Managing for Resilient Ecosystems: Examining the Options

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Ecosystems in Transition

Landscape Changes ~

- Cheatgrass conversion (>6%)

  80% susceptible; 45% of that area moderate to high risk
- Pinyon and juniper expansion (>10%)

  2-6 fold increase since 1860; canopy closure in next 50 yrs
- Larger and more frequent fires

Management Goals & Actions ~

- Increase resilience of native ecosystems to stress and disturbance and enhance resistance to invasive species

Great Basin Vegetation Types

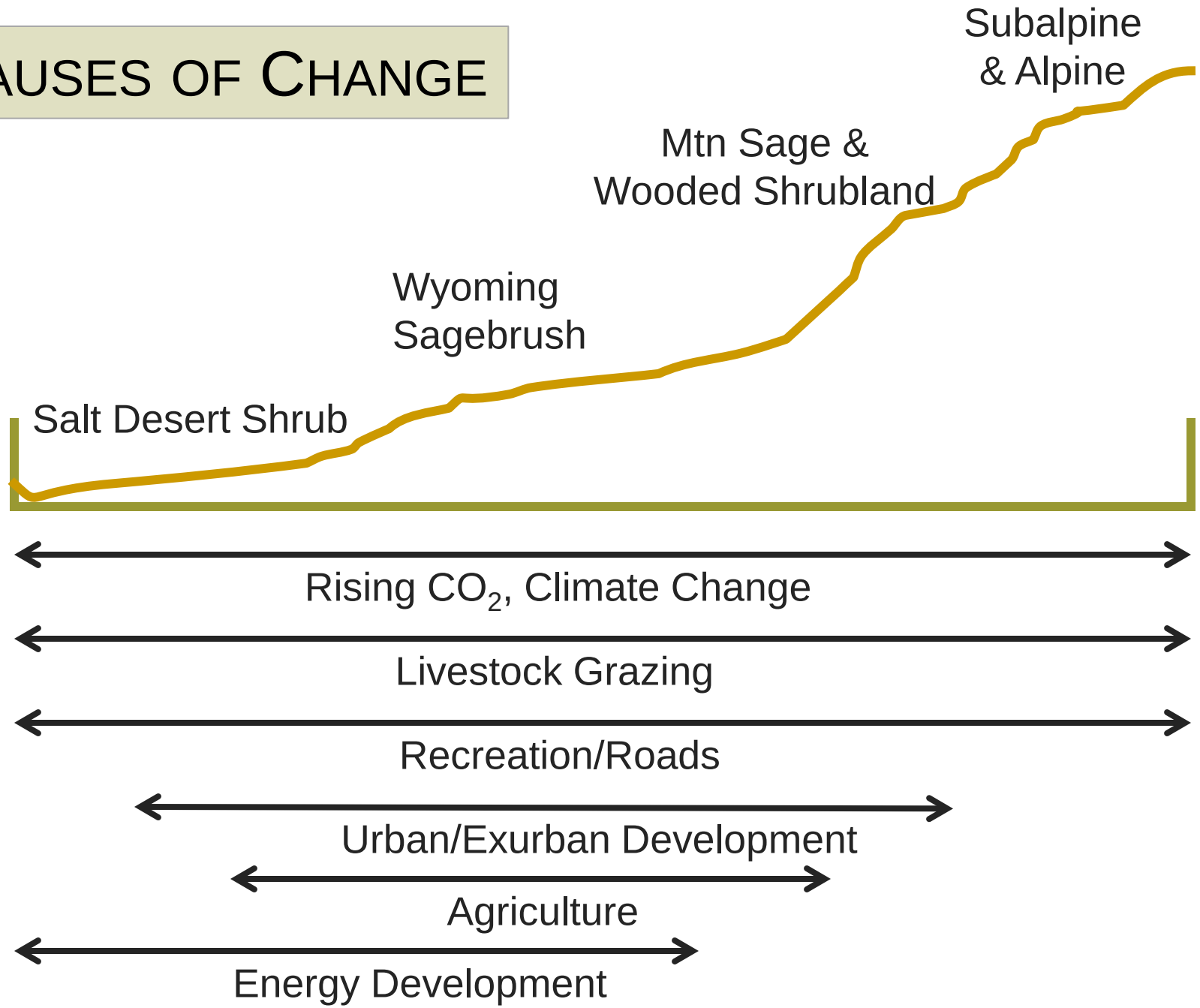
4”

12”

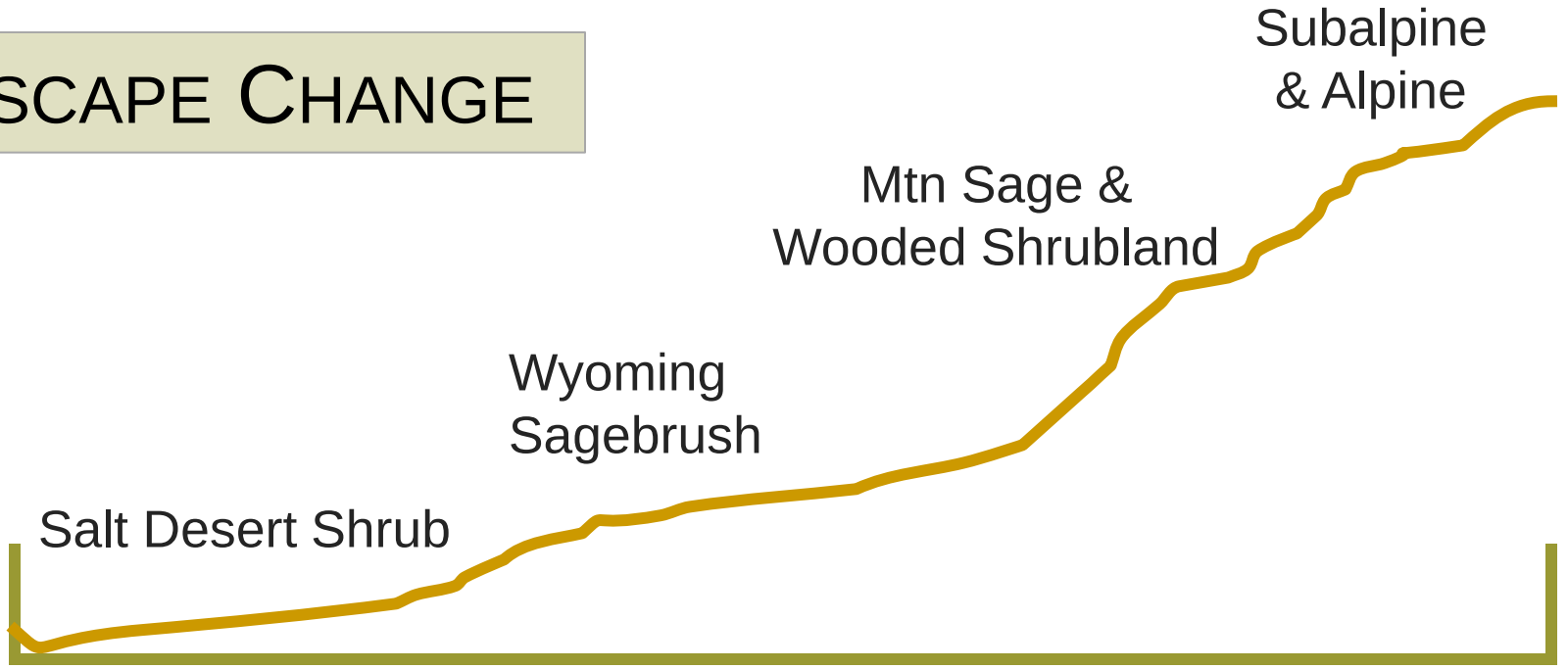
24 +”

Annual Precipitation

Causes of Change



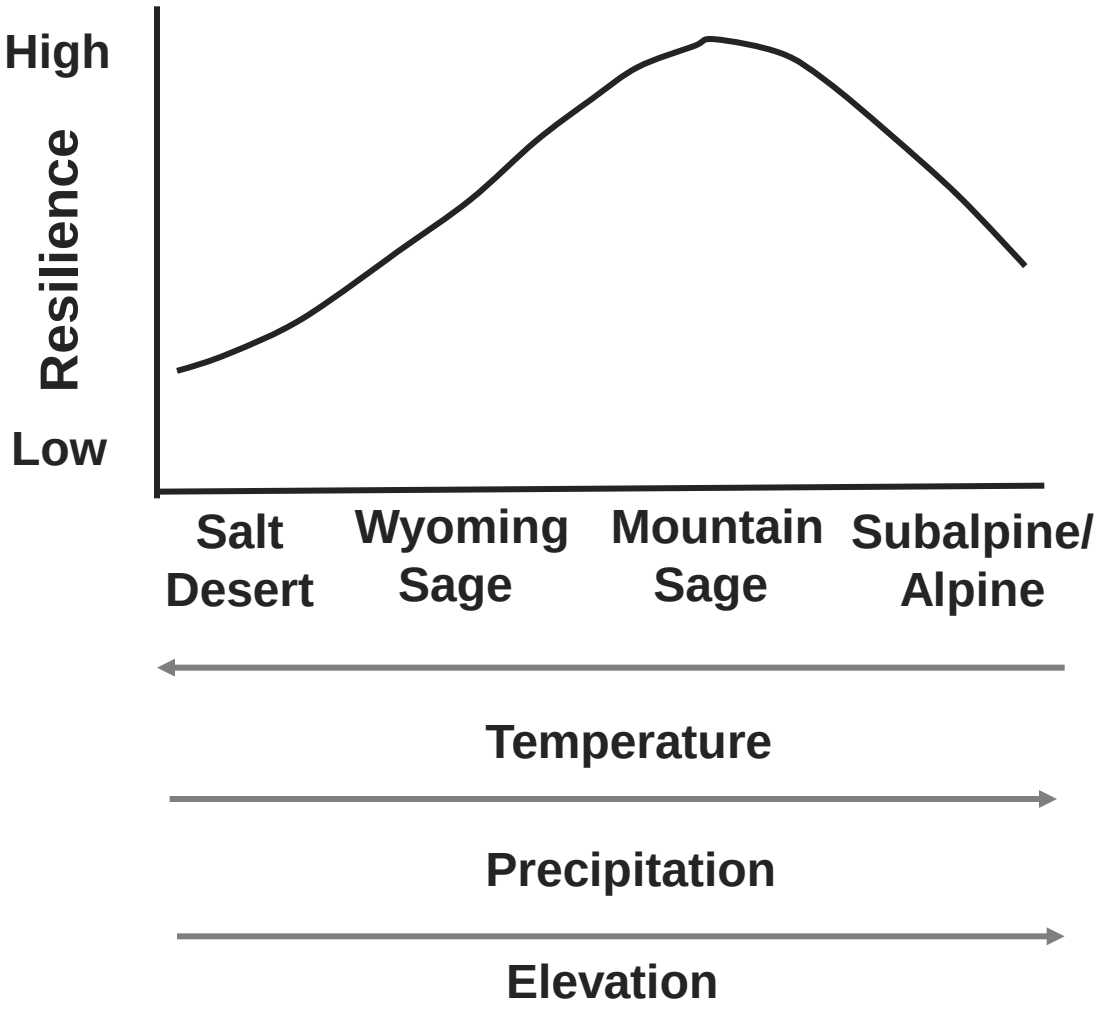
Landscape Change



Primary Invaders	Cheatgrass Red brome Annual forbs	Cheatgrass Medusahead Ann/Per Forbs	Cheatgrass Japanese bro Ann/Per Forbs	Lower Elevation Species
Historic Fire	Almost Never	200-350	50-70; 150-300	Rare
Current	↑	70 -160	70-160?	**?**

(Baker et al. 2011; Balch et al. 2012)

Resilience to Disturbance

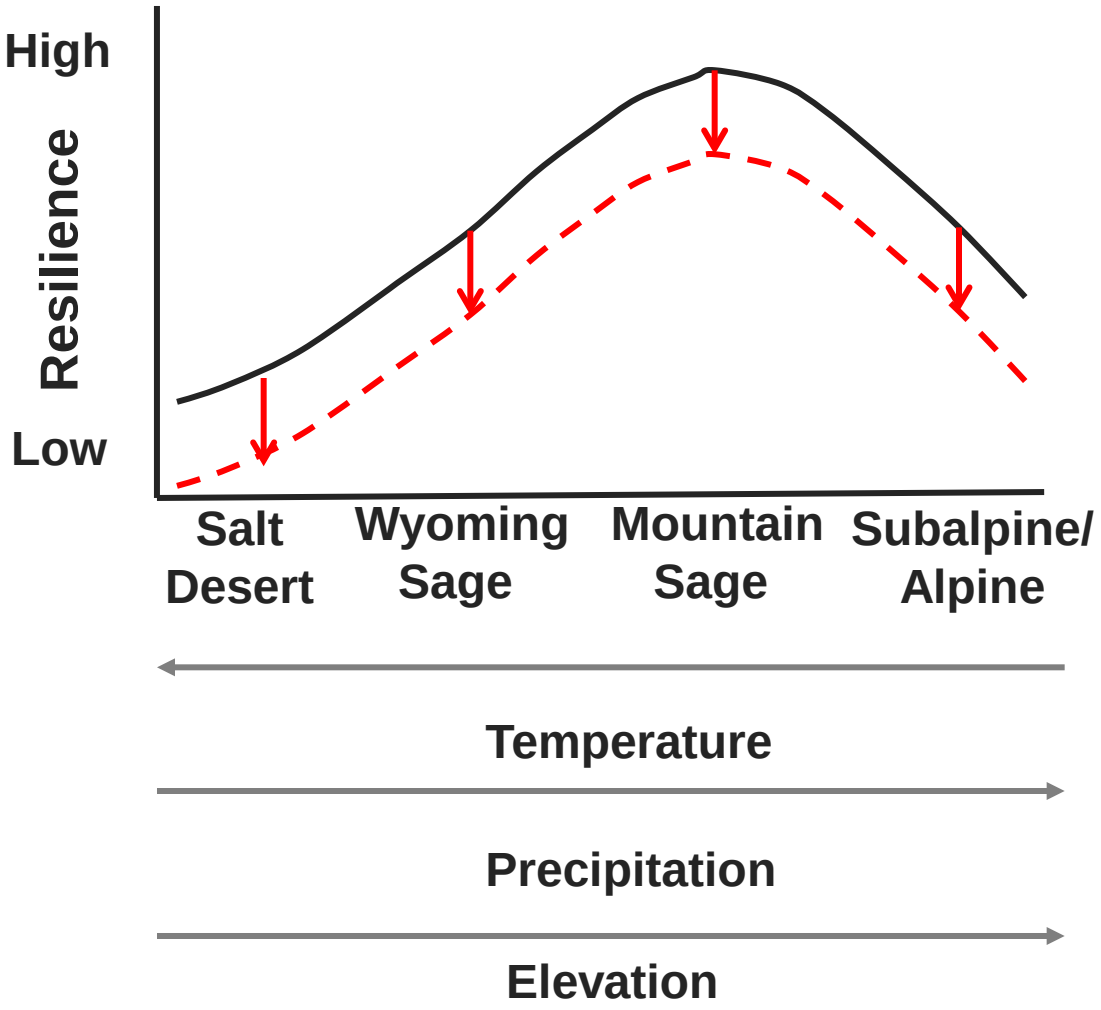


Resilience changes over environmental gradients

- Productivity & more favorable growing conditions
- Highest for mountain big sage and mountain brush
- Lowest for salt desert and alpine

(Wisdom & Chambers 2009; Brooks and Chambers 2011; Condon et al. 2011; Chambers et al in process.)

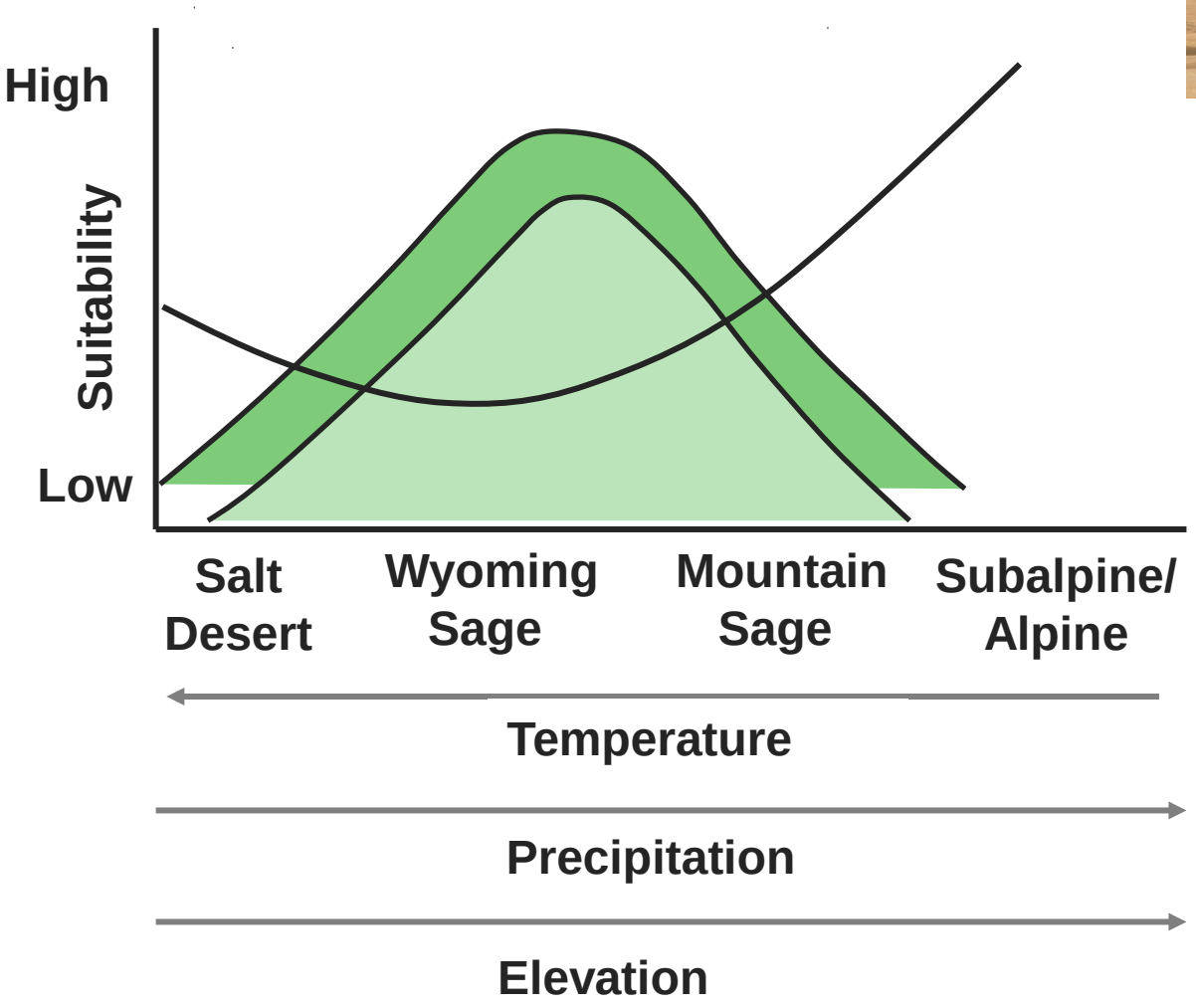
Resilience to Disturbance



Resilience decreases with disturbance/stress outside of historic range of variability

- Changes in vegetation structure or composition
  - ↓ Perennial grass/forb
  - ↑ Woody species
  - ↑ Invasive species
- Altered fire regimes
  - ➢ Severity, extent, frequency

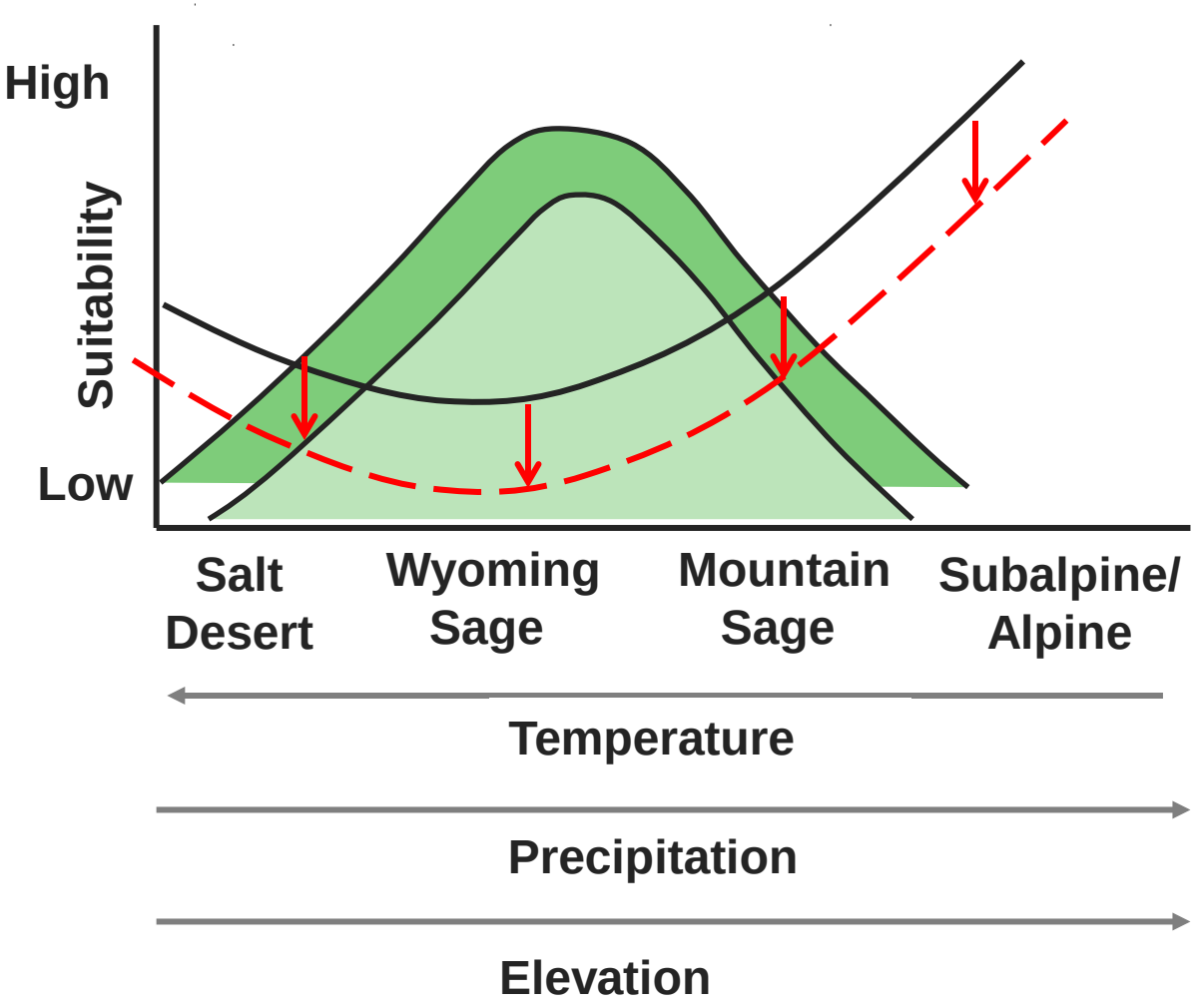
Resistance to Cheatgrass



Resistance reflects a species fundamental & realized niche

- Fundamental niche determined by environment
  - Lowest- salt desert and alpine
  - Highest- Wyoming sage
- Realized niche determined by species interactions (competition/facilitation)

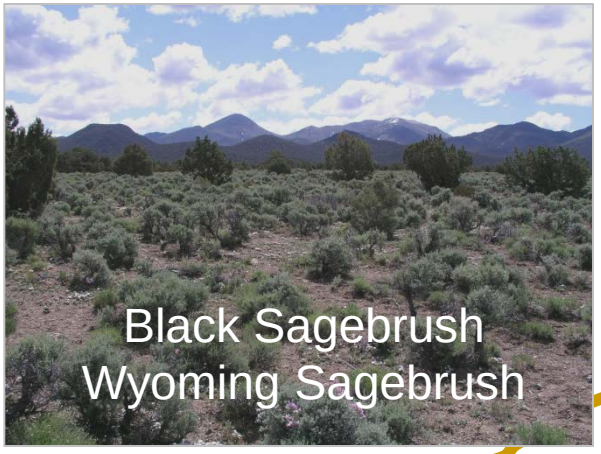
Resistance to Cheatgrass



Resistance decreases with disturbance/stress

- Increases in resource availability
  - Removal – 2 to 3 fold
  - Burning – 2 to 6 fold
  - Removal + Burning –10 to 30 fold
- Perennial grasses and forbs best competitors

Sagebrush Treatment Evaluation Project

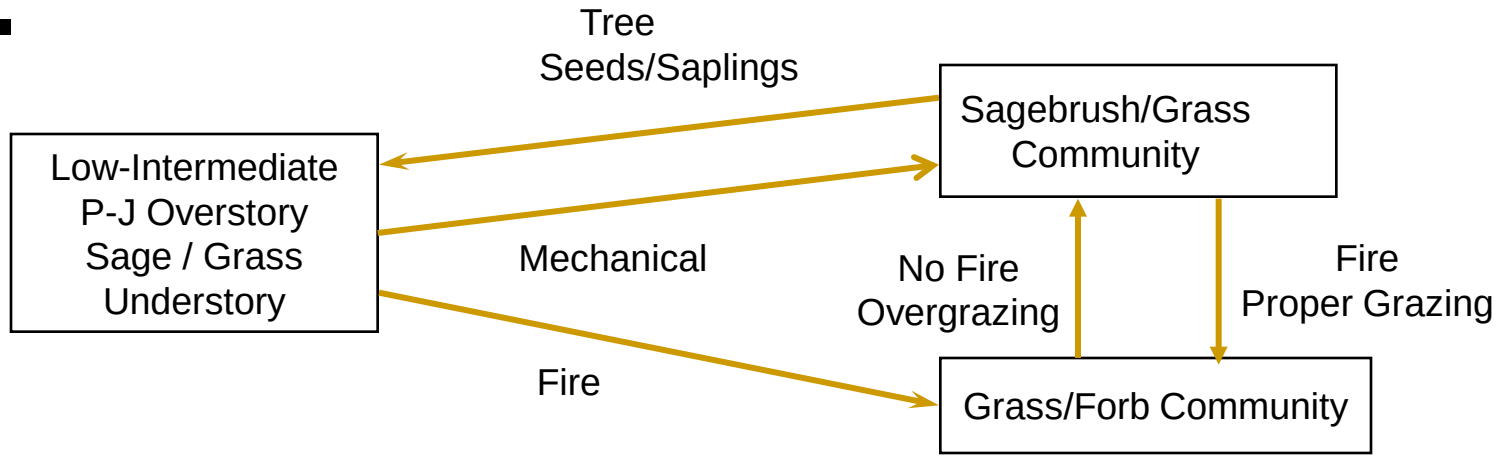


SageSTEP.org

Warm & Dry

Cool & Wet

State and Transition Model
State I - Wyoming/Mountain Sage



Highest resilience and resistance

- Lower treatment severity
- Sufficient perennial grasses and forbs to facilitate recovery

Caveats

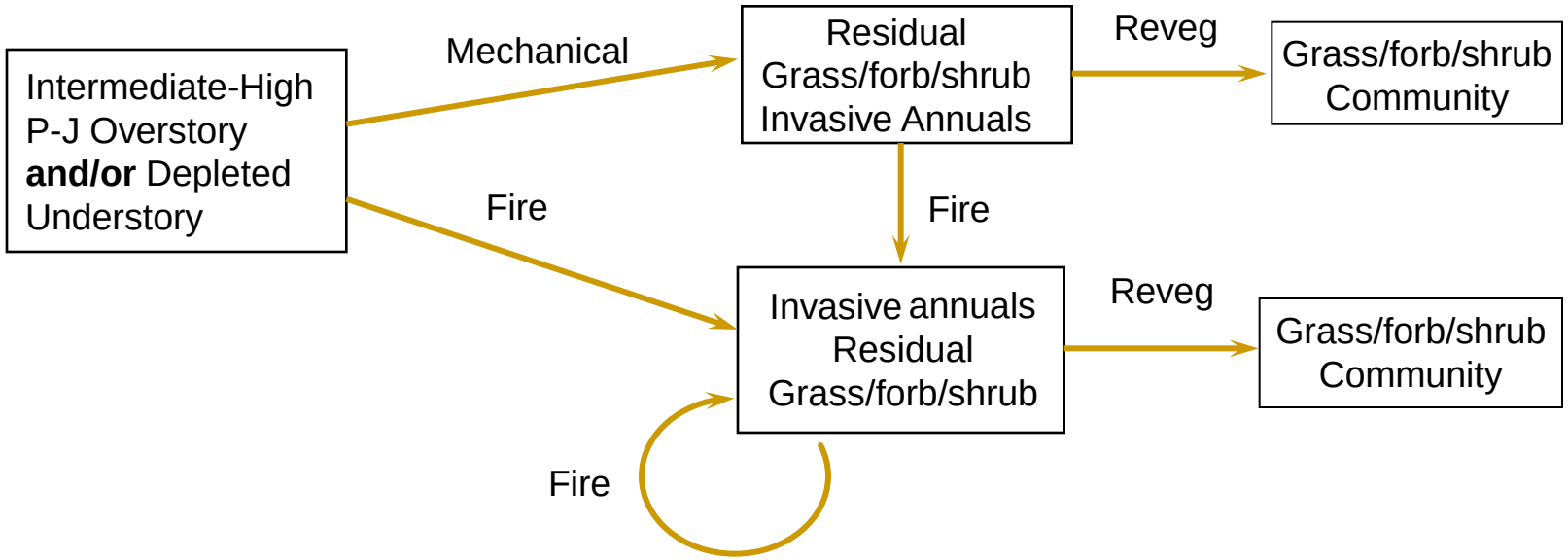
- Cheatgrass will probably always occur on Wyoming sage and warmer mountain big sage sites given a seed source
- Wyoming sage highest risk of cheatgrass dominance after fire
- Overgrazing post treatment can result in cheatgrass dominance

Cool mountain big sagebrush and Idaho fescue site

3 years post-burn

Black sagebrush/Wyoming sagebrush
and bluebunch wheatgrass site
5 years post-treatment

State II – Wyoming/mountain sage



Lowest resilience and resistance

- High treatment severity
- Insufficient grasses and forbs to facilitate recovery

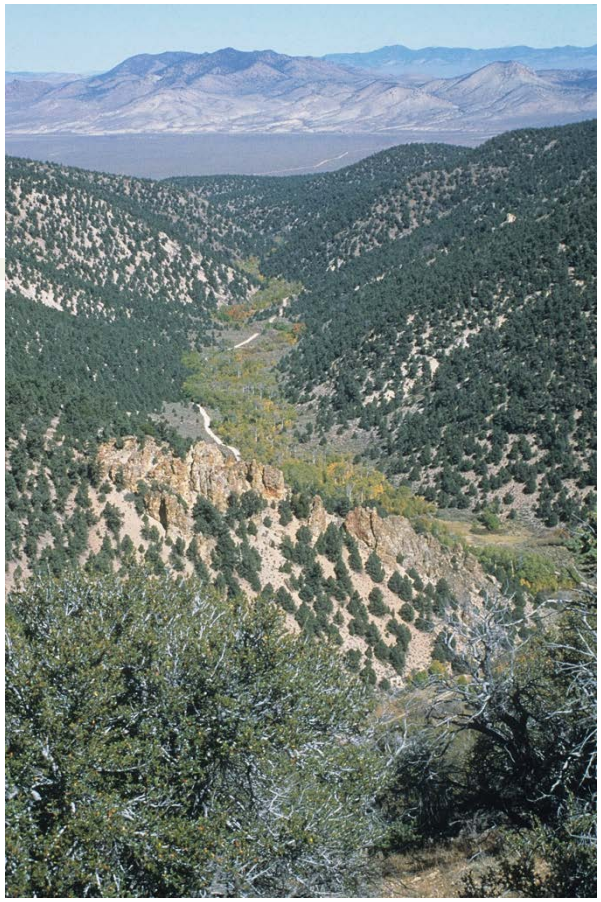
Caveats

- Effects of mechanical vs fire will depend on site conditions
- Revegetation can be difficult
- Livestock management necessary

Warm mountain big sagebrush and Idaho fescue site

5 years post burn

Landscape Approach



- ***First*** → assess environmental characteristics, vegetation types and ecological conditions at management scales
- ***Second*** → prioritize management activities at both site and landscape scales based on ecosystem resilience and resistance

  ~ Protection, Prevention and Restoration
- ***Third*** → monitor outcome and adapt management

PROTECTION

- Areas with inherently low resistance or resilience (salt desert, Wyoming sage, subalpine and alpine)
- Areas of high conservation value

- Eliminate stressors like repeated fire and inappropriate livestock grazing
- Control surface disturbances and invasion corridors
- Increase efforts to detect and eradicate invasives

- ***Create refugia for all ecosystem types***

Prevention - Vegetation Treatments

- Areas with moderate to high resilience and especially resistance
  - Wet and cool Wyoming & mountain sage
  - Adequate perennial herbaceous species and shrubs to ensure recovery

- Consider disturbance severity
  - Fire eliminates all fire intolerant species, increases resources for invasive species
  - Mechanical treatments that remove only trees, less effect on resources

- ***Minimize other stresses***

Transformative/Adaptive Restoration

- Most successful prior to invasive plant dominance
- Post-fire rehabilitation, fire breaks adjacent to intact areas, WUI areas, critical habitat for T&E species

- ***Climate Change*** → species adapted to drier and warmer conditions; assisted migration (climate suitability;seed zone shifts)
- ***Invasive species*** → different phenologies and rooting depths (must compete with annual and perennial invaders)
  → Weed Suppressive Bacteria - Seed Bank Fungal Pathogens?
- ***Fire*** → species tolerant of fire and capable of soil stabilization (perennial, root-sprouting, rhizomatous)

- ***Address the establishment bottleneck***

MONITOR AND ADAPT

- Implement comprehensive monitoring to track landscape change & management outcomes

- Regional network of monitoring sites that includes major environmental gradients
- Monitoring of all major land treatments
- Common data base for all monitoring results (Land Treatment Digital Library)
- Monitoring products that track change across Region

- ***Transcend agency boundaries***

EMBRACE CHANGE

- Increasing resilience and resistance to invasives best management option
  - Both protection and prevention important
  - Transformative restoration & assisted migration require greater emphasis
  - Comprehensive monitoring essential

- Increase capacity to address emerging issues
  - Improve funding mechanisms & increase flexibility
  - Mobilize research and management teams

- ***Emphasize collaboration and information sharing***

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Exotic Bromus Grasses in the Western US: Current and future invasions, impacts, and management - USDA AFRI REENet

Integrating ecological forecasting methods to improve prioritization of invasive species management – USGS Powell Center