PERIL: Toolkit for the design of wildfire trigger buffers in WUI evacuations

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EWWF 2019, Cardiff
• Wildfires impact millions of people annually
• When is a safe time to call for an evacuation?
Evacuation timescale

- Available safe evacuation time
- Required safe evacuation time

![Diagram](image)

- Origin
- Available time
- Required time
- Population evacuated
- Fire intersects populated area
- Urban Population
- Egress Route

$t$
Wildfire Modelling

Semi-Empirical Model

GIS Datasets

Rothermel Model

Huygens' Principle

Spread Rate = f(slope, wind, fuel)

Finney. FARSITE, 2004
Wildfire Test Scenarios

Homogeneous

Fuel Quadrant

Wind

Valley

Heterogeneous
Methodology

• Single wildfire spread scenario run in FARSITE
• Direction and rate of fire spread taken from FARSITE
• Calculate travel times between adjacent GIS cells
Methodology

- Travel time network
- Shortest Path algorithm
- is shortest travel time $< t_{tb}$?
Application to Test Scenarios
Swinley Forest : Wildfire Case Study

• Largest wildfire recorded in Berkshire, UK

• Caused evacuation of 13 residences

• 165 Ha burnt

• Calibrated wildfire model (Smith, 2015)

Summary: UK, Small wildfire, well studied & modelled
Swinley Forest : Wildfire Case Study

Key
A – Populated Region, Crowthorne
B – Research Laboratory
C – Broadmoor Hospital
D – Pub, The Golden Retriever
E - Populated Region, Easthampstead

At-Risk Region
Swinley Fire Model

- Multiple fire scenarios
  - Prometheus fire model
  - Fuel/Topography/Wind

- Perfect/Failed Fire Breaks

- Safety factor

Key
A – Populated Region, Crowthorne
B - Populated Region, Easthampstead

Potential Modelled Burnt Region
- Perfect Firebreaks
- Failed Firebreaks

Land Types
- Urban and Lawn
- Heathland
- Conifer Forest
- Major Roadways

Smith. Swinley, 2015
Evacuation Model Coupling

1. Modify fire scenario

2. Run fire scenarios with NESW Wind

3. Population at risk?
   - Yes: Identify most significant fire scenario
   - No: Modify fire scenario

4. Evacuation model, WASET = ∞

5. Run PERIL

6. Generate Trigger Buffer Perimeter

7. Evacuation model WASET, defined by PERIL trigger buffers

8. Fire affect evacuation?
   - Yes: Update WRSET
   - No: PERIL complete, coupling completed

9. Generate Trigger Buffer Perimeter

10. Run PERIL
Summary

• PERIL developed (Population Evacuation Trigger algorithm).
• Tested using simplified fire scenarios.
• Applied to UK case study (Swinley Forest, 2011) to develop unique trigger buffer perimeters.
• Development of iterative coupling with Evacuation models
• PERIL has potential to be applied worldwide to inform WUI wildfire strategies.
Thank you for listening!
Roxborough—Evacuation case study

• Colorado, USA
• Evacuation drill ran to determine community evacuation behaviour and required evacuation time

Summary: USA, large WUI community, evacuation drill
Roxborough—Evacuation case study

- Trigger buffer generated for populated region B using required evacuation time from evacuation drill.