Integrated fuels management

Program overview and Synthesis

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Integrated fuels management

- Wildland Fire and Fuels Research and Development Strategic Plan. “Portfolio D. Integrated Fire and Fuels

  “Providing a suite of approaches and techniques from which managers can select the most appropriate means for meeting their objectives requires integrated understanding and modeling, [of fire and fuels] at landscape, regional, national, and international scales”
Context for integrated fuel research

• Primary focus is supporting federal agency hazardous fuel management programs
  • Reducing hazardous fuels to restore ecological conditions and human values
  • $200 – $300 million annual expenditures
  • > 2,000,000 acres treated per year
  • Part of an integrated wildfire risk management strategy.
Integrated fuels management

- Ecological restoration
- Economics
- Monitoring and performance
- Conservation biology
- Silviculture
- Decision support tools and models
Fuels research is an integral part to USFS initiatives

- Accelerated restoration
- Forest plan revisions
- Collaborative planning
- FLAME Act and Cohesive Strategy
  - (Federal Land Assistance, Management and Enhancement Act or FLAME Act)
Diversity of fire regimes
Diversity of ecological values

Fire adapted  Fire resilient  Fire intolerant
Diversity of fuel management objectives
Diversity of fuel management strategies

- Fire resilient landscapes
- Fire adapted communities
- Wildfire response

Restoration | Protection | Containment

- Low hazard fire containers
- Strategic Restoration of natural fuel breaks
- Focused defensible fuel breaks
- Dispersed fuel breaks
- Treatment optimization model
- High hazard fire containers

Landscape treatment strategies (Black polygons represent treatment units)
Fuel management research is conducted before, during, and after wildfires

<table>
<thead>
<tr>
<th>Approach and system</th>
<th>Preparing for fire - fuels management</th>
<th>Responding to fire</th>
<th>Recovering from wildfires</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Wildfire simulation modeling</td>
<td>• Landscape planning</td>
<td>Active fire behavior observations in treated areas</td>
<td>Assessment of wildfire intensity and spread patterns around known treatments</td>
</tr>
<tr>
<td>• Field studies on ecological impacts and treatment effectiveness</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Key challenge for fuel management research

- Wildfire events are highly stochastic
- Difficult to test effectiveness of fuel management
- Difficult to prioritize investments within and among national forests
- Where is the risk?
Fire simulation models

– FlamMap
– Fsim
– FSPPro
– Farsite
Consistent definition of risk

Wildfire risk = probability of a fire of a specific intensity x the loss at that intensity

“expected loss”

Let... \( p(f_i) = \) Probability of burning at intensity level \( i \)

\( R(f_i) = \) Response for intensity \( i \)

\( E(L) = \) Expected loss

\[
E(L) = \sum_i p(f_i) \times R(f_i)
\]

We sum over \( i \) because fire can arrive at many intensities at a particular location
Estimating burn probability

\[ E(L) = \sum_{i} p(f_i) \times R(f_i) \]

- **BP** = number of fires that hit the pixel/total fires simulated
Risk assessment for fuels planning
National Forest wildfire exposure assessments

- Annual probability fire >20k ha
- High intensity annual area burned
- Area of WUI burned by FS ignitions
- Predicted population exposure
- Count of high risk subwatersheds
- Departure from MFRI
Risk assessments for individual national forests
Simulation at the national forest scale

- Fine-scale maps of wildfire exposure generated from simulation models inform local managers on fuel management priorities
Risk–based strategic fuels planning

Risk based allocation and prioritization

Risk based monitoring, adjustment and learning

National program

Regions

Forests

Districts and projects

Risk based decision support tools and framework
Fuel treatments: science and implementation

- Thinning
- Prescribed fire
- Managed fire
- Piling
- Jackpot burning
- Mastication
What stand treatments are needed to make a difference?
Modeling stand silviculture for fuels management

Initial condition

Thin

Wildfire without treatments

Wildfire with treatments

Masticate

Underburn
Effect of treatment area and treatment type on spread rate
Successes from fuel management

How Fuel Treatments Saved Homes from the Wallow Fire

Red arrow indicates the direction of the crown fire’s spread toward the Alpine community’s homes. Yellow lines delineate the approximate location of the Alpine Wildland-Urban Interface Unit 2 Fuel Treatment Area. As the fire raced downslope, numerous Alpine houses were at risk from the crown fire. (While only a few of the house roofs can be seen in this photo, approximately 40 homes are located in this area—and a total of 100 homes were threatened in south Alpine.) Just as was illustrated in the photo on the previous page, this photo also shows how the fuel treatment area slowed and diminished the Wallow Fire’s intensity, helping to save these homes.
Failures

- Four Mile Fire, Colorado
- Sept 6 2012
- Extensive fuel treatments
- 162 homes burned first day
Wildfire risk transmission

- Who owns the risk?
Wildfire risk transmission
Grand challenges

1. Are we making a difference?
2. Tipping point?
3. Invest in suppression or fuel management?
4. Private sector sharing the risk
5. Scale mismatches in fuel planning
CHANS Approach

Coupling human and natural systems to manage wildfire risk dynamics
CHANS Modeling

FORESTS, PEOPLE, FIRE
INTERACTIONS, DYNAMICS AND ADAPTATION IN FIRE-PRONE LANDSCAPES OF THE EASTERN CASCADES OF OREGON

User login

Username: *

Password: *

Log in

Request new password

Regrowth near Santiam Pass, Oregon
Agent-based modeling of landscape change: Envision

**Actors**
Decision-makers managing the landscape by selecting policies responsive to their objectives

**Landscape Production Models**
Generate Landscape Metrics Reflecting Ecosystem Service & Economic Productions

**Scenario Definition**
Select policies and generate land management decision affecting landscape

**Policies**
Fundamental Descriptors of constraints and actions defining land use management decision making

**Multi-agent Decision-making**
Select policies and generate land management decision affecting landscape

**Autonomous Change Processes**
Models of Non-anthropogenic Landscape Change

**Landscape Feedbacks**
Spatial Container in which landscape changes, ES metrics are depicted

Slide Courtesy John Bolte