Network perspectives on risk assessment: Applications of wildfire transmission networks and collaborative networks for implementing the Cohesive Strategy

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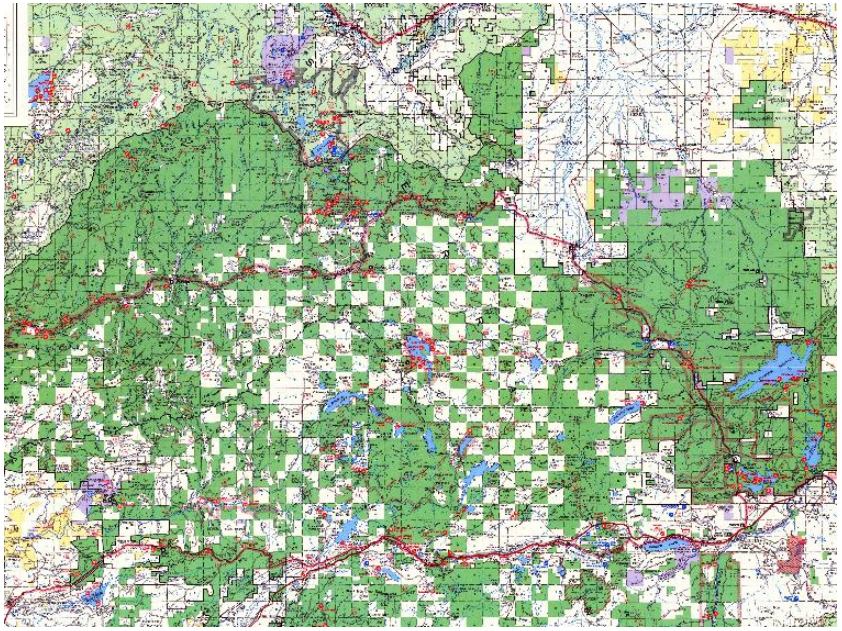
Drivers of transboundary risk

- Development patterns and fragmentation
- Wildfire size relative to parcel size
- Parcel geometry (length/width)
- Wind direction
- Ignition probability
- Fuels

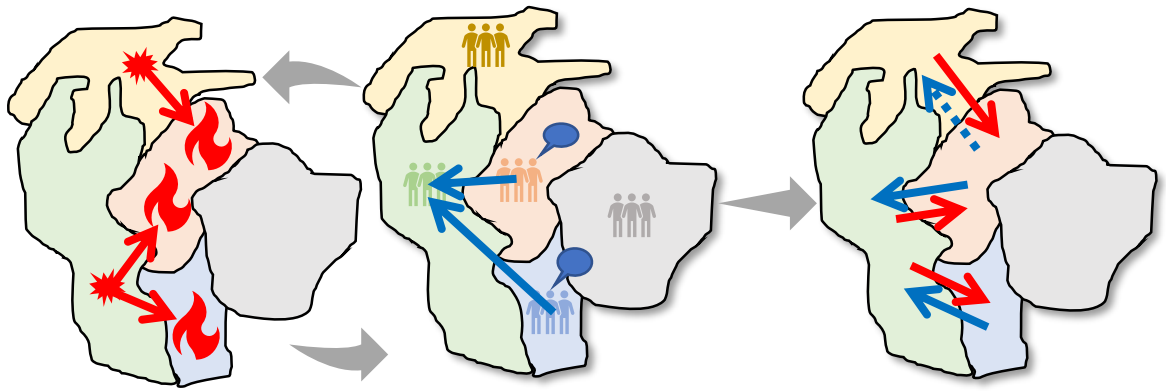


Core concepts and tools that are unique to transboundary wildfire risk (i.e. not in WRAPS)

Concept	Explanation
Risk transmission	Wildfire events in one parcel affect risk and exposure on another
Wildfire networks	Measures wildfire connectivity among landowners
Firesheds	Defines the scale of risk. Used to identify specific contributors and potential to mitigate
Transboundary risk governance	Institutional framework to manage transboundary risk

Ager, A.A., P. Palaiologou, C. Evers, M.A. Day, and A.M. Barros. **In press**. Transboundary wildfire risk: Concepts and case study from the southwestern USA. **Risk Analysis**.

Network perspectives on risk assessment: insights from the Eastern Cascades, Oregon

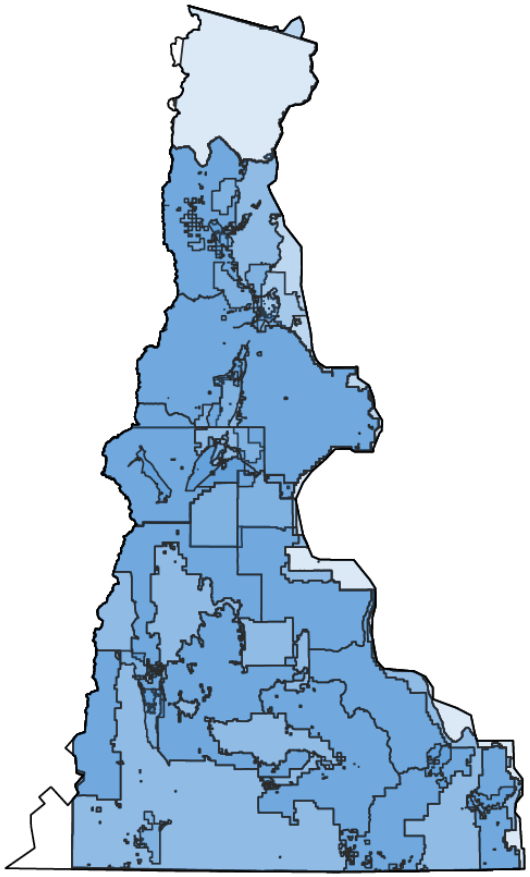


Risk spans jurisdictional boundaries and affects areas that are jointly managed.

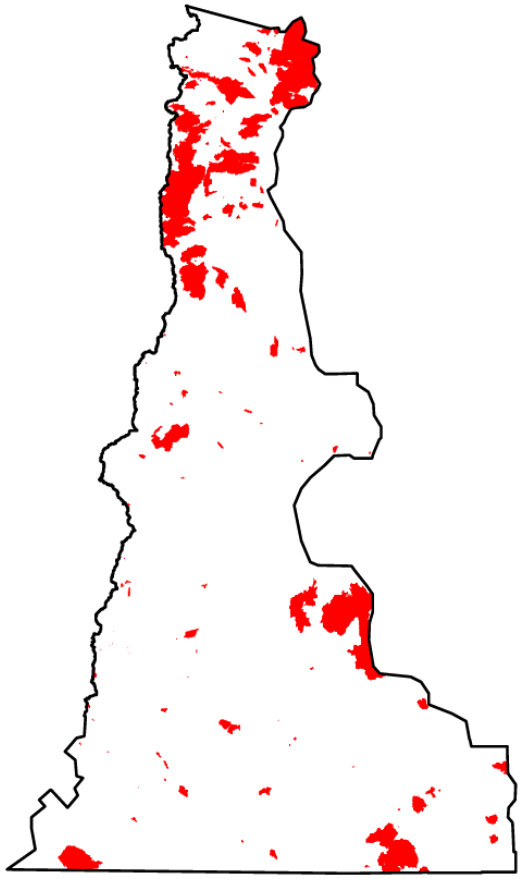
Risk mitigation must account for biophysical and social connectivity.

Biophysical connectivity: **transmission of fire (or of smoke)**

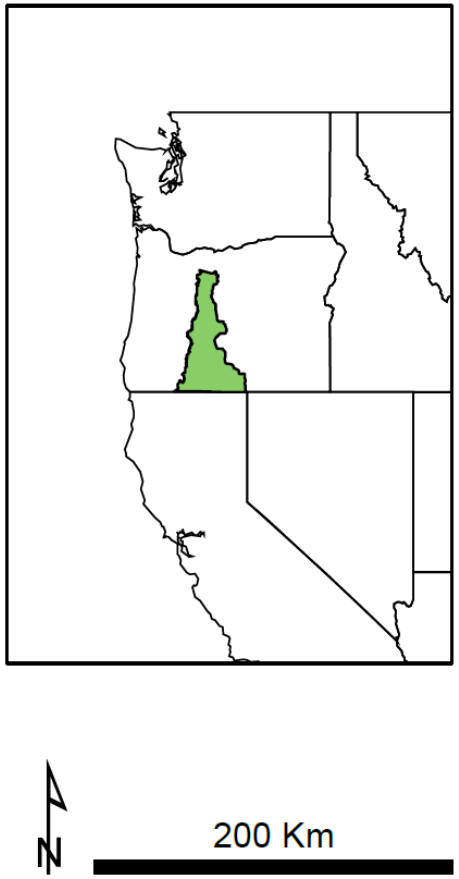
Social connectivity: **collaboration, information exchange, policy pressure, MOUs, mutual aid agreements**



Land management

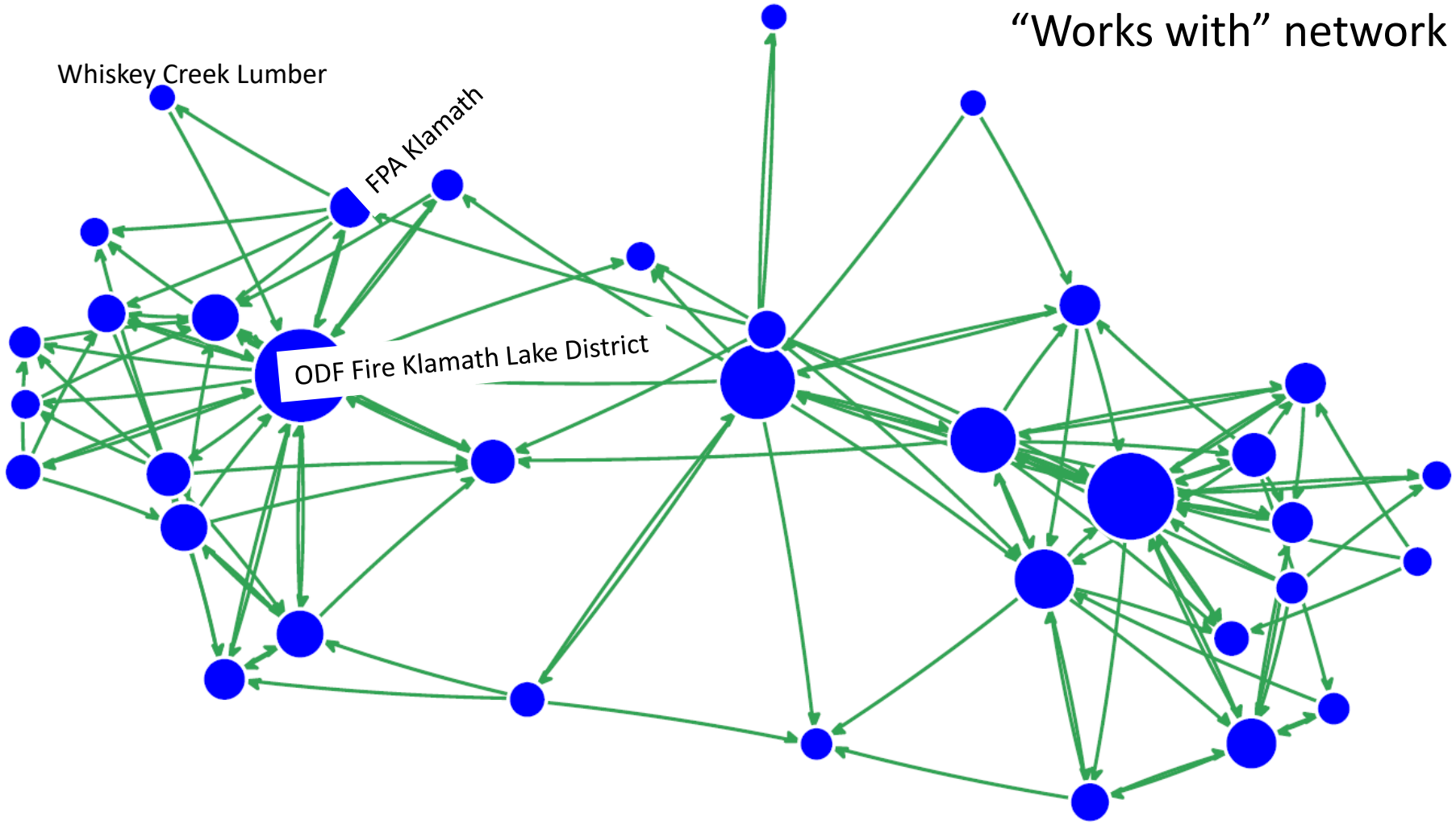


Recent wildfires (2000 – 2014)

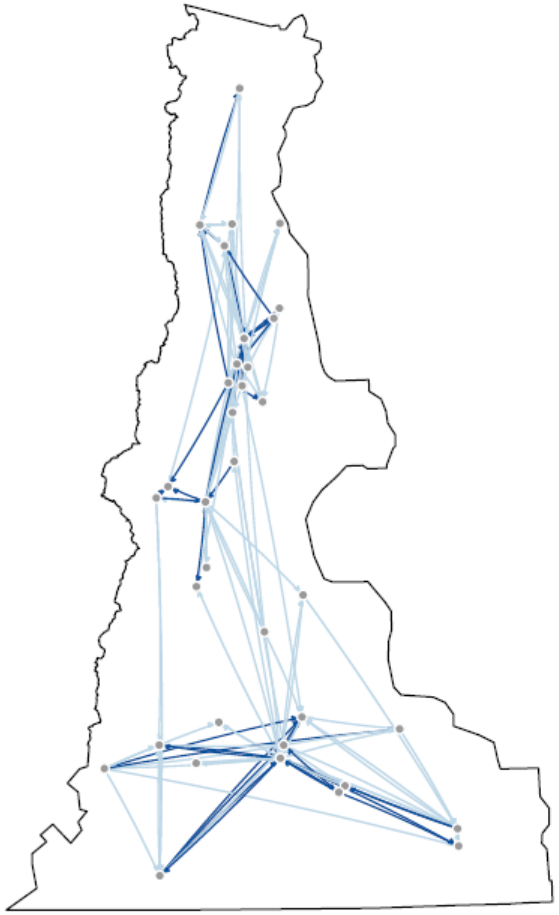


Forest/fire management organizations in the Eastern Cascades Ecoregion of Oregon

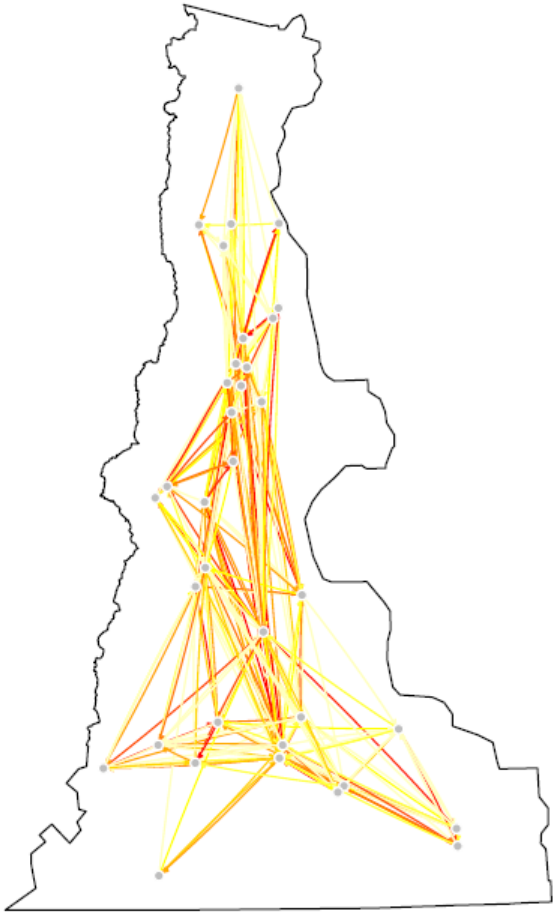
Central Cascades Fire and EMS
City of Bend Fire Department
COFMS
Collins Pine
Confederated Tribes of Warm Springs
Deschutes Land Trust
FPA Klamath
FPA Walker Range
FS Deschutes NF
FS Deschutes NF Bend–Fort Rock RD
FS Deschutes NF Crescent RD
FS Deschutes NF Sisters RD
FS Fremont–Winema NF
FS Fremont–Winema NF Bly RD
FS Fremont–Winema NF Chemult RD
FS Fremont–Winema NF Chiloquin RD
FS Fremont–Winema NF Klamath RD
FS Fremont–Winema NF Lakeview RD
FS Fremont–Winema NF Paisley RD
FS Fremont–Winema NF Silver Lake RD
FS SCOFMP
ODF Fire Central Oregon District
ODF Fire Eastern Oregon Area
ODF Fire Klamath–Lake District
ODF State Forests Klamath–Lake District
RFPD Bend
RFPD Bly
RFPD Chiloquin–Agency Lake
RFPD Crooked River Ranch
RFPD Keno
RFPD La Pine
RFPD Oregon Outback
RFPD Sisters–Camp Sherman
RFPD Sunriver Resort
Three Rivers Volunteer Fire Department
Whiskey Creek Lumber


“Works with” network
Whiskey Creek Lumber
FPA Klamath
ODF Fire Klamath Lake District

A. Actor−actor network: Coordination

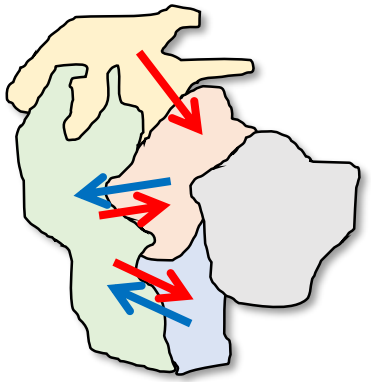


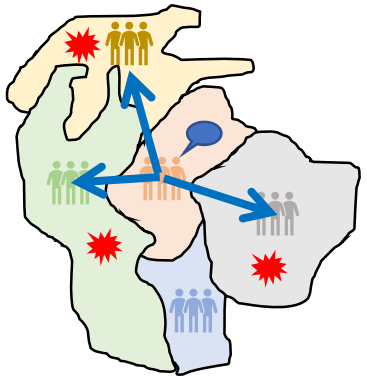
B. Forest−forest network: Wildfire transmission



Improving risk mitigation interventions / policy, guided by questions like:

- Where are the gaps in gaps in coordination to reduce wildfire risk?
- How can “network organizations” be even more effective, by creating linkages between organizations (or individuals) that should be coordinating forest or fire management?
- Which individuals or organizations can play a key role in improving risk reduction outcomes based on their relationships?





Arizona All-Lands, Cross-Boundary Fire Project

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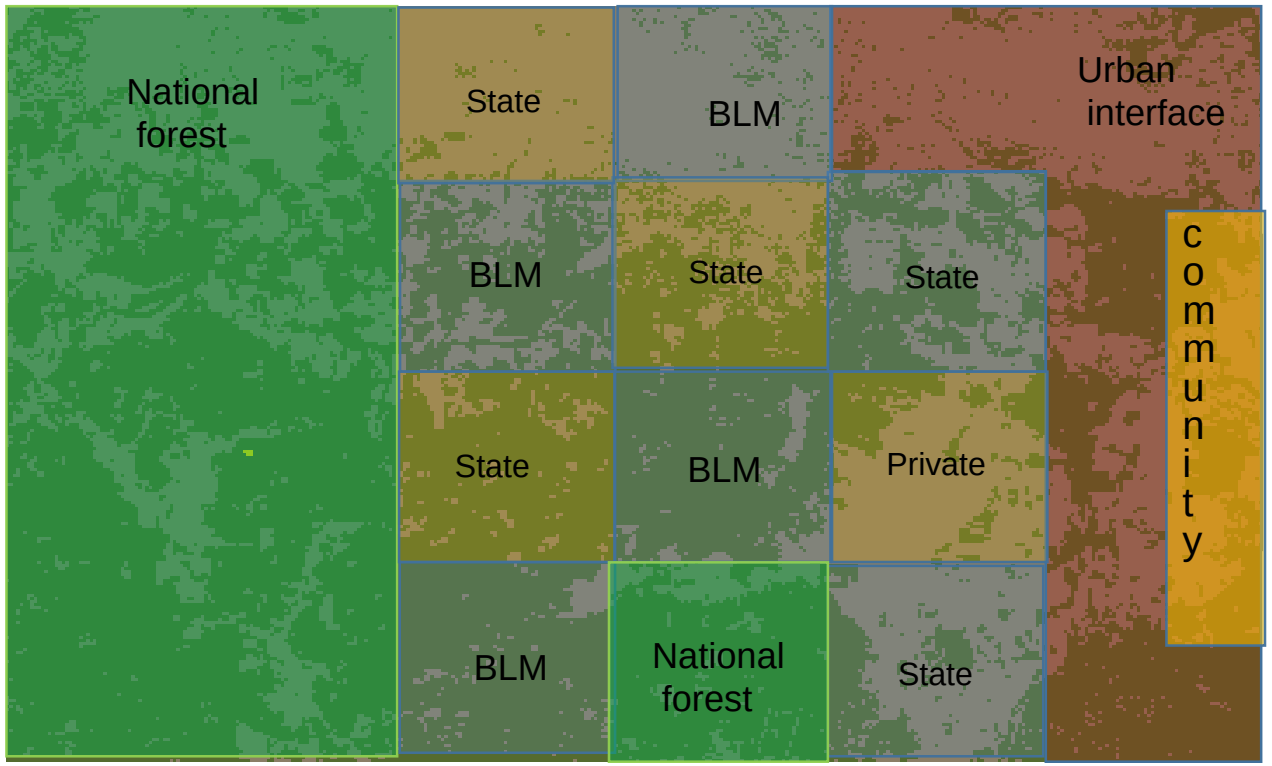
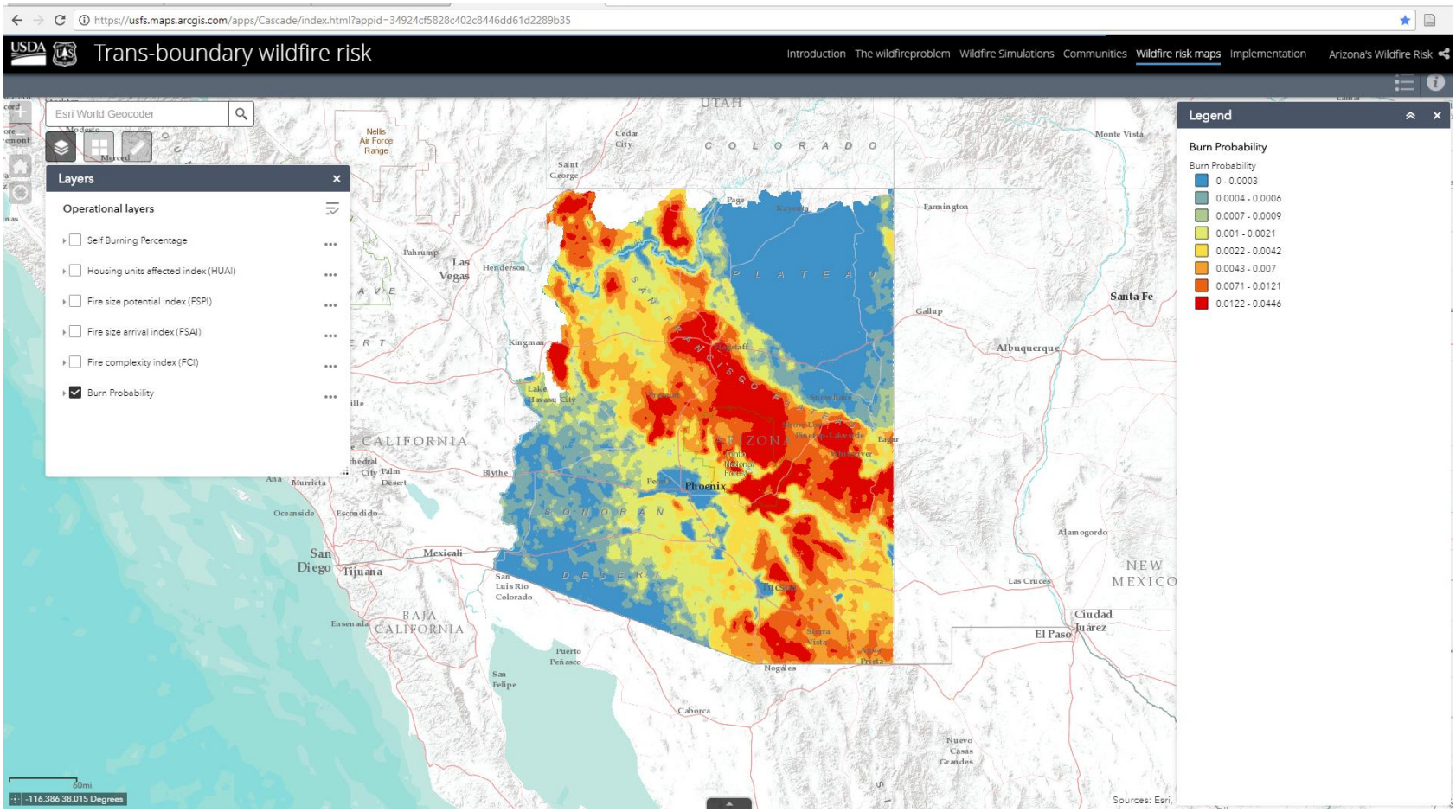
- Objectives
  - Collaborate to refine RMRS cross-boundary wildfire risk framework (Ager et al. 2018) for two landscapes in Arizona
  - Translate the outputs of the cross-boundary wildfire risk framework and develop outreach materials for multiple audiences
  - Target and test the framework with key land jurisdictions
  - Identify and communicate lessons-learned for successful multi-jurisdictional collaboration and implementation of fire risk reduction activities

Fire Transmission Across Land Tenures

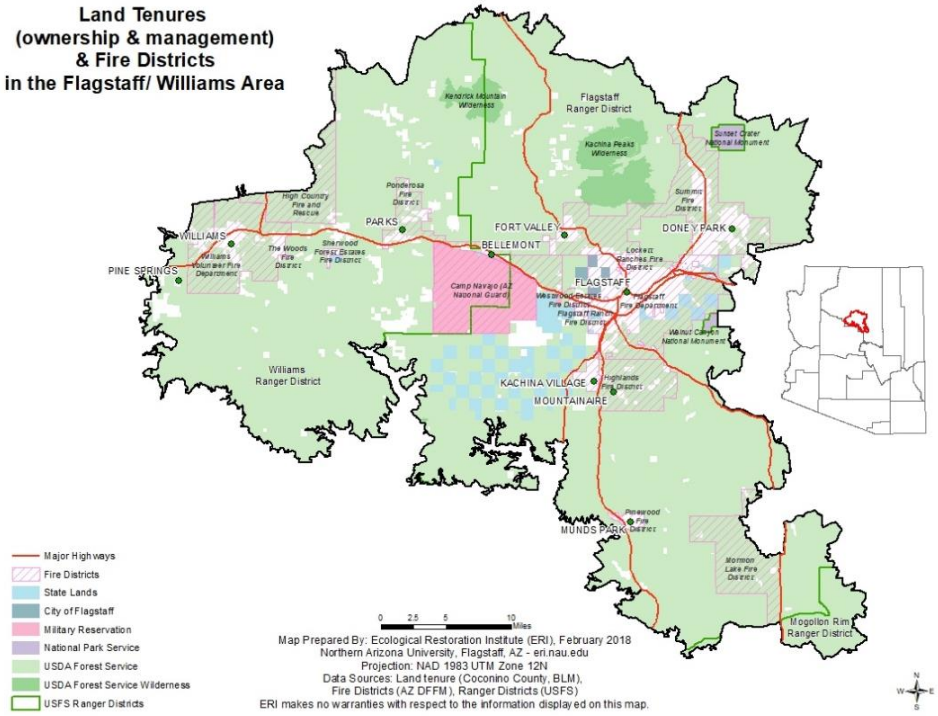


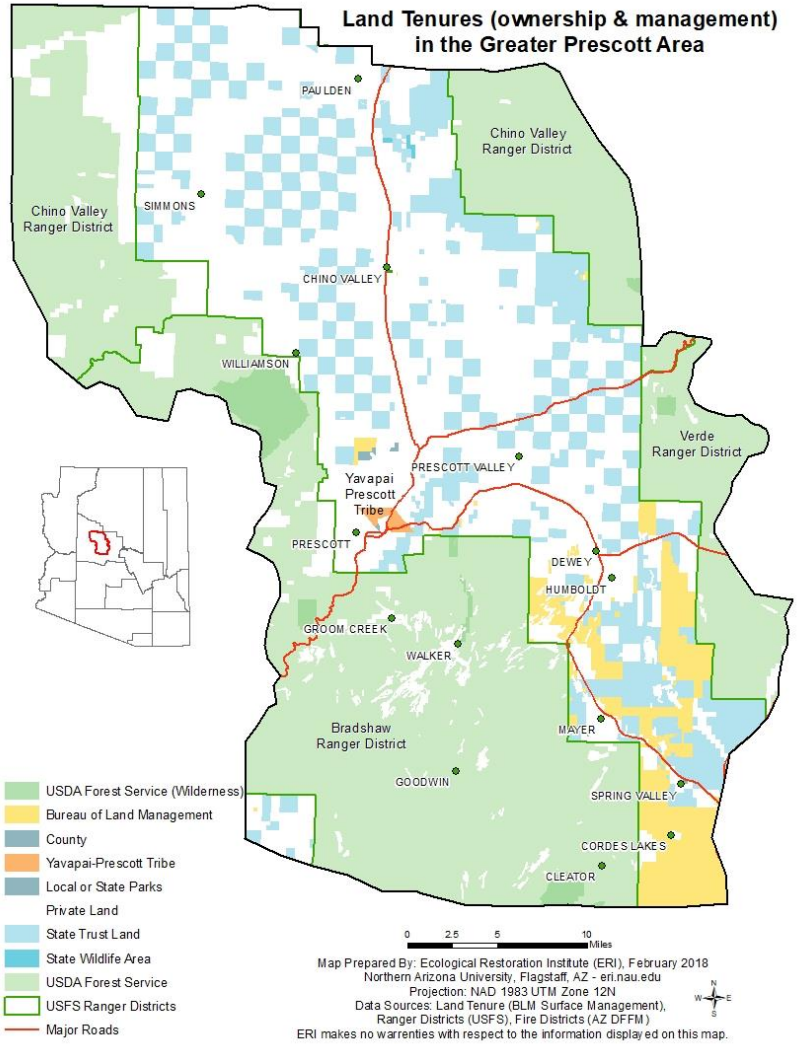
Slide From Alan Ager, RMRS

Arizona Statewide Cross-boundary Wildfire Risk Assessment



Greater Flagstaff And Prescott Area Case Study Landscapes





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What The Framework Results Can Tell Us

- Predictions of how fire is exchanged among land jurisdictions (annual acres burned).

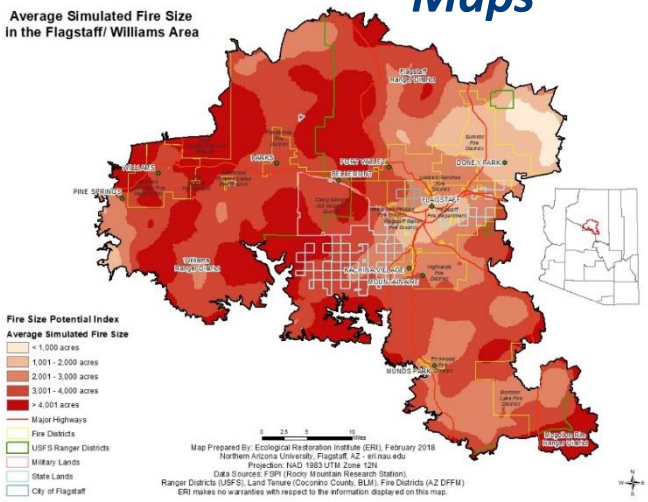
- Predictions of what communities are most exposed to fire (annual housing units exposed to fire).

- Recommendations for where and with whom to coordinate and prioritize cross-boundary management to reduce wildfire risk.

→ The framework results can be used with local information on community protection & fuels treatments to look at opportunities and risk.

Examples of Outputs Developed for Arizona Project

Maps

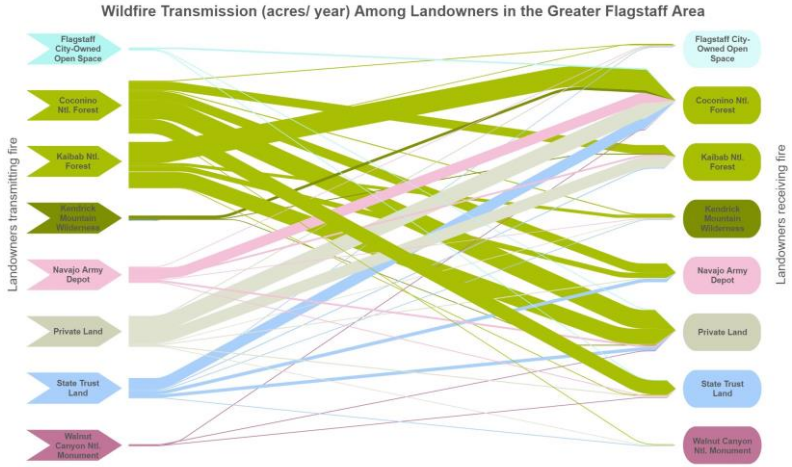


Tables

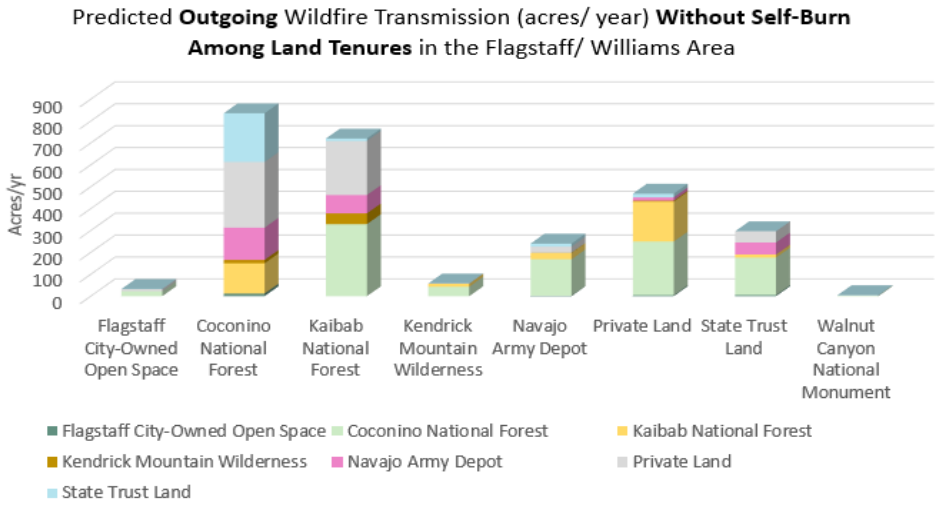
Land tenures receiving fire

Land tenures transmitting fire	Flagstaff City-Owned Open Space	Coconino National Forest	Kaibab National Forest	Kendrick Mountain Wilderness	Navajo Army Depot	Private Land	State Trust Land	Walnut Canyon National Monument	Total Transmitted
Flagstaff City-Owned Open Space	*4.35*	22.34	0.00	0.00	0.00	10.42	0.22	0.00	**37.34**
Coconino National Forest	12.41	*4996.73*	137.78	15.47	147.33	300.26	222.46	7.49	**5707.91**
Kaibab National Forest	0.09	329.04	*2449.43*	48.97	83.71	247.57	10.98	0.00	**3168.96**
Kendrick Mountain Wilderness	0.00	42.99	13.58	*12.95*	0.00	1.54	0.00	0.00	**71.05**
Navajo Army Depot	2.18	166.38	28.99	0.53	*169.99*	28.29	13.95	0.00	**408.33**
Private Land	4.35	245.41	182.81	3.69	15.47	*101.39*	16.63	0.49	**565.95**
State Trust Land	4.99	171.30	14.00	0.19	54.93	51.47	*107.82*	0.54	**403.79**
Walnut Canyon National Monument	0.00	3.25	0.00	0.00	0.00	0.33	0.85	*0.49*	**4.91**
Total Received	**28.37**	**5836.84**	**2826.59**	**81.80**	**471.43**	**741.26**	**372.91**	**9.01**	

Sankey Diagrams

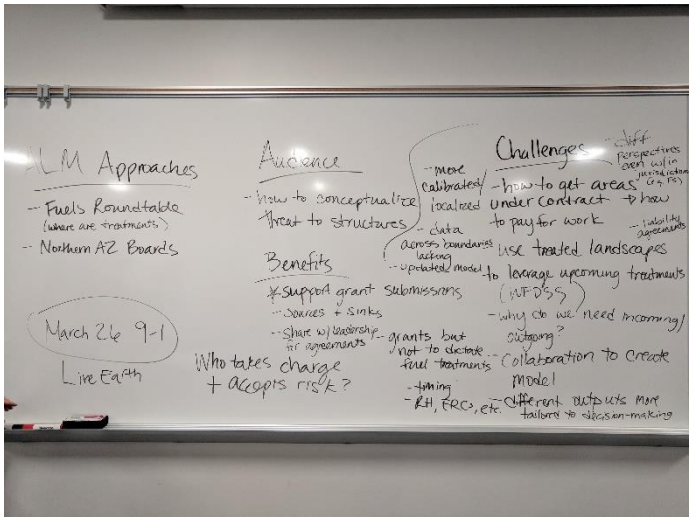


Bar Graphs



What We Learned in the Arizona Assessments

- Increase in understanding of fire transmission concepts
- Increase in motivation for multi-jurisdictional coordination
- Maps were the most preferred communication outputs
- In addition to maps, bar graphs were preferred in Flagstaff, while Prescott respondents preferred the oral delivery of information and written project summary



Lessons Learned In Arizona Project

- Many model outputs validated what managers already thought they knew about the landscape, which is significant for the model's credibility.
- At the same time, it is important to have data that is as up-to-date and accurate as possible for input to the modeling.
- Managers expressed interest in being more involved in the model development.
- Model outputs can be used in tandem with local knowledge and information to enhance decision-making at different scales.
- Model outputs have different types of utility in different places. For example, where there is ongoing all-lands collaboration, outputs might be helpful for funding proposals and discussions with policymakers. Where there is not ongoing all-lands collaboration, outputs might be helpful for highlighting high risk areas across the landscape.

Additional Information

- **Story Maps:**
  - Arizona statewide assessment: https://usfs.maps.arcgis.com/apps/Cascade/index.html?appid=34924cf5828c402c8446dd61d2289b35
  - Greater Flagstaff area: https://usfs.maps.arcgis.com/apps/Cascade/index.html?appid=d0bd9fc4a05c4ff5808e86da25717a3a
  - Greater Prescott area: https://usfs.maps.arcgis.com/apps/Cascade/index.html?appid=153d682ed84041b38bf54645f5098b2e
- **Contact:**
  - Melanie Colavito: melanie.colavito@nau.edu / 928-523-6651
  - Tzeidle Wasserman: tzeidle.wasserman@nau.edu / 928-523-7488
- **Acknowledgements:**
  - Alan Ager, Pal Palaiologos, Ken Bunzel, RMRS
  - Arizona Department of Forestry and Fire Management

Applying All Lands Cross Boundary Wildfire Transmission Analyses in Utah

Tom Quigley – Senior Wildland Fire Consultant

St George, Utah

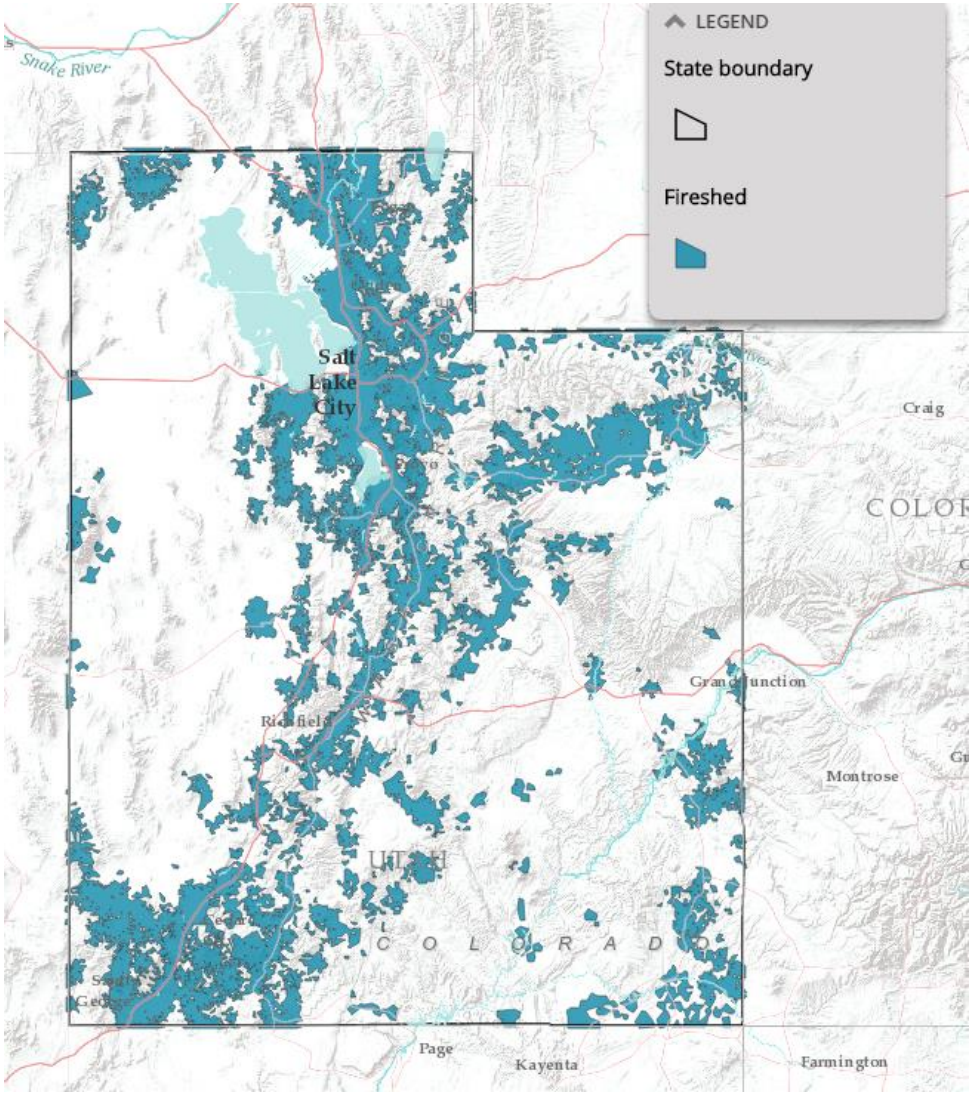
Varying Scales

- Utah level
- Five County SW Utah
- Individual County
- Specific Community

- Additional information is needed to inform overall risk assessment
- Designing specific projects requires more detail

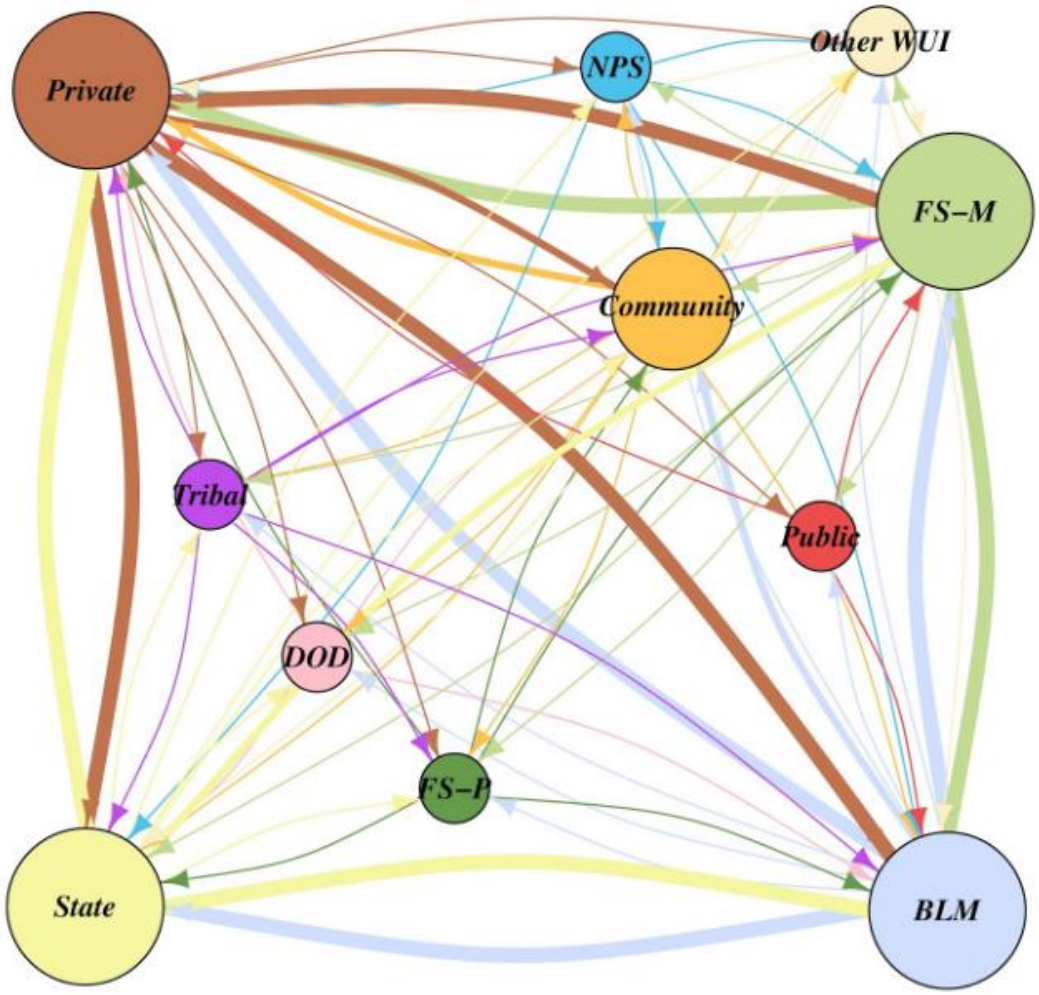
Community Firesheds

- Areas that transmit fire to communities

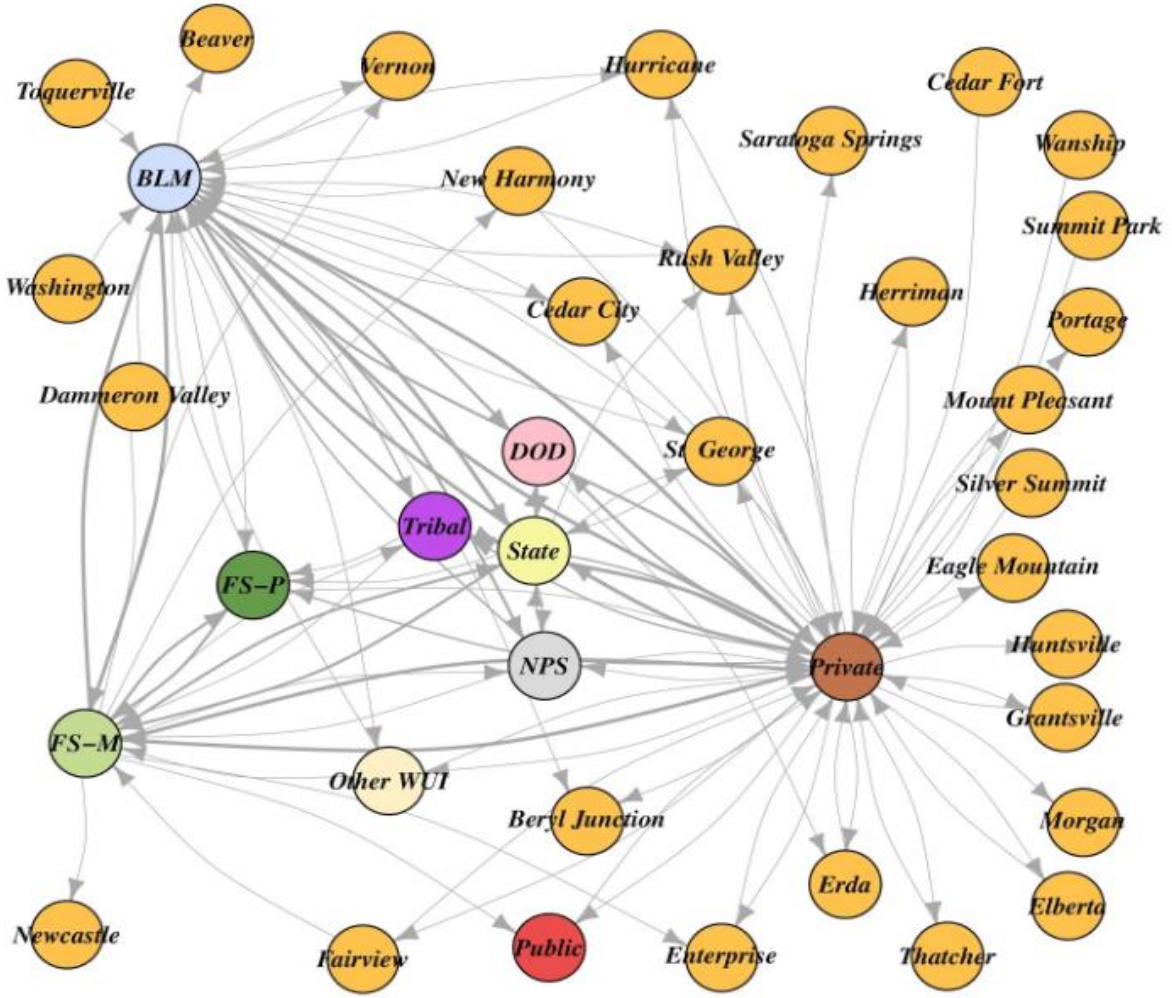


Fire Transmission Network - Exposure among large land tenures

Size of ownership node and width of arrows is proportional to total fire activity



All lands community exposure network – consider state level, county level, and community level



SW Utah Five County Area

- **Alan Ager's RMRS science team is committed to work with 5 County CWPP updates and moving to implementation**
- **Building a bridge between local planning and CS implementation**
- **Enhanced understanding of cross boundary fire risk**
- **An all lands approach**

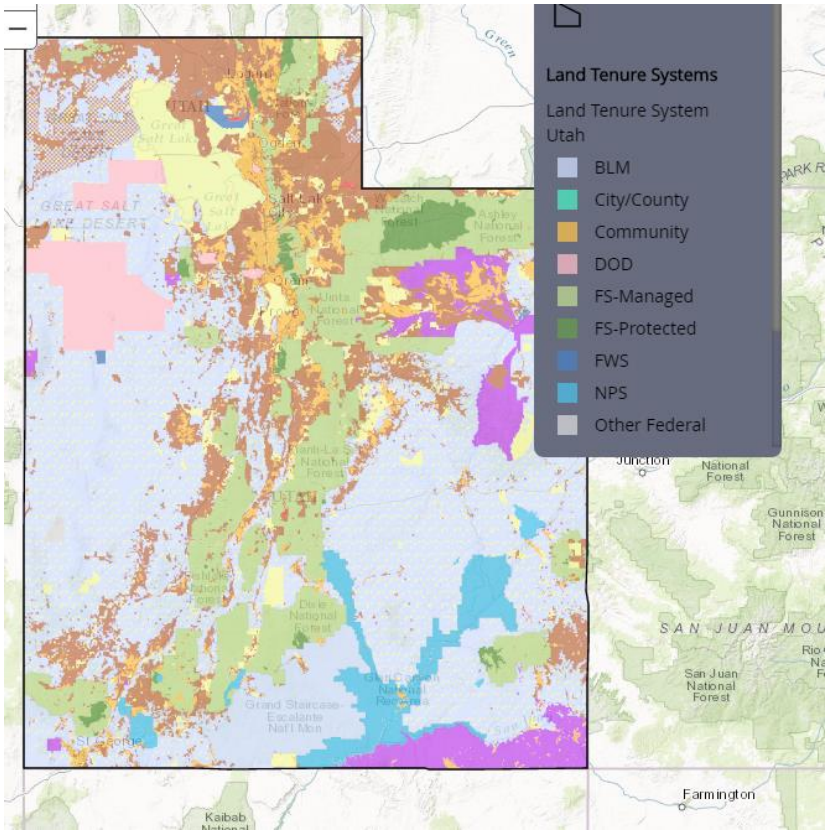
Key Points

- **Scale matters : Large fires matter - ignitions miles away from a community may be important to consider**
- **Fire transmission data helps understand the scale to include in analyses - “firesheds”**
- **“Firesheds” are areas where ignitions can result in fires that impact a community**
- **Most wildfire risk analyses do not include fire transmission networks – this misses an important risk of large fire**

Questions?

- **Potential questions for open discussion:**
  - What are the most helpful strategies in fostering all-lands coordination and planning for restoration and wildfire risk reduction?
  - What are the biggest barriers to taking action on all-lands coordination and planning for restoration and wildfire risk reduction?
  - What information sources do you use in all-lands planning, and what information needs do you have?

Utah Study


Land Tenure Systems
Land Tenure System
Utah
BLM
City/County
Community
DOD
FS-Managed
FS-Protected
FWS
NPS
Other Federal
Green
GREAT SALT LAKE DESERT
Salt Lake City
Ogden
Provo
Uinta National Forest
Ashley National Forest
Manti-La Sal National Forest
Dixie National Forest
Grand Staircase-Escalante Natl Mon
Glen Canyon National Recreation
Junction
National Forest
Gunnison National Forest
SAN JUAN MOU
San Juan National Forest
Farmington
Kaibab