Centering a U.S. Wildfire Response: Perspectives on the Second Decade of the 21st Century

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Part 1:
Issues Du Jour
The effects of climate change will continue to result in greater probability of longer and bigger fire seasons, in more regions in the nation.

Cumulative drought effects will further stress fuels accumulations.

There will be continued wildfire risk in the Wildland Urban Interface despite greater public awareness and broader involvement of communities.

Emergency response demands will escalate.

Fire agency budget resources – federal, tribal, state or local – will be strained by increased demands and rising costs during a period where government budget revenues will be very tight or falling.
Flame Act of 2009 – Cohesive wildfire management strategy

- The identification of the most cost-effective means for allocating fire management budget resources
- The reinvestment in non-fire programs by the Secretary of the Interior and the Secretary of Agriculture
- Employing the appropriate management response to wildfires
- Assessing the level of risk to communities
- The allocation of hazardous fuels reduction funds based on the priority of hazardous fuels reduction projects
- Assessing the impacts of climate change on the frequency and severity of wildfire
- Studying the effects of invasive species on wildfire risk
Response to wildfire is largely impact driven

- Long-term fire exclusion leading to reduced species diversity
- Hazardous fuels buildup
- Watershed function
- Vegetation stress from drought and tree mortality from beetle infestations associated with climate variability and change
- Expansion of the wildland-urban interface
- Human health related to smoke
- Economic costs for suppression and treatment strategies
Part 2: Tool Time
A list of decision-support tools -1988 (fire weather/behavior/danger related)

- NFDRS
- Behave
A partial list of decision-support tools – today

- NFDRS – National Fire Danger Rating System
- BehavePlus – predict wildland fire behavior
- FireFamilyPlus – weather and fire danger
- FARSITE – Fire Area Simulator
- WFAS – Wildland Fire Assessment System
- Wind Wizard – Hi-resolution gridded wind
- WindNinja – Hi-resolution gridded wind
- FireStem - tree mortality based on fire behavior and intensity
- FlamMap – Landscape Fire Behavior Simulator
- FPA – Fire Planning and Analysis
- Fsim – Large Fire Simulator
- HFPAS – Hazardous Fuels Prioritization and Allocation System
Decision-support tools

Fuel Characteristic Classification System (FCCS)
http://www.fs.fed.us/pnw/fera/fccs

Natural Fuels Photo Series
http://www.fs.fed.us/pnw/fera/research/fuels/photo_series

Digital Photo Series
http://depts.washington.edu/nwfire/dps

Consume 3.0
http://www.fs.fed.us/pnw/fera/research/smoke/consume

Fire Emission Production Simulator (FEPS)
http://www.fs.fed.us/pnw/fera/feps/
Decision-support tools – Wildland Fire Air Quality Tools

- Smoke Guidance Point Forecast
- Smoke Guidance Regional Maps
- Diurnal Surface Wind Pattern Analysis
- Climatological Ventilation Index Point Statistics
- Current Air Quality Conditions Map
- Fire Information and Smoke Trajectories
- Probabilistic Smoke Impacts based on Past Weather
- Customized Fuels, Consumption and Smoke Modeling
Decision-support tools –
Wildland Fire Decision Support System

- **FSPPro – Fire Spread Probability Model**
  - Spatial model that calculates and maps the probability of fire spread, in the absence of suppression, from a current fire perimeter or ignition point for a specified time period

- **RAVAR – Rapid Assessment of Values at Risk**
  - Spatial model showing the primary resource values to be protected and/or at risk by ongoing large fire events
What is WFDSS Used For?

• To match analysis and deliberation with risk characterization and decisions,
• To improve strategic decision making for all wildland fires,
• To simplify support to decision making,
• To document decisions and rationale.
Fire Related Links

- Weather Related Links
  - Air Quality - Wildland Fire Air Quality Tools
  - Predictive Services - Links to Predictive Services (NCC Weather page)
  - Seven Day Forecast - Predictive Services Current 7 Day Forecast (RSAC)

- General Fire Related Links
  - FAMWEB - National Fire and Aviation Management / Web Applications
  - FPA - Fire Program Analysis
  - FireModels.org - Fire Behavior and Fire Danger Software
  - REGIMAG - Geospatial Multi-Hazard Coordination - Wildland Fire Support
  - LANDFIRE - Landscape Fire and Resource Management Planning Tools Project
  - MODIS - MODIS Active Fire Mapping Program (RSAC)
  - NIFC - National Interagency Fire Center
  - ROSS - Resource Ordering and Status System
  - WFDSS - Wildland Fire Decision Support System Home Page

- Geographic Area Coordination Centers
  - NIFC - National Interagency Coordination Center
  - ASCC - Alaska Interagency Coordination Center
  - EACC - Eastern Area Coordination Center
  - EGBC - Eastern Great Basin Coordination Center
  - NACC - Northern Rockies Coordination Center
  - NWACC - Northwest Coordination Center
  - NCC - Northern California Coordination Center (North Ops)
  - SCC - Southern California Coordination Center (South Ops)
  - RMACC - Rocky Mountain Area Coordination Center
  - SACC - Southern Area Coordination Center
  - SCWC - Southwest Coordination Center
  - WGBCC - Western Great Basin Coordination Center

Return
Fire Behavior Tools & Weather Analysis

Short Term

Basic
Fire weather

FIRE WEATHER PLANNING FORECAST FOR SW IDAHO AND SE OREGON
NATIONAL WEATHER SERVICE BOISE ID
221 PM MET MON OCT 5 2009

...CLEARING AND COLD TONIGHT WITH DRYING THROUGH THE WEEK...

.DISCUSION...
THE POTENT LOW PRESSURE SYSTEM THAT Brought SNOW TO THE HIGH
COUNTRY WILL MOVE EAST TONIGHT. THIS WILL ALLOW CLEARING SKIES
AND COLD TEMPERATURES WITH PATCHY FOG DEVELOPING IN THE VALLEYS.
THE REMAINDER OF THIS WEEK WILL BRING A SERIES OF DAY COLD FRONT
TO CENTRAL IDAHO...WITH LITTLE MORE THAN PERIODS OF CLOUDINESS
TO THE IDAHO FORESTS BUT NO ADDITIONAL PRECIPITATION UNTIL THE
NEXT WEATHER SYSTEM WHICH SHOULD HOLD OFF FOR ANOTHER WEEK OR SO.

.IDS468-415-061230-
TREASURE VALLEY-WESTERN TWIN FALLS BLN-OMYHER MOUNTAINS-
221 PM MET MON OCT 5 2009

.TONIGHT...
SKY-WEATHER.... MOSTLY CLOUDY WITH WIDELY SCATTERED RAIN AND

Fire danger

ERC Graph

Fire Danger: 103209 - TWIN BUTTE
1990 - 2009

Point
Latitude
Longitude
Elevation
Station
43.03283
114.38396 W
1,095 meters
42.0000
115.13510 W
1,015 meters
The distance between the point and station is 25.2 miles
Multiple Resolutions & Views
What is Fire Program Analysis?

Congressionally Mandated –

- Agencies to develop single approach to maximize effectiveness of national Wildland Fire Management budget

- Through design & development of a computer system that simulates fire behavior –

Calculating preparedness options

Calculating effectiveness of prevention actions – how does reduction of hazardous fuels reduce risks?
Computer Simulations

How do managers determine when local resources are enough to manage a fire.....

then predict suppression costs should a fire exceed local capacity and national resources are called in?
Software allows local Planners to evaluate investment alternatives by simulating fires, growth rates with varying fuel, weather, and topography – to predict the final size & costs.

Investment alternatives then analyzed by national budget personnel.
Part 3:
*It is very dangerous; be afraid* (Risk)
Definition of Risk

- Long definition: The probability and magnitude of a loss, disaster, or other undesirable event
- Short definition: Something bad could happen

Source: Danny Lee et al; USFS; WFLC presentation
Probability Functions as Measures of Uncertainty

Source: Danny Lee et al; USFS; WFLC presentation
Loss Function (or Response Function) Assigns Loss to Outcomes

Source: Danny Lee et al; USFS; WFLC presentation
Probability Function plus Loss Function provides Risk Profile

Source: Danny Lee et al; USFS; WFLC presentation
Conceptual Model of Wildfire

- Fuel Treatments
- Prevention Programs
- Ignition
- Weather
- Topography
- Fuels
- Fire Extent & Intensity
- Consequences (Loss & Gain)
- Expected Change
- Response Capacity
- Reduce Exposure

Source: Danny Lee et al; USFS; WFLC presentation
Illustration of the quantitative, spatial risk assessment process employed in the baseline example risk assessment.

**Highly Valued Resources**

- Very High
  - Municipal Watersheds
- High
  - Northern Spotted Owl
  - Bull Trout
  - Cell Towers
- Moderate
  - Fire-adapted Ecosystem
  - Class I Aligned

**Wildfire Hazard**

**Response Function**

- Low
- Moderate
- High
- Very High

Net Value Change (%)

Source: Danny Lee et al; USFS; WFLC presentation
Major Challenges

- Future vegetation change from combination of factors (wildfire, growth, insects and disease, weather, etc.)
- Changes in population and human development
- Feedback effects of wildfire (positive and negative)
- Uncertainty in future climate
- Smoke / Regulations
- Indirect effects, such as tourism and lost economic opportunities
- Prescribed Fire
- Carbon sequestration

All are areas of active research and development. Various models exist to address these issues in regional analyses, especially in ecoregions that have been previously analyzed.

Source: Danny Lee et al; USFS; WFLC presentation
Part 4:
Knowledge is good
A seeming paradox

- With over 30 years of tool development, each claiming to be better than what was before, why is the fire problem getting worse?
  - 1) Most of the increasing important influences on fire risk are non-climatic factors (e.g., WUI, changing values, perceptions)
    - Current decision support tools focus primarily on the physical system and costs – they do not yet account for the various societal components that defines much of the risk
  - 2) Operating in an applications framework versus an adaptation framework
## Basic, applied and adaptation research

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From Roger Pulwarty; AMS 2008
Adaptation research

- Usual interaction
  - Concentrates on the incorporation of new knowledge or experience into existing models, decision processes and practices

- What is needed
  - The most important learning involves values, norms, goals and the basic “framing” of issues in terms of the drivers and importance
  - Innovative partnerships
  - Using facilities to cope with immediate problems and leaving slack or reserve for coping with conjunctive or future problems

From Roger Pulwarty; AMS 2008
Co-production of knowledge

Fig. 1. Model for co-production of science and policy through integrative science.

From Lemos and Morehouse, 2005
Framing effective communication

- Is the information *relevant* for decisions in the particular fire management context or decision-support system?
- Are the sources/providers of information *credible* to the intended user?
- Are fire managers *receptive* to the information and to research?
- Is the research *accessible* to policy/decision maker?
- Is the information *compatible* with existing decision models and fire management practice?
- Do the decision makers have the *capacity* to use this information?

Adapted from Roger Pulwarty 2009
JFSP Consortia

Map of the United States showing regions including Great Basin, Southern Rockies, Lake States, Appalachians, Southwest, California, and South.
Part 5: Timstrodomus
Future tools (Tim’s predictions)

- Gridded data widely accepted
- Finer scale physics models
- Probabilistic forecasts
- Improved climate/fire forecasts (RH, wind, biogeophysical)
- Detection based fire growth modeling
- Incorporation of climate predictions/extremes
- Long-term (decadal-century scale) planning
- Tools that focus on the societal components of risk
- Tools that emphasize mitigation and adaptation strategies
The End