Vulnerability to fire-catalyzed vegetation shifts

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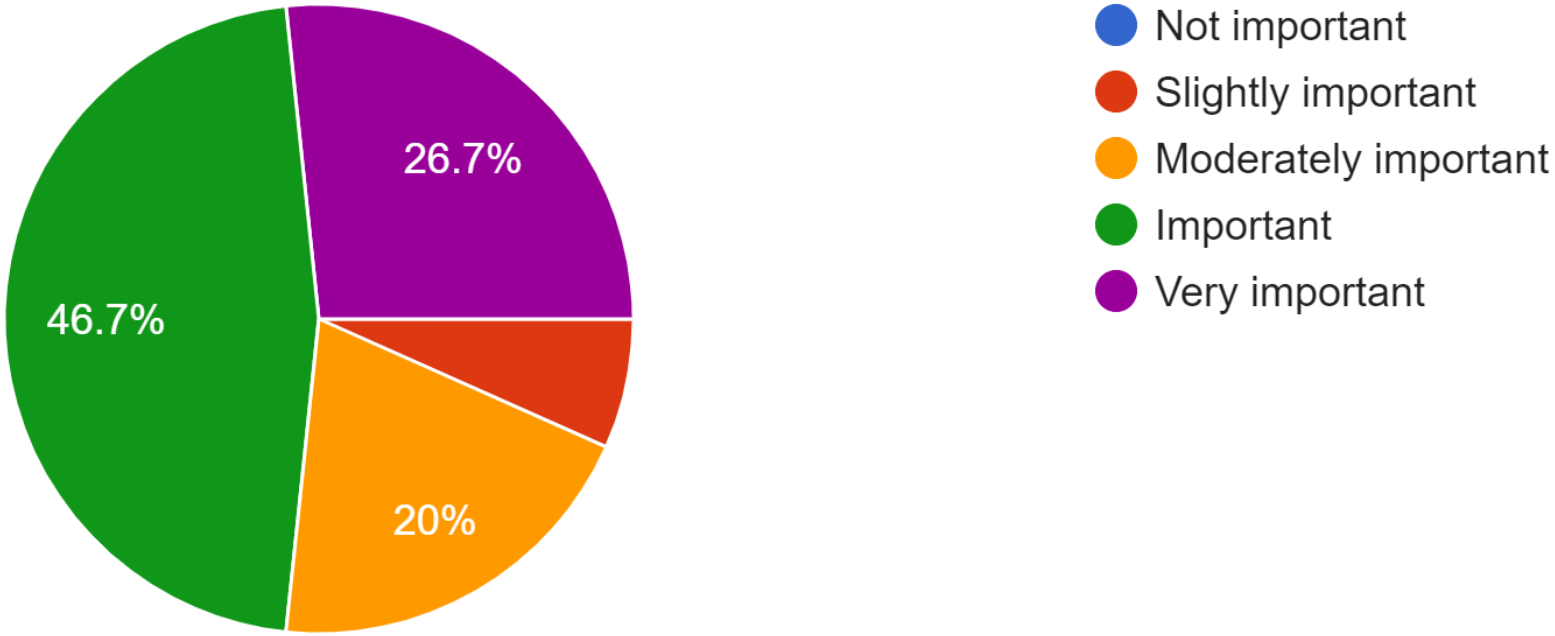
Fire-catalyzed vegetation shifts: survey responses

How important a concern are post-fire vegetation transitions for your day to day work?

15 responses



Fire-catalyzed vegetation shifts: survey responses

What type of transitions?

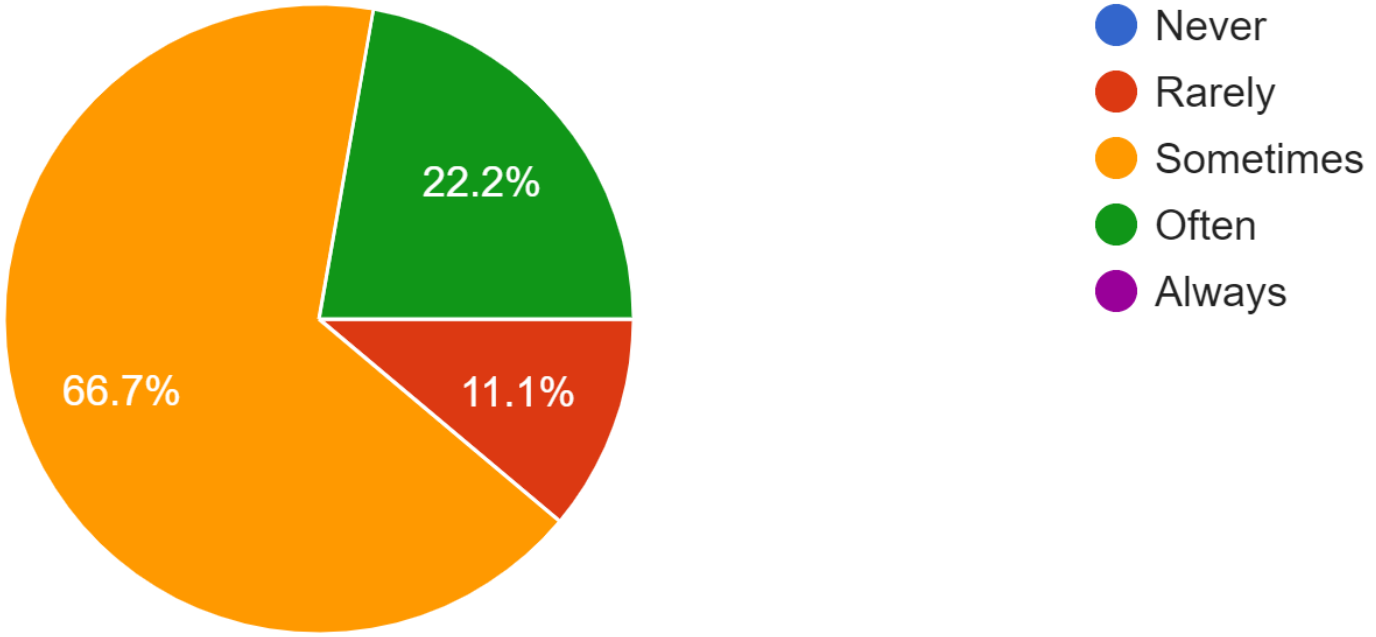
- Conifer to grass/shrub transitions (ponderosa, Doug-fir, spruce/fir), in some cases due to short-interval fires
- Less abundant lodgepole and western larch
- Potential increases in aspen
- Concern about interactions between drought, insects, & wildfire
- Some areas not observed yet (e.g. ponderosa in Black Hills)

9 years post-fire, Payette NF, ID

Fire-catalyzed vegetation shifts: survey responses

If you have observed post-fire vegetation transitions where you work, how frequently do you observe these transitions?

9 responses



Fire-catalyzed vegetation shifts/conversions/transitions

Wildfire-Driven Forest Conversion in Western North American Landscapes

JONATHAN D. COOP, SEAN A. PARKS, CAMILLE S. STEVENS-RUMANN, SHELLEY D. CRAUSBAY, PHILIP E. HIGUERA, MATTHEW D. HURTEAU, ALAN TEPLEY, ELLEN WHITMAN, TIMOTHY ASSAL, BRANDON M. COLLINS, KIMBERLEY T. DAVIS, SOLOMON DOBROWSKI, DONALD A. FALK, PAULA J. FORNWALT, PETER Z. FULÉ, BRIAN J. HARVEY, VAN R. KANE, CAITLIN E. LITTLEFIELD, ELLIS Q. MARGOLIS, MALCOLM NORTH, MARC-ANDRÉ PARISIEN, SUSAN PRICHARD, AND KYLE C. RODMAN

August 2020 / Vol. 70 No. 8 • BioScience

Coop et al. 2020

Fire-catalyzed vegetation shifts/conversions/transitions

Wildfire-Driven Forest Conversion in Western North American Landscapes

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- Fire extent & severity
- Fire frequency
- Pre-, during, and post-fire climate/weather
- Feedbacks

Coop et al. 2020

Fire-catalyzed vegetation shifts/conversions/transitions

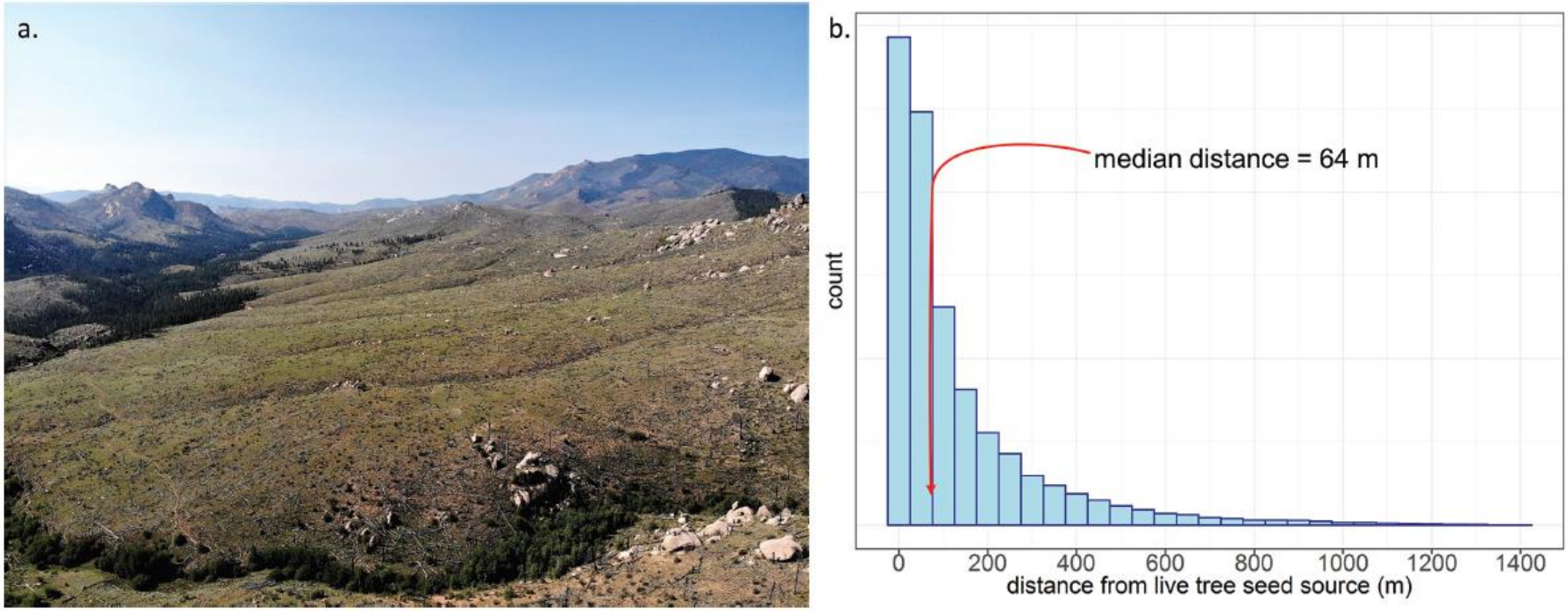
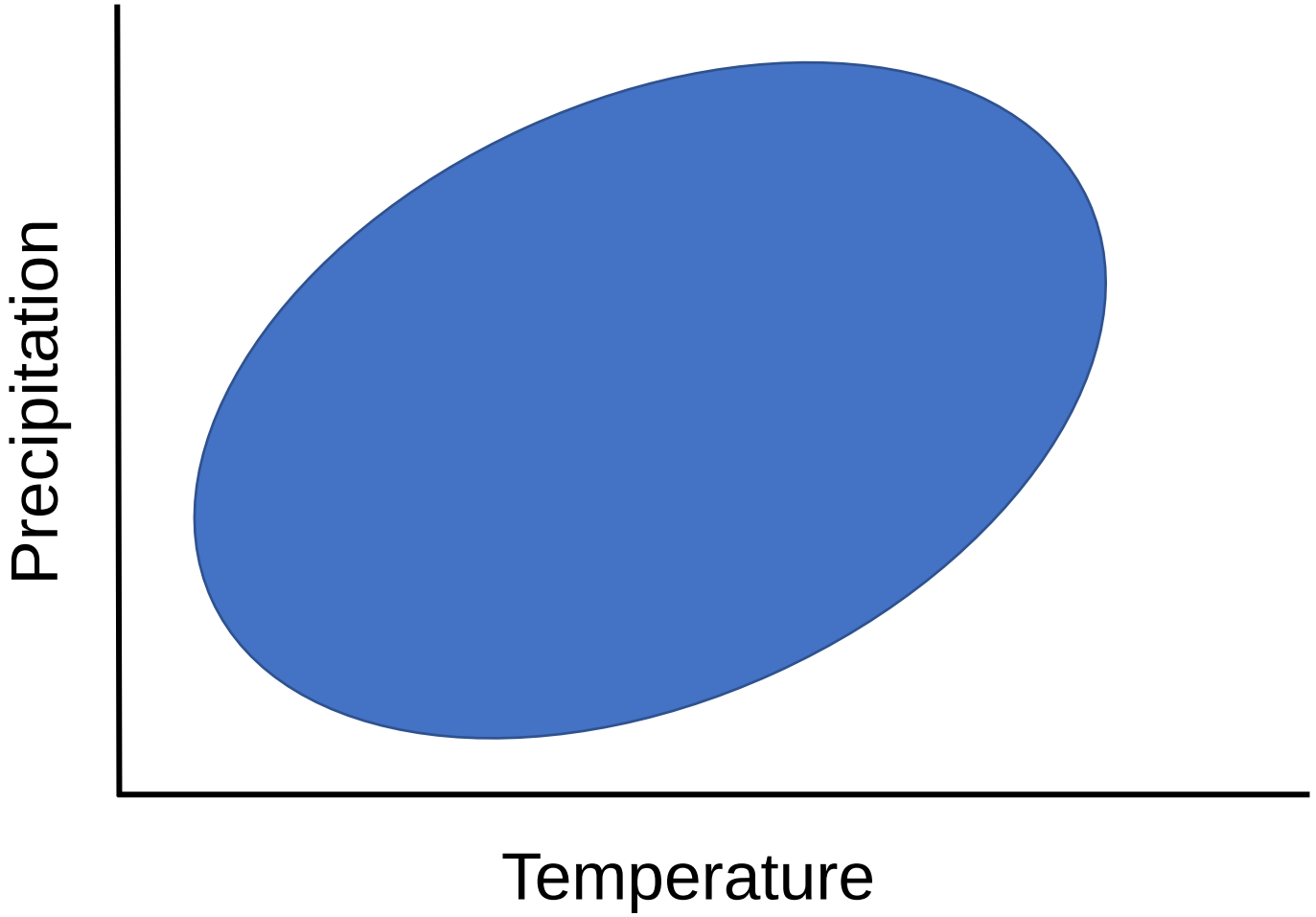


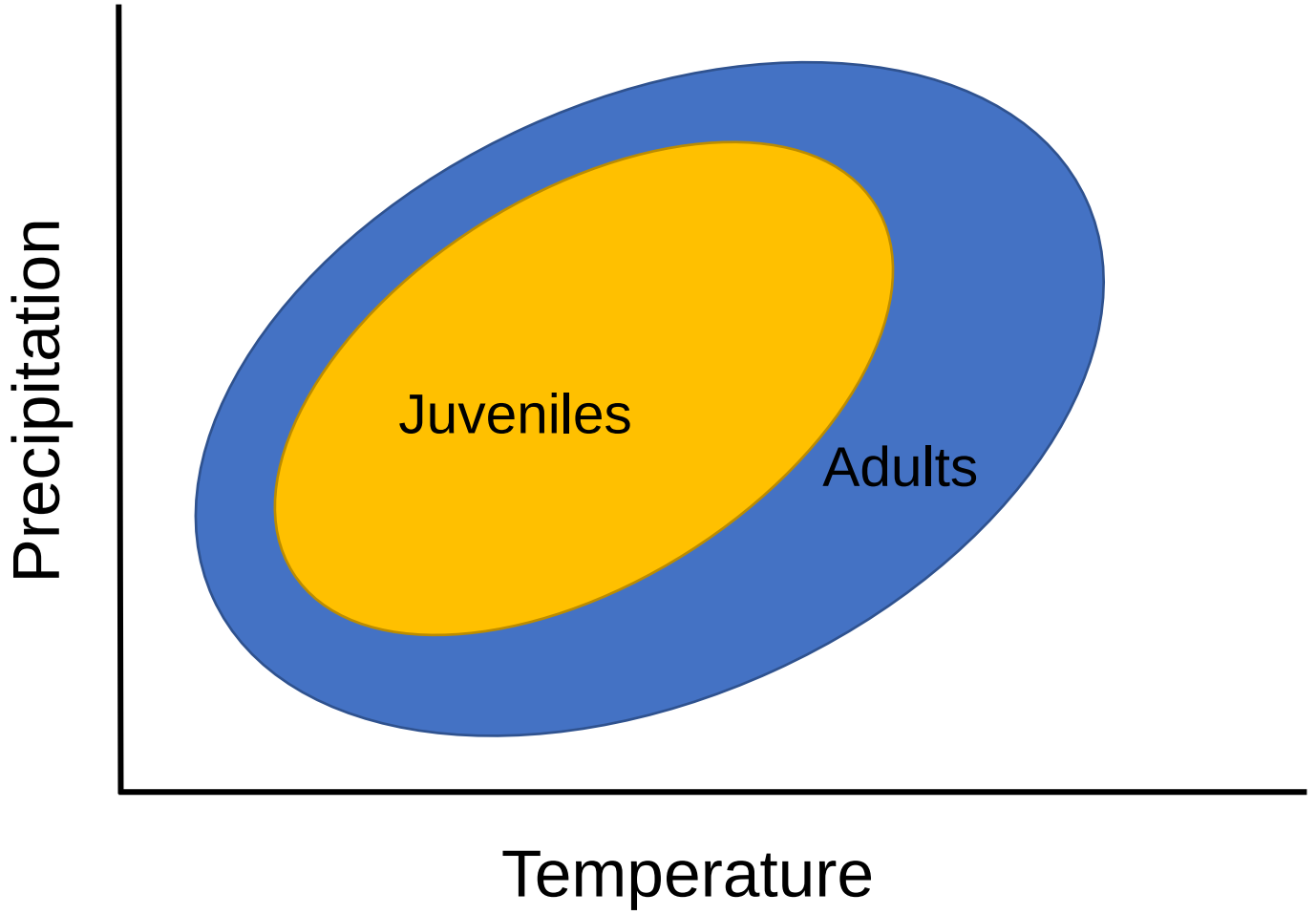
Figure 4. Exceptionally large high-severity patches in a frequent-fire forest type. (a) The postfire landscape of the Hayman fire in Colorado; (b) distribution of distances from high-severity patches to surviving tree seed sources within the burn perimeter. Fifteen years after a fire, Chambers and colleagues (2016) found that sites less than 50 meters from tree seed sources were not recovering toward prefire forest densities, and most of this landscape is now dominated by shrubs and herbs. Photograph: O. Rhoades. The data are from Jonathan D. Coop.

Coop et al. 2020

Climate niche



Regeneration niche



Vulnerability to fire-catalyzed vegetation shifts

- How vulnerable are ponderosa pine and Douglas-fir forests in the interior western US to fire-catalyzed vegetation shifts?
- Where is this vulnerability the highest under current and future climate?

Vulnerability to fire-catalyzed vegetation shifts

1. High severity fire that kills adults
2. Failure of prior dominant species to regenerate

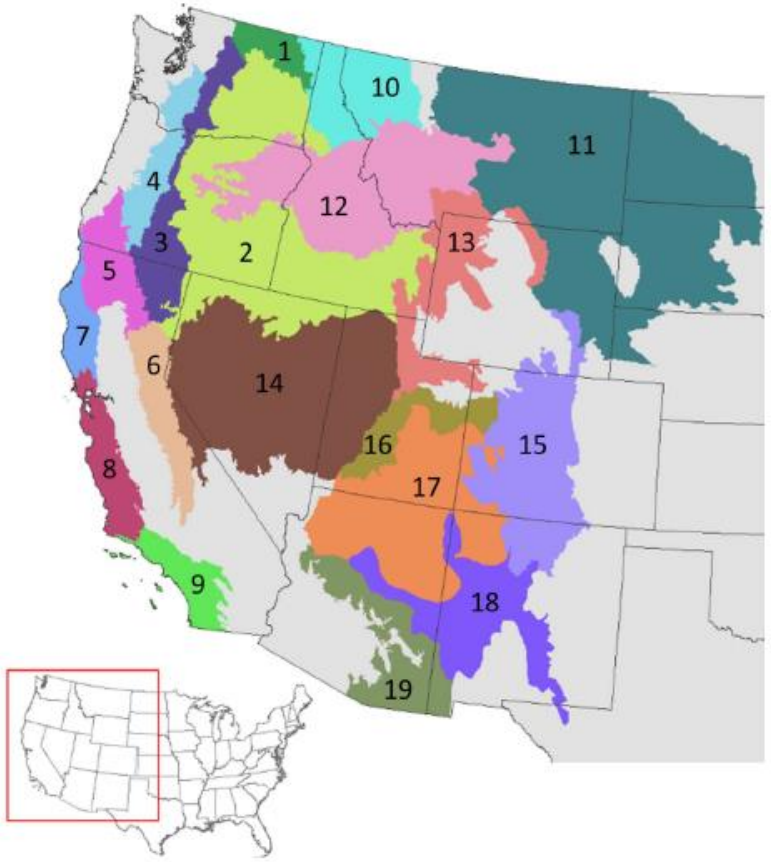
Vulnerability to fire-catalyzed vegetation shifts

1. **High severity fire that kills adults**
2. Failure of prior dominant species to regenerate

Where will fires burn at high severity?

High-severity fire: evaluating its key drivers and mapping its probability across western US forests

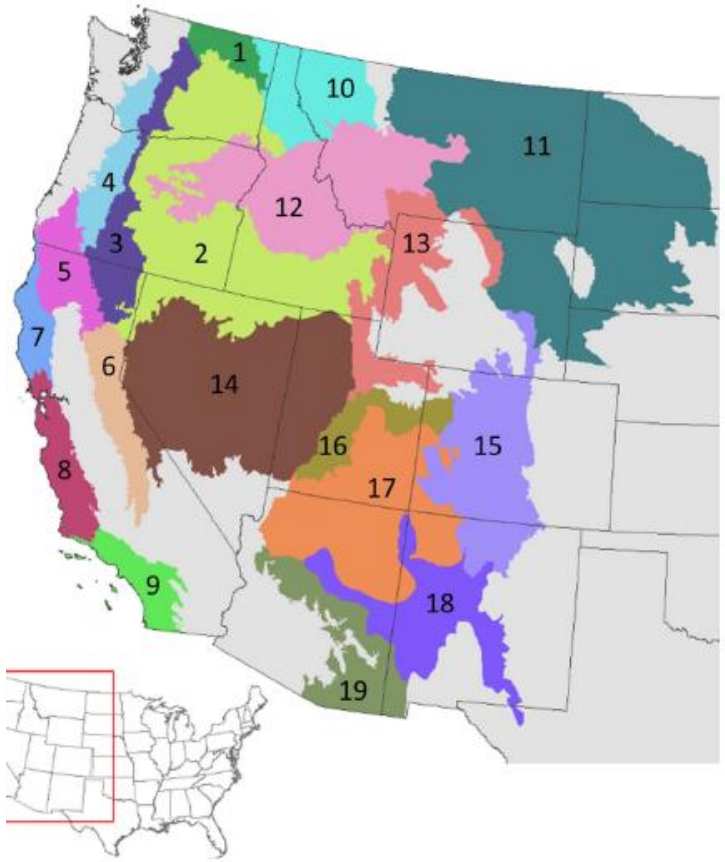
Sean A Parks[1,4], Lisa M Holsinger[1], Matthew H Panunto[2], W Matt Jolly[2], Solomon Z Dobrowski[3] and Gregory K Dillon[2]

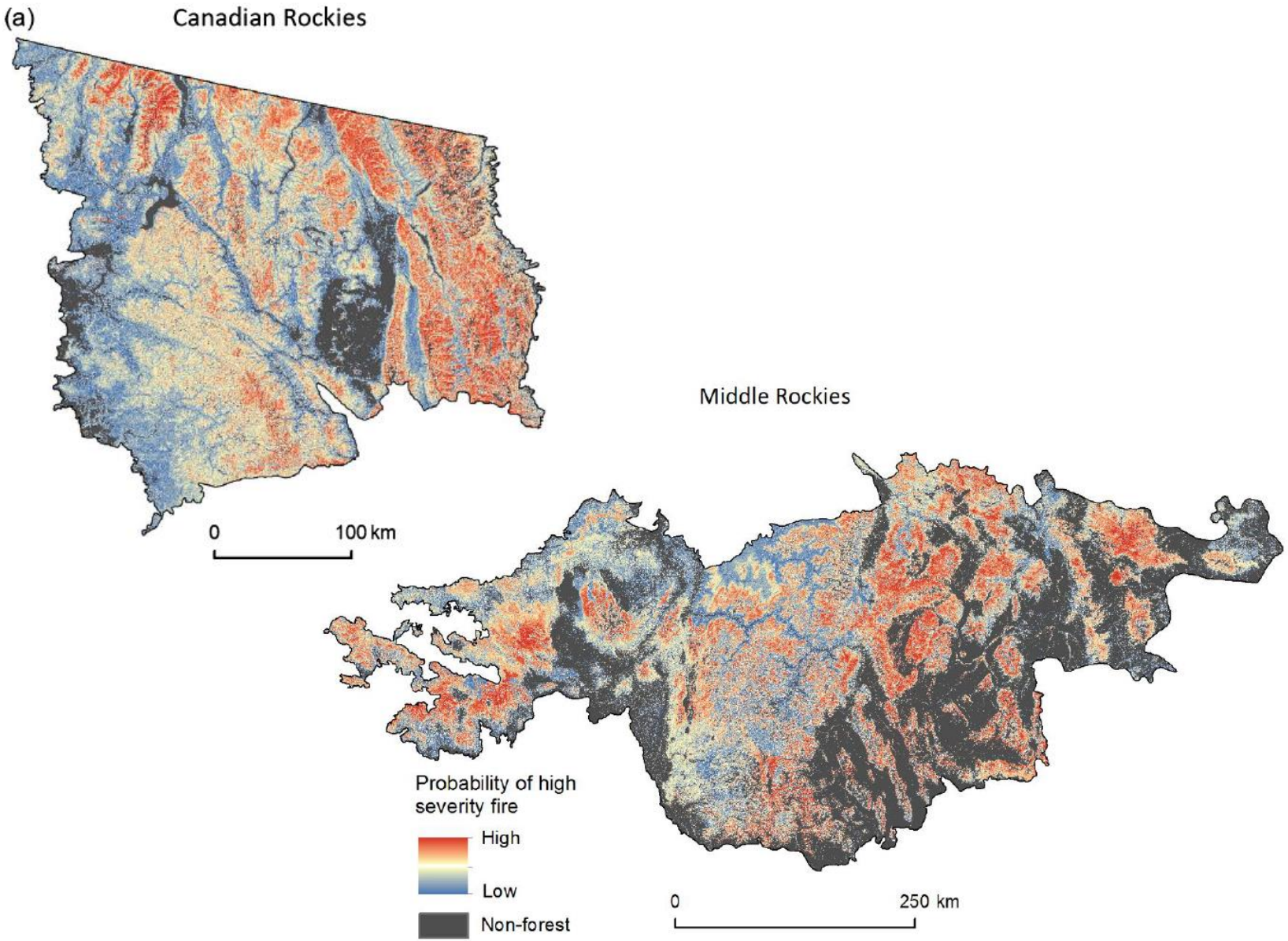


1. Okanagan
2. Columbia Plateau
3. East Cascades
4. West Cascades
5. Klamath
6. Sierra Nevada
7. California North Coast
8. California Central Coast
9. California South Coast
10. Canadian Rockies
11. Northern Great Plains
12. Middle Rockies
13. Utah-Wyoming Rockies
14. Great Basin
15. Southern Rockies
16. Utah High Plateaus
17. Colorado Plateau
18. Arizona-New Mexico Mountains
19. Apache Highlands

Data available:
https://www.frames.gov/NextGen-FireSeverity

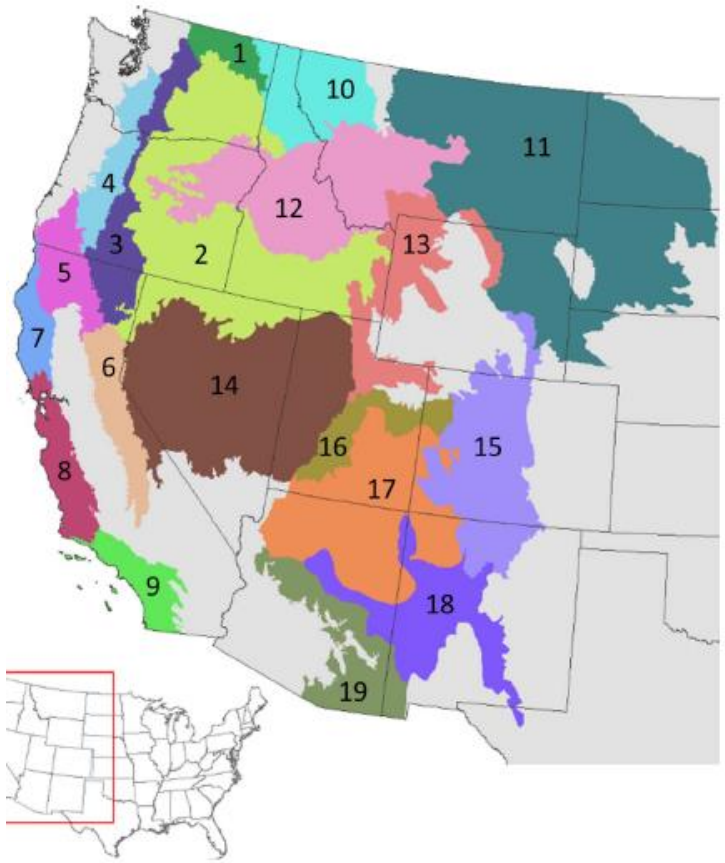
Where will fires burn at high severity?

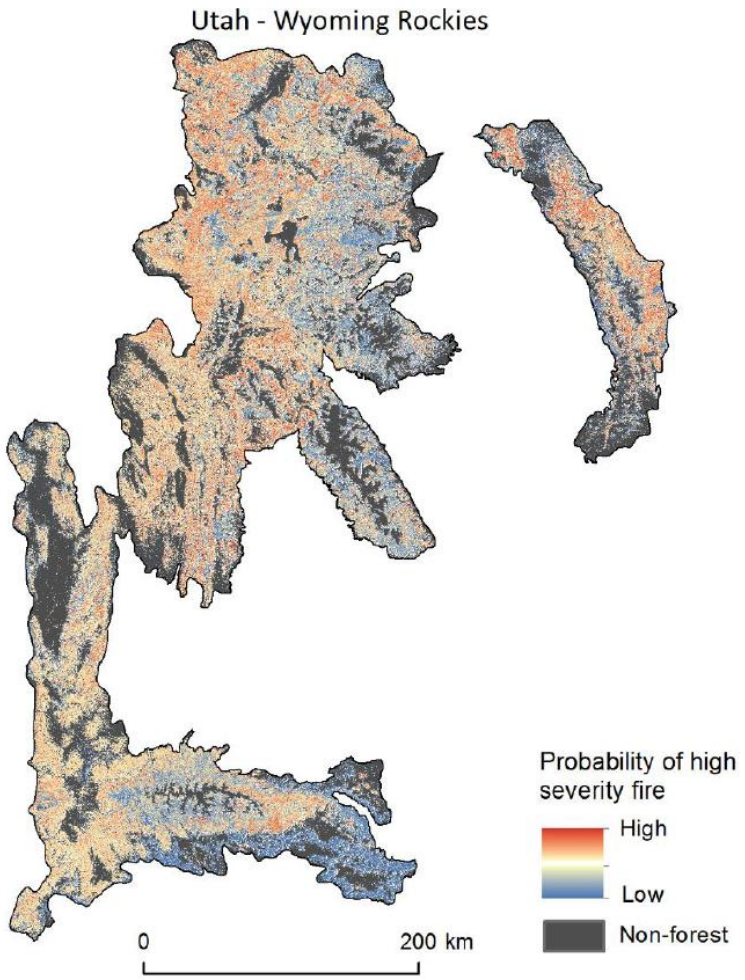


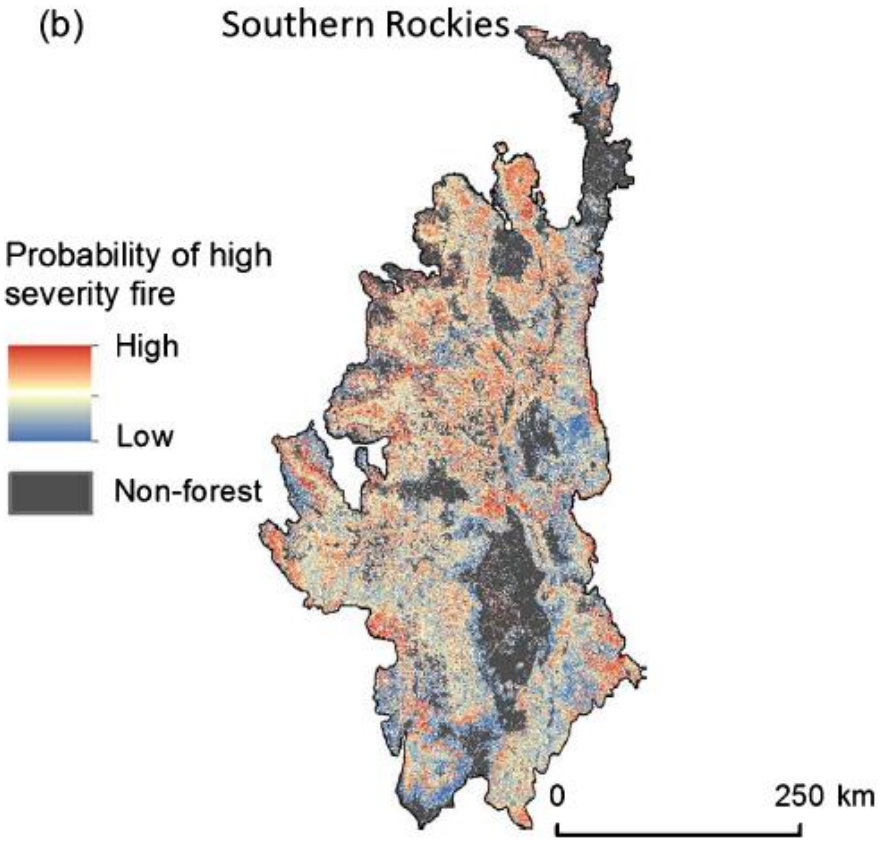


Parks et al. 2018

Where will fires burn at high severity?

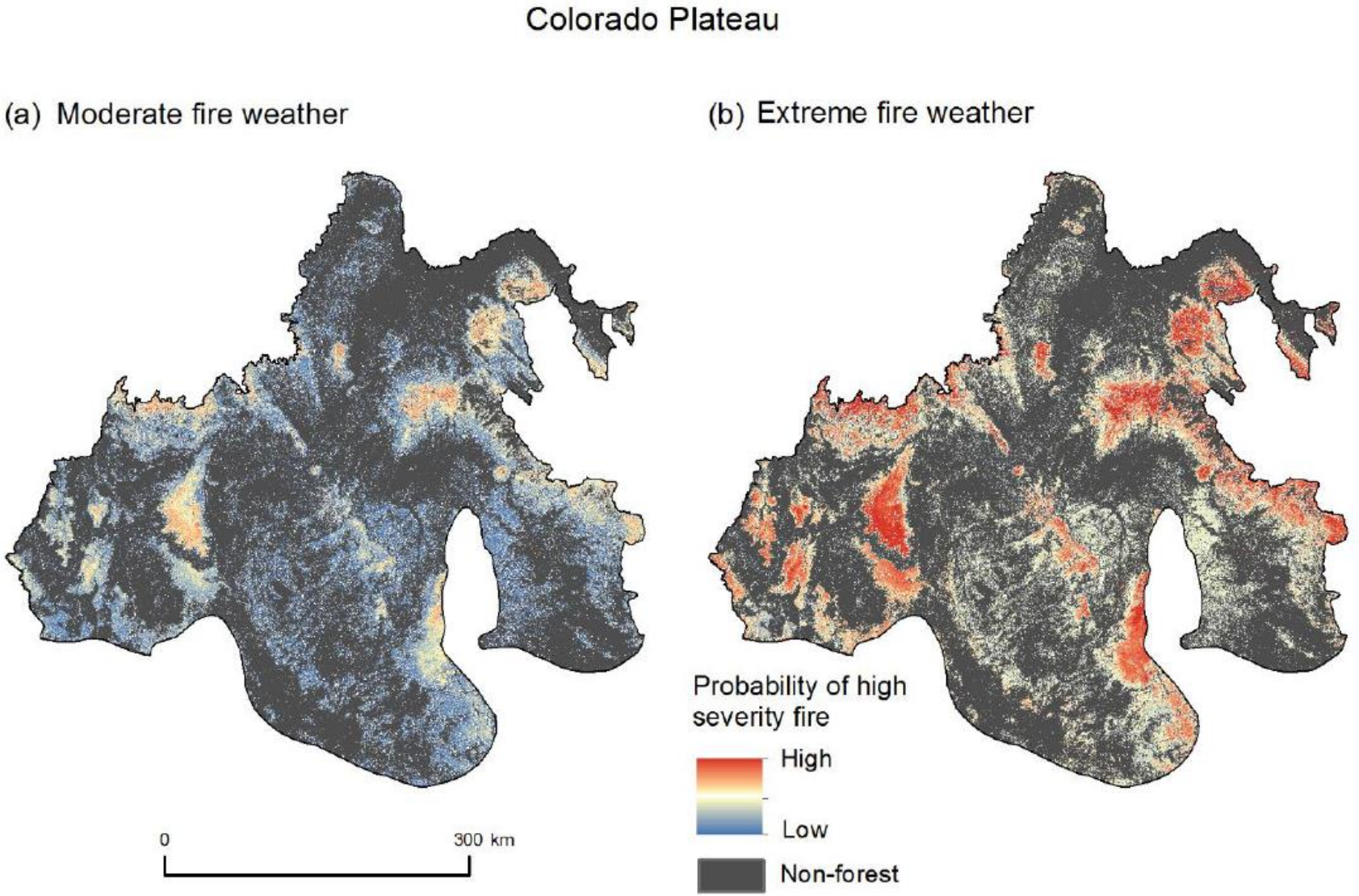






[Parks et al. 2018]

Where will fires burn at high severity?

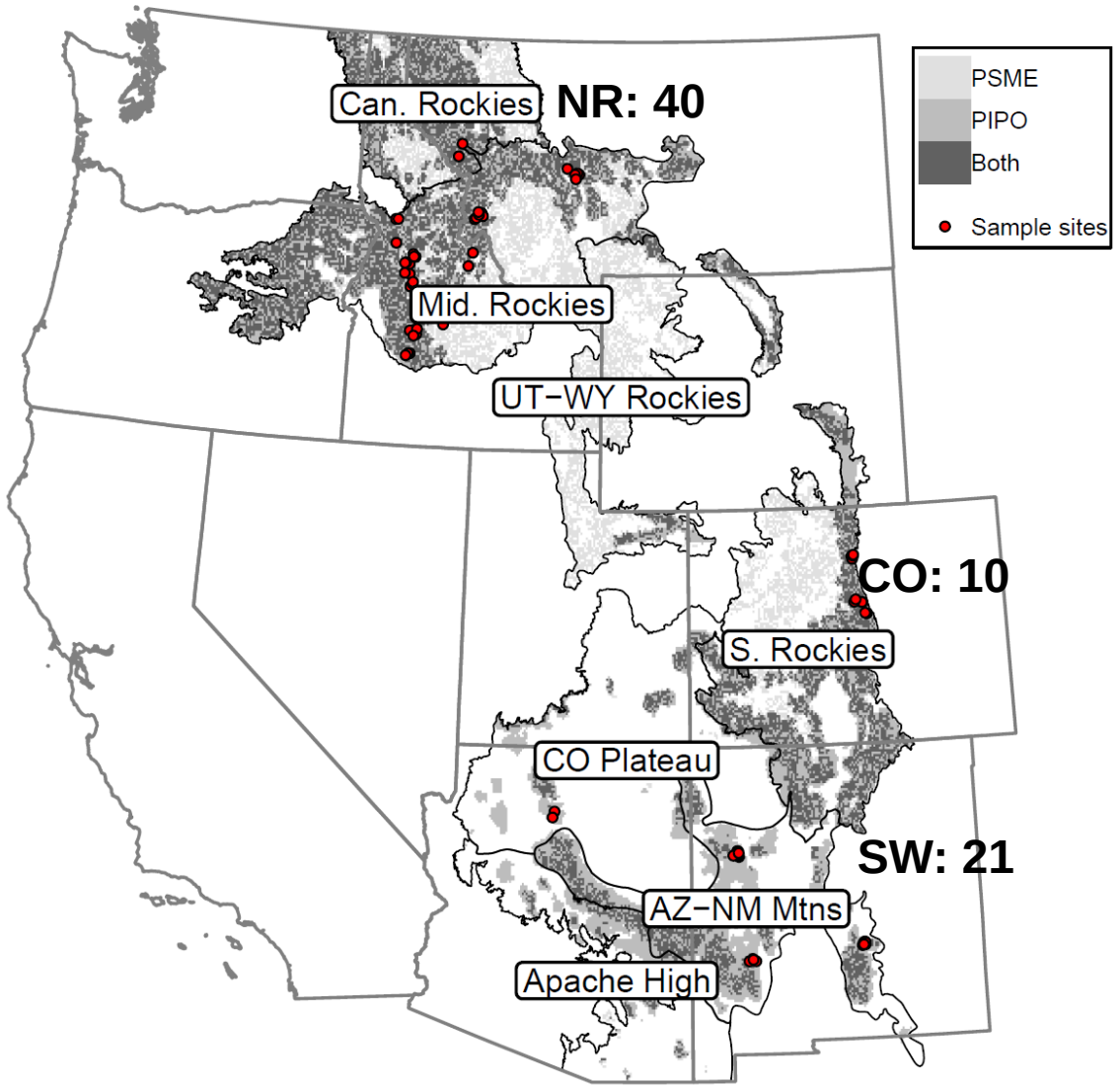


Parks et al. 2018

Vulnerability to fire-catalyzed vegetation shifts

1. High severity fire that kills adults
2. **Failure of prior dominant species to regenerate**

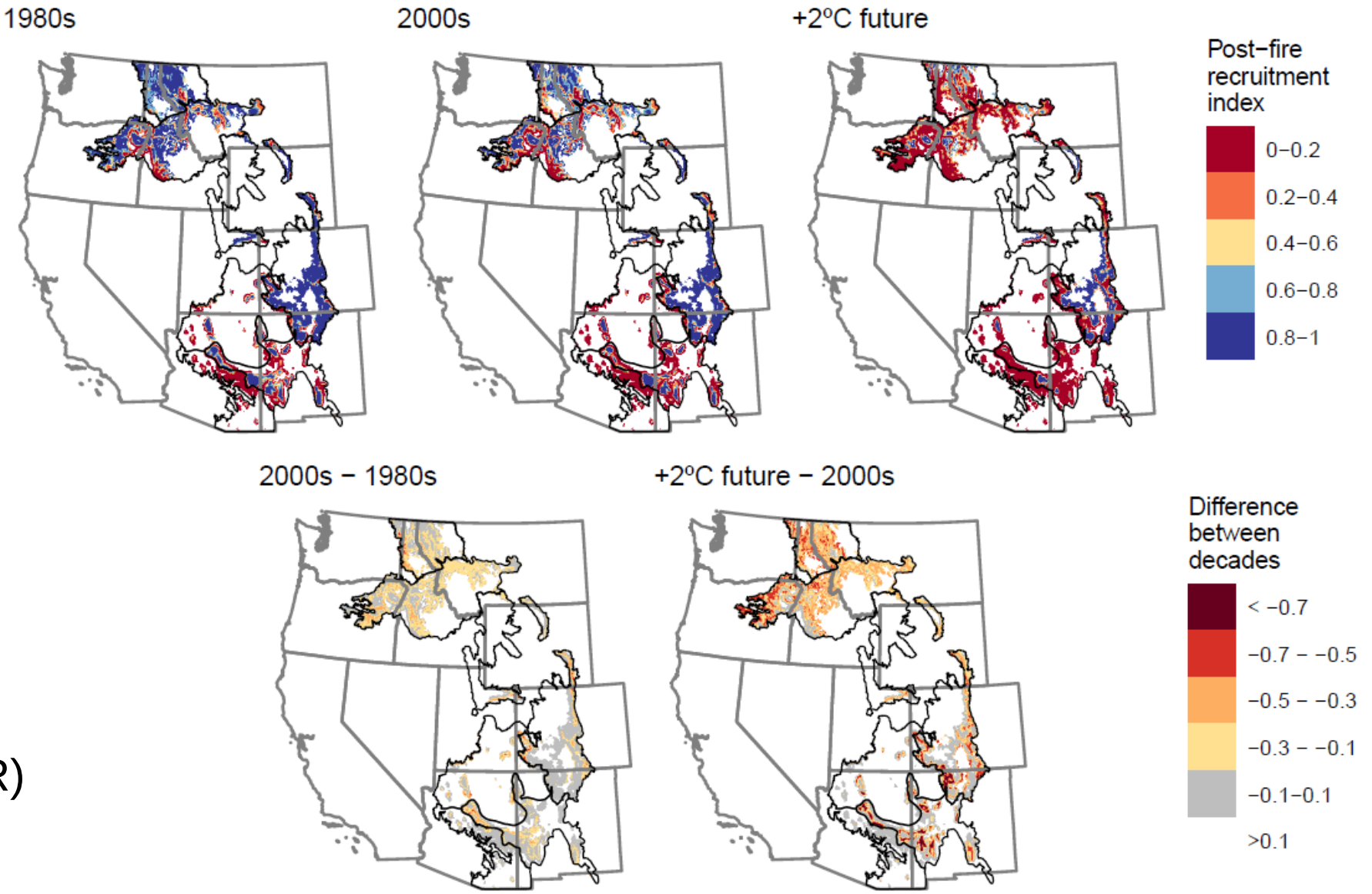
Where will trees fail to regenerate due to climate?



CO data: [Rother & Veblen 2017]
[Davis et al. 2020 *ERL*]

Recruitment probability projected to decline in future

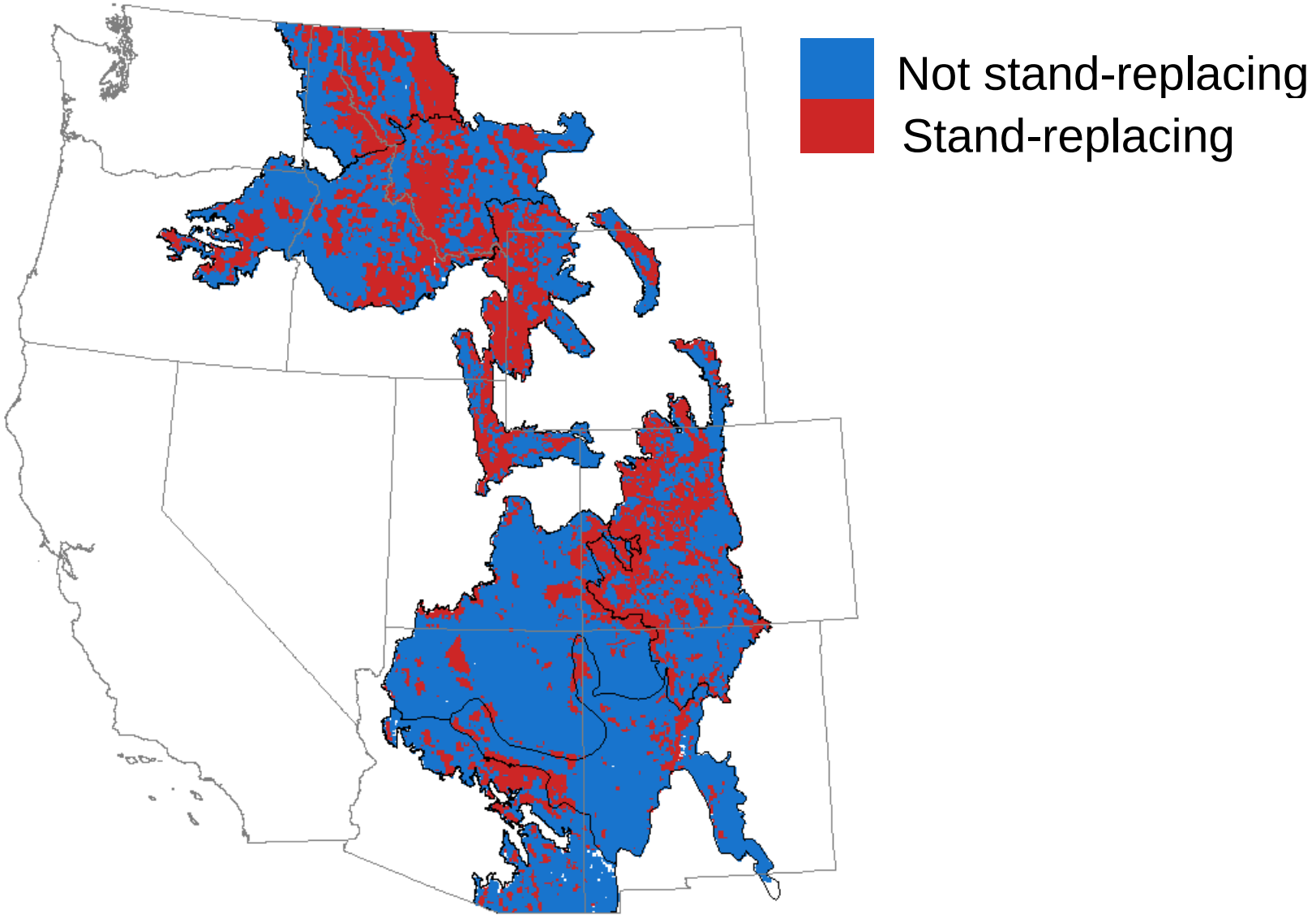
Ponderosa pine



4-km Terraclimate
Max temp. warmest month
Summer VPD
High severity fire (400 dNBR)
50 m to seed source

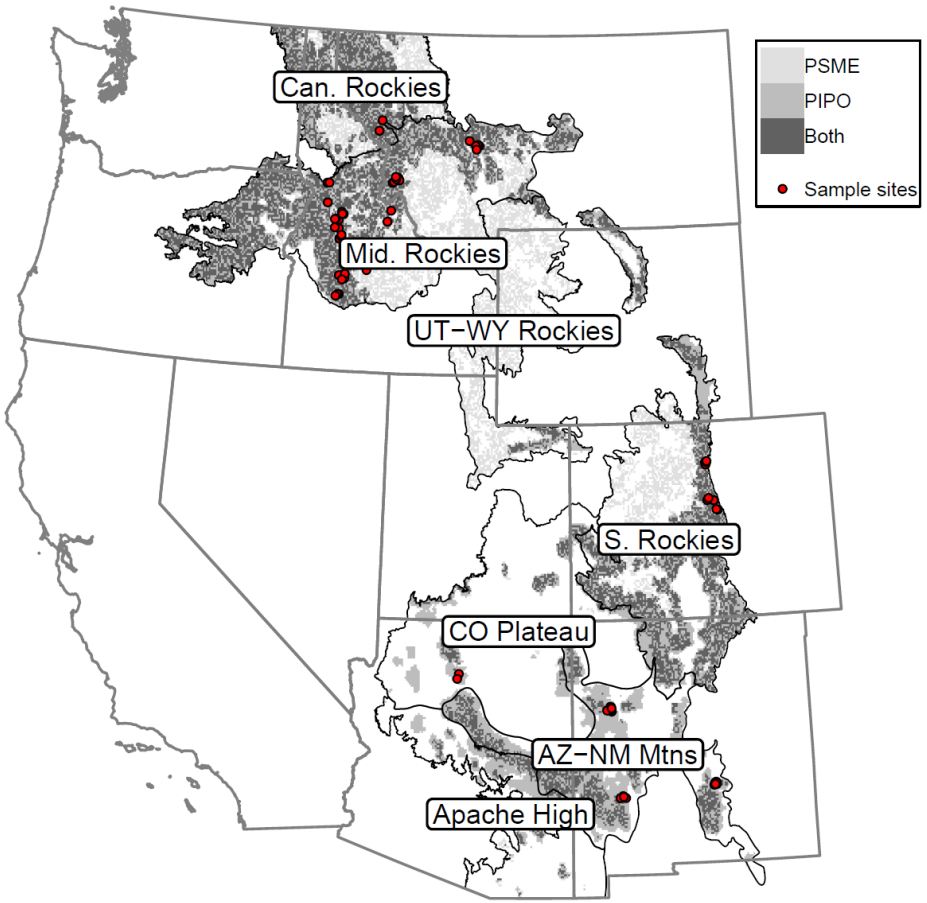
Davis et al. 2020 *Environmental Research Letters*

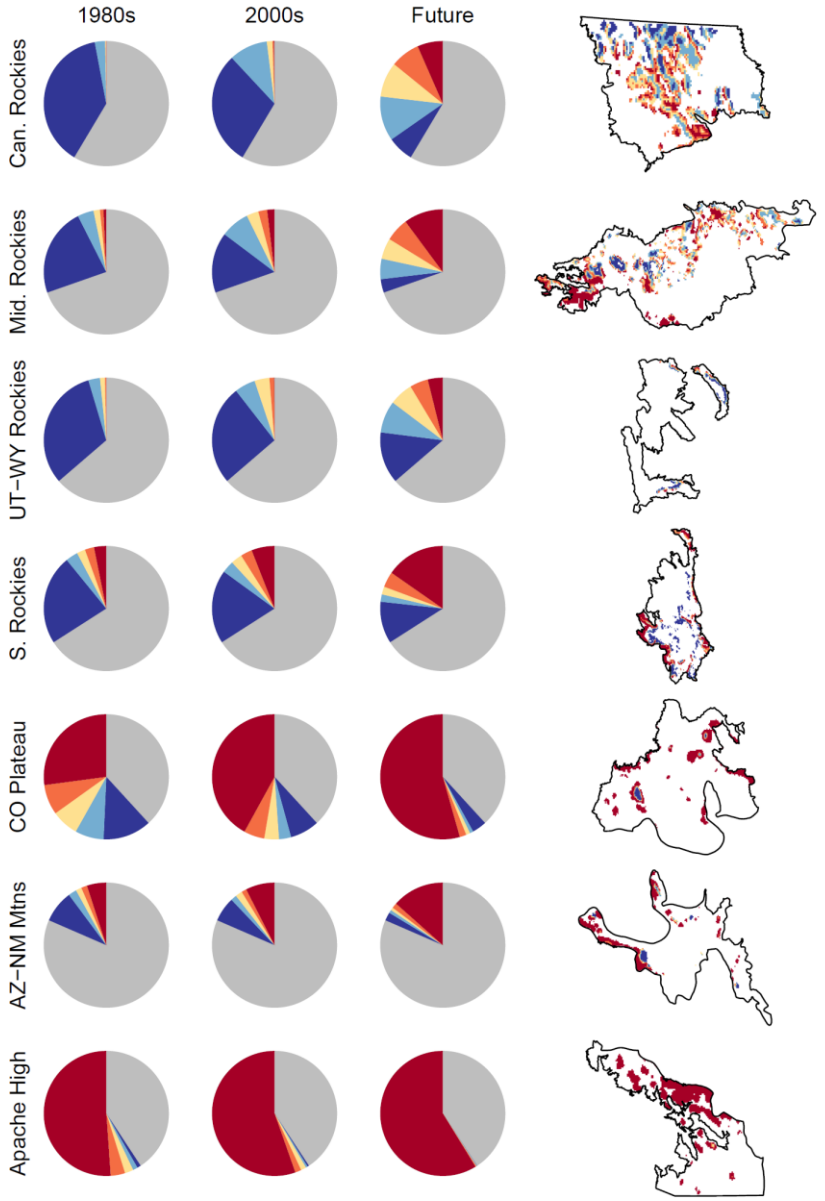
Where will fires burn at high severity?

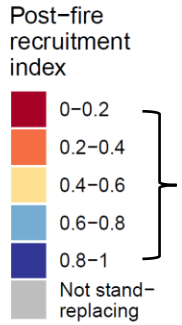


Parks et al. 2018 *Environmental Research Letters*

Risk of fire-catalyzed vegetation shifts is increasing





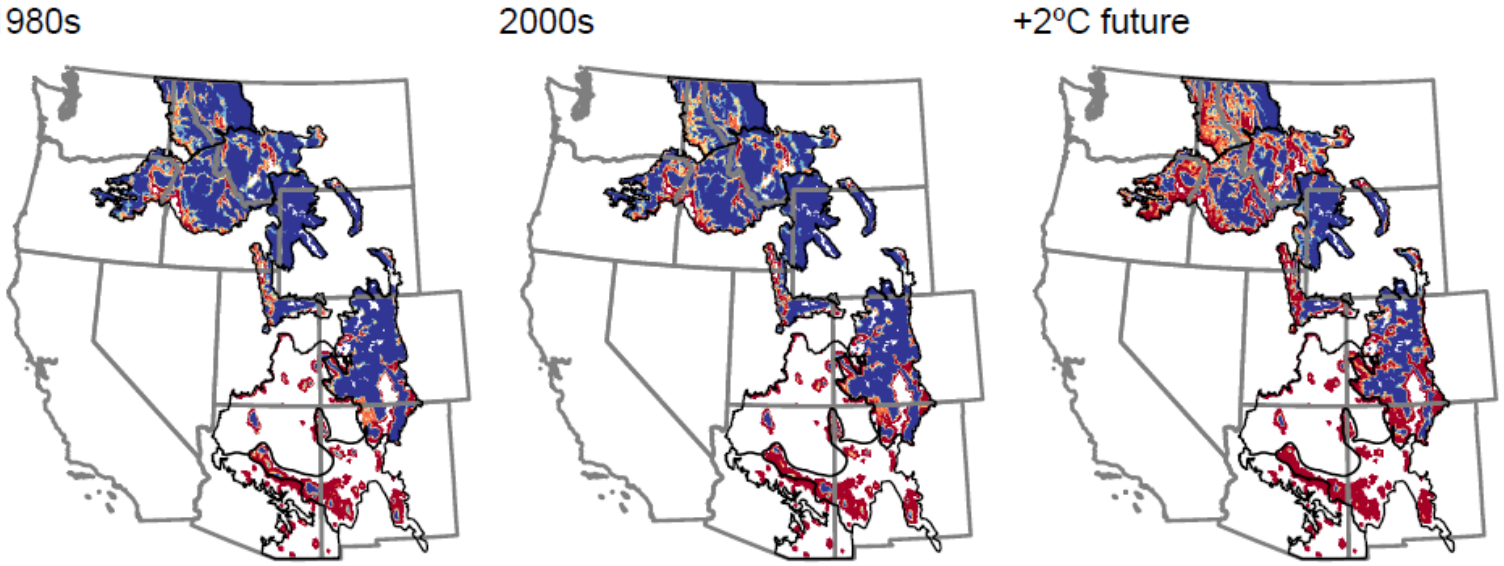


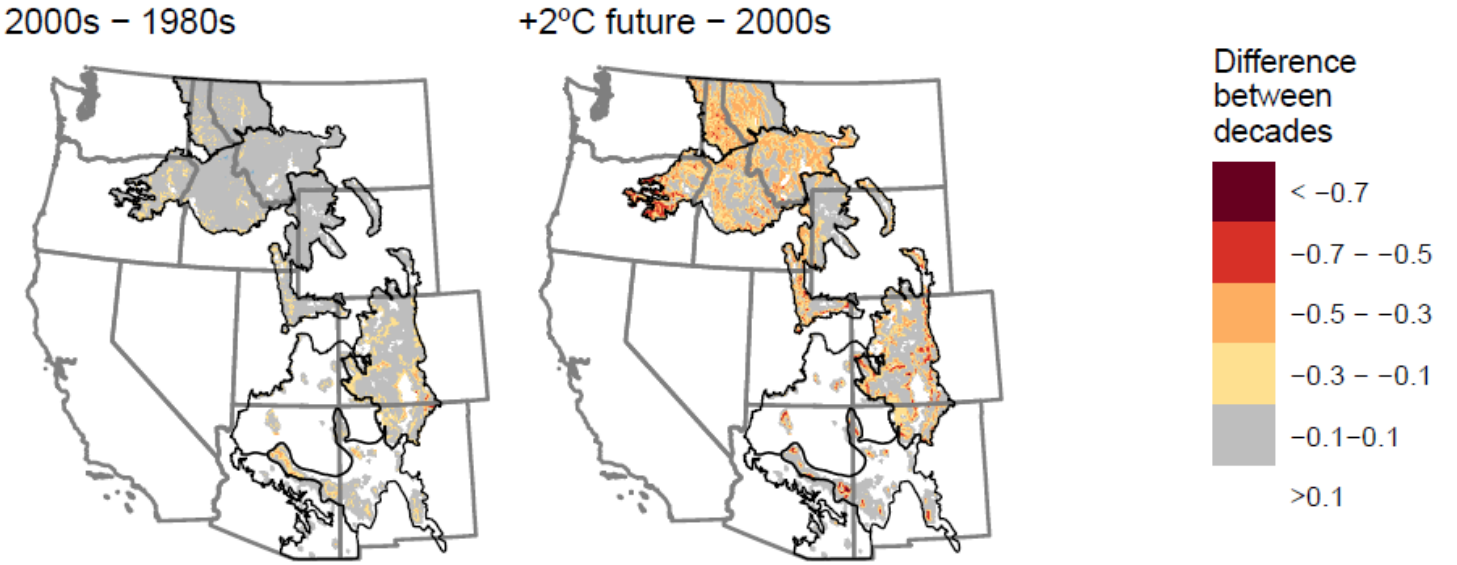
Likely to burn with stand-replacing severity

Davis et al. 2020 *Environmental Research Letters*

Recruitment probability projected to decline in future

Douglas-fir

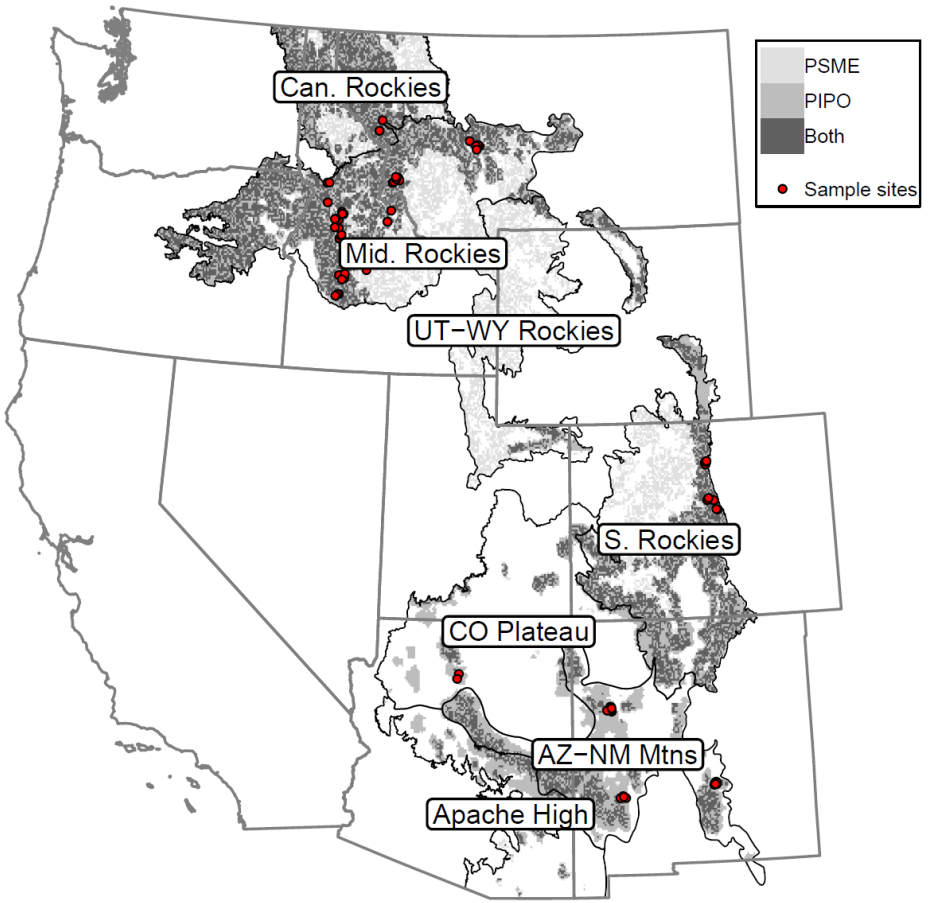


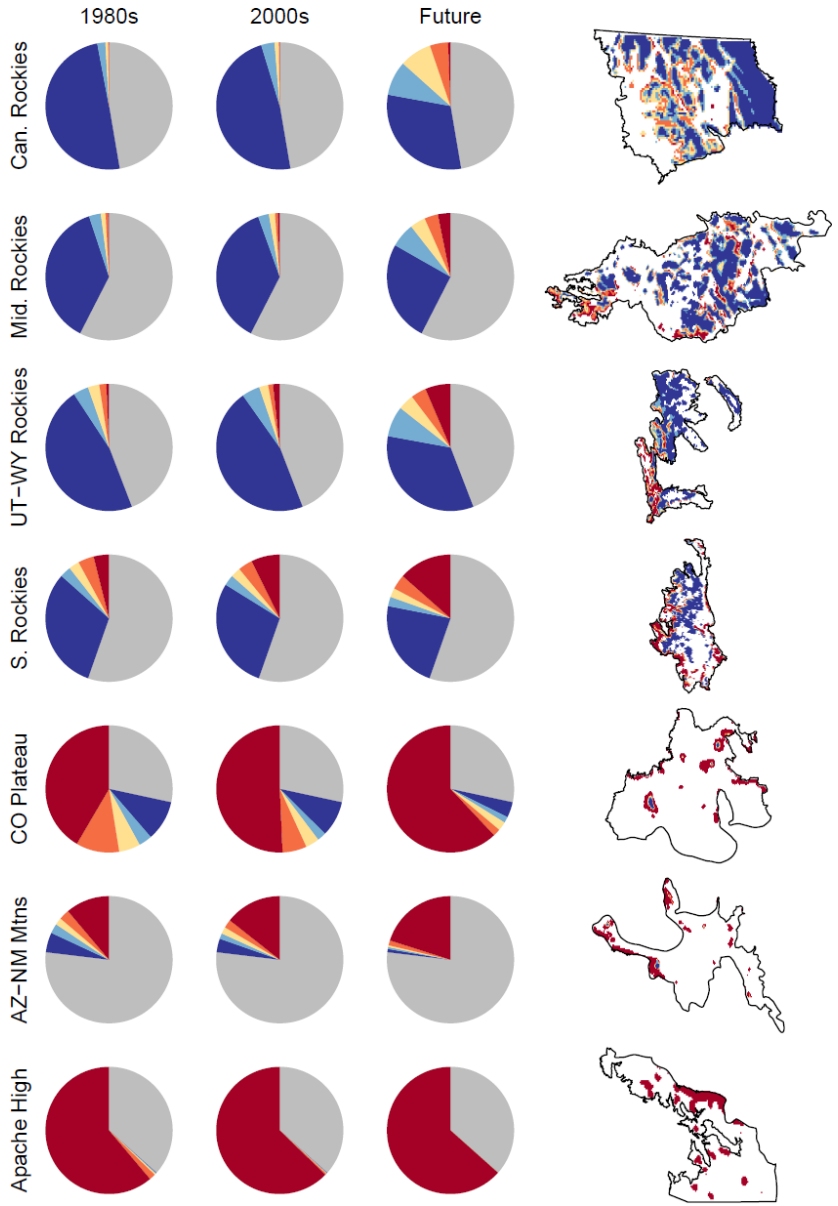


4-km Terraclimate
Max temp. growing season
Water deficit growing season
High severity fire (400 dNBR)
50 m to seed source

Davis et al. 2020 *Environmental Research Letters*

Risk of fire-catalyzed vegetation shifts is increasing





Davis et al. 2020 *Environmental Research Letters*

Sharing data on vulnerability to fire-catalyzed vegetation shifts

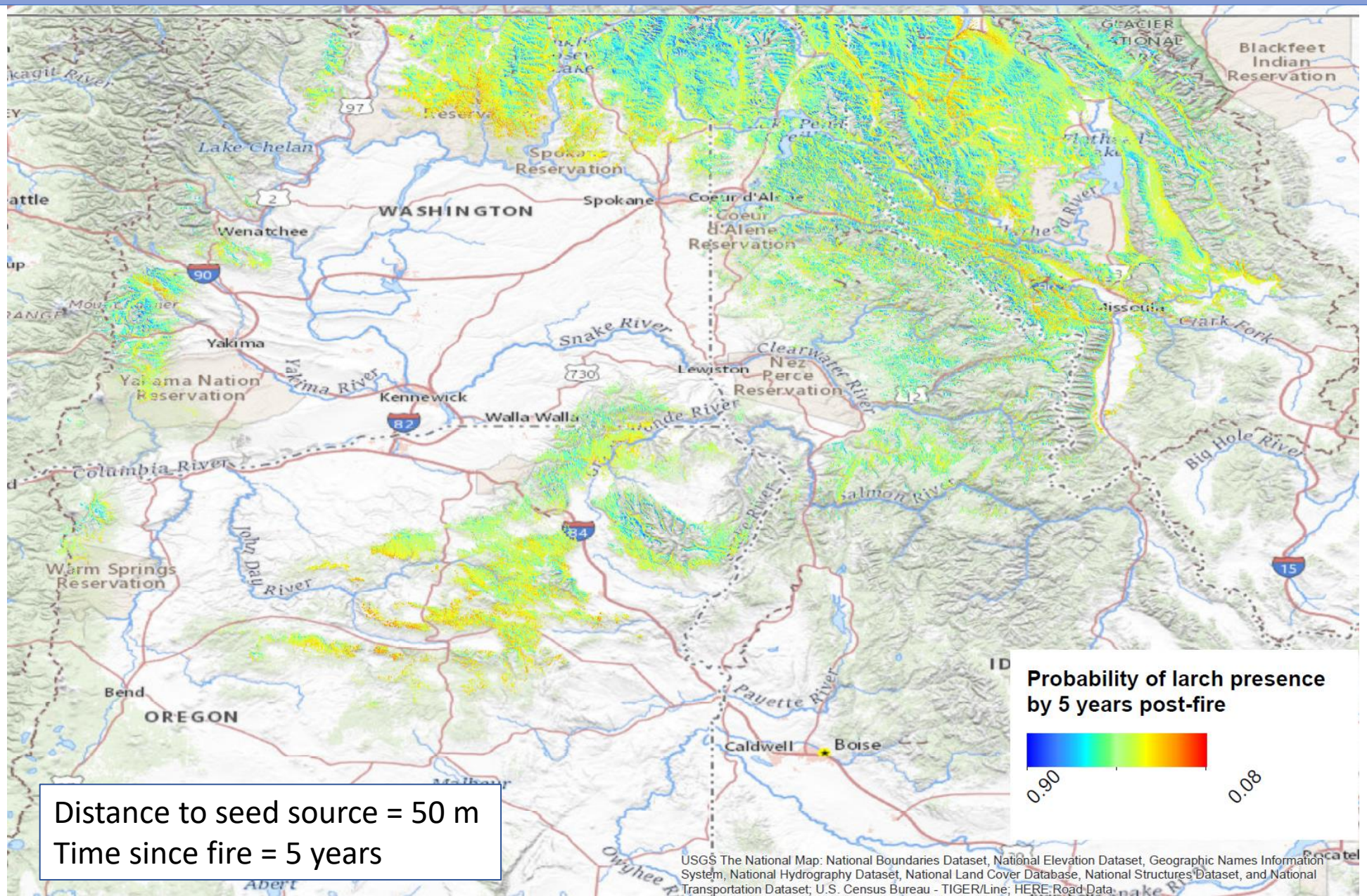
Products

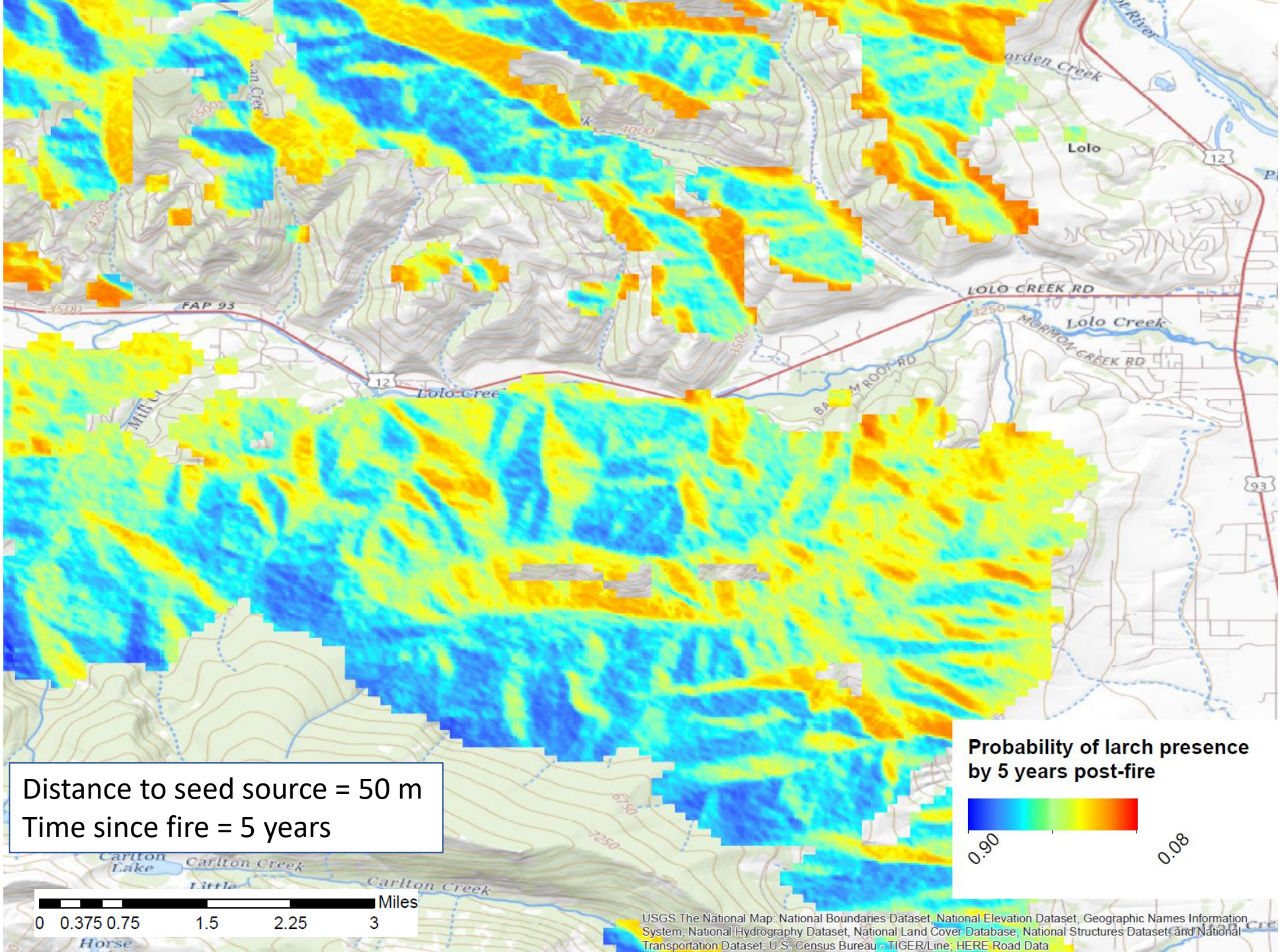
- Maps of recruitment probability given scenarios of distance to seed source and time since fire under current and future climate conditions
- Maps from Parks et al. 2018 of fire severity
- Clipped maps showing recruitment probability in areas with high likelihood of stand-replacing fire

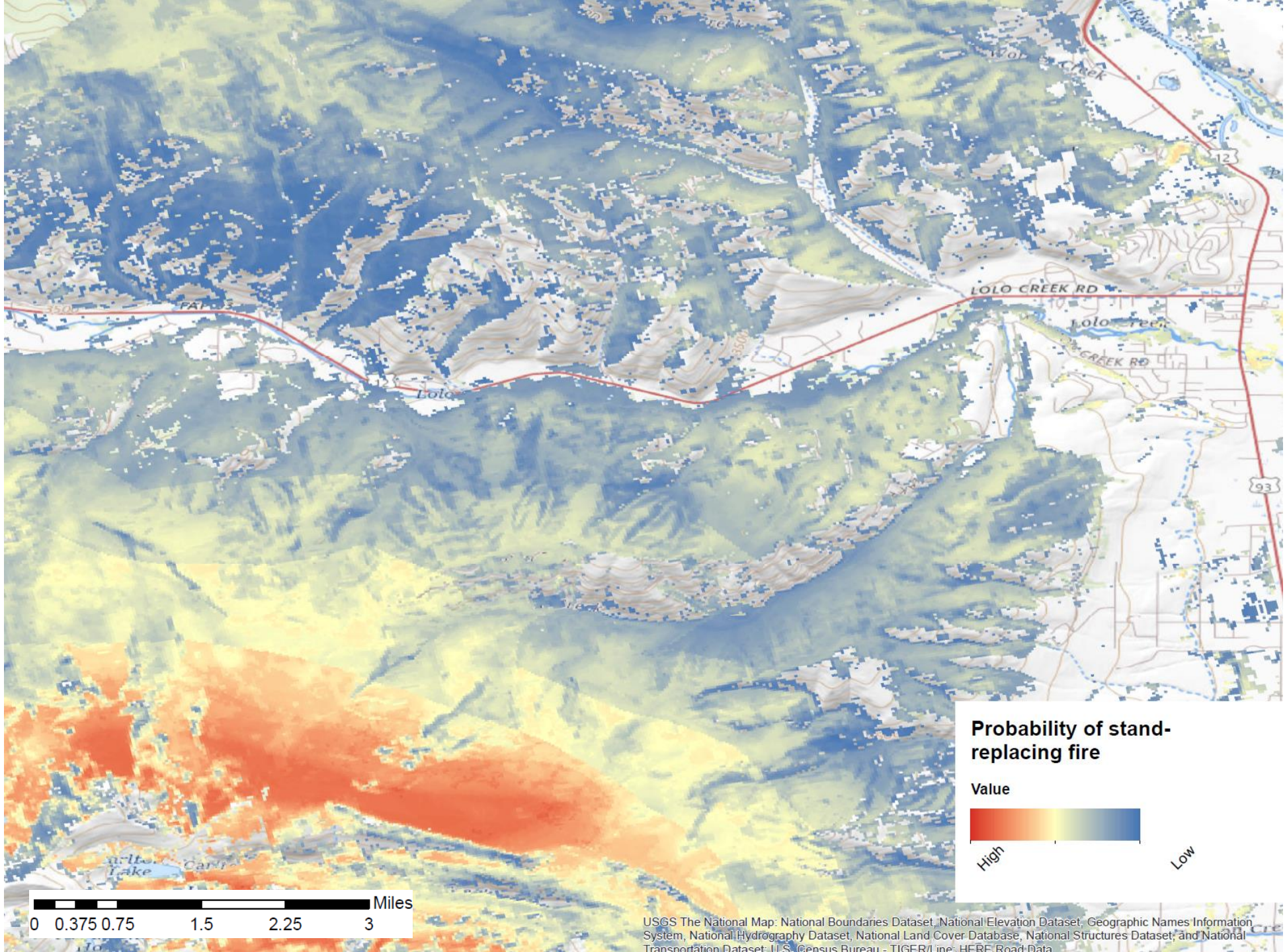
Potential applications

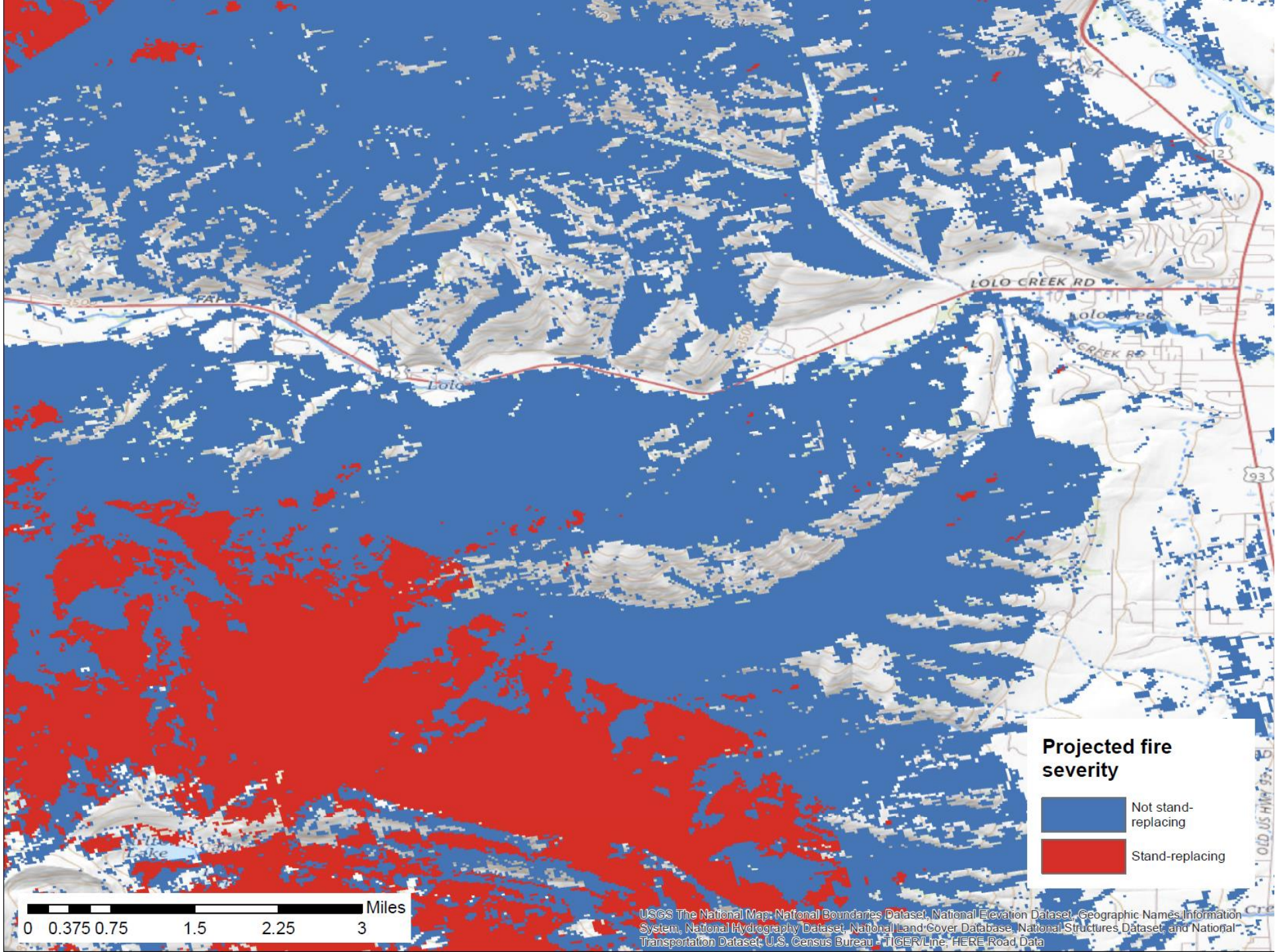
- Pre-fire planning
- Understanding potential for forest loss across management unit
- Prioritizing areas for pre-fire fuel reduction treatments

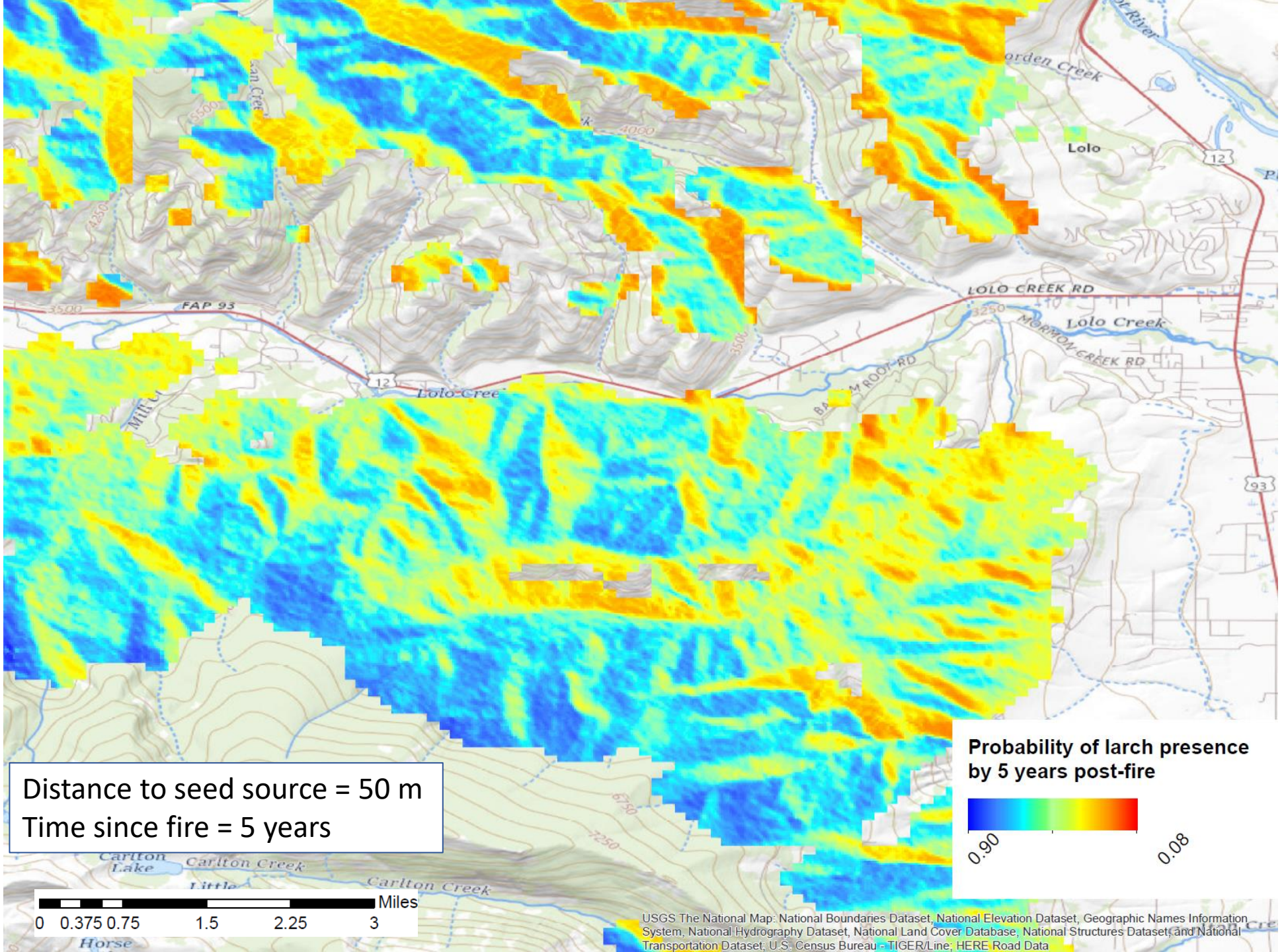
Example application: anticipating fire-catalyzed change




Distance to seed source = 50 m
Time since fire = 5 years
Probability of larch presence by 5 years post-fire
0.90
0.08
Miles
0 0.375 0.75 1.5 2.25 3
Lolo
LOLO CREEK RD
FAP 93
Lolo Creek
MORMON CREEK RD
Carlton Creek
Carlton Lake
USGS The National Map: National Boundaries Dataset, National Elevation Dataset, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; U.S. Census Bureau - TIGER/Line; HERE Road Data


LOLO CREEK RD
Lolo
Lolo Creek
Probability of stand-replacing fire
Value
High
Low
0 0.375 0.75 1.5 2.25 3
Miles
USGS The National Map: National Boundaries Dataset, National Elevation Dataset, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; U.S. Census Bureau - TIGER/Line; HERE Road Data


LOLO CREEK RD
Lolo
Projected fire severity
Not stand-replacing
Stand-replacing
Miles
0 0.375 0.75 1.5 2.25 3
USGS The National Map: National Boundaries Dataset, National Elevation Dataset, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; U.S. Census Bureau - TIGER/Line; HERE Road Data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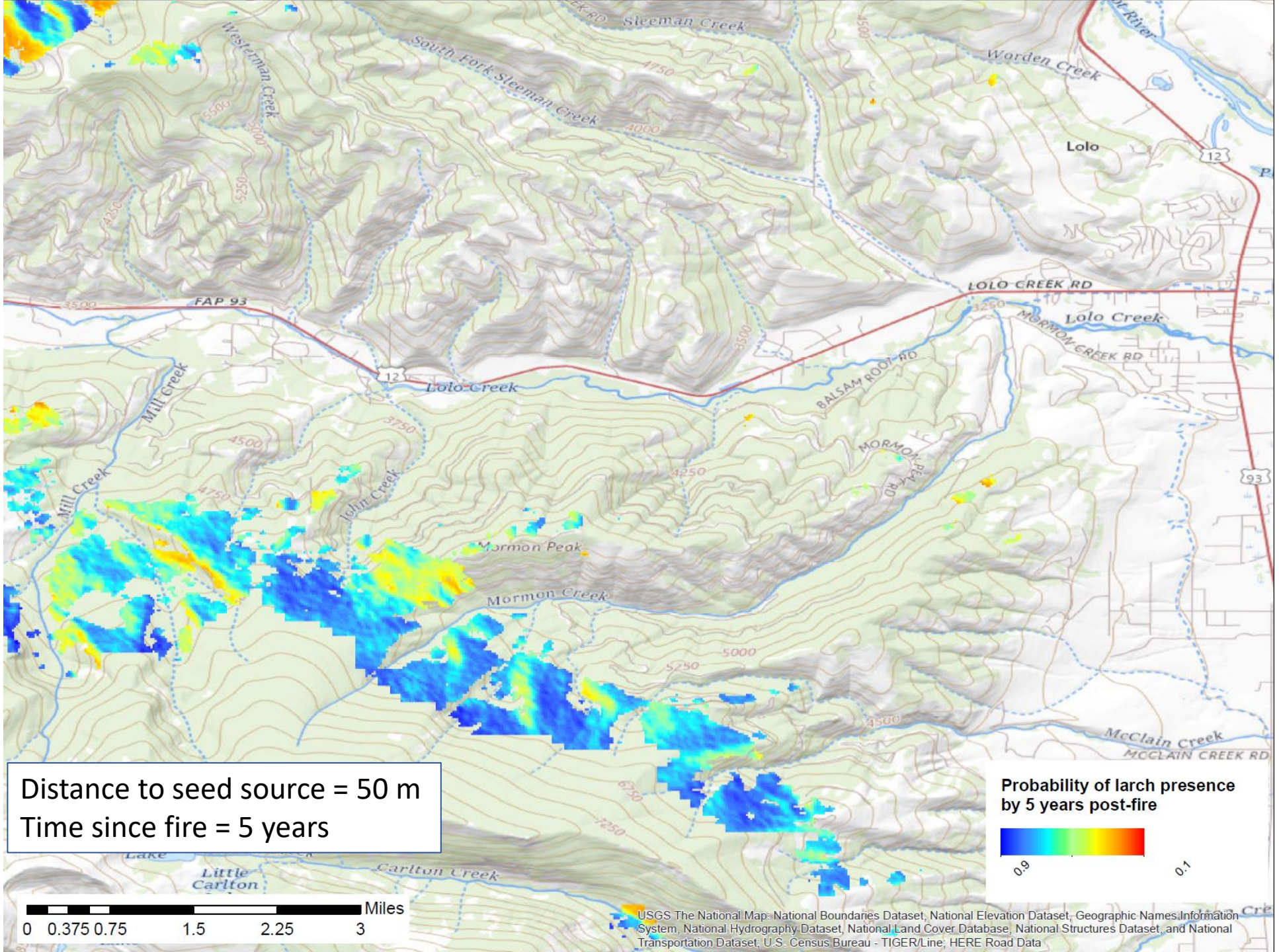
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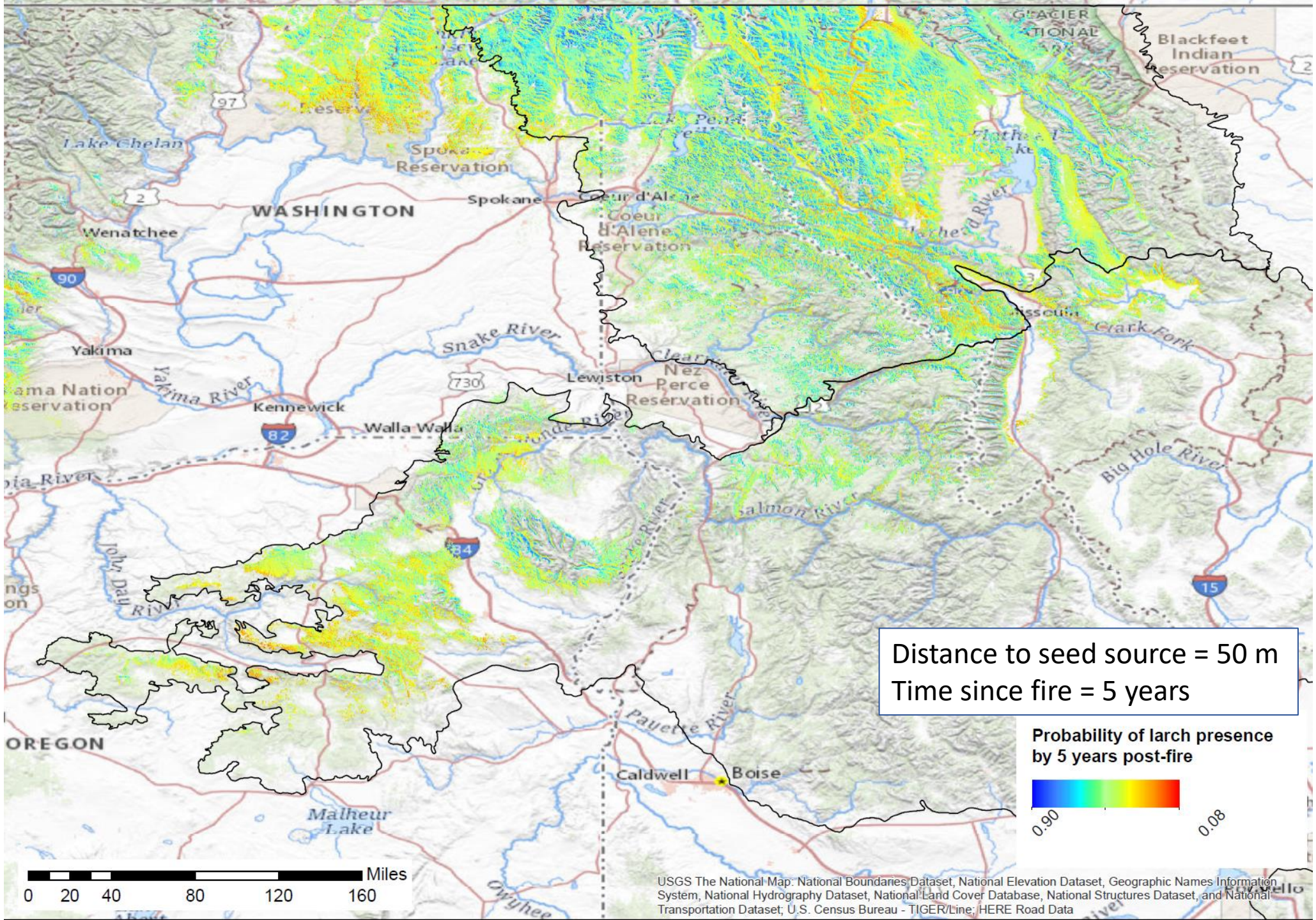
0.1
Miles
0 0.375 0.75 1.5 2.25 3
USGS The National Map: National Boundaries Dataset, National Elevation Dataset, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; U.S. Census Bureau - TIGER/Line; HERE Road Data
Lolo
LOLO CREEK RD
FAP 93
Lolo Creek
Mormon Peak
Mormon Creek
Mill Creek
John Creek
Worden Creek
Sleeman Creek
South Fork Sleeman Creek
Westerman Creek
McClain Creek
Carlton Creek
Little Carlton
Lake
BALSAM ROOT RD
MORMON PEAK RD
MORMON CREEK RD
MCCLAIN CREEK RD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0.08
Miles
0 20 40 80 120 160
WASHINGTON
OREGON
Spokane
Coeur d'Alene
Wenatchee
Yakima
Kennewick
Walla Walla
Lewiston
Caldwell
Boise
Lake Chelan
Snake River
Yakima River
Clearwater River
Big Hole River
Salmon River
Payette River
Malheur Lake
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Nez Perce Reservation
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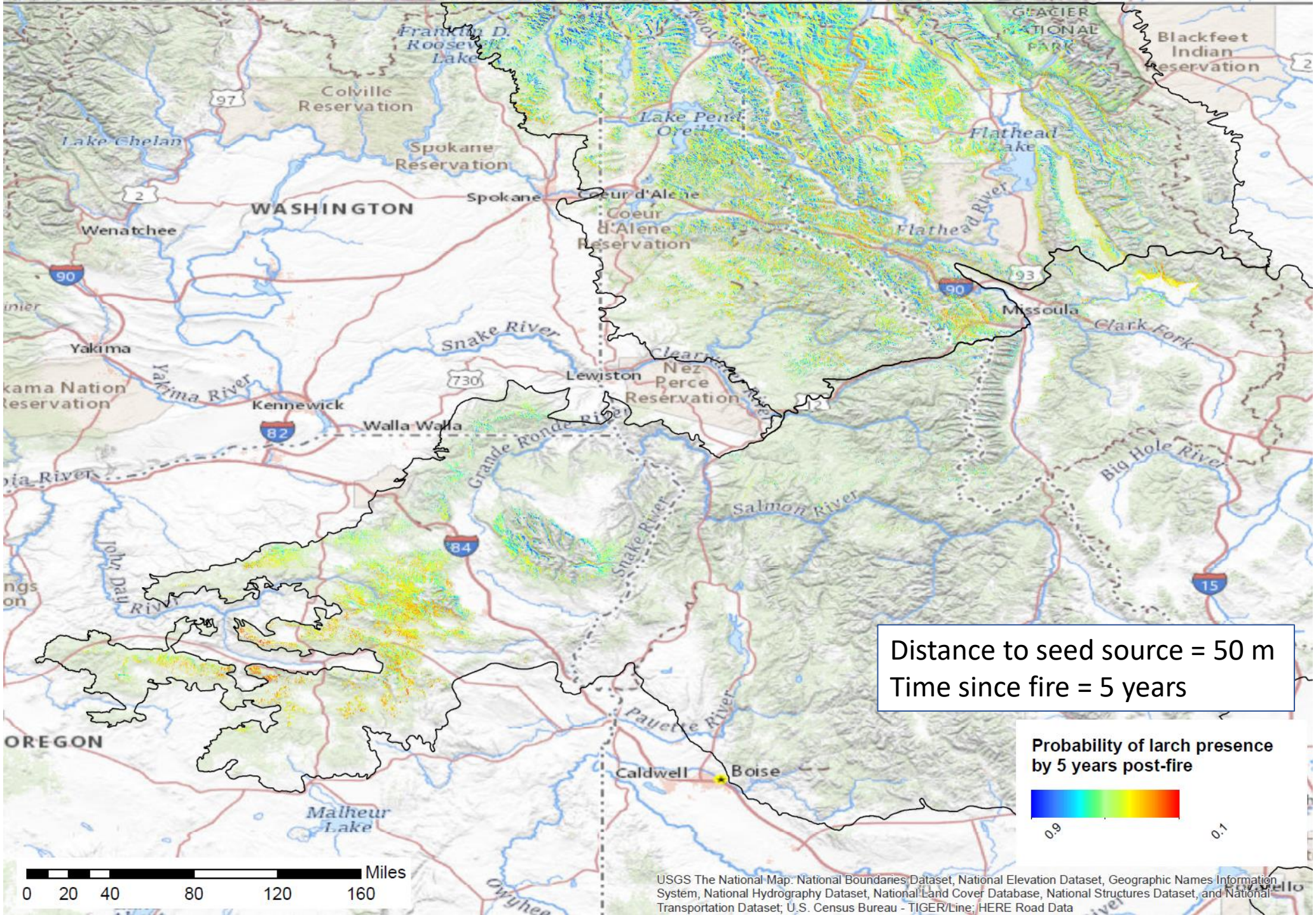
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0.1
Miles
0 20 40 80 120 160
WASHINGTON
OREGON
Spokane
Coeur d'Alene
Wenatchee
Yakima
Kennewick
Walla Walla
Lewiston
Missoula
Flathead Lake
Flathead River
Clark Fork
Snake River
Yakima River
Grande Ronde River
Salmon River
Big Hole River
Payette River
Boise
Caldwell
Malheur Lake
Colville Reservation
Spokane Reservation
Coeur d'Alene Reservation
Nez Perce Reservation
Blackfeet Indian Reservation
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Plan for web app

- Better map baselayer and ability to zoom in and pan
- Choice of species
- Ability to select dry or wet year
- Ability to add high severity layer
- Ability to select only areas predicted to burn at high severity
- Ability to download raster data and/or pdf maps

We need your help – breakout discussions

1. Can you provide us with 1-3 examples of when and how you might use this tool or information?

2. What is the maximum spatial resolution that would still be helpful to you?

3. What file format would be most useful for this data?

4. Describe how you would prefer accessing this information, considering efficiency, accessibility, and resources.

5. If we could add other spatial data to this tool, what type of information would be your highest priority?

Questions?

Valley Complex Fire, 2000
Bitterroot National Forest
Photo year : 2017