NSW 2024 Tree Conference

Natural Capital: Trees as an alternative crop

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Central Tablelands Regional Landcare

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Welcome

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Landcare

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Welcome to Country

Auntie Shirley Scott

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Introduction

Ash Bland

NSW TREE CONFERENCE 2024

Keynote Presentations

Rowan Reid

Bambra Agroforstry Farm

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Growing Trees on Farms

For Conservation AND Profit

Rowan Reid

Bambra Agroforestry Farm

I’m a Forester on a farm

I’m also a Forest Scientist

B.For.Sci. M.For.Sci.

THE UNIVERSITY OF MELBOURNE

Senior Lecturer

till 2010

World Agroforestry Conference France 2019

Native Forestry!

Big timber plantations!

Conventional plantations on farms

CARBON! - Could be even worse

Converting farmland to indigenous forest!

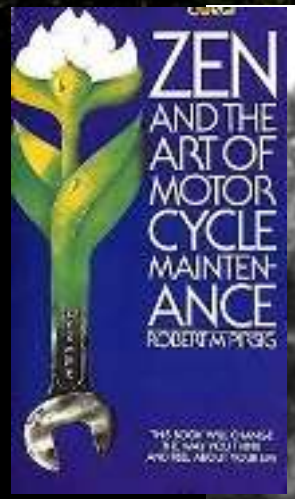
Natural Regeneration – The Irrational Option

Natural Regeneration – The Irrational Option

Silos of administration, industry, knowledge, and funding

Brim silos - artwork by Guido van Helten

Forestry on farms can be so much more

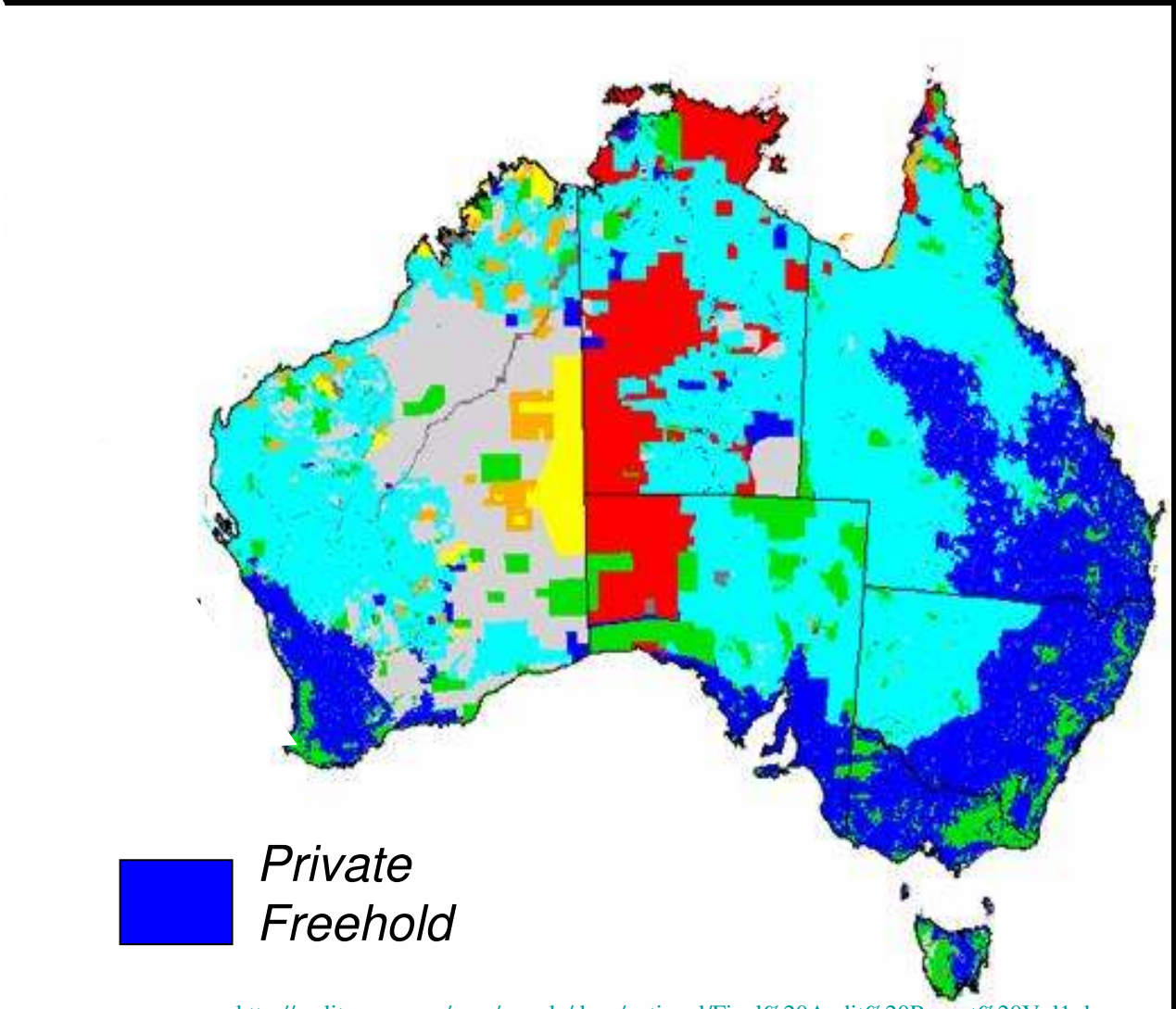


Forestry is just the growing of trees and cannot by its own nature be ugly or there would be no beauty in gardens, which also involve growing trees.

Forestry on farms can be beautiful

Farmers growing trees for the reasons that are important to them

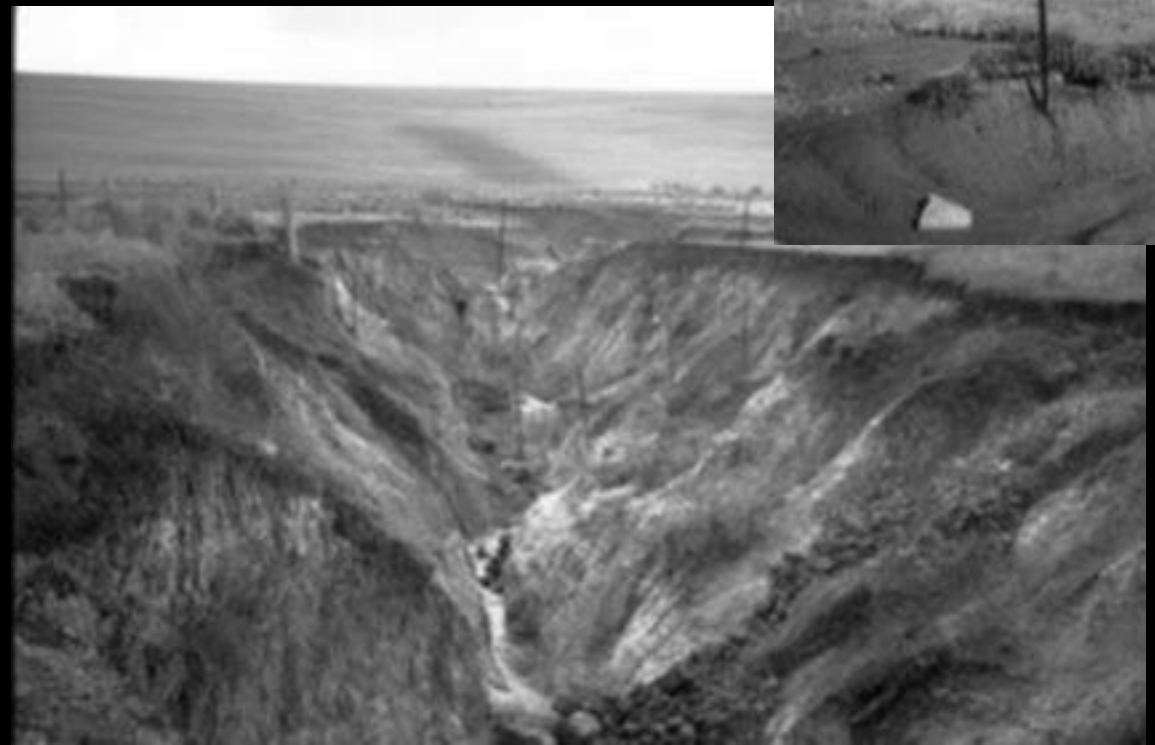
The family farming landscape



http://audit.ea.gov.au/anra/people/docs/national/Final%20Audit%20Report%20Vol1.doc

The family farming landscape!

Ugly: for soil and water quality ….



Ugly: for biodiversity .....

Ugly: for stock shade and shelter .....

Ugly: for comfort!

My grandfather’s farm

Cropping v’ s native vegetation

Drawing profit from native vegetation


Forestry
for
profit
Forestry for
conservation


Forestry for
conservation
and profit

Bambra Agroforestry Farm

Make *forestry* attractive to family farmers

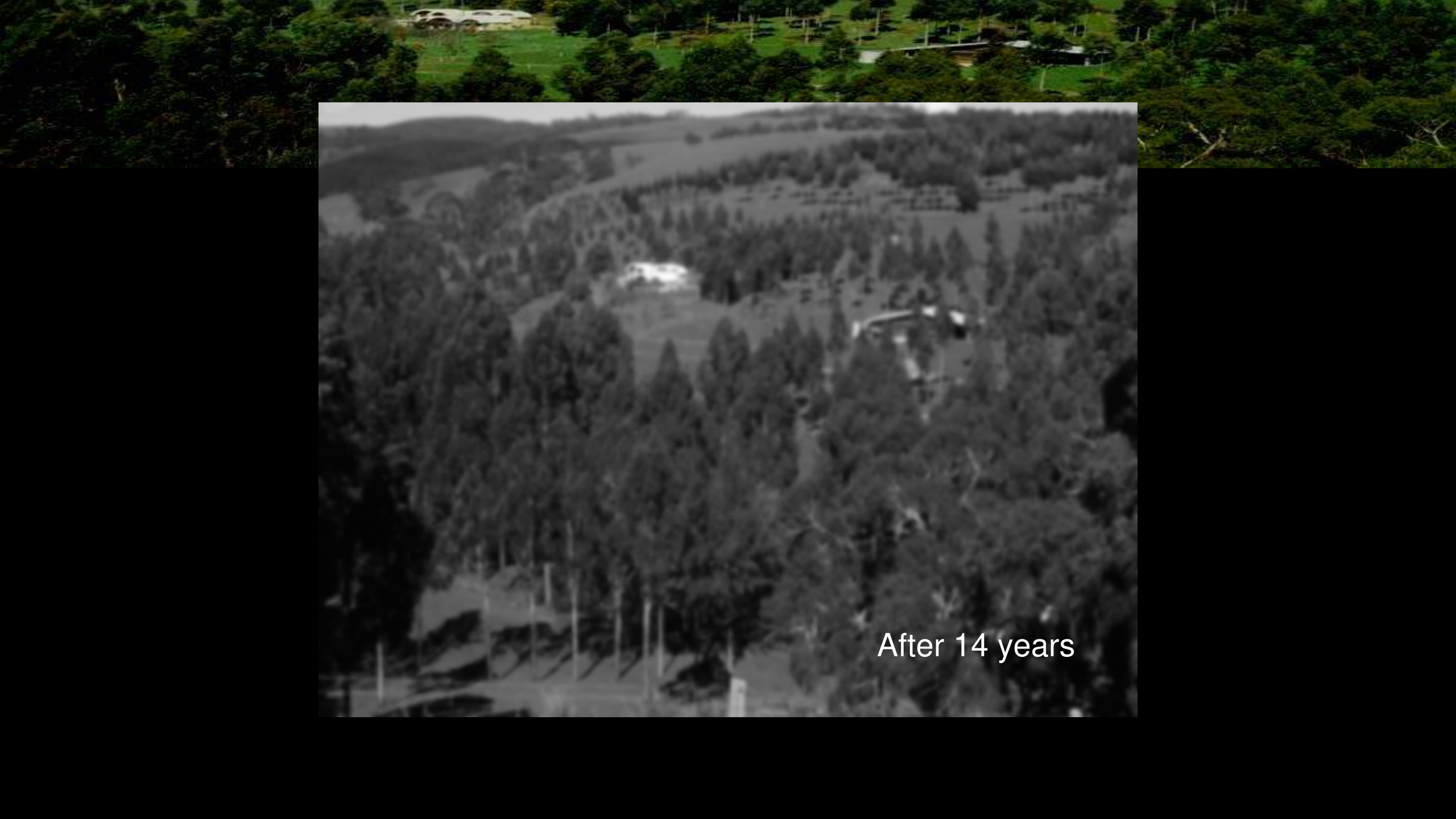
1987

Bambra Agroforestry Farm

This meant changing forestry

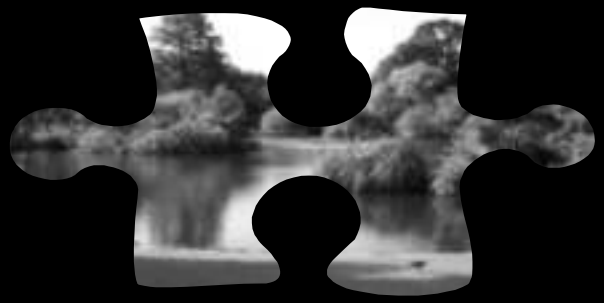
Plant for Conservation & Agriculture

Manage to create opportunities ($)

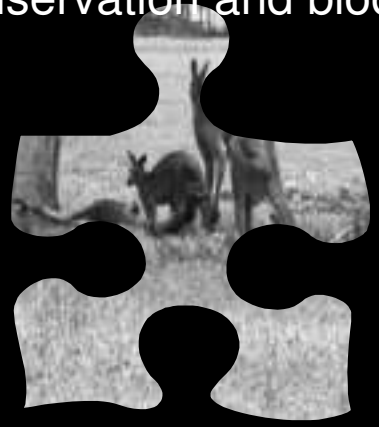

After 14 years

Trees on farms for multiple values

Aesthetics



Conservation and biodiversity



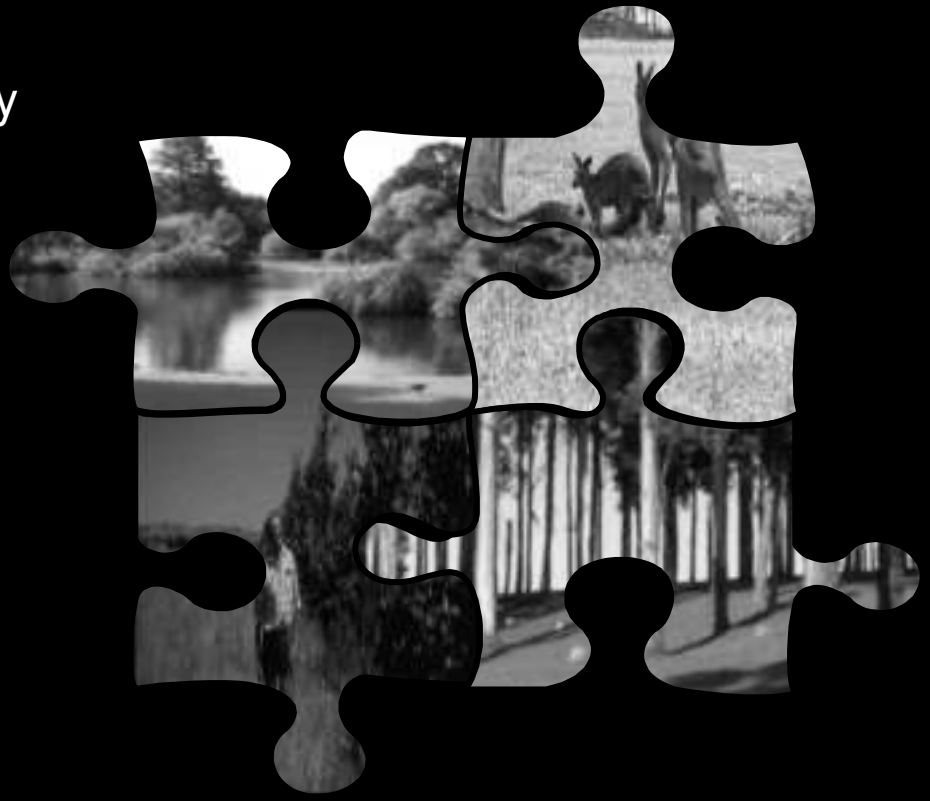
Shade and shelter

Tree Products

Trees on farms for multiple values

Aesthetics
biodiversity

Conservation and



Shade and shelter

Tree Products

Timber as a by-product of growing and managing trees for

- Soil and Water
- Biodiversity
- Shade and shelter
- Aesthetics


F17 Eucalypt 35-yr-old
F7 Pine - Clearwood
F5 Pine
Board-form concrete using Redwood

Active management is the key

I don’t just let

“Nature take its course”

Blackwood
Acacia
melanoxylon

4-years-old


NORWOOD
LumberPro

This can be an “Act of Conservation”

From: ABC’s Gardening Australia

36-yr-old high-pruned Eucalypt

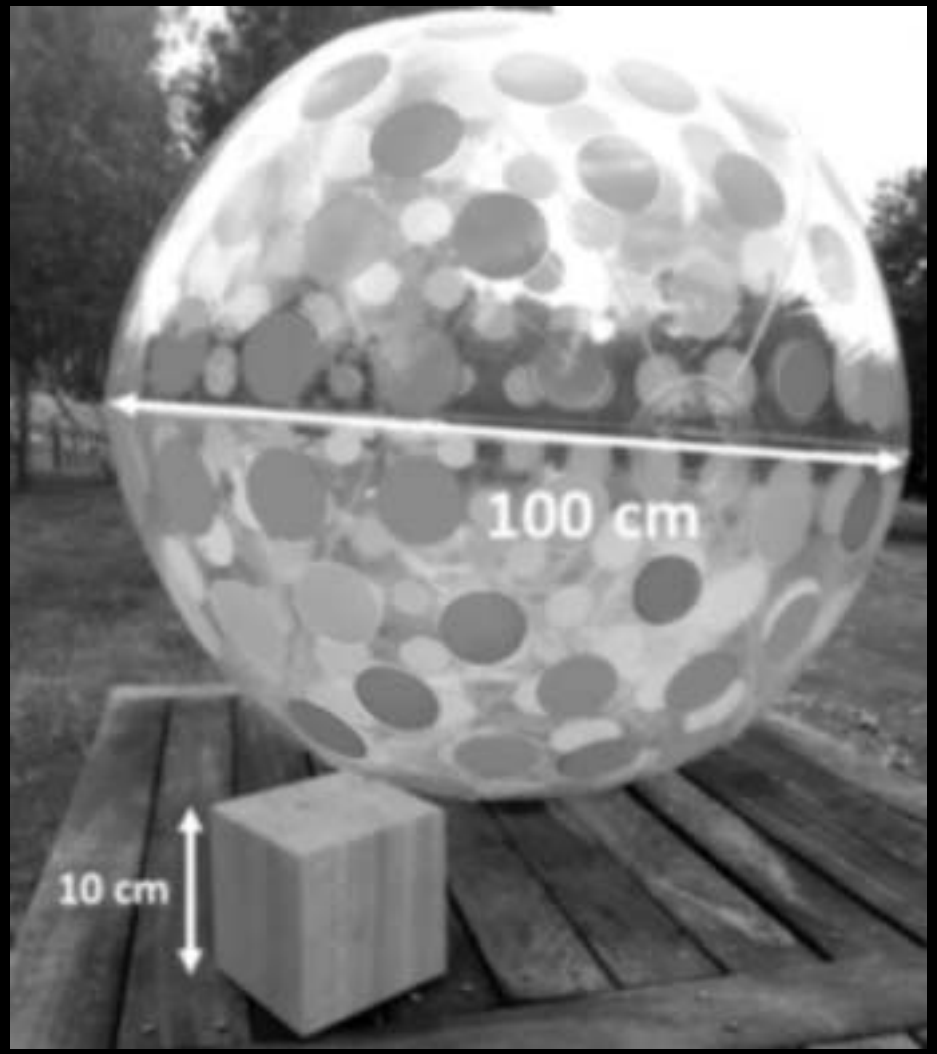

GT40


IGS
MOUNTAIN
ASH
E. regnans
26 yr

$200 tree - $2000 wood - $20,000 furniture

Mark Tuckey Furniture,
Melbourne

Locking up carbon in wood



Wood is 50% carbon

Volume of the block	1000 cm^3
Weight of the block	850 grams
Moisture content of wood	12%
Bone dry weight of the block	760 grams
Carbon content of dry eucalypt wood	50%
Carbon weight in block	380 grams
CO2 Equivalent (multiple by $^{44}/_{12}$)	1.4 kg
Volume of CO_2 (1kg = 0.55m^3)	0.8 m^3
Diameter of a ball containing the CO_2 gas locked up in the block of wood	1 metre

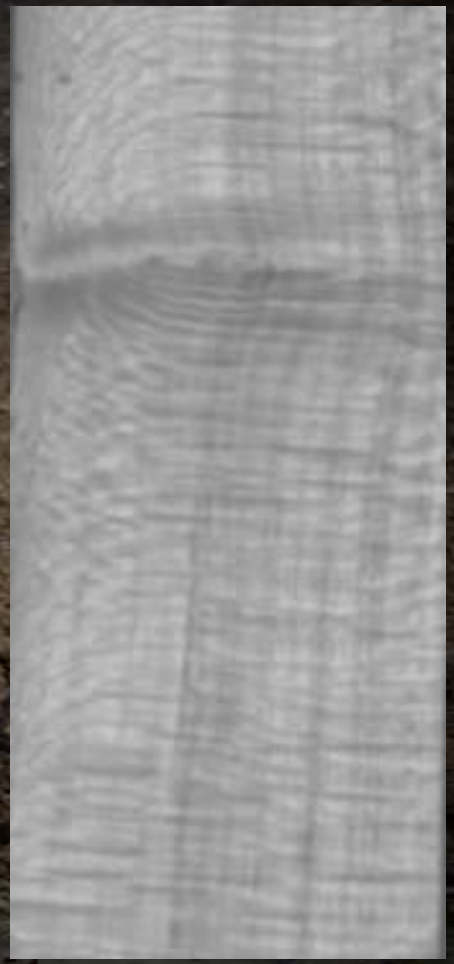
There is still a forest – growing and locking up carbon

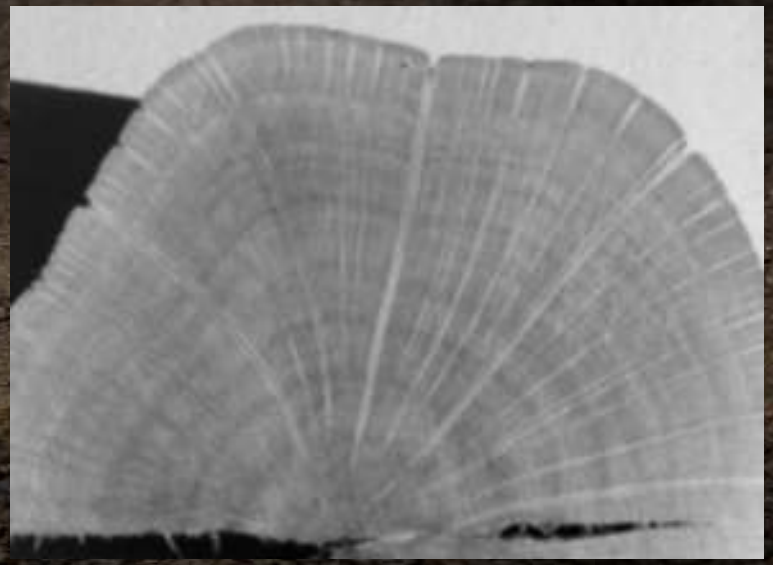
Carbon “factory”

Not just a carbon “sink”


Chapter 5
Australian
Silky Oak
Grevillea
robusta

Silky “Oak” rays





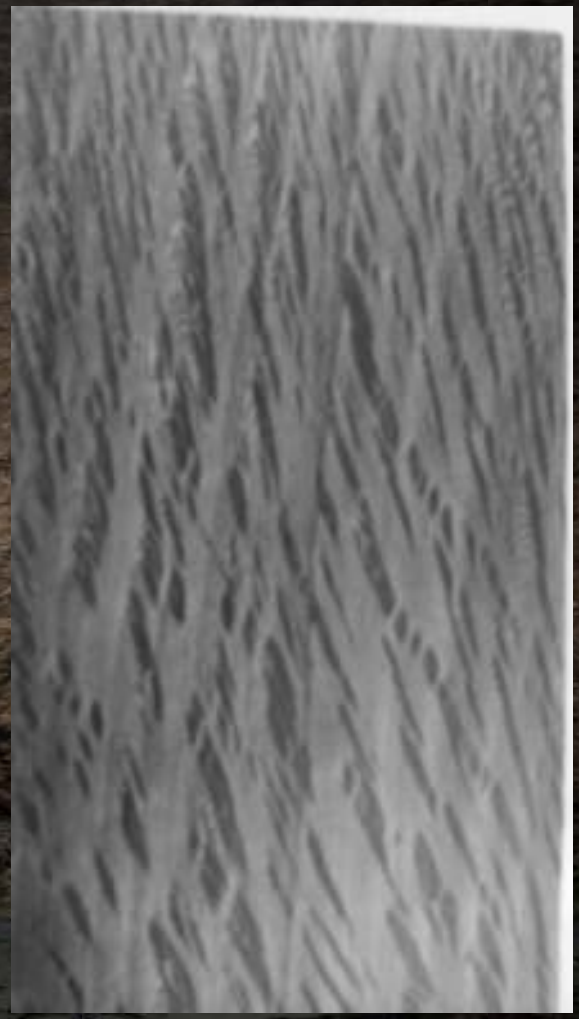
She “Oak” rays

Feed Trees

Sugar Glider feeding on Silky Oak in winter

River
Sheoak
Casuarina
cunning-
hamiana

Drooping Sheoak
Allocasuarina verticillata



Yellow-tailed Black Cockatoo - Pines

Red-tailed Black Cockatoo
(Sheoak and Banksia)

Production that supports conservation and agriculture (and looks great)

Wood in Waterways

Wood on the ground - “Messy farms”

Brown Antechinus
Antechinus stuartii

"During the day it can be found in large communal nests in tree hollows, crevices or ***logs on the ground****."*

https://australian.museum/learn/animals/mammals/brown-antechinus/

Charles Massy

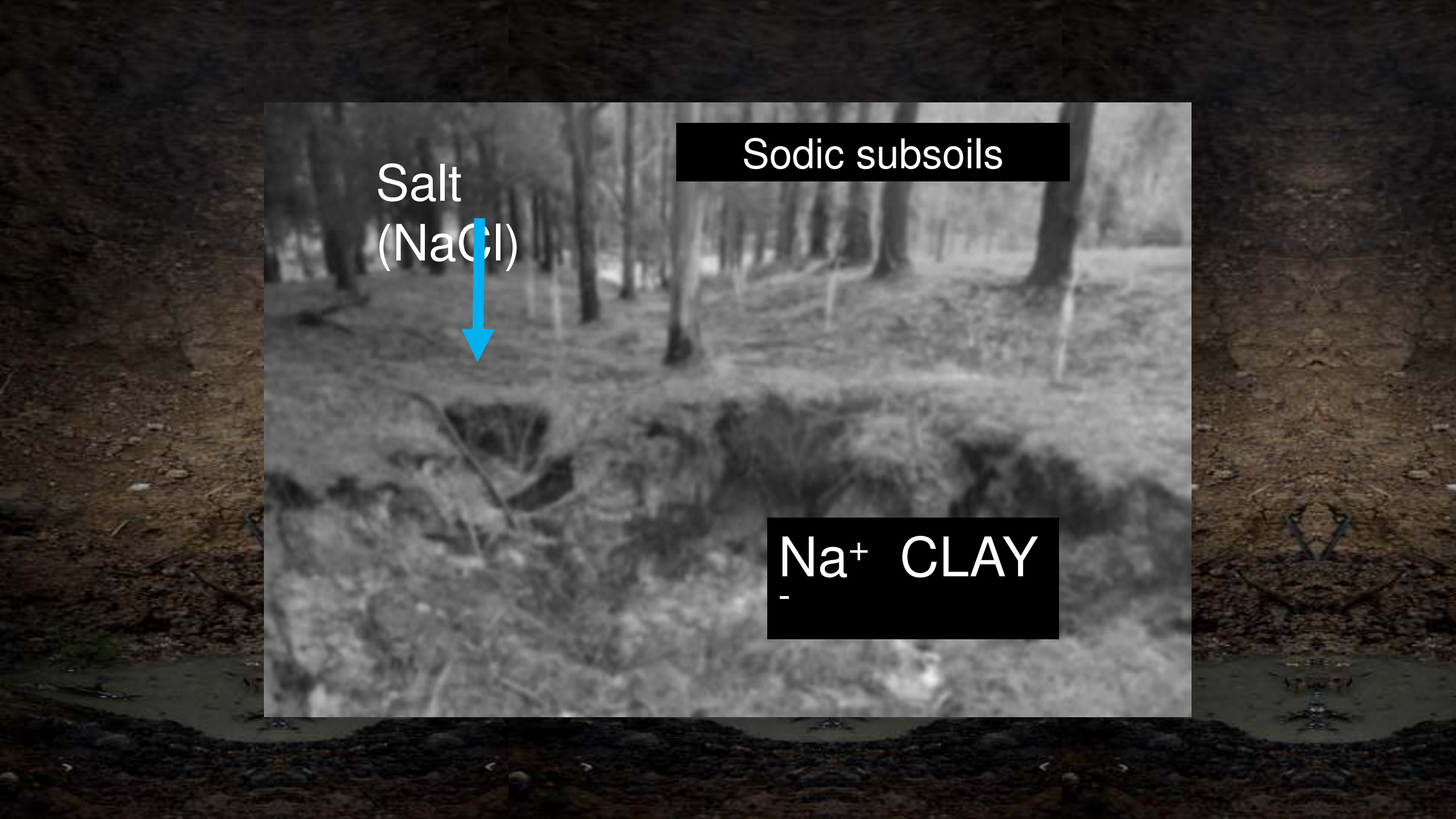
"this new form of agroforestry is based on not just restoring landscape function but also on building economic, ecological and social resilience into rural communities and landscapes"

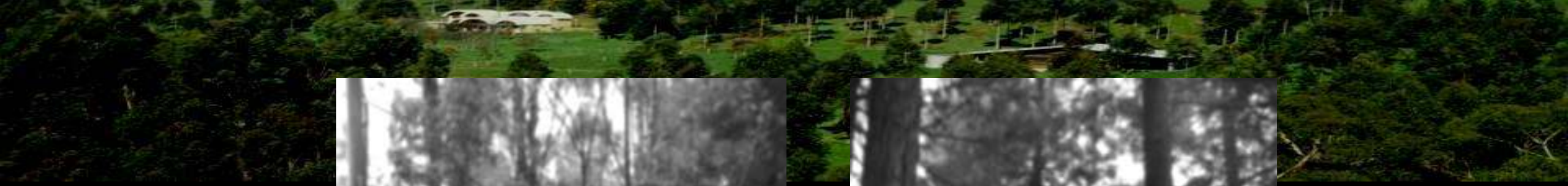
Call of the Reed Warbler (page 419)

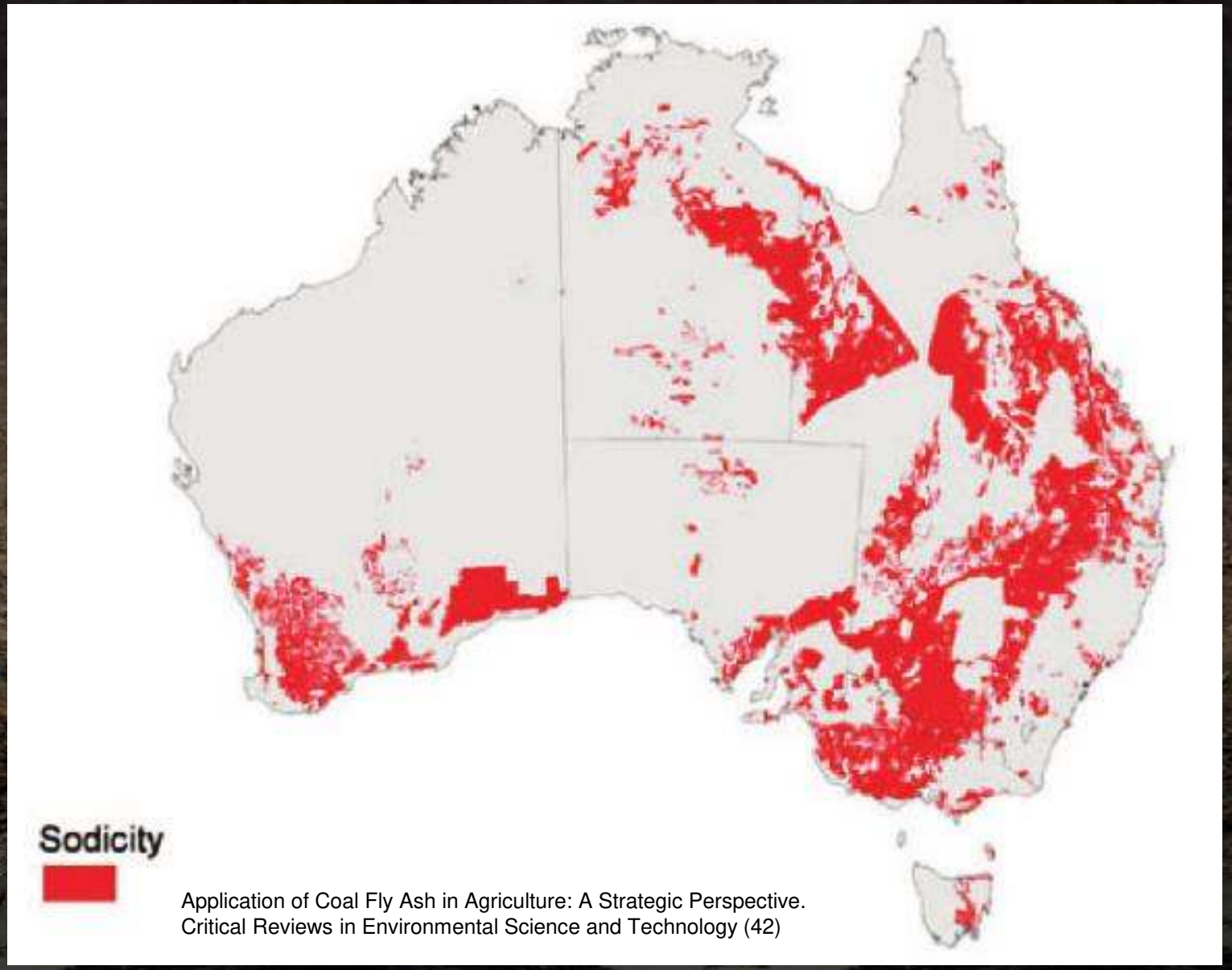
A place for exotics?

Black Walnut *Juglans nigra*

Coast
Redwood
Sequoia
sempervirens


Sodic subsoils
Salt
(NaCl)
Na+
-
CLAY

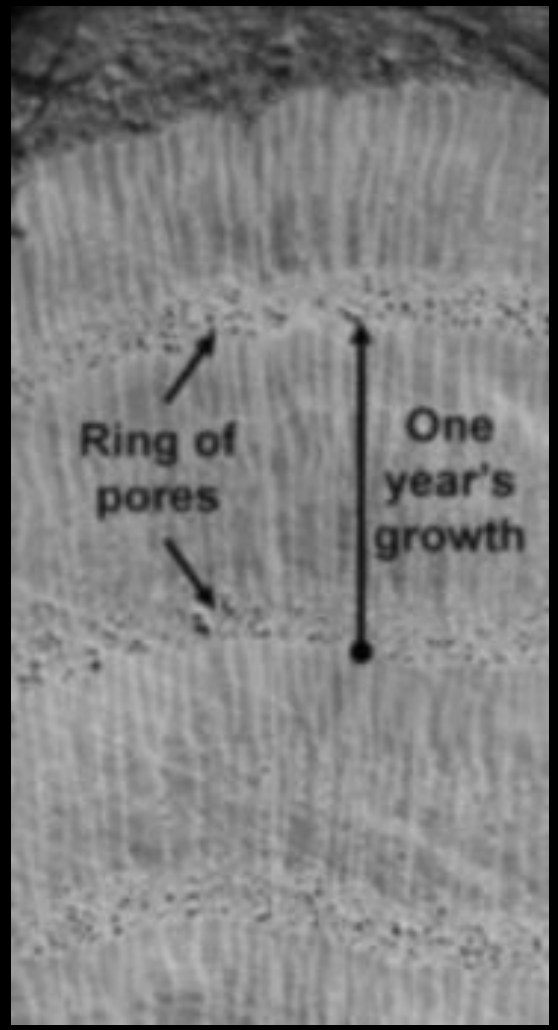




Application of Coal Fly Ash in Agriculture: A Strategic Perspective.
Critical Reviews in Environmental Science and Technology (42)

English Oak *Quercus robur*

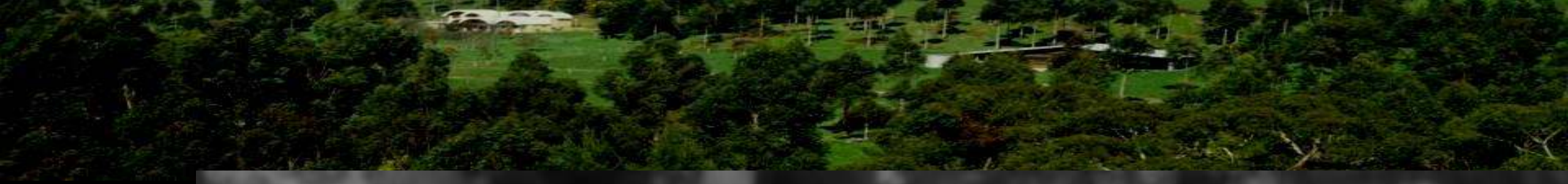
English Oak



Faster growth = much heavier wood

No chapter on pines!

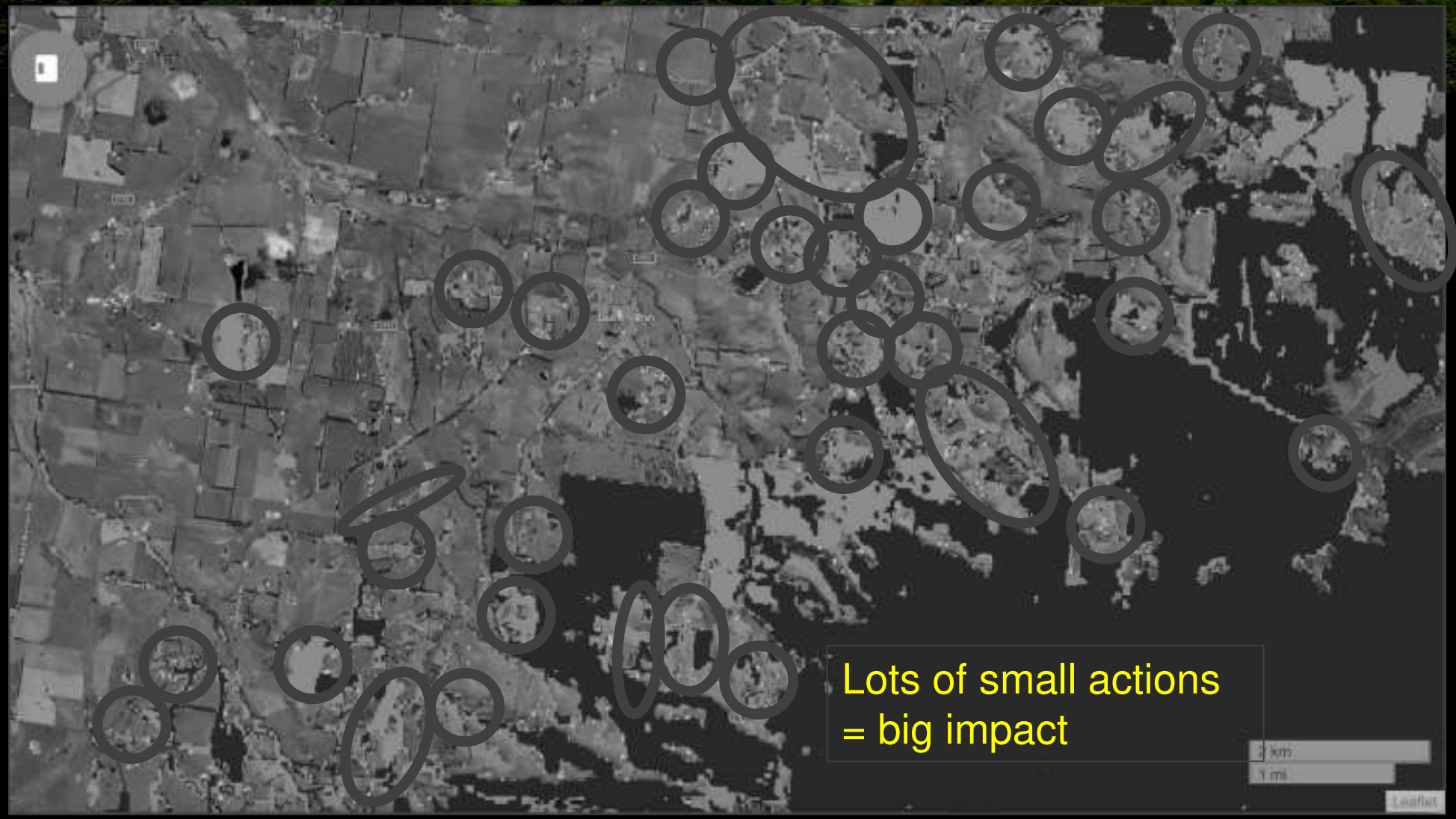
Eucalypts (7)
Blackwood
Redwoods
Silky Oak
Sheoaks
Poplars
Black Walnut
Oaks
Red Cedar



Quality Pine

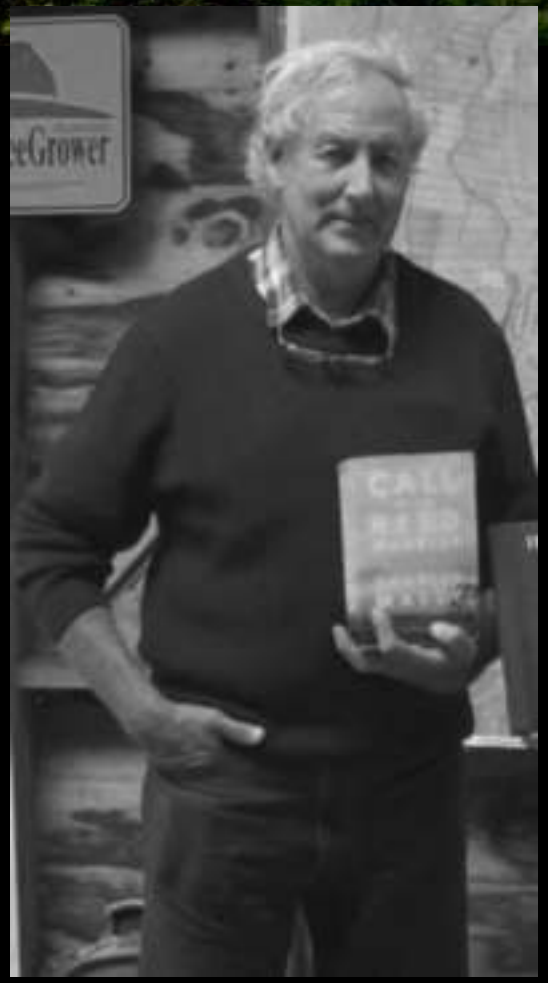
Quality Pine

Structural Grading


Lots of small actions
= big impact
3 km
1 mi
Leaflet

A community of change

Charles Massy



" undoubtedly the most innovative, constantly evolving and forward-looking farmer-driven agroforestry network in the nation" (page 420).

OTWAY AGROFORESTRY NETWORK

What we do do

- Run MTG courses
- Undertake site visits
- Provide peer mentors
- Facilitate markets
- Build information networks
- Lobby govt/industry

No demonstrations
No $ for trees and fences

Support farmer decision making

Peer Group Mentoring

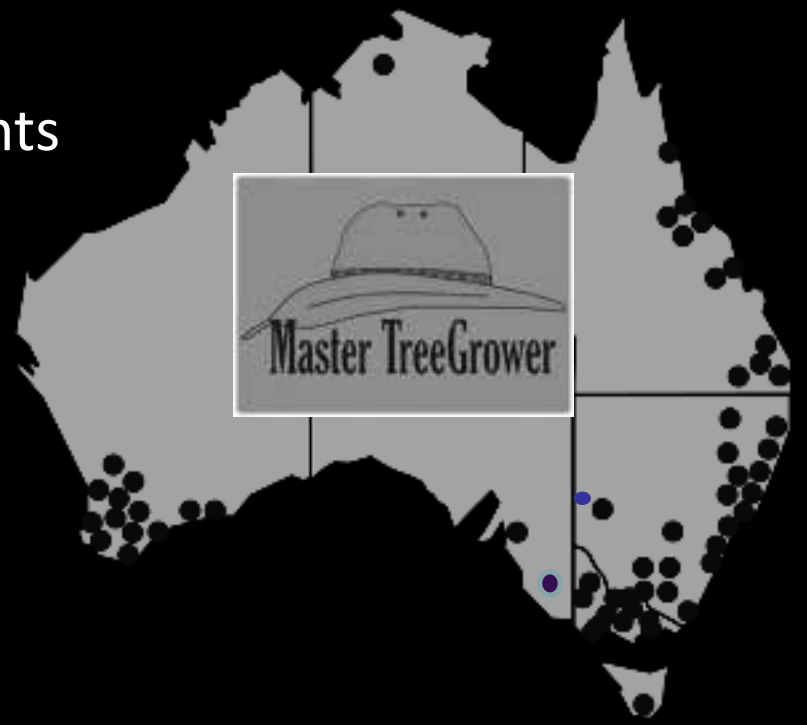
Pay farmers to talk to farmers… about trees

Like teaching someone to paint

The Australian Master TreeGrower
Since 1997

125 Courses
>2500 Participants

AUSTRALIAN AGROFORESTRY FOUNDATION



A diversity of forests ……..

….. reflects the inherent diversity within our community

Farmer-led forestry can deliver more biodiversity, quality timber and lock up more carbon

Trees don’t change landscapes – People do

OTWAY AGROFORESTRY NETWORK

Master TreeGrower

AUSTRALIAN AGROFORESTRY FOUNDATION

Questions

Fabiano Ximenes

Senior Research Scientist Forest Science, NSW DPI

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Integration of short-rotation native trees in farms

Fabiano Ximenes (NSW DPI) – March 2024

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Landcare

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DPI Forest Science

- DPI Forestry: Forest Science; Forest Policy and Plantations Regulation Unit
- Forest Science: ~ 25 staff (research scientists, technical officers, professional officers, project officers)
- 4 key areas of research:
  Forest Ecology
  Forest Health and Biosecurity
  Forest Resource Assessment
  Forest Carbon

ABBA (Australian Biomass for Bioenergy Assessment)

- http://nationalmap.gov.au/renewables/
- https://portal.ga.gov.au/

Bioenergy and other markets

- Electricity / hydrogen generation
- Industrial Heat
- Liquid Biofuels
- Biochar (Pyrolysis systems)
- Green chemicals
- Eucalypt oils
- Bio-plastics

Bioenergy – co-benefits

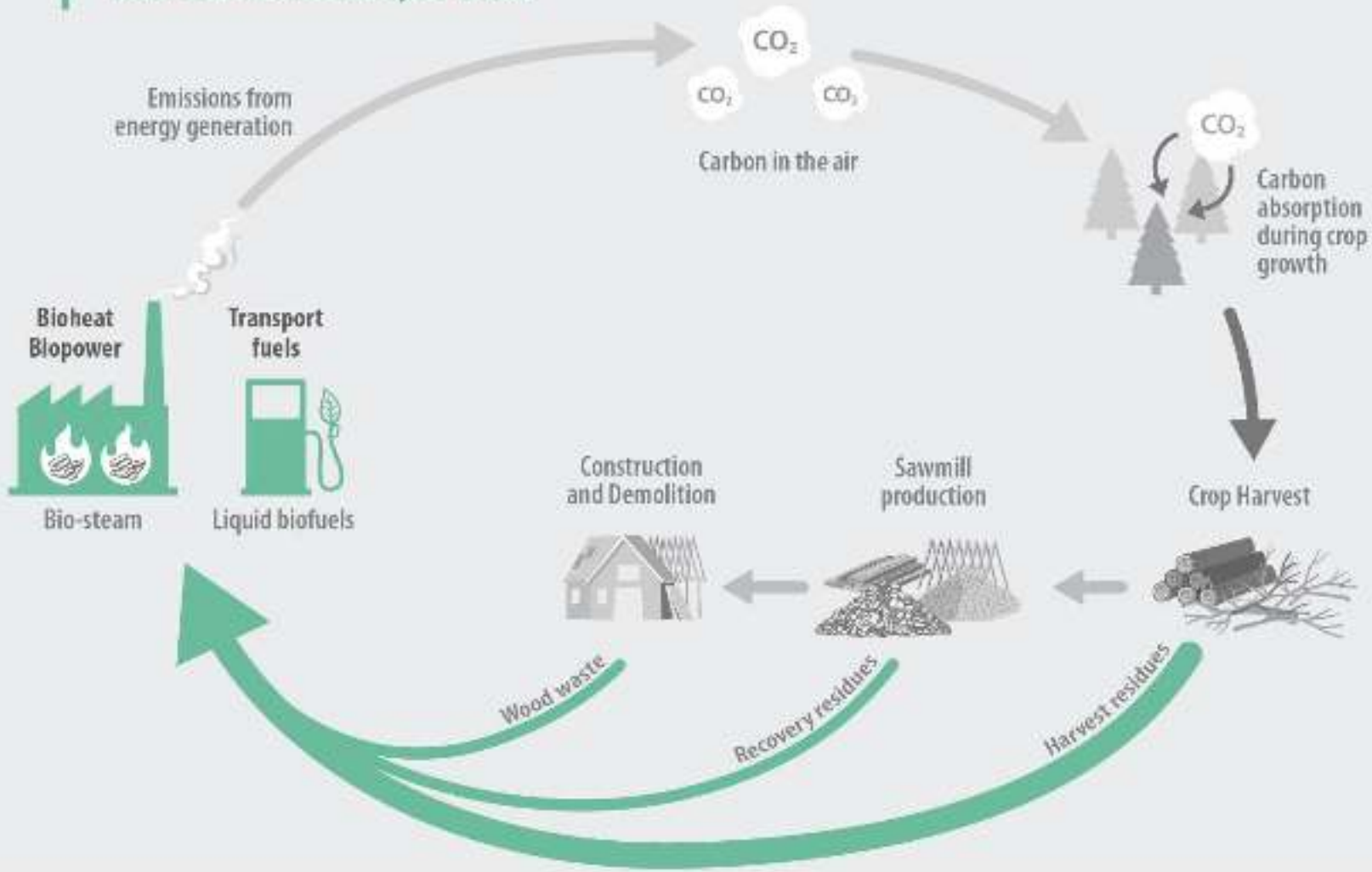
Some bioenergy technologies produce byproducts that can be used to make useful products such as renewable bitumen; green chemicals, etc...

Additional benefits from bioenergy may include:

- Emission reductions (if sourced sustainably)
- Waste reduction
- Energy security
- Job generation in regional areas

Biomass for bioenergy

How does the carbon cycle work?



Industry interest

- Verdant Earth: Aim to rely 100% on biomass crops to supply 150 MW energy (equivalent to about 80,000 ha)
- Cape Byron Power: Aim to transition from current residues to dedicated crops; aim to plant around 6,000 ha

Hard to decarbonise sectors:

- SAF: large volumes needed, active interest in dedicated woody crops
- Steel production – Bluescope Steel

Biomass residues in NSW

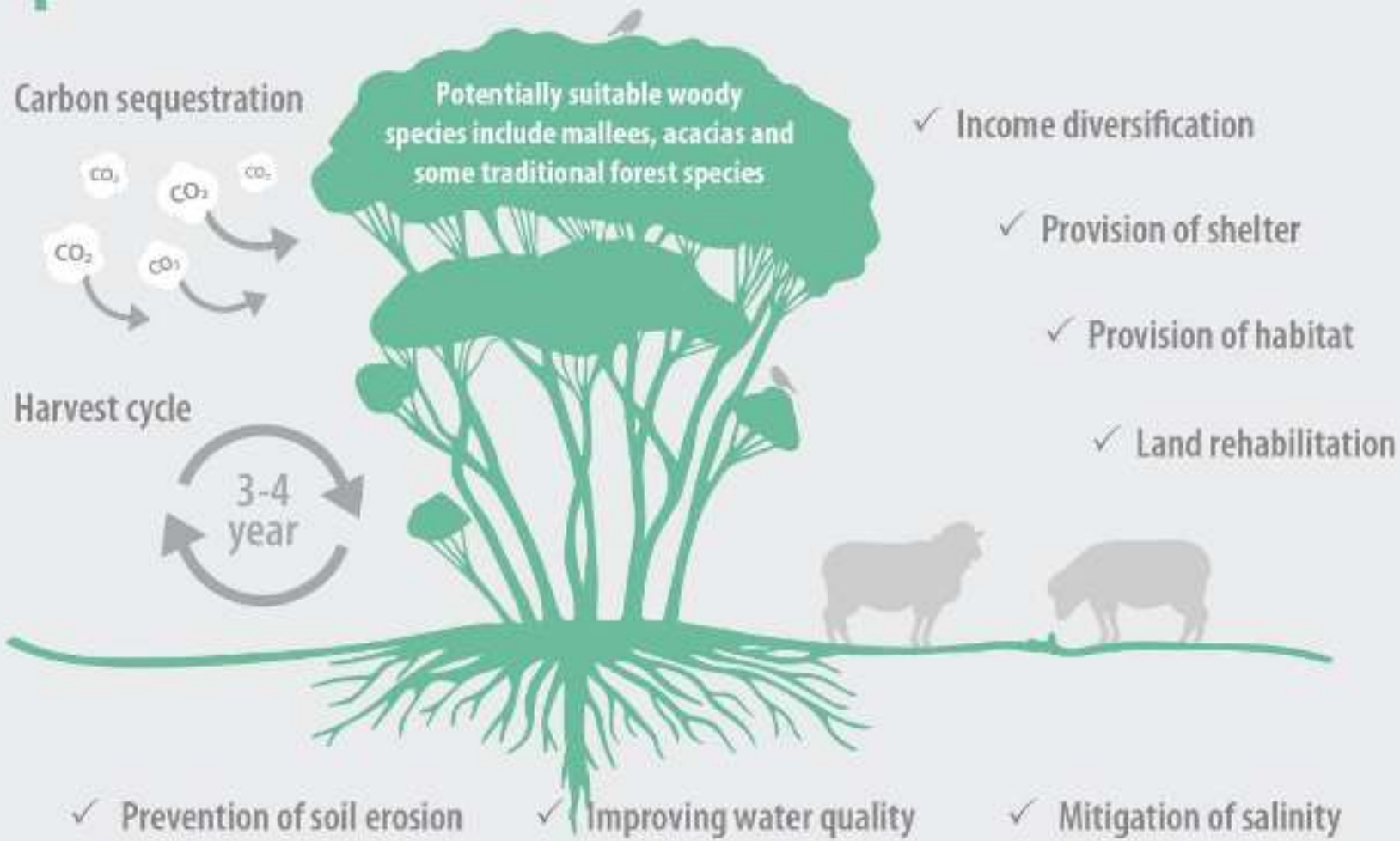
Feedstock type	Tonnes
Cropping	12,200,000
Forestry	2,250,000
Livestock	1,260,000
Other	6,749,000
Total	**22,459,000**

Significant amounts but…

- *Demand for biomass will increase exponentially*
- *Not necessarily where needed*
- *Much of it cropping residues – seasonal issues*

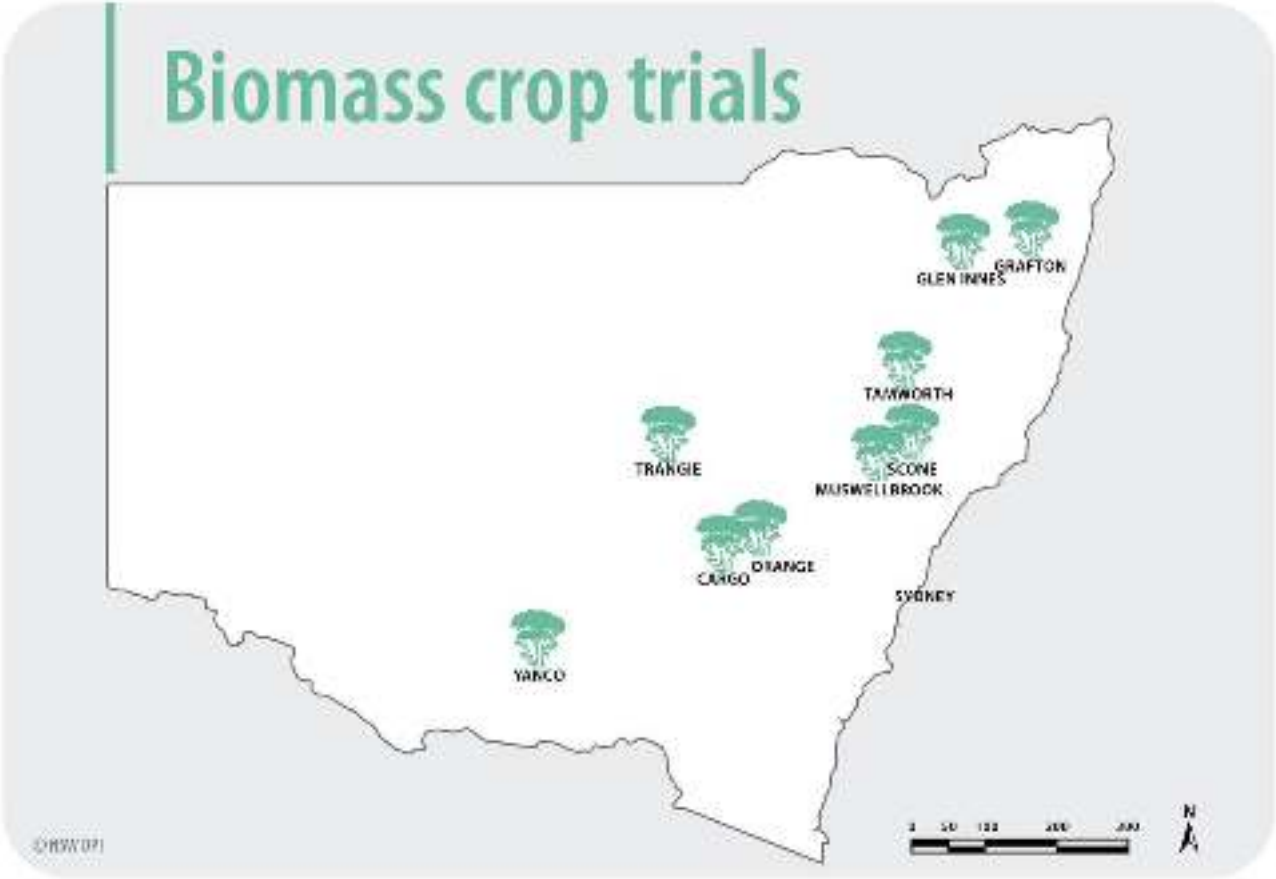
Biomass crops for energy

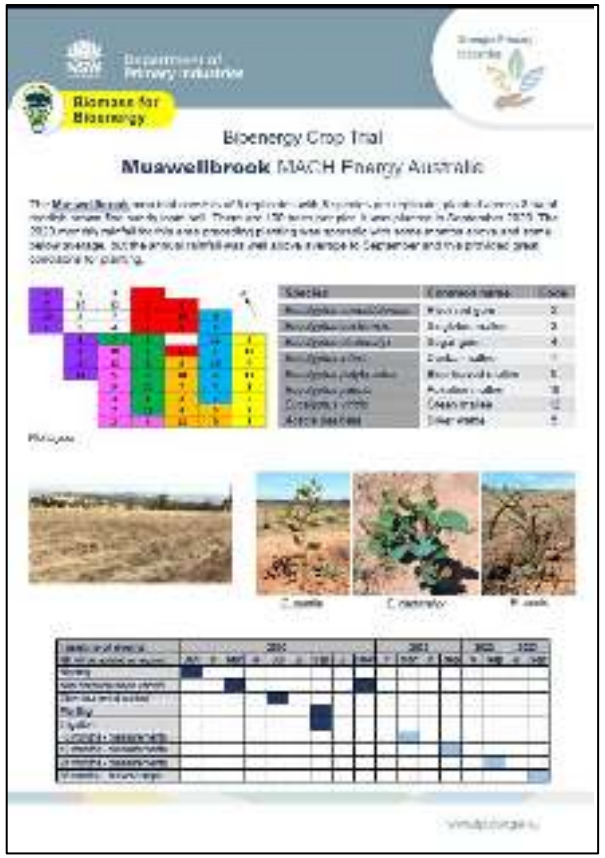
Potential benefits



- ✓ Income diversification
- ✓ Provision of shelter
- ✓ Provision of habitat
- ✓ Land rehabilitation
- ✓ Prevention of soil erosion
- ✓ Improving water quality
- ✓ Mitigation of salinity

Woody crop trials





https://www.dpi.nsw.gov.au/forestry/science/forest-carbon/biomass-for-bioenergy/biomass-crops

Species selection criteria

- Potential for rapid early growth
- Resistance to stressors including drought and some frost
- Ability to coppice strongly preferred
- Some track record of performance preferred
- Australian native species

Why not annual crops

- More limited geographically
- More limited in uses
- Can be damaging to hardware
- No carbon credits
- Fewer ecosystem benefits
- Social license – visual amenity

Acacias

Species	*Common name*
A. dealbata	Silver wattle
A. saligna	Golden wreath wattle
A. salicina	Black wattle

A. dealbata

Mallees

Species	*Common name*
E. castrensis	Singleton mallee
E. horistes	Pointed-bud mallee
E. infera	Durikai mallee
E. polybractea	Blue malee
E. viridis	Green mallee
E. pumila	Pokolbin mallee

E. infera

Other Eucalypts

E. cladocalix

Species	*Common name*
E. camaldulensis	River red gum
E. cladocalix	Sugar gum
E. benthamii	Camdem white gum
E. macarthurii	Camdem woollybutt
E. moluccana	Grey box
E. occidentalis	Swamp yate
E. spathulata	Swamp mallet
Corymbia maculata	Spotted gum

What we are measuring

- Tree parameters: D10, DBH, height, CVI
- Destructive sampling: moisture content, density, carbon content
- Individual tree weights – allometric relationships
- Plot-based productivity (tonnes/ha)
- Coppicing potential
- Soil carbon and nutrients

Tamworth crop trial

Scone 24-month growth

E. pumila

E. polybractea

E. cladocalyx

Tamworth 36-month growth

E. polybractea

E. infera

E. camaldulensis

Eucalyptus pumila
Pokolbin mallee

Eucalyptus macarthurii: Camdem woollybutt

Corymbia maculata: Spotted gum

Acacia dealbata: Silver wattle

Eucalyptus camaldulensis: River red gum

Eucalyptus cladocalix: Sugar gum

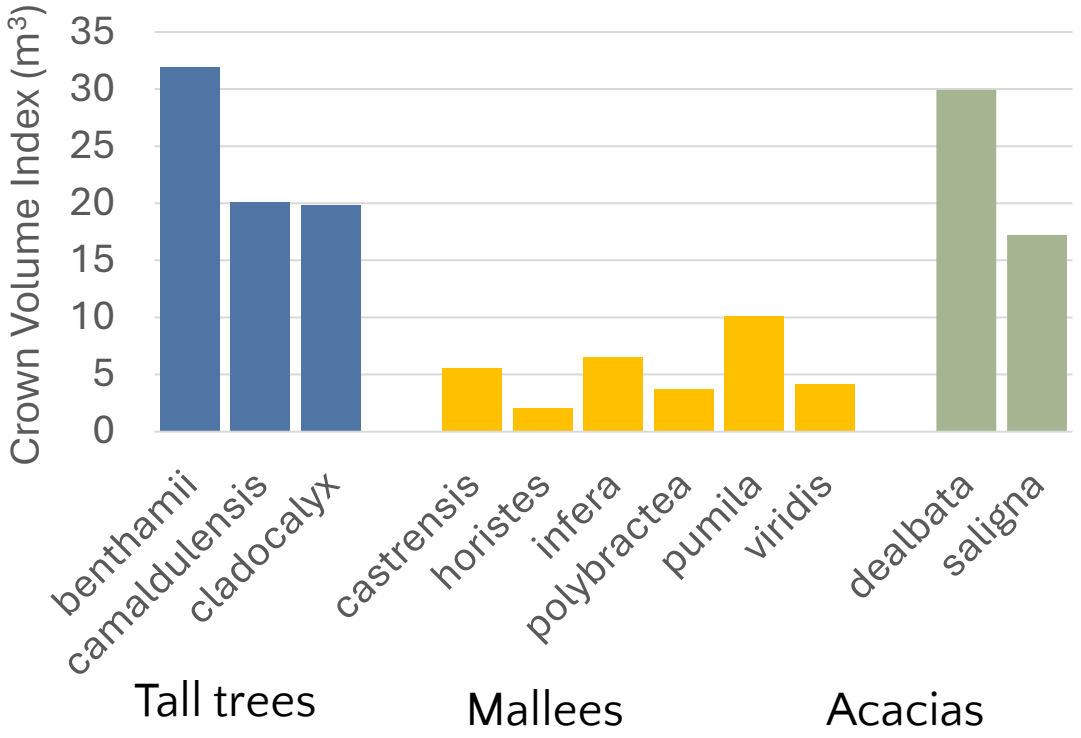
Eucalyptus infera: Durikai mallee

Eucalyptus viridis: Green mallee

Yanco coppice

- 4 months post harvest: 2 to 2.5 m

Which species did well?



24-month result (adjusted means across eight sites)

- *E. benthamii* did well on the cold Glen Innes site
- *E. camaldulensis* was consistently good on many sites
- The mallees started slowly and were out-grown
- The acacias did well on some sites
- Rainfall was v. below average prior to and immediately after establishment in 2019
- Very good seasons post-establishment in 2020

Higher rainfall

- Favoured the tall trees
- Disadvantaged mallee establishment due to weed competition

Tamworth productivity

- 3-year first rotation:

Tree type	Productivity (tonnes/ha)
Fast growing Eucs	43-58
Acacias	30
Mallees	12-25

- First research trial
- Productivity gains: tube stock, survival, configuration; first rotation more likely 4 years
- For coppicing species – gains after first rotation

Key considerations for establishment

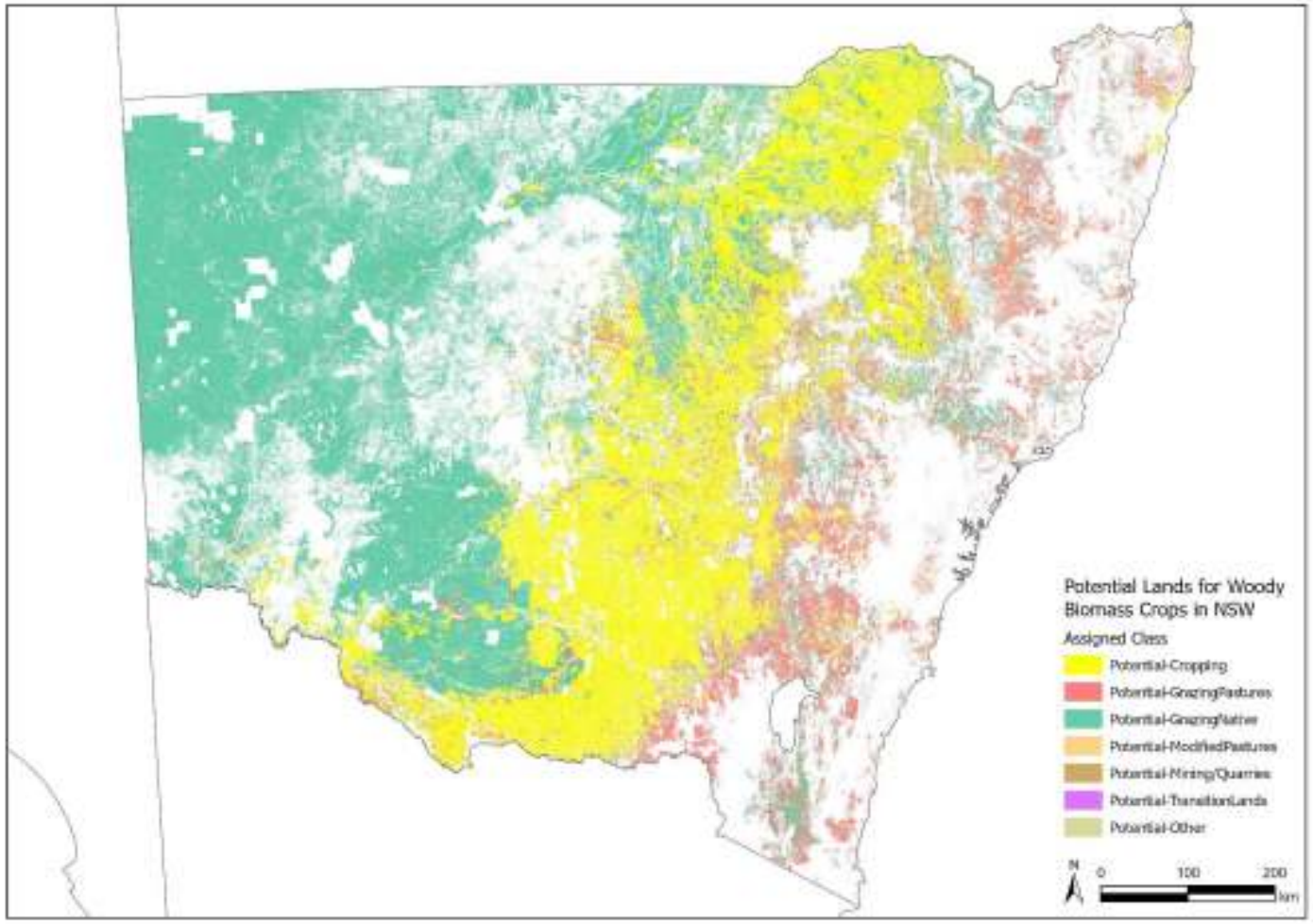
- Adequate site prep
- Good quality tube stock
- Match the right species with the right site
- Ensure access to water in the initial stages
- Management of weeds
- Staggered planting

Potential lands for woody biomass crops in NSW

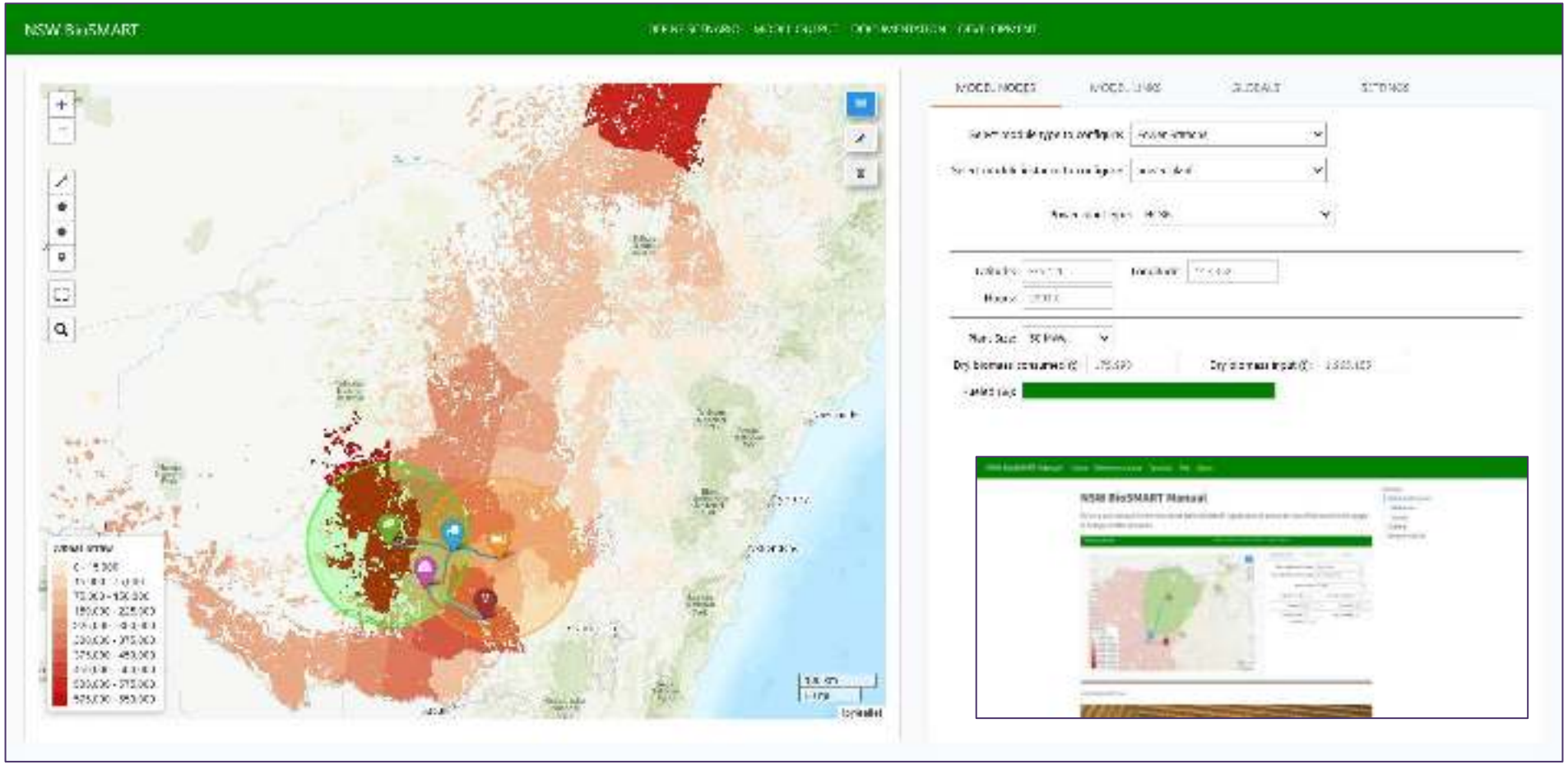
Taking into account existing land practices and within regulations to protect both native woody vegetation and native groundcover.

<u>Base data</u>:

- *NSW Native Vegetation Extent v1p2 5m 2017. tif*
- *NSW Landuse 2017 v1p2 vector layer*



NSW BioSMART (Spatial and Modular Assessment of Resources Tool)



https://www.dpi.nsw.gov.au/forestry/science/forest-carbon/biomass-for-bioenergy/nsw-biosmart

Integration into farming systems

- Block planting or belt systems (windbreaks)
- Inter-row pasture – integration of livestock
- Mixed planting systems
- Projects – Dubbo, Cobar

Carbon credits

- Under the Climate Solutions Fund: 2 pathways (Plantation Forestry and Farm Forestry) – use of FullCAM
- Current options do not reflect high density (2,500 stems/ha); majorly underestimating biomass
- Very short-rotation: typically 3-4 years
- For example E. cladocalyx; at year 3 currently yields insignificant biomass in FullCAM
- FullCAM just updated; next opportunity in next review cycle.
- Meanwhile: Potential for measured approach

Rapid assessment of biomass

- Use of drone imagery or ground-based lidar
- Opportunity to correlate captured imagery with easy to measure tree attributes
- These include tree height and tree canopy (crown volume index); correlation with biomass
- Important for cost-effective implementation of carbon projects

Future considerations

- Performance on poorer soils
- How to process biomass on site – harvest systems
- Whole tree removal / Retain leaves on site
- Leave trees on site for a period to reduce moisture?
- Mixed species plantings – relative performance
- Coppicing ability over time

Summary

- Growing native trees for biomass can contribute to carbon neutral energy generation
- Several suitable species identified
- Tall tree species have done well initially
- Coppicing ability and adverse climate phases may favour hardier mallees
- Opportunity to integrate threatened species into plantings along with other biodiversity benefits

- **The biomass trials have been a critical first step in developing an additional biomass resource in NSW**

https://www.dpi.nsw.gov.au/forestry/science/forest-carbon/

Questions

slido

Audience Q&A Session

NSW TREE
CONFERENCE
2024

Rodney Keenan

University of Melbourne

NSW TREE CONFERENCE 2024

greeningbathurst

Landcare

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The Business Case for Trees on Farms

Rod Keenan, Rachelle Meyer, Hugh Stewart, Alex Sinnett, Kaitlyn Height, Richard Eckard

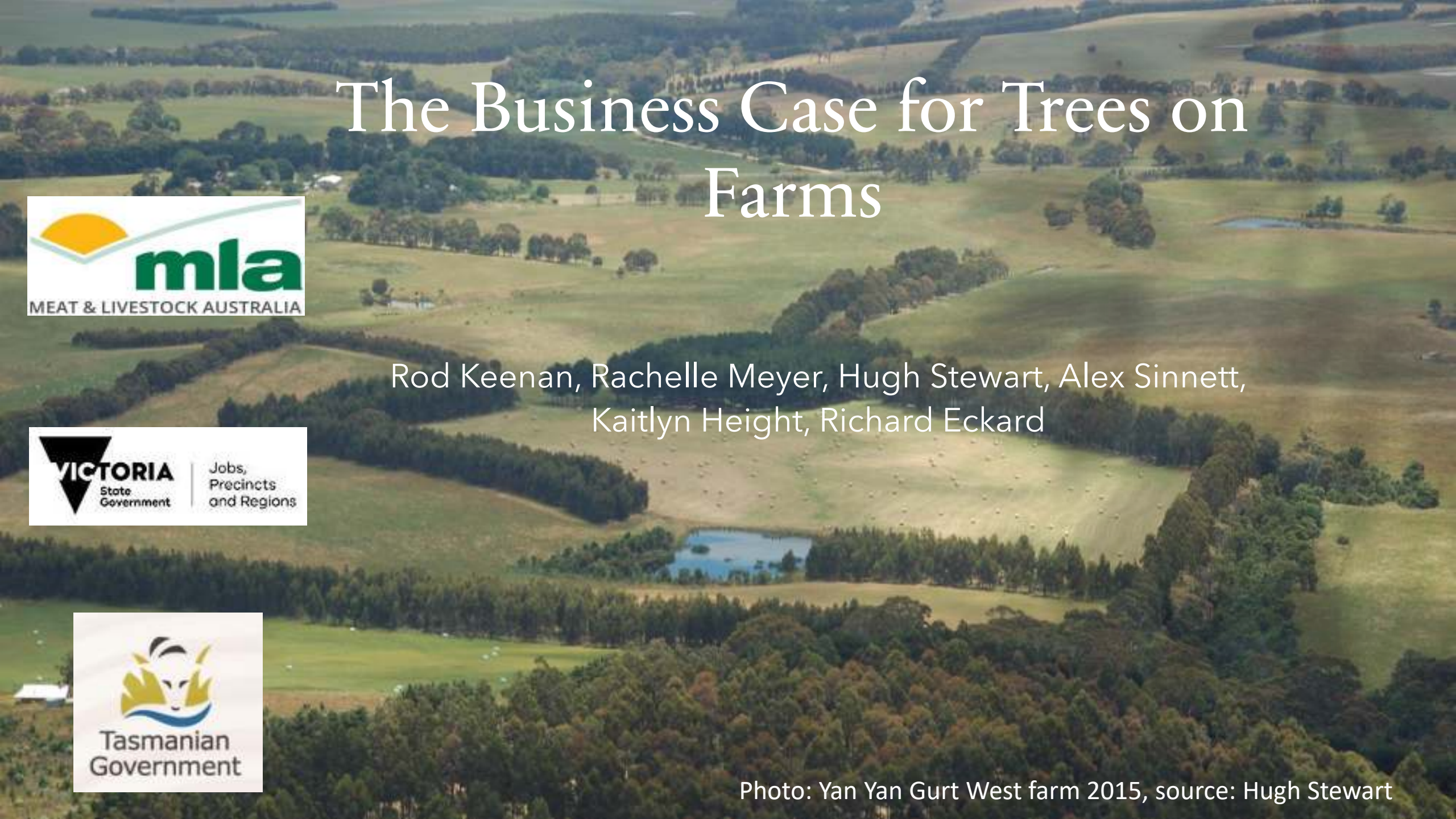


Photo: Yan Yan Gurt West farm 2015, source: Hugh Stewart

Background

- The red meat sector has committed to an ambitious target of net zero emissions by 2030
- This can be achieved by:
  - Reducing herd size and increasing management efficiency.
  - Feedstock technologies to reduce methane emissions.
  - Increasing carbon stored in trees and soils
- What is the potential value for the farm business of increasing carbon in trees on farms?

Project objectives

Document information on benefits and disadvantages of integrating trees on farm from the literature and farmer interviews

Co-design a decision-making framework that assists farmers incorporate this information into decisions on farm

Case study modelling to quantify the value of co-benefits from trees on farm

Methods

- Focus on high rainfall zone sheep (wool and lamb) and cattle systems in southern Australia
- Literature review
  - Topics include productivity co-benefits, animal welfare, and carbon
- Farmer interviews
  - 42 in-depth interviews
- Productivity modelling and economic assessment for 3 case study sites

Literature Review: sheep survival with shelterbelts

Metric	Data type	State	Benefits with shelter	Citation
Lambs (marking rate)	Farm data	Tasmania	4.8%	Tree Alliance (2021)
Lambs (percentage)	Farmer observation	Victoria	up to 11%	Norton and Reid 2013
Lambs (mortality rate)	Unpublished data	Victoria	36%	Bird (1981) *Trees and Victoria's Resources* 23(4): 2-6
Lambs (mortality rate)	Experiment	Victoria	Singles: 68% Twins: 52%	Egan et al (1972)
Shorn sheep	Farmer observation	Victoria	Unspecified reduction	Bird and Cayley (1991)
Shorn sheep	Farm data	South Australia	Direct comparison not possible, mortality during wind event. No mortality in flock that sheltered in clump of trees. Positioning of shelterbelts in relation to fencing important. Travelled with wind until confined by fence and remained there	Geytenbeek (1963)
Lamb	Field Exp	Sw Vic	In the first year area of known shelter increased the survival of single and twin lambs in the first 48 hours of birth. This was not observed in the second year.	McLaughlin et al 1970 (ordered, in a proceds maybe biomed)
Lamb	Field experiment	Victoria	Marking: 24% increase Lamb survival: 10% increase twin bearing ewes	Agricultural Victoria Linden factsheets 2022

Interviews: Sheep survival with shelterbelts

- “Lambing paddocks are selected based on shelter. Shelter drastically improves the survival when lambing in bad weather. Fenced off treelines are useful, but when lambing nice for the sheep to be in there with the trees. ”
- “We lamb in timbered country, to provide privacy and avoid mismothering”
- “Shelter is the most important thing for any lambing ewe. A ewe in great condition with lots of food won't save lambs from a bad weather event if there is no shelter. A skinny ewe without a lot of food can still produce and bond with a lamb, if in a sheltered paddock. For twins, …shelter and then small mobs are most important”
- “Chill factor is a big deal here. With smaller sheltered lambing paddocks get 10% increase in survival from lambing to marking; it is especially important for twins and triplets”.

Other benefits of trees on farms

- Animal Welfare
  - The sheep need the shelter on the hot days because of late shearing. Prefer to plant in clumps of trees where the sheep would go by choice so there is shade and still some breeze.
  - “Sheep prefer the paddock trees for shade and shelter from rainfall. Next best is boundary trees.”
  - “Paddock trees are superior for shade because of the airflow is higher than with a shelterbelt.
  - “Dairy cow production increases because cows are comfortable, in cold and heat.“ “It is 10° cooler under the trees”
  - “Beef cattle start to use the shelterbelts early on a hot days.”
  - “Our livestock use the shelter all the time. They love it.”

Biosecurity

- “In the beginning planted mainly while installing double fencing for privacy and biosecurity. Keeps lice from neighbour sheep from getting in.”
- Trees planted for “biosecurity of boundaries… keeps neighbours' problems on their land”

Property privacy, blocking undesirable views

Aesthetic benefits, staff retention and farmer wellbeing

Case studies

Jigsaw Farms

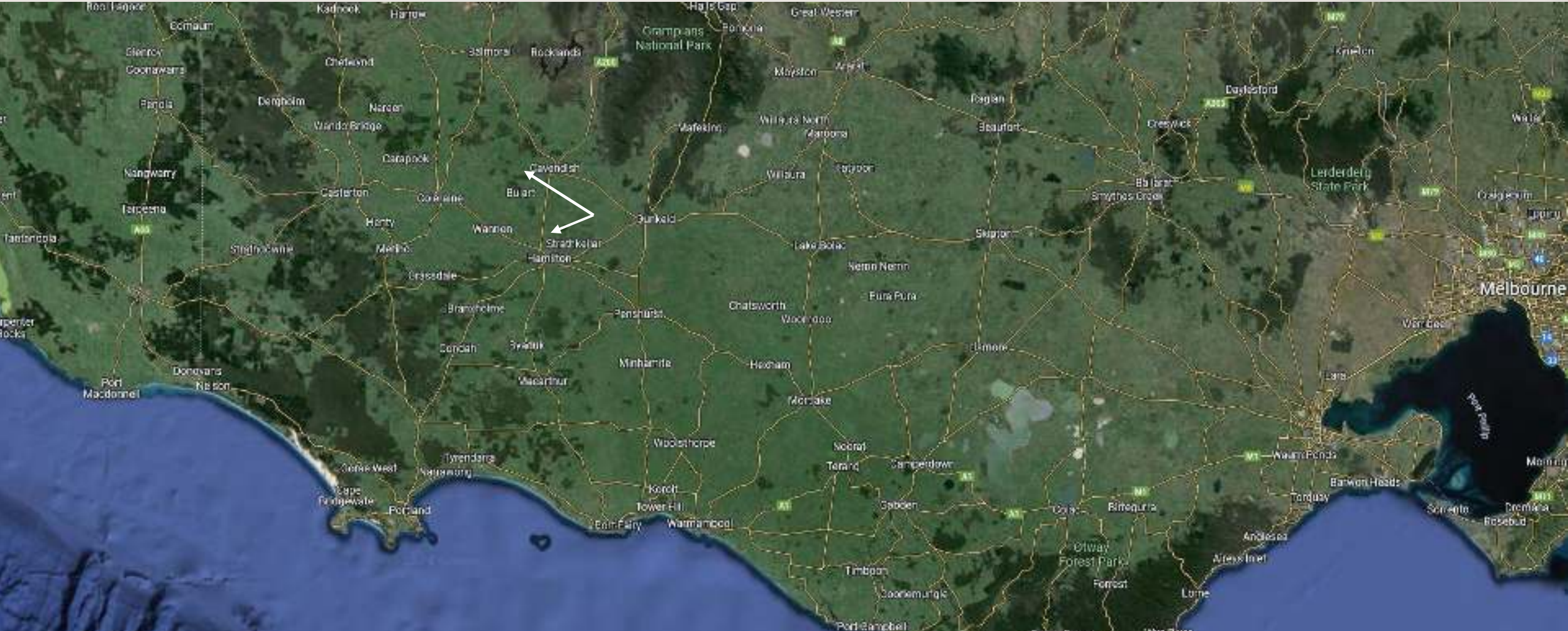
- Owners: Mark Wootton and Eve Cantor
- 3147 ha, 15 km north of Hamilton.
- Integrates agroforestry, carbon, and indigenous trees and shrubs with high-production and environmental outcomes
- Fine wool sheep, prime lambs, Angus/Poll Hereford breeding, and an Spotted Gum (Corymbia maculata) agroforestry

2022 emissions in tCO2-e/years
estimated by Ainslie Macdonald using GGAF

Scope 1 Emissions	
CO_2 - Fuel	119.26
CO_2 - Lime	714.78
CO_2 - Urea	25.62
CH_4 - Fuel	0.02
CH_4 - Enteric XB	1,869.98
CH_4 - Enteric Merinos	4,922.23
CH_4 - Enteric Cattle	1,305.84
CH_4 - Enteric Feedlot	620.0
CH_4 - Manure Management	429.61
CH_4 - Savannah Burning	23.49
N_2O - Fertiliser	24.27
N_2O - Urine and Dung	458.13
N_2O - Atmospheric Deposition	50.13
N_2O - Leaching and Runoff	0.00
N_2O - Savannah Burning	0.00
N_2O - Fuel	0.76
Scope 1 Total	**10,564**
Scope 2 Emissions	
Electricity	15
Scope 2 Total	15
Scope 3 Emissions	
Fertiliser	132.85
Purchased feed	844.08
Herbicides/pesticides	16.25
Electricity	1.50
Fuel	6.18
Lime	45.13
Purchased livestock	43.17
Livestock on agistment	0
Scope 3 Total	**1089**
Total Farm Emissions	**11,668**

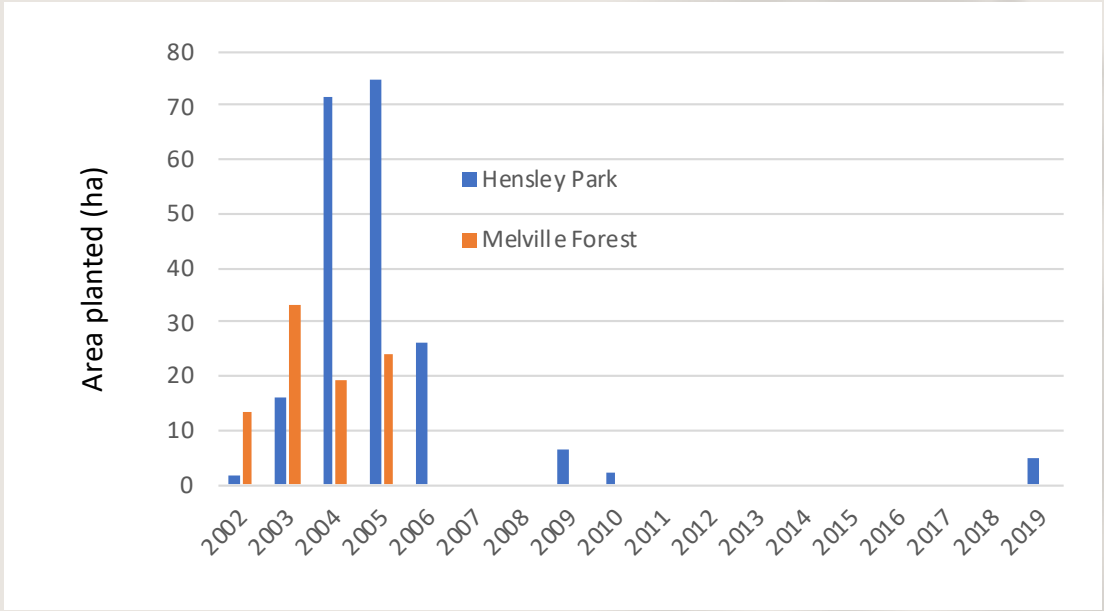
Sites and vegetation

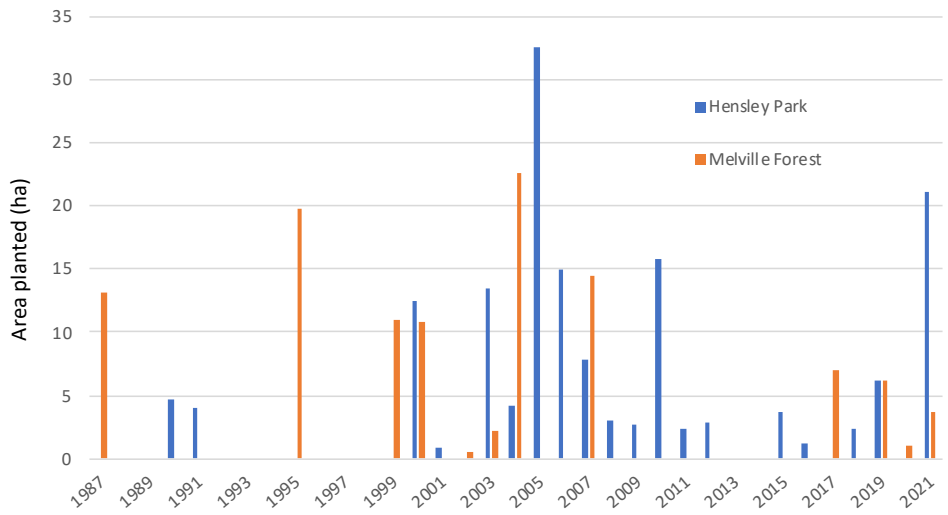
- Hensley Park on the Victorian Volcanic Plain, Melville Forest on the Dundas Tablelands, Elevations 220 to 280 m
- Extensive remnant River Red Gum paddock trees and remnant forest. EVCs Plains Grassy Woodland and Plains Grassland

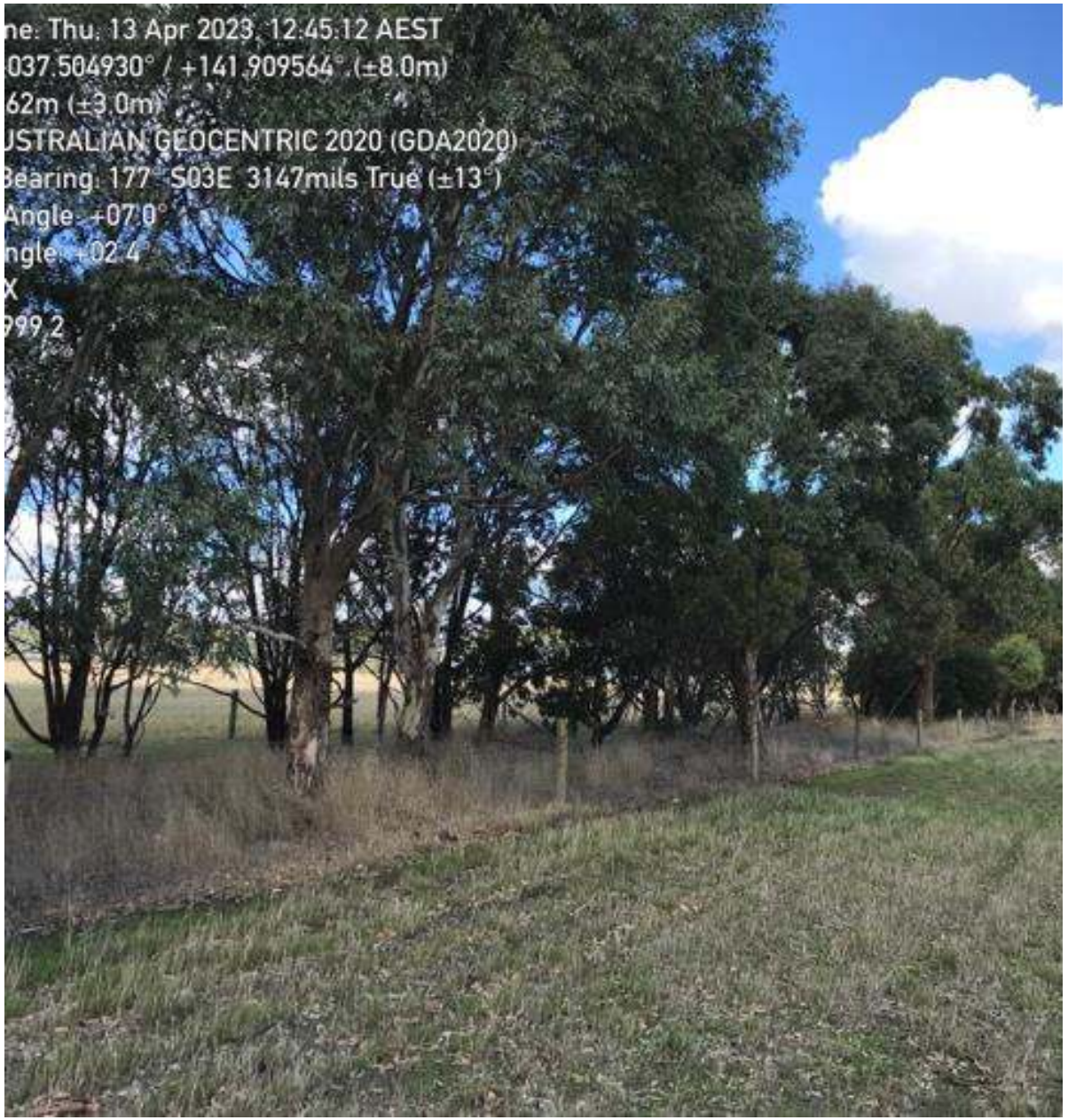


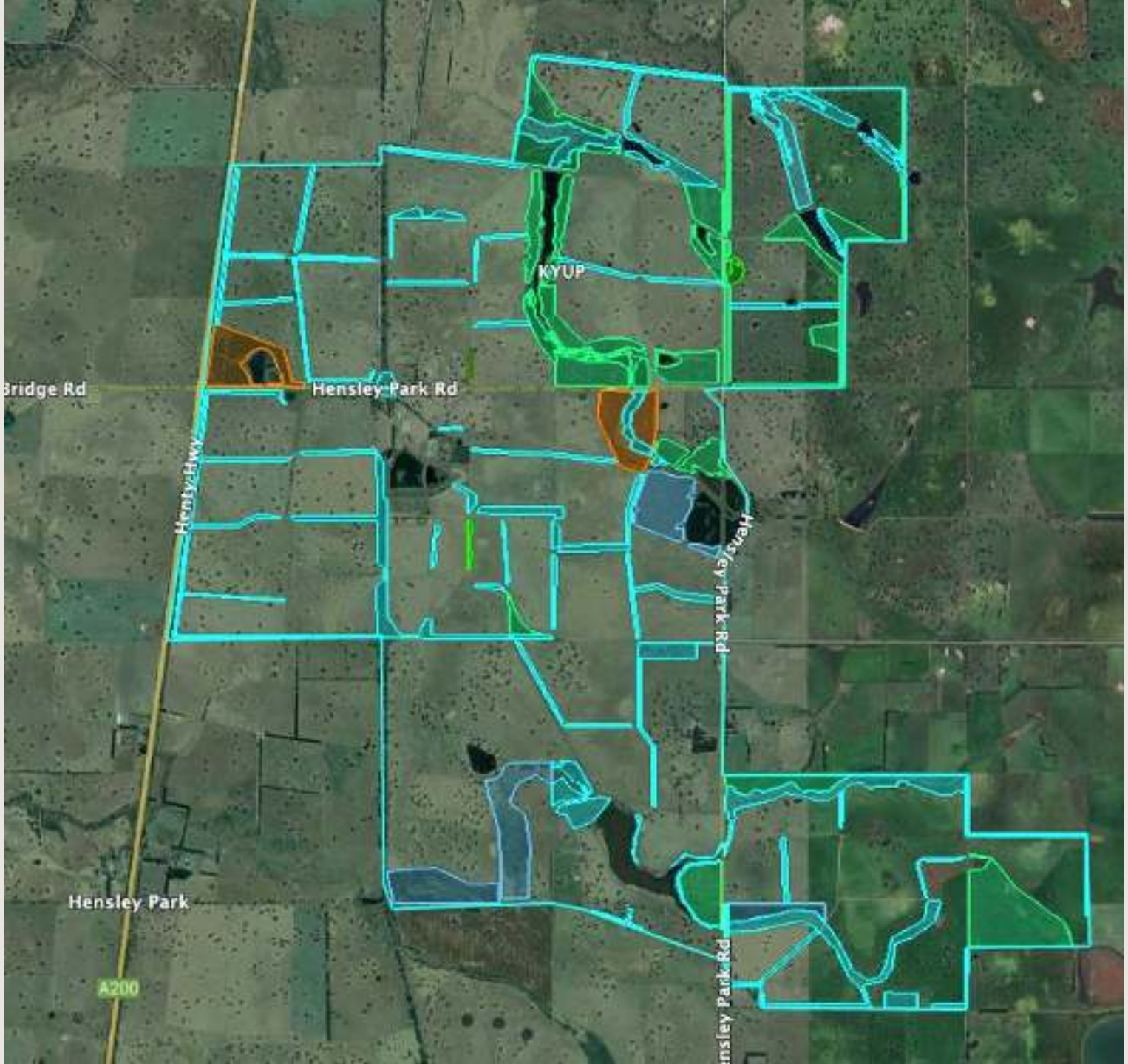
Jigsaw Farms

Property	Area (ha)	Proportion of property	Proportion of tree area	
Property	3417			
Agroforestry	295	8.6%	50%	
Permanent revegetation	268	7.8%	46%	
Remnant forest	24	0.7%	4%	
Total area of trees	587	17.2%		


Area planted (ha)
80
70
60
50
40
30
20
10
0
Hensley Park
Melville Forest
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019


35
30
25
20
15
10
5
0
Area planted (ha)
Hensley Park
Melville Forest
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021

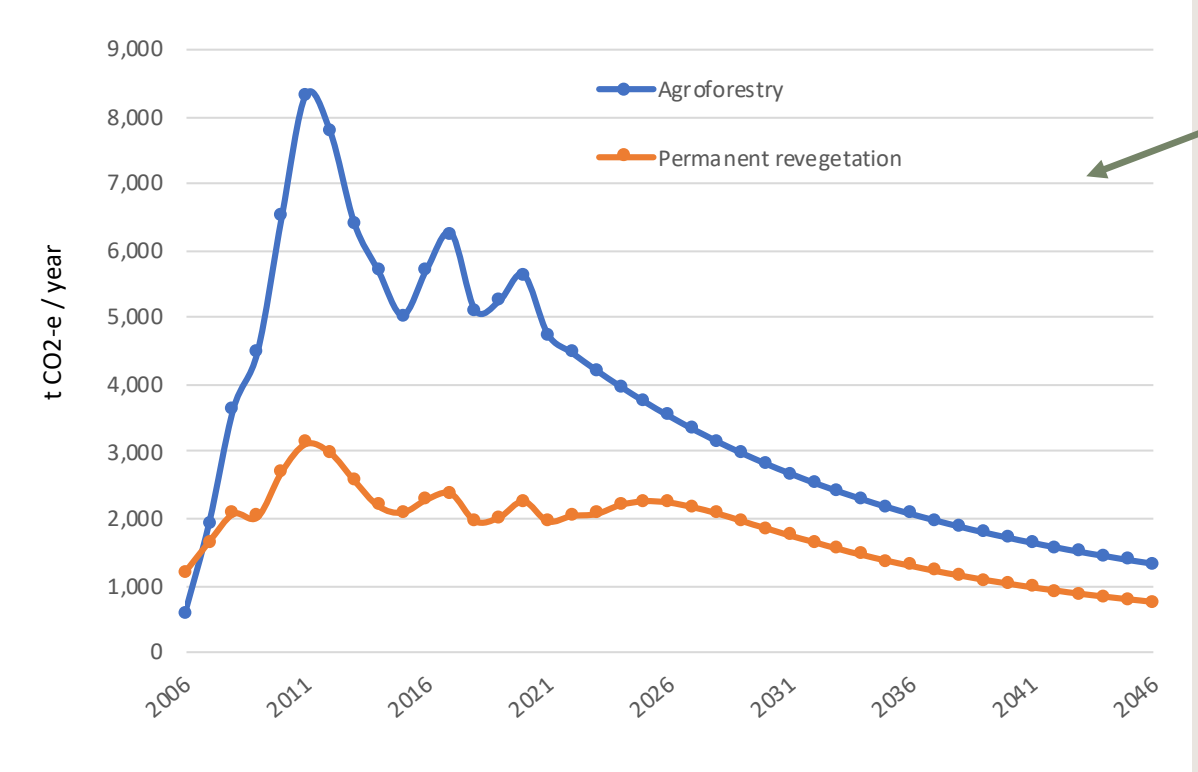

ne: Thu, 13 Apr 2023, 12:45:12 AEST
037.504930° / +141.909564° (±8.0m)
62m (±3.0m)
USTRALIAN GEOCENTRIC 2020 (GDA2020)
Bearing: 177° S03E 3147mils True (±13°)
Angle: +07.0°
ngle: +02.4°
X
999.2


KYUP
Bridge Rd
Hensley Park Rd
Henty Hwy
Hensley Park Rd
Hensley Park
A200

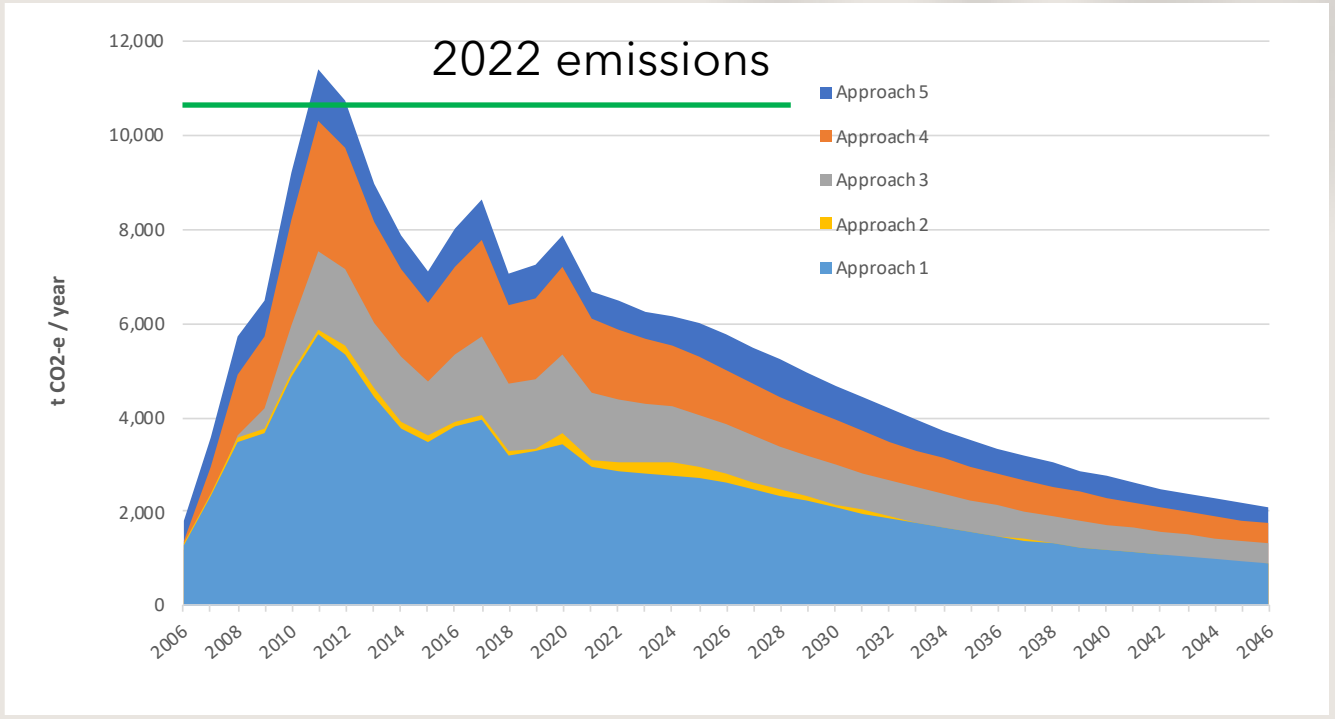
Modelling carbon sequestration

Approach	Tree planting type	FullCAM calibration
1	Permanent revegetation Agroforestry	'Mixed species environmental planting temperate – block planting' calibration used for all types of plantings.
2	Permanent revegetation Agroforestry	As for 1, but 'Mixed species environmental planting temperate – Belt plantings <1500 sph' applied to permanent revegetation in narrow belts.
3	Permanent revegetation Agroforestry	As for 2, but 'Plantation' calibration used for agroforestry plantings
4	Permanent revegetation Agroforestry	As for 2 but 'Plantation' calibration for agroforestry plantings was adjusted using site measurements collected in August 2022.
5	Permanent revegetation Agroforestry	As for 4 but environmental planting calibration (block or belt) used for permanent revegetation adjusted using site measurements collected in April 2023.

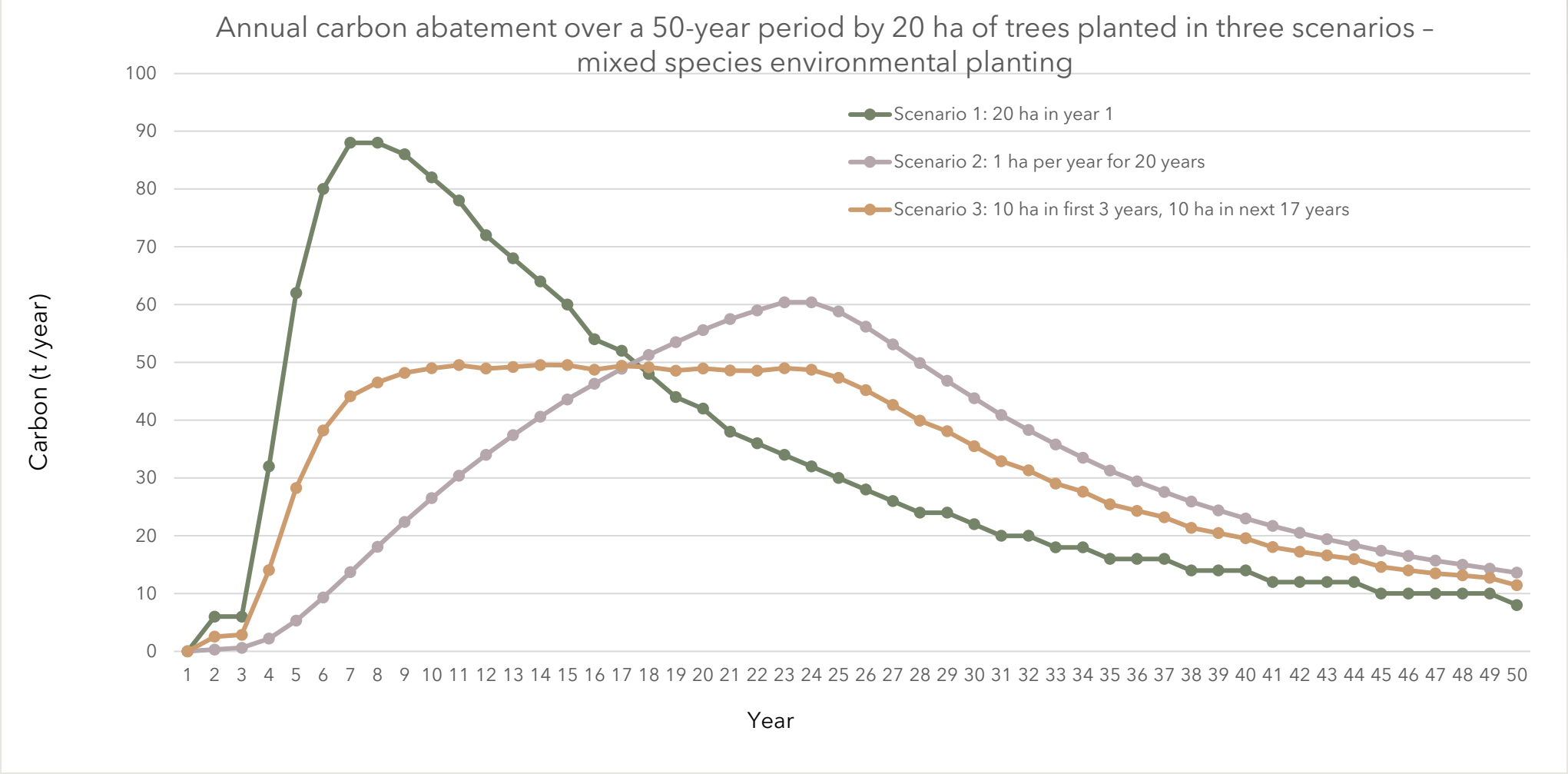
Jigsaw Farms carbon sequestration results



Most sequestration in agroforestry plantings



Spreading planting/sequestration over time



Jigsaw farms conclusions

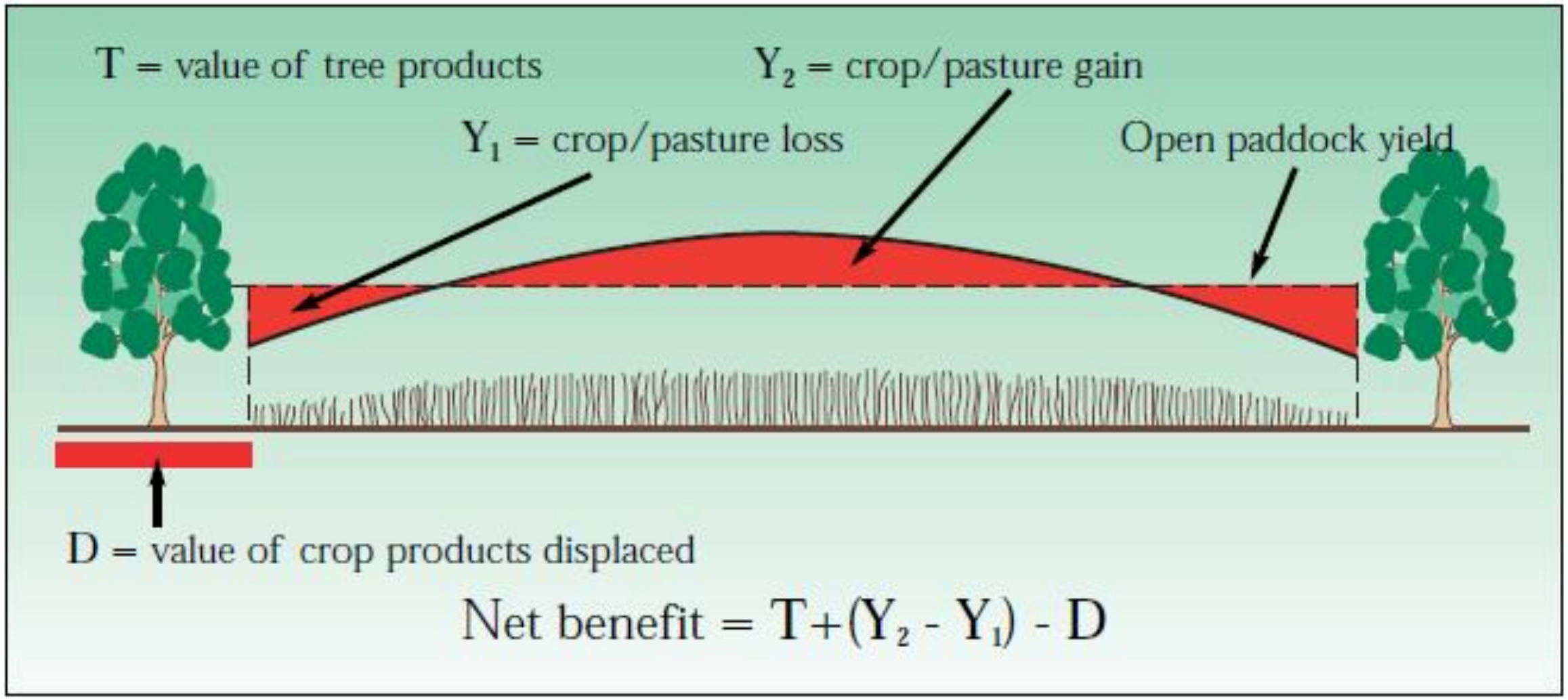
Maintaining carbon sequestration is challenging

- Plant more trees
- New technology to reduce livestock emissions
- Change farm system

Markets for wood products?

Many other benefits of trees on farms – for people, livestock and nature

Analytical framework



Abel et al 1997. Design Principles for Farm Forestry.

Farm trees accounting framework

Net benefit =
(T2-T1) + (Y2-Y1) – D

Benefits/where	Financial Benefits	Non-monetised 'Services'
From trees (T2)	Timber net returns - Sawlog, Pulpwood, Firewood, Poles, posts Non-timber - Foliage, Fruit, Nuts	
On farm (Y2)	Crop yields Lambing losses Pasture production Cattle weight gain Milk yields	Pollination Pest control Aesthetics Climate regulation Fire risk
Society or other beneficiaries	Employment Regional economic benefit	Water quality Carbon sequestration Biodiversity Aesthetics
Costs		
Trees (T1)	Establishment Maintenance	
Farm losses (Y1)	Crop yields Pasture yields	
Opportunity costs (D)	Lost production on land	
Society or others		Water yield Fire hazard

Process

Engaged with landowners/property managers on objectives, production system and planting scenarios

Modelling and analysis of alternative futures

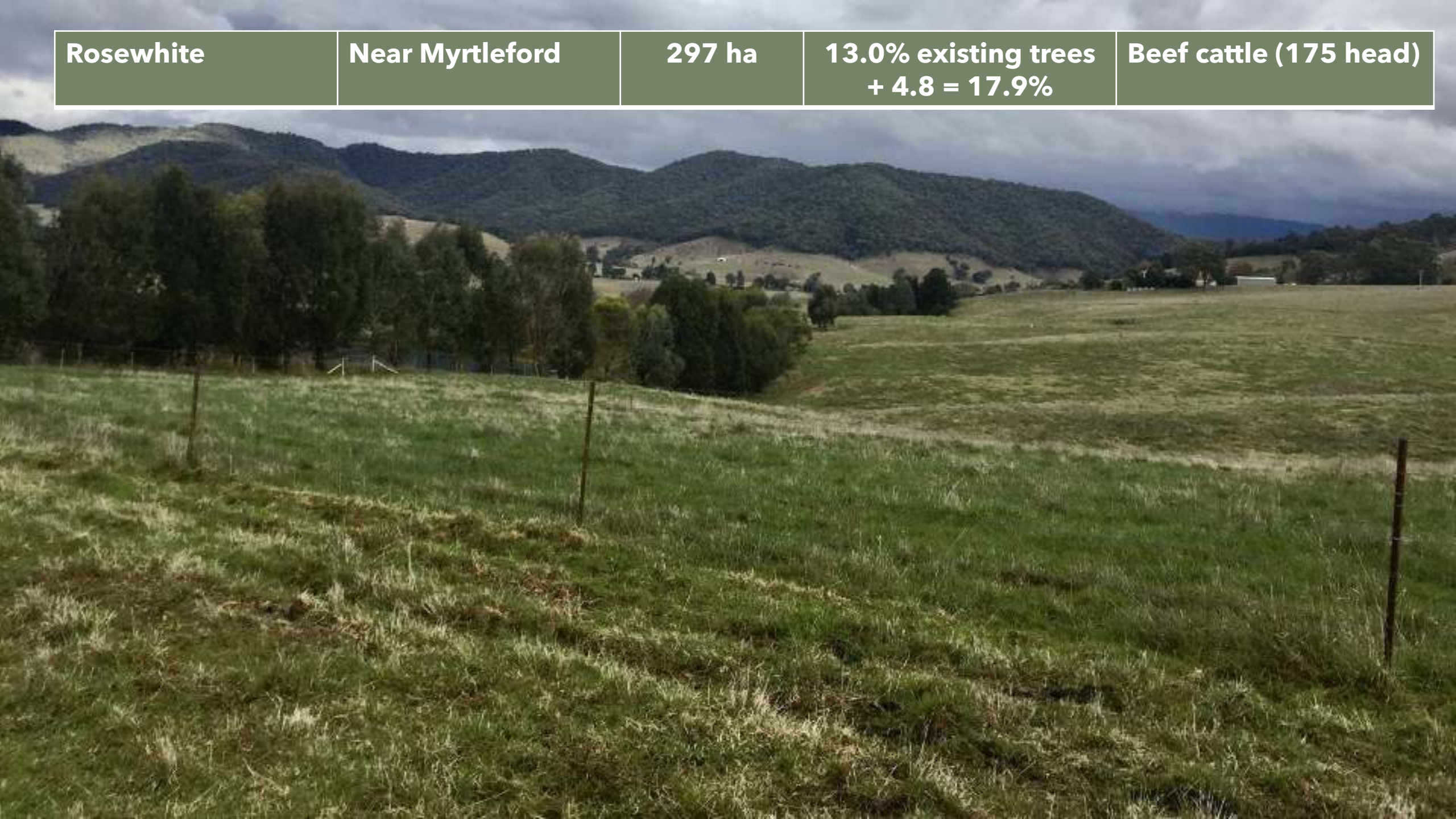
Evaluation

- **Carbon budgets**
- **Productivity benefits/impacts of trees**
- **Financial outcomes**

Dunkeld (Blackwood)	**Western Victoria**	**3,090 ha**	**8.7% existing trees + 11.6 = 20.3%**	**Sheep meat, wool (33,500 head) and cattle**

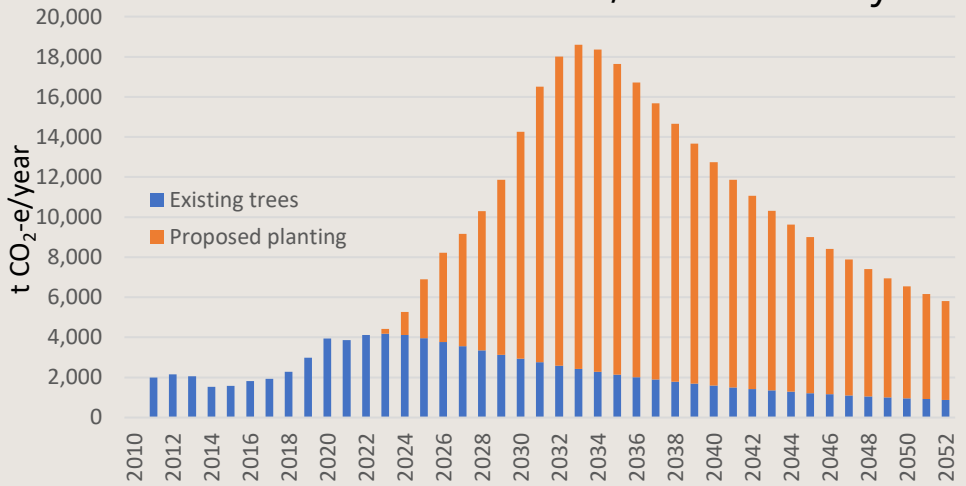
Tambo Crossing	East Gippsland		9.6% existing trees + 5.2% = 14.7%	Sheep meat, wool (1200 head) and cattle (250 head)

Rosewhite	**Near Myrtleford**	**297 ha**	**13.0% existing trees + 4.8 = 17.9%**	**Beef cattle (175 head)**

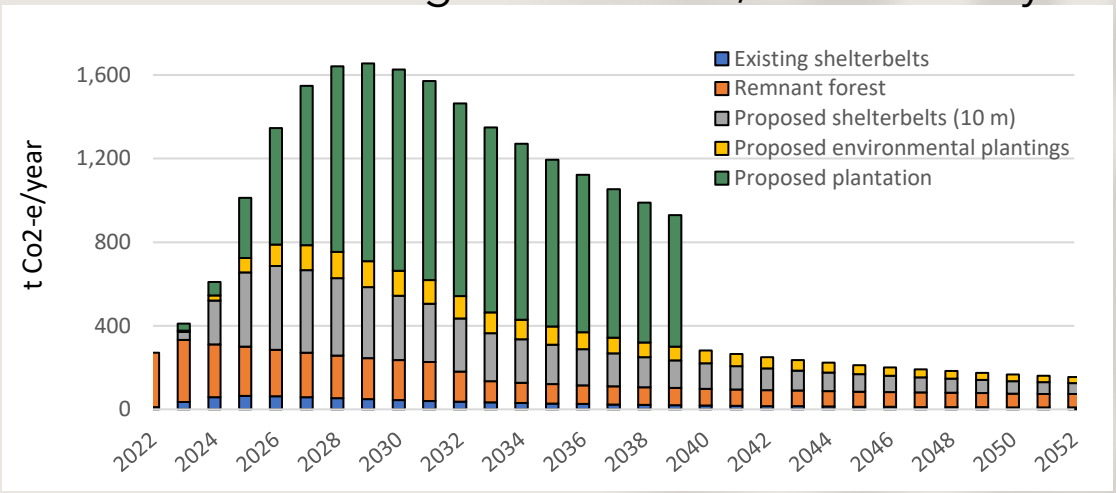


Carbon

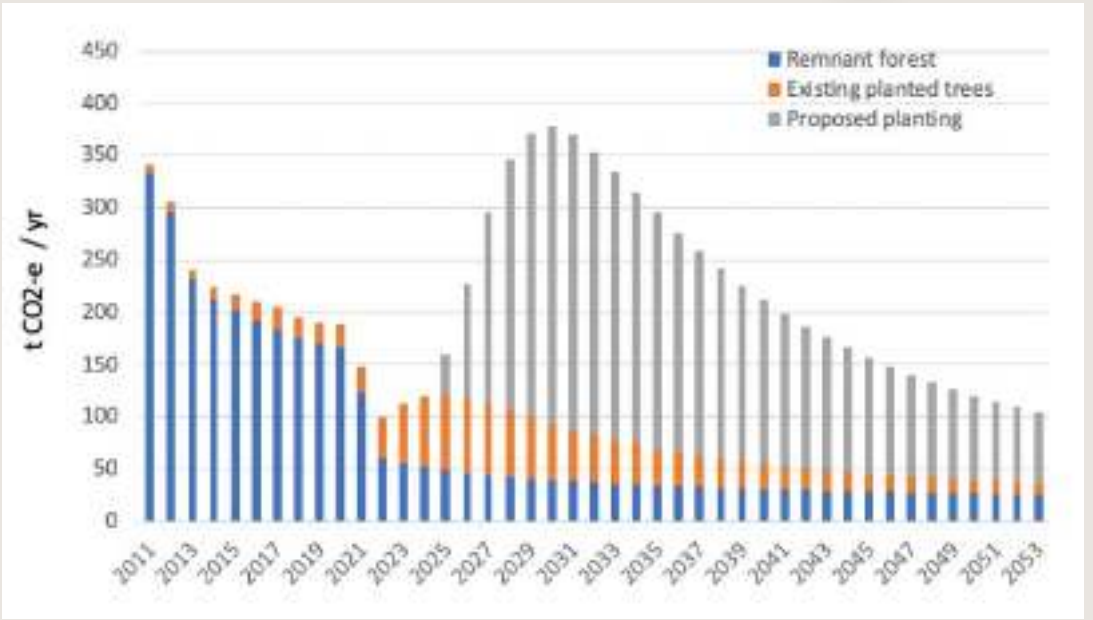
Dunkeld: Emissions 22,000 tCO-e/year



Tambo crossing: Emissions 2,731 t CO2e/year



Rosewhite: Emissions 758 t CO2e/ha



Mostly environmental planting

Hardwood timber plantation on Tambo Crossing property

Productivity modelling: lamb production

Based on GrassGro model

Different environmental conditions across Victoria

Different effects of wind speed reduction

Dunkeld **From 8.7% to 20.3% trees**	**If wind speed 30% lower** **Additional lambs sold** **3,516**	**If windspeed 60% lower** **Additional lambs sold** **7,675**
Tambo Crossing	**If wind speed 15% lower** **Additional lambs sold** **18.7**	**If wind speed 50% lower** **Additional lambs sold** **59.6**

Economic analysis

30-year horizon, Discounted costs and benefits

Real terms before tax

10% discount rate

Costs

Tree establishment and maintenance (capital, inc. fencing and ongoing)

Forgone production ($35/DSE) – higher and lower productivity sites

Benefits (from year 7)

Increase in lambs sold (average net margin $45)

Carbon ‘value’ (either ACCUs or on farm value - $35/tCO2-e rising to $80/tCO2-e, less audit costs)

Timber (Tambo Crossing only)

Returns from investing in trees on sheep farms

Property (wind reduction)	IRR if trees replace low production pastures	IRR if trees replace high production pastures
Dunkeld (high)	10%	5%
Dunkeld (low)	7%	1%
Tambo (high)	7%	4%
Tambo (low)	6%	4%

Net returns from additional lamb sales, carbon 'value' and timber income (Tambo) minus costs of tree establishment and maintenance

Assumes carbon audit costs 10% of carbon value

Potential returns from carbon in trees on beef property

Grassgro modelling showed no impact on beef cattle productivity

For 10% real return pa on capital invested:

- **Trees replacing pasture providing 3 DSE/ha need a carbon value of $106/tCO2-e**
- **Trees grown in areas not used for grazing need a carbon value of $96/tCO2-e**

Conclusions

- Strong evidence from literature and farmer interviews that shelterbelts increase lamb survival and sheep losses after shearing
- Anecdotal evidence of:
  - reduced heat stress on livestock especially with paddock trees
  - improvements in beef and milk production
  - Improved animal welfare, disease risk and farm aesthetics
- Investment in trees can generate acceptable returns when trees replace low value pasture, particularly in exposed situations for sheep properties
- Returns vary with market conditions, location and degree of exposure
- Carbon ‘value’ is important in returns – either as ACCUs or offset value
- Offsetting livestock farm emissions with trees needs a significant land area (15-20% of the property)
- Time span of offset is limited as trees mature and sequestration rate slows
- Other benefits of trees – animal welfare, biosecurity, aesthetics also part of the ‘value proposition’

Challenges

- Varying site conditions, farming methods complicate general interpretation of the impacts of trees
- Overall change to farm system makes it difficult to isolate impacts of trees
- Information gaps
  - Effects of shade on liveweight gain of sheep and cattle
  - Effects of shade or shelter on beef and dairy cattle
  - Productivity implications of environmental benefits, e.g. water quality

Questions

slido

Audience Q&A Session

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Morning Tea

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David Bush

Director, CSIRO Australian Tree Seed Centre

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Species selection for agroforestry

David Bush

CSIRO Australian Tree Seed Centre

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Australian Tree Seed Centre

- The Australian Tree Seed Centre is a collection and research centre for Australian native trees.
- For more than 60 years the centre has been collecting, researching and supplying quality, fully documented tree seed to both domestic and overseas customers.
- Collections of seed are sourced from wild populations and genetically improved seed is sourced from our domestication and improvement programs.

Australian tree and shrub flora

- ‘mega-diverse’ continent
- a high degree of species endemism
- *Acacia* – 1200 species
- *Eucalyptus* - 950 species and varieties
- *Melaleuca* - 250 species and varieties
- *Angophora, Callistemon, Casuarina, Grevillea, Leptospermum, Lophostemon, Syncarpia, Tristania* etc.





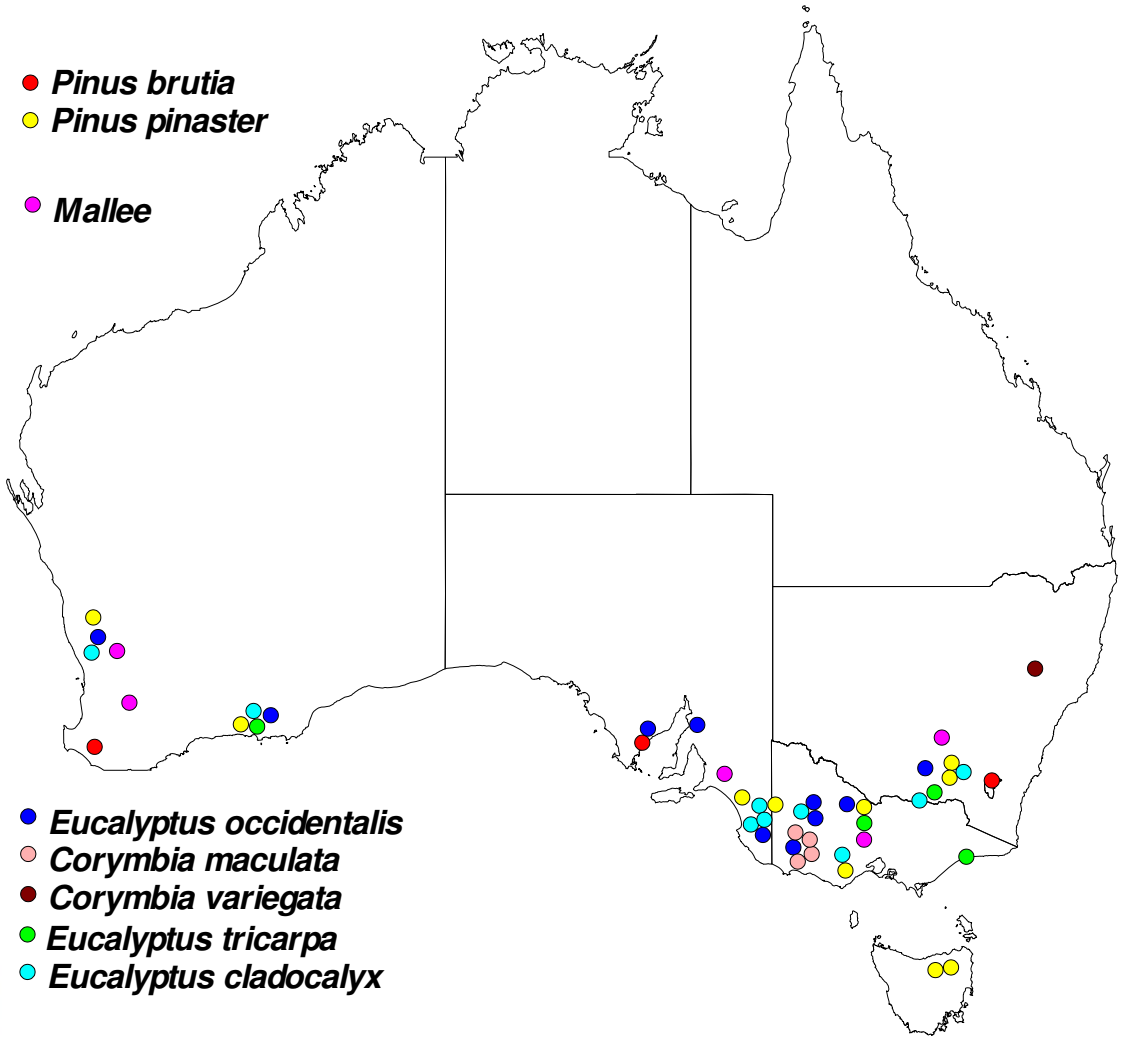
Examples of work

- Low rainfall species
  - Much of Australia's available farmland is in the sheep-wheat belt
  - Alternative species to *Pinus radiata* and *Eucalyptus globulus/nitens*

- Naturally durable wood
  - Seeking: phenolic compounds and wood structure - mode of action not fully understood – heritable traits?
  - Commercial target – agriculture and vineyard industry that currently use heavy metal-treated posts

- Crops suitable for biomass/bioenergy/essential oil/ biofactory
  - Multiple compounds – for bioenergy lignocellulosics, low mineral content
  - Target is marginal farmland, bioenergy industry, carbon sequestration, activated charcoal, aviation, plastics
  - Many plants fit the bill but few domesticated options for tough sites

Low rainfall species trials established in early 2000s



- Many trials established in early 2000s
- Best-bet species confirmed
- Now reaching small sawlog size
- Seed orchards and genetically improved seed now available

ALRTIG sugar gum seed orchard in western Victoria

Seed crop harvest from ALRTIG stands

Naturally durable low rainfall spp.

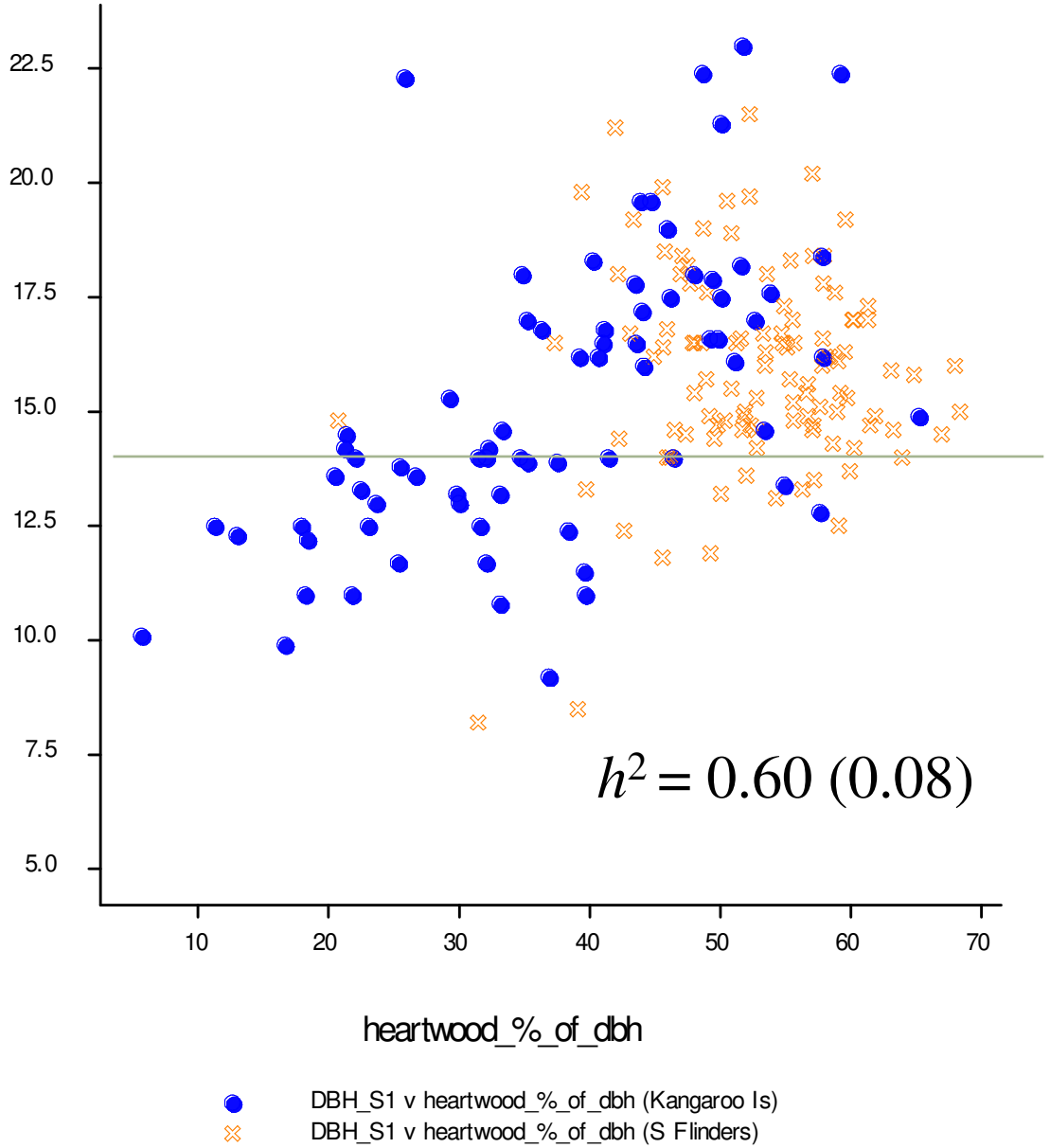
Background

- A small number of species suited to southern Australia's low rainfall sheep-wheat belt are under domestication (genetic improvement)
- Initial objective was to create breeds suitable for small sawlogs grown on ~20-25 year rotation
- Species are dense, sites are inland, what to do with thinnings?
- Most species quite durable when mature – farm/vineyard posts?

Project

- Examination of durability traits in two low rainfall species
- Research done on young trees of about vine post size

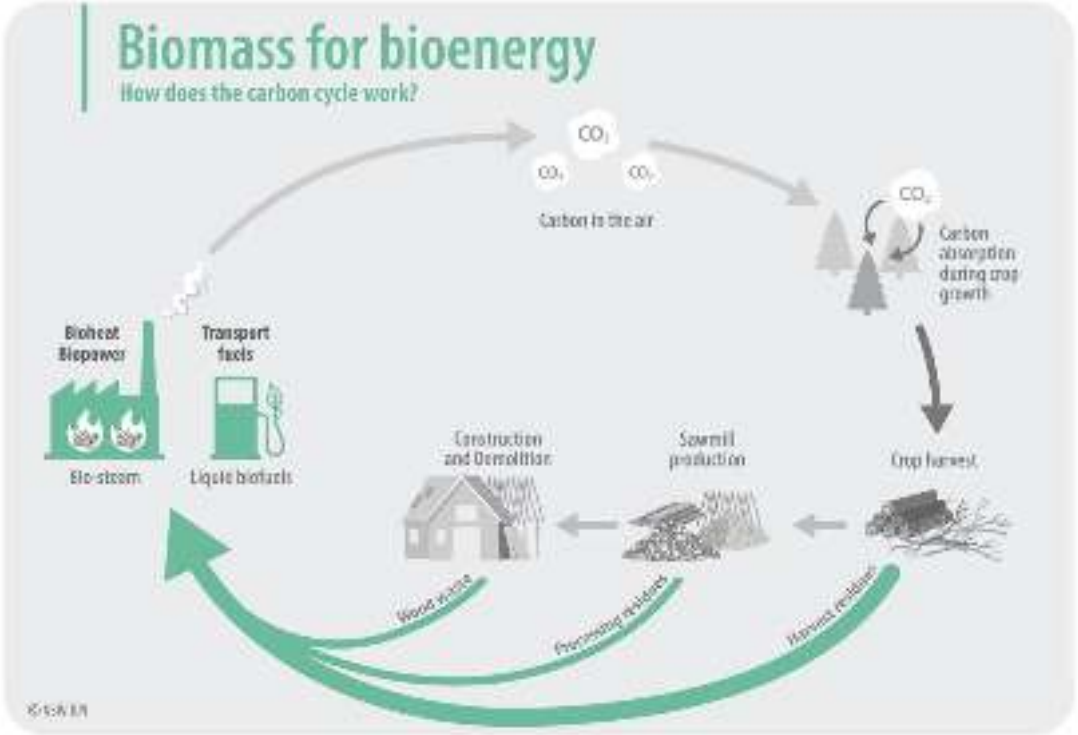
E. cladocalyx provenance variation in heartwood proportion



A tree of about 14 cm diameter would likely have <6 cm of heartwood if from KI but up to 10 cm if from SFR

E. cladocalyx (Lismore Vic.), 8 years

Biomass for bioenergy (project with NSW DPI)



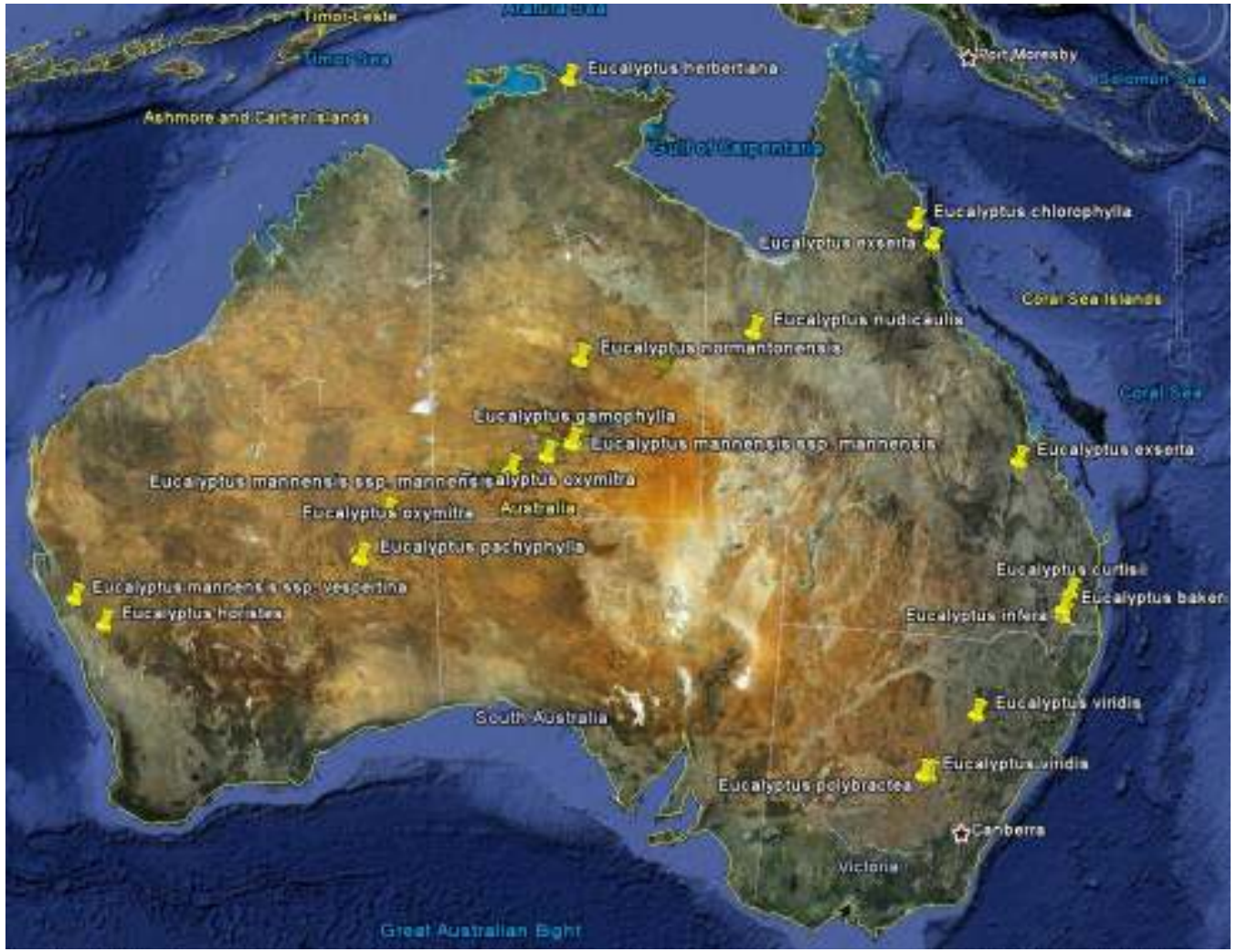
https://www.dpi.nsw.gov.au/forestry/science/forest-carbon/biomass-for-bioenergy

- Wood pellets can be made from wood residues
- Can also be made from dedicated woody crops
- Can be co-fired with other fuels

Biomass for bioenergy

- Screening woody native species for biomass production (NSW & QLD)
- ID trees with rapid early growth (3 – 4 year harvest cycle)
- Hardy – adapted to marginal sites or marginal parts of farms
- Trees likely to coppice or regenerate after cutting preferred
- A mix of “tall” and mallee tree species
- Many species already tested under some conditions plus some untested species
- Native species for biodiversity benefits

Mallees for biomass



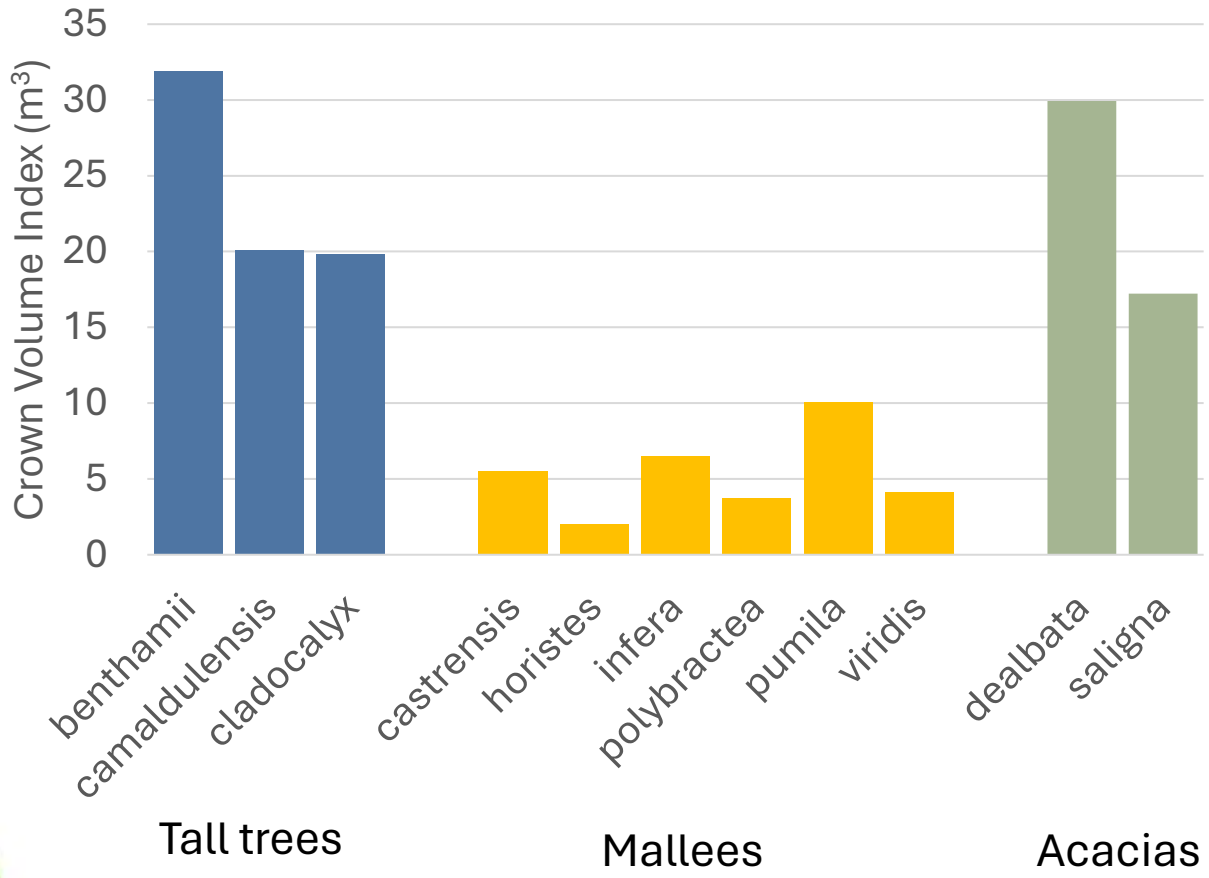
There are dozens of dryland mallee species that have never been tested in cultivation

Biomass trials 11 trial sites, 50k+ trees, 15 species, 4 threatened species

Seedlot	Provenance	Species	Glen Innes	Grange SF (Grafton West)	Muswell-brook	Orange Ag	Cargo upland	Cargo saline	Scone	Tamworth	Trangie	Yanco 1	Yanco 2
15800	Moora, WA	*A. saligna*						x			x	x	
21475	various locations, ACT	*A. dealbata*	x	x	x	x			x	x			
16362	Singleton, NSW	*C. glauca*					x	x			x		
21213	Kowen Seed Orchard	*E. benthamii (V)*	x										
20561	Lake Albacutya, VIC	*E. camal.*	x	x	x	x	x	x		x	x	x	x
21463	Singleton, NSW	*E. castrensis (E)*	x	x	x	x	x	x	x		x	x	
21153	Hamilton SSO	*E. cladocalyx*		x	x	x			x	x		x	x
20841	N of Canna, WA	*E. horistes*										x	
21304	Durikai, QLD	*E. infera (V)*	x	x	x	x		x	x	x	x	x	
20771	Coominglah SF, QLD	*E. moluccana*		x							x		
21111	SSO SW Victoria	*E. occidentalis*	x	x				x					
20680	West Wyalong, NSW	*E. polybractea*	x	x	x	x	x		x	x	x	x	x
21462	Pokolbin, NSW	*E. pumila (V)*		x	x				x				
21498	Tincurrin cultivated, WA	*E. spathulata*						x					
21464	Dubbo, NSW	*E. viridis*		x	x	x	x		x	x	x	x	x

E *endangered* *NSW Biodiversity Conservation ACT*; V *vulnerable* *EPBC*

Which species did well?



24-month result (adjusted means across eight sites)

Summary of results

- *E. benthamii* did well at Glen Innes (cold)
- *E. camaldulensis* was consistently good on many sites
- The mallees started slowly and were out-grown
- The acacias did well on some sites
- Rainfall was v. below average prior to and immediately after establishment in 2019
- Very good seasons post-establishment in 2020

Higher rainfall

- Favoured the tall trees
- Disadvantaged mallee establishment due to weed competition

Biomass for bioenergy

Scone 24-month growth (CVI)

E. pumila (threatened mallee)
(6.5 m^3)

E. polybractea
(widely grown mallee)
(2.6 m^3)

E. cladocalyx (tall tree)
(19 m^3)

Biomass for bioenergy

Seed orchards for seed production

- Collecting commercial quantities of seed from wild stands of threatened species will further endanger them
- Cultivated seed production capacity is essential
- Intensively managed seed orchards have been established for each species - it is an easy commercialisation path for us

E. castrensis seedling seed orchard, Boorowa

E. benthamii grafted clonal seed orchard, Black Mountain

E. benthamii seedling seed orchard, Canberra

Nick Milham

Group Director Forestry Policy, Research & Development, NSW DPI

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Regulation of plantations in NSW

Plantations and Reafforestation Act

Objects of the Act are to:

- Facilitate the reafforestation of land
- Promote and facilitate the development of timber plantations on essentially cleared land
- Codify best practice environmental standards (through the Code)
- Provide a streamlined and integrated scheme for the establishment, management and harvesting of timber and other forest plantations.

DPI is responsible for implementing the Act and Code including authorisation and compliance.

The Act applies to public and private land.

What are plantations?

Plantations are planted (by sowing seed or otherwise) trees and shrubs for timber *and non-timber* purposes.

The Act defines a plantation as an area of land on which the predominant number of trees or shrubs forming or expected to form the canopy are trees or shrubs that have been planted:

- for the purpose of timber production, or
- for the protection of the environment (including rehabilitation, biodiversity plantings and carbon plantings), or
- for any other purpose,
- but not principally for the purpose of the production of food or any other farm produce other than timber.

Plantation authorisation

- Authorisation required for plantings (environmental, carbon and timber) over 30ha in total on a farm.
- Authorisation continues until cancelled or significant change in ownership or management
- Timber plantations may be harvested
- Assessment required for authorisation including threatened species assessment
- It provides exemptions from some other legislation including planning approvals

450,000 ha authorised plantable area

40,000 ha retained native vegetation

Exempt farm forestry

Exempt farm forestry:

- Plantation area not exceeding 30 hectares total on the property
- Does not require clearing approval (no clearing of native vegetation)
- Authorisation not required but other approvals may be required
- Authorisation can be obtained voluntarily for exempt farm forestry
- Authorisation continues with change in zoning

Plantations and Reafforestation Code

The Code sets out standards for establishment and management of all plantations including biodiversity and carbon plantings.

The Code also sets out standards for harvesting on timber plantations.

All authorised plantations are required to comply with the Code.

Plantations and Reafforestation Code

The Code provides for:

- The protection of soil and water including buffers zones for drainage features
- The protection of places, objects or items of heritage significance
- The protection of biodiversity including through the retention of rainforests, wetlands, high conservation value grasslands
- Bushfire risk mitigation – setbacks from dwellings and powerlines
- Roading and harvesting requirements for environmental protection

Unique and special wildlife provisions

Part 4 of the Plantations and Reafforestation Act provides protections for unique and special wildlife values

Unique or special wildlife (USW) are endangered species or communities.

Land has unique or special wildlife values if USW inhabits or grows or is likely to inhabit or grow on the land.

The plantation owner/ manager is required to notify DPI when they become aware of a plantation operation impacting or likely to impact unique or special wildlife values (including establishment and management operations).

An evaluation is undertaken and report prepared and a direction may be made to minimise adverse impacts on USWV.

Process to obtain authorisation

Plantations Assessment Officers in:

- Wollongbar
- Albury
- Coffs Harbour
- Moss Vale
- Ourimbah

Review information on the Plantations Regulation webpage

Contact your nearest DPI Plantation Assessment Officer

The DPI Plantation Assessment Officer will discuss the proposed plantation and undertake desktop checks

The DPI Officer will undertake a site visit to assess requirements under the Act and Code

The DPI Officer may work with the applicant to amend the proposal to ensure it is Code compliant

A map will be prepared and the applicant will complete the application form

Once submitted an outcome will be determined within 14 days if complying.

Where to go for more information

- DPI Plantations Regulations webpage
- One of DPI's five authorisation and audit staff across the State

Heath Molden

Central West Forestry Hub

NSW TREE CONFERENCE 2024

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Central Tablelands Regional Landcare

NSW GOVERNMENT

Central West NSW Forestry Hub

Heath Molden

Hub Manager

NSW TREE CONFERENCE 2024

CENTRAL WEST NSW FORESTRY HUB

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What is the Hub?

- The Central West Forestry Hub was established in 2020 with funding from the Commonwealth Government.
- Our purpose is to provide the Commonwealth Government with strategic planning, technical assessments and analysis that aims to support growth in the Forest Industries in the regions.
- The Hub is funded until Mid 2025 with a possible extension to mid 2027.
- We are **not** permitted to provide extension services.

CENTRAL WEST NSW FORESTRY HUB

The Hub area

- The Hub area was determined using existing statistical boundaries and historical economic haulage distances for plantation products.

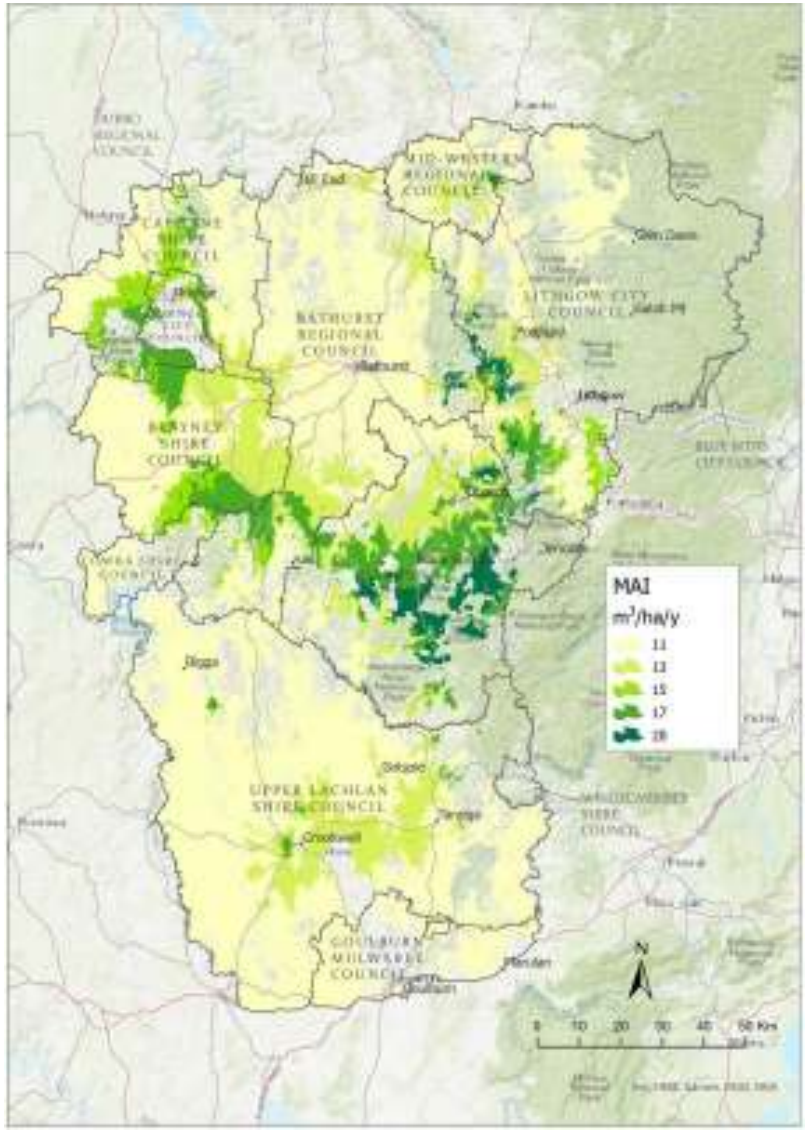
CENTRAL WEST NSW FORESTRY HUB

Supporting Growth

- The industry agreed that expanding the plantation estate would support investment in manufacturing facilities in the region.
- In order to support plantation expansion the Hub undertook projects to investigate following
  - How much of land has the potential to support productive plantations
  - How much carbon could be sequestered in plantations
  - How a plantation on cleared land in the Central West would perform financially

CENTRAL WEST NSW FORESTRY HUB

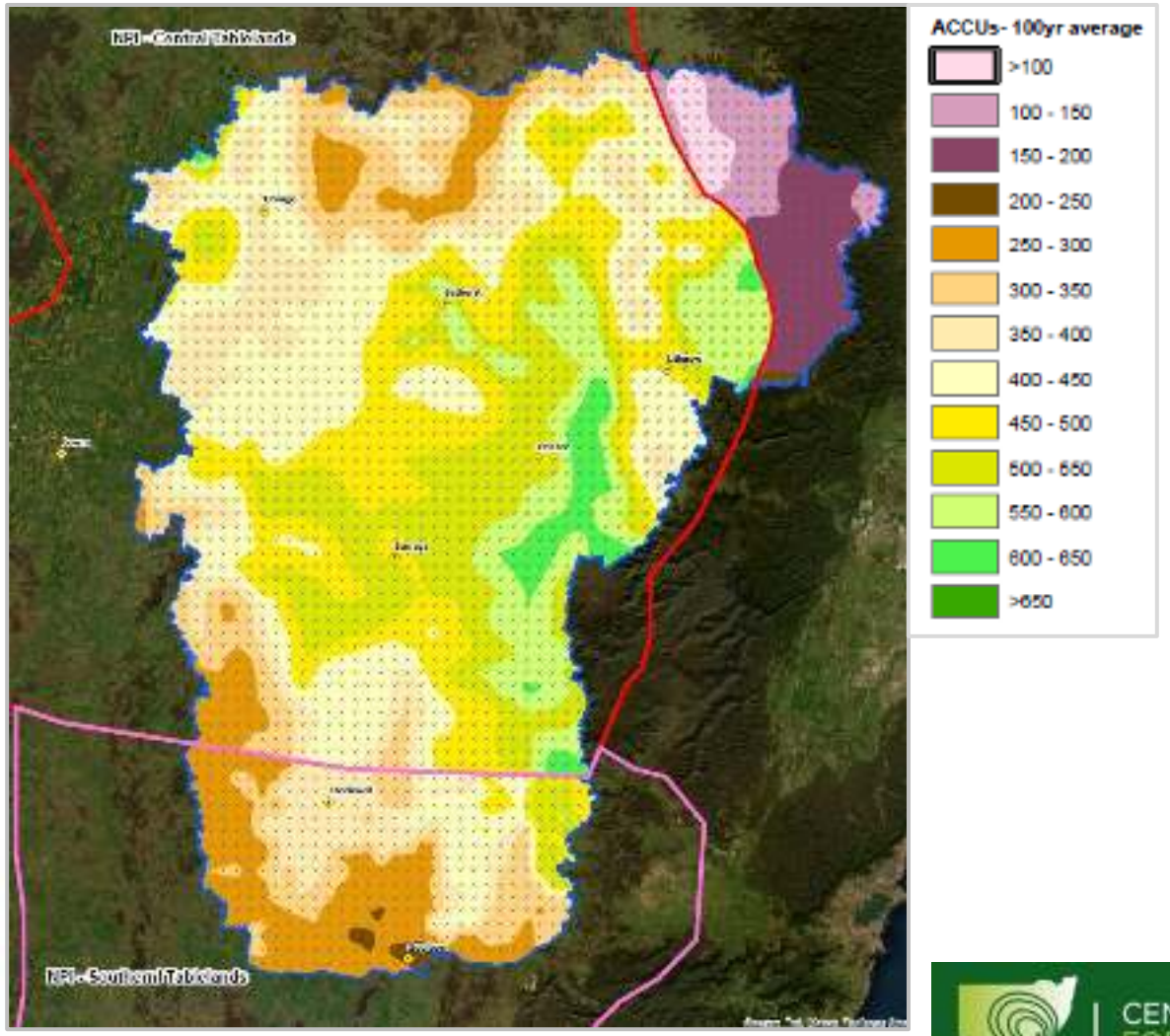
Productivity estimate



- The Hub modelled the potential pine plantation for our defined region.
- The modeling accounted for:
  - Rainfall
  - Slope
  - Soil Fertility
  - Existing land use
- Approximately 1,039,175ha of suitable land across five productivity classes

CENTRAL WEST NSW FORESTRY HUB

Carbon generation estimate



- The Hub modelled the potential carbon sequestered for pine plantations.
- Three heat maps were developed for three different silvicultural regimes. Each map was produced with 2,500 FullCAM runs.

CENTRAL WEST NSW FORESTRY HUB

Landowner Plantation Assessment Tool (LPAT) - Inputs

Proposed size of plantation:	100	ha
We suggest a proposed plantation of 20 hectares or greater to be of interest to timber mills and to ensure that the		

Distance from the proposed plantation to each mill:			Go
Australian United Timbers	50	km	Au
Highland Pine Products	50	km	Hi
Plantation Pine Products	50	km	Pl
AAM	50	km	AA

To help estimate the distance from the proposed plantation to each mill, you can click on the Google Map Pin adjace of the website, the mill comes up as the starting point. In the input box below that, enter the address of the propose plantation. The website will then provide an estimated distance by road between the two locations. Input this distan

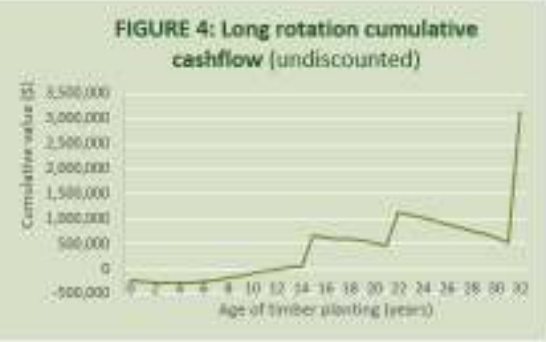
Expected MAI:	15	m^3/ha/year

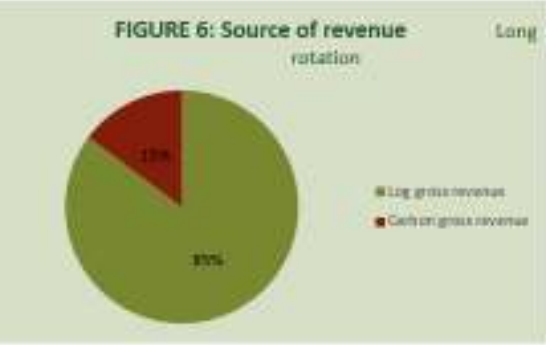
The MAI, or Mean Annual Increment, refers to the average growth rate of the proposed plantation. To estimate the the legend to determine whether the plantation is in an area with an estimated MAI of 11, 13, 15, 17 or 20m^3/ha/y the dropdown list in the blue cell above.

- The Hub has developed a high-level 'first look' tool that requires limited inputs from users.
- The tool contains, costs, revenues, yields and other information that landholders may be interested in understanding

CENTRAL WEST NSW FORESTRY HUB

Landowner Plantation Assessment Tool (LPAT) – Results





Financial analysis per ha ($/ha)	Short rotation 2 rotations	Long rotation 1 rotation
Log gross revenue	$32,200	$46,875
Carbon gross revenue	$5,954	$8,116
Total gross revenue	$38,154	$54,991
Costs	$19,386	$23,556
Net revenue	$18,768	$31,434

- The tool outputs provides high-level indicative information that may lead to users to seek further specific investigation by professional foresters.
- Results are expressed in ROI, NPV and return in $/ha/year

CENTRAL WEST NSW FORESTRY HUB

Hub resources and contact information

Website: www.cwfh.com.au

Contact info: info@cwfh.com.au

CENTRAL WEST NSW FORESTRY HUB

Dan Florance

Senior Research Officer, Australian National University Sustainable Farms Team

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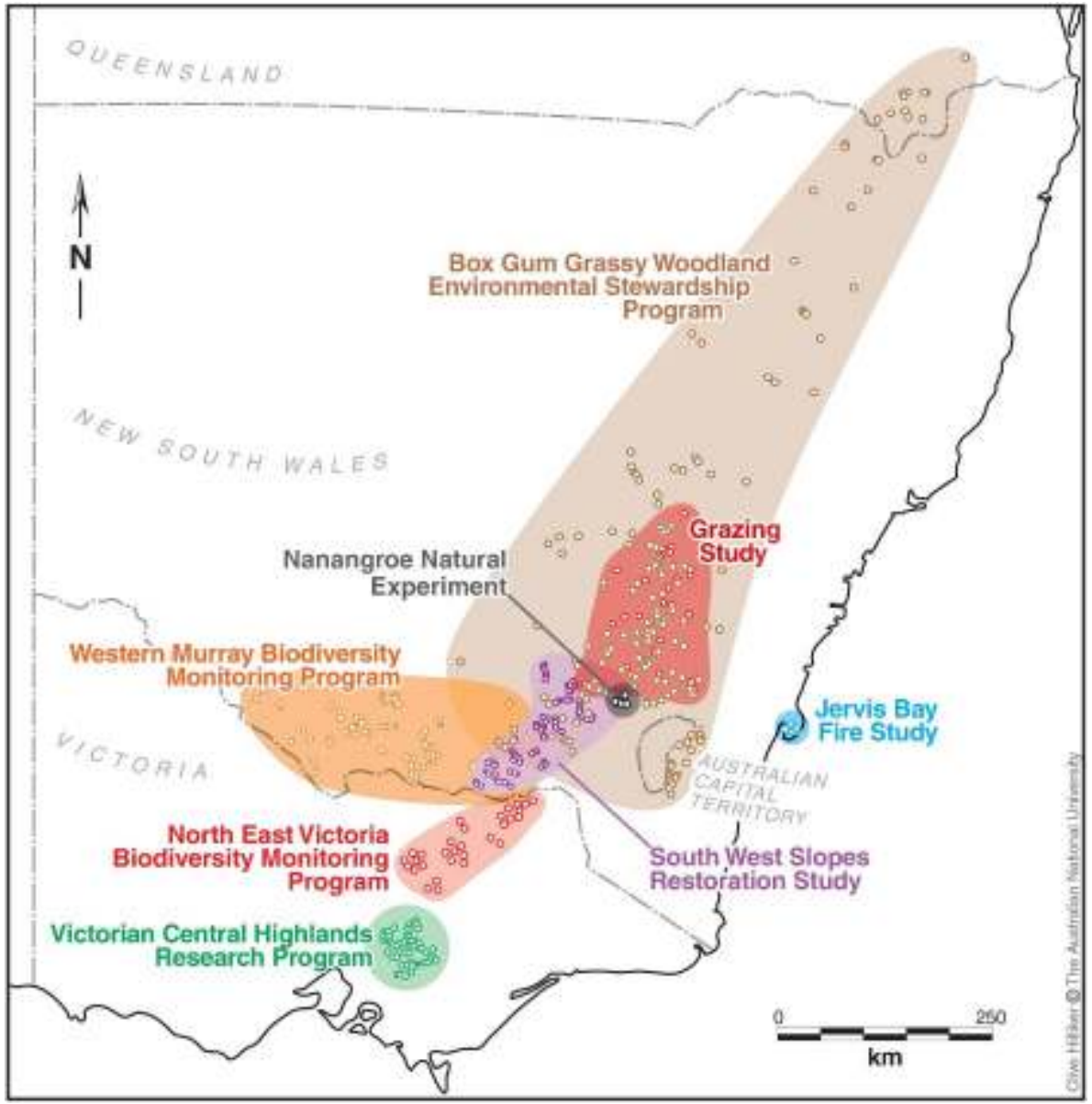
Designing shelterbelts for Biodiversity & Production

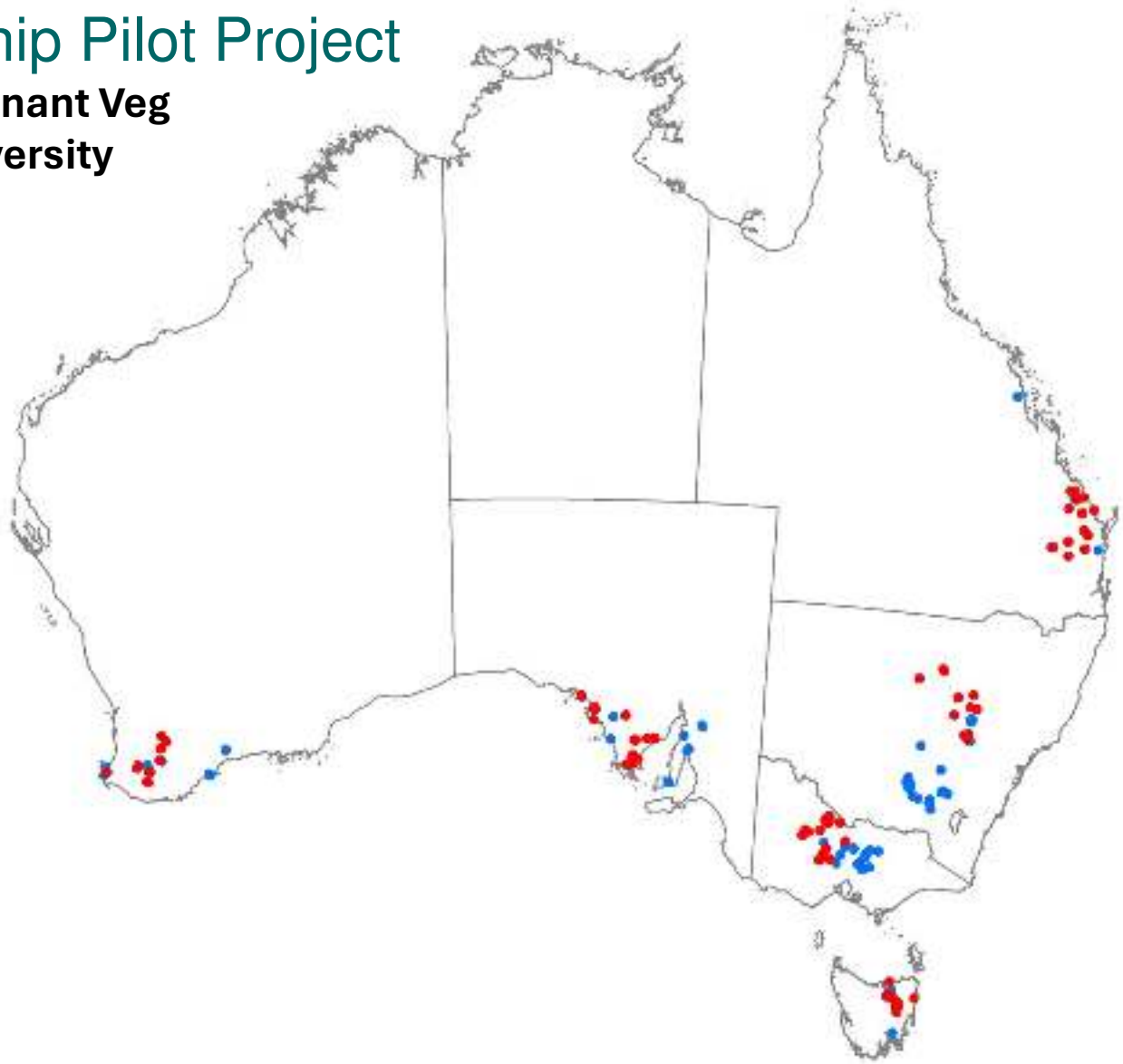
- Summary of 20+ years of research and monitoring

- **Ecology**
- **Economics**
- **Production**



Ag Stewardship Pilot Project

- **Enhancing Remnant Veg**
- **Carbon + Biodiversity**

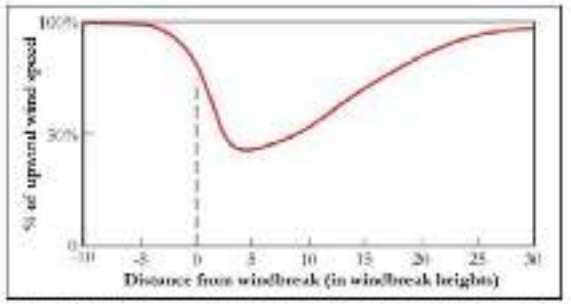


Quite a bit of research demonstrating production benefits

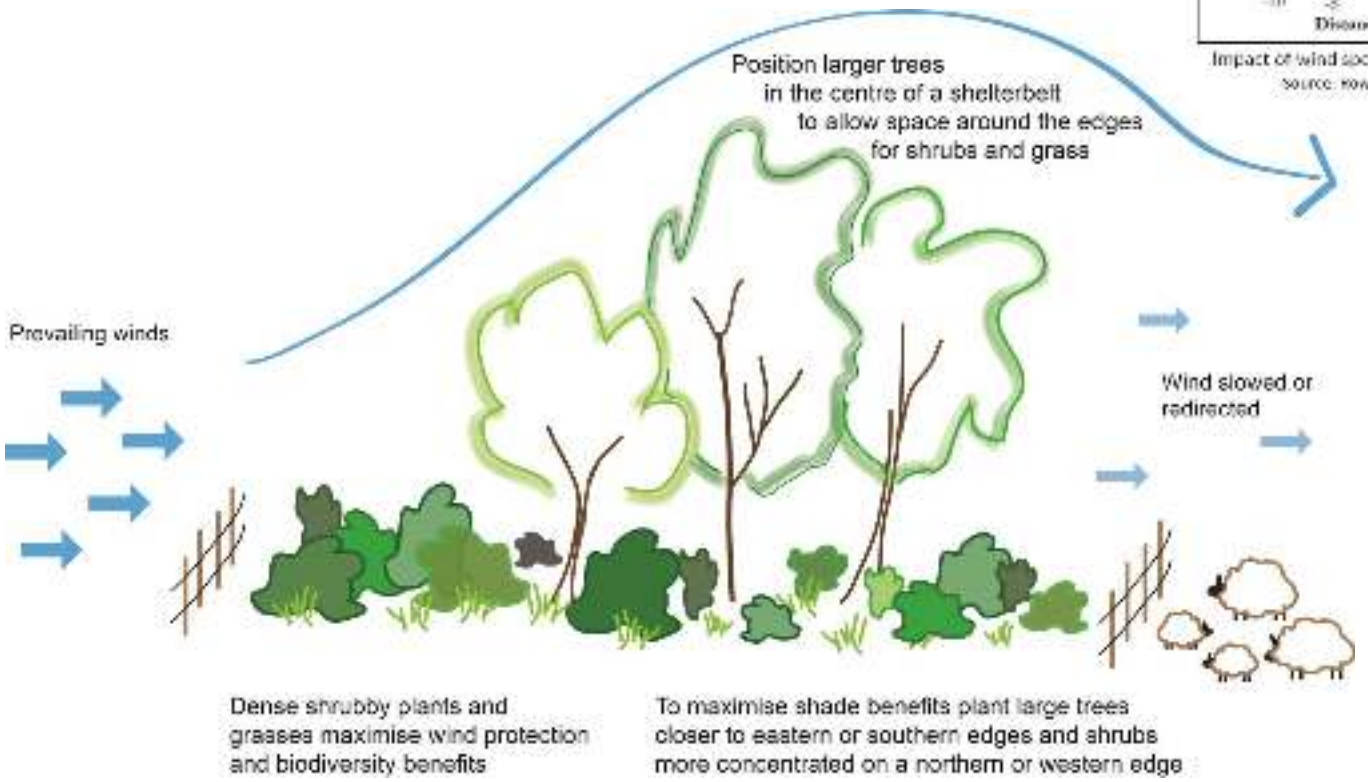
Production benefits

- Erosion
- Livestock feed
- Water retention & quality
- **<u>Alternative income streams</u>**
    - Carbon
    - Biodiversity credits/offsets
    - Stewardship/Nature Repair Markets
    - Product premiums (organic, ethically sourced, sustainably produced etc)
    - Woodlots – firewood and timber production (agroforestry)

Shelterbelts- the concept



Impact of wind speed reductions and distance from windbreak. Source: Rowan Reid (University of Melbourne) (2014).



Plantings - Bigger is generally better

- Wildlife & Biodiversity
- Production
- Block plantings
  - Better protection from multiple directions, stock can move according to weather, season
  - May also offer protection to multiple paddocks

Block Plantings

- Better protection within planting for lambing, off shears, inclement weather etc
- But may not protect as much of pdck as linear plantings
- Whole of Paddock Restoration (WOPR)

Linear Plantings

- Linear plantings
  - May work better for your farm
  - Paddock/property boundaries
  - Biodiversity connectivity

Size/Shape – Linear Plantings

- 20-30m ideal width
- Wider plantings better for biodiversity & shelter
- Narrow plantings more susceptible to edge effects (cropping, spray drift, fertiliser runoff etc)
- Narrow planting shelter integrity also compromised – losses of plants within shelterbelt has bigger effect – creating wind gaps etc

Size/Shape – Intersections and connection

Natural assets - Build on existing linear vegetation

Plantings - Include paddock trees

Plantings - Clusters

- Stepping stones
- Aim for something

Natural assets - paddock trees

Riparian areas & dams

Improving existing plantings/remnants

- Incorporate key habitat features eg remnants, logs, rocks
- Introduce key habitat features eg relocating logs, rocks if cleared elsewhere
- Introduce new habitat features
  - Nest Boxes
  - Artificial hollows

Planting Composition

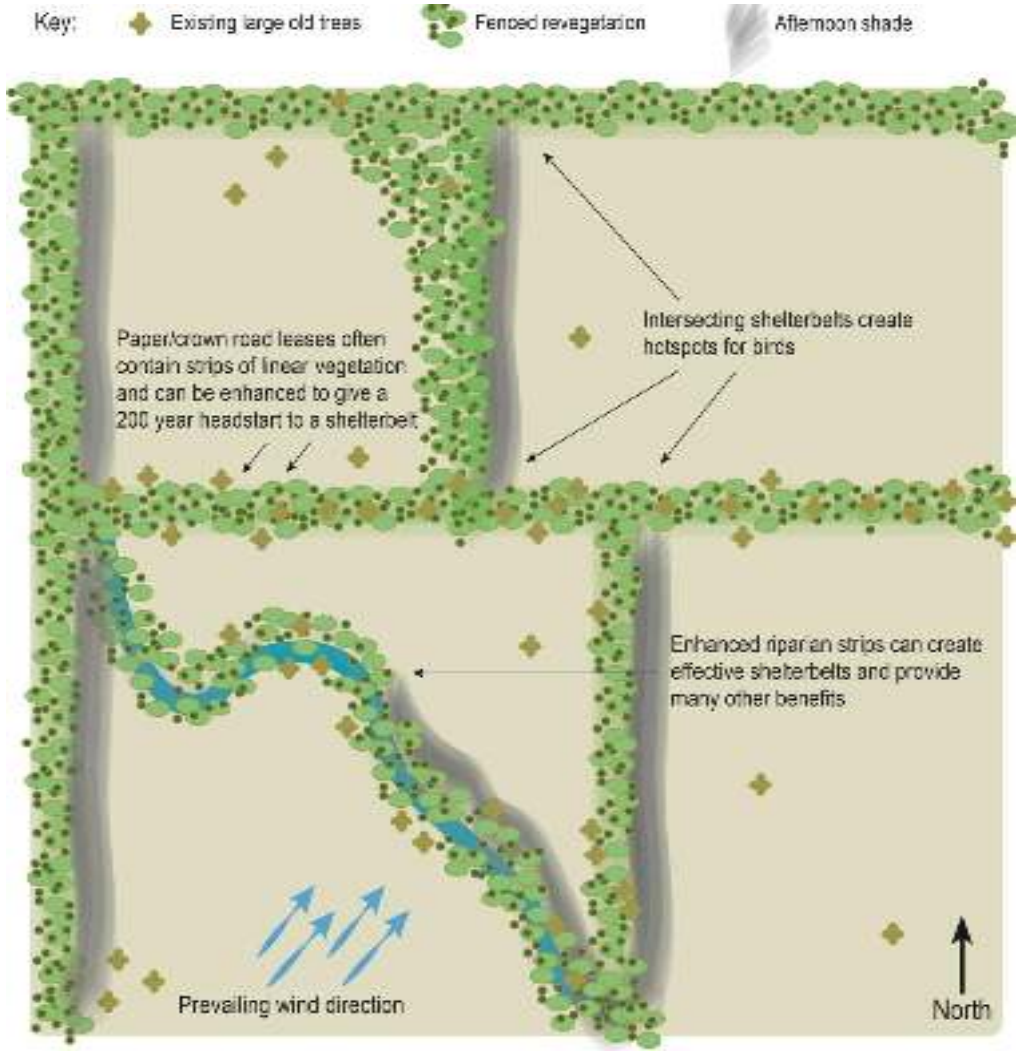
- Depends on objectives
- What's missing?
- Mixed locally endemic native species
- Species suitable for landscape
- **Structural complexity** – multiple layers
  - Shrubs
  - Trees

Planting Composition

- **Species complexity** – provides diverse life cycles – growth and reproduction rates at diff. times
- Flowering at diff. times
  > Pollinators

Location

- Depends on weather conditions, landscape
- Make connections
- Riparian areas and flow lines good targets
- Multipurpose benefits
- BirdCast App
  - https://www.sustainablefarms.org.au/resources/birdcast-tool/

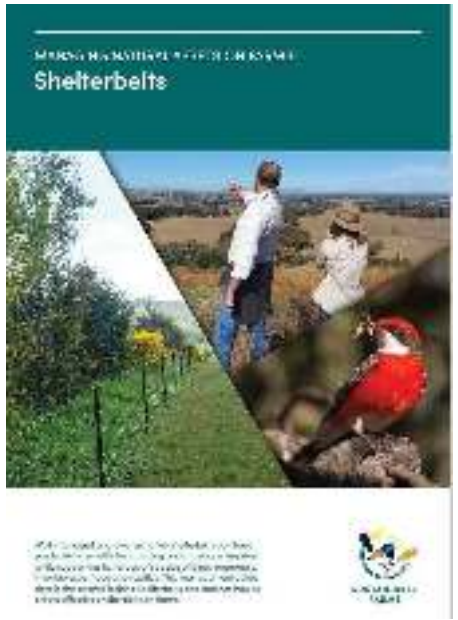


Multipurpose Benefits

- Biosecurity
  - Property boundaries
  - Disease
  - Spray drift
  - Dust
- Agroforestry
- Carbon farming
- Salinity
- Erosion
- Water filtration
- Evaporation
- Aesthetics
- Privacy
- All can be tailored to maximise habitat values

Grazing plantings

Wildlife friendly fencing



SUSTAINABLE FARMS

www.sustainablefarms.org.au

https://sustfarm.shinyapps.io/BirdCast/?

Sustainable Farms

@SusFarms_ANU

Panel Discussion

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Workshop Sessions

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Group Reflections and Sharing

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Closing Remarks