Focus on the treatment of risk in forest valuations*

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Abstract

New Zealand forest valuations are commonly based on a discounted cash flow (DCF) modelling approach. Since this requires the prediction of future financial performance, the valuation structure inherently invites the consideration of potential risks. Risk may be addressed in a DCF environment by two means: through the application of a risk-adjusted discount rate, or through making sufficient allowances in the projected cash flows. Informed opinion recommends the latter. The paper describes example models in which risk-modified cash flows have been simulated, and in particular those which have employed stochastic modelling procedures. Forest valuers are not observed to apply such measures routinely. In their practice of applying Implied Discount Rates (that is, those derived from market evidence), New Zealand valuers are in effect using rates which are in some measure risk-adjusted. The paper includes observations on the greater refinement emerging in reporting sensitivity analyses, and the propensity to refer to risk in the valuers’ disclaimer.

Introduction

Other papers at this conference have described the risks facing forestry investments. In this paper I will describe how some of these risks may be recognised in a forest valuation. Most New Zealand forest valuations involve some measure of discounted cash flow analysis. The two broad areas in which risk may be incorporated are: the derivation of future cash flows and the selection of the discount rate. This paper concludes with a discussion of the valuer’s professional responsibilities regarding declaring risk in valuation reports.

Valuation Structure

The general methods of forest valuation applied in New Zealand will be considered, for it is within these that allowance for risk may be incorporated. Risk may, of course, be acknowledged in more than just the forest valuers’ models. Adjustments may, for instance, be applied after the valuation. An example of this is the lending security ratio that banks apply to the valuations that they receive.

A primary purpose of forest valuations applied in the New Zealand forest sector is to estimate market value. This type of valuation may have the following features:

- Forest stands, which are ready to harvest, have their value based on the estimated net sale price of their current realisable content.
- The values of young, recently planted stands may be related to their establishment cost.
- Stands at the intermediate ages of the rotation are generally valued on the basis of the Net Present Value (NPV). This is derived from future cash flows these stands are predicted to produce.

Variations on these methods are used both locally and internationally. These include:

- Valuations prepared in accordance with accounting practices - the value reported being the accumulated investment in the forest. No forward-looking estimates are required.
- Valuations that differ in their interpretation of when a stand is ‘ready-to-harvest’. For some, this is largely a physical criterion, and the stand is considered merchantable as soon as it contains enough logs meeting saleable specifications, that it can be harvested for a positive margin. Within New Zealand valuation thinking, ‘ready-to-harvest’ is more likely to be related to the stand attaining optimum economic rotation age.
- Valuations based on cash flows derived at the forest estate level may not try to isolate the values that are effectively assigned to young age classes. They may not, therefore, relate the values of these stands to their establishment costs.

Despite these variations, NPV-based methods of forest valuation are the predominant form of valuation in New Zealand. This generally means that for a high proportion of the forest being considered, the value is based on future projections. The process of valuation itself therefore sets a framework in which the consideration of future risks is unavoidable.

Where Should Risk Be Incorporated in the Valuation?

In an NPV environment, there are two broad alternatives for addressing risk: including suitable allowance in the derivation of future cash flows, or incorporating some extra margin in the discount rate.

A number of authors describe the issues involved, including Price (1989), Clutter et al (1983), Klemperer (1996) and Brearley and Myers (1988). All acknowledge that in calculating the NPV for risky projects it may be common practice to add a risk premium to the discount rate. Because decision-makers tend to be risk-averse, penalising more risky investments would appear to be a valid means of adding extra stringency to the investment process. However, the user does need to be aware that this approach can distort the relative magnitude of immediate and future cash flows.

Clutter et al (1983) identify the problems succinctly:
"First, use of a risk-adjusted discount rate assumes risk is compounding over time. Second, no specific guidelines are available on how to determine the appropriate adjustment factor".

Price (1989) concedes that often, the further into the future that the revenues arise, cash flows will become less certain, however:

- Not all risks increase over time. (In New Zealand plantations, for instance, windthrow risk may be greatest between two years and four years old (toppling), and then after thinning operations which may occur before age 10 years).
- Where risks do increase through time, it may not be exponential as with compound interest.
- Market uncertainty is not a sufficient reason for discounting, as it may involve outcomes better or worse than expected.

Klemperer (1996) addresses the risk premium through using "certainty-equivalents". Using a simple algebraic formulation he demonstrates that for any given perceived risk level, the correct risk premium for the discount rate declines with increasing the payoff period. As a result he suggests that the further into the future a risky revenue is, the lower the correct risk-adjusted discount rate (RADR) should be, given the same degree of risk and risk aversion. Thus, he observes, "forestry's long production periods may often require lower RADRs than average short-term industrial RADRs".

Accordingly, Klemperer identifies that there is no such thing as the correct RADR for forestry's expected values. "In reality, a different RADR should be used for each cash flow, depending on its probability distribution, on its time from the present, and on the decision-maker".

There are difficulties in identifying the most appropriate RADR. As a result, it seems that a process of explicitly modelling risk in the cash flows would be worthwhile pursuing, not least because it might give some indication of the impact of risky events, and the size of NPV reduction that an appropriate RADR should produce.

I have encountered several examples of studies where some risk factors have been explicitly represented in woodflows and cash flows, these are described below. Some of these have been actual valuations; others research papers. The list is not exhaustive.

In modelling risk the distinction is drawn between deterministic and stochastic treatments. Models constructed to incorporate risks in a random manner can be referred to as stochastic. Since the model inputs vary according to chance, a range of results may arise. This is in contrast to those models that represent only one possible scenario, and are referred to as deterministic.

**A Wind Damage Model for Taupo County**

The distinction between the approaches is discussed

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1. FOLPI, the Forest Oriented Linear Programming Interpreter. A licensed product of the New Zealand Forest Research Institute.
2. IFS, the Interactive Forest Simulator. A licensed product of the New Zealand Forest Research Institute.
Figure 1: Example Damage Profile from Wind and Fire Model

Wind and Fire Model Results - Run 44

Area affected %

- Total wind destruction
- Severe wind damage
- Moderate wind damage
- Fire destruction


were transferred to ‘damaged’ croptypes. These continued to grow on, but with a reduced level of standing volume. Beyond threshold levels of damage, damaged stands were assumed to be clearfelled, and their age would determine whether salvage volume was available.

Figure 1 illustrates an example of a wind and fire damage profile. For each risk profile produced, IFS was then run iteratively to find what the long-term sustainable level of harvest would be, in the face of such risks. This operating aspect is certainly important, as it does not contemplate adaptive management scenarios developed after the damage has occurred. In effect, the model was being applied in finding a

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defensive strategy; what was a ‘safe’ level of harvest, such that whatever chance sequence of natural events might arise, a Non-Declining Yield (NDY) production profile could be maintained. This conservative NDY profile was then used as the basis for the valuation.

"Stochastic event simulation is an attractive way of analysing forest-management problems that involve risk. The inclusion of random elements reflects the uncertain environment that surrounds decision-makers. Recognising the risk explicitly leads to a picture of the world that is much different from the one conveyed by deterministic models."

The aim of his report was to extend the Faustmann formula to incorporate the uncertainty faced by stand owners from catastrophic events and future price fluctuations, and to see if this affected rotation length policy and harvest timing decisions.

Martin produced two models for stochastic event simulation. Model A was developed to value a stand while recognising the uncertainty attached to its future cash flows. A by-product of the model was the capacity to determine the rotation age at which risk is minimised and expected return maximised. The model suggested the comparatively short rotation age of 23 years for windthrow-prone stands on the Canterbury Plains. The optimum rotation age produced by the stochastic model was less than that suggested by a deterministic version.

Martin’s Model B moved from the examination of optimum rotation age when the stand was not yet planted, to the best strategy for harvesting stands that were already part way through their life. This model also suggested rotation lengths significantly shorter than those prevailing in less risky locations. Martin acknowledged that the market’s acceptance of younger wood had not been fully explored in making the rotation length recommendation.

Martin’s report provides a useful literature review on the subject of incorporating stochastic treatments in forest investment analysis. He identifies that the models he has used are based on the fire simulation model of Buongiorno and Gilless (1987), but with the distinction that revenue from salvage operations is included.

An Estate-based Stochastic Wind and Price Model for Canterbury

The principles presented in Martin’s analysis were extended in a subsequent thesis by Horacio Bown (Bown 1996). His study took the analysis to an estate level - that is, he modelled the accumulated stands in a collective resource. The example employed was the 8,400 ha Solwyn Plantation Board forest estate.

Storms were generated randomly over a planning horizon of 50 years, and with an average return period
of 28 years. In keeping the model within workable bounds, the extent of the damage at each storm event was assumed to be proportional to that which occurred in the 1975 Canterbury storm.

Bown’s model resulted in an average NPV of $38,278 million under stochastic conditions compared to $43,208 million under deterministic conditions, a reduction of 11%. A further product of the modelling was the frequency distribution of NPV. There was a decreasing overall trend in probability from the stochastic maximum to the stochastic minimum. As anticipated, the lowest NPVs occurred where there were a greater number of windthrows within the planning horizon, with the first windthrow usually occurring at the start.

Sensitivity analysis produced the interesting finding that the model solution was not very responsive to the assumed return period. The average NPVs for return periods five years longer and five years shorter than 28 years did not vary by more than 2%. This suggested that the accurate estimation of return period might not be critical.

Testing of the Consequences of Different Log Price Trend Scenarios

In some recent assignments, Jaakko Pöyry Consulting has extended the sensitivity analysis usually applied in valuation procedures to test the effect of stochastically generated log price series. Some log prices demonstrate common behaviour. In this particular example it was assumed that export prices would maintain a certain relativity. By comparison, pruned logs and pulp logs followed unrelated trajectories.

In testing the sensitivity of the valuation, these price series were applied to woodflows after a forest estate model had been run. The optimising model was not therefore given the opportunity to vary the cut based on anticipated future prices.

Jaakko Pöyry Consulting has observed this type of analysis within the purchase price derivations of major forest purchasers.

A Stochastic Model for Addressing Uncertain Future Demands and Prices

Another recent masterate level study in New Zealand has addressed stochastic issues in forest modelling. Simon Papps (1998) describes a modelling system that is "...primarily aimed at developing operational plans where uncertainty in log product demands and process are described as possible future outcomes. The model, which applies stochastic Benders decomposition to efficiently solve large linear programming problems, produces a hedged plan that makes the best decisions based on the information available".

Conceptually, Papps' model is considerably more advanced than the more common forest estate modelling applications. It provides a modelling framework that more adequately reflects reality in that risky events unfold in an unpredictable fashion, and then the model, acknowledging the change in state, forms a revised view of the optimal forward strategy. This contrasts, for instance, with the Fiji fire and wind model described earlier. There, although the sequence model had been run. The optimising model was not therefore given the opportunity to vary the cut based on anticipated future prices.
of future events was generated stochastically, once generated, it was known from the outset.

In a summary of his findings, Papps observes that a better management plan can be developed if uncertainty is incorporated in the modelling system. All other things being equal, a stochastic programming with recourse (SPR) model will give a higher valuation for a forest estate than a deterministic model with expected prices. This is because the deterministic scenario does not consider the opportunity for taking advantage of a change in situation, such as harvesting more when prices are high. He notes that because the SPR approach considers every scenario simultaneously, the derived management solution will be more risk-averse than a deterministic plan. The value of the stochastic solution also increases with the variability of the possible outcomes.

Papps’ thesis describes the extra computational requirements associated with the SPR modelling. Because a new set of sub-models is created at each reporting interval in the model, the processing requirements tend to rise massively compared to more familiar forest estate modelling structures. The solution time requirement is one of the reasons that Papps’ thesis has concentrated on short-term harvest planning.

Despite the prospect of creating very large problems, the techniques that Papps describes remain tractable, since they require only one sub-problem to be held in computer memory at a time. In the near future the current problem of very large number of stochastic elements and outcomes will be solvable due to increased processor speeds, and the emergence of parallel computing.

Options Pricing Theory

The Forestry Valuation Standards produced by the New Zealand Institute of Forestry briefly introduce the concept of option pricing theory. The theory addresses the situations where a firm is able to adapt to future decisions in reaction to unexpected market developments. Some forest owners are in the position of being able, in theory, to halt log production when prices are low and increase production when prices are high.

Hughes (1997) has described the application of the theory in the case of valuing the Forestry Corporation assets, sold in 1996. His analysis suggested that there was an extra 15% of value associated with harvesting options, which was not captured by the expectation value approach.

Henk Berkman (1996) has also examined the role of option pricing methodology for New Zealand forestry stocks. His paper tests the empirical implications of an American call option-pricing model of forestry companies and concentrates on the value of the option to wait. He found that, consistent with the option-pricing model, a change in the value of flexibility (the difference between the market value and the calculated NPV) is negatively related to changes in wood prices and interest rates. The paper does not extend to a demonstration of how option-pricing theory might be actively applied in forest valuation.

The NZIF Valuation Standards record that the associated Working Party is not aware of any routine practical application of option pricing theory applied to New Zealand forests. Zinkhan et al (1992) make brief reference to option pricing theory having “reached the testing stage...” as a basis for forest valuation models.

Incorporating Risk through Insurance

The inclusion of insurance in valuation models is regarded as a legitimate means of recognising risk. There is more certainty of eventual returns, and accordingly, less need to consider any risk adjustment to the discount rate. The cost of the insurance premiums reduces the free cash flow and, as a result, the NPV.

Historically, the larger forest owners in New Zealand have ‘self-insured’ their forests. Because their estates were both extensive and geographically dispersed, the prospects of losing more than a limited proportion of the crop in any event was low. Accordingly, it appeared more appropriate to dedicate funding to fire protection measures. Recently with the considerable expansion in the number of smaller forests, the interest in insurance has increased. The scheme pioneered by the New Zealand Forest Owners Association and NZI has been joined by those from at least three other insurance providers. The range of insurable risks has expanded in the process from fire losses to windthrow, earthquakes, malicious damage, flooding, hail, lightning, aircraft damage and volcanic eruption.

In preparing this paper, I have tried to locate the actuarial basis for insurance premiums. I have not managed to find information on this subject. One insurance broker’s response suggested that identification of the forest loss risk for New Zealand remains as much a craft as a science. This is not surprising, since the statistical base is still in a fledgling state. It will require more empirical evidence yet to resolve whether insurance premiums are too high or too low for the damage that may occur.

Incorporating Risk in the Discount Rate

Portfolio theory, which is concerned with addressing collective risk, provides the following definitions:

Systematic risk (also known as non-diversifiable risk).

This part of the risk in a business’s performance is attributable to market-wide economic forces, such as inflation, interest rates, or business cycles that affect all investments to some extent.

Non-systematic risk (also known as diversifiable risk).

This component of a business’s risk is due to factors that are specific to the investment.

The systematic risk is taken into account in the discount rate, through the Weighted Average Cost of Capital (WACC), if the Capital Asset Pricing Model
In principle, there is a strong case for the LEV, particularly if there is no intention of actually selling the forest, but instead simply registering a notional sale. Indeed, the LEV is a convenient means of bringing the contribution of a series of succeeding rotations into the valuation as a single terminal sum. The current rotation model with the LEV as terminal value should be no different from the results of a perpetual valuation.

However, the usual motivation in Jaakko Pöyry Consulting's valuations for confining the analysis to just the current rotation is that at the discount rate applied, the contribution of the succeeding rotations is negative. It appears counter-intuitive to expect that an investor will spend money on an investment that is not capable of meeting their hurdle rate. Three possible, but not mutually exclusive, explanations arise:

- The investor expects that they can economise on their costs in the next rotation, and thereby come closer to earning their hurdle rate.
- The investor is optimistic that they can get increased yields and prices, and thereby match or exceed the hurdle rate.
- The investor does not have as high a discount rate for the second and succeeding rotations as they may apply in valuing the current crop. This is not an untenable prospect. Significant risks attach to the process of assembling the large amount of capital necessary to buy a standing forest and the cost of capital accordingly may be comparatively high. Finding the funds to reinvest in succeeding rotations is generally more straightforward as these can be drawn from harvesting proceeds.

Naturally there is reluctance in valuation practice to assume that the forest performance can be so substantially turned around that the succeeding rotations may make a positive contribution to the NPV. There is however, a more credible case that they will, at least, prove capable of matching whatever discount rate they are charged with earning. This would lead to them making a NPV contribution to the overall forest value of zero. Rather than talking then, of a 'current rotation' model, with the potential implication that the forest is not perpetuated, it may be more helpful to think in terms of a 'second rotation-NPV-neutral' (2R-NPV-neutral) model.

Where does risk come into this?

The problem may be that risk is not being considered. Once started on the practice of 2R-NPV-neutral formulations we may simply cease examining what it actually takes to make second rotations earn the discount rate. Clearly, however, it may be easier to achieve this result with some crops than with others, and the market can be expected to recognise this. For forests in which there is more risk that succeeding rotations cannot be made capable of earning an investor's hurdle rate, an adjustment to the current rotation value seems necessary.

A second issue is that of risk faced by parties in leases

Land Value in Response to Risk Perceptions

Forests represent the combination of a tree crop and the land beneath it. In a competitive, rational market, improved profitability in forestry investments can be expected to eventually result in increased land values. Turland (1990) provides an examination of the principles.

This subject could form the basis of a lengthy examination in its own right. The various negotiations and arbitrations over Crown Forest License fees that have taken place in the last decade have brought the issue under the spotlight for foresters.

One important question is whether to value forests on the basis of the current rotation only or on the basis of a perpetual investment. In the case of the former, it is appropriate to recognise any terminal value applying at the end of the investment. A clear candidate for this is the value of the land. Which land value, however, should apply? The choices are: the land market value, or the land expectation value (referred to as LMV and LEV respectively in the NZIF Forest Valuation Standards).
and joint ventures. Most joint ventures revolve around land ownership and tree crop investment, but the participants do not necessarily share the same risks. It would seem credible that a lessor getting an annual payment (in advance) faces a considerably lower risk profile than the person investing in the tree crop. This characteristic can be expected to be recognised in the Crown Forest License fee negotiations. It will also be reflected in the manner in which potential rental movements are recognised in forest valuations.

Methods Applied in Practice

Forest valuation is a significant part of Jaakko Pöyry Consulting’s business. We produce a number of forest valuations ourselves, and are frequently in the situation where we view our contemporaries’ work.

General ongoing attrition in stands is usually reflected in the valuation yield tables. The general base level of forest mortality is sufficiently predictable, that it can be incorporated within the growth model formulation.

In practice, although various approaches to modelling the high-amplitude but low-frequency risks within cash flows have been advanced, I find few instances of such methods applied in practice. Certainly a number do incorporate partial insurance, although I recall few that have discussed the nature of the insurance cover in any detail.

Many of the valuations are reasonably thorough in describing the nature of the risks, even if they do not attempt to quantify them. The typical risk factors discussed include:

- Fire
- Wind damage
- Browsing animals
- Pathogenic agents
- Bureaucratic restrictions (e.g. charges for transporting logs on county roads)

Within valuation reports I have found that there is generally little discussion of the risks associated with New Zealand’s Radiata pine monoculture, even though it has been addressed in various articles. This is expected to change with the greater use of clonal propagation. The companies leading this activity are already advising the market of the strategies they intend to use to spread the risk.

Analysts’ cash flows do not generally extend to a representation of catastrophic losses. As a result, the implied discount rates reported (e.g. Keating 1990) can be regarded as interpretations of the market’s view of risk-adjusted discount rates (c.f. Klemperer).

The one notable example of an acknowledgement of catastrophic potential is demonstrated in Bruce Manley and Alan Bell’s analysis of the Crown Forest Asset Sales (Manley and Bell 1992). Their formulation was solved to provide an implied discount rate. Within the model, the accident-prone Canterbury forests were assigned an additional risk premium.

In principle it might be expected that implied discount rates might vary depending on whether or not insurance was included in the underlying cash flows.

Value Reporting

The NZIF Forest Valuation Standards are prescriptive in matters of value reporting. However, they contain relatively few requirements or recommendations relating to risk. The principal references are shown in Table 1.

As Table 1 indicates, the Standards do encourage the forest valuer to identify what risks may affect forest value. The Standards are not prescriptive in how the risks are quantified or incorporated in estimating the value. To some extent, with the presentation of sensitivity analyses, the reader of the valuation is invited to make a selection of value consistent with their own perception of the risks.

<table>
<thead>
<tr>
<th>Standards Document Reference</th>
<th>Requirement or Recommendation</th>
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<tbody>
<tr>
<td>Risk and the Discount Rate pp A4-21</td>
<td>“The preferred approach ...is to adjust future cash flows, rather than the discount rate”.</td>
</tr>
<tr>
<td>Standard B3.1 relating to the reporting of stand history</td>
<td>“...the forest description shall: ...Describe the completeness of the stand records with respect to crop characteristics including: ...adverse events (fire, wind, drought, land movement, pests, disease...”).</td>
</tr>
<tr>
<td>Standard B8.2: Disclosure of the Sources of Price</td>
<td>Where relevant, price volatility should be described.</td>
</tr>
<tr>
<td>Standard B3.8: Disclosure of Price Movements</td>
<td>Where forecast log price trends have been prepared, statistical analysis showing confidence limits on the forecasts should be described.</td>
</tr>
<tr>
<td>Standard B10.3 Rationale for the Discount Rate</td>
<td>Whatever ‘risk treatment’ is represented in the discount rate is to be declared.</td>
</tr>
<tr>
<td>Valuation Checklist, Chapter D6. Valuation, Sensitivity Analysis</td>
<td>“The reader will benefit from analysis of how sensitive the valuation result is to critical assumptions. In most cases these will be: Discount rate, Log price. However in certain circumstances other key assumptions may influence value significantly, e.g. Land value, Stocked area (where not known precisely). Future yields”.</td>
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Sensitivity Analysis

Jaakko Pöyry Consulting has misgivings about using traditional sensitivity analysis tables. As a result we are increasingly using Monte Carlo techniques. In particular, we are using Crystal Ball™, a software package specifically designed to handle such analysis. Monte Carlo analysis is useful in:

- Acknowledging that the prospect of all inputs being unfavourable, or favourable, at the same time, may be very remote. Monte Carlo analysis procedures are used to produce a forecast chart that shows the entire range of possible outcomes and the likelihood of achieving each of them.
- Providing the opportunity to incorporate positive and negative correlations between input variables where they are expected to exist.
- Recognising that input variables are unlikely to lie on uniform distributions.
- Recognising that the value may not vary linearly in response to the input.

Disclaimers

The valuer’s perception of risks may not only find expression in sensitivity analysis, but also in the form of their Disclaimer. General expressions commonly include words such as, "Nothing in this valuation is, or should be, relied upon as a promise, representation, opinion or forecast of the future". Disclaimers may also be extended to refer to more specific factors.

One of the most comprehensive discussions of forest investment risk factors is found in a recent Offering Circular, relating to shares in a New Zealand company, but prepared for a North American audience. In meeting statutory requirements the underwriter declared: "An investment in the Ordinary Shares offered hereby involves a degree of risk. In addition to the other information contained in this Offering Circular, prospective purchasers should carefully consider the following risk factors in evaluating whether to purchase any such Ordinary Shares. Moreover, prospective investors are cautioned that the statements in this Offering Circular that are not descriptions of historical facts (including, in particular, the time frame within which the Company is able to commence sustainable harvesting operations, pay dividends and meet its growth objectives) may be forward looking statements that are subject to risks and uncertainties. Actual results could differ materially from those currently anticipated due to a number of factors, including those set forth below."

The "Risk Factors" section of the Offering Circular proceeds to discuss risks within the following categories:

- Uncertainties relating to forest valuation
- Limited Operating History; Fluctuations in Operating Results
- Management of, and Approvals Required for, Growth; Future Capital Requirements
- Differences between NZ GAAP and US GAAP
- Competition
- Reliance on Key Management Personnel
- Consequences of Diseases Pathogens and Natural Disasters
- Concentration of Ownership and Control; Related Regulatory Matters
- Environmental and other Regulations and Related Costs
- Potential Future Maori Issues
- Dependence on New Zealand Economy and Commodities
- Impact of Currency Fluctuations
- Restrictions Imposed by the Lender
- Ordinary Shares Eligible for Future Sale
- Limited Market for Ordinary Shares; Active Market May Not Develop
- Absence of Dividends

While several of these factors have more bearing on the potential value of shares than that of the underlying forest assets, the list nonetheless represents an attempt to treat potential sources of downside comprehensively.

Conclusion

This paper has first discussed the processes by which risk may be included in cash flows. The examples cited represent only a few cases, but they have been identified and described within the New Zealand forest valuation environment. They represent a combination of academic and operational initiatives.

Examination of the issues confirms that the treatment of risk in forest valuation (or investment analysis) has been the subject of substantial attention. Useful summaries include...

There is the potential to devise and apply more advanced methods of modelling. In producing market valuations, though, our role is to try to emulate the market's perception. As forest valuers we must not be presumptuous in saying that the market should be doing things a certain way, and that therefore is the way we will value the forest. There is the opportunity for considerable worthwhile research in this area. A better understanding of how our forest investments may behave will improve the availability and cost of the financial resources that the forestry sector needs.

References

Berkman, H. The Value of Expected Cash Flows: Does the Market Value Real Options? Department of Accounting and Finance, University of Auckland, 1996


