# Managing post-fire vegetation transitions

Kim Davis Research Scientist University of Montana Kimberley.Davis@umontana.edu















# Managing for resilience

**1. Resilience** is an increasingly common goal for natural resource management (e.g., National Cohesive Wildland Fire Management Strategy).

- 2. Applied to **social-ecological systems**, resilience concepts become much broader than basic ecological definitions; this can be confusing.
- 3. Land management inherently operates in the context of social-ecological systems



**Ecological resilience:** "...the capacity of a system to absorb disturbance and reorganize while undergoing change so as to *still retain essentially the same function, structure, and feedbacks*" -Walker et al. (2004; emphasis added)



When deciding how to manage...we are inherently weighing <u>biophysical</u> and <u>social</u> aspects of a system.

Integrating Subjective and Objective Dimensions of Resilience in Fire-Prone Landscapes

Forum

PHILIP E. HIGUERA, ALEXANDER L. METCALF, CAROL MILLER, BRIAN BUMA, DAVID B. MCWETHY, ELIZABETH C. METCALF, ZAK RATAJCZAK, CARA R. NELSON, BRIAN C. CHAFFIN, RICHARD C. STEDMAN, SARAH MCCAFFREY, TANIA SCHOENNAGEL, BRIAN J. HARVEY, SHARON M. HOOD<sup>®</sup>, COURTNEY A. SCHULTZ<sup>®</sup>, ANNE E. BLACK, DAVID CAMPBELL, JULIA H. HAGGERTY, ROBERT E. KEANE, MEG A. KRAWCHUK, JUDITH C. KULIG, REBEKAH RAFFERTY, AND ARIKA VIRAPONGSE

#### Invasive-grass-fueled fire (Cheat-grass invaded sage steppe)



#### Large, high-severity fire in dry mixed-conifer forest (2011 Las Conchas Fire)



### Probability of state change

Very Likely

Very High

Very Unlikely

Resilience



Very High

Resilience

Prefer

Current



Very Unlikely Very High

### **Probability of state change**

Very Likely

Resilience

Acceptability of state change

Very

Prefer Very Current Unacceptable



Acceptable Change Unlikely to Change

--- Consider transformation ---

Surface fire in ponderosa pine (Metolius NRA, OR)



### Acceptable Change Likely to Change

--- Prepare for uncertainty and change ---

Unacceptable Change Likely to Change

--- Accept high mitigation costs ---

#### Very Unlikely

### Probability of state change

Very Likely

Very High

Resilience

Managing for resilience necessarily involves evaluating <u>subjective</u> and <u>objective</u> dimensions of resilience



\*We've focused on where systems are along the x-axis, and if/how the location can be changed with varying management "levers."

### **One size does NOT fit all:**

# Different systems justify different approaches, based on:

- human exposure
  - fire novelty
  - fire regime

#### nature sustainability

PERSPECTIVE https://doi.org/10.1038/s41893-019-0353-8

#### Rethinking resilience to wildfire

David B. McWethy <sup>1</sup>\*, Tania Schoennagel<sup>2</sup>, Philip E. Higuera <sup>3</sup>, Meg Krawchuk<sup>4</sup>, Brian J. Harvey<sup>5</sup>, Elizabeth C. Metcalf<sup>6</sup>, Courtney Schultz<sup>7</sup>, Carol Miller<sup>8,9</sup>, Alexander L. Metcalf<sup>6</sup>, Brian Buma<sup>10</sup>, Arika Virapongse<sup>11</sup>, Judith C. Kulig<sup>12</sup>, Richard C. Stedman<sup>13</sup>, Zak Ratajczak<sup>14</sup>, Cara R. Nelson<sup>3</sup> and Crystal Kolden<sup>15</sup>

https://www.fs.fed.us/rm/pubs\_journals/2019/rmrs\_2019\_mcwethy\_d001.pdf

### Prioritize among basic, adaptive, and transformative "resilience"



McWethy et al. (2019)

### Prioritize among basic, adaptive, and transformative "resilience"

### Basic Resilience

- Allow or assist postfire recovery pathways
- Promote home air filters to create clean air spaces
- Identify community safe zones, to use during fires
- Rebuild infrastructure after fire events

### Adaptive Resilience

- Fuels treatments and Rx fire to lower fire hazard in strategic locations
- Share info. on where to recreate during and after fire events
- Reduce flammability of the built environment
- Shut down power lines during high fire danger

### Transformative Resilience

- Accept or facilitate firecatalyzed ecological transformations
- Smoke-filtering HVAC systems in all public facilities
- Achieve adaptive resilience across multiple communities
- Decentralize power grid to reduce vulnerability to high wind events

### Application to natural resource management specifically

### For natural resource management, this can be simplified: RAD!



Schuurman et al. 2020

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ACCEPT

DIRECT



# Resist, Accept, Direct Framework (RAD)



**RESIST** the trajectory of change, by working to maintain or restore ecosystem processes, function, structure, or composition based upon historical or acceptable current conditions.

**ACCEPT** the trajectory of change, by allowing ecosystem processes, function, structure, or composition to change, without intervening to alter their trajectory.

**DIRECT** the trajectory of change, by actively shaping ecosystem processes, function, structure, or composition towards desired new conditions.

# Applying the RAD framework

Managing post-fire, climate-induced vegetation transitions in the Northwest synthesis of existing knowledge and research needs

Workshop Summaries Summer & Fall 2020



IMPACTS

GROUP

- Interdisciplinary collaborative effort to identify knowledge gaps
- Biophysical knowledge group explored the RAD framework in this context
- NWCASC Deep Dive <u>website</u> (final report forthcoming)

# **RESIST** – where to prioritize?

- Important habitat (e.g. spotted owl, fisher, sage-grouse)
- Old growth microclimate refugia
- Fire refugia (remaining seed sources)
- Areas important to maintain connectivity
- Areas important for ecosystem services (e.g. municipal watersheds, timber production, established carbon mitigation projects)
- Culturally important landscapes



Nps.gov

Hessburg et al. 2016; Coop et al. 2019; Downing et al. 2019; Frey et al. 2016; Halofsky et al. 2018a,c; Wynecoop et al. 2019; Krawchuk et al. 2020; Morelli et al. 2020; Chambers et al. 2016, 2019

#### **Reduce fire severity and extent**

- Fuel reduction treatments
- Managing wildfires for resource benefit under more moderate conditions

Prichard et al. 2020; Hudak et al. 2011; Pyke et al. 2014; Chambers et al. 2019; Halofsky et al. 2018; North et al. 2019; Hessburg et al. 2016; Hill & Ex 2020; Sloan, Pinto, & Gurney; Reiser et al. 2013; Symstad et al. 2020

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### **Replant following fire**

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#### **Replant following fire**

• "Reforest for resilience"



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#### Reduce exotic annual grass cover

- Early detection rapid response
- Herbicides (e.g. Imazapic)
- Seed native perennial grasses
- Reduce land-use and new development, establish conservation easements
- Fall prescribed fire (e.g. Northern Great Plains sites with low to moderate invasion densities)

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### NC Regional Invasive Species and Climate Change

- Starting Jan 2021
- Building a network of researchers and managers to integrate management of invasive species and climate change
- Activities will include two stakeholder workshops and research summaries
- Will coordinate with NE, NW, and PI regions
- <u>Contact:</u> chelsea.nagy@colorado.edu





# **DIRECT** – where to prioritize?

- Areas that will transition to exotic plants without intervention
- Areas no longer climatically suitable for current tree species but management goals include maintaining forest
- Areas where directing change of some species may help maintain habitat for endangered species
- Important cultural landscapes that have been affected by fire suppression or other factors leading to loss of food sources, ceremonial sites, or other important cultural features



# **DIRECT** – management strategies

- Promote partnerships between tribes and federal agencies to allow TK to guide burning and other management practices
- Assisted migration/gene flow
- Plant early seral, fire resistant tree species
- Reduce forest density

# **ACCEPT** – where to prioritize?

- Where allowing ecological disturbance processes to operate is a primary objective
- In some areas allow transitions following fire as natural experiments to observe natural recovery/adaptation pathways
- South-facing slopes, steep slopes, poor soil basically areas that may have been nonforest in past prior to fire suppression
- Where restoration is unlikely to be successful due to climate or edaphic conditions, especially in systems that already have limited ability to support desired resources and habitats



National Archives and Record Administration, Seattle, WA, from the William Osborne Collection from Hessburg et al. 2016

Halofsky et al. 2018; Hessburg et al. 2016; CSKT Fire on the Land; Schuurman et al. 2020

### **ACCEPT** – management strategies

- Monitor changes to the system
- Consider defining 'undesired' conditions which would trigger a different response strategy (resist or direct)





### More resources

Map and database to support post-fire vegetation management Map FAQ



Previous 1 Next



Managing for resilience necessarily involves evaluating subjective and objective dimensions

Management decisions will vary across biophysical and social contexts

The RAD framework helps guide specific decisions around post-fire vegetation change.



