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FUTURE SCENARIOS AND ECONOMICS

CRC AUSTRALIA

THE AUSTRALIAN NATIONAL UNIVERSITY

Project Objectives

(i) Develop future scenarios of bushfires for selected areas in Australia using critical, evidence-based knowledge

(ii) Identify appropriate economic methods for understanding key examples of economic implications associated with bushfires

(iii) Preliminary analysis of projected economic implications associated with future bushfires in Australia, based on the future scenarios

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Project team members

Lead End-users

Andrew Stark, Chief Officer, ACT Rural Fire Service

Shane Wiseman, Manager, Fire Management Branch, DENR, SA

Researchers

Eddy Collett, Research Officer, Future Scenarios

Dr Helena Clayton, Postdoctoral Fellow, Economics

Dr Malcolm Gill, Bushfire Science

Professor Steve Dovers, Environmental Policy/Economics

Dr Geoff Cary, Project Leader, Bushfire Science

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Publications to date

Peer-reviewed book chapters

Cary GJ, Bradstock RA, Gill AM and Williams RJ (2012) **Global change and fire regimes in Australia**. In *Flammable Australia: Fire Regimes, Biodiversity and Ecosystems in a Changing World* (Eds. Bradstock RA, Gill AM, Williams RJ). pp. 149–169. CSIRO Publishing, Melbourne.

Gill AM and Cary GJ (2012) **Socially Disastrous Landscape Fires in South-Eastern Australia: Impacts, Responses, Implications**. In D. Paton, & F. Pedrosa, (Eds). *Wildfire and Community: Facilitating preparedness and resilience*. Springfield, Ill., Charles C. Thomas.

Gill AM (2012) **Bushfires and biodiversity in southern Australian forests**. In *Flammable Australia: Fire Regimes, Biodiversity and Ecosystems in a Changing World* (Eds. Bradstock RA, Gill AM, Williams RJ). pp. 235–252. CSIRO Publishing, Melbourne.

Poster

Cary G, Bradstock R, Gill M, Williams R, Collett E (2011) **Future Scenarios for Australian Bushfires**. Poster presented at the AFAC/Bushfire CRC 2011 Conference, Sydney, August.

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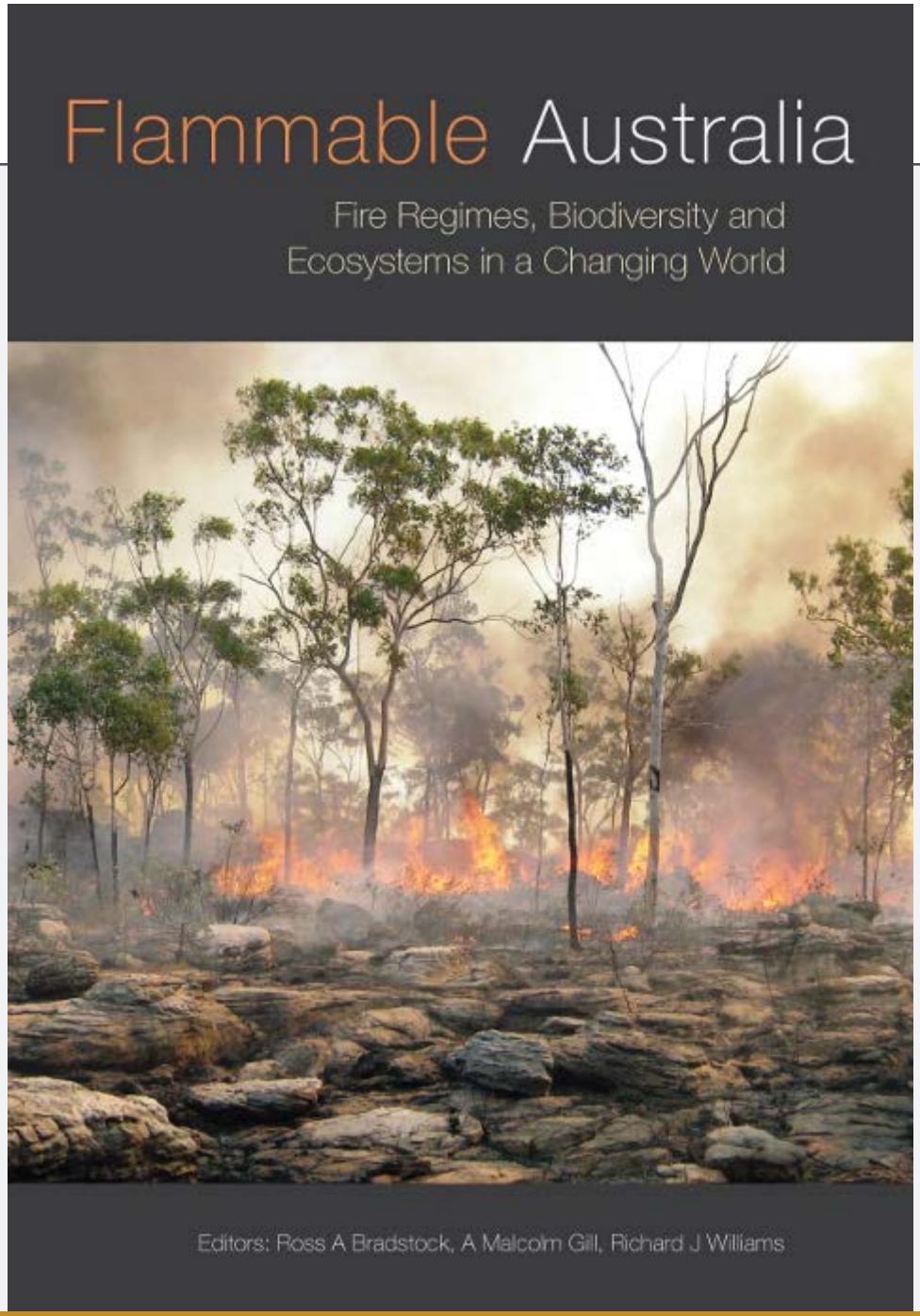

Flammable Australia Fire Regimes, Biodiversity and Ecosystems in a Changing World

Edited by:

Ross A Bradstock
Centre for Environmental Risk Management of Bushfires, University of Wollongong

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Richard J Williams
CSIRO Ecosystem Sciences

Colour photographs, Colour illustrations
344 pages, 245 x 170 mm
Publisher: CSIRO PUBLISHING

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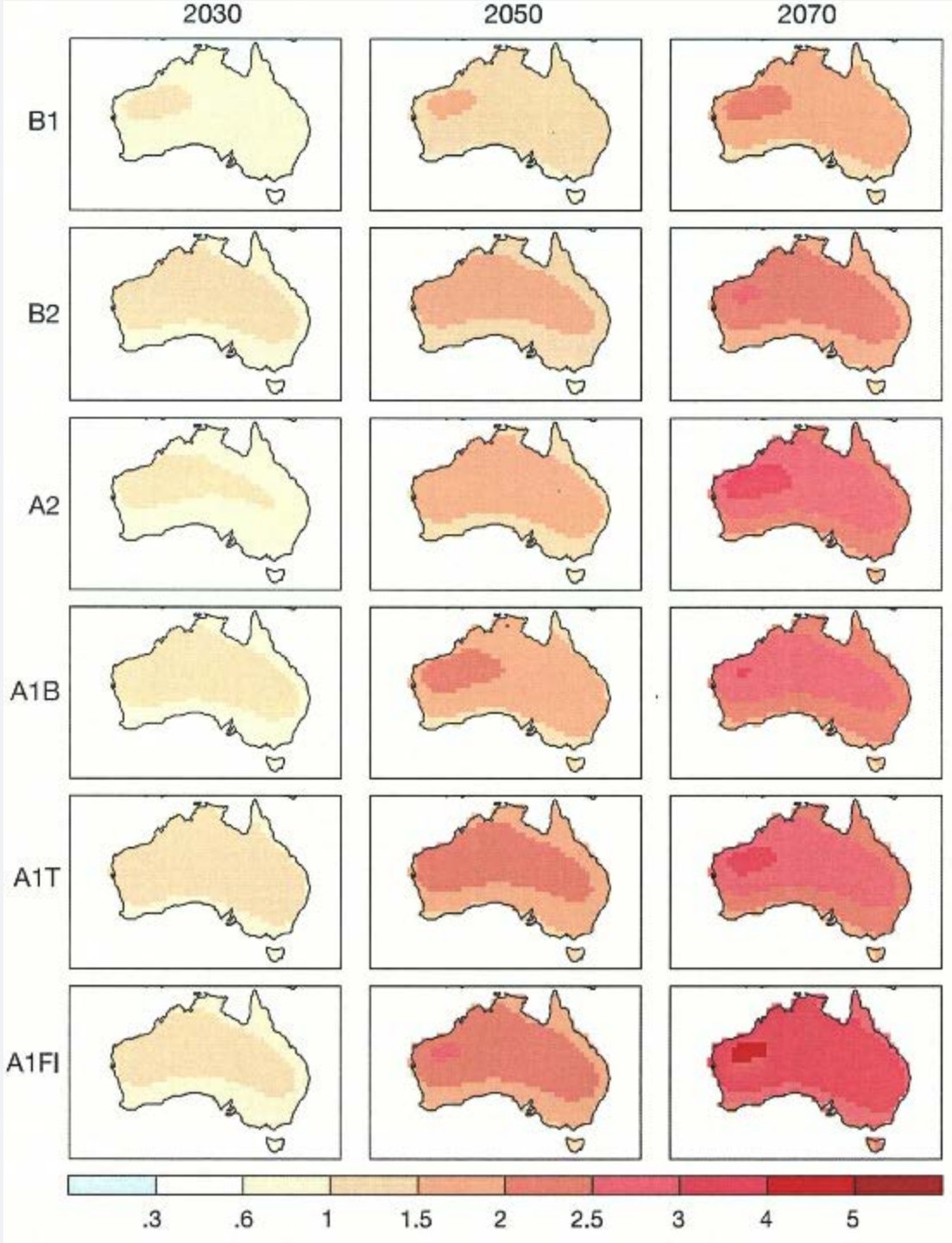
Temperature

Best estimate (50th percentiles) of projected change of mean annual temperature (°C)

Results are for six emission scenarios (B1, B2, A2, A1B, A1T and A1FI)

Source: CSIRO and Australian Bureau of Meteorology 2007

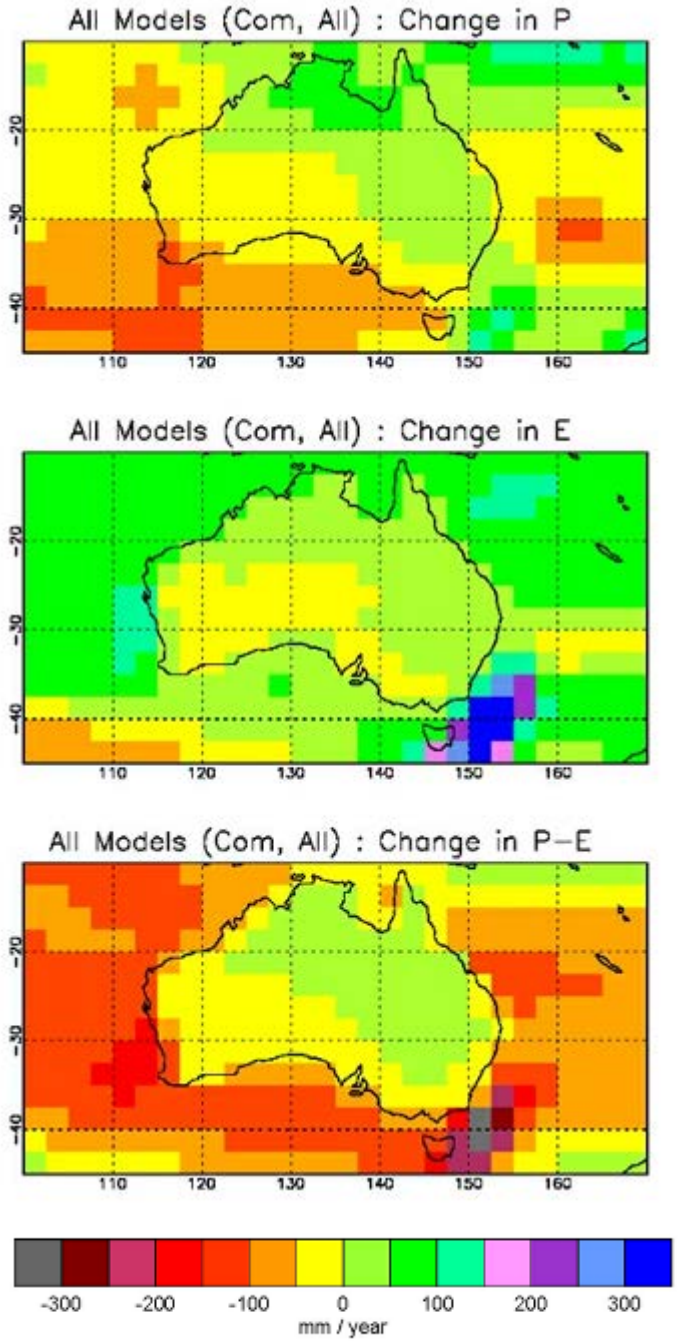


Precipitation & Evaporation

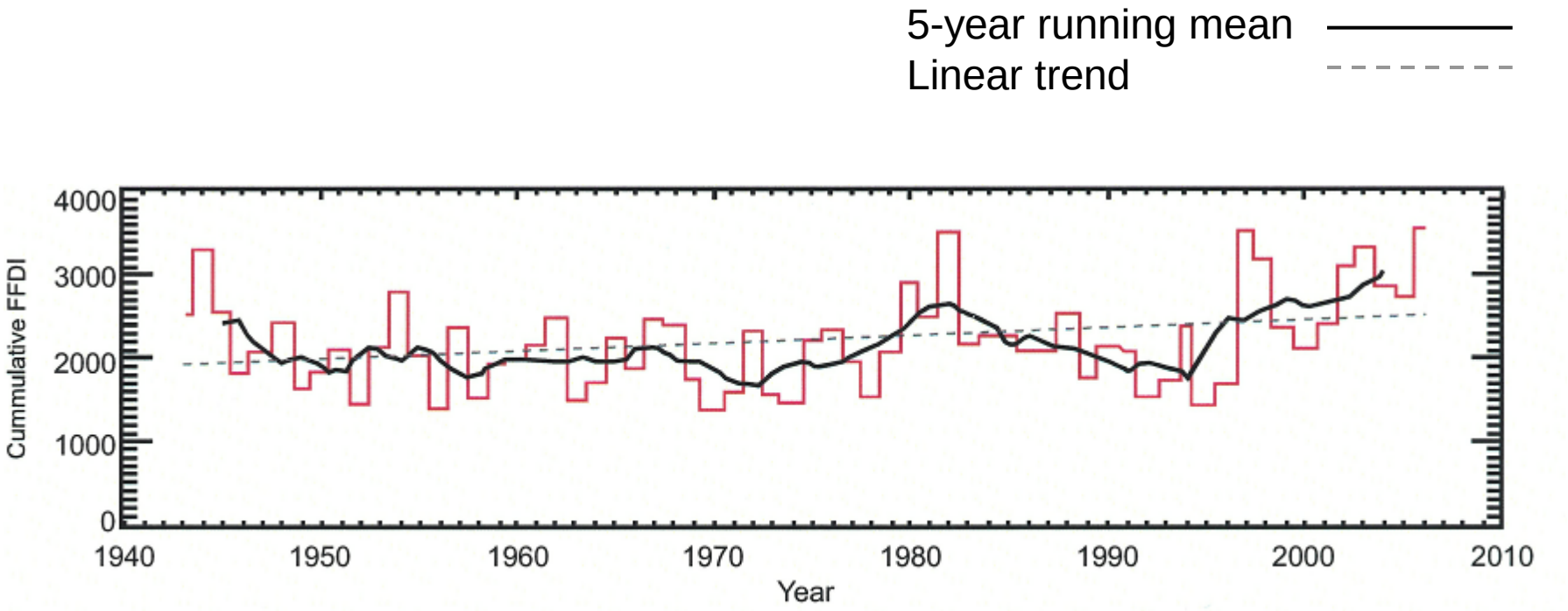
Projected average changes in precipitation (P), evaporation (E) and their difference (P–E) from 1970–1999 to 2070–2099

Averaged across 39 model runs from 20 Global Circulation Models, assuming a mid-range emissions scenario (A1B) for a future climate.

Source: Lim and Roderick 2009.



Fire Danger



Long time-series of cumulative FFDI (ΣFFDI) at Melbourne airport (Source: Williams *et al*. 2009. See Esplin *et al*. 2003 and Lucas *et al*. 2007 for similar analyses).

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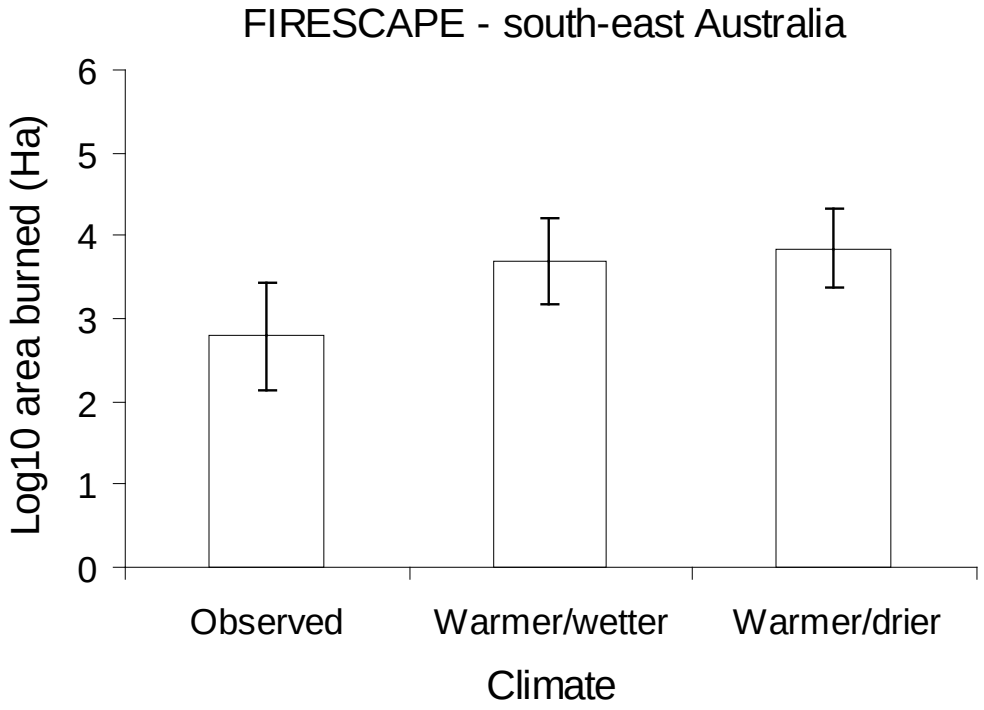
Scenarios for area burned

Area burned under three climate scenarios in a comparison of landscape-fire models (see Cary *et al*. 2006)

Warmer climates = + 3.6^{o}C
Drier = - 20% precipitation
Wetter = + 20% precipitation

Source: Williams *et al.* 2009.



Williams RJ, Bradstock RA, Cary GJ, Enright NJ, Gill AM, Liedloff AC, Lucas C, Whelan RJ, Andersen AN, Bowman DJMS, Clarke PJ, Cook GD, Hennessy KJ, York A (2009) *Interactions Between Climate, Fire Regimes and Biodiversity in Australia: A Preliminary Assessment*. Report to Australian Government – Department of Climate Change and Department of Environment, Water, Heritage and the Arts, Canberra

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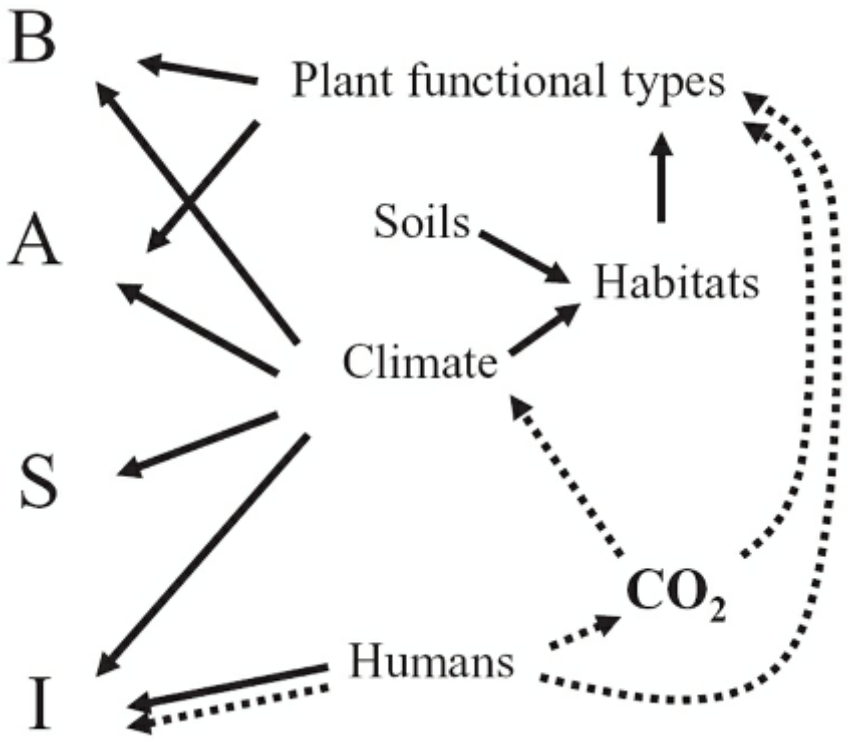
Climate effects: Fuel - Weather - Ignitions

B - Biomass growth

A - Availability of fuel for burning

S - Ambient fire weather

I - Ignitions



Bradstock RA (2010) A biogeographic model of fire regimes in Australia: contemporary and future implications. *Global Ecology and Biogeography* **19**, 145–158.

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Climate/CO_2 effects: Fuel

Declining precipitation

Lower productivity	- Fuel
Less decomposition	+ Fuel

Increasing CO_2

CO_2 fertilisation?	+ Fuel
Higher C:N	+ Fuel

Shifting species?

Altered plant communities	? Fuel
(e.g. invasive species)	

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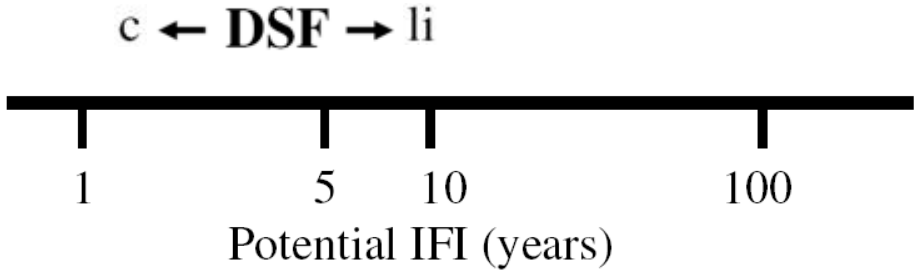
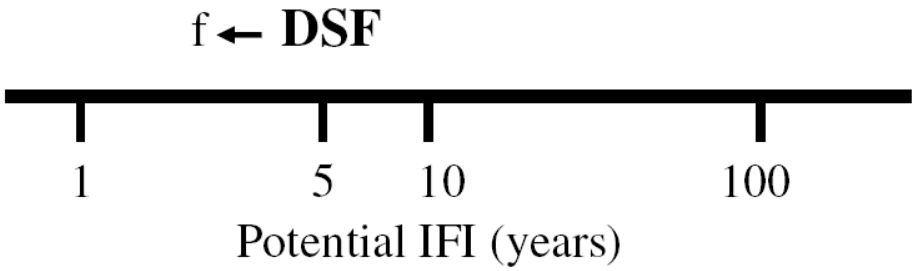
Climate/CO_2 effects: Fire interval

Effect of biomass growth



Effect of fire weather



Modified from: Bradstock RA (2010) A biogeographic model of fire regimes in Australia: contemporary and future implications. *Global Ecology and Biogeography* **19**, 145–158.

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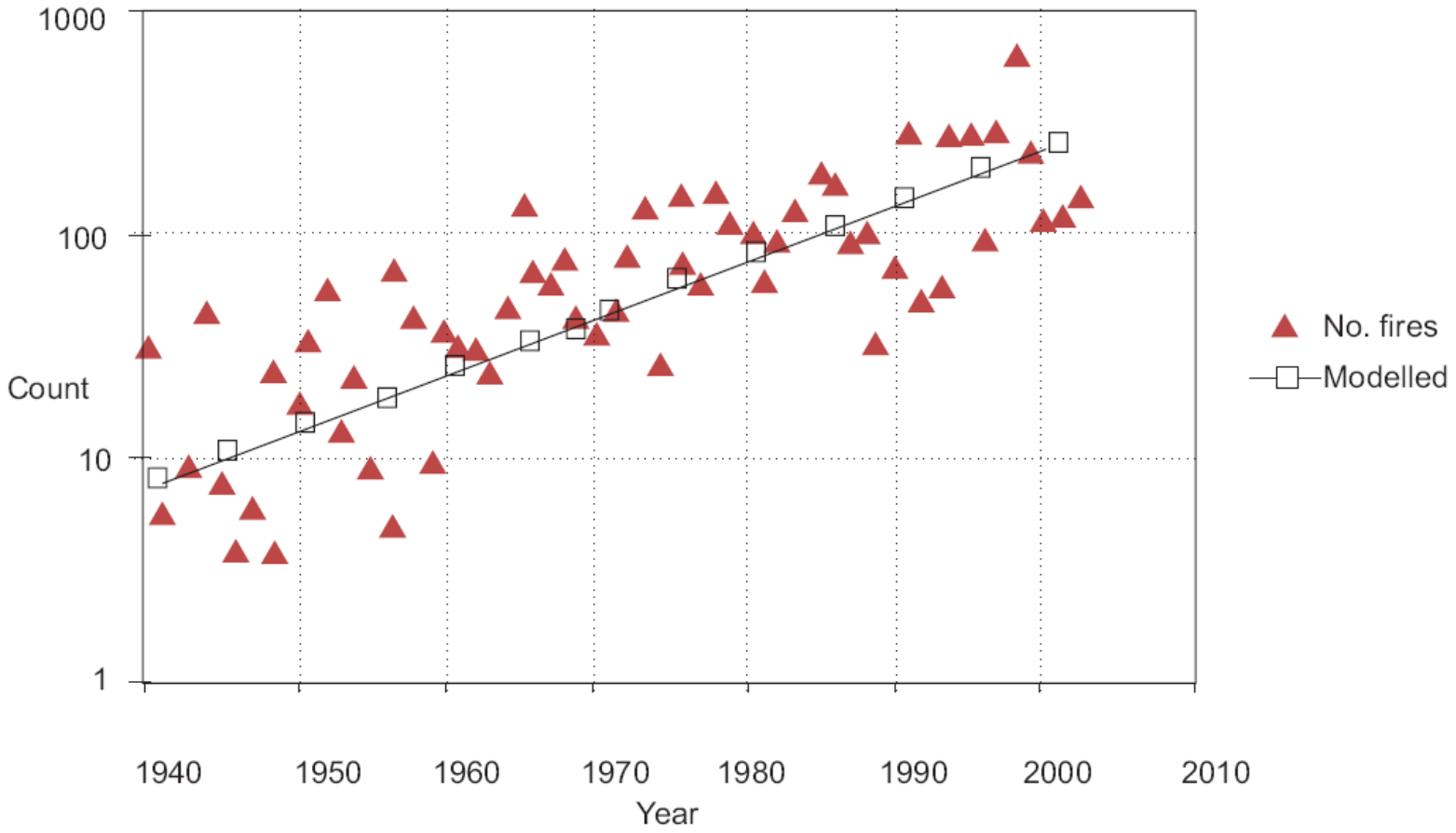
Ignition rates



Derived from data of R McRae, ACT Emergency Services Authority

Williams RJ, Bradstock RA, Cary GJ, Enright NJ, Gill AM, Liedloff AC, Lucas C, Whelan RJ, Andersen AN, Bowman DJMS, Clarke PJ, Cook GD, Hennessy KJ, York A (2009) *Interactions Between Climate, Fire Regimes and Biodiversity in Australia: A Preliminary Assessment*. Report to Australian Government – Department of Climate Change and Department of Environment, Water, Heritage and the Arts, Canberra

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Towards more comprehensive scenarios …

- Other key aspects of global change influencing future fire scenarios

- Moving towards implications of changed fire regimes for society/management

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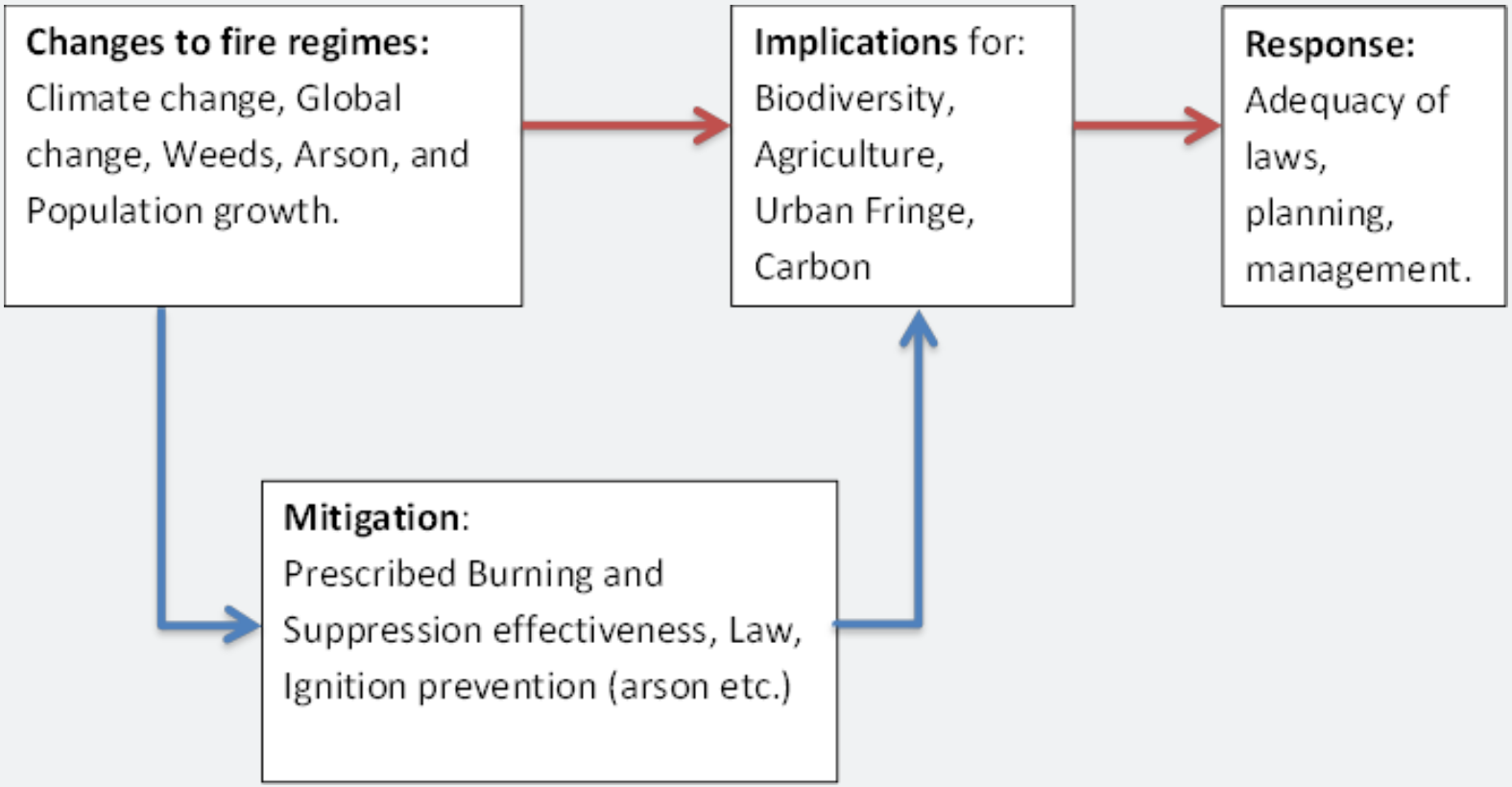
WORKSHOP FRAMEWORK



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WORKSHOP PARTICIPANTS

- Participants from a range of different disciplines:
  - Policy
  - Planning
  - Demographics
  - Fire modeling
  - Law
  - Ecology
  - Criminology
  - Economics
  - Emergency Services Industry
- Develop nation scale prediction of bushfire scenarios for 2050

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WORKSHOP AGENDA

Workshop Agenda

Workshop program (14th & 15th November)

Prior to the workshop:

Prior to the conference, participants will be given a set of background notes outlining the background of future bushfire, the objective of the project, and some suggested points to guide their inputs toward the aims of the project.

Each person would be asked to prepare a report and presentation discussing their field in the context of future bushfire. The suggested format for the report is a 2 page discussion paper with an additional page of references, guided by the background material and suggested topics. This report would then be used by the participant as the basis for a PowerPoint presentation (no longer than 15 minutes), that highlights their key findings and rationale.

14th November:

10:00 -10:30 – Morning tea and welcome (optional)

10:30 -12:30 – Presentations by attendees

12:30 -13:15 – Lunch

13:15 -15:00 – Presentation continued

15:00 -15:30 – Afternoon tea

15:30 -17:00 – Discussions regarding the state of knowledge, challenges and unifying points from presentations

18:30 – Workshop dinner

15th November:

09:00 -10:30 – Discussions regarding the frameworks (adequacy for representing research)

10:30 -11:00 – Morning tea

11:00 -13:30 – Discussion regarding scenario formulation

13:30-14:30 – Lunch

14:30- 15:30 – Discussions regarding writing of fire note and synthesis paper, authorship, journal, and ongoing research collaboration.

15:30- 16:30 - Debrief (Researchers and lead End-users, if available)

Following the workshop:

Follow up attendees who presented ideas of key interest to the project and propose further research collaboration in those areas.

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WORKSHOP PRODUCTS

- Workshop to inform synthesis paper of multiple disciplines outlook for future scenarios
- Fire note to be published by Bushfire CRC

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BEYOND THE WORKSHOP…

- Workshop will contribute to a comprehensive understanding of future scenarios.
- Further research to fill any key knowledge gaps.
- Collaborate with economics to better understand future scenario implications

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ECONOMICS COMPONENT

Helena Clayton and Stephen Dovers

TWO BROAD RESEARCH PHASES:

1. Review of economic contributions to bushfire management and policy
   - *Preliminary outline developed**
2. Evaluation of the implications and response to future bushfire scenarios
   - *Integrated research (with case study application)*
   - *Examples of exploring economic dimensions…*

     --What are the implications of future scenarios for fire management investment priorities?

     --What are community preferences for bushfire risk mitigation under future scenarios?

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SEEKING FEEDBACK FROM END-USERS

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Some questions to start thinking about (handout)

1. What value would a broad-level review of the economics literature hold for you?
2. Where do you feel economics has or can support your fire management program decisions?
3. What are your key management or policy questions and challenges?
4. How do you currently approach questions around investment prioritisation?

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PHASE I: REPORTING ON EARLY PROGRESS

- **Limited but expanding international literature**
  - increasing bushfire activity (under climate change)
  - increasing suppression costs
  - evaluating value of fire prevention
  - expanding urban interface and community expectations
- **A broad-level approach to the review**
  - Where and how economics has and can assist in bushfire management and policy decisions
  - Aims: build sector understanding; contribute to the literature; inform future research

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PRELIMINARY STRUCTURE FOR THE REVIEW

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A:
Resource allocation & prioritisation

1. Benefit-cost analysis

2. Decision-support frameworks

B:
Institutions, incentives & policy

3. Human behaviour & institutions

4. Public Choice Theory

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A: RESOURCE ALLOCATION AND PRIORITISATION

1. BENEFIT-COST ANALYSIS

- Evaluating and comparing program and investment decisions (B>C?)
- What is the management or policy question? (e.g. getting beyond “what are the total/future cost of fires”?)

2. DECISION SUPPORT FRAMEWORKS

- Prioritising investment to meet management objectives
- Integrative and flexible
- Links with CRC project on the economics of prescribed burning (UWA)

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B: INSTITUTIONAL AND POLICY CONSIDERATIONS

3. HUMAN BEHAVIOUR AND INSTITUTIONS

- 'Institutions' as the broader context in which we make decisions
- Understanding people's values, motivations and preferences; and how institutions shape or influence these
- In context:
  - Where people choose to live in the landscape
  - People's willingness to invest in private risk mitigation
  - Volunteering; cooperative and free-riding behaviour
- Is there a role for public or community intervention to meet social goals?
- Links with CRC project on Sharing Responsibility (RMIT)

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4. PUBLIC CHOICE THEORY

- Brings together political science and economics
- Investigates incentives within political and governmental systems
  - Do these support socially optimal (efficient) management decisions?
- In context:
  - Incentives/disincentives created by emergency funding arrangements or public inquiry mechanisms
  - E.g. Incentives/disincentives to account for the full benefits of fire in the landscape or the opportunity costs (tradeoffs) of alternative fire suppression policies or decisions.

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AN EXAMPLE: 'TREE CHANGER' TREND

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RESPONDING TO THE "PROBLEM"

- Ban/restrict through planning laws?
- Prioritisation of risk mitigation?
- Increase suppression effort?
- Non-government responses?

An economic framework:

Issues Considered	Area of Inquiry
Amenity benefits enjoyed	Benefit-cost analysis/Human behaviour
Private acceptance of risk	Benefit-cost analysis/Human behaviour
Public/private benefits of risk mitigation	Decision-support frameworks
Tradeoffs of prioritising public resources	Decision-support frameworks
Unintentional effects of public policy	Human behaviour - Institutional context
Efficiency of the market in mitigating risk	Human behaviour - Institutional context
Political pressure and risk mitigation	Public Choice Theory

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Are you interested in:

…Progress updates on the economics review?

…Providing general or specific feedback and guidance?

…Participating in an economics workshop next year?

- Contact: Helena.Clayton@anu.edu.au

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