Integrating Forestry & Carbon into Farming

Graham West

West Land Use Solutions Ltd

Issues covered

1. Productivity
   a) Scale
   b) Tree species
   c) Siting
2. Financials
   a) Timing
   b) Carbon & Cash flows
   c) Economics

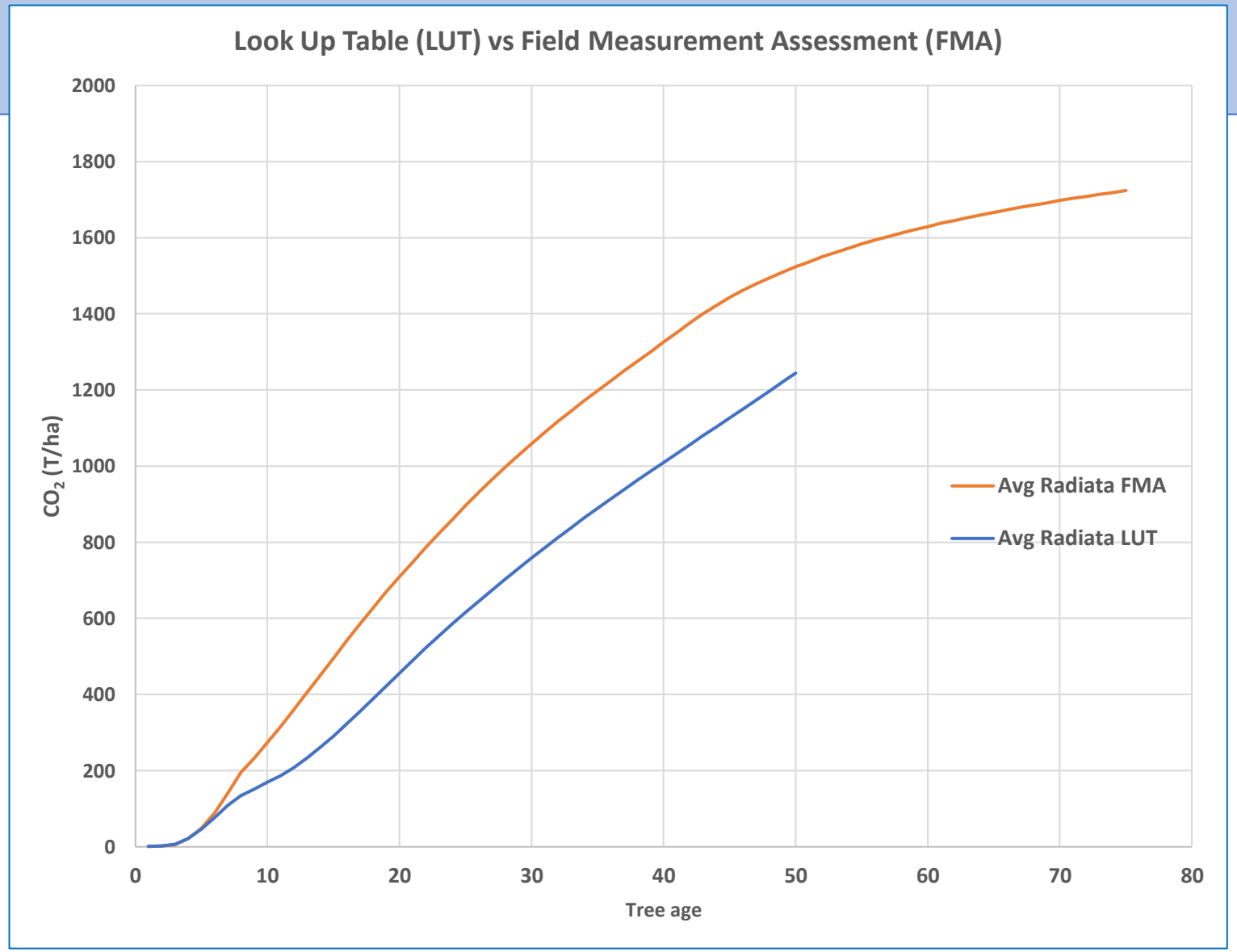
Scale

Affects Costs: Set up, crop types, measurement, management

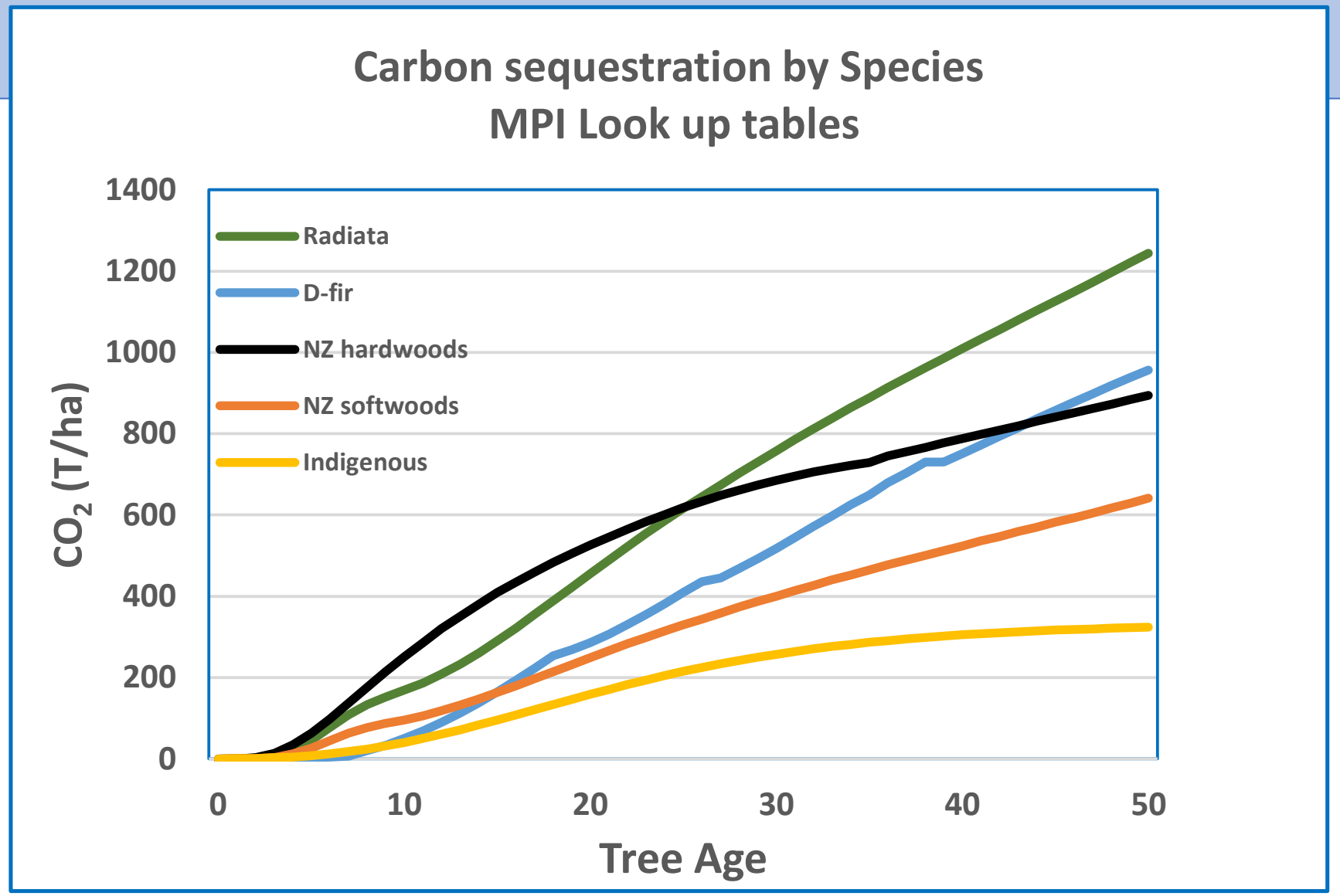
ETS Rules:

- >= 1ha up to 99ha use MPI Look up Tables
  - Quick
  - Lower compliance cost
  - Conservative by ~30%
- >= 100 ha use Field Measurement Assessment
  - Field plot measurement
  - More expensive to set up
  - Repeated every 5 years
  - Higher carbon yield

Scale



Species

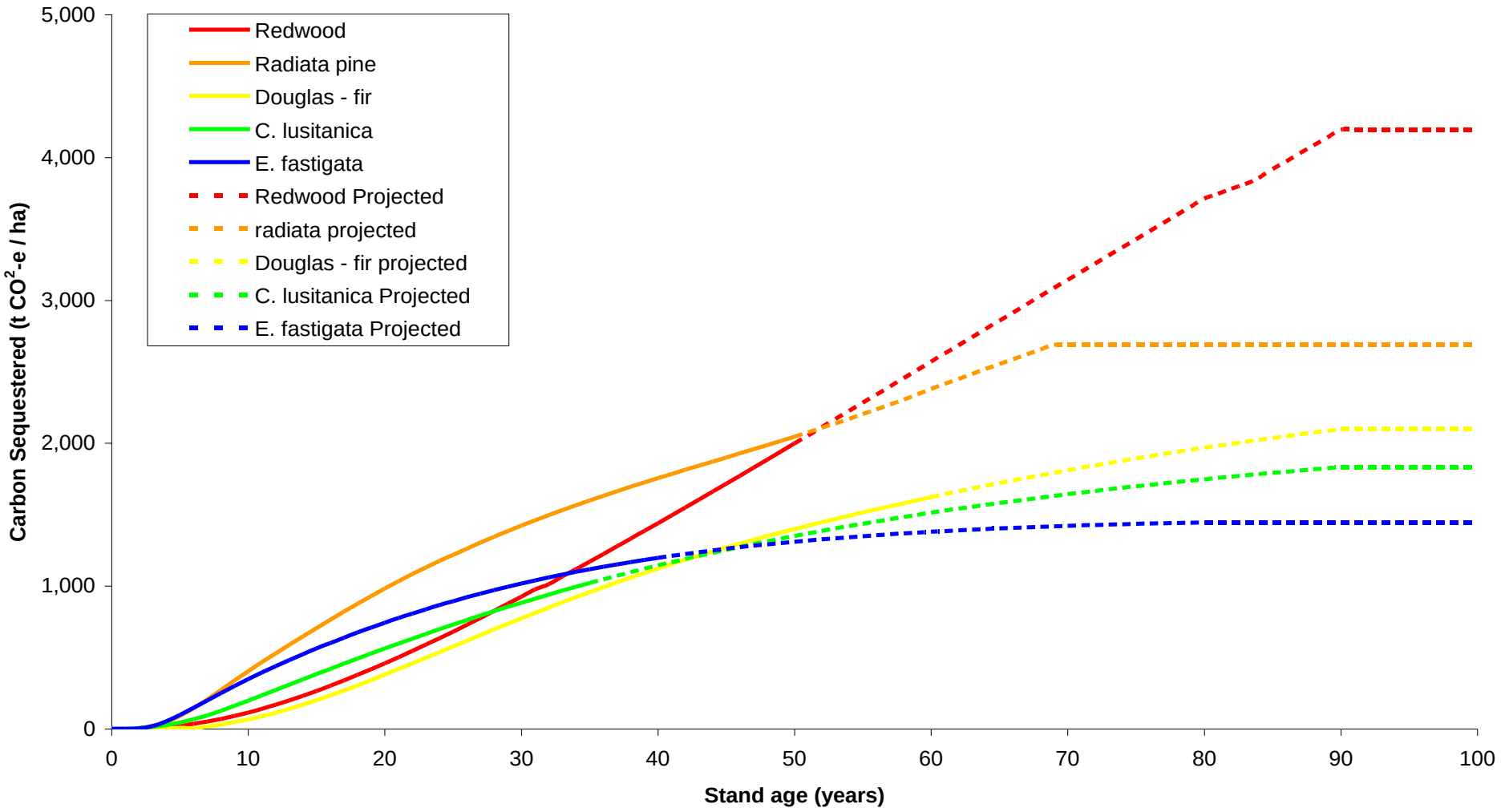


Hardwoods:
Eucalypts
Poplar
Oak
Acacia
Walnut
Chestnut

Softwoods:
Redwood
Cypresses
Abies
Spruce
Larch

Carbon sequestered by stand age and species

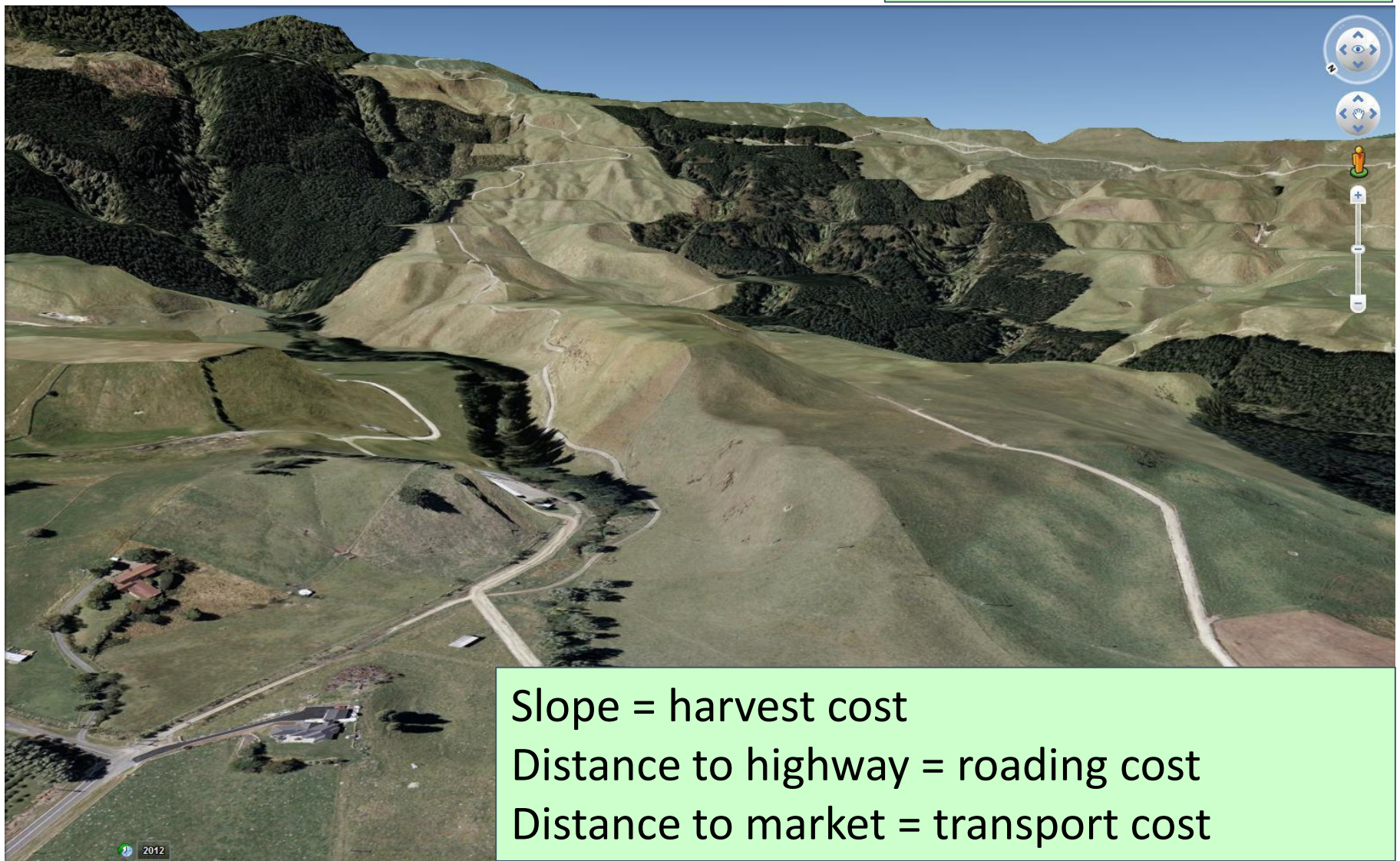
800 stems per ha regime



Major drivers of Timber profit - $$$$$

- Location, location, location!

The Flaw of Averages



Slope = harvest cost
Distance to highway = roading cost
Distance to market = transport cost

Site

Major driver of Timber net profit - $$$$$

But…. for Carbon major driver is

Productivity

Scale = lower unit costs

Waterways = environmental constraints

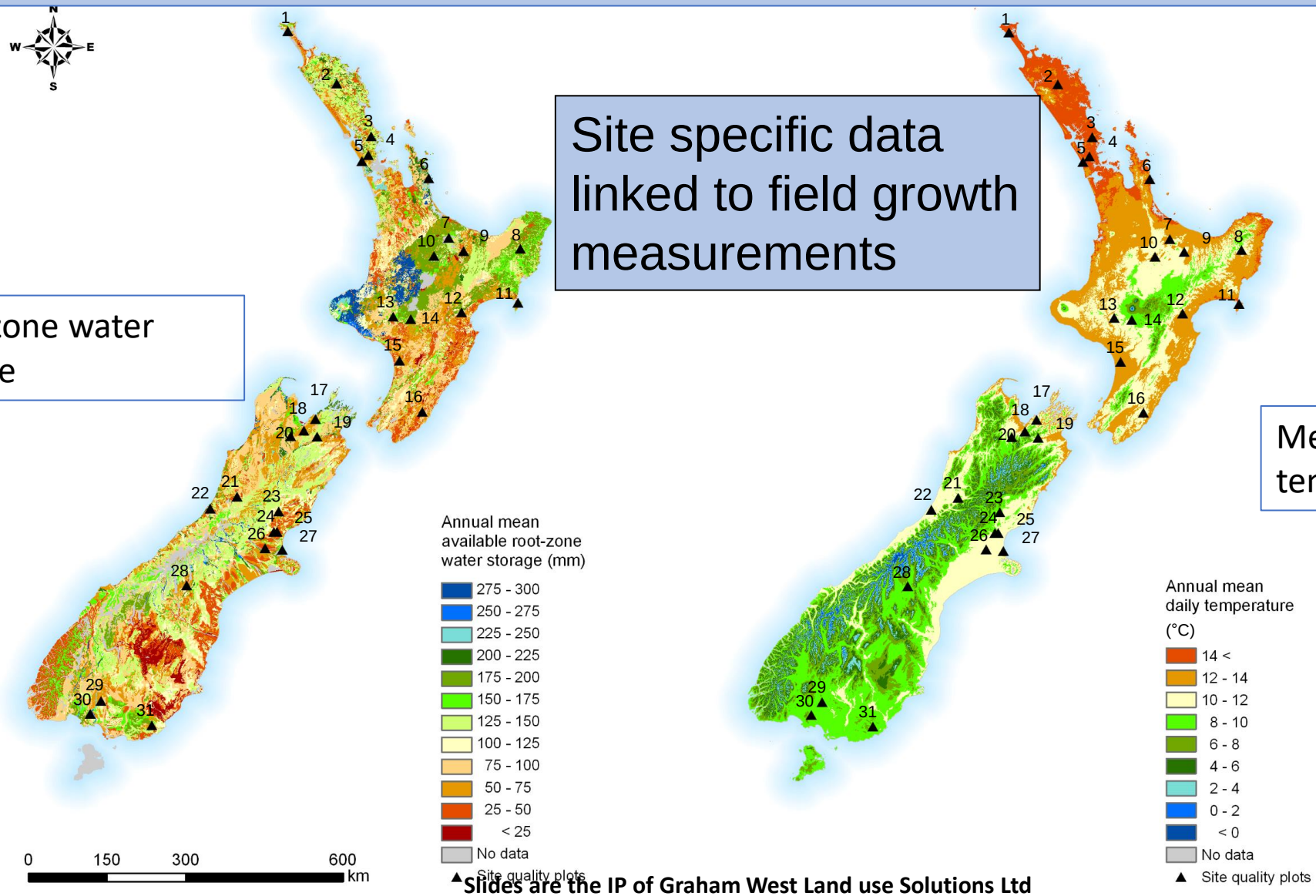
Site - Modelling *Pinus radiata* forest productivity

D. Palmer et al, Scion - 2011

Site specific data linked to field growth measurements

Root-zone water storage

Mean daily temperature



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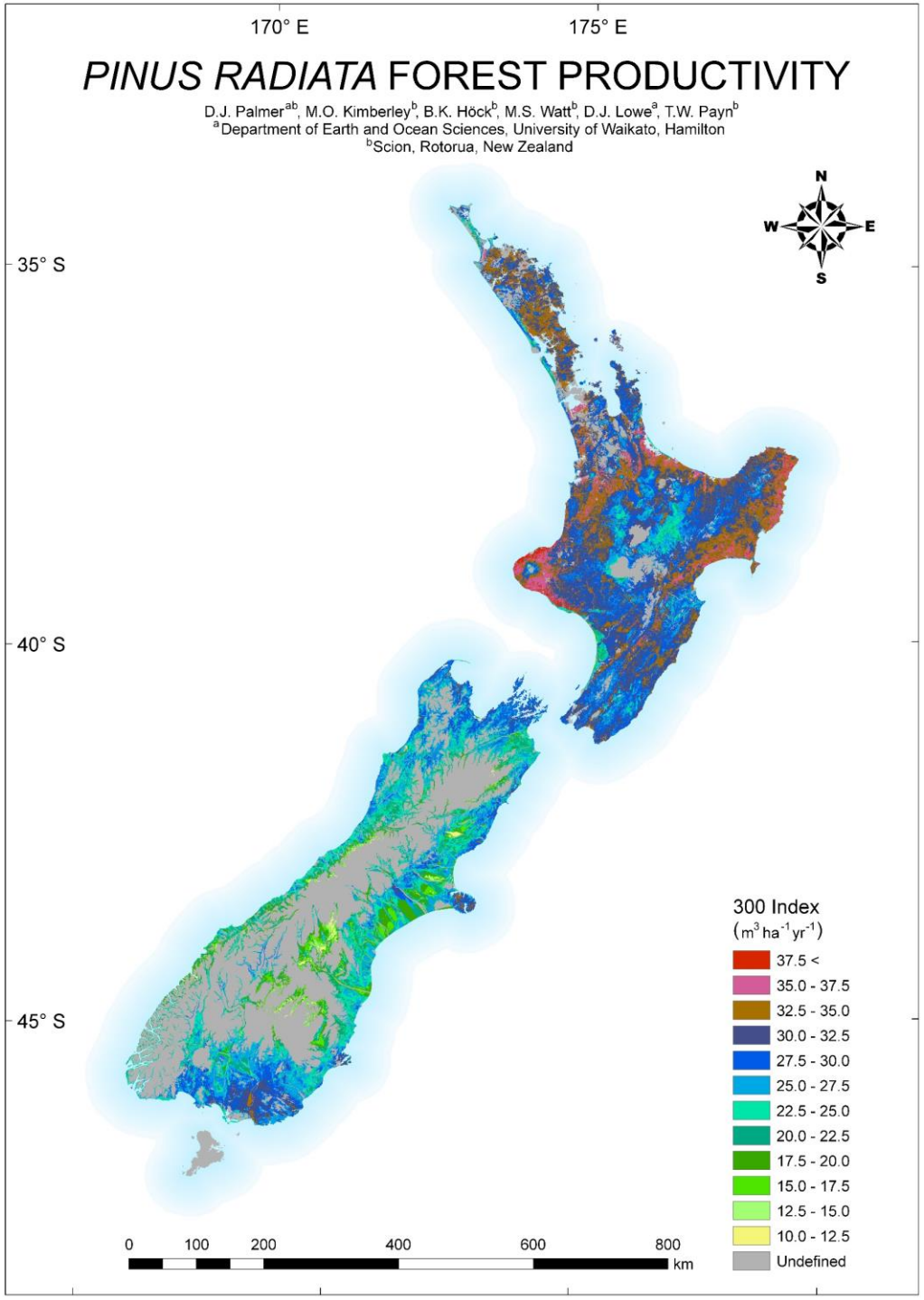
300 Index

Annual Volume growth on 300sph at age 30

m3/ha/yr



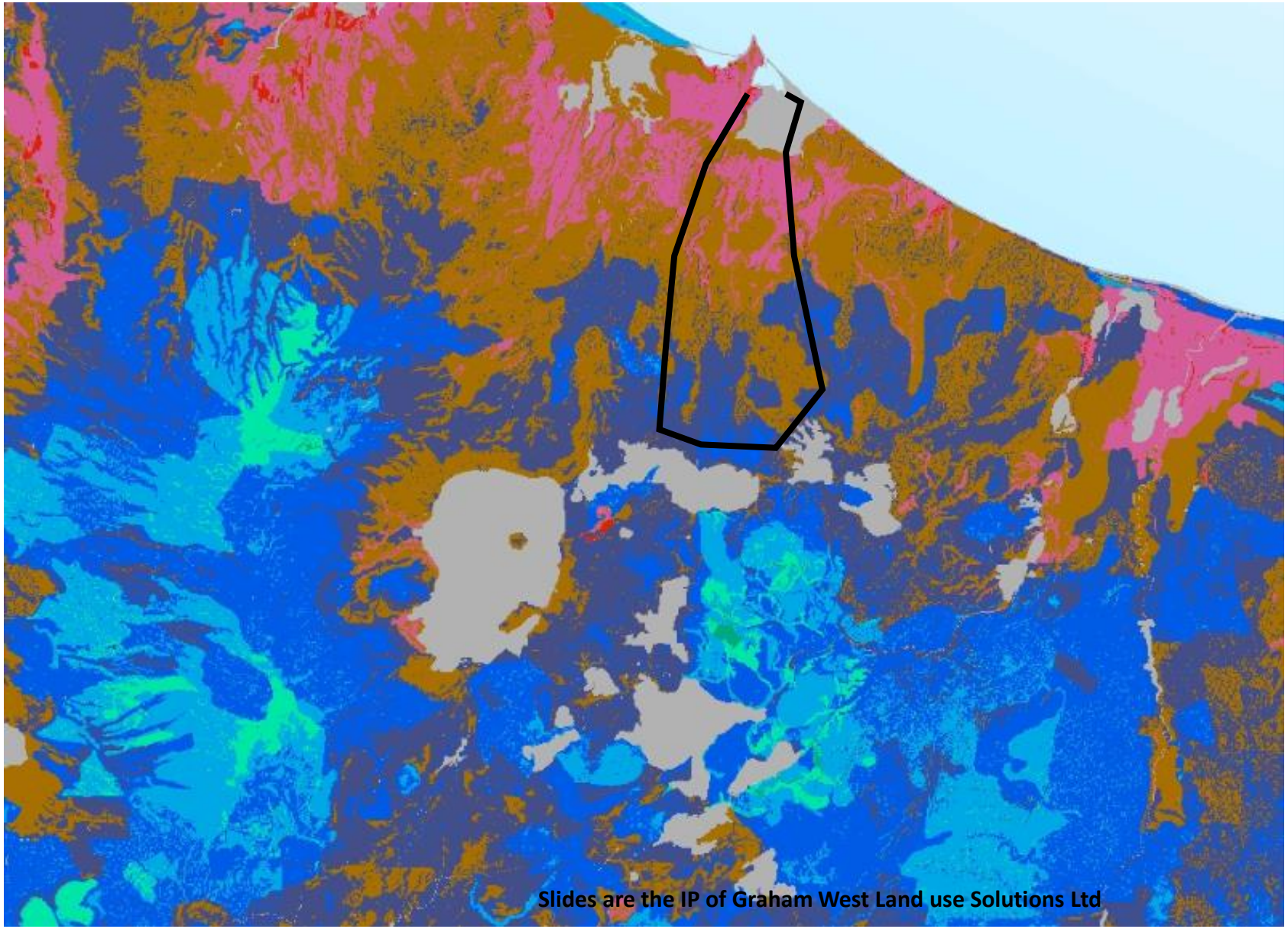
Could add :

7 -10% for farm sites

10 -15% for Genetic Gain

19% for increased CO_2 concentration

BOP Productivity map = Radiata pine volume production @ 100m x 100m pixel



Volume growth
$m^3/ha/yr$

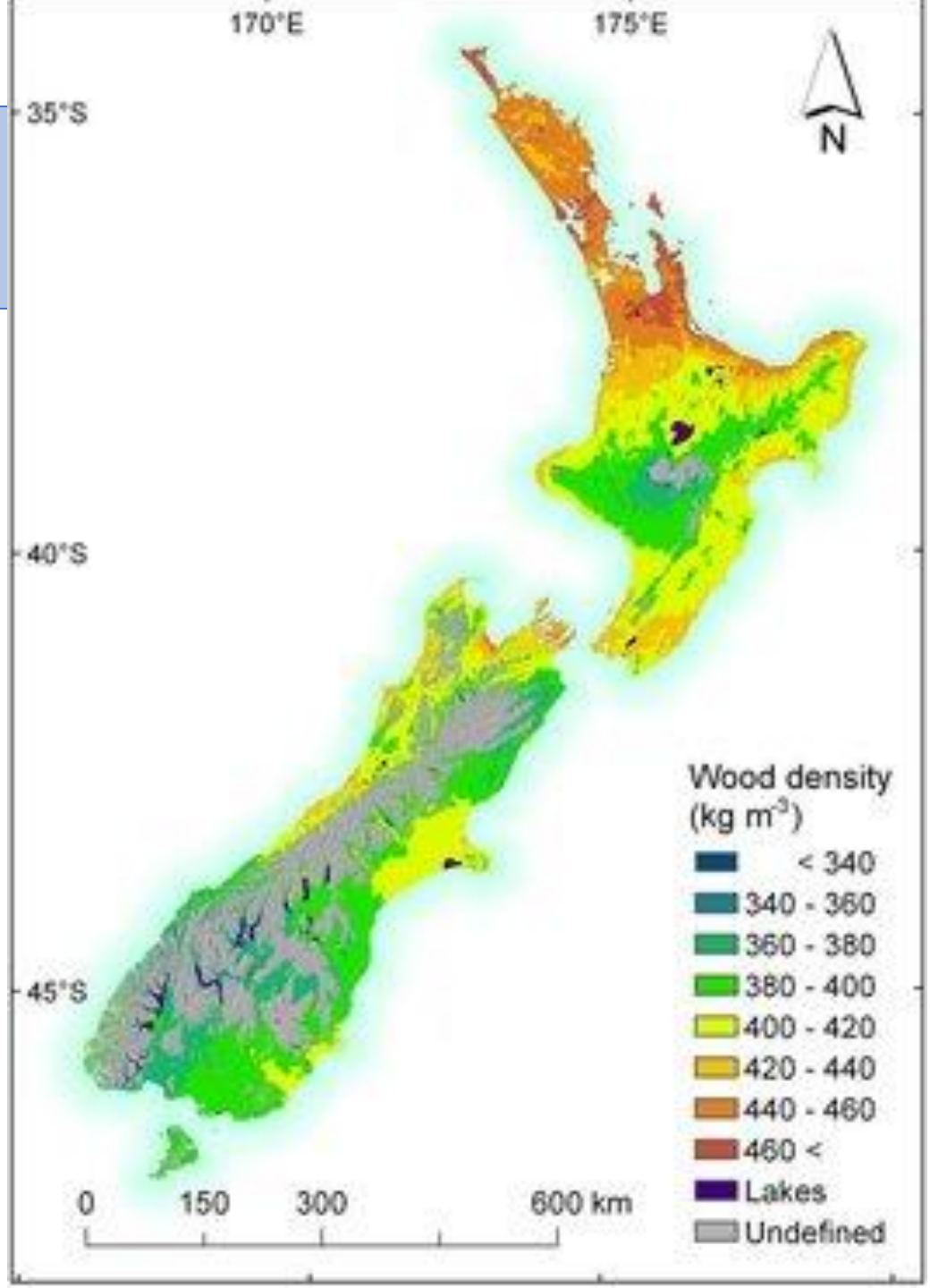
- 35-37
- 32-35
- 30-32
- 28-30

Wood volume = Dry Matter = Carbon

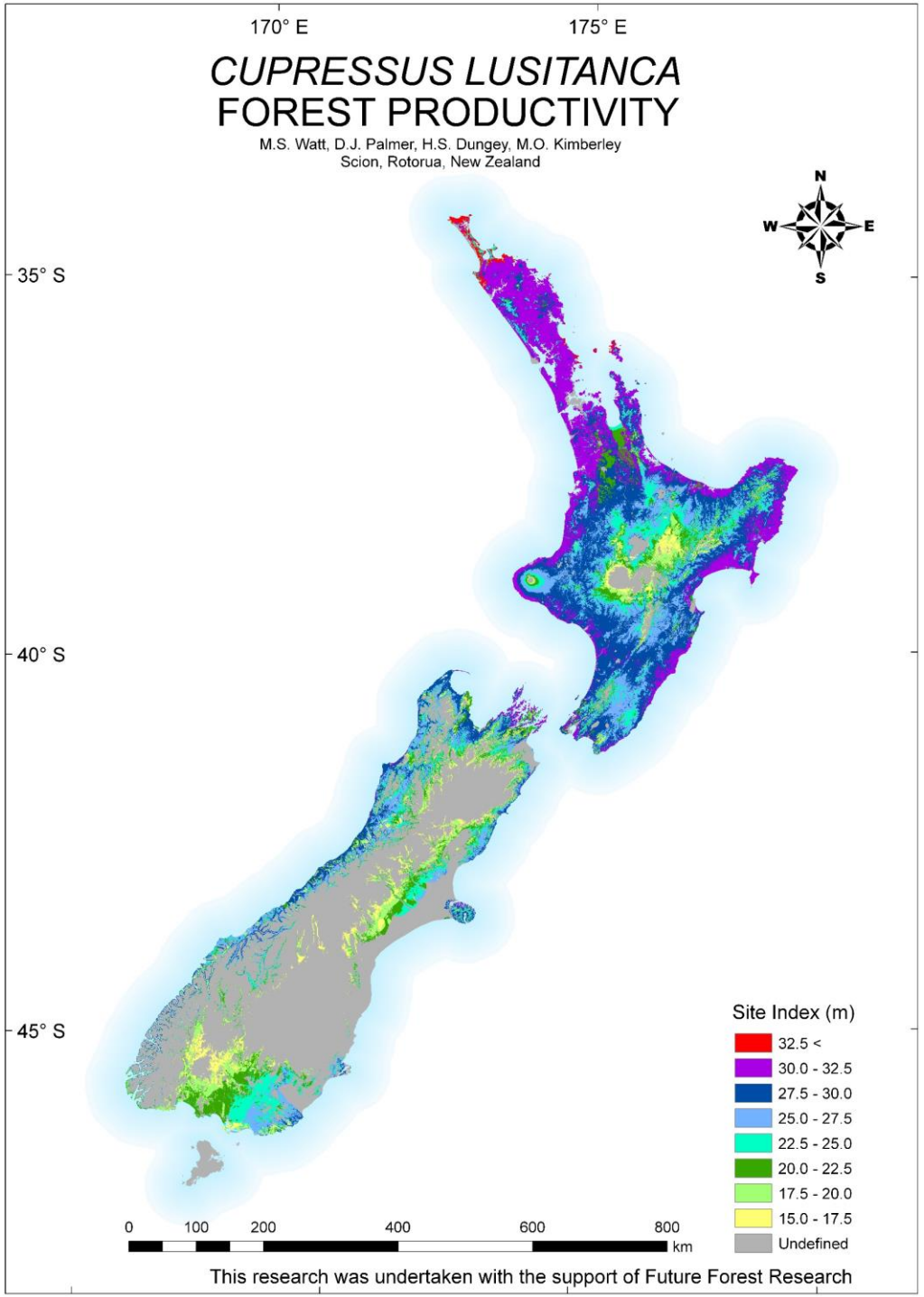
Species	Stem volume/ha/yr (m3)	Wood Density (kg/m3)	Dry matter /ha/yr (kg)	Carbon/ha/yr (t)
Radiata pine	35	440	15,400	40
Radiata pine	32	430	13,760	36
Radiata pine	30	420	12,600	34
Radiata pine	28	410	11,480	32
Radiata pine	24	400	9,600	27
Euclyptus	20	520	10,415	23
Indigenous	7.5	550	4,141	8.6

Wai Kokopu Catchment Radiata pine = 32 -35 m3/ha/yr

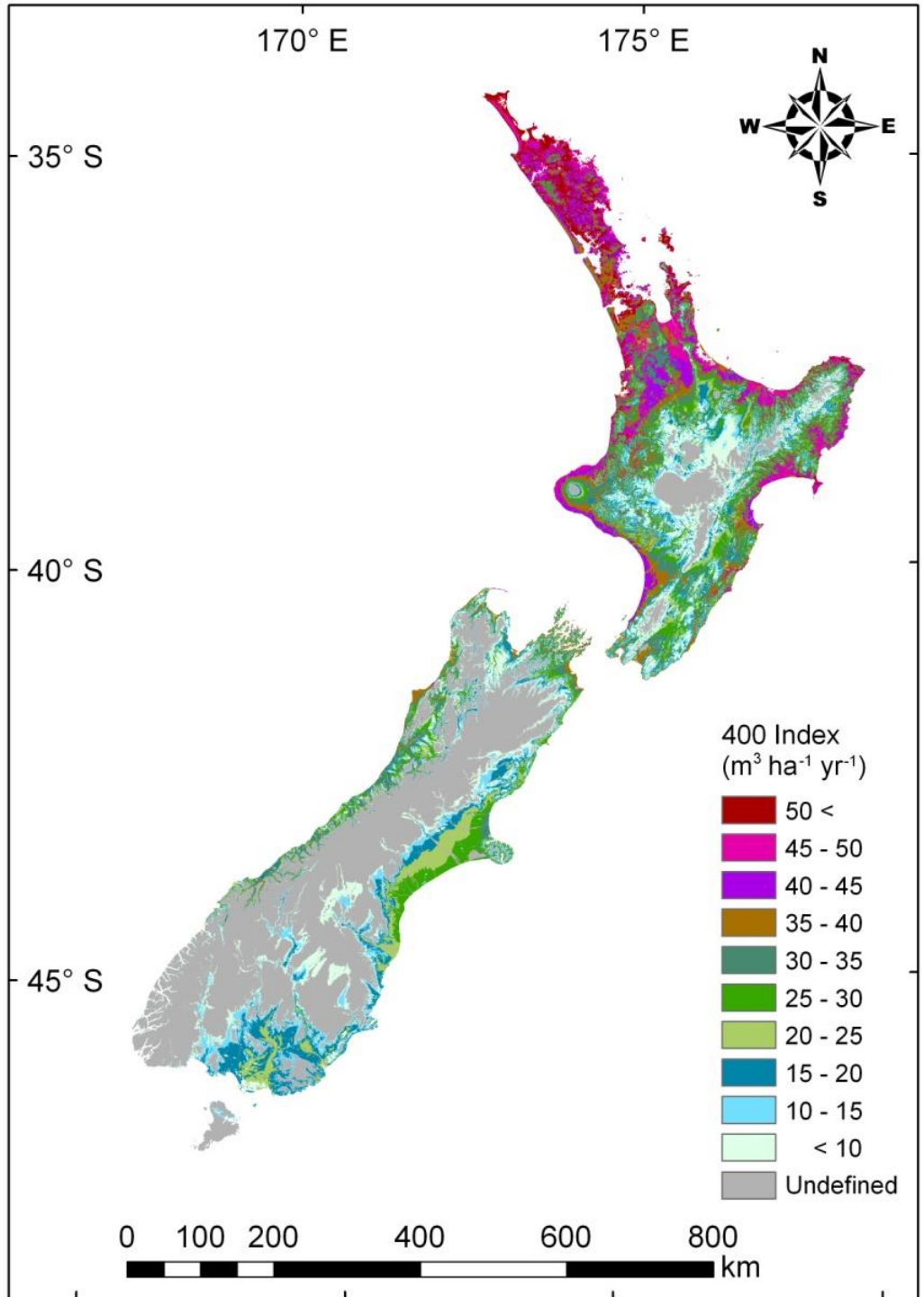
Wood Density (Radiata pine)



Cypress
(Cupressus lusitanica)

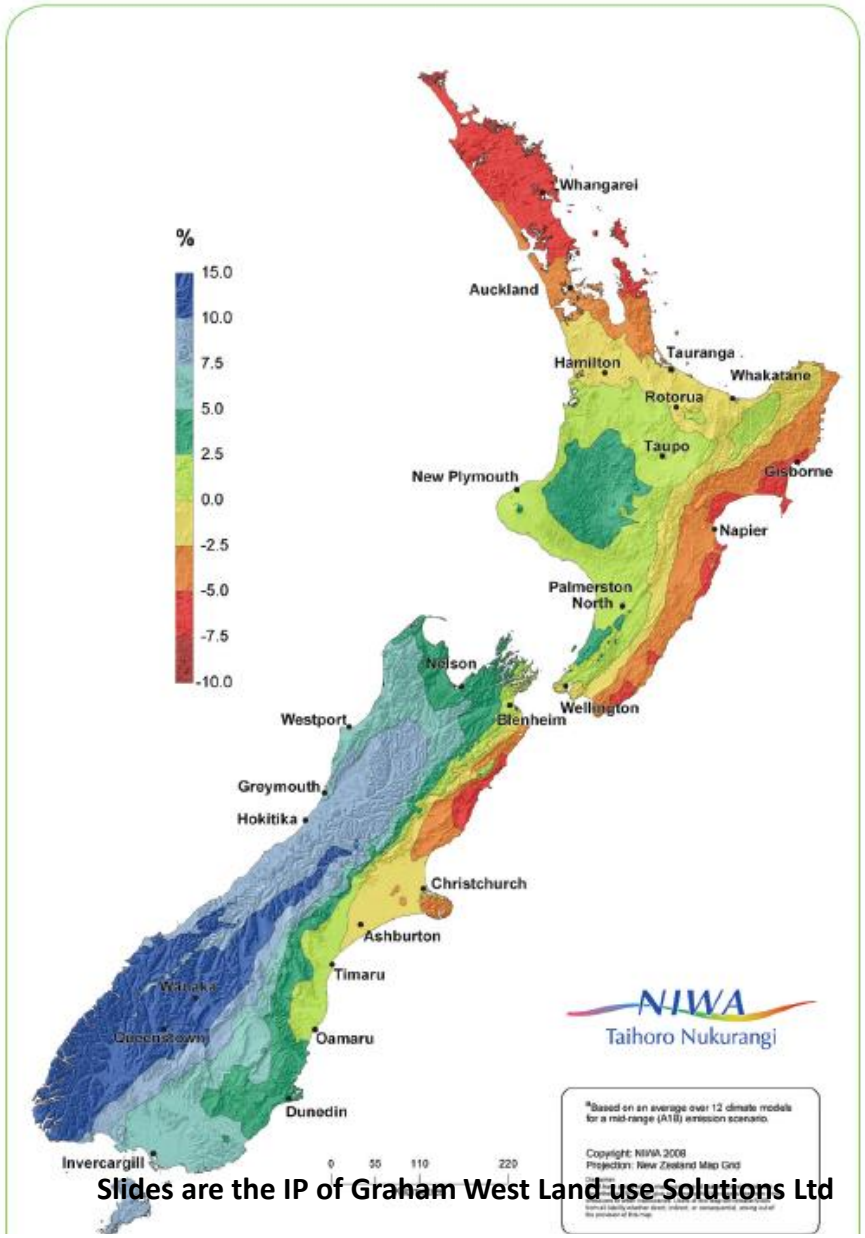


Coast Redwood (Sequoia sempervirens)



Climate Change (CC) Rainfall

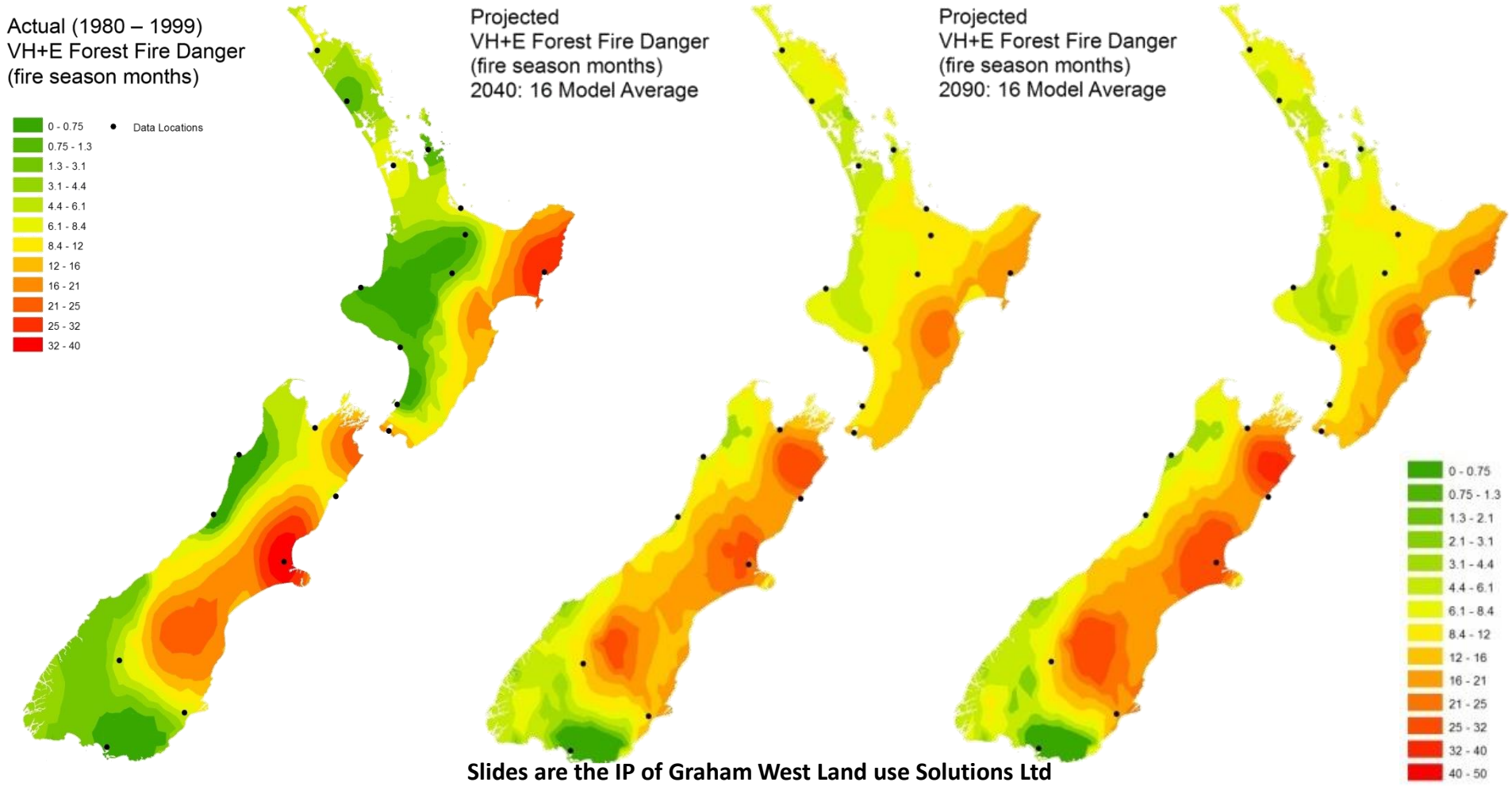
FIGURE 1: PROJECTED ANNUAL MEAN PRECIPITATION CHANGE FOR NEW ZEALAND BETWEEN 1980–1999 AND 2080–2099 BASED ON AN AVERAGE OF 12 CLIMATE MODELS FOR A MID-RANGE SCENARIO



Risk

Forest fire danger with CC
(average of all 16 Global Climate Models)

Current **2040** **2090**



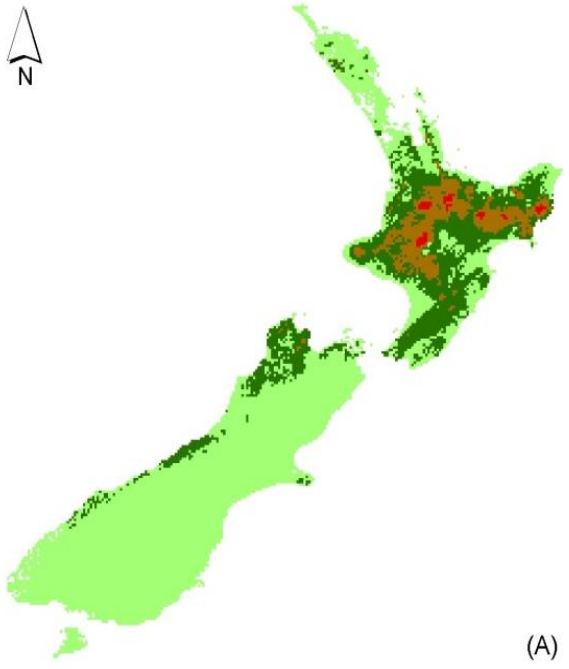
Slides are the IP of Graham West Land use Solutions Ltd

Risk

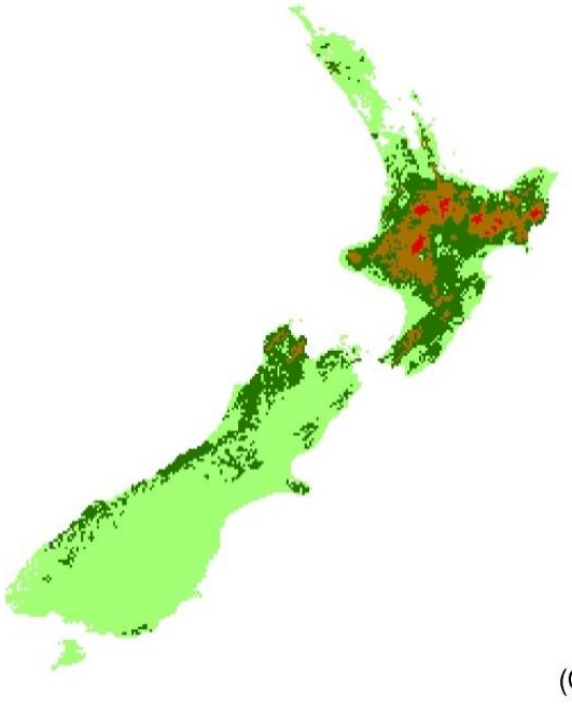
Severity of Cyclanuesma needle cast with CC

- By 2040
  +3% NI
  +75% SI
- By 2090
  +7% NI
  +162% SI

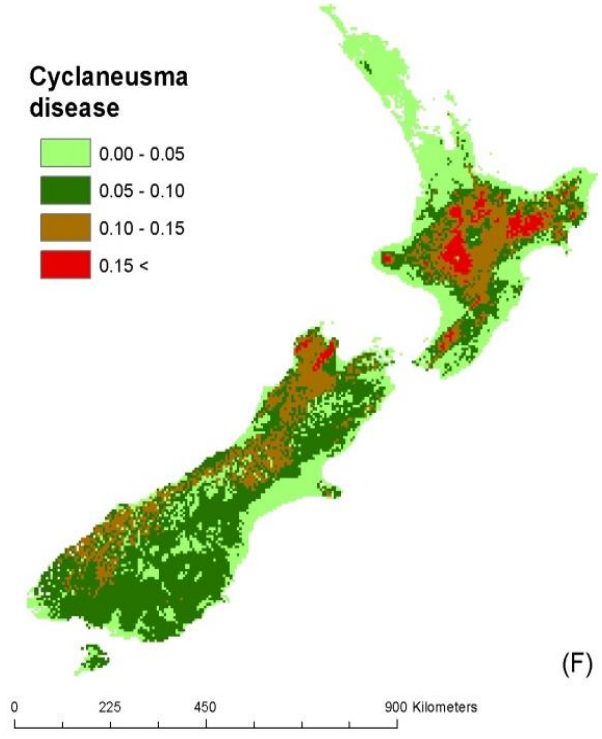
Current climate



2040 most change



2090 most change



TreeFarmer

http://treefarmer.fgr.nz/

supported by forestgrowers commodity levy

Farm Forestry New Zealand

- Tree Farmer has been developed with Forest Growers Levy funds for use by all New Zealand Small Scale Forest Growers. This web tool is intended to provide knowledge and awareness of forest operations and improve forest investment outcomes.

- This version is a prototype aimed at giving limited harvest planning functionality with indicative results only. It does not provide an operational plan nor replace the need to involve professional harvest planners and consultants.

- For further information is available from Forest Growers Research at : https://fgr.nz/

Graham West – Project Manager

ORBICA LOCATION. DATA. CONNECTIVITY.

TreeFarmer Results

Report generated 06/10/2021, 5:17:33 pm
Developed by Orbica

Report created at https://fgr.nz

Integration

Site factors

- Access
- Contour – LUC
- Vegetation cover
- Power lines
- Stock movement
- Fencing

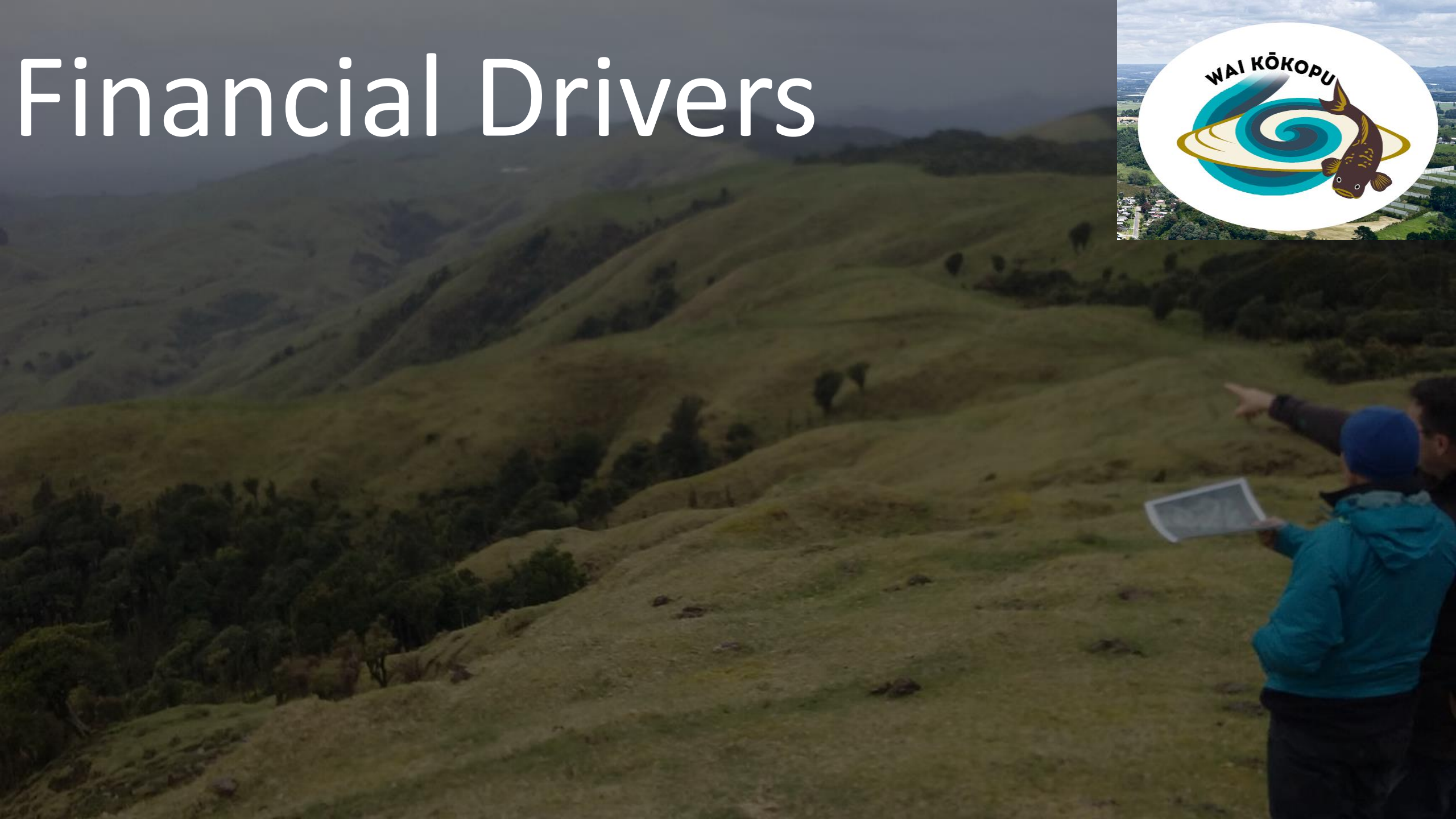
Integration

https://www.nzffa.org.nz/farm-forestry-model/resource-centre/videos/

Conclusions - Productivity Drivers

1. Scale - affects Costs, Carbon Yields, >=100ha gains ~ 30%
2. Tree species – affects growth rate and carrying capacity
3. Site - affects species choice, productivity, disease & fire risk
4. Integration – need support and planning

Financial Drivers



Major Issues and Drivers

- Establishment Costs
- Timing – in ETS
- Carbon & Cash flows
- Economics

Typical small scale forest grower

Forest establishment Costs

Radiata Pine – Stand Select Seedlings

Total Establishment costs for 833 stems/ha ($/ha)					
Site prep	Trees stocks	Planting	Release Spray	Management	
					https://treefarmer.fgr.nz/
Average Slope	Pasture	Cutover	Blackberry	Gorse & Broome	Tall scrub or weeds
0° - 15°	1555	1615	1668	1961	3284
15° - 22°	1601	1664	1720	1991	3374
22° - 29°	1707	1778	1840	2197	4085
> 29°	1992	2089	2172	2636	5148

Forest establishment Costs

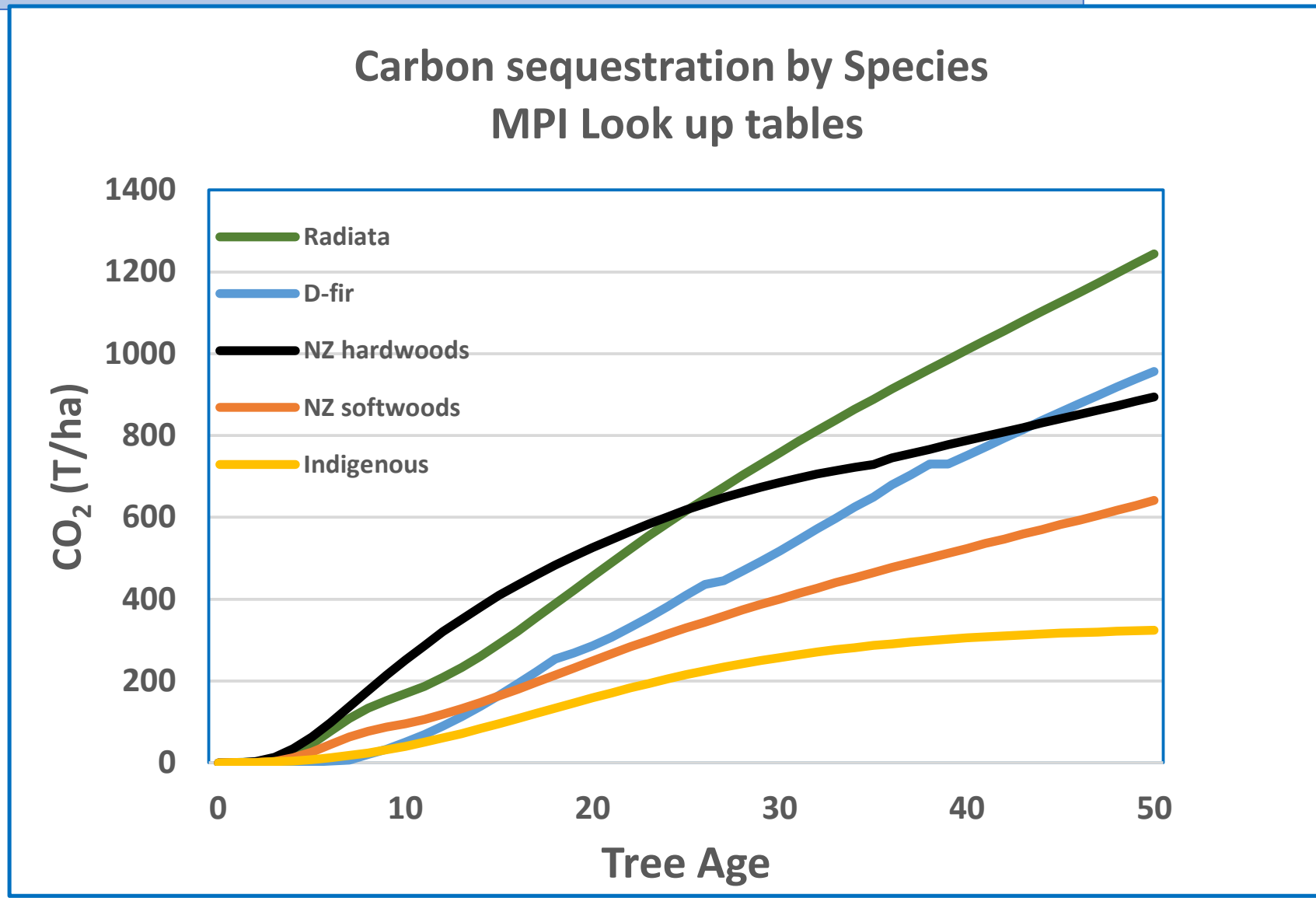
https://treefarmer.fgr.nz/

Total Establishment costs for by species						
Site prep	Trees stocks	Planting	Release Spray	Management		
Average Slope	Radiata Pine	Eucalyptus nitens	Poplar Species	Redwood	Douglas fir	Indigenous*
0° - 15°	$1,668	$1,918	$1,251	$2,502	$2,002	$11,676
15° - 22°	$1,720	$1,978	$1,290	$2,580	$2,064	$12,040
22° - 29°	$1,840	$2,116	$1,380	$2,760	$2,208	$12,880
> 29°	$2,172	$2,498	$1,629	$3,258	$2,606	$15,204

*Can range from $5,000 to $50,000

Timing- year of ETS registration

- Planted Pre 1990 – out
- Planted Post 1989 - out until 2008
- Pre 2019 = Stock change
- 1 Jan 2019 – 31 Dec 2022 = Stock change & Averaging
- 1 Jan 2023 =
  - Averaging 16yrs
  - Permanent 50 years
- 5 year Emission reporting period = 2018 to 2022



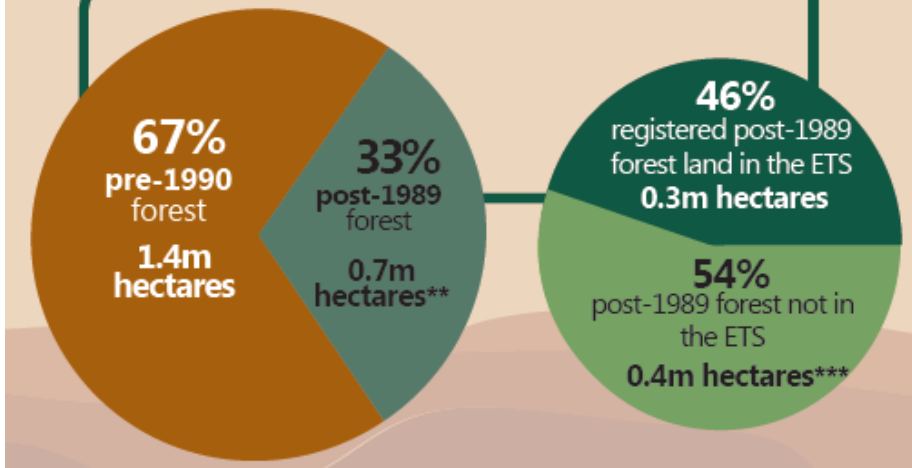
Emissions Trading Scheme for Forestry

as at 30 September 2021

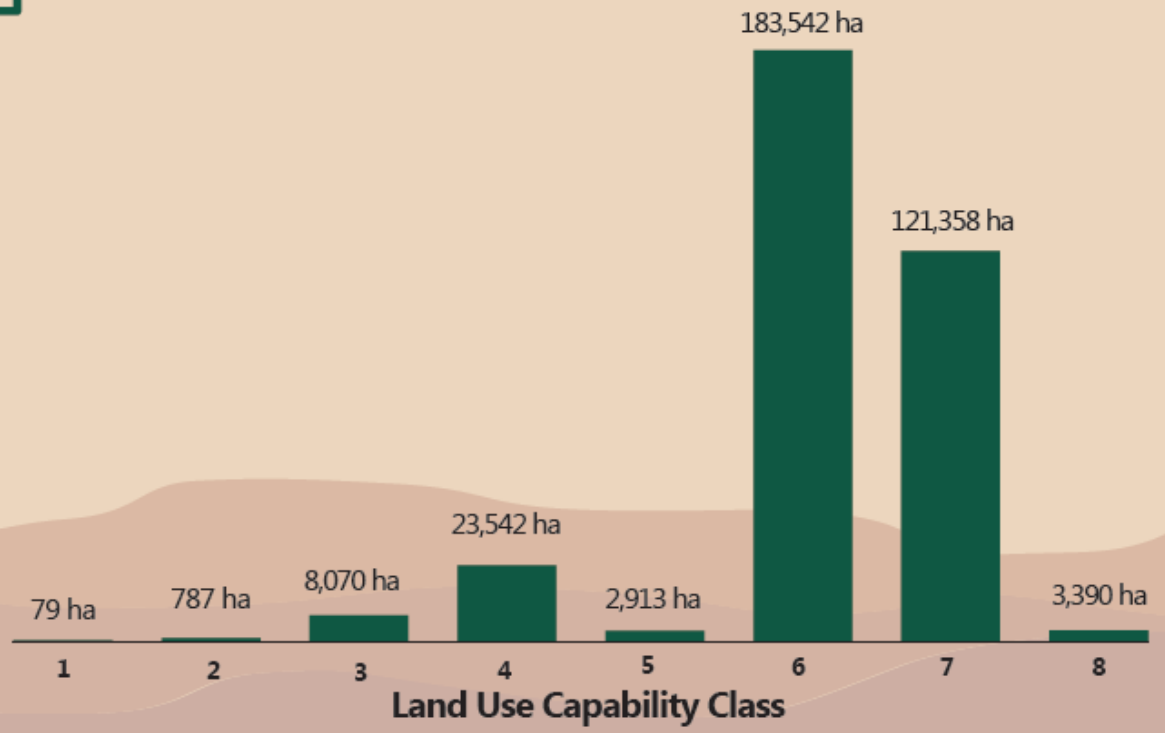
Te Uru Rākau New Zealand Forest Service

2.1 million hectares*

of forest classified as **pre-1990** or **post-1989**



Post-1989 ETS registered forest land by **Land Use Capability class**

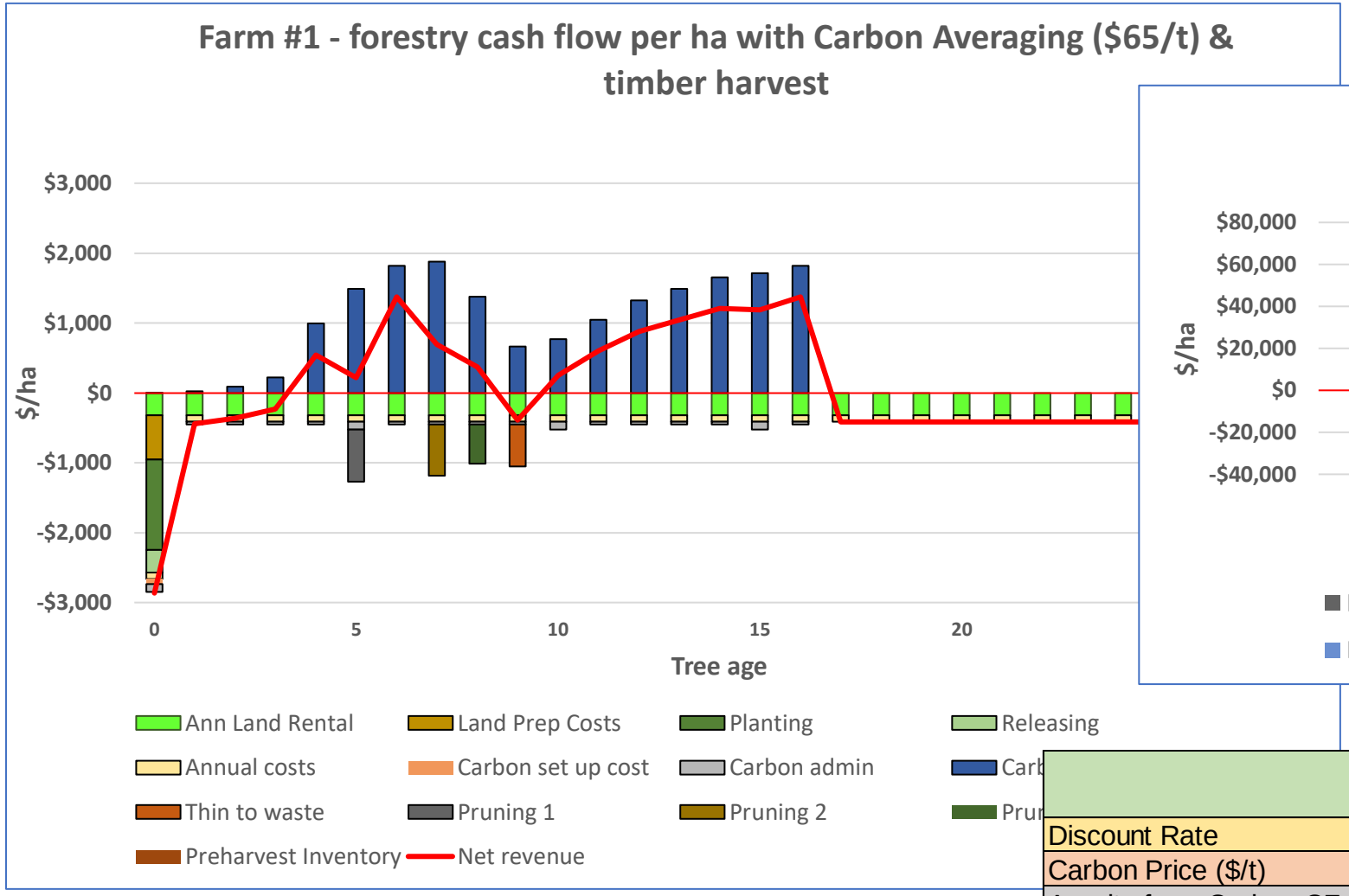


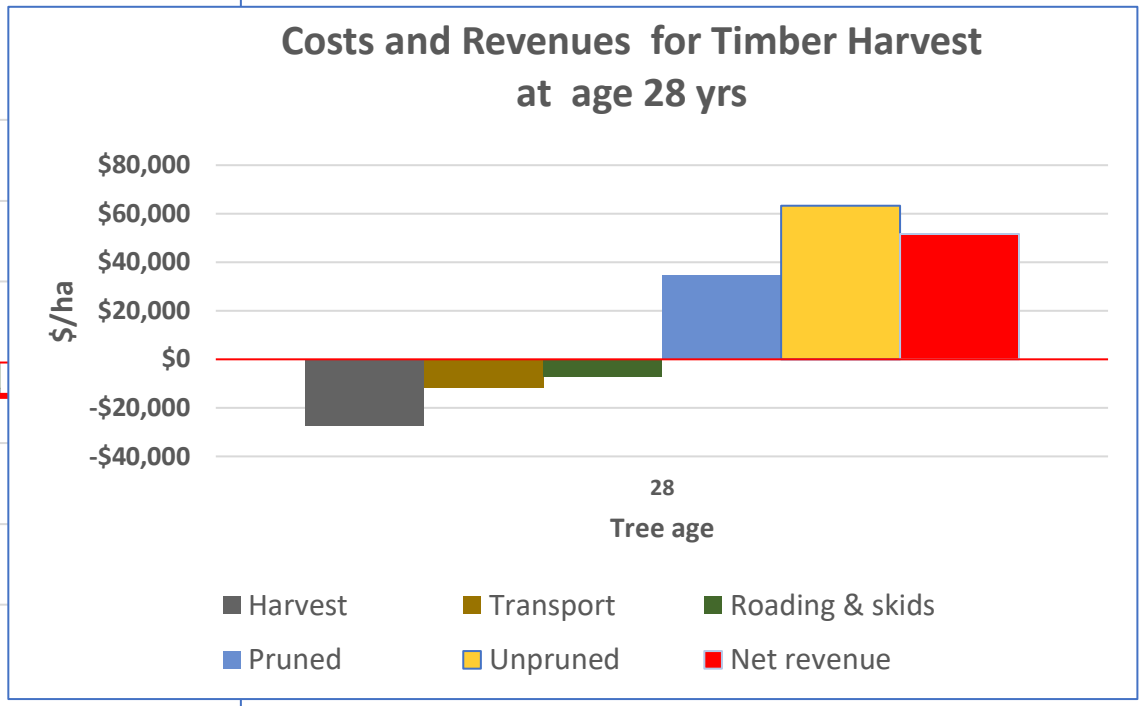
*Based on *New Zealand's Greenhouse Gas Inventory 1990-2018* published by the Ministry for the Environment in April 2020. Total 'forest land' area is based off the definition used for reporting to the United Nations Framework Convention on Climate Change.
**Existing forest land, not the total area of land available that could be eligible for the ETS.
***Due to differing criteria, some of the area reported may not be eligible for registration in the ETS.

343,877 ha

ETS **post-1989** forest land

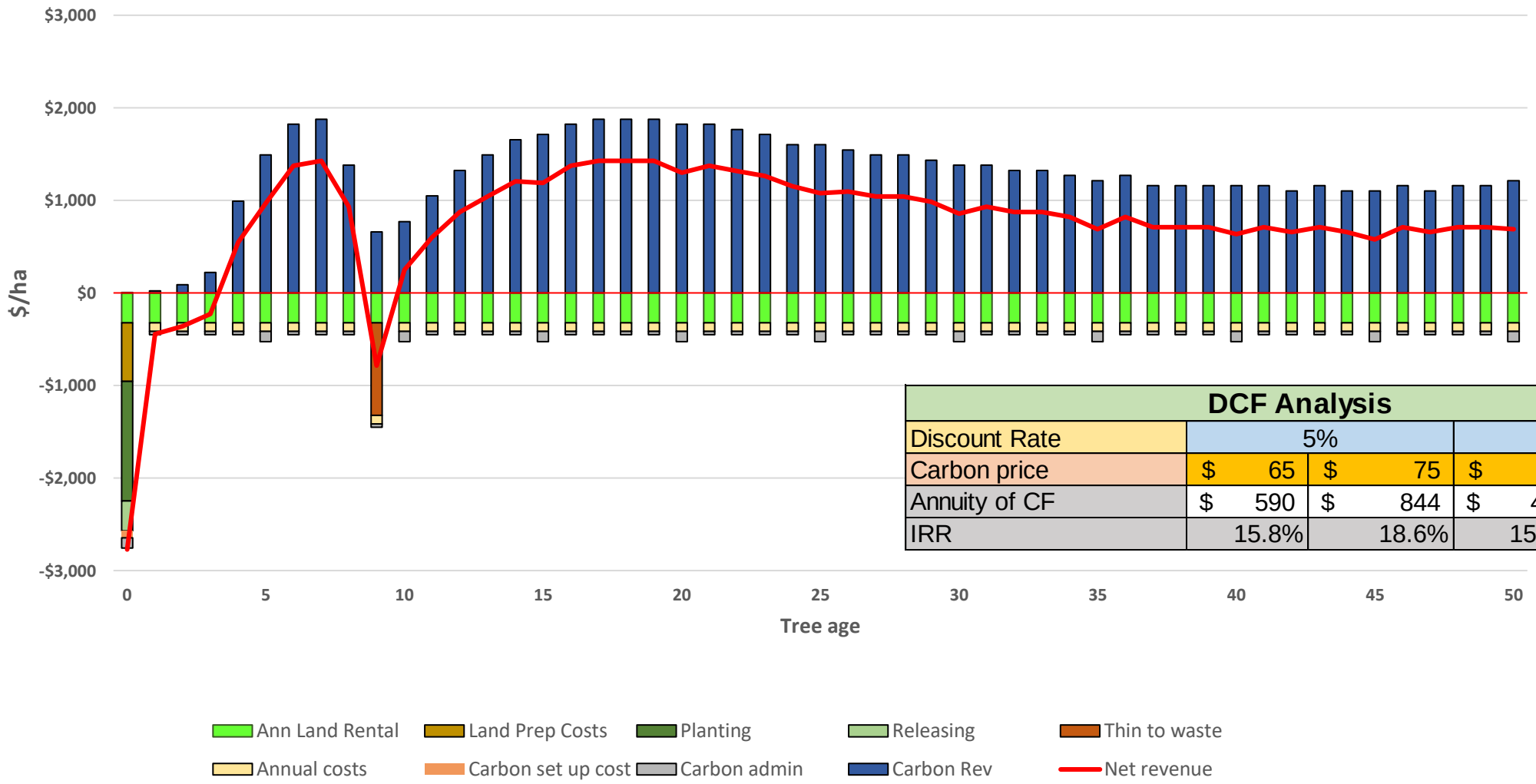
The **Land Use Capability (LUC)** classification shows land capability and versatility for various uses. All of New Zealand's rural land is classified into eight





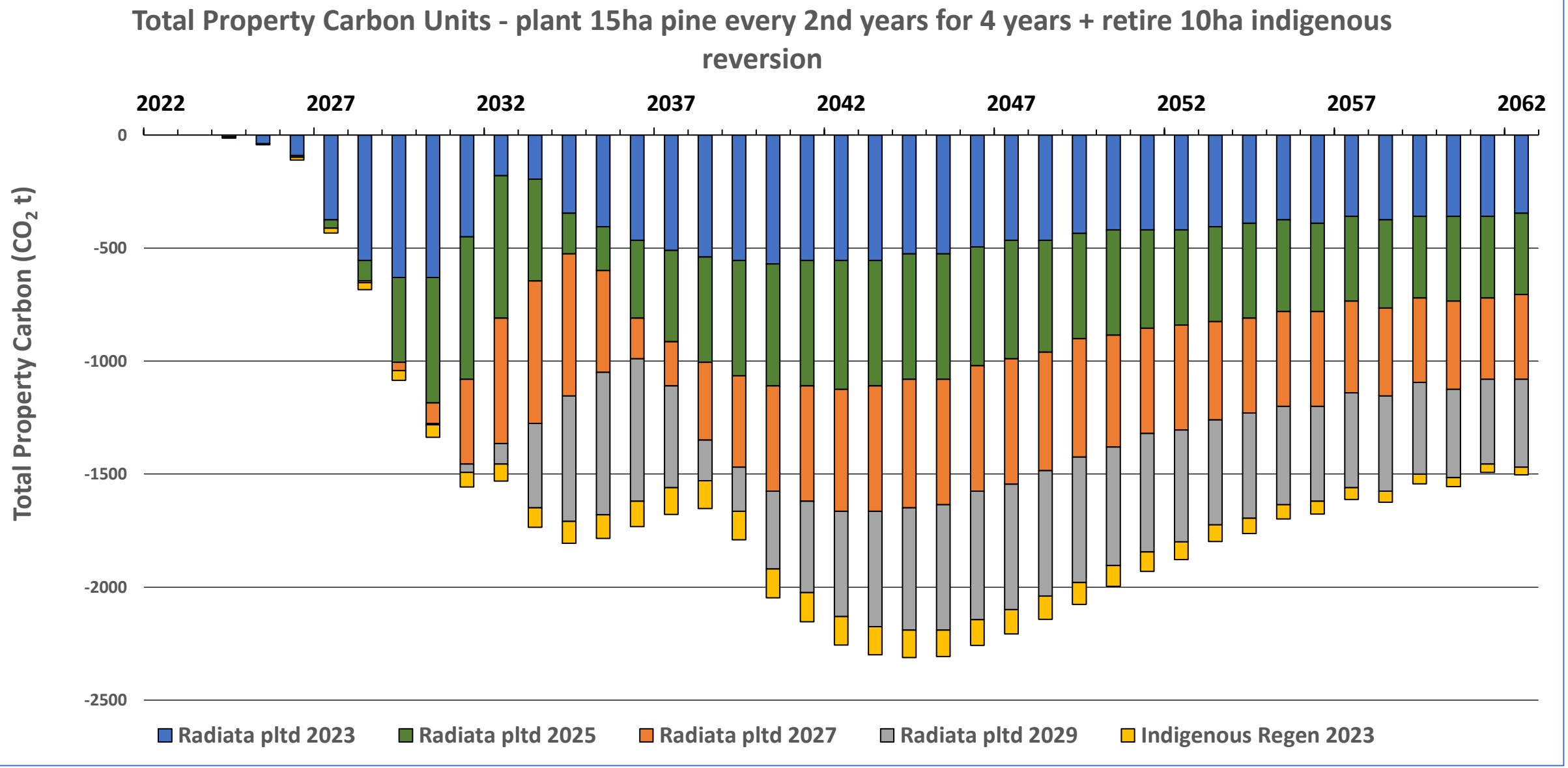
DCF Analysis				
Discount Rate	5%		7%	
Carbon Price ($/t)	$ 65	$ 75	$ 65	$ 75
Annuity from Carbon CF	$ 991	$ 1,153	$ 951	$ 1,108
Annuity from Timber CF	$ 163	$ 163	-$ 131	-$ 131
IRR for Timber only	6.1%	6.1%	6.1%	6.1%
IRR Timber & Carbon	13.6%	15.5%	13.6%	15.5%

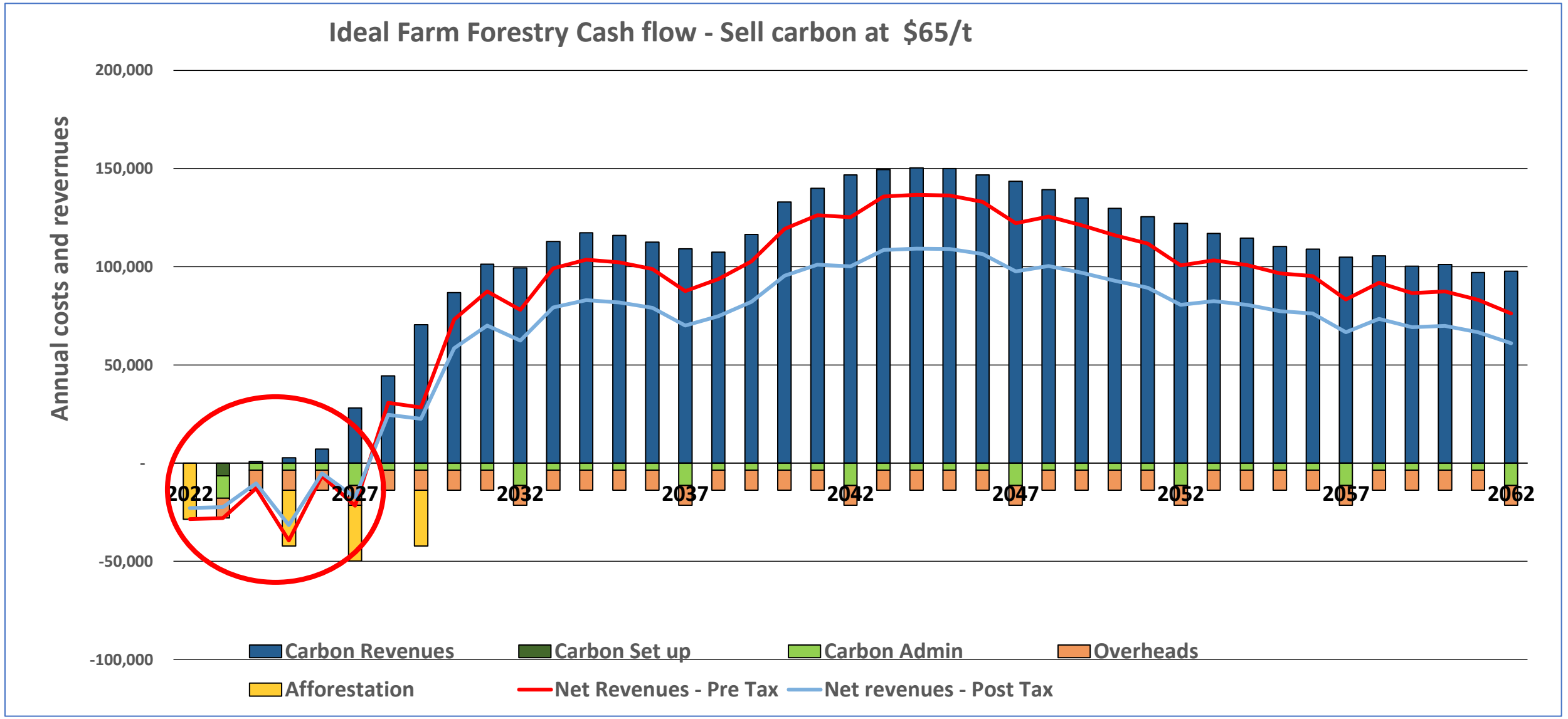
Farm #1 - forestry cash flow - Permanent Carbon @ $65/t

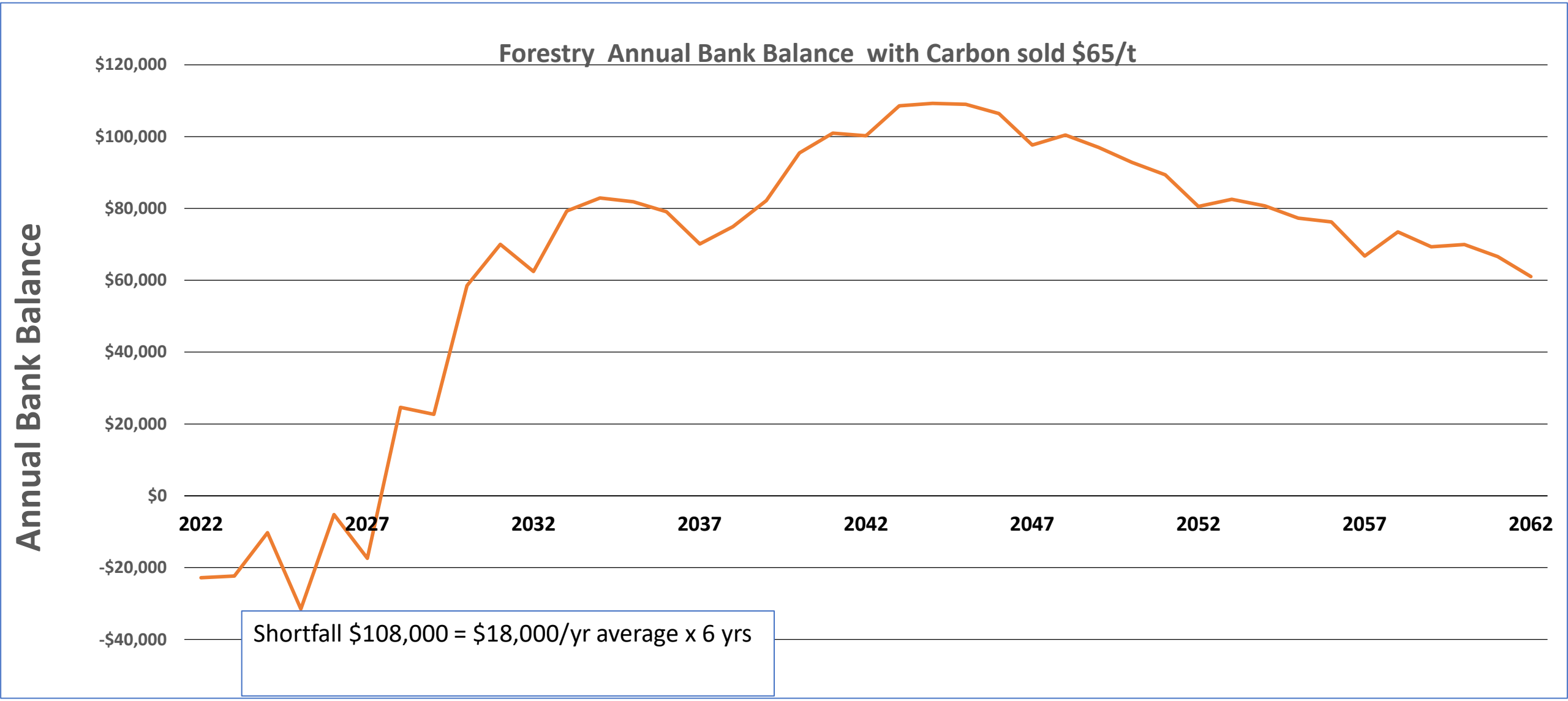


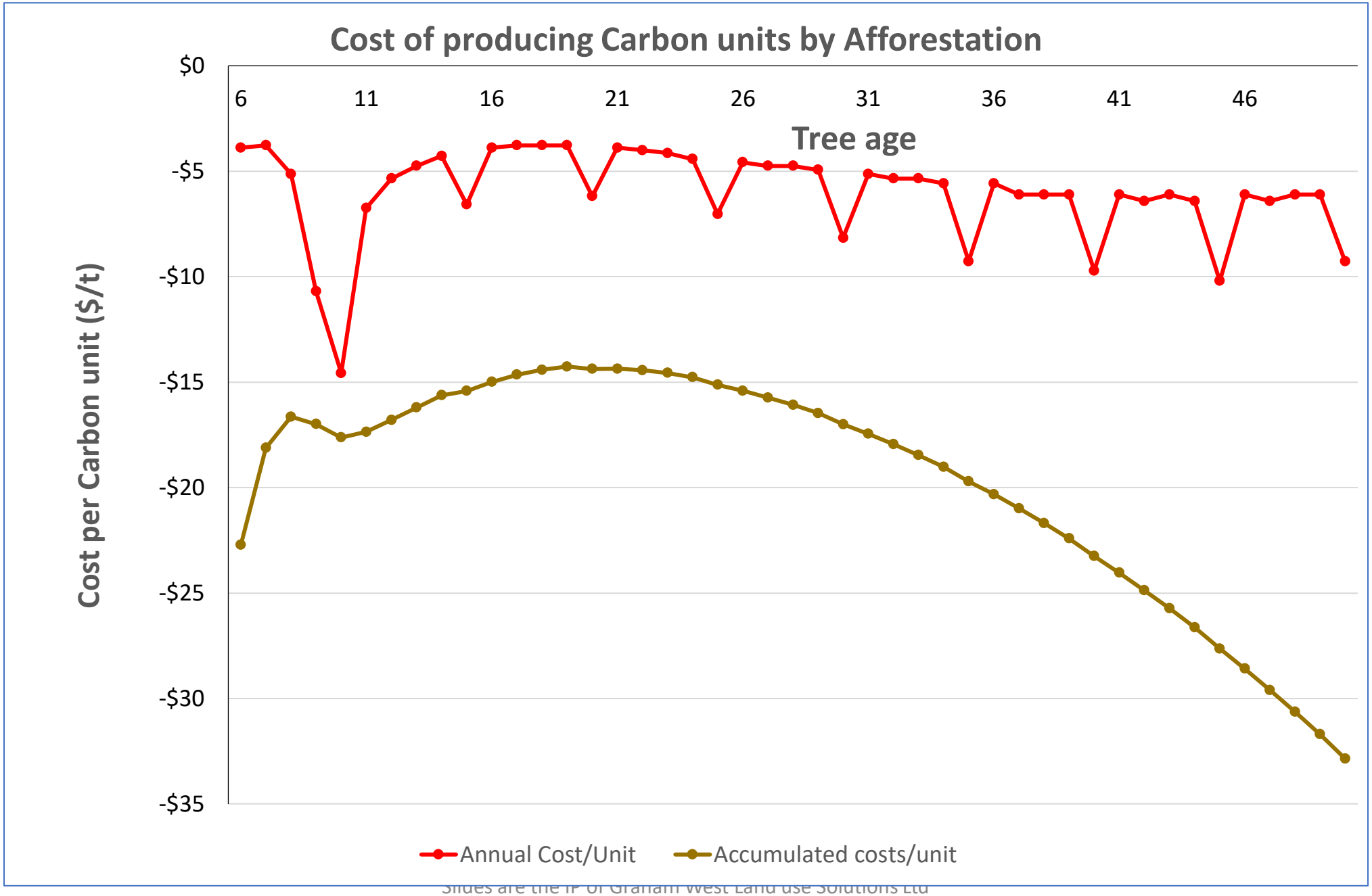
DCF Analysis				
Discount Rate	5%		7%	
Carbon price	$ 65	$ 75	$ 65	$ 75
Annuity of CF	$ 590	$ 844	$ 485	$ 710
IRR	15.8%	18.6%	15.8%	18.6%

Ideal Farm Forestry - carbon flows

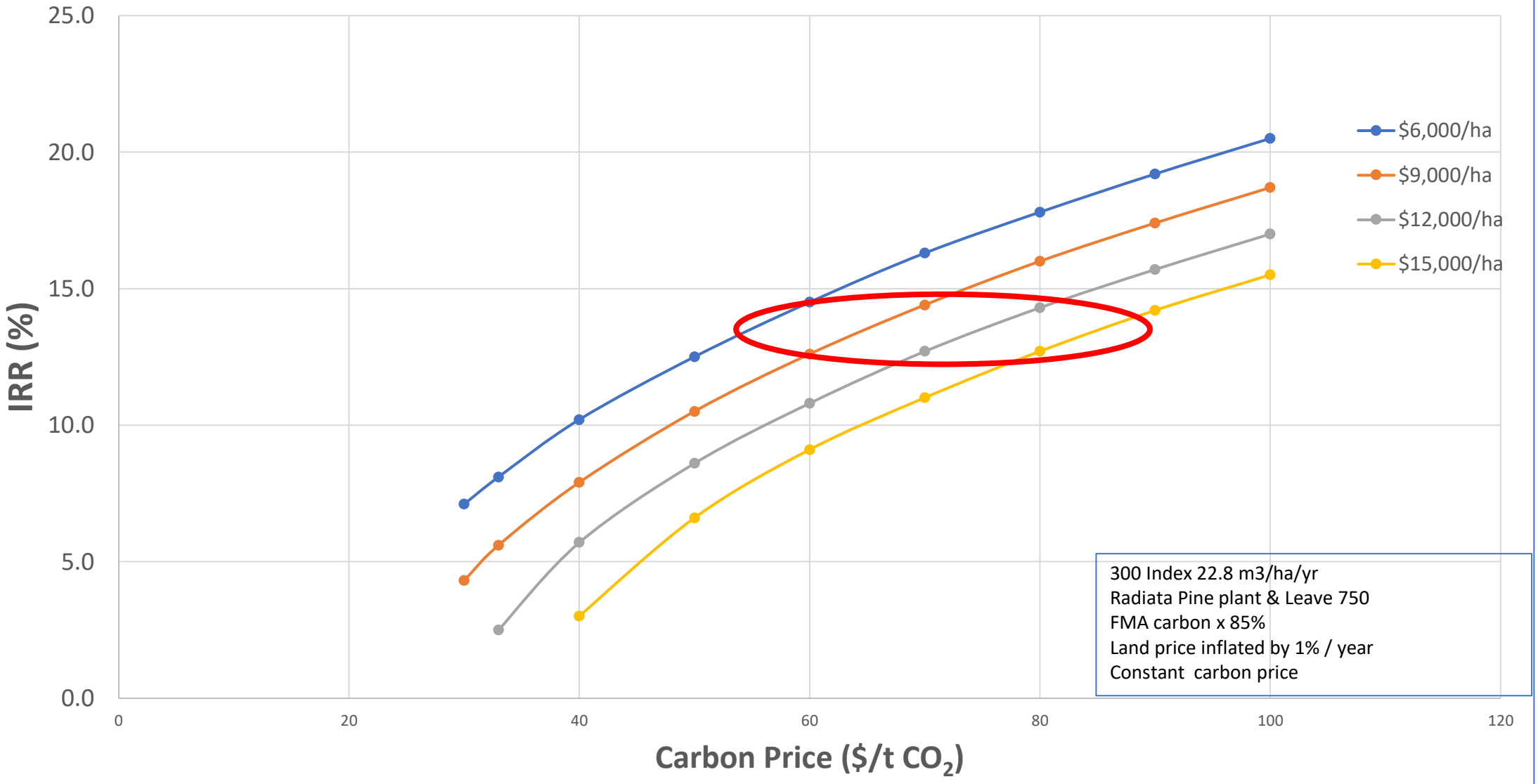




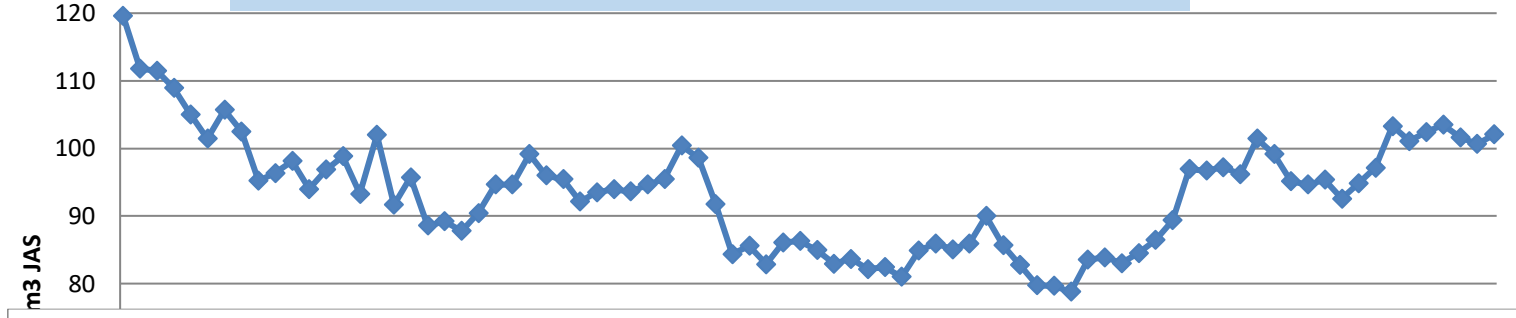




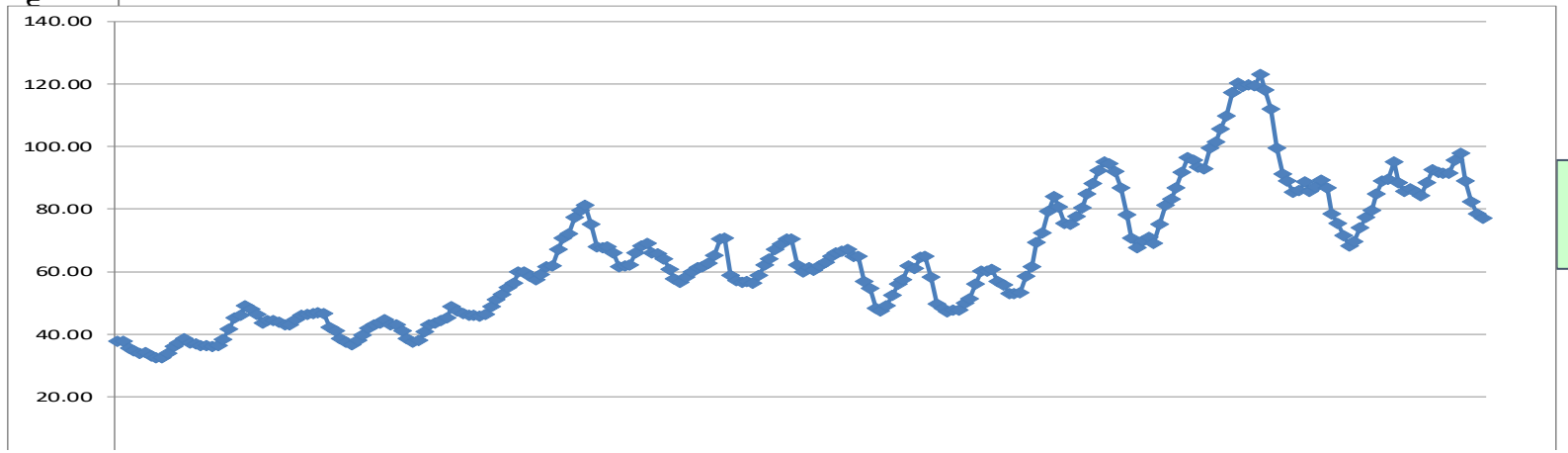
Impact of Carbon price and land cost on IRR



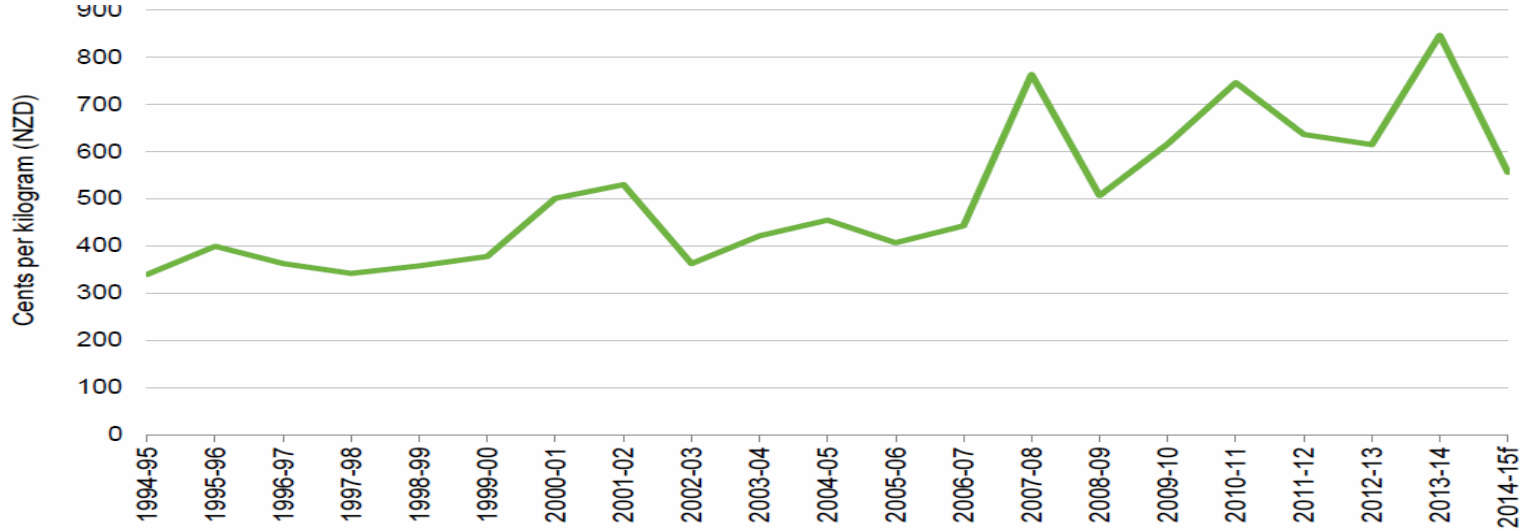
Accounting for uncertainty



Domestic log prices

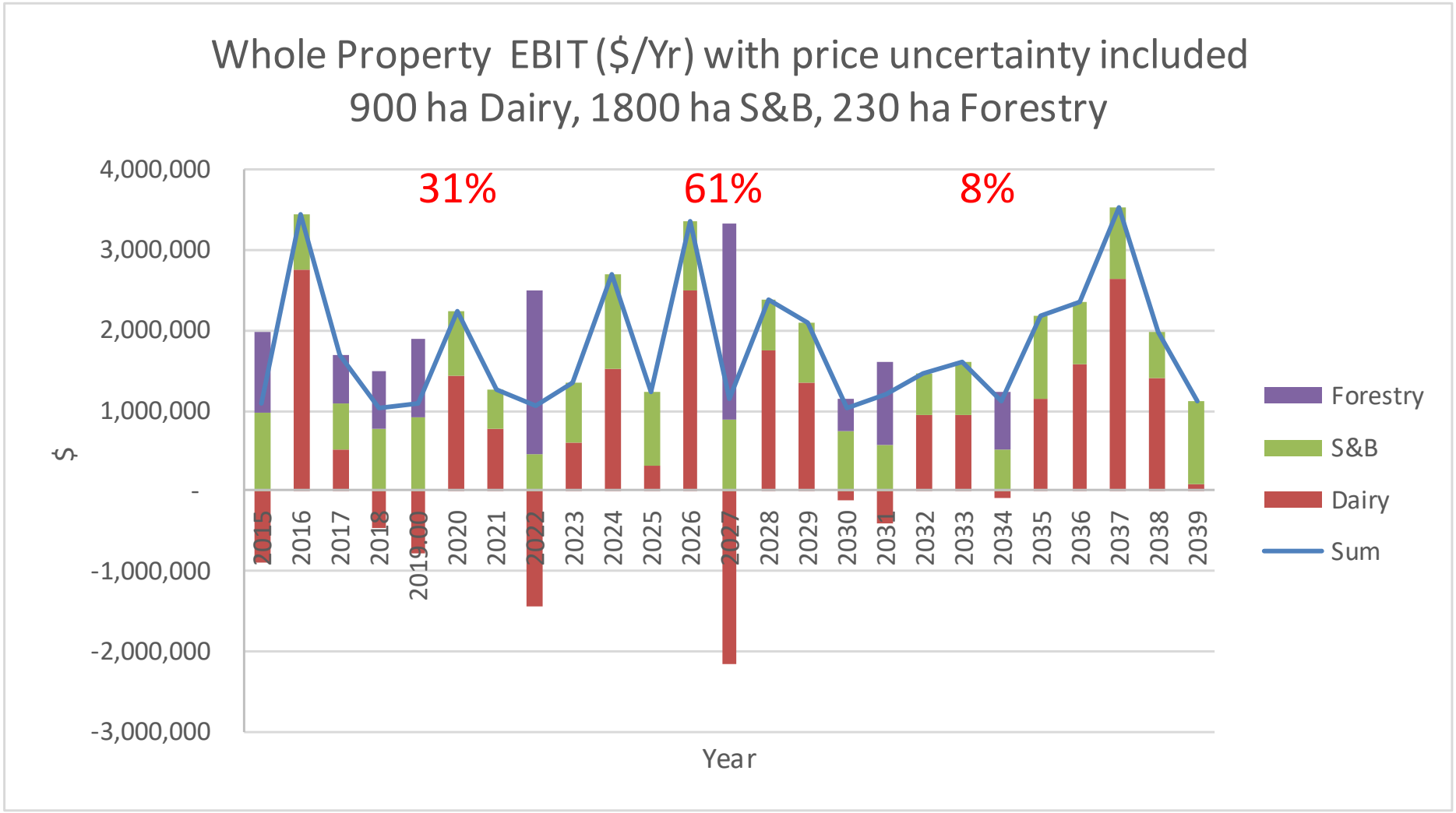


Lamb prices



Milk solids prices

Hedging pastoral income with forestry



Goals - Minimum net income maintained at >$1m/year for 2,930ha property

Summary

Successful integration of Forestry & Carbon will bring benefits

to farmers but need to accommodate site and timing factors:

1. **Site factors influence species, productivity, afforestation and harvest costs**
2. **Timing - planting rate, Carbon flows, ETS rules, carbon price**
3. **Finance - structures for early shortfall**
4. **Planning - land use for resilient cash flows**

Thank you