FARMING BY LAND TYPE

AN APPROACH TO BUILDING RESILIENT NORTHLAND SHEEP AND BEEF FARMS

Northland is dominated by hill country and as a result sheep and beef operations tend to dominate pastoral livestock production. The sector experiences more pressure on profit margins, is less land use competitive and as a consequence dairy farming dominates the easier contoured and more productive land. The price of essential and major farm working expenses such as fertiliser, labour, fuel and agrichemicals continue to increase while product prices have been volatile resulting in a squeeze on profit margins. The response to this pressure has been to improve efficiencies. For example NZ exports a similar volume of sheep meat despite a halving in the national flock since the 1980's. This response is expected to continue as profit margins continue to be squeezed. Careful analysis of the land use options to maintain and/or increase net returns are needed to ensure the sheep and/or beef farm business remains viable.

This info sheet details an approach to understanding where profitability comes from on a "typical" sheep and beef farm in Waiotira, central Northland. The farm encompasses a full range of land types in one farm business which grazes almost 4000 Stock Units on 376ha. See photo below.

KEY MESSAGES

- Continuing to apply fertiliser to steep land provides a poor return on investment.
- The profitability of steep land can equal that of easy to moderate land by changing to radiata pine forestry.
- Diversification into timber and carbon production could improve the ability of Northland sheep and beef farms to cope with unexpected adverse events like drought and price downturns and achieve better financial and physical resilience.

PASTURE PRODUCTION

The biggest source of energy on the farm is the pasture grown. The annual output of this pasture factory can be measured as kg Dry Matter per hectare per year (kgDM/ha/yr). Over the past 23 years a number of detailed measurements have determined pasture production by month at a range of locations in Northland including Kaeo, Pakiri and on the case study farm itself at Waiotira. Annual pasture production ranges from 4,350 to 12,950 kgDM/ha/yr depending on fertility, pasture type and slope. Aspect has less influence on pasture production as compared with locations further south. These studies have shown that slope is the most important determinant of annual pasture production.

APPLICATION TO CASE STUDY FARM

The pasture production data from Kaeo has been used as the basis for this analysis. While this may slightly underestimate production for the steep land compared with the case study farm as fertiliser was not applied in all the years measurements were taken, measurements are representative and were taken over the last three years so provide average annual data.

Table 1 shows the effect of the four land classes on pasture production at Kaeo. Note that the average pasture production across all land types was approximately 7,000 kgDM/ha/yr and comparable to moderate contour which is the dominant land type. Pasture production from the steep land was 60% of the moderate land and less than half that of the easy land.

INFLUENCE OF SLOPE OR CONTOUR

The farm was mapped in detail (fences, contour, land use capability) using a geographical information system (GIS) to produce digital maps on aerial images. Each paddock was placed in one of four contour classes depending on the dominant slope angle (see Figure 1). Slope or contour class was assigned when 80% or more of the land in a paddock was within a specified range (see Table 1). These related to a slope class for which pasture production has been measured.

Figure 1 Farm map showing dominant contour of each paddock

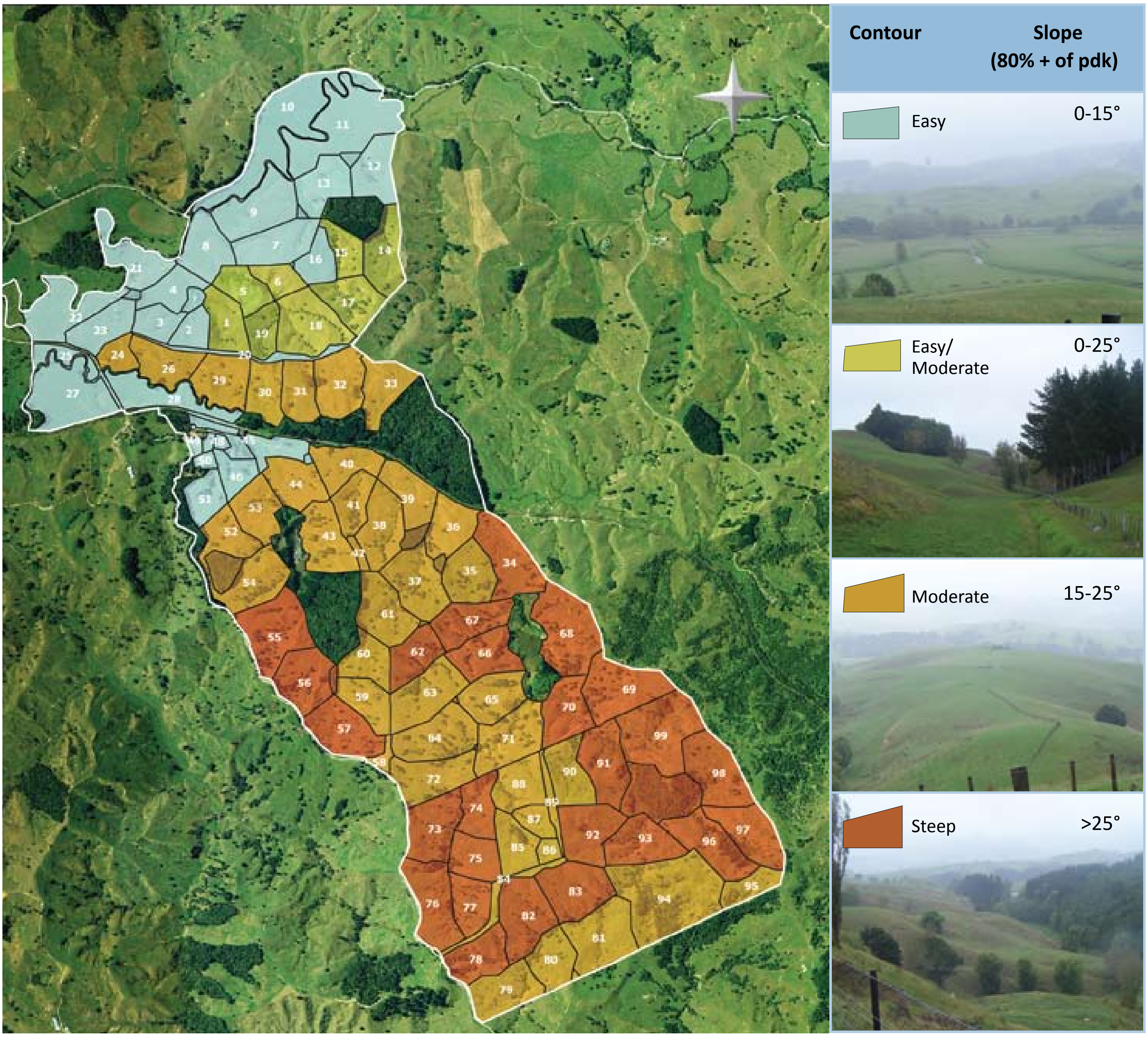

Table 1 Effect of slope on annual pasture production – Kaeo 2008-2011

Contour	Area (ha)	% of Total	Slope Degree	Relative pasture production	Pasture Production[1]
Easy	88	23%	0-15^{o}	130%	9425
Easy/Moderate	27	7%	0-25^{o}	115%	8338
Moderate	146	39%	15-25^{o}	100%	7250
Steep	115	31%	>25^{o}	60%	4350
Total	376				

[1] Measured under cages. Cages protect pasture from grazing animals. Pre and post grazing dry matter is removed for drying and weighing.

TURNING PASTURE INTO CASH

Livestock consume pasture and convert it to meat and wool but what is it worth? The approach used here was to draw on results and experience from Farmax® analysis. Farmax is a computer programme which enables the modelling of the biology of the farm. The programme utilises knowledge about feed demand profiles and couples this with pasture production profiles to determine the feasibility and profitability of the farming enterprises. Farmax can also be used to analyse the profitability of stock enterprises and land areas within the farm and express these in terms of profit based on Gross Margins. Table 2 lists the gross margin for three livestock operations (2010-11 season). The average gross margin per kg DM is 12c/kg. The gross margin is defined as sales less purchases and direct costs such as shearing and animal health, and the indirect cost of interest on capital invested in the enterprise.

Table 2 Effect of livestock operation on gross margin

Operation	Gross margin (c/kg DM)
Breeding Ewes	12 – 14
Breeding Cows	8 – 9
Bull Beef	10 - 14

LIVESTOCK PRODUCTION

The range in land types identified by contour also support a range animal production levels. These are shown in Table 2 and are based on moderate contour as being the farm average. Carrying capacity is indicated as ranging from 14 Stock units (SU) /ha down to 6 SU/ha. Production (meat and wool) was estimated to range from 325kg/ha on easy contour down to 150 kg/ha where the contour was steep.

PROFIT

Gross margin per hectare was calculated from dry matter production per hectare and gross margin per kg dry matter. This ranged from $1,122/ha down to $370/ha. Once farm working expenses are subtracted, net profit ranged from $672 down to $20/ha. This reflects expected long-term North Island product prices. Averages of $3.75/kg carcass weight for bull beef, $3.90/kg Cwt for prime beef, $5.50/kg Cwt for sheep meat and $2.82/kg wool were used for this analysis. While current prices are considerably higher, the relativity between the land types remains the same. Fertiliser, which adds about $100/ha to farm working expenses for steep land, has been included in farm working expenses despite the fact that some farmers have discontinued this practise. We have assumed continued application will be required to maintain production in the long term.

Table 3 Effect of slope on pasture and animal production

Contour	Pasture Production (kgDM/ha/yr)	Adjust to actual 85% Utilisation (kgDM/ha/yr)	SU/ha	Product/ha (kg)	Gross Margin[2] c/kgDM	Gross Margin $/ha[3]	Farm Working Expenses $/ha[4]	Net Profit ($/ha)[5]
Easy	9425	8011[1]	14	325	14	$1,122	$450	$672
Easy/ Moderate	8338	7087	12	288	13	$921	$425	$496
Moderate	7250	6193	11	250	12	$740	$400	$340
Steep	4350	3698	6	150	10	$370	$350	$20

1 Cage measurement overestimates actual availability and consumption, estimated utilisation is 85% of cage measurement.

2 As slope increases potential gross margin / kg DM decreases for example it is difficult to finish beef or lamb on steep land

3 Gross margin/ha = kgDM/ha x GM/kg DM

4 Farm Working Expenses, based on industry average, adjusted for maintenance fertiliser by 1.8kgP/ha/SU, excludes wages to management, tax, interest on mortgage, depreciation and capital expenditure

5 Net profit/ha = gross margin less farm working expenses.

ALTERNATIVE LAND USE

There are 115 hectares of steep land paddocks on this property returning little to the profitability of the farm. Forestry is an alternative land use which could provide diversity of income from timber and carbon while stabilising and protecting land from future storm events. With forestry, biodiversity would also improve on the farm along with enhancing water quality. Additionally there is potential to offset the cost of agricultural emissions in the future but what are the economics? A series of paddocks were identified (shown with white dots in Figure 2) for potential conversion to forestry. These paddocks were either close to the road (55, 56, and 57) or were contiguous in an area which if retired would have minimal impact in stock movement and other farm operations and would maximise the value from the roading required during harvest. In steep land such as this a minimum of 15 to 20 ha in one area would be required to make it economic for a contractor to set up harvest operation. A total of 54 ha were identified. For this analysis we have assumed an initial project to convert 15 ha by the road to radiata pine and use existing fence boundaries. Ideally tree planting boundaries should follow land type and a balance between adding upfront cost and long term optimisation of land use should be considered.

ECONOMICS

Investing in a new forest has a long time lag between investment and return (25+ years) and is therefore difficult to compare with livestock operations which produce annual returns. Discounted cash flow analysis is used to account for the time value of money in this case. The value of $1 in the future is worth less than a $1 now. How much less is determined by the interest or inflation rate. The Emissions Trading Scheme (ETS) recognises the carbon absorbed and stored by a new forest and is currently traded under the scheme. It is anticipated that carbon will feature in markets in the long-term. The New Zealand Unit (NZU) is the unit of trade and equates to one tonne carbon dioxide. The addition of an early annual income from carbon significantly improves the attractiveness of investment in forestry and greatly reduces the time lag between investment and return from 25+ years to around 5 years. However, the initial cash flow is still lumpy. We have calculated an internal rate of return to compare the economics of the current livestock operation with forestry on land of steep contour. The internal rate of return predicts the percentage return from an investment and income stream over time.

Figure 2 Farm map showing potential paddocks for afforestation

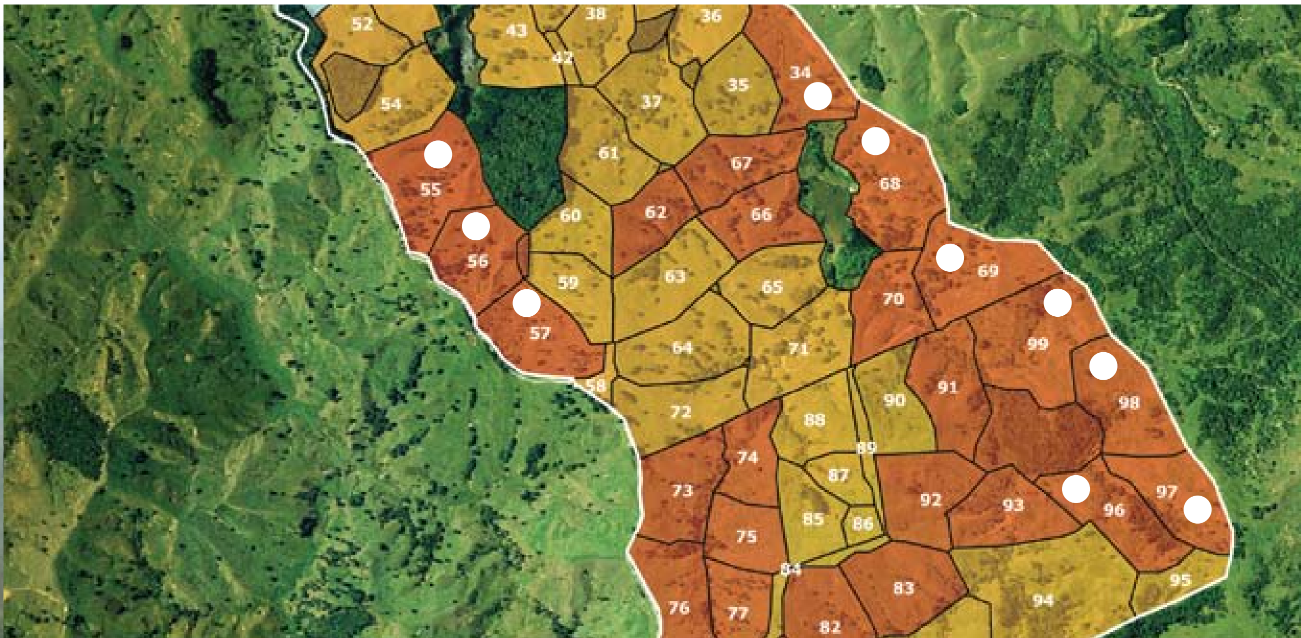

Table 4 The effect of landuse option on investment and returns for steep land

	Livestock	Timber	Timber + carbon ($20/NZU)	Timber + carbon ($30/NZU)
Investment ($/ha)	$600[1]	$2,850	$2,850	$2,850
Average Profit/year over 30 years ($/ha)	$20	$537	$785	$908
Internal rate of return over 30 years	2.9%	6.7%	18.5%	26%

[1] six Stock Units (eg in-lamb ewes) @$100

FOREST COSTS AND RETURNS[1]

Forest cost is based on establishing 1000 radiata pine/ha, pruning twice (years 5 and 8) and thinning (year 8) with an annual management and insurance fee of $60/ha. Total cost in first 8 years is $2,850/ha. Gross income at harvest in 30 years is estimated to be $46,862/ha based on conservative yield of 550 m^3/ha and three year average log prices. The net income or "stumpage" is estimated to be $21,837/ha once roading, logging, management, RMA and transport costs are taken care of, returning approximately $40/$m^3$ of timber. A distance of 60km from port was used. Every additional 10km distance reduces stumpage by about $1100/ha. Where carbon value was included, the value of an NZU was assumed to be the same at harvest and during the growth of the crop.

For the 15ha project, after annual management and insurance fees and establishment costs are paid for, the net return at 30 years is $241,913 or $537/ha/yr. The addition of carbon income at $20/NZU increases net return to $353,182 or $784/ha, rising to $908/ha at $30/NZU. Table 4 compares the investment, profit and internal rate of return for four steep land use options.

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SUMMARY

By using a long-term approach, the profitability of the steep land could match that of easy/moderate land by changing from producing meat and wool to producing timber. The addition of an income from carbon vastly improves the cash flow and internal rate of return for the landowner. Workload is also reduced as the cost of contractors has been factored in. This approach to assessing relative returns could be further developed. For example, pasture production from steep land is more variable than for other land classes exacerbating oversupply in the spring and producing the least in the winter. On paper, converting 54ha of steep land could see 320 less SU on the farm. However, experience from other farms shows that in reality focusing management inputs on the better land is unlikely to result in less livestock being run or loss in overall production. For example moving from an average flock of ewes to a high performance flock could increase profitability by up to $220/ha.

Implementing a new farm strategy which establishes 54 ha of forestry over the next 20 years could provide a harvest of 9 ha every 5 years. This could realise an income of almost $200,000 every 5 years but unlike livestock, there is flexibility to access that income over a ten year period. This could provide the financial resilience needed to cope with unexpected adverse events such as droughts and major price downturns which can cost farms of this nature around $100,000 over 2 years.

Should greenhouse gas emissions from livestock become subject to charges, having a source of carbon credits on the farm would insulate the business from a high carbon cost.

[1] Further detail can be obtained from the author jp.praat@pahandford.co.nz