Quantifying potential economic benefits of incorporating gridded fuel moisture and weather data into wildland fire decision support in the Northern Rocky Mountains, USA.

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Weather, fuel moisture and fire management

Nine Mile RAWS Station, Montana
Current fire management DSS depends on RAWS

- Data from nearby RAWS extrapolated to entire landscape
- What could possible go wrong?
Nighttime minimum temperature Decoupling from Free Atmosphere

Correlation Matrix
10 RAWS stations on The Bitterroot NF

All within 50 mile Radius

Circled Stations are At mid-slope or valley bottom locations
Wildland Fire Decision Support System (WFDSS)

• Fire Behavior Analyst providing support on an incident

• Local RAWS data from nearest station used to generate gridded weather data for fire behavior simulations (flammap, FARSITE)

• Ignores terrain position of RAWS station and ignores pre-fire conditioning (e.g. snow)
Prescribed fire planning

• RAWS data from nearest station used to estimate whether current weather conditions are within a prescription window

• What if there is snow on the north side of the mountain?
2 big challenges

• Challenge 1: translating new data into Rx and wildfire decisions, showing how much they may influence outcomes

• Challenge 2: Quantifying the cost savings or alternative decision outcomes that could result from using this information
The question is not whether gridded data will improve the quality of our information.

It’s how much.
Task 1

how do spatially explicit gridded fire danger maps impact estimates of areas on the landscape that are within prescriptions for prescribed burning? (M. Jolly)

Methods
For a sample of spring dates, use RAWS to quantify areas within burning prescription

Compare with gridded estimates

Translate differences into decision outcomes and potential lost opportunities
Task 2
How do topographically resolved gridded fuel moisture estimates influence modeled fire behavior, and fire spread rates? (Russ Parsons, Chad Hoffman)

Methods
For a sample of fires in the US Northern Rocky Mountains we will quantify modeled fire behavior, rates of spread and size using existing methods, relying on the nearest RAWS and the same fires using improved gridded weather and fuels moisture data.
Wildland Fire Dynamics Simulator (WFDS; Ruddy Mell)

- Level Set method
- Nested models (simple to full physics based)
- Level Set 1 equivalent to FARSITE
- Provides basic spread information equivalent to operational model

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A comparison of level set and marker methods for the simulation of wildland fire front propagation

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Fire behavior methods

• Estimate how decision space would be expanded by better information (e.g. presence of natural barriers, i.e. snow)

• Use a value of information approach to demonstrate how refined information on fire behavior and opportunities could improve incident decisions

• Quantify these improvements using a vector of outcomes that at a minimum will include suppression cost and responder exposure.
Task 3: How much will gridded weather and fire danger improve models of aerial fire retardant success?
(Keith Stockman)

- Aerial fire retardant applications are expensive (> $75,000 per drop)
  - sometimes they have no effect at all on fire spread

- Wildland fire managers at the national level have invested in the development of models aimed at predicting whether a proposed retardant drop is likely to be effective

- A logical question is whether gridded weather and fuel moisture data (or drought indices) can improve the accuracy of these models over using local RAWS data alone
Methods

evaluate the potential for gridded weather and fire danger data to improve models aimed at estimating the probability of success for aerial retardant application

Based on higher amounts of explanatory power we will estimate the potential economic benefits of more cost effective retardant delivery using the expected value of perfect information based on real wildfire examples from the 2015 and 2016 seasons.

This change in the quality of information can be directly translated into decision making and cost saving
Questions