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Reducing fire risk to Naseby

An integrated economic assessment of management actions

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bushfire CRC

Background

- Many policies used to reduce fire risk to life and property
  - ❖ Education campaigns
  - ❖ Regulation
  - ❖ Prescribed burning

- All deliver different risk reductions, all cost money

- How can decision makers pick the strategy that's the best value for money?

www.bushfirecrc.com/education

Case study: New Zealand

- Workshops in November 2011 and May 2012 in Central Otago to define the decision problem

- Participants: farmers, NRFA, DOC, councils, scientists

- Agreement on a case study site

Case study: Naseby

- Naseby is a small town in Central Otago, New Zealand

  - ❖ 100 permanent residents
  - ❖ Large tourist population

- High fire risk

  - ❖ Surrounded by a forest
  - ❖ Town characterised by large trees and overgrown vegetation

- Variety of land uses and management

  - ❖ Conservation
  - ❖ Farming and forestry
  - ❖ Urban and recreation

Modelling approach

- Decision support model

- Assess the cost-effectiveness of strategies to reduce fire risk to Naseby town and forest

- Accounts for different aspects in calculating a Benefit Cost Ratio (BCR) of various strategies:

  ❖ Probabilities of fire escapes and spread, in different weather conditions
  ❖ Benefits as avoided loss of assets
  ❖ Costs of the management regime
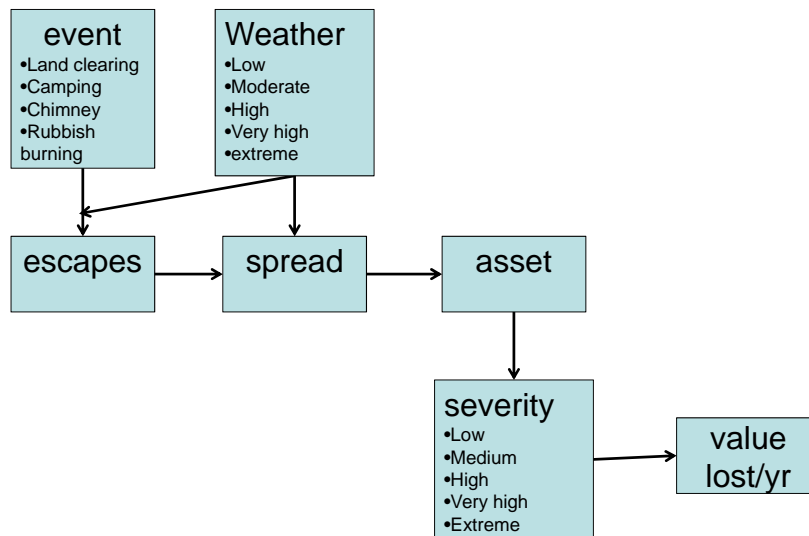 ❖ Behaviour change and strategy risk

Some terms used

- Escapes: the number of ignited fires that requires a fire crew for their control. These fires are officially reported fire incidents.

- Spread: movement of an escaped fire beyond the zone it started in, towards the assets of concern.

- Severity: the level of damage to the assets caused by an escaped fire.

Current fire risk and expected loss

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┌─────────────┐  ┌─────────────┐
│ event       │  │ Weather     │
│ •Land clearing│ •Low        │
│ •Camping    │  │ •Moderate   │
│ •Chimney    │  │ •High       │
│ •Rubbish    │  │ •Very high  │
│ burning     │  │ •extreme    │
└─────────────┘  └─────────────┘
       │   ↘         │
       ↓     ↘       ↓
┌─────────┐  ┌─────────┐  ┌─────────┐
│ escapes │→ │ spread  │→ │ asset   │
└─────────┘  └─────────┘  └─────────┘
                              │
                              ↓
                         ┌─────────────┐  ┌─────────┐
                         │ severity    │  │ value   │
                         │ •Low        │→ │ lost/yr │
                         │ •Medium     │  └─────────┘
                         │ •High       │
                         │ •Very high  │
                         │ •Extreme    │
                         └─────────────┘
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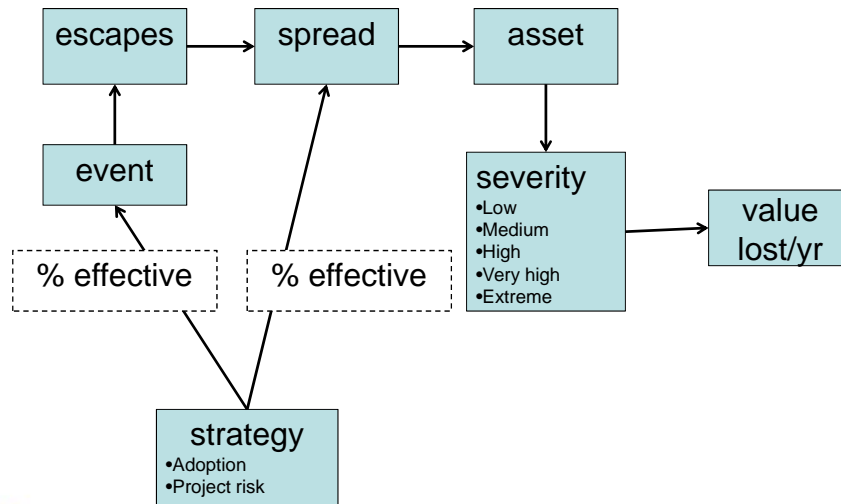
Management and policy strategies

- Current: Regulation and suppression

- Model tested strategies came from the workshops

- Preventative strategies not currently in place

    ❖ Stricter regulation and payments for management
    ❖ Education and training
    ❖ On-ground support
    ❖ Fire breaks
    ❖ Prescribed burning
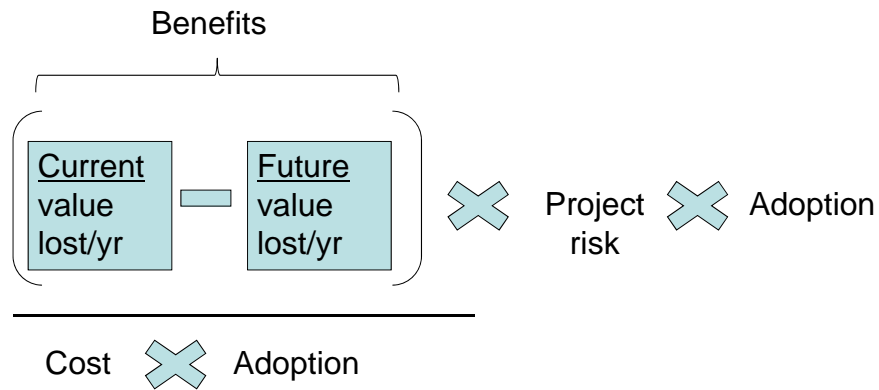
Future fire risk and expected loss

Benefit: Cost Ratio

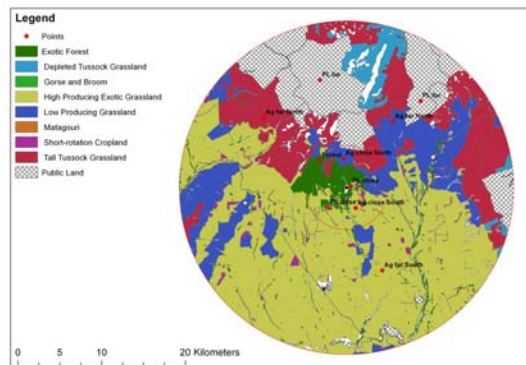- Evaluates whether the new strategies are better or worse than the status quo

- If BCR > 1, then the additional benefits of the new strategy are greater than the additional costs ⇨ new strategy is better than the status quo

Benefit: Cost Ratio

Benefits

Current value lost/yr — Future value lost/yr ✕ Project risk ✕ Adoption

———————————————

Cost ✕ Adoption

Information

- Complex problems are data intensive

- Data drawn from a variety of sources: use the best available

- Quality is variable

Legend
- Points
- Exotic Forest
- Depleted Tussock Grassland
- Gorse and Broom
- High Producing Exotic Grassland
- Low Producing Grassland
- Matagouri
- Short-rotation Cropland
- Tall Tussock Grassland
- Public Land

0   5   10   20 Kilometers

Vegetation type within a 20 km boundary surrounding Naseby

Selected results

Current loss per year

Town	

Fire Severity	Number of fires/year	Loss/year
Low	1.41	$38,810
Medium	0.21	$28,686
High	0.05	$33,102
Very high	0.02	$191,649
Extreme	0.01	$947,971
Total	1.71	$1,240,217

Forest	

Fire Severity	Number of fires/year	Loss/year
Low	0.16	$7,382
Medium	0.08	$18,194
High	0.02	$29,548
Very high	0.01	$60,969
Extreme	0.00	$40,039
Total	0.26	$156,131

Town: community education

- Escape effectiveness = 50%

- Adoption = 50%

- Project risk = 20%

- Benefit = $439,000/yr

- Cost = $20,000/yr

- Benefit: Cost Ratio = 17.57

Town: regulation

- Escape effectiveness = 90%

- Project risk = 10%

- Compliance = 90%

- Benefit = $791,000/yr

- Cost = $201,000/yr

- Benefit: Cost Ratio = 3.54

Forest: fire breaks

- Spread effectiveness = 96 – 62%

- Adoption = 100%

- Project risk = 10%

- 10 metre
  - ❖ Benefit = $77,000/yr
  - ❖ Cost (annualised) = $12,000/yr
  - ❖ Benefit: Cost Ratio = 5.61

Agricultural: payments

- Escape effectiveness = 90%

- Payments = $200/ha for land area burnt per year

- Adoption = 80%

- Project risk = 19%

- Benefit = $17,000/yr

- Cost = $4,220,000/yr

- Benefit: Cost Ratio = 0.0015

Agricultural: regulation

- Escape effectiveness = 90%

- Compliance = $200/ha for land area burnt per year

- Adoption = 90%

- Project risk = 36%

- Benefit = $17,000/yr

- Cost = $4,580,000/yr

- Benefit: Cost Ratio = 0.001

Why is the BCR so low?

- Costs of practices are high (~$4m)

- 75 fires over 14.5 years in agricultural zone (5/yr)

- Fire risk reduces with distance from Naseby

- Strategy only controls the proportion of fires from agricultural burning (40%)

- How many fires start by farmers in the agricultural region and reach Naseby each year? 0.0073 (1 in 136 years)

Agricultural: training program

- Escape effectiveness = 80%

- Adoption = 65%

- Project risk = 10%

- Close and distant zones
    - ❖ Benefit = $15,000/yr
    - ❖ Cost = $6,000/yr
    - ❖ Benefit: Cost Ratio = 2.33

Sensitivity analysis

- Provides guidance to which parameters affect BCRs the most

- Process helps identify knowledge gaps

- Tested escapes and spread effectiveness of strategies

- Results are robust to large changes in these key parameters

Key findings

- Cost-effective to focus management close to the asset (within the town and forest)

- Payments and regulation have low BCRs as farmers bear high opportunity or compliance cost

- Low cost strategies were more likely to be cost-effective

- Findings are robust to variation in key parameters

- Process highlighted information gaps

Thanks for listening

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