There are lots of products, but few markets

Primary school children learn from an early age of the wide range of products and services that trees and forests provide. The school poster shows a clean stream of water flowing out of a rich native forest that provides a habitat for native animals, clean air and healthy soils. People can be seen bush walking or fishing and there are groups of school children learning about forest life. Beside the forest, there are rural communities and industries that draw on the forest for timber, honey and other products. There are also farms with animals sheltering from the wind and trees along waterways protecting the soil. Electricity lines from the hydro schemes and water pipes from the dams link the forests with the all-consuming cities.

All these products and services that forests provide are real and benefit individuals, private companies and communities. While conventional wood products continue to be traded in local and international markets, there is renewed interest in identifying alternative tree and forest products such as bush foods, oils and pharmaceuticals. In addition government agencies and catchment boards are seriously considering, and even testing, market mechanisms for the purchase of conservation values from forest owners.

Forest owners may be able to capture and sell other services, such as opportunities for recreation and tourism. There are also farmers who have gained skills and experience through working their own forests that are now employed by industry, government and community groups to work on forestry and revegetation extension programs.

This chapter considers the potential for farmers to benefit personally from the "harvest" of products and services from their farm forests. The emphasis is on assisting farmers identify who may value the forest products and services they can provide, what specifications may affect the reward they receive and what marketing mechanisms exist for the "sale".

Making money from trees

Like commercial farming there are many factors, other than simply the price paid for the product, that will affect the ultimate profit the forest grower receives. These include the cost of production, the ability to gain market access, harvesting and transport costs and the impact of harvesting on other values. Because farmers are often small producers of forest products they have traditionally had difficulty accessing markets or achieving similar prices to those received by industrial growers. To participate in the market, farmers
need to have an eye to quality, cost reduction and multiple benefits. There are many ways that farmers can receive financial benefit from their forests or improve their competitive advantage such as:

- Ensuring the forest products and services neatly match the specifications of the purchaser.
- Designing forests for multiple values, thereby sharing the costs between a number of potential products and services.
- Value-adding or direct marketing forest products to avoid monopoly buyers and increase the number of potential purchasers.
- Involving off-farm family members who can take advantage of the investment and taxation advantages of forestry.
- Utilising otherwise idle farmland, labour or equipment in the production or value adding of forest products.
- Enhancing the property value through the use of forests for beautification, shelter and wildlife.
- Utilising forest products on farm as a means of reducing living (e.g. heating) or farming costs (e.g. fence posts).
- Reducing the impact of generation transfer by building wealth in an investment that can be separated from the land.
- Developing on-farm business activities that are supported by the farm forest such as farm-stays, nurseries, contracting or tours.
- Using the forest to support professional activities in such fields as natural resource management, financial services, etc.
- Diversifying the farm business to reduce exposure to fluctuating agricultural markets and climatic risks.
- Using the environmental values provided by the forests as leverage in dealing with local government.

In any market it is the buyer who ultimately judges the quality of a forest product or service. Farmers must follow the market and accept that product preferences can change over time as a result of changes in the market or in harvesting and processing costs. Changes in government regulations and the introduction of product certification may also impose market anomalies.

In long term investments like forestry it is the farmer who carries the market uncertainty through the rotation unless they are able to forward sell by entering into secure long term leases or selling the property rights of their forest prior to maturity.

Being aware of the existing market opportunities and considering how these may change over time provides valuable information that can guide planting design and early management. Although governments and industry
spend a great deal of time trying to predict future markets for forest products and services, past experience would suggest that these predictions be looked upon with caution. Farmers might do well to respect their own judgments as to how they see international trade negotiations, government policy, intergovernmental agreements on environmental issues, forest certification and consumer trends influencing the supply and demand of forest products and services in the future.

**Defining a target tree or forest**

Having a clear vision or target (structure, function, location, and scale) of the ideal forest and a feeling for its relationship with other activities on the farm, provides a basis on which to design a farm forestry project. From this a strategy for how a forest will be established, managed, harvested and marketed in order to meet market specifications and the farmer’s other goals can be developed. In the process, the farmer will also identify what skills, knowledge, resources or contacts they require and the risks involved.

Market research is aimed at highlighting the tree, forest and site specifications required to maximise market value and improve market access while gaining an appreciation of the likely penalties associated with not meeting the specifications.

### Target tree specifications may include:
- Tree species or variety.
- Tree dimensions, in terms of height, diameter and form.
- Branch location, size and the need for pruning or shaping.
- Tree age.
- Defects and their allowable limits.

### Target stand specifications may include:
- Tree spacing or distribution within the forest.
- Mix of trees, shrubs and ground cover species.
- Minimum areas required for mechanical harvesting or marketing.
- Planting design - belts or blocks.
The Farmer’s Forest

- Need for uniformity of tree characteristics.
- Minimum volume per hectare.

Target site specifications that may influence productivity and market value may include:
- Climate e.g. rainfall, frosts, humidity, etc.
- Soil type, fertility, depth and parent material.
- Slope, aspect and landscape position e.g. recharge area.
- Existing vegetation e.g. native forest, weed species etc.
- Relationship with other land uses.
- Access to the site for harvesting equipment.
- Distance to processing plant or point of sale.
- Local government jurisdiction.

In some cases it will not be possible, or desirable, to design a forest such that it perfectly satisfies all market and site specifications. Multipurpose designs are rarely perfect for any one outcome. The important point is to identify which criteria are limiting and to judge how these may affect production costs, rewards or access to markets. The better the farmer is able to meet the market requirements the stronger their ability to negotiate higher rewards. Bear in mind that product specifications are likely to vary over time so it is worth considering options should markets evaporate or new markets materialise. The common recommendation is to aim for a high quality forest that meets the criteria of a number of possible products and services. A perfect hardwood sawlog can always be used for firewood but a perfect firewood plantation is unlikely to produce a viable sawlog.

Wood products

There are thousands of different solid and reconstituted wood products commercially available, ranging from fine furniture to paper. Wood and wood residues are also the basis of many chemically derived products, such as cellophane, charcoal, dyestuffs, explosives, lacquers, turpentine, and yeast. For almost all wood markets and processes it is possible to identify preferable wood characteristics as well as a range of "defects" that may reduce log value. Although cellulose and lignin are the...
main constituents of all woods, cell structure and the presence of resins, minerals and other compounds can greatly affect wood properties. To understand the market specifications for timber products it is therefore necessary to understand wood.

HARDWOODS AND SOFTWOODS

Trees are classified into two groups: the hardwoods and the softwoods. To add confusion the wood of the hardwoods is not necessarily hard. Balsa wood, for example, is actually a hardwood, while some of Australia’s hardest timbers, such as Callitris pine, are softwoods. The difference is in the cellular structure of the wood.

Hardwood timbers are made up of four types of cells, the bulk of which are small fibres. Large cells, called vessels, act as pipes for moving sap up the tree through the mass of fibres. Other cells are largely used to store food. With some experience it is possible to distinguish different hardwood timbers based on the number, size and location of the vessels.

Softwoods do not have vessels. Their wood has a simpler fibrous structure based on only two cell types. The easiest way to distinguish between the two groups is to remember that the flowering trees are all hardwoods (eucalypts, wattles, oaks etc) and that the cone bearing trees are softwoods (pines, cypresses etc).

GROWTH RINGS AND THE PITH

As the tree trunk and branches thicken, a series of concentric layers of wood cells are laid down around a central core called the pith. These appear as growth rings. The pith is the remnant of the grow shoot that gave the tree its height. Because the pith is quite different in cell structure, it can often been easily seen as a corky pipe up the centre of the log.

Growth rings often, but not always, represent annual growth. In temperate areas tree growth during spring is made up of large cells with thin walls and therefore appears lighter in colour. The darkness of the ring itself is the result of the smaller, thick walled cells that are laid down towards the end of the growing season. In the hardwoods the vessels may form a ring in the early wood (ring-porous species) making the rings more clearly evident.

SAPWOOD AND HEARTWOOD

The cambium, just below the bark, is a very thin layer of cells that divide to produce the wood cells and bark cells. The inner bark, or phloem, is where sugars produced in the leaves travel down the stem feeding the cambium and the roots. Only a very small proportion of the wood cells inside a tree are actually living. The newly formed wood cells form the sapwood through which water and dissolved minerals travel up from the roots to the leaves.

The sapwood is also used to store food provided by photosynthesis including starch. The sapwood is almost always creamy white or yellow in colour and commonly 2 to 5cm thick. In most tree species the sapwood band can be easily distinguished from the inner heartwood.

The heartwood doesn’t perform any function in the growth of the tree other than supporting the stem. The colour of heartwood is the result of resins, minerals and other compounds being deposited in the cells as they are decommissioned from their role as sapwood. These deposits, and the lack of food, add durability, colour and strength to the timber.
Wood properties

Wood is a complex, natural product. Wood density, stability, durability, strength, burning properties, electrical resistance, reaction during drying, impact resistance, bending properties, acoustic properties, pulping qualities, workability and appearance varies markedly between tree species.

Tree age, stem form, soil types, climate, latitude, and forest management may also affect many of these properties. Within the tree, wood properties will also vary across the growth rings, with distance from the pith, and with height up the tree. The presence and nature of knots, pockets of resin or gum, decay or insect attack, the pith, sloping grain and other anomalies may also affect wood properties.

Natural durability is just one important wood characteristic. In almost all cases, the sapwood is susceptible to fungal and insect attack. The heartwood of many species may be durable in ground, above ground, or even under seawater, or particularly resistant to certain agents such as termites or fungi. The high silica content of the native Turpentine (Syncarpia glomulifera), for example, deters marine organisms.

In Australia, timber species are rated from Class 1 (highly durable) to Class 4 (non-durable) although it is becoming apparent that the tree age and the source of the timber may influence durability. The ability of timbers to absorb and retain preservative also varies, making some species of low natural durability (such as Radiata Pine) ideal for preservation treatment while many of the more durable eucalypts cannot be easily impregnated.

Sawn timber products

Sawn solid timber products are used for engineering and also have appearance uses in construction, flooring, lining, joinery, furniture and crafts. For a given product, many factors will affect the value of a log at the mill including: species, diameter, age, straightness, length, presence of product or processing related defects, and growth stresses. All these factors can influence processing costs and the recovery of particular products. The value of a "good" log at the mill door can be many times that of a "poor" one and may well be reflected in market interest and price.

Before looking at the factors that may affect sawlog quality it is worth defining a few sawing terms:

RECOVERY

Sawn recovery is the output of timber products of particular grades produced from a log, as a percentage of log volume. Due to the inherent difficulties of producing useful dimensions of timber from round logs and the waste associated with product related defects, the sawn recovery can vary widely. For products that require a high proportion of heartwood or clearwood, recoveries may be as low as 10 or 15% from small diameter or defective logs. Recoveries as high as 60% are possible from large diameter softwoods, sawn for structural timber where the presence of sapwood, small knots, or other non-structural defects is of less concern.

BACKSAWN AND QUARTERSAWN

Depending on the species, product preferences and sawing methods, a mill may prefer to cut boards as either backsawn or quartersawn. As shown in Figure 1, backsawn boards are cut so that the faces of the board are roughly tangential to the annual growth rings. In practice, timber is regarded as
backsawn if the growth rings meet the face of the board at an angle of less than 45 degree. Backsawing often allows for a higher recovery from small diameter or pruned logs, although backsawn boards may be less stable in drying. When the sawn boards are cut so that the face shows the vertical lines of the growth rings it is quartersawn. Quartersawn timber has a number of advantages including lower shrinkage and less cupping during drying, less reaction to moisture changes when in use and easier reconditioning of boards from species prone to collapse. Each sawing pattern gives a different appearance especially in species with prominent rays or interlocking grain.

FIG 1.
Backsawn and quartersawn boards have very different growth ring patterns.

NATURAL GROWTH STRESSES
The formation of stresses (tension and compression) is common in many trees as a result of normal growth. As new growth rings are laid down around the tree, a longitudinal (up the tree) tensile stress is imposed as these cells mature. The result is that the surface of the log can be in tension (like an elastic band) and balanced by compression stresses (like a compressed
spring) in the central core. These stresses can be very pronounced in eucalypts, seriously affecting recovery rates and processing costs.

Growth stresses are often responsible for end splitting in logs and bending in sawn boards. Backsawn boards tend to bow as a result of longitudinal stresses whereas quartersawn boards will spring. Bow is of less concern as the boards can be easily straightened so mills may prefer to back-saw highly reactive logs. Spring is difficult to correct without large reductions in recovery. Research supports the observation that growth stresses are of less concern in larger diameter logs. This is because in larger diameter logs, the difference in longitudinal stress between the bark to pith are proportionally lower than in smaller diameter logs.

JUVENILE WOOD

The age of the tree can affect the quality of the sawn timber. In Radiata Pine, for example, the density of the timber laid down in each successive growth ring is greater. Therefore, the timber produced in the first ten years of growth (central ten growth rings) may be as much as 40% lower in wood density than the wood being laid down in mature trees. The early growth of pine, or "juvenile wood", also has shorter fibers and a higher fiber angle making it lower in strength and difficult to dry. Because of this, many pine millers may specify that they prefer logs from forests over 25 years due to concerns about wood quality. Eucalypt timbers also appear to increase in density with age. But the fact that the timber of many mature eucalypt is much heavier than most internationally recognized cabinet species, like Blackwood and Oak, suggests that a reduction in wood density may actually be an advantage in some cases.

Contrary to popular belief, growth rate has little effect on wood density for most species, including pine and eucalypts, other than the fact that fast grown trees may be harvested earlier. In fact, fast grown oak (and other ring-porous hardwood species) is actually higher in wood density than slow grown oak. Poplar is one of the few species for which faster growth appears to lead to lower wood density irrespective of age.

KNOTS OF BRANCH STUBS

A major defect in sawn timber for most uses is the presence of knots or branch stubs. Knots interfere with the grain of the timber and reduce its strength and appearance qualities. They may also become entry points for rot and discolouration that can spread through the tree. Loose, dead knots that result from dead branches can greatly reduce the strength of sawn timber and can be unsightly in appearance products whereas small, tight, live knots may add character to the timber without affecting strength. Pruning live branches can confine the knots to a central core around which the sawmiller may be able to cut clearwood or knot-free timber.

DEFECTS AND EFFECTS

Other factors that may affect log quality for sawn timber are: rot, insect tunnels, unusual grain patterns, fungal infection, kino veins, resin pockets and fire scares. Although some of these may enhance the appearance of the timber for use in crafts or designer furniture, defects rarely enhance log value. Where it is possible to see that a particular log has an interesting grain pattern, such as "fiddleback" or "birdseye", it may be worth separating it for sale to a sawmiller who is able to take advantage of the unique qualities of the timber.

Any foreign material imbedded in the tree, such as fencing wire,
electrical insulators, horse shoes or nails present a great risk to safety and milling equipment. If there is any risk of metal or other solid material in a log, the miller will clearly be very reluctant to purchase or saw the timber. In some cases metal detectors are used to scan the log before milling.

LOG SHAPE AND TREE FORM
For sawn timber production it is often critical that the logs come from straight upright trees. Leaning trees are susceptible to compression wood (in softwoods) and tension wood (in hardwoods) that can cause down grading of the sawn timber and high losses during sawing and drying. Leaning trees also tend to develop a sweep that makes milling long, straight lengths very difficult. Sharp bends and kinks are also a problem.

Although small bends in young trees may grow out over time, a "wandering pith" will lower recovery of the better sawn timber grades. The pith or "heart" of the log is commonly "boxed out" and discarded because of problems of drying boards containing the pith. The degree of taper can also be critical. Logs that are near perfectly cylindrical are clearly best. Where the diameter decreases rapidly up the stem, the recovery of sawn timber will be greatly reduced. Sawmills may even choose to buy logs on the basis of the small end diameter if taper is excessive.

LOG LENGTH
Depending on the sawing equipment and product options, a sawmill should be able to specify a minimum and maximum log length. The tendency is to prefer longer logs as these will incur lower fixed costs in the milling and drying. In some cases saw millers may cut longer logs in two if there is concern about growth stresses or excessive taper.

LOG DIAMETER
Once a tree is felled and cut into lengths, it is the diameter of the log, not the height of the tree, that will be most important to the miller. Generally speaking, the larger the log diameter the greater the sawn timber recovery, the lower the fixed costs of milling and the greater the proportion of higher value grades. Larger logs are also able to be more easily quartersawn and may be less prone to exhibiting problems due to growth stresses. Larger dimension boards can only be cut from large diameter logs.

Plenty of tall, fat, straight, pruned trees - a perfect pine sawlog plantation.
Other wood products

PLYWOOD AND VENEERS
Logs suitable for peeling or veneering are generally quoted as attracting the highest prices. Thin veneers are used for the production of plywood or are glued onto chipboard to give it the appearance of being a solid wood product. Plywood veneers are peeled on a rotating lathe. Large diameter, clean logs are generally preferred, although the recent introduction of spindle-less lathes has made the peeling of smaller diameter logs possible. Knots are generally considered a defect, especially for the higher value veneers used on the outer layers of plywoods. The highest value timber veneers are sliced. The best logs are sawn into large flitches (e.g. 25 cm square) then put on a slicing machine. In some cases the flitches are steamed to ensure they cut cleanly. The slices can be dried immediately. One large, clean log can produce "acres" of veneer for use in panelling and cabinet work. The sliced and rotary veneer log market is relatively small in Australia. Fortunately, a good veneer log is also a good sawlog.

WOODCHIPS FOR PULP, PAPER AND WOOD PANEL PRODUCTION
A well-known farm forester once said, "growing trees for woodchips was like growing sheep for dags". While more then 50% of a sawlog may end up as woodchips and sold out the back of the mill he argued that it is the sawn timber that makes a tree worth harvesting.

Some chip buyers actually prefer mill waste to whole logs (e.g. such as young thinnings) because they are easier to handle, require less preparation and are commonly higher in wood density. On the other hand, it has been suggested that there are speciality woodchip buyers, such as the Japanese paper makers, who will pay a premium for young, clean, white plantation grown eucalypt woodchips, despite the lower wood density.

Woodchip exporters and the few local paper and wood panel makers are invariably large-scale operations influenced by world prices rather than local demand. Low margins and high transport costs generally limit the viable haulage distances to around 100km to these facilities. Any further and the grower is likely to be making a loss on the sale, although this may be acceptable in the case of thinning to improve stand quality. Log quality and stand specifications for woodchip production may be as critical, perhaps even more so, than for any other timber product.

Critical factors within the growers control include species, age, tree size, access, scale, and the uniformity of the stand. Even where the stand meets the market specifications, small growers may find they face monopoly contractors who can dictate prices. Where this is the case, farmers may be better to enter into lease or joint venture arrangements with the buyers or traders rather than act alone.

POSTS AND POLES
In some regions, there are attractive markets for large poles. Although the prices can be very attractive, only very high quality tall, straight trees of selected species (usually class one durables) have been traditionally sold for telegraphs poles. Preservation treatment has allowed less durable species to be used and trials are underway with plantation eucalypts. However, pressure treatment of eucalypts with preservatives has proven difficult due to the impermeable heartwood.
The specifications for all types of posts can also be extremely tight and it is common for only a small proportion of any harvest or thinning to meet the specifications. For example, the recent expansion of vineyards has increased the demand for small diameter, treated pine posts. But from a single tree, only one short post may meet the tight market requirements, while the market for posts of other sizes may be flat. There have also been problems with the low density and strength of small diameter treated pine posts from young plantations and this has led some processors to specify that posts must be of a certain age.

Consumer concern over the use of the commonly used preservative, Copper Chrome Arsenic (CCA), has renewed interest in naturally durable timbers. Although many species harvested from native forest are classed as highly durable, questions have been raised about the durability of the same species when grown in plantations and harvested at a young age (say less than 15 years). Growers should therefore be wary of assuming that young trees will exhibit similar properties to those harvested from native forests, even where the log size is similar.

FUELWOOD AND EXTRACTIVES

Despite the fact that the greatest use of timber internationally is as fuel, growing fuelwood for profit remains a specialised business. Market preferences may be based on misconceptions with some consumers assuming, for example, that the red coloured eucalypts are best. All timbers produce a similar heat output per unit of weight, so density is often the most important feature.

Once again density is known to vary with age such that young plantations grown for fuel may provide wood with a density 20 to 30% less than mature trees of the same species. Burning properties that are important are the rate of combustion (faster means hotter) and the presence of resins or other extractives that may cause spitting, smouldering or create soot problems.

The major problem with fuelwood production relates to the costs of processing and retailing. Before reaching the market the timber needs to be felled, cut to length, split, stacked, dried, loaded and transported. Any plantation design or management technique that can reduce these costs will improve returns. The future of the higher value fuelwood markets may also be uncertain. There are moves in some Australian cities to introduce incentives and penalties to encourage a shift away from wood burning. Those considering producing timber for the valuable urban markets should consider the impact that future local government or EPA controls may have on the use of wood heaters and open fireplaces.

Naturally durable and fire resistant species like Raspberry Jam (Acacia acuminata) are highly valued for posts and poles due to concerns about chemical treatment.

The urban firewood market looks attractive but is expensive and labour intensive to supply and may have an uncertain future.
BIOMASS FOR ENERGY

Nationally there are a number of research programs focusing on the potential of trees as a renewable energy source. Timber can be converted into a range of energy forms including electricity, heat, liquid and gaseous fuels, and charcoal. Although the product specifications for each may vary, what appears certain is that harvesting and transporting costs will be critical. As a result, possible areas for market development may be where there is an existing timber resource, large areas of land suitable for revegetation, a high demand for energy and lack of low cost alternatives. Politics is certain to have a great influence on the development and use of biofuels. Current government targets for renewable energy may help, but there may also be community preferences for other types of renewable energy, such as wind power, that sway government policy.

Log Prices

The price paid for a standing tree is called the "stumpage" or "royalty". Stumpages are based on the value of the product at the mill door minus the cost of harvesting and transport. The stumpage received will also reflect the ability of the grower to negotiate a favourable deal. As the native forest timber industry becomes more sophisticated and the quality of logs from native forests declines, the price differential between logs of high and low value appears to be increasing.

Plantation softwood logs of similar wood characteristics have traditionally been sold on the basis of diameter with the larger logs receiving much higher prices. In some cases there are minimum specifications that, if not meet, mean the logs have no value. Small diameter cabinet timbers are often not worth milling and have no woodchip market due to their colour.

For small growers, the differential between high and low value logs is expected to be greater than suggested by the stumpages received by industrial growers or government agencies because of their lack of market power.

It is common for farmers to state they "can not give away" their lower value timber, whereas if they had large diameter logs with special qualities, they could attract higher prices than the larger growers by taking the time to carefully target premium markets.

FIG 2.

MARKETS FOR FARM FORESTRY PRODUCTS AND SERVICES

Harvesting and transporting logs

All too often farmers discover that their timber plantations or native forests are unviable to harvest due to the low value of the trees and the high costs of access, harvesting, loading and transport. The economics of harvesting dictate that where the logs are low in value, the operation must be highly mechanised in order to be viable. The equipment required for mechanised logging is very expensive and the contractors involved commonly prefer large forest areas with relatively easy access.

If a farmer has year round access for harvesting due to good roads and well drained, sandy soils, they may be able to harvest when the contractors are otherwise idle during the wet season. Site characteristics that increase logging costs are slope, dense undergrowth, exposed rocks, distance to made roads, soil types and creek crossings. Adapted farm equipment, such as tractors, and manual felling with chainsaws is only viable where the log value is high.

Research in Australian pine plantations suggests that manual felling and tractor log skidding will only be viable in well-spaced, pruned stands of large diameter sawlogs (over about 40cm). The advantage of pruning is that it greatly reduces the labour required to de-limb and allows the trees to be more widely spaced making felling and access easier.

Hand harvesting and delimbing of small diameter pine is rarely viable and farmers often lack the scale to attract the harvesting contractors with specialised machinery.

The point of sale is commonly the mill door. Transport costs can be as high as 10c/km/tonne thereby reducing the payment to the grower by more than $10 per cubic meter for logs that need to travel over 100km to get to the mill. For farmers considering planting or harvesting relatively small areas (less than say 20 hectares) or low volumes (less than say 2000 cubic meters) careful thought should be given to value adding on the stump and designing their plantations for easy access so as to reduce the impact of harvesting costs.

Non-timber products

Alternative tree products of existing or potential significance for farm forestry includes: essential oils, honey and pollen products, wildflowers and foliage, nuts and other tree crops, tree seed and propagation material, gums and resins, bush tucker and Christmas trees. Many are already produced in some form from native forests, although restrictions on harvesting and product differentiation within the market may provide farmers with commercial opportunities. The Joint Venture Agroforestry Program is supporting research and development into a range of non-timber products based on native species in the hope that commercial tree production opportunities for low rainfall areas will provide a powerful economic driver for large-scale revegetation.
BUSH TUCKER

Until recently Macadamia Nuts and the Desert Quandongs were the only native Australian tree species grown for food. Over the last decade the "rediscovery" of bush foods has driven a national search for commercial opportunities. Today a number of gourmet bush food wholesalers are supplying everything from ice cream flavouring, teas, preserves, vinegars, sauces and vegetables to compliment native Australian meats.

While many bush tucker plants will be incorporated into intensive horticultural production systems for the fresh food markets, some may remain less intensive and suited for farm scale revegetation. Wattle seed, for example, has the potential for use in widely consumed products such as bread that could provide commercial support for broad-scale production from multipurpose farm forests. Current research is focused on Black Wattle (Acacia mearnsii), Silver Wattle (A. decurrens) and the Soft or Velvet Wattle (A. fulva). Factors affecting the economic viability of wattle seed production are yields, harvesting methods and the farm gate prices. Mechanical harvesting methods appear to be critical in reducing production costs, so any plantation would need to be designed to suit. Methods under examination include "butt-shaking", "stripping" and "biomass harvesting".

INDUSTRIAL PRODUCTS

Wood contains a range of natural compounds that can be extracted or converted into high value products for use in the manufacture of adhesives, tannins, oils and even explosives. In some cases, wood is an alternative source of commonly used compounds, otherwise obtained from oil or produced in non-environmentally friendly ways. In most cases the processing plants for these products are likely to be located near sawmills or other sites where wood waste is cheap and available.

Although farmers may not grow timber specifically for these markets, new industries may have a role in underpinning the profitability of sawmills.

One example of special plantations for industrial products is tannin from wattles. Tannins are present in high concentrations in the bark of species like Black Wattle (Acacia mearnsii). Although Australia currently imports wattle tannins from Africa, research is considering the potential of revitalising the industry on the basis of genetically improved stock and mechanical harvesting.

EUCALYPTUS OIL

Overseas plantations currently satisfy most of the worlds demand for cheap eucalyptus oil. Recent Australian research and development is looking at the prospects for large scale, multipurpose, mechanised eucalyptus oil production systems in the hope that Australia may regain its prominence in the supply of eucalyptus oil and its derivatives. Although it is felt that the pharmaceutical market for oil (soaps, decongestants etc) is unlikely to escalate, there may be greater potential for specially refined products suitable for use as industrial solvents to replace those currently used that are expensive or ozone depleting.

The viability of eucalyptus oil production is highly affected by the oil content of the leaves. Increasing the oil content through genetic selection or management to around 5% is seen as essential because of the high fixed costs of harvesting, transporting and distilling of the leaves. The research and development of on-farm oil extraction options, low cost mechanical harvesting systems and the integration with biomass energy production systems is continuing.
MARKETS FOR FARM FORESTRY PRODUCTS AND SERVICES

TREE SEED AND PROPAGATION MATERIAL

Increased interest in a wide range of native and exotic tree species provides the opportunity for farmers to grow seed commercially. The market covers the full range, from genetically improved seed resulting from long-term breeding trials to selections of locally indigenous varieties. Breeding programs for commercially valuable tree species involve incorporating selected wild trees into seed orchards and testing their progeny. Although knowing the characteristics of the progeny is a marketing advantage, the lead times and costs involved means that improved seed is only available for a small number of commercial species.

This leaves an opportunity for farmers to harvest seed from their plantings, particularly where they have undertaken intensive thinning of poorer individuals leaving the best to breed. Research suggests that where plantations have been established using a wide genetic base (such as a number of different provenances) and are intensively thinned on the basis of tree vigour and form, the seed produced from the remaining trees will be better than the original seed lot. For frost sensitive species, such as Spotted Gum (*Corymbia maculata*), farmers may find that they are able to use natural selection to establish a seed orchard for improved seed.

Specially tending trees to reduce seed harvesting costs may be an option. Widely spaced trees produce greater leaf area and therefore seed production. The use of pollinators can increase seed set in those species pollinated by insects. Even tall native trees can be pushed or bent over to allow harvesting of seed from ground level. Horticultural hormones that induce flowering have been used successfully to increase seed production of native trees.

When collecting seed, farmers must be aware of the risks of inbreeding and hybridisation. A small genetic base in the original seed lot may increase the rate of inbreeding with dramatic affects on seed viability and vigour. Because many of the eucalypts can interbreed, seed collected from mixed species planting or from plantations located near native forests or gardens may not be strictly true to species.

For those species that can be grafted or struck from root or stem cuttings, there may be opportunities to sell propagation material. Many exotic timber trees are commonly grown from cuttings, including: poplars, pines, and Eucalypt oil may provide a commercial by-product for W.A. wheatbelt farmers growing trees for salinity control.
"cricket bat" willows. Recent research has found that some of our promising native cabinet timber species, such as Blackwood (*Acacia melanoxylon*), can also be propagated from root cuttings. Vegetative propagation produces genetic clones, so where there is high genetic diversity within the species that can increase costs, such as pruning, the mass production of trees of better form can greatly reduce production costs. However, clonal forestry can also increase the risks of disease, so it is common to use a number of unrelated clones in a plantations.

**NUT TREES**

Although nut and fruit trees are generally grown in horticultural systems, some of the forest-type nut species also produce high quality timber. Pecan, chestnut and walnut can be incorporated into extensive multipurpose farm forestry plantings for timber, nuts, shade and beautification. Designing and managing the trees so they provide high value timber may reduce the risks associated with uncertain nut prices. Because of their wood quality and growth habit, achieving a short, pruned log of around 2 metres might be all that is required.

**CHRISTMAS TREES**

Up until recently, the bulk of the Christmas trees purchased by Australian families came from the early thinnings of conventional pine plantations. Specialised Christmas tree production, including potted and cut trees, has expanded enormously to the point that the only marketable tree in many cities is one has been carefully nurtured to provide a dense conical shape.

Repeated shearing of selected branchy varieties of *Pinus radiata* is now common practice. Alternative species such as Douglas fir, Norway Spruce or even a native pine may be able to attract a premium price, despite their slower growth rates. Marketing options span the full range from "cut-your-own" to the direct supply of wholesale fresh produce markets. Although small trees are the most common, some growers have been able to achieve high prices for large trees suitable for shopping centres or open air displays.

**Selling the services of farm forestry**

Can a farmer sell the view? Recognition that forests provide real economic, environmental, social and community values without the need to harvest any products has stimulated debate about the opportunities that may exist for farmers to make a profit from selling forest services.

**ENVIRONMENTAL SERVICES**

The potential for the sale of carbon credits has generated interest in the opportunities, mechanism and prices for the "sale" of other environmental services such as salinity benefits and biodiversity. In 1999, the Federal Government released a natural resource management discussion paper that included information on the potential of a number of "instruments" that could be used to correct the apparent market failures that were encouraging degradation and to reward those who were providing environmental goods. The list included: tradable permits for pollution, salt and greenhouse gasses, fees on polluters, differential rating, land swaps and trading, stewardship payments, voluntary management agreements, levies and subsidies, grants and the auctioning of delivery rights.

The response to the discussion paper highlighted widespread public support for stewardship payments. Their introduction would allow farmers to receive payments for managing their land, wholly or in part, for the provision
of natural resource benefits. Payments could be in the form of lump sums or annuities and may be based on agreed management or performance measures. For example, farmers may be paid to retain areas of remnant vegetation in an agreed state for biodiversity, salinity and water production. The difference to being provided with a grant to establish or protect vegetation is that farmers will treat stewardship payments as income. If they are able to provide the service at a low cost they can make a profit.

The commercialisation of environmental values seems inevitable, despite the risks and uncertainties regarding the measurement and payment methods and liabilities. To access these markets, farmers may need to gain accreditation as providers or otherwise be able to demonstrate that they can provide the values the market is paying for.

Where farmers enter into long term contracts for the provision of environmental services, like carbon, they may need to be cautious about their obligations and the risks involved should fire, disease or other factors come into play. Where the sale of environmental services reduces management flexibility within the forest and on the remaining areas of the farm, there may be additional costs, production losses or even decline in property values associated with any contract.

TOURISM, RECREATION AND EDUCATION

Where farmers are able to utilise the recreational or educational aspects of their farm forest for income, they are effectively selling these values. Some Australian farm foresters have been paid to provide tours of their farms for school groups, international visitors, other farmers and the general public. It is not a job that suits everyone, but those with good communication skills, who enjoy public speaking can be well rewarded. There may also be some costs in terms of preparing the farm for visitors, taking out additional insurance and the impact on other farming activities.

Farmers should not underestimate the time required to plan, prepare and conduct tours. The most important thing is having something to show that is of interest to guests. Demonstrations, displays, handouts and the involvement of farm staff, neighbours and invited experts may add strength and interest to the tour.
Wildlife tourism and recreation is popular in the USA, although it is largely based on hunting. In Australia, farmers may be able to capitalise on the public's interest in wildlife watching, fishing, bushwalking and natural heritage by providing accommodation, meals or other services to complement their forest.

**PROVIDING LAND FOR FORESTRY RESEARCH, EXTENSION AND DEVELOPMENT**

Farmers are often asked to provide land for the establishment of farm forestry research trials or demonstration projects. In these cases the farmer can effectively "sell" a range of other benefits, in addition to the land, that the researchers or extension agents might value such as: free access to the site, a commitment to protect and possibly manage the trees or the promise of being available to participate in field days and tours. What farmers don't always consider is that they are also selling their support for these projects and their credibility within the farming community. In return the farmer may receive trees, labour and expertise required to establish and manage the forest. In most cases the tree products and services remain the property of the farmer. Where data is collected, the farmer may be able to use this to improve their management.

Unfortunately many farmers have accepted demonstrations and research trial on their properties without fully appreciating what they have given up. In some cases, especially when the trees are neglected, unmanaged, or disrupt other farming activities, farmers get frustrated about having to carry obvious failures. Other problems occur when farmers are expected to continually give up their time for field days and meetings without compensation or feel that research data or management control is being withheld.

**JOINT VENTURES AND LEASE ARRANGEMENTS**

Some governments and plantation developers offer joint ventures or land lease options to farmers for the development of commercial plantations. Joint venture arrangements often involve some form of profit share or annuity based on a certain percentage of the expected return. In most cases the partner will determine the species, planting pattern, management and
products based on their own requirements. Farmers should be aware of the risks they are taking on when they enter into a long-term, commercial agreement. In joint ventures it may be assumed that the plantation will be managed to maximise returns, however where an industrial partner is managing a large number of different forest areas, it is feasible that they will choose to harvest the trees at a time that best suits the company rather than the farmer. For example, if they require more woodchips to complete a sale, or fill a boat, they may choose to harvest a particular plantation early, or even at a loss. Even where the farmer enters into a standard lease arrangement, there may be unforeseen risks. For example, if the plantation fails after only one or two years, or the company goes into receivership, the landowner may find they are left with a non-commercial plantation and the full cost of returning the land to agricultural production.

Agreements with government agencies may be even more unpredictable. The political motivations driving government forestry programs are often related to achieving regional environmental goals, placating special interest groups or attracting votes. Over a 20 or 30-year period the motivations behind the program, like the government itself, may change many times. In addition to understanding the legal aspects of any contracts, farmers should consider carefully what may happen if the government of the day chooses to withdraw their support, change their emphasis or even sell their ownership to a third party.

By being aware of the degree to which the design is financially, legally, or physically flexible, farmers may be able to negotiate a better result that meets their own needs and reduces their risk. Understanding the principles of silviculture and the needs of the industry partner will help in the negotiations.

AGRICULTURAL AGISTMENT

A well treed farm that provides high quality shade and shelter for stock should be more attractive to other farmers seeking land for lease or agistment. Well designed shelterbelts and stock havens have been proven to increase lambing rates, enhance liveweight gain, increase milk yields and improve ram and ewe fertility. For tree growers without their own stock
being able to attract agistment while the trees are growing can provide value income and control the fire hazard.

**Marketing farm forestry products and services**

Being able to capitalise on the sale of farm forestry products and services is dependent on having a product that is in demand, having access to those who are prepared to pay, being able to utilise effective trading mechanisms and the ability to negotiate sufficient rewards.

This chapter has highlighted the importance of meeting the product specifications of the market and looking at ways to reduce harvesting and marketing costs. As small, independent producers, farmers may consider entering into cooperatives with other farmers or engaging brokers who can put together marketable parcels or search out buyers. There are many marketing lessons to be learnt from past failures:

- Do not produce a product for which there is only one likely buyer or processor unless you are able to negotiate an agreement prior to investment.
- Do not assume that if you produce the same product as large growers you will receive the same access to the market or the same price.
- Get agreement on all aspects of the sale, including payment arrangements, point of sale, method of measurement, and classification of product grades.
- If there are concerns about being paid, ask for payments to be put into a trust account prior to harvesting.
- Be cautious when adopting forestry regimes that are ultimately dependent on achieving a commercial thinning of dubious viability.
- Document the history of forest management including the seed source, chemicals used, and tree management. In some cases this may require certification. At least keep a tree diary and record management as it is undertaken. Taking photographs and regularly recording tree growth in fixed measurement plots can be of great value.
- Ensure that contractors complete the operation to your satisfaction before they are paid.