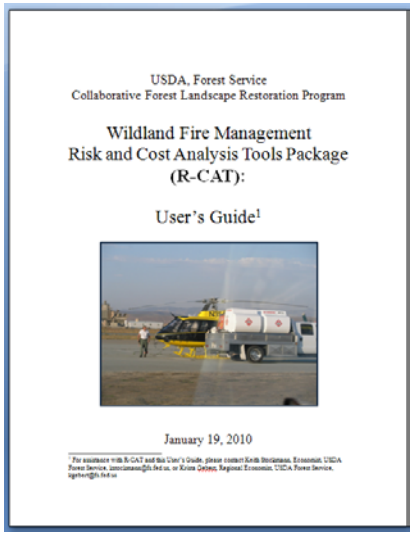
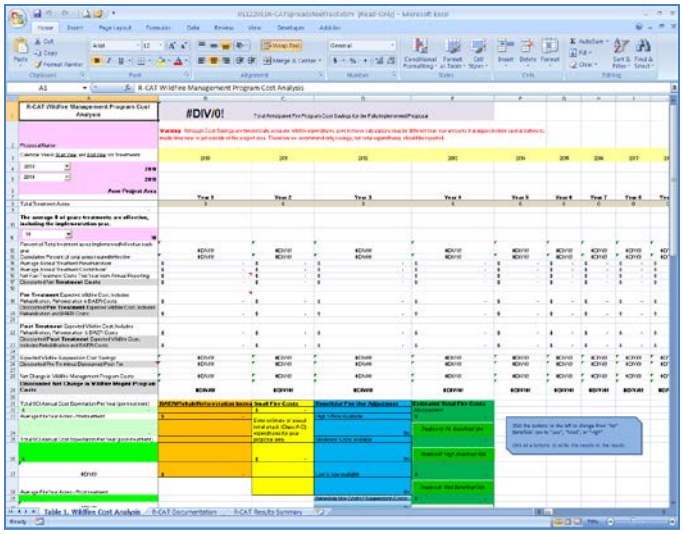
Estimating Fire Program Management Cost Savings and Risk Reduction for the US Forest Service's CFLRP Fuel Treatments, Using the Risk and Cost Analysis Tools Package (R-CAT)


USDA, Forest Service
Collaborative Forest Landscape Restoration Program

Wildland Fire Management
Risk and Cost Analysis Tools Package
(R-CAT):

User's Guide[1]

January 19, 2010



February 9, 2012- NFF Peer Learning Call

Tom Mafera and David Owens, Deschutes National Forest

Krista Gebert USFS, Regional Economist, Keith Stockmann, PhD, Economist, R1

Matthew Thompson, Research Forester, PhD, RMRS

Nicole Vaillant, PhD, Ecologist (Fire), PNWRS

Presentation Outline

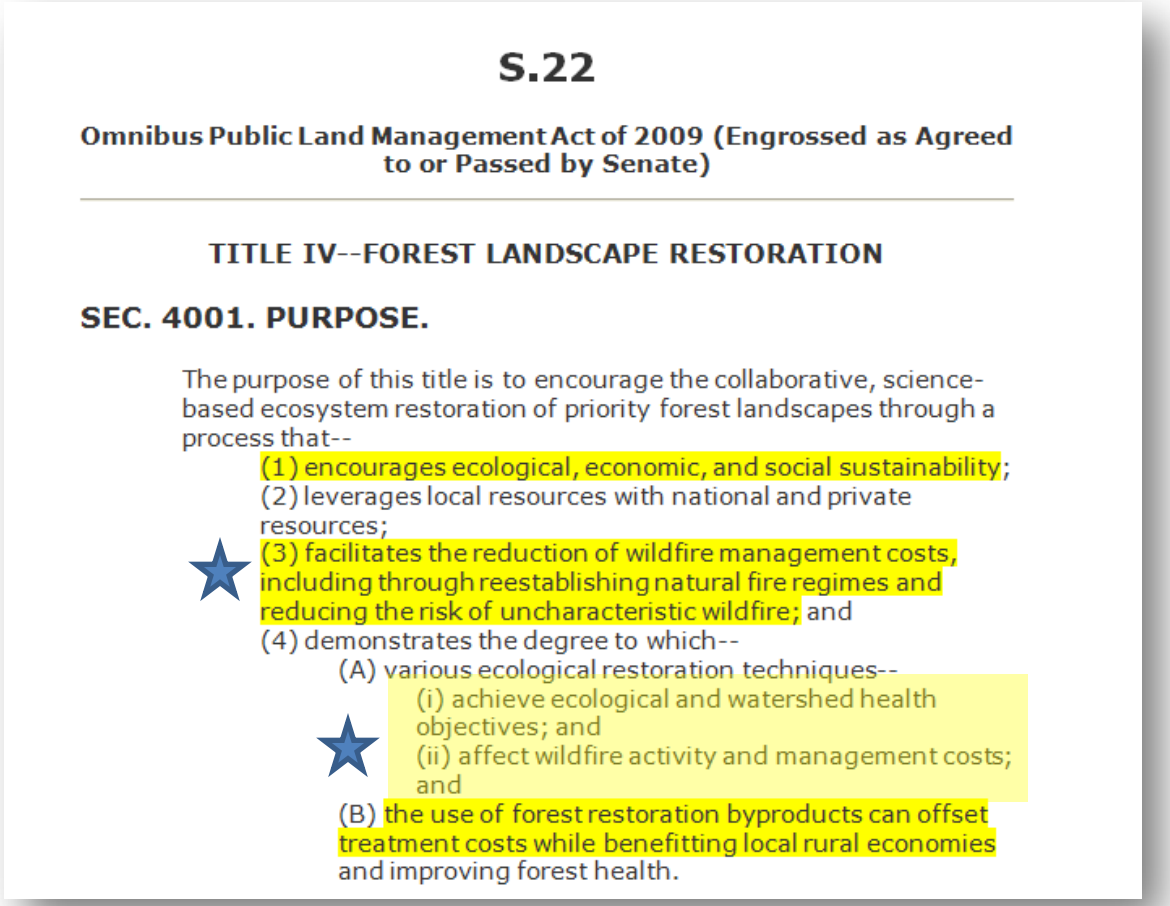
- Why was RCAT developed, what is the point of the analysis?
- Overview of pieces to the R-CAT analysis and who does them (Keith Stockmann)
- Brief description of FSIM and what is needed and lessons learned thus far as to what works best (as far as getting information from the field) (Nicole Vaillant)
- Explanation of the work that needs to be done by the CFLR team (Deschutes)
- Description of FSIM results and how they are currently used in the analysis to compute suppression cost savings (Matt Thompson)
- Filling in the R-CAT spreadsheet (Keith Stockmann)
- What to do with the analysis – exploring options (Krista Gebert)
- Thinking about the "R" in R-CAT - how to include a risk component (Matt)- using the work that Matt did on the Deschutes HVR
- Conclusions (Keith Stockmann)

Why attempt to quantify impacts of fuel treatments on suppression costs?

- Background
  - Strategic Placement of Treatments
  - National pressure to contain wildfire costs
  - Needs based on comments
  - 2011 Cohesive Strategy
- Review of Act Language
  - Competition for limited funds
  - National Indicator?
    - Demonstrating the value of fuel treatment investments at the landscape scale, does it affect fire management costs.

Title IV Language

- Highlighted excerpts relevant to economic analysis:



S.22

Omnibus Public Land Management Act of 2009 (Engrossed as Agreed to or Passed by Senate)

TITLE IV--FOREST LANDSCAPE RESTORATION

SEC. 4001. PURPOSE.

The purpose of this title is to encourage the collaborative, science-based ecosystem restoration of priority forest landscapes through a process that--

(1) encourages ecological, economic, and social sustainability;
(2) leverages local resources with national and private resources;
(3) facilitates the reduction of wildfire management costs, including through reestablishing natural fire regimes and reducing the risk of uncharacteristic wildfire; and
(4) demonstrates the degree to which--
(A) various ecological restoration techniques--
(i) achieve ecological and watershed health objectives; and
(ii) affect wildfire activity and management costs; and
(B) the use of forest restoration byproducts can offset treatment costs while benefitting local rural economies and improving forest health.

Under Eligibility Criteria

(1) (C) incorporates the best available science and scientific application tools in ecological restoration strategies;

(3) describe plans to--

(A) reduce the risk of uncharacteristic wildfire, including through the use of fire for ecological restoration and maintenance and reestablishing natural fire regimes, where appropriate;

(B) improve fish and wildlife habitat, including for endangered, threatened, and sensitive species;

(C) maintain or improve water quality and watershed function;

(D) prevent, remediate, or control invasions of exotic species;

(E) maintain, decommission, and rehabilitate roads and trails;

(F) use woody biomass and small-diameter trees produced from projects implementing the strategy;

(G) report annually on performance, including through performance measures from the plan entitled the `10 Year Comprehensive Strategy Implementation Plan' and dated December 2006; and

(H) take into account any applicable community wildfire protection plan;

Under Eligibility Criteria

(4) analyze any anticipated cost savings, including those resulting from--

(A) reduced wildfire management costs; and

(B) a decrease in the unit costs of implementing ecological restoration treatments over time;

(5) estimate--

(A) the annual Federal funding necessary to implement the proposal; and

(B) the amount of new non-Federal investment for carrying out the proposal that would be leveraged;

Under Selection Criteria

(C) the strength of the collaborative process and the likelihood of successful collaboration throughout implementation;

(D) whether the proposal is likely to achieve reductions in long-term wildfire management costs;

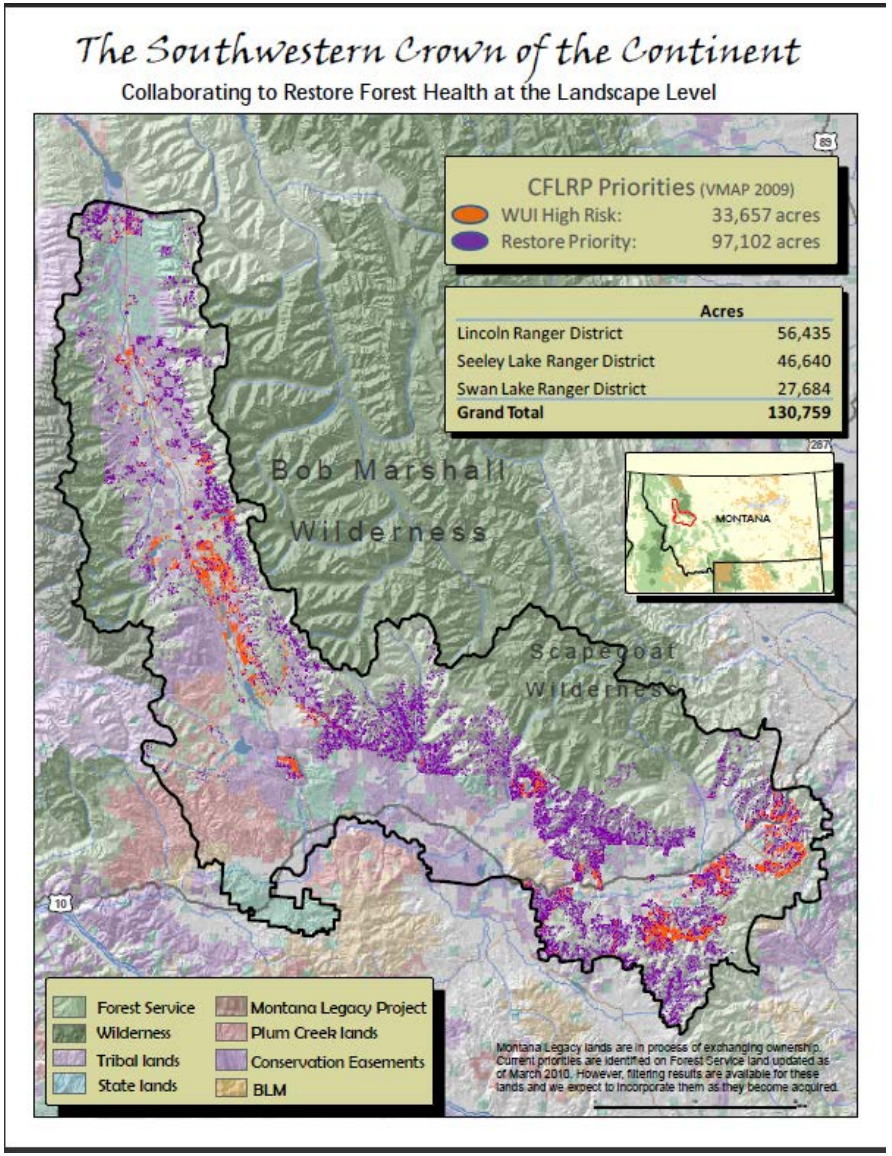
(E) whether the proposal would reduce the relative costs of carrying out ecological restoration treatments as a result of the use of woody biomass and small-diameter trees; and

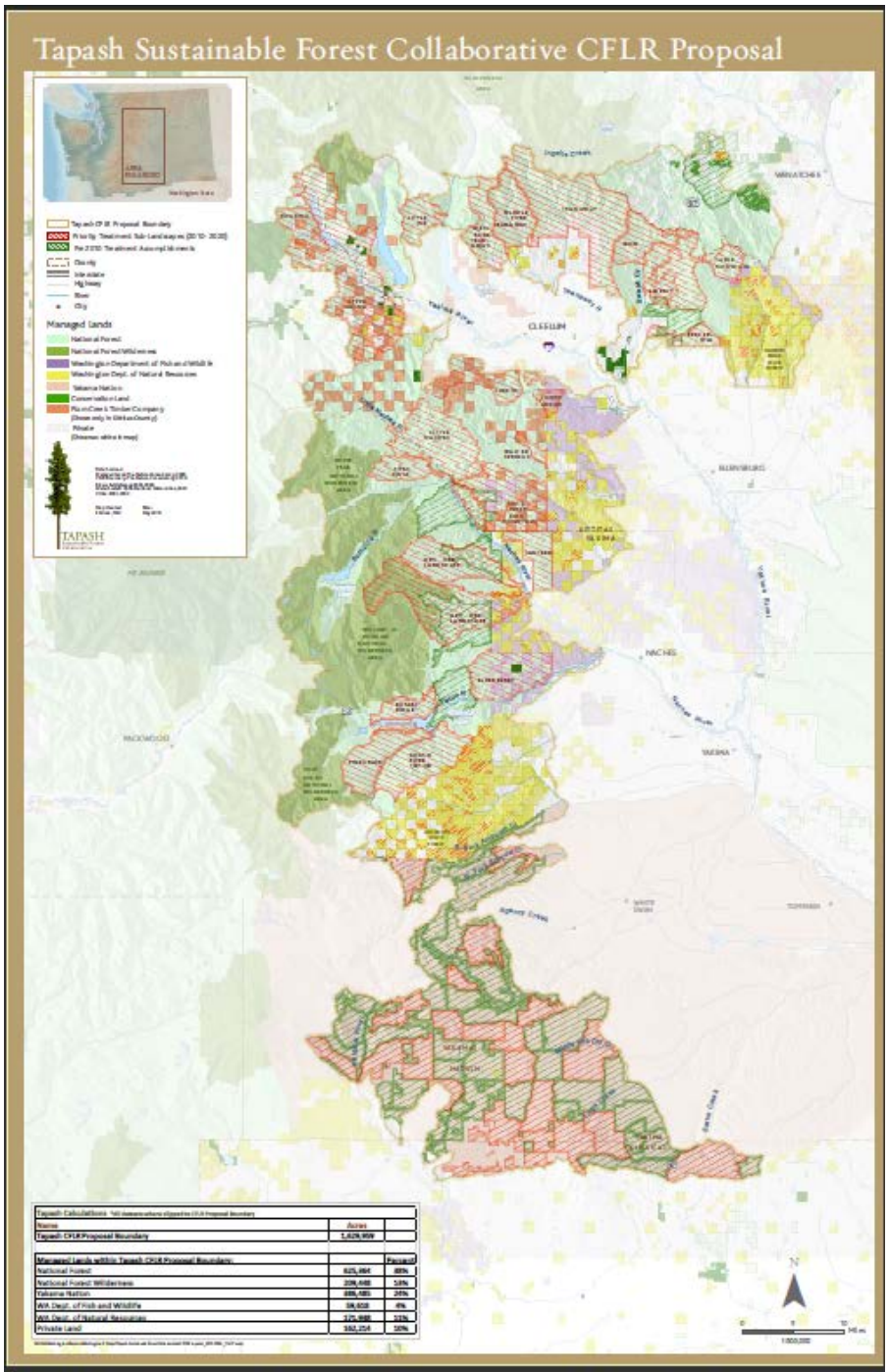
(F) whether an appropriate level of non-Federal investment would be leveraged in carrying out the proposal.

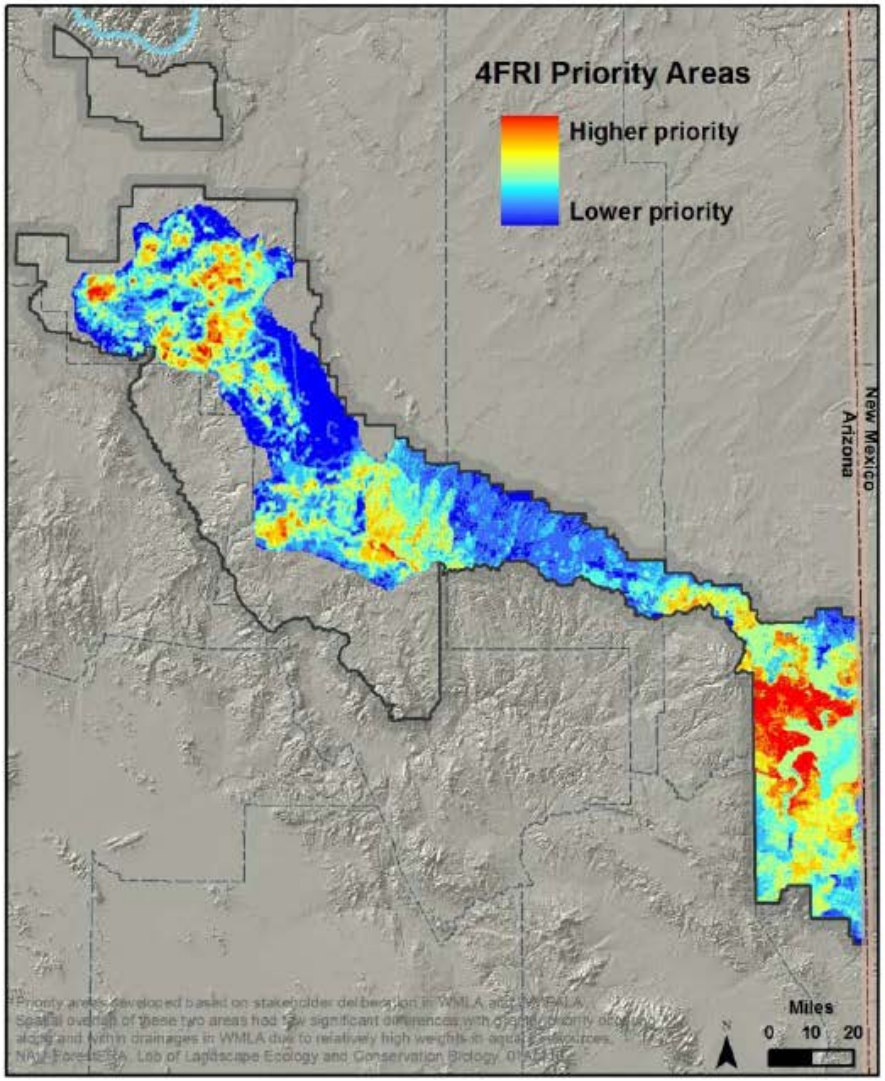
USFS Personnel Involved

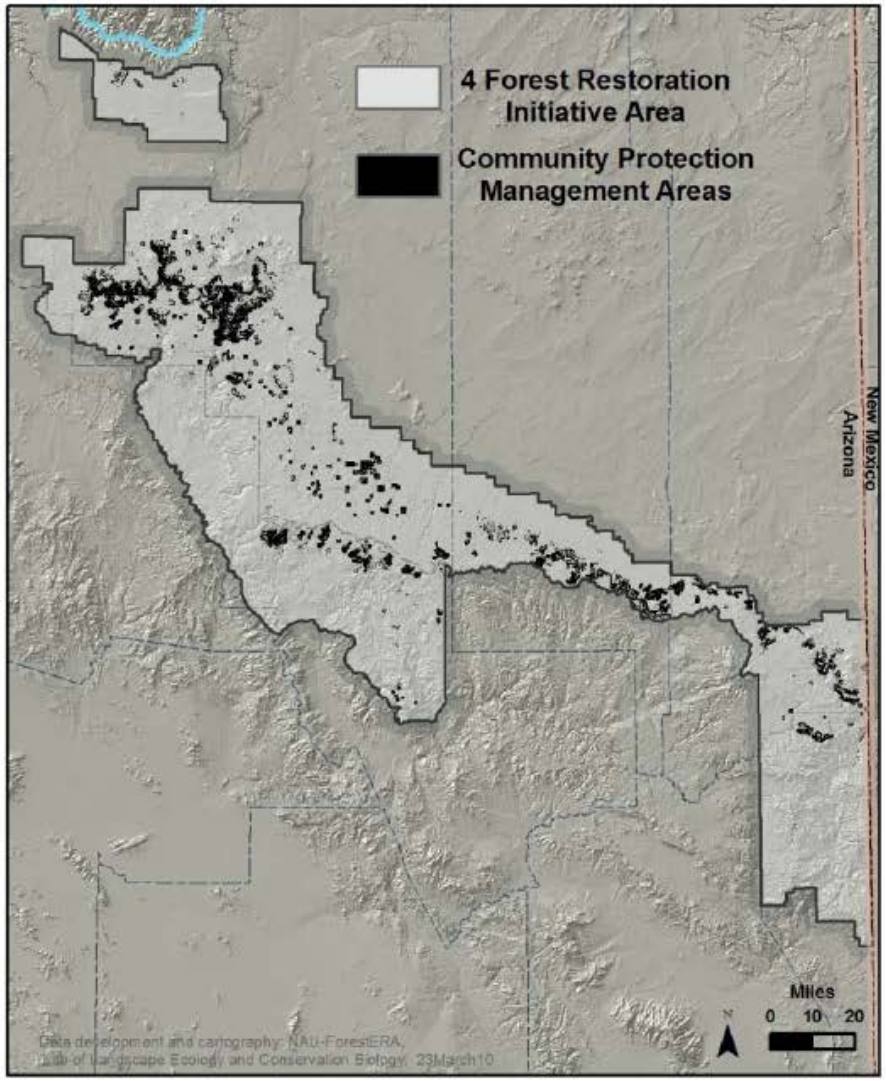
- Title IV Fire and Economics Economic Procedures Advisory Team / RCAT
  - Keith Stockmann, R1
  - Krista Gebert, RMRS now R1 Regional Economist
  - Matthew Thompson, RMRS Forestry Sciences Lab
  - Doug Smith, WO EMC
  - Dave Calkin, RMRS Forestry Sciences Lab
  - Alan Ager, WWETAC
  - Nicole Vaillant, WWETAC
  - Mark Finney and crew, Missoula Fire Sciences Lab
  - Karen Liu, WO EMC
  - Chris Miller, WO EMC
  - Susan Winter, WO EMC
  - Greg Jones, RMRS Forestry Sciences Lab
- Headquarters CFLPR Team
  - Frank Fay, WO
  - Frank Burch, WO
  - Bill Timko, WO Vegetation Management
  - Megan Roessing, WO Vegetation Management
  - Rob Harper, WO Vegetation Management
  - James Youtz, R3 Silviculturist

Would treating some or all of these stands reduce fire management costs? Reduce Risk?






4FRI Priority Areas
Higher priority
Lower priority
New Mexico
Arizona
Miles
0 10 20
N


4 Forest Restoration Initiative Area
Community Protection Management Areas
New Mexico
Arizona
Miles
0 10 20
N

Here's what they are claiming when they ask for money

SW Crown: Wildfire will continue to be managed commensurate with seasonal fire activity, resource availability, and cost of suppression actions versus the potential environmental losses. Wildfire caused by natural ignitions will be actively managed where resource management objectives can be met. Fire managers will establish a strategy based on topography, weather, fuels, and seasonal conditions under which the fire will be managed…. Fire managers, due to reduced fire intensity, will have a greater array of tactical responses so that individual fires can be man-aged with variable levels of resources, **potentially reducing costs**.

Tapash: On the Tapash landscape 401,202 acres are in the dry forest type, making up 25% of the total landscape. Our proposal plans on returning 50% of these acres back into ecological balance where fire plays its natural role. The estimated cost of all proposed treatments is $50 million. Compare this to a 10 year average of 226,000 acres burned, at a cost of $206 million to suppress. **When these projects are completed the estimated suppression costs will be 50% of current expenditures**, based on the ability of line officers to take advantage of fire playing a more natural role in the ecosystem.

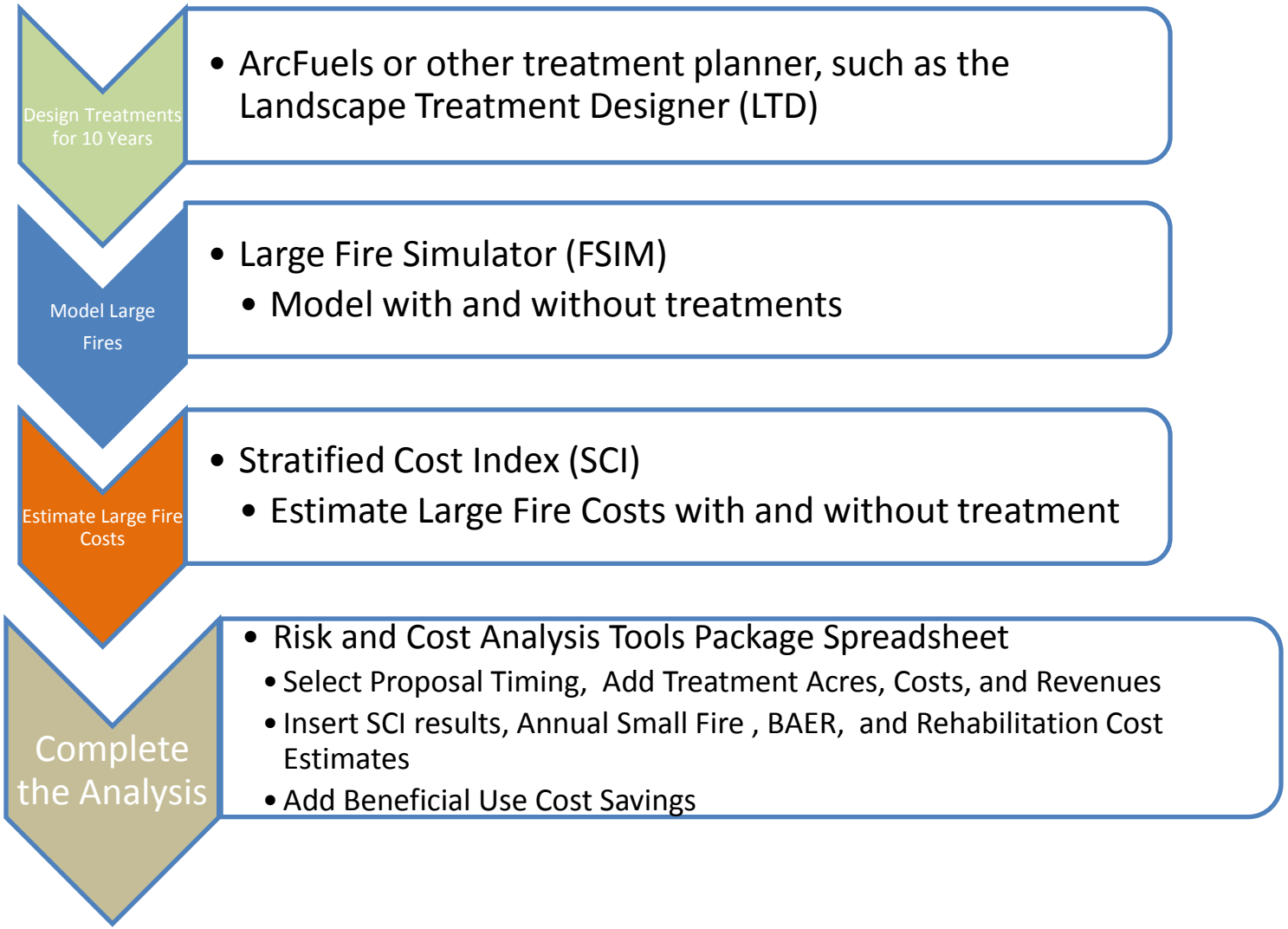
4FRI: The 4FRI mission to treat fuels strategically across the 2.4 million acre planning area would not only maximize restoration effectiveness, but enhance the ability to manage fires for restoration objectives, while **simultaneously protecting values-at-risk and minimizing fire management costs.**

R-CAT Cost Savings Mechanisms

Cost Category	Category	Mechanism	Recommended R-CAT Evaluation Approach	Alternate Methods
Fuel treatment	Net unit costs decrease	Processing demand increases as volume offered spurs processing infrastructure, byproduct value increases, net costs per acre decrease	Show increases in annual net treatment revenues through time in R-CAT Spreadsheet tool	
Fuel Treatment	Unit costs decrease	Maintenance slashing and burning replace thinning, net costs per acre decrease	Show reductions in annual net treatment costs through time in R-CAT Spreadsheet tool	
Suppression	Small fire costs	Reduced initial attack costs as small fires become easier to extinguish*	Adjust small fire costs in R-CAT Spreadsheet Tool	
Suppression	Large fires costs	New fuel patterns lead to changes in fire behavior and fires sizes are reduced following treatment	Changes in FSim outputs to SCI, captured in R-CAT Spreadsheet Tool	Changes in large fire costs based on expert opinion.
Suppression	Large fires costs	New fuel patterns lead to changes in fire behavior near WUI / communities, and fires are less costly to fight	Changes in FSim outputs to SCI, captured in R-CAT Spreadsheet Tool	Changes in large fire costs based on expert opinion.
Resource Protection	Large fires costs	New fuel patterns lead to changes in fire behavior near WUI / communities, and fires cause less damage to VAR	Use ArcFuels to demonstrate changes in burn probability and reduced risk, where risk = probability of threat times value at risk.	Use another approach to demonstrate changes in burn probability and reduced risk, where risk = probability of threat times value at risk.
Suppression	Large fire costs	New fuel patterns lead to more fire for beneficial use	Use FSim fire intensity information and a GIS exercise with Fire Management Plans to estimate Low, Moderate, and High rate reductions to adjust SCI estimates based on estimates of contiguous area and monitoring: full suppression cost relationships.	Use expert opinion to estimate low, moderate and high percentages and the portion of monitoring costs compared to full suppression in contiguous areas where this will now be possible.
Post-fire	Post fire costs	New fuel patterns lead to reduced fire intensity, and create less need for post-fire expenditures	Change the BAER, Rehab and Reforestation Costs in R-CAT Spreadsheet Tool	

Suggested Modeling Approach

- Fire Management Program Costs Analysis



Overview of pieces to the R-CAT analysis and accomplishes each step

- Determination of spatial layout of fuels treatments and types of fuel treatments
  - Who: Fire and Fuels specialists identified by each CFLRP team, working with their collaborative and line officers, with help from fire modelers.

- Creating and modifying landscape files for use in Fsim
  - Who: Fire and Fuels specialists identified by each CFLRP team, with help from fire modelers.

- Running Fsim
  - Who: Western Wildland Environmental Threat Assessment Center (WWETAC), Alan Ager and Nicole Vaillant

- Calculating suppression cost savings using SCI
  - Who: Rocky Mountain Research Station, Matthew Thompson and others

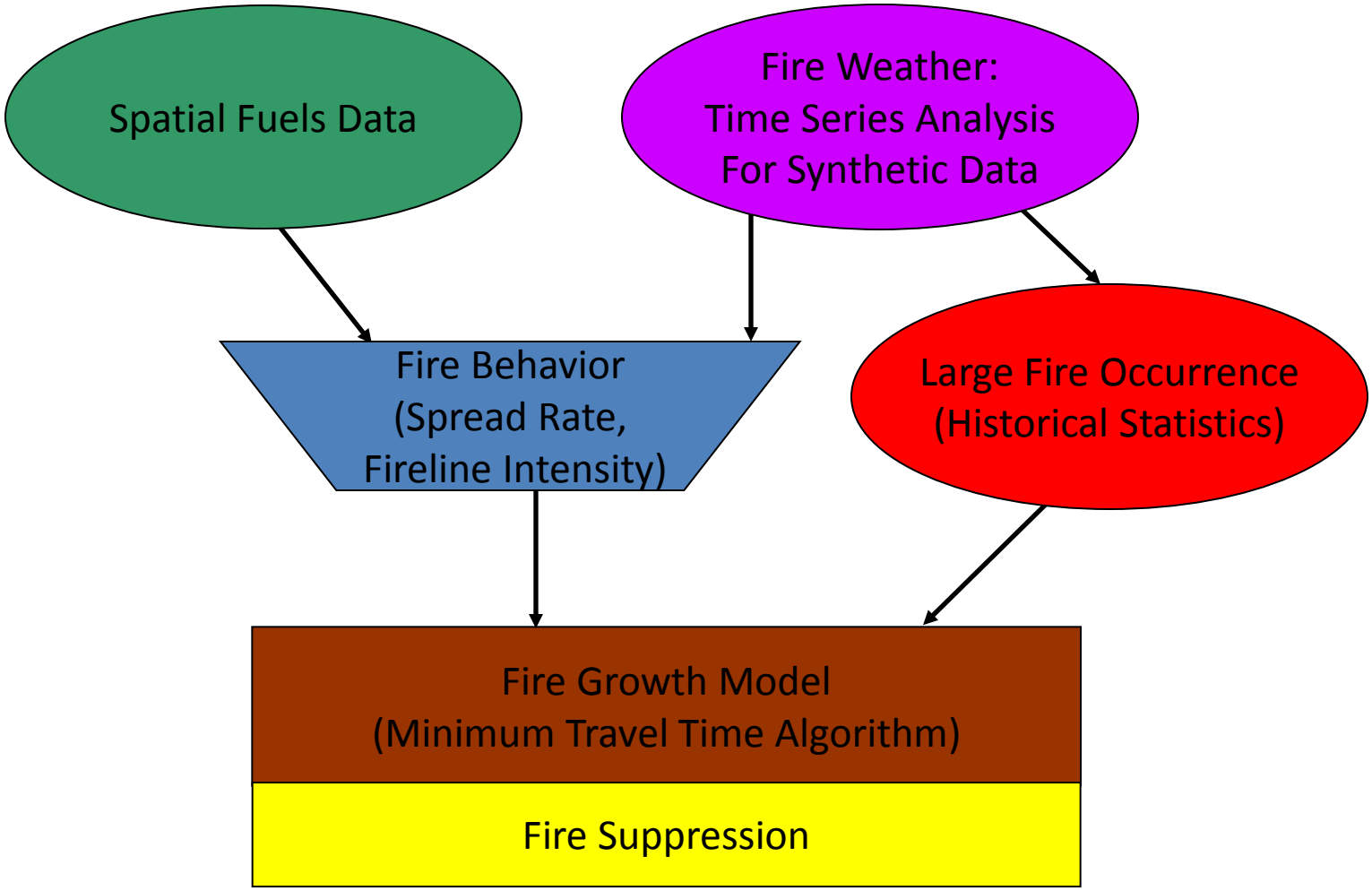
- Putting it all together in the R-CAT spreadsheet
  - Specialists identified by each CFLRP team, with help from Stockmann and Gebert , fire and fuels specialists and fire modelers.

Assumptions – R-CAT Spreadsheet Set-up

- R-CAT is based on a **before and after look at fire management costs**, modeling pre and post CFLRP treatments
- The new projected annual wildfire program costs would be estimated for the year when all treatments are completed and become effective, generally 2019.
- This total cost could be subtracted from the expected fire costs associated with no treatment to reveal potential wildfire management cost savings, or **avoided costs** in the project area attributable to the treatments.
- **A portion of this savings**, which matches the portion of total acres treated by year **could then be credited to each an acre of treatment becomes effective, before full completion of the treatment schedule**.
- The length of time this **cost savings** is expected will **depend on** the site-specific **treatment effectiveness longevity**, which each CFLPR team sets.
- **Using expert opinion or modeling tools such as FVS-FFE**, this savings can be projected into the future where the appropriate portion of costs savings persists as long as the **effects of each treatment persists**.
- This cost savings is **compared to the net cost of the treatments** to conduct the complete cost analysis.
  - Requires estimates of treatment and activity unit costs and revenues (from estimates of merchantable output volumes) over the duration of implementation
- All figures are discounted annually at 4% (OMB Circular A-94).

FSIM – What is it?

- FSIM is the large fire simulation system and is used by Fire Program Analysis (FPA) System



FSim – Required input needs check list

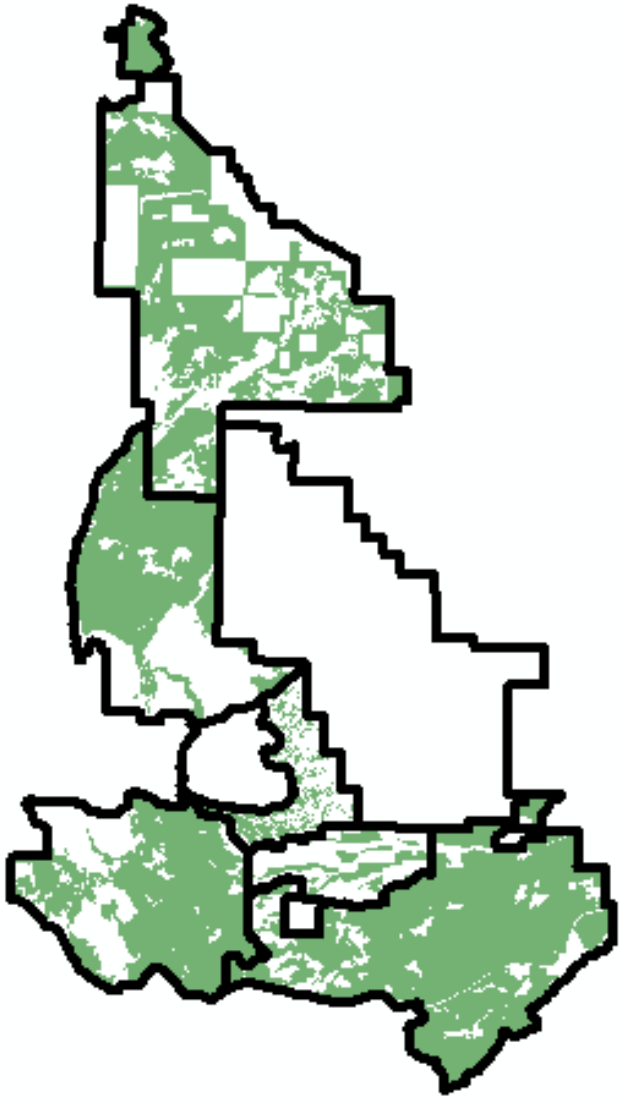
- ❑ Landscape file(s) – and resolution of data
- ❑ RAWS station
- ❑ Fire association data to use (FPU, Forest, District, etc.)
- ❑ Fire season start date
- ❑ Crown fire method (Finney vs. Scott/Reinhardt)
- ❑ Maximum fire size allowable
- ❑ Desired resolution of outputs (multiple of input data)

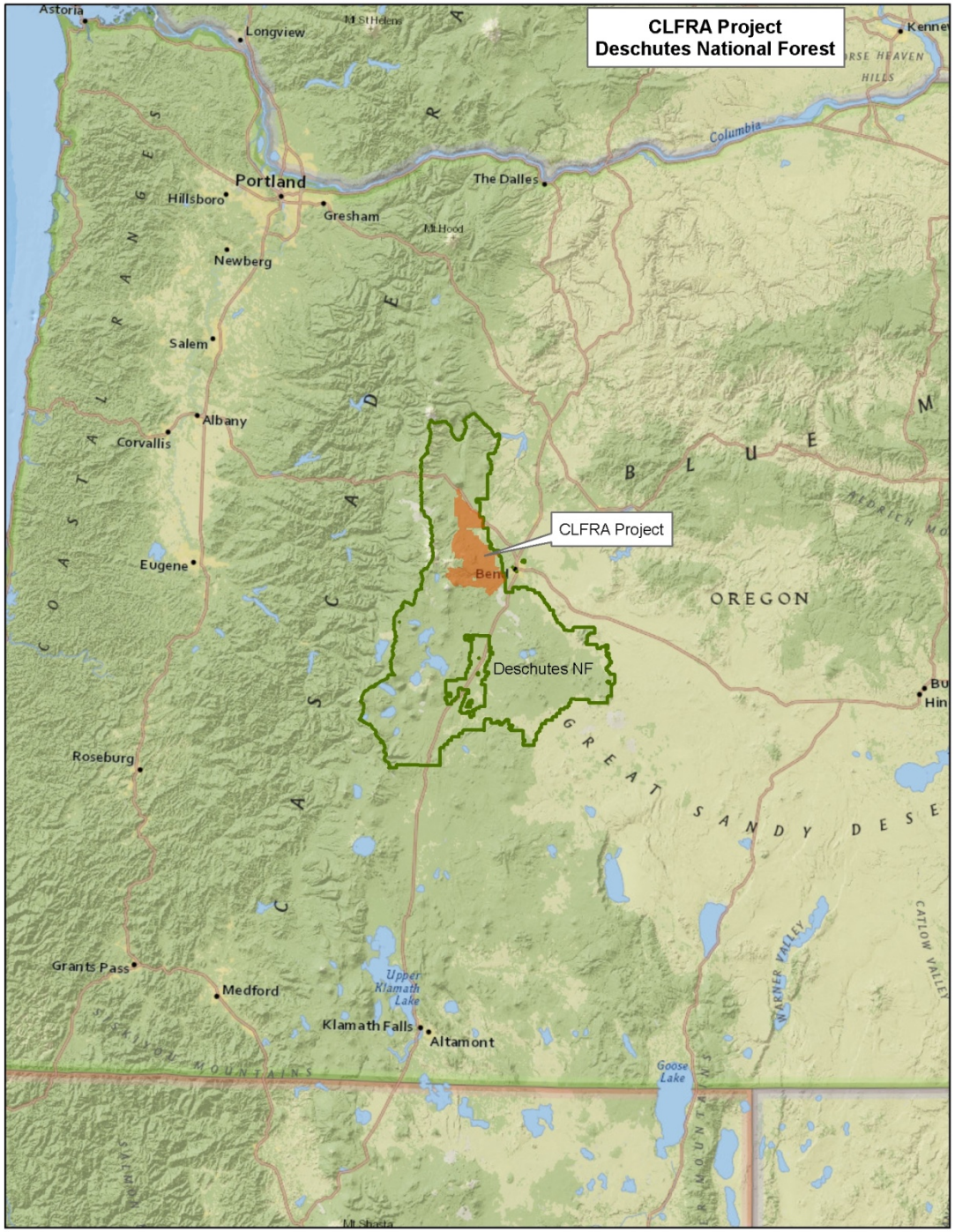
FSim - Optional input needs check list

- ❑ Ignition density grid (*.asc) – same resolution & projection snapped to the LCP grids, can be larger than the LCP but cannot be smaller
- ❑ Rate of spread adjustment file (*.txt)
- ❑ Custom fuel model file (*.fmd)
- ❑ Live fuel moisture files for 80th, 90th, and 97th percentiles (*.txt – similar to *.fms)

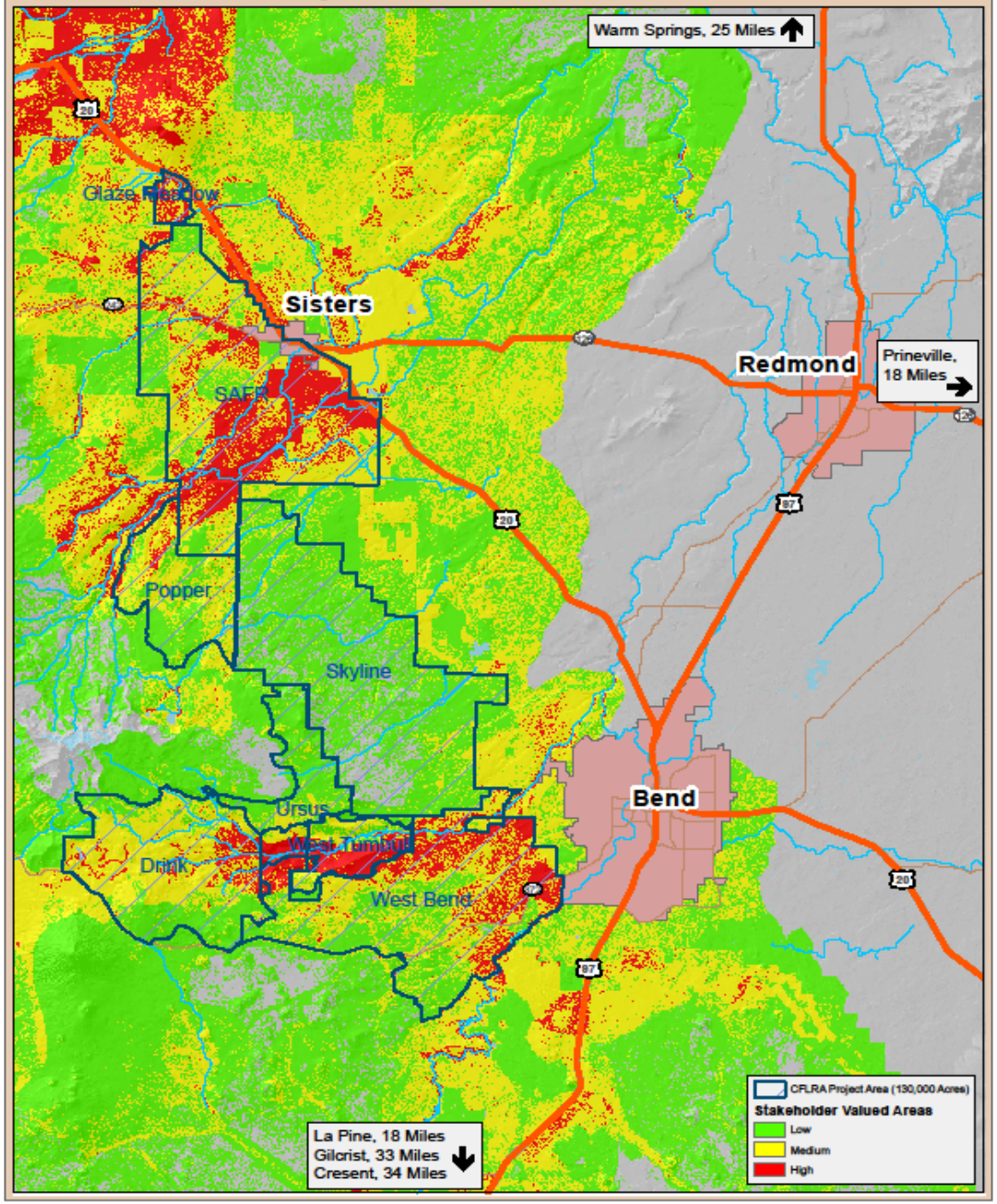
FSim – Other useful data

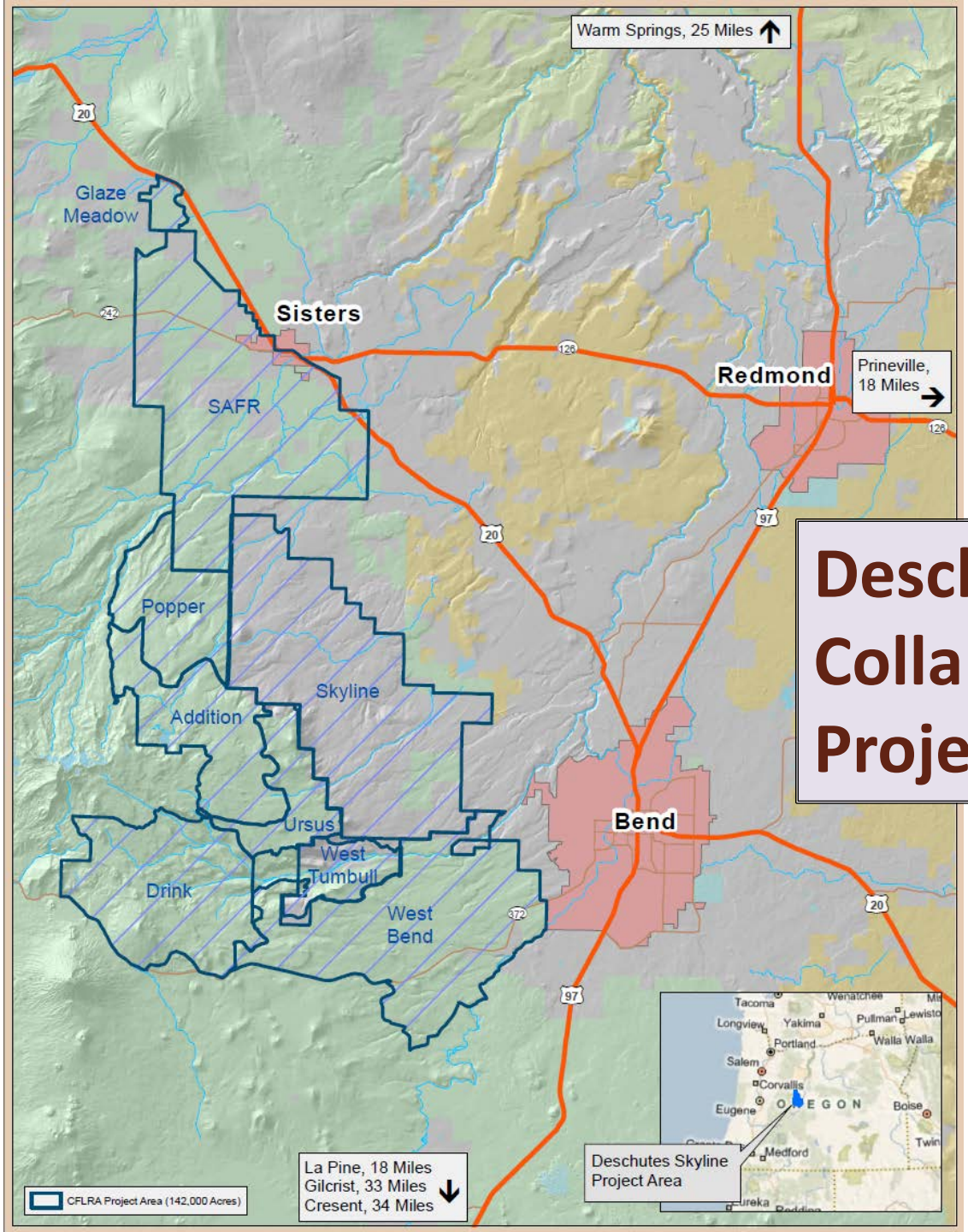
- GIS data layers for analysis
  - CFLRP study area
  - Treatment units
  - Values at risk
  - Input fuel layer grids




CLFRA Project
Deschutes National Forest
CLFRA Project
Deschutes NF
Astoria
Longview
Mt St Helens
Portland
Hillsboro
Gresham
Mt Hood
The Dalles
Columbia
Newberg
Salem
Albany
Corvallis
Eugene
Bend
OREGON
Roseburg
Grants Pass
Medford
Upper Klamath Lake
Klamath Falls
Altamont
Goose Lake
Mt Shasta
COAST RANGES
CASCADES
BLUE MOUNTAINS
GREAT SANDY DESERT
WARNER VALLEY
CATLOW VALLEY
SISKIYOU MOUNTAINS
KLAMATH MOUNTAINS

Deschutes Skyline: Stakeholder Valued Areas



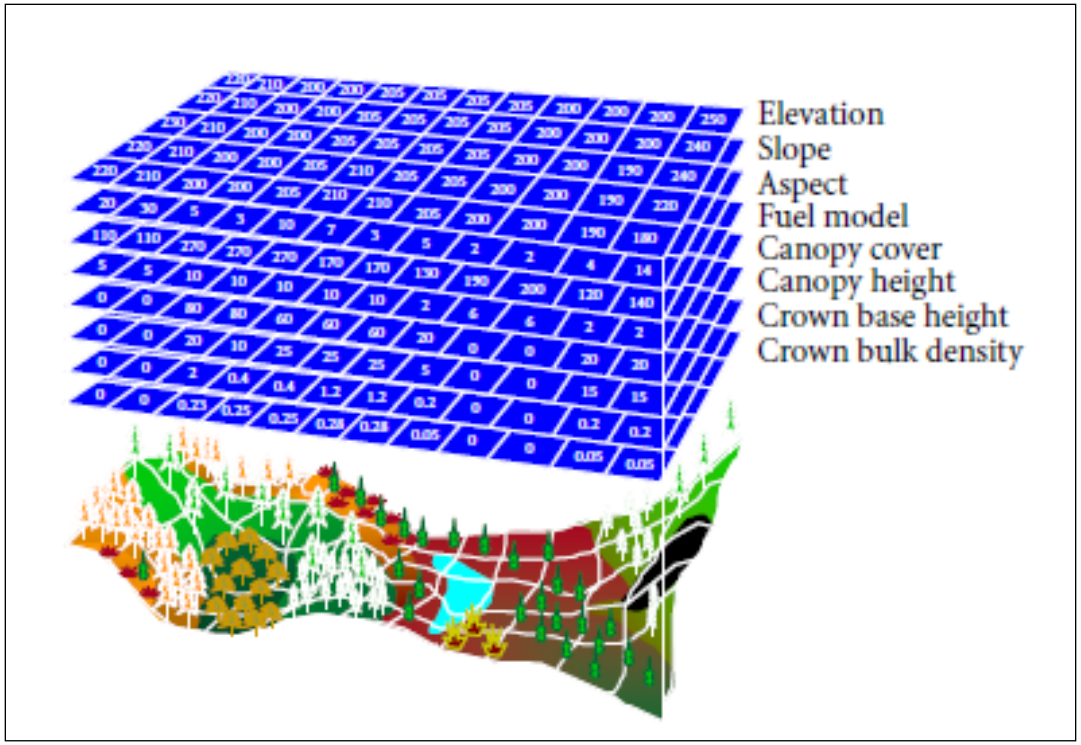


Deschutes Forest Collaborative Project -DFCP

Landscape file to run FSim for the RCAT research project.

The landscape file consists of a grid sandwich with data themes for:

Elevation
Slope
Aspect
Fuel model
Canopy cover
Crown height
Canopy base height
Crown bulk density



Two landscape files are required:

1 Existing condition
2 Post-treatment

Landscape file to run FSim for the RCAT research project.

Skills/Knowledge Needed:

- GIS
- Fire Behavior
- Treatment effects to vegetation and fuel conditions

Working knowledge of fire models such as Farsite or FlamMap would be helpful with creation of the landscape file. Knowledge of local weather and fire conditions would also aid in selection of the appropriate RAWS data.

Time Needed:

Creation of Existing Condition Landscape File: 10-15 days

Post-Treatment Landscape: 5 – 10 days

Total: 15 – 25 days

Landscape file to run FSim for the RCAT research project.

For the Deschutes Project

- Fire Planner coordinated and created the existing and post-treatment landscape files.

- A combination of lidar and gnn data was used to create the forest canopy data. The Area Ecologist and silviculture staff developed this data.

- Treatment data was collected from the ranger district vegetation and fuels staff.

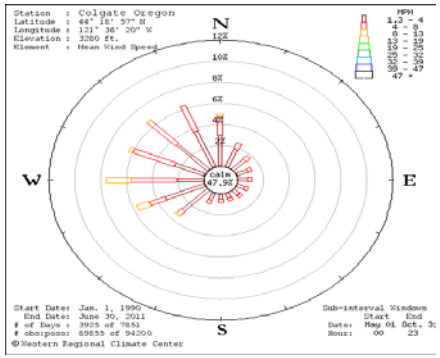
Developing Needed Fuel Model Data

- Fuel Model: A query of the FACTS database fuel treatments accomplished 2004 – 2008 was performed using GI. The results of this query were reviewed by fuels specialists on the Sisters and Bend-Ft Rock Districts for input on the post-treatment fuel model. From this input the 2004 fuel model theme was updated to 2009.

- Forest Canopy Themes: A combination of lidar and gnn data was used to create the forest canopy data. Mike Simpson, Ecologist and Leo Yanez, Silviculturist developed this data.

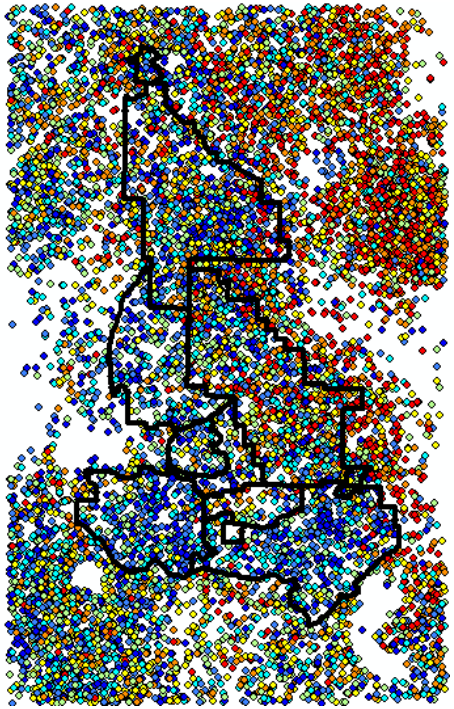
- After the existing landscape file was created the project units were located and adjustments were made to forest canopy and fuel model data themes as appropriate. The adjusted treatment grids were then mosaic-ed with the existing landscape to create the treated landscape file.

- The Colgate RAWS (352620), located northwest of Sisters was identified for use in the simulation. A wind rose for this station is displayed here.

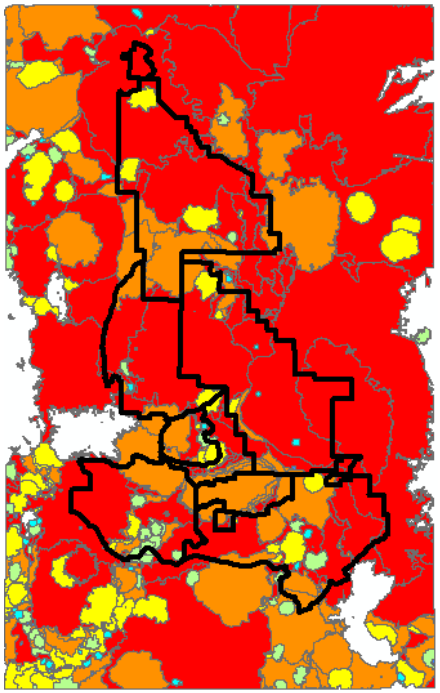


FSim – All outputs

- **Fire size list (*.txt)**
- **Fire perimeter shapefile(s) (*.shp)**
- Flame length probability (*.txt)
- Annualized burn probability (*.asc)
- Annualized mean fireline intensity (*.asc)



Existing conditions fire size list



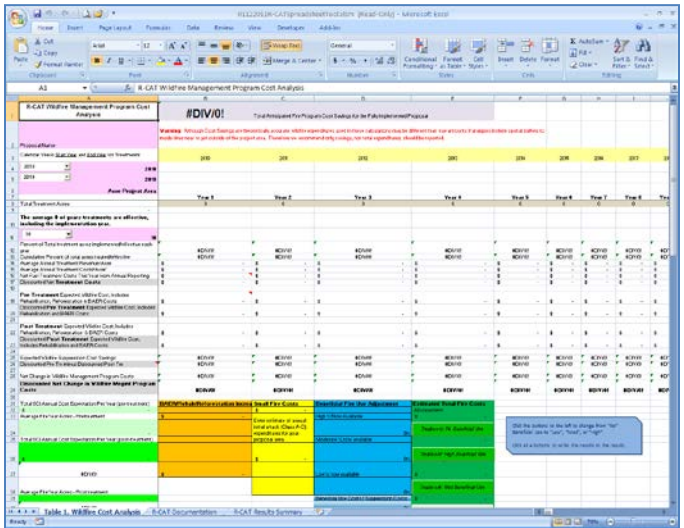
Existing conditions fire perimeters

Per season cost summary stats Deschutes R-CAT Analysis

	Existing Conditions ($)	Post-Treatment ($)	% Reduction
Max	$66,177,307	$51,585,439	22.05
Min	$170,239	$21,150	87.58
Mean	$5,401,950	$4,512,393	16.47
25% Quartile	$1,337,778	$1,224,218	8.49
Median (50% Q)	$2,675,639	$2,282,279	14.70
75% Quartile	$6,473,991	$5,203,485	19.62

Filling in the R-CAT spreadsheet:

- Overview of the R-CAT spreadsheet (Keith Stockmann)
- Filling in the R-CAT spreadsheet: (Deschutes)
  - Fuel treatment acreages over time
  - Fuel treatment effectiveness
  - Fuel treatment costs and revenues
  - Pre- and post-treatment suppression costs



NEPA Proposed Treatments

Activity - West Bend Project Area	Project/Landscape Acres
Commercial Thin with small diameter thinning, brush mowing, and prescribed fire	6165
Commercial Thin with small diameter thinning, slash piling, mowing and prescribed fire	5174
Commercial Thin with small diameter thinning, lopping slash, mowing and prescribed fire	830
Commercial Thin with small diameter thinning, slash piling, and pile burning	1313
Commercial Thin with small diameter thinning, lopping slash, and prescribed fire	824
Commercial Thin, slash piling, mowing, and prescribed fire	646
Skid&Deck – Pile/Mow/Rx Fire	1966
Skid&Deck – Mow/Burn	336
PCT – Pile/Mow/Rx Fire	570
PCT – Lop/Mow	79
Mow/Burn	4154
Total Treatment Area	22,057

Schedule of Treatments

Treatments – West Bend Project Area	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
CT/PCT/Fuels Treatment					5000	4952	5000				14952
Skid & Deck/Fuels							2302				2302
PCT/Fuels			108	109	108	108	108	108			649
Prescribed Fire			593	596	593	593	593	593	593		4154
Total	0	0	701	705	5701	5653	8003	701	593	0	22057

Deschutes Collaborative Project Total Treatments	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
Total Acres R-CAT Input	3065	3064	3766	10577	10282	13074	10229	5371	3985	3395	66808

Costs and Revenues

- Used actual costs associated with vegetation/fuels treatments from 2010 and 2011.
- Estimated costs associated with vegetation/fuels treatments for 2012 through 2019 based on our CFLR proposal. (% of total request, adjusted for actual allocation).
- Revenue - based on actual timber receipts received for products removed.

Optional R-CAT data entry:

- BAER / Rehabilitation Costs
- Small fire costs
- Beneficial fire use (Keith Stockmann)

Per season cost summary stats Deschutes R-CAT Analysis

	Existing Conditions ($)	Post-Treatment ($)	% Reduction
Max	$66,177,307	$51,585,439	22.05
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Median (50% Q)	$2,675,639	$2,282,279	14.70
75% Quartile	$6,473,991	$5,203,485	19.62

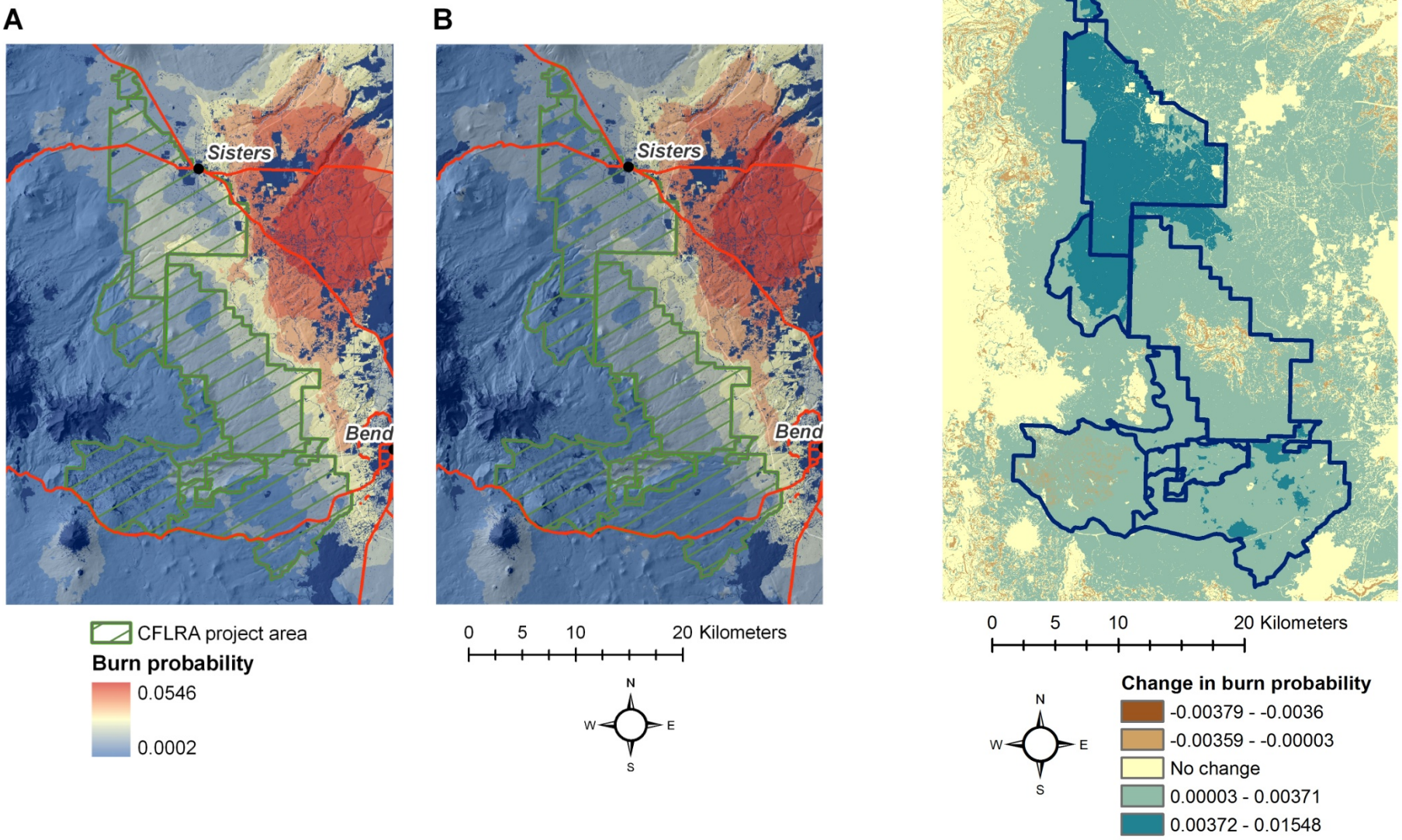
What to do with the results – exploring options

- Sensitivity analysis of results to suppression cost savings
  - How do the results change if you use percentiles other than the median?
  - What if you have one really bad year?
  - Calibrating to your actual average suppression costs
- RCAT does not capture all of the benefits of fuel treatments. Other benefits could include:
  - Protection of values at risk
  - Greater ability to capture fires in initial attack
  - Greater ability to use less aggressive (less costly) suppression strategies
  - How do you tell your story, especially if analysis shows negative cost savings?

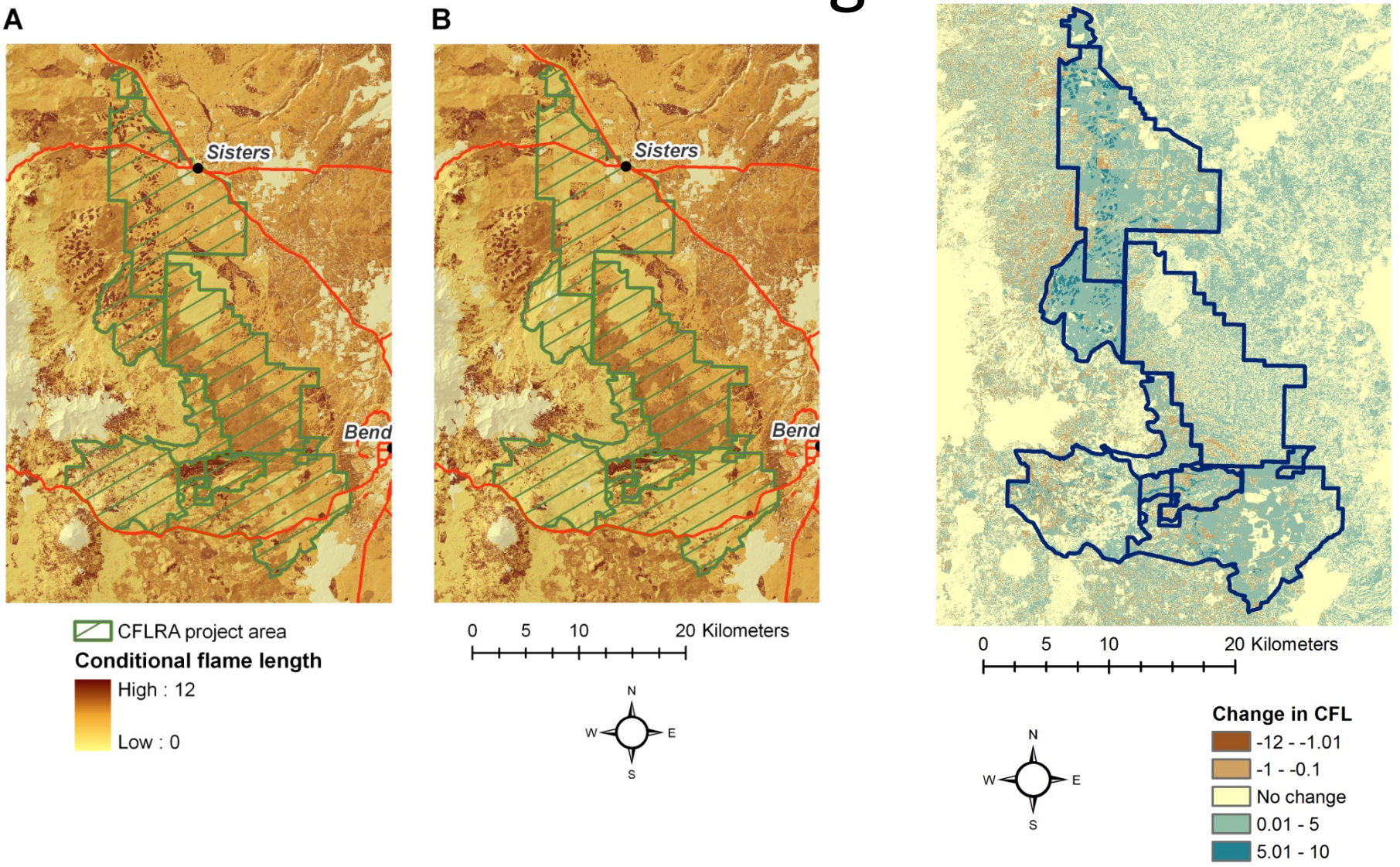
Thinking about the "R" in R-CAT - how to include a risk component (Matt)

- Optional FSIM Analysis

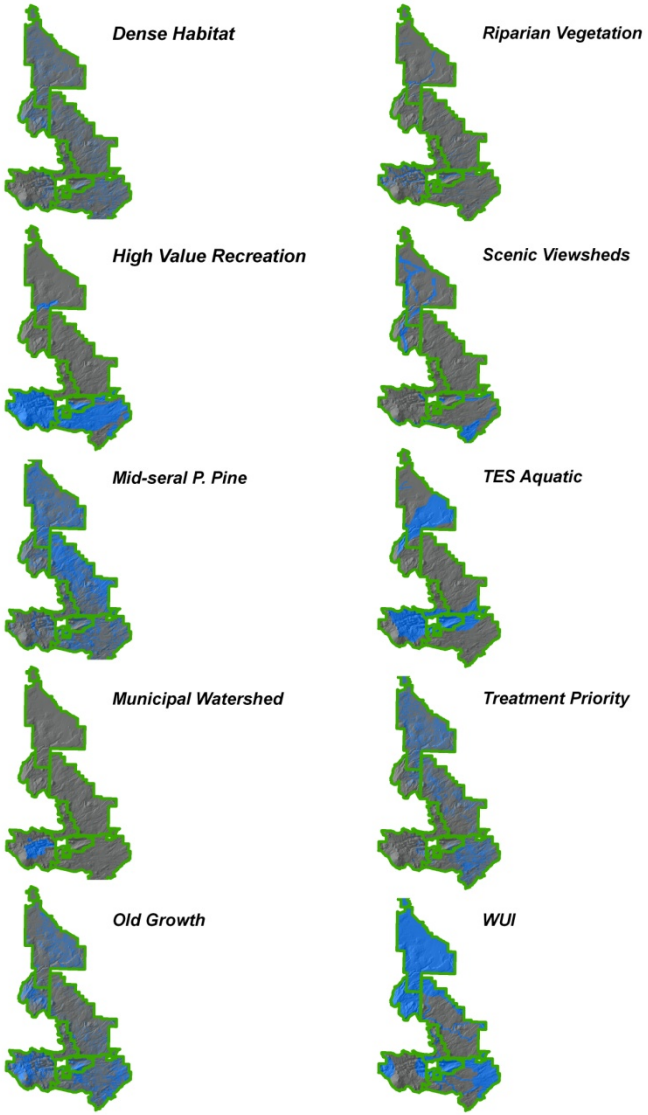
Evaluating changes in Burn Probability

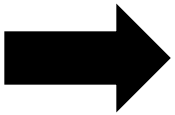


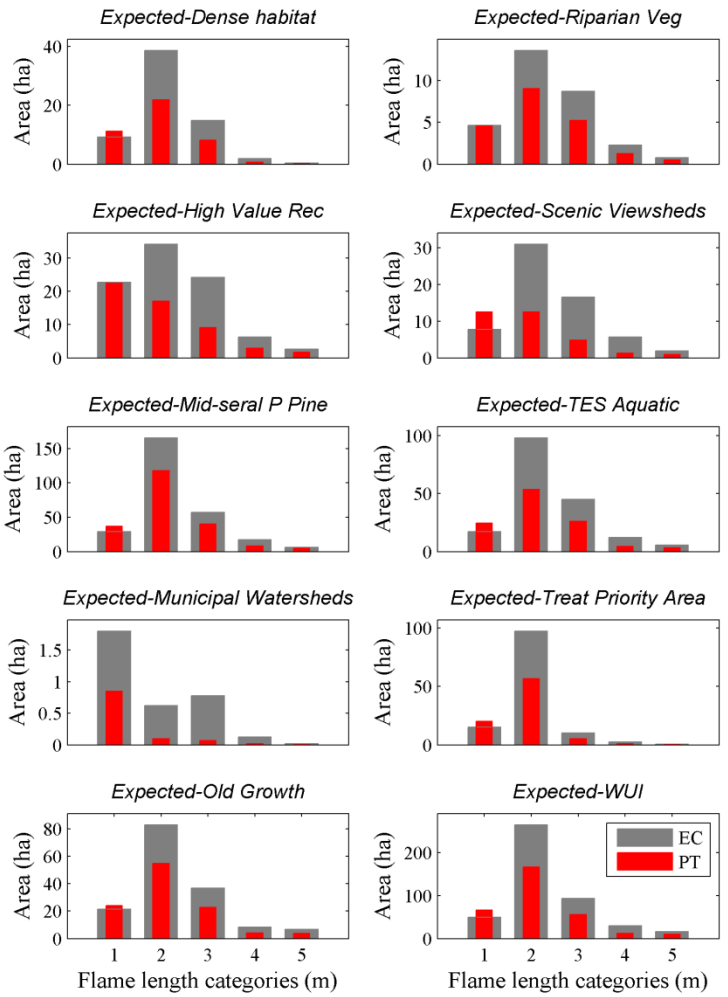
Evaluating changes in Conditional Flame Length



Evaluating changes in Exposure







Taking lessons from the pilot to create a template for upward reporting

- Identify potential suppression cost savings
- Show fire program costs savings (increase)
- Describe suppression tactic options not shown in the tool
- Describe risk reduction expectations

Conclusions

- Convergence of reasons to do this analysis
- Challenges of modeling properly are exacerbated by budget and NEPA uncertainty, but analysis must proceed
- Help is available throughout the process
- We aim to use the results to help justify or redesign treatments
  - Fire program cost savings, and/or
  - Risk reduction
- This tool can help keep funding coming to teams
- We will post a new version to the CFLRP website soon

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