Fuel Treatment Leverage: Encounter Rates and Net Cost Impacts

National Fire Decision Support Center

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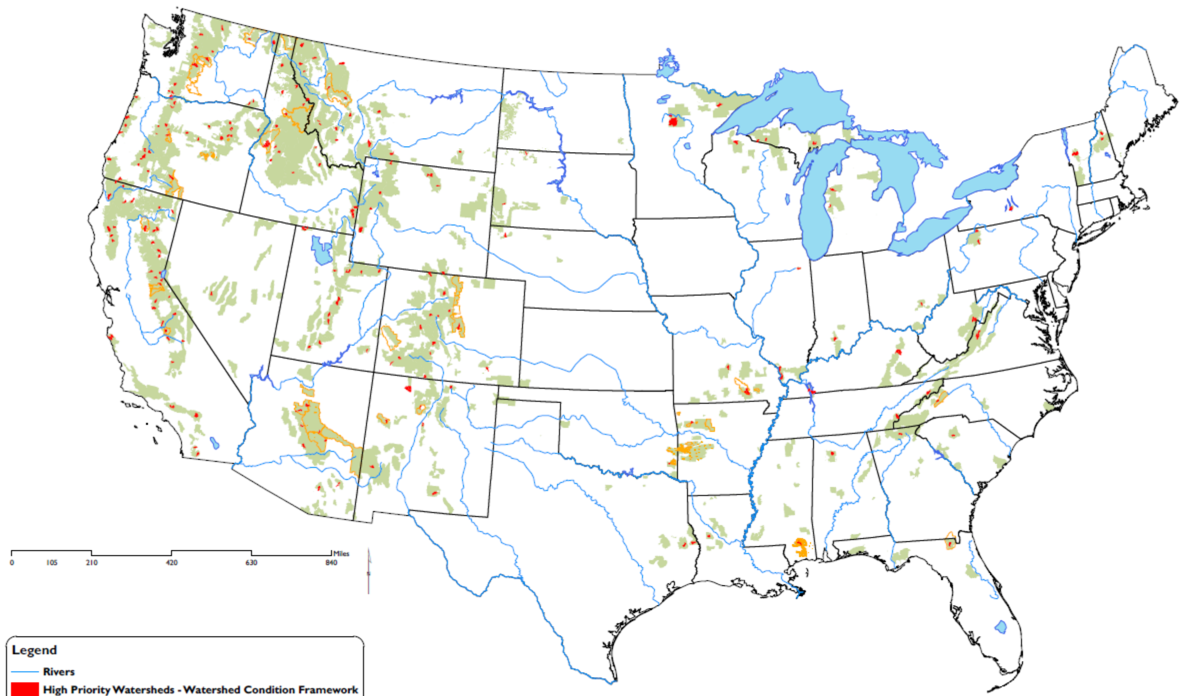
Collaborative Forest Landscape Restoration

“facilitate the reduction of wildfire management costs, including through reestablishing natural fire regimes and reducing the risk of uncharacteristic wildfire”

Collaborative Forest Landscape Restoration and High Priority Restoration Project Boundaries Overlaid with High Priority Watersheds



Legend
- Rivers
- High Priority Watersheds - Watershed Condition Framework
- Lakes
- State Boundaries
- CFLRP/HPRP Project Boundaries
- National Forest

Description

This map shows the boundaries of the Collaborative Forest Landscape Restoration (CFLR) projects and other High Priority Restoration Projects (HPRP) funded by the U.S. Forset Service (USFS) in Fiscal Year (FY) 2012. These boundaries are overlaid with the High Priority Watersheds identified by the USFS using the Watershed Condition Framework in FY2012.

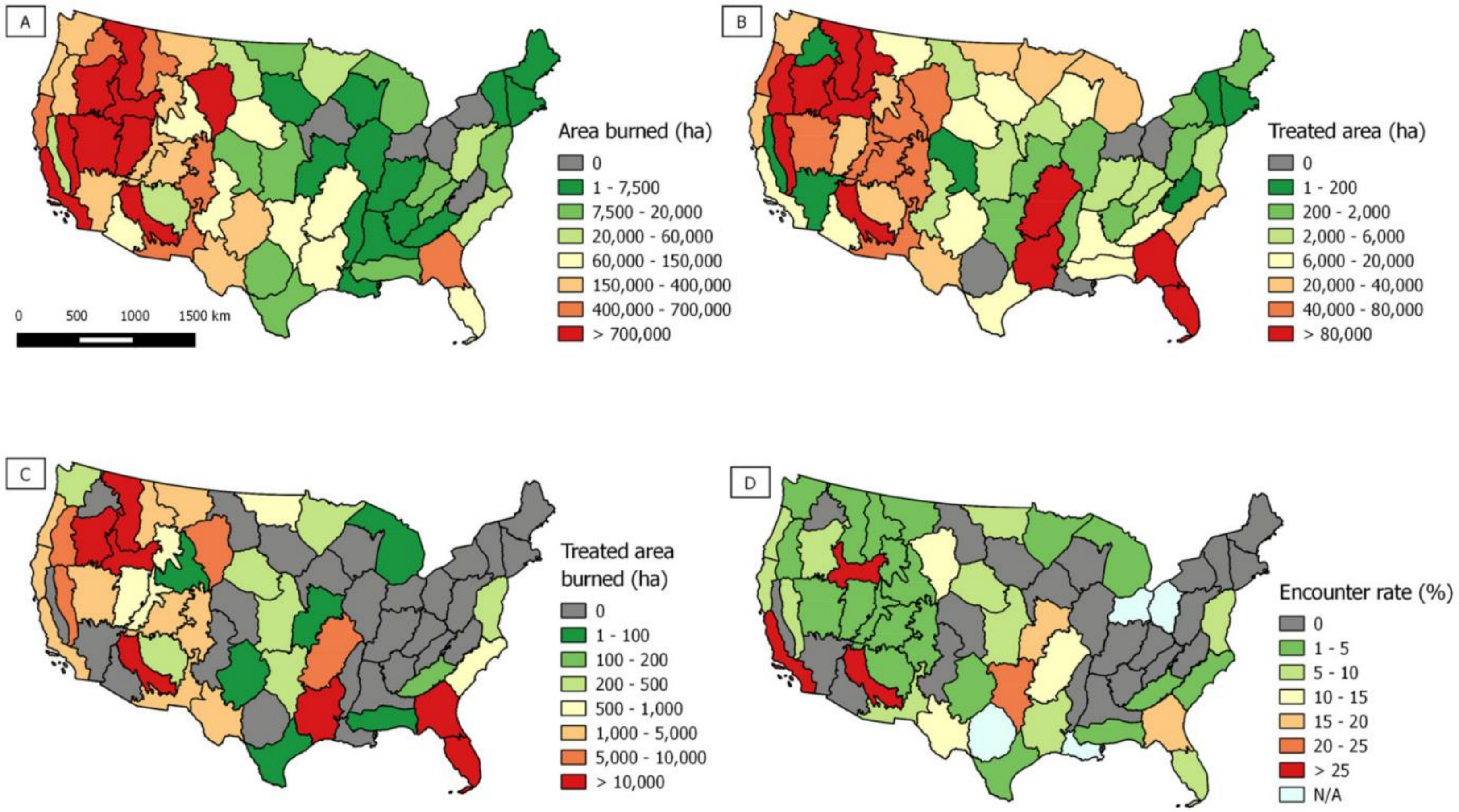
Many of the CFLR/HPRP project landscapes also contain high priority watersheds, highlighting the synergistic priorities between these programs.

fs.fed.us/restoration/CFLRP/index.shtml

Research Objectives

- Generate efficient frontiers and explore tradeoffs across risk reduction, volume production, and cost minimization objectives
- Explore the impact of variable spatial extent and dispersed versus clustered treatment strategies
- Quantify frequency-magnitude distributions of fire-treatment interactions
- Quantify and expand “leverage” concept
    - Unit treatment area versus burned area avoided
    - Unit treatment cost versus suppression cost avoided
    - Unit treatment NVC reduction versus NVC avoided

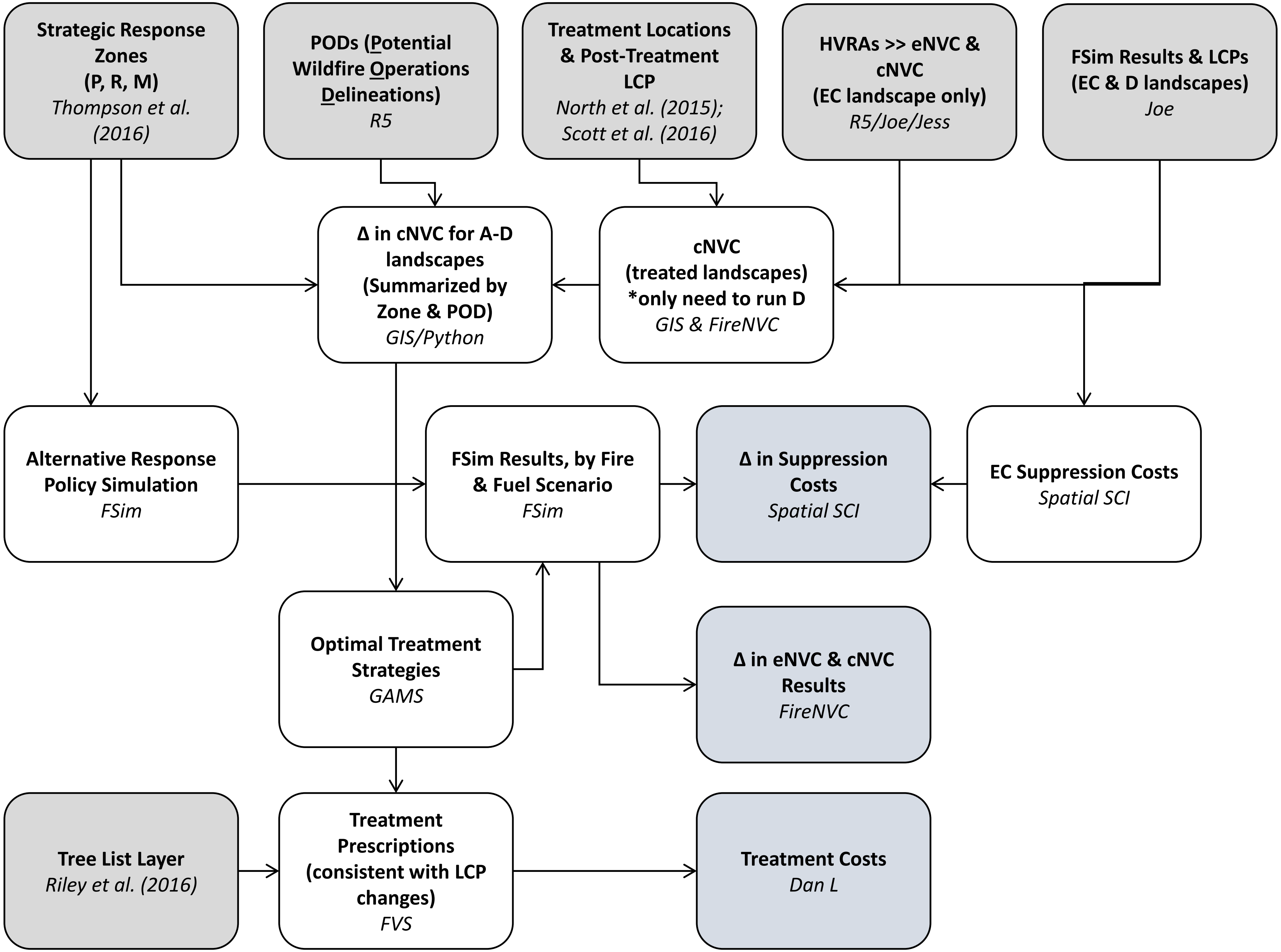
Fire & Treatment Interactions



Barnett et al. (2016)

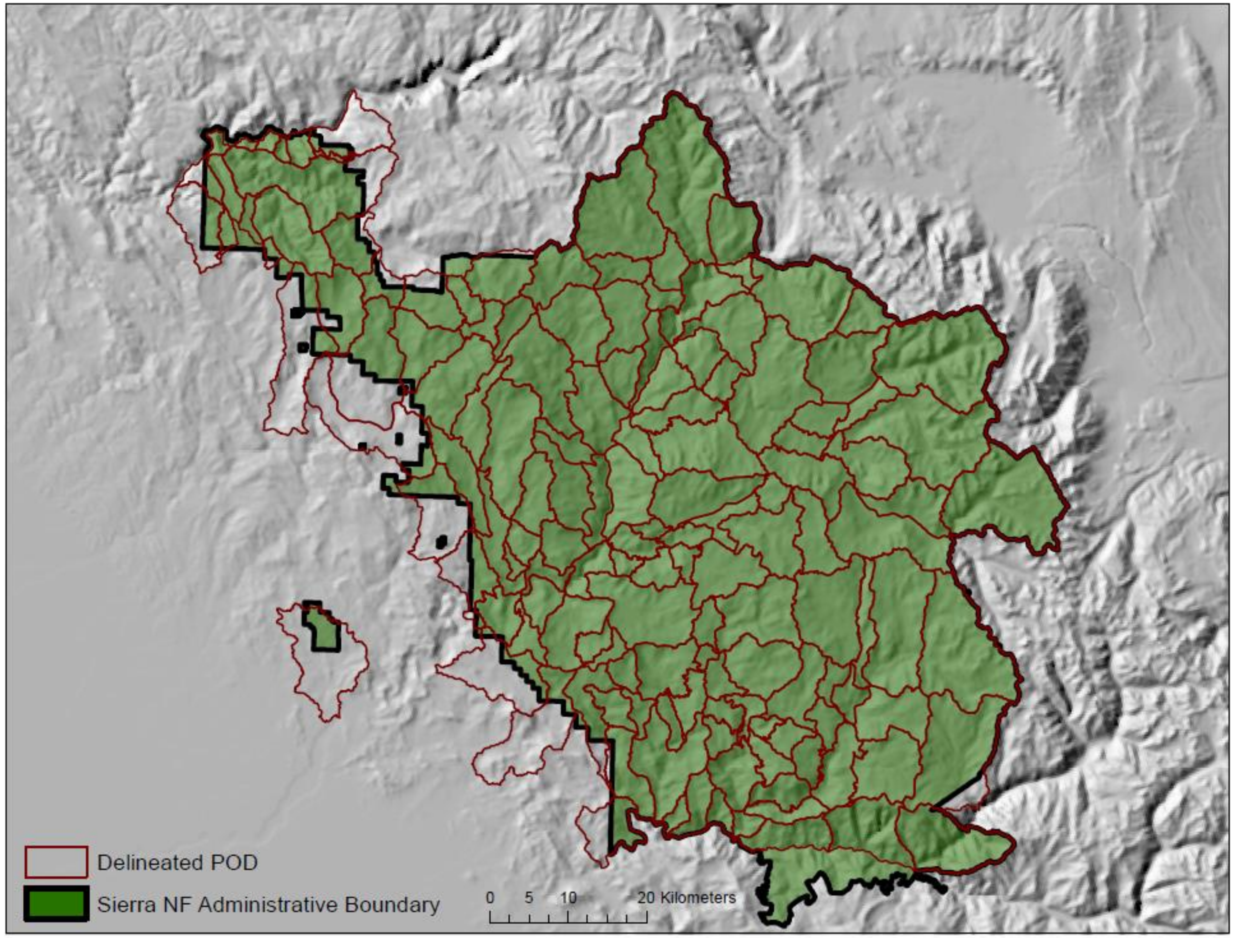
One critique is that fuel treatment benefits are unlikely to transpire due to the low probability that treated areas will be burned by a subsequent fire within a treatment's lifespan…

6.8% of treatment units created between 1999 and 2012 on federal lands outside of the $WUI_{2.5}$ were encountered by a subsequent fire by 2013



Strategic Response Zones (P, R, M)
Thompson et al. (2016)
PODs (Potential Wildfire Operations Delineations)
R5
Treatment Locations & Post-Treatment LCP
North et al. (2015); Scott et al. (2016)
HVRAs >> eNVC & cNVC (EC landscape only)
R5/Joe/Jess
FSim Results & LCPs (EC & D landscapes)
Joe
Δ in cNVC for A-D landscapes (Summarized by Zone & POD)
GIS/Python
cNVC (treated landscapes) *only need to run D
GIS & FireNVC
Alternative Response Policy Simulation
FSim
FSim Results, by Fire & Fuel Scenario
FSim
Δ in Suppression Costs
Spatial SCI
EC Suppression Costs
Spatial SCI
Optimal Treatment Strategies
GAMS
Δ in eNVC & cNVC Results
FireNVC
Tree List Layer
Riley et al. (2016)
Treatment Prescriptions (consistent with LCP changes)
FVS
Treatment Costs
Dan L

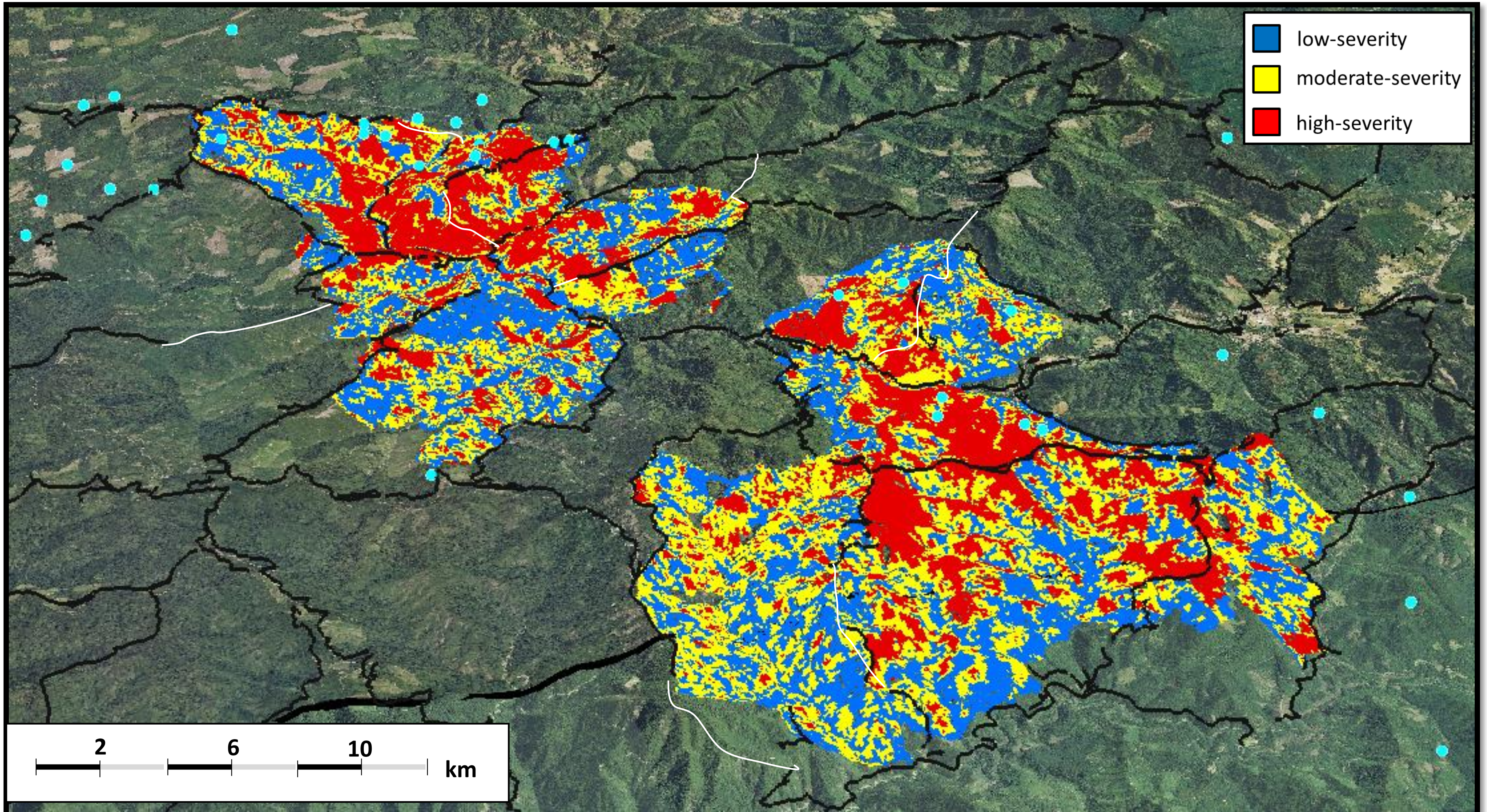
RESPONSE PLANNING
Features Relevant to Fire Operations



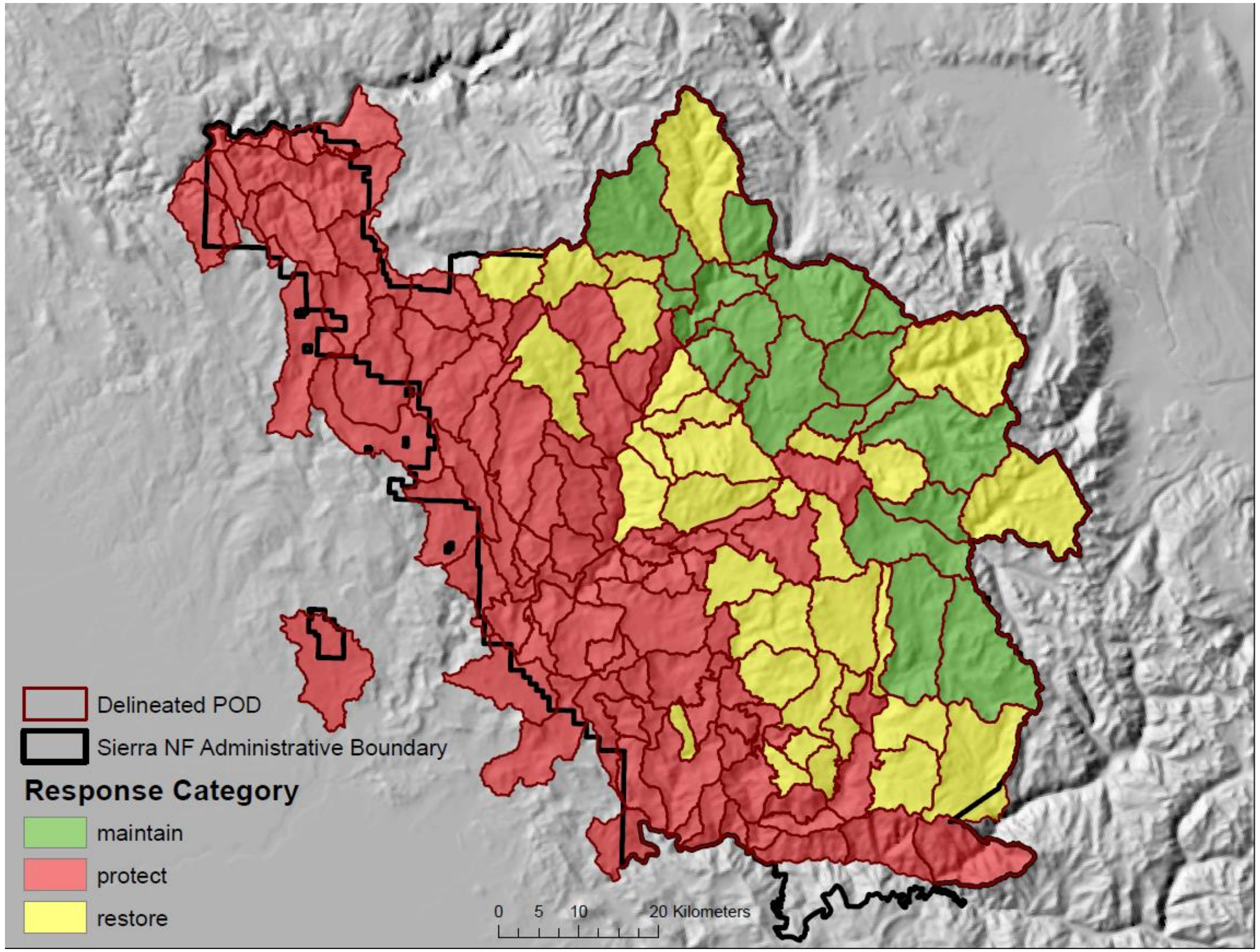
Potential wildland fire Operations Delineations (PODs)

Roads, ridges, water bodies, fuel transitions, etc.

Identify control points from PODs



RISK-BASED POD CATEGORIZATION



Assignment schema

In situ risk

Transmitted risk

Simulating Fuel Treatments

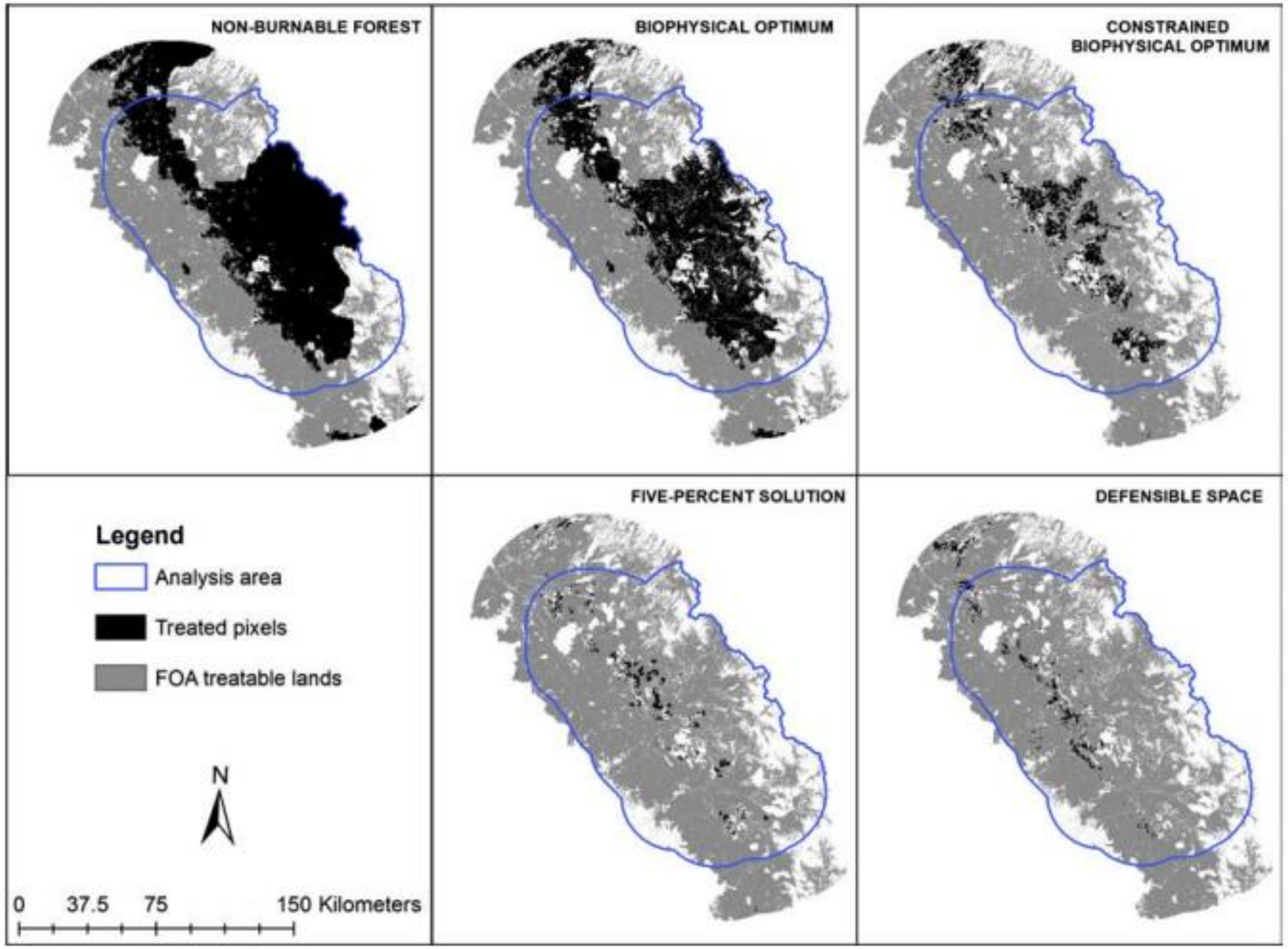
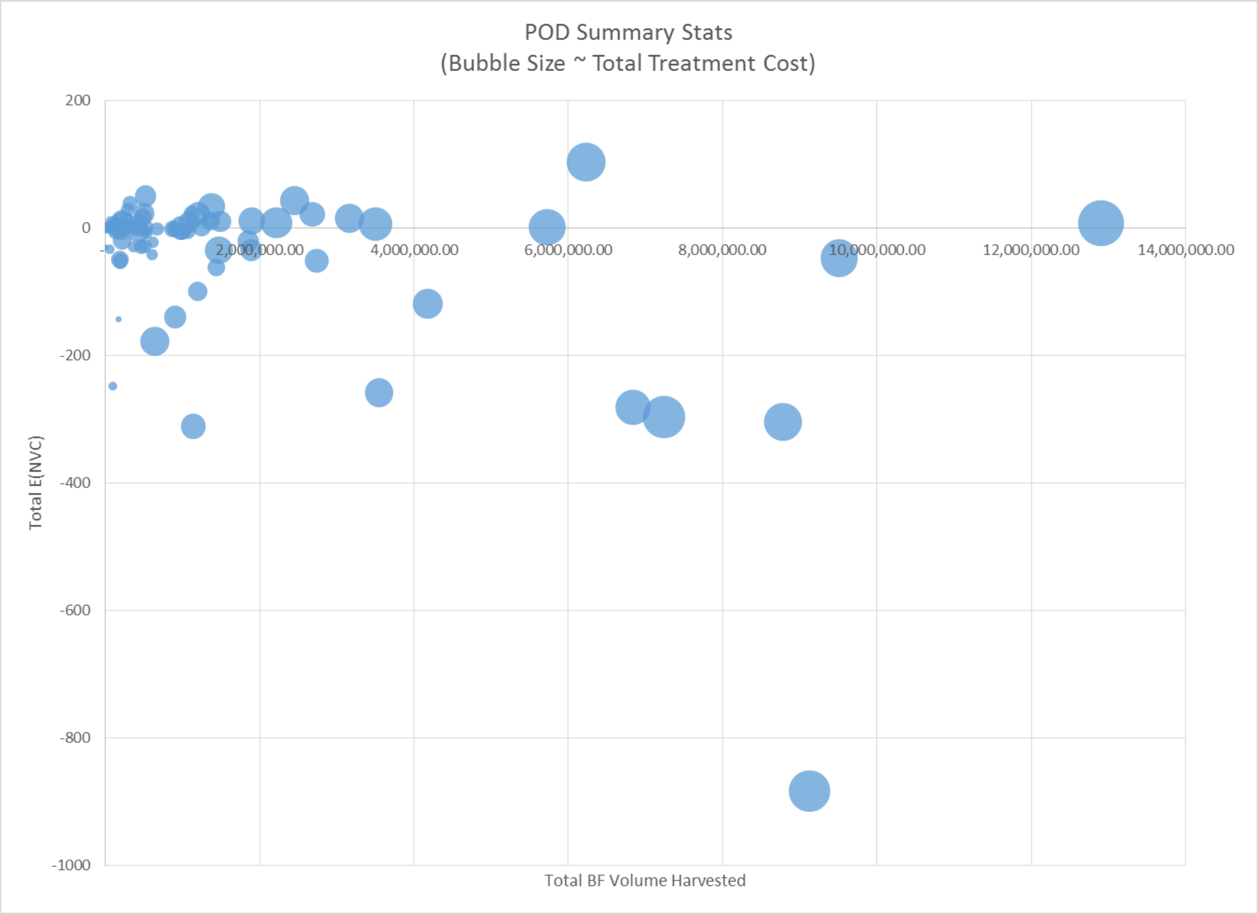


Fig. 2. Treatment masks showing the locations of each of the five hypothetical treatment scenario implementations. The Non-burnable Forest, Biophysical Optimum, Constrained Biophysical Optimum, and Five-percent Solution treat locations within USFS lands only (all of which are treated in the NF scenario, and subsequent fuelscapes treat smaller amounts). The Defensible Space treatment scenario includes treatments both within and outside of USFS lands. Treatments outside of the analysis area are modeled to avoid artificial edge effects.

POD Summary Stats



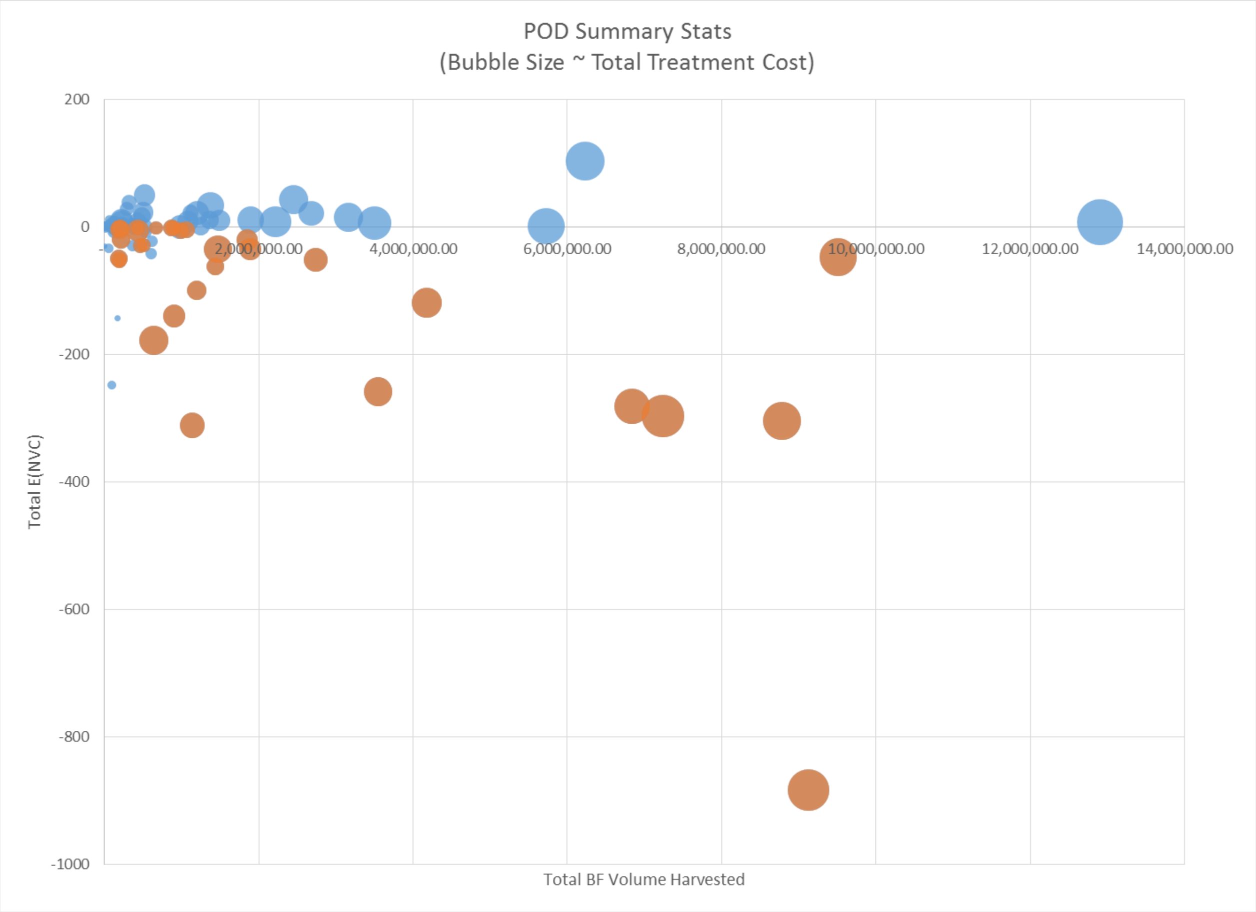
Initial summary of POD-level stats on:

- Total board foot (BF) volume harvested
- Total e(NVC)
- Total treatment cost

Additional filters then applied for treatment prioritization:

- Minimum treatable area (500 ac)
- Negative e(NVC)

Eligible PODs



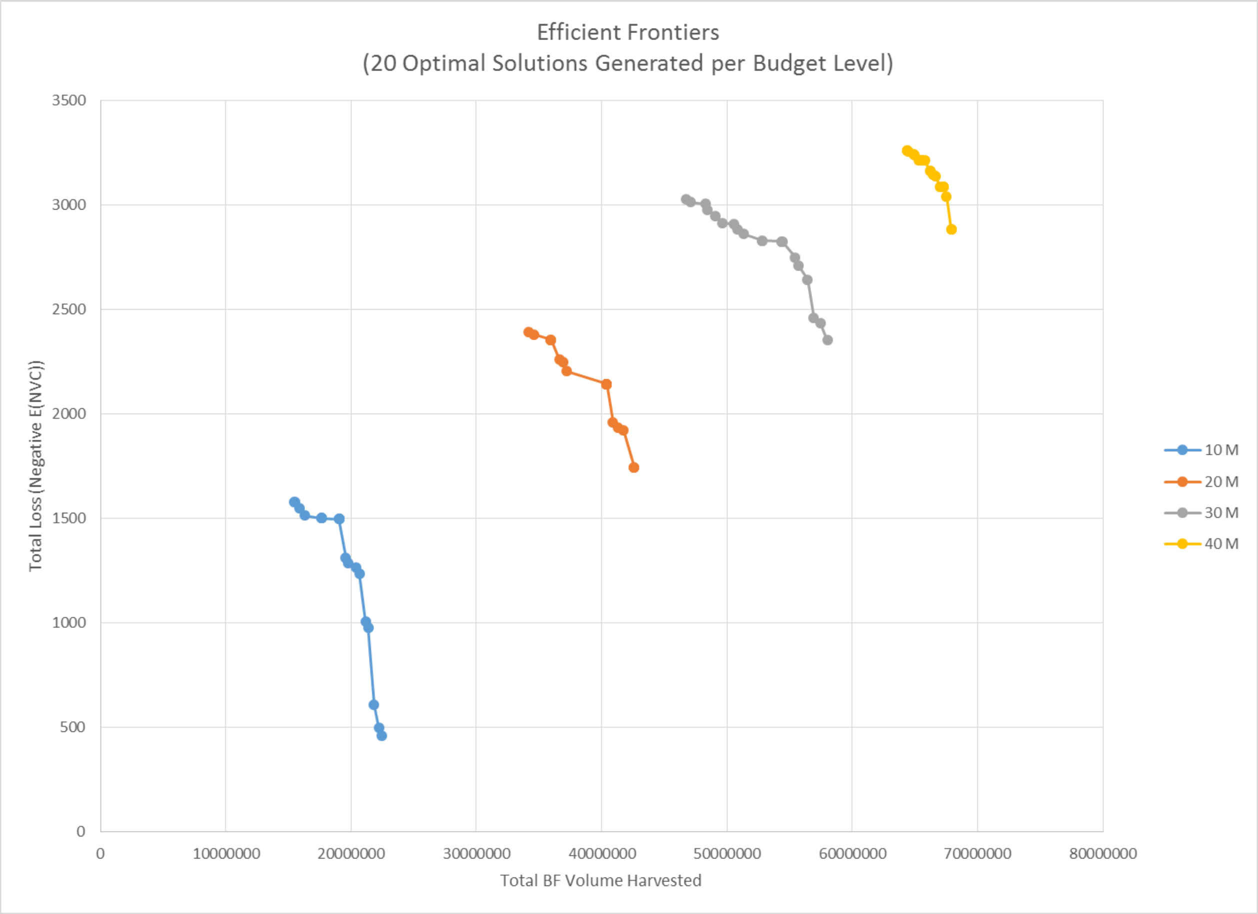
- 31 PODs remained eligible for treatment
- Treatable area ~ 51,000 ac

- POD 40 (bottom-most) appears in nearly every optimal solution generated (high risk, high volume, but high cost)

Dispersed Treatment Strategy

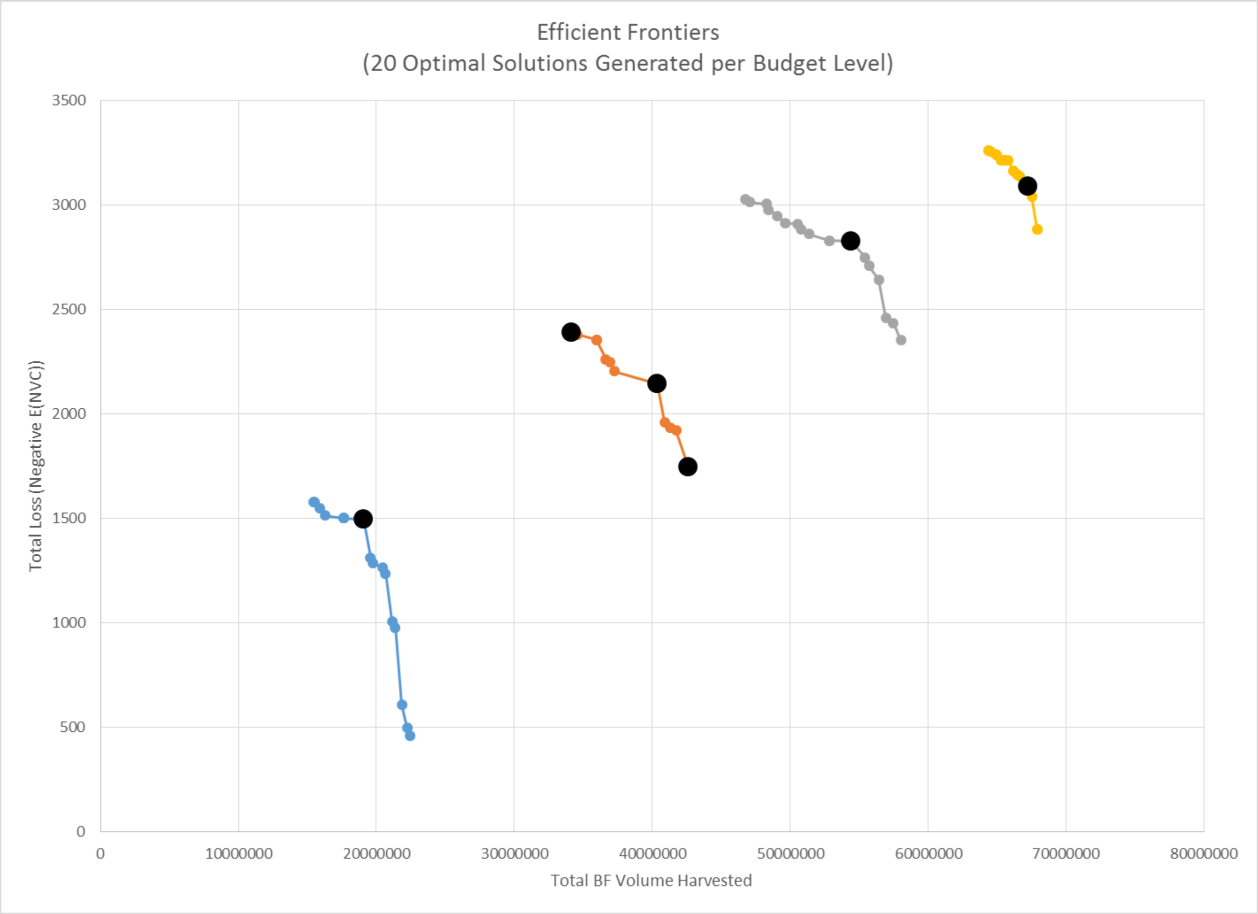
- POD as treatment unit (0/1 variable)
- 31 decision variables (small problem)
- Mixed Integer Program solved to optimality with GAMs

Efficient Frontiers across Budgets



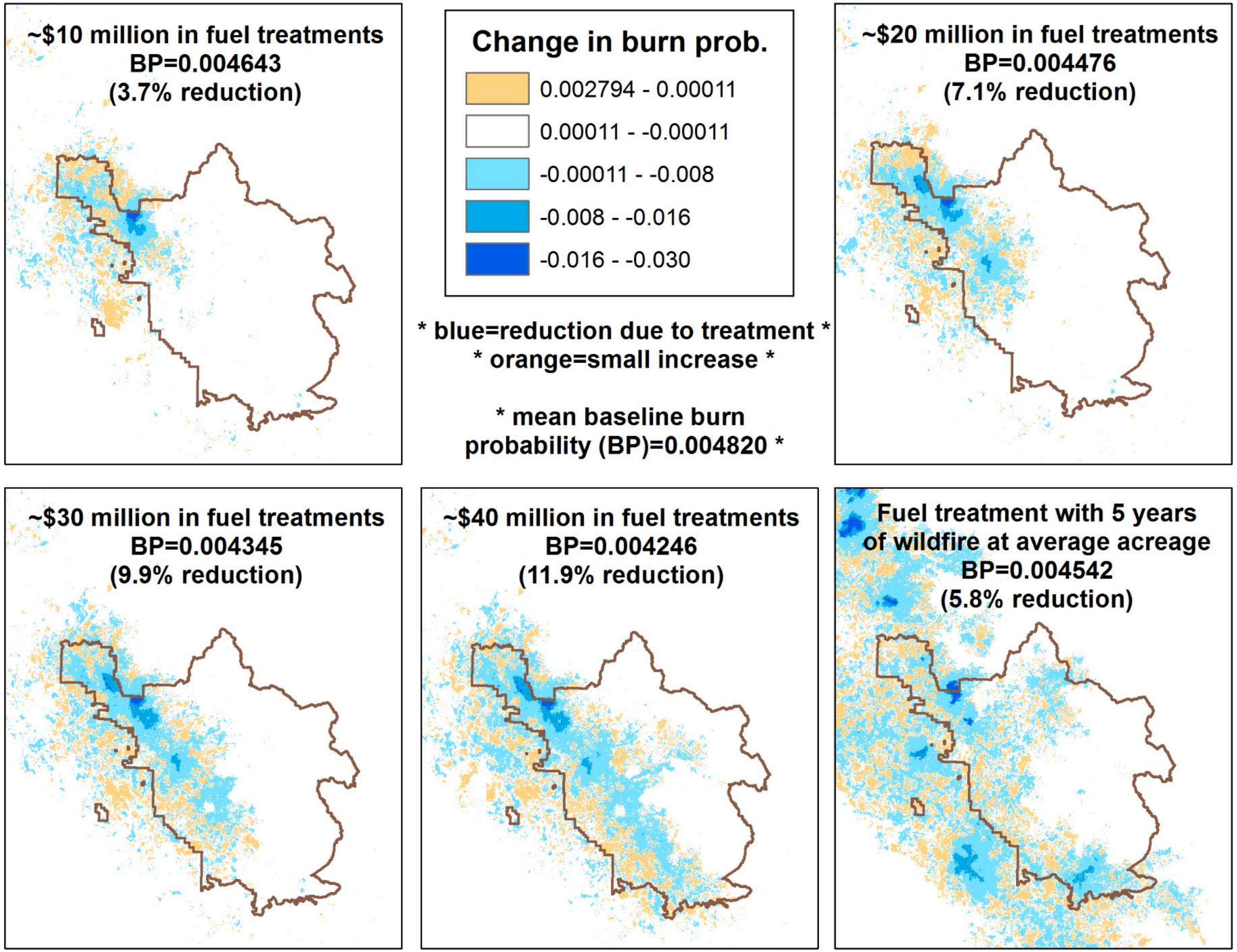
- Exclusive of PODs with beneficial e(NVC)
- Vertical axis reoriented, now looking only at losses in positive dimension
- Steepest slope on 10M budget, suggesting small reductions in volume can lead to significant increases in risk reduction
- Range of frontiers narrows as budget levels increase (coalesce around common set of PODs to treat)

Selecting Subset of Optimal Solutions

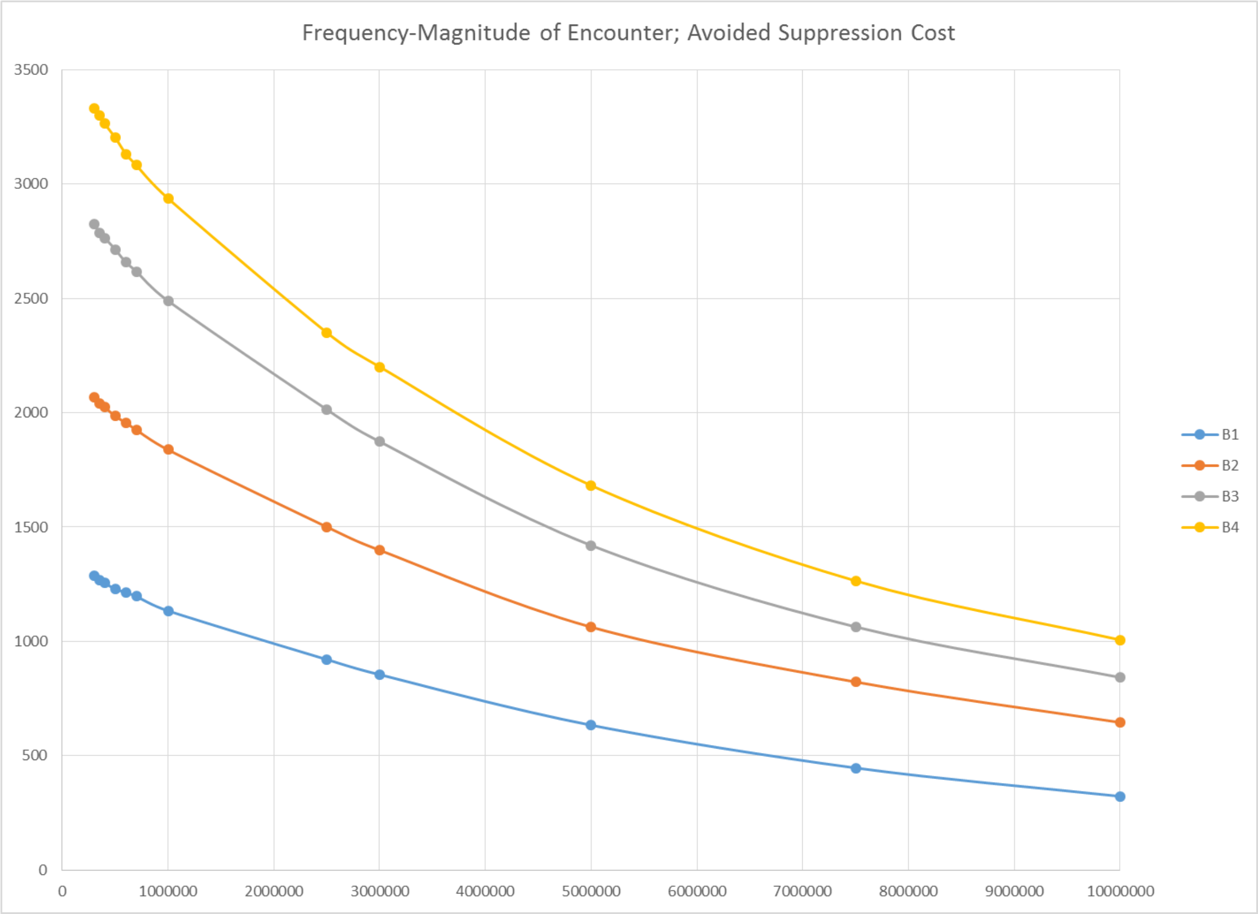


- Selected 6 solutions for additional analysis, at least 1 from each budget level
- For all budgets
  - Determine solution according to even-weighted sum of normalized (0-1) objective scores
- For 20M budget
  - Select endpoints as well

Modeled fuel treatment effect on burn probabilities in the Sierra National Forest



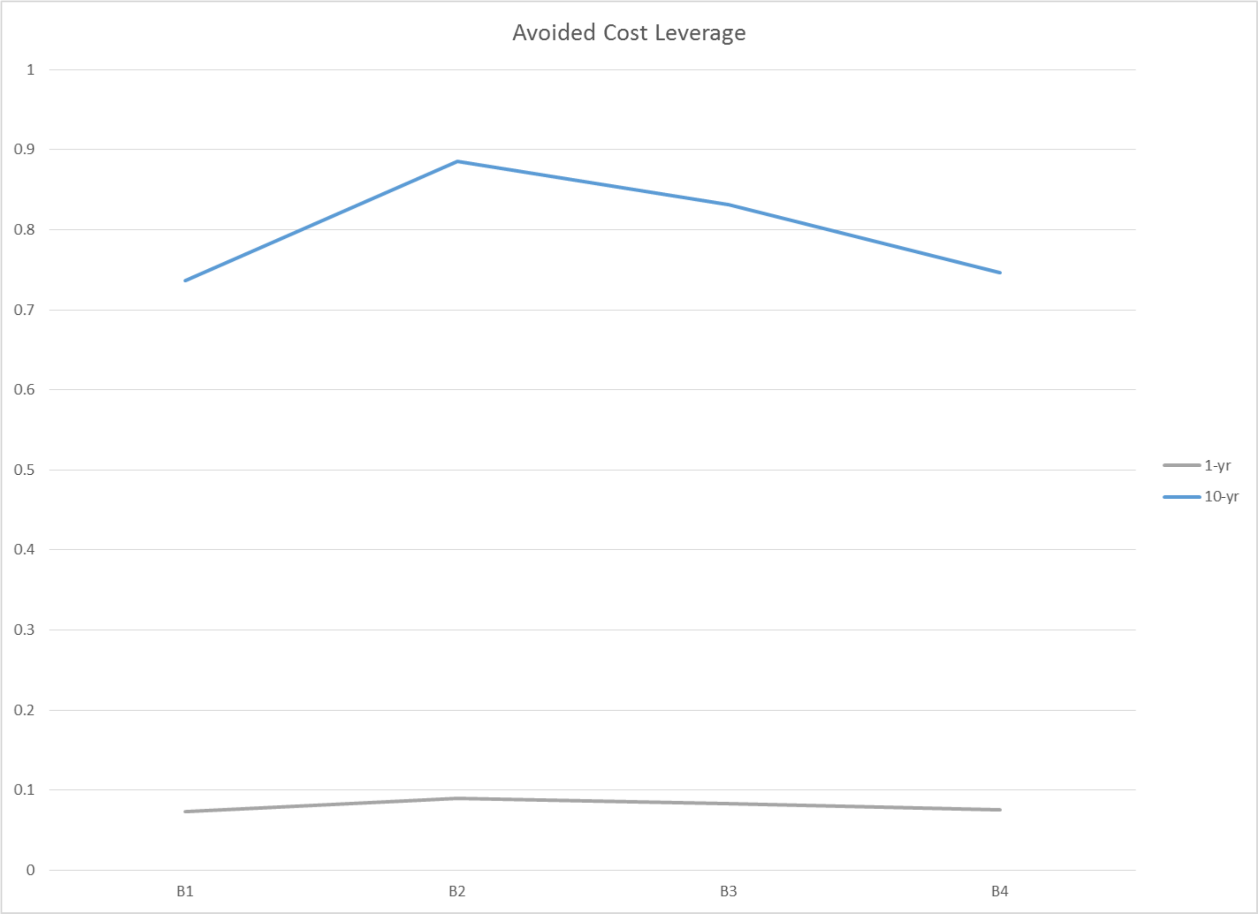
Preliminary Results – Encounter Rate



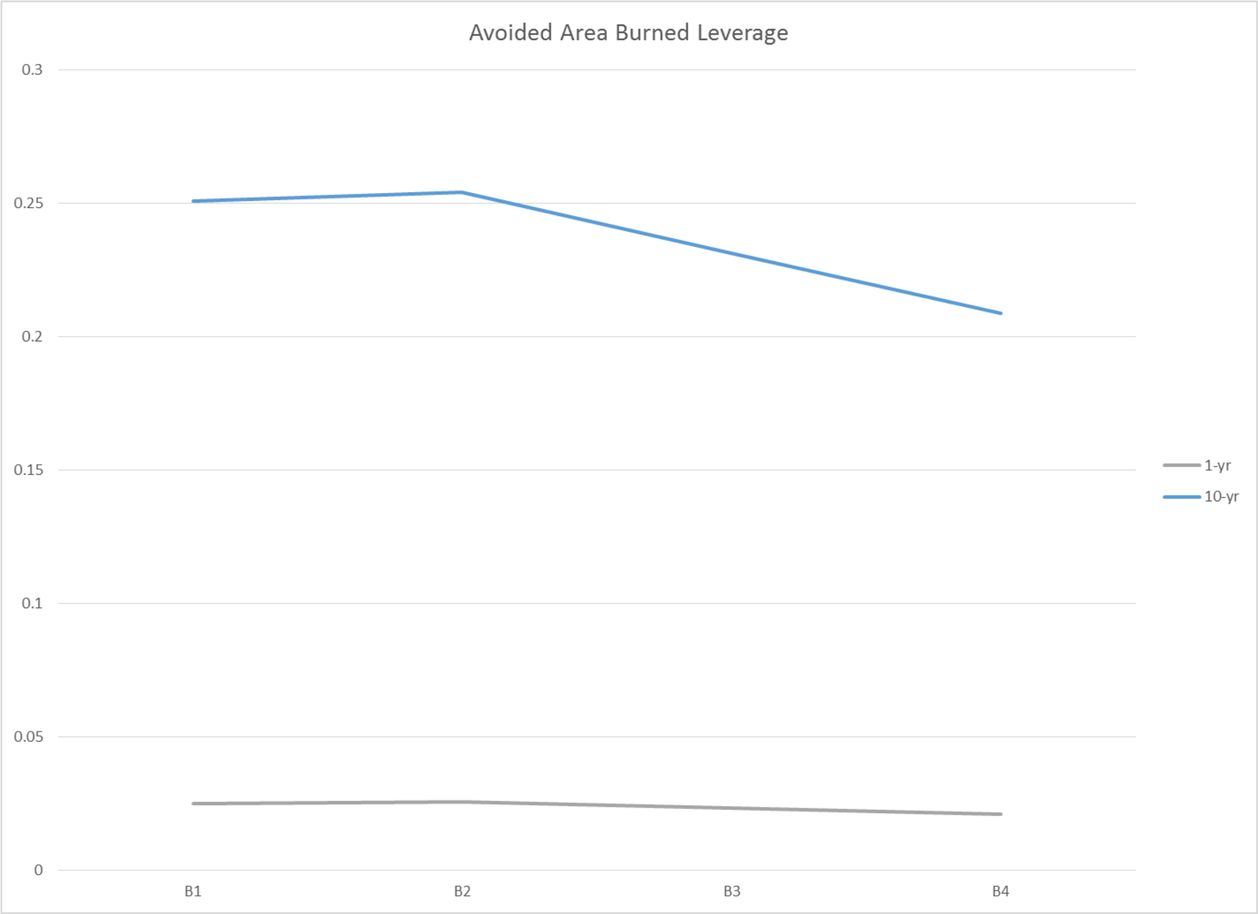
Preliminary Results – Summary

	Budget $10M	Budget $20M	Budget $30M	Budget $40M
Area Treated	9,960	19,575	29,935	40,856
Avoided Area Burned	248	500	695	856
Avoided Suppression Cost	726,783	1,795,659	2,506,016	3,008,376
Change NVC	3,125	5,688	8,344	10,674

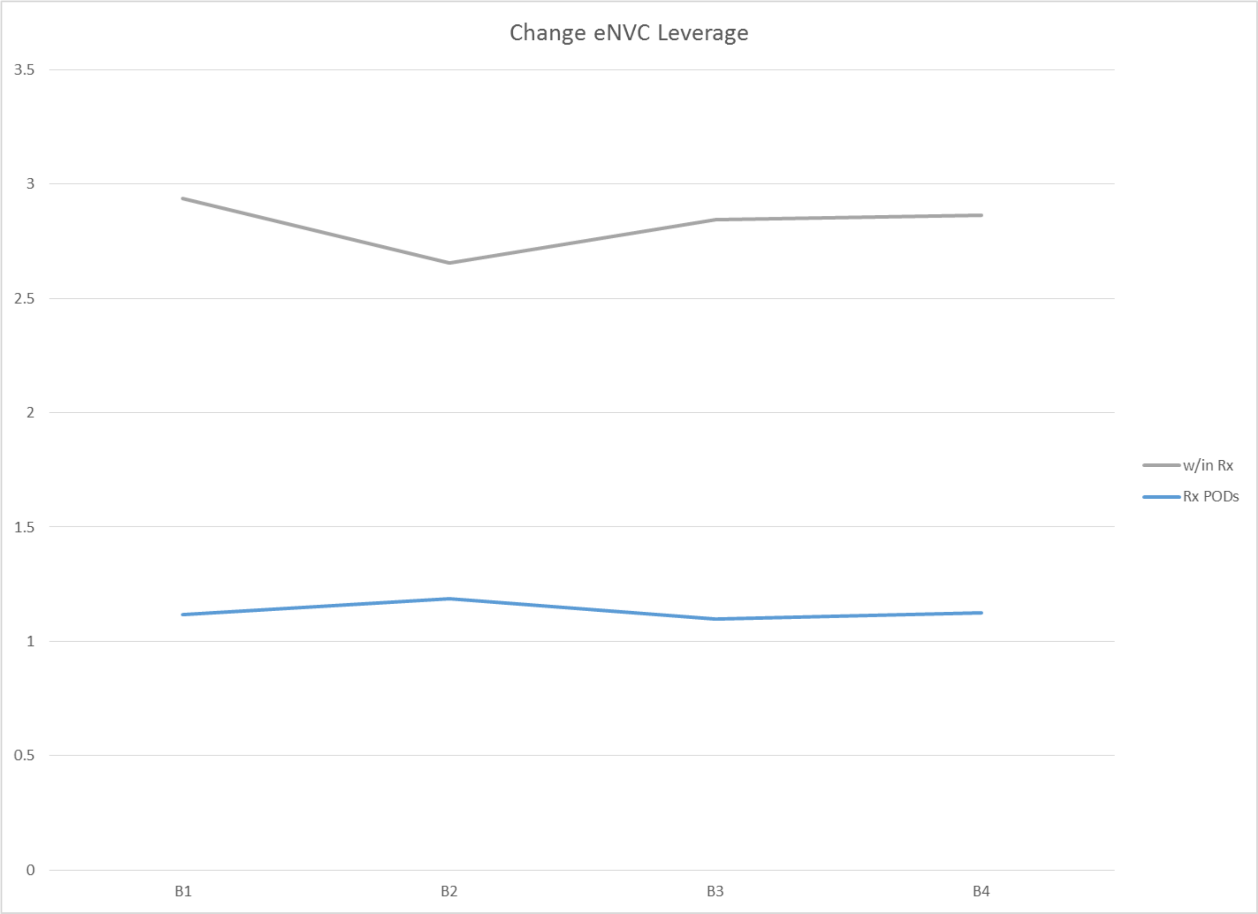
Preliminary Results – Avoided Cost



Preliminary Results – Avoided Area Burned



Preliminary Results – Change in eNVC



Insights & Future Directions

- Net Value Change may be where biggest signal is present
  - How to relate to $ for ROI?
  - How to extend across time?

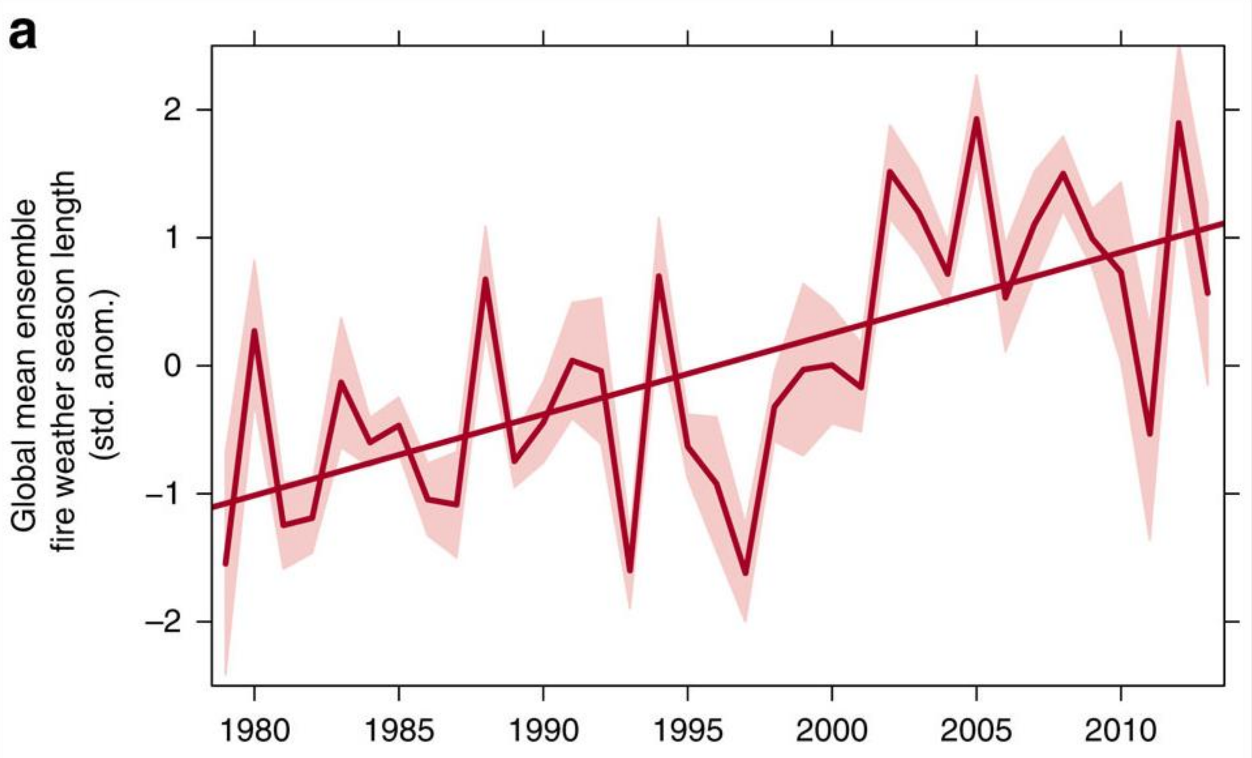
- Encounter rates & interpretation
- Simulating “clustered” treatments – interrupt fire spread & offsite impacts
- Accounting for harvest revenues

Questions?

Ask at your own peril

Increasing Fire Activity & Damages

From
Climate-induced variations in global wildfire danger from 1979 to 2013
W. Matt Jolly, Mark A. Cochrane, Patrick H. Freeborn, Zachary A. Holden, Timothy J. Brown, Grant J. Williamson & David M. J. S. Bowman
Nature Communications **6**, Article number: 7537 | doi:10.1038/ncomms8537



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Colorado Wildfires Threaten Water Supplies

As fires are contained, water managers assess the damage, draw more on the Colorado River, and try to prepare for a dry future.

Smoke rises around Rampart Reservoir from Waldo Canyon Fire in this aerial photograph taken in Colorado Springs, Colorado, on June 27, 2012.

Photograph by John Wark, Reuters

NEED FOR CHANGE

<u>Direct from the Chief:</u>

We are at a <u>critical moment</u> in the history of the Forest Service. <u>Urgent action is needed</u> in order to ensure that the Forest Service does not become further hindered by the continually <u>increasing percentage of our budget that is dedicated to wildfire suppression activities</u>

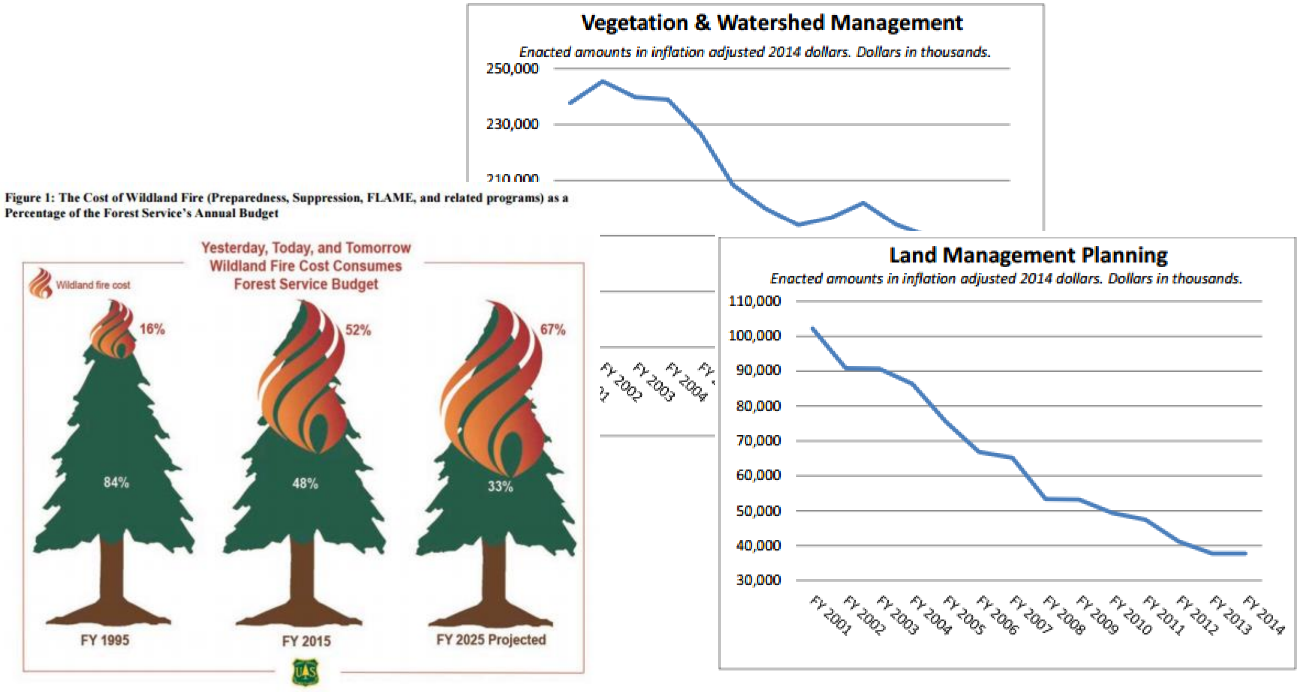
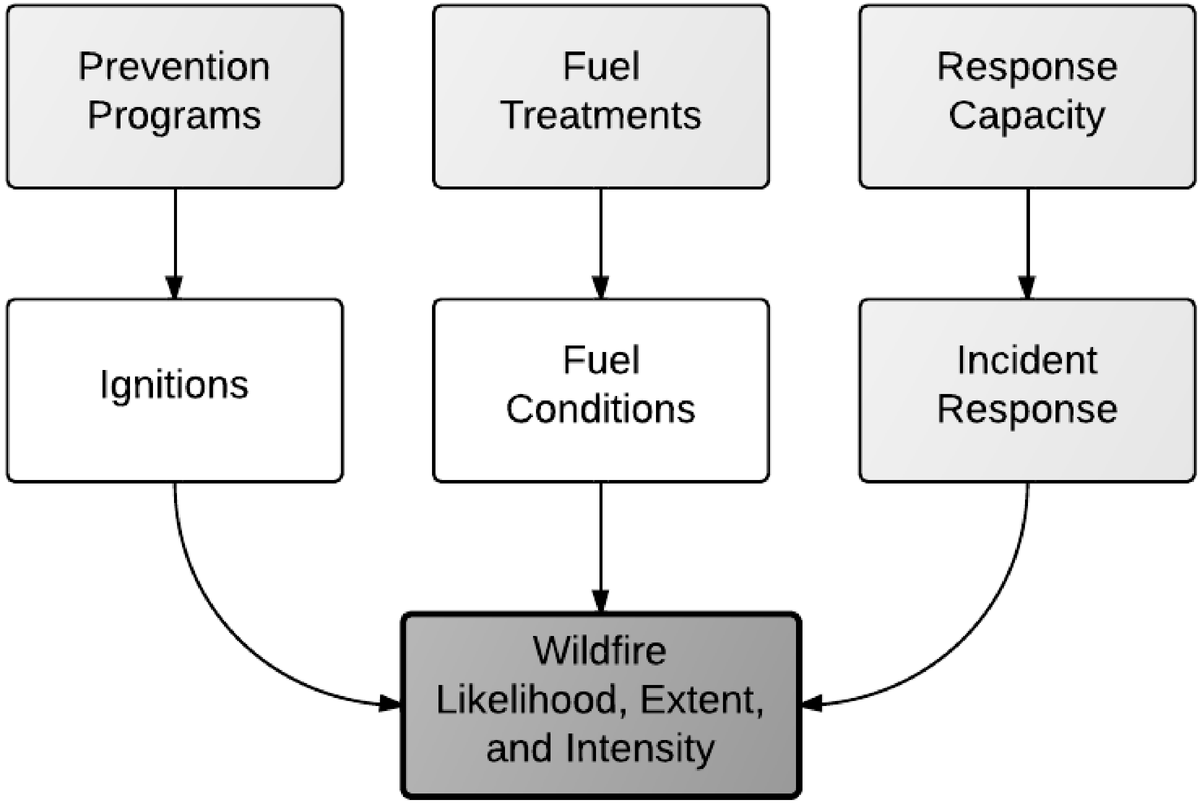


Photo © by Kari Greer

Toolkit



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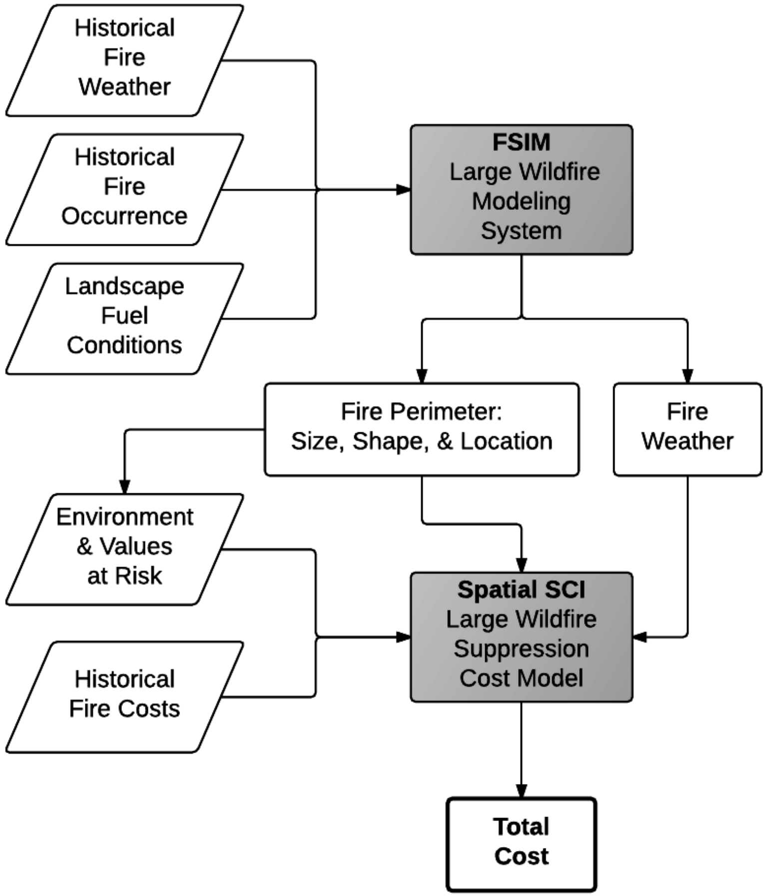
Suppression Cost Modeling



Foundation is stochastic fire modeling outputs

Assign costs on a per fire basis

Capture geographic variation in expected suppression costs

Generate cost distributions