Economic Analysis of Bushfire Management Programs: A Western Australian Perspective

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Outline

Why apply economics to fire management?
Bushfire economics literature
Economic model
Application to a synthetic landscape

Results

Conclusion
Why apply economics to fire management

Why economics?

What are the implications of different uses of limited human and financial resources?

How do we maximise social welfare?

Why economics?

What proportion of our efforts should be allocated to different fire management activities?
The bushfire economics literature

Bushfire economics

Resource allocation

- Pre-fire stage (pre-suppression)
- During fire (suppression)
- Post-fire (damages)
United States

Australia

Spain

Chile

Bushfire economics

- Costs of prescribed burning ($/ha)
- Costs of other fuel reduction treatments
- Cost effectiveness of prescribed
- Resource allocation for different fire-fighting equipment
- Use of new technologies
- Effect of the wildland-urban
- Costs of bushfires (financial)
- Costs of bushfires (intangibles)
- Compare costs of bushfires with costs of other natural disasters
Bushfire economics

Pre-suppression
Suppression
Damages

C+NVC

Resource allocation for all fire management activities

The economic model

The Cost plus Net Value Change
The economic model

The Cost plus Net Value Change

Cost-benefit analysis

The most efficient level of pre-suppression effort

Minimise sum of costs plus net damages

For a given year
Application to a synthetic landscape

Application of the Cost plus Net Value Change to a synthetic landscape

100,000 ha
Application to a synthetic landscape

Size of treatment areas

- 4,000 ha
- 500 ha
- 50 ha
Application to a synthetic landscape

Rotation cycles

- Every 20 years
- Every 10 years
- Every 5 years
- Fuel age uniformly set at 15 years across the entire landscape

Weather conditions

- High
- Very high
- Extreme
- Catastrophic
### Application to a synthetic landscape

<table>
<thead>
<tr>
<th>Size of treatment areas</th>
<th>Rotation cycles</th>
<th>Weather conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,000 ha</td>
<td>20 years</td>
<td>High</td>
</tr>
<tr>
<td>500 ha</td>
<td>10 years</td>
<td>Very high</td>
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<td>Extreme</td>
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<td>Fuel age uniformly set at 15 years</td>
<td>Catastrophic</td>
</tr>
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</table>

3 sizes treatment area × 3 rotation cycles = 9 combinations 
(9 + 1 uniform fuel age) x 4 weather conditions = 40 scenarios

### Application to a synthetic landscape

**AUSTRALIS Wildfire Simulator**

Rate of spread of fires:  
“McArthur Mk V” forest fire meter

Fuel load as a function of fuel age:  
Fuel accumulation table for Jarrah forest  
(Sneeuwjagt and Peet, 1998)
Application to a synthetic landscape

40 scenarios x 30 random ignitions: 1,200 simulations

Application to a synthetic landscape

Timber
Ecological
Recreational
Urban
Results

Prescribed burning costs  Damages  Suppression costs  Costs plus losses
Sensitivity Analysis

50% reduction in prescribed burning costs

- Prescribed burning costs
- Suppression costs
- Prescribed burning costs (base)
- Damages
- Costs plus losses

Percentage area prescribe-burned vs Dollars

0% 5% 10% 15% 20% 25%

0 250,000 500,000 750,000 1,000,000 1,250,000 1,500,000 1,750,000 2,000,000
50% increase in prescribed burning costs

Sensitivity analysis

<table>
<thead>
<tr>
<th>50% reduction</th>
<th>50% increase</th>
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<tr>
<td>Suppression costs</td>
<td></td>
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<tr>
<td>Urban area value ($/ha)</td>
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<tr>
<td>Probabilities type of fire occurrence</td>
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<td>Prescribed burning costs ($/ha)</td>
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Minimum of the cost plus losses curve in AU dollars

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Sensitivity analysis

<table>
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<tr>
<th>Most efficient prescribed burning strategy (% of landscape prescribed burned)</th>
<th>Initial estimation</th>
<th>50% reduction</th>
<th>50% increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescribed burning costs ($/ha)</td>
<td>5%</td>
<td>&gt;5% and &lt;10%</td>
<td>0%</td>
</tr>
<tr>
<td>Probabilities type of fire occurrence</td>
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Conclusion

Integration of all fire management activities

Decisions for optimal levels of different strategies

Implications of changing a prescribed-burning strategy

Factors that most affect the results
Next step

Application to a real landscape in the Forest regions of the south-west of WA

- Risk
- Long-run dynamics

Thank you!

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**Multi-period cost plus net value change**

Period one

Period two

**Fire management: a dynamic problem**

- Pre-fire stage
- During fire
- Post-fire