Forest fuels evaluation and fuels treatment planning

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Introduction

- Wildland fuels have accumulated in many western forests of the US for over 70 years.
- These additional fuels are contributing to more intense fire behavior and increasing fire resistance to containment and control.
  - Property and natural resources have been destroyed.
  - Costs of fire management have escalated.
  - Fire-dependent forest and rangeland ecosystems have deteriorated.
  - Risk to human life and property continue to escalate.
Objectives

- Describe a decision-support system for interpreting data and synthesizing information to
  - evaluate fuel conditions and potential fire impacts, and
  - prioritize subwatersheds for fuel treatments.
- Demonstrate use of the system with an example from the Rocky Mountain region in the State of Utah.
  - A planning area of about 4.8 million ha, encompassing 575 complete subwatersheds.
- Discuss considerations for extending the application to support strategic planning at national, regional, and local scales.
Assessment area
The decision-support system

- Our application is built with the Ecosystem Management Decision Support (EMDS) system
  - ArcMap extension for ArcGIS 8.1 and later.
- Major components of the application
  - A logic engine that evaluates fire hazard in terms of fuels, fire behavior, and climate.
  - A decision engine that prioritizes 6th-code HUCs for fuels treatment.
- Evaluation *versus* planning
Logic models

- A form of meta database
  - A formal logical representation of how to evaluate information.
- Graphically designed with networks of interrelated topics
  - Intuitive and easy to understand.
- Mental map
  - Adds rigor to an assessment process.
Logic models: forms of uncertainty

- **Probabilistic uncertainty**
  - Uncertainty of events

- **Linguistic uncertainty**
  - Uncertainty about the definition of events
  - Vagueness or imprecision
Logic models: strength of evidence

An example: strength of evidence for suitable slope for tractor logging.

Degree of support

![Graph showing the relationship between percent slope and strength of evidence for degree of support.]

Boolean reasoning

![Graph showing the relationship between percent slope and strength of evidence for Boolean reasoning.]

Strength of evidence vs. Percent slope for degree of support:
- Yes at 0%
- Partial between 0% and 100%
- No at 100%

Strength of evidence vs. Percent slope for Boolean reasoning:
- Yes at 0%
- No at 100%
Outline of the logic

- **Fire hazard**
  - **Fire vulnerability**
    - Surface fuels
      - Fire behavior fuel model
      - Fuel characterization class
    - Canopy fuels
      - Canopy bulk density
      - Canopy base height
    - Fire regime condition class
  - **Fire severity**
    - Spread rate
    - Flame length
    - Fire line intensity
    - Crown fire potential
  - **Ignition risk**
    - Palmer drought severity index
    - Keetch-Byram drought index
    - NDVI Relative Greenness index
    - Lightning strike
Data sources for logic model

- Fire vulnerability
  - LANDFIRE program
- Fire severity
  - FIREHARM model (Keane)
- Ignition risk
  - NOAA
Interactive tour of fire hazard

Launch tour of fire hazard analysis
Decision model for fuels treatment
Priorities for fuels treatment
Influence of wildland-urban interface

Treatment priority

WUI
Contributions of primary criteria

Contributions to Criterion [Fuel treatment priority] from [Level 2]

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<th>SMART Priority Scores</th>
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Application to multiple scales

- **Strategic planning**
  - National, regional, and subregional.
  - Broad-scale decisions (e.g., resource allocation).
  - Spatial extent of assessment is user defined.

- **Tactical planning**
  - At smaller spatial extents (e.g., a Forest), strategic results provide context for tactical tools.
  - Extension of methods to fine scale (San Bernardino NF).
Outputs versus outcomes

- Change in performance standards
  - Old (outputs): acres treated per year
  - New (outcomes): acres of reduced fire danger per year

- New planning rule and EMS
  - Adaptive management (ISO 14001)
  - Hypothesis testing
  - Shift in distribution of outcomes?

![Graph showing shift in distribution of fire danger over time](image)
Additional info

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- **Website**
  - http://www.fsl.orst.edu/emds
  - For PDF publications, etc., see the literature page.