Report to

Crown Forestry Rental Trust

Economics of Alternative Land Use on Crown Forest Licensed Land

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FOREWORD

Maori have a significant stake in the forestry sector. With the return of the Crown forest licensed land to iwi in the Central North Island in July 2009, some 440,000 hectares of exotic forestland will be owned by Maori. Maori ownership is likely to increase to over 700,000 hectares (40% of the 1.8 million hectare exotic forest estate) over the next few years once the remaining Crown forest licensed lands are settled and returned to iwi.

In 1990, the Crown Forestry Rental Trust (the Trust) was established to receive the rental proceeds from Crown Forestry Licences and make the interest earned from the rental proceeds available to assist Maori in the preparation, presentation and negotiation of claims before the Waitangi Tribunal that involve, or could involve, Crown forest licensed land.

Crown forest licensed land is a valuable asset which claimant groups may wish to include in their settlement packages. Before deciding whether to include Crown forest licensed land in their settlement packages, however, claimant groups need to agree with the Crown on the value of the land. Generally this involves the claimant groups undertaking a thorough due diligence process early in the negotiations. To assist with this process, and subject to certain criteria being met, the Trust funds valuations of Crown forest licensed land.

In addition to valuations, claimant groups also usually seek funding from the Trust for feasibility studies on the commercial potential and opportunities of alternative land uses for Crown forest licensed land. This additional information assists claimant groups to ascertain the future potential of the land and informs their decisions on the role of the Crown forest licensed land in their settlement packages.

The attached report prepared by Burleigh Evatt Consulting Ltd provides a comparative analysis of the economics of a number of pastoral enterprises with that of forestry as well as commercial options for the future management of Crown forest licensed land. A companion report prepared by Buddle Findlay, *Impacts of the New Zealand Emissions Trading Scheme on Crown Forest Licensed Land*, is available on the Trust website. It discusses how the NZ ETS works and how it applies to Crown forest licensed land.

The Trust believes that these reports will provide claimant groups with a comprehensive introduction to the impacts of the NZ ETS on Crown forest licensed land, including the potential for claimant groups to have NZ ETS obligations as future owners of the land, and on the economics of alternative enterprises and land uses. While claimant groups always need to consider the specific circumstances relating to their own claims, these reports will assist claimant groups to seek the necessary information during the negotiation stage, and ultimately make informed decisions on the merits of selecting Crown forest licensed land as part of their commercial redress package.

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Disclaimer

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Introduction

The Crown Forestry Rental Trust has engaged Burleigh Evatt to prepare advice[1] for claimants whose settlement redress includes Crown land subject to Crown Forest Licence (CFL). Such land is also known as Crown Forest Licensed Land (CFLL). The advice is in relation to assessing the economics of alternative land uses to forestry.

The question is relevant because large areas of CFL land, approximating one-half of the total of such lands, will transfer to claimant groups in 2009 under settlement agreements reached in 2008. Forestry returns are low which has a knock-on effect to rental returns. Many claimants will be wondering whether forestry is the best long term use for the lands they have resumed through the Treaty settlement process. Coupled with this is the aspiration of claimant groups to build an economic base within their respective rohe based around settlement redress. The purpose of such economic development aspirations is to provide economic resources to support tribal infrastructure and employment opportunities. Many people who live in regions where forestry is concentrated have experience of the cyclical nature of the forestry industry and its negative impact on local employment. For all these reasons it is valid for CFL land owners to ask the question whether alternatives to forestry might provide better value opportunities and a firmer foundation for sustained employment.

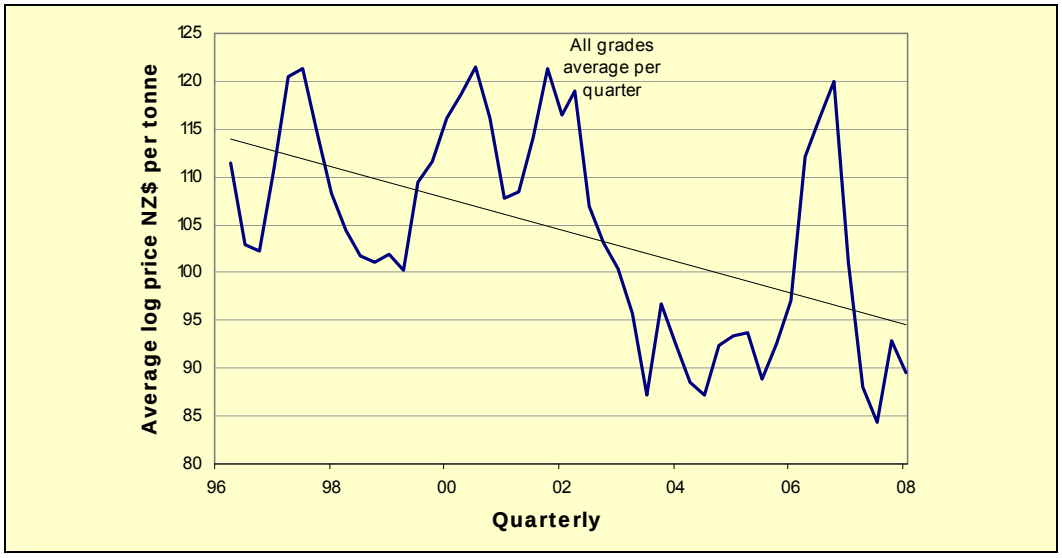
An added complication is the Emissions Trading Scheme (ETS) that was passed into law in 2008. Under this scheme, owners of land that was planted in plantation forests before 1 January 1990 (pre-1990 land) face liabilities if the land is permanently deforested. The liabilities relate to the amount of carbon sequestered in the mature trees. Such potential liabilities are large. The liabilities are roughly thirteen times the value of the land on a per-hectare basis even taking into account the 18 emissions units per hectare free allocation. All CFL land is pre-1990 land for ETS purposes. All claimants that have accepted CFL land as part of their settlement redress are affected by the ETS. The ETS is a significant barrier to alternative land use that requires permanent deforestation.

This paper has two objectives. The first is to develop a framework and financial model to assess the economics of alternative use for CFL land. The options developed measure on a per-hectare basis the costs and financial benefits of land conversion to active forestry, dairy, mixed sheep and beef, and deer farming. These options are looked at from the perspective of two states of the world namely, with and without the ETS. Not surprisingly the effect of the ETS is to change the preferred ranking in a "with ETS world" to make retention of land in forestry the highest valued approach. Correspondingly options requiring permanent deforestation become the lowest-ranking alternatives to continued forestry use.

[1] In developing this advice the authors have relied on assumptions and opinions about future events, which by their nature, are not able to be independently verified. Inevitably, some assumptions may not materialise and unanticipated events and circumstances are likely to occur. Therefore, actual results in the future will vary from the forecasts upon which the authors have relied. These variations may be material.

The second objective relates to structures to engage in forestry. Such structures usually address the means of preserving value in a commercial investment situation. Forestry is a cyclical commodity industry (as illustrated in Figure 1 below) with low profitability. Land owner's rental returns reflect that economic fundamental. Growing trees is not where the value is. Unless land owners can also invest downstream in processing and marketing opportunities, and such options may be beyond the reach and appetite of most land owners, they must look to achieve the best value possible from the activities carried out using their land. Therefore the imperative for CFL land owners seeking to improve their returns is to cut, contain, and as far as possible, share costs with other land owners in similar circumstances. This provides a rationale for collective action for CFL land owners. This intensified when it was recognised that under the termination provisions of the relevant CFLs, and the most likely harvest plans, land will return to the owners piecemeal over the three decades before the occupiers must quit.

Figure 1 **Trend of Log Prices**



Filename: CF91-2 September 2008 Report Working.xls.
Sources: MAF, Burleigh Evatt analysis.

There is an additional consideration arising from the ETS liabilities for permanent deforestation of pre-1990 land, arising from the possibility and consequences of inadvertent deforestation. While deliberate acts to deforest to gain economic advantage are one thing, CFL land owners also face the potential risk of deforestation as a result of acts by the occupier during the termination of the CFL that they may not be in a position to remedy[2]. Another potential source of inadvertent permanent deforestation is from "Acts of God". The central North Island forestry region contains New Zealand's most important area of potential volcanic activity. The volcanic zone running from Mt Ruapehu to White Island, 50 kilometres off the region's coastline, is called the Taupo Volcanic Zone (TVZ). The TVZ runs straight through the centre of the Bay of Plenty region. Attention to ways and means of containing, managing or avoiding inadvertent deforestation risk from such origins is therefore appropriate.

[2] This is a theoretical risk arising from differences in the definitions of clearance of land under the CFL provisions and the definition employed in the ETS.

1.1. Intended Audience

The advice contained in this paper is generic in nature. It provides a framework for claimants and CFL land owners who may seek to investigate the feasibility and desirability of conversion. CFL land owners will need to seek specific advice on actual situations, but such advice may be based around the framework presented in this paper. Land owners will need to form their own judgements on the advisability, risks and rewards of changed land use.

The advice presented in this paper is intended to equip someone who has an existing modest grounding in finance concepts with the tools to direct the engagement of professional advisers towards gathering the "right" information and answering the "right" questions.

All investment analysis is challenging to apply in practice. It is much harder to get it right than a novice might imagine. Nevertheless, there are high-level principles of thinking and acting like an investor, understanding how commercial value is created, and exercising caution, which provide guidance to anyone charged with making or overseeing commercial investments. Ultimately, it is about applying a structured approach to two key questions. The first question is whether the proposed venture is an attractive commercial proposal. The second question is about how to protect the investment from risk of loss. All business ventures entail risk of loss, so it is important to understand how much risk of loss exists and whether this will improve over time (say with a successful start-up venture). Hand-in-hand goes consideration of how you could extract your investment if events unfold differently from expected, or if you lose your appetite, or if something better comes along. The final consideration needs to be a focus on the extraction path. If the venture fails, what are your contractual and legal rights, and if the worst happens what is likely to be left?

These matters are discussed further in "A Framework for the Commercial Appraisal of Joining the CNI Iwi Collective Settlement", pp 12-15, available from the Crown Forestry Rental Trust website.

1.2. Background

The decision to sell the Crown's commercial forestry assets was announced in the 1988 Budget. The commercial forestry assets had been managed by the Forest Service from 1919 to 1987, and by the Crown-owned Forestry Corporation from 1987. These were exotic plantation forests consisting mainly of *Pinus radiata* that had been planted to replace native forests harvested for timber to feed housing construction in the early part of the 20th century.

Māori objected to the proposed sale of the associated forestland out of Crown ownership and were successful in blocking the sale process. This was a direct follow-on from the 1987 "Lands" case[3]. The Court of Appeal[4] recommended negotiations to resolve the dispute. In July 1989, the

[3] New Zealand Maori Council v Attorney-General [1987] 1 NZLR 641. This concerned the establishment of State-owned Enterprises (SOEs) to administer nine Crown-owned businesses. The State Owned Enterprises Act 1986, section 9, provides that nothing in the Act permits the Crown to act in a manner that is inconsistent with the principles of the Treaty of Waitangi. Māori were successful in arguing that transferring land to SOEs, without ensuring that land

Crown and the New Zealand Māori Council (NZMC) and the Federation of Māori Authorities Inc. (FOMA) entered into the 1989 Crown Forests Agreement. The 1989 Agreement provided that the Crown could sell plantation forests, but would retain ownership of the land, with protection mechanisms to safeguard Māori claims[5] to the land.

The Crown Forest Assets Act 1989 was passed and the Crown Forestry Rental Trust (the Trust) was established as a result of the 1989 Agreement. The Trust comprises three trustees appointed by the NZMC and the FOMA, and three by the Crown. The Trust receives and invests rental income from Crown Forestry Licensed (CFL) land, and uses the interest earned to assist claimants with claims before the Waitangi Tribunal involving CFL land.

The Act created Crown Forestry Licences (CFLs) that separated land ownership from the right to occupy and use the forestland for plantation forestry. Of particular importance were two aspects of the CFLs:

- Termination arrangements that protected the occupier in the event of a successful land claim. On transfer of land ownership from the Crown to Māori, a termination notice is given to occupier. During the next 35 years, occupancy progressively returns to the Māori land owner as trees are harvested. The occupier may not replant harvested areas and improvements to the land transfer to the Māori land owner at no cost.
- The payment of accumulated rentals to successful claimants following a Waitangi Tribunal recommendation that CFL land be returned to them.

There were clear expectations among the parties that settlement of the CFL lands would occur quickly and as a matter of priority as a result of the deal struck in 1989.

Twenty years have passed since this deal was struck. In many parts of the country, CFL land is the major land asset available to the Crown to settle historic Treaty claims. It is an attractive asset for claimants with valid mana whenua interests that are seeking to regain control over ancestral lands. In most cases, the accumulated rentals associated with CFL land now exceeds the land value itself, and, being regarded as outside settlement quantum, is a significant addition to the tribal assets acquired through the Treaty settlement process. Many claimants regard the combination of the CFL land and accumulated rentals as means of regaining ancestral lands without having to use the settlement quantum.

However there are three snags with CFL land. The first is that forestry as an industry suffers poor profitability and may be seen by some claimants as an unattractive commercial activity in which to invest their settlement redress. The second is that the termination arrangements for CFLs may

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remained available for future Treaty settlements, was inconsistent with the principles of the Treaty, and therefore a breach of section 9.

[4] New Zealand Māori Council v Attorney-General [1989] 2 NZLR 142.

[5] Under the Treaty of Waitangi Act 1975 (and a 1985 Amendment) the Waitangi Tribunal investigates historical breaches of the 1840 Treaty of Waitangi and makes recommendations to the Crown which then negotiates redress with the successful claimants.

take up to 35 years to be complete. Claimants may face a long wait before all their land is in their hands. During that time, land returns to the claimant piecemeal as the trees are cleared by the CFL licensee compartment by compartment. Until the land is cleared the claimant is locked in a landlord role receiving the licence fee (rent on the land's unimproved value at fairly low rates). The third snag concerns New Zealand's response to climate change, the Emissions Trading Scheme (ETS). The ETS imposes on owners of land on which forests were planted before 1 January 1990 an obligation for the carbon sequestered in the trees if the land is deforested. Thus any change of land use entailing permanent loss of forest cover obliges the land owner to reimburse the Government for the emissions units represented by the carbon sequestered in the trees, typically about 700 tonnes per hectare. All CFL land was planted before 1990.

In Table 1 below we show:

Table 1 **Abbreviated Tables of Carbon Stock per Hectare for pre-1990 Forests**

Expressed as tonnes of carbon dioxide (CO_2e) per hectare.

	Pinus Radiata by Region									Other species		
Age	Ak	W/T	BOP	Gis	SNI	NM	CW	O	S	DF	ES	EH
10	265	235	237	296	286	193	174	200	240	135	139	310
20	568	518	485	578	566	401	312	375	452	308	260	541
25	725	676	631	732	721	551	441	529	612	420	335	626
26	753	704	657	760	749	580	467	559	643	446	349	n.a.
27	781	733	683	787	777	609	493	588	673	446	363	n.a.
28	807	761	709	814	804	637	519	618	704	454	377	n.a.
29	834	783	735	840	830	666	546	648	734	475	390	n.a.
30	860	816	760	866	857	694	572	677	764	500	403	n.a.
31	885	842	784	891	882	721	598	706	794	524	416	n.a.
32	909	868	808	916	907	748	623	735	823	550	429	n.a.
33	933	894	831	940	932	775	649	763	852	576	442	n.a.
34	956	919	854	964	956	801	674	791	880	601	454	n.a.
35	979	943	876	988	980	827	699	819	908	529	466	n.a.
40	1090	1061	981	1103	1098	948	817	952	1044	753	525	n.a.
50	1313	1297	1187	1348	1346	1170	1028	1206	1309	957	642	n.a.
60	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1138	n.a.	n.a.
70	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1296	n.a.	n.a.

Abbreviations: Ak means Auckland, BOP means Bay of Plenty, CW means Canterbury and West Coast, Gis means Gisborne, SNI means Hawke's Bay and Southern North Island, NM means Nelson and Marlborough, O means Otago, and S means Southland, W/T meansWaikato/Taupo.
DF means Douglas fir, ES means exotic softwood tree species, and EH means exotic hardwood tree species.
- = nil or zero, n.a. = not available.

Filename: CF93-3 Tables of Carbon Stock per Ha.xls]Pre-1990.

Source: Climate Change (Forestry Sector) Regulations 2008.

For all of the reasons discussed above, it is sensible for claimants to be asking the question about whether forestry is right for them in the long term. Ought they to be considering other alternative uses of the land as well? An additional factor for many is their experience that forestry is a cyclical industry and downswings negatively affect employment possibilities within their respective rohe. The history of the North Island CFL lands is of multiple ownership changes affecting the trees growing on them. Consideration of the local workforce has come a distant second to the commercial preoccupations of the various occupiers. Forestlands are not well populated as a rule, and many claimants aspire to re-create viable communities within their rohe as part of their post-settlement restoration. This carries with it the idea of building a viable economic base with sustainable jobs that will attract people back to live within the rohe.

When a claimant group opts to receive some of its settlement redress in the form of CFL land it is implicitly making an investment decision. That may not be top-of-mind during the Treaty settlement negotiation process, but it is the commercial reality. Moreover the CFL land investment decision is blurred by the accumulated rentals. Accumulated rentals represent the income from the CFL Land since 1989 when the Crown settled litigation with the Māori Council and FOMA of the sale of Crown forestry assets; in effect it is a back-dating of the settlement to 1989.

Part A: Economics of Alternative Land Use

1.1. Comparing Forestry and Farming Investment Opportunities

A complicating factor in comparing alternative land use proposals is that farmers and foresters use different investment performance measures[6]. Not only are the approaches different, but they are not readily comparable. It is important to understand why this should be so because it relates to the underlying reality of farming versus forestry as a commercial activity.

Farmers tend to look at key performance indicators (KPIs) on a per-hectare or per-sheep stock[7] unit basis, and separate capital or development costs from net revenues. Typically there is a fairly fixed relationship between the cost of development of a certain type of land type in a part of the country and its livestock carrying capacity. Farming is a cyclical business reflecting climatic variation year-to-year, changes in international commodity prices and exchange rates. Farmers look through the cycle using a maintainable earnings concept to evaluate performance. This may be thought of as a long-run average or cyclically-adjusted measure of gross profitability. Thus farmers will readily compare development costs per hectare and the gross or effective farm surplus from a hectare, and armed with knowledge of the carrying capacity (sheep stock units per hectare) based on the contour, soil type and climate these metrics give a break-even type measure of financial performance.

Foresters, in contrast, tend to measure the performance of forest blocks based on the net present value of the future cash flows using the discounted cash flow (DCF) method. This is a much more complicated approach, but made necessary by the very long term nature of forestry with typically 28 or more years separating the planting of the tree crop and its harvest. DCF analysis is a tool that allows the value of a single investment, or the relative values of a number of alternative investments with different cash flow profiles in time to be compared on a like-for-like basis. The DCF method works by condensing the forecast future cash flows whenever they appear in the future into a single lump-sum amount. This lump-sum amount is called the present discounted value or net present value (NPV). As the method's name implies, condensing the future forecast cash flows into a lump-sum involves weighting the future cash flows according to when in the life of the project the cash flow item occurs. Greater weighting is given to costs and/or revenues occurring early in an investment's life, greater than that given to more distant costs and revenues. When the DCF method is used to compare the relative worth of two or more investments, the investment that delivers the biggest lump-sum amount is considered to be the best.

Tax plays a critical role in all investment analysis and must be considered explicitly taking due

[6] Evison 2008 expands this discussion to reveal other matters that cloud the comparison of investment returns from competing land uses. He cites, for example, differences in the availability of information between agriculture and forestry and the influence of land value appreciation. Evison points out that while MAF annually publishes comprehensive data on the economics of agriculture and horticulture, no such data is available in respect of forestry.

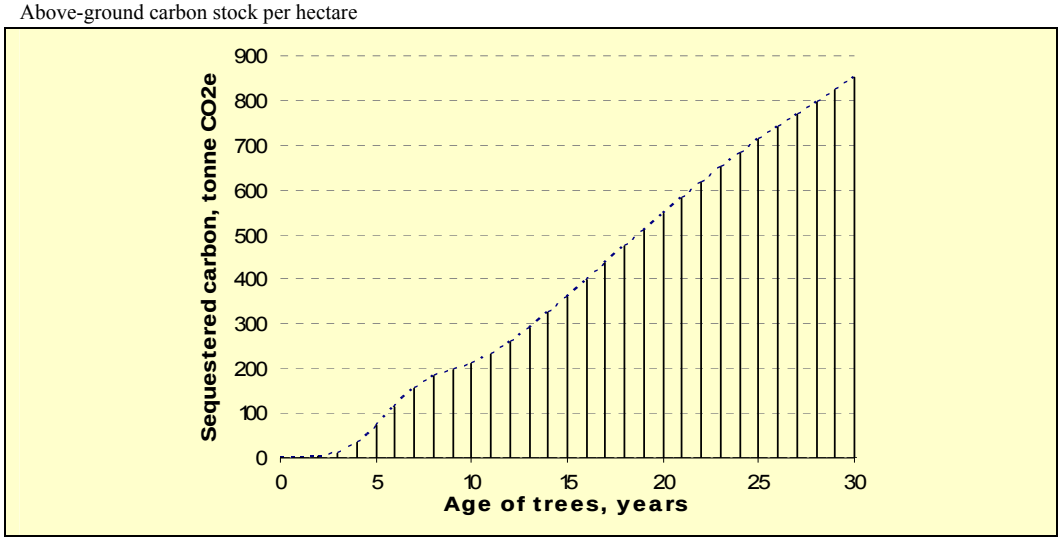
[7] Stock unit (SU) or livestock unit (LSU), also referred to as ewe equivalent (EE). It is the feed requirement used as the basis of comparison for different classes and species of stock. It expresses the annual feed requirements, equivalent to one 55 kg ewe rearing a single lamb. 1 SU requires approximately 520 kg of good quality pasture dry matter per year.

account of timing, recognition of tax losses and non-cash deductions such as depreciation. Foresters look at net present value of cash flows after tax, while the gross farm surplus is a pre-tax concept[8].

There is nothing intrinsically right or wrong about the differing approaches, they are simply different. The differences reflect the respective nature of the businesses; farming, once the initial development of a property is complete, is a fairly steady-state business, compared with forestry which experiences huge growth rates year-on-year (see Figure 2 below). Over the last 23 years of a rotation, pine trees add mass at a compound annual growth rate (CAGR) which exceeds 10 percent. By contrast, increases in farm output tend to appear more slowly as the result of improved pasture, livestock management, genetics and animal health, subject to the vagaries of climate. Upgrades of plant and equipment and infrastructure tend to occur in the normal cycle of replacement. Similarly with livestock, where improvements occur progressively by livestock selection, rather than the culling and replacement of whole flocks/herds. Inflation and the value of money over time are critical to forestry because of the quarter-century or more separation of expenses and revenue. Inflation can hurt farmers especially if there is a mismatch between cost rises and currency movements but nowhere near as greatly as for a long-lived tree crop.

Figure 2 **Progress of Carbon Sequestration For Standing Pinus Radiata**

Above-ground carbon stock per hectare



Filename: CF63-8 Forest Rotation Economics Analysis.xls

Sources: Schedule 6, Climate Change (Forestry Sector) Regulations 2008, Burleigh Evatt analysis.

1.2. Crossing the performance measurement divide

The most comprehensive measure of investment performance is the discounted cash flow method. The DCF method is preferred in this case for the following reasons:

- It is a fundamental valuation technique that makes use of all available information about present and future prospects of a business.
- It allows explicit account to be taken to the value consequences of the timing of cash flows and the differing inherent rates of growth of farming and forestry businesses.

[8] Land expectation value (LEV) is a form of DCF analysis sometimes used by foresters.

- It allows the effect of tax losses to be included in the analysis.
- It allows us to model the impact of ETS liabilities on agriculture from 2013.

However, the DCF method relies heavily on forecasts about future events which may or may not come to pass. It can be criticised validly as an exercise that is so heavily reliant on assumptions as to be of questionable relevance. Nevertheless, when comparing costs and benefits it is necessary to take account of how they are spread over time, for at least some of the following reasons:

- Prices change over time, with general inflation and relative to each other.
- The resources used to produce a future revenue flow might instead be invested elsewhere.
- In addition to project-specific risk there may be some non-negligible chance that the future cost or benefit would not occur, because of some natural or man-made catastrophe.

The first of these items, price changes, while sometimes overlooked or misunderstood, is technically undisputed and generally handled by means other than discounting. Discounting processes can normally take account of the other two items listed above. One word of caution in relation to including a component for the general risk of catastrophe is that such events are likely to mean that the post-catastrophe cash flows will dry up altogether, rather than diminish in value in present-day terms.

1.3 Land Expectation Value as a Possible Compromise

Land expectation value (LEV) may be a possible compromise method for comparing alternative land use investment in a way which is readily understandable by both foresters and farmers. LEV is simply a measure of the maximum value of land to the particular investment. LEV is a yardstick that can be compared with the market price of land to judge whether the proposed land use might be more profitable. LEV may be compared with alternative investment proposals to determine whether the proposed investment is a higher or lower-valued use of land.

Such an approach, while no less technically challenging than the DCF method[9], does lead to simple and intuitive comparisons of alternative uses of the same land. Simple statements will emerge from such analysis such as, “this land is worth more in dairy than in forestry”, or “dairy is a higher valued use of the land than sheep and beef farming”. This approach is consistent with the general method used in investment analysis of ignoring any asset or resource that is common to each proposal under consideration provided the alternatives are all mutually exclusive uses of the asset or resource.

1.4 Time Value of Money

The concept of resources having different alternative investment values is known as the time

[9] The main difference from the DCF method is that land-related opportunity costs are excluded. Such costs are the purchase and sale of land or rent. Otherwise the techniques are identical except in the respect that the net present value of future cash flows (NPV) is interpreted as the LEV.

value of money. The concepts of present and future value hinge upon the premise that an investor prefers to receive a payment of a fixed amount of money today, rather than an equal amount in the future, all else being equal. In particular, the time value of money represents the interest in investor might earn on a payment received today, if held, earning interest, until that future date.

All the standard calculations derive from the most basic algebraic expression for the present value of a future sum, discounted to the present by an amount equal to the time value of money. For example, a sum of future value (FV) to be received in one year is discounted (at the rate of interest r) to give a sum of present value (PV), as follows:

$$PV = \frac{FV}{(1+r)}$$

Conversely a sum of PV could be invested for one year at the rate of interest r to give an amount of FV.

$$FV = (1+r)\ PV$$

It is rare for discounting to be applied in a commercial setting to periods of more than one decade. For most firms in the private sector even one decade would be beyond any sensible horizon for formal appraisal of costs and revenues. The public sector sometimes has longer horizons, especially when considering infrastructure projects, but it is rare for costs and revenues beyond two decades to be material to practical decision-making at prevailing discount rates[10]. At a 10 percent discount rate, for example, the value of a cash flow occurring in the 20th year is just 15 percent in present value terms, as illustrated in Table 2.

Table 2 **Discount Factors**

The present value (PV) of $100 received n years in the future ad varying discount rates

Years	3%	5%	6%	8%	10%	12%	15%
1	97.09	95.24	94.34	92.59	90.91	89.29	86.96
2	94.26	90.70	89.00	85.73	82.64	79.72	75.61
3	91.51	86.38	83.96	79.38	75.13	71.18	65.75
4	88.85	82.27	79.21	73.50	68.30	63.55	57.18
5	86.26	78.35	74.73	68.06	62.09	56.74	49.72
6	83.75	74.62	70.50	63.02	56.45	50.66	43.23
7	81.31	71.07	66.51	58.35	51.32	45.23	37.59
8	78.94	67.68	62.74	54.03	46.65	40.39	32.69
9	76.64	64.46	59.19	50.02	42.41	36.06	28.43
10	74.41	61.39	55.84	46.32	38.55	32.20	24.72
15	64.19	48.10	41.73	31.52	23.94	18.27	12.29
20	55.37	37.69	31.18	21.45	14.86	10.37	6.11
25	47.76	29.53	23.30	14.60	9.23	5.88	3.04
30	41.20	23.14	17.41	9.94	5.73	3.34	1.51
40	30.66	14.20	9.72	4.60	2.21	1.07	0.37
50	22.81	8.72	5.43	2.13	0.85	0.35	0.09
100	5.20	0.76	0.29	0.05	0.01	0.00	0.00

Filename: CF93-3 CF93-3 Alternative Land Use Analysis (Ian.Dickson v1).xls.
Source: Burleigh Evatt analysis.

1.4 Choice of Discount Rate

An important consideration is the choice of discount rate that is used to convert future cash flows

[10] Since the mid-1990s following from the emergence of nuclear waste and global warming has problems which may impose material costs on distant generations, there has been a growing interest in whether and how discounting should be applied to much more distant periods.

to a present value. In a long-lived investment such as forestry even a small change in discount rate can have a big impact on the present value of future cash flows. It is generally agreed that an appropriate discount rate should be the opportunity cost of the capital that has been used to fund the investment. The opportunity cost should take account of the relative riskiness of the investment compared with other opportunities available. While the concept is generally agreed, there is much debate about the appropriate way of selecting the discount rate. A common approach is to use the cost of borrowing for money used to fund the investment. While this sets a lower-bound or floor on the discount rate, the cost of borrowing by itself does not adequately capture the returns necessary to compensate the investor for what he or she could obtain in other similar investment situations that provide an equity return.

In some methods the cost of borrowing in the return on equity investments are combined into a weighted average cost of capital (WACC). The weightings given to debt and equity reflect the mix of the two that are typical for the industry. While the cost of borrowing may be readily observed it is often much harder to observe the cost of obtaining equity capital. To overcome this analysts use models such as the capital asset pricing model[11] (CAPM) to estimate the cost of equity capital.

1.5. Emissions Trading Scheme

The Climate Change Response (Emissions Trading) Amendment Act 2008 brought into law the New Zealand Emissions Trading Scheme (ETS). The ETS has profound impacts for owners of pre-1990 forestland, which includes all CFL land. The forestry sector was subject to the Act and the ETS from 1 January 2008.

As legislated, the ETS will also profoundly affect agriculture by imposing on farmers a liability for the emissions of greenhouse gases by farming activities. Principally these liabilities will relate to emissions of methane (CH_4) from the gut of ruminant animals and nitrous oxide (N_2O) from animal urine or the application of nitrogenous fertiliser. Other indirect emissions such as from the consumption of fossil fuels and use of electricity will also incur a carbon liability that will be passed on to farmers in increased costs.

A separate paper, *"Impacts of the New Zealand Emissions Trading Scheme on Crown Forest Licensed Land"* is available on the Trust's website[12]. Briefly, owners of pre-1990 forestland, and owners of the trees, are able to harvest and replant forests without joining the ETS or incurring any emission unit liabilities. If a decision is made to permanently deforest, i.e., change the predominant land use from forestry to an alternative non-forestland use, the land owner automatically becomes a participant in the ETS, must report on the level of deforestation, and meet the associated emissions unit liability. Owners of pre-1990 forestland are not able to earn

[11] Under the CAPM the required return on an equity investment depends on the risk-free rate of return, typically a long-term government bond yield, thus statistical relationship between the returns on investment and a diversified portfolio such as all companies listed on the NZX.
[12] See www.cfrt.org.nz.

any credit for the carbon sequestered in the trees standing on the land. In contrast owners of post-1989 forestland who elect to join the ETS are able to earn credit for increases in the level of carbon stored on trees growing on their land, but must also meet the liabilities associated with any subsequent decreases.

At the time of writing, important details on how agriculture will be affected by the ETS have yet to be made public. The Climate Change Response (Emissions Trading) Amendment Act 2008 requires agriculture to be included in the ETS with effect from 1 January 2013. The point of obligation will be processors. This means that a deduction will be made from the income of farmers for an assessed amount of carbon emissions based on each carcass, kilogram of milk and kilogram of wool etc. The full impact of the ETS is not meant to be felt until 2030. In the meantime farmers will be allocated free emissions units based on 90 percent of the sector's greenhouse gas emissions in 2005. With the increase in agriculture greenhouse gas emissions since 2005 this means that the average level of compensation will be approximately 70 percent of projected emissions levels in 2013. This compensation will phase down in a linear fashion over the ensuing years ending 2030. How the compensation will be allocated at a sub-sector level between dairy and other pastoral farming is still under development. It is unclear what the position would be for land that was not in use for farming in 2005, the base year for compensation assessment. At one extreme, it is conceivable that the land owner would receive nothing to compensate for agriculture emissions if the use in 2005 was other than pastoral agriculture. We model both approaches.

At the time of writing a Parliamentary Select Committee is reviewing the ETS and is expected to report back to Parliament in June or July 2009. Ministers have stated that they anticipate amendments to the ETS to be enacted by October 2009. Ministers in particular, have indicated an attraction to aligning the New Zealand ETS with the Australian Carbon Pollution Reduction Scheme (CPRS). While having the same basic structure as the ETS, the CPRS is different in important material respects particularly as it would apply to agriculture. The Australian government has indicated a desire to include agriculture in its CPRS on condition that a number of practical issues can be solved, issues which have not yet been solved in the New Zealand context. The Australian government has also made a commitment to ensure that trade-exposed sectors such as agriculture are not disadvantaged by having to meet the cost of carbon emissions associated with the production and export goods. If such an approach was adopted in New Zealand much of the potential burden of carbon emissions for agriculture would be mitigated. However at this stage there is no certainty about the direction of developments in this area.

The other important dimension to the ETS that needs consideration is the future price of emissions units. Because there is currently no market for New Zealand Units (NZU), the "currency" of the ETS, we are not able to observe a current or future price of carbon abatement. However, it is possible to infer from established carbon markets in Europe an approximation of a

future price for NZU. Before September 2008 and the onset of the current economic recession in Europe, carbon abatement credits were trading at around €20 per tonne of carbon dioxide equivalent (tonne CO_2e), equivalent to NZ$40 at the then prevailing exchange rate. With the subsequent reduction in demand for electricity generated from coal in Europe the price of carbon has fallen to around €12 per tonne CO_2e. As the European economies recover it is expected that the price of carbon abatement will also recover and over time will have an upward trend with some forecasts indicating that it may go as high as € 40 per tonne CO_2e, or about NZ$100 by 2030[13]. At present the New Zealand ETS has no mechanism for controlling the supply of NZU in order to set the "price" of the "currency". In contrast, the Australian government has indicated that it will set a cap of A$45 per tCO_2e. For the sake of simplicity in the following analysis we have worked from the assumption that the long run price of carbon abatement will be NZ$42 per tonne CO_2e.

1.6. Continued Forestry Use

Claimants that have accepted CFL land as part of their settlement redress may face a long wait before all their land is in their hands under the typical termination arrangement for a CFL. The timing of the return of lands is a function of the harvest profile of the trees. Largely this is determined by the age of trees, although there is some latitude to vary the time of harvest depending on market conditions. During the termination period, land is returned to the claimant piecemeal as the trees are cleared by the CFL licensee compartment by compartment[14]. Until the land is cleared the claimant is locked in to a leaseholder (landlord) role receiving the licence fee (rent on the land's unimproved value at fairly low rates).

The first decision faced by land owners is whether to continue in forestry or not. It may be, for example, due to the characteristics of the land, access or other factors that continued use of the land for growing tree crops makes good sense. If it is decided to remain in forestry there are two potential roles that may be adopted:

- Leaseholder. The land owner could lease, licence or, by other means, grant the occupier a long-term right to use the land for the purpose of growing trees. In return, the land owner would earn a licence fee set by reference to land values (rent). At its simplest level this might be an agreement with the occupier to roll-over the current licence as the compartments are cleared. In this respect the claimant group would be the landlord to the occupier for at least one more rotation.
- The second alternative is to become an active forester. As the CFL compartments are cleared the owner resumes control of the land and arranges replanting. The land owner will

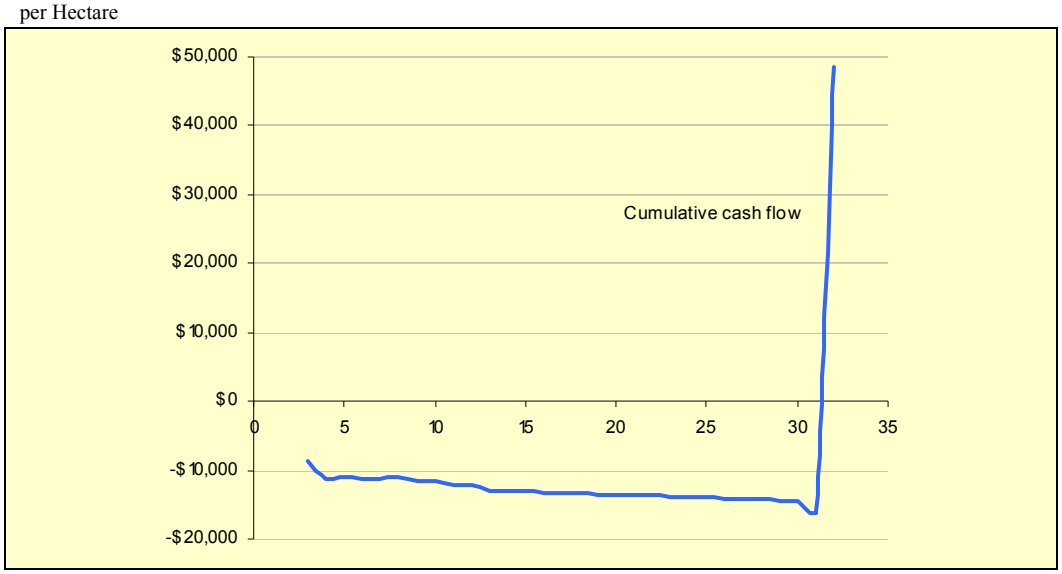
[13] McKinsy analysis shows it would be technically possible to capture 26.7 giga-tonnes of carbon abatement globally by addressing measures costing no more than €40 per tCO_2e. Of this potential for reducing emissions, electric power generation and manufacturing account for almost half.

[14] As a rule of thumb, the amount of land that will typically return each year can be worked out as 90 percent of the total land area divided by 30. Thus for an area of 3,300 Ha containing 3,000 productive Ha, roughly 100 Ha will be returned each year.

own the trees and will meet the costs of tending until harvest in roughly 28 years time. During this time, the land owner may own the trees outright and fund all the tending and other costs, or alternatively it may enter a joint venture and share some of the costs and benefits. Borrowing is not a suitable source of funding.

The options for the future management of CFL lands remaining in forestry use are discussed in more detail in Part B of this report.

Figure 3 **Cumulative Cash Flows for Active Forestry**
per Hectare



Filename: CF93-3 Alternative Land Use Analysis.xls1. Leasehold or Forestry
Source: Burleigh Evatt analysis.

1.7. Changing Land Use

The alternative that land owners may wish to consider is a land use change. The obvious alternative to forestry for big land tracts is pastoral farming. In this section, we look at the economics of conversion to dairy, sheep and beef, and deer as alternative land uses to forestry. Our analysis is based on large scale "economic" units rather than traditional farm size.

The starting point, as always, is the land. As forest compartments are cleared by a retiring licensee, the terms of the CFL require the land to be left in a condition suitable for replanting trees. In practise, this means the stumps will be present and there will be some clearance of slash[15] but most residues from harvesting will be present on the land. The licensee is entitled to remove any improvements made to the land, and given the nature of forestry activities, there will be limited fencing, access and drainage works in place. Nor is the site likely to be connected to a reticulated supply of electric power.

The task for the land owner seeking to change from forestry use is as follows:

- Resource consents. The land owner will need to obtain all necessary resource consents associated with the proposed change of land use, the abstraction of water to meet farm

[15] The accumulation of limbs, tops, and miscellaneous residue left by forest management activities, such as thinning, pruning, and timber harvesting.

water supply requirements, and at the disposal of effluent.

- Land clearance:
  - Stumps. These may either be left in the ground to rot down or mechanically removed by machine. Pulling stumps is costly but facilitates land contour earthworks and improved pasture. Complete stump pulling is considered essential for dairy, but for other pastoral farming use some stumps may be left behind to rot down by themselves as non-dairy livestock are able to cope better with such conditions.
  - Slash. The usual practice will be to recover any logs suitable for firewood suppliers. The remaining harvest revenues would be heaped up and either burned or mixed with earth and left to rot down.
- Pasture seeding and fertiliser, shelter belts.
- Fencing. Dairy conversions require extensive fencing. Deer fencing is obviously of a different nature to the fencing required for dairy and sheep and beef given the ability of the animals to jump. With sheep and beef the fencing regime may be one which develops over time with portable fencing arrangements such as electric fencing being used in the interim to manage animal access to pasture. However suitable animal-proof seven- or eight-wire boundary fences will need to be in place from commencement. More detail on the fencing part of the model is provided on page 25.
- Access, water, drainage, stabilisation works. This category covers both access to the farm, farm tracks and raceways. Good water supplies are essential for both human and animal consumption and attention is needed to the ability to maintain continuity of supply in dry years. Areas with steep contour that have been previously forested may need to be replanted in trees to maintain soil cover and prevent slumping.
- Infrastructure and accommodation. Farm infrastructure includes implement sheds, storage of supplementary feed and hay, a shearing shed and, in the case of a dairy conversion, a dairy shed and effluent disposal system. Additionally, accommodation is needed for farm managers, workers and their families.
- Plant, equipment and vehicles. The land owner will need to procure the usual range of on-farm plant and equipment and vehicles for on-farm and off -farm use.
- Off- farm infrastructure, e.g., telephone and internet, reticulated electricity supply and suitable roading. The land owner may also need to make arrangements for the children of farm workers to be transported to and from school.

Conversion emissions units must be surrendered to cover the loss of sequestered carbon in the former tree crop. This occurs in the year following the year in which land is cleared of trees and the changed use occurs. The number of emissions units required relates to the assessed amount of sequestered carbon as show in Schedule 4 to the Climate Change (Forestry Sector) Regulations 2008. In our model this is 709 units per hectare based on the stipulated figure for

Pinus radiata of 28 years of age growing in the Bay of Plenty region[16]. This is the relevant figure for most of the CFL land that will be resumed as a result of Treaty settlements negotiated in 2009. This also determines the location of our hypothetical farm somewhere in the central North Island, in the vicinity of Taupo or Rotorua.

Once the land conversion is in place the property needs to be stocked. We have worked on the basis that the full development of the farm will take ten years from conversion. This is on the basis that working on the land has an experiential dimension because not everything can be anticipated and the interaction of biological, climate, human, and market processes are at work. As well as this, managers have individual approaches based on their own experience and expertise.

1.8. Modelling Approach

In this section we describe the modelling approach that we have used to represent the economics of alternative land use options. By its nature, this section is technical and non-technical readers may wish to skip over it.

Financial modelling is a general term that means different things to different people. In this context it means the development of a mathematical model to predict a price for an asset, in this particular case the asset is land in alternative uses. Financial modelling is the task of building an abstract representation (a model) of a financial decision-making situation. This is a mathematical model designed to represent a simplified version of the performance of a business, a project, or any other form of financial investment.

1.9. Some Preliminary Warnings

The users of information that has been produced by financial models need to exercise a degree of caution and judgement for the following reasons:

- Just as a map is a representation of the main features of interest of any area of land (or sea), and cannot hope to reflect all the detail of the area being mapped, neither can a financial model represent all of the possible relationships and complexities that bear on a decision-making situation. A financial model is a synthetic representation of the reality that captures “the essence” of that reality. The craft of the modeller is to exercise judgement on how much detail is necessary to reflect on key decisions that a decision-maker will take, within the availability of information that bears on that decision, and what matters are treated as detail. Thus no financial model can be considered to be more than an approximation of the real-world situation based on information available at the time of its construction.

[16] See Schedule 1 to the Climate Change (Forestry Sector) Regulations 2008 for definitions of growing regions.

- The vast proportion of financial models are spreadsheet-based. Although spreadsheets were developed to be used for "scratchpad" applications, with the increasing power of personal computers they are now also used to develop many large-scale applications. Unfortunately, spreadsheets are inherently error-prone applications because of the informal, sequential processes used in their development. Spreadsheets should in the first instance, therefore, be regarded with the same degree of caution as a loaded gun until it can be positively proved to be free of error by cell-by-cell checking and testing of the model's logic.

The users of information that has been produced by financial models need to exercise a degree of caution and judgement when considering the advice for this reason.

1.10. Our Modelling Approach

The basic framework of the financial model is determined by the longest-lived asset, production forestry with a 28-year rotation. All other alternative land uses to be considered need to be modelled on an equivalent basis in time to avoid mismatches. In fact we have adopted a perpetual perspective, treating subsequent rotations beyond the first as part of the consideration of the land expectation value, even though they contribute only a tiny amount of value.

The model is framed in nominal dollars, i.e., dollars of the day. Inflation is projected forward at a constant 2 percent per annum.

Future cash flows are discounted to present value amounts using a discount rate that is the weighted average cost of capital (WACC[17]) for the forestry (8 percent) and agriculture (8.1 percent) industries. These WACC estimates have been obtained from the "Cost of Capital Report" for September 2008 published by PricewaterhouseCoopers Corporate Finance[18].

Effective for the financial year ending 2005, a tax rate of 19.5 percent applies to the taxable income of Māori authorities (previously 25 percent). The taxation treatment is not considered to be a preference but a notional arrangement to reflect more accurately the average marginal tax rates of relevant shareholders (many of whom would be on a 19.5 percent personal tax rate).

The ETS is a major new development affecting the economics of alternative land uses. The elements of ETS that need to be considered are the free allocation to pre-1990 forestland owners, the units that need to be surrendered representing the carbon sequestered in standing forests when the land is deforested, and the units that farmers will be required to surrender representing on-farm emissions of greenhouse gases with effect from 2013. It is proposed that farmers will be allocated free units covering part of the emissions liabilities from 2013 until 2030. We have roughly estimated this as being approximately 70 percent of 2013 emissions by

[17] Weighted Average Cost of Capital is an average representing the expected return on all of a firm's liabilities. Each source of capital, such as equity and debt, is assigned a required rate of return, and then these required rates of return are weighted in proportion to the share each source of capital contributes to the firm's capital structure. The resulting rate is what the firm would use as a minimum for evaluating a capital project or investment proposal.

[18] See http://www.pwc.com/extweb/pwcpublications.nsf/docid/748F5814D61CC2618525693A007EC870

projecting the trend of agriculture emissions between 2000 and 2006. A possibility is that no free units will be allocated to a land owner undertaking a conversion after 2005.

The methodology we had selected for determining the area of land to be converted from CFL to pastoral farming is somewhat unusual but, we believe, appropriate to the decision that would be taken by a CFL land owner. The issue affects the size of the base over which the fixed costs of conversion are spread. Rather than select a fixed land area to convert, we have instead focused on a size of farming and this makes sense from an efficiency perspective. Thus for dairy we have chosen a land area that will support 800 cows. For sheep and beef, and deer, the land area is based on the number of sheep stock units that are believed to represent an efficient farm size. The result is that for sheep and beef, and deer, the land areas are considerably bigger than average farm sizes. Our thinking is that a land owner would target any efficient farm size rather than replicate the pattern of land use typically seen; an artefact of historical considerations. We note trends towards the aggregation of farmland reflecting underlying scale economies.

Fencing model approach

Out modelling approach to determine the length, and hence cost of fencing the property provides an illustration of the financial modeller's "craft".

The problem arises because of the method used to determine the farm size based on an efficient economic unit concept. This leaves a mathematical problem to determine the length of fence line required for the farm, based on an assumed average paddock size of 4 Ha for dairy and 30 Ha for sheep and beef and deer, and a rectangular property. The steps necessary to model this are as follows:

- The total farm size is divided by the average paddock size for the type of farm to obtain the number of individual paddocks, p.
- The square root of the number of paddocks ($\sqrt{p}$) on each side of the farm is one less than the number of fence lines running perpendicular to that side.
- The same exercise is repeated on the perpendicular boundary (if the farm is not square).
- This gives us the number of fence lines on each side, $1 + \sqrt{p}$.
- This enables us to calculate the length of the individual paddocks on both sides and the means of determining the length of boundary and subdividing fence lines.

To be conservative we have increased the number of fence lines by one to cater easily with rounding of square roots, and to allow for double-fenced access ways.

Imagine a square area 200 metres by 200 metres comprising four hectares to be subdivided into four by 1-hectare square paddocks. This is illustrated below.

Along the "north-south" axis there are two by two paddocks sets (1 and 3, 2 and 4) and three fence lines, and the same along the "east-west" axis. So in this case, p = 4, conveniently $\sqrt{p} = 2$ and the required fence lines per perpendicular side are $1 + \sqrt{p} = 3$. Thus there are 600 metres of fence line along each axis for a total of 1,200 metres.

If there is an internal access way across the farm (in the shape of a cross) then another 400 metres of fencing is required for 1,600 metres total.

The results of using this model are sensitive to the assumed farm shape. For this reason we have done two things:

- Made provision in the model for rectangular paddocks.
- Required the paddocks to have the same aspect ratio as property. The aspect ratio of a shape is the ratio of its longer dimension to its shorter dimension.

The architecture of the model is in five main parts as follows:

Part 1 Landlord

Part 1 models the decision by the land owner to lease land for forestry purposes in perpetuity. Two scenarios are considered:

- A rental of 5.5 percent, approximately the rate for CFL land at present, earned in perpetuity.
- A rental of 5.5 percent is earned over the first 28-year rotation, and thereafter the investment returns the WACC in perpetuity.

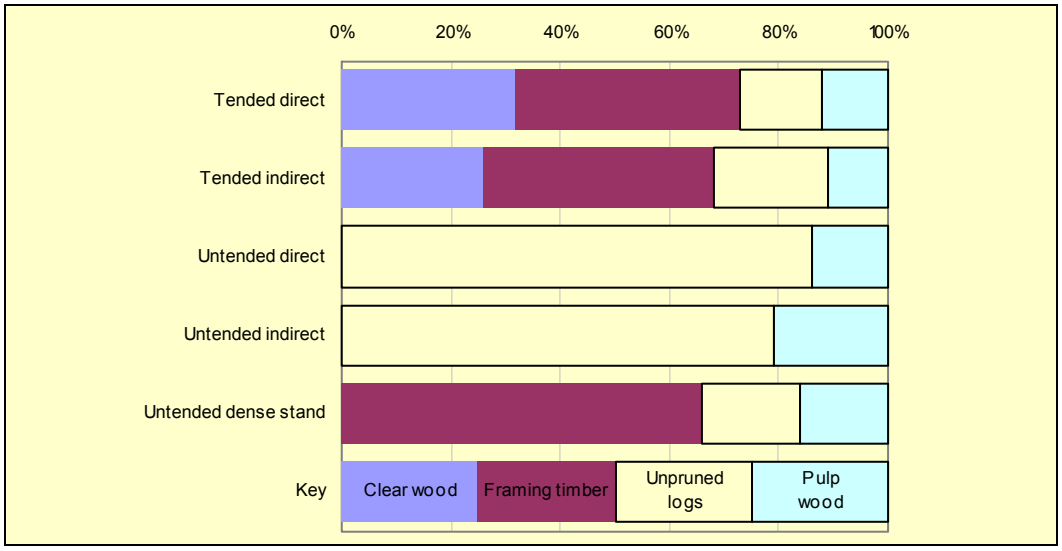
These scenarios provide bounds on the potential returns to the leaseholder.

Part 2 Forestry

Part 2 models the decision by the land owner to become a "first person forester" by planting the land in *Pinus radiata*. The model is for a hypothetical hectare of forest located 50 km from a mill. The model provides five different regimes for management of the forest with the resulting differences in average harvest prices (see Figure 4). These regimes are; tended direct[19], tended indirect, untended direct, untended indirect and untended dense. In the tended regimes it is assumed that the cost of tending is exactly offset by revenue from production thinning. Harvest prices have been derived from weighted average forest product prices from 2003 to 2008[20] (see Figure 5). Harvest in the 28th year after planting is preceded by construction of access roads.

The Maori land owner also benefits from 18 emissions units/hectare of CFL land to be allocated has part of a Treaty settlement after 1 January 2008.

Figure 4 **Assumed Mix of Forest Products from Modelled Management Regimes[1]**



Notes: Although the model provides for all five management regimes (and the possibility of mixed regimes) only the two tended and untended dense regimes are reported. Returns from the other untended regimes are too low to be considered as viable.
Filename: CF93-1 PDF log prices.xls
Sources: Burleigh Evatt analysis.

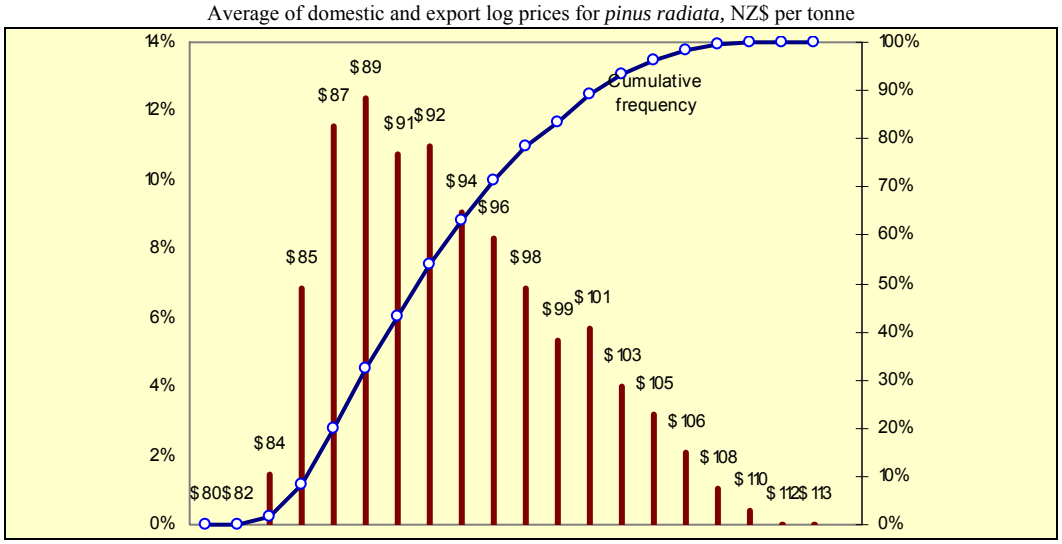
[19] Direct regime: the stand is waste-thinned directly to final crop at time of pruning. Indirect regime: the stand is production-thinned several years after final pruning to minimise branch growth and keep knot diameter small in framing timber milled from the upper log.
[20] Source MAF.

Figure 5

Since 2003, average log prices have ranged between $80 and $110 per tonne, with a mode of $89.

Distribution of Average Log Prices Since 2003

Average of domestic and export log prices for *pinus radiata*, NZ$ per tonne



Filename: CF93-1 PDF log prices.xls
Sources: MAF, Burleigh Evatt analysis.

Part 3 Dairy

Part 3 models the conversion of the forestland to dairy. The model is for a hypothetical conversion of enough land to support a herd size of 800. Based on an assumed stocking rate of 16.6 sheep stock units per hectare and a 90 percent effective land area this sets an area of land to be converted of 290 hectares.

The costs are modelled of clearing and developing the land, putting in place the necessary infrastructure and purchasing livestock and supply shares.

In addition to the above costs, the land owner must meet the requirement to surrender enough emissions units to cover the sequestered carbon represented by the standing crop of trees that has been cleared to make way for the conversion.

Also allowed for it is a number of scenarios for the carbon cost of farming activity including:

- No cost of agriculture emissions.
- A cost of agriculture emissions from 2013 abated by a free allocation of units based on 70 percent of 2013 emissions declining in a straight line until 2013 when the full cost is incurred.
- A full cost of agriculture emissions from 2013.

Farm outputs are; milk solids and trading stock. A base milk solid price of $5.2 per kg is used as announced by Fonterra on 29 April 2009.

Part 4 Sheep and Beef

Part 4 models conversion to a mixed sheep and beef farming operation. This has a target 10,000 sheep stock unit size with an average carrying capacity of 9 sheep stock units per hectare and 90 percent effective area for an overall conversion size of 1,222 hectares. The model allows different mixes of sheep and beef cattle to be modelled and we have used 60/40 sheep:beef as a working assumption. Thus 60 percent of the sheep stock units are sheep numbering 6,000 with the remaining 40 percent or 4,000 sheep stock units represented by 800 cattle.

Farm outputs are; sheep meat, wool, beef and trading stock.

Part 5 Deer

Part 5 models the conversion to deer farming producing crops of meat and velvet. This has a target 8,000 sheep stock units (4,200 animals) with an average carrying capacity of 15.7 sheep stock units per hectare, in line with the national average. The overall size of the property converted is 560 hectares.

Farm outputs are; deer meat, velvet and trading stock.

Table 3 presents the classes of livestock and their emissions per head/year.

Table 3 **Assumed Sheep Stock Unit and Emissions Factors**

	Stock Units[1]	Emissions factors		Stock Units	Emissions factors
	per head	tonne CO_2e per head		per head	tonne CO_2e per head
Sheep			**Deer**		
Ewes	1.0	0.12	Hinds breeding	1.9	0.6
Hoggets	0.7	0.12	Hinds 1 ½ yr	1.8	0.6
Wethers	0.7	0.12	Hinds weaner	1.2	0.6
Rams	0.8	0.12	Stags weaner	1.4	0.6
Beef Cattle			Stags 1 ½ yr	1.8	0.6
Cows	5.5	0.6	Stags mature	2.2	0.6
Heifers 1 ½ yr	4.5	0.3			
Heifers weaners	3.5	0.3			
Bulls weaners	4.5	0.6			
Steers weaners	4.5	0.6			
Steers 1 ½ yr	5.0	0.3			
Steers 2 ½ yr	5.5	0.6			
Bulls	5.5	0.6			
Dairy heifers	4.5	0.6			

Notes: See footnote 7 above for definition of a sheep stock unit.
Filename: CF93-3 Alternative Land Use Analysis.xls.
Sources: MAF.

All farming components of the model allow for two stages of growth, in the first 10 years and from the 11th year in perpetuity. As a working assumption the dairy conversion maintains a constant 800 cows. This two-stage growth approach is intended to allow the model to reflect the reality of the developing productivity of the farm in its early years after conversion. In Parts 3 to 5 the continuing value beyond the 28th year is represented by a continuing value estimate derived from

the 28th year free cash flows using the growth in perpetuity method or Gordon Growth Formula[21].

The drivers of farm production are an assumed rate of progeny production and a percentage of progeny retained as replacements. This is a simplified model of actual farming practice but within the limitations of models of this type is an acceptable representation of current farm economics. At a conceptual level, the modelling approach is based on a time to event "survival" model[22]. Survival models are commonly used to represent death in biological organisms, failure in mechanical systems and the spread of disease amongst populations. More generally, survival analysis involves the modelling of time to event data; in this context, death or failure is considered an "event" in the survival analysis literature. Another example of time to event modelling could be the rate or time to which former convicts commit a crime again after they have been released. In this case, the event of interest would be time to committing a crime. In this case the event is the time to production of saleable progeny by the "population" of store stock. For the purposes of this model the survival process has been modelled very crudely to represent a single-aged progeny. An area for development in the model is the replacement of simple survival functions with more complex functions.

The model also allows for growth in the real price received by farmers for farm outputs; milk solids, sheep meat, wool, beef, deer meat, velvet and trading stock. This allows the model to be adapted to reflect the views of the future evolution of farm product prices. All prices are escalated to nominal dollars of the day.

A base depreciation is calculated at an average five percent of the expenditure on depreciable plant and equipment during conversion. This is escalated at the inflation rate to provide an annual allowance for a depreciation charge in line with the amounts revealed in MAF's farm monitoring reports. As a non-cash item that is included in the calculation of taxable income, depreciation must be accounted for several times. We have also used the conventional working assumption for a steady-state business that depreciation will be routinely spent.

Costs are split between fixed costs of operating the farm and a variable costs element that changes with the number of sheep stock units being farmed, and manager wages. This is intended to dampen the scale economy effect of differing sizes of operation. No interest or other financing costs are considered as these are implicitly accounted for in the discount rate.

Income tax is calculated using the net profit before tax, adjusted for tax losses. GST is ignored completely.

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[21] It is common to use the next value of C given by : $C_1 = C_0(1 + g)$, thus Gordon's model can be stated as

$$P = C_0 \frac{(1 + g)}{(r - g)}$$

Where C_n is a cash flow for year n, r is the discount rate and g is the constant perpetual growth rate.

[22] Survival analysis attempts to answer questions such as: what is the fraction of a population which will survive past a certain time? Of those that survive, at what rate will they die or fail? How do particular circumstances or characteristics increase or decrease the odds of survival?

1.11. Calibration

For any financial model, a stable calibration to market data is indispensable to obtaining valid parameters. The calibration process also provides an opportunity to validate aspects of the model's architecture and detect and correct errors. There are two general approaches to calibration based on historical or market-implied parameters. Both approaches have advantages and drawbacks, but ultimately an implied calibration is superior provided enough current market data is available. As a practical matter most financial model calibrations are a compromise because of practical limitations on available data to perform the calibration.

The model was calibrated to the Ministry of Agriculture and Forestry's 2008 Pastoral Monitoring Report. Updated price data for 2008/09 was obtained from the AgriFax[23] and Fonterra[24] websites.

1.12. Economics of Land Use Alternatives

The results of our analysis of the economics of alternative land use on CFL land need to be considered in two states of the world. The first state is without the ETS, and the second takes account of our best view of the impact of the ETS scheme that was passed into law in 2008. Importantly aspects of the scheme particularly as they will affect agriculture are yet to be developed and made public.

We present our results as a "merit order rank" in decreasing order of land expectation value. Figure 6 shows the merit order rank without any affects from the ETS. It can be seen that pastoral farming alternatives to leasing and untended forestry are generally higher-valued uses of land. Dairy farming sits well above alternative land uses. Tended forestry regimes sit between deer farming and sheep and beef farming. Moreover, when risk is introduced in the form of the "beta" it may also be seen that pastoral farming alternatives are lower-risk than forestry.

[23] Agri-Fax is a commercial information service for the agricultural sector. Agri-Fax's database dates from 1987, covering farm and export prices for lamb, beef, venison, dairy products, wool, wheat, forestry, seafood and horticultural products. See www.agri-fax.co.nz.

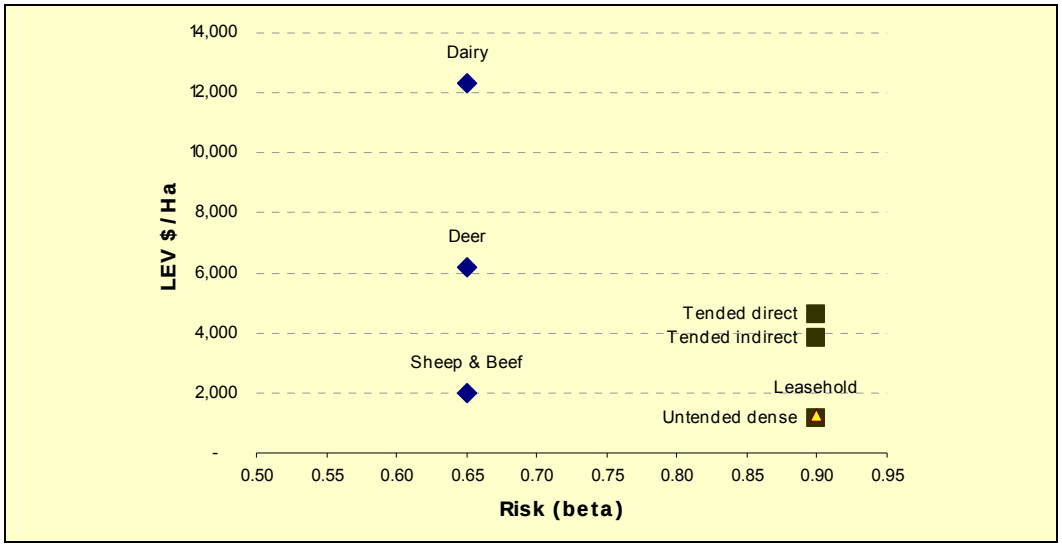
[24] Fonterra Co-operative Group Limited. See www.fonterra.com.

Figure 6

Without ETS, pastoral farming alternatives are generally higher valued uses of land than forestry-related options, and lower risk.

Merit Order Ranks for Alternative Land Uses to CFL Land

Without ETS



Filename: CF93-3 Alternative Land Use Analysis.xls.
Sources: Burleigh Evatt analysis.

In a without ETS world, the clearly superior use of land from a value perspective is to convert CFL land to dairy farming. Next preferred is deer farming followed by forestry in tended regimes. Sheep and beef farming ranks next, followed by untended forestry regimes and leasing land.

However, the impact of the ETS is to change the merit order ranking by devaluing all farming options relative to forestry and leasing. The merit order rankings between pastoral farming alternatives is maintained, with dairy farming continuing to the highest ranking alternative to forestry in a with ETS world.

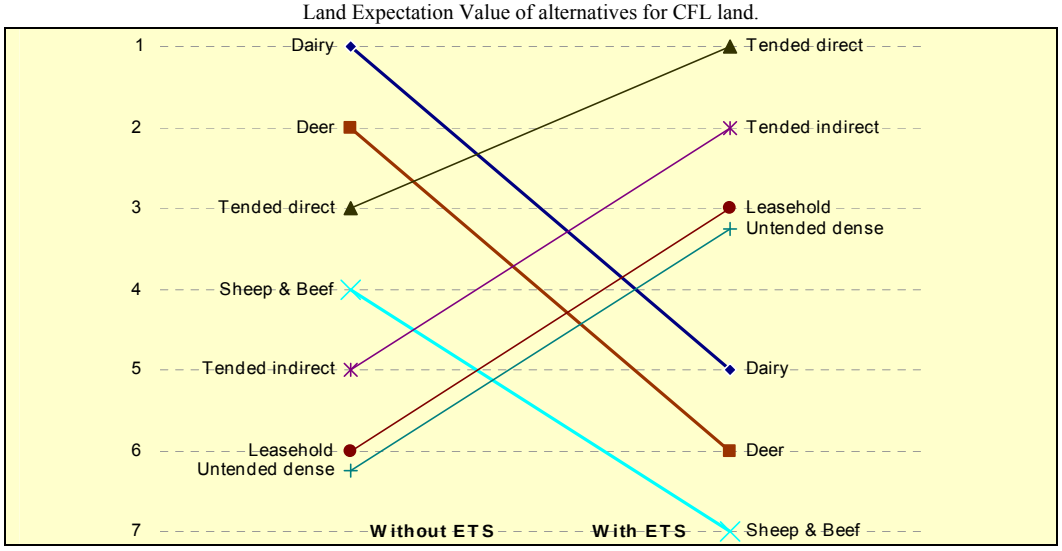
The change in merit order rankings brought about by the impact of the ETS is depicted in Figure 7.

Figure 7

The ETS changes the merit order ranking by devaluing all pastoral farming options relative to forestry, with dairy being the biggest loser.

ETS Changes the Merit Order Rankings for Land Use Alternative

Land Expectation Value of alternatives for CFL land.



Filename: CF93-3 Alternative Land Use Analysis.xls.
Sources: Burleigh Evatt analysis.

The ETS changes the merit order markedly by devaluing all farming options relative to forestry and leasing. The merit order becomes tended forestry and leasing, followed by untended forestry, dairy, deer and sheep and beef farming.

The impact on the land equivalent values (LEV) associated with the land conversion options of the various aspects of the ETS can be seen in the following Table 4.

Table 4 **Value Implications for CFL Alternatives under the ETS**

LEV in $ per Ha	LEV before ETS effects		Land conversion GHG cost		ETS with comp[1]	ETS without comp[2]	LEV with full ETS effects	
	LEV	Rank	Change	LEV	Change	Change	LEV	Rank
Lessor	1,250	6=	n.a.	1,250	n.a.	n.a.	1,250	3=
Active Forestry						n.a.		
Tended direct	4,600	3	n.a.	4,600	n.a.	n.a.	4,600	1
Tended indirect	3,830	4	n.a.	3,830	n.a.	n.a.	3,830	2
Untended dense	1,160	6=	n.a.	1,170	n.a.	n.a.	1,170	3=
Dairy	12,300	1	- 19,120	-6,820	-430	- 240	- 27,040	5
Sheep & beef	1,990	5	- 19,120	-17,130	-350	- 200	- 37,130	7
Deer	6,210	2	- 19,120	-12,910	-1,240	- 700	- 35,190	6

Notes: 1. Farmers compensated for 70 percent of 2013 emissions phasing out by 2030. The full impact of the ETS emissions cost from 2030.
2. Full cost of ETS from 2013.

Abbreviations: - = nil or zero, n.a. = not applicable.
Filename: CF93-3 Alternative Land Use Analysis.xls.
Sources: Burleigh Evatt analysis.

Table 4 may be interpreted as follows; the greenhouse gas emissions costs associated with any conversion from (pre-1990) forestry use is $19,120 per hectare. This cost makes the LEVs associated with pastoral alternatives to forestry negative in a with ETS world, i.e., the land owner would need someone to pay them compensation for it to be worth their while to convert to pastoral farming use. In addition to the conversion cost, pastoral farming faces the additional cost of greenhouse gas emissions from agricultural production. This is highest for cattle and dairy cows, and the lowest for sheep. This reflects on the additional cost of $1,240 per hectare for deer farming, $430 per hectare for dairy, and $350 per hectare for sheep and beef which reduce the corresponding LEVs. These costs assume that the land owner would be compensated for roughly 70 percent of agricultural emissions in 2013, with that compensation phasing out by 2030. If instead, no compensation is available, as is likely, there is an additional reduction in LEVs of $240, $200, and $700 for dairy, sheep and beef, and deer farming respectively. These later figures provide an estimate of the value of the proposed compensation package relative to the cost to land owners of inclusion of agriculture within the ETS.

1.12. Conclusion

The results demonstrate the effect of the ETS. The effect is to lock in pre-1990 forest land into forestry use and act as an effective barrier to conversion involving clearing trees from pre-1990 land. This should come as no surprise as it is the intended effect of the ETS. The intention behind the policy is to prevent deforestation of pre-1990 land and encourage tree planting on post-1989 land and discouraging greenhouse gas emitting farming activities.

Part B Commercial Options for Future Management of CFL Land

1.1 Introduction

The second object of this paper relates to structures in which to engage in forestry. If, as a result of the ETS, the practical effect is that CFL land owners are locked into continued forestry use of their lands, they have the following two choices about how to manage that involvement:

- Leaseholder, leasing or licensing the occupier a long-term right to use the land for the purpose of growing trees in return for a licence fee set by reference to land values (rent).
- Active forester. In this role the land owner would resume control of the land as it is cleared by the current occupier. This may take up to 35 years from the giving of the termination notice under the CFL. The land owner would arrange replanting, tending and harvesting the next and subsequent tree crops in perpetuity.

If the CFL land owner decides to become an active forester they face the additional subsidiary choice about whether to carry on forestry activities independently on a stand-alone basis, or to combine with other land owners in a collective arrangement.

Forestry is a cyclical commodity industry with low profitability. Land owners who lease the land for forestry use achieve low rental returns that reflect this economic fundamental. Growing trees is not where the value is in the forest and timber products supply chain. As in most commodity industries, the greatest value is added and captured by the suppliers who are closest to the final consumer. The customer end of the value chain is not generally accessible to the land owner. The imperative for land owners seeking to improve their returns is to cut, contain, and as far as possible share costs with others in similar circumstances. This provides a rationale for collective action. By collective action we mean combining with other CFL land owners in informal or formal (incorporated) arrangements.

CFL land owners are not prevented from standing alone from collective arrangements and managing the lands, either in a leaseholder or an active forester role independently. However, an independent operation will suffer relative to operations of a larger scale. They can achieve economies of scale by spreading fixed costs over a larger activity base, and by exercising more commercial influence with customers and suppliers. This commercial influence may extend to long-term contracts for supply that included in specified tending and harvesting the regimes a line to providing a continuous stream of raw material to meet a mill or end customers' needs.

But there is an additional management consideration arising from the ETS liabilities for deforestation of pre-1990 land. There is a risk for the land owner that dwarfs in magnitude the value of land. While deliberate acts to deforest to gain economic advantage are one thing, land owners also face the risk of deforestation as a result of acts by a third party (the licensee during

the term of the CFL[25]) that the land owner may not be in a position to remedy, and resulting from "Acts of God"[26]. Some attention is therefore appropriate to ways and means of containing, managing or avoiding deforestation risk.

These matters are discussed in turn below.

1.2. Leaseholder Stand Alone or Collective

If a land owner chooses to continue to lease the land for forestry purposes the key driver for them is to minimise cost and ensure that at rent reviews they are able to keep up with the market generally. The owners of individual blocks will be unable to influence the rental market but they do need to ensure that they are well-informed about rent reviews.

The functions that need to be carried out by the land owner in relation to CFL land blocks include the following:

- Administration of Crown Forest Licenses and any succeeding license/leasing arrangements including:
  - Collection of licence fees (rent) and payment of expenses.
  - Management of licence fee reviews at three-yearly intervals.
  - Negotiating terms of renewal of licenses.
  - Managing termination of licenses.
- Land management including:
  - Wai tapu and other sites of cultural significance.
  - Watercourses and waterways.
  - Fencing, roading, drainage and other improvements.
  - Pest and weed control.
  - Public access arrangements for tramping, hunting and fishing.
- Emissions Trading Scheme compliance (if necessary).

The administrative task of collecting rents and ensuring they correctly paid, and on termination that the land is left in the state that it ought to be, are all tasks that could be efficiently contracted to a professional administrator. At this level there is no need for special structures relating to the period of termination of the CFL, and in any subsequent periods in which the CFL is rolled over.

There is a limited case for collective action by CFL land owners who have determined that the

[25] This is a theoretical liability then arises because of differences in the definitions of clearance under the CFL and permanent deforestation under the Climate Change Act. The former relates to compartments while the latter relates to an area of two hectares.

[26] Acts of God is a legal term for events outside of human control, such as natural disasters, for which no one can be held responsible.

leaseholder role is their best long-term option[27]. During the termination phase of Crown Forestry Licences collective action will enable partners to share and reduce costs of administration.

For land owners who choose to continue to lease the land, there are many potential informal means of co-operation short of incorporating a joint venture. This could include formal and informal arrangements to share information and co-operate around rent reviews and land valuation. It would be merit, for example, in banding together and using the same advisers who would work from a single base of information when renegotiating rent with the licensee. As the participants would not be committing capital there is no need for a formal legal structure, unless of course, the participants wish to exclude those who do not join with them. In this respect, the means of co-operation could be thought of more like membership of a labour union then a formal joint venture. Establishment requires a steering committee representing the affected land owners and an agreement between the legal entities that they will share information and co-operate in the three-yearly rent reviews and nine-yearly general reviews of the CFL licence fee.

On the other hand, if the desire is to become involved in active forestry in which the participants will be committing capital to develop a forestry asset, then there is a need for more formal structures to safeguard the investment and the joint venture shareholders' respective interests.

1.3 Active Forestry

If the CFL land owner wishes to engage in active forestry then the following additional functions must be undertaken:

- Forestry management including:
  - Development of forest management plans.
  - Replanting, tending, pruning, thinning and harvesting trees planted on resumed land areas.
  - Fire protection.
  - Marketing.
- Management of commercial relationships with neighbouring forest land owners.
- Establishment and maintenance of a "corporate" vehicle to hold assets and issue liabilities with the associated shareholder relations, management and governance.
- Capital raising from investors.
- Financial and risk management.

If the CFL land owner wishes, these activities may be undertaken on a stand alone basis. The most efficient arrangement would be to contract the forestry management activities to an established forestry management business operating in the district. Thus the forest-owning

[27] For example, a harvest profile there is "back-end loaded", or a total CFL land area that is small, may mean that the land owner has few practical choices other than to continue an arrangement comparable to the terms of the CFL.

vehicle (which may also be the post-settlement governance entity) would simply contract with a forestry manager to carry out the planning, planting, tending, harvesting and marketing of the tree crop in exchange for a fee. In many cases the forestry manager will also have access to investors that may provide the capital necessary to finance such activities from planting to harvesting. The degree of participation by the land owner, and the means of such participation, will vary from case to case, but the land owner would generally be required to contribute some capital upfront towards the planting and tending, or sacrifice part of the otherwise payable rent, in order to obtain a share of the value of the arising tree crop. However stand-alone active forestry is unlikely to be as attractive commercially as active forestry undertaken with an element of economic scale. How attractive or otherwise is active forestry on small land blocks is often not apparent to the land owner until the time arises when they are due to market the tree crop and find themselves dealing in a limited market facing large costs associated with harvest.

1.4. Joint Venture Active Forestry

The alternative approach to stand alone is to pursue active forestry on a collective basis. This is interpreted as an expression of the desire by the CFL land owner to have more control over the forestry activities taking place on the land. Part and parcel of this is to be able to have influence on who is employed to undertake the planting, tending and harvesting work and to ensure that the employment opportunities provided amount to “good jobs”. There are a range of potential structures through which prospective joint ventures may organise themselves. However, before considering the broad options available, a key consideration is to determine the critical mass of forestlands to be economically co-managed by an independent forestry manager. Unless such a minimum co-managed area can be assembled, independent management is unlikely to be commercially attractive.

In attempting to define the minimum co-managed area, our approach has been to survey independent forestry managers in New Zealand. These are commercial managers that carry out a range of forestry-related functions including organisation of tending, harvesting, and replanting, as well as marketing. The larger forestry managers also take on other functions including syndicated investment.

Table 5 shows the approximate areas managed by a range of forestry managers. It may be seen that the mid-sized managers have between 25,000 and 30,000 hectares under management.

Table 5 **Forestlands Under Management by Selected Forestry Managers**

Independent regional forestry managers

Forestry Manager	Estate managed	Develop -ment	Pruning & thin- ing	Manage -ment staff
	Ha	Ha	Ha	No.
NZ Forest Managers	56,000	2,500	6,000	n.a.
Juken New Zealand	56,000	n.a.	n.a.	n.a.
Pan Pac Forests	48,000	n.a.	n.a.	n.a.
Hikurangi Forest Farms	26,000	n.a.	n.a.	n.a.
Blakely Pacific	25,000	n.a.	n.a.	n.a.
Northland Forestry Managers	25,000	n.a.	n.a.	6
Forest Enterprises	21,500	n.a.	n.a.	5
Roger Dickie NZ Ltd	28,500	n.a.	n.a.	n.a.
Wenita Forest Products	23,000	n.a.	n.a.	n.a.
Independent Forestry Services	18,000	n.a.	n.a.	5
Global Forestry Partners	16,000	n.a.	n.a.	n.a.

Abbreviations: - = nil or zero, n.a. = not available.
Filename: [CF93-3 Alternative Land Use Analysis.xls]Forest Management.
Sources: NZ Forest Owners' Association, individual company information, Burleigh Evatt analysis.

A number of independent forestry management firms are considerably bigger than this, but this gives an indication of where the economics of joint management by an independent firm becomes commercially attractive. Using our rule of thumb of a 90 percent effective area and around one-twenty eighth of that area harvested annually, gives an annual area of 800 hectares being harvested and replanted. This minimum size is enough to support a management team of around three individuals[28] and provide permanent employment for at least 100 contract staff. Obviously this area will vary if the forested areas are less or more mature than the average. Nevertheless it is a guide to how much land area needs to be assembled to create a base for a sustainable joint venture.

If such a portfolio of forestlands could be assembled for the purpose of active forest management, the next question becomes what is a desirable structure. In this context we are looking at a formal incorporated legal entity that will own the tree crop on behalf of the joint-venture who will be shareholders. Broadly, there are four main options:

- **A trading trust.** Trading trusts are familiar structures and many Māori ventures relating to landholdings are held in trust. The trust may also qualify as being charitable, in which case their income may be exempt from tax. The drawbacks of trust relate to capital raising and the relative unfamiliarity in the wider commercial community. Trustees are required to exercise prudence rather than demonstrate commercial skill. The trust is largely self-regulating.
- A Māori Incorporation. Māori incorporations are formed under the Te Tura Whenua Māori Act 1993 and regulated by constitution in the Māori Land Court. Māori incorporations are intended to provide a corporate legal for the exploitation of Māori land while safeguarding such land from alienation. While they provide many of the benefits of a company, there is

[28] As a rough guide, an average of 1.8 managers are employed for every 10,000 hectares under management by the smaller forestry managers.

an understanding that there is a reluctance to transfer the ownership of land that has been resumed as a result of a Treaty settlement from post-settlement government entities to an incorporation. Aspects of the supervision of Maori incorporations by the Maori Land Court impose additional costs compared with self-regulating vehicles. Maori incorporations are taxed as Maori authorities[29]. Maori incorporations are not generally regarded as suitable as a vehicle for combining land with third-party capital without some intermediate structure. Such an arrangement may compromise the Maori authority taxation status.

- **A company.** Companies are formed under the Companies Act 1993 and are regulated by constitution. Companies are very flexible structures with widespread recognition. There is considerable law and practice on the operation of companies and the duties of directors. However, the Companies Act is a very detailed and complex piece of legislation which many believe is too heavy-handed for the majority of situations of small and medium enterprises in New Zealand. While companies are taxed as companies under the Income Tax Act, they may also be regarded as a Maori authority for taxation purposes under certain strict conditions. Those conditions may be compromised if, for example, a third-party capital provider was part of the joint-venture.
- **A limited partnership.** Limited partnerships are relatively new in New Zealand having been created by the Limited Partnerships Act 2008. Limited partnerships are self-regulating under the partnership agreement which is a contract between the partners. While new on the New Zealand scene, limited partnerships (LP) are a preferred investment vehicle overseas in Europe, the United States, and Australia. Limited partnerships were introduced to replace the old special partnerships and provide a familiar investment vehicle to foreign investors seeking opportunities in this country. Limited partnerships provide a number of potential advantages as a joint venture vehicle in forestry involving Māori land owners. Those potential advantages include the following:
  - Limited partnerships are self regulating. The opportunity, therefore, exists to develop procedures for directors' and shareholders' meetings, election of officers, and dispute resolution procedures that are compatible with tikanga.
  - Limited partnerships are transparent for tax purposes. Tax transparency means that all taxable income (and losses) are allocated to be shareholders in relation to their shareholdings as if the income was earned by the shareholder. Questions of whether or not the limited partnership qualifies as a Maori authority are no longer relevant. This feature facilitates the combination of Maori land-providers and non-Maori capital-providers in the joint-venture. This feature also simplifies the compliance aspect of taxation for all members of the joint-venture.

[29] Maori authorities are taxed at 19.5 percent instead of 30 percent for companies. An important difference is that Maori authorities are able to obtain a refund of imputation credits in respect of tax-exempt shareholders, while companies are not. However Maori authority taxation status relies upon strict criteria as to the ownership and activities of the Maori authority and will generally be compromised if non-Maori authorities are shareholders.

- Limited partnerships are familiar structures for non-New Zealand investors, including forestry investors.
- In a setting in which land owners contribute the use rights associated with their land to the joint-venture while retaining ownership of the land, the general arrangement of limited partnerships with a number of limited partners is a single general partner who managers the partnership and fits neatly with the actual roles of the joint-venturers.

Consideration needs to be given to the many ways in which Māori hold land. By and large, the post-settlement governance entities that received land from the Crown will be common trusts, but this is not always the case. Also, land owners may have other non-CFL land that they would wish to bring with them to the joint-venture and which may be held by a variety of possible legal entities. Such legal entities include companies, Maori incorporations, a variety of trusts, and in multiple ownership. Knitting together this myriad of potential joint venturers without requiring all of them to incorporate their land is a challenge.

Figure 8 **Decision Matrix for Collective Forestry Management**

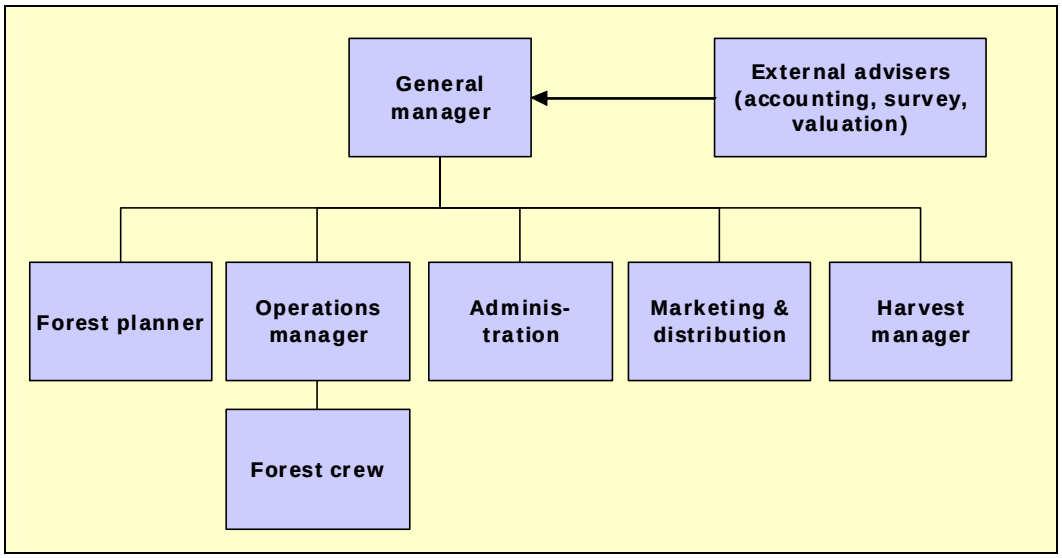
	Operational					
Structure / Criteria	Cost efficiency & scale benefits	Manage-ment expertise	Director expertise requireme nt		Com-mercial focus	Compat-ible with land holding
Independent	Nil	Nil	Low	Low	Low	High
Informal cooperation	Low	Nil	Low	Low	Med	High
Trading trust	Med	Low	Low	Med	Med	High
Maori Incorporation	Med	Med	Med	Med	Med	Low
Limited partnership	Med	Med	High	Med	Med	High
Shareholders in company	Med	Med	High	Med	Med	Low

Structure / Criteria	Commer-cial credibility	Tax benefits	Access to capital	Minority share-holder protection	Work-force	Regu-latory influence
Independent	Low	High	Low	Low	Low	Low
Informal cooperation	Low	High	Low	Med	Low	Low
Trading trust	Low	Low	Low	High	Med	Med
Maori Incorporation	Low	Low	Low	Low	Med	Med
Limited partnership	Med	High	Med	High	Med	Med
Shareholders in company	Med	Low	Med	Low	Med	Med

Filename: CF93-3 Alternative Land Use Analysis.xls.
Sources: Burleigh Evatt analysis.

Figure 8 above illustrates the range of operational and financial constraints of these entities. Direct management of forestland areas including the planting, tending, harvesting and marketing of the tree crop requires a different skill set from buyers entailed in the leaseholder role. Of particular importance is the functions related to the forest plan, management of the contract workforce, and marketing. There are other functions that need to be carried out by the forest manager, as illustrated in Figure 9 below, but these are the core.

Figure 9 **Organisation Chart for a Forestry Management Business**



Filename: CF93-3 Alternative Land Use Analysis.xls.
Sources: Burleigh Evatt analysis.

The previous section has demonstrated that the active forest experiences a value gain compared to the leaseholder. This varies depending upon the forest management regime employed. At the low end untended regimes that deliver pulpwood produce LEV figures that are comparable with the value of land to a leaseholder. The regimes involving tending the trees to produce increasing proportions of clearwood add value that is in line with the LEV figures obtainable from the low end of pastoral farming. In other words taking over management of the forests could provide a significant enhancement to the value that would be captured by the land owner. The caveat is that there is a minimum land size necessary in order to capture the benefit of between 25,000 and 30,000 hectares.

1.5. Managing the Deforestation Risk

The issue that land owners do need to consider is the management of the ETS deforestation liability that they gained along with ownership of the CFL land. Broadly there are two approaches available:

- Leave the inadvertent deforestation risk with the Crown.
- Implement measures that quarantine the liability from other tribal assets.

The two approaches are not mutually exclusive and may be pursued simultaneously to ensure that land owners do not face a risk that is beyond their capacity to manage as a result of the ETS.

The first approach requires negotiating with the Crown an exemption[30] for the emissions unit[31] liability associated with any unintended deforestation that results from an "Act of God". In this context, Act of God is a legal term for events outside of human control, such as natural disasters,

[30] Section 60 of the Climate Change Response (Emissions Trading) Amendment Act 2008 provide the legislative power for exemptions to be made by Order-in-Council.
[31] The primary unit of trade in the ETS is the New Zealand Unit (NZU). One NZU represents one tonne of carbon dioxide (CO_2) either released to the atmosphere (emissions) or removed from the atmosphere (removals).

for which no one can be held responsible. It should be borne in mind that much of the central North Island CFL land has a high level of exposure to volcanic and hydrothermal activity. Such activity has the potential to destroy the relevant land together with any vegetation standing on it. The risk to the owners of that land is that they lose the productive capacity and in addition, if that land proved unsuitable for replanting within the timeframes stipulated by the ETS, the land owners would face the additional liability for surrendering sufficient emissions units to cover the carbon sequestered in a mature crop of trees standing on the relevant land. This is a liability which amounts to almost $20,000 per hectare compared to land values of under $1500 per hectare typical for the lessor interest in CFL land. How willing the Crown may be to grant such exemptions is yet to be tested.

The alternative approach is to quarantine that liability from other tribal assets. Mechanisms to achieve such a quarantine that are compatible with cultural values relating to land holding may be difficult to achieve and, in any case, are beyond the scope of this paper. However the general principle would be to ensure that any liability for emissions units associated with the land that the land owner could not satisfy did not result in either the land itself, or other tribal assets, being taken in recompense for any shortfall in the available emissions units to be surrendered.

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Appendix A: The DCF Method and Financial Modelling

Introduction

This appendix discusses in more depth the methodology employed in our analysis. The DCF methodology is the technically preferred and theoretically most correct method of determining the value of an investment, business or asset.

The DCF Method

The DCF method is a fundamental approach, which assesses the present value of future cash flows, recognising both the time value of money and risk. The value of an investment is equal to the value of the future free cash flows arising from the investment, discounted at the investor's required rate of return.

A DCF analysis involves calculating the net present value (NPV) of projected cash flows using a discount rate that reflects the risk associated with the projected cash flow stream.

In its elemental form, a DCF analysis proceeds through the following steps:

Step 1 Set aside the value of all assets, current and fixed, not used directly in the business to produce the estimated future earnings stream that is to be discounted.

Step 2 Estimate future sales revenue year-by-year over the pre-selected time horizon (also called the value growth period or estimation period) in nominal "dollars of the day".

Step 3 Estimate costs of sales and other expenses year-by-year including depreciation or replacement of property, plant and equipment also in nominal dollars of the day.

Step 4 Estimate profit (earnings) before interest and taxation (EBIT) year-by-year.

Step 5 Calculate net earnings from operating activities (NPAT) by deducting interest (if applicable) and taxation year-by-year.

Step 6 Add back depreciation (subtract depreciation recoveries) year-by-year.

Step 7 Estimate and deduct the average incremental working capital (accounts receivable less payable, inventory, and work in progress) required year-by-year.

Step 8 Estimate and deduct the average incremental capital investment cost (for property, plant and equipment) year-by-year (add back asset sale proceeds).

Step 9 Arrive at an estimate of the year-to-year free cash flow (FCF) attributable to the owners of the business.

Step 10 Calculate the continuing (terminal or residual) value at the end of the horizon period by capitalising the last year's projected earnings. See below for further discussion on this topic.

Step 11 Discount all year-by-year values, including the continuing value, to a present value using a risk-adjusted cost of capital for the discount rate. The result will be an estimate of the value of the investment, or if a business, the "enterprise value".

Step 12 Add back all set-aside values from Step 1 for non-revenue producing assets and deduct the continuing value of any debt. The total will be the NPV of the shareholders' equity. This value is analogous the market capitalisation of a listed company and may be expressed on a per share basis by dividing the value of shareholder equity by the number of shares on issue.

Application of a DCF valuation requires a medium to long term cash flow forecast, ideally for a period of at least five years.

Continuing value

A significant assumption in DCF analysis is the calculation of a value of cash flows occurring beyond the horizon. Continuing value and terminal value tend to be used interchangeably although strictly they refer to different concepts. The most common methodologies used are, as follows:

- Residual value method. Under this method the business is regarded as no longer fulfilling a going concern purpose. It is assumed to be broken up or liquidated with the residual or scrap value of the assets realised. This is a terminal value.
- Exit multiple method. This assumes the business will be sold as a going concern in the terminal year at a multiple of a financial operating metric (usually EBITDA). This is a continuing value.
- Growth in perpetuity method (the Gordon method) assumes that the business is held in perpetuity and that free cash flows continue to grow at an assumed rate. This is a continuing value.

All methods are accepted and used in business valuation. However, the underlying assumption of the continuing value methods, that of perpetual existence, let along perpetual growth[32], is increasingly under challenge by academics and practitioners.

The terminal or continuing value is discounted to the reference date using a discount rate relevant to the time period.

[32] A positive rate of real growth implies the business can forever outperform its costs of capital, a feat that few businesses have managed over even short time periods.

Financial Modelling

Just as a map is a representation of the main features of interest of any area of land (or sea), and cannot hope to reflect all the minute detail of the area being mapped, neither can a financial model represent all of the possible relationships and complexities that bear on a decision-making situation. A financial model is a synthetic representation of the reality that captures “the essence” of that reality. Since a model only captures certain aspects of reality, it may be inappropriate for use in a particular application as it may capture the wrong elements of the reality. Temperature is a model of climatic conditions, but may be inappropriate if the interest is in rainfall, for example. Thus, the usefulness of a model is dependent upon the aspects and the appropriateness of the elements of the reality it captures.

While there has been some debate as to the nature of financial modelling whether it is a craft, or a science, the task of financial modelling has been gaining rigor over the years. The craft of the modeller is to exercise judgement about just how much detail is necessary to reflect on the key decisions that a decision-maker will take, within the availability of information that bears on that decision, and what matters are treated as detail. No financial model can be considered to be more than an approximation of the real-world situation based on information available at the time of its construction. The users of information that has been produced by financial models need to exercise a degree of caution and judgement when considering the advice for this reason.

There is another important reason to exercise judgement and caution about financial models. The vast proportion of financial models are spreadsheet-based, and within this market, Microsoft Excel has by far the dominant position, having overtaken Lotus 1-2-3 in the 1990s. Although spreadsheets were developed to be used for “scratchpad” applications, with the increasing power of personal computers they are now also used to develop many large-scale applications. In recent years, we have learned a good deal about the errors that people make when they develop spreadsheets. Spreadsheets are inherently error-prone applications. Errors seem to occur in a few percent of all cells, meaning that for large spreadsheets, the issue is how many errors there are, not whether any error exists. In programming, strict development disciplines have been successful in eliminating most errors. Surveys of spreadsheet developers indicate that spreadsheet creation, in contrast, is informal, heightening their risk of error. Spreadsheet financial models should in the first instance, therefore be regarded with the same degree of caution as a loaded gun until it can be positively proved to be free of error by cell-by-cell checking and testing the model’s logic.

Microsoft Excel’s =NPV Function

Most such analysis these days is carried out using electronic spreadsheets. The most commonly used is Microsoft Excel. In Excel, the =NPV function purports to return the net present value of an investment. The syntax for the =NPV function is =NPV(discount_rate, value1, value2, ... value_n), where discount_rate is the discount rate for the period and value1, value2, ... value_n are the

future cash flows for the investment. There can be up to 29 values entered.

Microsoft Excel's NPV function does not account for the initial cash outlay, or may account for it improperly depending on the version of Excel. However, there is a workaround. This workaround requires that you not include the initial investment in the future cash flows for the investment (i.e., value1, value2, ... value_n), but instead, you need to subtract from the result of the NPV function the amount of the initial investment. The workaround is also different depending on whether the cash flows occur at the end of the period (EOP) or at the beginning of the period (BOP).

If the cash flows occur at the end of the period, you would use the following formula:

=NPV(discount_rate, value1, value2, ... value_n) - Initial Investment.

If the cash flows occur at the beginning of the period you would use the following formula:

=NPV(discount_rate, value2, ... value_n) - Initial Investment + value1.
