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DEPARTMENT OF
PRIMARY INDUSTRY AND FISHERIES



Burn your bush before it bites back!

Lessons from Kidman Springs fire study 1993-2013

Robyn Cowley
Katherine Research Station





Poll

What is your background

1. Industry / Land manager
2. Service industry / consultant
3. Research
4. NRM / Landcare
5. Extension



Poll

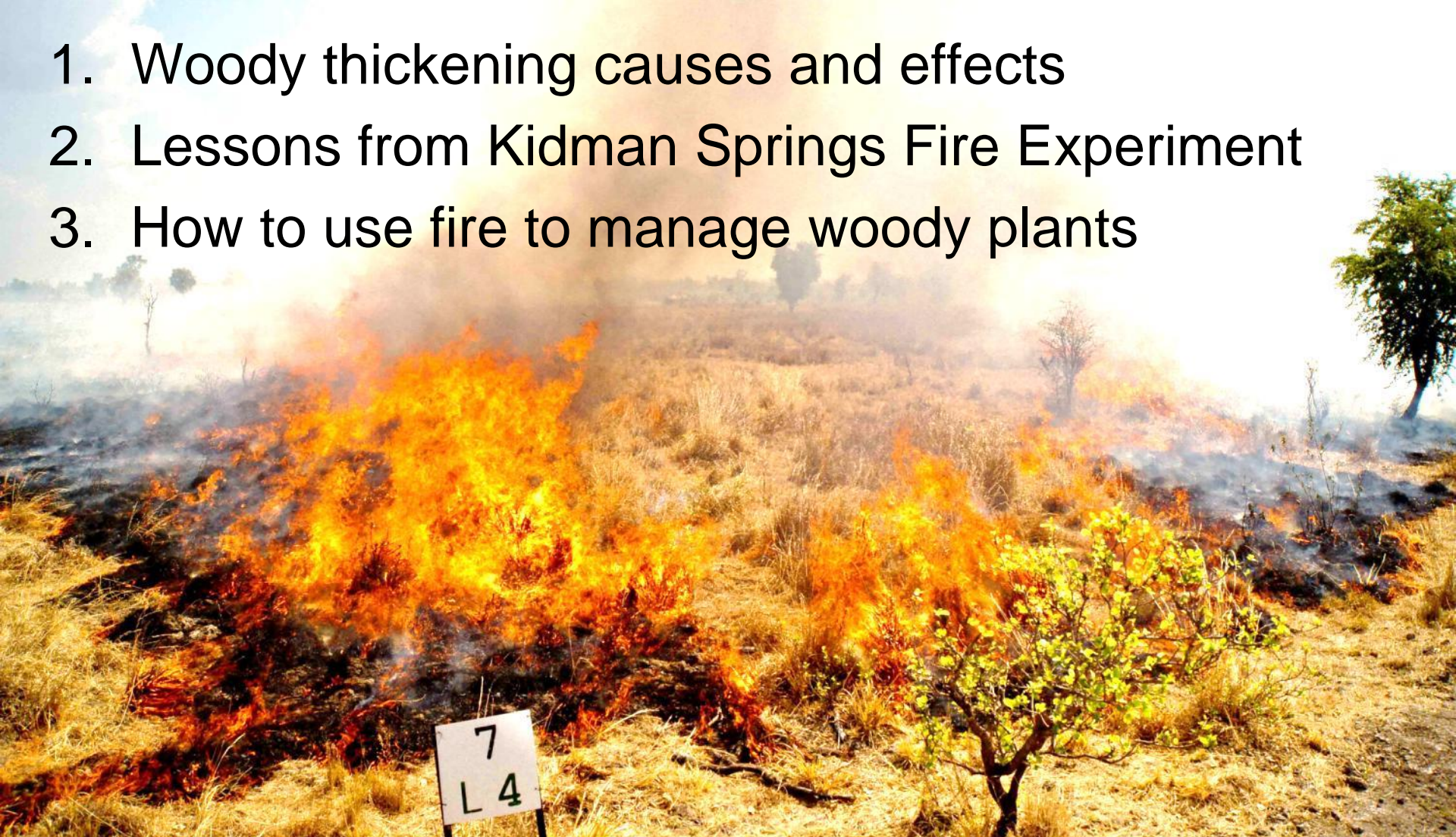
Where are you normally located?

1. NT
2. WA
3. Qld
4. Other Australia
5. Outside Australia



Outline of today's webinar

1. Woody thickening causes and effects
2. Lessons from Kidman Springs Fire Experiment
3. How to use fire to manage woody plants



Woody thickening – what is it?

When trees and shrubs increase over time

- Number / density
- Size

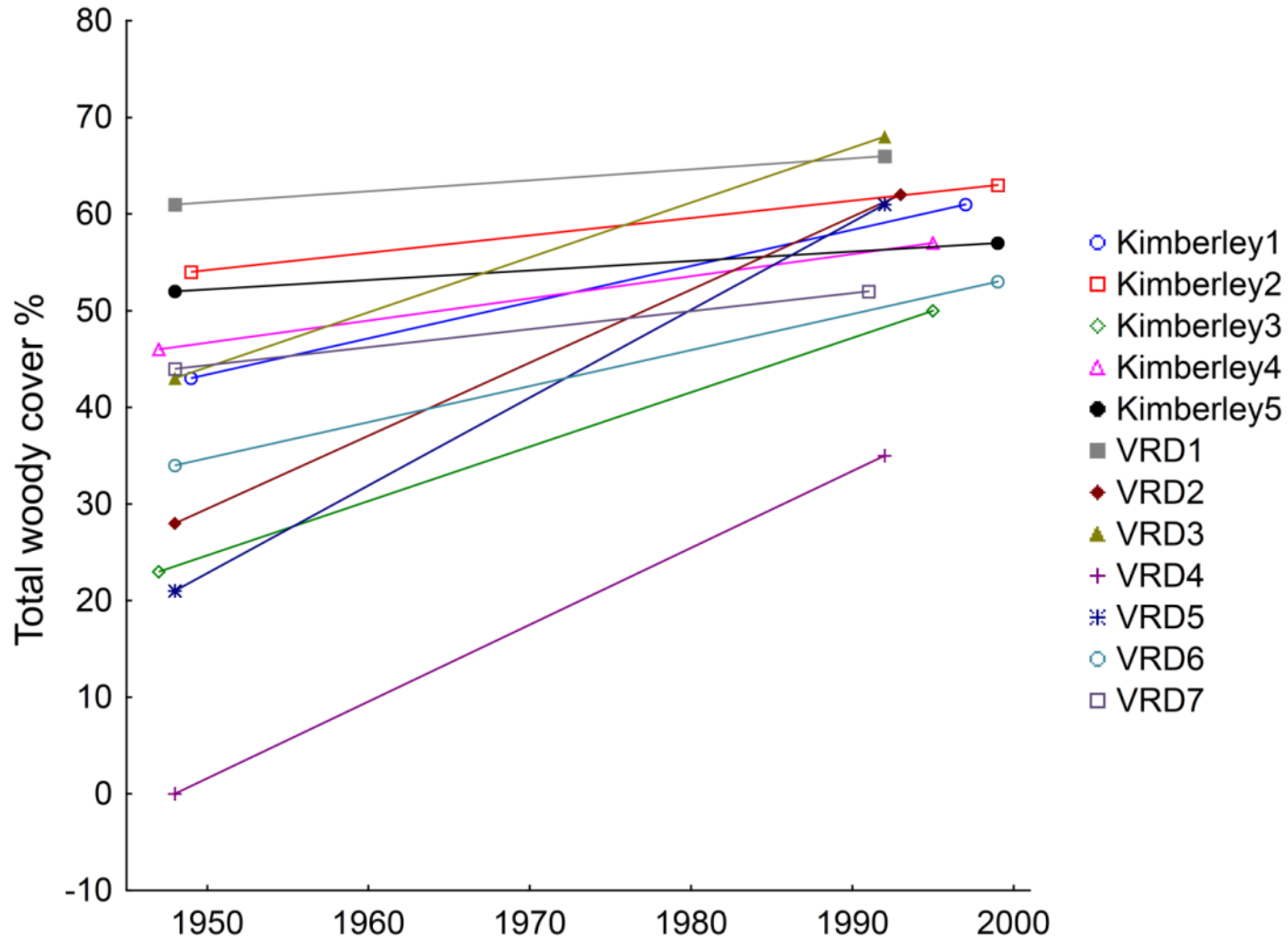
Kidman Springs 1973



Kidman Springs 1989



Woody cover changes - pastoral land in VRD and Kimberley



Woody thickening – what is it?

- Can be in bursts or gradual increases
 - Very good seasons can lead to new woody plant ‘crops’
 - Gradual growth of existing plants year in year out and is often difficult to ‘see’
- Woody plants can naturally thin out too
 - Droughts
 - Wildfires



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Woody *thinning* in the Jasper Gorge area of the VRD



Jasper Gorge, 1953.



1997.

Darrell Lewis (2002) *Slower than the eye can see: environmental change in northern Australia's cattle lands, a case study from the Victoria River District, Northern Territory*. Tropical Savannas CRC.



Woody cover changes – why sometimes increasing and other times decreasing?

Pastoral land

Woody cover increasing

- Higher rainfall since 1975
- Increasing carbon-dioxide
- Grazed



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Other land uses

Woody cover declining

- Higher rainfall since 1975
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Woody cover changes – why sometimes increasing and other times decreasing?

Pastoral land

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Other land uses

Woody cover declining

- Higher rainfall since 1975
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- Non-grazed

Grazing can lead to increased woody cover in 2 ways

- Fewer fires due to lower fuel loads or deliberate exclusion
- Grazed pastures don't compete with woody plants as much, leading to better woody growth

Browsing can reduce woody cover

Woody thickening– what’s the big deal?

Decreased pasture growth





Effect of woody plants

Negative

1. Decreased pasture growth
2. Poorer land condition if stocking rates not reduced with lower growth
3. Mustering costs

Positive

1. Browse
2. Shade
3. Soil conditioning (adding nutrients & carbon through leaf fall)
4. Better microclimate for pasture growth (at low densities)



Poll time

Is woody thickening a problem in your area?

1. Yes
2. No
3. Sometimes
4. Not sure

If thickening, do you think this is a problem and why?

Free answers

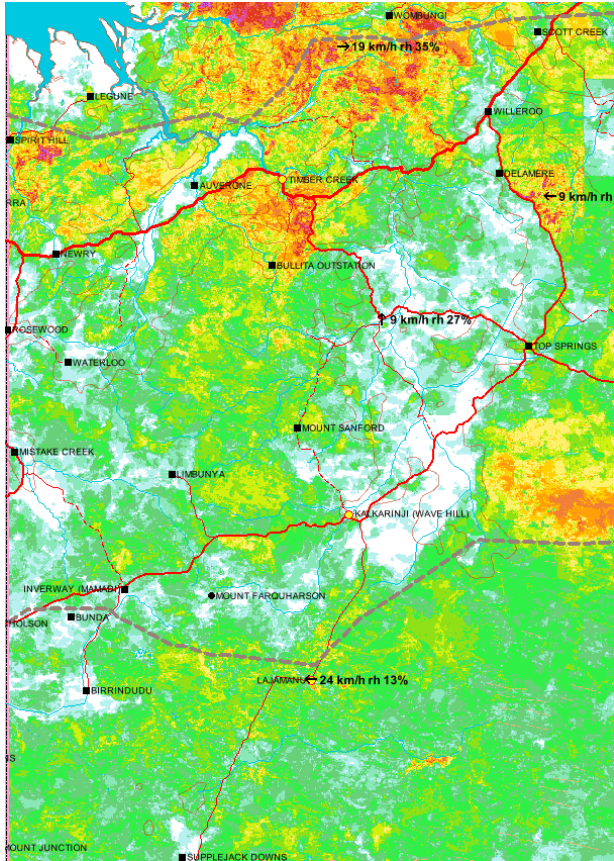
Fire as part of the solution

- Australian savannas are adapted to fire
- But fire incidence has changed since European settlement
- It has changed in different ways in different areas





What burns where?



Map Legend

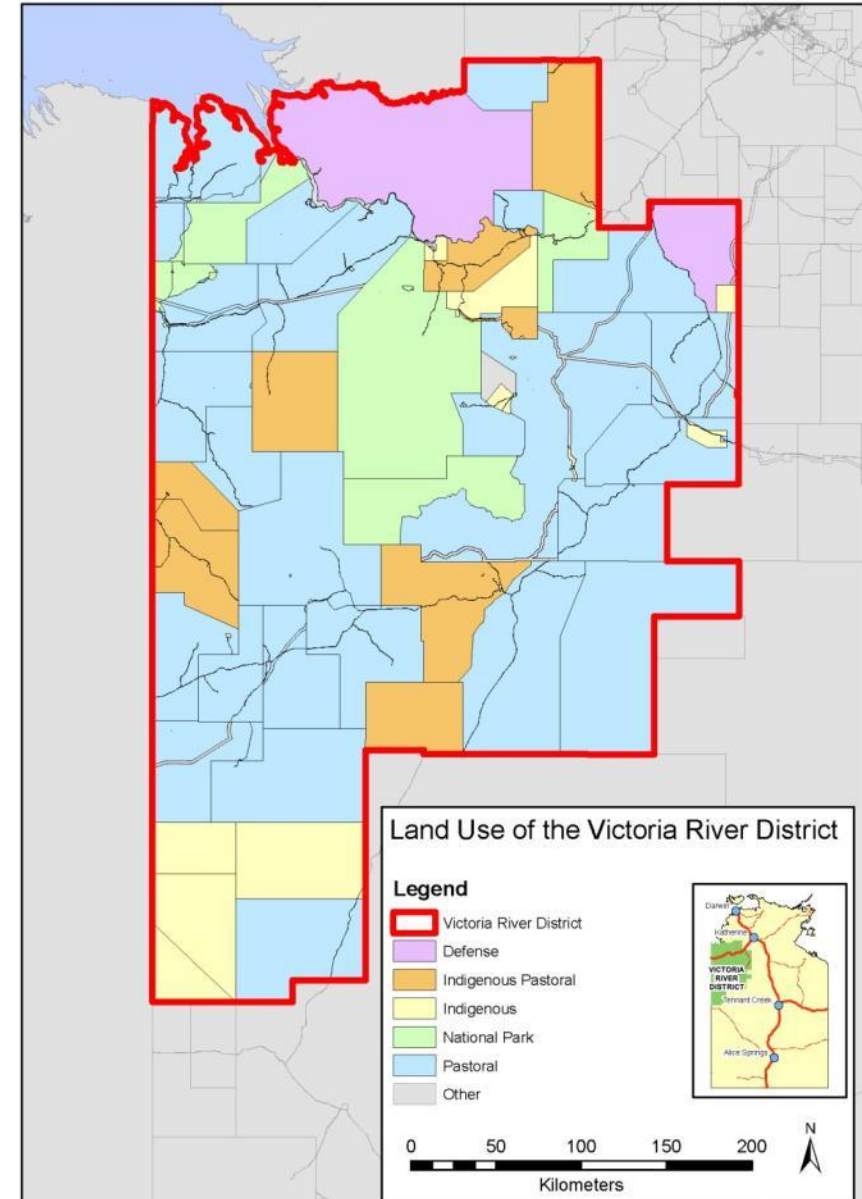
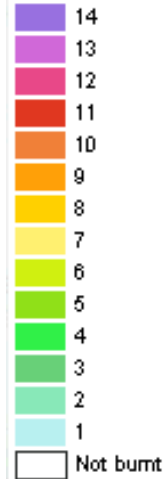
Weather Station

↗ Wind dir and kph

Avg Rainfall 69-09

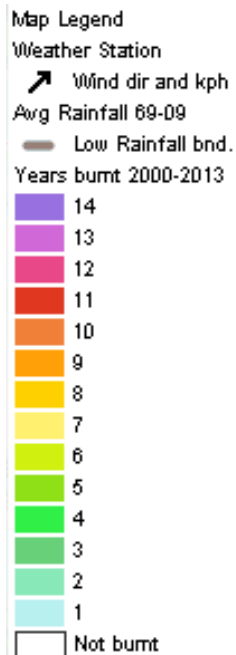
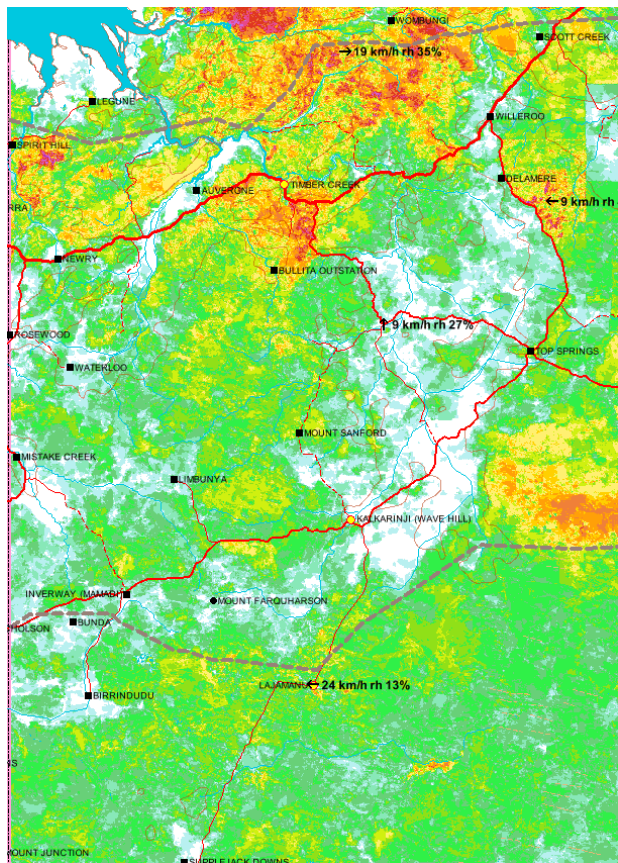
— Low Rainfall bnd.

Years burnt 2000-2013



NAFI site <http://www.firenorth.org.au/nafi2/>

What burns where?

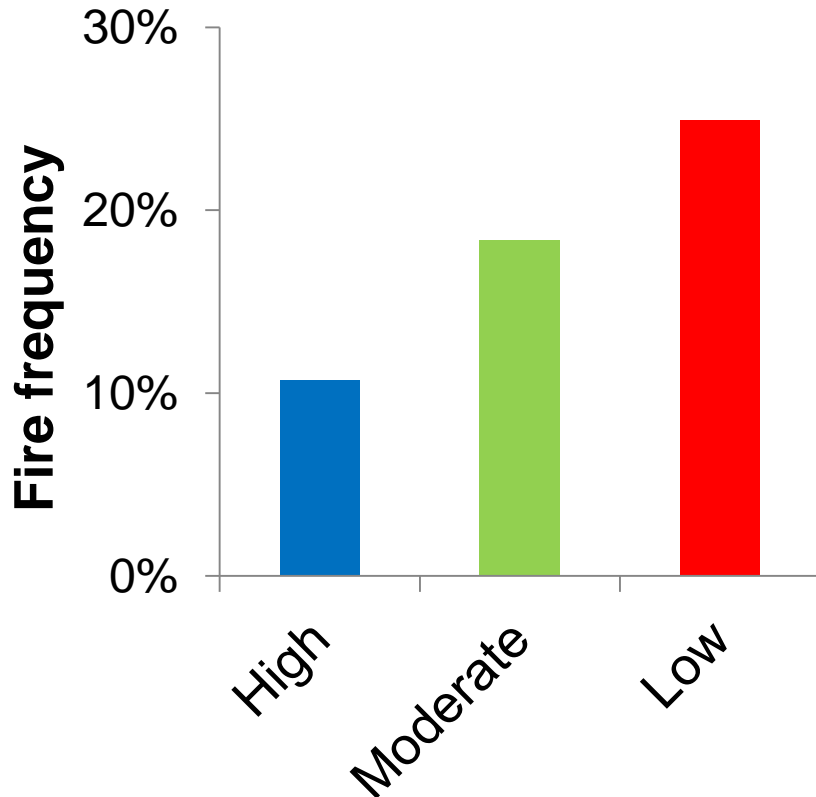


Land Use	Average fire frequency
Defense	39% (2 in 5 yrs)
Park	31% (1 in 3 yrs)
Indigenous	26% (1 in 4 yrs)
Indigenous Pastoral	26% (1 in 4 yrs)
Pastoral	19% (1 in 5 yrs)

NAFI site <http://www.firenorth.org.au/nafi2/>



Land type and fire

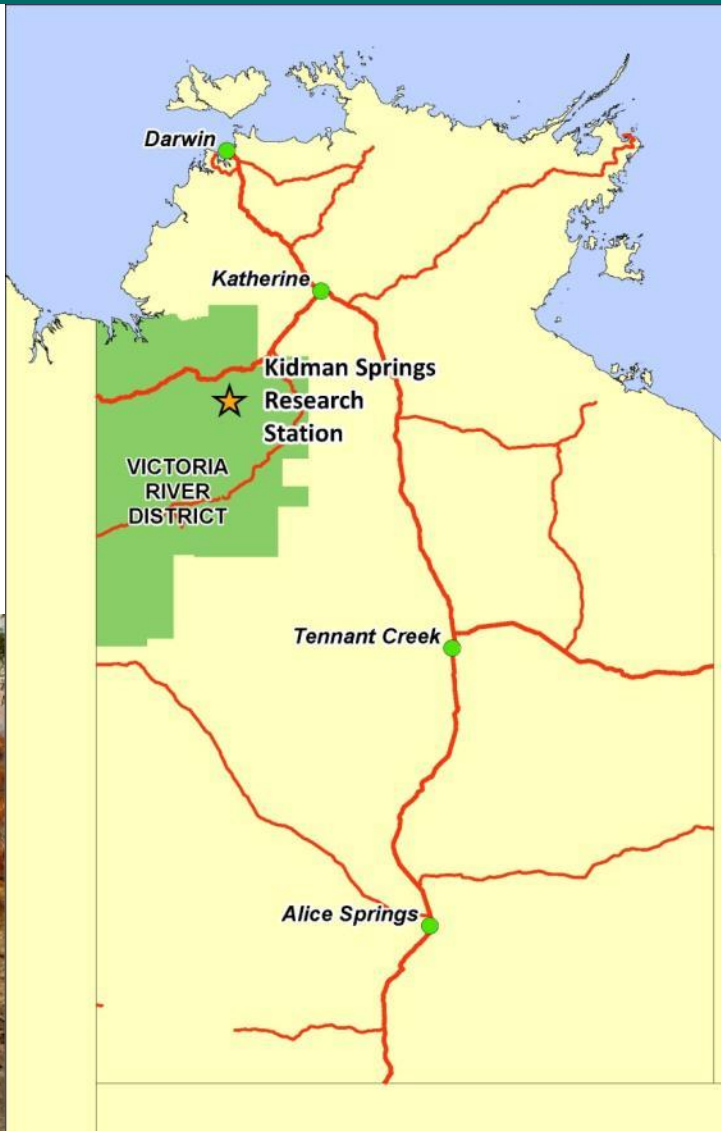


Land type grazing value

- For pastoral land, most valuable is burnt least
- Poorest productivity land types burnt the most

VRD fire experiment 1993-2013

- Soil type
 - Black cracking clay and red earth
- Fire season
 - Early and late dry
- Fire interval
 - 2, 4 and 6 yearly and control (not burnt)



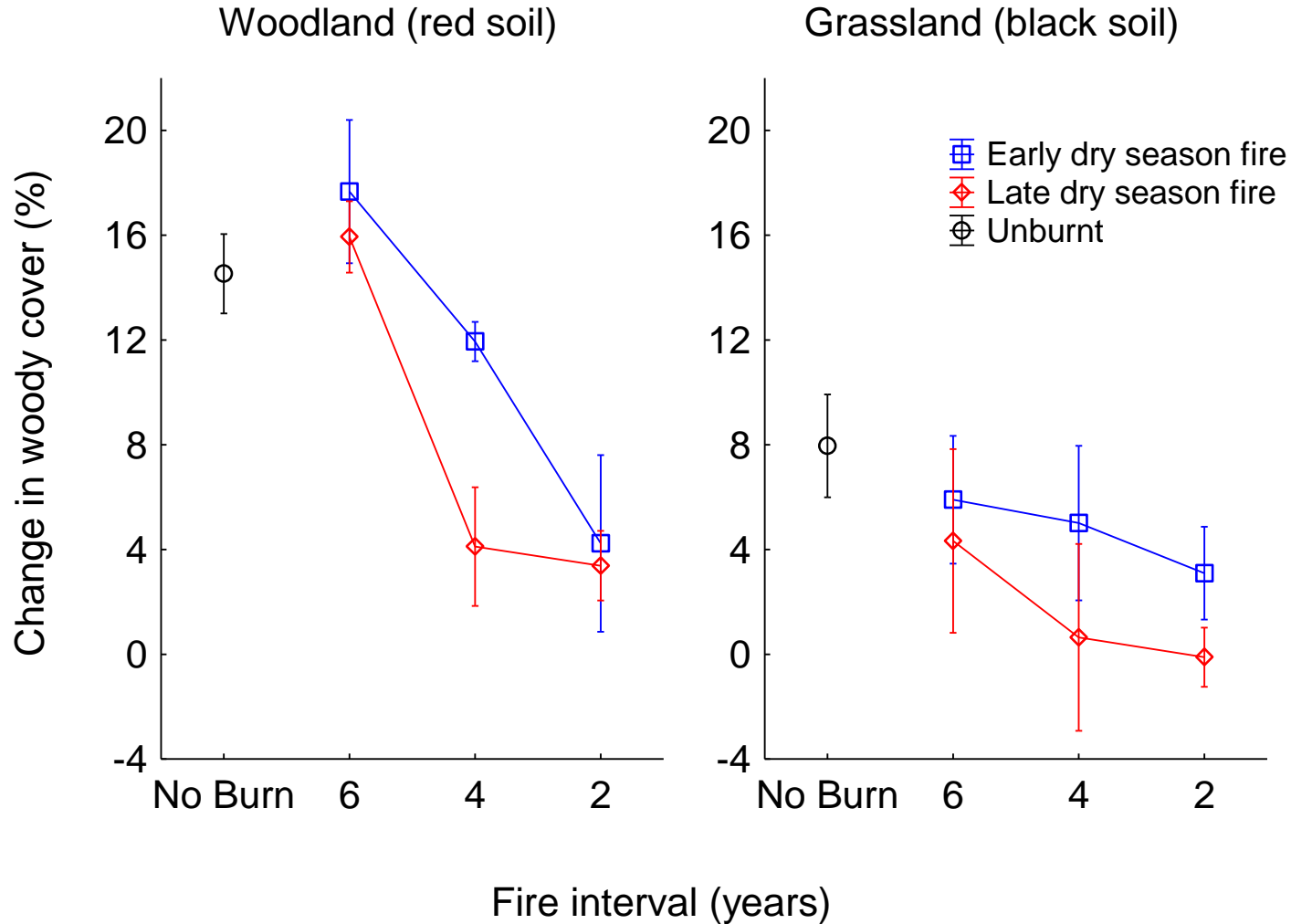
Red Soil Site



Black Soil Site



Fire impacts on woody cover change 1995 - 2013





Long term fire impacts on pasture

- **On the red soil**

- 2 yearly fire suppressed perennial grass yield and promoted annuals and forbs
- 4 yearly *late* fire did not affect total yield, although higher proportion of annual vs. perennial grasses
- 4 yearly *early* fire reduced total and perennial grass yield and increased unpalatable forbs

- **On the black soil**

- 2 yearly or *early* fire reduced total yield by 15-20% and perennial grass yield by 25%, and increased annual grass yield
- 4 yearly *late* fire had little impact on yield or composition
- 4 yearly *early* slightly lower yield



Short term effect of fire on pastures one year after fire vs. long unburnt

June 2014*	Grassland	Woodland
Total yield lower	-4%	-14%
Ground cover	+4%	-13%
% Perennial grass lower	-5%	-20%
% Annual grass higher	+3%	+13%
% Forbs higher	+3%	+10%

*After wet season spell following fire in 2013



How does fire frequency compare to study recommendations?

- On pastoral land, the best grazing land is currently burnt the least, and 89% is burnt less than the four-yearly fire our fire study suggests is best to manage woody cover
- Moderate productivity pastoral land, 73% burnt less frequently than four yearly



More or less fire?

- Recommendations for less fire are relevant where current fire frequencies are high - often the case for ungrazed lands
- The least productive pastoral lands may present a potential opportunity for producers to reduce fire frequency and associated GHG emissions, with biodiversity benefits



Timing of fire

- Although early fire is being promoted for biodiversity benefits off-farm, in the grazed context, early fires can cause pasture decline
- 4 yearly *late* fires were most effective for managing woody cover and pasture composition



Questions

- Open to questions from audience



How to use fire to manage your woody plants

- Different fires for different goals – today focusing on managing woody cover
- Pre-fire planning
 - Spelling before (to build up fuel) and after to promote pasture recovery
 - Check the long range forecasts – and avoid burning if below average seasons likely
 - Permits, notifying neighbours, firebreaks
 - Equipment tested fire bugs, water cart, grader, UHF's
 - Training from Bushfires



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Firebreaks





How to use fire to manage your woody plants

To burn or not to burn

Do burn

- When plenty of grass
- Good continuous cover
- Before woodies > 2m high
- Before wattles flower and seed
- Late dry season or spring when hot and dry, some but not too much breeze

Don't burn

- Fire sensitive vegetation
- If you don't have enough fuel to be effective
- Poor condition pastures
- If follow-up seasons likely to be poor
- If you can't spell after

Fire characteristics for woody management

- Flame height high enough to burn woody canopy
- Some breeze to carry fire, but not too windy for safety and containment
- Late dry season
- Every four years



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Cool June fire



How much is enough fuel?

- The more fuel, the hotter the fire and the higher the flames, leading to greater top-kill of woodies. Aim for 1500kg/ha (grass and litter)

1350kg/ha grass





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Before and after a hot dry season fire



Before and after a hot dry season fire





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Before and after a hot dry season fire



Before and after a hot dry season fire



Before and after a hot dry season fire

Fuel = 2260kg/ha
Wind 5-10km/hr



6 months after fire with wet season spell



How much is enough fuel?

- Fuel too low and patchy, flame low, ineffective and patchy



How much is enough fuel?

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How much is enough fuel?

- Fuel too low and patchy, flame low, ineffective and patchy

Less than 800kg/ha and
patchy



How much is enough fuel?

- Fuel too low and patchy, flame low, ineffective and patchy

Less than 800kg/ha and
patchy

1300kg/ha but patchy
fire between tussocks
due to grazing



How much is enough cover?

- Continuous cover (not patchy) more than 50%
- Wet season spelling helps with continuous cover, because cattle tend to graze between tussocks





How much is enough cover?

- Continuous cover (not patchy) more than 50%
- Wet season spelling helps with continuous cover, because cattle tend to graze between tussocks





When burning part of a paddock

- Can rotationally burn a paddock, e.g. burn a quarter every year to give 4 yearly fire
- Large enough area so that if all stock graze burnt areas post fire, wont be too heavily grazed
- Small enough that still enough grass left for stock
- At least $\frac{1}{4}$ - $\frac{1}{2}$ of paddock
- Don't burn same part every year
- Don't burn areas that already preferred by stock – e.g. near water



Stock management

- Grazing of pastures after fire as they regrow can lead to poorer pasture condition
- Best if can destock and spell post fire until after pastures regrown and set seed
- Sometimes need to spell prior to burning to have enough continuous fuel for a clean burn
- Plan stock movements to fit in with other musters
- Don't overstock another paddock to achieve spell, as can lead to poorer pasture condition

Mixing fire with other goals

- Improve pasture quality and LWG
- Improve evenness of grazing
- Weed control
- Spelling to improve pasture condition



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Questions



Acknowledgements

- MLA funded the original fire research
- Rodd Dyer Masters Thesis

Photography - Caz Pettit, Robyn Cowley, Elaine Mitchell,





Further information

- Qld yield photo-standards at <http://futurebeef.com.au/topics/pastures-and-forage-crops/pasture-photo-standards/>
- Project info and links to fire publications <http://futurebeef.com.au/resources/projects/kidman-springs-fire-experiment-shruburn/>
- Col Paton's fire webinar <http://www.youtube.com/watch?v=rQ96c37bx94&feature=youtu.be>



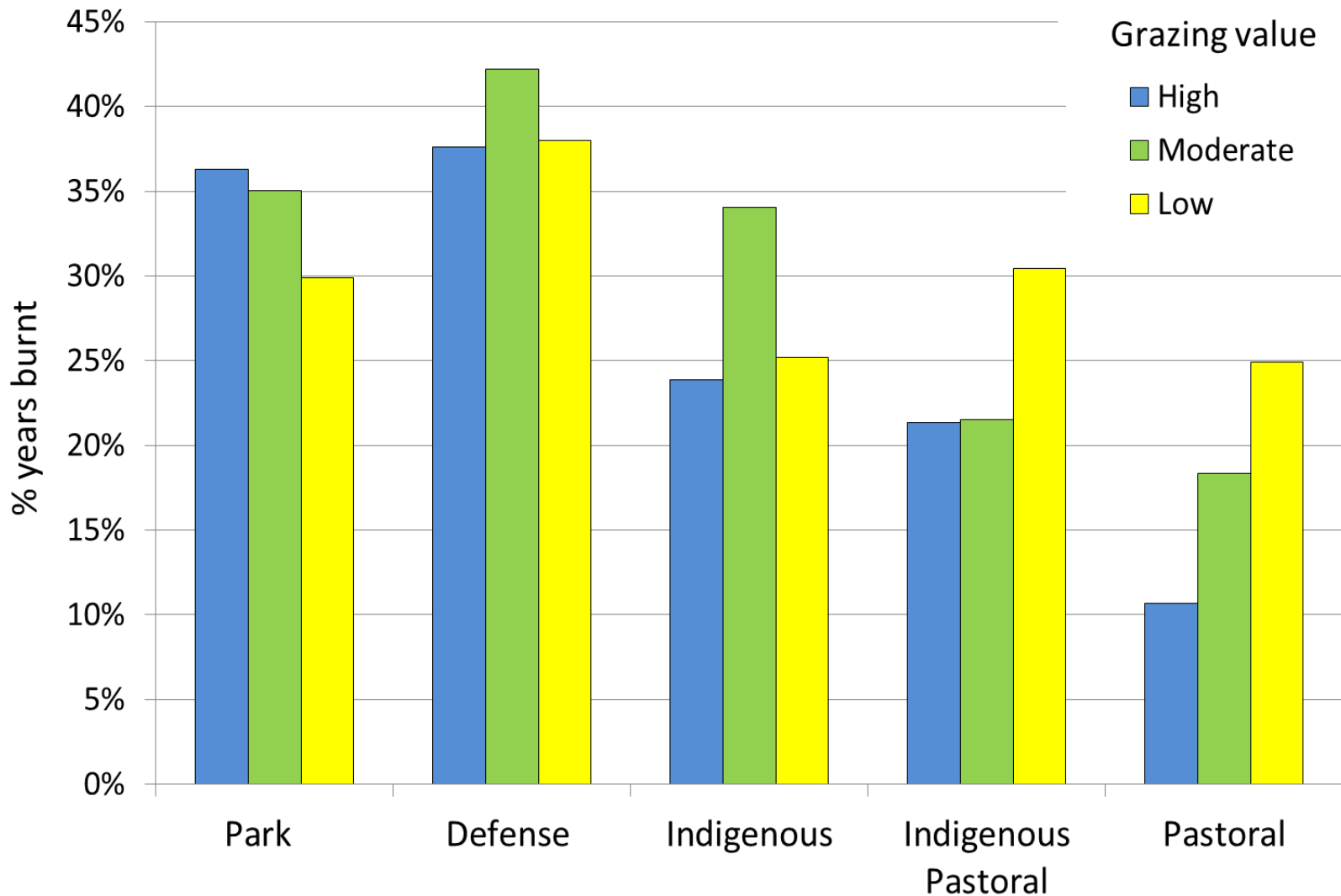
Further information

- Scientific paper on the fire study

<http://www.publish.csiro.au/paper/RJ14030.htm>

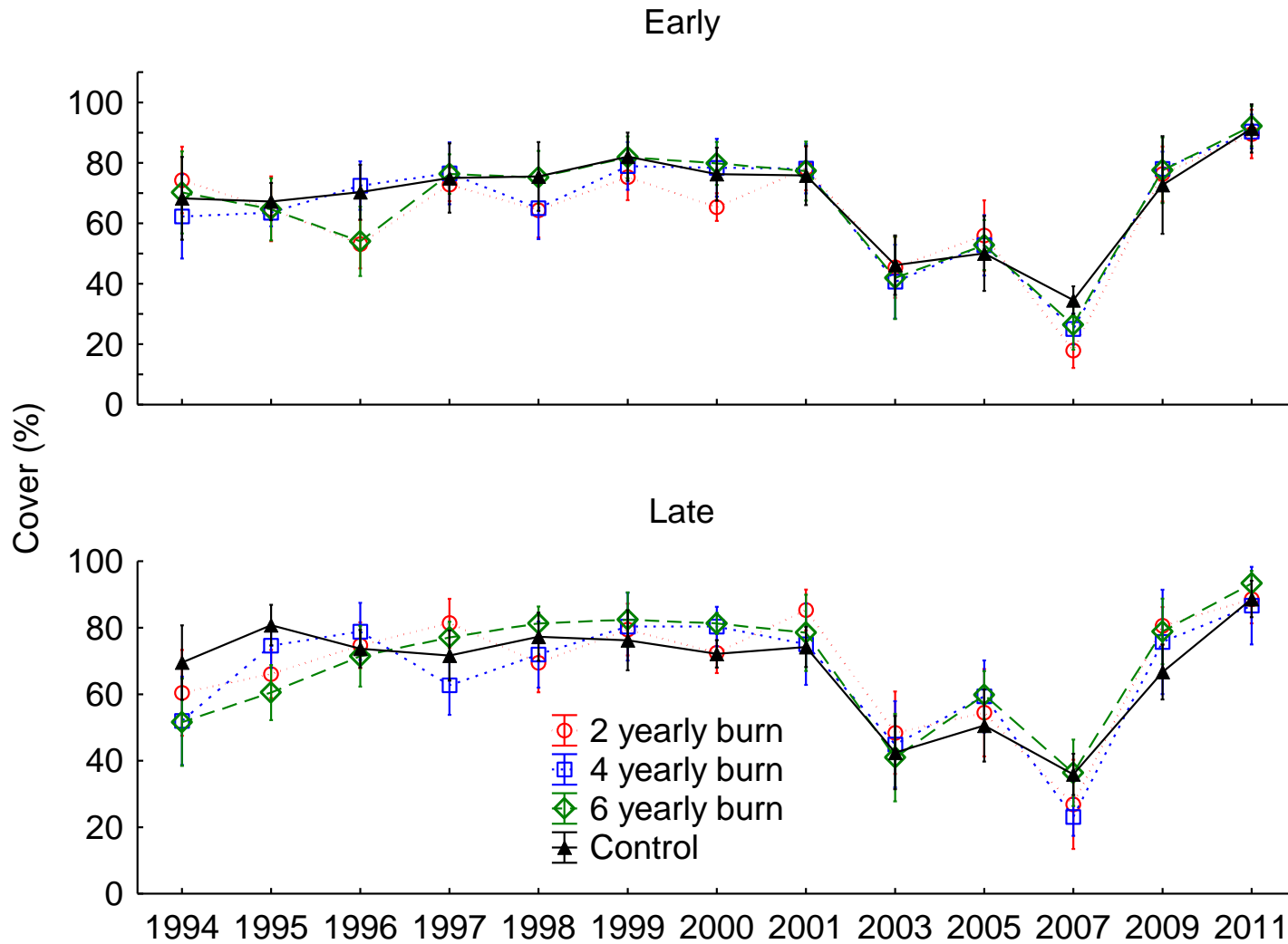
Cowley, R.A., Hearnden, M.H., Joyce, K.E., Tovar-Valencia, M., Cowley, T.M., Pettit, C.L., and Dyer, R.M. (2014). How hot? How often? Getting the fire frequency and timing right for optimal management of woody cover and pasture composition in northern Australian grazed tropical savannas. Kidman Springs Fire Experiment 1993–2013. *The Rangeland Journal* **36**, 323-345.

VRD fire frequency by land type





Ground cover and fire





Fire effect on pastures

June 2014		Time since fire (years)		
		1	3	31
Yield (kg/ha)	Woodland	1348	1409	1576
	Grassland	2251	2415	2342
Ground cover (%)	Woodland	49	60	62
	Grassland	60	61	56