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

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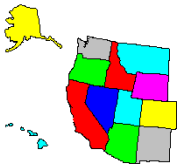
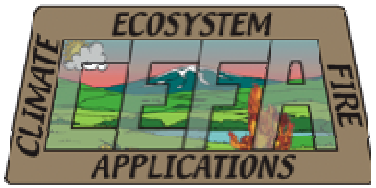
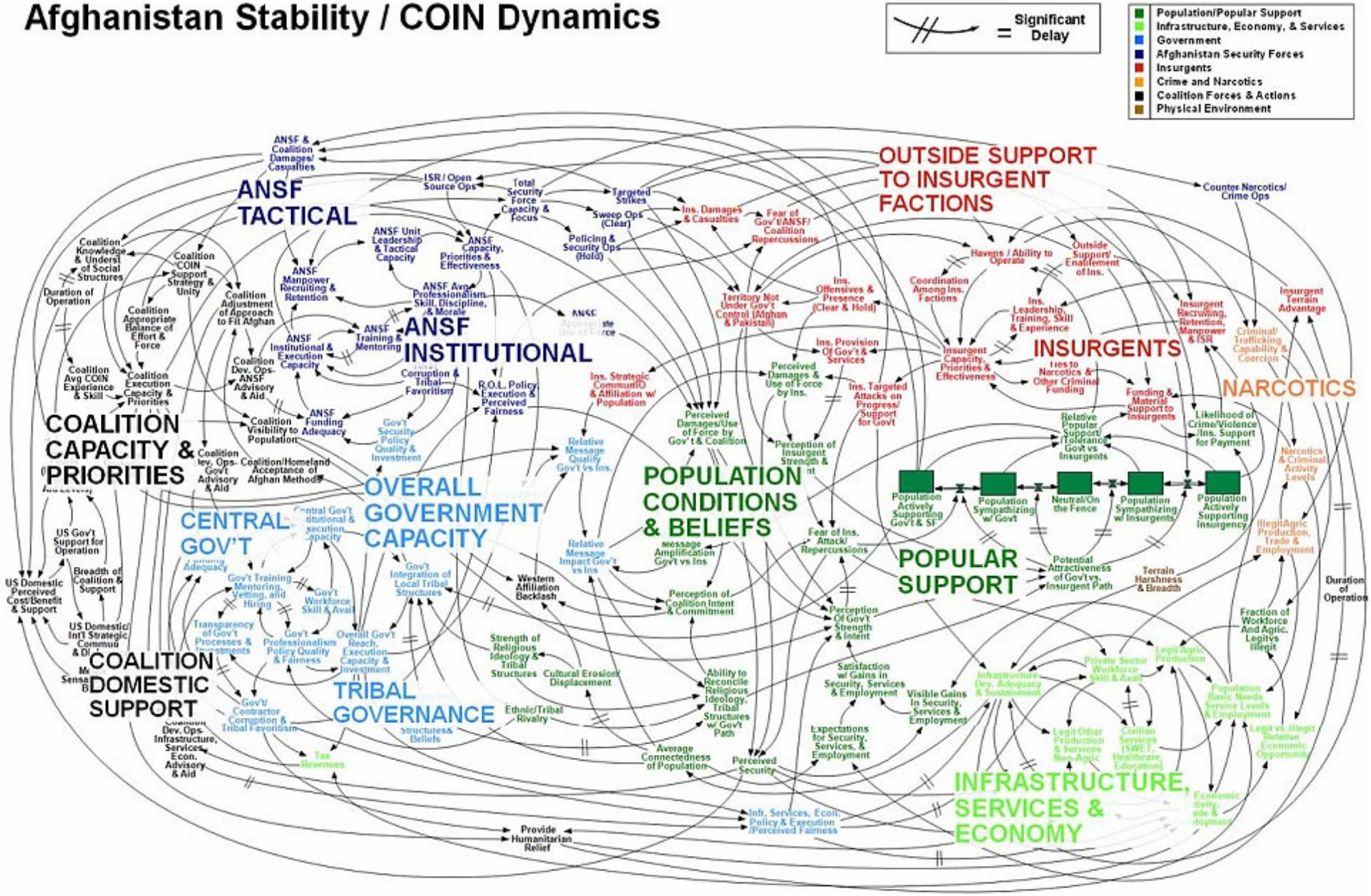
Desert Research Institute



Western Regional
Climate Center



Afghanistan Stability / COIN Dynamics



WORKING DRAFT – V3

Part 1:

Issues Du Jour

Quadrennial Fire Review - 2009

- 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

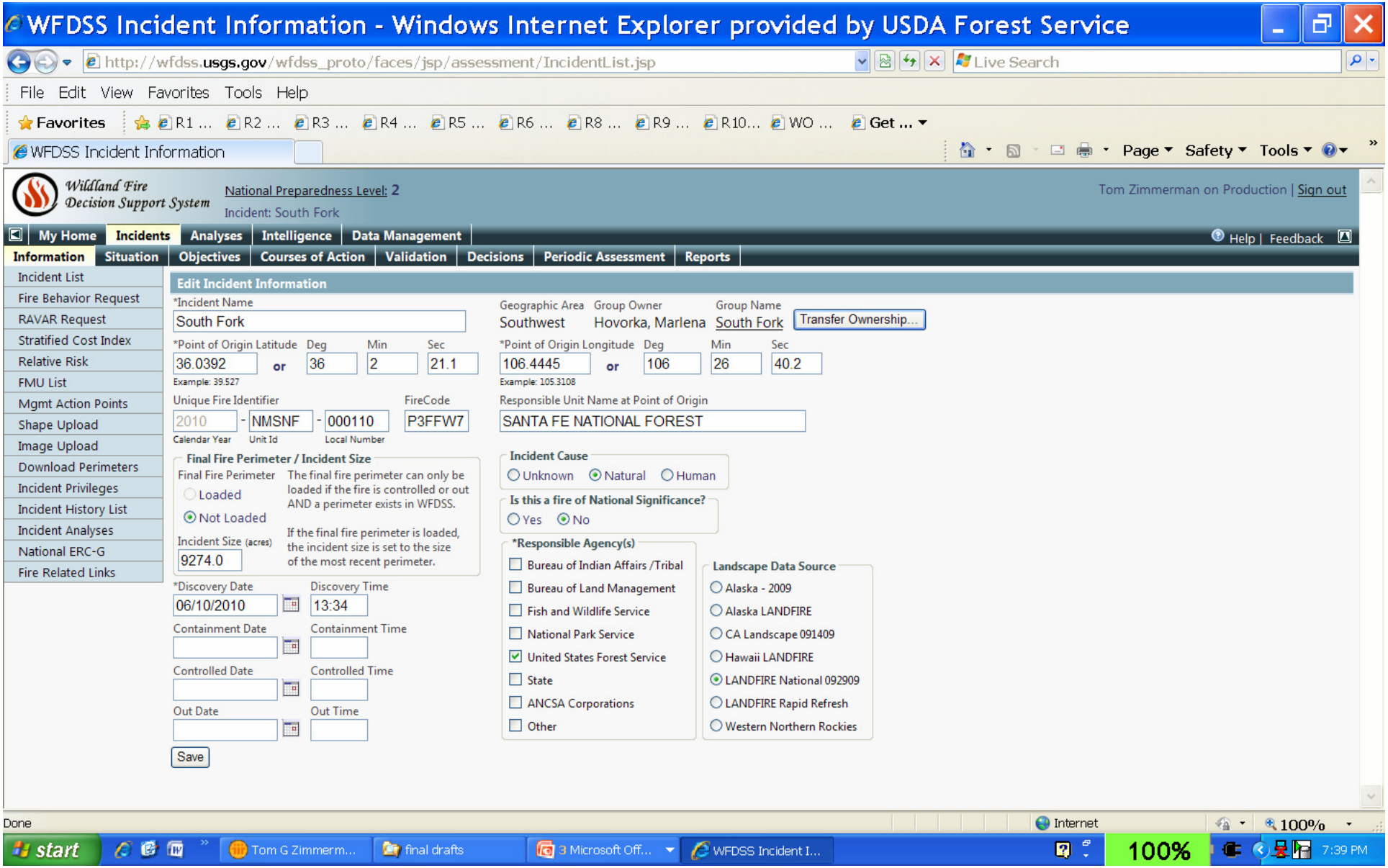
- Smoke Guidance Point Forecast
- Smoke Guidance Regional Maps
- Diurnal Surface Wind Pattern Analysis
- Climatological Ventilation Index Point Statistics
- Current Air Quality Conditions Map
- Fire Information and Smoke Trajectories
- Probablistic Smoke Impacts based on Past Weather
- Customized Fuels, Consumption and Smoke Modeling

Decision-support tools – Wildland Fire Decision Support System

- FSPro – 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.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Page Safety Tools
Wildland Fire Decision Support System
National Preparedness Level: 2
Incident: South Fork
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My Home Incidents Analyses Intelligence Data Management
Help | Feedback
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Incident List
Fire Behavior Request
RAVAR Request
Stratified Cost Index
Relative Risk
FMU List
Mgmt Action Points
Shape Upload
Image Upload
Download Perimeters
Incident Privileges
Incident History List
Incident Analyses
National ERC-G
Fire Related Links
Edit Incident Information
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South Fork
Geographic Area
Southwest
Group Owner
Hovorka, Marlena
Group Name
South Fork
Transfer Ownership...
*Point of Origin Latitude
36.0392
Deg
36
Min
2
Sec
21.1
Example: 39.527
or
*Point of Origin Longitude
106.4445
Deg
106
Min
26
Sec
40.2
Example: 105.3108
Unique Fire Identifier
2010 - NMSNF - 000110
Calendar Year Unit Id Local Number
FireCode
P3FFW7
Responsible Unit Name at Point of Origin
SANTA FE NATIONAL FOREST
Final Fire Perimeter / Incident Size
Final Fire Perimeter
Loaded
Not Loaded
The final fire perimeter can only be loaded if the fire is controlled or out AND a perimeter exists in WFDSS.
If the final fire perimeter is loaded, the incident size is set to the size of the most recent perimeter.
Incident Size (acres)
9274.0
Incident Cause
Unknown Natural Human
Is this a fire of National Significance?
Yes No
*Responsible Agency(s)
Bureau of Indian Affairs /Tribal
Bureau of Land Management
Fish and Wildlife Service
National Park Service
United States Forest Service
State
ANCSA Corporations
Other
Landscape Data Source
Alaska - 2009
Alaska LANDFIRE
CA Landscape 091409
Hawaii LANDFIRE
LANDFIRE National 092909
LANDFIRE Rapid Refresh
Western Northern Rockies
*Discovery Date
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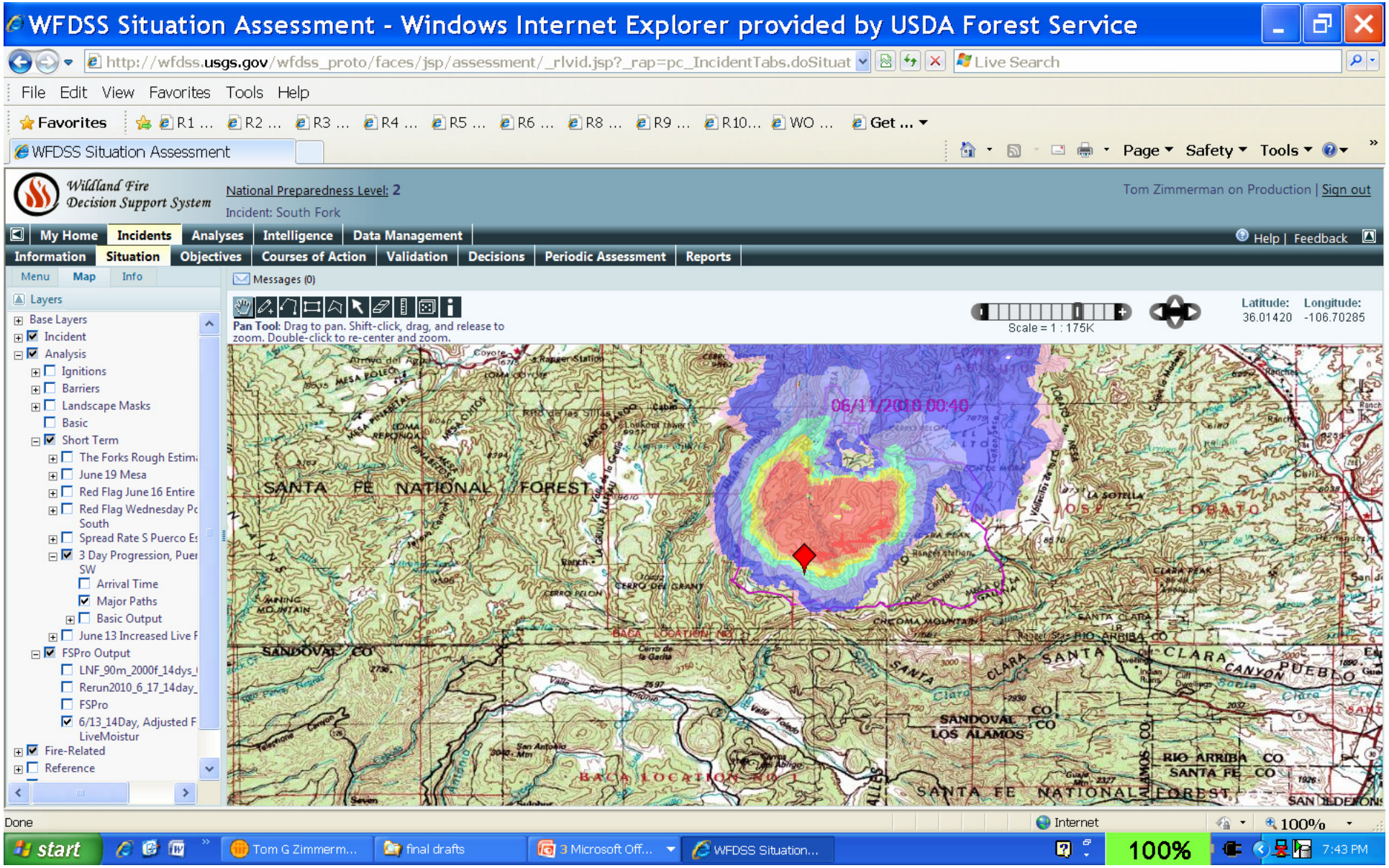
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Landscape Masks
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SW
Arrival Time
Major Paths
Basic Output
June 13 Increased Live F
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LNF_90m_2000f_14dys_
Rerun2010_6_17_14day_
FSPro
6/13_14Day, Adjusted F
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Fire-Related
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Messages (0)
Pan Tool: Drag to pan. Shift-click, drag, and release to zoom. Double-click to re-center and zoom.
Scale = 1 : 175K
Latitude: 36.01420
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SANTA FE NATIONAL FOREST
SANDOVAL CO
RIO ARRIBA CO
SANTA FE CO
LOS ALAMOS
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BACA LOCATION NO 1
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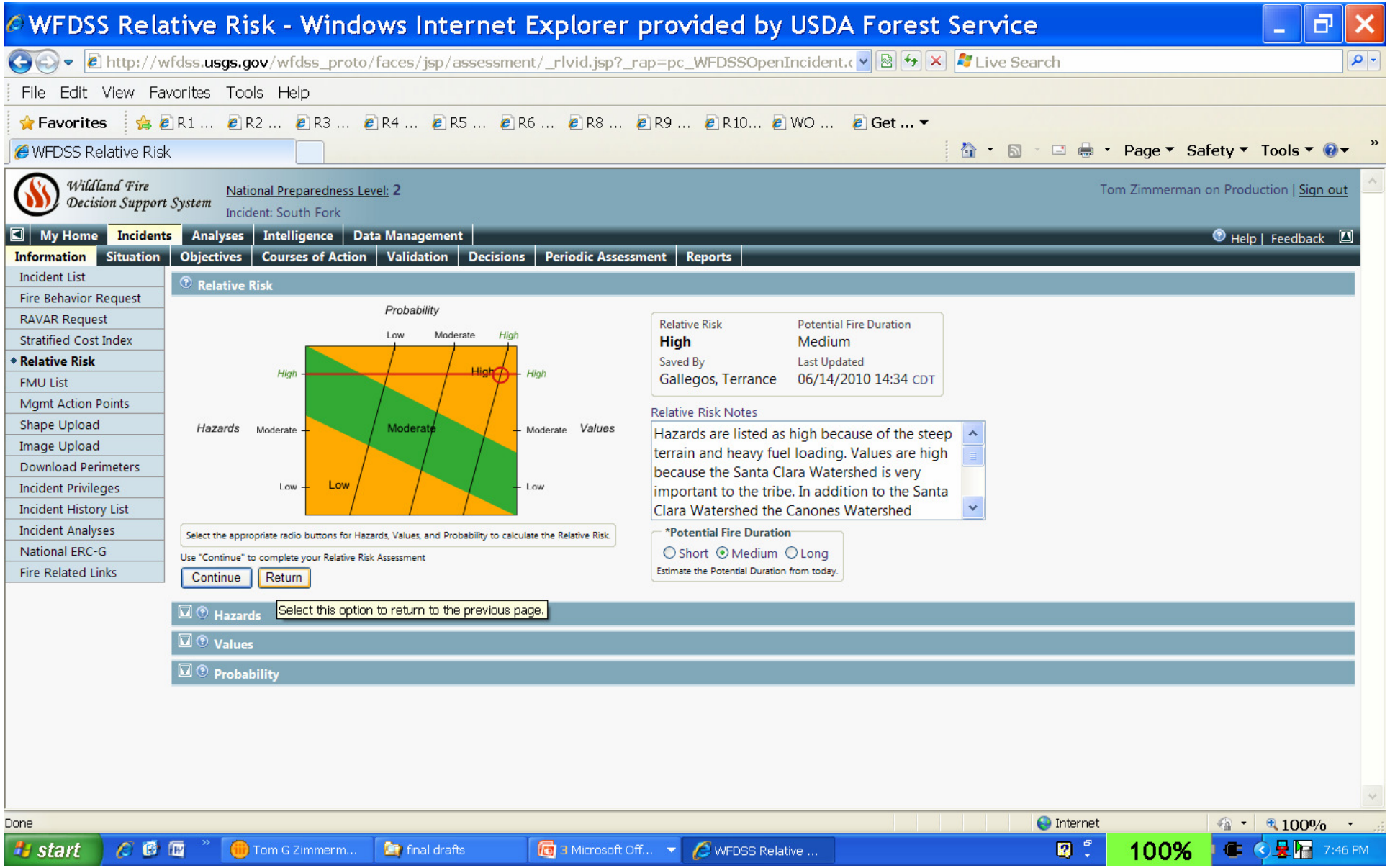
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FMU List
Mgmt Action Points
Shape Upload
Image Upload
Download Perimeters
Incident Privileges
Incident History List
Incident Analyses
National ERC-G
Fire Related Links
Relative Risk
Probability
Low Moderate High
High High High
Hazards
Moderate Moderate Moderate
Values
Low Low Low
Relative Risk
High
Potential Fire Duration
Medium
Saved By
Gallegos, Terrance
Last Updated
06/14/2010 14:34 CDT
Relative Risk Notes
Hazards are listed as high because of the steep terrain and heavy fuel loading. Values are high because the Santa Clara Watershed is very important to the tribe. In addition to the Santa Clara Watershed the Canones Watershed
Select the appropriate radio buttons for Hazards, Values, and Probability to calculate the Relative Risk.
Use "Continue" to complete your Relative Risk Assessment
Continue
Return
*Potential Fire Duration
Short Medium Long
Estimate the Potential Duration from today.
Select this option to return to the previous page.
Hazards
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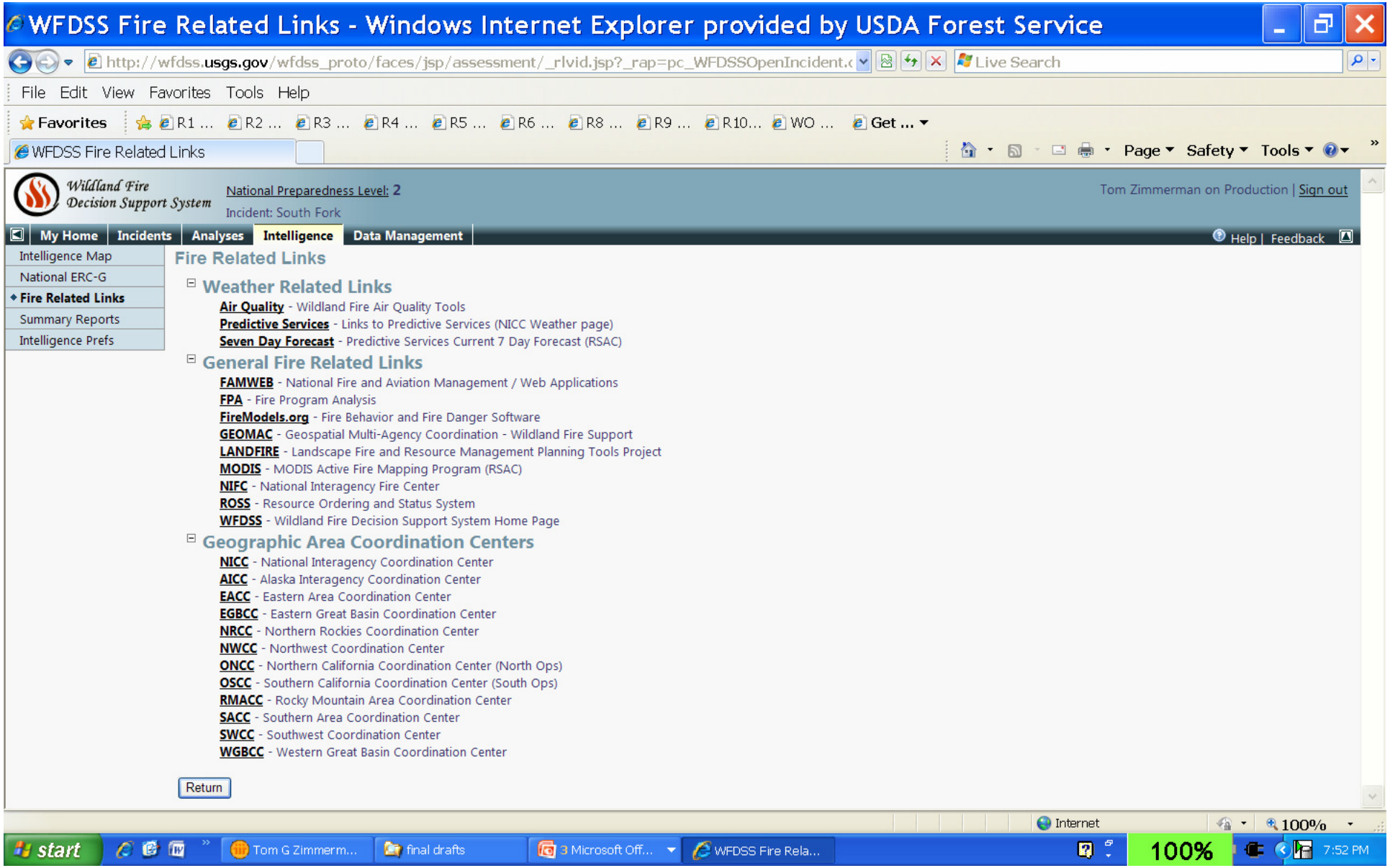
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Fire Related Links
Summary Reports
Intelligence Prefs
Fire Related Links
Weather Related Links
Air Quality - Wildland Fire Air Quality Tools
Predictive Services - Links to Predictive Services (NICC Weather page)
Seven Day Forecast - Predictive Services 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
GEOMAC - Geospatial Multi-Agency 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
NICC - National Interagency Coordination Center
AICC - Alaska Interagency Coordination Center
EACC - Eastern Area Coordination Center
EGBCC - Eastern Great Basin Coordination Center
NRCC - Northern Rockies Coordination Center
NWCC - Northwest Coordination Center
ONCC - Northern California Coordination Center (North Ops)
OSCC - Southern California Coordination Center (South Ops)
RMACC - Rocky Mountain Area Coordination Center
SACC - Southern Area Coordination Center
SWCC - Southwest Coordination Center
WGBCC - Western Great Basin Coordination Center
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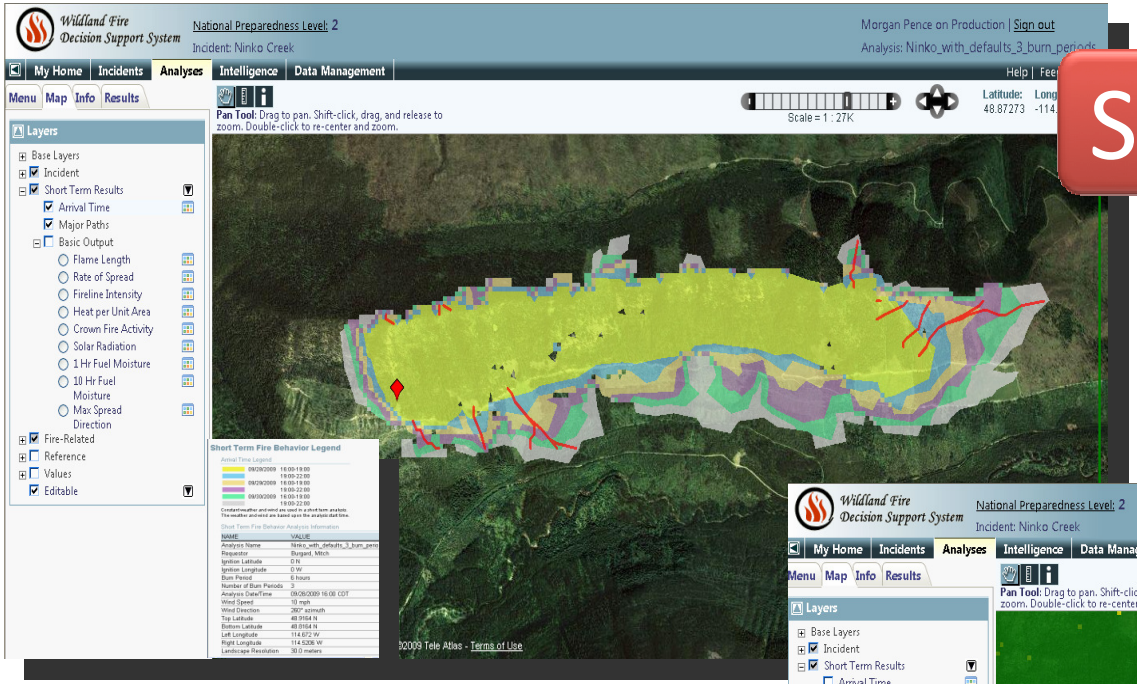
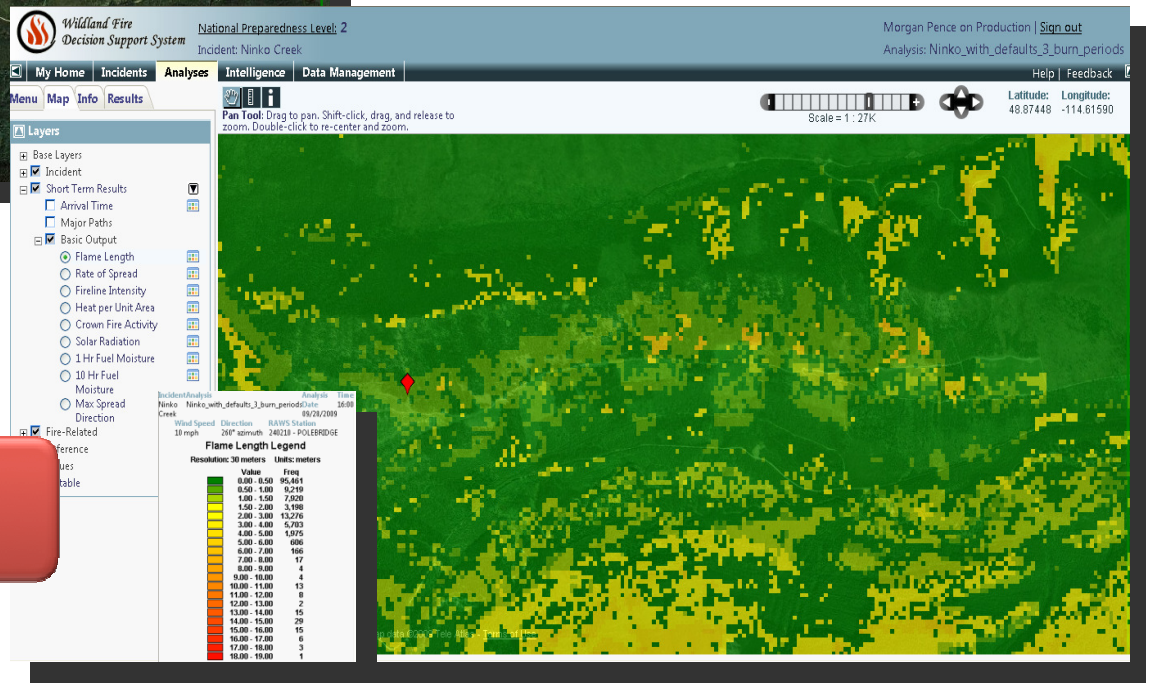
Fire Behavior Tools & Weather Analysis



Short Term



Basic

Fire Behavior Tools & Weather Analysis

Fire weather

Wildland Fire
Decision Support System

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FWFBOI

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

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

.DISCUSSION...
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 DRY 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


IDZ408-418-419-061200-
TREASURE VALLEY-WESTERN TWIN FALLS BLM-OWYHEE MOUNTAINS-
221 PM MDT MON OCT 5 2009

.TONIGHT...
SKY/WEATHER.....MOSTLY CLOUDY WITH WIDELY SCATTERED RAIN AND
```

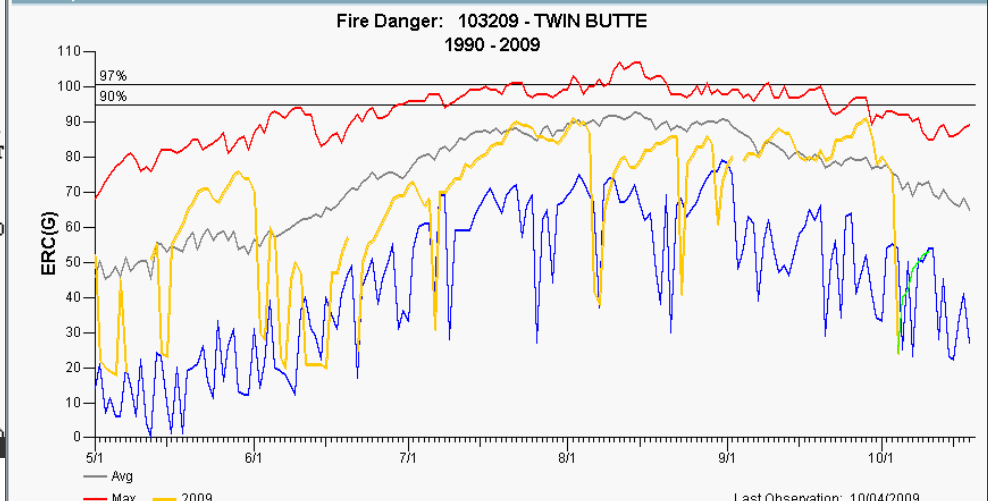
Fire danger

Wildland Fire
Decision Support System

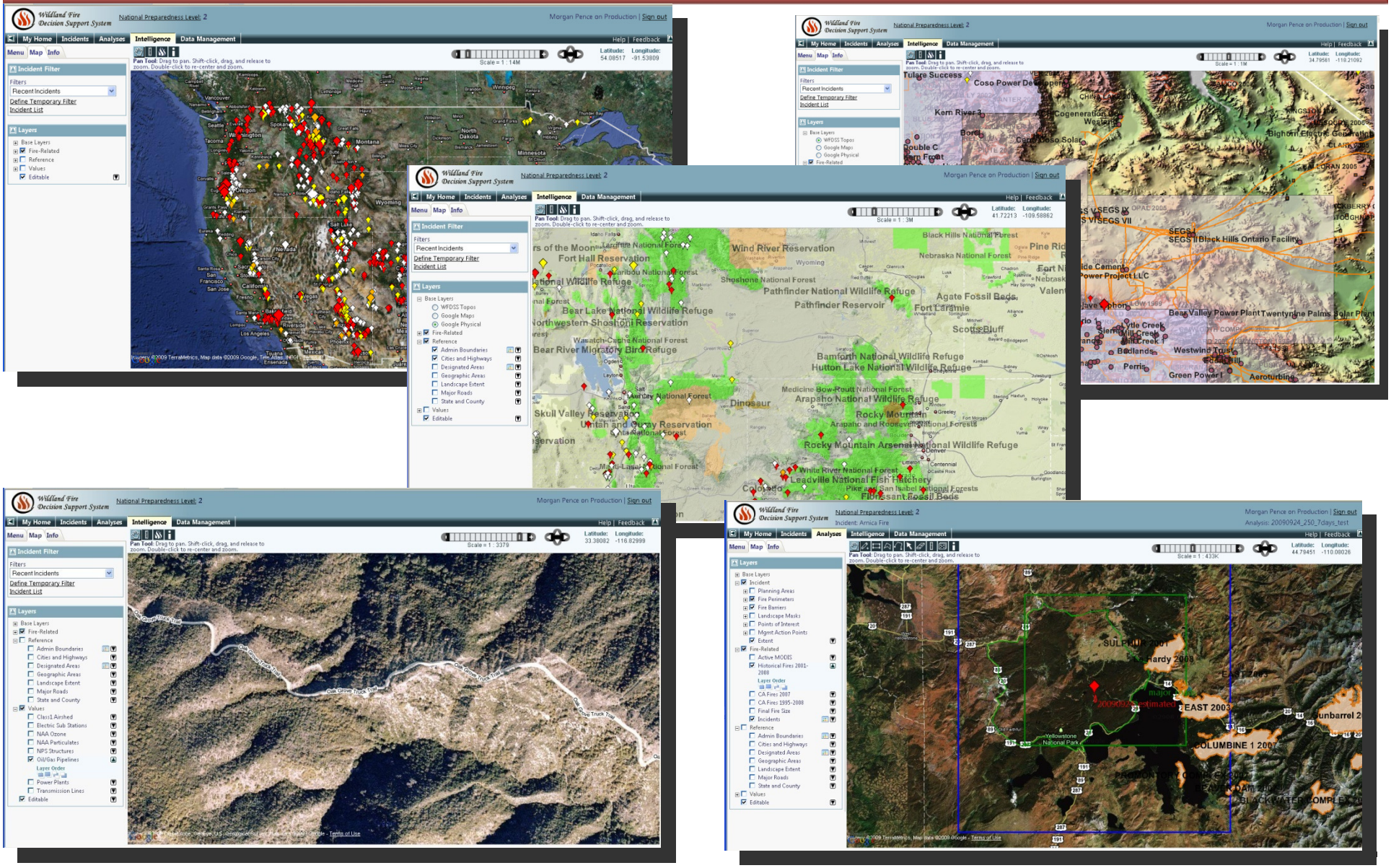
	Latitude	Longitude	Elevation
Point	43.05283	114.93896 W	1,095 meters
Station	42.69056	115.19528 W	1,015 meters

The distance between the point and station is 28.2 miles

ERC Graph



Multiple Resolutions & Views



What is Fire Program Analysis?

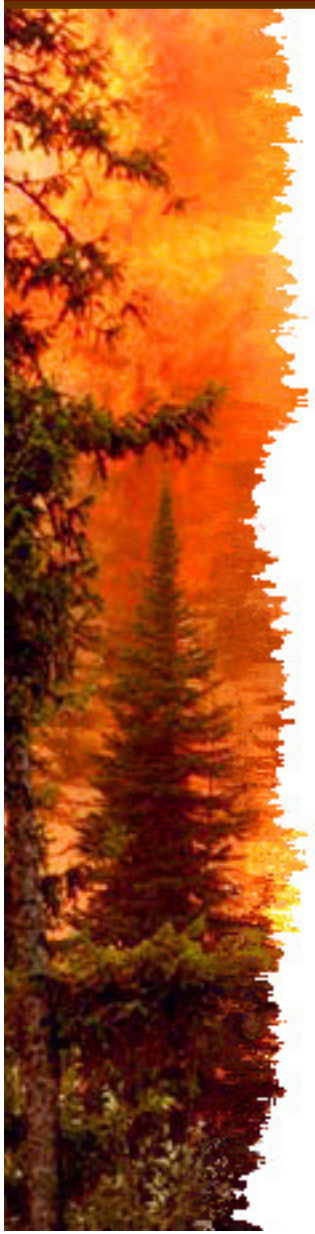
Congressionally Mandated –

- 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…..

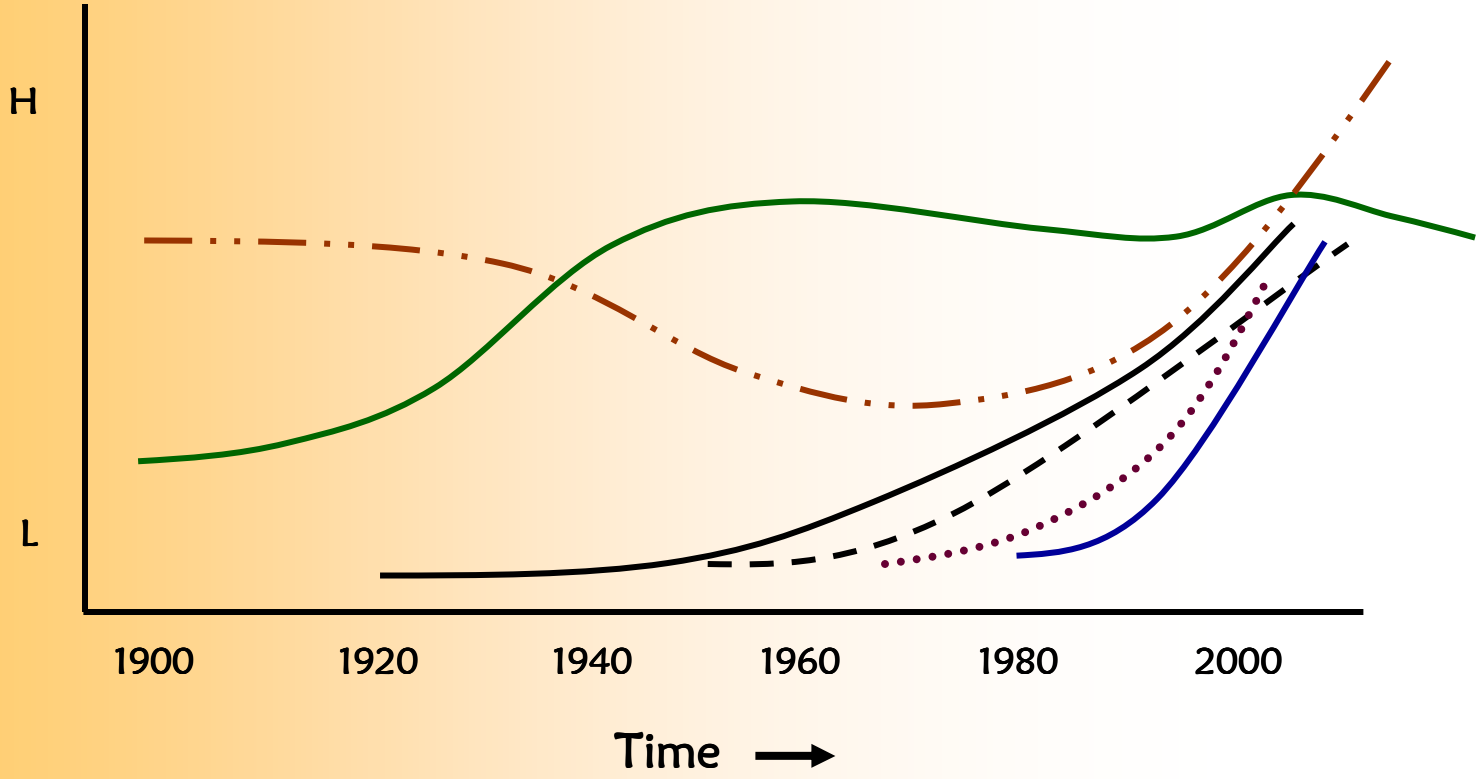
then predict suppression costs should a fire exceed local capacity and national resources are called in?

Software Design Apps

- 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

Wildland Fire Management – Complexity and Capability



Fire Complexity

Operational Capability

Prescribed Fire

Science and Technology

Decision Support

Wildland Fire Use

Source: Tom Zimmerman; USFS RD&A

Part 3:

It is very dangerous; be afraid (Risk)

Definition of Risk

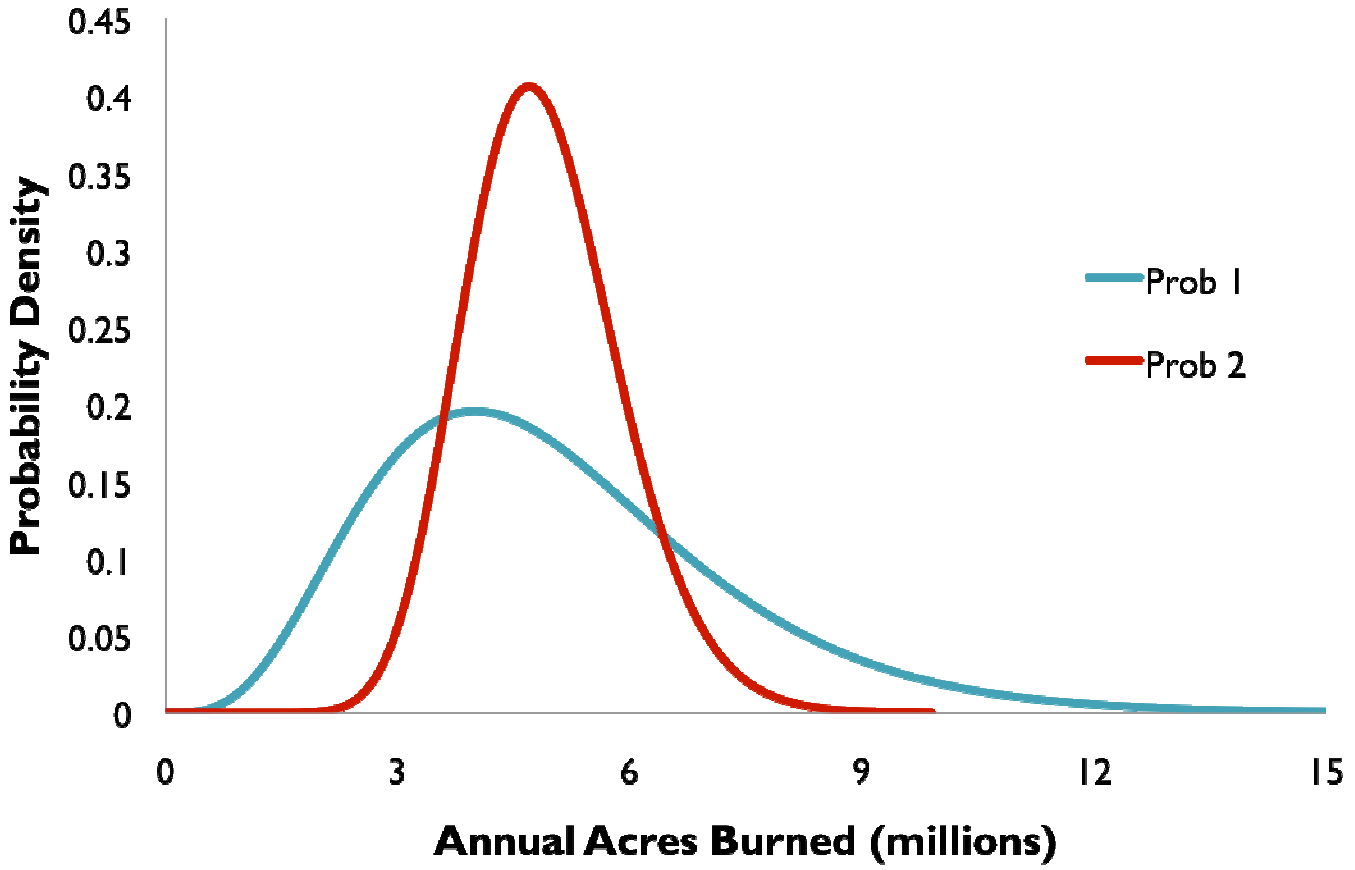
- Long definition: The probability and magnitude of a loss, disaster, or other undesirable event
- Short definition: Something bad could happen

Source: Danny Lee et al; USFS; WFLC presentation

WWETAC Western Wildland Environmental Threat Assessment Center

EASTERN FOREST ENVIRONMENTAL THREAT ASSESSMENT CENTER

Probability Functions as Measures of Uncertainty



Source: Danny Lee et al; USFS; WFLC presentation

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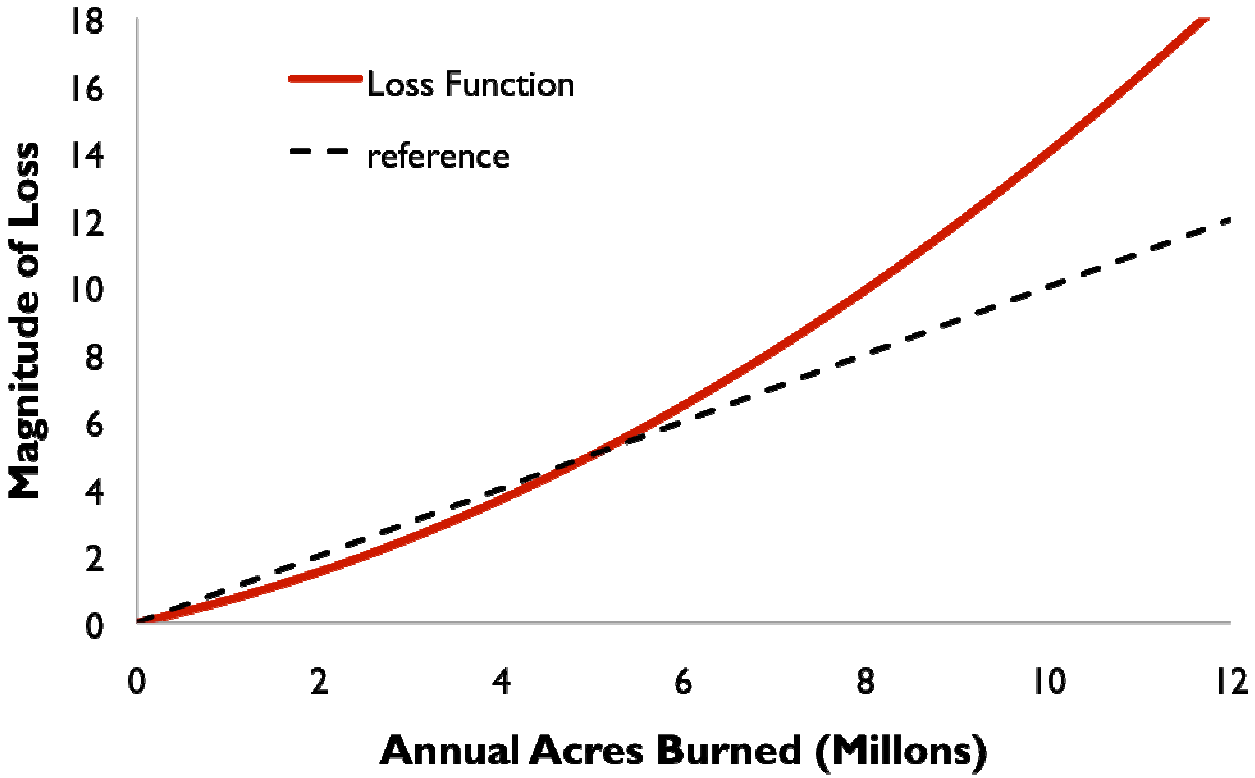
Loss Function (or Response Function) Assigns Loss to Outcomes



Source: Danny Lee et al; USFS; WFLC presentation

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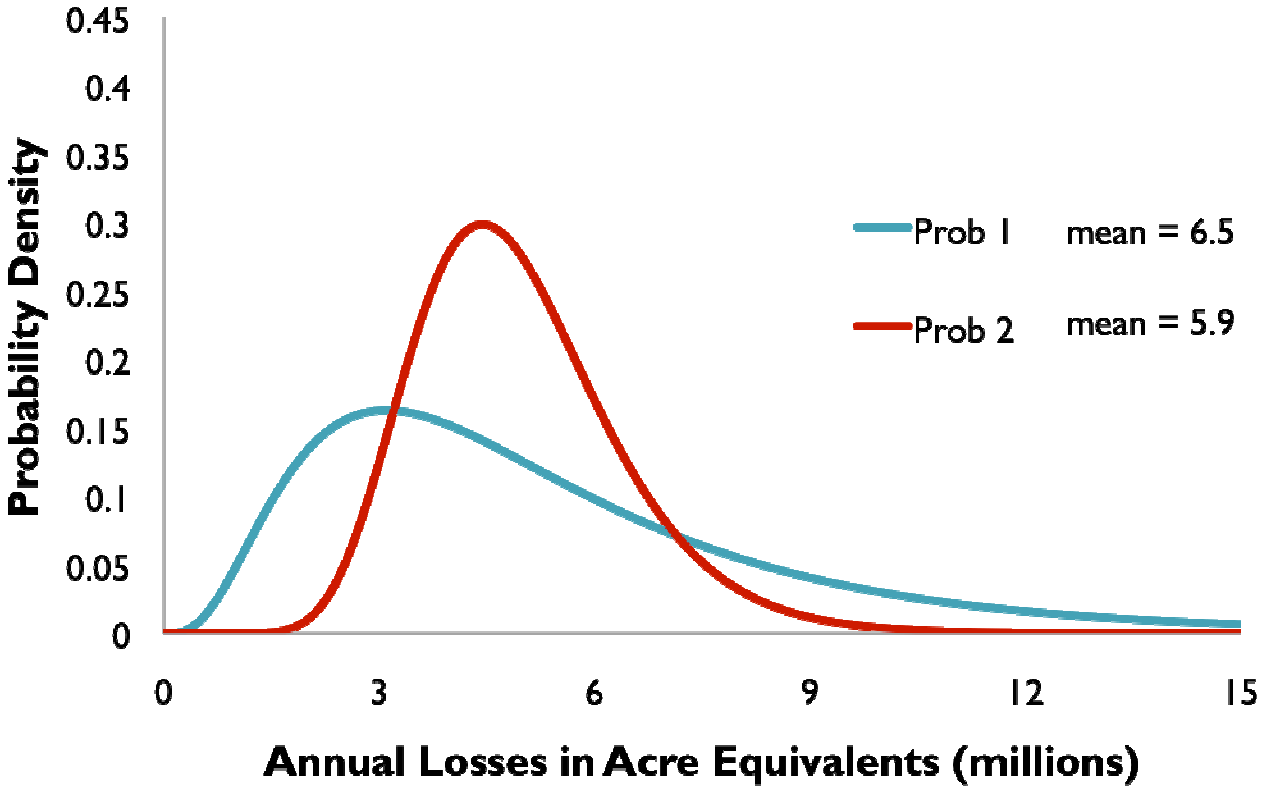
Probability Function plus Loss Function provides Risk Profile



Source: Danny Lee et al; USFS; WFLC presentation

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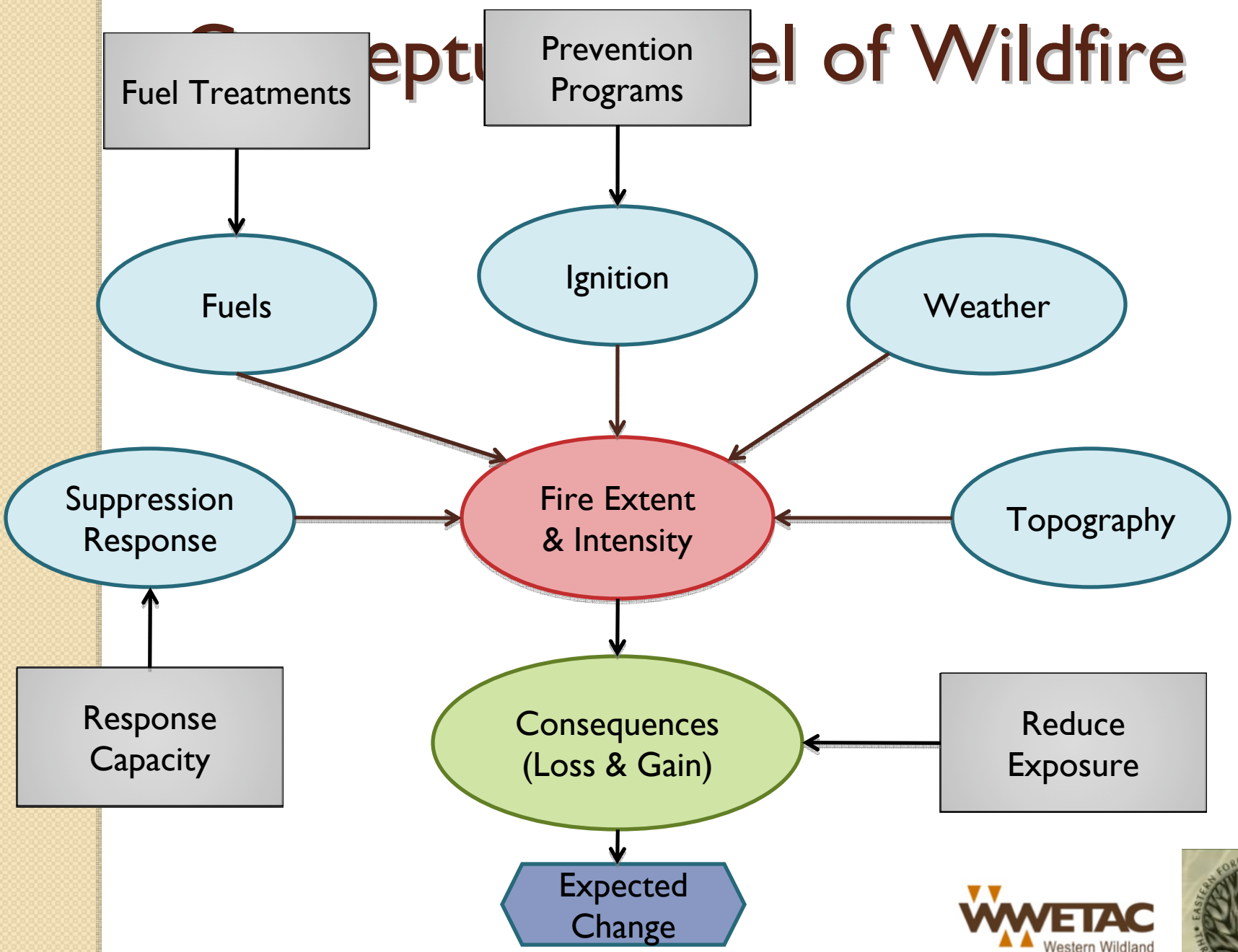
Conceptual Model of Wildfire



Source: Danny Lee et al; USFS; WFLC presentation

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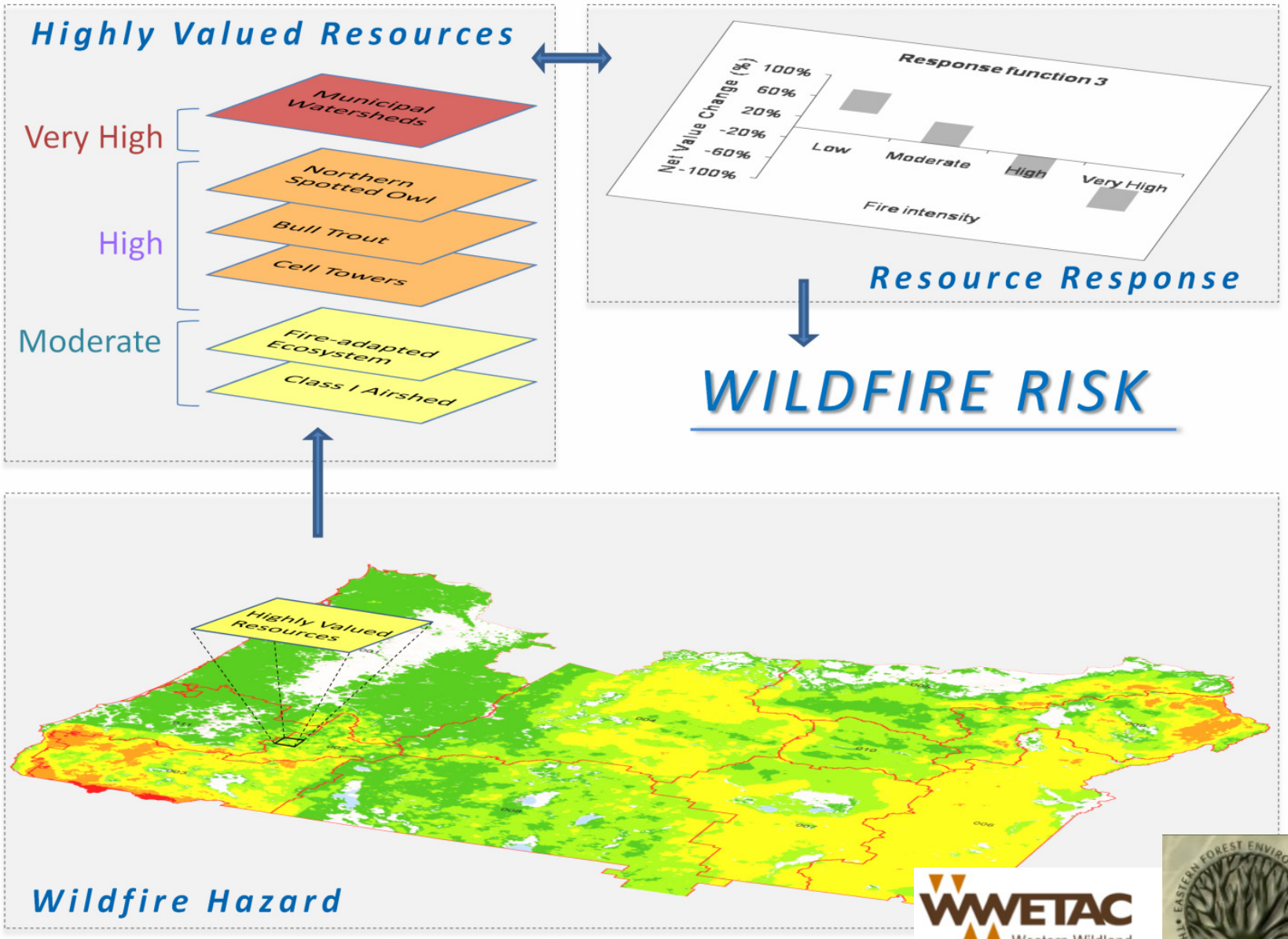
Illustration of the quantitative, spatial risk assessment process employed in the baseline example risk assessment.



Source: Danny Lee et al; USFS; WFLC presentation

WWETAC Western Wildland Environmental Threat Assessment Center

Eastern Forest Environmental Threat Assessment Center

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

WWETAC Western Wildland Environmental Threat Assessment Center

EASTERN FOREST ENVIRONMENTAL THREAT ASSESSMENT CENTER

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

Basic frame	Applied frame	Adaptation frame
Quality	Relevance	Access
Consistency	Compatibility	Legitimacy
Economic	Usefulness	Usability
Dissemination	Communication	Capacity
Efficiency	Efficiency	Equity
Expert	Consultative	Co-production

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

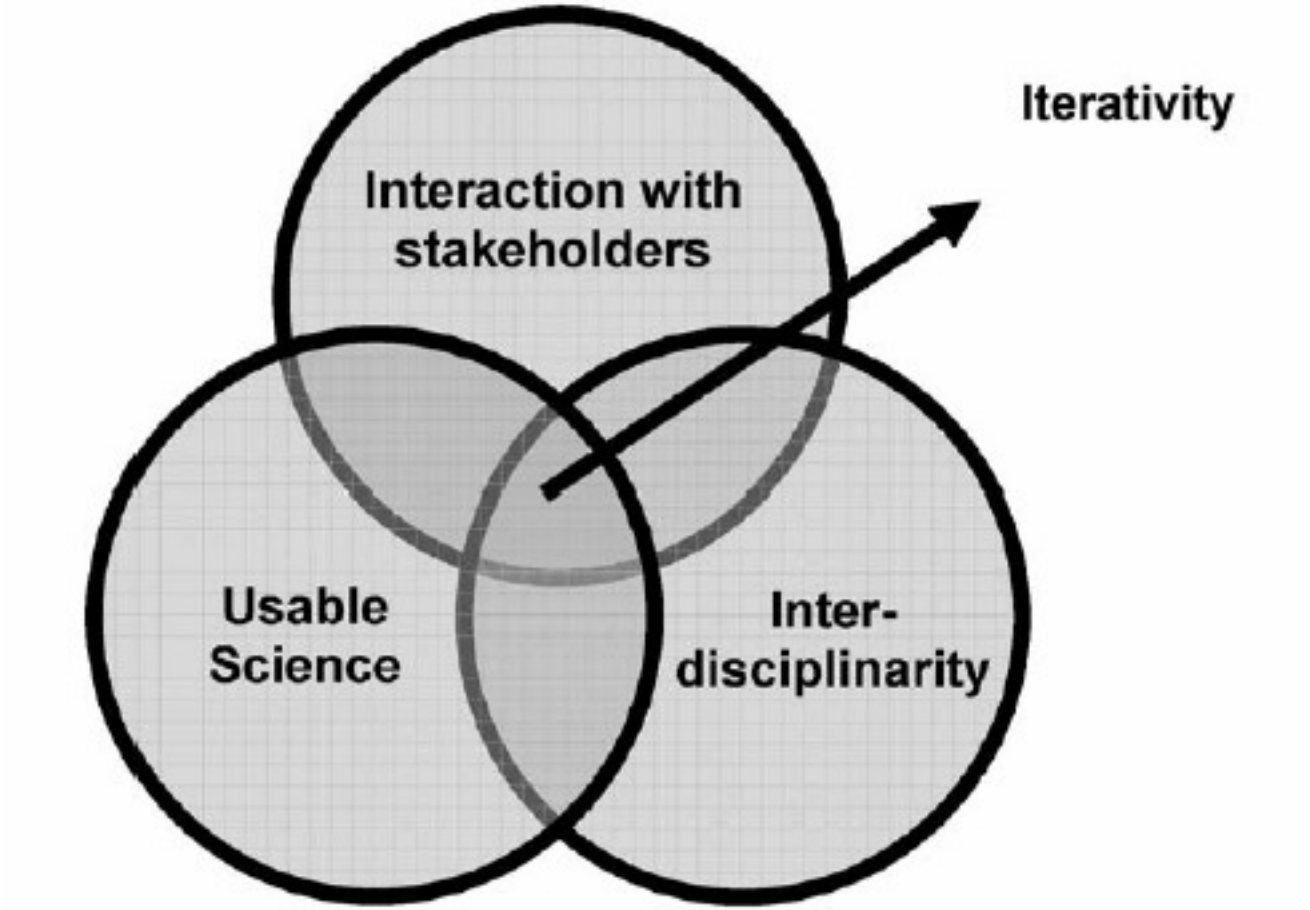


Fig. 1. Model for co-production of science and policy through integrative science.

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

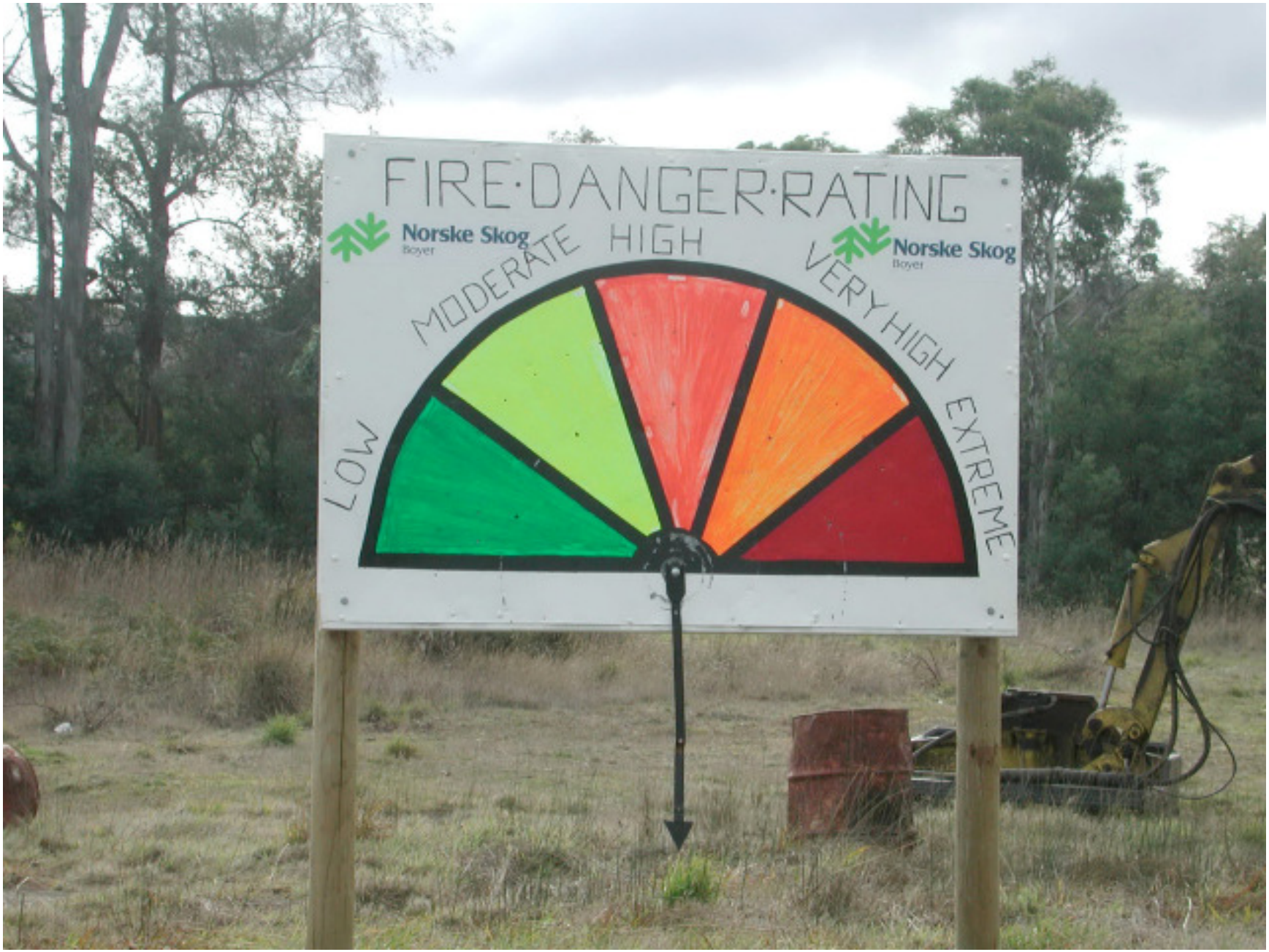
JFSP Consortia


RIDGID
MARAZZI

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


FIRE·DANGER·RATING
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LOW
MODERATE
HIGH
VERY HIGH
EXTREME
Norske Skog
Boyer

The End