How to farm hardwoods profitably

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Abstract

The possibility of adding tree farming to the usual farming repertoire is discussed in the light of experience in converting reverting hill country near Warkworth of some 105 hectares into a tree farm. A brief history of the project is recorded. Two studies on commercial aspects of the project are given. The first relates to the commercial acceptability of exotic blackwood lumber to manufacturers in the Auckland metropolitan region and was effected by survey. The second was done by interview on eucalypt milling and merchandising and was carried out in the Auckland and Northland areas. An alternative to existing methods of marketing was hypothesised.

From the survey, it appears that most manufacturers know little about the characteristics of Tasmanian blackwood but are willing to learn. From the interviews it appears that any potential special purpose wood industry in New Zealand must struggle with lack of organised planting, undercapitalised mills, poorly maintained woodlots, low conversion rates for logs and significant competition from the logging of primary forests overseas. In spite of these handicaps (which can be overcome), the return from on-site processing of sustainable log production could be about 15 times that expected from conventional farming.

Definition

Tree farming may be defined as a use of land aimed at the management of trees for cropping purposes primarily designed to yield wood and energy. It is akin to the sustainable management of primary forest but (predictably) would operate in a more efficient and productive manner. The family farm of New Zealand could supply the management model. Tree farming differs from woodlot management in that it would not be ancillary to some other form of farming, although it might well be additional thereto. It envisages restricting annual harvest to annual growth (once the basic forest has matured) and recovering an annual income from the trees just as farmers currently do from their pasture. Economies of establishment and sale are expected from the adaptation of farm practice to include tree cropping and from on-site processing

History

Te Awa Awa forest near Warkworth has only recently come of age. In 2001 the first harvest of pine logs got under way. That harvest marked its transition from a farm forest (raising animals and growing trees) to a tree farm, producing wood annually. After some 29 years, the original goal had been reached.

Of the tree species tested, some have failed. Others have been found suitable for farming. Not all findings accord with professional predictions based on site and

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Photo 1 – The author next to a 12 year-old Eucalyptus saligna *at Te Awa Awa Forest.*

region. The failures have included *Juglans nigra* and *Eucalyptus diversicolor, obliqua* and *camaldulensis*. Slow growers have included the North American *Quercus falcata, Q. schumardii* and *Liriodendron tulipifera*. Successes have included *Acacia melanoxylon, Cupressus lusitanica* and *Eucalyptus saligna, botryoides, pilularis* and *microcorys*. Promising results have been obtained for *E. maculata* and *Cryptomeria japonica*.

Management has reached the point where the commercial success of the tree farming concept remains to be proven. The concept departs from both the practice of logging primary forests unsustainably (which, incidentally, goes back 4700 years (Perlin 1989)) and the sustainable management of large-scale softwood plantations producing the feedstock for major industrial undertakings. Tree farming is thought of as akin to mixed farming because it seeks to supply a variety of materials and a variety of different forms of energy.

As time approaches for the harvesting of special purpose trees, managerial attention has been increasingly focused on marketing. Early investigation revealed that special purpose logs could be sold only to a few small mills but prices were sacrificial. A mill south of

Photo 2 – Acacia melanoxylon at age 15 years. The stand was planted with Eucalyptus saligna *as a nurse crop.*

Auckland offered about $58 /m³ for blackwood logs. A mill near Whangarei handles mainly *Eucalyptus saligna* and *E. pilularis* but accepts *E. botryoides*, *E. fastigata* and *E. Muellerana*. Prices for logs landed at this mill were:

- A grade – clear wood with a minimum sed of 65cm. $135/tonne
- B grade – knots on 1 side only; min. sed 40cm. $105/tonne
- B1 grade – knots 2 sides only; min. sed 65cm. $85/tonne

Mostly, the supply of logs for this mill was from farm and orchard woodlots and shelterbelts. To arrive at stumpage values from these figures, something like a deduction of 50% of log prices to cover harvesting costs and overhead would have to be made.

On the evidence, tree farming could not survive if the status quo remained undisturbed. The alternative was to find a different system. First, however, it would be essential to identify problem areas in sharp outline. Two separate studies were undertaken for this purpose:

1 In 2001, Holdt and Associates carried out a survey to assess demand for plantation hardwoods among Auckland manufacturers.
2 Last year, I interviewed a number of millers and merchants in an attempt to build up a picture of the existing commercial system.

Blackwood survey

Holdt and Associates were a market research firm carrying on business at Auckland. They were commissioned to examine the reaction to blackwood of manufacturers of furniture and joinery at the expense of my family company, the owner of Te Awa Awa. The researchers attempted to obtain telephone interviews with 248 manufacturers in the Auckland metropolitan region who appeared to produce goods incorporating high-quality, solid wood. They found that 73 firms did not use solid wood. This reduced the target population to 175. A further 101 firms either could not be contacted or refused to participate. Respondents numbered 74, or 42% of the possible population. Of the firms participating, 42 stated that they would be happy to receive follow-up visits from representatives of growers. The size of these firms ranged from 1 to 50 employees. Over all respondents, the average number of staff was 11.2.

The manufacturers currently draw their raw material from a number of sources. Those relying on old growth stands in native forests accounted for 83.8% of respondents. When use was broken down into species, respondents drew on special purpose woods as detailed in Table 1.

Table 1: Use of special purpose wood by 74 survey respondents

Species	***Percent using***	***Total volume (m³/annum)***
Beech	50	141
Rimu	87	1112
Tropical hardwood	45	223
Eucalypt	37	84
Blackwood	13	3
Total		**1563**

The small volume of material drawn from local plantations deserves comment. According to MAF data (NEFD), as at 1 April 2001 areas planted in hardwoods aged 1 to 80 within easy reach of Auckland merchants were as follows:

Wood Supply Region	Total Plantation Area (ha)
Northland	4244
Auckland	1134

It seems likely that the bulk of the material drawn from this meagre resource was used for flooring.

Because respondents numbered 42% of the manufacturing population, we might guess annual use of special purpose timber at some 3720 m³ per annum. Compared with softwood usage, this figure is very low. However, it may well represent a low-level of use of wood at the high point of the petroleum age. (As petroleum winds down, the adaptation of wood to yield energy in modern form represents one of a number of strategies needed to introduce sustainable energy.) Historically,

Table 2: Importance of different properties to respondents.

Property	*Unimportant*	*Little importance*	*Moderate importance*	*Important*	*Very important*
Colour	0	0	6	37	57
Wood grain	2	3	17	43	35
Workability	2	0	20	29	49
Resistance to borer	24	15	21	16	24
Density	5	8	34	41	12
Rupture strength	16	11	31	29	13
Elasticity	26	19	26	19	10
Crushing strength	23	12	34	23	8
Impact value	8	8	42	26	16
Surface hardness	3	2	28	35	32
Cost	2	3	17	14	64

forest depletion commenced with the use of wood for ships. Maritime trade and navies were dependent on access to quality wood. This access determined the rise and fall of empires over some 45 centuries (Perlin 1989). It was not until the 19th century that other materials challenged the supremacy of wood.

The development of aircraft in part replicated wood usage in ships. The famous Mosquito fighter-bomber of World War II had a wooden framework. It stood up well to the stresses of low level raids and night-time target marking for the RAF bombers. An English engineer to whom I have spoken states that he would be delighted to use *Eucalyptus microcorys* in yacht building if it were available. Te Awa Awa experience suggests that it could be grown well in New Zealand plantations. History suggests that boat and aircraft manufacturers would love to use wood in their products if material of the right quality can be found. While this remains a reasonable conclusion, no suggestion is made that wooden boats and aircraft could include the commercial monsters of today. They are likely to be comparatively small and found in private ownership.

Subsequent research showed why blackwood ranked so low in manufacturing use: supplies simply did not exist. Respondents were reasonably satisfied with the range and quality of the woods available. Some 10% expressed dissatisfaction and some 13% were very satisfied.

Respondents were asked to express an opinion on the possibility of special purpose woods being drawn from plantations on a sustainable basis. Some 28% were either disinterested or only a little interested. A total of 72% were either quite interested or very interested. This suggests that the majority of Auckland manufacturers are willing to undergo a learning process needed to enable them to use unfamiliar material.

Some species capable of plantation growth were mentioned to respondents. Those interested in finding out more about the materials were as follows:

Species information	*Percent interested in more*
Blackbutt	87
Blackwood	84
Spotted gum	75
Tallowwood	75
White stringybark	73
Yellow stringybark	69

The likelihood of respondents considering the use of NZ-grown, sustainably produced woods in the foreseeable future was as follows:

Species	*Likely*
Blackbutt	89
Blackwood	88
Spotted gum	79
Tallowwood	77
White stringybark	71
Yellow stringybark	71

An attempt was made to elucidate the value attached by respondents to different wood properties and cost. Because this issue is highly important to potential growers, responses are shown in Table 2.

These findings need to be put into perspective and compared with the properties suggested by respondents. To all of them, the following factors were very important:

a) Wood character and defects.
b) Consistency of colour.
c) One length.
d) Dryness.
e) Dimensional stability.

Also important were availability and "good clean quality".

Clearly, there are differences between how scientists and technologists perceive wood properties and how manufacturers perceive such properties. Further, individual differences among manufacturers are probably important. A property such as impact value is likely to be seen as important by manufacturers of tools attached

to wooden handles but not by others. The pleas by manufacturers for standard dimensions and for "good clean quality" can be most effectively met by manufacturers themselves developing an accord on standard dimensions and lumber grades. Finally, growers should remember that the market place for special purpose lumber is likely to become increasingly volatile under the impact of fashion, changes in boat design and construction, and demands for sustainability.

Taken together, the issues between growers and manufacturers suggest the need for a commercial catalyst. The catalyst might take the form of an agent or agents able to:

a) Promote and arrange woodlot investment and sales.
b) Procure professional forestry advice and management.
c) Arrange silvicultural contracts.
d) Advise on and arrange the installation of on-site processing facilities.
e) Broker the sale of dried and finished lumber.

Commercial system

The present disastrous position of growers prompted visits to merchants, millers and an industrial machinist. All sawmills handling special purpose logs are very small. Their work is supplemented by the efforts of a small number of mobile sawmillers. The latter produce lumber at low rates and of varying quality. Special purpose sawmillers typically have little capital. What they do have is usually spent on adding to mill capacity rather than on drying facilities. The result is that in the northern part of New Zealand sawmillers sell their lumber green. It is bought by merchants who carry out the necessary air and kiln drying. The merchants then on-sell to manufacturers and builders. One result of this system is that successive profit-taking adds to costs in cumulative fashion. In other words, the existing commercial system is so structured that it adds needless costs to timber and so diminishes the returns to growers.

The cumulative effect of successive profit-taking is not the only problem. A common finding among sawmillers is their low recovery rates. Among eucalypts it is usually between 35% and 39%. Blackwoods sometimes yield as little as 13%. Rates like these reflect the current origins of the material. Typically, farmer-growers are interested in seeing how a given species grows but are not interested in carrying out the silvicultural work that could yield a high quality product.

The third problem confronting growers is the bundle of hazards created by the Resource Management Act 1991. On-site processing is highly likely to be opposed if neighbours include life-style block owners. Opposition commonly takes 2 forms: objection to sawmill noise (regardless of evidence); and objection to logging trucks. The first objection can be avoided by the use of mobile sawing equipment, which does not require RMA consent. The second is avoided by only moving dried, sawn timber from the forest site.

The obvious strategy for hill country farmland is to plant trees in woodlots, to maintain them properly and to process them on site. At Te Awa Awa the maintenance work has been carried out and an on-site processing unit is being designed. The facility is about half a kilometre from the nearest road. It comprises an air drying barn, a service block, 3 purpose-built trailers, a fork hoist and two kilns, only one of which would be installed in the first instance. Felling, logging and milling is planned on a contractual basis. Drying is proposed as a three-stage process to allow for flexibility in managing the variation in release of moisture content found in different species of hardwoods. The facility would be capable of taking sawn material from other small growers if the imposed conditions of consent so allowed.

The concept of on-site processing was adapted to support an annual input of logs calculated by taking one-fourth of the trees planted (to allow for losses of three fourths due to planting failures and thinnings) and by spreading the expected output over 30 years to achieve rough sustainability. Returns were estimated on the basis of wholesale prices charged by merchants to manufacturers. Commercial logic suggests that detailed figures for investment and yield at Te Awa Awa should not be recorded. They have been examined and tested by chartered accountants so far as that can be done from hearsay information. However, a few highlights will be quoted.

On-site finance

The capital cost of establishing a drying unit along the lines discussed is of the same order of magnitude as the cost of building a herring-bone or circular revolving milking shed on a dairy farm of comparable size. It is expected to be somewhere between $250,000 and $350,000. The net profit of on-site processing appears to be about 15 times the net profit recoverable from log sales under the existing system. The annual return on processing capital would be of the order of 95% per annum. It is expected that the whole of the capital invested in processing would be recovered in 13 months.

To check these figures, a worst-case scenario was drafted and the outcome calculated. The annual return covered the expected log sale return more than 8 times. The return on plant capital was expected to be 77.9% per annum. In neither scenario was allowance made for managerial or directors' fees.

Just how the operations of the proposed unit work out remain to be seen. They would obviously benefit from marketing being handled by a skilled corporate entity. That would enable management to concentrate on improvement to the processing unit and the addition in due course of an energy unit able to handle forest and mill waste. In this way, a direct attack on the imbalance in the carbon cycle attributable to human and animal intervention, and on some components of the greenhouse gases, could start to be mounted.

Conclusions

The ability of trees to supply human needs for

materials and energy will become of increasing importance in the 21st century. According to Hubbert's cycle, production of the middle 80% of world petroleum will end between 2025 and 2030. From then on, petroleum will make a negligible contribution to the world's energy supply. The end of natural gas will lag about a decade behind petroleum (Piel 1992). The winding down of these resources is expected to have a major effect on world demand for alternative energy and for low-energy materials.

As alternative forms of energy are developed, costs are likely to rise and thus render the fabrication of materials more expensive. Because trees capture sunlight and the production of wood has the lowest requirement for non-mammalian energy of all materials used in construction, its cost advantage over competing materials must increase. Consequently, forest research should put special effort into studying how to supply the range of wood densities used by manufacturers of wood-based products by expanding special purpose plantations (especially of hardwoods) in hill country. The predictable changes in fossil fuel supply support Dr. Wink Sutton's general prediction of an increasing market demand for wood this century but put greater emphasis on wood displaying the higher density range.

From the Holdt report, it becomes clear that furniture manufacturers are highly sensitised to the effect of wood colour as a selling feature. From this perspective, blackwood has a special appeal. It is one of only six species world-wide sought for gun butts. For practical purposes, in New Zealand that narrows down to two: blackwood and black walnut. To those who have worked with the two species, blackwood seems to be preferred. The importance of gun butt quality can be gauged from prices paid. Gun dealers say that a pair of top class blanks is worth $30,000 to a maker of sporting pieces. It seems clear that, by world standards, blackwood is in the running for top place in the quality stakes.

If on-site processing opens the door to the conversion of hill country land to special purpose forests, there are a number of obvious implications:

a) Administrative. Some regulatory provisions affecting land use (e.g. Resource Management Act 1991) will require drastic revision.
b) Environment. The more hill country can produce top quality plantation wood, the more it will relieve logging pressure on primary forests.
c) Carbon cycle. Replacing animals with trees reduces CO2 and methane emissions, increases oxygen release, and opens up opportunities for bio-energy from forest and mill residues, in conjunction with other sources of alternative energy, to replace the fossil fuels at an increasing rate.
d) Economics 1. An increased availability of first class wood will find an insatiable demand from overseas and should stimulate the development of first class products in NZ.
e) Economics 2. Increasing supplies of top quality wood will tend to retain the rural population in a rural setting but with an improved standard of living.
f) Political 1. Basic on-site processing of hardwoods will obviate the use of logging trucks to convey logs from farm to mill or port and will not increase road damage.
g) Political 2. The production of high quality wood from plantations should enable governments to progressively ban imports of such material and so reduce commercial pressure on the tropical rain forests.
h) Political 3. The production of bio-energy from hill country farms should in time enable governments to move progressively from reliance on fossil fuels to reliance on tree wastes for the production of electricity and liquid fuel, while at the same time benefiting from reduced emissions of greenhouse gases from animals.
i) Value. As farmers and investors become aware of the magnitude of returns possible from tree farming on suitable land, hill country land values must increase.

To sum up: what cheap oil meant to the US in 1950, cheap special purpose wood could mean to NZ in 2035 if we have the brains and courage to organise it.

References

Perlin, John. 1989: "A forest journey. The role of wood in the development of civilisation". Harvard University Press, Cambridge, Mass.

Piel, Gerard. 1992: "Only one world". Freeman & Co., New York.

5-Year Review of Registration

The following individuals have made an application under Article 41 (2) of the NZIF Articles of Association for the Five Year Review of Registration as Registered Members.

Alan Barnes	Rotorua
David Buckleigh	Rotorua
John Robert Eyre	Wellington
John Edward Gaskin	Rotorua
Harold Pemberton Heath	Wanaka
Gordon Hosking	Rotorua
Ian Donald Jenkins	Whangarei
Dennis Neilson	Rotorua
Kevin Snowdon	Turangi

The review process as approved by Council allows any Member of the Institute the right to object to the continuation of a Member's Registration.

Any objection should be made in writing and sent to: The Registrar, NZIF Registration Board, PO Box 19840, Christchurch within 20 days after the date of dispatch of this journal.