Wildfire risk and treatment effectiveness of protecting highly valued resources and assets with fuels management

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Project Goals

SCIENCE

- Expand the knowledge base regarding risk-based assessment of fuel treatment effectiveness
- Better establish linkages at the nexus of fuel treatment planning, suppression response planning, and wildfire incident decision making

DELIVERY

- Yield significant improvements in:
  - How fuel treatments are designed and implemented
  - How incident managers understand and respond to wildfire-treatment interactions
Motivation

Risk-Based Decision Support

WFDSS: Wildland Fire Decision Support System

Zaca Fire, CA
4 August 2007 - July 31, 2007

Major Values-at-Risk per FSPro Fire Spread Probabilities
14 days as of 3 August 2007

FSPro Fire Spread Probability
- 1%
- 4 - 15%
- 16 - 30%
- 31 - 50%
- 51 - 80%
- > 80%

FSPro Spread Barriers
- Wildfire Threats
- Building Densities: Vertical Co
- Hazardous Materials: Santa Barbara Co
- Water: Dams & Reservoirs
- Water Supply: Well
- Water Treatment Plants
- Water Pumps - Impound - Canal
- Powerlines
- Industrial Plants
- Power Plants
- Communication Towers
- Oil & Gas Transmission Lines
- Airports
- Commercial Activity
- Police Stations
- Hospitals
- Fire Stations
- Schools
- Military
- Hazardous Materials
- Others

Jurisdiction
- Private
- State
- BLM
- DOI
- National Forest
- Designated Wilderness
- Other Jurisdictions
- Building Clusters: Santa Barbara Co

*Building Clusters represent the center of parcels where major values are located. Mid-1990s values indicate significant improvements as present. One or more structures and/other improvements may exist proximate to these point locations.

CAUTION Refer to all photos or local knowledge for exact structure and other feature locations.

FSPro RAVAR: Rapid Assessment of Values-at-Risk

SAN LUIS OBISPO COUNTY

KERN COUNTY

SANTA BARBARA COUNTY

VENTURA COUNTY

City of Santa Barbara
City of Carpinteria

PACIFIC OCEAN

1:120,000 0 5 10 15 20 Miles
Risk-informed fuels management

- How do fuel treatments:
  - affect spatial patterns of wildfire likelihood and intensity?
  - affect the exposure of highly valued resources and assets (HVRAs) to risk factors?
  - affect the response of HVRAs to wildfire?
How does fuel treatment effectiveness vary with:

- Geographic characteristics
- Treatment type & age
- Fire weather conditions
- Spatiotemporal wildfire-treatment interactions
- Suppression operations
Basic Approach

- Earth Observation data
  - Landsat: burn severity & fuels
  - MODIS: active fire detection & progression maps

- Stochastic wildfire simulation

- Geospatial analysis

- Exposure & risk assessment
E.O. Data >> Treatment Effects

ON-SITE: SEVERITY

OFF-SITE: PROBABILITY & INTENSITY

Wimberley et al. 2009
Fuel Treatments & Exposure
How do treatments of varying types and ages affect burn severity?

How sensitive are fuel treatment impacts on fire size to different wind speeds?
Results: HVRA Exposure

Prevented Spread

Promoted Spread
Results: Suppression Actions

Las Conchas Fire Burn Probability Analysis

- Ignition Point
- Valle II Fuels Project
- Chochita Mesa Fuels Project
- 2010 South Fork Fire
- 2000 Cerro Grande Fire
- 1998 Oso Fire
- 1996 Dome Fire

>10 year old Treatments
- Activity Fuels Broadcast Burn
- Natural Fuels Broadcast Burn
- Precommercial thinning - individual or selected trees
- Las Conchas Perimeter

Legend:
- Created Dozer Line
- Completed Line
- Hand Line
- Uncontrolled Fire Edge
- July 5 Perimeter

Treatments Promoted Fire Spread
- 0 - 50 ('+')

Treatments Prevented Fire Spread
- 0 - 80 ('+')

Legend:
- Completed Dozer Line
- Completed Line
- Hand Line
- Uncontrolled Fire Edge
- July 5 Perimeter
Expanding analysis of treatment effectiveness
- HVRA response to fire and avoided losses
- Temporal dynamics; windows of suppression opportunity
- Suppression effectiveness and safety
- Incident decision making
Planned deliverables

- Treatment Design
- Treatment Evaluation
- Treatment Decision Process
<table>
<thead>
<tr>
<th>Motivation</th>
<th>Restoration</th>
<th>Protection</th>
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<th>Restoration</th>
<th>Protection</th>
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</thead>
<tbody>
<tr>
<td>Fire regime</td>
<td>Low severity (+ fire)</td>
<td>Mixed severity (+/- fire)</td>
<td>Mixed severity (+/- fire)</td>
<td>High severity (- fire)</td>
<td>High severity (- fire)</td>
<td>High severity (- fire)</td>
</tr>
<tr>
<td>Pattern of values</td>
<td>Dispersed (large trees)</td>
<td>Dispersed and prevalent (low density WUI, T&amp;E)</td>
<td>One clump</td>
<td>Clumpy</td>
<td>Any</td>
<td>Low or none</td>
</tr>
<tr>
<td>Treatment Strategy</td>
<td>Create large contiguous areas of low hazard (minimum treatment for maximum area)</td>
<td>Strategic (SPLATs/SPOTs)</td>
<td>Localized protection (targeted treatments)</td>
<td>Localized protection (targeted treatments)</td>
<td>Restore natural fire barriers</td>
<td>Defensible fuel breaks along roads and other barriers</td>
</tr>
<tr>
<td>Treatment system</td>
<td>Low hazard fire containers</td>
<td>Treatment optimization model (FlamMap; TOM)</td>
<td>Defensible fuel breaks</td>
<td>Defensible fuel breaks</td>
<td>Strategic restoration</td>
<td>High hazard fire containers</td>
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<td>Spatial treatment pattern</td>
<td><img src="image1.png" alt="Image" /></td>
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