bushfire&natural HAZARDSCRC

OPTIMISATION OF FUEL REDUCTION BURNING REGIMES FOR FUEL REDUCTION, CARBON, WATER AND VEGETATION OUTCOMES

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An Australian Government Initiative

CRC AUSTRALIA

THE UNIVERSITY OF SYDNEY

PROJECT TEAM

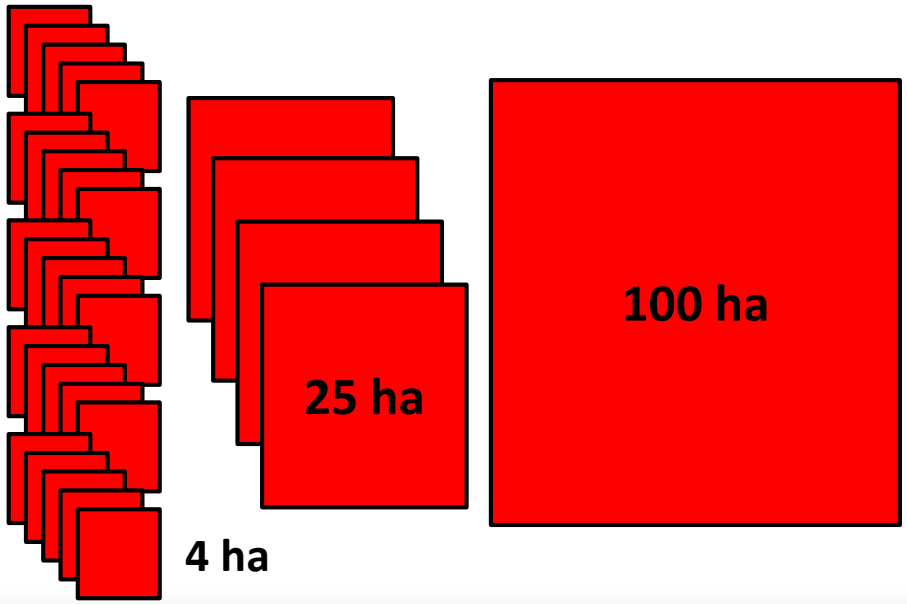
1) **University of Sydney Researchers**: Tina Bell, Malcolm Possell, Tarryn Turnbull, Tom Buckley, Mark Adams

2) **New appointments:** Mana Gharun (Postdoctoral Research Associate), Ariana Iaconis (Research Assistant)

3) **End Users Agencies**: NSW NP&WS; NSW RFS; Tasmania Fire Service; ACT Parks, Conservation and Land; Victoria DEPI; Parks Victoria; Melbourne Water; WA DEC; SA DENR

LAND MANAGERS WANT TO KNOW

1) What does it cost to implement fuel reduction burns and how effective are they?
2) What is the cost to environmental values for the size of each burn?
   - Carbon outcomes
   - Water outcomes
   - Vegetation outcomes



MAJOR OUTPUTS EXPECTED

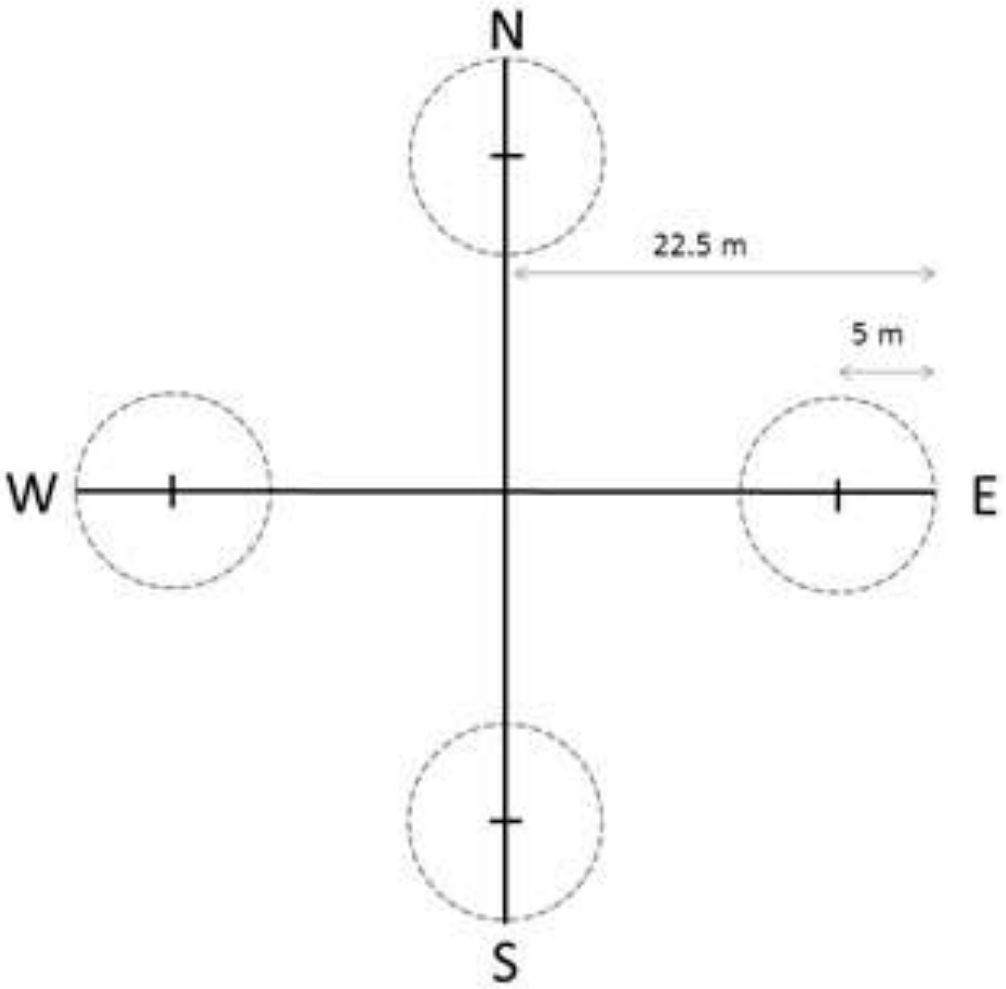
A predictive model and framework for planning of fuel reduction burning

Provision of capacity to predict the effects of fuel reduction burning on **fuel loads**, **broad vegetation types** and **carbon and water potential** (e.g. capacity for carbon sequestration, water yield) of forests at a manageable spatial scale

OBJECTIVES

1) **Development of a sampling protocol to quantify key variables at fuel reduction fires**
2) **Design and test a statistical robust sampling scheme for use at range of spatial scales**
3) Application of sampling schemes and field techniques at fuel reduction fires
4) Laboratory analysis of soil and plant samples
5) Data analysis and synthesis to assess the effects of size of fuel reduction fires
6) **Developing routine and reliable measures of effects of fire intensity on soil carbon**
7) Developing spatially accurate measures of soil water storage and dynamics based on soil moisture content

OBJECTIVE 1 – SAMPLING PROTOCOL



Volkova and Weston (2013) *Forest Ecology and Management* 304, 383-390

Possell *et al*. (2014) *Biogeochemistry* 11, 13809-13839

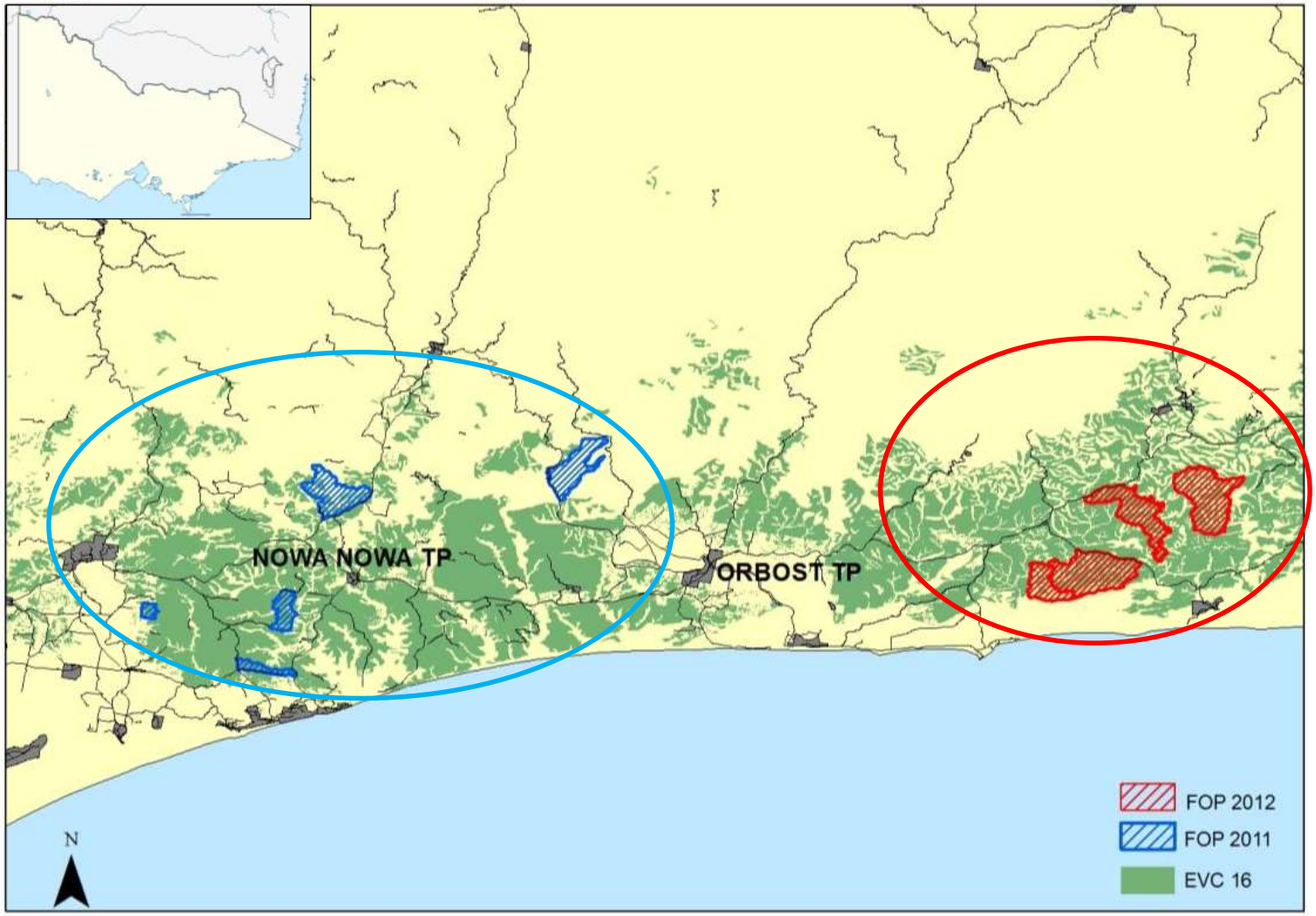
Jenkins *et al*. (2015) Production of pyrogenic carbon during planned fires in forests of East Gippsland, Victoria (*in preparation*)

EXAMPLE: MEASURING CARBON POOLS

Component	Type	Level	No. per plot
Overstorey (trees ≥20 cm DBH)	22.5 m R circular plot	Plot	1
Coarse woody debris	45 m transects	Plot	2
Understorey (≥2 cm to <20 cm DBH)	5 m R circular plot	Subplot	4
Litter and ground cover biomass	1 × 1 m quadrat	Subplot	4
Soil (0–10, 10–30 cm)	Auger or core	Subplot	4
Pyrogenic carbon	30 × 30 cm quadrat	Subplot	4-8

Jenkins *et al*. (2015) (*in preparation*)

OBJECTIVE 2 – TESTING OUR SAMPLING SCHEME



PLOT-, SITE- AND LANDSCAPE-SCALE DATA

1) Data from a single vegetation type
2) Known location and elevation, similar aspect
3) Known burning conditions

   (i.e. relative humidity 43–79%; air te[illegible]
   surface fuel moisture 10–16.5%[illegible]

   area burnt
   149–2824 ha
4) 9 sites, 3 plots per site
5) Measurements taken pre-fire, 1 week, 1 month and 1 year post-fire
6) Overstorey and understorey biomass, litter and elevated fuel, soil carbon
7) Burnt 2011–2013 (annual variation)

OBJECTIVE 6 – FIRE INTENSITY AND SOIL CARBON

EXAMPLE: SOIL BURN SEVERITY INDEX IN TROPICAL FORESTS

Level of soil burn severity	Indicator characteristic 1	Indicator characteristic 2	Indicator characteristic 3
0	Unburned	No evidence of recent fire	-
1	>40% litter cover	Charred and unburnt litter present	Mineral soil with black char; litter fall since fire
2	2 – 39% litter cover	Mineral soil with black char	Grey char from burnt logs; litter fall since fire
3		Mineral soil with black or grey char	Lines of orange under logs; litter fall since fire
4	<1% litter cover	Mineral soil with black char	Grey and orange-coloured soil under logs; litter fall since fire
5		Mineral soil with black or grey char	Orange-coloured soil under logs; litter fall since fire
6		Mineral soil with orange char	Black ash line present below soil surface

Modified from Jain *et al*. (2008) *Ambio* 37, 563–568

OBJECTIVE 6 – FIRE INTENSITY AND SOIL CARBON

1) Change in physical properties of soil

2) Change in chemistry of soil including carbon content

3) Indicators of fire intensity

PROGRESS AND END USER ENGAGEMENT: NEXT 6–12 MONTHS

1) Objectives 1 and 2: complete review/reports/manuscripts related to sampling schema

   Feedback from End Users required

2) Objectives 3 and 4: commence field work and laboratory analysis of soil and plant samples

   Work closely with End Users in NSW and Victoria to access fuel reduction fires for sampling

3) Objective 6: continue refining physical/chemical/ analytical methods for measuring effects of fire intensity on soil carbon