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Integrated economic assessment of prescribed burning

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Centre for Environmental Economics and Policy

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Following recent major fires

- Increased emphasis on prescribed burning outside WA

Contribution of economics

- Economic analysis could provide insights into whether, where, how much prescribed burning is advisable
- Doing a worthwhile economic analysis of this is challenging
  - Complexity
  - Data
  - Controversies
- Bushfire CRC approached us requesting that we tackle it

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Aim

To provide an integrated economic assessment of prescribed burning and other fire mitigation strategies

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Case studies

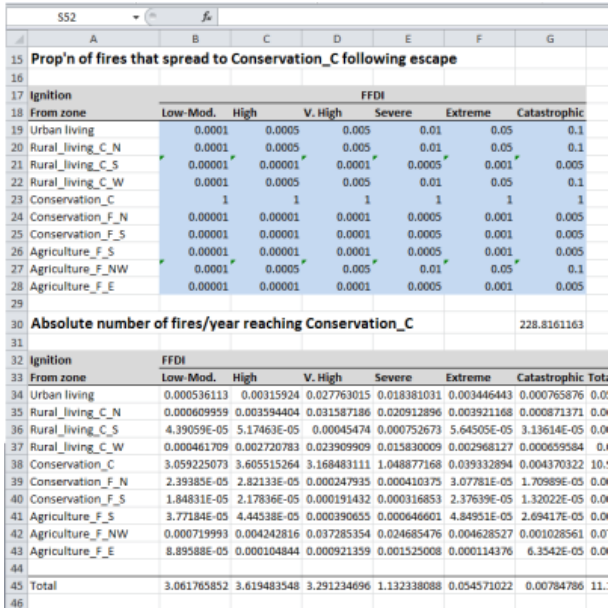
- New Zealand
  - Central Otago
  - A different issue – managing burning by farmers
- South Australia
  - Mount Lofty Ranges
  - Prescribed burning on public lands
  - Very preliminary results

Process 1

- Workshops with stakeholders to clarify the problem and identify data needs
  - ❖ Various agencies and organisations
  - ❖ Helps with mutual understanding amongst participants
  - ❖ Focuses the work on stakeholder priorities

Process 2

- Collect data/info
  - ❖ Define the study region and zones
  - ❖ Asset types and asset values (by zone)
  - ❖ Frequencies of fire weather conditions
  - ❖ Frequency of fires in the landscape
  - ❖ Causes of fires (lightning, the public, escaped PBs)
  - ❖ Fire spread (probabilities, by distance, by weather)
  - ❖ Different levels of fire severity/impact (by zone, by asset type, by weather)
  - ❖ Fire management strategies (prescribed burning)
  - ❖ Effectiveness of fire management strategies (compliance, reduced losses, reduced suppression costs)
  - ❖ Costs of fire management strategies
  - ❖ Regulatory context



S52

	A	B	C	D	E	F	G
15	**Prop'n of fires that spread to Conservation_C following escape**						
16							
17	**Ignition**	**FFDI**					
18	**From zone**	**Low-Mod.**	**High**	**V. High**	**Severe**	**Extreme**	**Catastrophic**
19	Urban living	0.0001	0.0005	0.005	0.01	0.05	0.1
20	Rural_living_C_N	0.0001	0.0005	0.005	0.01	0.05	0.1
21	Rural_living_C_S	0.00001	0.00001	0.0001	0.0005	0.001	0.005
22	Rural_living_C_W	0.0001	0.0005	0.005	0.01	0.05	0.1
23	Conservation_C	1	1	1	1	1	1
24	Conservation_F_N	0.00001	0.00001	0.0001	0.0005	0.001	0.005
25	Conservation_F_S	0.00001	0.00001	0.0001	0.0005	0.001	0.005
26	Agriculture_F_S	0.00001	0.00001	0.0001	0.0005	0.001	0.005
27	Agriculture_F_NW	0.0001	0.0005	0.005	0.01	0.05	0.1
28	Agriculture_F_E	0.00001	0.00001	0.0001	0.0005	0.001	0.005
29							
30	**Absolute number of fires/year reaching Conservation_C**						228.8161163
31							
32	**Ignition**	**FFDI**					
33	**From zone**	**Low-Mod.**	**High**	**V. High**	**Severe**	**Extreme**	**Catastrophic**
34	Urban living	0.000536113	0.00315924	0.027763015	0.018381031	0.003446443	0.000765876
35	Rural_living_C_N	0.000609959	0.003594404	0.031587186	0.020912896	0.003921168	0.000871371
36	Rural_living_C_S	4.39059E-05	5.17463E-05	0.00045474	0.000752673	5.64505E-05	3.13614E-05
37	Rural_living_C_W	0.000461709	0.002720783	0.023909909	0.015830009	0.002968127	0.000659584
38	Conservation_C	3.059225073	3.605515264	3.168483111	1.048877168	0.039332894	0.004370322
39	Conservation_F_N	2.39385E-05	2.82133E-05	0.000247935	0.000410375	3.07781E-05	1.70989E-05
40	Conservation_F_S	1.84831E-05	2.17836E-05	0.000191432	0.000316853	2.37639E-05	1.32022E-05
41	Agriculture_F_S	3.77184E-05	4.44538E-05	0.000390655	0.000646601	4.84951E-05	2.69417E-05
42	Agriculture_F_NW	0.000719993	0.004242816	0.037285354	0.024685476	0.004628527	0.001028561
43	Agriculture_F_E	8.89588E-05	0.000104844	0.000921359	0.001525008	0.000114376	6.3542E-05
44							
45	Total	3.061765852	3.619483548	3.291234696	1.132338088	0.054571022	0.00784786
46							

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Process 3

- Data
  - Use best available
  - Inevitably, there are many gaps
  - Often, where there is data, it isn't directly useable – has to be interpreted, massaged, patched
- Sources
  - Official statistics and databases
  - Published information
  - Fire modelling
  - Scientist opinion
  - Agencies
  - Landholders

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Process 4

- Develop integrated model
  - ❖ Lots of to-ing and fro-ing with stakeholders about data/assumptions
- Preliminary results
- Feedback & requests from stakeholders
- Modify model
- Final results/report

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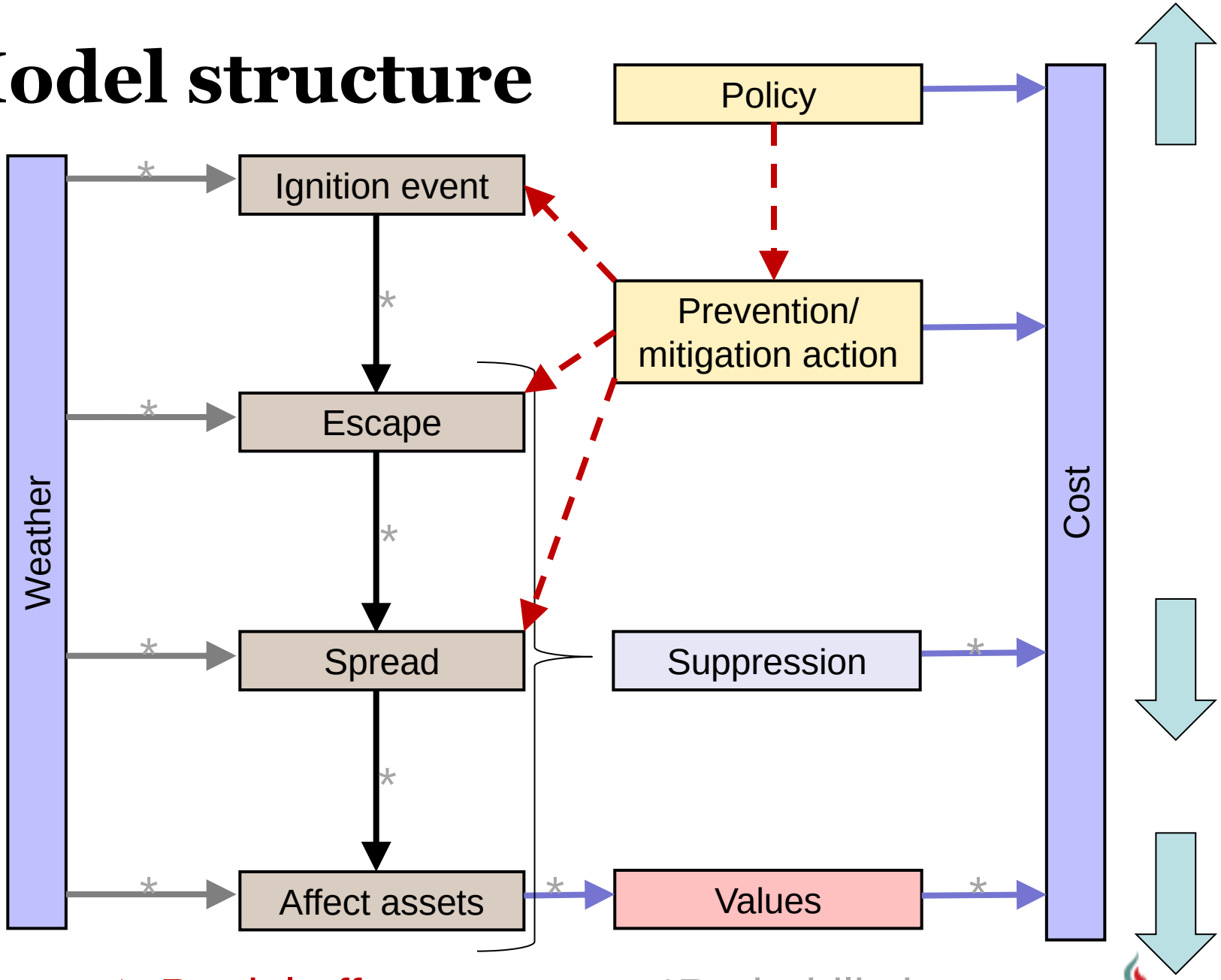
The decision model

What it does

- Represents a range of potential management/ policy regimes (chosen by stakeholders)
- Evaluates whether they are better or worse than the status quo
  - ❖ Are the additional benefits of the new regime greater than the additional costs?
- It deals with all the elements, but each individual element is handled quite simply

Model structure



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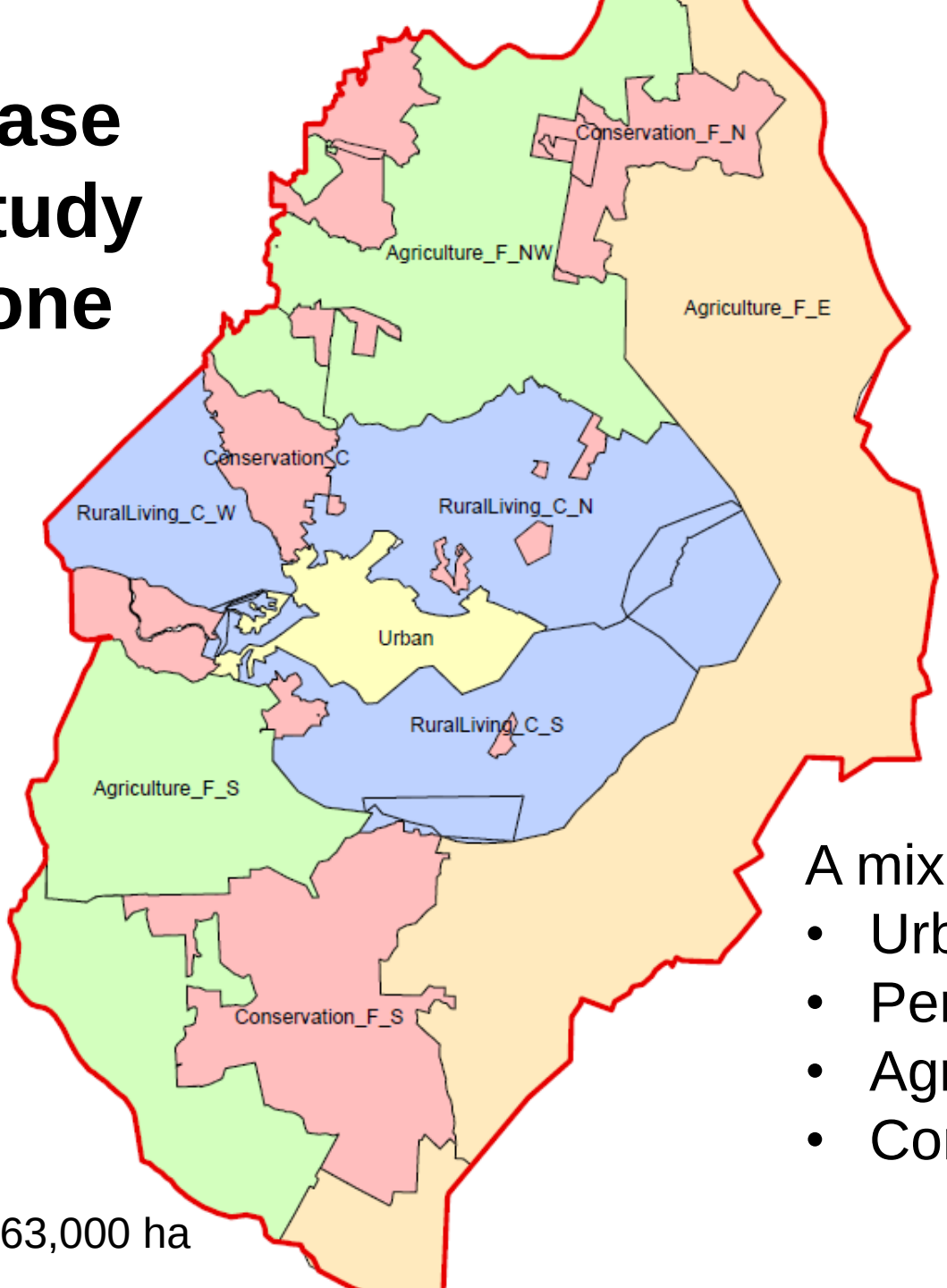
Salisbury
Adelaide
Parafield Airport
Kersbrook
Mount
Pleasant
A20
B10
Gumeracha
Birdwood
A16
A10
A11
Mount
Torrens
A17
Lobethal
Adelaide
Adelaide
Intl Airport
Unley
Burnside
Woodside
A3
Glenelg
Balhannah
Blackwood
M1
Marino
Nairne
Mylor
South Eastern Fwy
A15
Mount Barker
M2
Clarendon
Callington
Warla
Port Noarlunga
Kangarilla
Meadows
Macclesfield
A13
McLaren Vale
Woodchester
Hartley

Case study zone



A mix of

- Urban
- Peri-urban/lifestyle
- Agriculture
- Conservation/public land

Area: 63,000 ha

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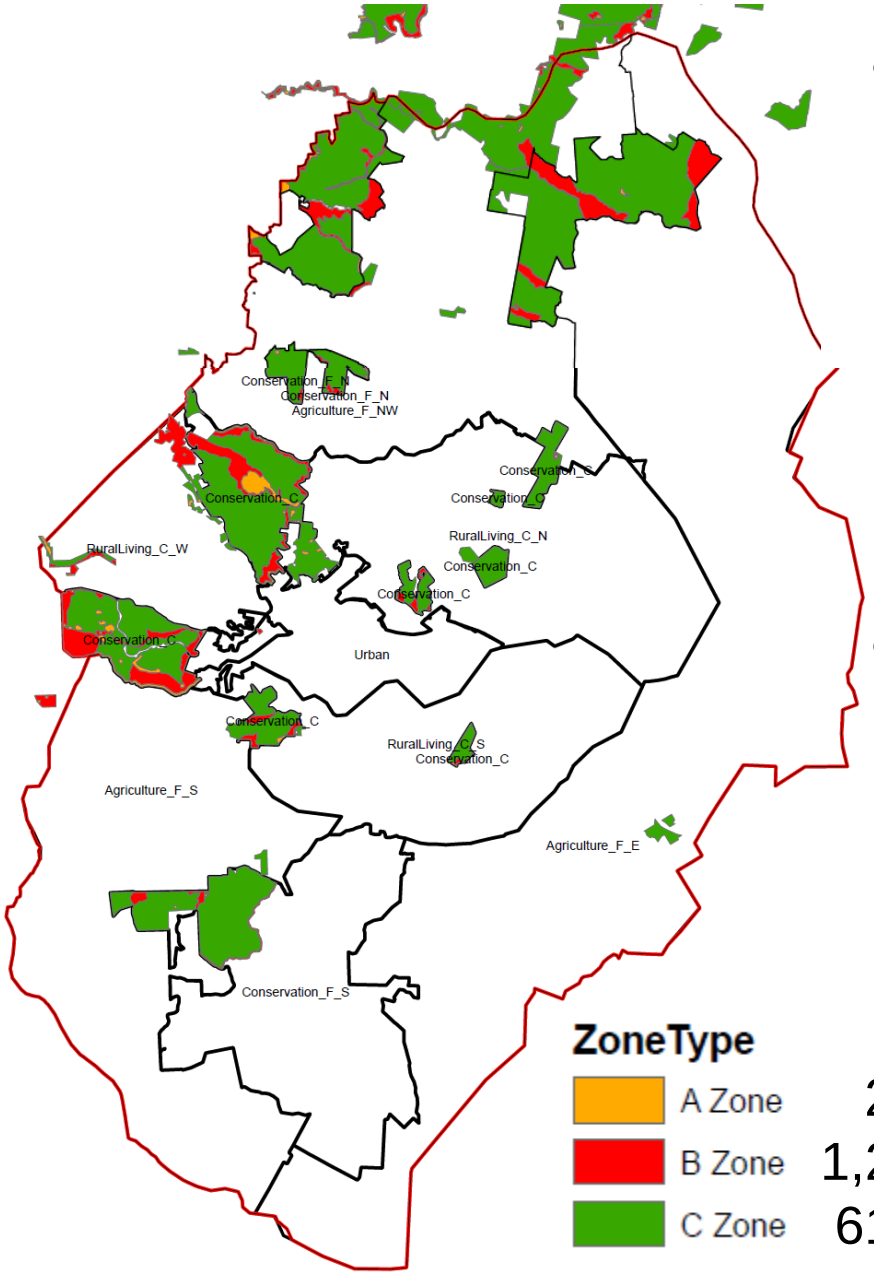

- Prescribed burning strategies (over 10 years)
  - 5% of A+B each year
  - 10% of A+B each year
  - 5% of A+B+C each year
  - 10% of A+B+C each year
- Base case/benchmark
  - No prescribed burning

A Zone	217 ha
B Zone	1,200 ha
C Zone	6100 ha

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Unpacking results

- One strategy (burn 10% of A+B+C each year)
- In one zone (Conservation_C)
  - ❖ Could be in any of the public-land zones
- Benefits in one other zone (Urban)
  - ❖ Benefits occur in multiple zones

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Base case

- 175 fires in Conservation_C from 1997-2013 (11 per year)
- Given historic frequencies, each year, expect …

FFDI	Days	Fires on FFDI days	Proportion that spread to Urban
Low-moderate	255	3.1	0.0001
High	66	3.6	0.0005
Very high	37	3.2	0.005
Severe	7	1.0	0.01
Extreme	0.6	0.04	0.05
Catastrophic	0.14	0.004	0.25

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Base case

- Impacts – Urban zone

Fire conse-quence	Frequency	Property loss (%/fire)	Property loss ($/year)	Suppres'n cost ($/fire)	Suppres'n cost ($/year)
Insignificant	17.8	0%	$0m	$0.5K	$9K
Minor	1.4	0.01%	$0.1m	$2K	$3K
Moderate	0.12	0.1%	$0.1m	$10K	$1K
Major	0.02	5%	$1.1m	$1m	$22K
Critical	0.01	20%	$2.4m	$5m	$60K

- High costs, but only a very small fraction of these fires come from the Conservation_C zone

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What difference does PB make?

- … in Urban zone due to PB in Cons+_C zone
- Reduction of around 0.03 fires per year (one per 30 years)
  - ❖ Most of those would be Insignificant or Minor
  - ❖ Tiny reduction in Major or Critical fires
- Reduced losses + reduced suppression costs = $7,500 per year

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The Benefit: Cost result

- Prescribed burning in Conservation_C zone

Benefits	Costs
Reduction in losses (all zones) $51K	Admin: $867/ha burnt x 251 ha = $218K
Reduction in suppression costs (all zones) $3K	Operations: $1652/ha burnt × 251 ha = $415K
Total benefits $54K	**Total costs $632K**
Benefit: Cost Ratio: 0.09	

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Results for various strategies

- Benefit: Cost Ratios

	Conservation _C zone	Conservation _F_N zone	Conservation _F_S zone	All three cons. zones
5% of A+B each year	0.3	0.1	0.09	0.2
10% of A+B each year	0.2	0.09	0.07	0.1
5% of A+B+C each year	0.1	0.03	0.01	0.05
10% of A+B+C each year	0.08	0.02	0.008	0.03

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Conclusions

- Prescribed burning far from assets generates only small benefits
- Catastrophic fires are far more likely to spread, but there are far fewer of them
- The big costs are from catastrophic fires, but PB makes little difference to them
- Results are consistent with the NZ study – strategies closer to assets had better BCRs

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A few observations

- This has been a pilot, to test the approach
- It's been harder to get the required information than expected
  - ❖ Past decisions about data had not been focused on evaluating value for money from management options
- We have clearly documented what's needed
- Even with the data challenges, results are proving useful

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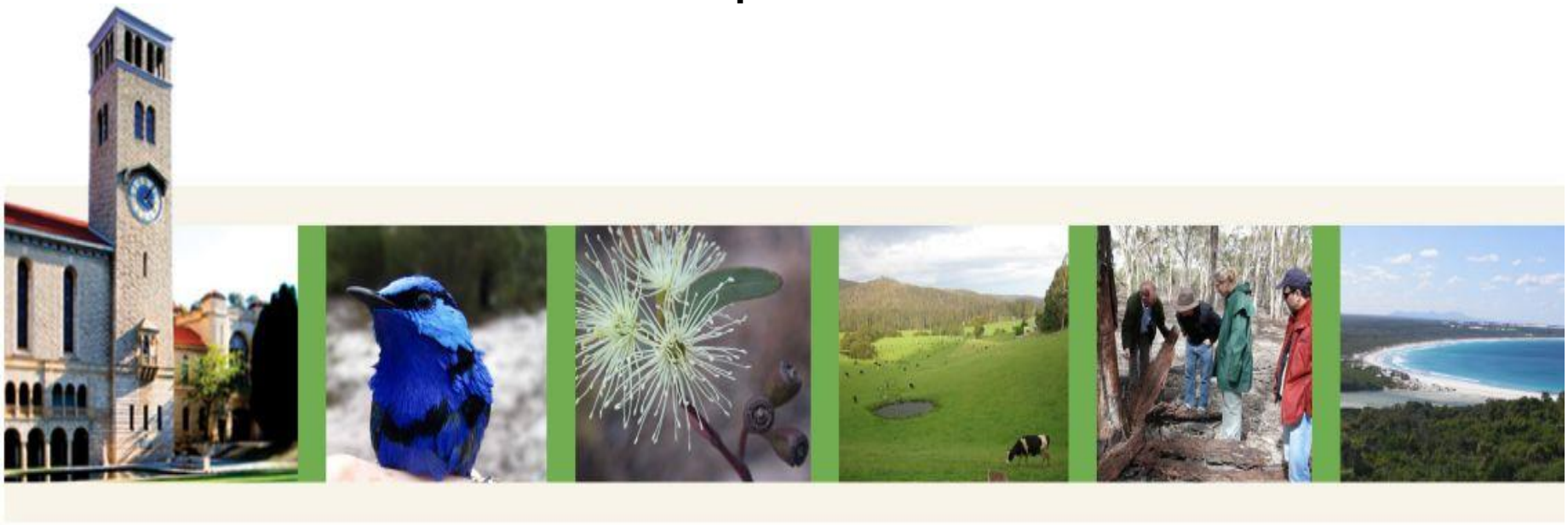

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