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Near or far?

Importance of fuel management proximity for house loss in wildland fires

Geoff Cary & Phil Gibbons

Fenner School of Environment and society

The Australian National University


Australian bushfire
July 2009
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House loss in wildland fire

Location	Year	Fatalities	Houses lost
California, USA	2003	26	3,361
Victoria, AUS	2009	173	2,133
Russia	2010	54++	~ 2,000
Slave Lake, CAN	2011	1	433
Colorado Springs, USA	2012	2	346

‘Black Saturday’ Fires - Geoff Cary 2009

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Location, effectiveness, approaches

Fuel treatment location & effort

89% Fuel-reduction treatments > 2.5 km from WUI in western USA
(Schoennagel *et al*. 2009. PNAS)

8.5 km Average distance from houses to prescribed burn
(Gibbons *et al*. 2012. PLoS ONE)

Fuel treatment effectiveness on …

Wildland fire at WUI or in peri-urban areas

House loss in the WUI in wildland fire

Methods of investigation

Landscape-scale simulation

Empirical study of house loss

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Objectives

- Quantify relative importance of proximal vs. distant fuel treatment
  - Area burned at WUI – simulation study
  - Probability of house loss – empirical study
- Quantify these effects in relation to variation in weather
- Explore consensus/divergence between different study approaches

Simulation study

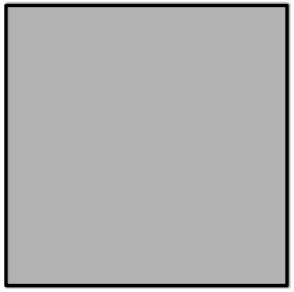
FIRESCAPE ~ landscape-scale simulation fire events/regimes

(Cary & Banks 2000, Cary 2002)

Management Approach

Random

Edge



Effort

0, 10, 20, 30 percent of landscape in low fuel state

0, 50, 100, 150 m wide edge treatment

10 separate years of daily weather x 20 simulation replicates

Response variable = Number of edge pixels ‘burned’

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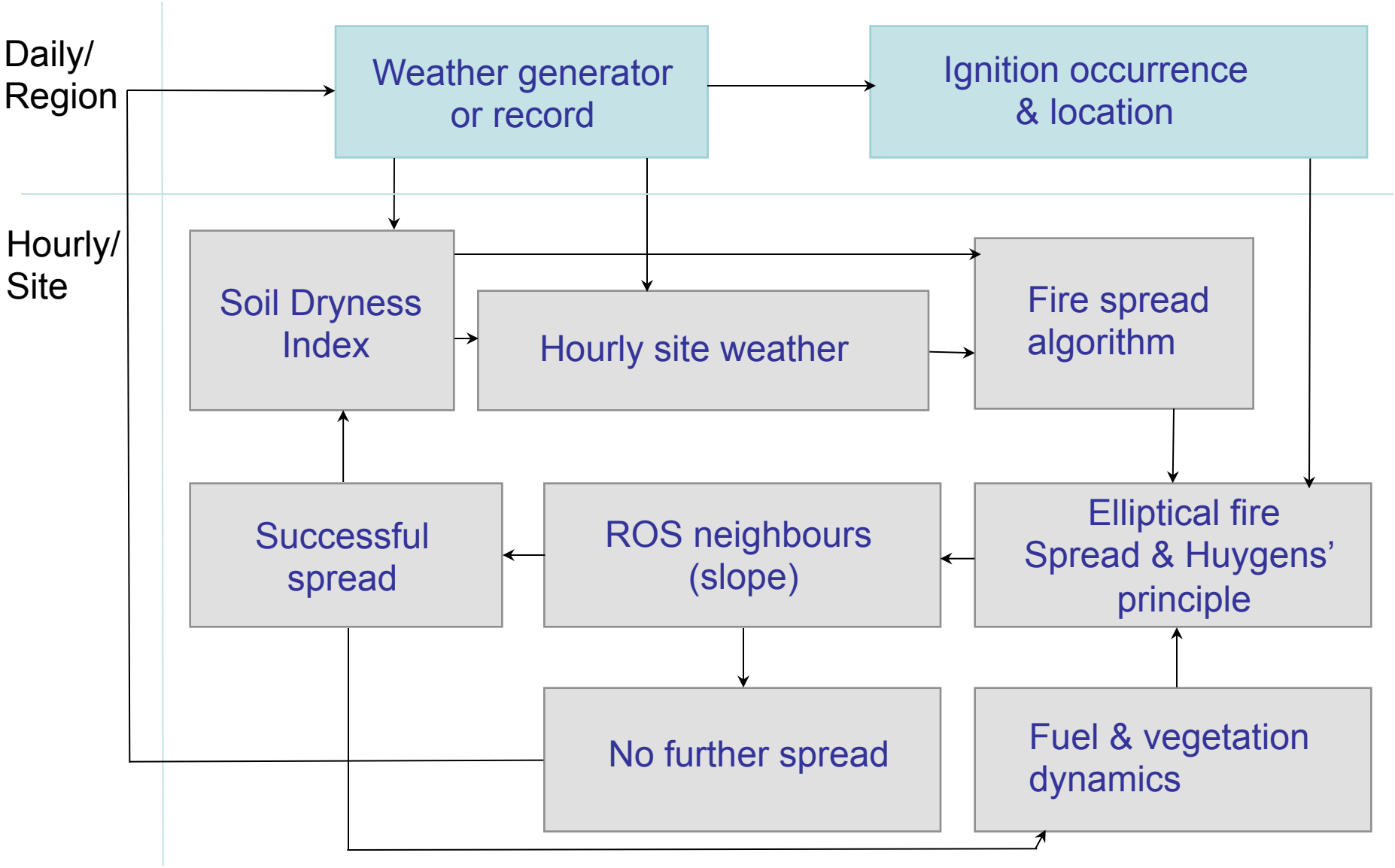
FIRESCAPE



Cary GJ, Flannigan MD, Keane RE, Bradstock RA *et al*. (2009) Relative importance of fuel management, ignition management and weather for area burned: Evidence from five landscape-fire-succession models. *International Journal of Wildland Fire* **18**: 147–156

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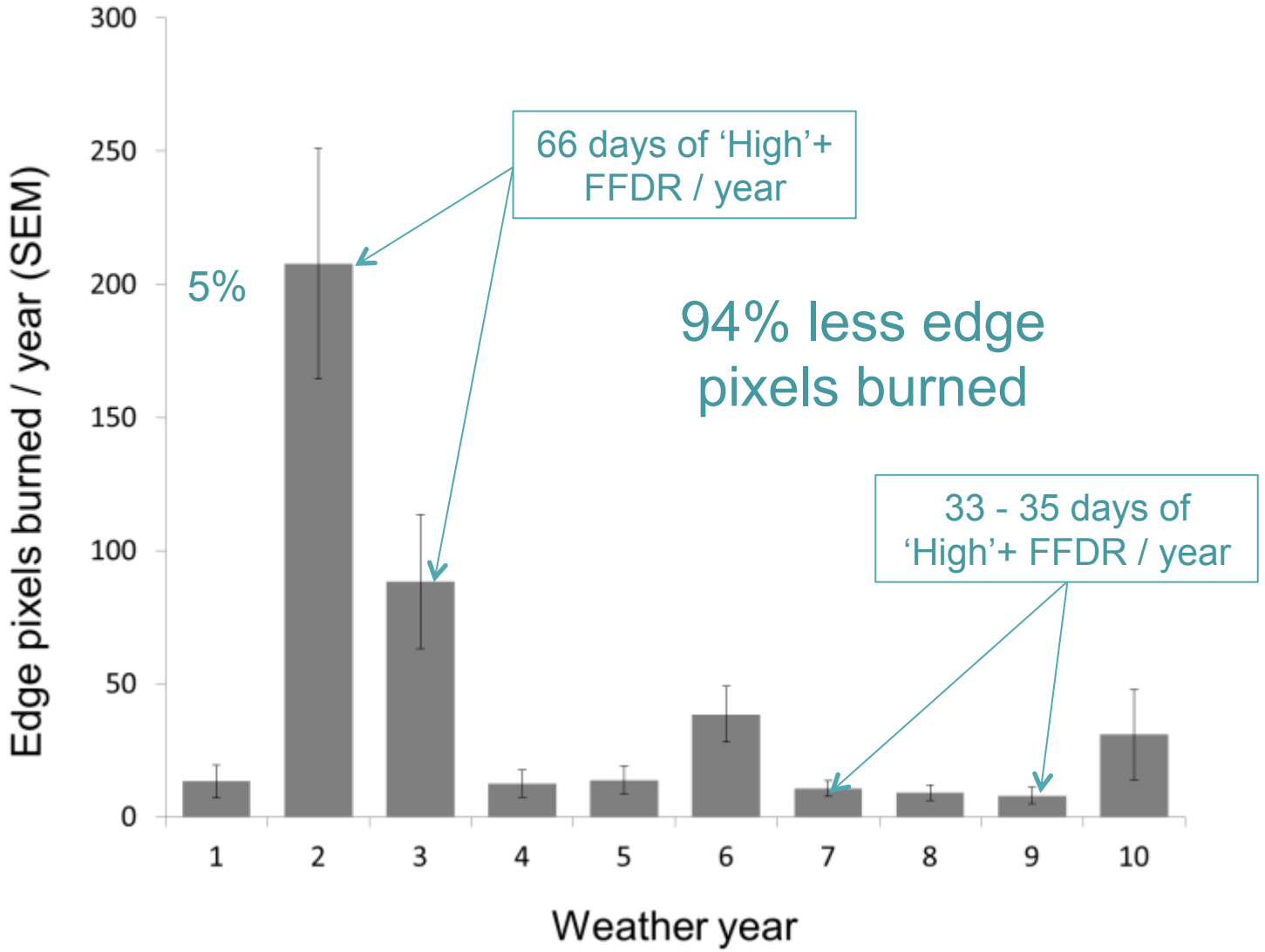
Results ~ Importance of weather

Simulation study



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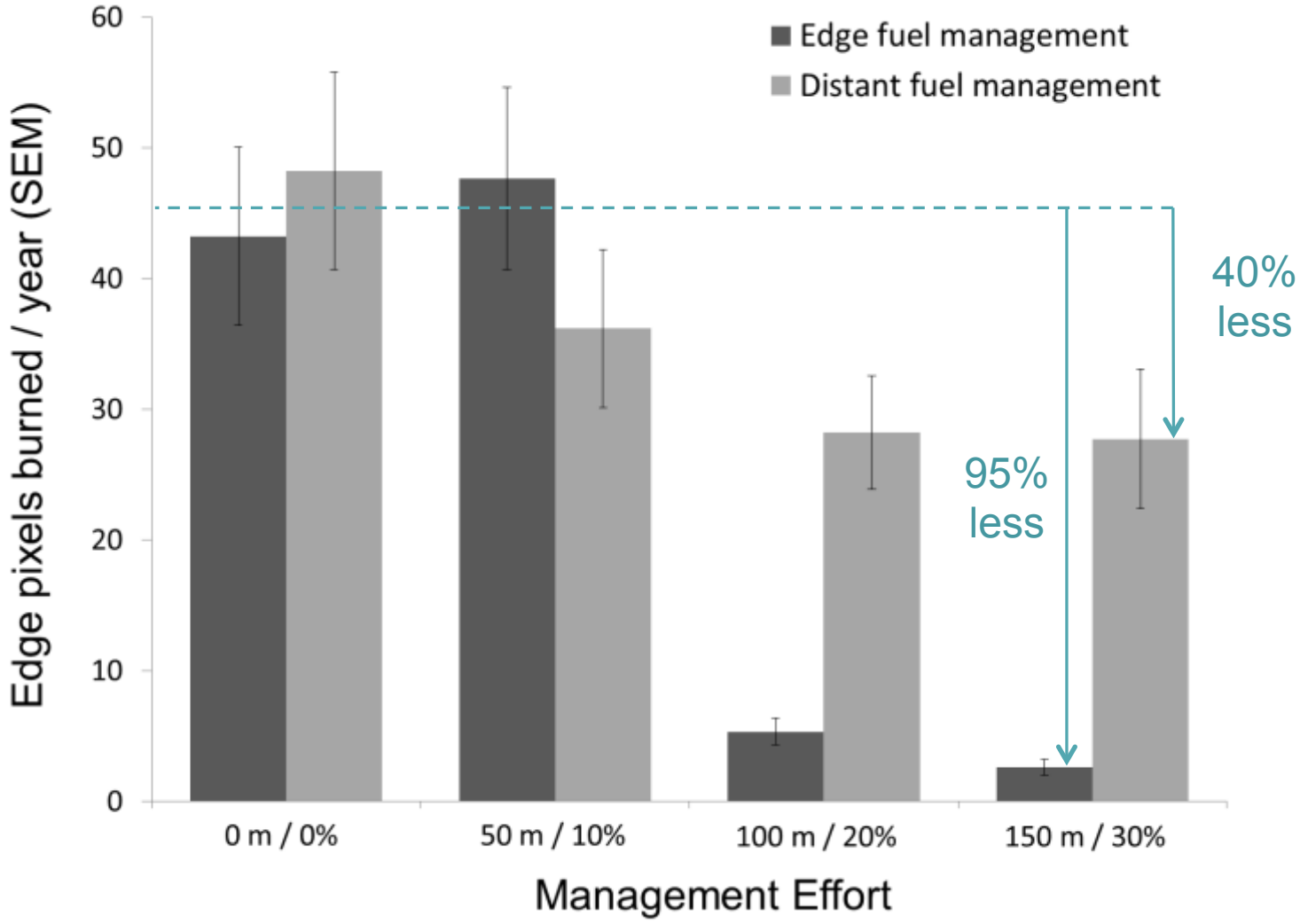
Results ~ Fuel management

Simulation study



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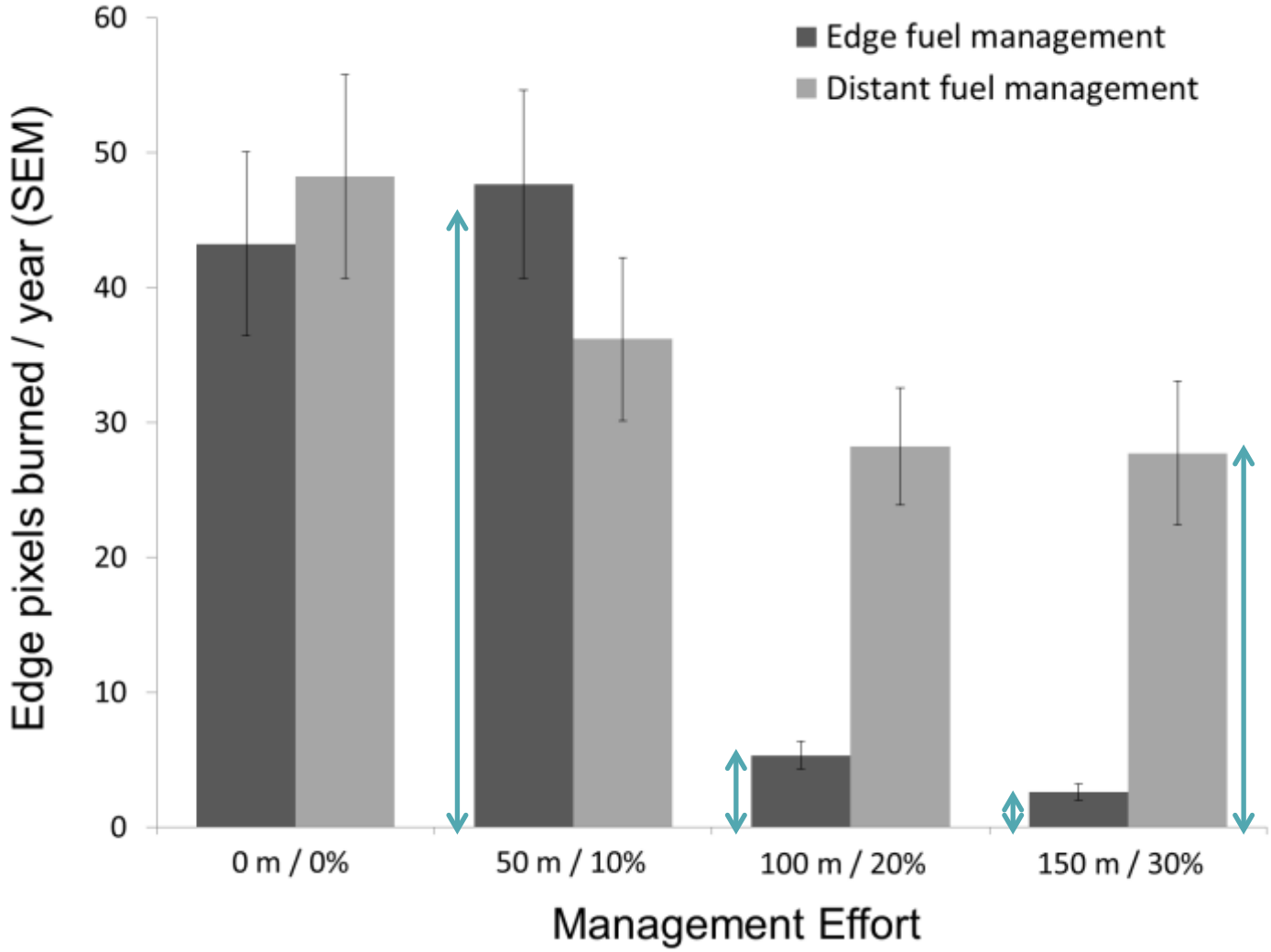
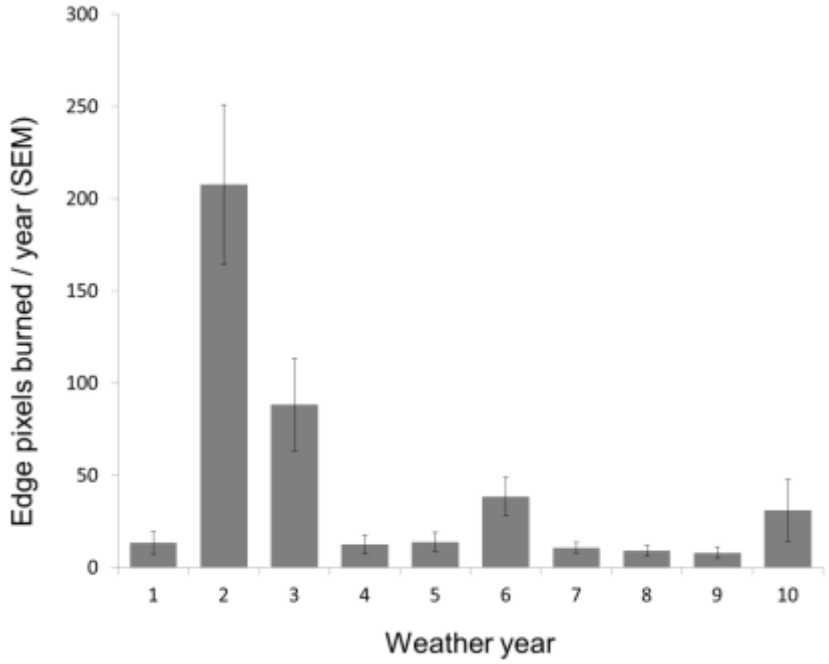
Results ~ Fuel management

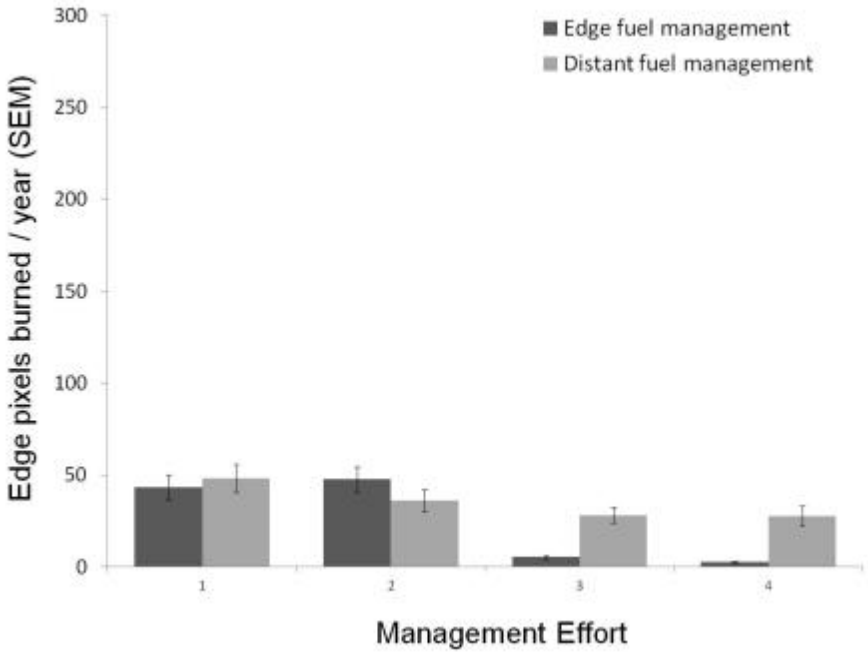
Simulation study



Results ~ Relative importance

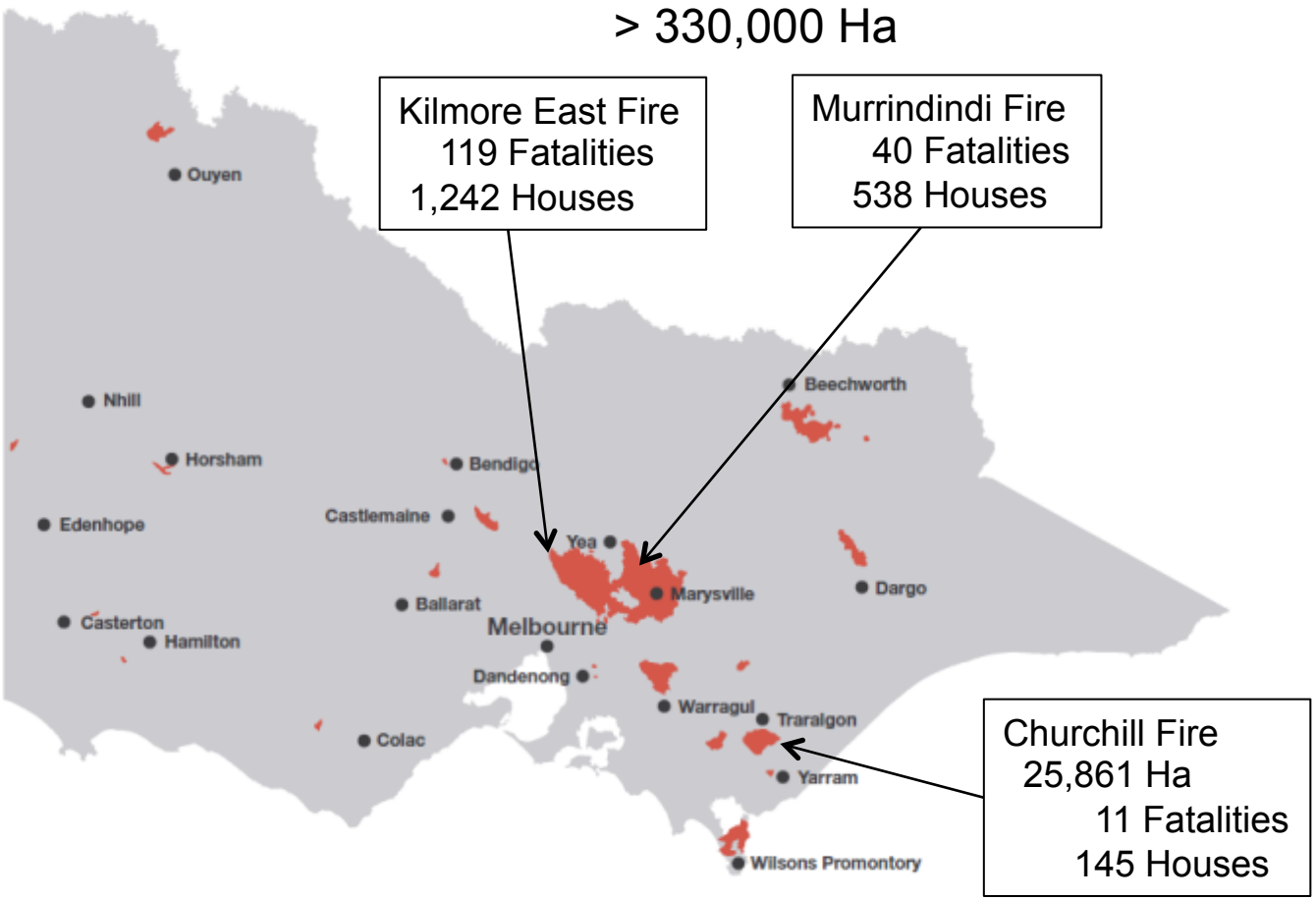
Simulation study





Empirical study

Figure 1 The January–February 2009 bushfires



Source: Exhibit 11 – Statement of Esplin, Attachment 1.[8]

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Tree/shrub cover$_{40}$ = 5 – 90%

Buildings$_{40}$ = 1 – 4

FFDI = 5 – 189

Slope = 0 – 23°

% Clr = 0 – 33%

% PB = 0 – 36%

% Log = 0 – 33%

Dist. To NP = 0.01 – 35 km

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Empirical Study

Data set

499 houses stratified by weather, terrain, fuel

~ 1/3 destroyed

12,000 measurements

Statistical Modelling

Logistic regression modelling

Binary response variable = Intact / Destroyed

OPEN ACCESS Freely available online

PLoS one

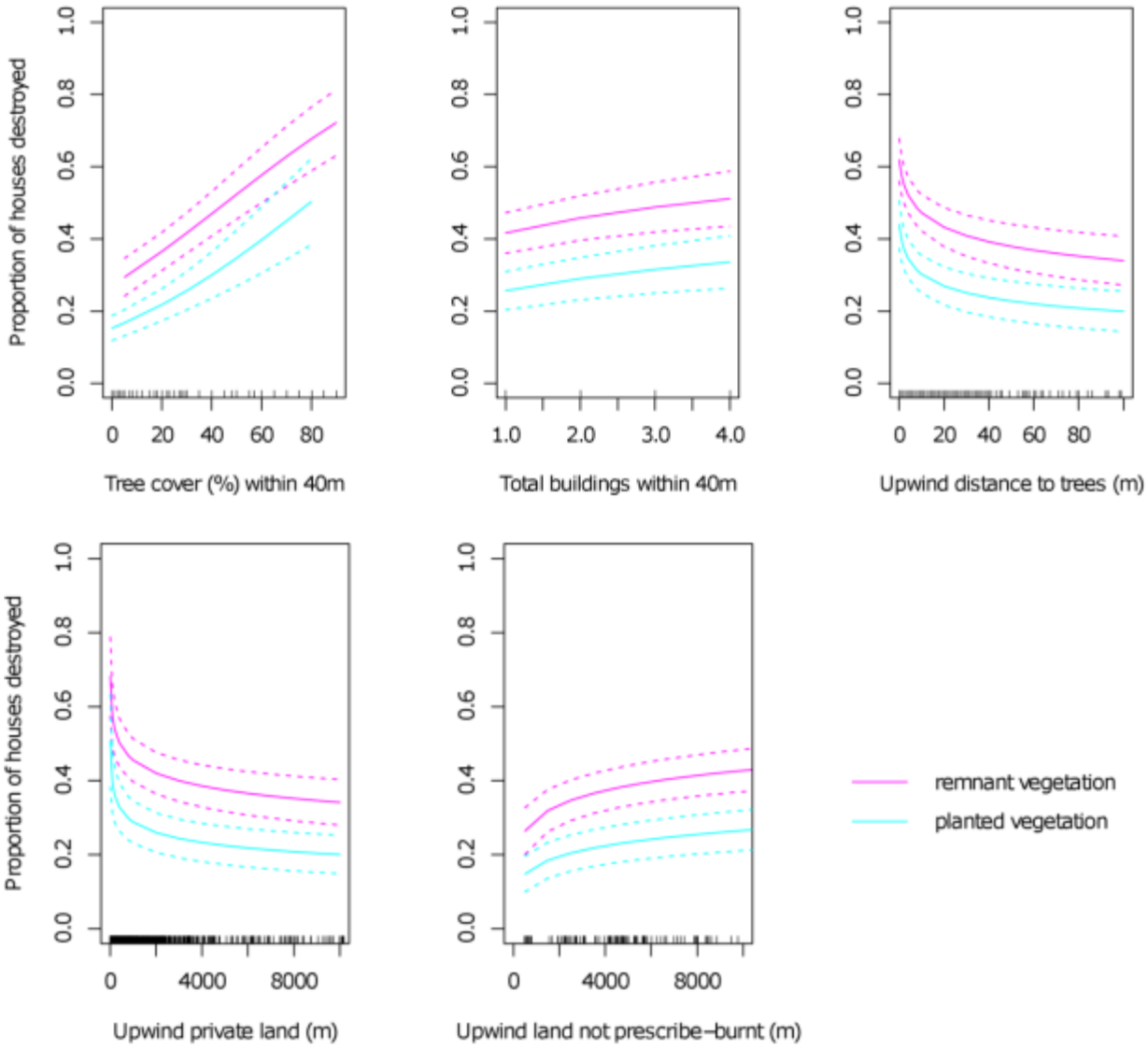
Land Management Practices Associated with House Loss in Wildfires

Philip Gibbons[1]*, Linda van Bommel[1], A. Malcolm Gill[1], Geoffrey J. Cary[1], Don A. Driscoll[1], Ross A. Bradstock[2], Emma Knight[3], Max A. Moritz[4], Scott L. Stephens[4], David B. Lindenmayer[1]

1 The Fenner School of Environment and Society, The Australian National University, Canberra, Australian Capital Territory, Australia, **2** Centre for Environmental Risk Management of Bushfires, University of Wollongong, Wollongong, New South Wales, Australia, **3** Centre for Mathematics and its Applications, The Australian National University, Canberra, Australian Capital Territory, Australia, **4** Ecosystem Sciences Division, Department of Environmental Science, Policy and Management, University of California, Berkeley, California, United States of America

Results ~ Fuel management

Empirical study



FFDI = 100

Other variables held at their mean observed value

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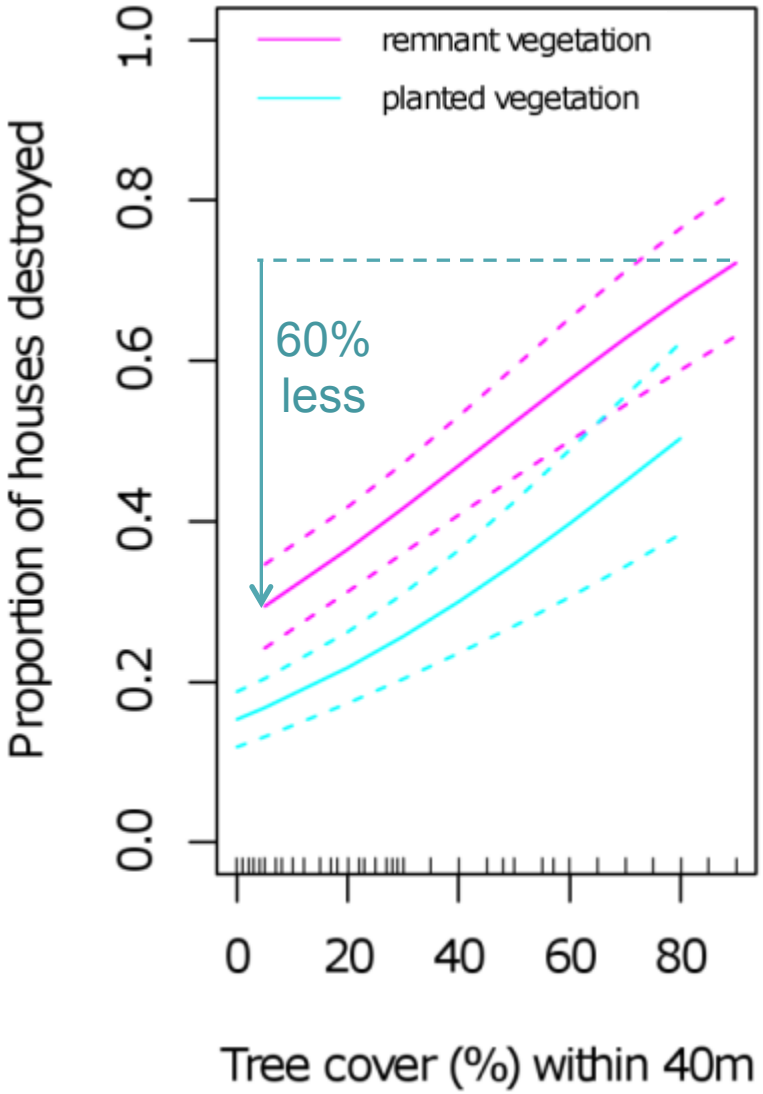
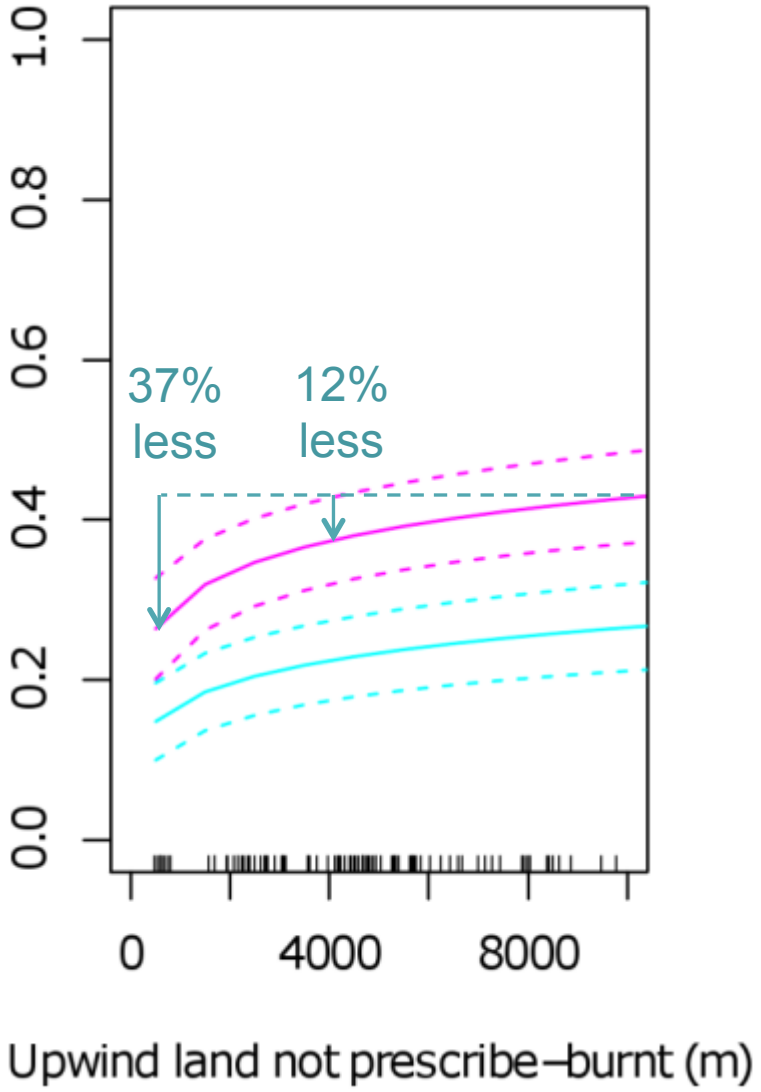
Results ~ Fuel management





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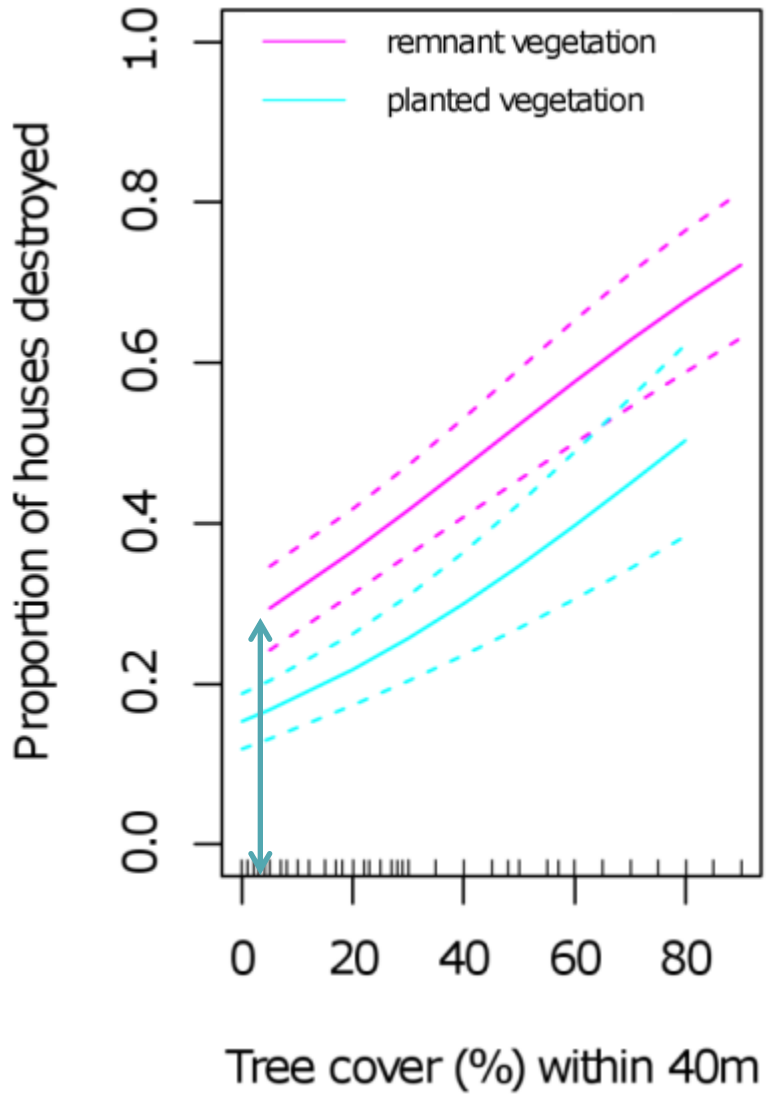
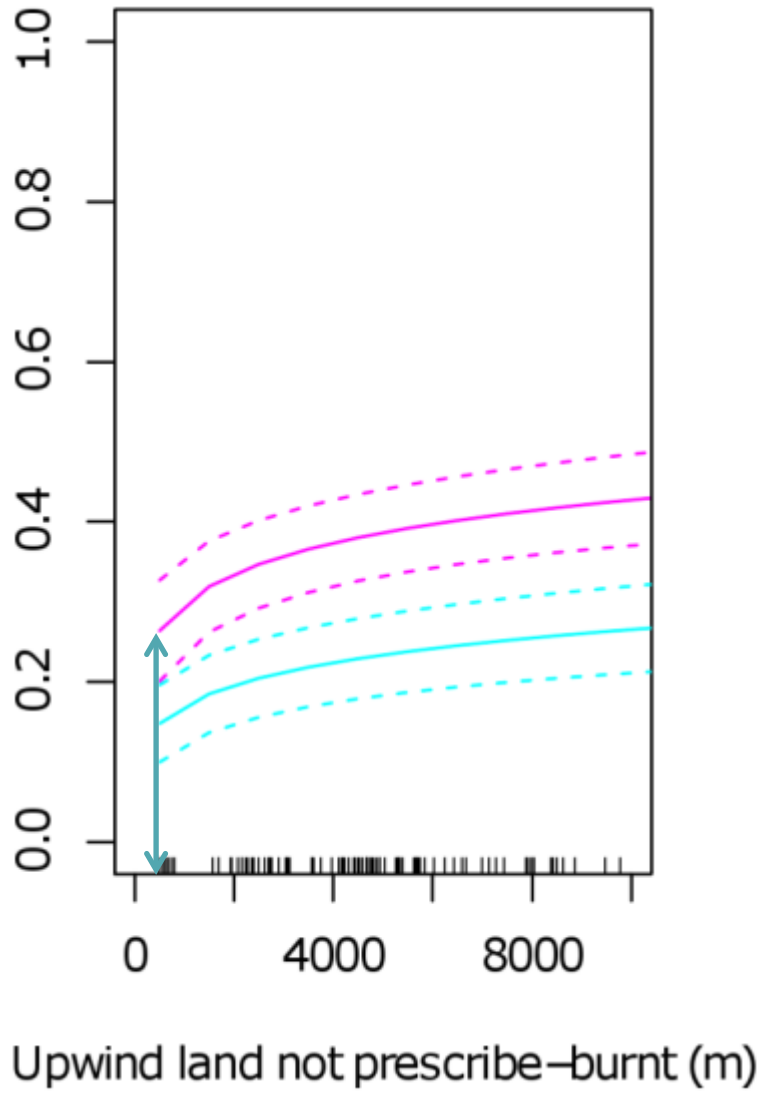
Results ~ Fuel management





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Key findings

Effect of Weather vs. Fuel

Weather ≥ Fuel Fire at edge (simulation) or Houses lost (empirical)

Effect of Proximal vs. Distant

Proximal	~ 90% ↓	Fire at edge (sim.)
	~ 60% ↓	Houses lost (emp.)
Distant	~ 30% ↓	Fire at edge (sim.)
	~ 10 - 30% ↓	Houses lost (emp.)

Residual risk

Significant residual risk ~ 30%

Reasonable consensus – Simulation & Empirical approaches

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PLoS one

Housing Arrangement and Location Determine the Likelihood of Housing Loss Due to Wildfire

Alexandra D. Syphard[1]*, Jon E. Keeley[2,3], Avi Bar Massada[4], Teresa J. Brennan[2], Volker C. Radeloff[4]

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"Rates of structure loss were higher when structures were surrounded by wildland vegetation, …

… but were generally higher in herbaceous fuel types than in higher fuel-volume woody types."*

*Relatively small contribution to explanatory power of model


San Bernardino Mts
April 2010
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Near or far?

Importance of fuel management proximity for house loss in wildland fires

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