On-Site Sawmilling and Timber Conversion

Information Pack

The Chilterns

TWIG Transnational Woodland Industries Group

Recite II

On-Site Sawmilling and Timber Conversion

Information Pack

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Loren Eldred,
Chiltern Woodlands Project,
September 2000.

On-Site Sawmilling and Timber Conversion

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Plate 1. A mobile sawmill can add a new dimension to your woodland management
L. Eldred, Chiltern Woodlands Project

1. Introduction

i The aim of this sawmilling pack

This pack is intended to illustrate to woodland owners how they can use a mobile sawmill to process their timber. It is not designed as a technical document but to provide an introduction to one important way of raising revenue from a wood. Owners can find out more about the process by contacting sawyers and woodland owners who have used mobile sawmills.

ii What is On-Site Conversion?

On site conversion is cutting felled timber into useful products within the wood. Using a mobile sawmill for on-site conversion is one way to do this. Other ways may be to use a firewood processor, woodchipper or a bark peeling machine. Which method of conversion you use depends on what products are required and the material available.

iii Why Use a Mobile Sawmill for On-Site Conversion?

On-site conversion can:

- Add value to your timber for sale.
- Can make small parcels of timber saleable.
- Convert material for your own use.
- Do away with road transport costs to and from a commercial sawmill.
- Produce many different items such as planks, beams, gateposts, flooring, feather-edged cladding boards and so on, which can be used around your estate. This can provide considerable savings as it cuts out the need to buy raw materials from elsewhere.
- Allow unusual timber, character or sizes to be cut.
- Assist the management of your wood.
- Allow specific trees to be processed into specific products.
- Produce valuable by-products such as sawdust that you can use yourself or sell on as a product.

iv Adding Value

Adding value by one or more of the methods to convert timber is a way to balance the cost of managing a small woodland. It can:

- Increase returns from felled timber
- Reduce expenditure on bought-in wood products
- Give the satisfaction of a known timber provenance

- Provide satisfaction in using one's own timber
- Stimulate other woodland management
- Encourage other local enterprises/wood uses
- Encourage local resource sustainability and produce benefits for recreation, landscape and the natural environment

v Profits

It may be possible to generate profits of **200-300%** through mobile sawmilling if the timber is sold. A standing tree worth £10 may increase to £150 if planked and if air seasoned may increase to £300 or more (figures from the Mobile Bandsaws leaflet by the Oxfordshire Woodland Project).

Plate 2. Using a mobile sawmill in your wood can not only convert timber into useful products, but provide satisfaction in using your own timber
L.Eldred, Chiltern Woodlands Project

2. How you can utilise your timber

Species	*Uses*	*Durability*
Ash	Framing, flooring, internal joinery, floors and furniture. Smaller diameter useful for tool handles. Gates if treated.	Not durable as exterior wood
Beech	Interior joinery, furniture and floors.	Not durable as exterior wood although will take preservatives well.
Birch	Furniture and floors.	Not durable as exterior wood, unless treated.
Wild Cherry	Furniture, cabinet making, kitchen workshops, high-class joinery and panelling.	Semi durable as exterior wood.
Sweet Chestnut	Fencing posts, tree shelter stakes, beams, furniture	Durable as exterior wood
Hornbeam	Charcoal, splitting wedges, traditional for gear teeth in water mills, turnery use.	Not durable as exterior wood.
Larch	Fencing posts, tree shelter stakes	Semi-durable as exterior wood.
English Oak	Structural work both interior and exterior. Floors, stairs, furniture and panelling. Gateposts, cladding boards for barns and beams for construction. May be used green in construction but requires careful sawing & carpentry to avoid problems on drying.	Durable as exterior wood. (Sapwood susceptible to powder post beetle infestation).
Sycamore	Joinery, furniture and floors. Timber showing good figure is especially valuable.	Will perish out of doors unless treated.
Yew	Decorative work, carvings and veneers. Small diameters used in turnery work.	Durable as exterior wood.

(Source-British Grown Hardwoods The designers' handbook, TRADA Technology 1996)

However, with the use of chemical treatments some timbers can be used out of doors which may not have been used in that role in the past.

Plate 3. Planks and beams produced with a mobile sawmill
J.Morris Chiltern Woodlands Project

3. Forestry Machinery

i Types of Mill

Static Mills – several types are widely used and are either circular or band saw mills.

Static mills may be a small saw bench used on a farm for occasional use or a larger saw used at a timber yard.

Conventional circular saw benches are widely used by many people to convert timber. They are reasonably simple to use but the saw has to be carefully maintained to achieve the best results. Maintenance of the circular saw involves both tensioning (which needs sawdoctor expertise) and sharpening (relatively easy for a trained operator). The depth of cut may be a restriction.

Circular Double Slabbers are simply two circular blades mounted on the same bench, which make two cuts at the same time. This decreases the time to convert a piece of timber but requires lots of power to run two blades at once. It can process short lengths of timber quickly but has diameter limitations. They have fewer teeth compared with a circular saw, sometimes as few as six. Usually two operators are required for the double slabber.

Vertical band saws are used at most timber yards and can process logs over 25cm diameter and 2m in length. The bandsaw blade needs sharpening after several hours work. Band saws produce a thinner cut than other types of mill (down to 1mm thickness) and can work faster. They have a low energy requirement.

Mobile Sawmills

Mobile sawmills are the type of mill that a small woodland owner is likely to use. There are many different models on the market from small, portable saws to trailer-mounted saws. Mobile sawmills are useful for cutting round timber over 25cm in diameter and 2m in length. Power can be from the mill's own engine, or from a tractor power take-off. Some of the sophisticated versions use a hydraulic system to load the timber and turn it to meet the saw. Most require just one operator although a second person can help with the loading and unloading of the logs and timber products.

For more information on the different mobile sawmills models available and a comparison of their performance, refer to the *Bibliography* and *Useful Addresses* at the end of this pack.

Plate 4. Chainsaw mill in action
Forestry Commission

Chainsaw mills are the cheapest types of mill to purchase. These are very effective at producing minor amounts of timber on site for the small-scale user. They are portable and easy to set up. Although cheap to buy, they are slow and more waste is generated because of the wide cut of the chain and are therefore not suited to producing valuable timber. The chain will have to be filed to a new profile for ripsawing and sharpening the chain can be a long process because the chainsaw has to be first dismantled from the mill. The chain tension will need checking as sawing progresses. Technical versions are available where the chainsaw is attached to an aluminium frame and is wound along on a rail. These types of mill have the advantage of making the chainsaw a more versatile tool from felling the tree to converting it. You must ensure that you have a current chainsaw certificate and have been properly trained.

Mobile bandsaws have a fast cutting speed, a narrow saw cut and low energy demands. Many weigh about a tonne, are towable behind a four-wheel drive vehicle and take very little time to set up, sometimes only 10 minutes. Narrow or wide bandsaws are available. Narrow bandsaw blades are able to take several resharpenings and are disposable. Wide bandsaw blades require sharpening by a skilled sawdoctor and are extremely accurate in their cutting. Mobile bandsaws are the most common mobile sawmill for hire and can cut logs as large as 90 cms in diameter into products ranging from beams to veneers.

Plate 5. A mobile bandsaw making the first cuts through a log Forestor – Standrange Ltd

Mobile circular saws are generally very compact to transport and can process timber quickly. Trailer-mounted, modern high speed circular sawmills are the fastest cutting mills for small diameter logs and are very popular in Scandinavia. The saw sits within a carriage unit which runs on rails either side of the log and is pushed or wound through the log. Two-cut circular saws can swivel through 90° to cut in the horizontal and the vertical planes while the log remains at ground level. Due to this sawing method, there is no requirement to turn the log as with mobile bandsaws which cut in one plane. The depth of cut is limited compared with a bandsaw, so in order to saw wider pieces such as beams, the saw can be reversed for a second cut. Metal rails can be joined on some models enabling very long logs to be sawn. Mobile circular saws generally produce a wider cut (kerf) than mobile bandsaws. The Blossom **Double-Slabber** is a type of mobile sawmill that uses two circular blades at once. It has been designed to process low-grade, small diameter timber originally for use in Welsh small woods and produce products like flooring boards and fence posts.

Plate 6. A portable circular saw which cuts horizontally on the forward run and vertically on the return. Forestor – Standrange Ltd

Mobile sawmills are best hired in when you have plenty of material to process. To purchase one of these can cost between **£5 000 to £30 000** (chainsaw mills cost less), so for processing small amounts such as three logs or more, hiring a mobile sawmill with an operator is more cost effective. Hiring a mobile sawmill can cost between **£200 – 280** per day. ***All types of sawmills require skill and care and should not be operated without proper training.***

ii Extraction Equipment

In some cases, it may be possible to bring the sawmill close to the felled trees. If this is not possible, the timber will need to be extracted to the milling site using a form of extraction equipment.

For small-scale extraction on an undemanding terrain, tractor-based machinery is adequate. Single drum, 3-point linkage **winches** are often used which can cost just over £1000 and can enable the logs to be pulled to the loading or working area. A **skidding cone** can be fixed in front of the logs to prevent them from digging into the ground when being winched. Logs can be attached to a **skidding bar** on a 3-point linkage and driven out behind the tractor although cleaning the logs after extraction will be necessary to prevent damage to the saw blade during processing. Small, hand-portable winches are useful across shorter extraction routes and difficult terrain and

cost around £1000 including wire cables and strops. Purpose-built timber **trailers** with hydraulic loaders mounted on them are more expensive (around £8000) but are useful in larger woodlands. Extraction using **horses,** a **mini forwarder and trailer,** or **a pedestrian-operated machine** could be considered. These three latter examples do not cause the ruts that may occur through using heavier, tractor-based machinery cause little compaction and are more manoeuvrable. Most forms of extraction may cause some damage to soft or wet ground, hence extraction is preferable in dry conditions.

Plate 7. A mini-forwarder being used to haul out timber
M. Furness, TWIG

iii Other Machinery

Using a **mechanical firewood processor** is a practical way to convert reject pieces of timber into something valuable. They cost below £1000 and can process the material near the felling area. **Peelers and pointers** are also available which can make fencing stakes. **Shredders and chippers** can convert surplus material into a useful product for mulches or woodchip heating requirements. Some of the equipment is available for hire to the woodland owner. Various forest management shows are held every year in the UK and are an ideal place to see mobile sawmills and other machinery in action.

Firewood processors can also add value to wood and there is a range of different types available. Plate 8 above shows a small portable version (M. Furness, TWIG) *and below, Plate 9, a tractor mounted version* (L. Eldred, Chiltern Woodlands Project)

4. Practical Issues

i Site factors

Most broadleaf trees should be **felled** in autumn or winter when the sap is down. If felled at other times of year, staining can result and decrease the value of pale timber such as sycamore and ash. Felling outside of autumn or winter may disturb wildlife. Beech should be processed soon after felling as it can be affected by fungal attack once felled although spalted beech may fetch a reasonable price for its use in turnery or furniture.

Extraction is preferable during a dry or frosty period in winter as tracks can easily be ruined through the use of heavy machinery during wet weather. Provision of a hard-surfaced track so that the vehicles and machinery can move right up to the timber in the wood will assist extraction or milling work. There should be enough space for the mobile sawmill and vehicle to turn around. Extraction routes should be planned before felling begins.

Wherever possible, logs should be moved without skidding them along the ground as stones and mud can become lodged in the logs and damage the sawblade. Also ensure the logs have no nails, fencing staples or wire in them for the same reasons. If the log has supported a fence and has to be sawn, ensure that the side of log which held the fence is marked clearly for the saw mill operator to see. Be wary of trees adjacent to bomb craters as shrapnel can be embedded in trees. A metal detector should locate any metal embedded in the wood although a quality one may be costly to purchase. The bark should be removed from the log at least on the side where the sawblade enters the wood. Using a pressure washer is a modern alternative to blast out stones and grit from the log. Many commercial static sawmills will refuse to cut small timber parcels unless they can be assured freedom from metal contamination.

ii Milling

It is vital to know your timber size requirements before the logs are felled or planked up. If you plan to sell the wood, then *it is vital to know your markets before hiring in a mill*. If the timber is processed to the wrong dimensions, it can be worthless or end up as firewood. A cutting list should be drawn up to give to the sawyer. Allow for timber to shrink as it dries. An experienced sawyer will be able to incorporate shrinkage into the cutting dimensions. If shake is discovered in the wood as it is being milled, ask the sawyer's advice on how best to utilise the timber. Allow for waste if the timber is going to be planed rather than left rough sawn such as 1/8 ”(about 3mm). It may be useful to contact local sawmills and ask for the prices per cubic foot for the various timbers they have.

The sawyer's time is your money. It is important to be organised and ensure the sawyer spends the maximum time sawing rather than moving timber around. If necessary, provide labour and machinery to help the sawyer with the moving of timber but be aware of safety regulations.

At an early stage, discuss the **log stacking area** with the sawmill operator to assess whether the site is practical for their machinery. Your stacking area may be situated in the woodland or at a yard depending on the practicalities of processing the timber. The stacking area should preferably have a hard surface and at least one day's worth of millable timber should be stacked. The logs should be as straight as possible and crosscut

carefully into required lengths leaving square and clean ends. The logs should be stacked with their butt ends together on 15cm high bearers to keep them off the ground and help with handling. There should be adequate room around the stack to enable the sawmill to work efficiently particularly if the mill has to be moved due to sawdust blow. Also, consideration must be given to the stacking area for the sawn timber which will take up more space than the unsawn logs. Again, an adjacent level site is needed and the intention should be to **prevent double handling** so each log is moved just once from the saw and onto its drying location. Contact different mobile sawing contractors for quotes and ask other woodland owners which sawyers they have used. After that, it is up to the sawyer to get on with processing your timber.

iii Technical aspects

Unless you are using heartwood oak for timber buildings, making roof shingles or selling to green woodworkers, the timber should be **dried** before it is used for its intended purpose. Air drying is a lengthy process and both the species of tree plus the size of timber will reflect how log it has to be dried. Oak, for instance, has a much higher **moisture content** than ash so a thick oak board will take longer to dry than an ash one. Timber will shrink as it is dried and will shrink around the circumference more than from the centre or radially. If the timber is to be used inside a heated building, it should be kiln-dried to lower the moisture content even further otherwise splitting will occur as the timber dries out too quickly. This will mean lowering the moisture content to around 10%. The timber can be taken to a commercial kiln for which there will be a cost to transport the timber and dry it.

Plate 10. It is important to stack timber carefully to help the drying process
J.Morris,
Chiltern Woodlands Project

The aim is lower the moisture content to around 15-25% and stacking the timber correctly will help this process. To measure the moisture content of your piece of wood, a meter can be purchased (see List of Useful Contacts for details). The **stacking site** should not only be level but the stack should be covered from the rain and out of direct sunlight. A suitable site for air seasoning sawn timber would be on the north side of a barn where the timber will dry out slowly. The lowest timber must be kept off the ground on bearers laid flat and level on the ground. As the timber is stacked, it should be separated from other timber pieces by **stickers** (thin pieces of softwood) to provide sufficient airflow through the stack. An adequate number of stickers should be used to prevent the timber planks from bending and enough weight placed on top of the stack to avoid warping. Stickers are usually 15-20 mm thick and placed about 0.4 – 0.5 m apart. The top of the stack should be weighted and the ends preferably strapped to avoid warping. An exception is sycamore which is ‘end-racked’ or stood up on its end between slats screwed to a wall as this prevents staining. It is important to spend time in stacking the timber evenly and neatly especially if it is to be sold. The appearance of the stack can help achieve a good price.

Sealing wax can be used on the ends of the timber to prevent it from drying out too quickly and splitting. If splits occur the timber will lose some of its value as the ends will be waste. An emulsion of wax can be sprayed onto the ends of the timber using a knapsack sprayer if the timber quantities are large enough.

iv Legal Considerations

Felling licences – if more than 2 cubic metres of material is felled, then a felling licence from the Forestry Commission is needed. This may be as part of a Woodland Grant Scheme (WGS) contract. Owners may fell up to five cubic metres per calendar quarter without the need for a licence as long as no more than two cubic metres are sold. Please consult your local Forestry Commission office for more advice.

Tree Preservation Orders and Conservation Areas – if these exist on the woodland then permission must first be obtained from the relevant local authority (usually the district or borough council) before any woodland management begins.

Sites of Special Scientific Interest and National Nature Reserves – Consent must be obtained from English Nature before any woodland management is undertaken.

Felling should avoid the **bird-nesting season** in the spring.

Greater care and consideration should be taken when felling near or adjacent to public highways including public rights of way and permissive access, other ownerships and easements.

v Health and Safety

It is good working practice to carry out a **risk assessment** on your woodland and woodland management operations.

Chainsaws, sawmills and other forestry equipment are potentially dangerous and sufficient **training** in their use must be ensured. Check that your contractor has undertaken recognised training.

Use appropriate **personal protective equipment** (ppe) when carrying out woodland management whether it is yourself or a contractor carrying out the work. A reputable contractor will wear the correct safety gear at all times.

Fresh green wood is very heavy! Avoid **backstrain** when handling green wood by using human or mechanical help.

Respect your **neighbours' requirements** when using noisy machinery, especially if your wood is adjacent to domestic properties.

Ensure the milling site is **separated** from livestock, the public and children. Temporary fencing may be needed.

Ensure timber is **stacked** neatly and safely.

Ensure any **arisings** from the woodland operations are disposed of in a safe manner. By-products like sawdust, bark and chippings may even be valuable as a product.

Avoid pollution of watercourses and **do not disturb** other areas of the site unnecessarily.

Avoid damage to sensitive areas such as important wildlife areas and archaeological remains.

Public Liability Insurance – An appropriate level of cover should be taken out. The Small Woods Association runs an **insurance scheme** for woodland owners. You could also contact an insurance broker who may be able to offer a similar scheme. Ensure that your contractor has sufficient public liability insurance.

vi Provision of Information

Plate 11. Positive signs can help you with your woodland management
J.Morris, Chiltern Woodlands Project

If your wood has public access, then it may be sensible to install temporary **signs** before any woodland management goes ahead. Such signs are compulsory for safety reasons and to comply with local authority permission. It is useful to reassure the public at an early stage that the work is part of a long-term plan to benefit the wood so they become used to seeing work happen. The signs should be simple and state the type of work to be carried out, why it is being done, its duration and a contact name and number. Some of the people reading the signs may even be interested in buying the products that you make from the timber.

5. Economics

i Costs of different operations

It is very difficult to put prices to the costs of converting timber because there are so many variables. Factors like quantity and quality of timber, the sawing costs, use of other machinery, the health of the timber market, the skill of the sawyer and the distance to transport the products will all determine the final cost. Activities which can be costed are felling, snedding, crosscutting, extracting, sawing, seasoning and delivery/ haulage (if not for own use).

It is possible to achieve **profits of 200-300%** provided that you are *selling quality hardwood to a known market*. At the Mobile Sawmilling Demonstration of 02.12.99. (See 6. Case Study):

- A three-metre long oak log took under 10 minutes to convert to a beam with a value of **£40.**
- If the sawyer can make seven of these an hour, then the value of the seven beams is **£280.**
- Minus the sawyer's hourly rate of approximately **£40/hour**
- Then the value of the beams is **£240/hour or £1800/day**.

Please note that:

- You may need to pay for haulage costs if the timber is to be sold on.
- You should allow for drying time.
- Labour may be needed to assist with stacking the timber.
- Machines can break down!
- 1/3 of the log can be lost as waste when sawn

Three examples of sawn timber prices*

- A 4 x 4" x 8ft post in untreated hardwood: £15
- A 12ft half-round rail: £3.60
- A 6ft. pointed half round stake: £1.80

Waste sawdust can be processed into fuel pellets, pet bedding or have uses in pottery. If used for heating requirements, it is worth about £50 per tonne delivered and equal to 13p/litre (heating oil equivalent).

* All prices for untreated hardwood, excluding VAT. For products in softwood, divide prices by half. Year 2000 prices.

If you intend to sell your timber, one of the latest ways is through **'Woodlots'**. This is a national 'exchange and mart' type of publication that is free to advertise in. The sawmill contractor may be able to assist in selling the processed timber.

ii Total value

Woodland management has to be concerned with more than trying to make a profit and must look at the total value of utilising timber from your wood. By beginning to manage the woodland, it can be brought out of neglect and develop a use for the future. Many woodland owners feel personally satisfied to initiate work in their woods and 'make things happen'. It can be satisfying to produce practical items like gateposts or cladding for your own use on your land from your own trees. It can bring improvements to the landscape and produce locally manufactured and sustainable materials. It can educate local people about woodland management. Utilising trees for milling opens up areas within the wood thus letting in more light for both ground flora and naturally-regenerating trees. By-products are generated like sawdust which can be used as a fertiliser or pet bedding material if clean and bagged. It can stimulate the local economy by using local forestry contractors.

6. Case Study:

Mobile Sawmilling Demonstration – 02.12.99.

A mobile sawmilling event was held in December 1999 to demonstrate to woodland owners the practicalities of using mobile sawmills and to generate interest in adding value to woodland products.

Twenty-six people attended the event at Horseleys Green, near Stokenchurch, Buckinghamshire to watch contractor, John Ayres demonstrate the use of his Woodmizer sawmill to convert timber into saleable material. A three metre long oak log was converted into a square beam for construction use in less than **ten** minutes. Four cuts of the saw increased the value to this item from firewood worth **£2.00** to a new value of **£40.00**. Beech planks were sawn for flooring for the owner's use.

Plate 12. Demonstrations like this one at Horseleys Green, Bucks can encourage woodland owners to consider the use of mobile sawmills in their woods.
J.Morris, Chiltern Woodlands Project

Costs for machine hire tend to be around **£35 per hour** plus the labour costs for an operator and their assistant. John Ayres uses a hydraulic lifting arm on a timber wagon to load the logs onto the saw bed.

John Ayres was pleased to provide answers to questions on mobile sawmilling after the demonstration. Half of the people attending the demonstration were students from Buckinghamshire Chiltern University College *Forest Products* degree course whilst half were local woodland owners and managers interested in the use of mobile sawmills in their woods.

The event was arranged by the Chiltern Woodlands Project as part of the Trans-national Woodland Industries Group (TWIG) project.

7. Glossary

Air-drying	Traditional way of seasoning wood outside which can take twelve months or more depending on the type of wood and the thickness
All-Terrain Bike (ATB) or quad bike	Small, four wheeled vehicle based around a motorbike and used over cross-country
Bearer	Strips of wood a timber stack rests on
Cross-cut	Cutting wood across the grain
Firewood processor	A machine to split wood into firewood
Forwarder	A forestry machine which can transport cut timber out of the forest – usually a tractor with grab & trailer
Kerf	The width of timber removed by a saw as sawdust
Kiln drying	Using a heated kiln to season wood for interior use
Mobile sawmill	A machine that can be taken on site to process timber
Moisture content	The amount of water in the wood
Natural regeneration	Trees & shrubs grown from the seed of surrounding parent plants
Pedestrian-controlled machine	A small, powered machine which can be used to extract timber where tractors cannot be used
Personal protective equipment	The safety equipment necessary to be worn when carrying out work such as chainsawing
Ripping	Cutting along the grain
Saw doctor	Person who can maintain and repair blades for circular and band saw blades
Sealing wax	A wax applied to end grain of drying timber to reduce splitting
Shake	A split defect in felled timber
Skid cone	A lightweight, conical device fitted to front of timber bundle when hauling out
Skidding	Dragging a log behind a tractor
Snedding	Removing the branchwood from log leaving flush surface
Sticker	Thin pieces of softwood used to separate drying timber in a stack
Sustainability	Using resources prudently to allow for their replenishment
Thinning	Removing trees to make space for others to grow
Veneer	Thin strips of wood peeled off a large log by a thin blade. The most valuable timber used on high quality cabinet making.

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Forestry Commission, Technical Development Branch, Ae Village, Dumfries, DG1 1QB

Marches Woodland Initiative, Forestry Commission Offices, Whitcliffe, Ludlow, Shropshire SY8 2HD

National Small Woods Association The Cabins, Malehurst Estate, Minsterley, Shropshire, SY5 0PF

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