Dynamic fire risk assessment

Research support to make risk assessments more useful to more people

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Why am I here?

Listen and learn. Ground my research in your reality.

Raise awareness of existing risk assessment products and platforms, and how they are created.

Share the objectives of our BIL-funded project while we are still early, so our deliverables are useful and actionable.

Invite further collaboration.
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Risk assessments support strategic planning and action

Active management and strategic incident response

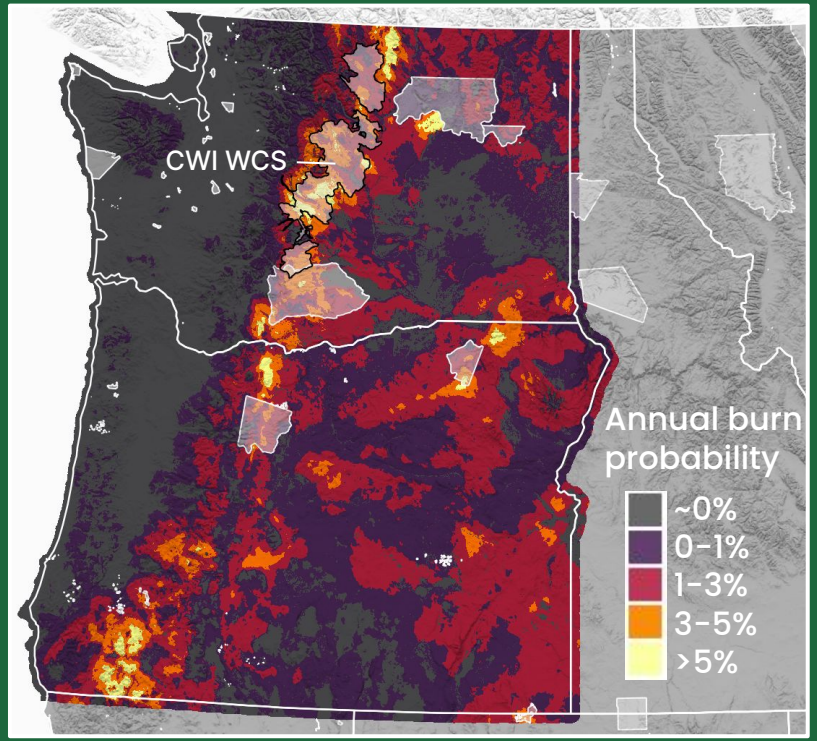
- Plan for safe, effective suppression
- Prioritize fuels mitigation for maximum return
- Identify opportunities for intentional fire use that minimize loss and reduce long-term risk

Scenario-based planning

- Understand and communicate uncertainty
- Identify management opportunities & intervention levers
- Adapt to climate change
- Prepare for extreme events

Social processes and communication

- Engage with subject matter experts and communities to co-produce information
- Build evidence and data to communicate with public and request resources



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Quantitative wildfire risk assessment (QWRA) framework

Likelihood: The frequency of conditions for disturbance

Using a stochastic fire simulation model (FSim), estimate the annual probability of burning

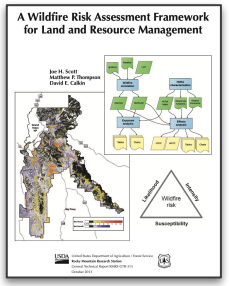
Intensity: The magnitude of disturbance exposure

Using a deterministic fire behavior model (FlamMap/WildEST), estimate intensity and flame length when fires occur

How can we strengthen each component?

Susceptibility: The impact of disturbance intensity on resources and values

Using spatial information about highly valued resources, assets, and areas (HVRAs), and likely responses to fire, estimate the most likely impacts of fire on resource (net value change)



Scott, J.H., M.P. Thompson, D.E. Calkin. 2013. A wildfire risk assessment framework for land and resource management. RMRS-GTR-315.

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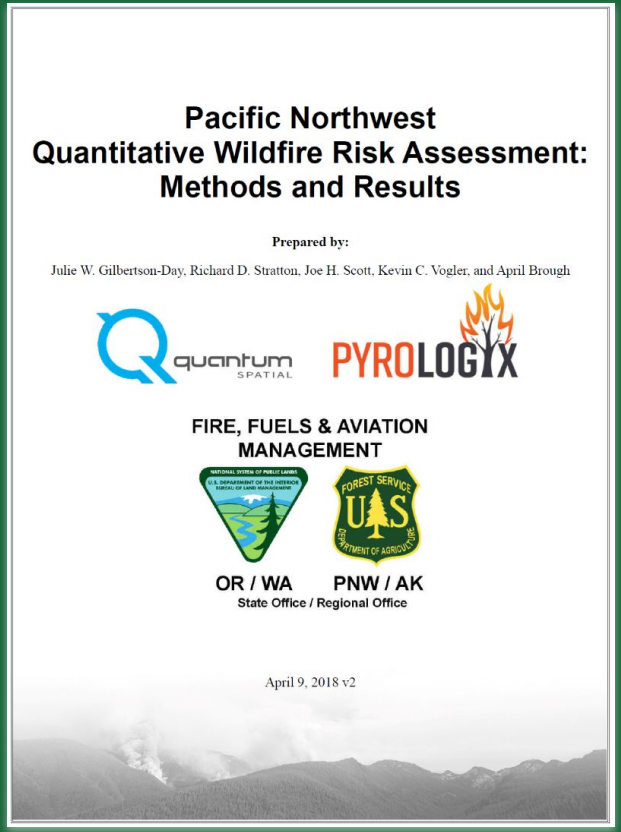

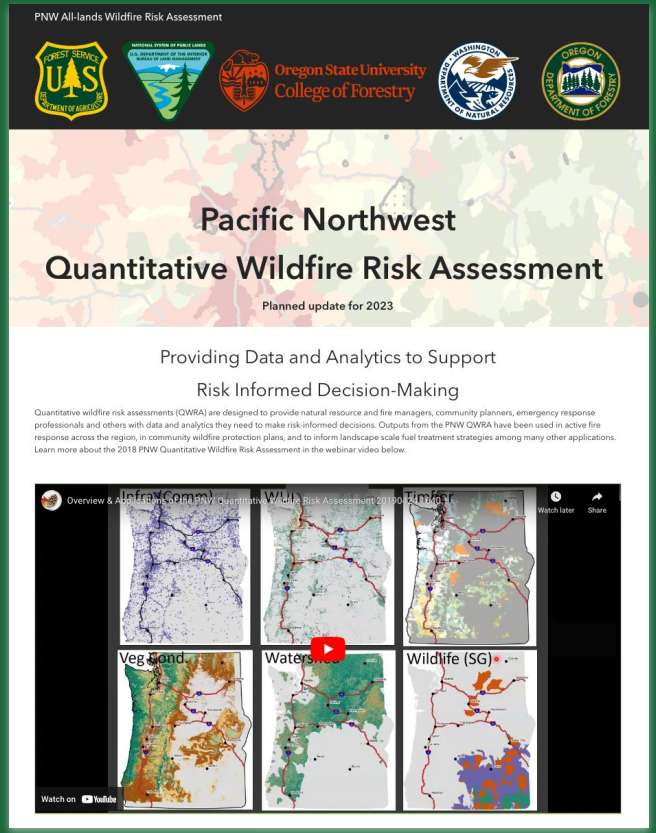

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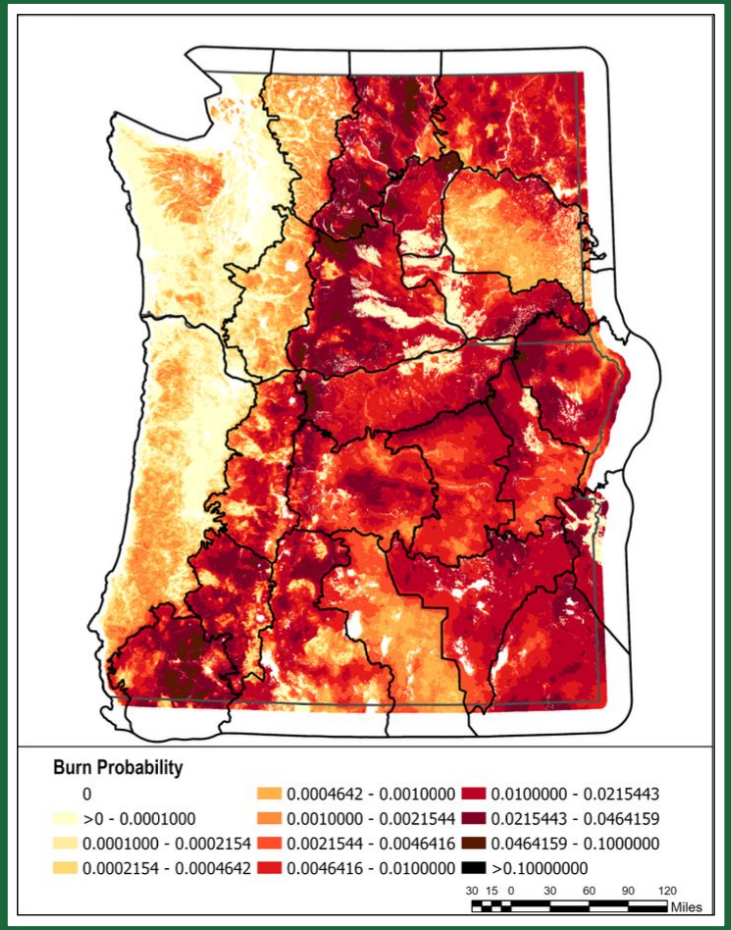
Burn probability

Characterizes the annual probability of fire under current fuels and high fire danger

- FSim - 10,000 stochastic simulations
- Calibrated to reproduce fire-size distribution of the recent past
- Fires are allowed to burn until reaching realistic sizes
- Fires can be “suppressed” under mild weather



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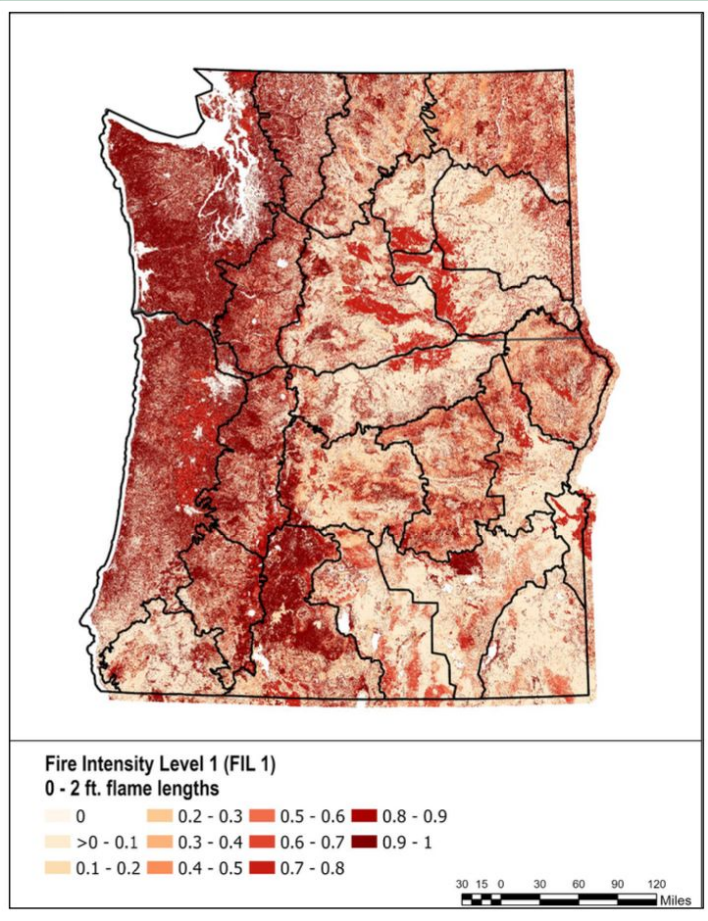
Fire intensity

Characterizes the most likely fire intensity under current fuels and high fire danger

- WildEST / FlamMap
- Deterministic - same result every time with same fuel and weather
- 216 “weather types” (wind speed x fuel moisture)
- Weather types consolidated into most conditions under which most area burns



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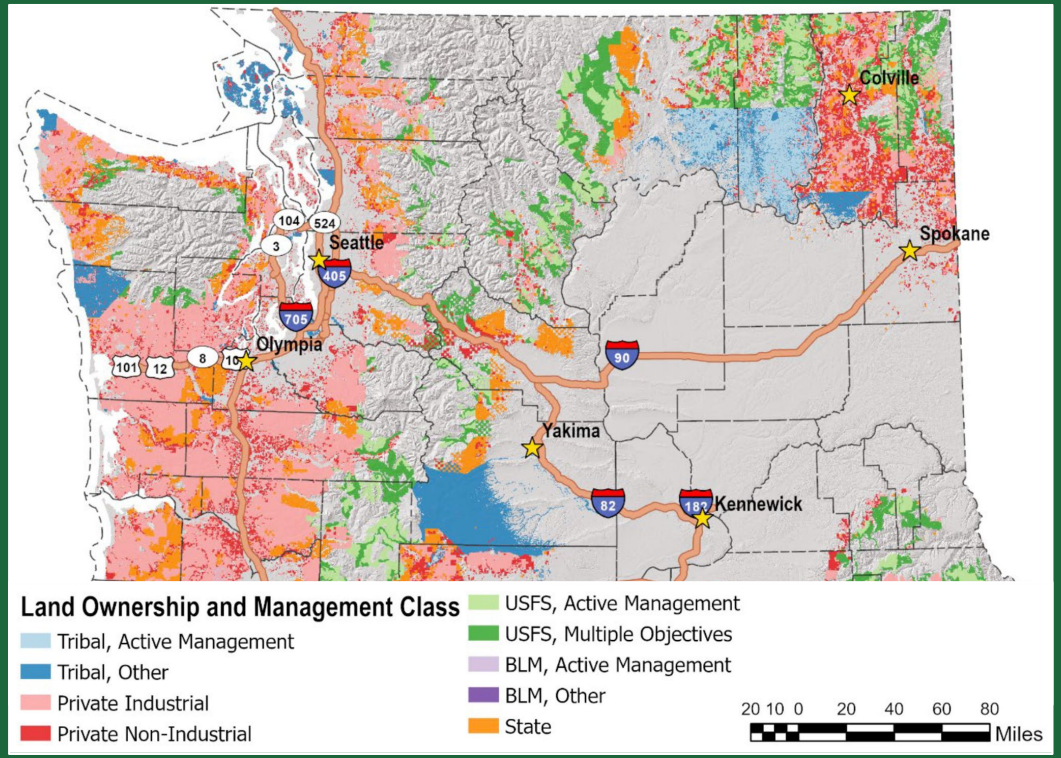
Susceptibility of resources

1. Identify highly valued resources and assets - HVRAs



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Susceptibility of resources

2. Create response functions

Sub-HVRA	Share of HVRA RI	Covariate	Fire Intensity Level (flame length)					
			FIL 1	FIL 2	FIL 3	FIL 4	FIL 5	FIL 6
			0 - 2'	*2 - 4'*	*4 - 6'*	*6 - 8`*	*8 - 12'*	*>12'*
Tribal Active Management, QMD < 10"	< 1%	FRG I	10	-20	-50	-100	-100	-100
Tribal Active Management, QMD < 10"		FRG III	0	-30	-60	-100	-100	-100
Tribal Active Management, QMD < 10"		FRG IV/V	-20	-40	-80	-100	-100	-100
Tribal Active Management, QMD 10" - 20"	1%	FRG I	50	30	0	-30	-75	-100
Tribal Active Management, QMD 10" - 20"		FRG III	20	0	-40	-80	-80	-100
Tribal Active Management, QMD 10" - 20"		FRG IV/V	-20	-40	-60	-80	-100	-100

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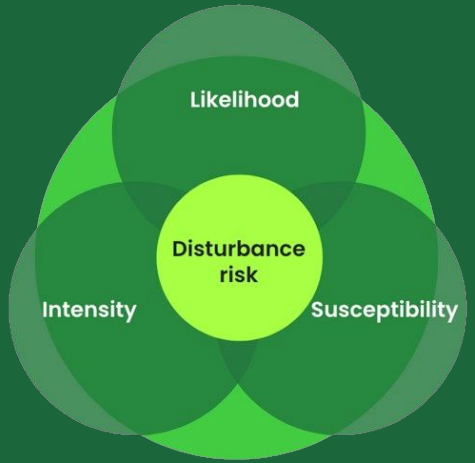
Susceptibility of resources

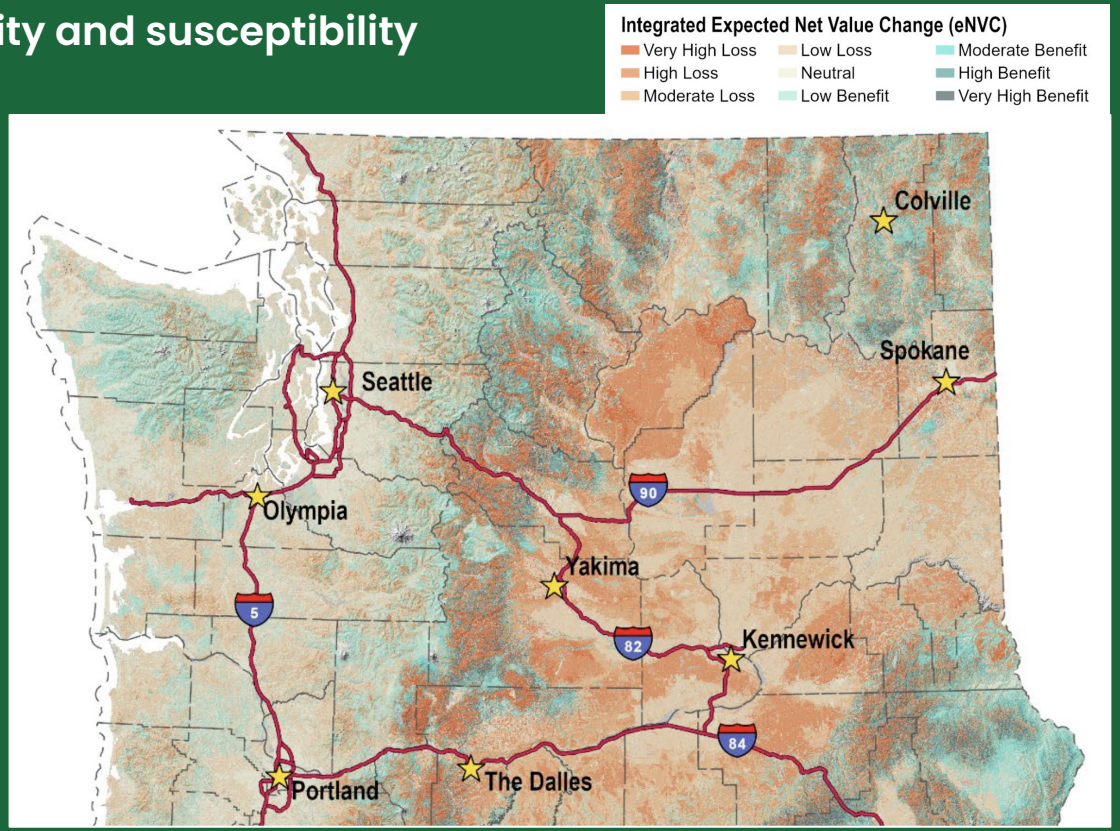
3. Rank their relative importance

HVRA	Relative Importance	Share of Relative Importance
People and Property	100	35%
Drinking Water	50	18%
Infrastructure	45	16%
Timber	35	12%
Wildlife Habitat	20	7%
Ecological Integrity	30	11%
Agriculture	3	1%
Recreation	1	0.40%
Total	**284**	**100%**

Net value change

Integrates likelihood, intensity and susceptibility into one view of risk





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The project

"Dynamic Wildfire Risk Assessment in Priority Firesheds using Potential Operational Delineations (PODs)"

Funding context

- Bipartisan Infrastructure Law (BIL)
- Decision support in WCS landscapes; PODs
- RMRS Wildfire Risk Management Science Team
- Subaward to Vibrant Planet, PBC via University of Montana

Scope

- Partner engagement in central Washington
- Fire risk under seasonal and management scenarios (in PODs)
- Improved representation of ecological HVRAs and tribal priorities
- Fire risk under climate change

Landscapes

Vibrant Planet/Tyler:

- Central Washington Initiative and **adjacent lands**

Collaborators:

- Colorado Front Range
- Four Forest Restoration Initiative (4FRI, AZ)

Team

- RMRS: Kit O'Connor, John Hogland, Jesse Young
- U. Montana: Alina Cansler, Vanessa Niemczyk, Joe St. Peter, Jamie Peeler, Phil Higuera
- CU-Boulder: Jilmarie Stephens
- NAU: Andi Thode, Gaby Ayres

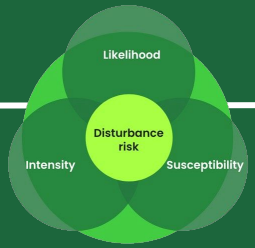
Scenario-based risk assessment

Prescribed burning & Cultural burning

Managed wildfires

Extreme fire complexes

Low hazard
High benefit



High hazard
Low benefit

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Seasonal scenarios fine tune risk

Season-long averages can hide opportunities for benefit

			Fire Intensity Level (flame length)					
Sub-HVRA	**Share of HVRA RI**	**Covariate**	**FIL 1**	**FIL 2**	**FIL 3**	**FIL 4**	**FIL 5**	**FIL 6**
(Habitat Importance)		*(Resilience and resistance score)*	*0 - 2'*	*2 - 4'*	*4 - 6'*	*6 - 8`*	*8 - 12'*	*>12'*
Species #1, *Priority Habitat*	55%	--	20	50	-10	-60	-80	-100
Species #1, *General Habitat*	15%	--	40	20	-10	-60	-80	-100
Species #2, *Priority Habitat*	24%	High RR	30	10	0	-30	-50	-90
		Moderate RR	-10	-20	-30	-60	-100	-100
		Low RR	-10	-30	-70	-100	-100	-100
Species #2, *General Habitat*	6%	High RR	30	10	0	-30	-50	-90
		Moderate RR	-10	-20	-30	-60	-100	-100
		Low RR	-10	-30	-70	-100	-100	-100

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Simulating prescribed fire

WildEST (FlamMap) fire behavior modeling

20-ft wind speed
0-3
3-8
8-13
13-18
...

1-hr fuel moisture content (%)
< 4
4-6
6-12

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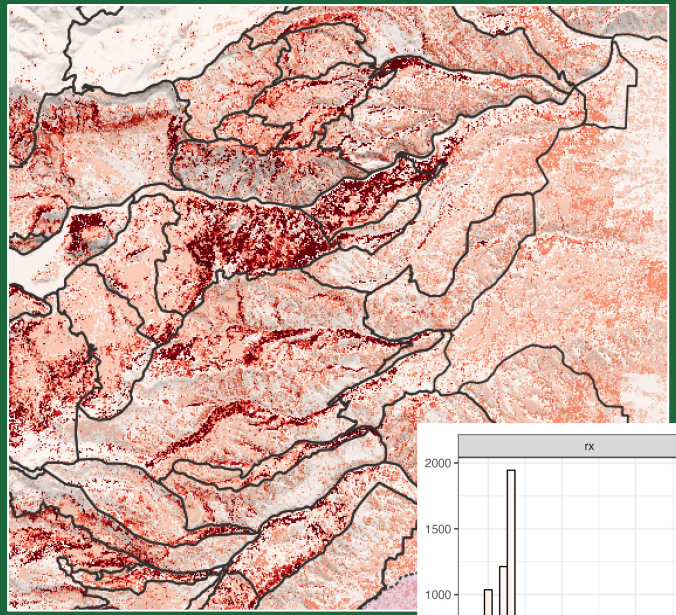
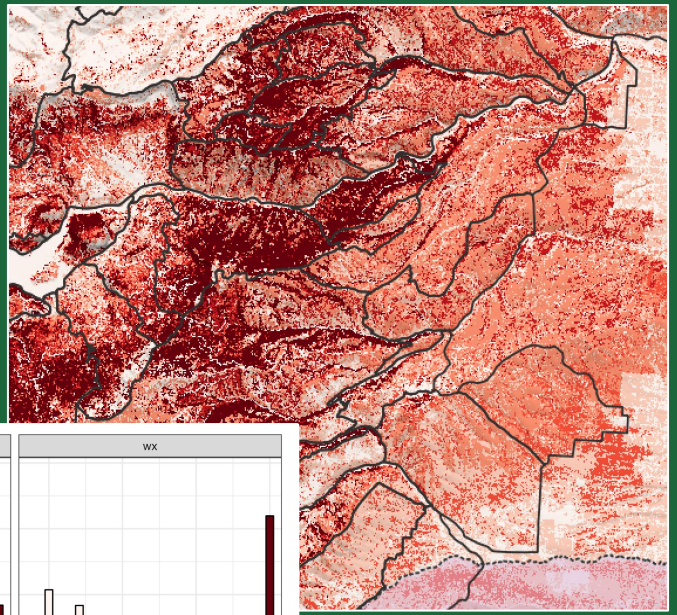
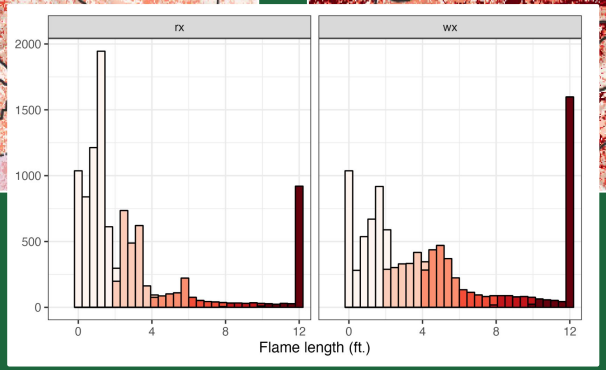
Wildest result

Prescription weather

High fire danger







Flame length (ft.)

< 2
2-4
4-6
6-8
8-12
> 12

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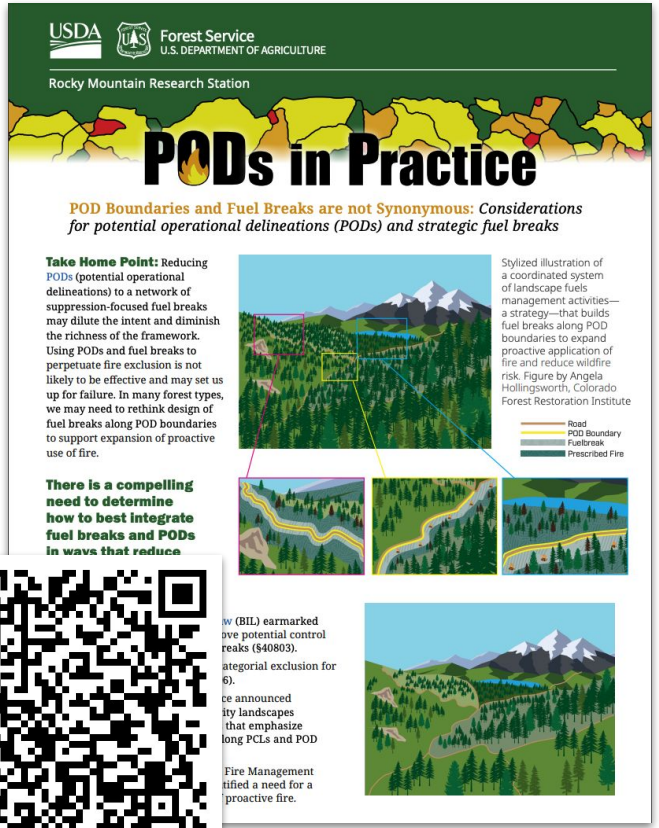
Potential Operational Delineations

What are PODs?

- Fire management and planning units with boundaries defined by potential control features
- Boundaries are a combination of roads, rivers, major ridges, barren areas, waterbodies, major fuel changes, etc.
- PODs are developed collaboratively by local managers, experts and community members
- Collaborators identify control features, often with analytical and quantitative information
- PODs complement risk assessments by assigning strategic responses for each POD based on QWRA


USDA Forest Service
U.S. DEPARTMENT OF AGRICULTURE
Rocky Mountain Research Station

PODs in Practice

POD Boundaries and Fuel Breaks are not Synonymous: *Considerations for potential operational delineations (PODs) and strategic fuel breaks*

Take Home Point: Reducing PODs (potential operational delineations) to a network of suppression-focused fuel breaks may dilute the intent and diminish the richness of the framework. Using PODs and fuel breaks to perpetuate fire exclusion is not likely to be effective and may set us up for failure. In many forest types, we may need to rethink design of fuel breaks along POD boundaries to support expansion of proactive use of fire.

There is a compelling need to determine how to best integrate fuel breaks and PODs in ways that reduce

Stylized illustration of a coordinated system of landscape fuels management activities—a strategy—that builds fuel breaks along POD boundaries to expand proactive application of fire and reduce wildfire risk. Figure by Angela Hollingsworth, Colorado Forest Restoration Institute

Road
POD Boundary
Fuelbreak
Prescribed Fire

w (BIL) earmarked
ove potential control
reaks (§40803).
ategorial exclusion for
6).
ce announced
ity landscapes
that emphasize
long PCLs and POD

Fire Management
tified a need for a
proactive fire.

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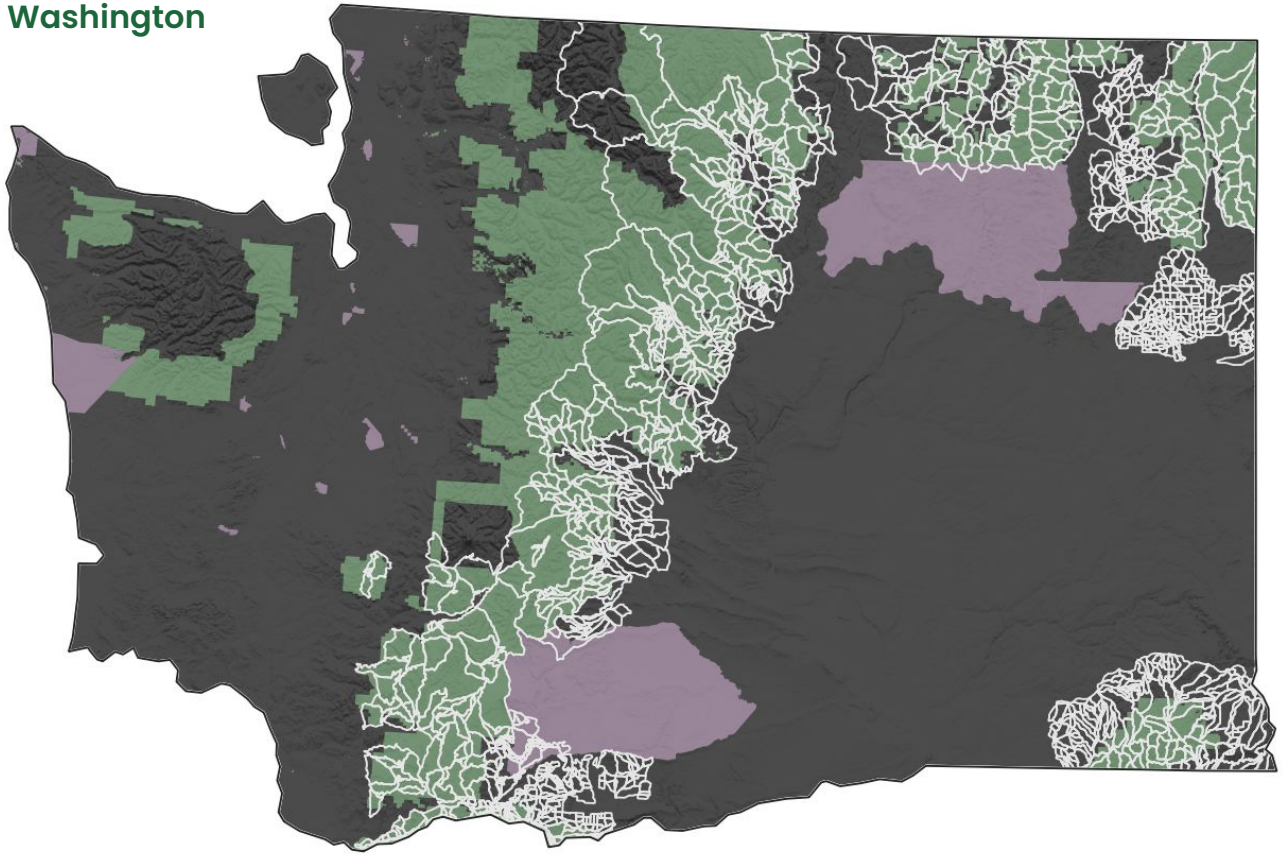
Potential Operational Delineations

POD network in Washington



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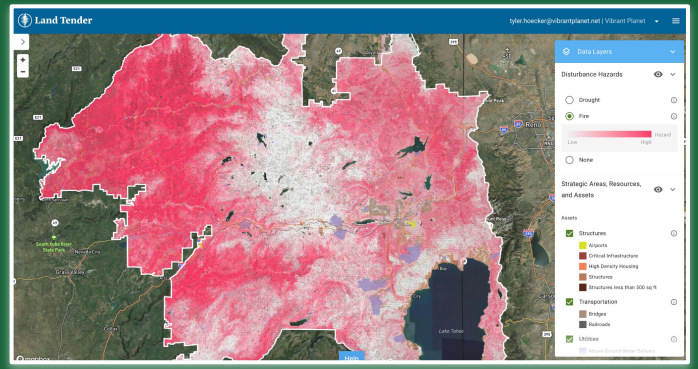
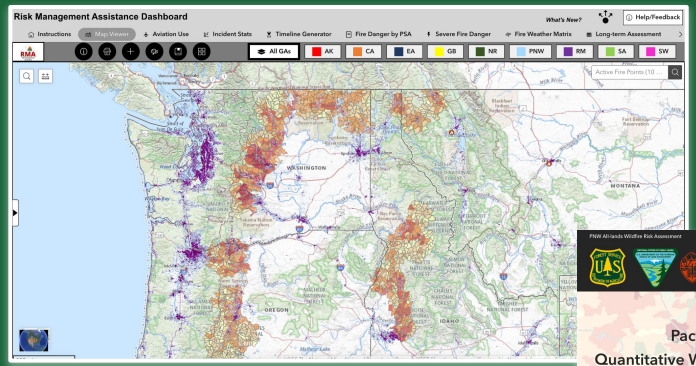
Decision-support platforms

LandTender

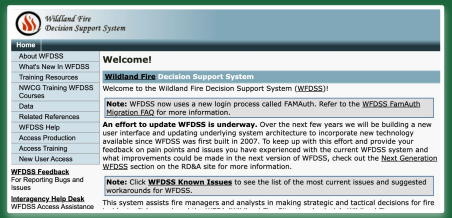


RMA Dashboard

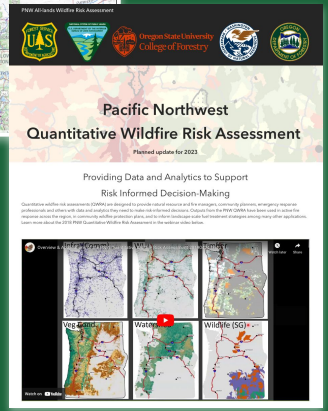


IFTDSS

WFDSS



Static QWRAs



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Opportunities to collaborate

- → Framework for representing tribal priorities
- → Aligning response functions with Indigenous & traditional ecological knowledge
- → Representing values not currently mapped, or alternative rankings
- → Feedback on fire hazard layers (are they consistent with your experience?)
- → General feedback on utility of QWRA, PODs and other decision-support tools

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