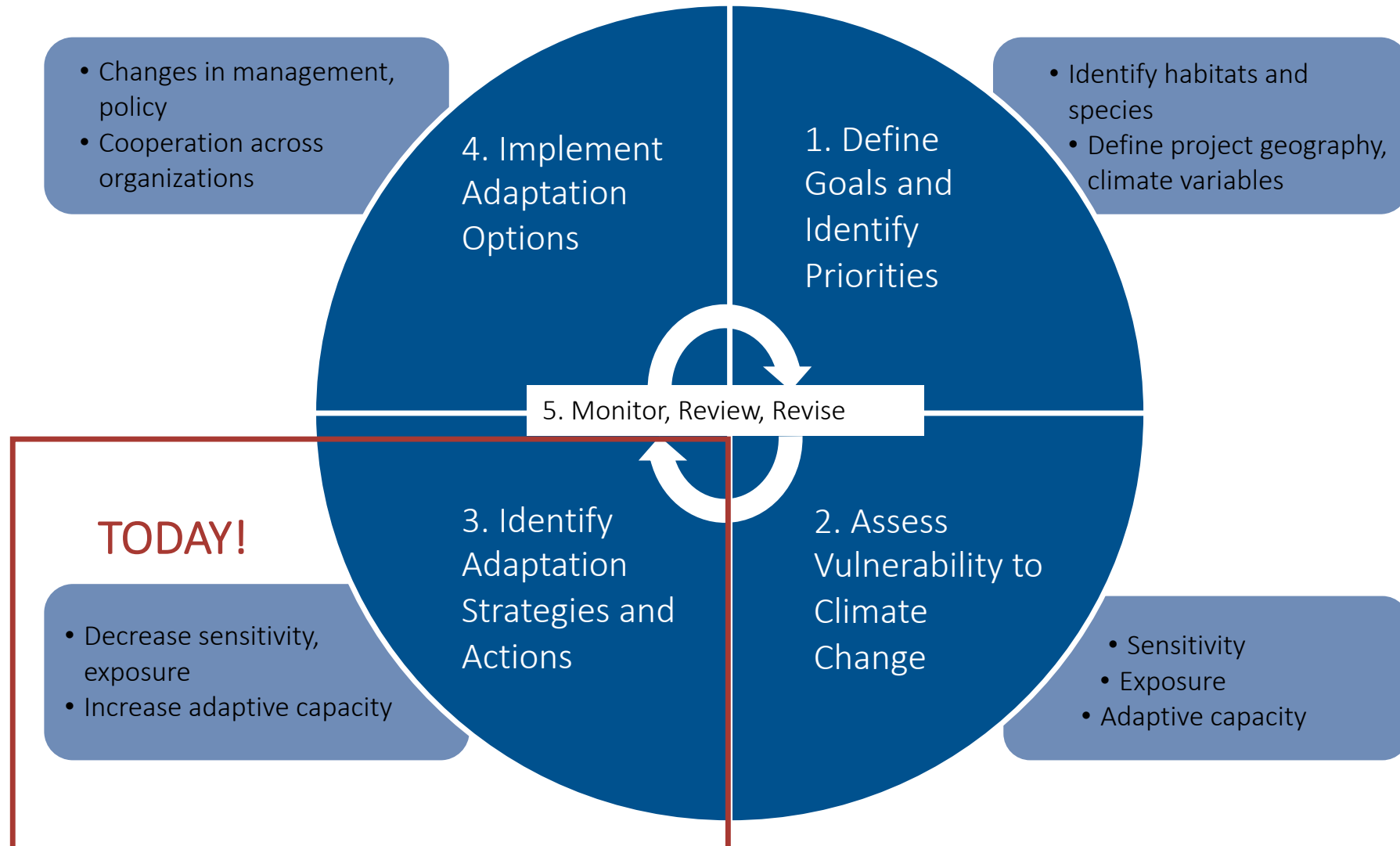




Identifying Climate-Informed Management Options

Introduction to Adaptation and Examples from the Field

Climate Adaptation Framework



What are all the changes that will happen and how can I respond?



~~What are all the changes that will happen and how can I respond?~~

What do I do, and how should I adjust that for the reality of climate change?



Decision Making in a Changing Climate

Current/same actions

- Remove invasive plants from intact remnant habitats



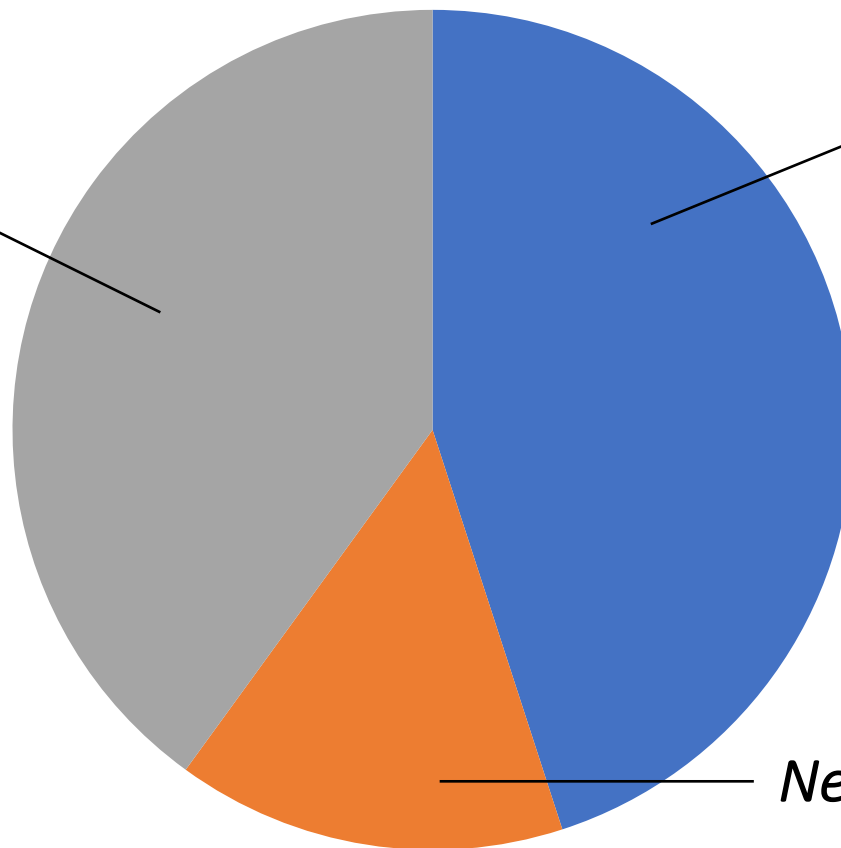
Modifications to actions

- Plant and seed with native species adapted to future conditions (e.g., drought-tolerant)



New/different actions

- Actively transition habitat to new ecological type (e.g., forest to shrubland)



Defining Adaptation

Adaptation refers to adjustments in natural or human systems in response to changing climate conditions.

Adaptation is how we prepare for and respond to changes that we are already experiencing or are likely to experience.

Adaptation activities can build on sustainable management, conservation, and restoration of natural resources.



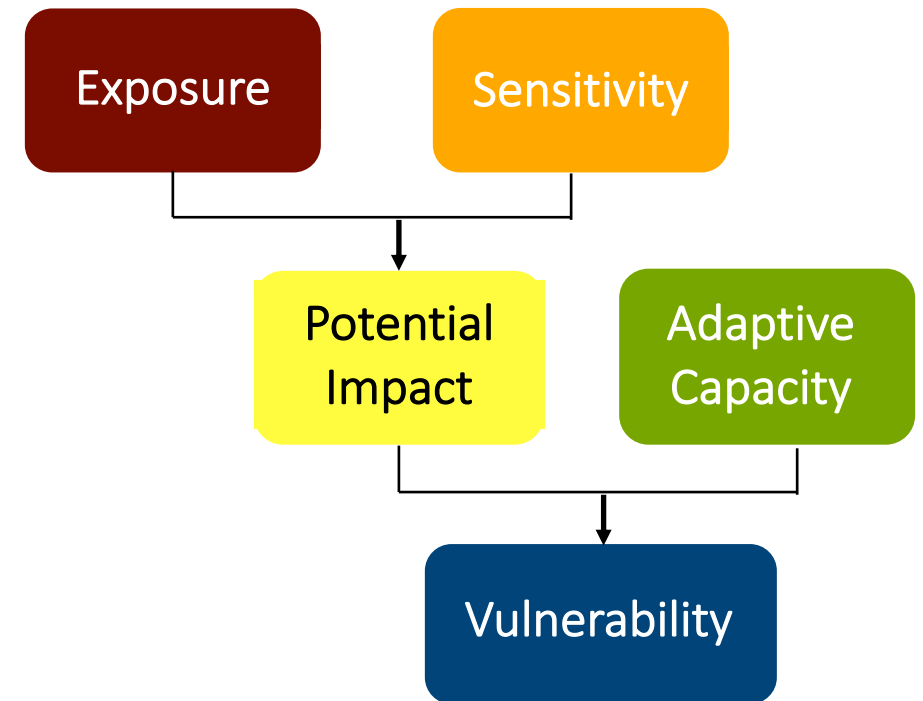
Applying Vulnerability Assessment Results in Adaptation Planning

$$\text{Vulnerability} = \text{Exposure} * \text{Sensitivity} - \text{Adaptive Capacity}$$

↓ *Exposure*

↓ *Sensitivity*

↑ *Adaptive capacity*



Applying Vulnerability Assessment Results in Adaptation Planning

↓ *Exposure*

- Protect resources and infrastructure from flood damage
- Plant riparian vegetation to shade streams
- Protect climate refugia



Applying Vulnerability Assessment Results in Adaptation Planning

↓ *Sensitivity*

- Actively plant drought-tolerant native species in an area projected to get drier
- Reduce invasive species that outcompete native species
- Reduce pollutants that increase sensitivity of a resource to climate stressors



Applying Vulnerability Assessment Results in Adaptation Planning

↑ *Adaptive capacity*

- Remove barriers to species movement/migration
- Adjust timing or route of access for recreation opportunities
- Develop genetic banks for species restoration



Adaptation Approaches

RESISTANCE/
RESILIENCE

ACCEPT/
NO ACTION

DIRECT/
RESPONSE

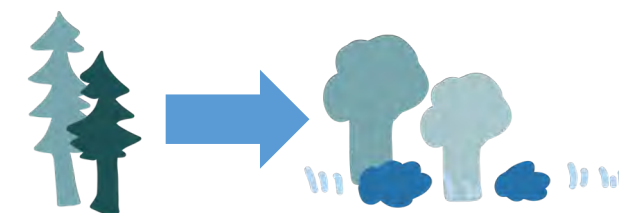
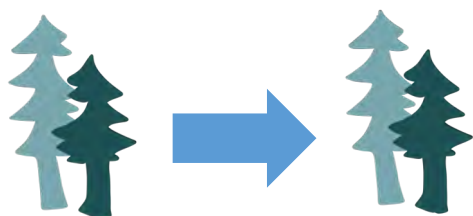


Managing for
Persistence

Managing for
Change

Still recognizable as same system

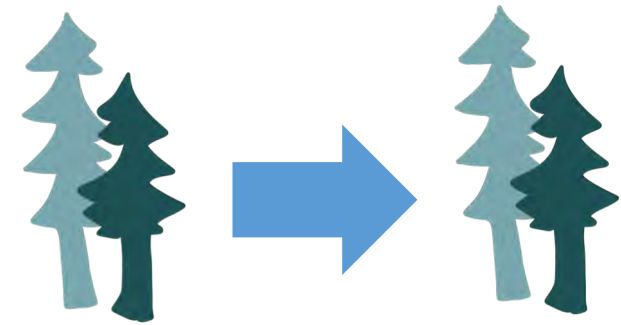
System fundamentally changed



Resistance

Strategies or actions that maintain current conditions by limiting change

- Near-term approach
- Resource and/or management-intensive



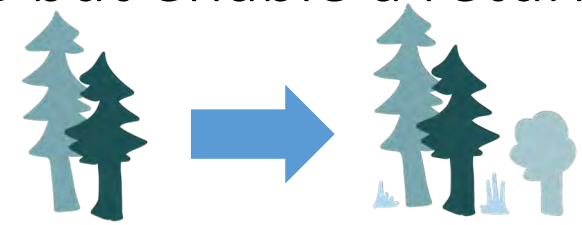
Examples:

- Preventing the spread of invasive species
- Expanding fencing and ungulate removal in areas more resilient to invasion
- Increasing fire prevention and fuel management efforts in most intact habitats

Resilience

Strategies or actions that accommodate some change but enable a return to a prior desired condition

- Near- to mid-term approach
- Management-intensive in the near-term; increasing resources needed to maintain desired condition



Examples:

- Promoting native genotypes and adapted genotypes of native species
- Increasing habitat heterogeneity
- Restoring hydrologic function (e.g., removing diversions)

Accept Change/No Action (aka “Let it go”)



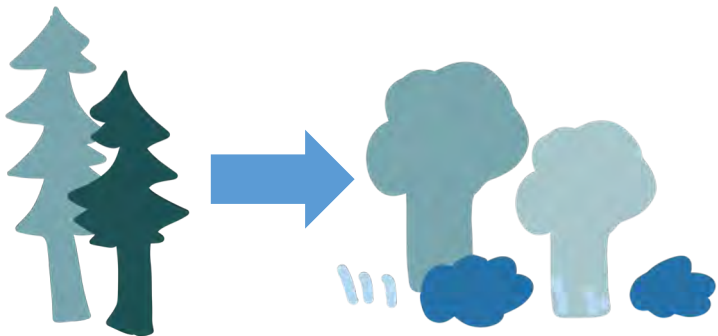
Examples:

- Allow newly arriving species to persist
- Allow transition from one habitat type to another (e.g., forest to shrubland or grassland) in response to changing climate conditions
- Monitor climate changes and impacts and resource conditions and trends

Direct/Response

Strategies or actions that intentionally facilitate or direct change and adaptively respond to new conditions

- Long-term approach
- Variable intensity (e.g., may require more resources up front, or gradual changes to put into practice)



Examples:

- Introducing species not historically present but better adapted to future climate conditions
- Proactively creating new places for habitat to migrate
- Accelerating the trajectory of change from one habitat type to another

Knowledge

Strategies or actions to gather information about climate changes, impacts, and/or management effectiveness

- Near- to long-term approach
- May be a precursor to implementing another type of approach



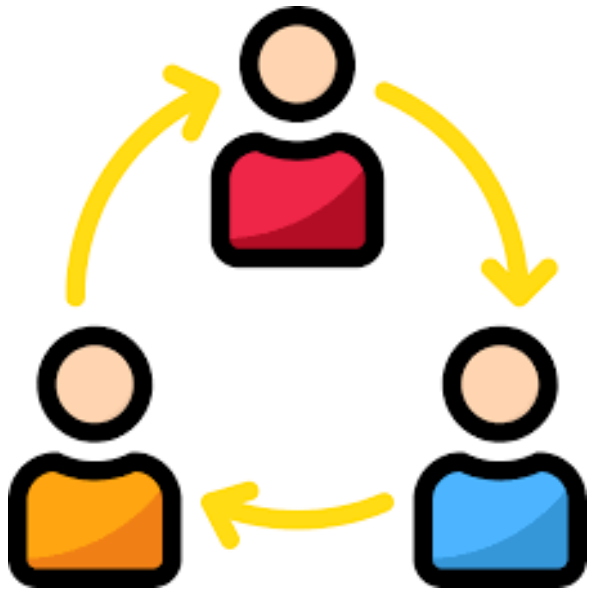
Examples:

- Identifying and monitoring rare species that are the most vulnerable to climate change
- Improving methods for native species propagation
- Monitoring the long-term effectiveness of rare species management and restoration

Collaboration

Strategies or actions that focus on coordinating management efforts and/or capacity across organizational, jurisdictional, or political boundaries

- Near- to long-term approach



Examples:

- Improving data sharing within and between agencies and organizations
- Identifying and/or developing cooperative management and land acquisition opportunities to proactively address habitat shifts due to climate change
- Building support for habitat conservation by conducting public education and outreach about climate risks and management responses

Examples?

UP NEXT!

Resistance/
Resilience

Accept/
No Action

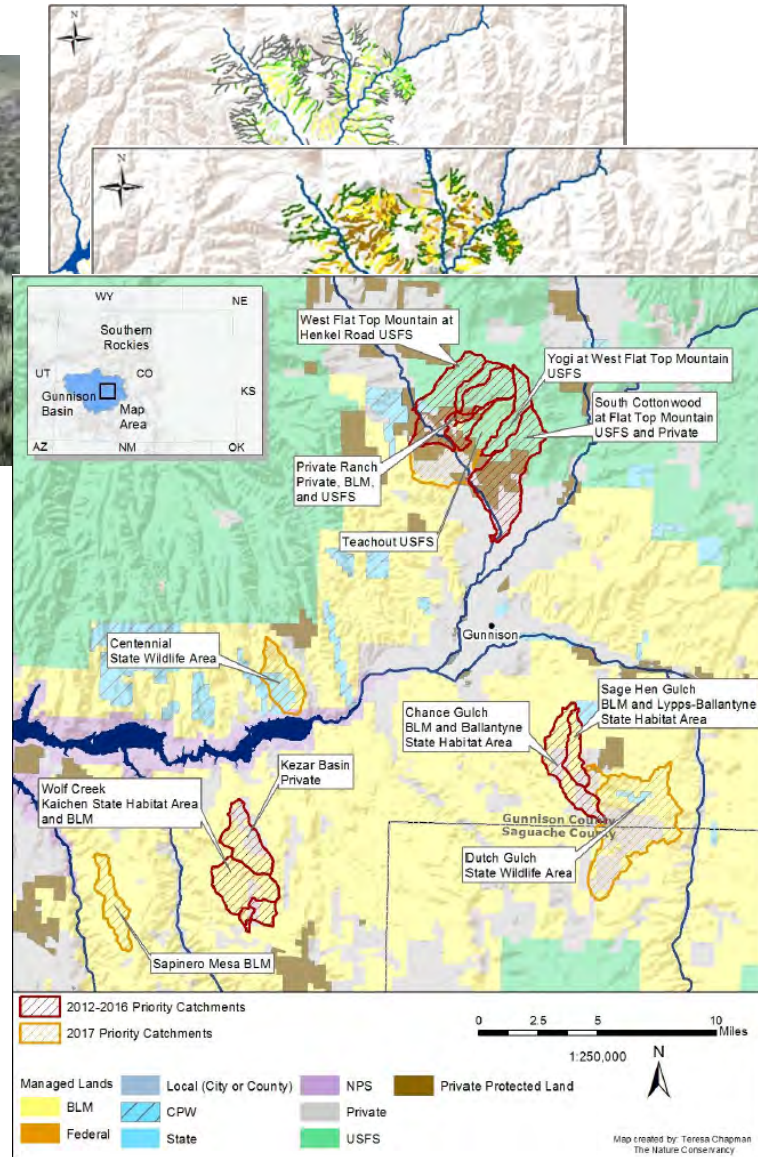
Direct/
Response

Knowledge

Collaboration

Restoring Riparian and Wet Meadow Habitats for Sage-grouse

The Challenge: Brood-rearing habitats already impacted by erosion and lowered water tables, and likely to be further degraded by increasing drought



Feasibility + Spatial Analysis

Value (High)

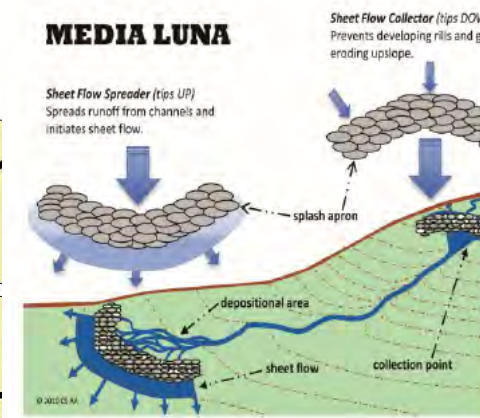
- Location within potential brood rearing habitat
- Close proximity to lek locations (≤ 2 miles)

Condition (Moderate and Poor)

- Riparian Condition Index (extent of floodplain, riparian vegetation)
- Restoration Potential Index (difference in greenness b/w wet and dry years)



Restoring Riparian and Wet Meadow Habitats for Sage-grouse

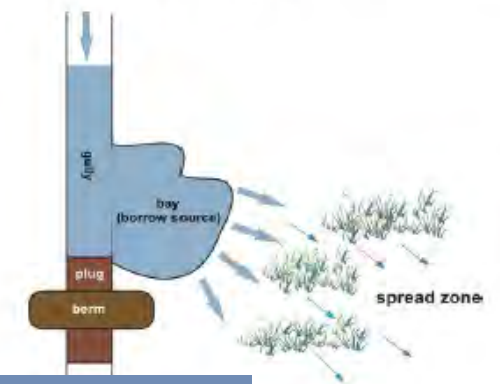


Actions

- Grade control structures (one rock dams, low water crossings)
- Flow dispersal structures (media lunas, plug and spread)
 - “Plug and spread” experiment in areas where transporting rock is not practical or channel incision is too deep
- Headcut control structures (log and fabric structures)
- Long-term monitoring

PLUG AND SPREAD

Used to restore sheet flow across an impaired wet meadow



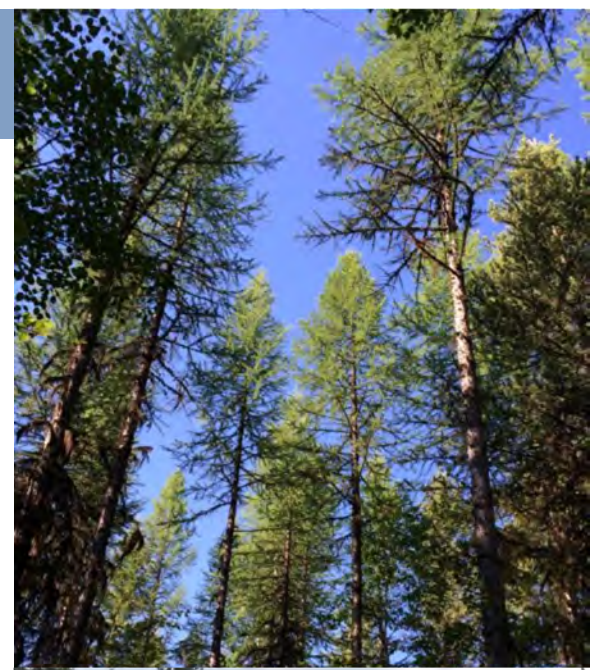
Adaptive Silviculture for Climate Change: Flathead NF

The Challenge: Western Larch Forests

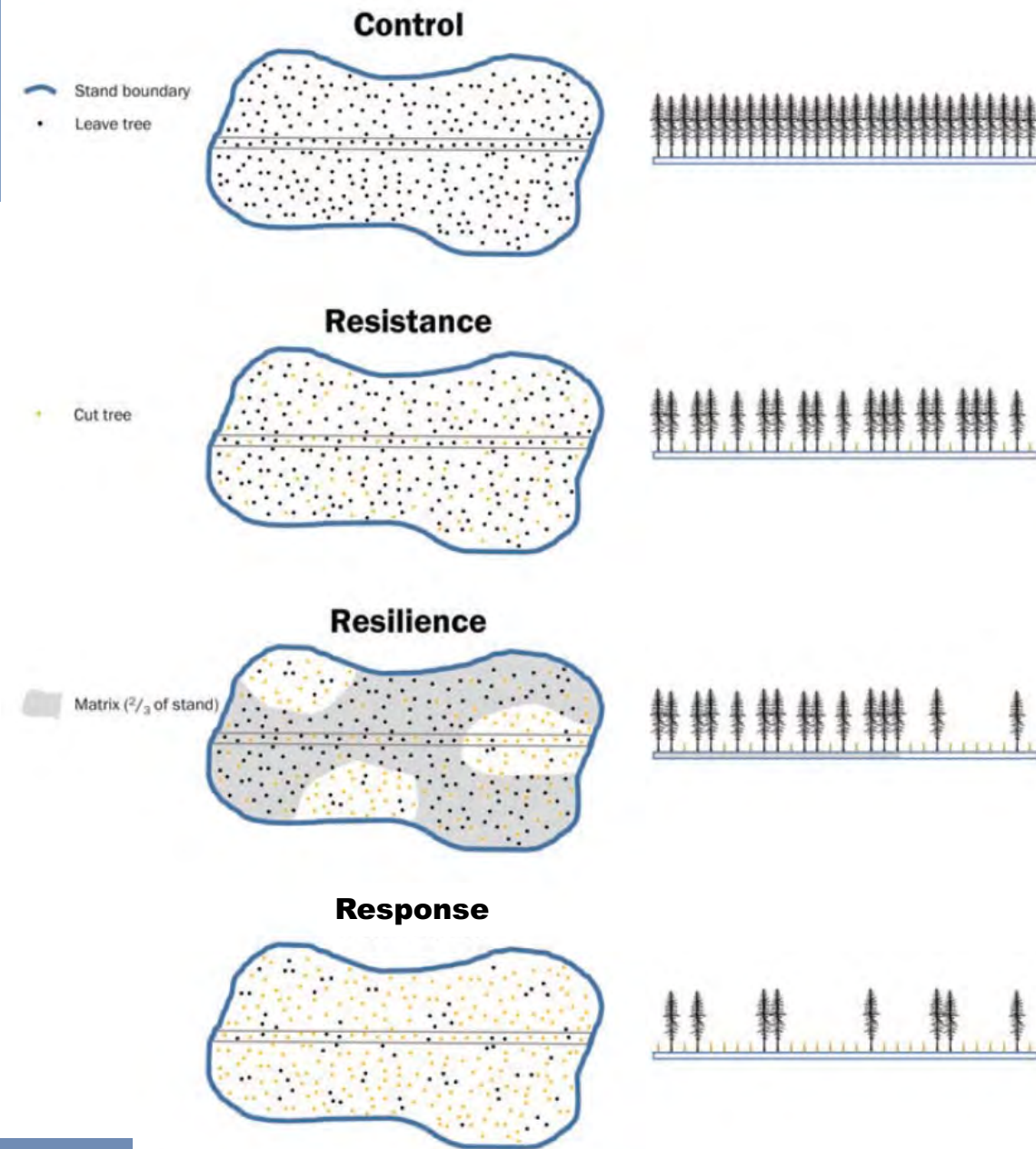
- Occupies cool and moist, mid-elevation sites in the interior northwest
- Shade-intolerant
- Resilient to and dependent on disturbances (e.g., insect outbreaks, wildfire)
- Predicted to be one of the most vulnerable forest types to warming and drying climate

The Response: Adaptive Silviculture for Climate Change

- Experimental effort to cooperatively develop silvicultural strategies that mitigate the negative effects of future climate
- Highly collaborative
- Identify four types of treatments: No Action, Resistance, Resilience, Response
- Short- and long-term monitoring



Adaptive Silviculture for Climate Change: Flathead NF



Resistance

- Strategies: maintain current tree species through thinning

Resilience

- Strategies: increase proportion of disturbance-adapted species, increase spatial and structural heterogeneity, plant seed from higher and mid-elevations

Direct/Response

- Strategies: increase proportion of disturbance-adapted species, introduce drought-resistant, fire-resistant species (i.e. ponderosa pine), plant seed from higher and mid-elevations

Resistance/
Resilience

Knowledge

Direct/Response

Ojai Community Defense Zone Project



- Ojai Ranger District within Los Padres National Forest
- Focused on creating fuel breaks in the wildland-urban interface
- Project has already been completed
- Purpose was to re-evaluate project goals and activities in light of climate impacts and vulnerabilities to identify adaptation options for *future* fuel breaks activities in the region

Ojai Community Defense Zone Project



Primary vulnerabilities:

1. Increased fire size, severity, and frequency makes it more dangerous for firefighters and the public
2. Fewer but higher intensity precipitation events can lead to high erosion, especially in areas with less vegetation
3. Increased abundance of invasive grasses, leading to flashier fuels and more fire

Do current project activities reduce any vulnerabilities?

1. Manage ground cover to result in mixture of bare ground, native grasses and forbs
 - ✓ Invasive grasses
2. Use irregular shapes in fuel break design
 - ✓ Erosion
3. Expand width of fuel break
 - ✓ Increased rate of spread of fire



Ojai Community Defense Zone Project



What new actions could be added to further reduce vulnerabilities?

1. Plant future-adapted native perennial grasses within fuel break
 - ✓ Invasive grasses, flashy fire behavior, erosion
2. Establish trigger points for recreation closures and restrictions
 - ✓ Reduces likelihood of human-caused ignitions

Resistance/
Resilience

Direct/Response

Adaptation Planning Activity

1. What current actions/activities can we keep doing given climate impacts, and can they be modified to better address impacts/vulnerabilities?
2. What new actions/activities could we consider implementing to further reduce vulnerabilities?



Adding a Scenario Planning component to the activity

Scenario Planning: A Primer

- Scenario planning is a process in which we envision multiple plausible futures given what we know now
- Allows us to consider the impacts on our priorities and decisions and capture potential adaptation strategies
- Identify common, near-term strategies that work across scenarios

THE SCENARIO DEVELOPMENT PROCESS

Define Focal Issue, Question, or Decision and Relevant Timeframe
Review Past Events & Alternative Interpretations

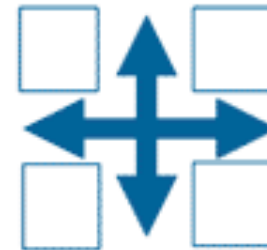
Identify
Driving
Forces



Identify
Critical
Uncertainties



Develop
Plausible
Scenarios



Discuss
Implications
& Paths



Adaptation Planning Activity – Up Next!

1. For each scenario (e.g., warmer/wetter), summarize potential impacts on your habitat/resource of interest.
2. What current actions/activities can we keep doing given these impacts, and can they be modified to better address impacts/vulnerabilities?
3. What new actions/activities could we consider implementing to further reduce vulnerabilities?
4. What actions show up in both scenarios? Would you select these as priorities for implementation?