats such as woodlands and ponds. A comprehensive plan should be drawn up to cover all suitable hedges on the farm, and an appropriate rotation and scale of working chosen.

An example of a hedgerow management plan can be found at <http://tinyurl.com/TWECOM>

Making sure a coppiced hedge regrows

It is essential that if you plan to coppice a hedge, you are confident it will regrow, and are able to protect it to ensure it does, otherwise you will lose the hedge and its benefits within the landscape. If a hedge does not regrow or regrowth is poor it will need to be replanted or gapped up.

To ensure vigorous regrowth it is important to coppice during winter dormancy. The quality of the cut may also impact regrowth; cuts should be clean with no separation of the bark from the wood. Ideally leave a minimum of 5cm of wood when coppicing a stem. If stems are cut too high the stool may become too tall and unstable over several coppice rotations. Cuts should be angled so water drains away from the centre of the stool or stump. The use of certain mechanised coppicing options, such as hydraulic tree shears, may require a chainsaw to tidy up their cuts following coppicing. The ability of stems to regrow following coppicing often declines with age and will vary with species and site conditions, so bear in mind some mature trees may fail to regrow when coppiced and could require replanting. Newly planted or coppiced hedges are vulnerable to browsing by rabbits, hares, deer and even livestock. Erection of temporary deer fencing may be necessary until the regrowth is well established and measures may need to be taken to control deer and rabbit numbers.

Preparing hedges for coppicing

To prepare a hedge for coppicing, fence removal and cutting back of outgrowth may be required. Some mechanised coppicing options, for example manual fell with chainsaw or machines with a good reach, such as tree shears or felling grapple with chainsaw bar, may be able to carry out coppicing without needing to remove external fences. However, it is important to remove all wire, such as old fencing, from inside the hedge before coppicing and chipping to ensure machinery is not damaged and the blades blunted. It may also be easier to coppice a hedge once its outgrowth has been cut back.



Overgrown hedge where outgrowth needs cutting back before coppicing

Other things to consider

Ownership: Ascertain the ownership of a hedge before you coppice it, particularly if it is a boundary or roadside hedge. Even if you do own it, you may want to consult your neighbours and inform local residents as coppicing a hedge will have a significant, but temporary, impact on the landscape.

When to coppice: Best advice is to coppice hedges between 1st September and 30th April, in line with the Cross Compliance rules (see p14). You can coppice either in late autumn, as soon as most of the leaves have fallen and before the ground gets too wet, or in late winter when the ground starts to dry out, depending on the weather and ground conditions each winter. If hedges are coppiced in autumn, coppiced material should ideally be left out in the field so the leaves fall off before chipping. Coppicing in late winter (January/February) allows birds to make good use of the hedgerow berries over the winter, although coppicing after the end of February should be avoided if at all possible because of the nesting season for birds and small mammals.

Access: Consider the accessibility of the hedge when choosing which machinery to use. Ensure all harvesting and processing machinery can get to the hedge without issues such as narrow gateways or overhead cables and powerlines.

Ground conditions: Where possible avoid coppicing when the ground conditions are poor. Some hedges may not be suitable for coppicing during the winter because of low-lying or wet ground; these hedges may have to be coppiced as soon as possible in September or in April. To minimise rutting and compaction, use extra wide or flotation tyres on heavy machinery and choose tracked vehicles where possible. Ground damage can also be reduced by the use of brush mats, rubber mats or metal tracking, however their use will have time and cost implications and may restrict machinery movement.

Wildlife considerations

Hedgerows are one of the most important farmland habitats for wildlife. They provide food and shelter for numerous mammals, birds and invertebrates, including rare species such as the dormouse and beneficial insects such as bees. When managing hedges for woodfuel it is essential to consider any potentially harmful impacts on wildlife, for example, hedges which link woodlands and are potential dormouse corridors could be mapped, and left to be maintained as thick hedges. It is also important to be aware of the legal restrictions with regards to nesting birds and protected species (see p14).

Managing hedges for woodfuel brings a number of benefits. Coppicing on a rotation provides a diversity of hedge structure within the landscape, providing more habitats for a wider range of flora and fauna. Although healthy hedges regrow rapidly, coppicing does create breaks in habitat continuity and may temporarily affect the movement of some species such as the hazel dormouse. A hedge allowed to grow tall to produce suitable sized stems for coppicing may also become less dense at the base reducing cover for wildlife.

Hedgerow management has a strong influence on fruit (berries and nuts) production with experimental studies showing hawthorn berry yields from hedges cut every three years exceed those annually and biennially flailed due to fruit only occurring on second year growth.¹⁰ Although fruit production will be diminished for a few years after coppicing, a hedge under coppice management which is only side flailed every three years is likely to provide a much better food resource to wildlife than a hedge which is flailed annually.

Recommendations

- No more than 50% of hedges on a farm should be managed for woodfuel⁹
- No more than 5% of hedges on average should be coppiced in one year, or 10% every two years⁹
- Aim to maintain and improve habitat connectivity across the farm, linking existing habitats
- Coppice hedges in late winter (Jan-Feb) to maintain food resources (hedgerow nuts and berries) and avoid nesting birds
- Retain dead wood within hedgerows wherever possible
- Maintain existing hedgerow trees, and allow new ones to grow up; ideally aiming for one mature hedgerow tree every 50m or so. As these trees mature they can be thinned to avoid shading out coppice regrowth.
- Use native and locally appropriate species when planting new hedges or gapping up old hedges. Layer existing hedgerow shrubs where possible to fill any gaps.
- Side flail every two to three years, or if cutting every year, retain about 4"/10cm new growth
- Do not cultivate, spray or fertilise within 2m of the centre of a hedge



Installing dormouse nesting tubes at Elm Farm. Inset, a dormouse nibbled nut

A healthy hedge for wildlife has

- **Good density:** especially at the hedge bottom providing food and cover
- **Good size:** good width and height to provide livestock shelter and wildlife habitat
- **Good diversity:** of tree, shrub and ground flora species to provide food and shelter for a wide range of wildlife
- **Good connectivity:** with other hedges and semi-natural habitats within the landscape
- **Well placed:** hedges across slopes (contour planted) to provide extra buffering from erosion and runoff.



Gatekeeper butterfly on brambles

More information

For further information on how to manage hedges for wildlife, see the *Hedgerow Guidance Leaflet* produced by PTES (www.ptes.org) and the Hedgeline website (www.hedgeline.com). The *Hedgerow Biodiversity Protocol* developed by The Organic Research Centre is a rapid survey-based tool which can be used to evaluate and monitor the wildlife impacts of managing your hedges for woodfuel. The protocol is freely available from the TWECOM project page of The Organic Research Centre website: <http://tinyurl.com/TWECOM>

Hedgerow berries, such as guelder rose are an important food source for many birds.

Harvesting machinery options

Many different machines and combinations of machines can be used for harvesting hedgerows mechanically; these can be broadly grouped by their cutting mechanism.

Hydraulic tree shears: cut or fell trees using hydraulically-powered shears or steel blades to slice through the timber. Usually integrated into a timber grab, feller-buncher or accumulator arm to hold and manipulate the felled tree and typically excavator mounted.



Integral chainsaw cutting bar: most often found in bioenergy felling heads or felling grapples, generally accompanied by some kind of timber grab and typically excavator mounted.



Integral circular saw: although not covered in this guide, these can be found in forestry harvesters such as the Bracke Forest C16.c (www.brackeforest.com), are usually integrated into a timber grab, feller-buncher or accumulator arm and are excavator mounted.



Circular saw: generally tractor-mounted on a hedge cutting arm, and can include one to four circular saw blades. Also known as shaping saws.

Manual chainsaw: aside from a manual saw this is the most basic yet versatile felling machine, which comes in a variety of sizes depending on the size of timber and situation.



Selecting the best options for you

All of the machinery options and methods detailed in this guide have their merits; however certain machines will be better suited to different situations. Which machinery option is best for your situation will largely depend on the type of hedge you are coppicing and how much hedge you plan to coppice.

For tall overgrown hedges with a large number of single stemmed trees, harvesting options such as the felling grapple with integral chainsaw bar or hydraulic shears work well. These options allow for the fast and safe felling of larger diameter material.

Similarly, a crane-fed drum chipper will be able to handle larger diameter timber. If a hedge is made up of smaller diameter material options such as assisted fell technique, manual fell with chainsaw, and circular saw will be more appropriate.

If you have a short section of hedgerow to harvest (less than 100m) it may be more economical to use smaller scale options such as manual fell with chainsaw and a manually-fed disc chipper. If using larger scale machinery options such as the assisted fell technique and a crane-fed drum chipper, make sure you have enough hedge length and material (around 250m) to keep hired machines busy for a full day. This could be achieved by leaving coppiced hedge material in situ until you have enough biomass to warrant the use of a large scale chipper. Alternatively, you could team up with neighbouring farms and share the cost. The length of hedge you can expect each option to harvest or chip in one day can be found within the machinery descriptions under the key performance attributes.


Information on a series of hedgerow harvesting machinery trials carried out by the Organic Research Centre, evaluating the performance of the harvesting and processing machinery options detailed in this guide, can be found on the TWECOM project page of the Organic Research Centre website: <http://tinyurl.com/TWECOM>

TOP TIP Make use of what you have. To minimise the costs associated with harvesting hedges, consider what machinery, equipment and resources you already own or have access to when deciding on which machinery option to use. Also consider working collaboratively with neighbours.

Harvesting machinery options

Key to performance attributes

Score	Machine availability	Purchase cost	Haulage requirements	Length of hedge /day
1	Regionally	Over £10,000	Low loader required	Less than 50m
2	Within county	£5,000-£10,000	Can use own trailer	50m – 100m
3	Locally	£1,000-£5,000	Self-drive within 10 miles	100m – 200m
4	On-farm or nearby	Under £1,000	Self-drive	More than 250m

Hire cost This chainsaw figure represents the day cost of hiring one chainsaw and operator (£150/day in 2015) and is used to represent the relative cost of each machinery option 

Purchase cost This is for new machinery, not including a tractor or excavator

Chainsaw man: INVERDE


Felling grapple with chainsaw bar

Options: Small to medium scale options include the Gierkink felling grapple GMT 035 (www.gierkinkmt.nl), the Mecanil XG220 energy wood head (www.mecanil.fi) or the Biojack 400S (www.biojack.fi)

Pros: Can be mounted on any size excavator from 5 tonnes upwards depending on ground conditions, site access and reach required. Very manoeuvrable enabling controlled felling. Can be used on a range of stem diameters. Well suited to larger single-stemmed trees. Produces a clean and tidy cut.

Cons: Requires good ground conditions. Thin, multi-stemmed material such as coppice stools found to be more difficult to cut because of minimum diameter of grab which cannot hold thin stems securely to cut cleanly. On sloping terrain it may be hard to cut close to the ground. Requires low loader to transport excavator:



Hire cost	Machine availability	Purchase cost	Haulage requirements	Length of hedge/day
	1	1	1	3

Based on Gierkink felling grapple GMT 035 on a 5t excavator cutting a tall overgrown hedge with many single-stemmed field maple trees


Tractor mounted single circular saw

Options: Numerous makes of circular or shaping saw are available both new and second hand, most are tractor-mounted on a hedge-cutting arm. Because of the lack of directional control of the material being felled, they are generally used in combination with a second tractor with front-mounted fork to move material after felling. Multi-blade saws are also available such as the Bomford Turner ProSaw (www.bomford-turner.com) or Kirogn tri-blade or 4-blade saw (www.kirogn.fr).

Pros: A common and relatively inexpensive piece of agricultural machinery. Very good at cutting back outgrowth before coppicing. Well suited to coppicing thin multi-stemmed material such as short rotation coppice.

Cons: Poorly suited to larger material due to lack of directional control of falling material; tall trees must therefore be cut in sections. Larger trees may need to be felled manually due to a limited cutting diameter and height. A second tractor with front-mounted fork may be useful to clear fallen material out of the way.



Hire cost	Machine availability	Purchase cost	Haulage requirements	Length of hedge/day
	3	3	3	2

Based on a tractor mounted Fisher Humphries 36"/90cm single circular saw cutting a tall overgrown hedge with many single-stemmed field maple trees. Purchase cost does not include hedge-cutting arm.


Hydraulic tree shears

Options: Dymax Tree Shears range from 10-20"/25-60cm (www.treeshears.co.uk). Larger tree shears are also available, such as the Westtech Woodcracker (www.westtech.at) which can fell large trees up to 20-24"/50-60cm diameter.

Pros: Flexibility to choose size of excavator and size of tree shears based on size of material to be coppiced and ground conditions. Well suited to larger single stems and lines of trees. Shears more robust against stones and wire than saw blades.

Cons: Requires good ground conditions. Not well suited to thin, multi-stemmed material such as coppice stools due to limited manoeuvrability. On sloping terrain it may be hard to cut low to the ground. Produces an untidy cut with splinters; however a chainsaw can be used after for a cleaner finish. Requires low loader to transport excavator.



Hire cost	Machine availability	Purchase cost	Haulage requirements	Length of hedge/day
	1	2	1	3

Based on 10"/25cm Dymax tree shears on an 8t excavator cutting a 28 year old hazel coppice hedge with blackthorn outgrowth


Assisted fell technique

Options: Assisted fell technique refers to a man with a chainsaw using the standard motor manual method of tree felling, but supported by an excavator or tractor with a front-mounted land rake or fork.

Pros: Able to work on most sites and hedges. Flexibility to choose size of excavator based on size of material to be coppiced and ground conditions. Excavator able to carry out most of the physical work in extracting and moving the hedge material. Effective at removing all biomass material from hedge, maximising biomass harvest. Ideal for long lengths of small to large hedge.

Cons: Needs good ground conditions. When using the land rake to extract material, brambles, dead twigs and soil may also be picked up which will negatively affect woodchip quality. Requires low loader to transport excavator. Requires chainsaw operator and excavator driver to work in close proximity. There are some health and safety concerns about this method.



Hire cost	Machine availability	Purchase cost	Haulage requirements	Length of hedge/day
	3	3	2	4

Based on two person team, chainsaw and excavator-mounted land rake cutting a 28 year old hazel coppice hedge with blackthorn outgrowth


Manual fell with chainsaw

Options: Two person team, one using a chainsaw to fell trees using the standard motor manual method, the other supporting stems and extracting and stacking the material.

Pros: Able to access most sites and hedges. No compaction or rutting in poor ground conditions. Clean and tidy cut. Able to remove all hedgerow material from hedge, maximising biomass harvest. Able to neatly stack material ready for chipping. Well suited to shorter, difficult to access lengths of hedge.

Cons: Slow work, particularly to extract and move brush and larger cordwood. Greater risk when felling tall trees. Time is required for re-fuelling and saw sharpening throughout the day. Rate of felling very dependent on mean diameter of hedgerow material and proportion of large diameter trees.



Hire cost	Machine availability	Purchase cost	Haulage requirements	Length of hedge/day
	4	4	4	1

Based on two person team and chainsaw cutting a 28 year old hazel coppice hedge with blackthorn outgrowth

Processing machinery options


Large-scale crane-fed drum chipper

Options: A tractor towed Heizohack HM8-500K fuel grade biomass drum chipper with telescopic crane can chip up to 28"/71cm diameter timber (www.heizomat.de). Tractor towed Jenz HM360 fuel grade drum chipper with telescopic crane can chip up to 14"/36cm diameter softwood and 12"/30cm diameter hardwood (www.jenz.de). Both can be fitted with an integral 35/40mm sieve to produce G30 chip and have auto feed/no-stress control as standard.

Pros: Crane-fed systems are very fast and effective, allowing for large bundles of material to be processed. Integral 35mm sieve prevents most shards and splinters going through to ensure good woodchip quality. Telescopic crane enables more material to be reached without having to move the chipper and cause further ground disturbance or compaction.

Cons: Heavy machinery that can cause rutting and compaction in poor ground conditions. Needs long lengths of hedge to justify its high hire costs.



Hire cost	Machine availability	Purchase cost	Haulage requirements	Length of hedge/day
	2	1	3	4

Based on a Heizohack HM8-500K crane-fed chipper chipping material from 28 year old hazel coppice hedge with blackthorn outgrowth. The Jenz HM360 fuel grade drum chipper scored similarly when chipping material from a tall overgrown hedge with many single-stemmed, 30 year-old field maple trees.

Small-scale manually-fed disc chipper


Option: 6"/15cm TW 150 DHB Timberwolf disc chipper has a Kubota 4 cylinder 35 horse power diesel engine and doesn't need a tractor or PTO shaft (www.timberwolf-uk.com). It is road towable with a braked road chassis, and as it is less than 750kg it does not require a special licence from DVLA to tow it. Popular with landscapers. Other small and medium-size disc chippers are available from TP Wood Chippers (www.linddana.com) and Forst (www.forst-woodchippers.com).

Pros: Very small, relatively light and can be manoeuvred by hand into tight spaces. Ideal for hedges where there is limited vehicle access. Causes little compaction of the ground. Capable of producing clean small woodchip. Feeding material by hand allows for a greater scrutiny of the material being chipped, enabling root balls with earth attached to be removed. Relatively easy and simple to use.

Cons: Labour intensive to manually feed material into chipper, especially if material is entangled. The quantity of material which can be fed at one time is limited by the intake width, designed for small diameter single-stemmed timber. Takes at least a two man team to keep the chipper fed and chipping. The chipper does not have variable intake speed control or any sieves or screens fitted as standard to prevent shards and splinters, although these can be retro-fitted on some models. Larger pieces of wood (6-8"/15-20cm diameter) may need cutting diagonally in two with a chainsaw in order to feed them into the chipper. Very noisy.



TOP TIP it is important to keep the blades of chippers sharp to ensure good quality chip and to use a sieve to screen out long shards and splinters

Hire cost	Machine availability	Purchase cost	Haulage requirements	Length of hedge/day
	3	3	4	2

Based on a 6"/15cm TW 150 DHB Timberwolf disc chipper chipping material from 28 year old hazel coppice hedge with blackthorn outgrowth

Storing and drying woodchip

There are a number of options when it comes to drying and storing your woodchip. Whether you are able to store coppiced material out in the field, have a concrete yard (to store woodchip under a geotextile), or a suitable barn for self-drying may determine whether you chip your hedge material green or dry.

Air-drying in field

If you have enough space to do so or are able to be flexible with agricultural operations, the coppiced material can be left in situ to air-dry for a few months before being chipped and moved to a barn for storage, covered by a geotextile or sold direct from the farm gate. Providing a relatively dry winter, you can expect the resulting woodchip moisture content to be around 25% after 3.5 months.¹¹ This method of drying often produces much cleaner chip than chipping green and self-drying, with little or no mould, and may be the least expensive option if sold as chip straight from the field reducing any further handling or storage costs. Depending on the species and size of the logs, fuel use and wear and tear on the chipper may be higher when chipping dry wood and may result in a higher percentage of shards and fines. A crane-fed chipper should be used to handle and process this material



Whole-tree hedgerow material left in field to air dry (above) and green woodchip being tipped in barn to self-dry (below).

Self-drying under cover

If chipping your hedge material shortly after coppicing, you can expect a woodchip moisture content (MC) of around 50%. This woodchip will need to be stored in a well-ventilated barn with open ends to aid the drying process and to avoid the growth of mould. It is advised not to turn the pile as this will encourage composting. Even small piles of green woodchip will quickly start to heat up. This heating process will drive moisture up through the heap from where it evaporates. Woodchip piles should be steep-sided to aid this process. After a few months you can expect a MC of around 25-30%, an acceptable level for use in most woodchip boilers. Although self-drying can be a cost-effective method of drying, a small amount of dry matter (3-5% per month when above 30% MC) is lost due to decomposition, lowering the calorific value of the woodchip. If mould does form, it is advisable to wear a protective dust mask when moving the woodchip to avoid any respiratory health issues. Green woodchip can also be stored outside to self-dry under a geotextile cover provided you have a suitable area of concrete hardstanding. Although there may be higher dry matter losses compared to drying in a barn, these may be partly compensated by the low costs of this method.



Forced drying

Green chip can also be force dried using a barn or hooklift bin with underfloor ventilation, where either heated or ambient air is forced through the heap using fans or a grain dryer. This is likely to increase the cost of drying but *may* decrease drying time and dry matter losses through decomposition. This method also produces much cleaner chip with little or no mould.

TOP TIP Hedgerow woodchip can also be used as gardeners' mulch, path surfacing material, animal bedding or composted and used as a soil improver. Alternatively the hedgerow woodchip could be screened at a larger-scale woodfuel hub to produce a higher quality chip, and the fines composted.

Woodchip quality

Woodchip is a highly variable fuel and can vary in size and moisture content. Using unsuitable woodchip in your woodfuel boiler may cause blockages in the fuel feeding system and inefficient operation. Some woodchip boilers are fussier than others when it comes to woodchip quality, with larger boilers tending to cope better with poorer quality or more variable woodchip. It is therefore important to match your boiler to the locally available woodchip or to the woodchip you plan to use.

The quality of woodchip is largely determined by the type of chipper, the screens used and how good the operator is at maintaining and setting up his machine, however the type of timber material being chipped also has a bearing. Whole-tree hedgerow woodchip contains a large proportion of twiggy material with a high percentage of bark, and is therefore likely to have a higher ash content (2-3%) than woodchip from virgin roundwood (around 1%). Removing cordwood from hedgerow material before chipping is likely to negatively impact the quality of the woodchip. Hedgerow woodchip may also contain a higher percentage of fine material and long shards or slithers. However with the right chipper and good operator experience, one can produce woodchip from hedgerow material that will meet industry standards, although it might be difficult to meet the larger grades such as G50. Hedgerow harvesting machinery trials have demonstrated that hedgerow woodchip can meet P16B and G30 grades under BS EN and Önorm woodfuel standards respectively.¹¹

Screening your woodchip to remove fines and large slithers could improve its quality and therefore market price; such processing will however increase the cost of production. Screening and drying costs approximately £1/m³ and £2/m³ of woodchip respectively.¹² Alternatively, some woodfuel hubs will buy hedgerow woodchip discounted by approximately £4/m³ on the basis they will then have to screen, dry and blend the woodchip before selling it on to their customers.¹²

Renewable Heat Incentive (RHI)

The Renewable Heat Incentive is a UK Government financial incentive to promote the use of renewable heat. By joining the scheme you will receive payments for seven years based on the amount of renewable heat you produce. For the non-domestic sector it provides a subsidy, payable for 20 years, to renewable energy producers. Ofgem is responsible for implementing and administering the scheme on behalf of the Department of Energy and Climate Change. For more information on eligibility and applications visit the Ofgem website (www.ofgem.gov.uk).

Biomass Suppliers List (BSL)

Self-suppliers, producers and traders of woodfuel who wish to access the growing RHI market will need to register on the Biomass Suppliers List, regardless of whether they sell, give away or use their woodchip themselves. BSL accreditation requires that 100% of timber in the supply chain is legal and 70% is sustainable. Application for small businesses and self-suppliers is quick and simple, requiring an online application where you will need to fill out a greenhouse gas calculator. For more information about BSL accreditation see the BSL website (www.biomass-suppliers-list.service.gov.uk).

Note: Arboricultural arisings or landscaper's waste is regarded as sustainable under the BSL; however there is currently no guidance as to how hedgerow material is classified.



Whole-tree hedgerow woodchip produced from chipping a hazel, blackthorn and field maple hedge at Elm Farm.

How does it stack up?

Cost savings

The major cost benefits to managing your hedges for woodfuel include the savings made on reduced flailing, reduced energy bills, and income generated from the sale of woodchip.

Managing hedges by flailing takes time and costs money, but earns nothing in return. By coppicing your hedges you reduce the need for regular hedge flailing to just side trimming every two or three years to control outgrowth if necessary. The potential savings from stopping annual or biennial hedge flailing for 15 to 20 years can be significant, although these will vary with hedge type and coppicing methods.

The table above shows a comparison of the management cost per metre of hedge over 15 years between flailing annually, flailing biennially, coppicing and chipping, and coppicing. The flailing costs assume £0.88 a metre. The coppicing cost is based on coppicing 280m of hazel coppice hedge using the assisted fell technique and side trimming every three years, while the coppicing and chipping cost includes the chipping of the resulting hedge material using a crane-fed drum chipper. A 280m hedge represents the optimum length of hedge to coppice using the assisted fell method and chip with a large drum chipper. All costs include haulage of machinery to site, but do not include the potential cost savings from using the woodchip as fuel, or the income from sale of the woodchip. The coppicing and chipping costs are based on the hedgerow harvesting machinery trials conducted by the Organic Research Centre in 2014/2015¹¹, where the assisted fell technique was found to be the most economical option trialled.

Based on the above costs, for a farm with 10 miles/16.1km of hedges, of which half are managed by coppicing for woodfuel, and around 400m are coppiced every year, savings of £29,880 over a period 15 years could be made. These potential savings from coppicing will, however, vary with hedge type and coppicing methods used.

Hedge Management	Management cost per metre over 15 years
Flailing annually	£13.20
Flailing biennially	£6.16
Coppicing and chipping	£8.22
Coppicing	£4.90

Energy value

The best way to make use of the woodchip you produce is to use it yourself in your own woodchip boiler. As a self-supplier you can expect a cost per unit of energy of 1.4-3.9 pence per kilowatt hour from hedgerow woodchip depending on hedge type and machinery used.¹¹ This is a favourable figure when compared to the cost of domestic heating oil which ranged from 3.6-7.3 pence per kilowatt-hour between 2010-2015.^{13,14}

Markets for woodchip

The market for woodchip from hedges is still developing and there is currently limited information on sale prices. Opportunities for selling your woodchip include community woodfuel co-operatives, woodfuel hubs, selling directly to neighbours or homeowners with woodfuel boilers and other self-suppliers. Larger more industrial woodheat installations such as power plants may also take larger quantities of woodchip and do not require high quality woodchip. Woodchip and wood pellets have become international commodities, but where the aim is to produce a local sustainable source of woodfuel, markets close by (within 25-35 miles) should be sought in order to minimise transport costs and maximise returns and sustainability.

The future of local energy?

Since the first German bioenergy village was set up in 2005, towns throughout Germany have started to source biomass from the local landscape.

The 850-person town of Oberrosphe is an award-winning bioenergy village with a cooperatively owned woodchip boiler which produces heat for 55% of the town's households. Landscaping waste from the local area is used as biomass for the plant.



Locally sourced landscape waste being delivered (above), and the processed aboriginal woodchip being stored at the Oberrosphe woodfuel heating plant (below).



Legal considerations

Cross Compliance

Farmers and landowners in England claiming rural payments from the government under the Basic Payment Scheme, Countryside Stewardship, and certain elements of the English Woodland Grant Scheme, need to comply with the cross compliance rules. These state that you must not cut or trim a hedgerow or tree between 1st March and 31st August, unless it is to carry out hedgelaying or coppicing during the period 1st March to 30th April (inclusive). Traditional hedge banks must not be cast up for maintenance between 1st March and 31st August. More information is available at www.gov.uk/government/collections/cross-compliance

Felling licence

A felling licence will be necessary from the Forestry Commission before coppicing a hedge if stems are to be felled which are 15cm or larger in diameter when measured at breast height (1.3m from the ground) and more than 5 cubic metres (timber volume) are to be felled in any defined calendar quarter, reducing to 2 cubic metres if any of the wood is to be sold. This licensable diameter reduces to 8cm or larger in diameter if felling single stems such as hedgerow trees. See the Forestry Commission website for more information (www.forestry.gov.uk).

Hedgerow Regulations 1997

It is not normally necessary to apply for consent under the Hedgerow Regulations 1997 before coppicing a hedge, provided cut stools are given adequate protection and allowed to regrow. If the intent is not to allow the hedge or any part of the hedge, however small, to regrow then a notice of intent to remove must be submitted to the local Planning Authority.

Tree Preservation Order

You will also need to contact your local Planning Authority if any of the trees to be felled or coppiced have a Tree Preservation Order (TPO) or are in a Conservation Area. Local Authorities usually have a map which shows the locations of all TPOs so you can check.

European Protected Species (EPS)

Several of the species covered by the Conservation of Habitats and Species Regulations 2010 may be associated with hedgerows. These regulations therefore have implications for how hedgerows can be managed and operations carried out. Such species include: all 17 species of bat, hazel dormouse, great crested newt, otter, sand lizard and smooth snake. For more information on EPS and the steps land managers should take to safeguard them see: www.forestry.gov.uk/england-protectedspecies.

Protection for designated sites

Work within Special Areas of Conservation (SACs) or Sites of Special Scientific Interest (SSSIs) may require Natural England's consent under Part II of the Wildlife and Countryside Act 1981 (as amended). Check with your Local Authority about more local wildlife site designations. For more details on protected sites see: www.gov.uk/topic/planning-development/protected-sites-species.

Wildlife and Countryside Act 1981

Wild birds and certain woodland animals and plants are protected under Part I of this Act. It requires you to carefully assess the impacts of tree work on wildlife, and ensure animals listed in the Act's schedules are not harmed or killed and that their nests or habitat are not damaged or destroyed.



Berry-rich mature hedgerow at Radford Mill Farm, near Bath

Summary

Owing their existence to agriculture, hedgerows have been shaped by centuries of human activity. However, the last century has seen a huge decline in their presence and quality due to the loss of a direct economic value, agricultural intensification, and the abandonment of traditional management practices such as coppicing and hedgelaying.

As a valuable resource in our rural landscapes, hedges need to be managed in a way which is sustainable, both economically and ecologically, and allows them to continue being healthy and vigorous so they persist for generations to come. The coppicing of hedges for woodfuel not only reduces the cost of managing hedges but provides farmers and local communities with a renewable, low cost energy source whilst supporting wildlife and improving the health of hedges. Although markets for hedgerow woodchip are in the early stages of development, those able to harvest and use woodfuel from hedges have an opportunity to make significant savings on the cost of energy. There's an opportunity to make the most of this underutilised resource and bring our hedges back into the farm business.

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Resources

Hedge management

Hedgelinek www.hedgelinek.org.uk

National Hedgelaying Society www.hedgelaying.org.uk

Devon Hedge Group www.devonhedges.org

The Woodland Trust www.woodlandtrust.org.uk are offering support for new hedge planting and reinstatement of old hedges. Contact the woodland creation team on Tel: 0330 3335303 or at plant@woodlandtrust.org.uk

Hedges for wildlife

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

Game and Wildlife Conservancy Trust www.gwct.org.uk

Policy and legislation

Defra www.gov.uk/government/organisations/department-for-environment-food-rural-affairs

Forestry Commission www.forestry.gov.uk

Natural England www.gov.uk/government/organisations/natural-england

Hedgerow woodfuel research

The Organic Research Centre <http://tinyurl.com/TWECOM>

TWECOM partners www.twecom.eu

The CORDIALE Project www.cordialeproject.eu

Sustainable energy and woodchip quality

DECC www.gov.uk/government/organisations/department-of-energy-climate-change

Ofgem www.ofgem.gov.uk

Biomass Energy Centre www.ofgem.gov.uk

Woodsure www.woodsured.co.uk

Grants and funding

Countryside Stewardship. A number of grants for hedgerow management are available www.gov.uk/countryside-stewardship-grants

The LEADER Programme. Fund mainly the purchase of capital items such as machinery. www.leader-programme.org.uk

Countryside Productivity Scheme. A new scheme for farmers, woodland owners and forestry contractors providing capital grants and funding for woodland management. www.gov.uk/government/collections/countryside-productivity-scheme

Useful publications

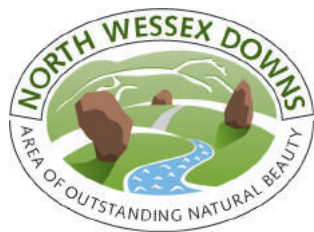
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TWECOM Best practice guide on Hedgerow harvesting machinery and methods (2015). Agrobeheercentrum Eco² and RLLK. Available from: www.twecom.eu

Further publications from The Organic Research Centre on the management of hedges for woodfuel are available from: <http://tinyurl.com/TWECOM>



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