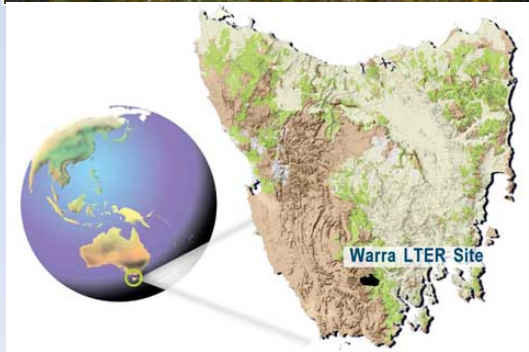
WARRA
long-term ecological research

Warra: Translating research into capital

Tim Wardlaw, Principal Scientist (Ecosystem Services)
Research & Development Branch
Forestry Tasmania



TERN
Terrestrial Ecosystem Research Network

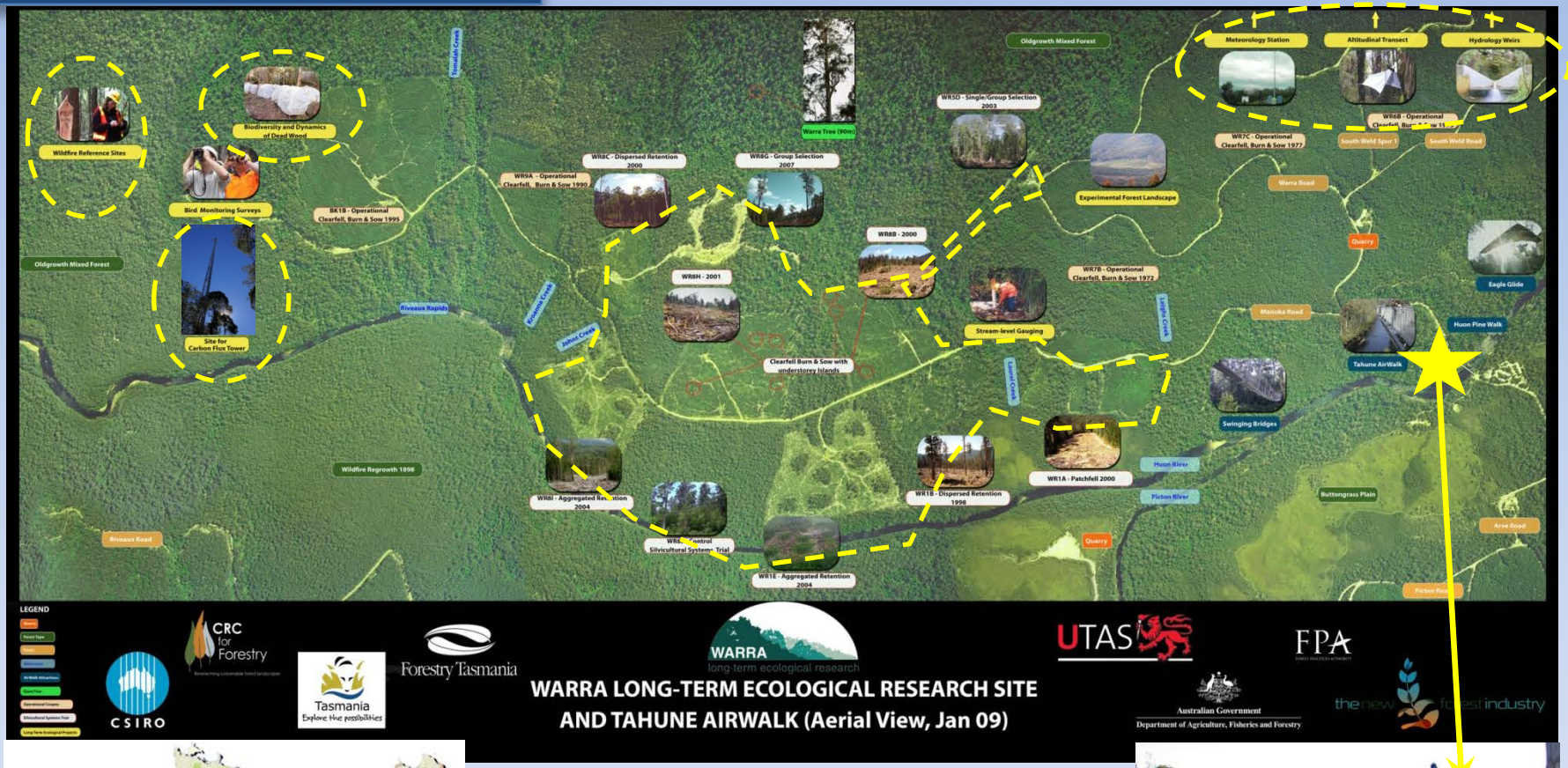
Australian SupersiteNetwork

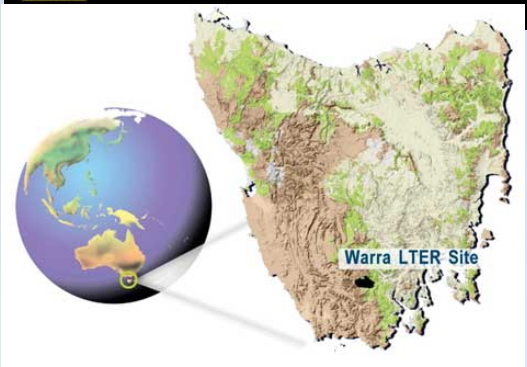
OzFlux

Outline of talk

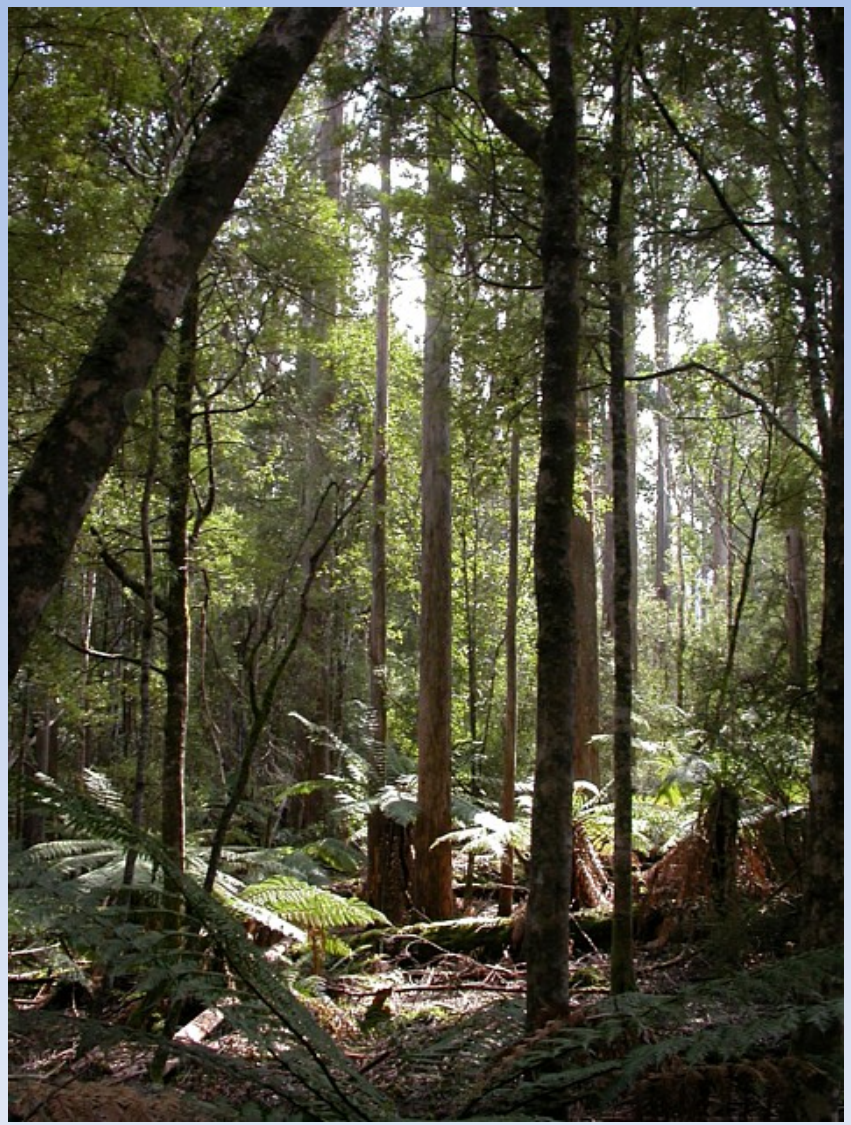
- Introduction
  - Where is it and what's there
  - Purpose of Warra
- What's been happening – generating science capital
- Using science capital to improve forest management
- Looking to the future – how can we convert research / science capital into social capital?

Where's Warra?





Purpose of Warra



A place to foster research

- Long-term
- Multidisciplinary

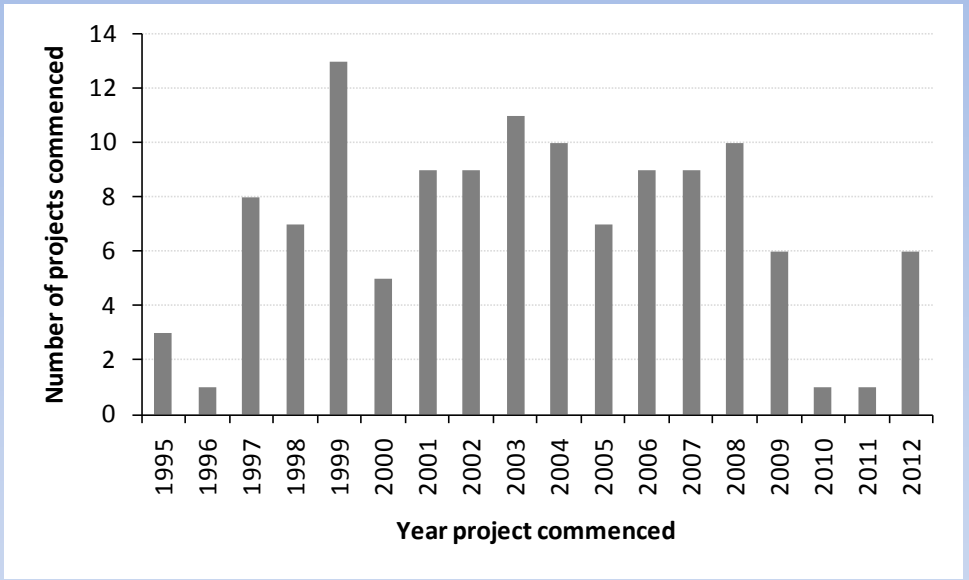
Focussed on the ecology of tall, wet eucalypt forests

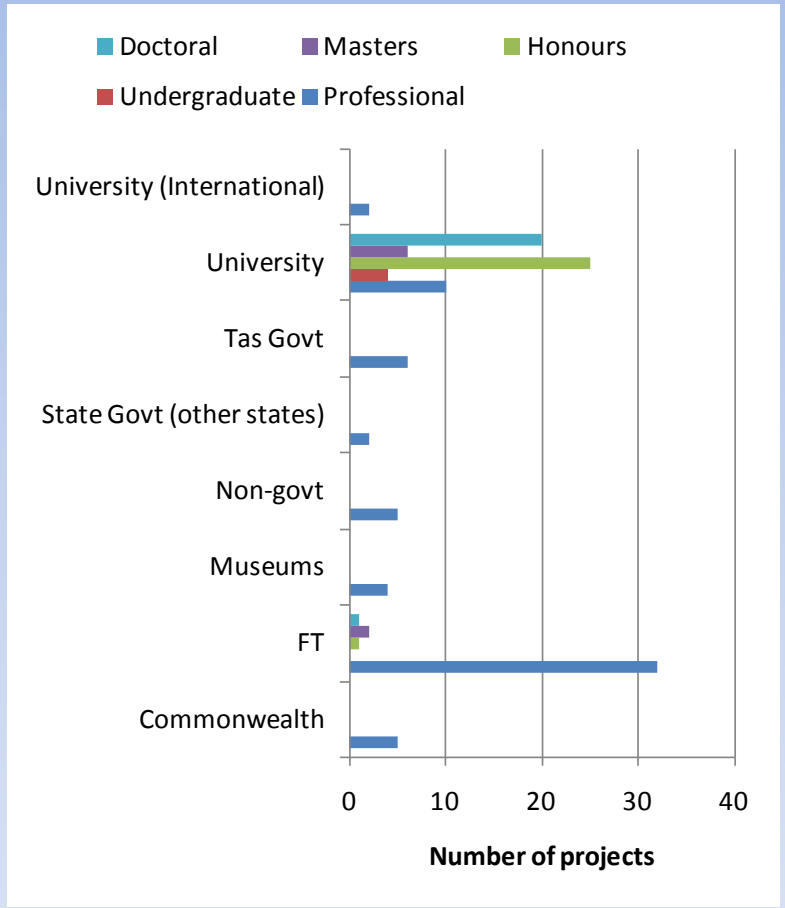
Understand the effects of disturbance:

- Harvesting
- Wildfire
- Climate

Inform management

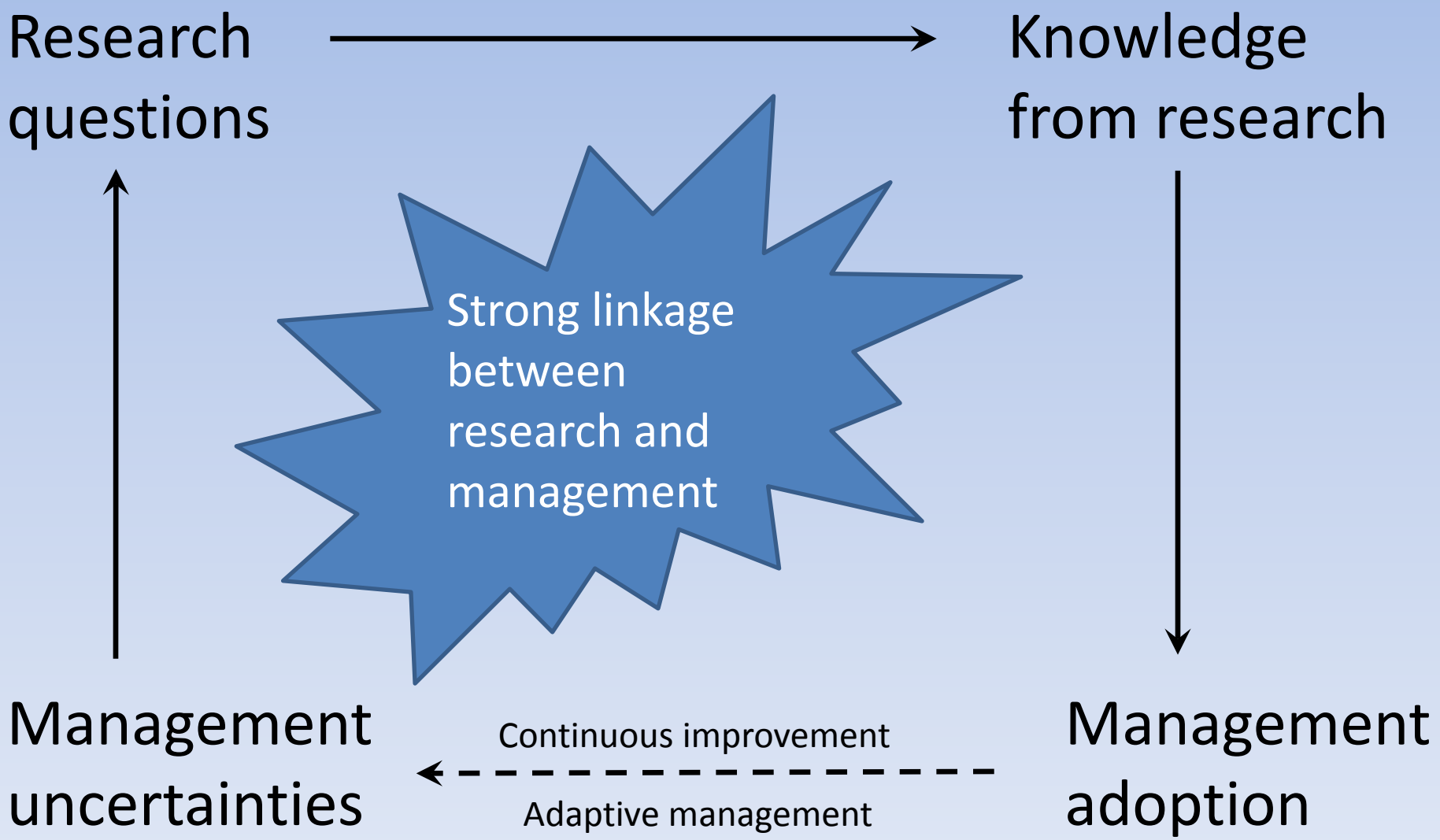
Fostering research





- 279 publications and reports
- 54 university graduate studies
  - 26 honours, 7 masters, 21 doctorates
- 5 ARC Linkage Grants
- 1 international conference

A strength of Warra research



Impact of fuelwood harvesting

Review of the science relevant to the sustainable use of native and plantation forest-harvesting residues for energy production in Tasmania

---

Client: Forestry Tasmania, National Power, John Holland Development and Investments

CSIRO

Authors: R J Raison, M U F Kirschbaum, R J McCormack
CSIRO Forestry and Forest Products
P M Attiwill, University of Melbourne
A M M Richardson, University of Tasmania

Final Report
31 May 2002

Uncertainties (biodiversity):

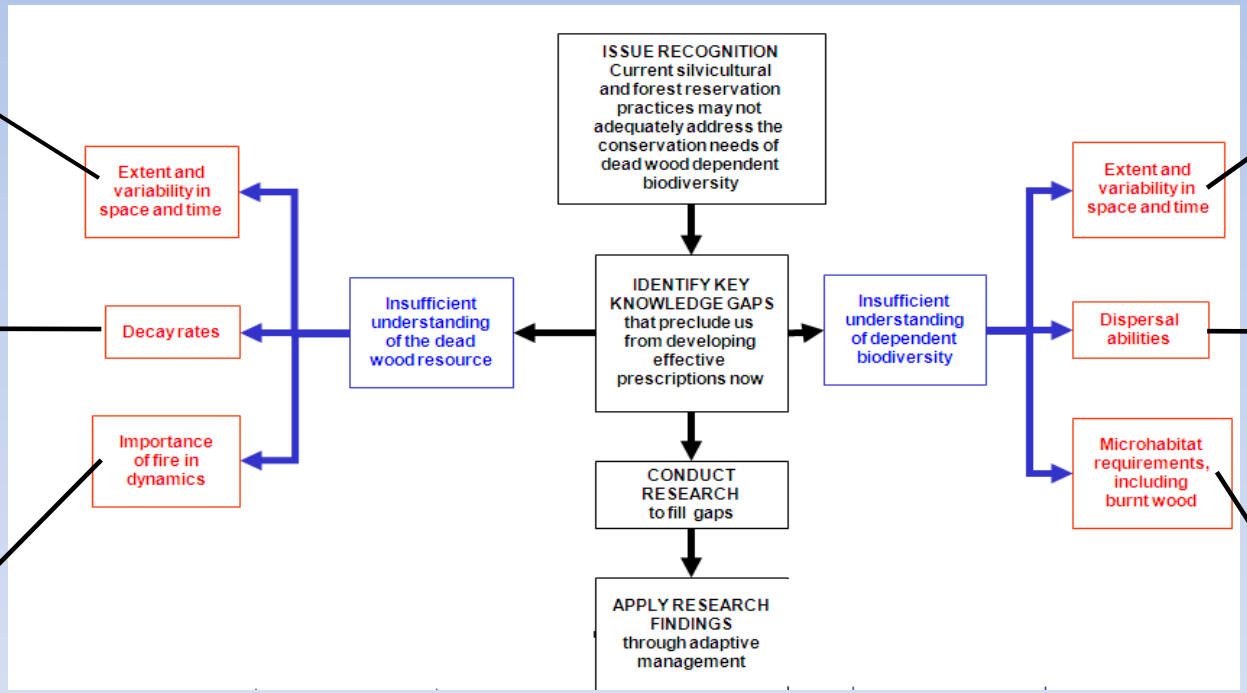
- Fate of CWD – how long does CWD take to decay?
- Dispersal abilities of the dependent biota
- Dependent biota that need large logs as habitat

CWD biodiversity research agenda

Extensive FT inventory + Masters

Hons study + consultancy

PhD Warra fire study

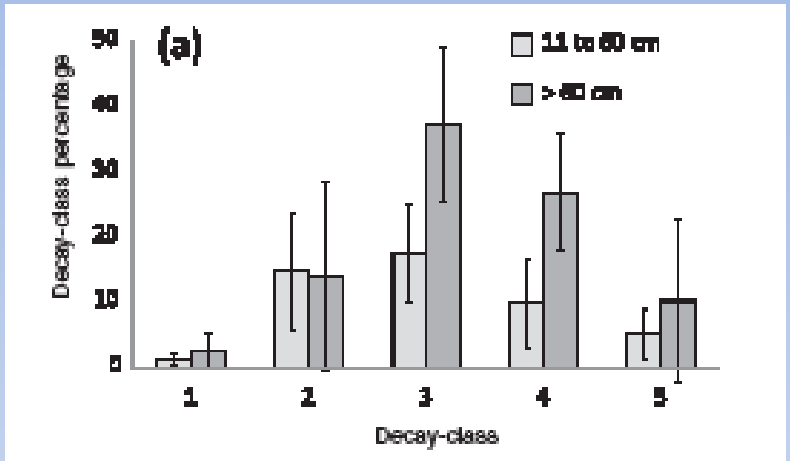


6 PhDs + 2 post-docs + 4 Warra Icon projects

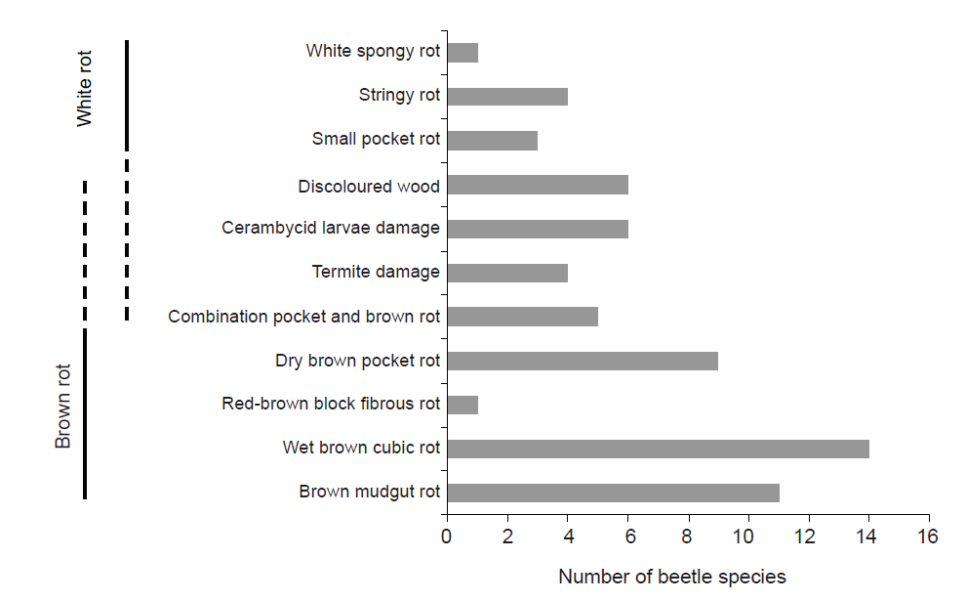
2 Hons studies + 2 PhDs + post-doc

2 PhDs + Masters

CWD Biodiversity research outcomes



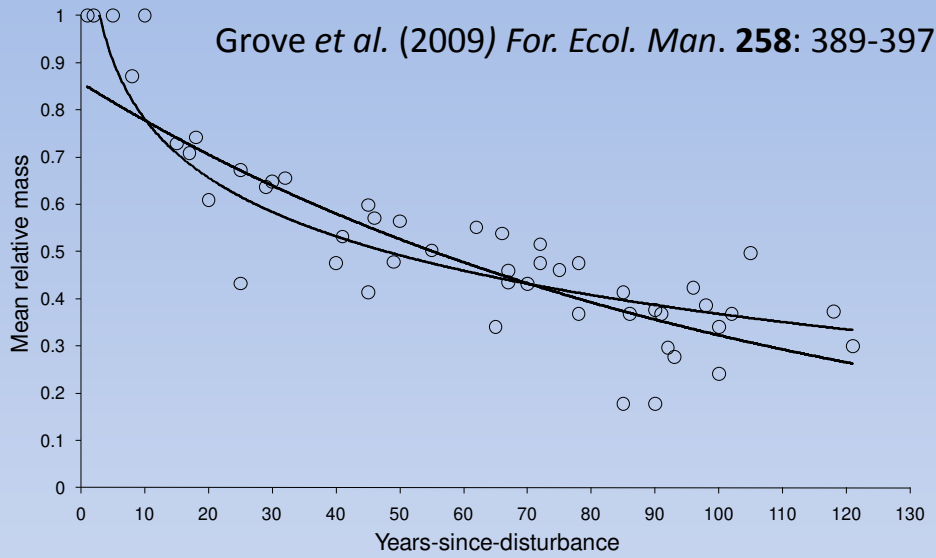
Grove *et al.* (2011) *For. Ecol. Man*. **262**: 692-670

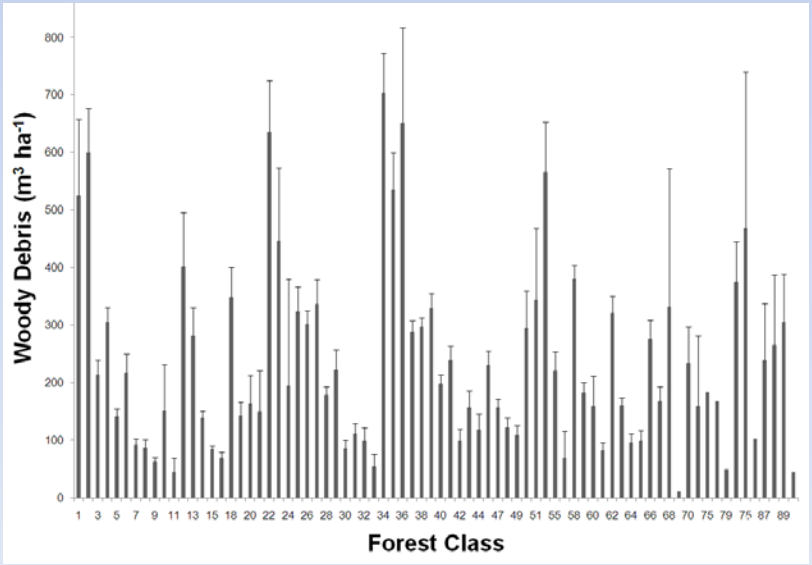


Harrison (2007) PhD Thesis University of Tasmania

Large logs from mature trees are a distinctive habitat

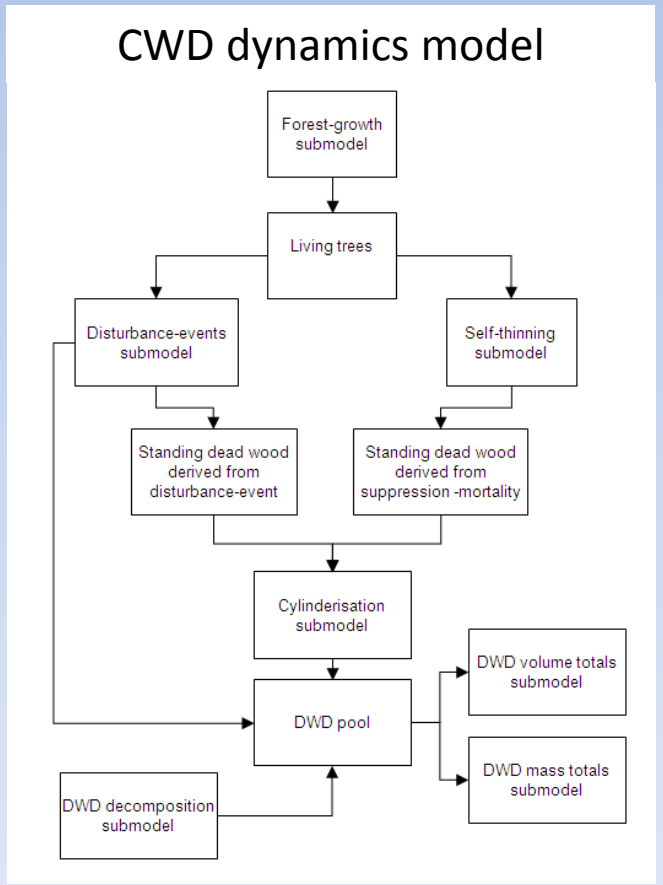
CWD Biodiversity research outcomes





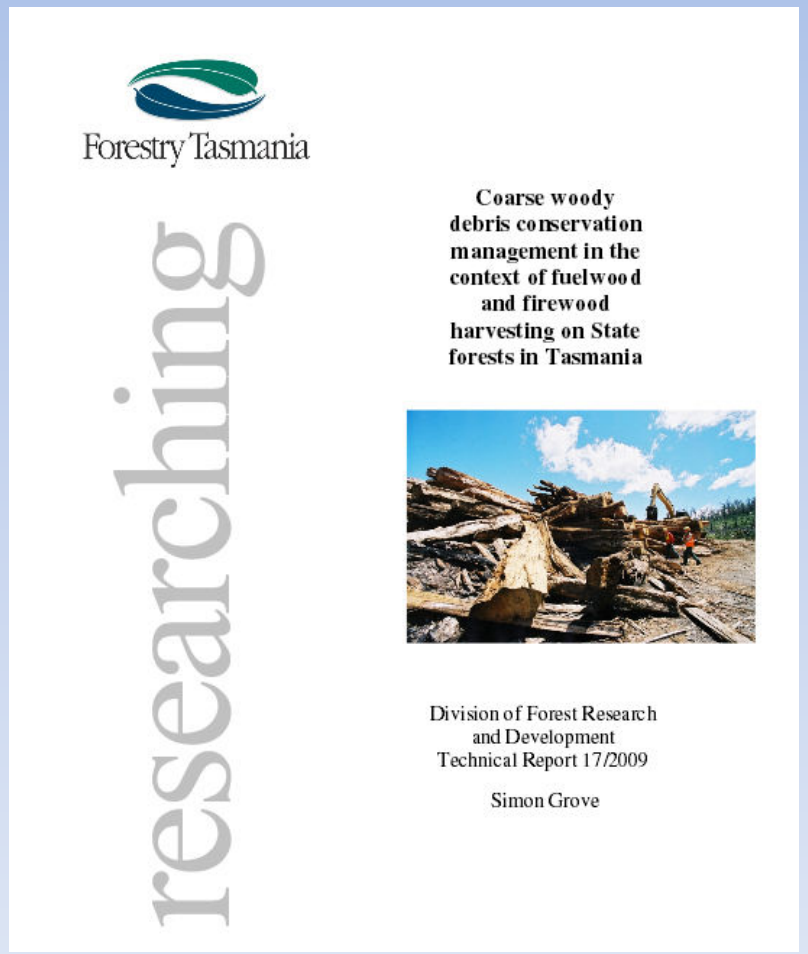
Moroni *et al*. (2011)

CWD persists but volumes are highly variable across landscape

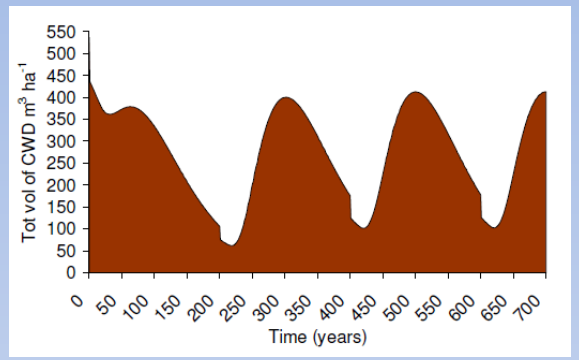


Stamm and Grove (unpublished)

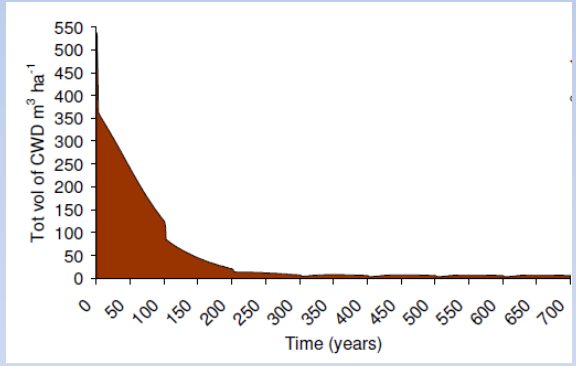
Prescriptions to manage CWD



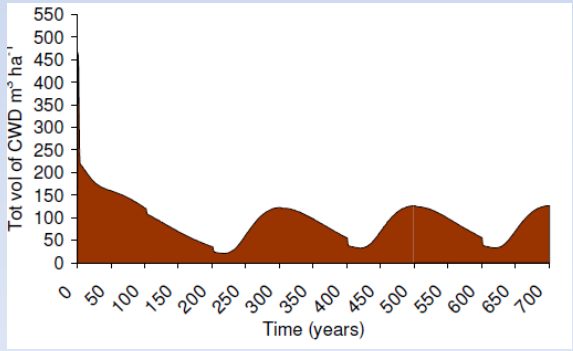
Wildfire (200 yr)



CBS (100 yr)



ARN – 30% retention (200 yrs+) + 70% CBS (100 yrs)



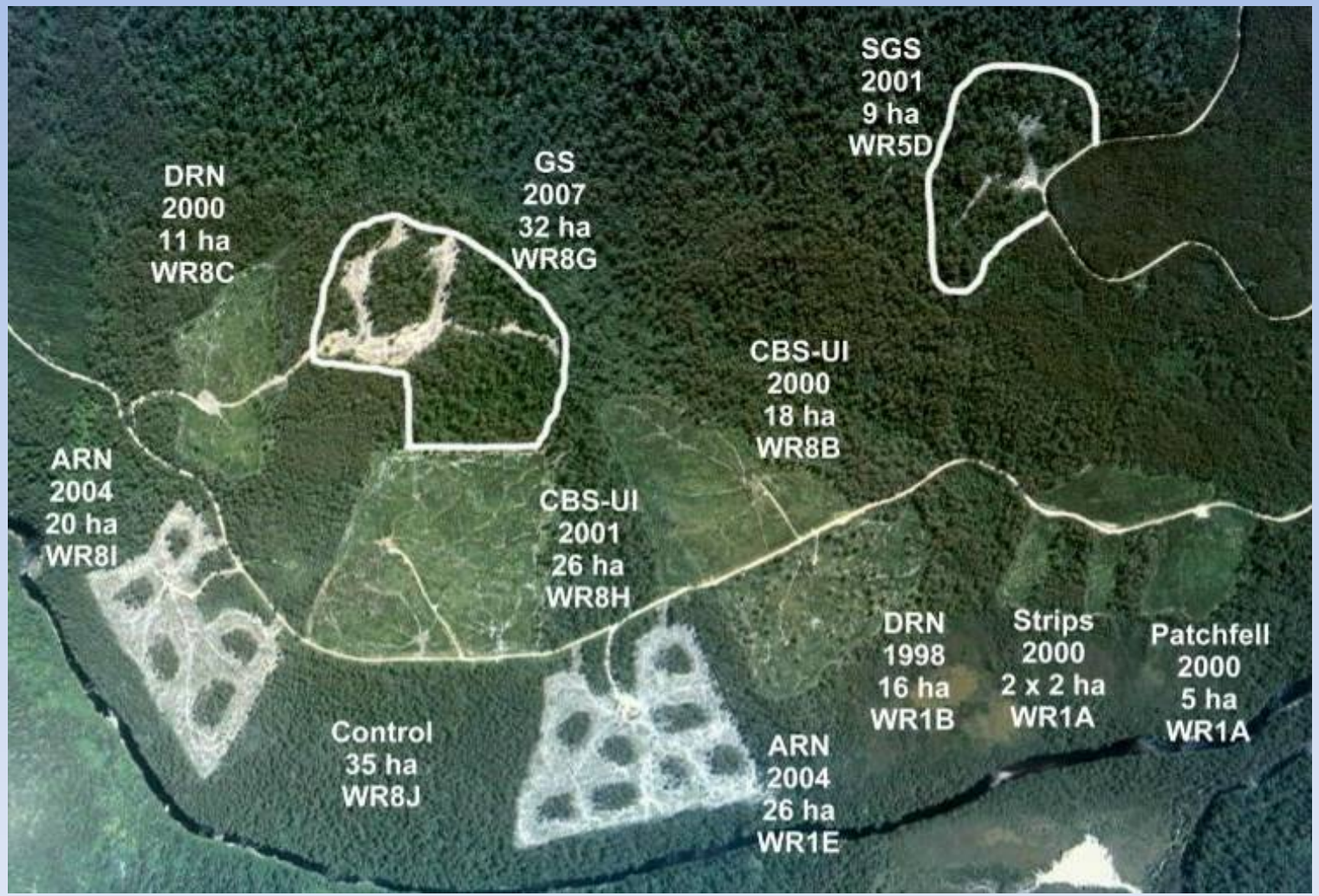
Alternatives to clearfell, burn and sow in wet eucalypt forests

Tasmanian Regional Forest Agreement (1997)
(Attachment 13 – Priority areas of research)

7. Silvicultural techniques

”Commercial viability of new and alternative silvicultural techniques especially for harvesting and regenerating wet eucalypt Forests and maximising special species timbers production and regeneration where appropriate.”

Warra Silvicultural Systems Trial



CBS-UI: Clear-fell, burn & sow with understorey islands

DRN: dispersed retention

ARN: Aggregated retention

GS, SGS: group selections

SST: multi-disciplinary & long-term

	Monitoring and assessment (years after harvest)											
	-1	0	1	3	10	20	30	40	50	60	70	80
Productivity		*										
Safety		*										
Economics		*										
Social acceptability	Simulated visualisations →											
Silvicultural		*	*	*	*	*	*	*	*	*	*	*
Biodiversity	*		*	*	*	*	*	*	*	*	*	*

Synthesis of biodiversity outcomes from SST: Short-term post-harvest responses

Forest Ecology and Management 258 (2009) 460–471

Contents lists available at ScienceDirect

Forest Ecology and Management

journal homepage: www.elsevier.com/locate/foreco

Early responses of birds to clearfelling and its alternatives in lowland wet eucalypt forest in Tasmania, Australia

Paul Lefort, Simon Grove *

Division of Forest Research and Development, Forestry Tasmania, GPO Box 207, Hobart, Tasmania 7001, Australia

Forest Ecology and Management 258 (2009) 444–459

Contents lists available at ScienceDirect

Forest Ecology and Management

journal homepage: www.elsevier.com/locate/foreco

Short-term responses of ground-active beetles to alternative silvicultural systems in the Warra Silvicultural Systems Trial, Tasmania, Australia

Susan C. Baker [a,b,1], Simon J. Grove [a,b,1,*], Lynne Forster [a], Kevin J. Bonham [a], Dick Bashford [a]

[a] Forestry Tasmania, Division of Forest Research and Development, GPO Box 207, Hobart, Tasmania 7001, Australia
[b] CRC for Forestry, Private Bag 12, Hobart, Tasmania 7001, Australia

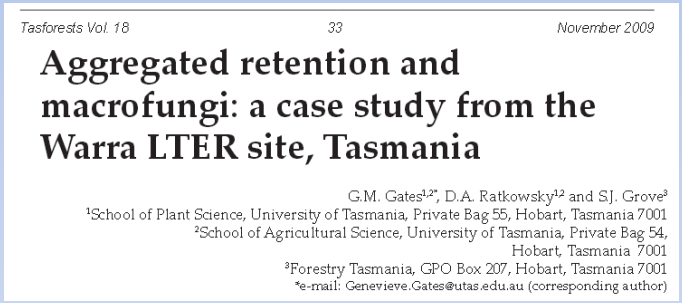
CSIRO PUBLISHING

Australian Journal of Botany, 2011, **59**, 701–712
http://dx.doi.org/10.1071/BT11081

Early impacts of harvesting and burning disturbances on vegetation communities in the Warra silvicultural systems trial, Tasmania, Australia

Mark G. Neyland[A,C] *and S. Jean Jarman*[A,B]

[A]Forestry Tasmania, 79 Melville Street, Hobart, Tas. 7000, Australia.
[B]Tasmanian Herbarium, Tasmanian Museum and Art Gallery, Hobart, Tas. 7000, Australia.
[C]Corresponding author. Email: mark.neyland@forestrytas.com.au



Tasforests Vol. 18 *33* *November 2009*

Aggregated retention and macrofungi: a case study from the Warra LTER site, Tasmania

G.M. Gates[1,2*], D.A. Ratkowsky[1,2] and S.J. Grove[3]
[1]School of Plant Science, University of Tasmania, Private Bag 55, Hobart, Tasmania 7001
[2]School of Agricultural Science, University of Tasmania, Private Bag 54, Hobart, Tasmania 7001
[3]Forestry Tasmania, GPO Box 207, Hobart, Tasmania 7001
*e-mail: Genevieve.Gates@utas.edu.au (corresponding author)

Biodiversity attribute	ARN	DRN	CBS+UI	CBS
Wide use by shrub, mid-layer and canopy birds	1[e]	2[e]	4[e]	4[e]
Maintenance of mature-forest ground-active beetles	1[e]	2[e]	3[e]	4[e]
Maintenance of mature-forest vascular plants	1[e]	3[e]	2[e]	4[e]
Maintenance of mature-forest bryophytes	1[j]	3[e]	3[e]	4[e]
Maintenance of mature-forest lichens	1[j]	4[e]	4[e]	4[e]
Maintenance of mature-forest ectomycorrhizal fungi	1[e]	2[j]	3[j]	4[e]
Provision of habitat trees for hollow-dependent fauna	1[e]	2[e]	3[e]	4[e]
Continuing availability of CWD	2[j]	2[j]	3[j]	4[j]
Sum of above rankings	9	20	25	32
Overall ranking for mature-forest biodiversity	1	2	3	4

Baker and Read (2011) *Australian Forestry*, **74(3)**: 218-232

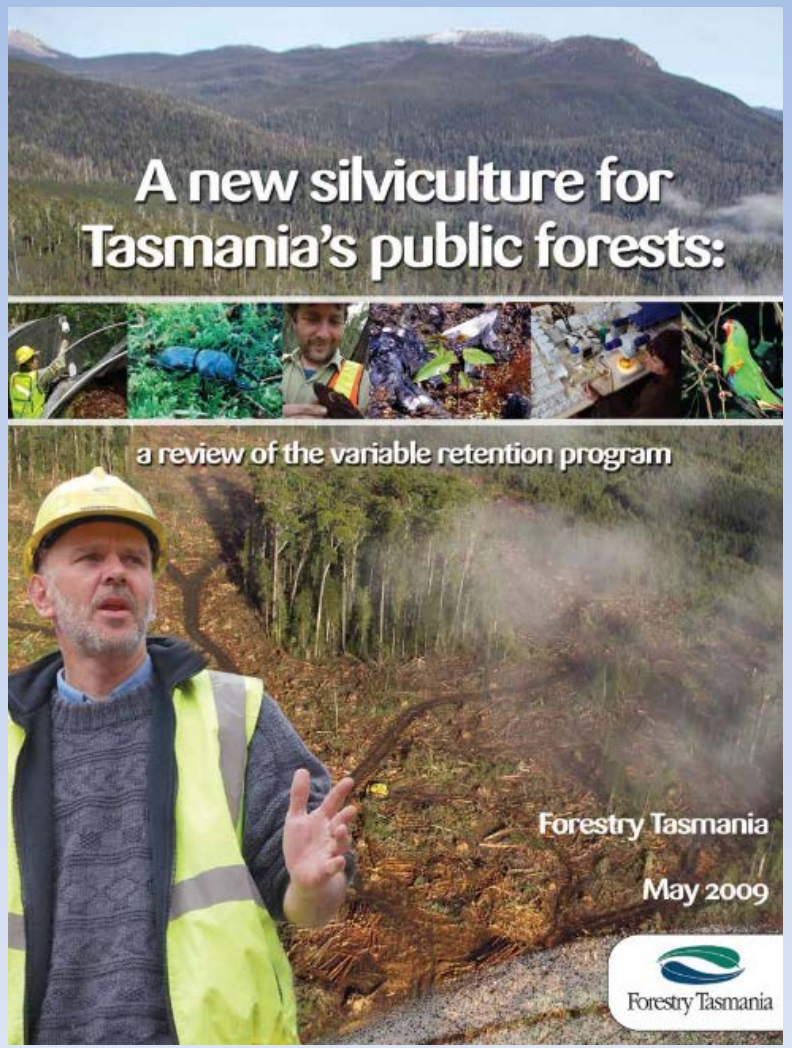
Overall synthesis of outcomes from SST

Warra criteria synthesis							
Criteria	Clearfell burn and sow with understorey islands	Patchfell	Strips	Dispersed retention	Aggregated retention	Single tree – small group selection	Group selection
Safety	1	2	2	3	2	3	2
Productivity	1	1	1	1	1	3	1
Economics	1	2	2	2	2	3	2
Biodiversity	3	3	2	2	1	2	2
Silviculture	1	1	1	2	2	3	3
Social acceptability	3	2	2	2	1	1	1
Overall	10	11	10	12	9	15	11

Treatments are ranked independently within each criterion. 1 = best, 3 = worst. The lowest total therefore indicates the best system overall, and vice versa.

Neyland *et al*. (2012) *Australian Forestry*, **75(3)**: 147-162

Translating SST research into practice



Forest Ecology and Management 276 (2012) 165–173

Contents lists available at SciVerse ScienceDirect

Forest Ecology and Management

journal homepage: www.elsevier.com/locate/foreco

Burning outcomes following aggregated retention harvesting in old-growth wet eucalypt forests

Robyn E. Scott [a,b,c,*], Mark G. Neyland [a,b], David J. McElwee [a], Susan C. Baker [a,b,c]

[a] Forestry Tasmania, GPO Box 207, Hobart, Tasmania 7001, Australia
[b] University of Tasmania, School of Plant Science, Private Bag 50, Hobart, Tasmania 7001, Australia
[c] Cooperative Research Centre for Forestry, Private Bag 12, Hobart, Tasmania 7001, Australia

Forest Ecology and Management 306 (2013) 192–201

Contents lists available at SciVerse ScienceDirect

Forest Ecology and Management

journal homepage: www.elsevier.com/locate/foreco

Factors influencing initial vascular plant seedling composition following either aggregated retention harvesting and regeneration burning or burning of unharvested forest

Susan C. Baker [a,b,c,*], Mona Garandel [b,d], Martin Deltombe [b,d], Mark G. Neyland [a,b,c]

[a] University of Tasmania, School of Plant Science, Private Bag 55, Hobart, Tasmania 7001, Australia
[b] Forestry Tasmania, Division of Research and Development, GPO Box 207, Hobart, Tasmania 7001, Australia
[c] Cooperative Research Centre for Forestry, Private Bag 12, Hobart, Tasmania 7001, Australia
[d] AgroParisTech-ENGREF, 14, rue Girardet – CS 14216, F-54042 Nancy Cedex, France

Forest Ecology and Management 302 (2013) 254–263

Contents lists available at SciVerse ScienceDirect

Forest Ecology and Management

journal homepage: www.elsevier.com/locate/foreco

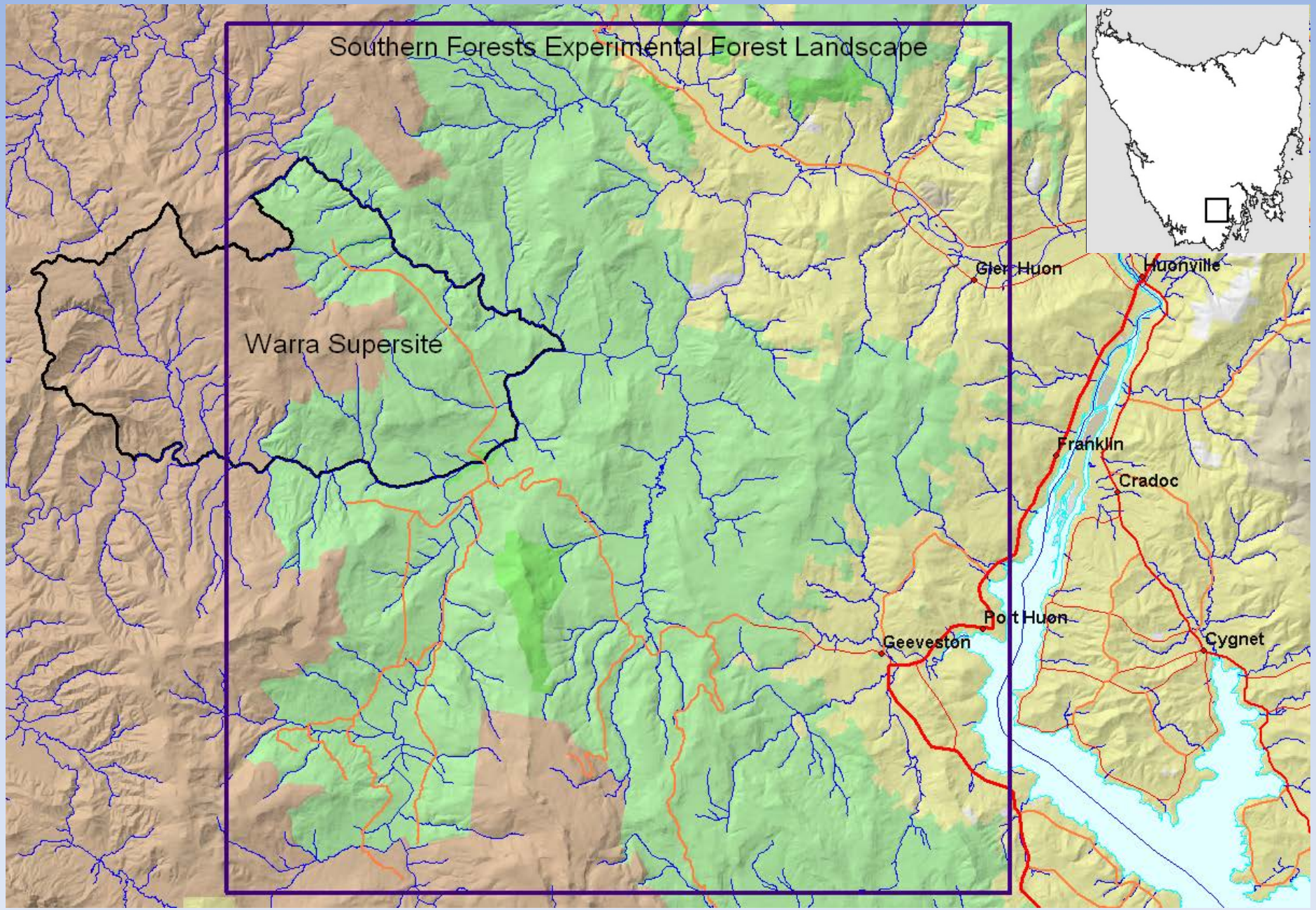
Early regeneration results following aggregated retention harvesting of wet eucalypt forests in Tasmania, Australia

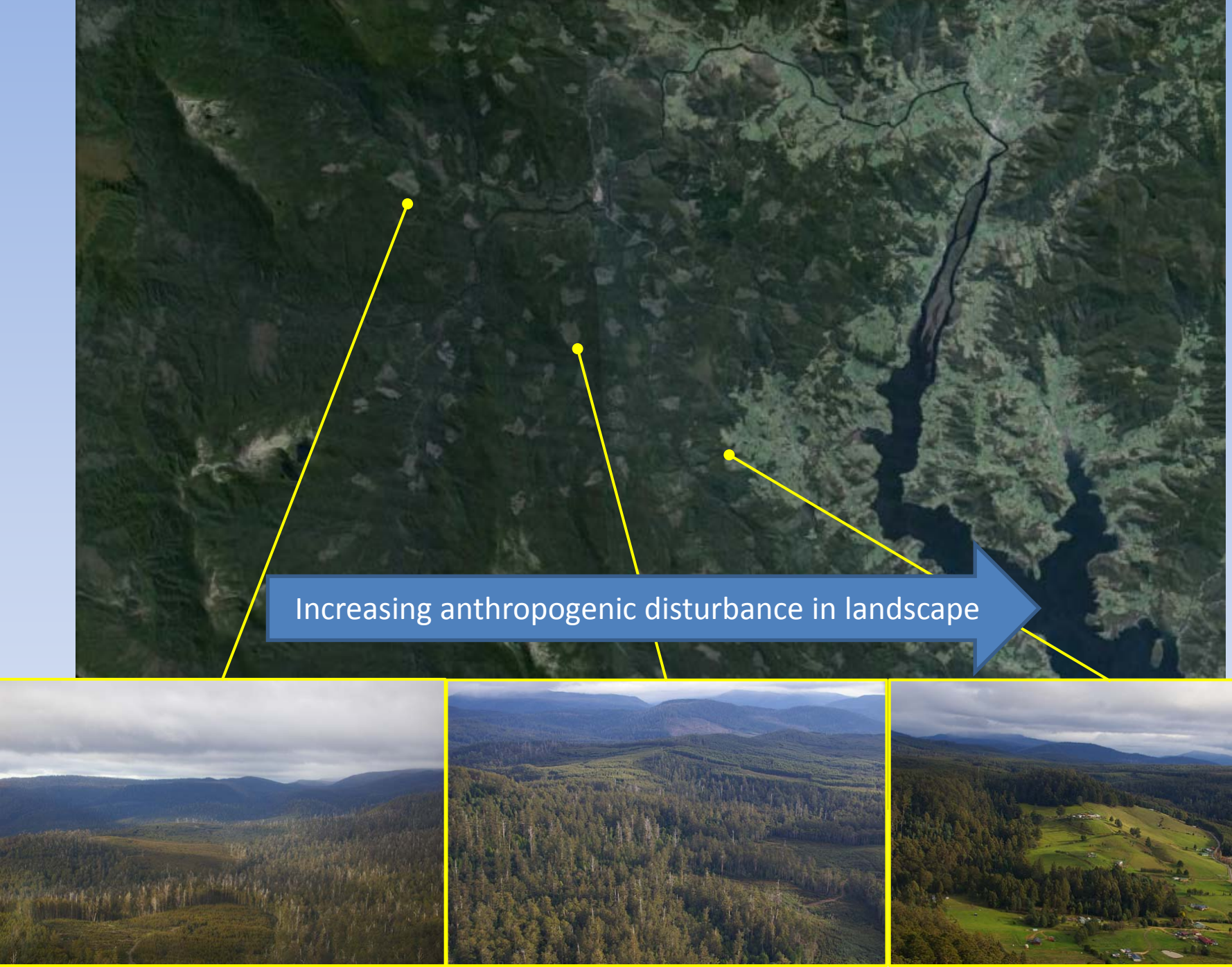
Robyn E. Scott [a,b,c,*], Mark G. Neyland [a,b], David J. McElwee [a]

[a] Forestry Tasmania, GPO Box 207, Hobart, Tasmania 7001, Australia
[b] University of Tasmania, School of Plant Science, Private Bag 50, Hobart, Tasmania 7001, Australia
[c] Cooperative Research Centre for Forestry, Private Bag 12, Hobart, Tasmania 7001, Australia

Considering the effects of forestry on biodiversity in the landscape

- Increasingly the focus of ecological science globally
- Highlighted in Forest Practices Authority biodiversity review
- Advice to Tasmania from international panel of experts

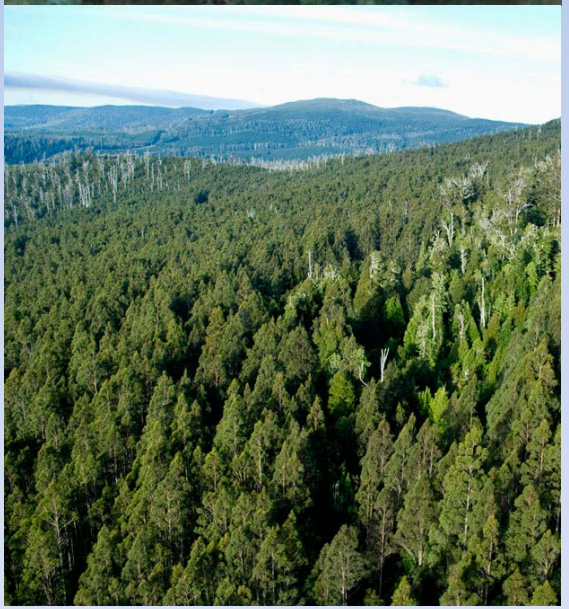

Southern Forests Experimental Forest Landscape
Warra Supersite
Glen Huon
Huonville
Franklin
Cradoc
Port Huon
Geeveston
Cygnet


Increasing anthropogenic disturbance in landscape

What we want to know

- Can mature forest species to persist in remaining mature eucalypt forests?

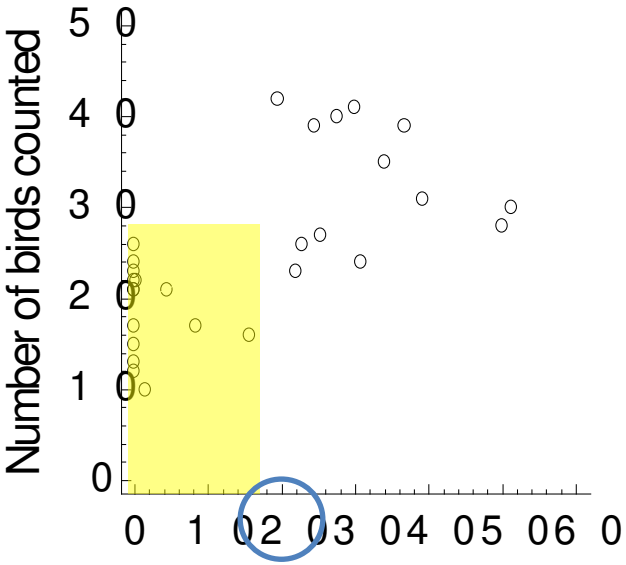
- Can mature forest species recolonise areas after harvesting?



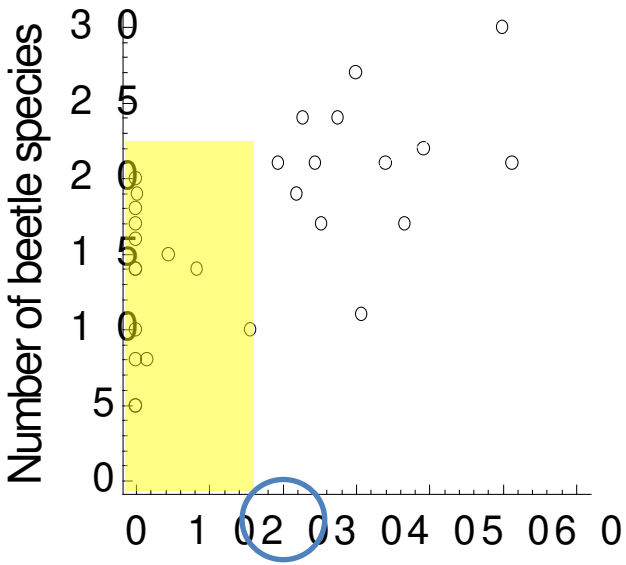
…….throughout forest landscapes

Biodiversity response to context-class = response to mature eucalypt forest in landscape

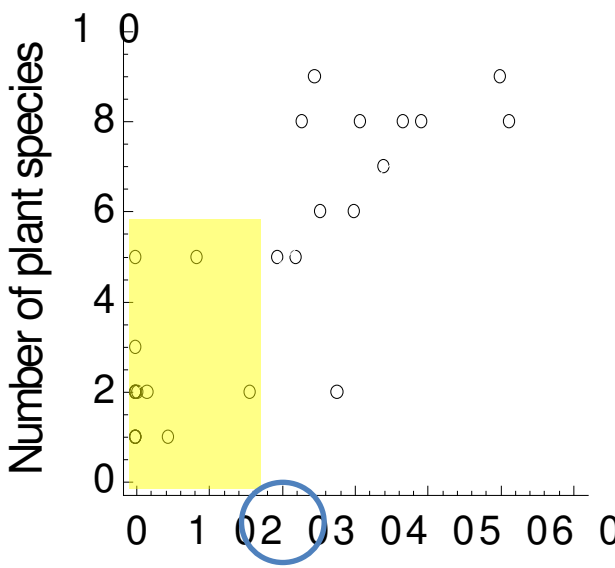
Dense forest birds



Disturbance-sensitive beetles



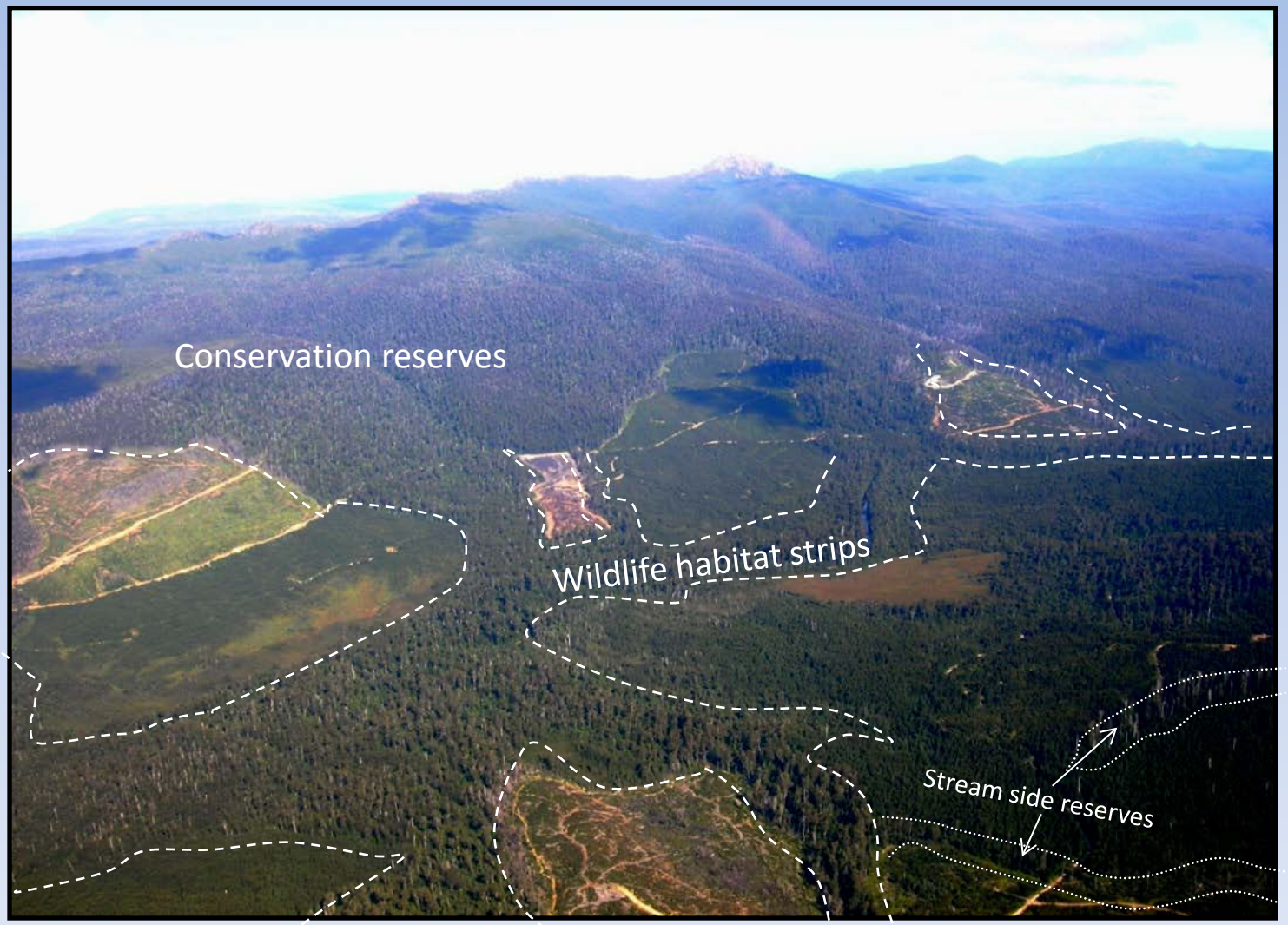
Rainforest plants



Amount of mature eucalypt forest in 1 km landscape (% area)

- **Poorer recolonisation in landscapes with little mature eucalypt forest**
- **Maintain at least 20% mature eucalypt forest**

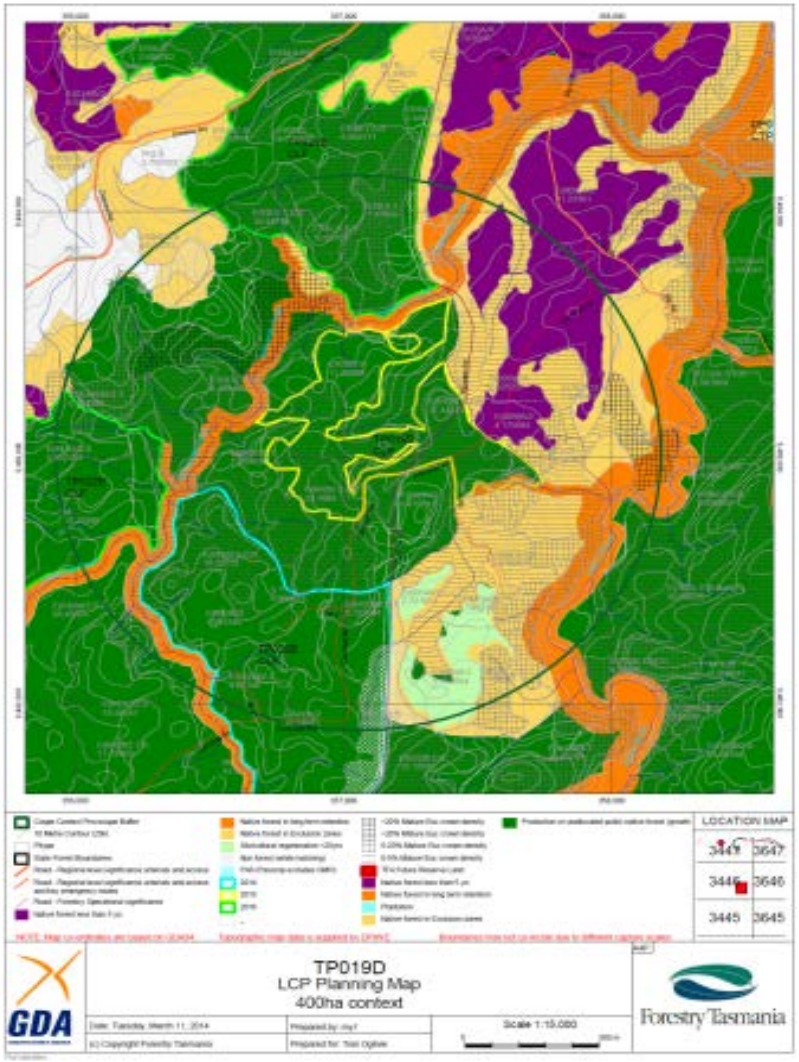
Landscape Context Planning System



Landscape Context Planning System

Landscape Context Planning Map and Report 400ha context– TP019D

Generated – 11 March 2014



Coupe details	LCP metrics – 400 Ha scale
Provcoupe – TP019D Harvest Year – 2015 Harvest System – Clearfell Provcoupe area – 37 ha	1. Dispersal metric = 41% 2. Long term retention metric = 30% (11% LTR + 19% EXC) 3. Duty of care metric = 22%

1. Dispersal metric[1] = 41%

Area of native forest < 5 years old = 27 ha of 2009 regen
Area of proposed 3YP coupes* within the surrounding 400ha landscape context = 132 ha [37ha (TP019D, 2015) + 27ha (TP021B, 2016) + 19ha (TP022E, 2016) + 49ha (TP020E, 2014)]

For TP019D, the harvesting of this coupe, including the surrounding 3YP coupes would result in between 34 and 41% of the 400 ha context area less than 5 years, which is within the dispersal metric limit of 50%.

*Coupes include clearfell or aggregated retention native forest operations only, including the proposed harvest operation.

2. Long term retention metric[2] = 30%

Long term retention areas (including streamside reserves) on public land = 118 ha
Total native forest area on public land = **392** ha

For TP019D, current levels native forest in long term retention exceed the Long term retention metric's 20% minimum, with 118 ha, or 30%, of public native forest 400 ha context area in MDC protection zones or in Exclusion zones.

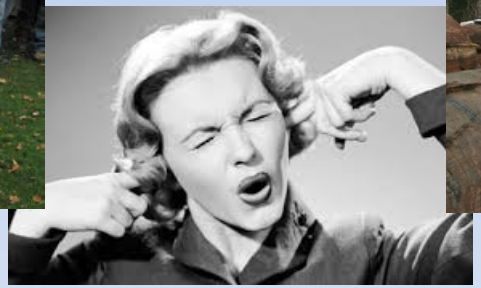
Mature habitat landscape statistics

		Total native forest (ha)	Total native forest with mature elements (ha)	Native forest by mature eucalypt crown density (ha)		
				>20%	5-20%	1-5%
Long term retention forest	MDC protected native forest (including Special Management Zones and stream side reserves)	43	22	5	4	13
	"Exclude Code" native forest	74	52	4	13	35
Public land (TOTAL)		392	213	18	30	164

% of public land native forest (400 ha context) containing mature forest[3] = 12%
% of public land native forest (400 ha context) containing mature forest[4] in long term retention[5] = 6%
Proportion of long term retention forest comprising mature forest elements[5] = 63%

[3] Mature forest includes any native eucalypt forest with greater than 5% mature eucalypt crown density
[4] Mature forest elements includes any native forest with greater than 1% mature eucalypt crown density (ie. includes f density).

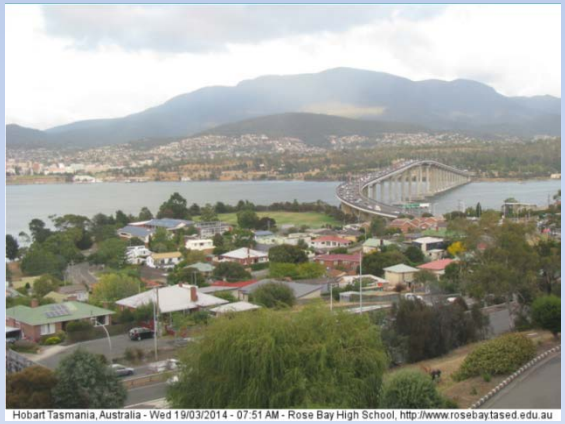
Science capital from Warra has provided improvements to management



Can we convert that to social capital?

Can we engage the general public? Can we interest and inform them about what's going on in forests?

We need something to grab the public's attention; something they can relate to.



We love to talk about the weather.
We know how it will feel.
Its always changing!

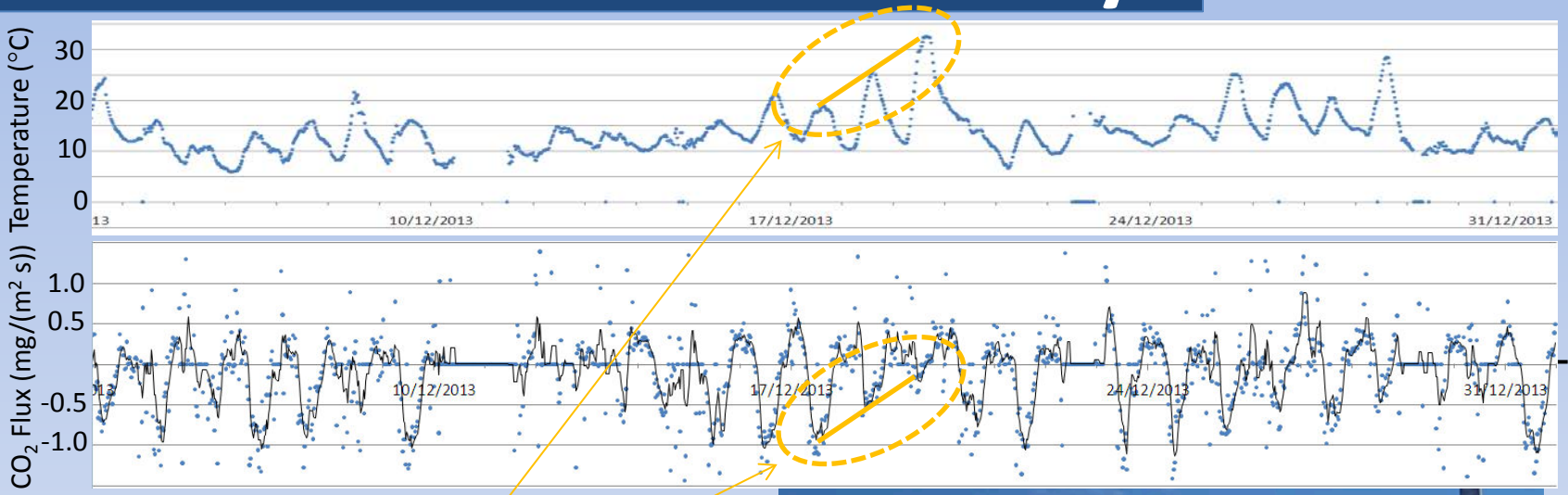
New technologies, new possibilities

Warra Flux Site:

Continuous, real-time measurement of:

- The weather
- What the forest is doing – is it absorbing CO_2 or not?
- Are the trees growing and how quickly?
- How does the forest cope with extreme weather?

We can get people to relate to forests in a different way



Forest losing carbon

Forest absorbing carbon

Forest didn't absorb much carbon when it got hot

Got the public's interest. Let them delve deeper.

- The major cycles (carbon, water)
  - What are the different components (e.g. living trees, dead trees / logs, soil) of the forest contributing?
  - How do the cycles change after disturbance?
  - Do mature trees behave the same way as younger, regrowth trees?
- Biodiversity
  - Is there a link between how productive the forest is and how many animals are in the forest?

But what's happening beyond the flux site?

Technological advances – biodiversity monitoring

Ecological Informatics 6 (2011) 354–363

Contents lists available at ScienceDirect

Ecological Informatics

journal homepage: www.elsevier.com/locate/ecolinf

The soundscape methodology for long-term bird monitoring: A Mediterranean Europe case-study

Almo Farina *, Nadia Pieretti, Luigi Piccioli

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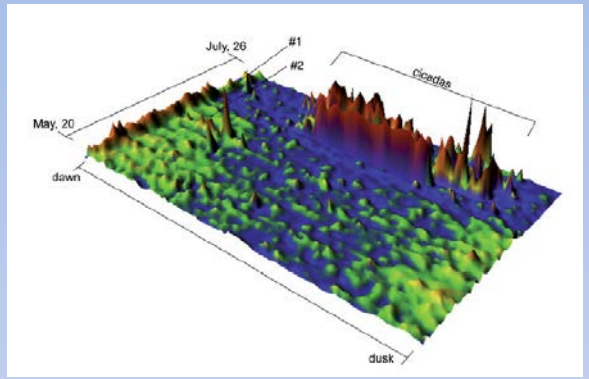

Methods in Ecology and Evolution

Methods in Ecology and Evolution doi: 10.1111/j.2041-210X.2012.00198.x

Biodiversity soup: metabarcoding of arthropods for rapid biodiversity assessment and biomonitoring

Douglas W. Yu[1,2]*†, Yinqiu Ji[1]†, Brent C. Emerson[2]‡, Xiaoyang Wang[1], Chengxi Ye[1], Chunyan Yang[1] and Zhaoli Ding[3]

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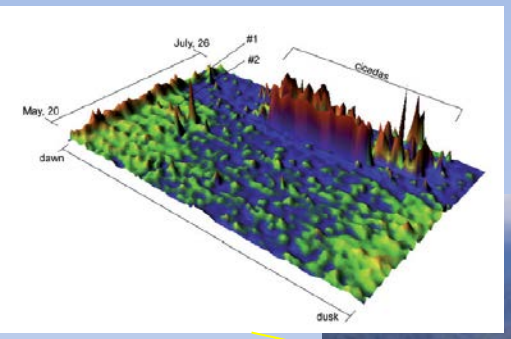
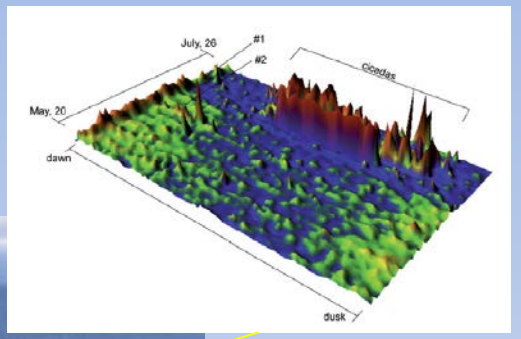
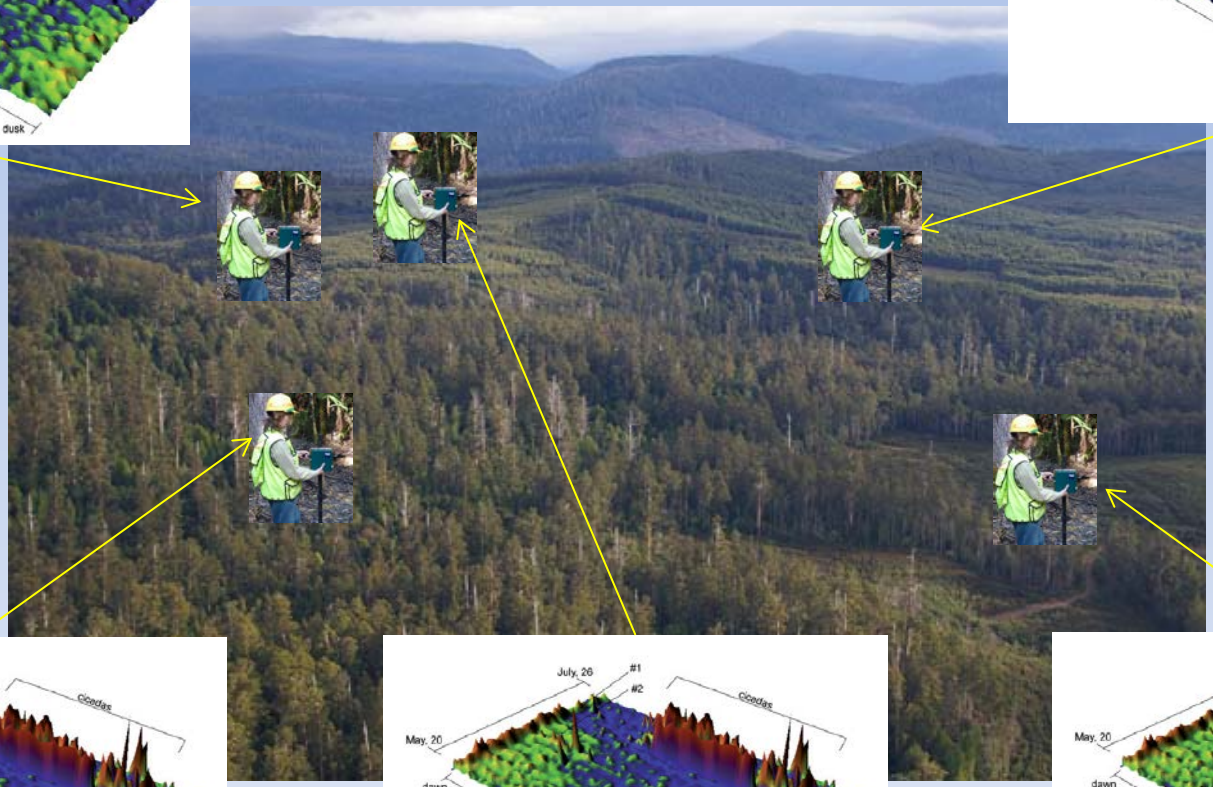
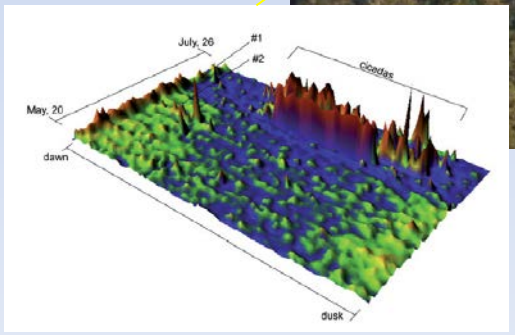
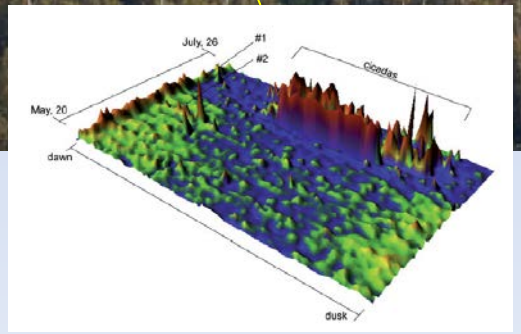
People can “see” biodiversity across the landscape with their own eyes!

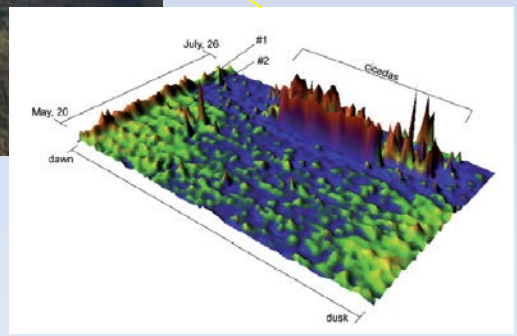












Our aim is for an engaged and more informed general public

- Who don't switch off when forestry is mentioned
- Who want to understand that forests are being managed well
- Who become discriminating in their choice of products to use
- Have access to trusted information to guide those choices

Chain of custody – ecosystem services maintained in forest landscape

Carbon

- Stocks remaining
- Stocks in store
- Energy emitted
- Energy substituted
- Fluxes

Water

- Change in flows
- Quality
- Aquatic health

Biodiversity

- Abundance
- Habitat diversity
- Species richness

There’s still a lot to be done at Warra!