Assessment and development of fuelwood uses for products from SSSI and ancient woodland conservation management at Wyre Forest, Worcestershire/Shropshire

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Executive summary

This report describes the research work into the potential for wood energy associated with the Wyre Forest, undertaken under contract to the Forestry Commission (FC) and English Nature, in two phases over the period 2002/3 to 2005/6. The study derived from English Nature's national policy work with the forestry sector, specifically to influence the local deployment of the England Forestry Strategy to support nature conservation priorities for Sites of Special Scientific Interest (SSSIs) and ancient woodlands. It was progressed under the local work programme for the FC/English Nature Joint Statement of Intent.

The choice of Wyre Forest for the study recognised that nature conservation objectives for the majority of this 897 ha SSSI and 572 ha National Nature Reserve require cyclical woodland management, including the reinstatement, then maintenance, of a major area of oak coppice. Furthermore, as a priority location for ancient woodland restoration, the Forestry Commission and several private woodland owners are converting plantation stands to semi-natural broadleaved woodland. While traditional timber and wood outlets remain important from these forestry practices, new markets for the products of management are required to support the goal of an economically viable and environmentally sound forestry operation. The use of wood chip for wood heating was perceived as a promising avenue, and the study sought to explore the principles, local stakeholder interest and logistics.

The research has informed English Nature's and the Forestry Commission's national positioning and advocacy with respect to biofuels and renewable energy policy, and illustrated the key factors involved in establishing a local wood fuel supply chain in lowland Britain.

The project operated in 2 phases:

Phase 1 Q4 2002/3 to Q2 2003/4. (See Annex B). A desktop analysis which identified the potential market for wood chip for heat generation for large heat user categories in the public and private sectors. An initial scoping of the scale of Wyre wood production, a specification for wood use as woodchip fuel, an outline of the infrastructure requirements and three indicative production scenarios from different silvicultural regimes were undertaken. Basic information on contractors' capacity/interest in wood fuel production was accrued. The work concluded that the potential local market was significant and well within the scope of the Forest's productive capacity, and that these twin aspects should be further researched.

Phase 2 Q2 2004/5 to Q3 2005/6. (See Annex A). This element built on the scoping work of Phase 1 and continued the twin - track approach to wood production and utilisation and market evaluation and promotion.

The former had four elements:

- a seminar with Wyre owners, managers and agents to share phase 1 findings and to 'ground truth' the estimates of potential fuel supply with their own planned production of suitable material;
- a survey of local contractors' business scope and technical capability to support a local woodfuel supply chain infrastructure to match the available material;
- a survey of local on-farm/estate infrastructure options for wood chip storage and distribution; and

- the scoping of 'high, medium and low' production scenarios for conifer and broadleaved wood chip based on public and private sector approved/projected management plans – a detailed scoping for 2005-2010 and a broad scoping for 2010-2020.

FC's Research Agency authored a supplementary technical report on the supply side logistics and economics of harvesting of typical timber and wood outputs for Wyre Forest (Annex F). These costings for the relevant silvicultural systems and harvesting options provide essential intelligence for economic appraisal of a local woodfuel chain.

The market development work had two elements:

- the categorisation of the prospective boiler localities from the Phase one research, through investigation of material factors determining fuel switch decisions. This enabled the prospects for realisation of a local wood chip market to be objectively guaged. (From this, further work is intended to support the front-runner localities to utilise boiler conversion grants etc).
- to follow up the influencing with NPower regarding utilisation of Wyre wood fuel for electricity generation by Ironbridge Power Station for the 5% biomass co-firing (renewables obligation) option. This sought to understand the economics and practicalities of bulk supply for this market, to evaluate the Forest's potential contribution and the infrastructure logistics.

Results

Wood production (supply)

A small sample of local woodland owner/managers' interests in wood fuel was accessed through a seminar convened in late 2004 to discuss the phase 1 findings. The event stimulated some useful discussion (Annex C), which was used to design the phase 2 questionnaire of all Wyre Forest woodland owners' (Annex E).

It is clear that active private sector involvement in wood fuel supply will take some time to develop, due to a cautious and sceptical attitude towards the development of such new markets and limited capacity to diversify.

The development of a forestry contractors' database for the Marches area of the West Midlands (Annex D) has provided a useful tool identifying what capacity and equipment is currently available to support wood fuel production. This survey also highlighted a general trend in woodland and forest management – that a minority are investing in mechanised production, which can enable reduced costs, whilst many others are leaving forestry work in favour of arboriculture. A wood fuel market opportunity may generate, indeed require, the growth of contractor businesses equipped to take maximum economic advantage of fully mechanised methods.

A successful mechanism for processing wood fuel and delivering it to boilers is being developed by MWEN, based around wood fuel 'depots' based on farms. This is entirely relevant to future demand in and around the Wyre and was flagged up as a case study in the recent Government response to the Biomass Task Force report.

Outline Production Forecasts (estimates of future supply) suggest that in principle, the Wyre Forest (public and private) is easily capable of serving potential demand for wood fuel, subject to costs. The most likely scenario is that wood fuel production will need to sit alongside the production of traditional products (logs, bars, pulp etc) rather than replace those markets, and will in turn be influenced by the price structure of these markets.

The next step in evaluating supply issues is to undertake a costed trial of methods of fuel production from planned felling/harvesting in Wyre Forest during 2006/7, aimed at servicing a local boiler installation.

Wood utilisation, market evaluation and promotion (Demand)

The use of wood chip fuel for heating is growing rapidly in the West Midlands, driven by rising fossil fuel prices, concern over greenhouse gas emissions, the establishment of a fuel supply model, and (limited) capital support. At present there are no known boilers in the immediate vicinity of the Wyre, but five sites with immediate potential and six further sites for conversion to wood fuel were identified. This would require 1,400 tonnes of wood chip or around 2000 green tonnes of wood per year with a carbon saving of some 800 tonnes per year.

The further uptake of wood heating would certainly be accelerated if greater capital support for boiler installation was in place. Existing national schemes are limited in their scale and availability and there is no current regional support for wood heating. Further promotional work to expand demand is identified.

A European example of how a cohesive national and regional energy policy can make a significant impact is highlighted for the region of Upper Styria, Austria .The Austrian focus on heat production is contrasted with the UK and West Midlands focus on electricity generation, which to date has yet to yield any successful schemes.

The use of locally produced wood for co-firing in coal-fired power stations has potential, subject to technical and economic issues, but material for co-firing is a global commodity, usually as by-products of other industries (eg palm nut husks or wood pellets).The biomass fuel currently in use at the region's two coal power stations is believed to be 100 percent imported. The regulations which permit co-firing stipulate that as of 2007, an increasing proportion of the fuel must be derived from Energy Crops, specifically, those grown on previously agricultural land. Since there is no pelletising capacity in the West Midlands (or even mainland Britain) – a necessary step in fuel preparation- it is likely that material for co-firing will continue to be imported, with the additional energy waste and pollution disbenefits.

It is unlikely that, unless policy is changed, or wood pelletising capacity is rapidly developed that co-firing will have any benefit to local wood fuel production, and is therefore may be of limited relevance to the future management of the Wyre. However, since this a potentially large market, further discussions with the power companies are advocated.

Future work is identified to build policy and institutional support, and to address wood fuel supply and demand aspects.

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Research Information Note

1 Introduction

1.1 Background

Policy support and funding for this subject commenced in 2002/3 through English Nature's People and Policies Programme work with the forestry sector. The national English Nature/FC Joint Statement of Intent was a framework for local collaboration between the Herefordshire and Worcestershire Team and West Midlands Conservancy, from which this joint study emerged. English Nature's overarching programme goal was to effect policy change to support nature conservation priorities for SSSIs and the wider countryside, through:

- policy development and advocacy (eg national liaison with Forestry Commission on the design of grant schemes);
- regional service delivery (eg guiding partners' implementation of the England Rural Development Plan (ERDP) and Objective 2);
- local policy advocacy (eg influencing the local deployment of the England Forestry Strategy);
- engaging local communities (eg building public/landowner support for sustainable management of ancient woodlands).

The choice of Wyre Forest for the study recognised that conservation objectives for this 897 ha SSSI and 572 ha National Nature Reserve require cyclical woodland management, including the large scale restoration then maintenance of oak coppice. While traditional timber and wood outlets remain important, new markets for the products of management are required to support an economically and environmentally sound forestry operation. The learning from the research sought to inform English Nature's national positioning and advocacy with respect to biofuels and renewable energy policy, and to illustrate the key factors involved in establishing a local wood fuel supply chain in lowland Britain.

A local woodland initiative 'The Heartwoods Project' was operational in the Marches area of the West Midlands between 2002-2005. The project's remit was to support and develop the West Midlands' wood supply chain by *inter-alia,* encouraging woodland product development and supporting sustainable woodland management. Thus Heartwoods Ltd provided a well-matched mechanism to employ for this study.

1.2 The preliminary study

Phase 1 of the research, (specification at Annex B) was undertaken by Marches Wood Energy Network Ltd (MWEN) for English Nature (MWEN 2004). It comprised a desk-top analysis of the potential market for wood fuel in and around the Wyre, quantified the overall size and composition of the Wyre's public and private woodlands and presented a generic analysis of the issues surrounding wood fuel supply. The main conclusion was that the potential local market was significant and well within the scope of the Forest's productive capacity. The consultants recommended that these twin aspects should be further researched and the following specific areas addressed:

1.2.1 Production

- Owners and managers should be invited to comment on the information presented in this report, and make their own assessment of the quantity of material which may be available.
- A seminar / workshop is arranged to discuss the issues raised.
- A survey is made of locally available forestry contractors and machinery which may be employed for mechanised felling and whole tree extraction.
- A survey is made to identify sites such as farms where wood chip may be stored and distributed and on the local availability of agricultural machinery and contractors for haulage and delivery

1.2.2 Market development

- Identify and develop boiler sites in both the public and commercial / industrial sectors, which have a realistic likelihood of switching to wood fuel.
- Work should be done with local farmers with regard to on-farm use of wood fuel.

The findings of Phase 1 are available on request to English Nature.

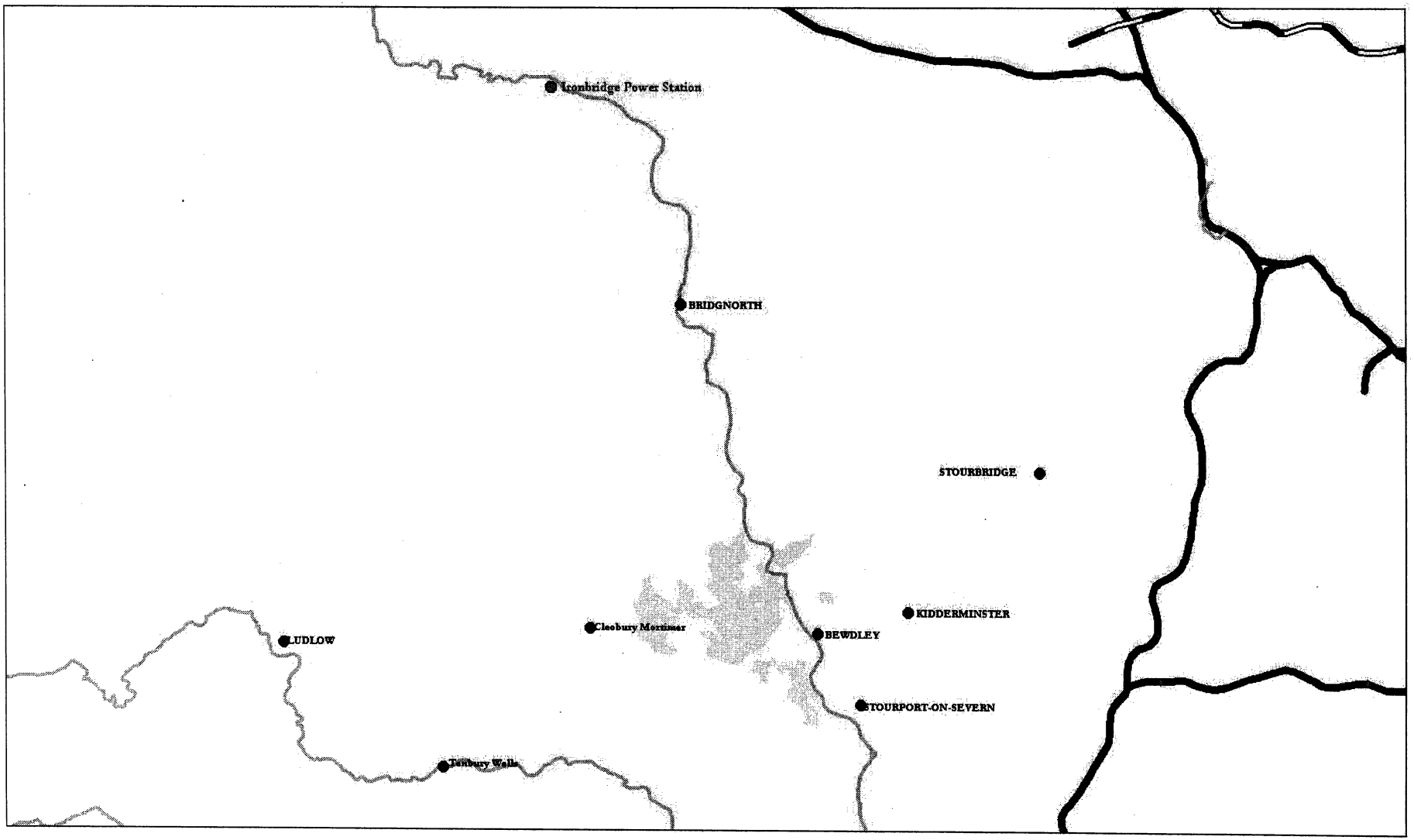
1.3 The primary study

In 2004/5 English Nature and the Forestry Commission co- funded a second, more detailed phase of the study, to examine in greater depth the identified potential for emerging local wood fuel markets and the practicalities of realising these markets. Whilst the central purpose was to assist the conservation management objectives for the Wyre Forest, this work also had wider applications for environmental sustainability by informing the generic and policy issues involved in developing a wood fuel supply chain in lowland England (specification at Annex A)

Heartwoods, assisted by Forestry Commission Research (FCR) focused on the potential timber resource availability from the Wyre. Marches Wood Energy Network focussed on issues of supply infrastructure requirements and potential demand for wood fuel.

This report presents the outcomes of Phase 2.

Map 1 shows the location of Wyre Forest and significant localities referred to in the report.



Map 1 - The location of the Study Area

2 Methodology

The brief for this second phase was:

2.1 Fuel supply

1 Hold a seminar with owners, managers and agents to share the findings of Phase 1, and to 'ground truth' the estimates of potential fuel supply.

2 Survey local owners and contractors to determine industry capabilities to serve a wood fuel market.

3 Suggest local infrastructure options for storage and distribution.

4 Scope the high, medium and low production scenarios for conifer and broadleaved wood fuel based on public and private sector approved management plans.

2.2 Demand

1 Further appraise and categorise prospective boiler locations through investigating material factors determining fuel switch decisions for each, and from this assess the potential demand size and likelihood of uptake from 'candidate locations'.

2 Further investigate the potential of co-firing at Ironbridge coal-fired power station.

3 Results

3.1 Supply of wood for wood fuel

3.1.1 Owners, contractors and agents seminar

This seminar was held at the Wyre Visitor Centre on the 15 December 2004.

There were 10 attendees, largely from public sector interests, with limited private sector attendance. The notes of this meeting are attached at Annex C.

The workshop covered the whole range of issues surrounding wood fuel, and some of the key discussion points were:

- Planning and Regulation – planning permission could be an issue for new wood boiler systems, particularly at the large scale, and that smoke control legislation needs to be considered.
- Production and supply costs – the need to minimise costs where possible by reducing haulage and handling.
- Machinery – the availability of chipping machines capable of generating a chip suitable for fuel use is limited, but is now being addressed.

The workshop endorsed the worth of the project's detailed appraisal of potential timber sources for a wood chip production chain and pursuit of closer involvement of all the significant Wyre Forest woodland owners and managers.

3.1.2 Contractors survey

The purpose of this survey of forestry and arboricultural contractors in the Marches area was to establish current availability, skills and equipment within the industry.

A previous contractor directory (Woodland Services Directory, Marches Woodland Initiative 2000 to 2001) formed the basis of the survey, augmented by the Yellow Pages and personal contacts.

In total, 48 direct telephone contacts were made. Of these, 22 were directly involved in forest and woodland contracting and management, and 26 involved in tree surgery work only.

The result of this survey is a database (Annex D) holding 47 entries and includes the following:

- each contractor's annual timber volume handled
- geographical area of operation
- scope of work undertaken
- machinery fleet

Analysis of this information reveals:

- The 2000 to 2001 Marches Woodland Initiative (MWI) directory identified 37 forestry contractors, of whom four (11%) are now only involved in tree surgery work or timber haulage. The trend is for forestry contractors to leave the industry, which is reducing overall capacity
- Of the 22 forest contractors contacted, only four used fully mechanised systems. This highlights the issue of limited availability of suitable contractors for wood fuel harvesting and processing ,as noted in the FCRA Technical Report (Annex F) and raised by Forest Enterprise.
- From this sample of contractors, the present availability of chippers suitable for wood fuel production is limited to two small hand- fed machines. Most chippers used by forestry contractors are designed to break wood down quickly for disposal (eg to the mulch or compost markets). Wood fuel production requires machines which can meet a higher specification (consistent chips size & quality).

3.1.3 Wood fuel handling options

In 2004, a new wood heating company Midlands Wood Fuel Ltd, was established to meet a market need for an effective fuel supply infrastructure, which was one of the main barriers to uptake of wood heat.

This company now operates three wood fuel depots – in North Shropshire, Telford and Worcester. All depots work on an identical basis.

Table 1 Typical arrangements in provision of wood fuel products/services at a wood fuel depot

Product/service requirement	Provider	Comments
Raw material		
Round timber	Farm/estate/other woodland	Bought in - material typically opportunistic/ spot market/small amounts
Sawmill slab	Sawmill	Bought in - co-product that otherwise would be low value/cost to sawmill
Storage depot		
Hardstanding	Farm	Hardstanding usually readily available on farm
Storage space	Farm	Surplus barn space on farm
Processing		
Chipper	Supply company	Most arboricultural chippers unsuitable
Handling equipment	Farm	Loaders, trailers readily available on farm
Drying	Farm	Usually air-drying, but grain dryers could be utilised on farm
Transport		
Haulage	Local haulier/Farm	Via RoRo bins or local delivery with hi-tip trailer or similar

The company has not experienced any significant difficulty in finding farmers interested in becoming involved in the wood fuel supply infrastructure, which suggests that local storage is unlikely to be a limiting factor for the Wyre Forest area. Local storage should be easily identified when needed.

The fuel depot model seems to work well as it:

- allows for the drying of the timber;
- ensures greater consistency of fuel quality;
- allows for the generation of strategic stocks- important when demand is growing rapidly and
- provides flexibility to respond to local demand.

The company expects to further expand its network of depots, in response to demand in other parts of the region. As demand develops in and around the Wyre Forest, the same model would be easily applied, obviously with a greater emphasis on direct forest products as the raw material.

3.1.4 Illustrative cost elements in a local wood fuel supply chain

A wood fuel supply company provided the following generic breakdown of costs of sourcing, processing and transporting wood to/from one of its depots.

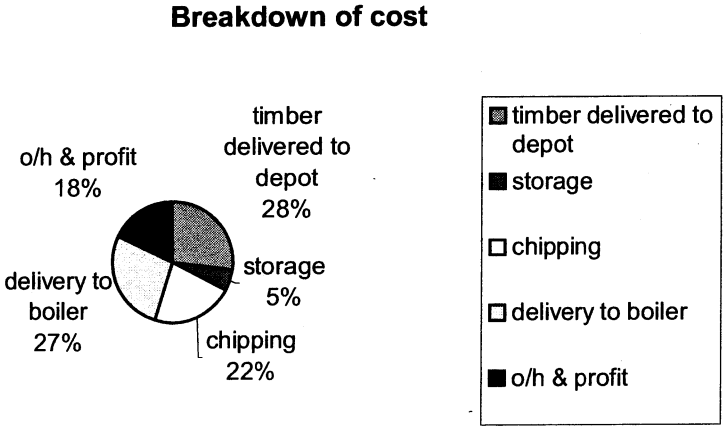


Figure 1 Cost apportionments for different elements of a wood fuel supply chain

3.1.5 Timber production scenarios

This aspect of the project sought to determine how much material of different types might be available from public and private woodlands in the Wyre area to supply new wood fuel boilers.

The two major woodland owners, (Forest Enterprise and English Nature) were contacted directly to provide data on production forecasts on their holdings within the area.

Other owners were contacted by letter and questionnaires (Annex E). Questionnaires were sent to 23 individuals/organisations owning or managing woodland in the Wyre Forest and surrounding area. Some of the questionnaire recipients had previously participated in relevant

meetings. 10 (43%) questionnaires were returned by post and three (13%) completed by phone. Follow up phone calls were made to gather any further volunteered information.

The results are drawn together below, covering the three main landowners:

- Forest Enterprise (FE)
- English Nature
- Other owners/managers

Table 2 Ownership and composition of the Wyre (estimate from phase one report)

Owner	Broadleaved hectares	Conifer hectares	TOTAL area hectares
Forest Enterprise	367	437	804
English Nature	196	0	196
Private	300	500	800
TOTAL	**863**	**937**	**1,800**

Response from Forest Enterprise

Recent production (Table 3) and production forecast figures covering the next 20 years plus (Table 4) were obtained from FE operations and planning staff. Local staff also provided details of operational issues. Neither operational processes nor silvicultural methods were seen as a deterrent to wood fuel production, current harvesting and marketing systems being efficient and capable of ready adaptation .

The UK Woodland Assurance Standard, (UKWAS) under which all FE woodlands are certified, was not seen as a constraint with regard to level of production or whole tree harvesting, as all works are carried out under a regeneration plan with biodiversity enhancement objectives.

In principle FE supports the production of wood fuel, but diversion of its products into this market would be dependent on the market price. No detailed product costs were given.

Table 3 Past timber production 2000 to 2004

	Public Sector (FC/English Nature)		Private Sector	
	(m3)		(m3)	
	Conifer	**Broadleaf**	**Conifer**	**Broadleaf**
2000		72	1000	Unknown
2001	2400	144	1000	Unknown
2002		48		Unknown
2003	100	104		Unknown
2004	100	80	500	Unknown
Total	**2600**	**448**	**2500**	

Table 4 Predicted future production 2005 to 2021

	Public Sector (FC only)		Private Sector	
	(m3)		(m3)	
	Conifer	**Broadleaf**	**Conifer**	**Broadleaf**
2005-2006	2803	670		2150
2007-2011	1272	491	400	3700
2012-2016	790	198		600
2017-2021	376	120		3600
Total	**5241**	**1479**	**400**	**10,050**

The production-forecast figures for the public sector are solely those from FC.

Response from English Nature

English Nature is currently revising the suite of management plans for the Wyre Forest National Nature Reserve (NNR). This will inform future nature conservation management and associated timber production. Similarly revised SSSI management objectives in preparation will influence the areas/volumes for future felling and thus wood fuel production options. Currently most harvesting work undertaken on the reserve consists of felling stored oak of coppice origin, which has a lower proportion of material suitable for conventional markets. Other silvicultural practices can include linear coupes for ride – widening, which enables greater harvesting of better quality timber. Recent prices obtained for various products and markets are shown in Table 5.

Table 5 Prices for various timber products from English Nature managed land at Wyre Forest NNR 2004 to 2005

Product	Market	£/m3 roadside (green)	£/tonne wood @ 30% mc (roadside)
Pulp (broadleaf)	St Regis	16.50	23.10
Pulp (conifer)	Kronospan	<10	17.50
Sawlogs	various	>35	61.25
Bars	various	26 to 28	45.50 to 49.00

Wood prices for fuel production are judged likely to compete with these pulp and other small roundwood (SRW) prices, before chipping and transportation costs are factored in. Other higher value products such as bars and sawlogs may help offset the lower prices of timber for wood fuel outlets.

An alternative to utilising pulp and small roundwood material is harvesting crown wood or 'lop and top' from canopy thinning (generally a zero value product). This is generally not favoured on the NNR/SSSI as this wood can be important for deadwood habitat. There may be potential to remove up to 50 percent of the crown wood, due to small volumes and coupe sizes and nature of the woodland involved, this may prove uneconomic in practice (Annex F). English Nature's central management objective is habitat conservation, and as there is limited deadwood, either standing or fallen within Wyre, adding to this will often be a preferred use of lop and top rather than removing it for wood fuel.

Wood fuel production is not seen to fit well with current English Nature's management objectives. It is regarded as a potential alternative market, but would have to compete with existing markets. Importantly, timber revenues are retained as income by the local team, to contribute towards the funding of capital works on NNRs, hence prices secured are relevant to annual NNR budgeting.

The productive area English Nature regards as most suitable for wood fuel currently consists of about one hectare per year of oak and birch coppice (c.90 m^3/ha – Annex F, table 1). This may increase to perhaps two hectares per year in 10 years time, cut in 0.5 hectare coupes (c30 m^3/ha – Annex F, table 1) on rotation. Worked coppice products are the preferred material available for wood fuel as this has little or no market. However, after the first cut to re-establish coppice, the likely rotation length and small area worked would possibly not yield any significant timber volume for a number of years. By itself, these small coppice volumes may even prove uneconomic to extract, hence the need for collaboration with other suppliers and sources of fuelwood if the economics are to be viable. (Annex F – Costs).

Questionnaire response from private sector owners/managers

Whilst there was mixed interest in a developing wood fuel market, ball park estimates of recent (Table 3) and future production (Table 4) were less easy to come by since most owners do not keep or chose to reveal records of current or likely future production. Similarly information on costs was sketchy, partly due to commercial sensitivity.

Two responses for costs of felling and extraction were received from this group of owners:

- average of £18/tonne (£18/m^3) roadside, describing a motor manual system with tractor, trailer and or skidder
- average of £13/tonne (£13/m^3), but working with a more mechanised system using a harvester and forwarder

It is not possible to compare these figures since the detail of the felling regime, product types and constraints outlined in the FRCA report (Annex F) are not known. However, the latter reveals that extraction costs for thinning (Box 1) are likely to range from £5-£15/m^3 for these types of harvesting systems. Felling costs might be in the range £3-£8/m^3.

Past volumes harvested

Information supplied from the questionnaire returns gives a partial indication of the volume of timber harvested and its uses from these woodland holdings within the last five years. Many of the respondents did not have access to (data known only to agents) or know the previous harvested volume from management they had undertaken. From the telephone follow ups the latter is mainly due to management objectives or practices that do not include timber production as an objective. Figure 2 illustrates the information supplied.

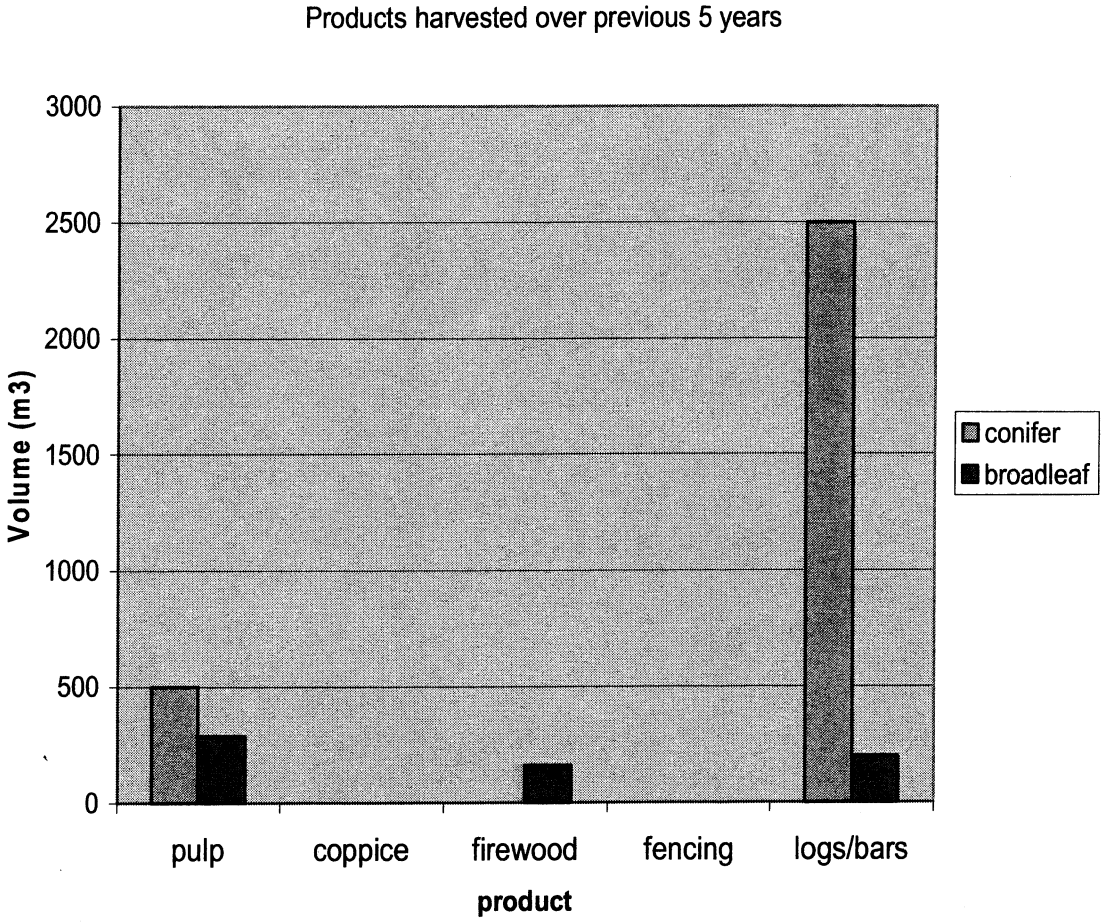


Figure 2 Existing Markets for Wyre Forest woodland products

3.1.6 Other supply side intelligence

Key factors influencing owners

The questionnaire returns enabled a snapshot of owners' perceptions of the problems and constraints influencing their attitude to wood fuel production, together with comments on unknowns such as the English Nature regulatory stance on NNR/SSSI conservation requirements. Shortcomings in information availability and the present day logistics combine in this sample. Figure 3 shows the number of instances that a factor was identified.

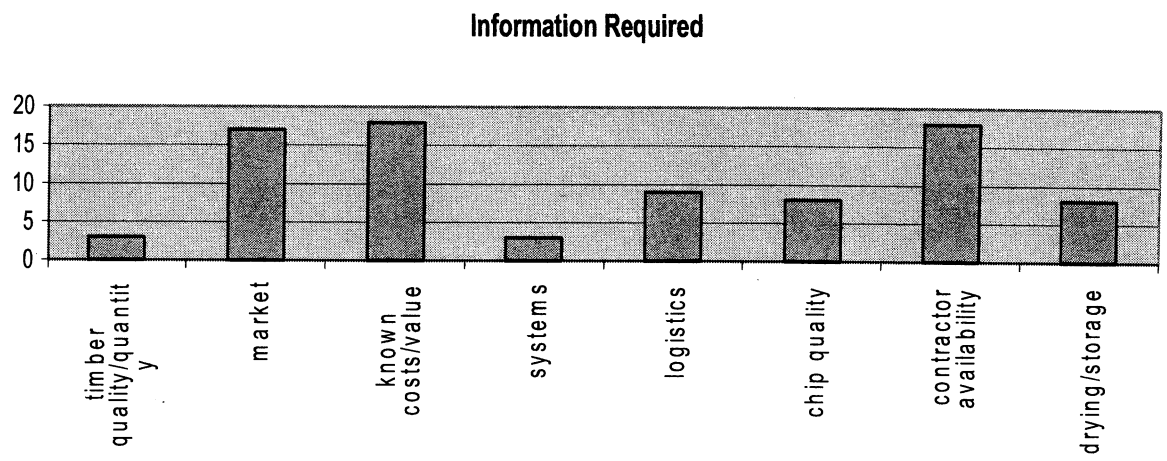


Figure 3 Questionnaire respondents' perceived problems limiting take up of wood fuel

Equipment utilised

Not unsurprisingly, given the variety of woodland owners and objectives in Wyre, equipment utilised for harvesting ranges from chainsaws and hand tools to mechanised systems including harvesters and forwarders. This fits within the scope of systems (and their costs) identified in the FCRA Technical Report at Annex F.

Management objectives

Woodland management objectives encompass timber production, landscape, biodiversity, amenity, public access, conservation and educational.

Silvicultural systems

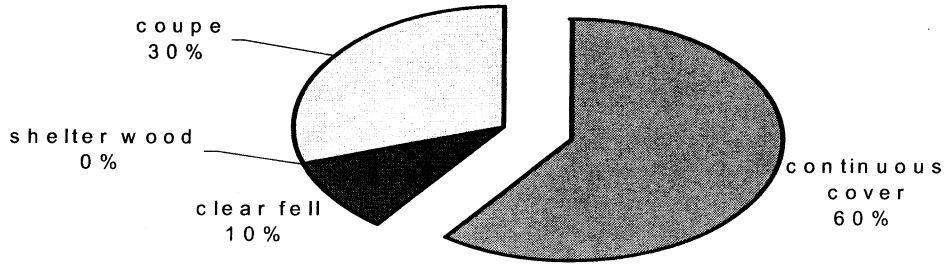


Figure 4 Questionnaire respondents' silvicultural systems employed in Wyre Forest

3.1.7 Summary of results for assessment of fuel supply

- For the sampled owners, there are a range of management objectives and silvicultural systems used. Continuous cover accounts for 60 percent of the area, group felling 30 percent and clearfelling 10 percent of the area managed by respondents.

- The survey showed (Table 3) that over 5,000 m3 (c.5000 tonnes) of coniferous timber (half public sector) and almost 500 m3 (c. 500 tonnes) of broadleaved timber (all public sector) has been harvested in Wyre over the last 4 to 5 years. The forecast over the next 15 years (Table 4) is over 5,600 m3 coniferous timber (mainly public sector) and over 11,500m3 of broadleaved timber (overwhelmingly private sector).
- The current markets are logs/bars (principally coniferous market) and pulp (conifer), with some broadleaved timber going for firewood.
- A range of generic problems with timber production were identified, pertaining to lack of information on eg markets, prices, quality issues and contractor availability.

The key supply-side issues are seen:

- the likely market price for wood fuel, ie whether this is sufficient to divert wood out of existing markets;
- the relationship between production scenarios for wood fuel and the economics of existing timber markets;
- lack of awareness of the issues surrounding production of wood fuel, including a lack of information and knowledge of woodland management generally, and on markets and services/technologies, and
- technical skills required to produce wood fuel, including suitable contractors.

3.2 Demand for wood for heating

The purpose of the demand side work was to begin to identity specific potential sites within the immediate vicinity of the Wyre, for the installation of wood fired boilers for heating only.

Marches Wood Energy Network have identified a cross section of such sites, in both the public and private sectors, some of which have immediate potential, others with potential in the medium to long term. The sites identified are not the entirety of potential local demand; rather, they indicate some of the most promising of a range of sites and situations that could be developed in the long term.

The broad search criteria for these illustrative sites was a) to investigate a range of types of properties and b) to concentrate on sites using the more expensive fossil fuels (oil and LPG).

A brief technical outline is provided for each site.

3.2.1 Bewdley Community Facility

This facility (working title) is a planned property development in the centre of Bewdley. It would involve the development of land and replacement of some existing buildings and provide an integrated facility comprising residential units, a new Medical Centre, a children's Nursery, a new Police Office, a Youth Centre and an Exhibition Space. The total area of the development, if all elements were included, would be in the region 6,000 m^2.

The project is at the design stage, and detailed calculations of heat requirements have yet to be made by the project architects. However, it is estimated that the development, if all heated from a common boiler room as planned, would require boiler capacity in the region 600 kW.

The diversity of heat loads for this project ie evening and daytime demands, means that a wood boiler would have a good load profile and would be sized at or near the design load of 600 kW. Such a boiler would consume in the region of 450 tonnes of fuel a year.

Summary for Bewdley Community Facility		
Likely Boiler Capacity	600	KW
Annual energy generation	1,575	MWh
Annual wood fuel demand	450	Tonnes
Carbon Saved (Annex G)	236	Tonnes

3.2.2 Pioneer Centre

The Pioneer Centre is a privately owned outdoor activity centre for children, located on the edge of the Wyre Forest, near Cleobury Mortimer. The Centre has a variety of buildings, including a recent major expansion. The site provides accommodation for 300 visitors, with on-site accommodation for staff.

The main buildings are heated by a liquid petroleum gas (LPG) - fired boiler. Some of the existing staff accommodation is based in wooden huts. These are currently heated using electric night storage heaters which are both expensive to run, and not very effective. The Centre management are in the process of renovating three of the huts, and would like to replace the electric heating with a radiator system running from a single boiler and underground heat main. Of the fuel choices suitable for the current boiler – oil or LPG - gas is favoured because it is environmentally cleaner, despite being the most expensive fossil fuel available. By the time the centre boiler is due for renewal, it is anticipated that the price of LPG will have escalated to such an extent that a wood - fuelled system will be financially very attractive.

The centre management have considered using a wood chip fired boiler because of potentially lower running costs and to demonstrate the organisation's commitment to environmental sustainability. A wood boiler of 60 kW would adequately serve the heating demand of about 120,000 kWh per year. Such a boiler would consume around 34 tonnes of wood chips a year.

Summary for The Pioneer Centre		
Likely Boiler Capacity	60	kW
Annual energy generation	120	MWh
Annual wood fuel demand	34	Tonnes
Carbon Saved	24	Tonnes

3.2.3 Lacon Childe School, Cleobury Mortimer

Lacon Childe School is a 600-place state secondary school in Cleobury Mortimer. The school site comprises various buildings, generally each one having its own (oil fired) boilers. The school has previously been considered as part of a community heating project for that area of the town. This project is thought unlikely to go-ahead due to uncertainties over the potential liabilities for Governors. It is however, worth considering the site in isolation.

There are two options for wood heating at the site. One is to look at the site as a whole, and consider linking all zones via underground pipework to a primary wood boiler, the other is to

look at individual zones and install a wood boiler at one or more of them. Depending on the option taken, the school would require up to around 100 tonnes per year.

Summary for Lacon Childe School		
Likely Boiler Capacity	400	kW
Annual energy generation	485	MWh
Annual wood fuel demand	139	Tonnes
Carbon Saved	97	Tonnes

3.2.4 Cleobury Mortimer Primary School

Cleobury Mortimer Primary School is a 220-place state primary school close to Lacon Childe School. It too has been previously considered as part of a potential district heating system. The school site comprises a single building and boiler house containing two 140 kW oil boilers. The site layout does lend itself to the installation of a wood chip fired boiler to replace one of the oil boilers, sited adjacent to the existing oil fired plant. The boiler would be in the region 140 kW, and requiring 43 tonnes of chips a year.

Summary for Cleobury Mortimer Primary School		
Likely Boiler Capacity	140	kW
Annual energy generation	152	MWh
Annual wood fuel demand	43	Tonnes
Carbon Saved	30	Tonnes

3.2.5 Wharton Park Golf Club

This privately owned golf club lies to the south west of Bewdley, and comprises a moderately sized clubhouse with shop, restaurant, bar, changing rooms etc. The building to heated by a single 100 kW LPG fired boiler. The site uses a large amount of LPG, for powering the golf carts, for cooking and for heating. Heating accounts for approximately one third of overheads.

A simple pay-back calculation showed that at this site, the payback would be quite prolonged , approximately eight years, so it is unlikely that the owners will consider wood fuel until the cost of LPG has risen further. Nevertheless, this site is worthy of inclusion in any future wood fuel demand promotion.

Summary for Wharton Golf Club		
Likely Boiler Capacity	100	kW
Annual energy generation	100	MWh
Annual wood fuel demand	28	Tonnes
Carbon Saved	12	Tonnes

3.2.6 Other potential sites

A number of other potential sites have been identified through the phase one scoping process, but not further evaluated:

- Little Lakes Golf Club
- West Midlands Safari Park

- Bewdley High School
- Stourport High School
- Frank Chapman Centre
- Replacement Forestry Commission Wyre Visitor Centre

The two schools are of particular interest because of the enthusiasm for wood fuel demonstrated by Worcestershire County Council, having installed a 700 kW system at County Hall. However, the schools are not managed directly by the Council.

A typical secondary school might have a total heating requirement in the range 400 - 600 kW and an annual wood fuel demand of 140 to 180 tonnes a year.

3.2.7 Summary of results for assessment of wood fuel demand

The five potential sites surveyed would have a combined annual fuel demand of 694 tonnes (at 30 percent moisture content). Adding the other potential sites identified might double this figure to nearly 1,400 tonnes. Taking into account drying during storage, this equates to about 2,000 green tonnes, which is roughly equivalent to its volume in cubic metres. Therefore, potential annual demand would be around 2,000 cubic metres of timber.

Table 6 Potential annual wood fuel demand from evaluated and prospective wood heating boilers in the vicinity of Wyre Forest

Wood fuel installations	Potential fuel demand (tonnes per year at 30% mc)	Green tonnes equivalent	Tonnes C saved per year
Five sites identified	700	1000	400
Six further prospective	700	1000	400
Total	1400	2000	800

Such a demand could easily be accommodated within the likely future management and forecast production (Table 4) of the Wyre Forest to support this demand, subject to cost.

3.3 Demand for wood for co-firing for electricity generation

The project did not encompass the local micro-generation or combined heat and power options, but only considered the demand options afforded by the nearest power stations. The situation regarding co-firing at the two coal fired stations in the West Midlands remains unclear with regard to wood.

Ironbridge Power Station (Powergen) is probably of most interest in this context. Co-firing of biomass is underway, utilising imported products such as milled palm husks, peanut kernel extract and olive cake.

Sawdust has also been tried, but this was not particularly successful for technical reasons relating to the manner in which fuel is pulverised and injected into the boilers. Wood chip has not been tried, but is considered unsuitable, again for reasons relating to pulverising.

Rugeley Power Station (International Power plc - IP) is also actively engaged in co-firing, importing wood pellets from Balcas in N. Ireland. These pellets are produced from sawmill co-products (sawdust and chips) of low moisture content (www.balcas.com). Balcas has invested £9 million in the pelleting plant and aims to produce in excess of 50,000 tonnes per annum. IP is also currently proposing trials with wheat and miscanthus.

Co-firing is partly price and partly technically driven. There is insufficient attention afforded to all environmental sustainability considerations in choice of co-firing fuel source. The current provisions of the Renewable Energy Order relating to co-firing require an increasing proportion of energy crop derived material in the fuel mix from 2007 onwards. This will adversely affect the potential for use of forest derived material for co-firing in the medium to long term.

4 Conclusions

4.1 Seminar

Owner/manager representation at the seminar to generate stakeholder interest was limited, but the event did provide a useful scene-setting event for the research.

Greater private sector involvement in the forward planning and discussion of the Wyre Forest, not just in relation to wood fuel, is necessary.

4.2 Contractors incentives, capacity and skills

The development of a database of contractors in the rural West Midlands has resulted in a useful tool with regard to promotion of wood fuel production (Annex D).

Feedback from practitioners has highlighted a general trend in woodland and forest management – that a few contractors are investing in mechanised production, and benefiting from reduced costs, whilst others are leaving forestry work in favour of arboriculture.

Workforce development in the West Midlands is being addressed through other forums. For the future management of the Wyre Forest, a conclusion is that mechanised production will become more relevant for economic reasons and in the light of the shrinking availability of a skilled workforce.

4.3 Fuel infrastructure

A successful mechanism for processing wood fuel and delivering it to boilers is developing, and is entirely relevant to future demand in and around the Wyre.

4.4 Timber production

Production forecasts suggest that in principle, the Wyre Forest is capable of serving potential demand for wood fuel, subject to costs.

The most likely scenario is that wood fuel production will need to sit alongside the production of traditional products (logs, bars, pulp etc) rather than replace those markets and will be influenced by the price structure that applies to such markets.

A costed trial of methods of fuel production, including environmental impacts, is proposed for real life forest management scenarios.

4.5 Demand - heat

The use of wood chip fuel for heating is growing rapidly in the West Midlands, driven by rising fossil fuel prices, concern over greenhouse gas emissions, the establishment of a fuel supply model, and (limited) capital support. At present there are no boilers in the immediate vicinity of the Wyre, but this will undoubtedly change in the near future.

The further uptake of wood heating would certainly be accelerated if greater capital support for boiler installation was in place. Existing national schemes are limited in their scale and availability and there is no current regional support for wood heating.

One European example of how a cohesive national and regional energy policy can make a significant impact is the region of Upper Styria, Austria -

Since 1994, 15,000 wood log and chip fired boilers have been installed in Upper Styria, Austria, totalling 850 MW capacity. There are 200 wood fired district heating schemes. 4,500 small pellet boilers have been installed and there are twelve pellet production plants.

The focus has been very much on heat production, in contrast to the UK and West Midlands focus on larger scale electricity generation, which to date has yet to yield any successfully implemented schemes.

4.6 Demand – co-firing

The use of locally - produced wood for co-firing has potential, subject to technical and economic issues, but material for co-firing is a global commodity, usually as by-products of other industries (eg palm nut husks or wood pellets). The actual and comparative 'carbon' cost of transporting such material is very low.

The biomass fuel currently in use at the regions two coal power stations is believed to be 100 percent imported after mixed success on early trials on wood derived biomass (sawdust, chip etc). The regulations which permit co-firing stipulate that as of 2007, an increasing proportion of the fuel must be derived from Energy Crops, specifically, those grown on previously agricultural land. Since there is no pelletising capacity in the West Midlands (or even mainland Britain) it is likely that material for co-firing will continue to be imported.

It is unlikely that, unless policy is changed, or wood pelletising capacity is rapidly developed that co-firing will have any benefit to local wood fuel production, and is therefore of limited if any relevance to the future management of the Wyre.

5 Recommendations

These recommendations address the operational and policy follow-up matters arising from the research undertaken at Wyre Forest by MWEN and Heartwoods for English Nature and FC, in two phases between 2003 to 2004 and 2005 to 2006. They should be considered in tandem with existing wood energy regional policy and strategy, (FC West Midlands May 2003) and in the context of the fast-moving national policy for biomass fuel development (Biomass Task Force October 2005).

Individual recommendations are cross-referenced to conclusions (bracketed numbers) from section four. The intended recipients of the recommendations are identified.

The recommendations are not listed in order of priority or timetabling. Some should operate in parallel and others follow a logical sequence. A task group should convene for this purpose.

Local recommendations

1 (1) The West Midlands Regional Forestry Framework (WMRFF) Wood Energy Task Group, the Wyre Forest Landscape Partnership Project, BioenergyWM

Maintain and encourage the interest and involvement of the private sector land/woodland owners and managers, and local contractors, in the development of a wood fuel market based upon the Wyre Forest, through information, training and business-support. (This ties in with the recommendations of the recent review of West Midlands Wood Energy Strategy – FC, 2005).

Possible means include: targeted mailings, newsletters, further workshops, follow- ups with individual questionnaire respondents, some of which may be supported through the rural development elements of the Wyre Forest Landscape Partnership Project (see below).

2 (5) MWEN, FC

a) Inform the owners/managers of the potential locations of wood fuel boiler of the results of this research, providing intelligence in an influential format to stimulate boiler conversion/purchase decisions. Seek to maintain these contacts, to ensure identified opportunities for local wood fuel heating are realised, and to provide guidance on sources of advice and assistance.

FC, English Nature

b) Disseminate the report of this research to other local interested parties, to maintain/attract local participation in Wyre-based wood fuel development.

3 (5) FC, Natural England, Local Authorities and Local Strategic Partnerships

Scope and resource an implementation stage for a Wyre Forest local project, with and through The Wyre Forest Landscape Partnership Project , which *inter-alia,* identifies and explores the local policy support for wood fuel heating relevant to the potential sites and others, through understanding the relationship with:

a) the sustainable development objectives of the Community Plans, Local Area Agreements and Economic Strategies for Shropshire, South Shropshire District, Worcestershire and Wyre Forest District.

b) the local planning policy context

c) the educational sector business drivers, with respect to local schools infrastructure, financial and green issues.

4 (5) The Wyre Forest Landscape Partnership Project

Utilise the research findings within the development of this project, currently proceeding with a Heritage Lottery Fund award. Project promoters to access HLF and other funding, for elements contributing to the establishment of a local wood fuel chain, to enable the project's woodland conservation and sustainable energy aims.

5 (4) FC, FE, English Nature, MWEN, private sector owners

Establish a costed trial of the practicalities, benefits and disbenefits of a mechanised harvesting operation for wood chip at Wyre Forest, applying to:

Ancient semi-natural woodland stands (ASNW)

- English Nature clear fells of various sized, oak high forest coupes, for re-establishment of a coppice or coppice with standards regime.
- English Nature first rotation cuts of existing coppice compartments.

Planted ancient woodland stands (PAWS)

- FC or private sector clear or selective fells of conifers, to instigate phased restoration of ASNW.

6 (4) FC, Natural England (NE)

As part of the above trial, undertake an ecological assessment of the impact of wood fuel harvesting (and, if relevant, within-forest woodchip processing) on the quality/condition of the woodland habitats and open spaces. Use this evaluation to determine local practice specifications for future harvesting contracts.

Regional recommendations

1 (2) MWEN, WMRFF Wood Energy Task Group, BioenergyWM

Maintain/update and develop, the regional database of forestry contractors' involvement with wood fuel, establishing database ownership and protocols. Consider whether and how an independent assessment of the quality of outcomes from contractors' operations might be incorporated. Provide analysis and feedback to contractors and potential employers, to assist their business planning.

2 (2) WMRFF Wood Energy Task Group, BioenergyWM, Defra, Advantage West Midlands

Support the needs and opportunities for wood fuel harvesting capacity development in the regional prioritisation for deployment of the project based schemes within the England Rural Development Programme (ERDP) 2007.

3 (3, 5) FC, Defra, AWM, CLAB Association, TGUK, FCA, FTA, Lantra

Promote the availability of ERDP capital grants for investment in mechanised wood fuel harvesting and processing to the contractors identified through the Wyre Forest research, to the managers of farming and forestry machinery rings and regional land-based industry bodies.

4 (5) WMRFF Wood Energy Task Group, BioenergyWM

As part of regional wood energy promotion, disseminate information to Local Authorities and other public sector managers to prompt consideration of wood fuel boilers in investment decisions for public buildings. Establish/promote a web-site where managers – developers can register the locations /specifications for projects with potential for wood fuel heating, to provide knowledge of local market potential, especially for local wood fuel suppliers. The aim is to help to break the 'chicken and egg' problem of demand and supply.

5 (5) GOWM, AWM, DTI, EnergyWM

Commission research to establish options for incentivised regional mechanisms for public and private sector uptake of wood heating (including the reduction in payback times on boiler conversions) based on accessing fuel from existing forests and woodlands. Utilise and interpret foreign (eg Upper Austria) and UK experience.

6 FC, English Nature

Present/disseminate the findings of this research to appropriate regional bodies, to foster support for next steps and applications.

7 Natural England, Sustainability WM

Embed the sustainable development advocacy for wood fuel in the Natural England Regional Advocacy and Partnerships Centre and in regional sustainability strategy.

8 (3) WMRFF Wood Energy Task Group, BioenergyWM

Consider how the fuel processing and supply infrastructure model summarised in the Wyre Forest research can be furthered and reproduced in other suitable localities by regional policies and programmes. Identify and progress specific activities through the annual implementation plan for the West Midlands Regional Forestry Forum.

9 FC

Consider how FC regional partnership funding can be increased to catalyse wider public/private sector investments for the establishment of a viable Wyre Forest wood fuel supply chain.

National recommendations

1 FC, Defra, NE, DTI

The Wyre Forest research should be used to illustrate and inform national policy development needs eg integration of wood fuel supply and demand, stimulating the public sector market for wood heating and enabling local wood chip as a fuel for biomass co-firing of power stations.

2 FC, NE

Promote opportunities to spatially integrate the delivery of woodland conservation priorities with potential wood fuel markets eg research ways and means of matching development of centres of demand for wood heating installations with strategic locations such as concentrations of coppice woodlands.

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Annex A The primary study project specification

The Heartwoods/Marches Wood Energy Network (MWEN) Wyre Wood Fuel Project 2004 to 2005

Project No. CONT/07/02

Introduction

English Nature's financial contribution to the Heartwoods Project derives from our People and Policies Programme funds for work with the Forestry sector and is informed by our corporate position statement on *Environmentally sustainable forestry and woodland management* April 2002. The programme goal is to effect policy change to support nature conservation priorities for SSSIs and the wider countryside, through:

- policy development and advocacy (eg national liaison with Forestry Commission on the design of grant schemes);
- regional service delivery (eg guiding partners' implementation of the England Rural Development Plan (ERDP) and Objective 2);
- local policy advocacy (eg influencing the local deployment of the England Forestry Strategy);
- engaging local communities (eg building public/landowner support for sustainable management of ancient woodlands).

The Heartwoods Project is a means to explore, facilitate and implement policy initiatives for wood and woodland commodity supply, which combine ecological benefits with social and economic. The Marches are a nationally important area for woodland nature conservation assets. English Nature's support for the Heartwoods Project seeks to achieve practical ways of ensuring conservation of these assets is aligned with improvements to the economic status of the chain of local wood using businesses, the creation of associated employment and the realisation of indirect/other benefits. By this means, we seek to advance woodland biodiversity safeguard and enhancement as integral to sustainable development of the Forestry sector at a sub-regional level.

English Nature funding support is for Heartwoods administration and overheads and to address specific woodland conservation issues, either through the direct deployment of Heartwoods staff time or project management/purchase of contracted services. It assumes this work area can be met in conjunction with the Advantage West Midlands Rural Regeneration Zone (RRZ) and the Government Office West Midlands Objective 2 funded outputs, that the projects' aims are shared by other partners and will attract matching or related funds or other in-kind assistance. Outline objectives will be supplemented by specifications and outcomes, to be agreed at set stages over the anticipated three years of English Nature support.

The two thematic projects using English Nature funds for deer and fuelwood sit under the Heartwoods strategic objective 1 for *Sustainable Woodland Management.* However, they have elements that relate to the other strategic objectives for *strengthening the supply chain for West Midlands woodland products, Product Development and Innovation and Marketing and Promotion.* This specification deals with the second year of the wood fuel project.

Assessment and development of fuelwood uses for the products from SSSI and ancient woodland conservation management at Wyre Forest, Worcestershire/Shropshire

Background

The unfavourable condition of more than 1000 hectares of Wyre Forest SSSI is mostly due to a woodland structure unsuitable for light demanding and shrub layer dependent plants and animals. Ongoing declines in biodiversity are associated *interalia* with the shading effects of even-aged oak high forest and the inadequate area of rotationally managed oak coppicing - as coppice markets and thus related employment have dwindled. The nature conservation objectives for the SSSI and the wider forest also embrace the restoration of plantations to native broadleaved stands. The project seeks to assess fuelwood's potential contribution to conservation management at Wyre by researching the Forest's fuelwood supply options and the local fuelwood market scope, including the associated infrastructure and business requirements. The project operates within the context of the Wood Energy Strategy for the West Midlands FC (2003) *Wood for Energy* and will build on existing knowledge and align with existing partnerships such as the 'Wyre Forest Biodiversity Centre Project. It seeks to further relevant objectives for rural economic diversification and the environmental economy in Advantage West Midland's Rural Regeneration Zone (RRZ) implementation plan, whilst enabling the achievement of management objectives for private sector, Forest Enterprise and English Nature Wyre Forest holdings. Marches Wood Energy Network Ltd is commissioned by Heartwoods as contractors for this work.

Phase One Q4 2002 to 2003 and Q1 2003 to 2004. This element of the project was a desktop analysis to identify the potential market for wood chip for heat generation for large heat user categories in the public and private sectors. An initial scoping of the scale of Wyre wood fuel supplies, a specification for wood use as fuel, an outline of the infrastructure requirements and three indicative production scenarios from different silvicultural regimes were undertaken. Basic information on contractors' capacity/interest in wood fuel production was accrued. The work concluded that the potential market was significant and well within the scope of the Forest's productive capacity, and that these twin aspects should be further researched.

Phase Two Q3 and Q4 2004 to 2005. This stage will continue the twin - track approach to wood production and utilisation research and promotion.

The former has four elements:

1.1 a seminar with Wyre owners, managers and agents to share phase 1 findings and to 'ground truth' the estimates of potential fuel supply with their own planned production of suitable material;

1.2 a survey of local (catchment to be defined) contractors' business scope and technical capability to support a local supply chain infrastructure to match the available material;

1.3 a survey of local (catchment to be defined) on-farm/estate infrastructure options for wood chip storage and distribution; and

1.4 the scoping of 'high, medium and low' production scenarios for conifer and broadleaved wood chip based on public and private sector approved/projected management plans – a detailed scoping for 2005-2010 and a broad scoping for 2010-

2020. Assistance will be sought from the FC Technical Branch for quantification of outputs and costings of material from the silvicultural systems employed.

The market development work has two elements:

2.1 the categorisation of the prospective boiler localities from the Phase 1 research through investigation of material factors determining fuel switch decisions for each. From this, to identify and further frontrunner localities to utilise conversion grants etc.

2.2 to follow up the influencing with NPower regarding utilisation of Wyre wood fuel for Ironbridge Power Station for the 5% biomass co-firing (renewables obligation) option. The need is to understand the economics and practicalities of bulk supply for this market, to evaluate the Forest's potential contribution and the infrastructure logistics.

If Defra participation in the project transpires, a future or 'bolt on' element may be the engagement with local farmers to explore their scope for on-farm heating uses for Wyre-sourced wood chip. A RES grant to a local private sector interest could be accessed for this purpose. English Nature/FC allocated funds do not allow for this work.

3 A concluding requirement is that the project's findings and achievements is drawn together in a phase two report, with next steps recommendations. An adjunct to this should be a summary of issues with a policy theme (needs/opportunities and barriers) relevant to achievement of English Nature's corporate policies (woodland management, climate change and electricity generation), distilled into succinct messages for policy makers/implementers.

Timetables and payments

2004 to 2005

English Nature has total earmarked funds to Heartwoods of £10,000 for this financial year, whose commitment must be assigned to agreed outputs by early October 04. The English Nature funds are match funded by FC through their wood fuel contribution to Heartwood (£10,000). English Nature's proposed allocation to this project is a maximum of £2,500 paid as follows:

£1,000 by 15 December 2004 for items 1.1, 1.2, 1.3. Outcomes to be the seminar of interested parties improved wood production information, a process for ongoing engagement with stakeholders, a sound knowledge base of contractors' capabilities and interest for planning purposes.

£1,500 by 28 February 2005 for items 2.1, 2.2 and 3. Outcomes to be a ranked, timetabled list of boiler conversion candidates, a 'situation report' of the key matters for attention relevant to Ironbridge wood fuel co-firing, and a draft summary report. The final report to be submitted by 30 March 2005.

Mark July
English Nature
24 September 2004

** note. If core funding for Heartwoods released, this sum will be £5,000

Annex B The preliminary study project specification

Research into the potential of wood fuel to assist with the revitalisation of coppice working and coppice produce markets for SSSI and ancient woodland conservation at Wyre Forest, Worcestershire/Shropshire

Background

The unfavourable condition of more than 1,000 hectares of Wyre Forest SSSI is mostly due to a woodland structure unsuitable for light demanding and shrub layer dependant plants and animals. Ongoing declines in biodiversity are associated with the effects of canopy closure from stored coppice and the inadequate area of rotationally managed active oak coppicing, as coppice markets and thus related employment have dwindled. The nature conservation objectives for Wyre Forest and many other important ancient woodlands in the Rural Regeneration Zone (RZZ) could be delivered through promotion of new markets for worked coppice/former coppice products, including fuelwood for energy generation.

- Wyre Forest includes both private sector, Forest Enterprise and English Nature holdings
- Only part of the Wyre Forest is in the RRZ, there are wood fuel market opportunities to the east of the forest in and around the conurbations of Kidderminster and Bewdley. This research will look at the opportunities for wood fuel from Wyre Forest irrespective of funding designations.

This project will work build on existing knowledge and work with existing partnerships such as the 'Wyre Forest Landscape Project', which is part of the RRZ implementation plan. The purpose of this first phase of the project is to identify and scope the potential market for wood chip and fuel logs for heat generation from coppice derived material within the Wyre Forest.

No	Task	Outcomes	Organisation	Timescale	Cost
1	To research the volume of material available to service a potential local market: Already available to the market (ie from woodland already under management agreement with a licence/permission to fell– to be classed as follows: Private sector Forest Enterprise English Nature managed land. Material type – existing coppice, stored coppice, High forest – conifer and softwood. Site designation SSSI, PAWS, ASNW RRZ non RRZ b) Potential - material that could be bought onto the market given site managers aspirations, suitable market and infrastructure conditions. A and b need to take into consideration seasonal factors/restrictions, contractor availability and the suitability of material.	Breakdown of actual/potential volume and availability of material over a five year period	MWEN & Heartwoods	Mid Feb 03	£3048.37 (MWEN) £400 (Heartwoods) Total cost of tasks 1and 2 £3484
2	A market survey including; large domestic, small to large business/industrial premises, public buildings - schools, hospitals, etc, agriculture – including horticulture, and potential community heating systems	Identification of potential sites for wood fuel boiler installation within a 15 mile radius of the forest, inc. estimation of heat demand in Kwh	MWEN & Heartwoods	Mid Mar 03	£3048.37 (MWEN) £400 (Heartwoods)
3	The results of the tasks 1 and 2 are expected to reveal a number of sites worthy of in-depth investigation for wood heat potential, and at least one potential district-heating scheme. An in depth investigation and recruitment, 'in-principle', of wood fuel users to the concept for sites outside the Rural Regeneration Zone only. (Those sites identified within the will be form part of the Heartwoods' project remit)Each potential site would have a technical appraisal of its potential in the form of a simple SWOT analysis.	Kwh of 'in principle' sites identified and linked back to a volume of wood fuel needed	MWEN & Heartwoods	End May 03	To be confirmed
	To investigate the availability of contractors, and their business needs, for harvesting/processing/haulage etc of fuel, when wood fuel sites identified		MWEN & Heartwoods	End May 03	To be confirmed

Annex C Note of seminar at Wyre Visitor Centre

15 December 2004

Present

Carol Bamber – Frank Chapman Centre
Peter Wall – Contractor
Simon Walker – English Nature
Wade Muggleton – Worcestershire County Council
Ewan Bent – Marches Wood Energy Network
Bob Evans – Forestry Commission
Simon West – Forestry Commission
Richard Boles – Forest Enterprise
Lionel Hill - Worcestershire Rural Hub
Duncan Webster – Abbey Forestry

1 Introduction

SW welcomed everyone and introduced the purpose of the seminar, based on the report substantially funded by English Nature.

2 Presentation of Phase One findings

EB went through the report and outlined the main findings in the context for wood heating in the region:

- Recent dramatic increase in wood heat installations, principally as a result of high energy prices
- Wood energy is now much more cost competitive, even with mains gas (table 1 – now 1.2-1.8 p/kWh and oil 2.5 p/kWh)
- Opportunity to concentrate on forestry material, but energy crops can also be used

3 Discussion

Key points raised around the table were:

Planning

LH – planning consent maybe an issue in the countryside.

This could be helped by use of case studies and working with local authorities, together with more supportive approaches as in the recent PPS 22 (Planning Policy Statement 22: Renewable Energy – available at http://www.odpm.gov.uk/stellent/groups/odpm_planning/documents/page/odpm_plan_030334.hcsp).

SWa - Smokeless zones maybe an issue:

Exempt appliances are available that can be used in such areas – local authorities will have lists of such areas (http://www.uksmokecontrolareas.co.uk) and usually exempt appliances.

Fuel supply

BE – fuel supply is critical in terms of what comes to market and that there will be contractors available to produce it.

One of the ways this is being addressed is via MWEN setting up a wood fuel supply company

DW - the price/kWh is clearly critical (table 2) and will be site dependent – could it be linked with C – offset as at Worcester?

In real terms fossil fuels are increasing in cost. Initially it may be important to concentrate on areas where producing wood for fuel is cheaper SWa – loading could be a key issue as secondary handling will add to the cost.

The logistics of handling have been looked at and eg RoRo bins and other techniques are being used to minimise additional handling, but there will always be some PW what is the capacity of these bins?

30 m^3 or 7-8 t of chips (perhaps a week's worth of fuel).

Logistics

WM - Worcs CC look to source 75% of material within 20 miles – there is some double handling etc.

LH – Careful planning for chip storage is essential.

SWa – are reliable chippers available?

Mostly arboricultural 'shredders' but bespoke wood fuel chippers now more widely available which are designed to produce a consistent chip.

PW – what size? Is brash a problem?

Say 3 centimetres x 3 centimetres. Brash okay if relatively small amounts in fuel mix – needles can be problematic due to moisture. This can be remedied by a suitable gap between felling and processing.

Wider benefits

WM – what about wood energy driving the management of neglected woodlands?
This is possible, particularly say farm and estate woods where the owner has installed their own boiler, but may be unrealistic in the short term for other small or inaccessible woods. It may be possible to cross-subsidise by using a much cheaper form of wood fuel such as clean waste wood (ie untreated, because of complications over waste & emissions issues)

4 Next steps (Phase 2)

SW outlined the next steps, which were:

- Heartwoods to contact woodland owners and agents to gauge interest in wood fuel production and refine estimates of material available (private sector, FE & English Nature)
- FC TDB (Technical Development Branch) to look at realistic models for wood fuel production
- Heartwoods/MWEN to complete survey of contractor resource and equipment available – some of this may be farm based
- Heartwoods/MWEN to survey potential storage areas (on farm)
- MWEN to undertake more detailed survey/feasibility of buildings highlighted in phase 1 for potential wood fuel installations
- The aim is to complete phase two by April 2005

Grants

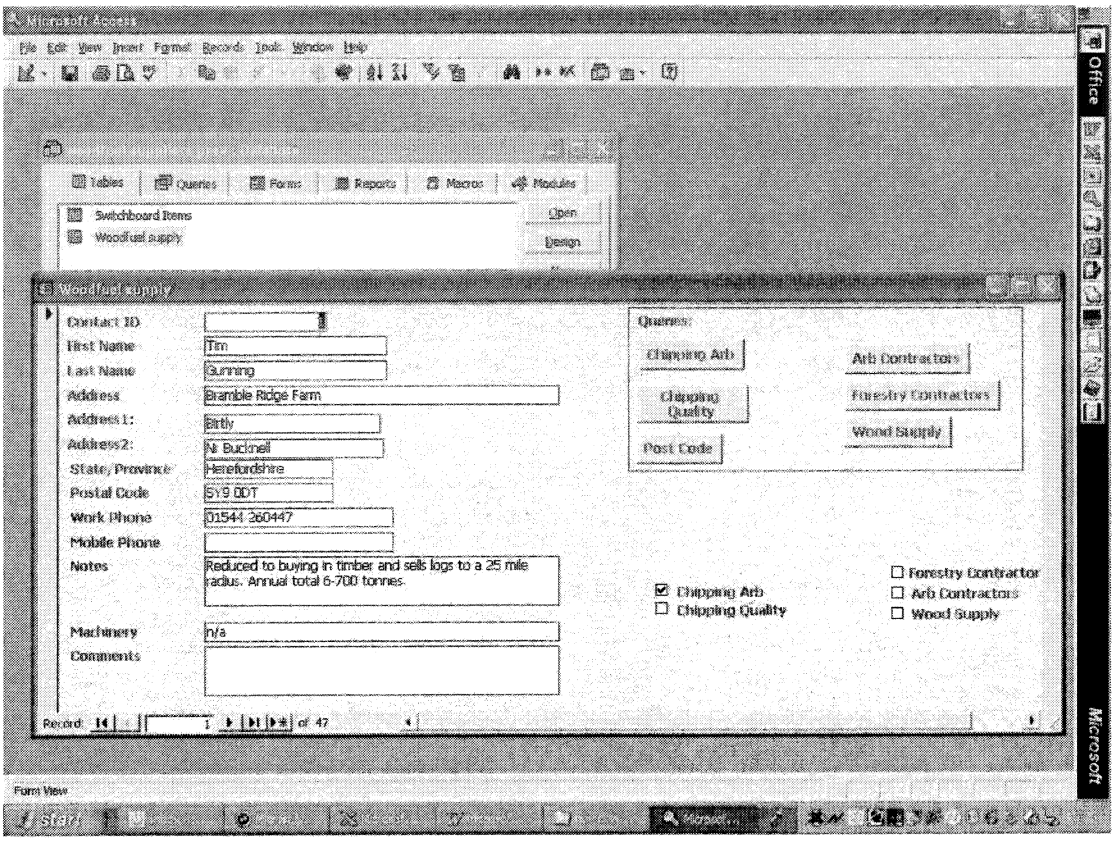
Grants are available – contact MWEN (01952 432814) for more info:

- Community buildings
- Small businesses – interest free loans
- Householders – up to £1,500

Forestry Commission
December 2004

Annex D Contractors' survey database

Screen print of DB:



DB attached....

Annex E Survey letter, questionnaire & distribution

Approximately 27 contacts received the following letter and questionnaire. These comprised individual woodland owners, private and public sector organisations, private sector forestry management companies and forestry agents, Local Authorities and Wildlife Trusts.

20 January 2005

Wyre Wood Fuel Project (phase 2)

I am writing to request some information about woodlands you own and manage within the Wyre Forest and surrounding area with a view to assessing the potential volume of timber available for the production of wood chip.

Phase one of the project looked very generally at the available resource and the potential demand, phase two of the project aims to better quantify the volume of timber being harvested from the Wyre over the next five years in detail and give an indication until 2020. From the information collated it will then be possible to identify what percentage of this is available for wood chip, along with the technologies, systems and infrastructure either existing or required to make wood chip a viable woodland product.

Information is being requested from the major land owners, managers and producers in the area, from both the public and private sectors, to ensure a comprehensive status of the productivity potential is identified so as to determine whether there is capacity to meet the potential demand identified during phase one of the project.

I would be very grateful if you could complete as much of the enclosed questionnaire as possible and return it in the pre-paid envelope. Hopefully much of this information you will already know as many are addressing management planning issues and possibly UKWAS certification. For the purposes of this project, information from draft plans, working proposals, vision maps or forest design plans would give a good overall view, but obviously the more detailed production figures provided the more accurate the results will be.

I will endeavour to contact you over the next few weeks by phone to discuss this further, as there are bound to be issues and constraints that may affect you uniquely and prevent the full utilization of the resource. Please feel free to contact me if you have any queries. The project is due to be completed by March 2005 with a draft report completed that will detail the findings and any gaps in the available systems, supply or demand.

Yours sincerely

John Tetley
Heartwoods Ltd

Wyre Forest Woodfuel Questionnaire issued by Heartwoods |Ltd in January 2005

1 Type of owner/manager

Private Public

2 Size of woodland holding in Wyre Forest?

3 Have you an active management plan?

4 Are you in a WGS, other grant scheme, certified?

5 What (if any) designations or operational constraints are there on your woodland? Such as access, SSSI,

6 What type of machinery is typically used in your operations?

7 What are your management objectives?

i. .....
ii. .....
iii. .....
iv. .....

8 How would you describe your silvicultural systems?
eg continuous cover, clear fell and replant, shelter wood system, coupe

9 If timber production is an objective do you have production forecasts?

If so can you complete the table below:

Forecast period	Total for broadleaves	Total for conifers
2005-2006		
2007-2011		
2012-2016		
2017-2021		

10 What type of material have you been harvesting over the last 5 years?

Year	Total volume		Product					Average cost to roadside per m3
	Conifer	Broadleaf	pulp	coppice	Fire wood	fencing	Logs/bars	
2000								
2001								
2002								
2003								
2004								

11 If conservation works are the main objectives, what is done with any harvested timber?

Please list any machinery or equipment you own/have access to, that might produce, harvest, store or transport wood chip. Such as, chippers, containers, storage barns etc

12 In your view do the woodlands that you work have the capacity to supply chip or round wood to locally installed boilers?

13 Have you looked at woodfuel in the past? What, in your view, is preventing the uptake?

14 Would you be interested in exploring further potential of woodfuel in the region, if so which of the elements listed below would you need information/assistance on in order to make woodfuel a realistic option? (please prioritise)

Timber quality/quantity	established market	known costs/value
silvicultural systems	transport & logistics	Chip quality
Contractor/machine availability		drying and storage

Please feel free to add any other comments or information you feel is relevant.

Annex F Wyre Forest - harvesting of wood fuel products

Date: March 2005

Project Leader: Dave Jones, Forest Research

Summary

The thousands of hectares of woodland in Great Britain are a potential source of wood fuel for local heating requirements but problems arise in identifying suitable and efficient harvesting systems. The four essential factors that influence the overall selection of a system are: woodland, product type and tree species; site and management constraints; harvesting system options; machinery options. The information is based on a series of field visits to the area and data gathered from the Forestry Commission, English Nature and private landowners. A summary of established wood fuel production costs and a comparative summary of harvesting options are both provided as tables.

Introduction

The Wyre Forest and surrounding area is comprised of both publicly and privately owned forest and small woodlands. Within this holding there is great potential to produce wood fuel for local heating requirements. However, many of the smaller woodlands are:

- Undermanaged
- Difficult to access
- Deficient in road or track infrastructure
- Often of low timber quality.
- Frequently remote from main markets or
- Have specific conservation considerations in relation to current and future management.

These negative factors can make it difficult to identify suitable, efficient harvesting systems.

This report gives guidance on the selection of harvesting systems, which would be appropriate for small-scale operations, particularly those, which seek to provide wood fuel in whole or as part of a product, mix from harvesting. It does not however provide specific guidance on felling options.

Many of the systems and machines described here are frequently used in forestry, and the principles to consider when selecting appropriate systems are common to normal forestry situations. However, products required for wood fuel may not be extracted during normal forestry

operations, for example, whole trees, very small diameter trees and small diameter material from crowns and branches. This guide draws together information to enable those interested in the smaller scale harvesting of wood fuel to make fully informed decisions. It describes the factors to consider and the advantages and disadvantages of the various system choices.

The four key factors that influence the overall selection of effective harvesting options are:

- Woodland, product type and tree species present.
- Site and management constraints affecting choice of harvesting system.
- Harvesting system options.
- Machinery options.

The first three factors, when taken together, will influence the selection of the appropriate extraction machinery. That is, the extraction machinery and system(s) best suited to a particular site and crop type or types.

Site and management constraints affecting system and machinery choice

The factors below will affect choice of machine and systems. Often a compromise needs to be made between these factors in terms of ordering priorities and balancing these against optimum performance. The key factor and primary difference in all of the systems described is the method of extraction, and this must be considered in conjunction with the costs and constraints.

Costs

- Type of capital cost. That is the direct purchase cost or lease/hire cost of machinery (the purchaser has little or no direct influence over these costs. However, once the need for a particular machine type has been identified and a sustainable quantity of work found, then purchase or hire of the appropriate type of machine becomes an option).
- Cost of machinery. This is affected by:
  - Whether it is already available (that is whether the owner already has machinery which could be used);
  - How much it will be utilised. (Generally the higher the usage the lower the hourly cost) and jobs should therefore be planned to ensure maximum utilisation.
- Fixed and variable costs (depreciation, planned maintenance, fuel and spares).
- Labour/contract charges/contractor availability/equipment availability.
- Product value(s), that is where higher incomes are generated by the production of higher value products, over and above wood fuel production.

Full costings incorporating all the aspects above are required to establish true unit costs. Consideration must be given to aspects such as machine availability, utilisation and the apportioning of optional charges. That is, if the machine can be used elsewhere on the 'estate', costs may be reduced.

Constraints

Environmental/Conservation

Small woodlands can sometimes be particularly vulnerable to site disturbance from harvesting due to:

- The use of available machinery, which may be inappropriate to the site (for example, agricultural tractors or skidders).
- The lack of brash available for machinery to run on.
- The soil types (clays and brown earth), which can be particularly easy to disturb and damage during wetter weather.
- Bad working practice: sites are often adjacent or close to watercourses and a lack of appropriate protection techniques can lead to unnecessary water pollution.
- Constraints that necessitate working in the wetter winter months of the year.
- The availability of skilled labour.

Relevant environmental protection requirements need to be identified in terms of soil, vegetation, wildlife, water, archaeology and other local constraints such as paths. Weather can influence the potential for damage, for example working during wet weather can considerably increase damage and harvesting may have to be postponed or an alternative system selected.

Note: It is understood that English Nature has concerns over removing wood from conservation areas. However if planned and managed properly to meet multiple objectives this need not necessarily be an issue.

An example of previous TD evaluation work in a conservation area – A Beech wood scheduled for thinning, was worked to test a range of low ground impact machinery and harvesting methods. To fit in with a requirement to protect local flora and fauna, a system for dealing with the state of the site left after these operations, was also put in place. This system created the widest diversity of ground level habitats deemed most suitable. The overall site effect was small, connected areas of relatively open ground beneath the thinned canopy, with loosely heaped structures of deadwood and lop and top at irregular intervals over the site. Although initially the effect looked a little artificial, within one year's growth of existing groundcover species, stimulated by an increase in canopy light penetration, the effect was entirely natural. Follow up monitoring by English Nature established that this approach had generally resulted in a greater diversity for a wider range of flora and fauna compared to an adjacent site that had been thinned with normal methods. Because of the form of the lop and top piles, the habitats created were considered likely to persist for longer than that resulting from normal harvesting work.

Care would be required in creating or managing existing standing deadwood in areas like Wyre where the public has access.

There are established (foreign) practices that could be considered which would both provide a deadwood' resource and yet also meet requirements for quality wood fuel production ie

conifer crops could be thinned by several methods which would leave them as standing deadwood. Whilst drying out to form a quality wood fuel they would present significant opportunities for colonisation by insects etc.

Thinning conifer, or broadleaved crops at an early stage of growth could be done in several ways, which both create greater habitat niches and an assured supply of wood fuel. There are many methods which have just such an established reputation, from use over decades of European and Scandinavian forestry practice ie branch wood, from larger broadleaved fellings, may be treated in a similar manner to the Beech wood thinings example, above. The thicker material removed for wood fuel and the branches etc. put into random heaps to form habitat piles. The overall conclusion from the above is that there are a range of methods, which may be introduced into existing harvesting practice, to provide both a suitable wood fuel resource and an increased diversity of flora and fauna.

Terrain classification

The following factors identify the site performance constraints within which the machinery must work.

- Ground firmness – can it support the machine for the whole operation?
- Roughness – what obstacles (such as boulders or stumps) or unevenness will the machinery have to cope with?
- Slope – what slopes will the machinery have to climb/descend and what are the dangers in terms of overturning or slipping?

Slope will always be the major limiting factor, imposing very definite constraints on the type of machinery, which may be used. Weather conditions, particularly rain, can change the significance of terrain factors and whether the machinery can still operate effectively and safely. For example ground firmness can decrease considerably in wet conditions, good planning, and the use of appropriate available materials such as brash, may reduce the limitation on extraction incurred due to softening of the ground.

Physical and logistical constraints

- **Access to the site.** Access must be available for machinery to get to the site and for the produce from harvesting to be transported away. If hard roading (forest road or adequate track) is not available then a suitable track may have to be constructed.
- **In-wood access.** The ground conditions in the wood may not be adequate to cope with all the machinery travel needed. In areas with or heavy traffic (for example key routes or extraction route convergence at forest roads), it may be necessary to construct a hard track. Such requirements will depend upon the total area to be harvested, extraction distances, load sizes and volumes to be extracted.
- **Extraction distance.** Long distances often make skidding uneconomical: 250 to 300 metres are considered the economical break point.
- **Felled yields per hectare.** Greater yields of produce will require more in-wood travel to extract. High volumes may require a review of the extraction machinery chosen or the specification of extraction routes or tracks to ensure the ground firmness can cope with the amount of traffic.

- **Types of products.** The different product types may affect the choice of extraction machinery or system, for example, crown-wood can be difficult to extract without some in-wood conversion; long poles or whole trees cannot be extracted by some forwarders.
- **Product mix and numbers of products.** If products are similar such as sawlogs of similar lengths, they can be taken out in mixed loads. If products are variable, for example sawlogs, stakes, crown-wood, each may have to be extracted separately. Depending upon the yields per hectare, this can result in small or part loads being extracted and this affects the volume of traffic and cost of the operation.
- **Roadside conversion space.** Crosscutting and stacking of the different products requires space, particularly at roadside where they are stacked ready for haulage. This provision should be planned. At sites where space is limited and high volumes are being extracted, specific space may need to be provided by clearing a small area of ground and constructing some additional hard road access.
- **Marketing strategy.** Small woodland owners may find benefits in co-operative working/marketing.

In general terms, all of the above will be major economic considerations in any planned operation. Site and in-wood access will dictate the shape of current and future operations, therefore various road and tracking options will need to be considered and planned for.

Crop protection

Extraction systems and routes should be planned to minimise tree and ground disturbance. For example avoid skidding long poles against standing trees and causing ground compaction as this could damage root systems.

Harvesting systems options

The following systems are described:

- Tree or pole-length
- Part pole-length
- Shortwood
- Whole-tree harvesting
- Terrain chipping

Note that the part pole-length system is the main variation of the tree or pole-length system.

Tree or pole length

Principal components

- Utilises only the stem wood and results in crown and branch wood residues.
- At one time the most common system in use in the UK and still popular in certain areas and crop types.

- A three-phase operation best suited to a tree size of greater than 0.1 m^3. The tree is felled and delimbed, normally extracted by tractor (winch skidder) or cablecrane to roadside. The pole is usually cut into various products (sawlog, pulp, fencing and wood fuel) and then sorted and stacked for collection. Some buyers may take the whole pole to the sawmill for conversion to enable a better judgement to be made on how best to convert and maximise the value of products.

Part pole-length system

Principal components

- Utilises parts of the stem wood and results in crown and branch wood residues.
- Commonly used in the harvesting of broadleaves, it allows a better standard of organised product presentation in certain situations.
- Sawlogs are removed from the main stem at stump, allowing easier product sorting. Load sizes may be smaller if product density is low and this can have an effect on outputs. The system is primarily suited to skidders, but forwarders or cablecranes can be used. Crown wood and other products and residues can be extracted by a variety of means as described in Shortwood systems.

Shortwood system

Principal components

- Utilises stem wood, crown and branch wood, normally down to a specific diameter size.
- A two-phase operation, generally very efficient and suitable for all tree sizes but efficiency can be limited by ground conditions or slope. The tree is delimbed and crosscut at stump. Extraction only deals with saleable products, including wood fuel, unusable residues being left in wood. The number of products should be kept to less than five. This reduces the need for product sorting, both at stump and at roadside. The preferred method of extraction is forwarder, subject to ground conditions (the soil structure, soil wetness and the localised terrain conditions will all have a bearing on the load carrying capacity of the site, in relation to the number of machine passes made). Although cablecranes can be used they tend to be expensive to set up and are therefore limited to difficult or otherwise inaccessible sites. Skidders can operate the system; subject to distance traveled (maximum 250 to 300 metres) and ground protection requirements.

Whole-tree harvesting

Principal components

- Utilises the whole tree and results in little or no crown and branch wood residues.
- Chipping is incorporated as part of the process; the whole tree or any part of the tree can be chipped. Chipping takes place at stump, in rack, at roadside or in any other suitable location, subject to extraction (machine access and maneuverability are often

constraining factors). Harvesting involves the recovery of nearly all the above ground elements of the tree (stem, branches, foliage) and in some crops can almost double the yield in terms of weight. Subsequent processing can be in wood or at roadside.

- Extraction is normally by wire rope (using skidder, cablecrane, highlead or portable winch) or 'Clambunk' skidding.

The system can be divided into three subsystems:

- Whole tree comminution – Whole tree harvested and chipped to provide one product.
- Integrated harvesting – Whole tree harvested, conventional roundwood products produced and residues chipped.
- Residue harvesting – Conventional Shortwood system used with branches and tops chipped in wood, at roadside or in any other suitable location.

Terrain chipping

Principal components

- Utilises the whole tree and results in little or no crown and branchwood residues.
- A self-propelled chipper unit is used in wood requiring some product accumulation prior to chipping either by forwarding or skidding. Chips are normally 'blown' into a trailer or purpose built bins and forwarded to roadside for subsequent haulage.

Other information

Wood chipping costs

If the wood fuel chip production costs are compared to extraction only costs, a noteworthy difference emerges, with felling and / or chipping comprising the most significant element of the cost. This is not the case for normal forestry operations. The reasoning is as follows:

The total cost of production per m^3 solid to 7 cm, equates to the measured volume put through the chipper. However the actual volume realised through the utilisation of branchwood can be higher so the unit cost can be less. Where a volume to weight ratio is expressed, for example 1:1, the cost of production per tonne, at moisture content for the species being worked, stays the same.

Where the above figure (tonne) has to be converted to a tonne @ 30% moisture content (mc) a greater volume of green timber will be required to produce 1 tonne at that required mc.

Example

If at 60% mc wet basis (wb) the wood part of the timber = 40% x cost of production / m^3.
At 30% mc, 70% will be wood. Therefore the cost of production for x% air dry wood = the production cost per m^3 divided by the known wood % at a given mc (wb) for the species x the actual wood % for target air dry mc.

It can be seen that the need to air dry the wood for chipping is inflating the cost of production. This drying cost when added to the cost of felling/extraction (primary and or secondary) produces an unusually high cost of production.

Table 1 Examples of wood fuel production costs

(a) From broad-leaved thinnings

Case study number	Resource	Crop type	Slope class[a]	System	Extraction machines	Product density (m^3/ha)	Wood fuel (chip) production costs £/tonne @ 30% MC (wb)[b]
3	Mid rotation thin	Beech (high forest (HF))	Level with steep 'snaps'	Pole length	Tractor skidder	68	28.50
4	Early thin	Oak (HF)	Level	Shortwood	'Small' farm forwarder	29	24.75
				Pole length	Tractor skidder	29	24.29
5	Early thin	Mixed Blv (HF)	Steep	Shortwood	Wire loader	36	39.31
				Pole length	Portable winch	36	33.60
					Tractor skidder	42	32.69
7	Early thin	Oak (HF)	Level	Shortwood	Wire loader	32.5	39.64
					Tractor cradle	32.5	34.00
					'Large' farm forwarder	32.5	28.91
					Purpose built forwarder	32.5	28.68
8	Mid rotation thin	Oak (HF)	Moderate	Shortwood	'Small' farm forwarder	– [c]	28.68
					'Large' farm forwarder	– [c]	26.87
					Mini forwarder	– [c]	27.69
					Wire loader	– [c]	45.09
				Pole length	Tractor skidder	– [c]	27.28

[a] Level/gentle slope <20%; moderate slope 20% – 33%; steep/very steep 34% – >50%.

[b] Moisture content (wet basis).

[c] No figure given.

(b) From mixed broad-leaved coppice

Resource	Crop type	Slope class[a]	System	Extraction machines	Product density (m^3/ha)	Wood fuel (chip) production costs £/tonne @ 30% MC (wb)[b]
Coupe felling	Mixed Blv coppice	Level	Shortwood	'Small' farm forwarder	160	30.66
				Mini forwarder	160	34.28
			Part pole	Tractor skidder	160	35.56
Coupe felling	Ash coppice	Moderate	Shortwood	Mini forwarder	90	28.91
				'Large' farm forwarder	90	30.01
				Purpose built forwarder	90	32.48

[a] Level/gentle slope <20%; moderate slope 20% – 33%; steep/very steep 33% – >50%.
[b] Moisture content (wet basis).

From crown wood, residues and 'scrub'

Resource	Crop type	Slope class[a]	System	Extraction machines	Product density (m^3/ha)	Wood fuel (chip) production costs £/tonne @ 30% MC (wb)[b]
Crown wood from late thinning	Beech (HF)	Moderate	Shortwood	Portable winch	71	49.16
			Pole length	Tractor skidder	71	27.28
Crown wood from mid rotation thinning	Oak (HF)	Moderate	Terrain chip	Tractor & trailer	–[c]	94.13
Crown wood from overstorey felling	Beech (CCF)	Level to moderate	Shortwood	'Small' farm forwarder	24	22.62
			Terrain chip	Tractor & trailer	27	48.64
Scrub clearance	Scrub	Moderate	Whole tree	Tractor skidder	16	69.79
Pre comm. thinning	Mixed Blv (HF)	Level	Shortwood	ATC forwarder	71	47.84
			Pole length	ATC skidder	71	52.44
Pre comm. thinning	Mixed Blv	Level	Shortwood	Mini forwarder	30	34.08
				ATC forwarder	30	36.69
			Pole length	ATC skidder	30	44.64
Conifer tops from thinning	Pine (HF)	Level	Part pole	Purpose built forwarder	Thinnings –32 Tops – 8.8	51.38

[a] Level/gentle slope <20%; moderate slope 20% – 33%; steep/very steep 33% – >50%.
[b] Moisture content (wet basis).
[c] No figure given.

Harvesting options guidance

A harvesting system is made up of a number of components, which fell, process and deliver a tree to an in wood loading area, roadside or customer location. Each process within the system utilises different work methods and equipment, which can be varied to suit particular site conditions, tree size or product types (see Table 1).

Table 2, pages 63-73), provides a comparative summary of harvesting options. It gives machinery costs, constraints (environmental, site, planning/organisational, crop protection, health and safety) and extraction costs for each of the recommended systems. Note that pros (green) and cons (red) need to be considered in the light of their overall performance, provided environmental and health and safety requirements can be satisfactorily met.

Table 2 Harvesting options. Pros (green) and cons (red) need to be considered in the light of overall performance. Indicative extraction cost by case study (£/tonne (£/t)) are based on 100 m travel in wood and 25 m on road unless specified.

Machine type: FORWARDERS
In this guide forwarder size classes are taken as large –15 to 20 tonnes; medium – 8 to 14 tonnes; small (or midi) 5 to 7 tonnes; mini – up to 5 tonnes.

Purpose built forwarder	Factors derived from harvesting systems					
	Cost(s)	**Environment**	**Site**	**Plan and organise**	**Crop protection**	**Health & safety**
Pros or Cons	1. Often have lowest unit costs on large-scale operations 1. High capital cost 2. High hourly cost 3. High transport costs (problem on small jobs)	1. Given the right conditions (ground, weather, brash availability) large forwarders will require fewer passes to remove produce 1. Route pre-organisation and maintenance requirements high on wet sites, in order to avoid excessive site damage that is rutting and subsequent risk of water pollution	1.Suitable for extracting conifer residues 2. Slopes <50% 3.Suitable for all woodland types 4. Slopes up to 60% for whole tree Clambunk forwarder; clearfell only	1.Greater load capacity and capable of dealing with large programmes efficiently 2. Particularly suited to distances >500 m 1.Cost of transport to site 2.Ease of access 3.Not always suited to whole tree or long pole systems, depends on limitations of 'bunk'	1. Damage generally less than that caused by skidding or cablecrane systems 1.May cause standing tree root damage	1. Good ergonomics in comparison to farm forwarders 1.Training required for efficiency and safety reasons

Farm forwarder	Cost	Environment	Site	Plan and organise	Crop protection	Health & safety
Pros or Cons	1. Flexible; can be cheaper in terms of unit cost than purpose built 8–10 t machines on small jobs 2.Mid range capital cost	1. Route pre-organisation and maintenance requirements high on wet sites. In order to avoid excessive site damage Route planning to take account of forwards machine movement limitation	1.Suitable for extracting conifer residues 2. Slopes <30% 3.Suitable for all woodland types 1.Obstacles and rough terrain can cause problems, but less for Powerdrive trailers	1.Greater load capacity 2. Can be used for other agricultural activities 3.Suited to distances >500 m 4. Small whole tree system can be effective with simple bunk and loading technique modifications 1.Not suited to long pole systems	1. Damage generally less than that caused by skidding or cablecrane systems 1.May cause standing tree damage/root damage.	1.Training required (for efficiency and safety reasons)

Purpose built mini forwarder carrying up to 1.5 tonne	Cost	Environment	Site	Plan and organise	Crop protection	Health & safety
Pros or Cons	1.Low unit costs for shorter extraction distances able to compete with larger purpose built machines on some sites 1. Relatively high capital cost, with higher unit costs than larger machines on bigger jobs/longer extraction distances	1.Very low ground impact	1. Slopes 30% to 50% dependent on machine design type (for example frame-steered = 50%). 2.Suitable for all woodland types 1. Less ground clearance than larger machines	1.Easy access 2.Easy transportation 3. Can be used for other off-road operations 1.Low load capacity 2.Suited to distances <250 m	1.Low ground impact 2.Manoeuvrable within crops	1.Training required (for efficiency and safety reasons) 2. No OP, FOP or ROP protection on some machines

ATC based forwarder	Cost	Environment	Site	Plan and organise	Crop protection	Health & safety
Pros or Cons	1.ATC cost varies 2.Attachments low cost 1. Generally high unit costs	1.High traction force + low weight can cause ground damage if not properly used	1.Slope - ATC & trailer <25% 2.Roughness can cause problems 3.Brash/waste can cause problems	1.Easy access 2.Easy transportation 1. Low load capacity, suited only to small jobs 2.Suited to distances <200m	1.Manoeuvrable. 2. Potential for crop damage low	1.Training required (for efficiency and safety reasons) 2.Some manual handling involved

Machine type: TRACTOR CRADLE

Tractor cradle	Cost	Environment	Site	Plan and organise	Crop protection	Health & safety
Pros or Cons	1.Low capital cost 1.Requires tractor unit	1.Allows access to difficult sites	1.Suitable for all woodland types 1.Slope limitations <25%. 2. High potential for site damage	1.Easy access 2. Easy transportation 3.Can be used for other agricultural activities 1.Low load capacity, only suited to small jobs 2.Suited to distances <150m 3.Only suitable for early thinning operations and shortwood system producing short lengths 4.Manual handling requirement precludes the production of large products 5.Not suited to whole tree or long pole systems	1.Manoeuvrable within crops 1.May cause standing tree/root damage	1.Training required (for efficiency and safety reasons) 2.Some manual handling involved

Machine type: HYDRATONGS

Hydratongs	Cost	Environment	Site	Plan and organise	Crop protection	Health & safety
Pros or Cons	1.Low capital cost 2. Can achieve lower unit costs over short extraction distances 1.Requires tractor unit	1.Allows access to difficult sites 1. Potential for ground damage, particularly on wet sites	1.Suitable for all woodland types 1.Slope limitations <25%. 2. High potential for site damage.	1.Easy access 2.Easy transportation 3.Can be used for other agricultural activities 1.Low load capacity, only suited to small jobs 2.Suited to distances <150m 3.Only suitable for thinnings operations 4.Suited to whole tree or long pole systems, working downhill	1.Manoeuvrable within crops 1. May cause standing tree damage/root damage.	1.Training required (for efficiency and safety reasons)

Machine type: WIRE LOADER

Wire loader	Cost	Environment	Site	Plan and organise	Crop protection	Health & safety
Pros or Cons	1.Low capital cost 1.Generally high unit costs	1.Allows access to difficult sites 1.May cause standing tree damage/root damage 2.Generally has lower flotation capacity than purpose built machines	1.Suitable for all woodland types	1.Easy access 2.Easy transportation 1.Low load capacity, suited only to small jobs 2.Suited to distances <500m 3. Limited product length for best efficiency 4. Detailed route planning and felling presentation essential to avoid high unit costs	1.Moderate ground impact 2. Able to work with very widely spaced racks	1.Training required and recommended as work requires specific combinations of skills 2.Some manual handling involved

Machine type: WINCH

Manually portable winches (for example Kolpi)	**Cost**	**Environment**	**Site**	**Plan and organise**	**Crop protection**	**Health & safety**
Pros or Cons	1.Low capital cost 1. High unit cost	1.Allows access to difficult sites	1.Suitable for all woodland types 2.Suitable for use on steep banks and wet soils 1.Suited mainly to small thinnings	1.Easy access 2.Easy transportation 1.Low load capacity 2.Suited to distances <40 m, only sustainable on small jobs	1.Low ground impact	1.Training required (for efficiency and safety reasons) 2.Some manual handling involved 3. Limited load control on downhill slopes

Machine type: SKIDDERS

Farm skidder	Cost	Environment	Site	Plan and organise	Crop protection	Health & safety
Pros or Cons	1.Relatively low capital cost/low sophistication 1.Only gives competitive unit costs over shorter extraction distances	1.May cause considerable terrain damage on vulnerable sites	1.Suitable for all woodland types 1.Not suited to wet sites or slopes > 30%	1. Can be used for other agricultural activities 1.Low load capacity 2.Suited to distances <150m 3. Requires conversion space at roadside	1.Manoeuvrable within crops 2. May cause considerable crop damage	1.Training required (for efficiency and safety reasons) 2.Some manual handling involved

Purpose built County skidder	Cost	Environment	Site	Plan and organise	Crop protection	Health & safety
Pros or Cons	1.Relatively low capital cost/low sophistication 2.Competative unit costs over shorter extraction distances	1.May cause considerable terrain damage on vulnerable sites	1.Suitable for all woodland types 1.Not suited to wet sites	1. Can be used for other agricultural activities 1.Load capacity up to 5 m^3 2.Suited to distances <250 m 3.Potential for site damage higher than any other system 4. Route planning essential to avoid terrain/crop damage 5. Requires conversion space at roadside	1. May cause standing tree damage/root damage.	1.Training required (for efficiency and safety reasons) 2.Some manual handling involved

Small tracked skidder	Cost	Environment	Site	Plan and organise	Crop protection	Health & safety
Pros or Cons	1.Relatively low capital cost/low sophistication 2. Equipped with stacking blade 3. Low unit costs over shorter extraction distances	1.Lower ground pressure than many other tractors 1.Will cause site damage on wet and on other vulnerable sites	1.Suitable for all woodland types 1.Not suited to wet sites 2. Track damage sensitivity on rough sites	1.Improved traction on up/down slopes 2.Able to cross narrow drains/ditches 1.Low load capacity 2.Suited to distances <150 m 3. More sensitive to side slopes than wheeled	1.Low ground impact	1.Training required (for efficiency and safety reasons) 2.Some manual handling involved

ATC Skid Arch 'Sulky' skidder	Cost	Environment	Site	Plan and organise	Crop protection	Health & safety
Pros or Cons	1.ATC cost varies 2.Attachments low cost 1.Relatively high unit costs	1.The Arch itself has lower potential for ground damage 1.High traction force and low weight from ATC can cause ground damage	1.Suitable for all woodland types 2.Can cope with some steep ground 1.Roughness can cause problems 2.Brash/waste can cause problems	1.Easy access 2.Easy transportation 1. Low load capacity, suited only to small jobs 2.Suited to distances <150 m	1.Manoeuvrable, but trailed load limits turning radii.	1.Training required (for efficiency and safety reasons) 2.Some manual handling involved

Machine type: CABLEWAY SYSTEMS

Highlead	Cost	Environment	Site	Plan and organise	Crop protection	Health & safety
Pros or Cons	1.Low capital cost 2.Competative unit costs over shorter extraction distances	1.Allows access to difficult sites 2.Low levels of site disturbance	1.Suitable for all woodland types 2.Suited mainly to small thinnings or shorter extraction distances 3.Suitable for use on steep banks and wet soils	1.Low load capacity 2.Suited to distances up to 150 m, but dependent on concavity of terrain. 3.Setup time, but lower than other cable systems. 4.Best suited for high product density 5. Stacking space required at roadside 6. May require secondary extraction	1.Low ground impact 1.Some potential for stem damage	1.Training required (for efficiency and safety reasons) 2.Some manual handling involved

Gravity System	Cost	Environment	Site	Plan and organise	Crop protection	Health & safety
Pros or Cons	1.Low capital cost 1.Competative unit costs over shorter extraction distances	1.Allows access to difficult sites 2.Low levels of site disturbance	1.Suitable for all woodland types 2. Suitable for steep banks using up hill extraction only 3.Suited mainly to small thinnings	1.Low load capacity 2.Suited to distances up to 300 m 3.Setup time. 4.Best suited for high product density 5. Stacking space required at roadside 6. May require secondary extraction	1.Low ground impact 1.Some potential for stem damage	1.Training required (for efficiency and safety reasons) 2.Some manual handling involved

Skyline	Cost	Environment	Site	Plan and organise	Crop protection	Health & safety	
Pros or Cons	1.High capital cost 2.High unit costs therefore generally only used on sites where forwarding/skidding is not an option	1.Allows access to difficult sites	1.Suitable for all woodland types 2.Suitable for use on steep banks and wet soils	1.Low load capacity 2.Suited to distances >300 m 3.Setup time 4.Best suited for high product density due to high unit cost	1.Low ground impact	1.High level of skill required therefore training essential 2.Some manual handling involved	

Machine type: TERRAIN CHIP

Terrain chip	Cost	Environment	Site	Plan and organise	Crop protection	Health & safety
Pros or Cons	1.Moderate cost depending on components used 2. Purpose-built units are expensive	1.Can cause site damage on wet sites, subject to route planning, construction and maintenance	1.Not suited to wet sites	1.Low load capacity 2.Suited to distances <250m 3. Best suited for high product density 4. Slope <25% 5.High organisational input required re presentation of residues	1.Limited maneuverability	1.Training required 2.Some manual handling involved with non-loader feed units

Indicative outputs and costs for chipping

The work of Technical development Branch has identified indicative costs and outputs for various common types of chippers and these are shown in Table 3.

Table 3 Chipping outputs and costs

	Disc chipper	Drum chipper	Screw chipper (small screw)	Comments
Outputs (m^3 solid wood/shr)	3 – 4	4 – 5	5 – 6	Output dependent upon material size Machine size: (semi-professional/small home models excluded).
Chipping costs (m^3 solid wood/shr)	£9.00	£6.50 – £7.50	£6.50 - £7.50	Two man team at £8.00/man hr[a] and includes £2.00/m^3 for cross cutting. No machine purchase costs or other operational costs are included.

[a] This 1998 figure relates to operations carried out at that time. It does not include oncosts or overheads.

Discussion

Any harvesting operation depends on the site; access and distance to roadside; methods used and the scale of the operation. Extraction machinery in particular will be a key influencing factor. Some systems may be inappropriate for small woods.

Costs vary widely according to the harvesting system used and are subject to the many factors already discussed. However, in simple terms, costs of extraction in thinning are higher than in clear felling, with basic costs increasing between £1.00 and £2.00 m^3 for every additional 100 m of extraction. Current indicative costs for extraction is shown in Box 1, page 23.

Box 1 Current cost for extraction in thinning on different terrains	
Steep ground	Cable-crane systems – range from £10/m^3 to £25/m^3
Moderate ground	Skidder (for example Ford County type) – range from £5/m^3 to £12/m^3 Portable winch (short distance only) – range from £3/$m^3$to £6/m^3 Forwarder – range from £3/m^3 to £15/m^3
Easy/flat ground	Forwarding systems (medium/large) – range from £3/m^3 to £12/m^3 Skidder (for example Ford County type) – range from £5/m^3 to £12/m^3 All Terrain Cycle equipment – range from 13/m^3 to £17/m^3 Small scale forwarder (mini) – range from £4/m^3 to £15/m^3

As can be seen, not all the case studies show optimum system or equipment performance. This is due in part to factors, which are specific to the individual case study.

Comments applicable to crop types

In broad terms the findings from the case studies are as follows:

- Forwarding tends to be more cost effective than skidding, which is considered to be inefficient for longer extraction distances (>250 m)
- Where difficult sites require maximum manouverability and flotation, mini forwarders should be considered.
- Forwarding using the appropriate machine is likely to cause less ground disturbance on drier sites than skidders and terrain chippers, with small-scale forwarders causing significantly less site disturbance.
- Skyline operations tend to be the most expensive option, their use being dictated by site and setup time constraints.
- System machine choice must take account of:
  - Machine availability
  - Machine flexibility
  - Differing machine/labour costs within and between areas
  - Site conditions
- Unit costs vary according to the cost factors charged to the primary and or secondary operations, that is, if the primary operation is to fell, extract and convert, irrespective of fuelwood production, and then the costs associated with those operational factors will already be incurred. Where this is the case, secondary operations such as fuelwood harvesting should be costed as such.
- In general terms harvesting costs increase when:
  - Slopes increase
  - Uphill extraction is used
  - Lower volume and product densities are harvested
  - Smaller product volumes or sizes are harvested
  - Poor tree and product forms are worked and produced
  - Access is poor or difficult
  - Extraction is over longer distances.

Early broad-leaved thinnings

- Lower volume returns, coupled with higher unit costs, make them the least profitable option.
- Pole length working is generally the cheapest system, but there is often little difference between skidding and forwarder shortwood options.
- Wire loaders are always the most expensive option in terms of hourly production costs, but they are one of the lowest capital cost units.
- On easy terrain a farm tractor-based forwarder is likely to be as cost effective as a larger purpose built unit, depending on extraction distance.

Mixed broad-leaved coppice

- Harvesting costs for machine/system combinations on each site were similar and choice is likely to influenced by other factors such as availability, capital cost and site / environmental constraints.
- On steep sites (>50%), purpose built forwarders are the most expensive option (forwarding is at its limits on these slopes).

Crownwood, scrub and residues

- 'Pre-commercial thinnings' are often felled and left on site, however there may be some cost benefit in utilising material as wood fuel.
- Crown wood can be a cost effective fuel resource although the correct harvesting system needs to be adopted, that is, skidding, forwarding (to stump or roadside) or terrain chipping, subject to the correct machine choice.
- The only case study on terrain chipping showed it to be expensive and not cost effective. However the major factor influencing this was inappropriate machine choice, and the study demonstrated that there was significant room for improving outputs by using a suitable machine.

NOTE: The data drawn together in this guidance relates to work carried out by Technical Development Branch over the last ten years. It relates to specific site and crop types dealt with during the studies. However, no specific cost comparison base has been established from these trials.

Conclusions

- ➢ This site could be the focus of a joint effort on behalf of English Nature and FC to show the tangible benefits of a suitable practical approach to achieving a balance between economic timber harvesting and the practical maintenance / encouragement of diversity of woodland flora and fauna.
- ➢ The area is relatively flat and well provisioned with roads/tracked.
- ➢ Machinery use would appear to be little compromised either by terrain or crop.
- ➢ For the terrain and crop types present, agricultural machinery with suitable attachments would be capable and efficient.
- ➢ There would appear to be plenty of scope for a significant amount of wood fuel production. From conifer crops this would be an alternative for the pulpwood / small roundwood element. Volumes could be increased by a smaller acceptable top diameter cut-off, (eg 2cm min.). For larger broadleaf crops, branch wood is well suited to the wood fuel market. Existing small roundwood markets for broadleaf crops are not usually as buoyant as conifer so wood fuel could offer more opportunity allowing for the limitations of local markets.
- ➢ Known volume potentials at the moment are not clear. However there may be sufficient volume to support the local development of a small community scheme, (20 to 30 houses) and a small village school / community center or similar.

- From some output costs quoted it would seem probable that suitably organised wood fuel supply chain systems could be economically viable in the Wyre area when compared to oil fuel equivalent costs.

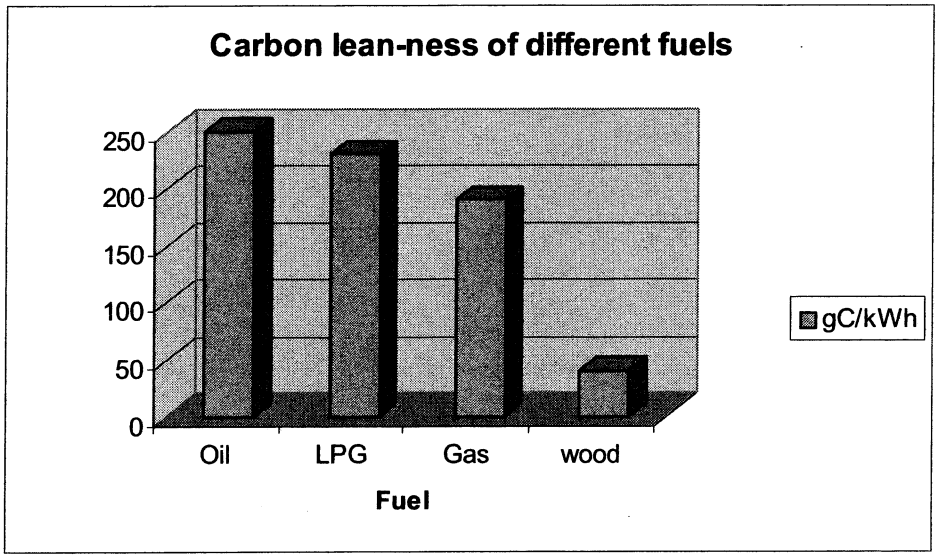
Factors yet to be determined

- A more exact and comprehensive analysis of production potential is required in order to better estimate volumes available.
- There is a need to establish actual deadwood requirements; what it would be for, ie state local flora and fauna requirements? And establish what deadwood accumulation/dispersal method suits these requirements?
- Are there any other specific conservation/access requirements?

Annex G Carbon savings for wood v fossil fuels

fuel	gC/kWh	saving/kWh
Oil	250	210
LPG	230	190
Gas	190	150
wood	40	0

gC/kWh = grammes Carbon per kWh for different fuels from DETR Environmental statistics June 1999



ENGLISH NATURE

Research Information Note

English Nature Research Reports, No 711

Assessment and development of fuelwood uses for products from SSSI and ancient woodland conservation management at Wyre Forest, Worcestershire/Shropshire

Report Authors: Heartwoods Ltd in conjunction with Marches Wood Energy Network Ltd (MWEN) and Forestry Commission Research (FCR). **Editors:** Simon West (FC) and Mark July (English Nature).
Date: September 2006

Introduction

This study arises from the national English Nature/Forestry Commission Joint Statement of Intent. The research addressed the need for policy development to support nature conservation priorities for woodland SSSIs and ancient woodlands in the wider countryside, specifically initiatives to market sustainable woodland produce.

Conservation objectives for the Wyre Forest - a 897 ha SSSI and 572 ha National Nature Reserve- require cyclical woodland management, including the large scale restoration then maintenance of oak coppice. The practical achievement of these objectives requires maintenance of traditional timber and wood outlets and creation of new markets for the products of coppice systems. The desired outcomes from the research were to inform local or regional woodfuel market development and English Nature's national positioning and advocacy with respect to biofuels and renewable energy policy. It sought to illustrate the key factors involved in establishing a local wood fuel supply chain in a favourable part of lowland Britain.

What was done

The primary objective was to assess fuelwood's potential contribution to support conservation management at Wyre by researching the supply options from the silvicultural systems employed and the scope of local markets to utilise that supply. Understanding the associated infrastructure and business requirements and key issues was also fundamental. Heartwoods Ltd – a local woodland initiative - provided expertise on sourcing fuel supply, a specialist contractor (MWEN) on fuelwood markets and FCRA on supply chain logistics.

The project operated in 2 phases. The preliminary phase (2002/3-2003/4) was a desktop analysis which identified the potential market for wood chip for heat generation for large heat user categories in the public and private sectors. An initial scoping of the scale of Wyre wood production, a specification for wood use as woodchip fuel, an outline of the infrastructure requirements and three indicative production scenarios from different silvicultural regimes were undertaken. Basic information on contractors' capacity/interest in wood fuel production was accrued. The work concluded that the potential local market was significant and well within the scope of the Forest's productive capacity, and that these twin aspects should be further researched.

The primary study (2004/5 to Q3 2005/6) built on the scoping work of Phase 1 and continued the twin - track approach to wood production and utilisation and market evaluation and promotion. The production side work entailed an event and questionnaire surveys aimed at communicating and accessing information on sources of wood fuel, and on the logistics of supply chain infrastructure. An ancilliary FCRA report focused on the outputs and costings from the range of silvicultural and harvesting systems, to inform the economic appraisal of woodfuel production. The demand side work entailed an appraisal of the woodfuel demand potential of specific local buildings, through investigation of energy needs and other factors affecting decisions to switch heating fuel. From this, to identify frontrunner localities to utilise boiler conversion grants etc. As an adjunct, the study looked at the option for utilisation of wood fuel for electricity generation by Ironbridge power station.

Continued.....

Findings

- The owner/manager seminar endorsed the project and helped to design the subsequent survey. It confirmed that active private sector involvement in wood fuel supply will take some time to develop, due to a cautious and sceptical attitude towards the development of new forest product markets and a limited capacity to diversify.
- The development of a database of contractors in the Marches area established the limited availability and capacity of contracting businesses to undertake viable wood fuel harvesting and processing operations, but that larger, mechanised operators were available and that business opportunities could be fostered.
- A successful mechanism for processing wood fuel and delivering it to boilers is being developed by MWEN, based around wood fuel 'depots' based on farms. This is entirely relevant to future demand in and around the Wyre and was used as a case study in the recent Government response to the Biomass Task Force report.
- Estimates of future timber supply reveal that the Wyre Forest (public and private) is easily capable of serving potential local demand for wood fuel, subject to costs. Wood fuel will accompany the production of traditional products (logs, bars, pulp etc) and will be influenced by the price structure of these markets.
- The use of wood chip fuel for heating is growing rapidly in the West Midlands. Presently, there are no boilers in the immediate vicinity of the Wyre, but five sites with immediate potential and six further prospective sites for conversion to wood fuel were identified. This would require 1,400 tonnes of wood chip or around 2000 green tonnes of wood per year with a Carbon saving of some 800 tonnes per year.

The potential for use of locally produced wood for co-firing in coal-fired power was found to be remote given a combination of policy, technical and economic constraints.

Results and conclusions

Wyre Forest can be a centre for the development of a local woodfuel supply chain, with multiple-use forest management serving a market for renewable energy in a mutually supportive relationship. The economics and logistics of local supply and demand can be made to work here if all the salient factors are tackled in an integrated way. The area has the potential to show national leadership in this aspect of sustainable development. Local partners will continue to progress this intent.

The above findings are the basis of recommendations to local and regional stakeholders on next steps to make a viable woodfuel supply chain an operational reality. Some of the barriers and constraints to implementation depend on national government action to stimulate the woodfuel market, and new supportive policy measures have recently been agreed. Other recommendations will be advanced through existing local and regional structures and projects and ongoing inter-agency co-operation.

English Nature's viewpoint

This research has furthered English Nature's April 2002 position statement on environmentally sustainable forestry by illustrating the economic potential and relevance of wood fuel, to support management of a major wildlife-rich, woodland area – one of the ten " critical actions" for the future of nature in the English lowlands (Townshend, D. and others 2004). The project has shown how a positive economic climate for the development of woodfuel markets could be put into local practical effect. It can also contribute to local efforts to retain and foster forest-based employment and to reduce carbon emissions from domestic heating.

English Nature will advance the wood fuel agenda for the Wyre Forest through the work undertaken by Natural England and its partners for sustainable use of the natural environment. The main mechanisms being the 'Wyre Forest Landscape Project' and the delivery plan for the West Midlands Regional Forestry Framework, actioned through the Wood Energy Task Group and BioEnergy West Midlands.

Further information

English Nature Research Reports and their *Research Information Notes* are available to download from our website: www.english-nature.org.uk

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