Chapter 1: Grazing and Rangeland Management

Prior to the introduction of domesticated livestock, sagebrush ecosystems were not heavily grazed by native herbivores (Osborne 1953, p. 267; Mack and Thompson 1982, p. 768; Miller *et al.* 1994, pp. 111, 113; Plew and Sundell 2000, p. 132; Grayson 2006, p. 921). Between 1860 and the early 1900's unregulated numbers of cattle, sheep, and horses rapidly increased across the western states, peaking at the turn of the century (Oliphant 1968, p. vii; Young *et al.* 1976, pp. 194–195; Carpenter 1981, p. 106; Donahue 1999, p. 15; Knick *et al.* 2011, p. 220). During this period, excessive overgrazing by domestic livestock, along with severe drought, significantly changed plant communities and soils across the sagebrush ecosystem (Knick *et al.* 2003, pp. 116, 616; Knick *et al.* 2011, p. 220). At low elevations, excessive overgrazing by livestock removed native vegetation and disturbed soils, promoting the establishment of non-native grasses and increasing the frequency of fires in sagebrush habitats (Boyd *et al*. 2014, p. 62). Conversely, at higher elevations, overgrazing reduced fine fuels and decreased fire frequencies, which encouraged the expansion of fire-sensitive native conifers into sagebrush habitats (Boyd *et al.* 2014, p. 62). Although the number of livestock and the intensity of livestock grazing has decreased since its historical peak in the early 1900s (Laycock *et al.* 1996, p. 3), the resulting impact on plants and soils remain commonplace in sagebrush ecosystems (Knick *et al.* 2003, p. 116; Knick *et al.* 2011, pp. 220, 221).

Livestock grazing is now the most widespread land use across the sagebrush ecosystem (Connelly *et al.* 2004, pp. 7–29; Knick *et al.* 2003, p. 616; Knick *et al.* 2011, p. 219; Boyd *et al.* 2014, p. 62). Throughout the range of the sage-grouse, there are XX are active grazing allotments occupying XX percent of suitable sage-grouse habitat. Many of these allotments are managed by the BLM and USFS, although grazing occurs on most land surface ownerships throughout the species' range. Nearly all sagebrush habitats have been grazed at some point during the last 150 years (Knick *et al.* 2003, p. 616; Knick *et al.* 2011, p. 219). (Figure X-X)

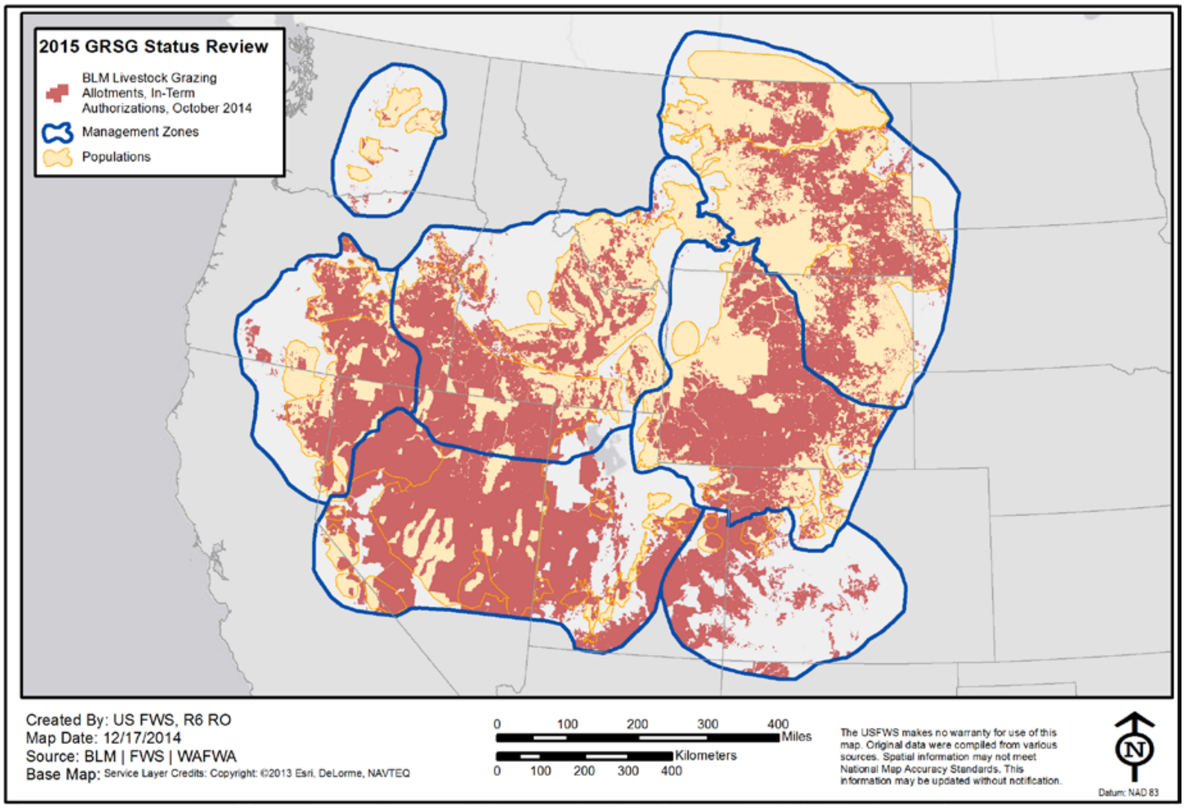

Figure X-X-. BLM Livestock Grazing Allotments, In-Term Authorizations as of October 2014

Impacts

Grazing can alter the composition of sagebrush plant communities (Boyd *et al.* 2014, p. 62). For example, sustained overgrazing can increase the density of sagebrush while reducing densities of perennial grasses (Boyd *et al.* 2014, p. 62), which degrades the quality of sage-grouse habitats. On the other hand, light to moderate livestock grazing can maintain perennial vegetation that provides important food and cover for sage-grouse (Miller *et al.*, 2004, p. XX; Boyd *et al*. 2014, p. 63). Grazing's actual influence on the ecosystem depends on the intensity and timing of grazing (Aldridge *et al.* 2008, p. 990; Boyd *et al.* 2014, p. 63) and the local climatic and ecological conditions (Crawford *et al.* 2004, p. XX; Boyd *et al.* 2014, p. 63). As a result, drawing inferences regarding the impact of grazing on sagebrush habitats across the range of sage-grouse is not possible.

Livestock grazing directly influences the composition, productivity and structure of herbaceous plants in sagebrush plant communities (Boyd *et al.* 2014, p. 64), which in turn influences the quality and quantity of food and cover for sage-grouse (Fleischner 1994, pp. 633–635). By reducing protective vegetative cover livestock grazing may make nesting and brood-rearing habitats less suitable for sage-grouse. Sage-grouse rely on the cover of tall grasses and shrubs to hide from predators, especially during the nesting season, and hens will preferentially choose nesting sites based on the height of grasses and shrubs (Hagen *et al.* 2007, p. 46). Grass height is a strong predictor of nest survival and hiding cover can increase nest success, a key vital rate for sage-grouse (Doherty *et al.* 2014, pp. 322–323). Loss of this hiding cover may increase predation during nesting and brood-rearing, subsequently reducing reproductive success rates (Gregg *et al.* 1994, p. 165). Maintaining adequate residual grass height and cover under shrubs minimized the negative effect of grazing on sage-grouse productivity (Boyd *et al.* 2014, p. 64). Livestock grazing may also reduce the cover and height of sagebrush in key wintering habitats (Rasmussen and Griner 1938, p. XX), potentially affecting the condition and survival of sage-grouse during the winter when resources are scarce.

Livestock grazing reduces the food available to sage-grouse (Braun 1987, p. 137; Vallentine 1990, pp. 240–241, 226; Dobkin 1995, p. 18; Connelly and Braun 1997, p. 231; Beck and Mitchell 2000, pp. 998–1,000; Pederson *et al.* 2003, p. 43). If food resources that provide important nutrients to pre-laying hens become scarce, the hen's overall nutrition can be negatively impacted which may influence nest initiation rates, clutch sizes, and reproductive success rates (Barnett and Crawford 1994, p.117; Coggins 1998, p. 30). A reduction in forbs can also reduce the survival of chicks (Aldridge and Brigham 2002, p. 441; Aldridge and Brigham 2003, p. 30). Livestock grazing may also reduce water infiltration rates, reduce the cover of herbaceous plants, compact soils, and increase soil erosion in mesic (wet), brood-rearing areas (Braun 1998, p. 147; Dobkin *et al.* 1998, p. 213), further affecting the ability of broods to obtain sufficient food resources. Alternatively, some grazing can improve forage conditions for sage-grouse by stimulating the regrowth of forbs (Evans 1986, p. 67).

As livestock graze, they may trample sage-grouse nests and food plants, and hens may abandon their nests if livestock approach too closely (Rasmussen and Griner 1938, p. 863; Patterson 1952, p. 111; Call and Maser 1985, p. 17; Holloran and Anderson 2003, p. 309; Coates 2007, p.28). Nearby livestock frequently force skittish females to flush from their nests (Coates 2008b, p. 462), inadvertently revealing the nest and its eggs to predators, such as ravens (Coates 2007, p.33). Livestock also may trample sagebrush seedlings, which could provide food and cover (Connelly *et al.* 2004, pp. 7–31). Trampling by livestock can also reduce or eliminate biological soil crusts, which may promote cheatgrass invasion (Mack and Thompson 1982, p. 764; Young and Allen 1997, p. 531; Masters and Sheley 2001, p. 503; Reisner *et al*. 2013, p. 10; Chambers *et al.* 2014, p. 361). In addition to increasing wildfire risk (Chambers et al. 2014, p. 366, and references therein), the establishment of invasive species, such as cheatgrass degrades sagebrush habitats by reducing plant diversity, understory cover and food resources. In some cases livestock grazing may help control invasives and woody plant encroachment (Riggs and Urness 1989, p. 358; Mosley 1996 as cited in Connelly *et al.* 2004, pp. 7–49; Merritt *et al.* 2001, p. 4; Olsen and Wallander 2001, p. 30), which may improve habitats and may have role in reducing wildfire risk (Boyd et al. 2014, p. 68). In some cases sage-grouse may also seek out and use openings in meadows created by cattle grazing (Klebenow 1981, p. 121).

Infrastructure associated with livestock grazing, such as watering structures and fencing, may concentrate disturbance, fragment habitats, kill sage-grouse during collisions, and create perches and access corridors for predators (Call and Maser 1985, p. 3; Connelly *et al.* 2000, p. 974; Connelly *et al.* 2004, pp. 1–2). Water developments for livestock, such as springs, tanks, and guzzlers, are common in sage-grouse habitats (Connelly *et al.* 2004, pp. 7–35), and influence the distribution of livestock and grazing intensity within a pasture (Boyd *et al.* 2014, p. 65). Congregation of livestock around water developments concentrates grazing and allows for trampling of vegetation around these structures (Braun 1998, p. 147; Knick *et al.*, 2011, p. 230). While these areas may subsequently be unsuitable for sage-grouse, the strategic placement of livestock water developments could protect other habitats by localizing and minimizing the area of impact. There have been documented incidences of sage-grouse drowning in stock tanks which can have substantial localized population level effects (Boyd et al. 2014, p. 65), but the range-wide impact is unknown. Water developments may also provide mesic vegetation on which sage-grouse forage. This could provide an important resource in summer habitats (Boyd et al. 2014, p. 65) when the availability of succulent plants may be limited.

Diverting water from waterways for livestock can reduce riparian and wet meadow habitats for sage-grouse, which provide key brood-rearing habitats (Schroeder *et al.* 1999, p. XX; Connelly *et al.* 2011, p. XX; Donnelly *et al.* in press).   Water diversions may therefore reduce the availability of these habitats, and potentially brood condition and survival. However, water developments could also breed mosquitos that spread the West Nile virus (WNv), which is fatal to sage-grouse (Boyd et al. 2014, p. 65; see Diseases chapter for more detail). The placement of salt or mineral blocks for livestock can also influence livestock grazing distribution and use, but results of studies examining this factor are inconsistent. In arid areas, such as the range of sage-grouse, water developments have a far greater influence on livestock distribution than do salt or mineral blocks (Boyd et *al.* 2014, p. 65, and references therein).

Thousands of miles of fences across the sage-grouse range are used to manage domestic livestock (Knick *et al*. 2011, pp. 224–225). Fences cause direct mortality through collision and indirect mortality through the creation of avian predator perch sites, the potential creation of predator corridors along fences (particularly if a road is maintained next to the fence), incursion of invasive plants along the fencing corridor, and habitat fragmentation (Call and Maser 1985, p. 22; Braun 1998, p. 145; Connelly *et al*. 2000a, p. 974; Beck *et al*. 2003, p. 211; Knick *et al*. 2003, p. 612; Connelly *et al*. 2004, pp. 1–2; see Fences chapter for more detail.).

Extensive rangeland treatment has been conducted to improve conditions for livestock in the sagebrush-steppe region (Connelly *et al*. 2004, p. 7–28; Knick *et al*., in press, p.28). Sagebrush has been deliberately eliminated and then seeded with nonnative grasses (Connelly *et al.* 2004, p. 7–28), effectively reducing, and in some cases eliminating, sagebrush and many native grasses and forbs used by the sage-grouse for food and cover (Hull 1974, p. 217; Connelly *et al.* 2004, p. 4-4). Impacts of the planting of non-native monocultures for the benefit of livestock are relative to scale of the planting (Boyd et al. 2014, p. 67). By the 1970s, over 2 million ha (5million ac) of sagebrush are estimated to have been mechanically treated, sprayed with herbicide, or burned in an effort to remove sagebrush and increase herbaceous forage and grasses for livestock (Crawford *et al*. 2004, p. 12). The BLM treated over 1,800,000 ha (4,447,897 ac) from 1940 to 1994 (Miller and Eddleman 2000, p. 20). All sagebrush habitats used by sage-grouse have been treated in some way to reduce shrub cover since European settlement in western North America (Braun 1998, p. 146). Reduction in sage-grouse habitat quality and likely numbers in the 1970s were associated with extensive rangeland treatments to increase forage for domestic livestock (Crawford et al. 2004, p. 12). Negative impacts of range treatments for domestic livestock to breeding sage-grouse (Connelly *et al.* 2000a, p. 972), nesting success rates, brood carrying capacity (Klebenow 1970, p. 399) and winter cover and food (Pyrah 1972 and Higby 1969 as cited in Connelly et al 2000, p. 973) have been documented. Sagebrush height, and grass and forb communities rarely return to pre-treatment conditions or even to the extent they provide sage-grouse habitat, even years (up to 30) after initial treatment (Hess and Beck 2012, pp. 91–92; Boyd *et al*. 2014, p. 66). The type and extent sage-grouse response to range treatments depends on the extent to which forbs and sagebrush are killed.

Some range-land treatments can be beneficial for sage-grouse habitats. Small treatments interspersed with non-treated sagebrush habitats did not affect sage-grouse use, presumably due to minimal effects on food or cover (Braun 1998, p. 147). Application of herbicides to reduce sagebrush cover may enhance some brood-rearing habitats by increasing the coverage of herbaceous plant foods (Autenrieth 1981, p. 65; Boyd et al. 2014, p. 66 and references therein). Mechanical treatments, if carefully designed and executed, can be beneficial to sage-grouse by improving herbaceous cover, forb production, and sagebrush re-sprouting (Braun 1998, p. 147), but this may only be true at higher elevations (Boyd et al. 2014, p. 66. Small chemical treatments may not impact sage-grouse if intact sagebrush remains nearby (Braun 1998, p. 147).

The success of restoring or rehabilitating overgrazed areas depends on the condition of the area relative to its site potential (Knick *et al.* 2011, p. 232). In areas with a balanced mix of shrubs and native understory vegetation, a change in grazing management can restore the habitat to its potential vigor (Pyke 2011, p. 538). Rest from grazing is known influence perennial grass response than other treatments (Wambolt and Payne 1986, p. 318), although prescribed grazing of non-native perennial grasses may help promote restoration of sagebrush (Boyd et al. 2014, p. 67). At least one author has suggested modifying grazing management, including removal of grazing in some areas, to allow for habitat restoration (Pyke 2011, p. 537). Active restoration is required where the native understory is reduced (Pyke 2011, p. 539). If an area has soil loss or invasives, returning the native plant community may be impossible (Daubenmire 1970, p. 82; Knick *et al.* 2011, p. 232; Pyke 2011, p. 539).

Livestock grazing on BLM lands is managed through limitations on number of animal unit months (AUM), and length and dates of grazing. Permitted AUMs represent potential maximum use based on land conditions and trend, whereas actual use will vary due to economics, non-use due to forage or drought conditions, and unreported trespass (Knick and Connelly 2011, p. 221). Land condition is a consideration in establishing grazing strategies for individual allotments and the BLM follows defined standards and guidelines for determining the health of individual allotments (Knick and Connelly 2011, p. 222). An important objective of the BLM in managing livestock grazing is to maintain residual cover of herbaceous vegetation to reduce predation during nesting and to maintain the integrity of riparian vegetation and other wetlands (BLM 2011, p. 14). Unfortunately, individual allotments are not assessed on a regular basis due to limitations in budget and staffing (cite), and therefore, permits can be renewed without a review of whether or not the allotment meets the necessary standards and guidelines. For example, In Nevada there are 550 grazing allotments managed by the BLM, but the BLM has only evaluated 36 percent of these to see if they meet land health standards. Of the 36 percent of allotments that have been evaluated in Nevada, only 45, or 23 percent, meet land health standards (BLM DEIS, p 472). Similarly, the BLM has evaluated 61 percent of the 155 grazing allotments that it manages in northeastern California, and 73 percent of these allotments meet land health standards (BLM DEIS, p. 470). BLM must consider many factors when establishing allotment restrictions, and sage-grouse habitat is not always considered if the allotment falls outside of PHMA. Therefore, not all allotments on BLM lands are managed for sage-grouse conservation.

NEED TO ADD INFORMATION ABOUT GRAZING ALLOTMENTS FROM THE NEW RMPS HERE- CONDITION STATS, AMOUNT IN AND OUT OF PHMA.

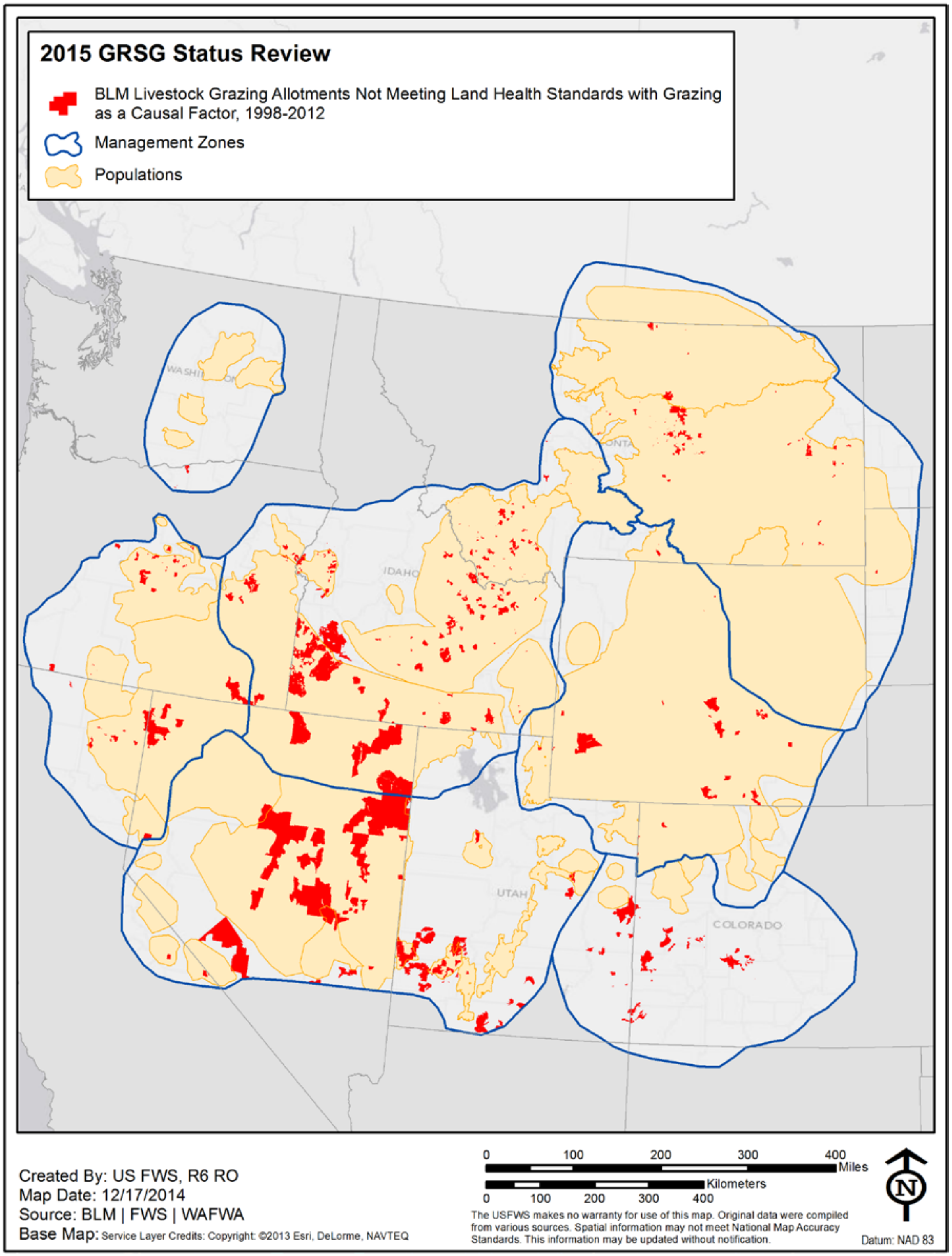

Figure X. BLM Livestock Grazing Allotments Not Meeting Land Health Standards with Grazing as a Causal Factor, 1998-2012

The relationships between livestock grazing and sage-grouse population levels are not well understood (Braun 1987, p. 137; Connelly and Braun 1997, p. 231), and there are no studies that directly evaluate the effects of livestock grazing on sage-grouse habitat (Boyd *et al.* 2014, p. 64). Impacts are often contextual relative to scale (i.e. localized severe impacts may not have larger population level impacts), and indirect impacts (e.g. increase in invasive plant species) are likely more problematic than direct impacts (e.g. nest trampling, food competition; Beck and Mitchell 2000, p. 997). Researchers have documented both positive and negative effects of livestock grazing on sage-grouse and their habitats (Beck and Mitchell 2000, p. 997; Davies *et al.* 2011; Pyke 2011, p. 537; Boyd *et al.* 2014; Chambers *et al.* 2014 pp. 369–370). Over the last 150 years, livestock have grazed nearly all sage-grouse habitats throughout the species range, confounding any evaluation of potential impacts, especially at the large landscape scales that are important to sage-grouse (Knick *et al*. 2011, p. 232). Poorly managed grazing will continue to degrade sagebrush habitats important to sage-grouse, but in many areas across the specie's range, well-managed grazing practices are compatible with sagebrush systems (Boyd *et al.* 2014, p. 60; Chambers *et al.* 2014, p. 369) and can improve habitat conditions for sage-grouse. None of the individual components discussed above (loss of cover, competition for food, etc.) have been demonstrated to have population level impacts to sage-grouse, although they have undoubtedly had localized effects. Range management treatments are the exception, where negative population responses have been recorded, although a range-wide impact has not been documented. Given the inconclusive nature of the scientific literature we cannot determine an overall impact of domestic livestock grazing on sage-grouse persistence. However, maintaining grazing activities compatible with local conditions on large landscapes may be preferable to the loss of those landscapes through habitat fragmentation caused by urbanization or other factors (Boyd *et al.* 2014, p. 67). We are also unable to determine if there is a change in the impact of grazing from our 2010 warranted determination.

Grazing by Wild Ungulates

Wild, native, ungulates (hoofed mammals), such as elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*), and pronghorn antelope (*Antilocapra americana*) share the sagebrush ecosystem with sage-grouse (Miller *et al*. 1994, p. 111) and feed on the same grasses, forbs, and shrubs (Kufeld 1973, p. 106–107; Kufeld *et al*. 1973 as cited in Wallmo and Regelin 1981, pp. 387–396 and 389–396; Allen *et al.* 1984, p. 1; Vallentine 1990, pp. 235, 236; Wambolt and Sherwood 1999, p. 225). Concentrated grazing by native ungulates may reduce vegetation available to sage-grouse for food and cover. Elk and deer may concentrate and overgraze near small-scale, supplemental feeding and watering stations (Doman and Rasmussen 1944, p. 319; Smith 2001, pp. 179–181). Additionally, native ungulates may graze heavily on sagebrush during the winter, when food is scarce, and overgrazing can kill sagebrush and reduce shrub cover in specific areas (Wambolt 1996, p. 502; Wambolt and Hoffman 2004, p. 195). However, unlike domestic livestock, wild, native ungulates roam freely, spreading potential impacts diffusely across the landscape or concentrating it in specific areas. Therefore, there is no evidence that grazing by native ungulates impacts sage-grouse population levels.

Projected Future impacts

Timescale for Projecting this THREAT

We have not identified any information indicating that either domestic livestock or wild ungulate grazing on public or private lands will cease in the future. While the intensity and species grazed will likely be fluid on a local scale, we cannot predict how these changes will impact sage-grouse at the population level or higher, if at all. Therefore, the time-scale for projecting this threat is that it will occur indefinitely into the future based on current information.

THREAT amelioration

Through the Conservation Efforts Database (CED), the Service collected information relating to conservation actions that were completed, in progress, or planned. Based on a summary report of that information created on XXXXXX, the following table indicate the number of actions and approximate areas for THREAT amelioration. These numbers are self-reported; the Service will further review and certify these actions if they are pivotal to any determination.

In 2010, NRCS launched SGI to voluntarily reduce threats facing sage-grouse on private lands. To date, SGI has assisted private landowners enhance rangeland health inside PACs by enrolling 2,437, 645 acres in grazing systems, re-vegetating 48,120 acres former rangeland with sagebrush and native perennial bunchgrasses, controlling invasives on 15,509 acres, and restoring 179 acres of wet meadow (NRCS 2015, p. 6). Of the over two million acres enrolled in grazing systems, 76 percent are clustered within five populations (MZ I: Powder River Basin, Yellowstone Watershed, and the Dakotas; MZ II: Wyoming Basin; MZ IV:Snake/Salmon/Beaverhead) (NRCS 2015, p. 7). In addition over 74 percent of the newly seeded acres are concentrated in five populations (MZ I: Dakotas, Yellowstone Watershed; MZ II: Northwest Colorado; MZ IV: Northern Great Basin, Box Elder) (NRCS 2015, p. 7).

Table 14-1: List of Conservation Efforts (ameliorating THREAT described in this chapter) by management zone

Management Zone	Type of Conservation Effort	Sum of Acres or Miles	Number of Actions	Notes
1				
2				
3				
4				

Management Zone	Type of Conservation Effort	Sum of Acres or Miles	Number of Actions	Notes
5				
6				
7				

THREAT Amelioration Summary

need to tie the summary back to the benefit of maintaining large landscapes, and good grazing = compatible. Summarize benefit to maintain large landscapes, and good grazing practices are compatible.

PLACEHOLDER FOR SYNERGISTIC THREATS – CHAMBERS ET AL. 2014 DESCRIBES HOW GRAZING INTERACTS WITH FIRE ALSO INVASIVES.