

USING RESILIENCE CONCEPTS TO MANAGE SAGE-GROUSE HABITAT AFFECTED BY ANNUAL GRASSES AND ALTERED FIRE REGIMES – A MULTI-SCALE APPROACH

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Photo - Nolan Preece

WILDFIRE AND INVASIVE INITIATIVE

Mission ~

- Develop a report of the current work and a set of concise, concrete, prioritized and integrated actions, land managers and policy makers can take to effectively preclude the dominance of invasive species and reduce their influence on the fire cycle in sagebrush ecosystems in the west.
 - **Objectives** include assessments of current efforts to manage or affect the wildfire/invasives threat and of problems or gaps
 - **Today's focus** addresses a new, integrated and biologically-based approach to assist in managing the wildfire/invasives threat

OUTLINE

- *Rationale*
- *Resilience to Disturbance and Stressors & Resistance to Invasive Annual Grasses*
- *Sage-grouse Habitat Requirements*
- *Sage-grouse Habitat Matrix & Management Strategies*
- *Implementation*
 - *Landscape Scale Prioritization*
 - *Local/site Scale Management Actions*

RATIONALE FOR RESILIENCE BASED APPROACH

FWS Conservation Objectives Team (2013)

Objective ~

“the long-term conservation of sage-grouse and healthy sagebrush shrub and native perennial grass and forb communities by maintaining viable, connected, and well-distributed populations and habitats across their range, through threat amelioration, conservation of key habitats, and restoration activities.”

Key element ~ managing for resilience

- Broadly distributed and widely ranging species
- Requires large populations in large blocks across full range of habitats
- Multi-scale approach – Landscape to site
- ❖ Note: Emphasis is on Great Basin

FIRE AND INVASIVE MANAGEMENT GOALS

- *Increase resilience of native ecosystems to disturbance*
- *Enhance resistance to invasive species*
 - Maintain amount of landscape sagebrush cover required for sage-grouse
 - Increase perennial herbaceous species
 - Decrease invasive annual abundance & spread

- ❖ *Habitat for Greater Sage-Grouse and other sagebrush obligate species*
- ❖ *Ecosystem services such as clean air and water*



ENVIRONMENTAL GRADIENTS



Warm-Dry ← → Cold-Moist

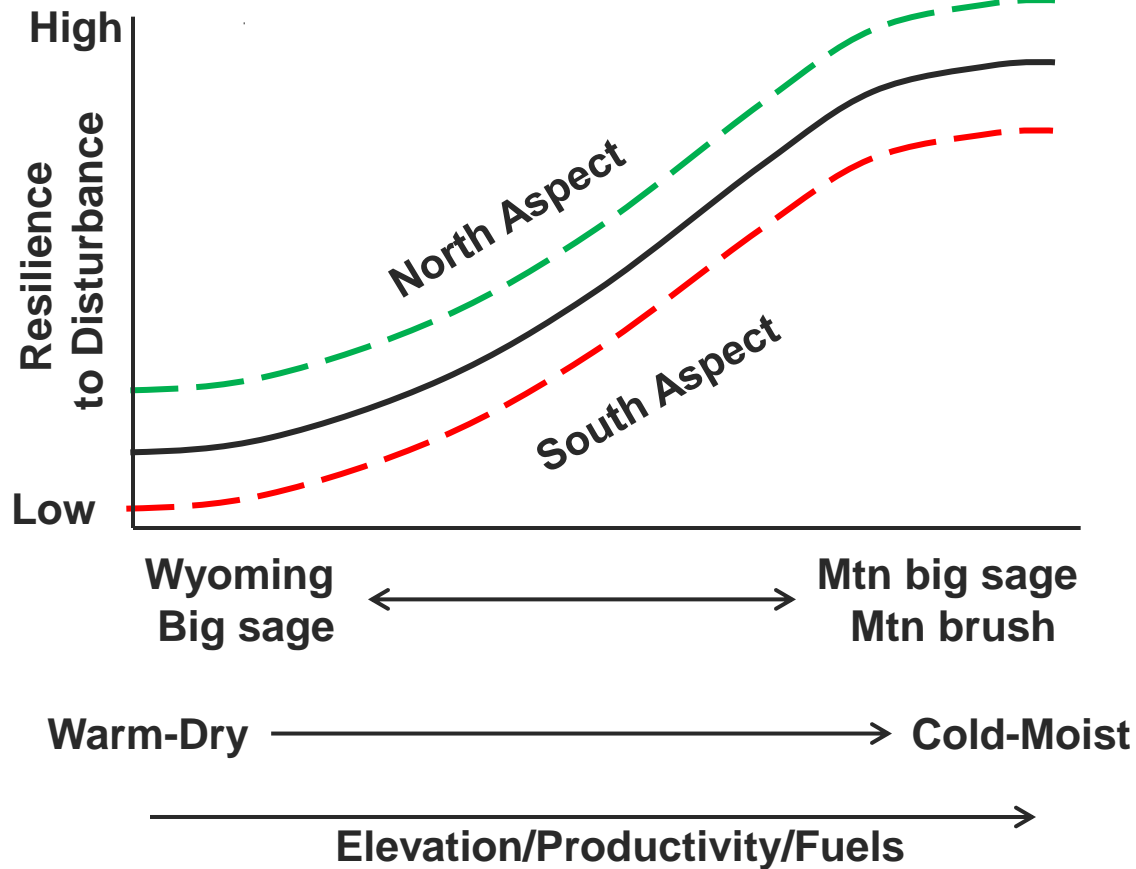
Elevation/Productivity/Fuels →

DEFINITIONS OF RESILIENCE & RESISTANCE

- **Resilience** ~ Capacity of an ecosystem to **regain** its fundamental structure, processes and functioning when altered by stresses like increased CO₂, nitrogen deposition, and drought and to disturbances like land development and fire (Allen et al. 2005; Holling 1973).
- **Resistance** ~ Capacity of an ecosystem to **retain** its fundamental structure, processes and functioning (or remain largely unchanged) despite stresses, disturbances or invasive species (Folke et al. 2004).
- **Resistance to Invasion** ~ Abiotic and biotic attributes and ecological processes of an ecosystem that limit the population growth of an invading species (D'Antonio and Thomsen 2004).

(from Chambers et al. 2013)

RESILIENCE TO DISTURBANCE

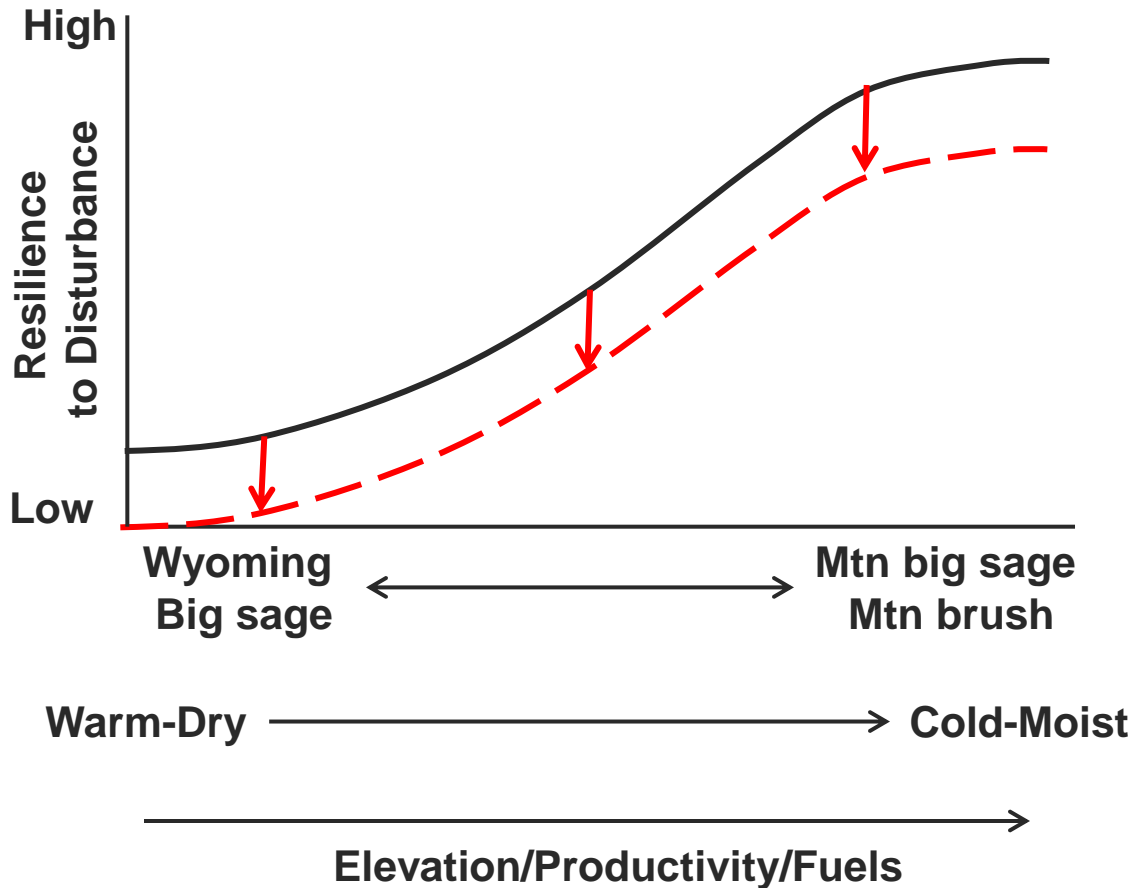


Resilience changes over environmental gradients

- ↑ Productivity & more favorable growing conditions
- Highest for mountain big sage and mountain brush
- Lowest for Wyoming sage

(Wisdom & Chambers 2009; Brooks and Chambers 2011; Condon et al. 2011; Davies et al. 2012; Chambers et al. 2013; Miller et al. in press)

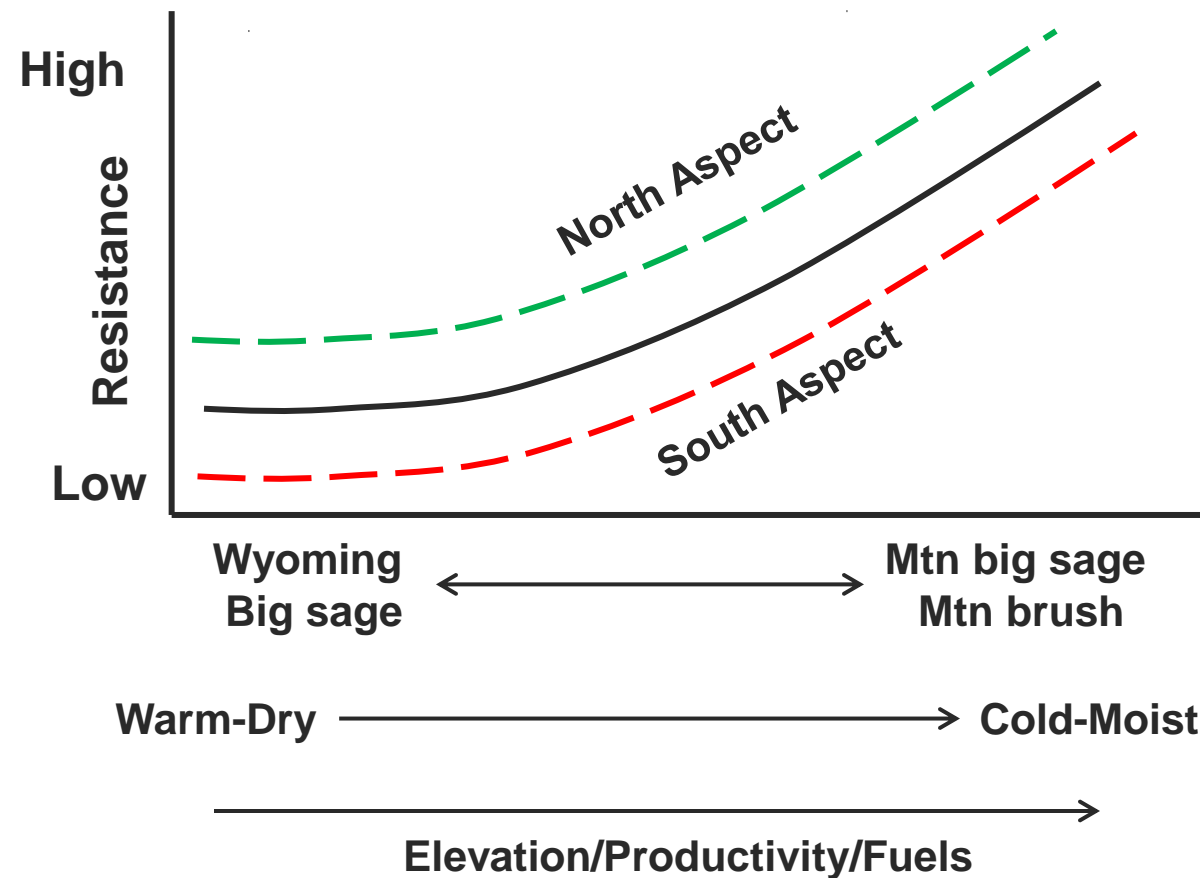
RESILIENCE TO DISTURBANCE



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

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

RESISTANCE TO CHEATGRASS

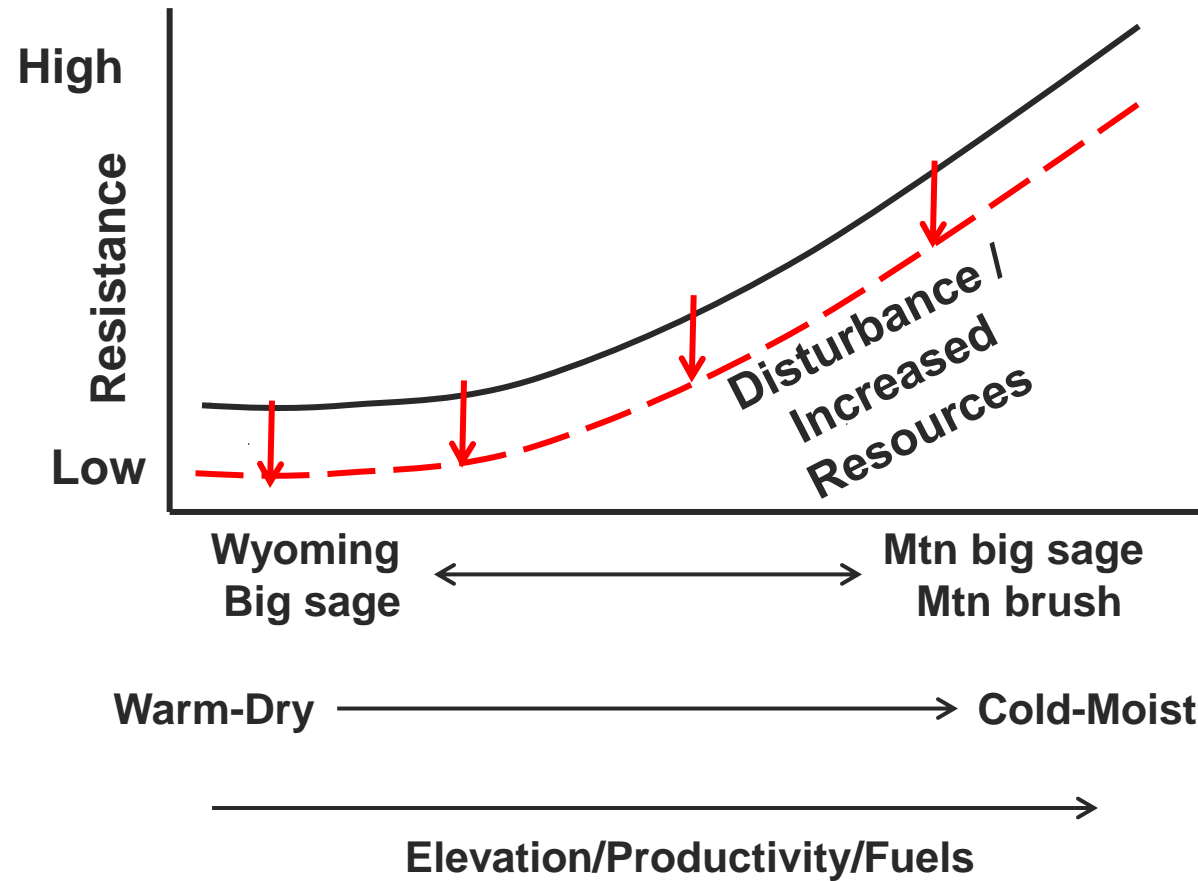


Resistance reflects environmental suitability

- Suitability differs
- Highest – Wyoming sage
- Lowest - mountain sage

(Chambers et al. 2007)

RESISTANCE TO CHEATGRASS



Resistance decreases with disturbance/stress

- Increases in resources, loss of perennial grasses and forbs
 - Removal – 2 to 3 fold
 - Burning – 2 to 6 fold
 - Removal + Burning – 10 to 30 fold

(Chambers et al. 2007)

SAGE-GROUSE HABITAT REQUIREMENTS

■ ***Landscape cover of sagebrush***

- Long-term persistence requires 25% to 65% land cover of sagebrush (30-km scale) (Aldridge & Boyce 2007).
- High risk of extirpation with < 27% land cover of sagebrush; high probability of persistence with > 50% (18-km of leks) (Wisdom et al. 2011).
- 90% of active leks had $\geq 40\%$ landscape cover of sagebrush (5-km radii around leks) (Knick et al. 2013).



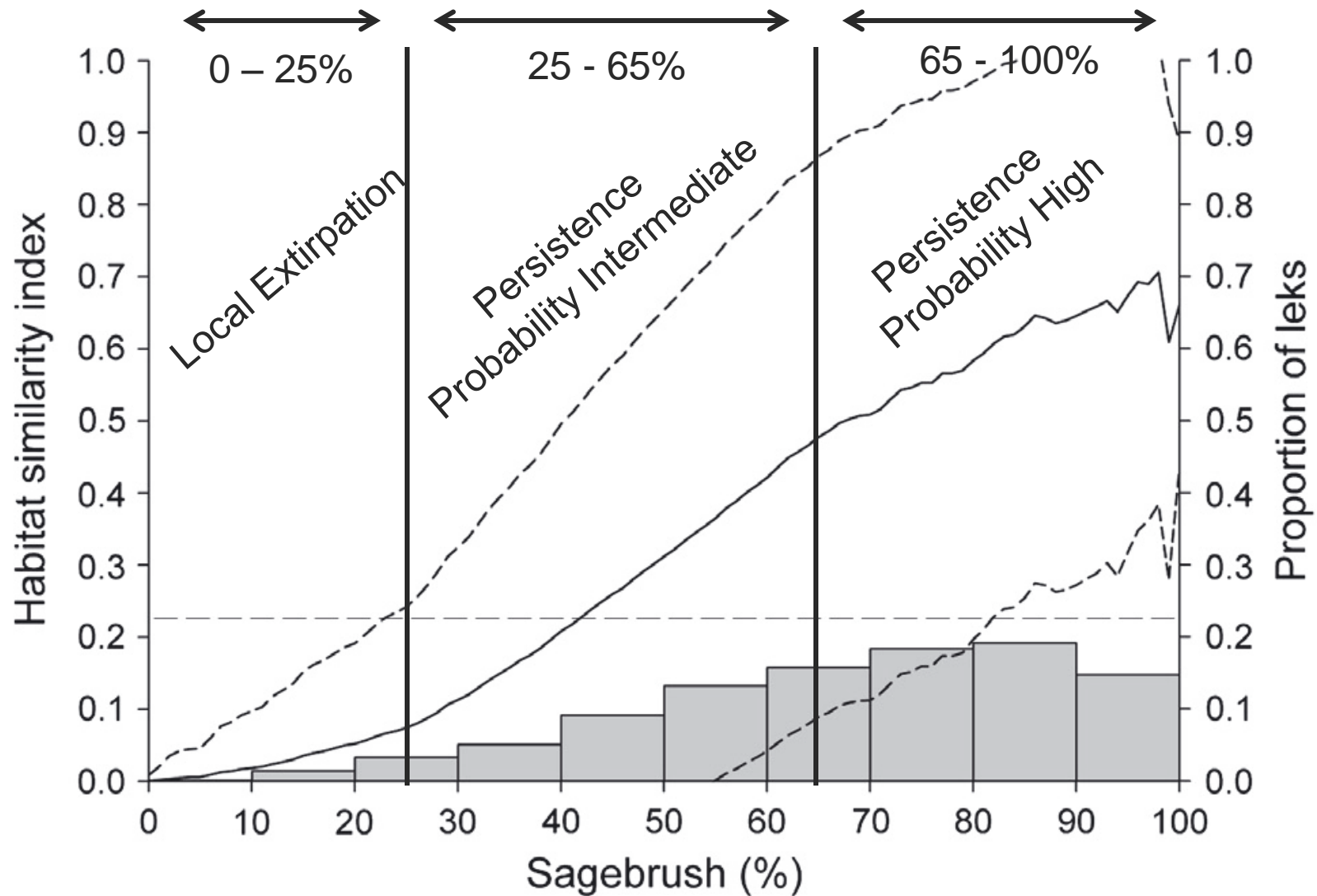
■ ***Landscape cover of conifers***

- Leks averaged < 1% with conifer cover within 5 km & were absent with > 40% conifer cover (5-km radii around leks) (Knick et al. 2013).

■ ***Cover of annual grasses***

- Nesting areas had < 6 to 8% annual grass (Johnson et al. 2011; Kirol et al. 2012; Lockyer et al. in press)

SAGE-GROUSE HABITAT REQUIREMENTS



(modified from Knick et al. 2013)

SAGE-GROUSE HABITAT MATRIX

- Integrates understanding of resilience and resistance, and landscape cover of sagebrush to support persistent populations of sage-grouse
- Provides basis for landscape management strategies
 - Sage-grouse Management Zones III, IV and V
 - Current or potential sage-grouse habitat
- Rows show the plant communities' relative resilience to disturbance and resistance to invasive annual grasses
- Columns show the current proportion of landscape sagebrush cover to support viable sage grouse populations over the long term
- Management goal is to move toward a better site condition within a row—it is not possible to move between rows within a landscape or site

DRAFT SAGE-GROUSE HABITAT MATRIX

Proportion of Landscape Dominated by Sagebrush

Resilience to Disturbance & Resistance to Invasive Annual Grasses

	<i>Low</i> < 25% Sagebrush-Dominated Landscape	<i>Medium</i> 25-65% Sagebrush-Dominated Landscape	<i>High</i> > 65% Sagebrush-Dominated Landscape
<i>High</i>	Sagebrush lacking Natural recovery likely Sufficient PNH Low annual invasive risk	Sagebrush limiting Natural recovery likely Sufficient PNH Low annual invasive risk	Sagebrush sufficient Natural recovery likely Sufficient PNH Low annual invasive risk
<i>Moderate</i>	Sagebrush lacking Natural recovery possible PNH site dependent Invasive risk site dependent	Sagebrush limiting Natural recovery possible PNH site dependent Invasive risk site dependent	Sagebrush sufficient Natural recovery possible PNH site dependent Invasive risk site dependent
<i>Low</i>	Sagebrush lacking Natural recovery unlikely PNH lacking High annual invasive risk	Sagebrush limiting Natural recovery unlikely PNH lacking High annual invasive risk	Sagebrush sufficient Natural recovery unlikely PNH lacking High annual invasive risk

DRAFT SAGE-GROUSE HABITAT MATRIX

Proportion of Landscape Dominated by Sagebrush

Resilience to Disturbance & Resistance to Invasive Annual Grasses

	<i>Low</i> < 25% Sagebrush-Dominated Landscape	<i>Medium</i> 25-65% Sagebrush-Dominated Landscape	<i>High</i> > 65% Sagebrush-Dominated Landscape
<i>High</i>	<p>Sagebrush lacking</p> <p>Natural recovery likely Sufficient PNH Low annual invasive risk</p> <p>Strategies - M1, M5, M6, M7, R1, R2</p>	<p>Sagebrush limiting</p> <p>Natural recovery likely Sufficient PNH Low annual invasive risk</p> <p>Strategies - M5, M6, M7, R1, R2, R3</p>	<p>Sagebrush sufficient</p> <p>Natural recovery likely Sufficient PNH Low annual invasive risk</p> <p>Strategies - M2, M5, M6, M7, R3</p>
<i>Moderate</i>	<p>Sagebrush lacking</p> <p>Natural recovery possible PNH site dependent Invasive risk site dependent</p> <p>Strategies - M1, M4, M5, M6, M7, R1, R2, R3, R5</p>	<p>Sagebrush limiting</p> <p>Natural recovery possible PNH site dependent Invasive risk site dependent</p> <p>Strategies - M4, M5, M6, M7, R1, R2, R3</p>	<p>Sagebrush sufficient</p> <p>Natural recovery possible PNH site dependent Invasive risk site dependent</p> <p>Strategies: M2, M4, M5, M6, R3</p>
<i>Low</i>	<p>Sagebrush lacking</p> <p>Natural recovery unlikely PNH lacking High annual invasive risk</p> <p>Strategies - M1, M2, M3, M4, M7, R4, R5, R6</p>	<p>Sagebrush limiting</p> <p>Natural recovery unlikely PNH lacking High annual invasive risk</p> <p>Strategies - M1, M2, M3, M4, M7, R4, R5, R6</p>	<p>Sagebrush sufficient</p> <p>Natural recovery unlikely PNH lacking High annual invasive risk</p> <p>Strategies - M1, M2, M3, M4, M6, M7, R3, R5, R6</p>

POTENTIAL MANAGEMENT STRATEGIES

Conserve – *maintain or increase resilience and resistance of areas with high conservation value*

- Current sage-grouse habitat
 - Areas with low to moderate resilience and resistance in relatively good ecological condition
 - Areas with conditions to support persistent populations
- Eliminate or minimize current and future stressors
 - Immediately suppress wildfires
 - Manage livestock grazing to increase abundance of perennial grasses and forbs
 - Detect and control new weed infestations and control invasion corridors and vectors.
 - Maintain and conserve remaining sagebrush patches from further disturbances including management treatments

POTENTIAL MANAGEMENT STRATEGIES

Maintain – *maintain or increase resilience and resistance of areas with declining ecological conditions*

- Current or potential sage-grouse habitat with moderate to high resilience and resistance that has declining conditions due to annual grass invasion or pinyon pine and juniper expansion
- Reduce fuel loads and decrease fire risk
- Increase landscape sagebrush cover and perennial herbs
 - Establish fuel breaks in strategic locations to facilitate compartmentalization of future fires.
 - Remove early to mid phase post-settlement pinyon pine and/or juniper to retain shrub/herbaceous cover and reduce fuels
 - Actively manage post-treatment areas to prevent improper grazing, OHV use, new weed infestations, etc.

POTENTIAL MANAGEMENT STRATEGIES

Restore - *increase resilience and resistance of disturbed, degraded, or invaded areas*

- Current or potential sage-grouse habitat
 - Burned by wildfire
 - Disturbed by recreation, development, roads, etc.
- Increase soil stability and curtail dust
- Control/suppress cheatgrass and other invasive plants
- Increase perennial herbs and landscape cover of sagebrush
 - Use integrated strategies to control/suppress cheatgrass and other annual invaders
 - Seed and/or transplant sagebrush to restore large patches of sagebrush cover and connect existing patches
 - Seed perennial grasses and forbs where depleted
 - Actively manage post-treatment areas to prevent improper grazing, OHV use, new weed infestations, etc.

HOW THE MATRIX AND STRATEGIES CAN BE USED

- Organizing framework for a landscape approach to manage invasives and fire
 - *A consistent approach for all partners*
- Planning and reporting tool at a regional and local level
- Ecologically-based recommendations for management and restoration
 - *Improve current programs*

PUTTING IT ALL TOGETHER



■ ***Landscape-scale assessment***

- Soil temperature/moisture regimes
 - Strongly related to ecosystem types
 - Resistance and Resilience Indicator
- Landscape scale vegetation/sagebrush cover
 - Sage-grouse habitat indicator
- Mapped landscape categories for sage-grouse habitat like those in the sage-grouse habitat matrix
 - Soil temp/moisture and land cover of sagebrush
- ❖ Landscape prioritization of management strategies

DRAFT SOIL TEMP/MOISTURE & ECOSYSTEM TYPES

Relative Resilience & Resistance

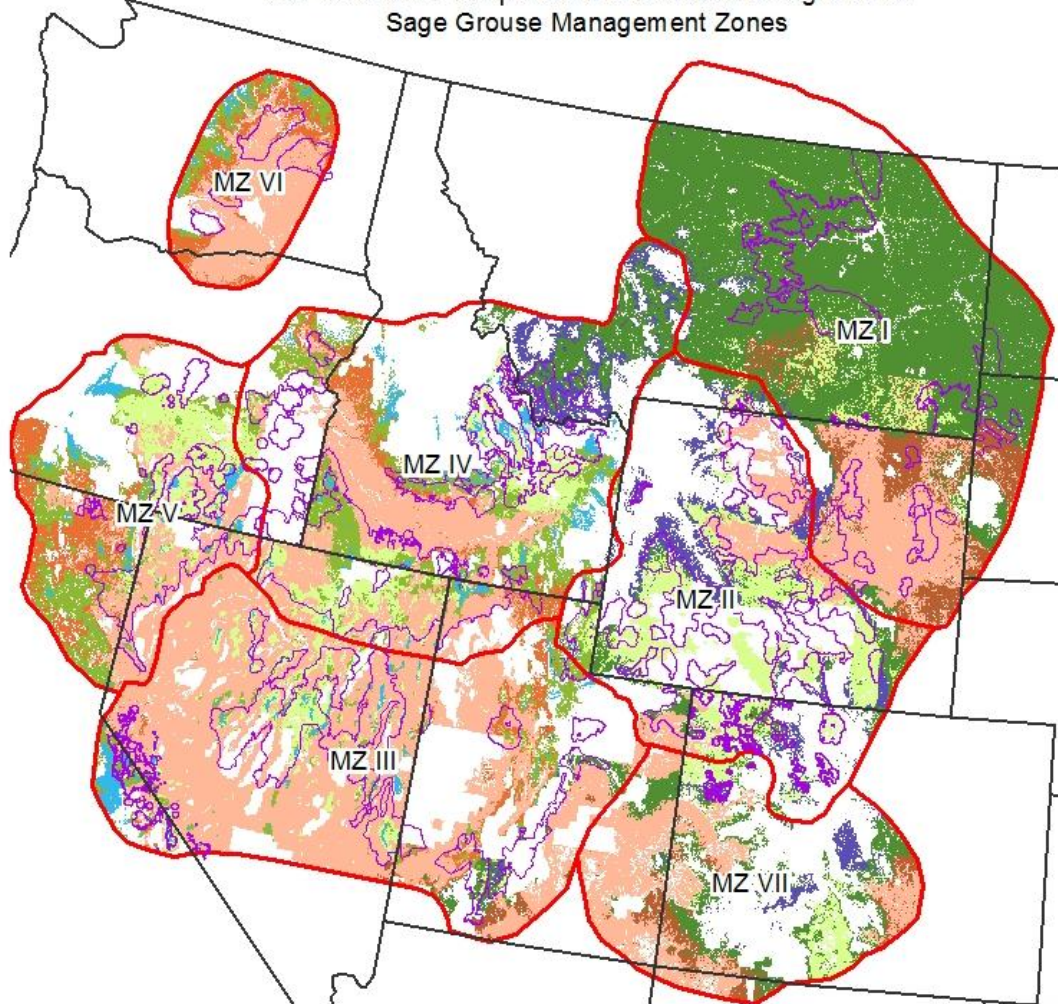
High



Low

Ecosystem Type	Characteristics	Resilience and resistance
Cold & Moist <i>Cryic (all)</i>	Typical shrubs: Mountain big sagebrush, Snowfield sagebrush, snowberry, serviceberry, silver sagebrush, and/or low sagebrushes	Resilience – Moderately high Resistance – High
Cool & Moist <i>Frigid/Ustic</i> <i>Frigid/Xeric</i>	Ppt: 16-22” Typical shrubs: Mountain big sagebrush, antelope bitterbrush, snowberry, and/or low sagebrushes Piñon pine and juniper potential in some areas	Resilience – Moderately high Resistance – Moderate
Warm & Moist <i>Mesic/Aridic-Xeric</i> <i>Mesic/Aridic-Ustic</i>	Ppt: 12-16” Typical shrubs: Wyoming big sagebrush, mountain big sagebrush, Bonneville big sagebrush, and/or low sagebrushes Piñon pine and juniper potential in some areas	Resilience – Moderate Resistance – Moderately low
Cool & Dry <i>Frigid/Aridic</i>	Ppt: 6-12” Typical shrubs: Wyoming big sagebrush, black sagebrush, and/or low sagebrushes	Resilience – Low Resistance – Moderate
Warm & Dry Winter <i>Mesic/Ustic-Aridic</i>	Ppt: 8-12”, summer monsoons Typical shrubs: Wyoming big sagebrush, Basin big sagebrush, Bigelow sagebrush, and or black sagebrush and/or low sagebrushes (large portion of the Colorado Plateau)	Resilience – Moderately Low Resistance – Moderately Low
Warm & Dry Summer <i>Mesic/Xeric-Aridic</i>	Ppt: 8-12”, wet winters Typical shrubs: Wyoming big sagebrush, and or black sagebrush and/or low sagebrushes (large portion of the Great Basin)	Resilience – Low Resistance – Low

Soil Taxonomic Temperature and Moisture Regimes for Sage Grouse Management Zones



Legend

SG_MgmtZones_ver2_20061018

Sage Grouse Priority Areas for Conservation

Temperature and Moisture Regimes

Mesic-Xeric
Mesic-Ustic
Mesic-Aridic

Frigid-Xeric
Frigid-Ustic
Frigid-Aridic
Cryic-Xeric
Cryic-Ustic
Cryic-Aridic

Data Source:

Gridded Soil Survey Geographic (gSSURGO) database

September 2013

Soil Temp/moisture = Indicator of resilience and resistance

- Moderate to high R&R
 - MZ I (Great Plains), II (Wyoming Basin), VII (Colorado Plateau) & most high elevation areas
- Moderate to low R&R
 - MZ III (Southern Great Basin), much of IV (Snake River Plains), V (Northern Great Basin), and VI (Columbia Basin)
- ❖ Next step: combine with landscape sagebrush cover to create categories similar to those in SG Habitat Matrix

PUTTING IT ALL TOGETHER

■ ***Local/site-scale assessment***

- Pilot Area – Priority Area for Conservation in Nevada (MZ III)
- Vegetation Coverages – Sage-Stitch & REAs
 - Sagebrush cover
 - Pinyon and juniper cover
 - Invasive annual grass cover
 - Fire history
- Ecological Site Descriptions
 - Land units defined by climate, topography, soils and vegetation
- State and Transition Models
 - STMs describe plant community dynamics as affected by invasives, disturbance & management treatments
- ❖ Local/site scale management strategies



WILDFIRE AND INVASIVES INITIATIVE WORKING GROUP

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QUESTIONS?

