

# Forest Value as an Alternative Fact

New Zealand Institute of Forestry  
Nelson  
9 July 2018

Bill Liley, Indufor Asia Pacific



## Proposed Coverage

The proposed coverage includes:

|   |                                     |
|---|-------------------------------------|
| 1 | Introduction                        |
| 2 | The NZIF Forest Valuation Standards |
| 3 | Three approaches to valuation       |
| 4 | Methods across the ages             |
| 5 | The discount rate                   |
| 6 | The treatment of land               |
| 7 | Concluding comments                 |



# 1: Introduction

## Alternative facts .....

White House adviser Kellyanne Conway used the term alternative facts during an interview in January 2017, shortly after Donald Trump was inaugurated.

She said at the time that then-White House press secretary Sean Spicer provided "alternative facts" to reporters during his first press briefing.

The phrase "alternative facts" has topped a 2017 list of notable quotes.



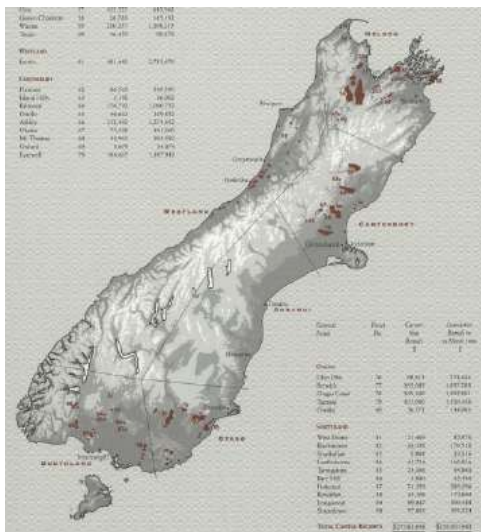
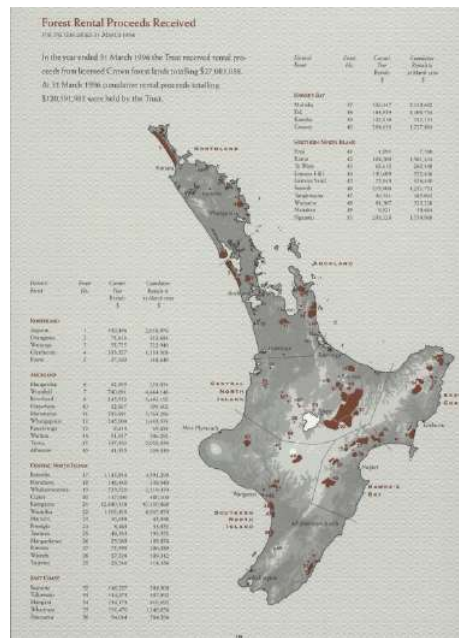
## 1: Introduction

WASHINGTON (July 3, 2018)— *“The string of insults, misstatements, exaggerations and outright falsehoods emanating from the White House began just after sunrise.”*

Given their proliferation, could "alternative facts" have a role to play in forest valuation?



## 2: NZIF Forest Valuation Standards - a Little History



### A New Zealand base:

- The Crown Forest Asset Sales in the period 1990-1996 resulted in the privatisation of approximately half of New Zealand's plantation forest area.
- The buyers included companies from New Zealand, Japan, China, Malaysia and USA.
- There had previously been local initiatives to develop forest value reporting mechanisms. These were specifically targeted at reporting *fair value*, avoiding the misleading results that could arise from Generally Applied Accounting Practices. Such initiatives, though were company-specific and had not proliferated
- The CFAS privatisation involved nearly 90 individual sale parcels. They were distributed across the length of the country. The vendor had a strong motivation to advise the bidders how they thought they should be priced.



**Indufor** ...forest intelligence

## 2: The NZIF FVS - Evolution

Faced with the three usual methods – *comparable sales, income and cost* – the compelling candidate for the CFAS process was the *income* approach. Reasons included:

- There was very little useful in-country transaction evidence
- Individual forests were very different in their circumstances and performance. Any process of extending comparable sales evidence was inherently challenging
- The commercial viability of the forests was still being proven. This denied the credibility of a cost-based approach.

New Zealand foresters were mostly very well versed in DCF techniques, and by 1990 the computer hardware and software for ambitious woodflow and cashflow generation was available. This further facilitated the income approach.





## 2: The NZIF FVS - Ongoing Activity

With the CFAS transactions based around an income approach, this set the pattern for subsequent activity:

- Revaluation for reporting asset values
- Subsequent resale of the forests to a new owner or equity participant

By 1993 it was evident that a sufficient body of practice was in place that it should be properly documented.

A Working Group within the New Zealand Institute of Forestry took the lead. In 1999 they published the NZIF Forest Valuation Standards.



## 2: NZIF FVS - 1999

The NZIF Forest Valuation Standards attempted a comprehensive coverage of forest valuation processes.

The document established standards and guidelines to be followed by members of the NZIF

It included a substantial orientation towards DCF-based analysis

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## 2: The NZIF FVS - Ongoing Activity

**MEMBERS OF NZIF  
FOREST  
VALUATION  
WORKING PARTY**

**1993**

Dr Bruce Manley (Convenor)  
Mr Alan Barnes  
Mr Peter Berg  
Mr Peter Clark  
Mr Steve Croskery  
Mr Jeremy Fleming  
Mr Peter Gorman  
Mr Bill Liley  
Mr Peter Casey (since 1994)  
Ms Tanya Lieven (since 1995)  
Mr Kevin Cooney (since 1996)  
Mr Brian Rawley (since 1996)

**2018**

Professor Bruce Manley (Convenor)  
Ms Jessica Brown  
Mr Gareth Buchanan  
Mr Philip Elworthy  
Mr Bill Liley  
Mr Angus Malcolm  
Mr Andre Neumann  
Dr Nick Ping  
Mr Brian Rawley  
Mr Rudolf van Rensburg  
Mr David Skilton



## 2: The NZIF FVS – since....

The Working Group has also produced technical papers that provide additions and updates to the FVS:

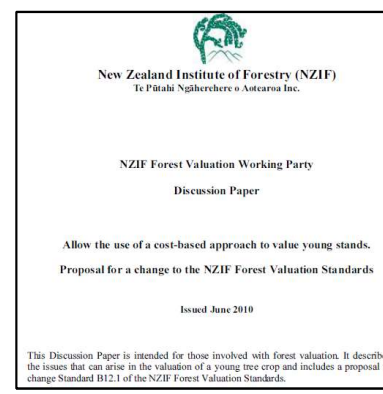
The  
compatibility of  
the NZIF FVS  
and IAS41



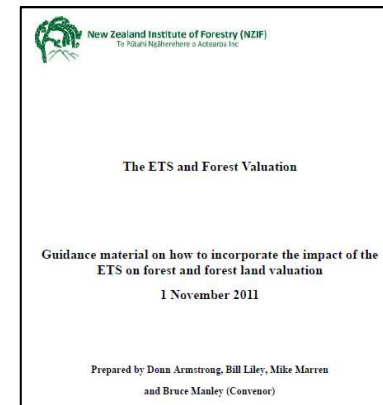
The treatment of  
land in a forest  
valuation



Cost-based  
approaches in  
valuing NZ's  
forests



Forest valuation  
recognising the NZ  
Emissions Trading  
Scheme



## 2: NZIF FVS – Recent Activity

Throughout the ongoing deliberations of the Working Group it has been recognised that it would be necessary, at some stage to produce a comprehensive update to the original document.

Such an update has, in fact has been underway for five years now.

A release of exposure drafts is approaching, but there have been some issues with which we have been pre-occupied.



## 2: What Constitutes a Forest? (an early opportunity for alternatives)

- The Components of Forest Value

|                |                                                                             |
|----------------|-----------------------------------------------------------------------------|
|                | Land value                                                                  |
| <i>plus:</i>   | Tree crops value*                                                           |
| <i>plus:</i>   | Other values (e.g. carbon, grazing, apiarist licenses, hunting licenses...) |
| <i>equals:</i> | <hr/> Forest Value                                                          |

\*Within the tree crops we can distinguish:

Current rotation ("1R")

Next and succeeding rotations ("2R+")

Perpetual rotations



### 3: Three Approaches to Value

**Comparable sales** (a.k.a “market”)

**Expectation value** (a.k.a. “capitalised income”, “income” )

**Cost** (a.k.a “replacement cost”)

**All** of the texts on valuation methodology refer to these.

They are all valid methods for estimating market/fair value



## 4: Methods Across the Ages





## 4: Methods Across the Ages

We can propose three broad stages in a stand's maturity

- Young
- Mid rotation
- Mature

What are their respective attributes that affect valuation? Is there any significance in defining three stages and applying three methods of valuation?



## 4: Methods Across the Ages – Mature

### Mature Stands

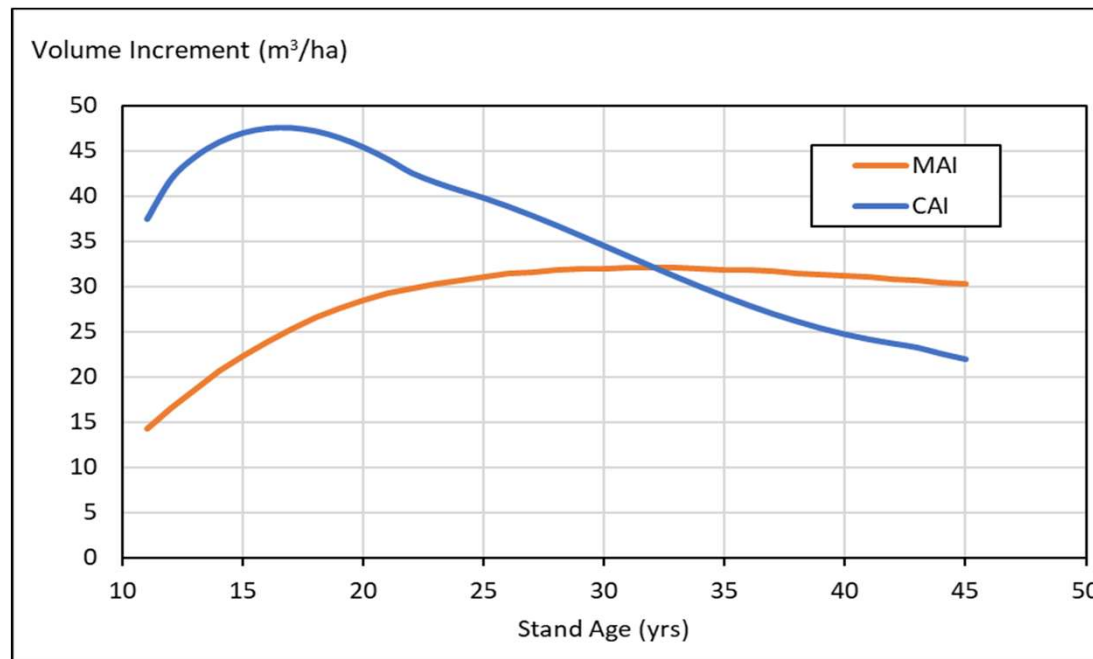
- Transaction evidence of delivered prices
- Transaction evidence of production costs (harvesting and transport)
- Derive residual stumpages by log type
- Cross-multiply the stumpages by the respective volumes from the processed Pre-Harvest Inventory (PHI)



## 4: Methods Across the Ages - Mature

If we are going to identify Mature Stands, how do we confirm maturity?

- There is a physical criterion



MAI = Mean Annual Increment

CAI = Current Annual Increment

- Capturing peak MAI is consistent with a target of maximising long term volume production



## 4: Methods Across the Ages - Mature

Gauging maturity?

There are also economic criteria

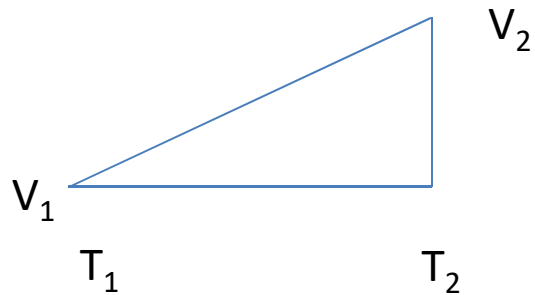
It is unwise to work off “conventional wisdom”, or generally demonstrated practice. The thorough-going forester considers:

- Total Recoverable Volume growth performance
- Ongoing change in log grade proportions
- Changing unit harvesting costs
  - » Piece size related
  - » Crew availability
- Real log price movement
  - » General
  - » Regional market absorption limits
- Other aspects of the operating environment



## 4: Methods Across the Ages - Mature

The marginal rate of value growth.



$$\triangle = V_2 - V_1$$

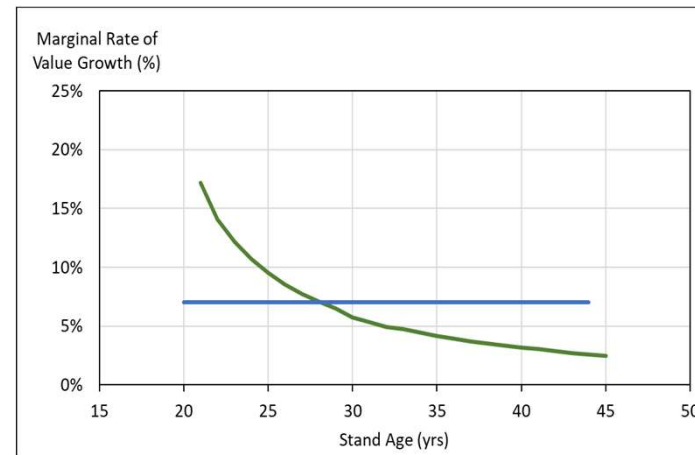
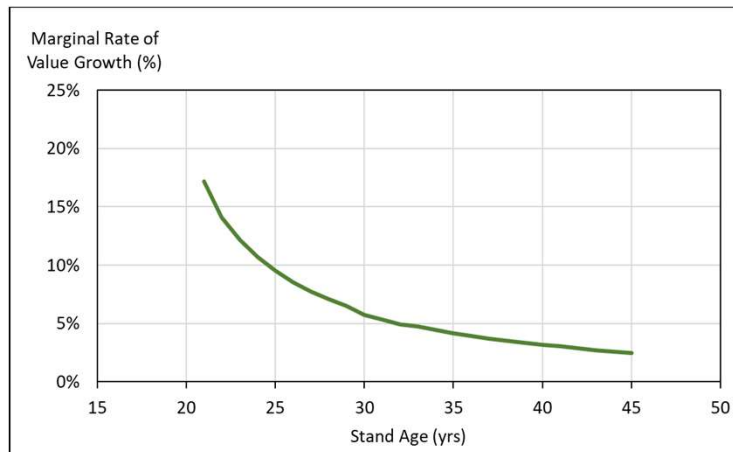
$$\text{Marginal rate} = \frac{V_2 - V_1}{V_1}$$



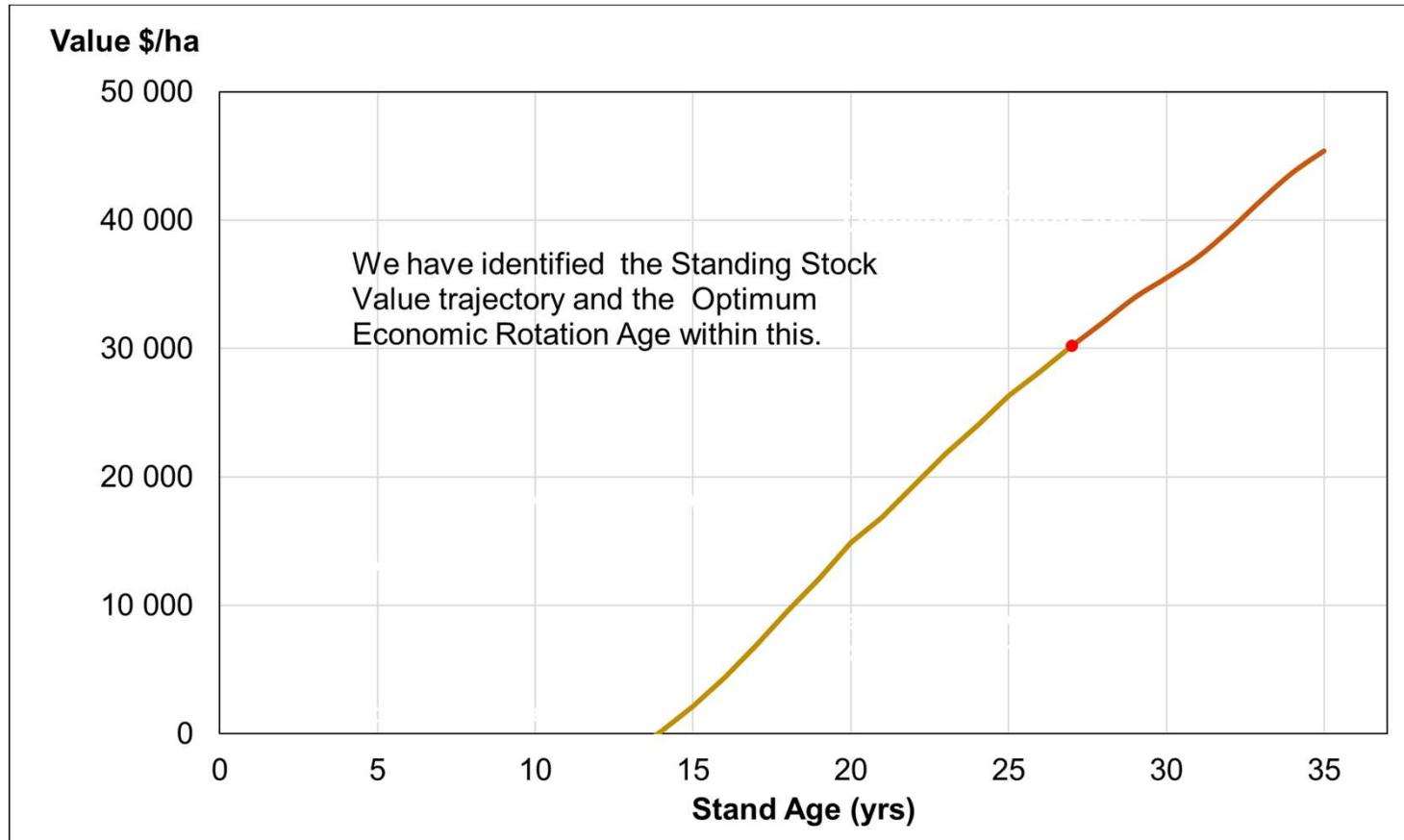
## 4: Methods Across the Ages - Mature

- Economic maturity?

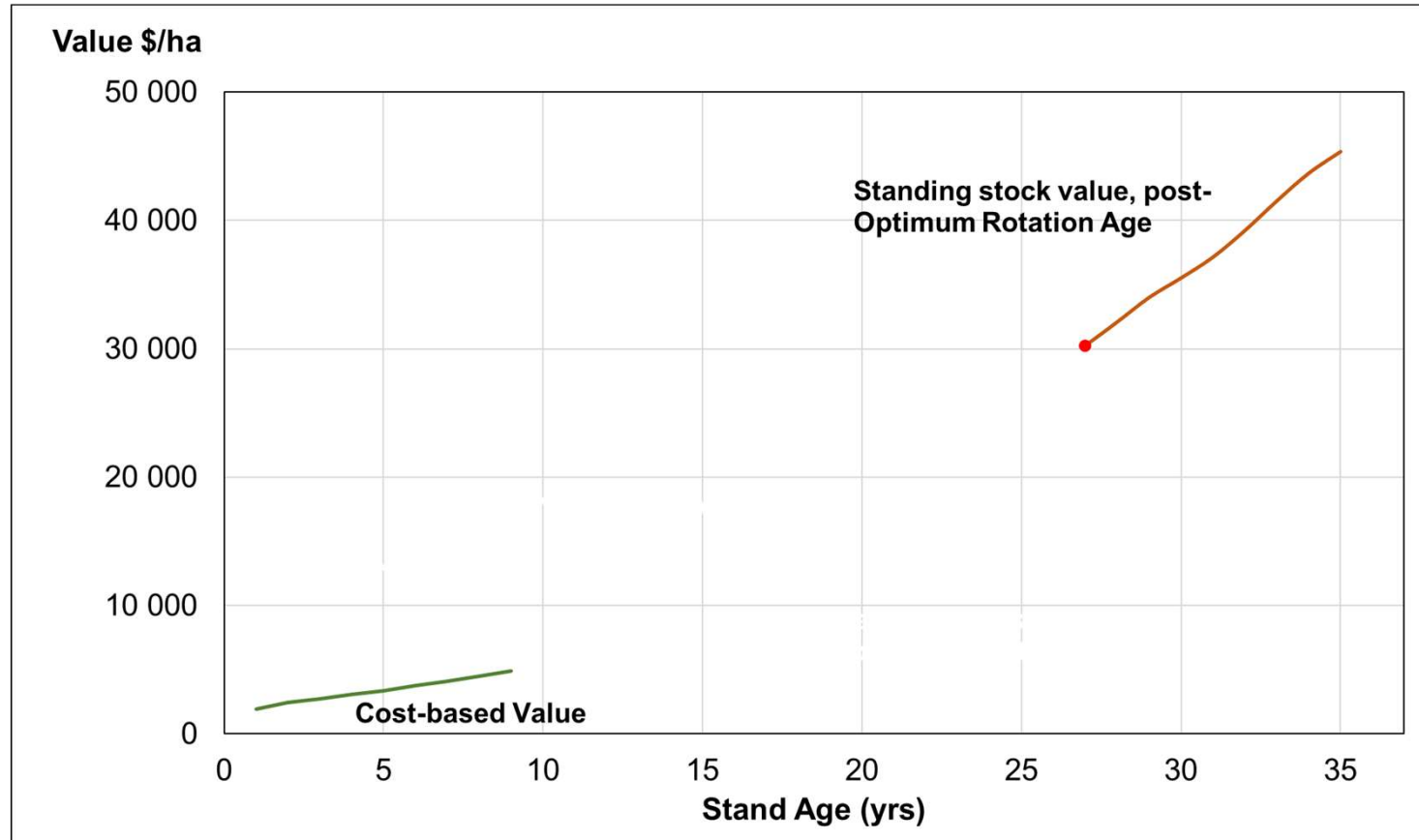
Once the marginal rate of value growth intersects the discount rate, one should harvest the stand



## 4: Methods Across the Ages - Mature



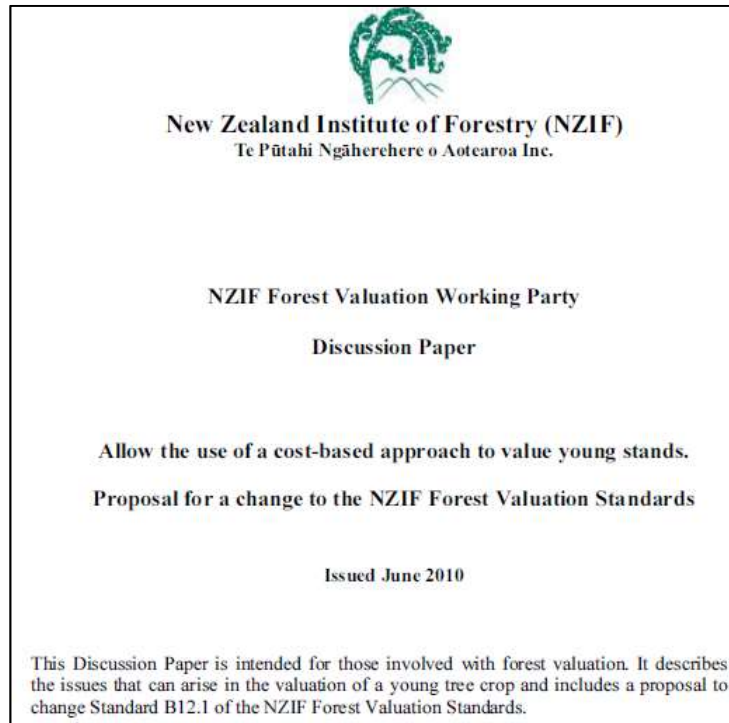
## 4: Methods Across the Ages - Young





## 4: Methods Across the Ages - Young

### Cost Approach



Hitchhiker's Guide to the Galaxy

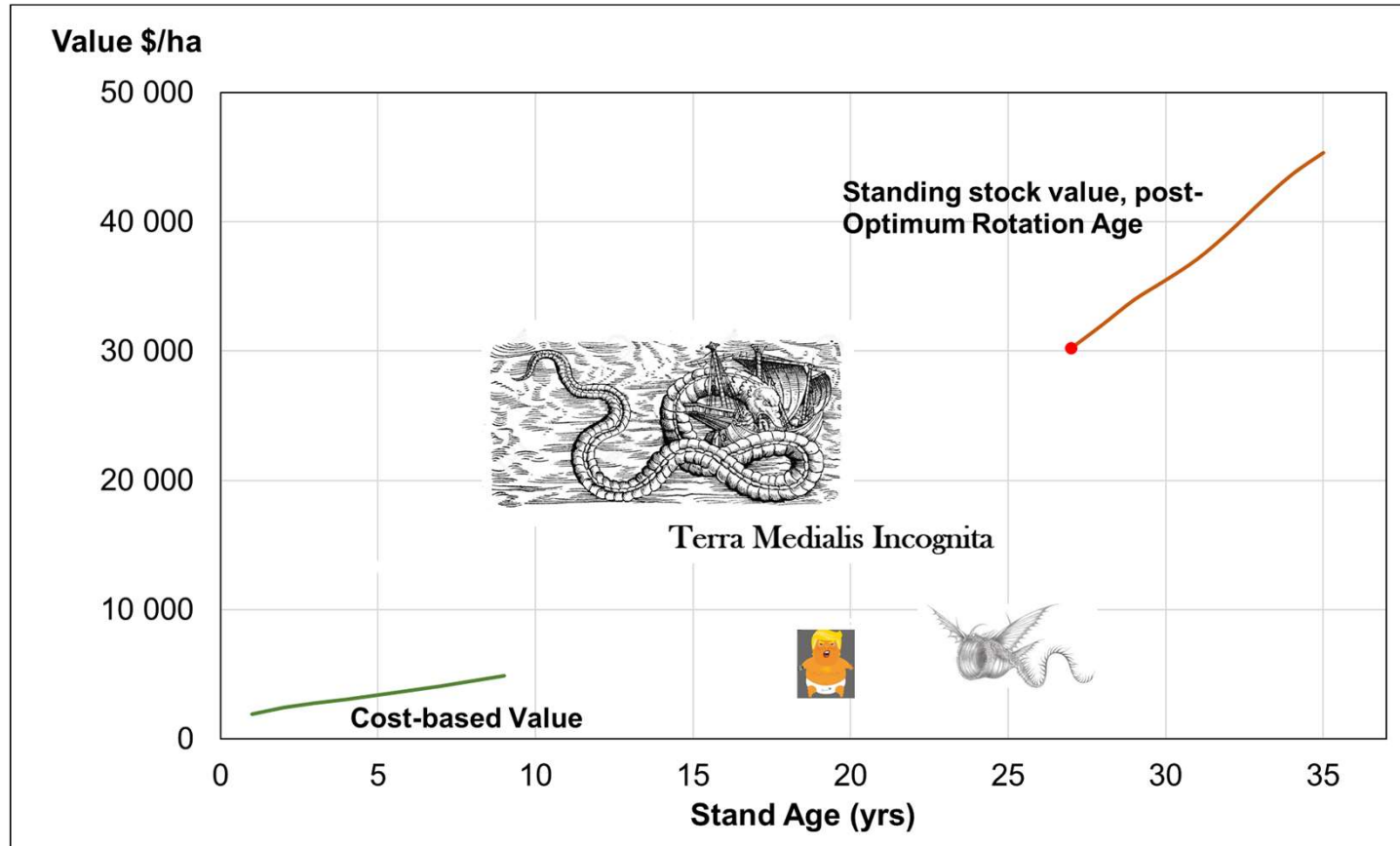
"Don't Panic".

NZIF guide to Cost Approach

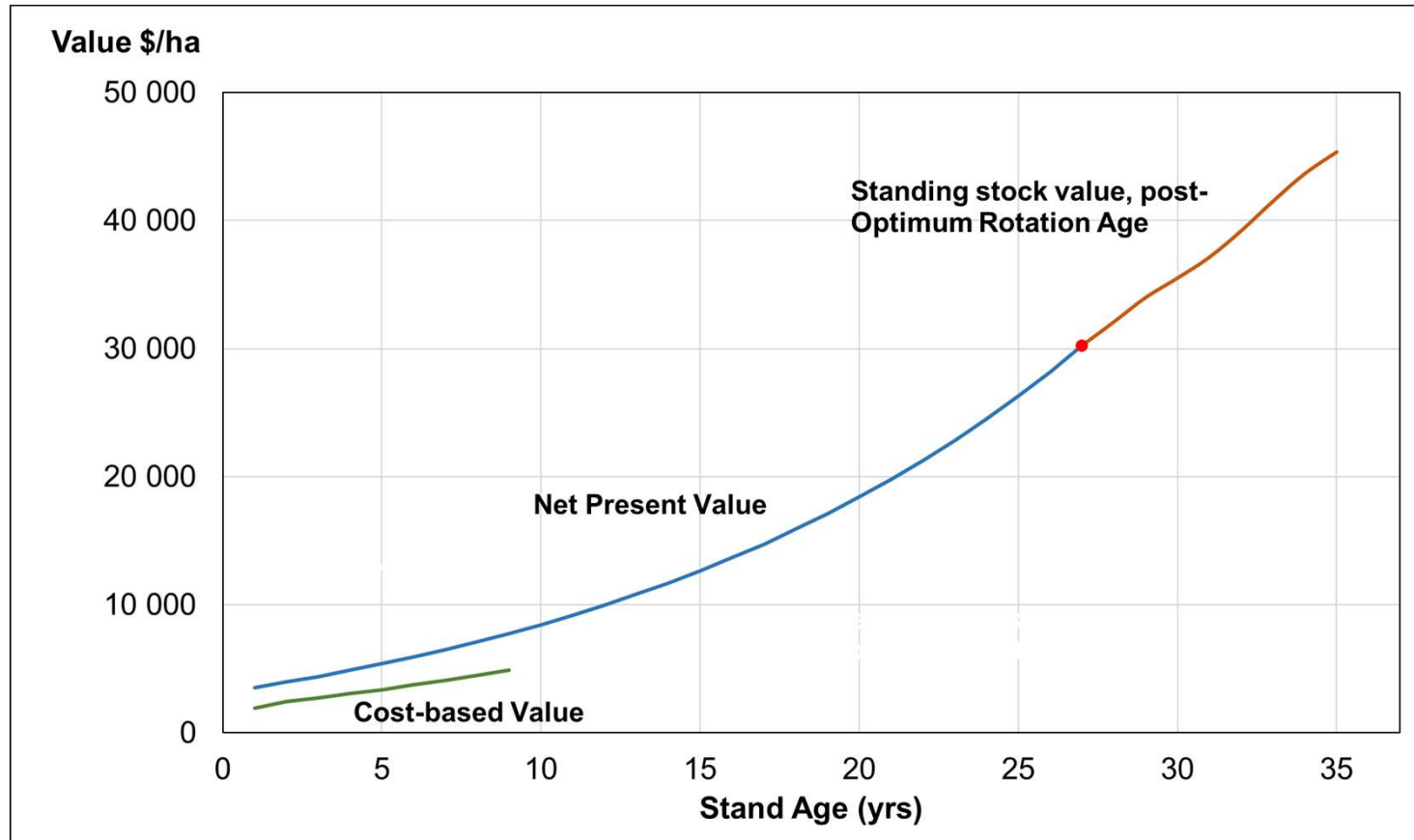
"Apply Common Sense"



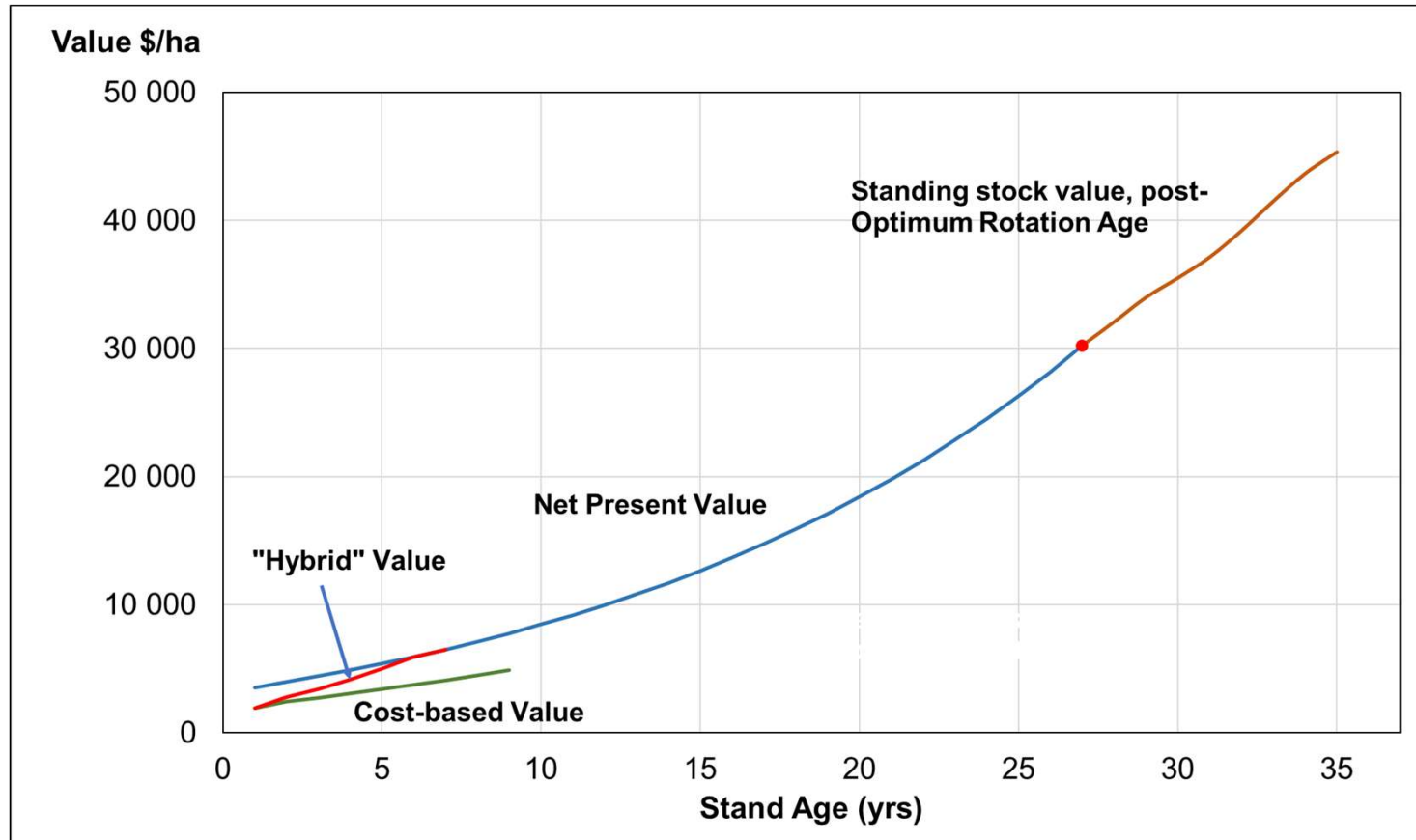
## 4: Methods Across the Ages – Mid-Rotation



## 4: Methods Across the Ages – Mid-Rotation

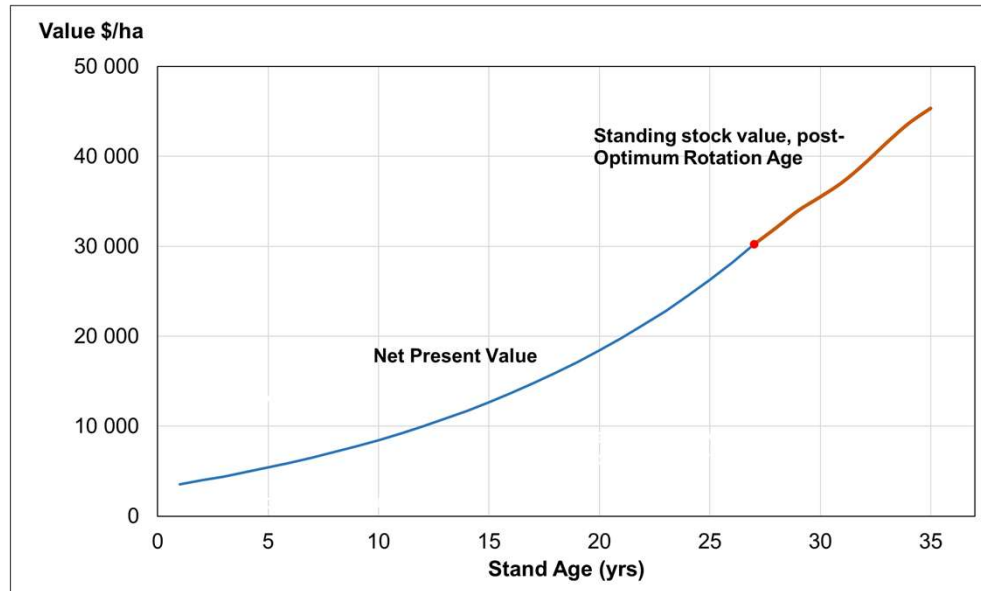


## 4: Methods Across the Ages – Mixing the Methods



## 4: Methods Across the Ages – Post - Mature

Here is a question though – if the stand has been grown on beyond the optimal economic rotation age, what happens to its value?



We have suggested that the harvest age is no longer optimal – should there be some form of impairment?

No – it is enough to recognise that although the standing stock value is valid, its year on year appreciation is less than the hurdle rate.

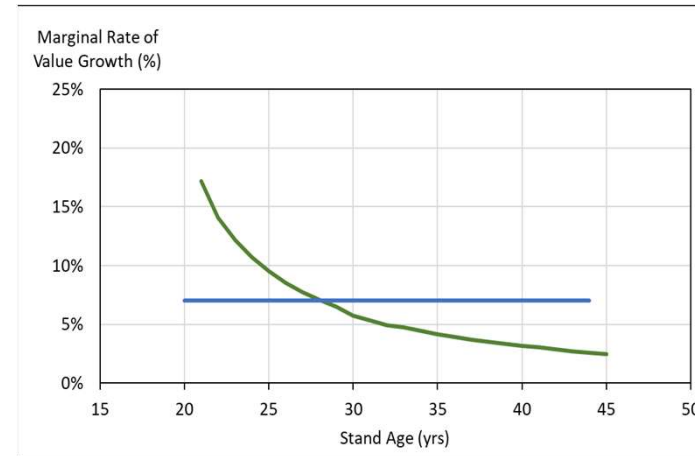
It is important to emphasize that we are only able to be comparatively unequivocal about the value in this manner if we are reasonably confident that we have indeed moved beyond the optimal economic rotation age.



## 4: Methods Across the Ages – Optimum Rotation Age

Recall that the indicated rule is:

*“Once the marginal value growth falls beneath the hurdle rate, then it is time to exit the investment cycle!”*



Disconcertingly, there is another rule:

*“None of the inputs to the calculation can be described with precision.”*

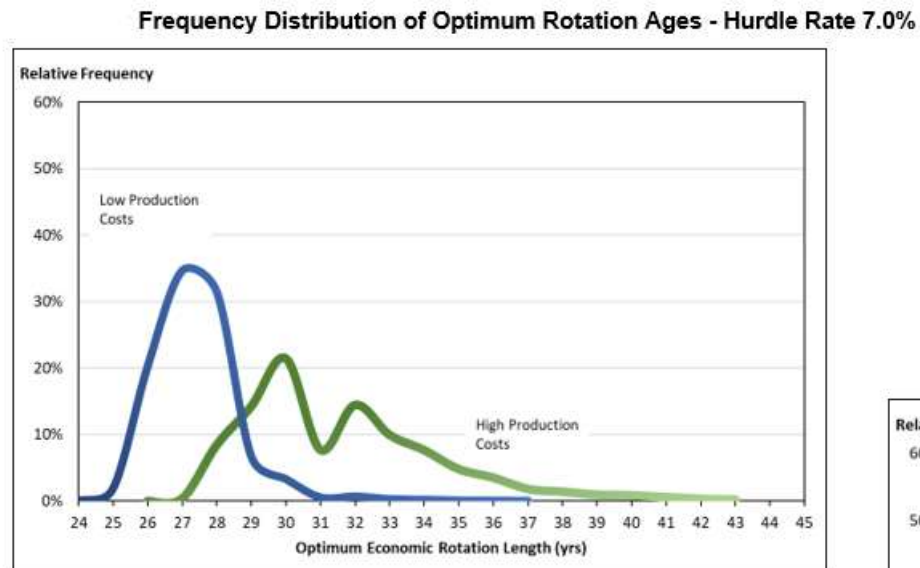
Frequency Distributions for Input Variables

|                            |  |                      |
|----------------------------|--|----------------------|
| Log price multiplier       |  | Normal distribution  |
| Harvesting Cost multiplier |  | Weibull distribution |
| Transport Cost multiplier  |  | Pert distribution    |

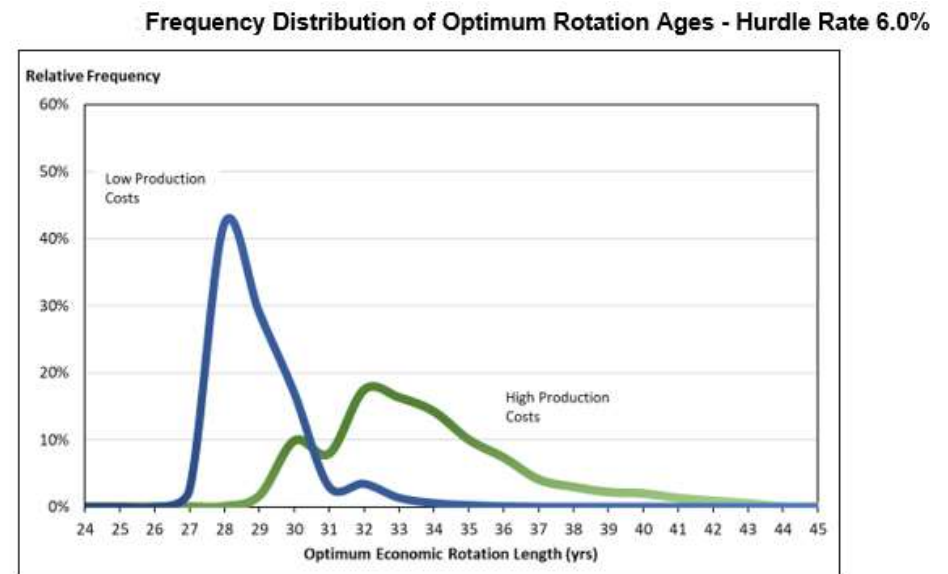
*[Distribution types for illustrative purposes only]*



## 4: Methods Across the Ages - Mature



Example results of Monte Carlo analysis



## 4: Methods Across the Ages – Latitude for Alternative Facts

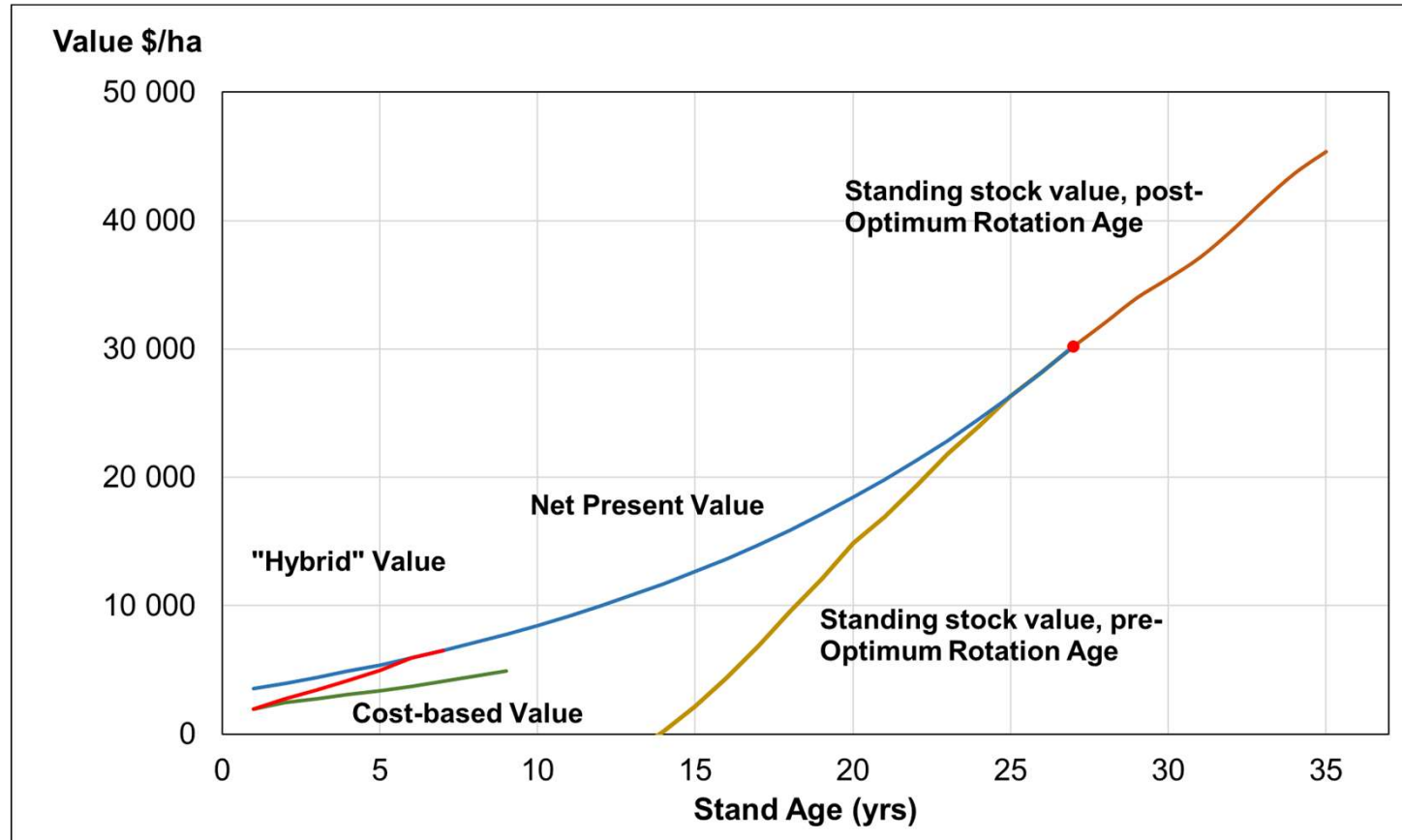
So what latitude have we still got for “alternative facts” when valuing the even aged stand?

There is still capacity for movement - not least because there is not any abundant transaction evidence for mid-rotation forests with a confined age-class distribution.





## 4: Methods Across the Ages – Latitude for Alternative Facts?



## 4: Methods Across the Ages – Latitude for Alternative Facts

One important observation that does distinguish the forest valuers from President Trump, Sean Spicer or Kellyanne Conway lies in the following declaration:

### **Nature of Value Estimate**

The appraiser's value estimate is their opinion of the probable price obtainable in a market free of abnormal influences. A basic limitation of any appraisal is that it is an opinion of value and is therefore not a guarantee that a property will sell at the appraised value.

The figure that the valuer provides is an estimate, and it represents the valuer's opinion. It is not an assertion of fact.

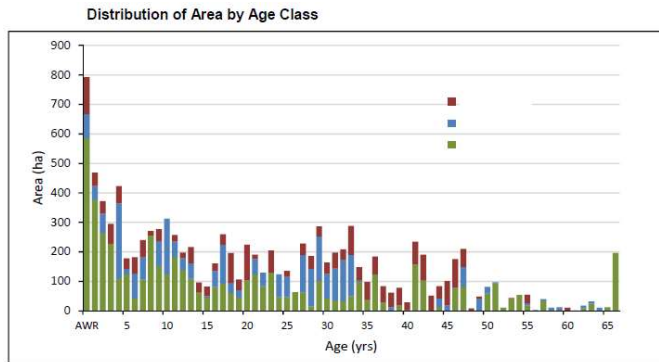


## Part 2: A Move to a Forest Estate Modelling Environment

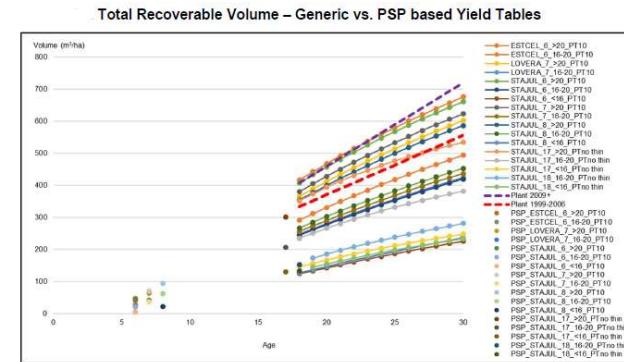


# Valuation Employing a Forest Estate Model

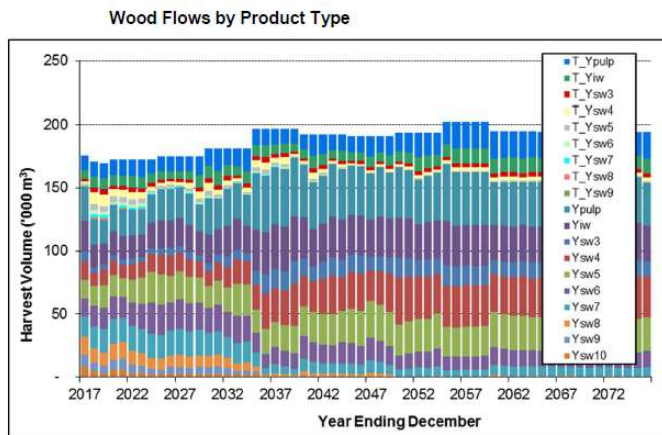
## Age Class Distribution



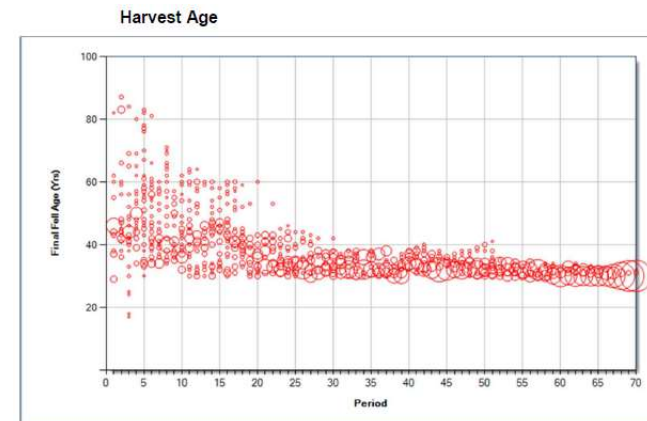
## Yield Tables



## Projected Woodflows



## Age of Harvest



# DCF Employing a Forest Estate Model

## Projected Cashflows

| PERPETUAL WOOD FLOW & CASH FLOW                  |                |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |        |
|--------------------------------------------------|----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------|
| Year End December                                |                | 2017      | 2018      | 2019      | 2020      | 2021      | 2022      | 2023      | 2024      | 2025      | 2026      | 2027      | 2028      | 2029      | 2030      | 2031      | 2032      | 2033      | 20     |
| <b>SUMMARY</b>                                   |                |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |        |
| <b>Volume</b>                                    |                |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |        |
| Roundwood volume from forest harvesting activity | [000 m3]       | 88.8      | 170.7     | 169.2     | 172.8     | 172.5     | 172.9     | 172.9     | 172.9     | 175.2     | 175.2     | 175.2     | 175.2     | 175.2     | 181.5     | 181.5     | 181.5     | 181.5     | 1      |
| Roundwood equivalent volume from used residue    | [000 m3]       | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -      |
| Total Delivered Wood Product Volume              | [000 m3]       | 88.8      | 170.7     | 169.2     | 172.8     | 172.5     | 172.9     | 172.9     | 172.9     | 175.2     | 175.2     | 175.2     | 175.2     | 175.2     | 181.5     | 181.5     | 181.5     | 181.5     | 1      |
| <b>Cash Flow</b>                                 |                |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |        |
| Revenue                                          | AWK: [AUD 000] | 6209.6    | 11114.7   | 11083.6   | 11203.7   | 11226.8   | 11195.4   | 11189.2   | 11156.9   | 11247.1   | 11282.4   | 11202.7   | 11281.0   | 11291.6   | 11239.8   | 11278.7   | 11065.5   | 11070.3   | 110    |
| Production Costs                                 | AWK: [AUD 000] | (1405.7)  | (3200.4)  | (3097.3)  | (3389.7)  | (3315.2)  | (3328.2)  | (3314.3)  | (3379.0)  | (3407.0)  | (3445.7)  | (3389.6)  | (3424.7)  | (3523.9)  | (3497.6)  | (3774.7)  | (3552.1)  | (3635.4)  | (375   |
| Transport Costs                                  | AWK: [AUD 000] | (1304.7)  | (2154.3)  | (2179.5)  | (2158.6)  | (2257.8)  | (2166.3)  | (2195.5)  | (1957.3)  | (2035.1)  | (1973.4)  | (2027.5)  | (1917.0)  | (1966.7)  | (2029.2)  | (2049.9)  | (1946.7)  | (1945.4)  | (194   |
| Third Party Share                                | [AUD 000]      | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -      |
| Operating Margin                                 | [AUD 000]      | 3299.2    | 5778.0    | 5806.9    | 5675.4    | 5655.8    | 5600.9    | 5679.3    | 5629.6    | 5805.0    | 5863.4    | 5885.6    | 5893.9    | 5799.2    | 5603.0    | 5454.1    | 5534.8    | 5491.3    | 53     |
| Operational Expenditure                          | AWK: [AUD 000] | (240.6)   | (816.3)   | (932.1)   | (956.6)   | (792.6)   | (1006.8)  | (920.2)   | (1051.7)  | (885.6)   | (872.0)   | (755.6)   | (932.0)   | (966.2)   | (973.4)   | (935.4)   | (912.7)   | (901.4)   | (97    |
| Capital Expenditure                              | AWK: [AUD 000] | (214.0)   | (520.7)   | (318.6)   | (297.7)   | (524.8)   | (385.6)   | (479.8)   | (400.5)   | (385.7)   | (370.9)   | (425.4)   | (384.0)   | (291.1)   | (375.2)   | (404.5)   | (425.0)   | (425.0)   | (41    |
| Area Based SG&A Expenditure                      | AWK: [AUD 000] | (561.4)   | (1129.0)  | (1095.1)  | (1085.2)  | (1085.2)  | (1085.2)  | (1085.2)  | (1092.6)  | (1092.6)  | (1092.6)  | (1092.6)  | (1092.6)  | (1094.5)  | (1094.5)  | (1094.5)  | (1094.5)  | (1094.5)  | (10    |
| Harvest Based SG&A Expenditure                   | [AUD 000]      | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -      |
| SG&A Modelled Using the 'Other' Worksheet        | [AUD 000]      | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -      |
| Investment Cash Flow before Non-Cash Charge      | [AUD 000]      | 2283.2    | 3302.0    | 3461.0    | 3235.8    | 3255.2    | 3411.1    | 3384.2    | 3284.8    | 3441.2    | 3528.8    | 3572.0    | 3473.3    | 3354.5    | 3144.0    | 3045.9    | 3123.0    | 3069.4    | 29     |
| Non-Cash Freehold Land Use Charge                | [AUD 000]      | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -      |
| Net Investment Cash Flow                         | [AUD 000]      | 2283.2    | 3302.0    | 3461.0    | 3235.8    | 3255.2    | 3411.1    | 3384.2    | 3284.8    | 3441.2    | 3528.8    | 3572.0    | 3473.3    | 3354.5    | 3144.0    | 3045.9    | 3123.0    | 3069.4    | 29     |
| <b>Cash Flow Timing</b>                          |                |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |        |
| Opening date of annual modelling period          | [Date]         | 01-Jan-17 | 01-Jan-18 | 01-Jan-19 | 01-Jan-20 | 01-Jan-21 | 01-Jan-22 | 01-Jan-23 | 01-Jan-24 | 01-Jan-25 | 01-Jan-26 | 01-Jan-27 | 01-Jan-28 | 01-Jan-29 | 01-Jan-30 | 01-Jan-31 | 01-Jan-32 | 01-Jan-33 | 01-Jan |
| Date of yield event in modelling period          | [Date]         | 30-Jun-17 | 30-Jun-18 | 30-Jun-19 | 30-Jun-20 | 30-Jun-21 | 30-Jun-22 | 30-Jun-23 | 30-Jun-24 | 30-Jun-25 | 30-Jun-26 | 30-Jun-27 | 30-Jun-28 | 30-Jun-29 | 30-Jun-30 | 30-Jun-31 | 30-Jun-32 | 30-Jun-33 | 30-Jun |
| Closing date of annual modelling period          | [Date]         | 31-Dec-17 | 31-Dec-18 | 31-Dec-19 | 31-Dec-20 | 31-Dec-21 | 31-Dec-22 | 31-Dec-23 | 31-Dec-24 | 31-Dec-25 | 31-Dec-26 | 31-Dec-27 | 31-Dec-28 | 31-Dec-29 | 31-Dec-30 | 31-Dec-31 | 31-Dec-32 | 31-Dec-33 | 31-Dec |
| Days between opening and closing date            | [Days]         | 365       | 365       | 365       | 366       | 365       | 365       | 365       | 366       | 365       | 365       | 365       | 366       | 365       | 365       | 366       | 365       | 366       | 365    |
| Days to yield event from opening date            | [Days]         | 180       | 545       | 910       | 1276      | 1641      | 2006      | 2371      | 2737      | 3102      | 3467      | 3832      | 4198      | 4563      | 4928      | 5293      | 5659      | 6024      | 6      |
| Date of cash flow occurrence                     | [Date]         | 30-Jun-17 | 30-Jun-18 | 30-Jun-19 | 30-Jun-20 | 30-Jun-21 | 30-Jun-22 | 30-Jun-23 | 30-Jun-24 | 30-Jun-25 | 30-Jun-26 | 30-Jun-27 | 30-Jun-28 | 30-Jun-29 | 30-Jun-30 | 30-Jun-31 | 30-Jun-32 | 30-Jun-33 | 30-Jun |
| Days from valuation date to cash flow occurrence | [Days]         | -         | 365       | 730       | 1096      | 1461      | 1826      | 2191      | 2557      | 2922      | 3287      | 3652      | 4018      | 4383      | 4748      | 5113      | 5479      | 5844      | 6      |
| <b>Cash Flow Discounting</b>                     |                |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |        |
| Discounting multiplier                           | [%]            | 100.0%    | 92.7%     | 84.9%     | 78.3%     | 72.1%     | 66.5%     | 61.3%     | 56.5%     | 52.0%     | 48.0%     | 44.2%     | 40.7%     | 37.5%     | 34.4%     | 31.9%     | 29.4%     | 27.0%     | 2      |
| Harvest dependent cash flow multiplier           | [%]            | 50.4%     | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 10     |
| Non-Harvest dependent cash flow multiplier       | [%]            | 50.4%     | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 100.0%    | 10     |

=SUMPRODUCT(Perpetual!G29:BN29,Perpetual!G46:BN46)



## 5: The Discount Rate



## 5: The Discount Rate – Categories

### Sources of the Discount Rate

WACC/CAPM

Implied Discount Rates (IDR)

Applied Discount Rates

Declared Discount Rates



## 5: The Discount Rate – WACC/CAPM

WACC:

$$WACC = \frac{k_e(1-t_c)E}{(1-t_c(1-\gamma))V} + \frac{k_d(1-t_c)D}{V}$$

Where:

|          |   |                                                                                                                                 |
|----------|---|---------------------------------------------------------------------------------------------------------------------------------|
| $k_e$    | = | cost of equity                                                                                                                  |
| $k_d$    | = | cost of debt                                                                                                                    |
| $E$      | = | market value of equity                                                                                                          |
| $D$      | = | market value of debt                                                                                                            |
| $V$      | = | $E + D$                                                                                                                         |
| $t_c$    | = | corporate tax rate.                                                                                                             |
| $\gamma$ | = | proportion of tax collected from the company which gives rise to the tax credit associated with an imputed or franked dividend. |

The WACC formula then invites the question of what should be the return to equity. A common approach is to turn to the Capital Asset Pricing Model (CAPM). A formula for this is:

$$k_e = r_f + \beta_L \times (R_m + \tau_m - r_f)$$

Where:

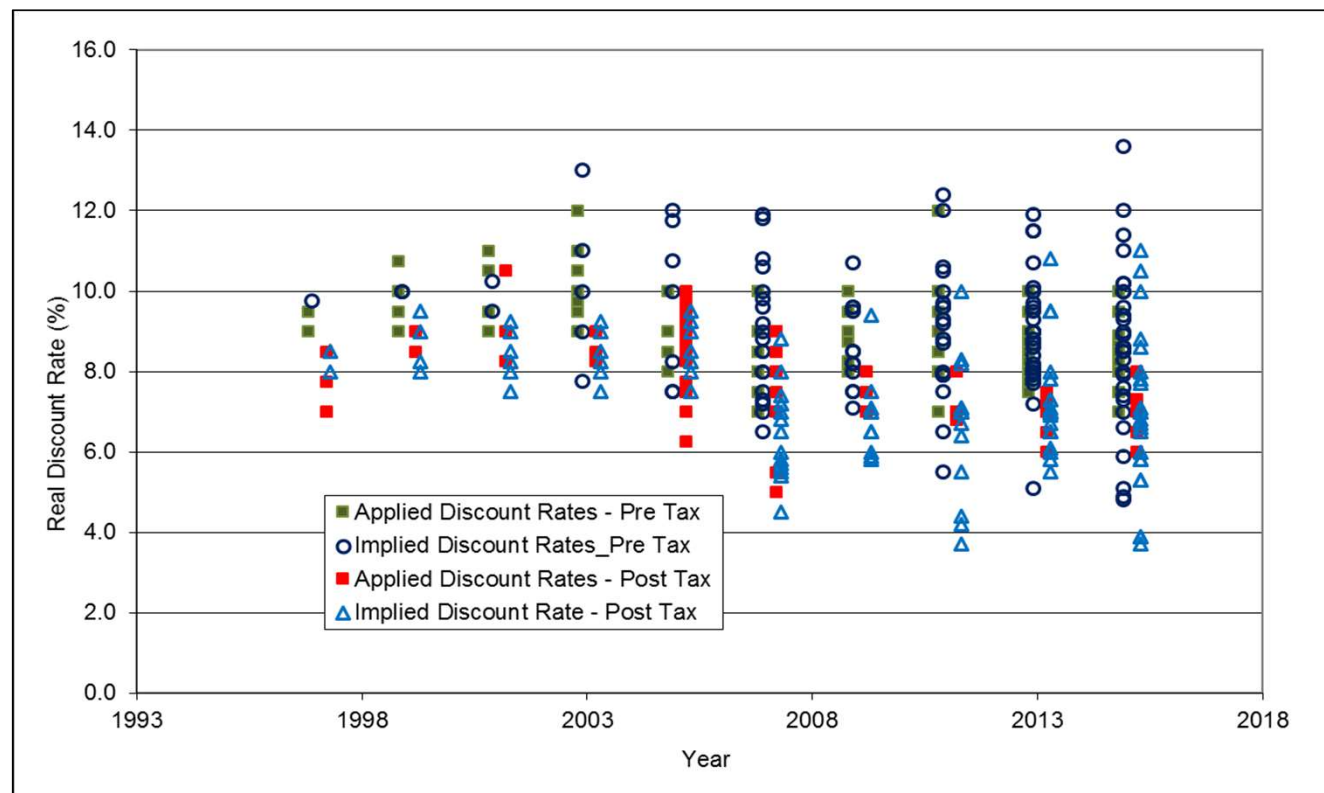
|           |   |                                         |
|-----------|---|-----------------------------------------|
| $\beta_L$ | = | the levered or geared beta              |
| $r_f$     | = | risk free rate                          |
| $MRP$     | = | $R_m + \tau_m - r_f$                    |
| $\tau_m$  | = | “value” of imputation tax credits       |
| $R_m$     | = | expected return on the market portfolio |





## 5: Implied Discount Rates

The long-running Manley surveys of implied and applied rates used by forest valuers.



**Indufor** ...forest intelligence

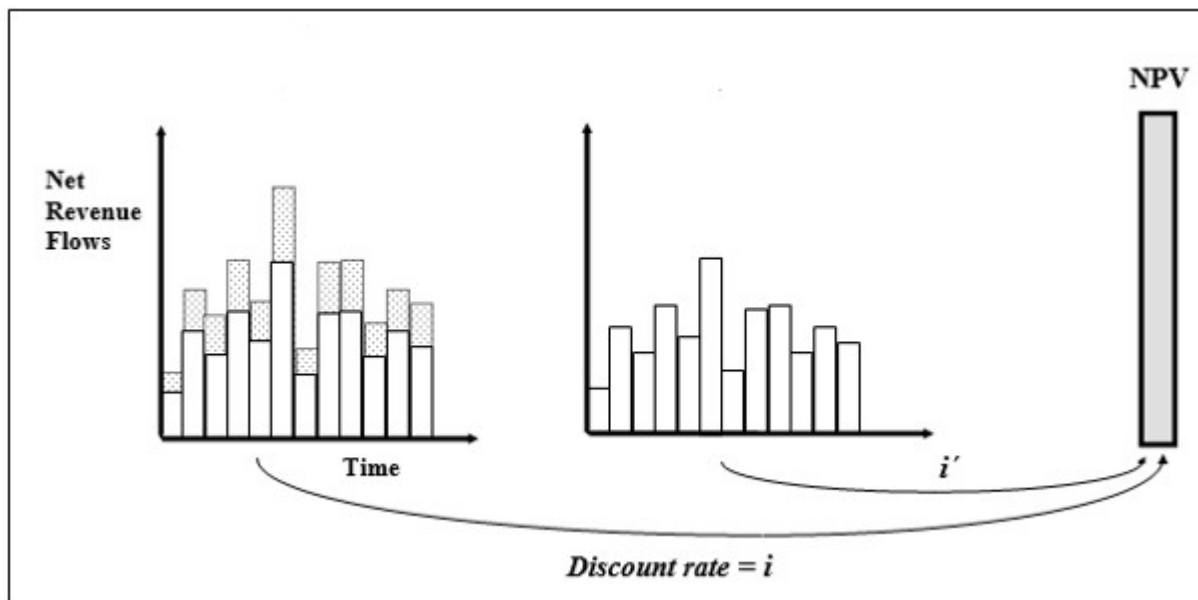
## 5: The Implied Discount Rate & Cashflow Format

- Fundamental to the concept of **market value** is that there is just one value for a timberland asset in a given market at a specified point in time
- In embracing the concept of **fair value** the accountancy profession has been moving on from a situation where a range of values could be defended as “technically correct”.
- Conceptually there is one single right answer - the figure on the cheque.



## 5: The Implied Discount Rate & Cashflow Format

- To have one figure on the cheque and yet multiple alternative forms of the cashflows means that something else has to give
- This is the discount rate



## 5: The Implied Discount Rate & Cashflow Format

There are a number of structural attributes in which cashflows may vary.

Examples are:

- Treatment of inflation - Real vs nominal
- Periodicity
- Term
- Timing
- Scope
- Investment cycle
- Harvest strategy
- Treatment of CAPEX vs OPEX
- Treatment of equity vs debt
- Acknowledgement of taxation
- Currency denomination
- Treatment of land
- Treatment of forest roads
- Treatment of risk



## 5: The Implied Discount Rate & Cashflow Format

- The Manley surveys now routinely canvass some of the bases for variation
- Responses confirm diverse practice; e.g.
  - **Taxation:** Four valuers apply the Income approach using only post-tax cashflows, nine valuers use only pre-tax cashflows, while three valuers use both.
  - **Timing of Cashflows:**

|                    |           |
|--------------------|-----------|
| Start of a period  | 4 valuers |
| Middle of a period | 8 valuers |
| End of a period    | 2 valuers |
  - **Investment Cycle:** When estimating the market value of a tree crop, 10 valuers only include cashflows from the current crop. However, the other 6 valuers undertake a multiple-rotation valuation as part of establishing a market value often as well as a single-rotation valuation that is accounting standard-compliant.



## 5: The Implied Discount Rate & Cashflow Format

14 example areas in which the cashflows might vary

If there were two alternatives in each (and this would clearly be an underestimate), the number of alternative combinations would be

$$2^{14} = 16\,384$$

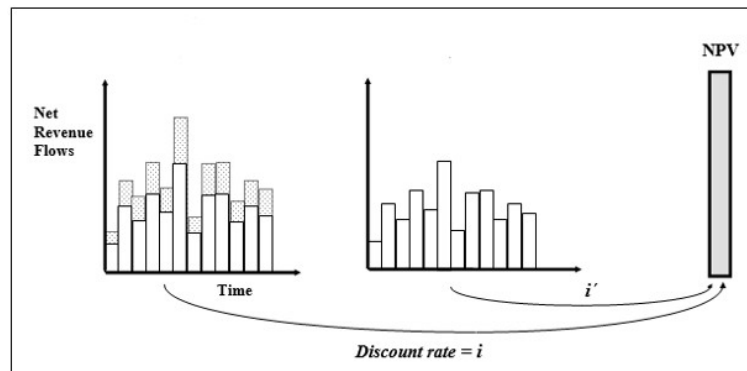
- |                                            |                               |
|--------------------------------------------|-------------------------------|
| • Treatment of inflation - Real vs nominal | • Treatment of CAPEX vs OPEX  |
| • Periodicity                              | • Treatment of equity vs debt |
| • Term                                     | • Acknowledgement of taxation |
| • Timing                                   | • Currency denomination       |
| • Scope                                    | • Treatment of land           |
| • Investment cycle                         | • Treatment of forest roads   |
| • Harvest strategy                         | • Treatment of risk           |

16 384 alternative forms of cashflows would need 16 384 unique IDRs to close on the same transaction value



## 5: The Implied Discount Rate & Cashflow Format

OK – but before we descend into paroxysms of despair, which drivers matter?



- |                                            |                               |
|--------------------------------------------|-------------------------------|
| • Treatment of inflation - Real vs nominal | • Treatment of CAPEX vs OPEX  |
| • Periodicity                              | • Treatment of equity vs debt |
| • Term                                     | • Acknowledgement of taxation |
| • Timing                                   | • Currency denomination       |
| • Scope                                    | • Treatment of land           |
| • Investment cycle                         | • Treatment of forest roads   |
| • Harvest strategy                         | • Treatment of risk           |



## 5: The Implied Discount Rate & Cashflow Format

Enter..... He Wenqian (Poppy)

- Masterate student at the School of Forestry.
- Supervisor Bruce Manley
- Assistance with an initial model structure and example inputs from Indufor Asia Pacific

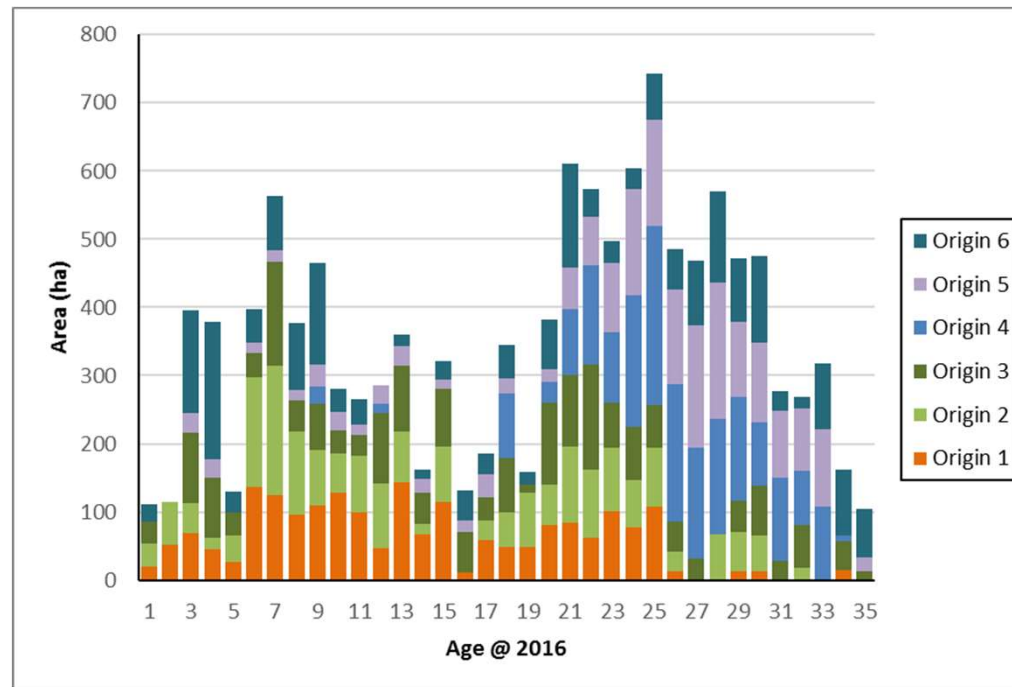




## 5: The Implied Discount Rate & Cashflow Format

### An Example Forest Estate

|               |                                    |                |                               |
|---------------|------------------------------------|----------------|-------------------------------|
| Area:         | 12 437.2 ha                        | Origins:       | 6                             |
| Yield tables: | 2 ( $MAI_{30} = 22.00$ & $26.13$ ) | Destinations:  | 8                             |
| Plunits:      | 800                                | Terrain types: | 2                             |
| Log types:    | 6                                  | Tenure types:  | 2 (Forestry right & freehold) |



## 5: The Implied Discount Rate & Cashflow Format

### An Example Forest Estate

The Base Case provides a tree crop value of 282.112 million

This is at a discount rate of 7.00% applied to real pre-tax cashflows from multiple rotations.

A terminal value based on perpetuating the average cashflow level in the last 10 years is included.

Example conventions in cashflow development that have been tested included:

- Yield regulation
- Market absorption limits
- Price development
- Current and multi-rotation



## 5: The Discount Rate – Implied Discount Rates

### Issues with the IDR - Inconsistent Procedures between Valuers

| Case | Scenarios           | Description                                                                                                                                                                                                   | Pre-tax   |         | Post-tax  |         | IRR    |
|------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------|-----------|---------|--------|
|      |                     |                                                                                                                                                                                                               | Perpetual | Current | Perpetual | Current |        |
| 0    |                     | Base case (partially regulated yield, no real log price increase, yield occurring at mid period, before tax cash flows). The NPV was discounted under discount rate of 7%, which is used as the market price. | 7.00%     | 6.42%   | 5.77%     | 4.74%   | 8.38%  |
| 1    | Yield regulation    | Unregulated                                                                                                                                                                                                   | 7.16%     | 6.59%   | 5.97%     | 4.92%   | 8.31%  |
| 2    |                     | 2% Smoothing                                                                                                                                                                                                  | 6.73%     | 6.17%   | 5.50%     | 4.56%   | 8.39%  |
| 3    |                     | Non declining yield                                                                                                                                                                                           | 6.15%     | 5.63%   | 5.06%     | 4.23%   | 7.95%  |
| 4    | Real price movement | Price ramp up 1% (only the first 5 years)                                                                                                                                                                     | 7.62%     | 7.21%   | 6.27%     | 5.41%   | 8.71%  |
| 5    |                     | Price ramp up 2% (only the first 5 years)                                                                                                                                                                     | 8.25%     | 7.99%   | 6.78%     | 6.08%   | 9.03%  |
| 6    |                     | Price ramp up 3% (only the first 5 years)                                                                                                                                                                     | 8.90%     | 8.77%   | 7.31%     | 6.74%   | 9.35%  |
| 7    |                     | Price ramp up 1% - over the 60 years                                                                                                                                                                          | 8.98%     | 8.22%   | 7.59%     | 6.33%   | 11.06% |
| 8    |                     | Price ramp up 2% - over the 60 years                                                                                                                                                                          | 10.51%    | 9.74%   | 8.96%     | 7.71%   | 13.24% |
| 9    |                     | Price ramp up 3% - over the 60 years                                                                                                                                                                          | 11.57%    | 10.81%  | 10.00%    | 8.80%   | 15.02% |
| 10   | Discount Timing     | Cash flow occurs in period-beginning                                                                                                                                                                          | 7.34%     | 6.90%   | 6.03%     | 5.09%   | 8.37%  |
| 11   |                     | Cash flow occurs in mid-period                                                                                                                                                                                | 7.00%     | 6.42%   | 5.77%     | 4.74%   | 8.38%  |
| 12   |                     | Cash flow occurs in period-end                                                                                                                                                                                | 6.70%     | 6.01%   | 5.56%     | 4.45%   | 8.39%  |
| 13   | Market absorption   | Unrestricted absorption                                                                                                                                                                                       | 7.42%     | 6.97%   | 6.08%     | 5.14%   | 8.44%  |

Variation in Implied Discount Rate  
impacted by different cash flow formats

A thesis submitted for the  
Master of Forestry Science

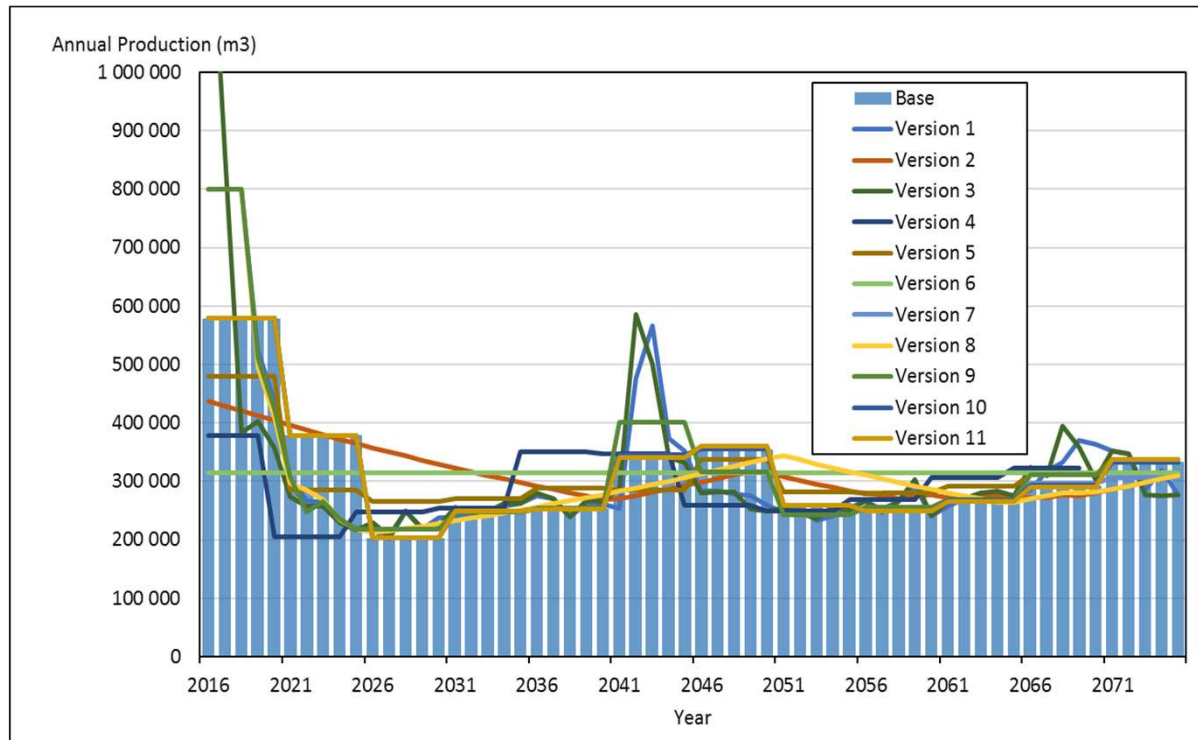
By Poppy He

University of Canterbury  
2017



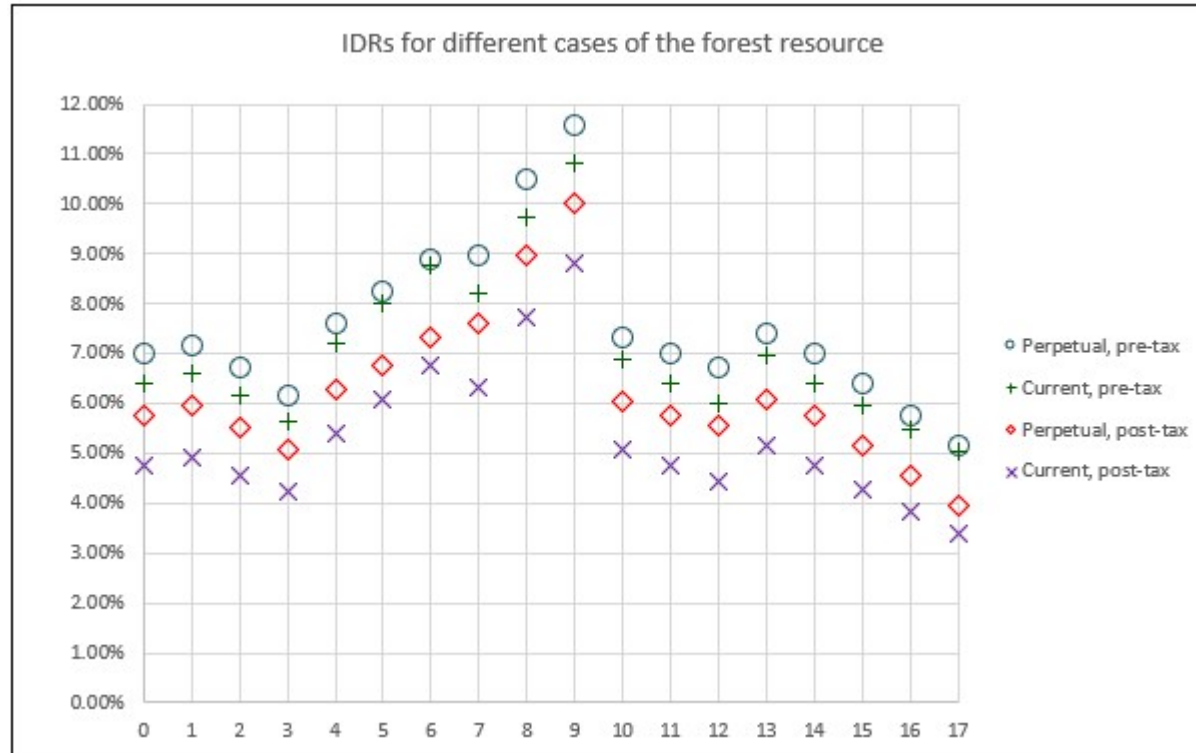
## 5: The Implied Discount Rate & Cashflow Format

### Woodflow profiles



## 5: The Discount Rate – Implied Discount Rates

### Issues with the IDR - Inconsistent Procedures between Valuers



Variation in Implied Discount Rate  
impacted by different cash flow formats

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2017



## 5: Declared Discount Rates

| Company                                           | 2014*                    | 2015*       | 2016*            | 2017*      | Cash Flows Basis                             |
|---------------------------------------------------|--------------------------|-------------|------------------|------------|----------------------------------------------|
| <b>Australia</b>                                  |                          |             |                  |            |                                              |
| Forest Products Commission (softwood plantation)  | 9.0%                     | 9.0%        | 9.0%             | 9.0%       | Current crop, pre-tax                        |
| Forest Products Commission (native forests)       | 9.5%                     | 9.5%        | 9.5%             | 9.5%       | Current crop, pre-tax                        |
| Forestry Corporation of NSW (softwood plantation) | 8.5%                     | 8.0%        | 7.5%             | 7.5%       | Current crop, pre-tax                        |
| Forestry South Australia                          | 7.6%                     | 8.5%        | 8.5%             | 8.5%       | Current crop, pre-tax                        |
| Forestry Tasmania (plantation and native forests) | 9.4%                     | 8.5%        | 9.4%             | 8.75%      | Current crop, pre-tax                        |
| Grand Ridge Plantations                           | 7.5%                     | 7.5%        | 7.0%             | 7.0%       | Current crop, pre-tax                        |
| Green Triangle Forestry Trust                     | 8.0%                     | 8.0%        | 7.5%             | 7.5%       | Current crop, not specified                  |
| Hancock Queensland Plantations                    | 10.9%/ 9.0% <sup>a</sup> | 10.2%/ 8.5% | 9.9%/ 8.5%       | 8.8%/ 7.5% | Current / Perpetual, pre-tax                 |
| Hancock Victorian Plantations                     | 7.5%                     | 7.5%        | 7.0%             | 7.0%       | Current crop, pre-tax                        |
| Hume Forests                                      |                          | 7.0%        | 7.0%             |            | Current crop, pre-tax                        |
| Midway Ltd                                        | 8.0%                     | 8.0%        | n/a <sup>b</sup> |            | Current crop, pre-tax                        |
| OneFortyOne Plantations                           | 8.5%                     | 8.0%        | 7.25%            |            | Current crop, pre-tax                        |
| VicForests (native forests)                       | 7.91%                    | 7.98%       | 7.71%            | 4.99%      | Current crop, 2014-16 pre-tax, 2017 post-tax |



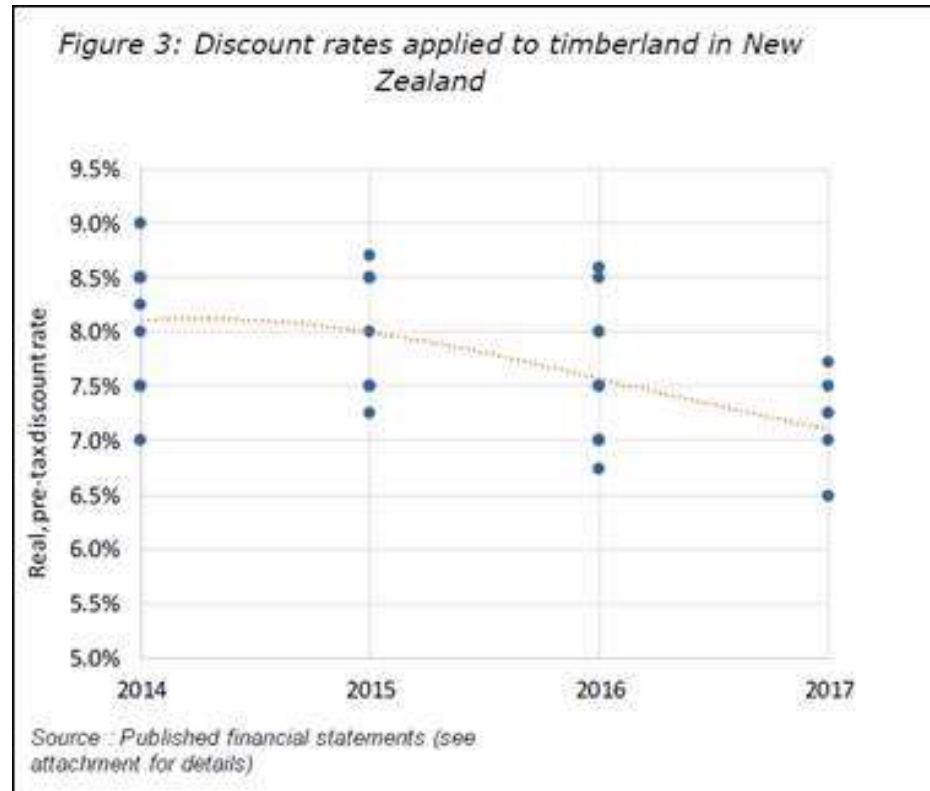


## 5: Declared Discount Rates

|                                                    |             |                   |             |             |                                               |
|----------------------------------------------------|-------------|-------------------|-------------|-------------|-----------------------------------------------|
| <b>New Zealand</b>                                 |             |                   |             |             |                                               |
| China National Building Materials                  | 6.5%        | 6.5%              | 6.5%        |             | Current crop, post-tax                        |
| Forestry Fund 9 NZ Limited - Hingarae <sup>c</sup> | 7.0%        |                   |             |             | Not specified, post-tax                       |
| Forestry Fund 9 NZ Limited – Clutha <sup>d</sup>   | 8.0%        | 7.5%              | 7.0%        |             | Not specified, pre-tax 2014, post-tax 2015-16 |
| Greenheart NZ Holding Co Ltd                       | 8.5%        | 8.5%              | 8.5%        | 8.5%        | Current, pre-tax                              |
| GTI 8 New Zealand Limited                          | 8.5%        | 8.5%              | 8.0%        |             | Current, pre-tax                              |
| Kaingaroa Timberlands                              | 7.5%        | 7.5%              | 7.0%        | 6.5%        | Perpetual 2014-16, current 2017, pre-tax      |
| Nelson Forests Limited                             | 8.25%       | 7.5%              | 7.5%        |             | Current crop, pre-tax                         |
| Pan Pac Forest Products                            | 7.0%        | 8.0%              | 7.5%        | 7.25%       | Not specified, post-tax 2014, pre-tax 2015-17 |
| SunChang Forestry NZ Ltd                           |             | 8.7%              | 8.6%        |             | Current crop, pre-tax                         |
| Taumata Plantations Ltd                            | 8.5%        | 7.5%              | 7.5%        | 7.25%       | Current crop, pre-tax                         |
| Tasman Bay Forest Company                          | 8.5%        | 8.5% <sup>d</sup> |             |             | Current crop, pre-tax                         |
| Te Waihou Plantations                              | 8.5%        | 8.5%              | 8.0%        |             | Current crop, pre-tax                         |
| Tiaki Plantations Company                          | 7.5%        | 7.25%             | 6.75%       | 6.5%        | Current crop, pre-tax                         |
| Timbergrow Plantations Company                     | 9.0% / 8.0% | 8.5% / 8.0%       | 7.5% / 8.0% | 7.5% / 8.0% | Current crop / carbon, pre-tax                |
| Wenita Forest Products Ltd                         | 7.5%        | 7.5%              | 7.0%        |             | Current crop, pre-tax                         |



## 5: Declared Discount Rates



<http://www.phaunostimber.com/content/uploads/2014/04/20180703-Stafford-2.7-Announcement.pdf>





## 6: The Treatment of Land



## 6: Treatment of Land

### Some Terminology

For our business it is impossible to avoid the reach of the International Financial Reporting Standards (IFRS).

They enforce a distinction between the asset values assigned to the land and to the tree crops.

Land value is reported according to IAS16 (Property, Plant and Equipment). Tree crops currently occupying the land are reported under IAS41 (Biological Assets)

At a general level this causes no disquiet with the NZIF FVS (which, notably pre-dated the release of IAS41).



## 6: Treatment of Land Some Terminology

At the outset I emphasized the terminology:

|               |                                   |
|---------------|-----------------------------------|
|               | <b>Land value</b>                 |
| <i>plus</i>   | <b>Tree crops' value</b>          |
| <i>plus</i>   | <b>Other assets (e.g. carbon)</b> |
|               | <hr/>                             |
| <i>equals</i> | <b>Forest value</b>               |



## 6: Treatment of Land Rent

Whichever standards we refer to, they do demand that the values of the components add up to the value for the whole forest.

An apparently simple situation is offered if the components are owned separately:

- a tree growing investor owns the trees
- another entity owns the land. The former pays the latter rent.

Utilising standard DCF, the tree grower's cashflows incorporate the rent charge.

Land value is underpinned by capitalisation of that same rent.

We see this well demonstrated.



## 6: Treatment of Land Notional Rent

Where the land and trees are in the hands of the same owner, there is no conceptual obstruction to assuming a *notional* rent.

As with an actual rent:

- The projected tree crop cashflows incorporate the notional rent (and so the tree crop value is less in consequence)
- Conversely, the notional rent is an income stream that is due to the land. It underpins its ascribed value.

Conducted carefully, the process provides two components that can credibly be added together to produce an overall “forest” value. This should neither double-count nor under-count the contributions of the respective components.



## 6: Treatment of Land Conducted Carefully...?

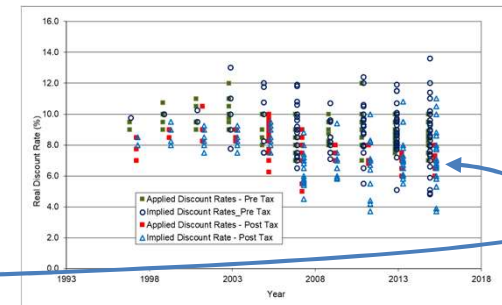
The previous slide indicated that a process involving notional rent needs to be “conducted carefully...” It looks fairly simple, so what is there to be careful about?

An immediate potential challenge is in the level of the rent. What should this be?

One apparent prospect would be to apply the discount rate that is used in valuing the tree crops to a perceived market value for the land.

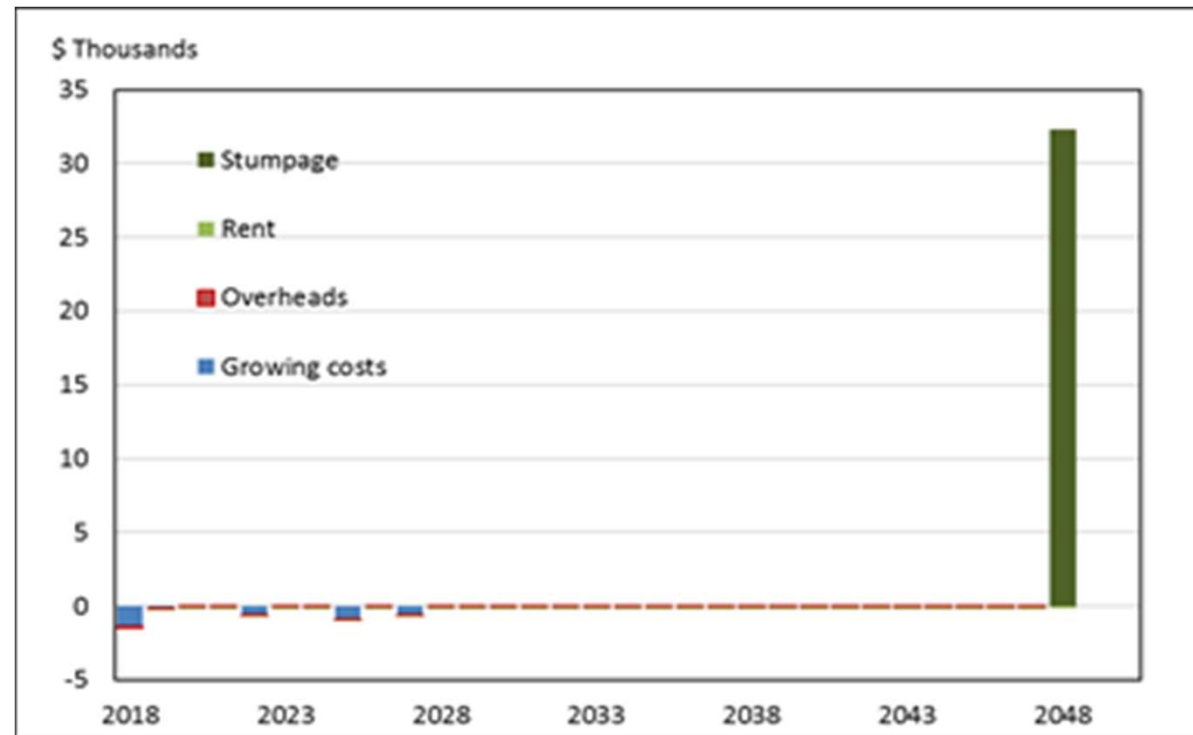
**Notional rent =  $i$  x Land Market Value ??**

Where  $i$  is the “forestry” discount rate  
...say 7%



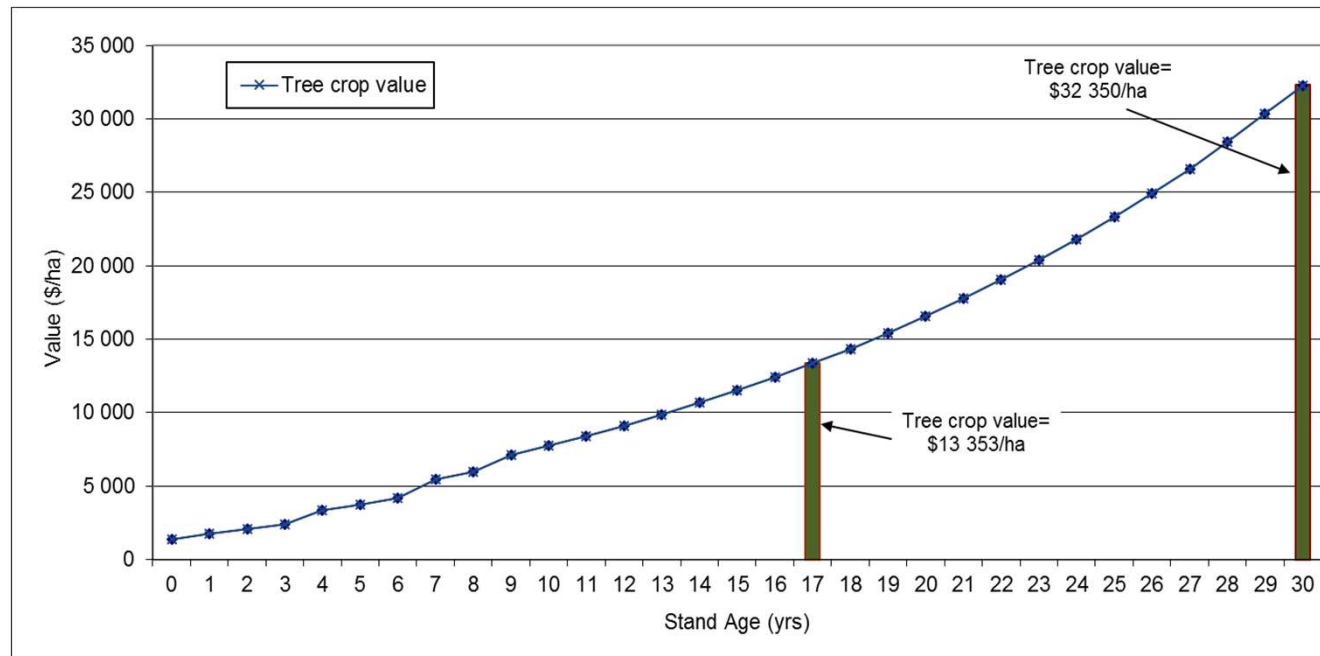
## 6: Treatment of Land Conducted Carefully...?

An illustration of the general form *cashflow profile* for a *single example hectare* of a tree crop is shown below:



## 6: Treatment of Land Conducted Carefully...?

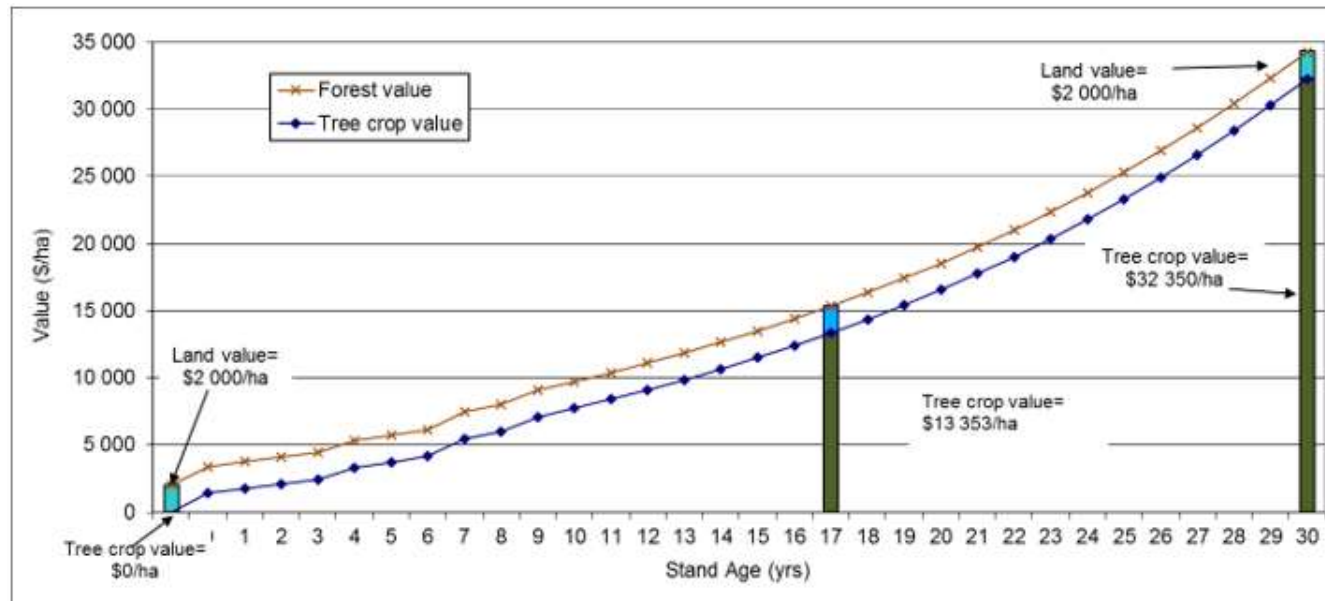
If we re-express this as the general form of accumulating value then the trajectory for the *tree crop* on the *single example rented hectare* is as shown below:





## 6: Treatment of Land Conducted Carefully...?

Moving now to a situation where the tree crop and land are owned by the same party, then we might conduct an analysis that represents both:

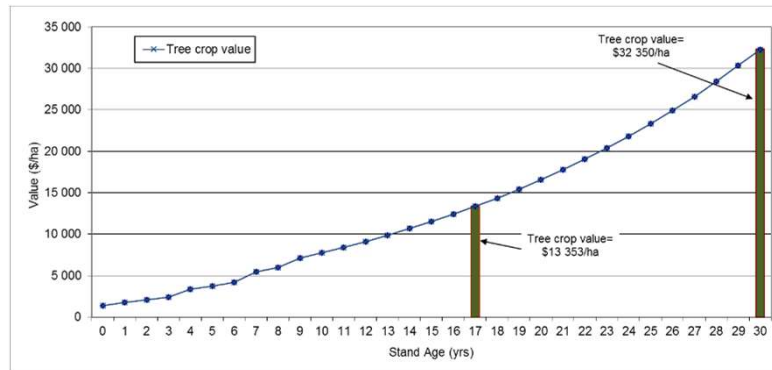


The figure here shows a DCF-based value profile with explicit representation of the land entering and then exiting the tree crop investment cycle as a lump sum.



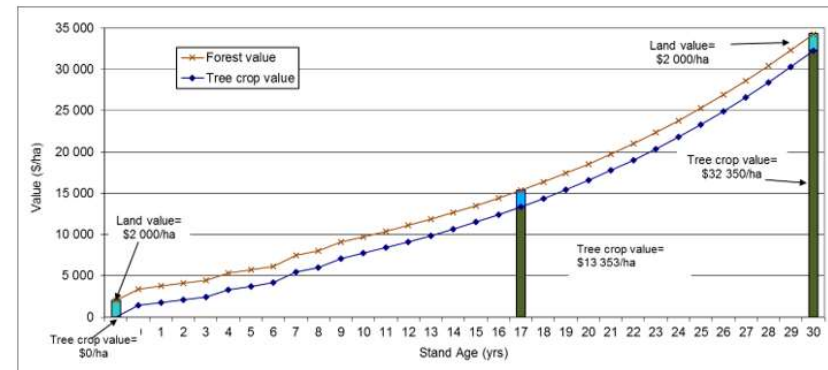
## 6: Treatment of Land Conducted Carefully...?

Tree crop on rented land



Freehold land:

Land-in ~ Land out model



Tree crop value = Forest  
value – Land value

If the rental rate (rent /LV) and the discount rate are the same, then the calculation produces the same tree crop value

This might seem sufficiently conceptually elegant to ensure that the tree crops' discount rate is indeed used as the rental rate.



## 6: Treatment of Land Conducted Carefully...?

However, when we go to find actual market rental rates, we typically find them lower than the tree-growing discount rate:

e.g. Forest valuation discount rate: **6 – 8 %** (real, pre-tax cashflows)

Land rental rate: **3.5 – 4.5%**

What might be afoot?

Two explanations beckon:

- The capitalisation rate for land ownership
- Land's real appreciation characteristics.



## 6: Treatment of Land

### Owning Land vs Owning Trees

| Attribute         | Tree growing                                         | Land owning                                                                                                                       |                                                                                                                  |
|-------------------|------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
|                   |                                                      | Leasehold                                                                                                                         | Freehold                                                                                                         |
| Revenue           | End of rotation                                      | Annual rent                                                                                                                       | Notionally annually, but not actually recovered until rotation-end                                               |
| Business collapse | Substantial or total loss of investment in tree crop | No forfeiting of rent actually received to date. Disruption in finding a new tenant. Possible need to remove inadequate tree crop | No recouping of notional rent. Land available for resale. Possible disruption if need to remove failed tree crop |
| Catastrophic loss | Loss of tree crop                                    | Land still intact                                                                                                                 | Land still intact                                                                                                |

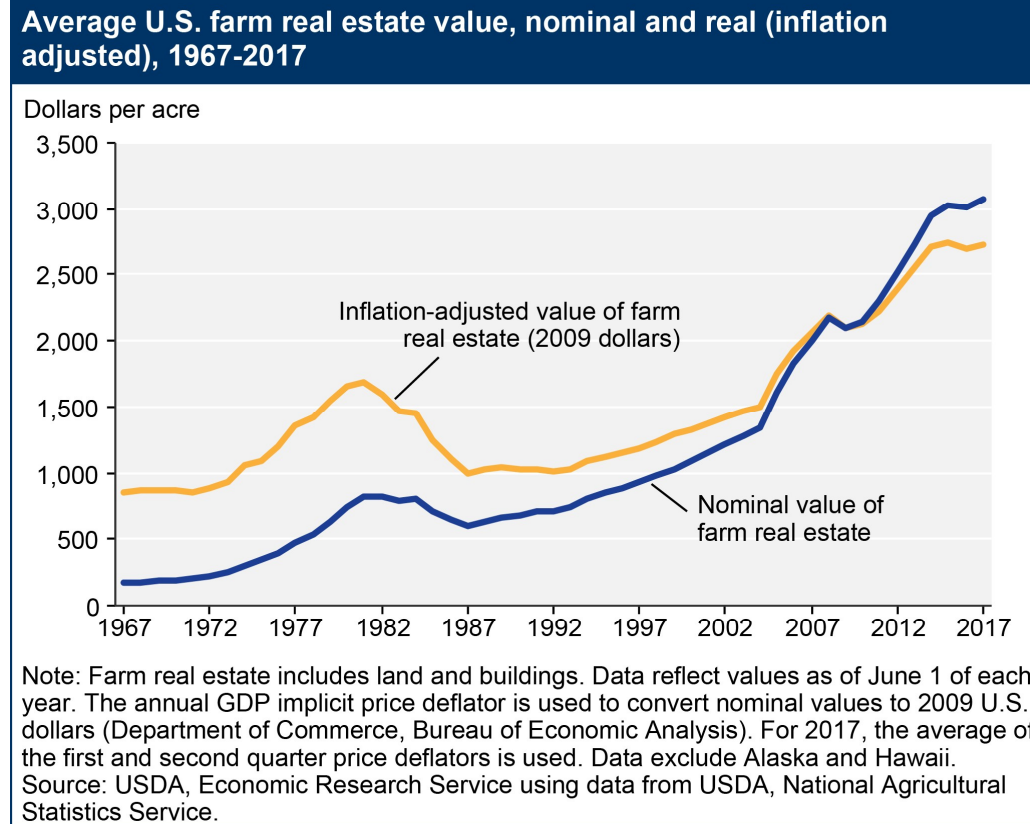
There are credible grounds for why the discount rates for the tree growing and land components of a forest venture might be quite different.



## 6: Treatment of Land

### Real Appreciation in Land Value

Real appreciation in land values is widely demonstrated.



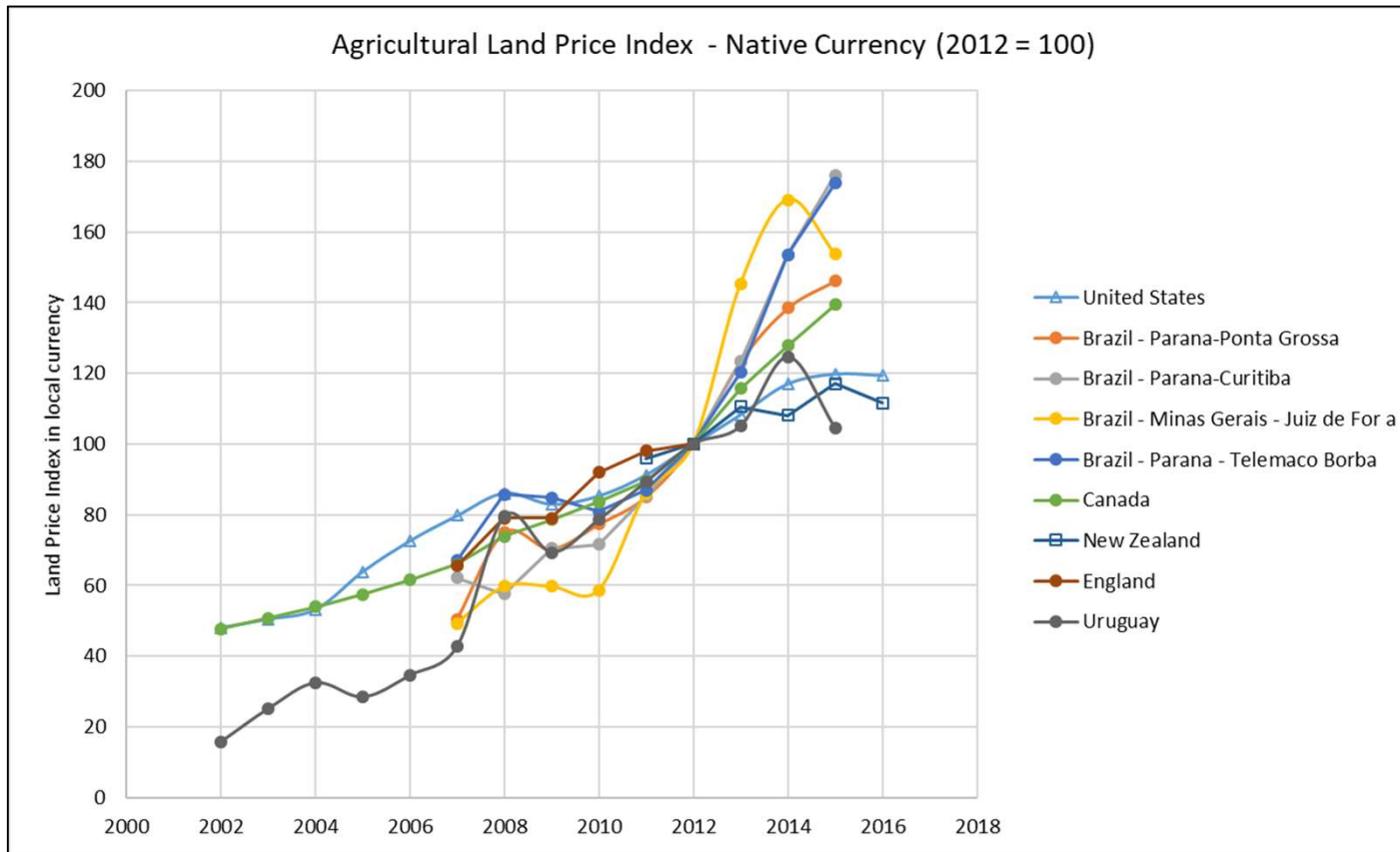
<https://www.ers.usda.gov/topics/farm-economy/land-use-land-value-tenure/farmland-value/>



## 6: Treatment of Land

### Real Appreciation in Land Value

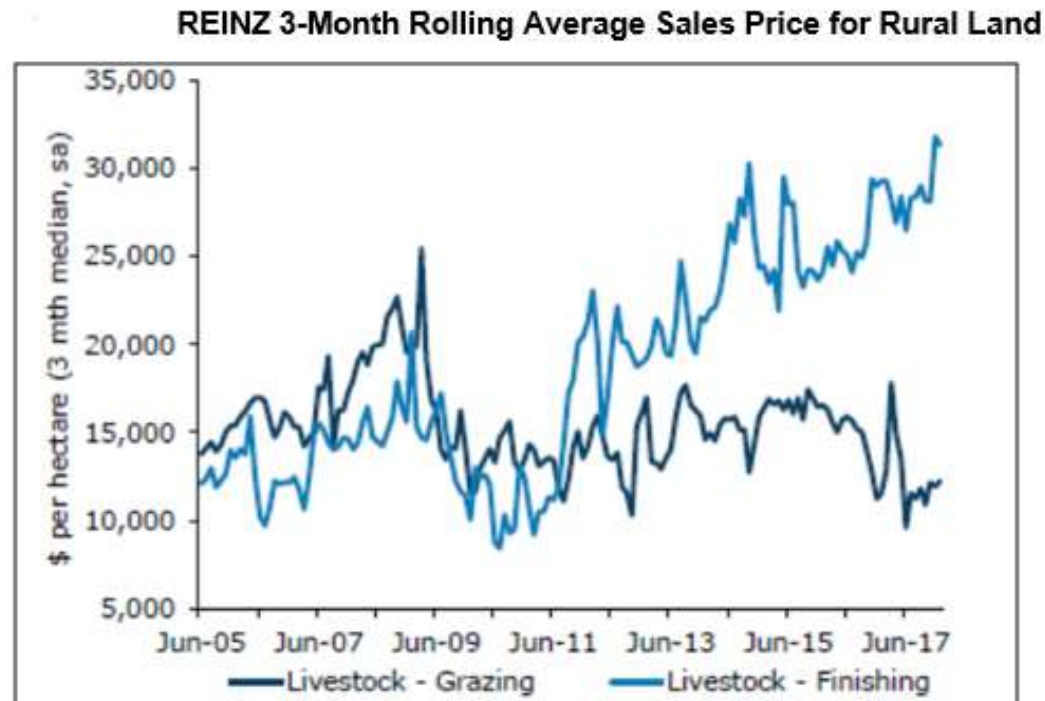
Real appreciation in land values is widely demonstrated.



## 6: Treatment of Land

### Real Appreciation in Land Value

Depending on the type of land, the evidence may be more equivocal



Source: ANZ, REINZ



## 6: Treatment of Land

### Real Appreciation in Land Value

This then allows the proposition that investors engage in land ownership to conduct two conjoint businesses

- One is based on obtaining revenue returns
- The other is based on obtaining any gains arising from long term appreciation.

On which components should the lessee be paying rent? The answer, clearly is just the revenue-based component. It is the lessor, and not the lessee who gets the benefit of the capital appreciation





## 6: Treatment of Land

### Have We Achieved Resolution?

So having addressed a distinct cap rate for land and the contribution of appreciation, are the issues now resolved?

- We can charge the tree growing business with a notional rent
- The rental rate that the notional rent represents is less than the tree-growing discount rate
- We can add the derived tree crop value to the land market value

Does this work?



## 6: Durable Assets

### The land~tree crop interface

- The Valuation Working Group of the New Zealand Institute of Forestry has produced a suggested treatment to handle the issue

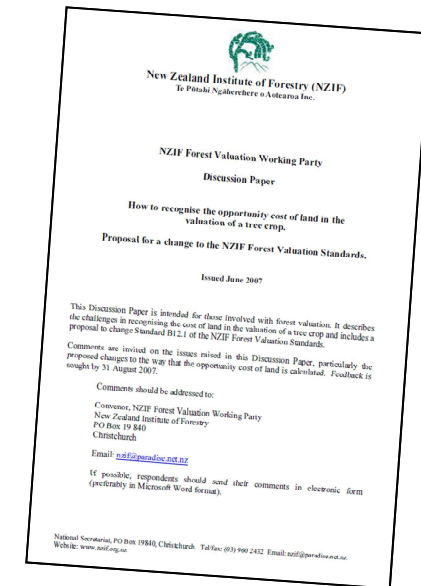
#### Example

##### Assumptions

|                                                                                |             |
|--------------------------------------------------------------------------------|-------------|
| <sup>1</sup> Assessment of market value of land by a Registered land valuer    | \$2500/ha   |
| <sup>2</sup> Assessment of prevailing rentals for the same land                | \$110/ha/yr |
| <sup>3</sup> Discount rate                                                     | 9.0%        |
| <sup>4</sup> NPV of the tree crop, with the cashflows incorporating the rental | \$7455/ha   |

##### Proposed report format

|                                                                                                     | \$/ha | \$/ha |
|-----------------------------------------------------------------------------------------------------|-------|-------|
| Tree crop value                                                                                     |       | 7455  |
| Land Value                                                                                          |       |       |
| <sup>5</sup> Attributable to revenue earning activity                                               | 1222  |       |
| <sup>6</sup> Attributable to real capital appreciation expectations and other less tangible factors | 1278  |       |
|                                                                                                     |       | 2500  |
| <sup>7</sup> Forest Value                                                                           |       | 9955  |



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## 6: Durable Assets

### The land~tree crop interface 10 years after ....

10 years after .... a reworked example with a land capitalisation rate

| Example                                                                                             |       |             |
|-----------------------------------------------------------------------------------------------------|-------|-------------|
| Assumptions                                                                                         |       |             |
| <sup>1</sup> Assessment of market value of land by a Registered land valuer                         |       | \$2500/ha   |
| <sup>2</sup> Assessment of prevailing rentals for the same land                                     |       | \$110/ha/yr |
| <sup>3</sup> Discount rate                                                                          |       | 9.0%        |
| <sup>4</sup> NPV of the tree crop, with the cashflows incorporating the rental                      |       | \$7455/ha   |
| Proposed report format                                                                              |       |             |
|                                                                                                     | \$/ha | \$/ha       |
| Tree crop value                                                                                     |       | 7455        |
| Land Value                                                                                          |       |             |
| <sup>5</sup> Attributable to revenue earning activity (Capitalised @ 5.0%)                          | 2200  |             |
| <sup>6</sup> Attributable to real capital appreciation expectations and other less tangible factors | 300   |             |
|                                                                                                     |       | 2500        |
| <sup>7</sup> Forest Value                                                                           |       | 9955        |



## 6: Treatment of Land

### Have We Achieved Resolution?

Inconveniently, it appears that we may not. As we look to make further sense of transaction evidence, there seem to be other factors.

The best rationalisation that we can currently offer relates to perceived “liquidity”.

The proposition is that once a land tract is occupied by a tree plantations, this limits the potential universe of buyers.



## 6: Treatment of Land Liquidity

When the land was purchased, the price paid that matched that from competing land uses.

As a planted “tree crop”, we can change the land use back at the end of the current rotation (with FWP conversion costs).

The tree crop is paying a commercial, competitive rent - shouldn't the afforested land be worth as much as the adjacent grazing land that is receiving the same rent?

In a bare state, at the end of the current rotation, the land can rejoin the market. Whatever interim real appreciation has occurred can be crystallised.



## 6: Treatment of Land Liquidity

So why, then should afforested land be subject to some additional discount? Consider the universe of buyers:

- When the land is occupied by trees, the buyer universe is confined to those who want to continue to grow trees on it, or maybe grow trees and then convert. Investors vary in their patience levels, and the more patience is required, the smaller the buyer universe.
- Investors do consider the liquidity of ventures. They pay less where the capacity to offload promptly is constrained.
- Sources of debt are more leery where the liquidity is doubtful. When they are stand-offish, the opportunities to leverage the investment are restricted.



## 6: Treatment of Land Liquidity - contd

Tree growing ventures may impose their own special limitations on the process by which the land may be sold and a flexibility of use re-established.

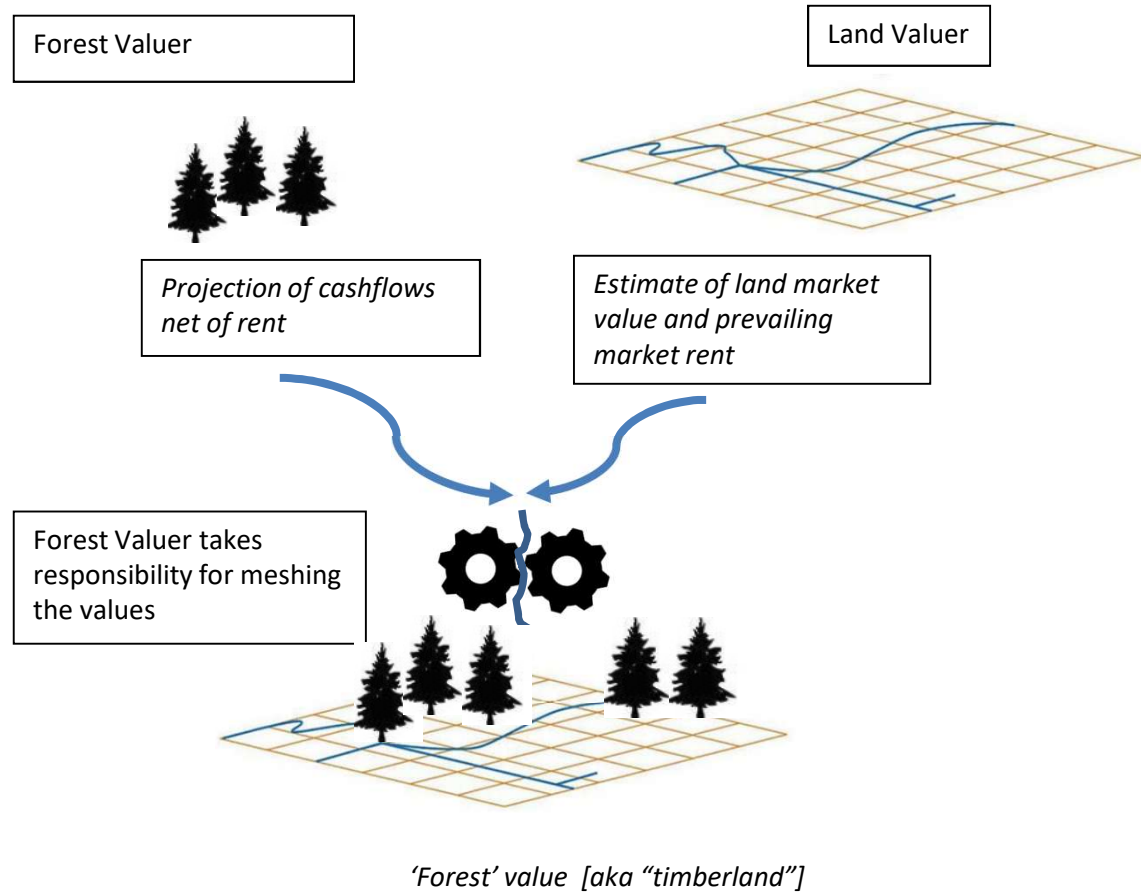
- The land cannot necessarily be sold on an incremental basis as harvested
- While a forest estate may have been established by buying a block at a time, the circumstances at divestment are more likely to involve selling the complete estate. Once again, the universe of buyers may be limited.

Quantification of the ‘liquidity adjustment’ remains work in progress.



## 6: Treatment of Land A Combined Effort

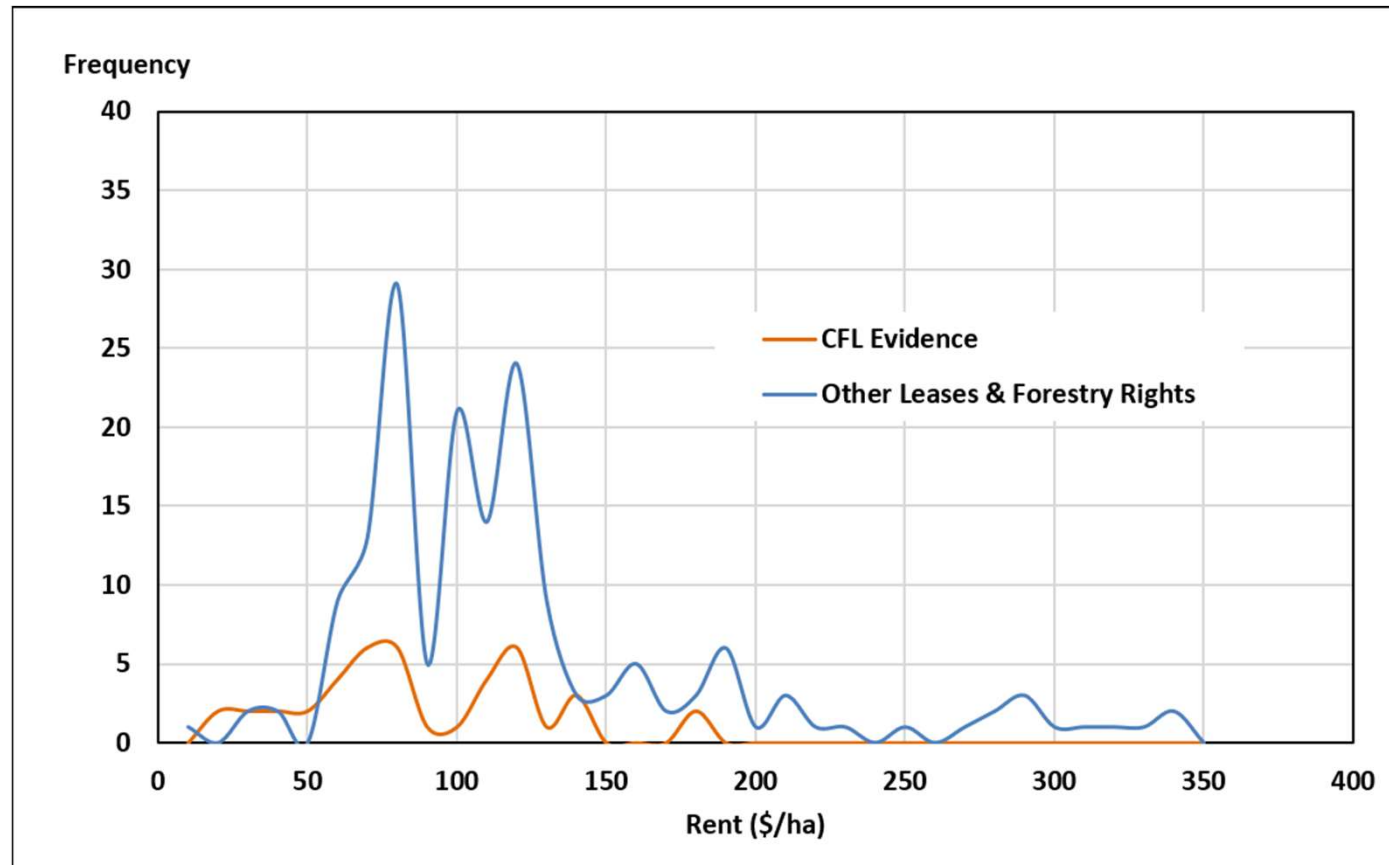
The process involves Forest Valuers and Land Valuers combining forces





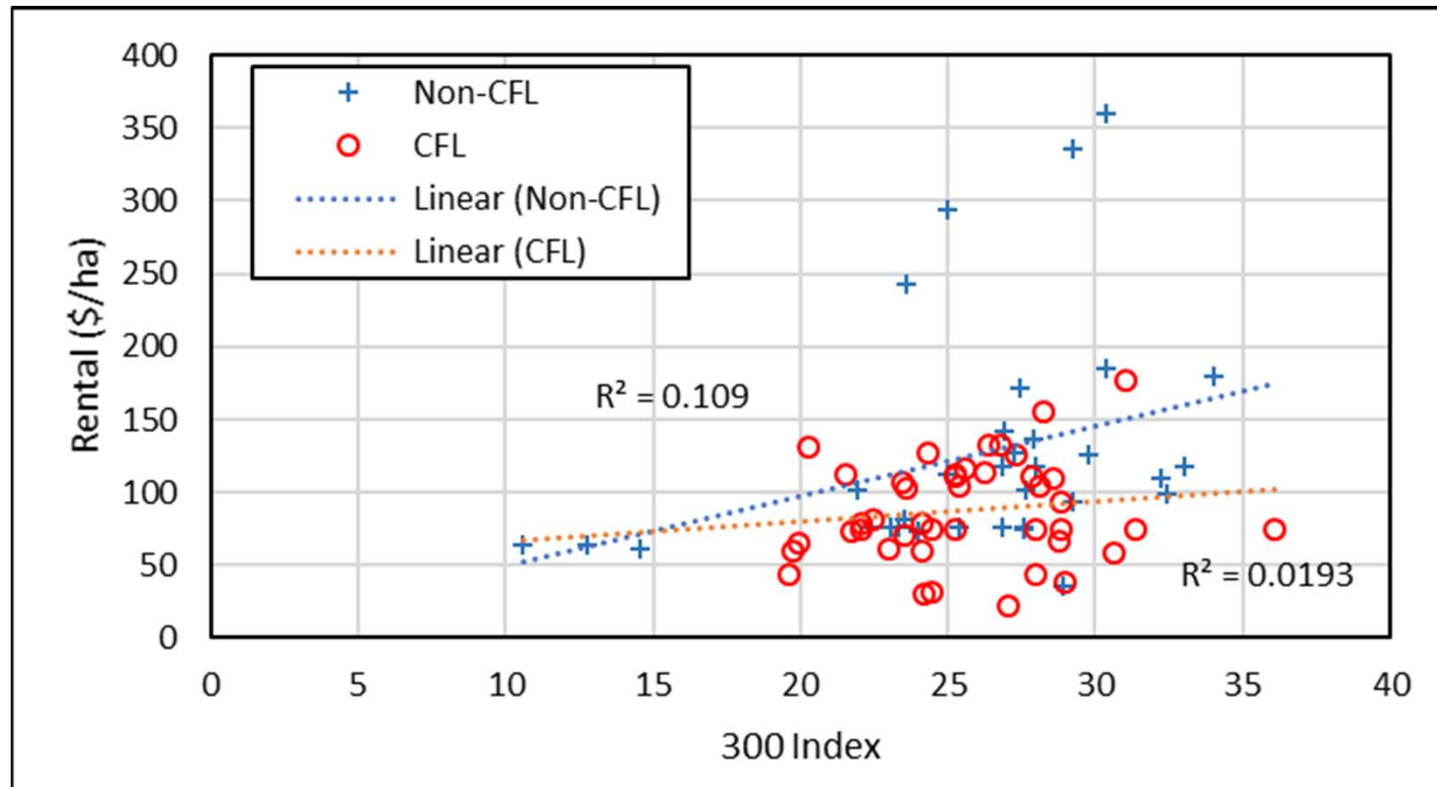
## 6: Land Rental

What evidence do we have available for New Zealand?



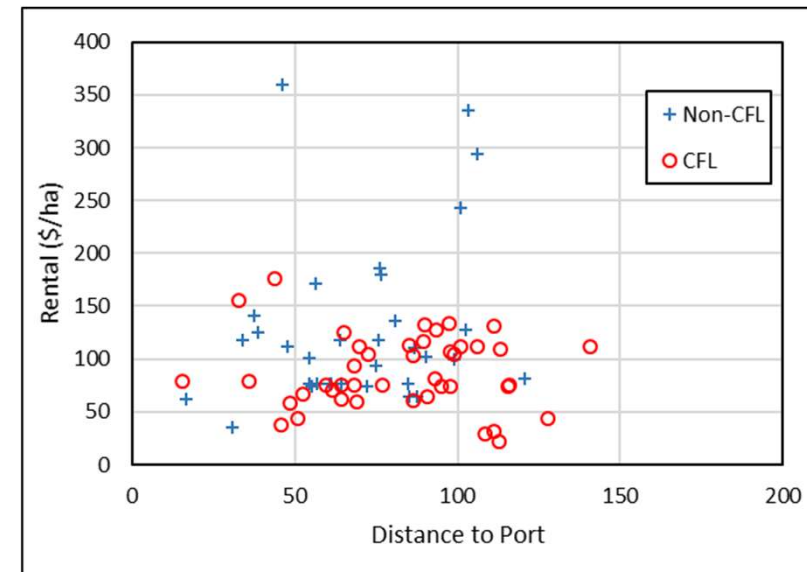
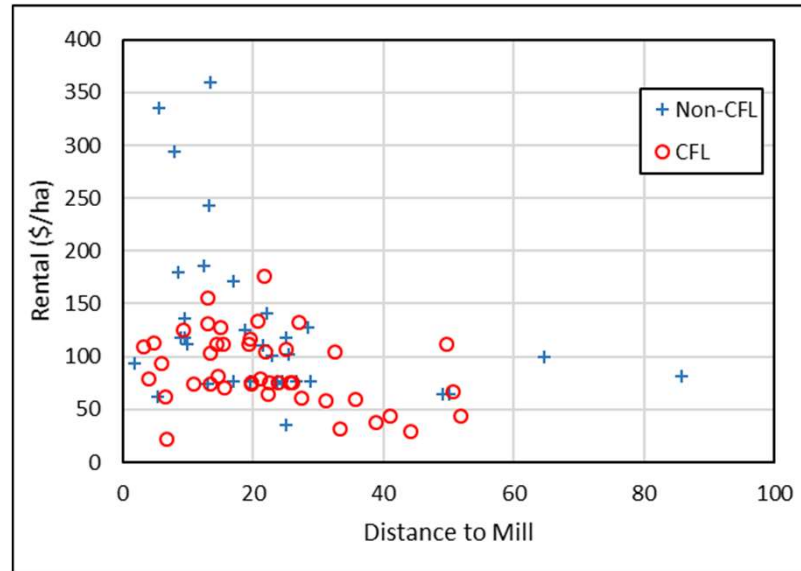
## 6: Land Rental

What evidence do we have available?



## 6: Land Rental

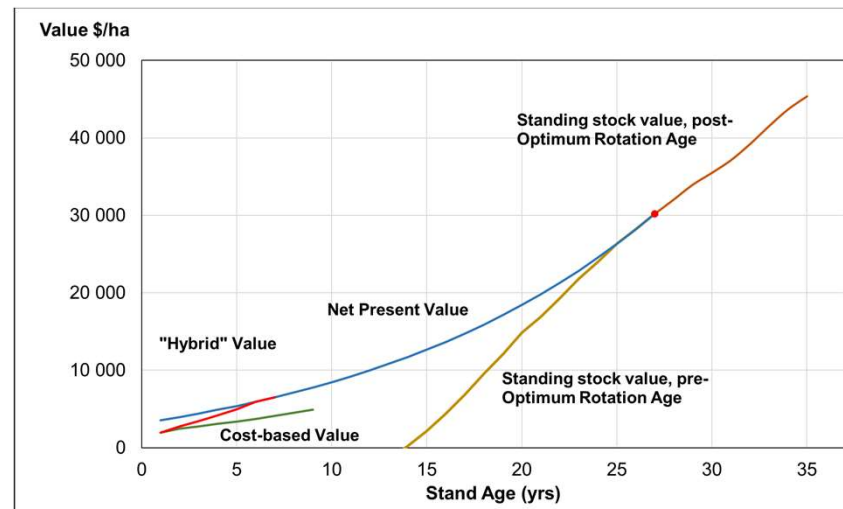
What evidence do we have available?



## 7: Concluding Comments

I have explored forest valuation methodology at the level a single example stand.

- At some stages in the life cycle, there may be a reasonably robust factual underpinning.
- At other stages, we turn to DCF analysis to provide a credible bridge.



## 7: Concluding Comments

In turning to a forest estate modelling environment, it has become very clear that so much of the process is about projections.

These cannot be facts, because they have not happened yet.

On closer examination, it is also evident that the some of the parameters, such as discount rate and rent have considerable latitude for movement.

Were we to declare that “...it all comes down to professional opinion”, this does not inherently mean that the result can be whatever we like.



## 7: Concluding Comments

The common target of a market valuation process is to identify the figure on the cheque.

The buyer writes a figure – they do not use the available space to draw a frequency distribution.

