



A1.1 Fire Behaviour Modelling

Project FuSE:

Fire Behaviour Experiments in Shrubland Fuels

Part I. Lake Taylor experiments, New Zealand



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Importance of heath/shrub fuels



- Significant component of land cover, including urban interface areas
- Fuel highly flammable, prone to high fire frequency
 - e.g. in NZ, 28% of land cover, 30% of fires, 35% of area burned
- Fires exhibit extreme fire behaviour, impacts public & firefighter safety
- High floristic diversity and important habitat, so high conservation value
- Prescribed fire frequently applied, escapes common



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Heath/shrub fire behaviour research

Australia:

- mallee shrublands, W.A. (McCaw)
- tea-tree heaths, Vic. (McCarthy)
- Sydney sandstone heath/shrub, NSW (Gellie, Catchpole, Bradstock)
- buttongrass moorlands, Tas. (Marsden-Smedley)



New Zealand (Forest Research):


- tea-tree (*Leptospermum* / *Kunzea*) heath and shrublands
- gorse (*Ulex*) scrub



International Heathland Fire Behaviour Modelling Group:

- Portugal (Fernandes) & Spain (Vega)

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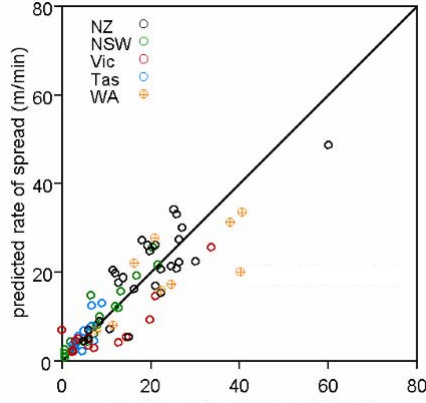



Heath/shrub fire behaviour research

IHFBMG model (Catchpole *et al.* 1999):

- ROS as f (wind speed, scrub height)

ROS = $0.801 U_{2m}^{1.10} H^{0.49}$





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Heath/shrub fire behaviour research

Model problems:

- lack of moisture response
- scrub height as surrogate for fuel structure (e.g., fuel load, bulk density)
- lack of info on effect of wind and slope
- gaps in model data

Heath/Shrub Fuels	Low wind speed (< 15 km/h)	High wind speed (> 15 km/h)
Low fuel moisture (<10%)	WA mallee NSW heath Vic heath	NSW wildfires
High fuel moisture (> 10%)	Tas buttongrass NZ scrub	NZ gorse NZ heath



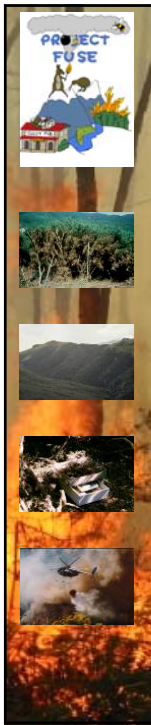
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Project FuSE:

- **F**ire **E**xperiments in **S**crub, with attention to wind 'u' (and slope)

Research Aims/Objectives:

- continued collection of data on heath/shrub fire behaviour
- increased understanding of fuel layers contributing to fire spread
- effect of slope on fire spread
- effect of ignition patterns on fire growth and shape



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Research Aims/Objectives: (cont.)

- applicability of visual fuel hazard scoring systems to shrub fuels
- effect of burnt/unburnt canopy permeability on ambient wind and fire spread
- fuel moisture modelling in shrub fuels

Also

- opportunities for evaluation of suppression effectiveness (aerial & ground)
- potential for fire ecology/effects research
- firefighter training



Project FuSE - NZ burn experiments

2 research sites in Canterbury high country on South Island:





Project FuSE - NZ burn experiments

Lake Taylor burns (Dec'04/Mar'05):

- **international research team**
 - CSIRO, UNSW-ADFA + NZ FR
 - CALM-WA, DEH-SA, TasFS
 - US Forest Service (Riverside)
- **NZ fire agency in-kind support**
 - Dept. of Conservation, Hurunui DC
 - Christchurch CC + Canterbury/WestCoast RRFC
- **assistance from landowners, FFNZ**



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Project FuSE - NZ burn experiments

Part 1 - Lake Taylor site:

- **2 burn areas in manuka/kanuka (*Leptospermum/Kunzea*) scrub**
 - slip block: 2-5⁺ m high, slopes 20-35°
 - wilding block: 2-3 m high, slopes 5-15°
- **6 fires completed during Mar.'05**
 - point and line ignition
 - point and 40, 60 & 80m lines
 - operational prescribed burn
- **emphasis on trialing of methods/instruments**



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Project FuSE: Part 1 – Lake Taylor expts.

Experimental methods:

- visual and destructive sampling of pre- and post-burn fuel load/consumption
- weather, fire danger and fuel moisture contents
- rate of fire spread/fire growth from in-ground spread timers, aerial visual and IR video
- flame lengths, in-fire temps from thermocouple array, in-fire video, ground IR video
- pre- and post-fire wind profiles on slope, and within and outside canopy



Project FuSE: Part 1 – Lake Taylor expts.

Fuel sampling





Project FuSE: Part 1 – Lake Taylor expts.

Weather/Fire danger

Weather

Temp. 17.1-21.4 °C
RH 56-82%

14-17 March, 2005

Wind speed 4-22 km/h
3-6 Days since sig. rain
(21.1 mm on 11/03/05)



FWI System

FFMC 77.1-84.3
DMC 6-8
DC 215-230
Scrub FDC Extreme

ISI 1.7-4.6
BUI 11-14
FWI 3.5-9.2
Forest FDC Low



McArthur FFDI

KBDI 115-117
DF 9-10

SDI 141-144
FDI 3-8

Forest FDR Low-Moderate

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Slip block





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Rate of spread loggers

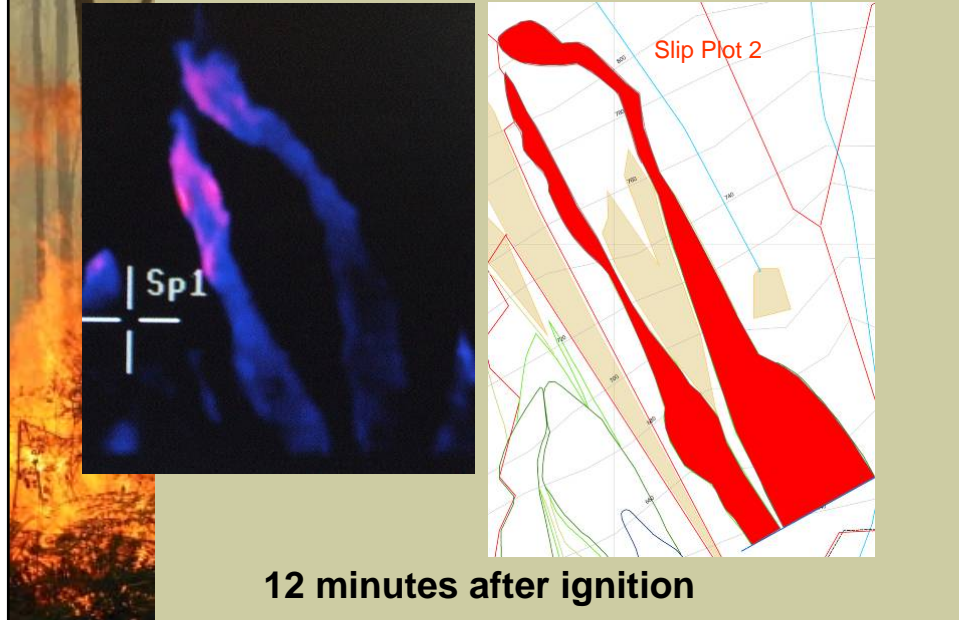


Lake Taylor: Slip plot 3 – fire growth



5 minutes after ignition

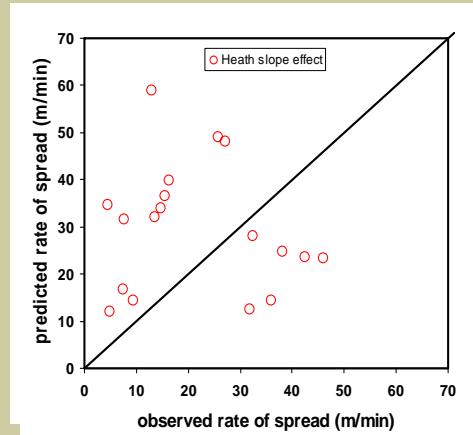
Lake Taylor: Slip plot 2 – fire growth





Project FuSE: Part 1 – Lake Taylor expts.

Slope-corrected fire spread rates



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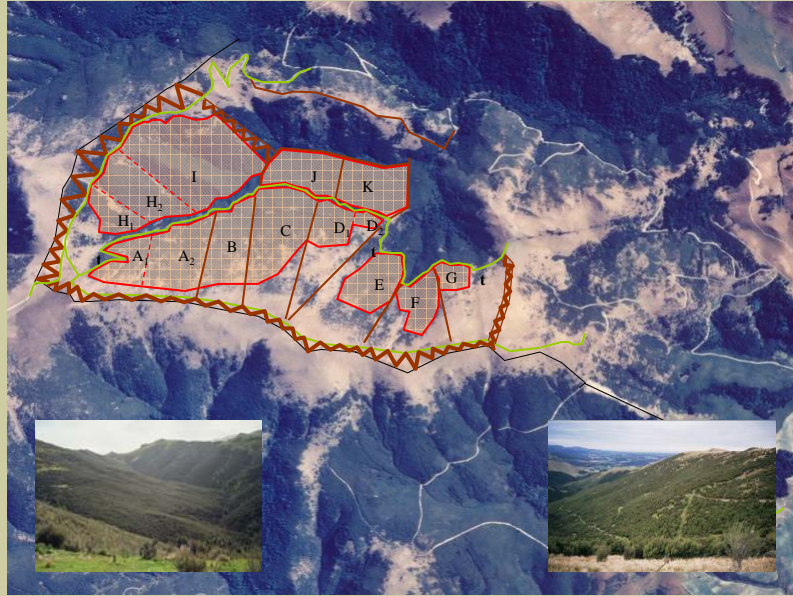
In-fire video



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Project FuSE: Part 2 – Torlesse burn site



Project FuSE: Future burns

Ngarkat, S.A:

- mallee shrub and heath
- initial pilot study burns conducted May '05
- main experiments May '06



Sydney Basin, NSW:

- sandstone heath
- burn sites identified
- larger scale experiments
- burning from 2006-08



Other Aust. + NZ burns likely



Project FuSE: Part 1 – Lake Taylor expts.

Job done!
but only just started...

