Table 5—Management strategies for persistent ecosystem threats, land use and development threats, and climate change in the West-Central Semiarid Prairies (MZ I), Western Cordillera, and Cold Deserts (MZ II and VII). Recommendations are provided for prioritizing and targeting strategies based on cells in the sage-grouse habitat resilience and resistance matrix (table 4). Threats and strategies are cross-cutting and affect multiple program areas. While many of these fall under the broad umbrella of vegetation management, an integrated approach will likely be used in addressing threats. For example, it is expected that multiple agency program areas such as invasive plant management, fuels management, range management, wildlife, and others will contribute to strategies that use vegetation manipulation to address persistent ecosystem and land use and development threats.

Threat—Nonnative Invasive Species

Management Strategies

- Use resilience and resistance categories and knowledge of invasive plant distributions to select appropriate management approaches.
    - Protect high quality (relatively weed-free) sagebrush communities with moderate-to-high sage-grouse habitat probabilities (cells 1B, 1C, 2B, 2C, 3B, 3C):
        - Focus on preventing introduction and establishment of invasive species, especially in low resistance areas with high susceptibility to annual grass invasion (in and adjacent to cells 3B, 3C).
        - Avoid seeding introduced forage species (crested wheatgrass, smooth brome, etc.) in postfire rehabilitation or restoration in moderate to high resilience and resistance areas because these species can dominate sagebrush communities.
        - Practice early detection-rapid response (EDRR) approaches for emerging invasive species of concern (in and adjacent to cells 1B, 1C, 2B, 2C, 3B, 3C).
    - Where weed populations already exist, seek opportunities to maximize treatment effectiveness by prioritizing restoration within relatively intact sagebrush communities (cells 1B, 1C, 2B, 2C, 3B, 3C). Restoration will likely be easier at locations in cooler and moister ecological types with higher resilience and resistance.
        - Prioritize sites with sufficient native perennial herbaceous species to respond to release from invasive plant competition.
        - Manage grazing to reduce invasive species and promote native perennial grasses. In the West-Central Semiarid Prairies and other cool and moist areas, manage grazing to reduce crested wheatgrass, Kentucky bluegrass, smooth brome, and other introduced forage species and to promote native cool season perennial grasses (see grazing strategies.
        - Attempt proactive management of invasive annual grasses in the understory of sagebrush stands to reduce wildfire risk where proven methods exist (rather than focusing efforts exclusively on postfire annual grass control). Restrict spread of large weed infestations located in lower habitat probability areas (cells 1A, 2A, 3A) to prevent compromising adjacent higher quality habitats (cells 1B, 1C, 2B, 2C, 3B, 3C).

Threat—Conifer Expansion

Management Strategies

- Addressing conifer expansion requires an interdisciplinary approach and necessarily involves multiple program areas.
    - Apply integrated vegetation management practices to treat conifer expansion, using an interdisciplinary approach in designing projects and treatments.
    - Focus tree removal on early to mid-phase (e.g., Phases I, II) conifer expansion into sagebrush ecological sites to maintain shrub/herbaceous cover.
    - Use prescribed fire selectively in moderate to high resilience/resistance (cells 1A, 1B, 2A, 2B) to control conifer expansion.
    - Prioritize for treatment:

- Areas with habitat characteristics that can support sage-grouse with moderate to high resilience and resistance (cells 1B, 1C, 2B, 2C), especially near leks. (Note: cells 3B and 3C are generally too warm and dry to support conifers.).
- Areas where conifer removal will provide connectivity between sagebrush habitats.
- Areas where sufficient perennial grasses and forbs exist to promote recovery.

Threat – Wildfire

Management strategies

Fire Operations: Protection of areas supporting sagebrush is important for maintaining sage-grouse habitat. The West-Central Semiarid Prairies (MZ I) have limited availability of sagebrush and all areas with moderate and especially low resilience and resistance have longer recovery periods. If resources become limiting, consider the following prioritization:

- Fire suppression typically shifts from low to moderate priority when resistance and resilience categories shift from high to moderate, but it varies with large fire risk and landscape condition (cells 1B, 1C, 2B, 2C). In low resistance and resilience areas, the priority shifts from moderate to high as sage-grouse habitat probability increases (cell 3B, 3C). Scenarios requiring high priority may include:
  - Areas of sagebrush that bridge large, contiguous expanses of sagebrush and that are important for providing connectivity for sage-grouse.
  - Areas where sagebrush communities have been successfully reestablished through seedings or other rehabilitation investments.
  - All areas during critical fire weather conditions, where fire growth may move into valued sagebrush communities. These conditions may be identified by a number of products including, but not limited to: Predictive Services National 7-Day Significant Fire Potential products; National Weather Service Fire Weather Watches and Red Flag Warnings; and fire behavior analyses and local fire environment observations.

Fuels Management: Fuels management includes vegetation projects that mitigate wildfire risk, improve resilience to disturbance, and restore habitat, as well as actions intended to protect intact sage-grouse habitat. Mechanical treatments are typically applied to reduce fuel loading or to alter species composition consistent with Land Use Plan objectives. Prescribed fire is one form of fuels management that may be used to improve habitat conditions or create fuel conditions that limit future fire spread in areas with moderate to high resilience and resistance, but should be considered only after consultation with local biologists and land managers. Chemical and seeding treatments are conducted to reduce invasive species and to change species composition to native and/or more fire resistant species where native perennial grasses and forbs are depleted. When setting priorities for fuels management, consider the following.

<u>Mechanical Treatments</u>

- Mechanical treatments conducted to minimize sagebrush loss (e.g., conifer reduction) is a high priority in areas with high breeding habitat probabilities and moderate to high resilience and resistance (cells 1B, 1C, 2B, 2C), and shifts to low in areas with low breeding habitat probabilities (cells 1A and 2A).
- In areas of low resilience and resistance, mechanical treatments to minimize sagebrush loss shifts in priority from low to high as the sage-grouse habitat probability increases (cells 3B, 3C). However, treatments intended to decrease fuel loads and increase perennial herbaceous species may be ineffective if insufficient perennial grasses and forbs exist to promote recovery and resist invasive plant species.
- Management activities may include:
  - Tree removal in early to mid-phase (Phases I, II) post-settlement conifers to maintain shrub/herbaceous cover and reduce fuel loads.
  - Removal of mountain shrub species that encroach into sagebrush communities (e.g., gambel oak, curlleaf mountain mahogany, snowberry, serviceberry.)
  - Tree removal in later phase (Phase III) post-settlement conifers to reduce risks or large or high severity fires.
  - Herbicide and/or seeding associated with mechanical treatments to reduce invasive species and restore native perennial species in areas with insufficient native perennial grasses and forbs for recovery.

Table 5—(Continued).

Prescribed Fire

- Consider alternatives to prescribed fire where other treatment alternatives may meet management objectives.
- In low resilience and resistance areas, consider prescribed fire only after consultation with local biologists and land managers and when:
  - Site information, such as state-and-transition models, affirm that the postburn trajectory will lead to functioning sagebrush communities. Most low resilience and resistance areas that receive <12 in (30.5 cm) of precipitation do not respond favorably to burning.
  - Burning is part of multi-stage restoration projects where burning is required to remove biomass following chemical treatments for site preparation.
  - Monitoring data validates that the preburn composition will lead to successful, native plant dominance postburn.
- Use prescribed fire selectively in moderate to high resilience and resistance areas, after consultation with local biologists and land managers and assessing site recovery potential and other management options based on the following:
  - Preburn community composition.
  - Probability of invasive species establishment.
  - Historic fire regime, and patch size/pattern to be created by burning.
  - Wildfire risk and desired fuel loading to protect intact sagebrush; and
  - Alternative treatments that may meet objectives.
- Prescribed fire activities may include:
  - Burning piles or concentrations of woody biomass resulting from mechanical treatments.
  - Broadcast burning in areas having conifer concentrations that interface with sagebrush communities, while intentionally avoiding burning intact sagebrush that is not fire tolerant.
  - Creating fuel conditions that constrain future fire spread.
  - Prescribed fire adjacent to intact habitat where treatment will aid in wildfire suppression.
  - Prescribed fire to create landscape patterns that improve resilience and desired species composition.

Chemical Treatment and Seeding: Herbicide treatments and seedings are used to decrease invasive species composition and increase native species dominance where perennial native grasses and forbs are insufficient for site recovery. Herbicide treatments may be selectively applied in conjunction with prescribed fire or mechanical treatments. Typically, these treatments are in response to clear evidence of a nonnative invasive species threat.

Postfire Rehabilitation: Postfire rehabilitation is a cross-cutting effort involving range, wildlife, soils, fire, and fuels subject matter expertise. General considerations for prioritization of postfire rehabilitation efforts are:

- Priority shifts from generally low priority (cells 1A, 2A, 3A, 1B, and 1C) to moderate priority in moderate resilience and resistance areas (cells 2B, 2C). Areas of low resilience/resistance shift in priority from low priority to high priority with increasing habitat probability for sage-grouse (cells 3B to 3C).
- Areas of higher priority include:
  - Areas where perennial herbaceous cover, density, and species composition is inadequate for recovery.
  - Areas where seeding or transplanting sagebrush is needed to maintain habitat connectivity for sage-grouse.
  - Areas threatened by nonnative invasive plants.
  - Steep slopes and soils with erosion potential.

Threat—Climate Change

Management strategies

- Where effects of climate change and its interactions with stressors are expected to be relatively small and knowledge and capacity high, continue to use best management practices.

Table 5—(Continued).

- Where climate change and stress interactions are expected to be severe, proactive management such as assisted migration may be necessary to facilitate transition to a new site potential.
- Practice drought adaption measures such as reduced grazing during droughts, conservation actions to facilitate species persistence, and seeding and transplanting techniques proven to work during drought.
- Use species and ecotypes for seeding and out-planting that are adapted to both site conditions and drought, and resilient to episodic drought where projections indicate long-term climate change.
- Monitor transition zones between climatic regimes (the edges). Plant community shifts that affect management decisions often occur between Major Land Resource Areas or Level III Ecoregions.

Threat—Grazing

Management strategies

- Manage livestock grazing to maintain a balance of perennial native grasses (warm and/or cool season species as described in ESDs for that area), forbs, and biological soil crusts to allow natural regeneration and to maintain resilience. Ensure strategies prevent degradation and loss of native cool-season grasses in particular. Areas with low to moderate resilience and resistance may be particularly vulnerable (cells 2A, 2B, 2C, 3A, 3B, 3C).
- Implement grazing strategies that incorporate periodic rest during the critical growth period, especially for cool season grasses, to ensure maintenance of a mixture of native perennial grasses. This strategy is important across all sites, but particularly essential on areas with low to moderate resilience and resistance supporting sage-grouse habitat (cells 2B, 2C, 3B, 3C).
- Ensure grazing strategies are designed to promote native plant communities and decrease nonnative invasive species. In ephemeral drainages and higher precipitation areas in the West-Central Semiarid Prairies that receive more summer moisture and have populations of nonnative invasive plant species, too much rest may inadvertently favor species such as field brome, Kentucky bluegrass, and smooth brome. Adjustments in timing, duration, and intensity of grazing may be needed to reduce these species.

Threat—Energy Development

Management strategies

- Avoid development, if feasible, in areas with high breeding habitat probability for sage-grouse and high sagebrush cover (cells 1C, 2C, 3C) and steer development in non-habitat areas (1A, 2A, 3A).
- Minimize habitat fragmentation in areas with moderate and high breeding habitat probabilities for sage-grouse (cells 1B, 2B, 3B, 1C, 2C, 3C).
- For disturbances that remove vegetation and cause soil disturbance, minimize and mitigate impacts (top soil banking, certified weed-free [including annual bromes] seed mixes, appropriate seeding technologies, and monitoring). Plan for multiple restoration interventions in areas with low resilience and resistance (cells 3B, 3C).
- Minimize energy transport corridors (e.g., roads, pipelines, transmission lines) and limit vehicle access, where feasible.
- Maintain resilience and resistance of existing patches of sagebrush habitat by aggressively managing weeds that may require the following management practices (especially important in low resilience and resistant areas—cells 3A, 3B, 3C):
    - A weed management plan that addresses management actions specific to a project area
    - Using certified weed-free (including annual bromes) gravel and fill material
    - Assessing and treating weed populations, if necessary, prior to surface disturbing activities
    - Removing mud, dirt, and plant parts from construction equipment
    - Addressing weed risk and spread factors in travel management plans
    - Ensuring timely establishment of desired native plant species on reclamation sites
    - Using locally adapted native seed, if possible

Table 5—(Continued).

- Intensively monitoring reclamation sites to ensure seeding success and to determine presence of weeds
- Using mulch, soil amendments, or other practices to expedite reclamation success when necessary
- Ensuring weeds are controlled on stockpiled topsoil.

Threat—Urban and Exurban Development

Management strategies

- Secure conservation easements to maintain existing sagebrush stands and sage-grouse habitat. Prioritize areas with high habitat probability for sage-grouse and high sagebrush cover (cells 1C, 2C, 3C).
- Encourage the protection of existing sage grouse habitat through appropriate land use planning and Federal land sale policies. Steer development towards non-habitat (cells 1A, 2A, 3A) where habitat is unlikely to become suitable through management.

Threat—Cropland Conversion

Management strategies

- Secure conservation easements to maintain existing sagebrush grasslands and sage-grouse habitat and prevent conversion to tillage agriculture. Prioritize all areas supporting moderate-to-high sage-grouse habitat probability (cells 1B, 1C, 2B, 2C, 3B, 3C) in locations where tillage risk is elevated (see Sage Grouse Initiative Cultivation Risk layer).
- Secure term leases (e.g., 30 years) to maintain existing sagebrush grasslands and sage-grouse habitat and prevent conversion to tillage agriculture as a secondary strategy to conservation easements. Prioritize all areas supporting moderate-to-high sage-grouse habitat probability (cells 1B, 1C, 2B, 2C, 3B, 3C) especially in locations where tillage risk is elevated (see Sage Grouse Initiative Cultivation Risk layer).
- Offer alternatives to farming on expired USDA Conservation Reserve Program lands through Federal and state programs. Prioritize lands in and around intact habitats (cells 1B, 1C, 2B, 2C, 3B, 3C).
- Encourage enrollment in the USDA Conservation Reserve Program to return tilled lands to perennial plant communities supporting mixtures of grasses, forbs, and sagebrush where there are benefits to sage-grouse. Prioritize lands in and around intact habitats (cells 1B, 1C, 2B, 2C, 3B, 3C).

Threat—Sagebrush Reduction

Management strategies

- Avoid intentional sagebrush removal (prescribed fire, chemical, or mechanical removal) across all areas in the West-Central Semiarid Prairies due to relatively limited sagebrush availability and extended periods of recovery in the region. Many areas are characterized by moderate to moderately low resilience and resistance, and many sagebrush species lack the capacity to resprout.
- Use caution when attempting to increase herbaceous perennials by reducing sagebrush dominance through mechanical or chemical treatments in general.
  - Lower resistance and resilience areas are prone to annual grass increases and potential dominance if annual grasses exist in the area before treatment.
  - Pretreatment densities of 2 to 3 native perennial bunch grasses per square meter are often necessary for successful increases in perennial herbaceous plants and for suppression of annual grasses after treatment in lower resistance and resilience areas (Miller et al. 2014, 2015).