Towards Eco-energetic Communities

Project Overview

Landscape features such as hedgerows have many functions and benefits within the agricultural landscape, including sheltering crops and livestock, supporting biodiversity, controlling erosion, buffering natural habitats from agricultural impacts and enhancing aesthetic appeal. They have significant cultural and historical value and are characteristic of many rural landscapes across Western Europe. Traditionally, they also provided a variety of wood products including woodfuel, although this economic function declined from the mid-20th century when fossil fuel replaced wood as the primary source of energy. Today, hedgerows are primarily valued for biodiversity, as reflected by their inclusion in UK agri-environment schemes. With the global development of the biofuel sector putting pressure on agricultural land to maximize both food and fuel production, is there a new role for hedgerows to provide a renewable energy resource and contribute to the sustainable intensification of agriculture? And how we optimise to harvest of hedgerows for woodfuel while maintaining their multiple ecological and social functions?

TWECOM (Towards Eco-energetic Communities) is an EU funded program running from January 2013 to September 2015. The project aims to investigate the feasibility of short chain biomass production for local communities using existing landscape features such as hedgerows.

What we want to achieve:

- *Enable local communities to become more independent for their energy needs*
- *Contribute to a more multifunctional landscape*
- *Contribute to reduction of carbon emissions and increasing carbon storage*
- *Support biodiversity*

Activities we are undertaking:

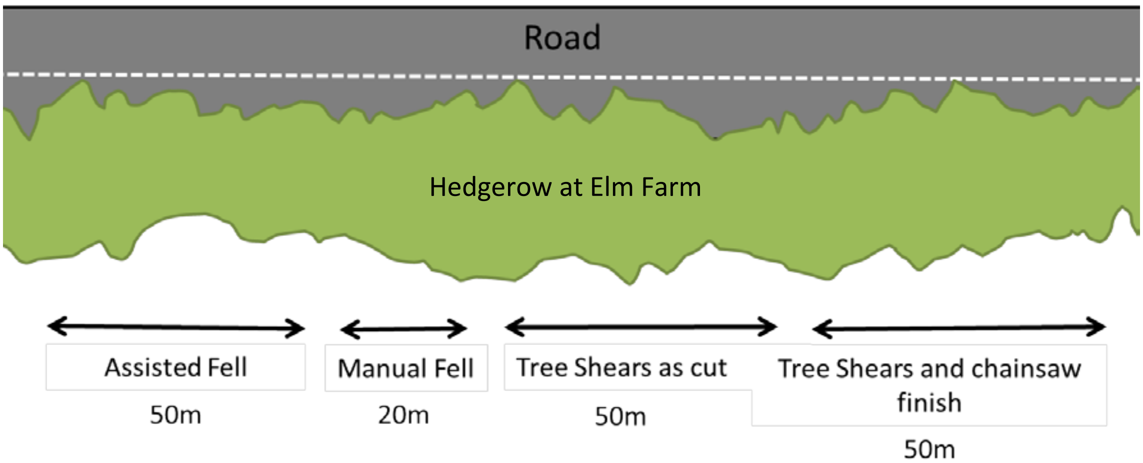
- *A pilot project at Elm Farm to develop a short chain system of harvesting biomass from hedgerows for local energy use through working with local farmers, landowners and the local community to develop a cooperative*
- ***Trialling the use of different machinery and methods for harvesting biomass from hedgerows***
- ***Investigating the effect of coppicing hedges on ecosystem service provision, including biodiversity, carbon storage and regional identity***
- *Developing a planning tool to optimise biomass production without compromising environmental and cultural values*

Our funders:

TWECOM Machinery Trials

Hedgerow at Elm Farm before coppicing: between 24-28 year old hazel coppice with blackthorn out-growth

Hedge at Wakelyns before coppicing: a mature hedge with large diameter trees predominantly field maple



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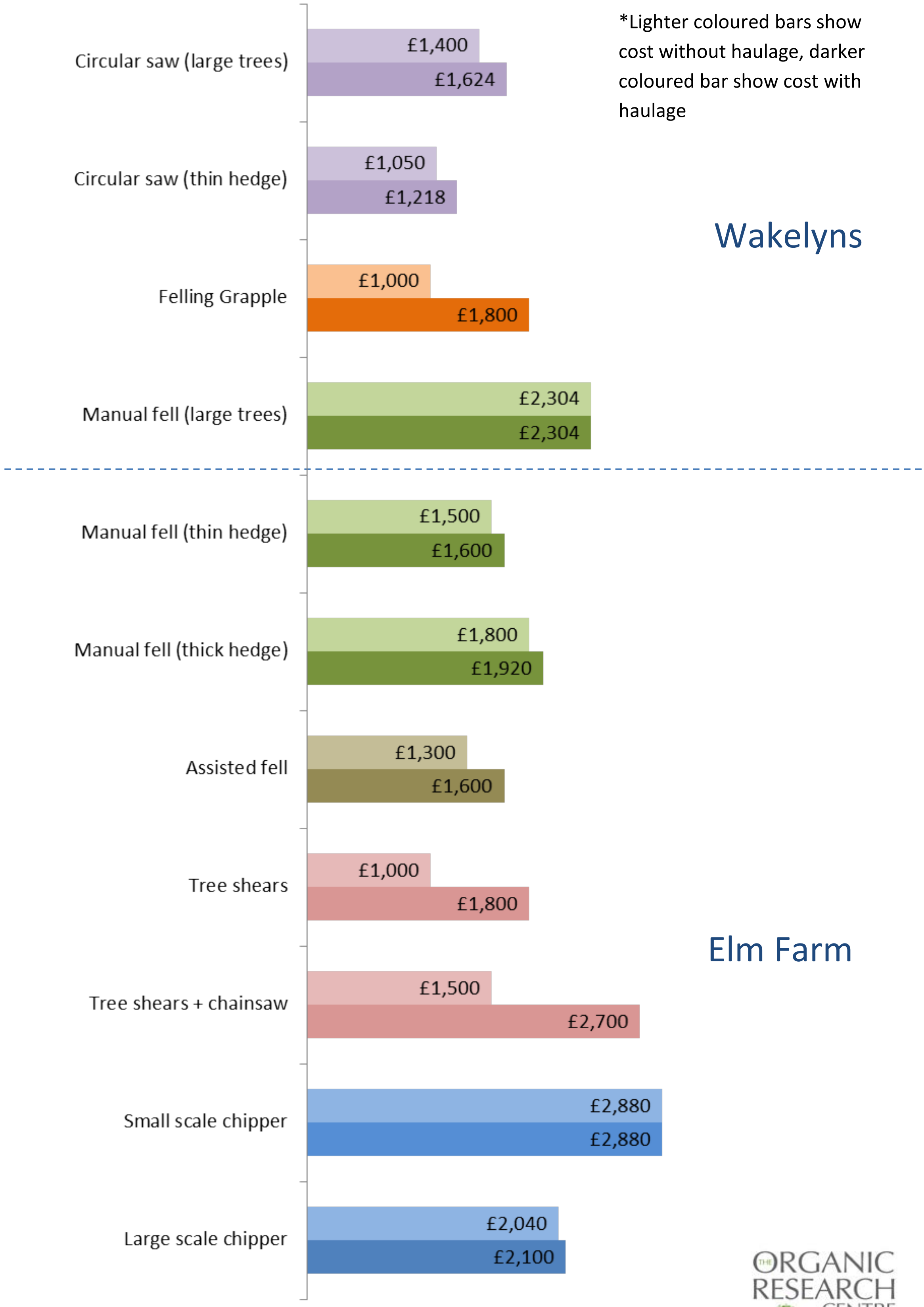
300m Hedge Case Study

How much would it cost to coppice 300m of hedge using each method?

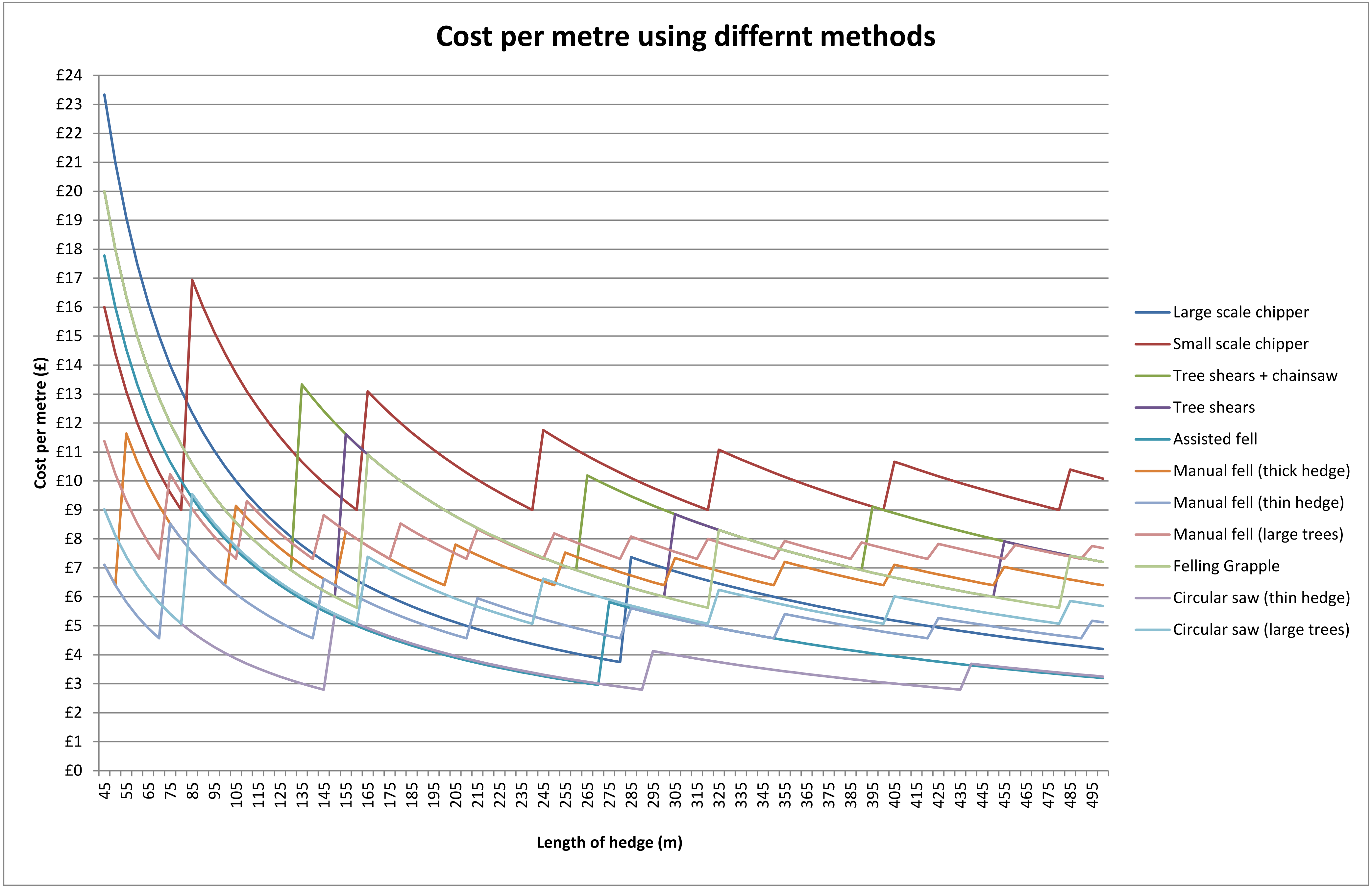




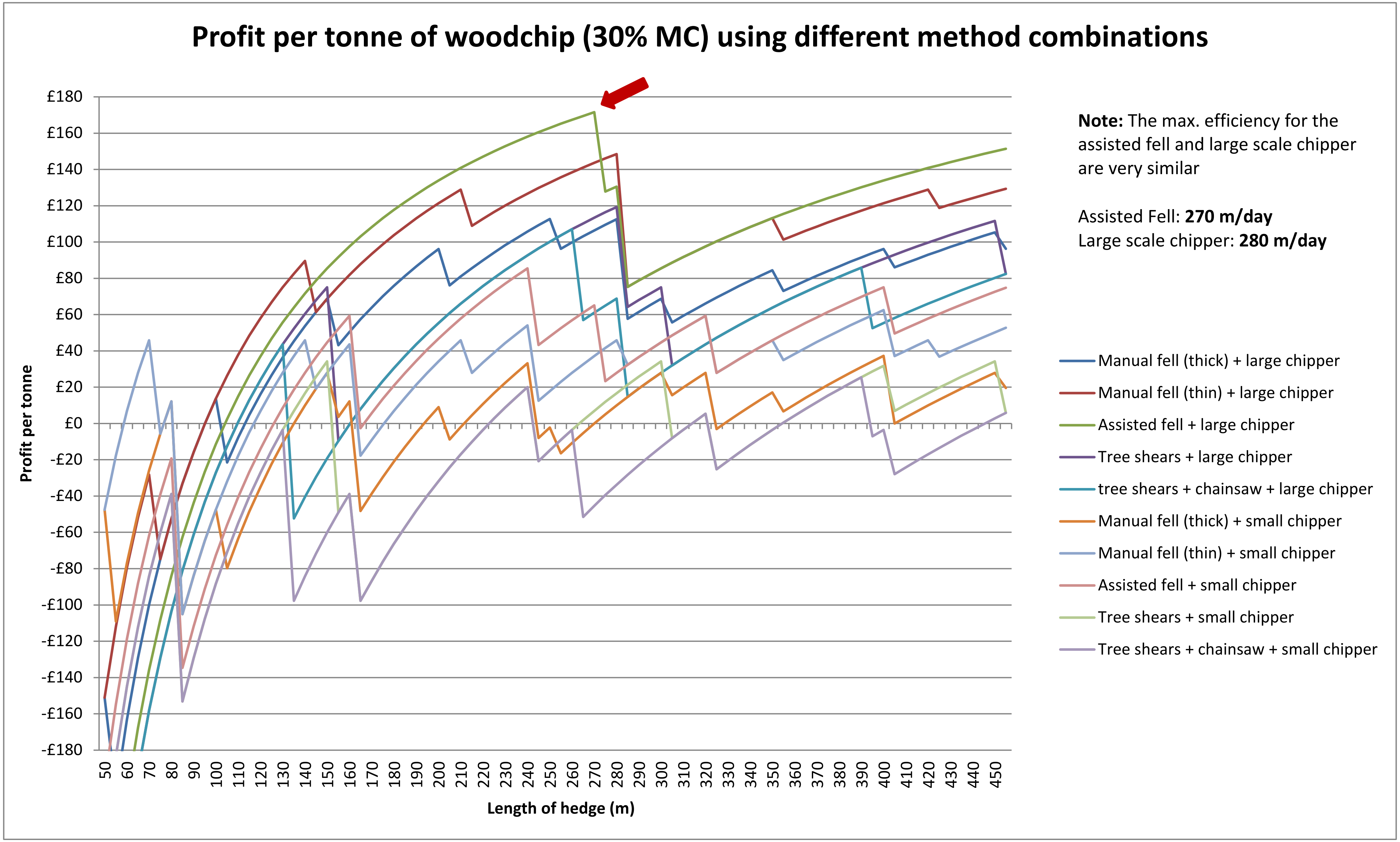




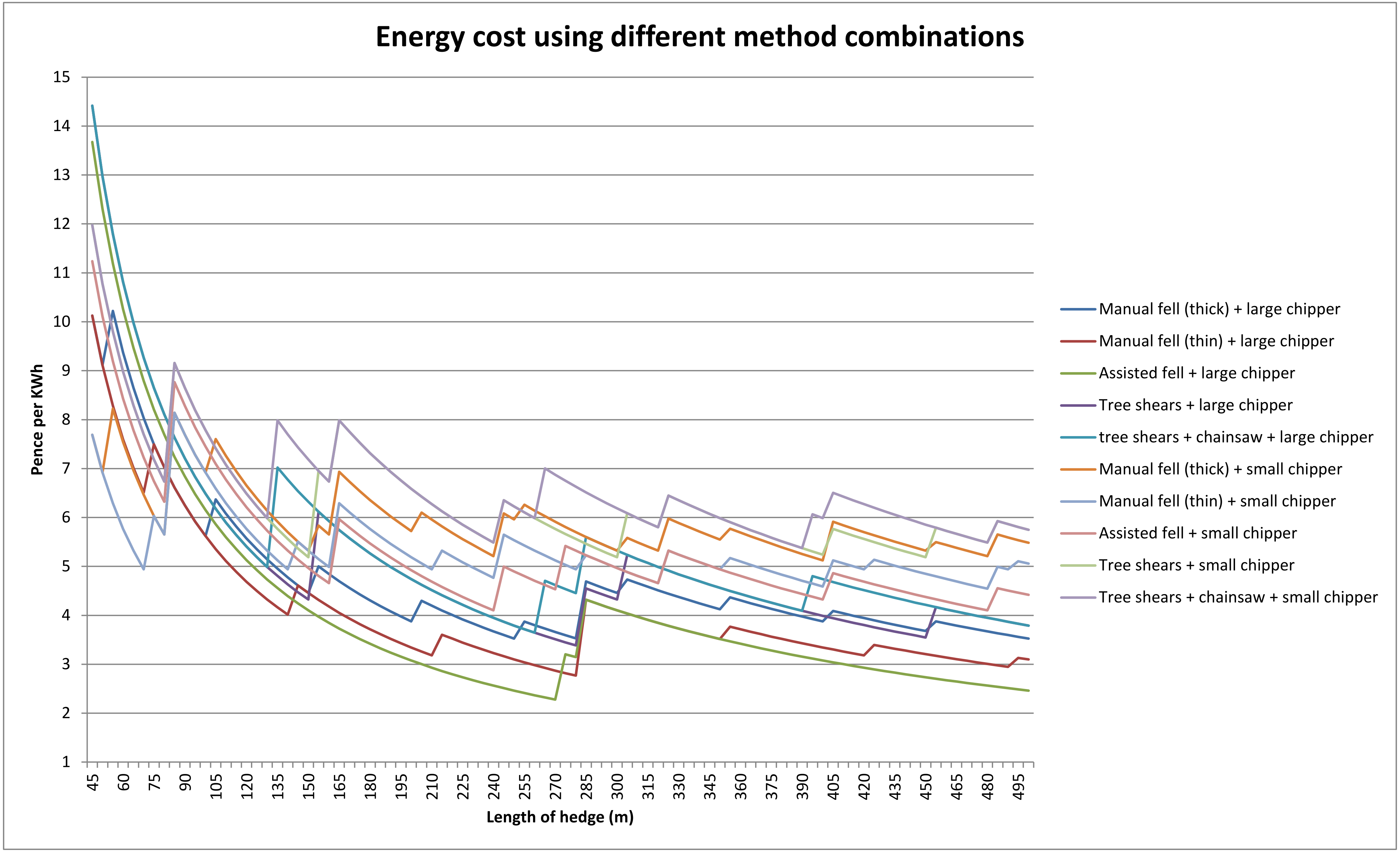
*Figures do not include VAT



*Figures include haulage costs but do not include VAT



*Figures assume a sale value of £75 per tonne (our best quote), include haulage costs but do not include VAT, and do not take into account transport costs to buyer



*Figures refer to woodchip at 30% MC, include haulage costs but do not include VAT, and no not include any transport costs for the woodchip

Potential Profit per Tonnes and Pence per KWh

Method	Optimal length of hedge (m)		Profit per tonne (25% MC) Exc. flailing savings at £13 per m		Profit per tonne (25% MC) Inc. flailing savings at £13 per m		Energetic cost (pence per KWh)	
Chipper choice	Large	small	Large	small	Large	small	Large	small
Manual fell (thick hedge)	250	400	-£91.43	-£166.80	£112.68	£37.32	3.5	5.1
Manual fell (thin hedge)	280	480	-£55.66	-£139.58	£148.46	£64.53	2.8	4.6
Assisted fell	270	240	-£32.58	-£118.65	£171.53	£85.47	2.3	4.1
Tree shears	280	150	-£84.82	-£169.94	£119.30	£34.18	3.4	5.2
Tree shears + chainsaw	260	390	-£97.11	-£178.64	£107.01	£25.48	3.7	5.4

*Figures include haulage, exclude VAT, and assume a sale value of £75 per tonne. Figures do not take into account the cost of transporting woodchip to the buyer.

Comparison of energy cost with other fuel sources

Fuel + method	Pence per KWh
Hedgerow woodchip @ 30% (large scale chipper)	2.3 - 3.7
Hedgerow woodchip @ 30% (small scale chipper)	4.1 - 5.4
Bought in woodchip @ 30%	3.5
Wood pellets	4.4
Natural gas	4.9
Heating oil	5.8
LPG (bulk)	6.5
Electricity	15

*Figures based on woodchip at 30% moisture content. Other fuel costs are from 2014 (source: Devon Hedge Group, 2014)

Hedgerows, Biodiversity and Ecosystem Services

The value of hedgerows

Hedgerows and their related features provide a wide range of ecosystem services. Biodiversity in British hedgerows has been well studied with hedgerows having been found to offer multiple micro-habitats, food sources, habitat refuges, and ecological corridors for a diverse range of flora and fauna. Given their significance in supporting biodiversity and ecosystem services, if hedgerows are to be widely promoted as a source of woodfuel any potential biodiversity impacts need to be assessed.

Restoring hedgerows and their functions

Hedgerows are dynamic, living landscape features which without management naturally develop into lines of trees. Efforts to stop this natural development through repeated flailing result in the decline of physical condition, biodiversity value, and eventually loss of the hedge. Equally, the under management of hedges results in them becoming tall and leggy, losing their shrub layer and eventually collapse. A hedgerow that has reached either of these extremes will require rejuvenation through laying or coppicing. Managing hedgerows for woodfuel may therefore provide a financial incentive to rejuvenate old hedges, restoring not only their economic function but their value to biodiversity.

The impact of managing hedgerows for woodfuel

Numerous factors determine the value of hedgerows to wildlife – hedge size, structure, network density, spatial arrangement, habitat availability and adjacent land use. Although many species are associated with hedgerows few, if any, are confined to them. Hedgerows may also have a negative effect on specific species, especially those typical of open farmland. Due to this variability in species requirement and use of hedgerows, it is unlikely one single prescription of hedgerow management can meet the needs of all wildlife in a given area. Hedgerow management should therefore either target specific species of interest or aim to increase overall biodiversity.

Managing hedges for woodfuel is likely to provide both synergies and trade-offs between ecosystem services and biodiversity. For example, coppicing creates a break in habitat continuity but is and likely to increase the structural diversity of hedges within the landscape. Providing diversity of habitat provides a diversity of organisms to exploit that habitat and is therefore likely to increase general biodiversity.

Hedge management recommendations:

- *No more than **50%** of hedges on a farm should be managed primarily for woodfuel*
- *No more than **5%** of hedges should be coppiced in one year*
- *Aim for a coppice rotation no longer than 20 years*
- *Aim to maintain habitat connectivity across the farm, linking existing habitats*
- *Cut late in the winter to maintain food resources*
- *When restoring or creating new hedges take into account the type of wildlife you would expect to be present and tailor planting design and hedge management*

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Woodchip Quality

Woodchip can be produced to different size and moisture content is a highly variable fuel. Unsuitable woodchip may cause blockages in the fuel feeding system, inefficient operation, emissions, or condensation in the flue. Some woodchip boilers are fussier than others about the quality of the woodchip used, with larger boilers tending to cope with poorer quality chip. It is therefore important to consider where you will source your woodchip and its quality before choosing a suitable boiler.

The woodchip produced from the hedge at Elm Farm has been tested to both BS EN and Önorm woodfuel standards, the latter being the most widely used measure of woodchip quality in the European biomass industry. Most domestic boilers use woodchip classified as G30 or G50 and 30W.

ONORM M7 133 Standards

Chip designation	<4% of particles	<20% of particles	60 - 100% of particles	<20% of particles	Max. area cm^2	Max. length cm
G30	<1 mm	1 - 3 mm	3 - 16 mm	>16 mm	3	8.5
G50	<1 mm	1 - 6 mm	6 - 32 mm	>32 mm	5	12
G100	<1 mm	1 - 11 mm	11 - 63 mm	>63 mm	10	25
G120	<1 mm	1 - 63 mm	63 - 100 mm	>100 mm	12	30
G150	<1 mm	1 - 100 mm	100 - 130 mm	>130 mm	15	40

G30

Quality class designation	Moisture content (wet basis)	Description
W20	<20%	Air dry
W30	20% - 30%	Storable
W35	30% - 35%	Storable within limits
W40	35% - 40%	Wet
W50	40% - 50%	Green (freshly harvested)

21% to 31%

Chip designation	Ash content as % of fuel weight	Ash content definition
A1	<1%	Low
A2	>1%	High

2.99%

Woodchip Value (£/m^3)

*HWFC Hampshire Woodfuel Co-operative, based on Feb 2015 rates, accounts for transport to buyer

Our Funders:

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