CHAPTER A3 - METHODS OF FOREST VALUATION

STATUS & REVISION HISTORY

Original Standard	May 1999	NZIF October 2020 revisions: • Recast into the three main valuation approaches (Sales comparison, Income, Cost); and • Updated option pricing approach.
Review by Forestry Australia Valuation Working Group	Sept 2020	Main revisions are: • reformatted the 1999 Word version (as not in 2019 Exposure Draft); • brought references to Australia to before references to New Zealand; • minor editing for context and addition of 'New Zealand' and 'Australia' in appropriate place; • flagged the approaches in the opening paragraph; • retained a comment re cross reference to Chapter E2 Glossary that needs to be checked when the glossary is finalised; and • removed 'buyer position' section as essentially a repeat of strategic factors.
CURRENT STATUS	July 2025	Released as final

Methods presented

- Transaction based approach (sales comparison);
- Cost based approaches – historic costs, current costs, compounded costs; and
- Income approaches
- Expectation value
- Liquidation approach
- Option pricing

TRANSACTION BASED (SALES COMPARISON) APPROACH

Background

The transaction-based approach involves the analysis of market transactions. It is the theoretically correct procedure to estimate market value for a forest. However, there are often practical difficulties.
The Australian and New Zealand markets for forests generally violate the perfect market in which large numbers of willing buyers and sellers enter transactions where identical goods are being exchanged, and transaction prices are readily observable. Consequently, the transaction evidence for forest sales should be interpreted with some caution.

However, despite this, available transaction evidence should always be considered and, where appropriate, used in the valuation of a forest.

Analysis of sales

The value of a forest can be estimated by an analysis of transaction information, often referred to as 'comparative sales'. The analysis essentially involves an interpolation or extrapolation of the values of past sales to the forest of interest.

Even if forest value is not inferred from past transactions, it can be possible to infer other relevant factors from sales. For example, units of comparison can be derived such as average value ($/ha). Given the differences in forest characteristics these may be of limited use. However, a useful unit of comparison is the implied discount rate. This provides a unit that not only indicates the relative value inherent in the transaction, it can also be applied in the valuation of other forests.

It is also possible to analyse transactions using multivariate models. An example of an analysis of sales is the work of Manley and Bell (1992) in developing a relationship between the prices paid for the State plantations sold in 1990 and their underlying characteristics. Manley (2016) updated this model to predict crop value from the discounted stumpage revenue associated with the average stand from 27 forest transactions.

Practical difficulties

There are often practical difficulties, not unique to forestry, in obtaining transaction evidence, in analysing it and in extrapolating it to the target forest:

i. Heterogeneous forests

No two forests are identical. They may differ in terms of maturity, distance to market, species composition, terrain, site productivity, past silviculture, and other factors which will influence their value. Therefore, it will generally be difficult to find a recently sold forest which is directly comparable to the forest of interest.

ii. Point in time

Prices, costs and other assumptions provide market information at a point in time. They must be interpreted with caution when subsequently used because underlying market conditions and a range of other factors may have changed.

iii. Liquid market

There are relatively few buyers in the market particularly of larger forests and of immature forests. Some sales may be forced (e.g. liquidation, matrimonial property split) and may not reflect a willing seller situation. Consequently, price might not represent market value (as defined in Chapter A2).

iv. Scale

There are limited transactions involving large forests other than, for example, Australia's public plantation forest 'sales', which have commonly been of a right to a long-term lease.

v. Strategic factors

Transaction evidence may incorporate strategic factors such as the wish to enter or exit a region, complementary age-class distributions, the provision of access or vertical integration opportunities. These can cause difficulties in extrapolation to the target forest. The strategic value recognises the margin the purchaser is willing to pay above what other parties may perceive as 'fair value'.

vi. Intangibles

In some situations, the price paid for a forest may reflect factors other than the crop and the land on which it is growing, e.g. in New Zealand, Wāhi Tapu (sacred places) and aesthetics can influence price.

vii. Lack of publicly available information

Forest sales information is often not available either for confidentiality reasons or because the forests represent one component of a 'bundled' sale involving other significant assets. To be useful, disclosure is required not just of price but also the forest characteristics noted in (i) above.

COST BASE APPROACHES

Background

Cost based approaches involve the accumulation of costs to provide an estimate of value. Cost based approaches to valuation have had appeal because of:

- a preference in some cases to value young stands based on replacement cost rather than on future expectations; and
- the influence of accounting practice and the concept of objectivity.

Cost not equal to value

The fundamental weaknesses of these approaches are that cost generally does not equal value. As noted by Davy (1987) a 'high' cost forest does not necessarily reflect a 'high' value forest and conversely a 'low' cost forest does not mean a 'low' value forest.

Historic cost method

The historic cost method equates forest value to the sum of the historic costs incurred in developing it. Variations of the method occur over:

- what are classified as development costs;
- whether maintenance costs are accumulated; and
- whether interest costs associated with the debt-financing of the forest are accumulated.

Characteristics of the method are:

- there is no adjustment for inflation; and
- costs relate to the technology of the time in which operations were carried out.

Current cost method

The current cost method accumulates the inflation-adjusted costs incurred in developing a forest. It has received limited application because of the lessening interest by the accounting profession in current cost accounting concepts.

Current replacement cost method (cost compounded method)

In the current replacement cost method, stand value is calculated as the sum of costs compounded forward from the time of occurrence to the present day. Costs are generally expressed in current day dollars. In addition, standard costs, representing current efficient practice, are generally used for each operation.

A modified current cost method is different to current cost method where the former included the accumulation of interest charges. The difference is that the compounding rate used in the current replacement cost approach represents the opportunity cost of capital, as distinct from the interest rate on borrowed funds used in a modified current cost method. As noted by Liley (1994) 'whereas the accountant's preference is to recognise only actual, tangible financial charges against the forest, the economist is prepared to recognise a notional cost of capital'.

The current replacement cost approach has some economic underpinning. 'Its claim to validity rests on the assumption of rationality on the part of the investor. It assumes that an investor would not willingly put money into a project without a reasonable expectation of at least getting it back'. (Fraser et al. 1985).
Its application to very young stands has reflected a view that 'this method is most relevant in the initial development stages prior to future revenue being ascertainable' (Davy, 1987).

A specific limitation of the method Is the need to determine an appropriate compounding rate. Often a rate below the opportunity cost of capital has been adopted.

Under specific circumstances the value of a crop estimated by the cost-compounded method will equal that estimated in the expectation method by discounting future cashflows. This is when the same cost, revenue and discount rate assumptions are used and a notional land rental is charged in both cases, based on the Land Expectation Value (LEV). This equivalence was noted in 1842 by Faustmann.

INCOME APPROACHES - Expectation Value Approach

Net Present Value (NPV) or Discounted Cashflow (DCF) approach

Under the expectation approach future wood volumes are forecast based on some underlying management and harvesting strategy. Future log volumes sold are multiplied by future log prices to give forecast revenue. Costs are subtracted from these revenues to give future net cashflows. These are discounted to the reporting date to give forest value. Variations of the expectation approach arise depending on whether:

- a single rotation or perpetual rotations are assumed; or
- the framework of an estate or a stand is adopted.

There is an economic school of thought that suggests that the replanting decision in forestry should be treated as a separate investment decision. Within this approach, a forest valuation should only capture the value of the existing crop.

An alternative viewpoint is that a forest should be valued based on a going concern. Accordingly, with this approach the value of a forest should capture not just the value of the existing crop but also the value of subsequent rotations. A characteristic of the expectation approach is that it uses price information from markets in which transactions are frequently occurring i.e. the log market. Whereas the market for forests tends to be 'shallow', there are regular transactions in the 'deep' log market. The disadvantage is that the log market of interest is that of the future.

Other features of the expectation approach are that it:

- requires forecasts or future woodflows, log price and costs; and
- requires the selection of an appropriate discount rate.

Estate based expectation value

The estate-based expectation approach values the forest as a single entity. The net cashflows of the total estate are forecast and discounted to give forest value. These cashflows are associated with an underlying management and harvesting strategy which applies to the whole estate.

The strategy varies depending on:

- assumptions or constraints placed on the level of harvesting – at one extreme, the harvest might be unconstrained with each stand harvested at its optimum rotation age and at the other extreme, total harvest (and harvest by log grades) might be constrained to be non-declining;
- assumptions about the intensity of silviculture;
- assumptions about replanting; and
- assumptions about new land planting cost.

Stand based expectation value

This approach values a forest as the sum of the values of each individual stand. The net cashflows of each stand are forecast and discounted to give stand value. As for the estate-based expectation method, assumptions are made about the underlying management and harvesting strategy.

The strategy varies depending on:

- rotation age, where the optimum rotation can be assumed or the rotation may reflect expectations about when the stand will be harvested to fit in with broader estate considerations;
- silvicultural regime; and

- replanting, where typically the assumption of no replanting is adopted in the stand-based expectation method.

Note: Given the same set of assumptions, the stand-based expectation method will give the same forest value as the estate-based expectation value.

INCOME APPROACHES - Immediate Liquidation Approach

Stock value or current realisation value
In the immediate liquidation approach, forest value is calculated by estimating the stumpage value of standing merchantable volume. The underlying assumption is that all merchantable stands in the forest can be liquidated immediately and sold at current stumpage prices. Young immature stands are assigned zero value. The approach therefore, ignores future realisable value.

Characteristics of the method are:

- the assumption, that a forest could be liquidated immediately without undue influencing stumpage prices, is unrealistic except for small forests;
- assigning young stands which are not currently merchantable a zero value ignores their future potential growth.

INCOME APPROACHES - Option Price Approach

Ability to choose when to harvest

Dixit and Pindyck (1994) develop an options approach to investment to deal with the situation where there is the ability to delay an irreversible decision. They use option pricing to value the situation where an investor has the right but not the obligation to make an investment.

The use of option pricing theory for forest valuation has been suggested (Hughes 1987). A forest owner has the option of when to harvest a stand. In theory, the owner may have the option to halt log production when prices are low and increase production when prices are high. Longley et al. (1993) suggest that the ability to defer the harvest has a value which is not captured by the expectation approach.

In the forest option model of Hughes (1987), forest value is a function of future harvest volume, future harvest cost, current stumpage value, stumpage price volatility (i.e. variance), the time to harvest and the discount rate. Hughes (1997) used this option pricing methodology to value the forest assets of Forestry Corporation of New Zealand sold in 1996. He estimated, using a discount rate of 7.5%, that the option value was $2.075 billion compared to an NPV of $1.804 billion. The implication is that there was an additional ‘option’ value of $271 million associated with harvesting options which was not captured by the expectation value approach.

Manley and Niquidet (2010) evaluated different option value approaches for the valuation of a New Zealand plantation stand. They found that differences between option value and expectation value NPV depended heavily on the log price model assumed. They concluded that ‘option valuation approaches have limited relevance for the practice of forest valuation in New Zealand. Practical issues (determination of the log price model, estimation of volatility, allowing for multiple log grades and modelling at the estate-level) need to be addressed before option value approaches can be routinely used for forest valuation.’

References

Davy, A. 1987: Accounting for forestry activities in New Zealand.
NZ Society of Accountants Research Bulletin R117.Dixit, A.K.; Pindyck, R.S. 1994: Investment under uncertainty.
Princeton University Press.
Fraser, T.; Horgan, G.P.; Watt, G.R. 1985: Valuing Forests and Forest Land in New Zealand: Practice and Principles. FRI Bulletin No. 99.

Hughes, W.R. 1987: Forest Valuation using option pricing theory.
University of Waikato Department of Economics Working Paper No. 87/2.
Hughes, W.R. 1997: Valuing a forest as a call option: The sale of Forestry Corporation of NZ. University of Waikato Department of Economics Working Paper No. 97/3.
Liley, W. 1994: The role of modelling in forest valuation. Pp 197 206 in Paredes, G. (Ed): Proceedings of International Symposium on Systems Analysis and Management Decisions in Forestry, Valdivia, Chile.
Longley, B.; Seed, P.; Sharp, B. 1993: Using option pricing theory to estimate option value — a preliminary study. Lincoln University Centre for Resource Management Information Paper No. 47.
Manley, B. 2016. Analysis of New Zealand forest transactions 2011-2013. NZ Journal of Forestry, 60 (4):29-32
Manley, B.; Bell, A. 1992: Analysis of the value of the State plantations sold in 1990. NZ Journal of Forestry 37(3): 22-27.
Manley, B.; Niquidet, K. 2010: What is the relevance of option pricing for forest valuation in New Zealand? Forest Policy and Economics 12: 299–307.

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