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ON-FARM FORESTRY DEVELOPMENT OPTIONS FOR NORTHLAND

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Abstract

Agroforests and woodlots offer Northland hill country farmers investment and diversification opportunities. Agroforests have less effect on the "whole farm" financial position than woodlots, especially where a progressive planting regime is adopted and where no further borrowing is required. Establishment and tending costs for agro-forests are lower, and returns come much sooner. The proven opportunity for continued grazing under trees established in this manner, apart from a short post-planting period, further enhances the agroforesty option. Even where there is reluctance on a farmer's part to plant trees on high fertility land, the expected financial returns from agroforests on low and medium fertility land will increase the overall long-term profitability and flexibility of the whole farming operation. Woodlots may be more appropriate on low fertility areas where weed reversion is likely. Joint ventures may be worth considering where farm finances are a limited factor.

Keywords: On-farm forestry development, Northland hill country, agroforestry, woodlots, diversification, joint ventures, progressive planting regimes, grazing availability.

Prompted in part by the economic downturn in traditional pastoral farming, more Northland hill country farmers are showing interest in establishing some form of forestry on their properties. Integrated on-farm forestry development offers them opportunities to improve long-term profitability, diversify their future income source and enhance the flexibility of their land resource.

Over recent months, farm advisers from the Ministry of Agriculture and Fisheries and forest extension officers from the New Zealand Forest Service in a joint study have been examining some of the on-farm forestry options open to Northland hill country farmers. Agroforests and woodlots were considered, the first as an "added value" investment, the second as a form of diversification. It is important to note that the study was not designed to compare the economics of forestry versus farming, but to incorporate forestry development options into the farm's existing financial and management structure.

The Advisory Services Division of MAF operate a farm monitoring scheme whereby farm advisers regularly evaluate the physical and financial performance of farms throughout the country. Hypothetical, but representative, farms in a number of farm classes are used to reflect trends occurring in the farming community. The farm monitoring scheme's "Northland hill country sheep and beef farm" was used as a base for this study. The three main soil types present on the farm each have differing fertility and pastoral productivity levels. Of the effective area, the low fertility Waiotira clay soils comprise 10 per cent (30 hectares), medium fertility Hukerenui clay soils 60% (180 hectares) and high fertility Mangakahia silt loams 30% (90 hectares). Their respective carrying capacities are 6, 11 and 17 stock units per effective hectare (s.u./eff. ha). Additional land not used for farming comprises 20 hectares of remnant bush and 30 hectares of regrowth scrub. The farm is carrying about 3,700 stock units, at a stocking rate of 12.3 s.u./eff. ha. The sheep to cattle ratio is 63 to 37 percent.

The forestry development options considered in this study were a 10 hectare woodlot on existing low fertility scrubland, and equal areas (10ha each) of agroforestry on the low, medium and high fertility soils. Using elite, genetically improved radiata pine cuttings, the woodlot was planted at 1,000 stems per hectare, pruned three times and thinned to waste twice to a final stocking of 200 stems per hectare by year eight.

Agroforestry blocks were planted at 300 stems per hectare, pruned four times and thinned to waste once to a final stocking of 100 s.p.h. by year five.

Making use of known tree growth data for Northland, SILMOD (the Forest Service's Silvicultural Stand Computer Model) simulated tree growth to determine the dates of clear-fell, and types and volumes of timber available. Using Auckland Conservancy stumpage prices and contract costs of forest establishment, tending, roading, etc., Internal rates of return, or I.R.R.s, were calculated for the four forestry options (Table 1). By way of explanation, an I.R.R. value (expressed as a percentage figure) indicates the rate of return which a future project is likely to show on the capital invested. If this is a positive figure and greater than the market rate of interest, then the project would provide an acceptable return. Despite some limitations, this method gives a reasonable indication of a project's likely economic worth. The stumpage prices used were $\$83/m^3$ for pruned logs, $\$50/m^3$ for unpruned logs, and, $\$5/m^3$ for pulp.

TABLE 1: Annual establishment and tending costs ($/ha) of woodlots and agroforestry on low fertility soils.

Year	Woodlot	Agroforestry
0	385 preparation	58 preparation
1	363 planting/fertilizer	304 planting/fertilizer/fencing
2	110 releasing	36 releasing
3	0	0
4	0	0
5	363 thinning/pruning	121 thinning/pruning
6	165 pruning	61 pruning
7	264 fertilizer	77 pruning
8	363 thinning/pruning/health	379 fertilizer/pruning/health
9	0	0
10	0	0
11	0	0
12	0	0
13	264 fertilizer	0
14	0	264 fertilizer
15	0	0
Total	2,277	1,300

I would like to mention the progressive, or gradual, nature of the planting system adopted. Agroforestry and woodlot establishment are considerable modifications of present land use on hill country farms. In order to reflect the approach taken by a "typical" farmer when thinking of "going into trees", a gradual rate of tree planting was decided upon, i.e. five hectares per year for six years. A progressive planting approach ensures that any stock displaced are more easily absorbed by the remainder of the effective farm area. In contrast, mass initial plantings immediately make some form of de-stocking necessary. In previous studies looking at on-farm forestry development, a mass planting approach has disadvantaged agroforestry as an investment option.

FINANCIAL ASPECTS

Greater volumes of wood harvested from woodlots compared with agroforests lead to higher stumpage values per hectare. However, woodlots have much lower returns on the capital invested. There are two main reasons for this. The first is that woodlot establishment and tending costs are a lot higher than for agroforests, especially if existing scrub areas are crushed. On low fertility land, the cumulative costs per hectare to year 15 (in today's values) are $2,277 for a woodlot (including scrub crushing) compared with $1,300 for agroforestry (Table 1). The second reason for the woodlot's relatively poor economic performance is the much longer period to clearfell — 10 to 14 years in this study, but it could be longer depending on the site (Table 3).

The difference between the profitability and the feasibility of a project must be emphasized. Even though the profitability may look good, as evidenced by the Internal rate of return values here, whether or not the project goes ahead should depend on the feasibility in a "whole-farm" context. The crux of the matter is whether the farm can adequately meet the demands for development funds during the time the trees are growing. An advantage of progressive planting is that the necessary annual tending costs are not too great,. A mass initial planting would mean that much greater sums of money would have to be spent, whereas a progressive approach allows a farmer to hold back on planting one or two years if finances are limiting. The total annual costs of the two forestry regimes on low fertility soils established at five hectares per year for six years are quite different (Table 2). At a gross margin per stock unit figure of $13.70 for the 1985/86 season, an increase of 234 stock units (or 6% of the current number) would fund the highest annual agroforest cost ($3,190), whereas 445 stock units (or 12%) would be required for the woodlot ($6,105).

TABLE 2: Annual establishment and tending costs ($) of progressive planting (5 ha/year for 6 years) of woodlots and agroforests on low fertility soils.

Year	Woodlot	Agroforestry
0	1925	292
1	3740	1810
2	4290	1991
3	4290	1991
4	4290	1991
5	6105	2596
6	5005	2607
7	4510	1474
8	5775	3190
9	5775	3190
10	5775	3190
11	3960	2585
12	3135	2283
13	3135	1898
14	1320	1320
15	1320	1320
16	1320	1320
17	1320	1320
18	1320	1320
19	0	1320
20	0	0

Northland hill country farmers should give priority to establishing agroforestry blocks in preference to woodlots, especially if the project can be funded out of farm income. At current high interest rates of 26% and climbing, further borrowing to finance forestry development would be unwise.

Although considerable information is available on woodlots in Northland, little research work has been done on agroforests in the North. Therefore, it must be recognised that some assumptions made by SILMOD, environmental factors and departures from the prescribed tending regimes are all potential sources of risk. To take some account of this risk, sensitivity analyses were carried out on the data (Table 3). I.R.R. values were relatively unaffected by significant reductions in volumes or prices of wood or by increases in costs.

TABLE 3: Summary of on-farm forestry development options.

Forestry type	Woodlot	Agroforestry		
Soil fertility level	low	low	medium	high
Age at clearfell (years)	36	26	24	22
Volumes (m^3) :Pruned logs	195	130	126	121
:Unpruned logs	243	152	151	147
:Pulp	110	37	45	48
Stumpage/ha ($)	28,705	18,395	18,043	17,453
I.R.R. (%) :status quo	8	14	17	18
I.R.R. (%) :30% increased costs	8	12	16	16
I.R.R. (X) :15% drop in volumes	n.c.	13	16	17
I.R.R. (%) :25% drop in revenue	7	12	15	16
Breakeven stumpage ($/$m^3$) at 10% I.R.R	91	30	19	18

n.c. = not calculated : volumes are more predictable in woodlots than in agroforests in Northland.

Of particular significance is the breakeven stumpage price required to give a ten per cent return on capital. The woodlot has to achieve an unrealistically high sawlog stumpage value to breakeven, whereas all agroforestry options have great flexibility over even unprecedented declines in stumpage expectations.

GRAZING UNDER TREES

There is a total loss of grazing on any area planted in trees for the 12 months or so after planting unless trees are protected from livestock in some way, or a farmer is in a mood for taking risks. Research work at Tikitere Forest Farming Research Area near Rotorua, has shown that at tree planting densities similar to those used in this study, grazing availability is about 40% by the second year after planting, and 90% by the third year. This gradually declines to 40% by year 15, then to 20% or so over the next 10-15 years.

Even when agroforestry was established on the high fertility areas, the maximum annual stock displacement effect on the representative Northland sheep and beef farm was equivalent to 340 stock units, about 9% of the total stock units currently carried on the property. With a reduced effective area, the overall stocking rate rose from 12.3 stock units per effective hectare to 13.2. In the normal course of events, stocking rates may change to a similar extent between seasons. Over the period to clear-fell, stocking rates are likely to lift by at least this degree due to improved pastoral husbandry. Therefore, the theoretical “opportunity cost” of any “lost” grazing and the value of any remaining grazing to the agroforestry options over time were not taken into account. It was felt that there was no significant effect on the whole farm situation in practical terms. However, if larger proportions of the farm’s total effective area were to be planted, both these points would assume greater importance.

The woodlot option used in this study could support grazing for a number of years on a less intensive basis than agroforests, and the introduction of Maku lotus would further improve grazing value. The non-grazing period after planting would assist clover seeding and establishment, but a black field cricket problem could become worse.

To minimise detrimental effects of shading on pastoral production capabilities, group or “shelter belt” (that is, double or triple row) plantings may be more appropriate than conventional “grid” arrangements on better quality land. Observations of Tikitere agroforestry blocks suggest that final stocking densities of between 50 and 100 stems per hectare would significantly slow the decline in grazing availability as the trees develop.

Agroforestry blocks should be greater than 3 hectares, as sheep management amongst trees in a paddock any smaller than this becomes rather awkward. It is probably fair to say that most farmers would be reluctant to plant trees on higher fertility land from which silage or hay is usually taken. However, this is not always the case, and some farmers harvest hay and/or silage from between the wide-spaced rows of trees for a number of years.

WEED PROBLEMS

In Northland, on low fertility farmland with a stock carrying capacity of six stock units per effective hectare or less, woodlots may be more appropriate than agroforests. In some areas, reinfestation with gorse, blackberry and Australian sedge would become a major problem during the non-grazing period following planting. The greater planting density in woodlots significantly reduces weed populations. Farmers would be able to save considerable sums of money if repetitive weed control measures could be avoided. However, even in woodlots grazed intermittently with cattle, satisfactory control of pampas can be hard to achieve, and it is often necessary to use weedicides.

ROADING COSTS

The cost of on-farm roading at the clear-felling stage has been identified in other studies as one of the key parameters reducing the profitability of forestry development. In this study, even when roading costs were significantly incresed (i.e. to the order of 2.5-4 times), the I.R.R. values dropped by less than one percentage point. This was equivalent to about a 6% reduction in sawlog stumpage value. Accessibility to good off-farm roading (that is, state highways or country roads) is critical to the viability of forestry operations.

PASTURE RENOVATION

After clearfelling of agroforests, there is obviously a need for some kind of pasture renovation, regardless of whether the forestry cycle is to continue or not. However, incorporation of regrassing costs had a minimal effect on the overall financial performance of the agroforestry options considered in this study.

FERTILISER APPLICATIONS

In this study, annual fertiliser dressings were continued on all agroforestry blocks until the ninth year after planting, and then in years 11, 13 and 15, largely for the pasture's benefit. According to soil fertility levels and financial constraints, a farmer may wish to vary the fertiliser regimes in this latter part of the agroforestry production cycle. Soil fertility levels on the representative farm were assumed to justify supplementary fertiliser dressings only on woodlots and agroforestry on low fertility soils. These were made by hand prior to planting and by air seven and 14 years later.

JOINT VENTURES

An alternative to additional borrowing to finance on-farm forestry establishment is a joint venture agreement. Northland farmers within a prescribed boundary now have the opportunity to become involved in joint venture woodlots with a major forestry company, The farmer can establish a share in the joint venture by re-investing rent payments in the project, paying all rates, levies and land taxes on the planted area, undertaking forestry work on the blocks or by investing cash from time to time within the limits of each year's scheduled expenditure. Sharing of the proceeds of the venture is in direct proportion to the costs paid by each party, adjusted for inflation and timing differences. Even if a farmer contributes nothing more than the minimum 20 hectares in a fenced block, the annual rent from the joint venture (about 6% of the assessed land value) for any idle land planted in this way will provide additional farm income.

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