



# Prescribed Fire Planning Tools: How to Best Operate in a Complex Environment

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SERDP • ESTCP  
**SYMPOSIUM**  
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# What should a useful Rx planning tool do?

- Should provide insight to the manager for planning
  - Inform on fire behavior and effects
  - Decision support for marginal conditions
- Provide a safety net for manager
  - Identify problems not recognized by operator
  - Worst case provide liability in event of an incident
- Ultimately increase the pace and scale of prescribed fire



# Prescribed Fire vs Wildfire

- Rx is “proactive” not “reactive”
  - Gives manager opportunity to make choices based on:
    - Weather conditions
    - Season
    - Fire return interval (feedback into fuels)
    - Firing techniques
    - Smoke mitigation
    - Resources required
    - Contingencies
- With Wildfire you have to make choices on the fly with what you got!



# Proactive Decision Points

- The burn boss has ownership in decisions and consequences
  - Reduce fuels - specific measurable indices
  - Maintain and create habitat for T&E - while avoiding damage
  - Minimize scorch both bole and crown
  - Keep smoke off or out of “insert smoke sensitive noun here”
- Has a list of “clients” to satisfy
  - Public
  - Timber
  - Wildlife
  - Cultural resources
  - Their Boss!



# Reactive Decision points

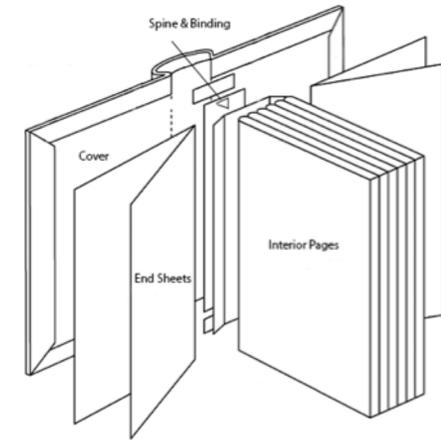
- IC has a cushion due to lack of control of conditions and no ownership in choice to initiate the operation
  - Provide for Firefighter and Public Safety
  - Limit fire size and contain where feasible
  - Limit fire intensity when possible
  - Provide timely information to public, cooperators, and administrators
  - Mutual respect, act appropriately
  - Manage costs



# Burn Plan as a Proxy for Rx Tools

## Anatomy of a Burn Plan

- Composed of 21 elements
  - Outline “rules of engagement”
- But what are we prescribing?
  - Fire Behavior
- Fire Behavior must achieve resource objectives
  - Intensity – Flame length, fuel consumption
  - Rate – Residence time, smoke production



# Prescription Element Rigidity

- Authorization
- Go/No Go Checklist
- Complexity Analysis
- Description of Unit
  - Physical, Fuels, Onsite Values
- Funding
- Briefing
- Organization and Equipment
- Communication
- **Public and Firefighter Safety**
- Test Fire
- Holding Plan
- Contingency Plan
- Wildfire Declaration
- Smoke management
  - Dispersion Index
  - Wind Speed and Direction



# Prescription Element Flexibility

## “Where we can get backed into a corner”

- Conflicting Management Objectives
  - Timber Management
  - Wildlife Management
  - Promotion of Specific Species
- Scheduling / Seasonality
- Pre-burn Considerations and Weather
  - **Making Go/No Go based on a single parameter (RH, Temp)**
  - **Not solar radiation, arrangement, species**
- Ignition Plan
  - Fire behavior
  - Smoke production

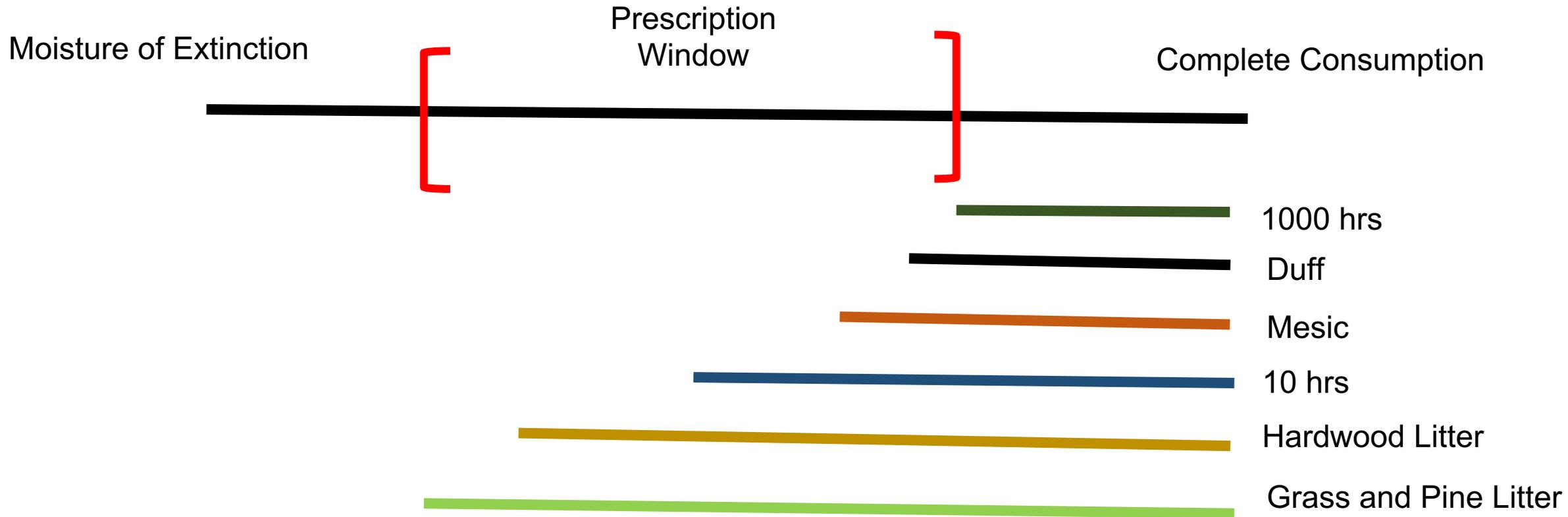


# Tunnel Vision

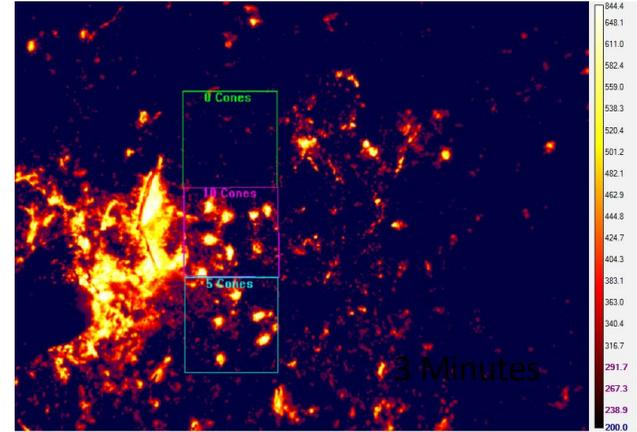
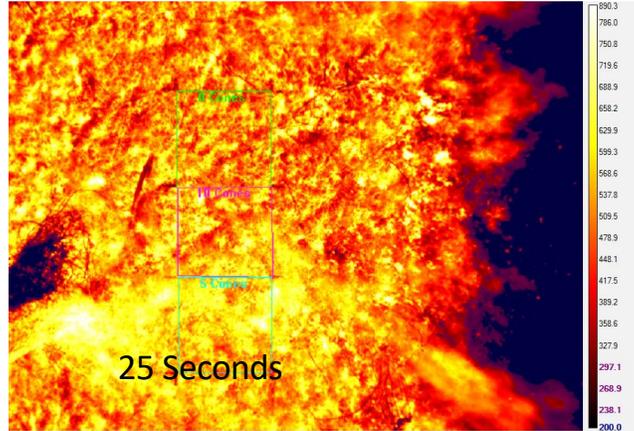
If we can learn to avoid this with regard to Firefighter Safety by practicing SA why don't we use this to better understand resource objectives and accomplishments



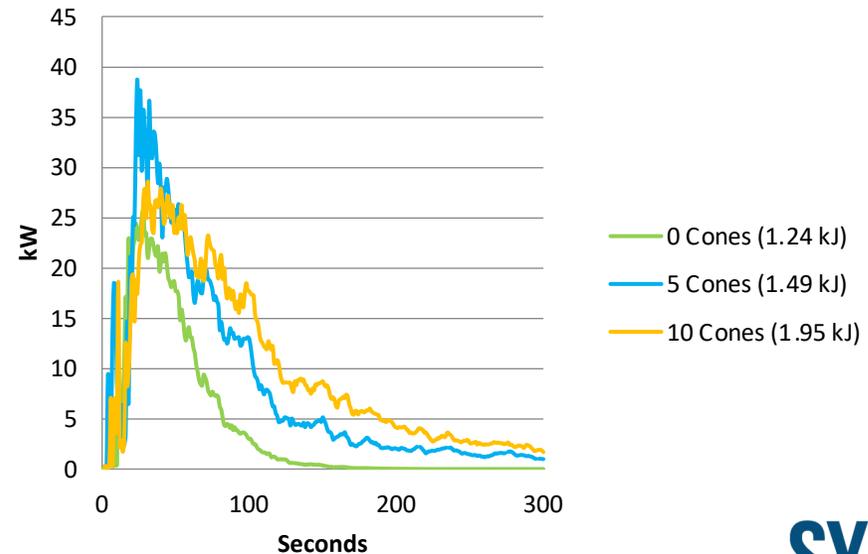
# Fuels Driving Fire Effects



# Fuels, Energy, and Community Assembly

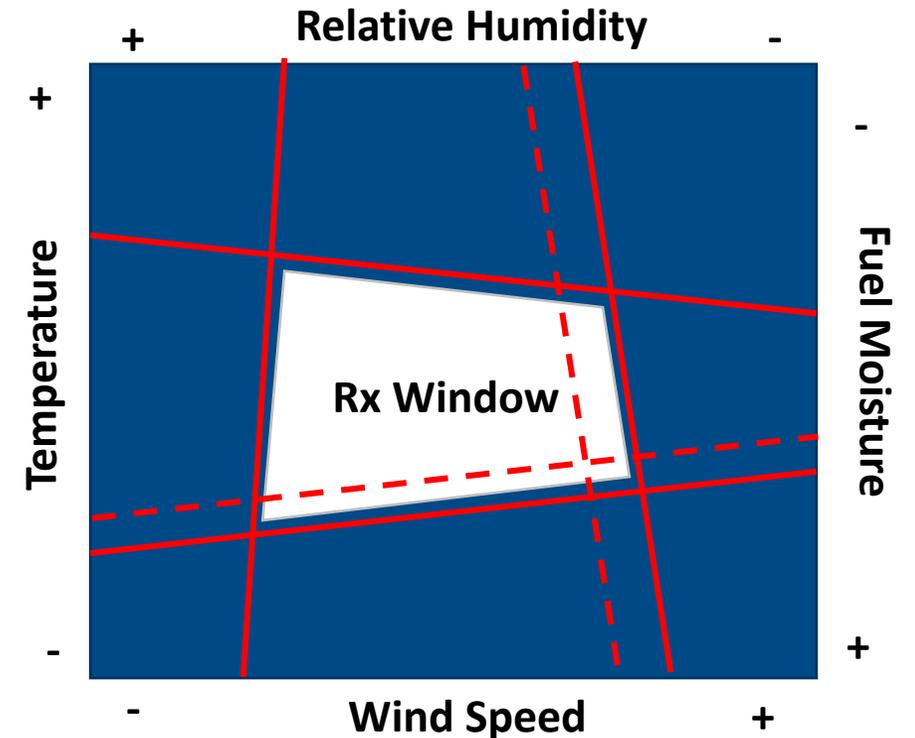


- Plants as fuel alter fire behavior
- Fire behavior and energy transfer drives post fire effects
- Recovering vegetation is the fuel to drive future fire



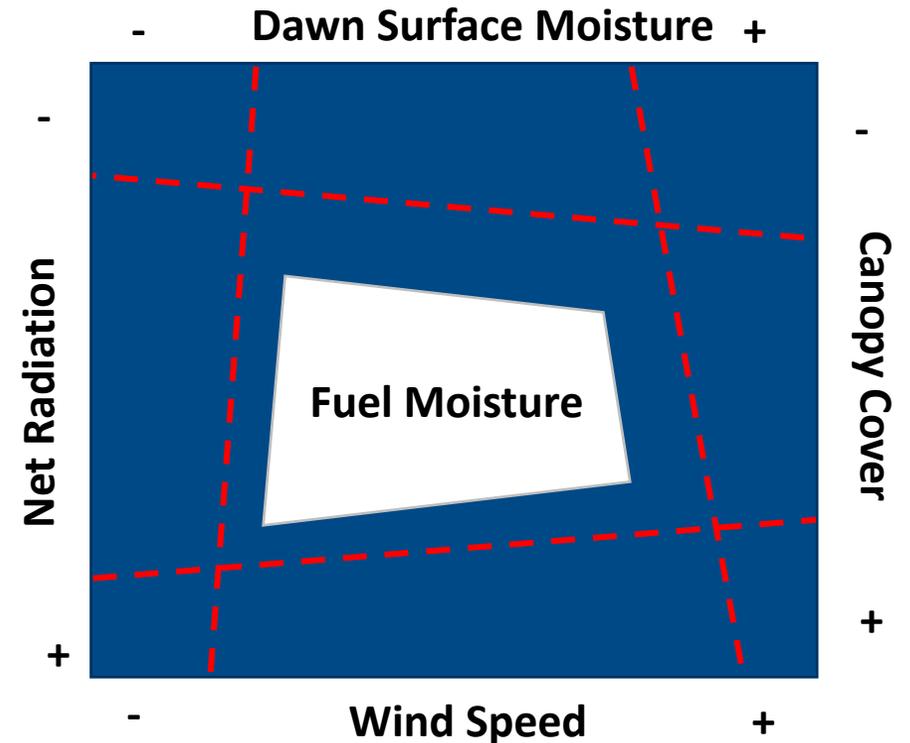
# Prescription Precisionism

- Prescriptions are either developed from Fire Behavior Prediction System.... OR
- Past experiences
- They are LEGAL documents with little science
- Fuel moisture and wind drives fire behavior in FBPS
- Rx mostly denotes RH and Temp to define windows for fuel moisture



# Prescription Precisionism

- What if Fuel Moisture is more complicated?
- How does dew or rain or soil moisture affect diurnal drying
- What if prescriptions are wider than we allow?
- Too many artificial constraints on fire managers already...



# Current Systems are Problematic

- NFDRS based on a 1/2" pine dowel
- Built on “worst case scenario”
- Fire lines interact
- Equilibrium moisture assumptions don't describe the real world
- Diurnal moisture cycles matter
- Fuels are heterogeneous and drive fire effects
- Days since rain aren't incorporated



# Synergy of Rx Parameters

- Parameter interaction can't be ignored!
  - Predicted low RH but only 2 days since rain
  - Max temp for dormant season burning
- Little science to relate time since rain to burn conditions
- Is the fire accomplishing the desired goals?
  - Decentralize the go/no go decision point



# The Burn Boss is The True Prediction System

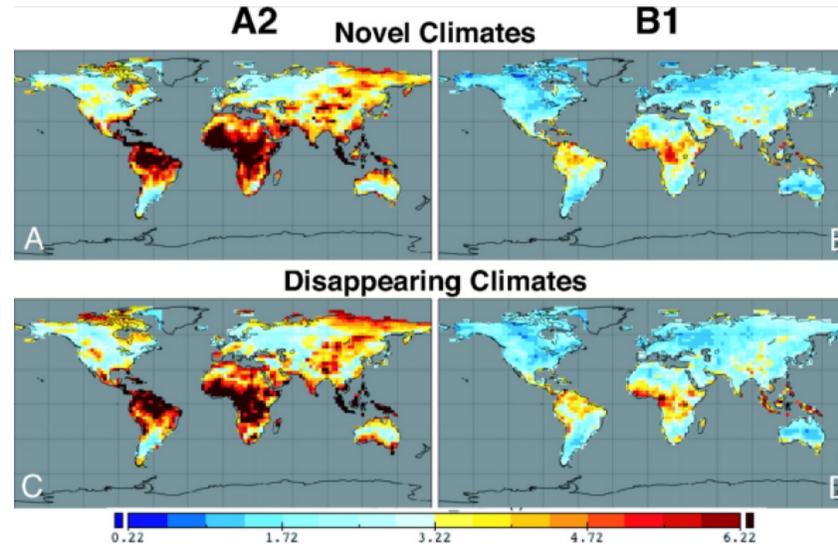
- The burn boss **commonly** recognizes the precisionism trap and mitigates with a variance
  - Not only has ownership but made a decision to proceed outside of the “recommended” parameters
  - Is the liability now jeopardized?



# Experience Under Changing Conditions

The fire culture in the south is comfortable with experience  
but...

## No-Analog Future or Present



Williams, John W., and Stephen T. Jackson. "Novel climates, no-analog communities, and ecological surprises." *Frontiers in Ecology and the Environment* 5.9 (2007): 475-482.



# East Is Not West and New Tools are Needed

- The foundation of knowledge exists but adequate tools don't
  - Duff ignition probability
  - Fuel moisture dynamics
  - 3D fuel modeling
  - Atmosphere and fireline interactions
  - Synergies can be captured and modeled to actually provide insight
    - QuicFire
    - LIDAR



# Questions?

