Trees on Farm:
Productivity Benefits

THE UNIVERSITY OF MELBOURNE

mla
MEAT & LIVESTOCK AUSTRALIA

VICTORIA State Government
Energy, Environment and Climate Action

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
- Increased tree cover is often seen as competition for pasture.
- Project aimed to assist in achieving both net emissions reduction and maintaining or improving farm productivity.

Methods and Project Team

EMISSIONS	Greenhouse gas accounting framework	Ainslie MacDonald, Brendan Cullen, and Rachelle Meyer
SEQUESTRATION	FullCAM modelling	Hugh Stewart
SHEEP PRODUCTIVITY	GrassGro modelling	Jane Court and Rachelle Meyer
ECONOMIC ANALYSIS	Threshold analysis, @Risk	Alex Sinnett
PROJECT SUPERVISION		Rodney Keenan and Richard Eckard

Methods
Case study farms:

Variable	Hamilton	Bairnsdale
Region	Western Victoria	Gippsland
Area included (ha)	6,456	770
Rainfall (mm)	690	775
Livestock	33,500 sheep	1,200 ewes
Lambs per ewe	1.24	1.39
Proposed tree plantings (%)	11.6	5.2
Total tree cover (%)	20.3	14.7

Methods: Productivity benefit

GrassGro incorporates the impacts of chill on lamb mortality

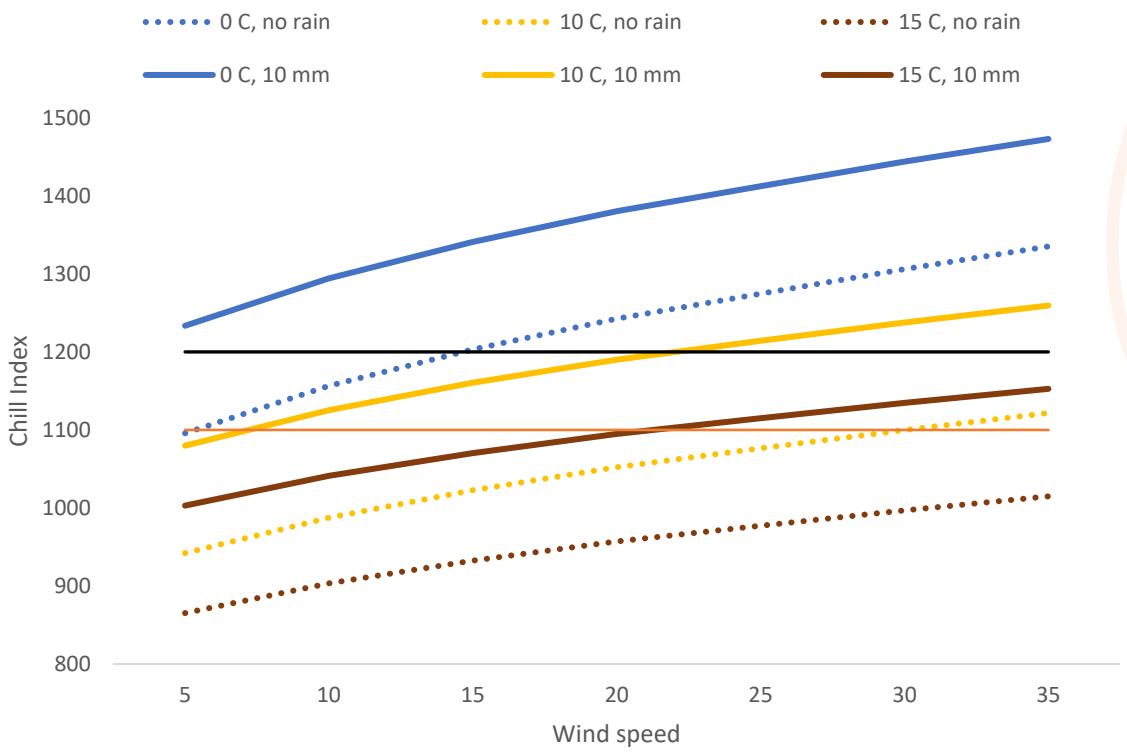


Photo by Hugh Stewart

Methods: Economic analysis

- 30-year timeframe, discounted costs and benefits
- Real terms before tax
- 10% discount rate
- Benefits
  - Average net margin of lambs = $45/ lamb, starts in year 7
  - Carbon value starts at $35 / t CO_2e and ends at $80 / t CO_2e
  - Timber at Bairnsdale only
- Capital and ongoing costs, informed by farmers and industry sources

Methods: Economic analysis

Site	Fencing cost/ha	Length of fence (m)	Tree establishment cost- year 1 ($/ha)	Tree establishment cost- year 2 ($/ha)	Annual cost (labour, insurance, etc) ($/ha)
Hamilton env planting (over 8 years)	13,000	24.0	3,450	120	50
Bairnsdale shelterbelt	14,000	7.0	4,500	400	75
Bairnsdale env planting	13,500	2.7	4,500	400	50
Bairnsdale plantation	13,500	0	4,000	400	Total $129,220, notes below

The Bairnsdale Eucalypt plantation had additional maintenance costs:

- pruning occurred three times at a cost of $1000/ha
- a non-commercial and a semi-commercial thinning cost $750/ha
- one application of micronutrients cost $400/ha

Methods: Economic analysis:

Bairnsdale timber revenue: 28.4 ha plantation

Age (years)	Description	Projected volume (m^3)
12	Semi-commercial thin (50 m^3/ha)	1,420
20	Commercial thin (90 m^3/ha)	2,556
30	Final harvest (310 m^3/ha)	8,804

Product	Proportion	Stumpage
From thinning at 20 years		
Poles, posts	0.8	$94,061
Firewood	0.2	$13,291
Total	1.00	$107,352
From final harvest at 30 years		
Sawlog	0.5	$836,380
Poles, posts	0.25	$134,261
Firewood	0.25	$90,241
Total	1.00	$1,060,882

Results: Lamb productivity

Average lambs per ewe (% increase)

100% wind: 1.24

30% reduction: 1.32 (6.5%)

60% reduction: 1.41 (13.7%)

Additional lambs produced at Hamilton

	30% reduction in wind speed	60% reduction in wind speed
median	3,382	7,380
20th - 80th percentile	3,245-3,935	7,066- 8,647

Average lambs per ewe (% increase)

100% wind: 1.28

15% reduction: 1.29 (0.8%)

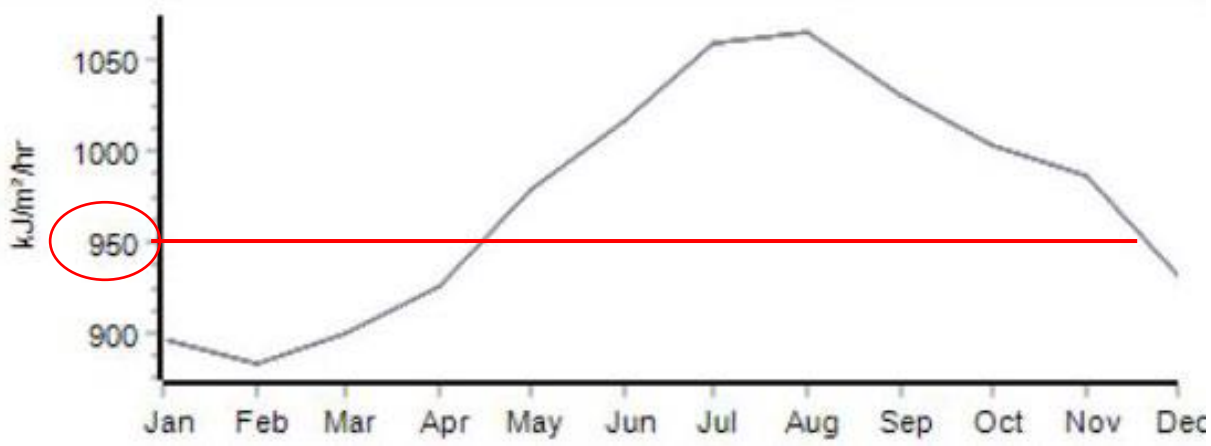
50% reduction: 1.31 (2.3%)

Additional lambs produced at Bairnsdale

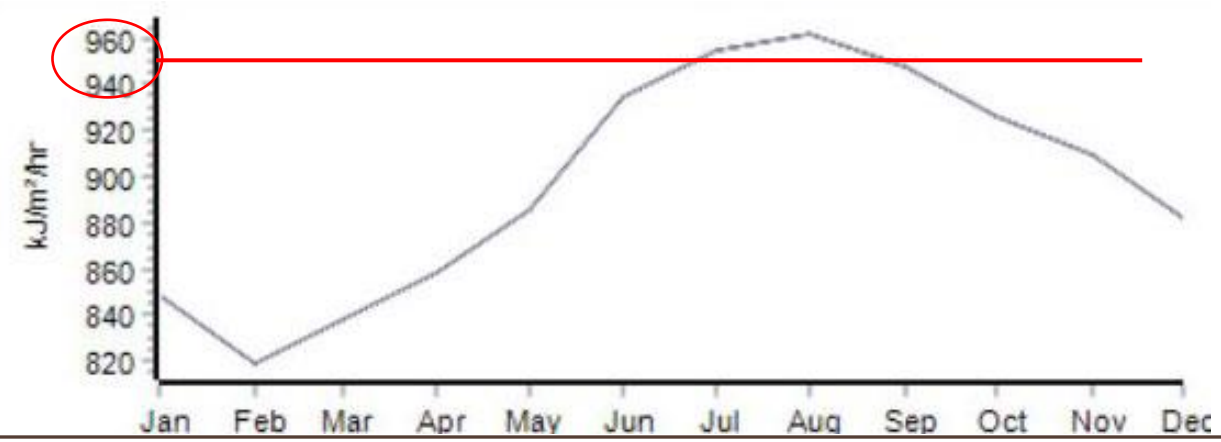
	15% reduction in wind speed	50% reduction in wind speed
median	15	67
20th - 80th percentile	3-37	34-91

Chill index at the two sheep case studies

Hamilton



Bairnsdale



Mean annual real return on extra capital invested in planting trees at Hamilton

Scenario	Trees replacing 9 DSE/ha pasture	Trees replacing 18 DSE/ha pasture
Wind speed reduction 60%, Auditing cost 10%	10%	5%
Wind speed reduction 60%, Auditing cost 30%	8%	2%
Wind speed reduction 30%, Auditing cost 10%	7%	1%
Wind speed reduction 30%, Auditing cost 30%	4%	Negative return

Mean annual real return on extra capital invested in planting trees at Bairnsdale

Scenario	Trees replacing 9 DSE/ha pasture	Trees replacing 18 DSE/ha pasture
Wind speed reduction 50%, Auditing cost 10%	6.7%	4.0%
Wind speed reduction 50%, Auditing cost 30%	5.3%	2.8%
Wind speed reduction 15%, Auditing cost 10%	6.4%	3.8%
Wind speed reduction 15%, Auditing cost 30%	5.1%	2.6%

Limitations

Risks not included:

- Fire
- Failed plantings (although this would be minimized with the expenses incurred in our planting scenarios)

Benefits not included:

- Water quality improvements
  - On farm can lead to live weight gains
  - Downstream benefits
- Improved welfare from reduced heat and cold stress
- Reduced wind erosion
- Reduced waterlogging and salinity issues
- Increases in biodiversity
  - Increases in pollinators
  - Reduction in insect pests
- Amenity values
- Potential increases in land value

Summary

Shelter productivity benefit depends on:

- Site conditions
- Effectiveness of shelter
- Productivity of pasture taken out of production
- Costs associated with auditing
- Type of planting, revenue from timber reduces need for productivity co-benefit

Next steps

Detection of productivity benefits is easier when

- Animals are sensitive to conditions (lambs in cold, dairy cows in heat)
- The change with improved conditions is observable
- In other cases, there is an information gap
  - cattle and sheep LW
  - Fertility
- Update of modelling capability to reflect how heat and cold impact weight gain to address these questions as well as the impacts of adaptation options. More data likely needed to achieve this.

Other potential productivity benefits (e.g. salinity, erosion, pollination)

- Requires metrics for environmental factors that can be applied on farm
- Research connecting environmental goals and productivity

thank you

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https://www.piccc.org.au/research/project/TreesOnFarm.html

References

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