Asset protection, fire weather and risk

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Major bushfire events in Australia that have caused house loss

Number of houses destroyed in Australia between 1939 and 2005

- NSW 1997: Loss: 123, FFDI: >120
- TAS 1967: Loss: 1400, FFDI: 105
- VIC SA 1983: Loss: 1500, FFDI: 102
- NSW 1994: Loss: 121, FFDI: 96
- ACT 2003: Loss: 50, FFDI: 103
- NSW 2001: Loss: 121, FFDI: 80
Times burned in 9 years

Number of houses destroyed 1939-2009, CSIRO Database
(Fatalities 1900-2009, Katharine Haynes Data)
Understand risk at the urban interface

House Impact

Urban Design

Building design (structure and material)

Human behavior (before, during and after the fire)

Environmental conditions

Hazard - arrival event

Forest (different characteristics)

Mechanisms of bushfire attack
Direct flame, radiant heat, embers
Bushfire impact on the urban interface over the past seven decades has taught us many lessons.

The general principles of how bushfires impact on the urban interface are now well established.

However we still lack the formal quantification of the most critical aspects of urban interface risk prediction.

The recent ACT bushfires stand as a reminder that previous urban impacts events do not represent the worst case scenarios for many aspects of the fire event.
Specific urban edge example

Photo: ESB ACT.
Observations: Malcolm Gill
Stage two - fire spread due to urban elements

Photo: ESB ACT
Quantifying house to house spread

Radiation emitted from house

Graph showing radiation levels from different distances.
First recorded bushfire event
About the research conducted on material performance in house we have assessed glazing system design. Plain, toughened and laminated glass have been tested with various aluminum and timber frame. The results provide the necessary information to assist occupant to make appropriate cost-effective solution (that's mean different solution of glazing for different level of bushfire exposure).

Other work in progress deal with effective timber deck design solutions to minimise ignition by embers attack. And assessing the viability of using external water spray systems as a risk minimisation strategy for buildings.

In the future we will assess the performance of roof system and study the behaviour of domestic gas bottle.
Urban interface Vulnerability Modeling

1. **Embers entry thru gaps**
   a) Ember attack: density and duration (type material, wind, distance)
   b) Ember entry function gaps, material and type of object

2. **Radiant heat exposure on window**
   a) Radiant heat attack: view factor, distance, temperature, ...
   b) Critical level cause failure
Designing urban environment in Google SketchUp

Defining objects
Designing urban environment - setting scenario

Terrain from Google earth
Designing urban environment - setting scenario

Ground cover
Designing urban environment - setting scenario
House from library (built from components)
Designing urban environment - setting scenario

Surrounding object - Fence
Designing urban environment - setting scenario
Surrounding object – Water tank
Designing urban environment - setting scenario
Surrounding object – Garden vegetation
Designing urban environment - setting scenario
Surrounding object – Tree
Designing urban environment - setting scenario

Forest
Vulnerability analysis - defining exposure - Radiant heat

Ray Analysis
Vulnerability analysis - defining exposure - Radiant heat

View from target point
Vulnerability analysis - defining exposure - Radiant heat

Fire front 200m away
Vulnerability analysis - defining exposure - Radiant heat

Fire front
Vulnerability analysis - defining exposure - Radiant heat

Fire front 160m from house
Vulnerability analysis - defining exposure - Radiant heat
Fire front 130m from house
Vulnerability analysis - Run time application
Thank you

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