~~Chapter 1:~~ Agricultural Conversion

~~THREAT~~~~Historically, one of the main causes of sagebrush loss was conversion to cultivated land for grain and hay crops (Baker *et al*. 1976, p. 165).~~ Agricultural conversion changes sagebrush rangelands to tilled agricultural crops or re-seeded exotic grass pastures, ~~resulting in habitat loss and fragmentation for sage-grouse (U.S. Fish and Wildlife Service 2013, p. 48)~~and is . ~~Agricultural conversion of sagebrush is~~ an important cause of habitat loss and fragmentation for sage-grouse (Baker~~-~~ *et al*. 1976, p. 165; Braun 1998, p. 143; Schroeder *et al*. 2004, p. 363; Aldridge *et al*. 2008, p. 983; Schroeder and Vander Haegen 2011, p. 519; Wisdom *et al*. 2011, p. 462; U.S. Fish and Wildlife Service 2013, p. 48). Agricultural conversion ~~, and~~ was identified as one of the primary causes of habitat fragmentation leading to the specie's decline in 2010 (75 FR ???).~~ Throughout the historical range of sage-grouse, agriculture is the largest single category of landcover in areas not currently mapped in sagebrush, but likely to have contained sagebrush historically (Connelly *et al*. 2004, p. 5-8; Miller *et al*. 2011, p. 156). Agriculture is the dominant land cover within the historical range of the sage-grouse in Washington (42 percent) and Idaho (19 percent) (Miller *et al*. 2011, p. 156).~~ A total of more than 230,000 km² (88,780 mi²)—approximately 11 percent of the sage-grouse's historical range—was converted to agricultural lands (Knick ~~-~~*et al*. 2011, p. 208). Agricultural conversion is particularly notable in~~ the following sage-grouse Management Zones (MZ):~~the~~ Columbia Basin (MZ VI), Great Plains (MZ I), and Snake River Plain (MZ IV) (Connelly~~-~~ *et al*. 2004, p. 5-55; Knick ~~-~~*et al*. 2011, p. 209). ~~Approximately 11 percent of the species' historical range was converted to agricultural lands (Connelly *et al*. 2004, p. 1-4; Knick *et al*. 2011, pp. 205, 208).~~ Topography, soils, and climate historically limited agricultural development on the remaining sagebrush rangelands; however, recent economic advantages (e.g., crops for biofuels) and technological improvements (e.g., extended irrigation coverage and cultivation) now permit development on steeper terrain and areas further from floodplains (Knick~~-~~ *et al*. 2011, p. 208).

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Agricultural conversion changes sagebrush rangelands to tilled agricultural crops or re-seeded exotic grass pastures, resulting in habitat loss and fragmentation for sage-grouse (U.S. Fish and Wildlife Service 2013, p. 48). Agricultural conversion is especially likely for sagebrush habitat with deep, fertile soils and higher precipitation rates (Connelly *et al.* 2004, p. 1-1; Davies *et al.* 2011, p. 2575). Indirect effects from agricultural conversion may include increased exposure to predation, West Nile virus (WNv), pesticides, fences, and invasive plants (Connelly *et al.* 2004, p. 7-23; Braun 2006, p. 11; Walker 2008, p. 184; USFWS 2013, p. 42). Sage-grouse are more likely to be extirpated from areas containing greater than 25 percent cropland and less than 25 percent sagebrush (Aldridge *et al.* 2008, p. 983).

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THREAT Historically, one of the main causes of sagebrush loss was conversion to cultivated land for grain and hay crops (Baker *et al.* 1976, p. 165). Cultivation of sagebrush rangelands began in southwest Idaho in the 1840s and throughout the Great Basin, which includes portions of California, Nevada, Oregon, and Utah, in the 1850s–1860s (Knick *et al.* 2011, p. 207). Beginning in 1862, a series of Homestead Acts accelerated development in the western United States by giving public lands to private entities, with the requirement that settlers build homes and develop land for agriculture (Knick *et al.* 2011, p. 207). In Washington, cultivation began in the late 1800s; by 1920 more than 80 percent of sagebrush rangelands in southeastern Washington were under cultivation (Knick *et al.* 2011, p. 208). Prior to World War II, most sagebrush was removed by mechanical methods such as plowing, chaining, and disking; however, after the mid-1940s, herbicides—initially 2,4-D and later tebuthiuron—became important tools (Baker *et al.* 1976, p. 166; Braun 2006, p. 12).

Throughout the historical range of sage-grouse, agriculture is the largest single category of landcover in areas not currently mapped in sagebrush, but likely to have contained sagebrush historically

~~(Connelly *et al.* 2004, p. 5-8; Miller *et al.* 2011, p. 156). Agriculture is the dominant land cover within the historical range of the sage-grouse in Washington (42 percent) and Idaho (19 percent) (Miller *et al.* 2011, p. 156). A total of more than 230,000 km² (88,780 mi²) – approximately 11 percent of the sage-grouse's historical range – was converted to agricultural lands (Knick *et al.* 2011, p. 208). Lands previously converted to agriculture continue to impact sage-grouse through habitat loss and fragmentation. Furthermore, additional conversion of sagebrush to agricultural land continues (Range-wide Interagency Sage-Grouse Conservation Team 2012, p. 7). Topography, soils, and climate historically limited agricultural conversion on approximately 90 percent of lands dominated by sagebrush; however, recent economic advantages (e.g., crops for biofuels) and technological improvements (e.g., extended irrigation coverage and cultivation) now permit conversion on steeper terrain and further from floodplains (Knick *et al.* 2011, p. 208). Irrigation canals cover an additional 991 km² (383 mi²); approximately 0.1 percent of the land area within the current range of the species (Knick *et al.* 2011, p. 209). In addition, the creation of reservoirs for irrigation, hydroelectric power, flood control, and other purposes has likely inundated some riparian habitat used during brood-rearing (Braun 1998, p. 144) and may attract predators.~~

~~***CURRENT IMPACTS***~~

~~**Mechanism**~~

~~Agricultural conversion eliminates sagebrush habitat through the removal of sagebrush and the subsequent cultivation of various crops. Sage-grouse~~ Agricultural conversion eliminates sagebrush habitat~~,~~ and the percentage of land in agriculture is almost three-fold higher in extirpated sage-grouse range than in occupied habitat (Wisdom *et al*. 2011, p. 462). S~~depend on sagebrush habitats, especially for nesting, early brood-rearing, and wintering habitats (Girard 1937, p. 7). Sage-grouse avoid cultivated cropland when selecting nesting and brood-rearing habitat (Aldridge and Boyce 2007, pp. 508 and 523). In winter, sage-grouse require sagebrush for both cover and food (Connelly *et al.* 2004, p. 7-44; Doherty 2008, p. 22). S~~age-grouse are more likely to be extirpated from areas containing greater than 25 percent

Comment [acn2]: This doesn't really describe mechanism for impacts to me mechanism = habitat loss and fragmentation, increased infrastructure, roads, etc = more fragmentation, Increased predation from fences, predator subsized, etc..

cropland and less than 25 percent sagebrush (Aldridge- *et al*. 2008, p. 983). In the western portion of the species' historical range (California, Idaho, Nevada, Oregon, Utah, and Washington), leks are more common in areas with less than 10 percent agricultural land cover within a 5 9m (3 mi) radius (Knick et al. 2013, p 1544). While sage-grouse will forage on some agricultural crops (e.g. alfalfa; Patterson 1952, p. ?) they avoid cultivated cropland when selecting nesting and brood-rearing habitat (Aldridge and Boyce 2007, pp. 508 and 523).

Several studies have documented population level impacts to sage-grouse as a result of the loss of habitat and fragmentation due to agricultural conversion. In Idaho, decline in the number of males per lek from 1975–1992 was strongly correlated with a 74 percent increase in the amount of land converted to agriculture (Leonard *et al*. 2000, p. 268), and lek persistence in Wyoming was negatively associated with the proportion of nearby lands in tilled agriculture (6.4 km [4 mi]; Walker *et al*. 2007, p. 2650). In Wyoming, Montana, and Colorado, a conversion of 16 percent or more of lands dominated by sagebrush through plowing or spraying herbicide correlated with a 50–100 percent reduction in the number of male sage-grouse occupying leks (Swenson *et al*. 1987, p. 129). C~~In Montana, c~~onversion of 30 percent of winter habitat to agriculture in Montana resulted in a 73 percent decline in the number of male sage-grouse occupying leks (Swenson *et al*. 1987, p. 130). In Montana, North and South Dakota and Canada (MZ I) lek activity and size were negatively correlated with increasing proportions of agricultural tillage (Smith *et al*. 2005, p. 314; Tack 2009, p. iii). Similar results were documented in a range-wide study (Johnson et al. 2011, p. 407). Lek-count declines begin when the proportion of sagebrush converted to agriculture is 1.5–2.5 percent of the landscape; substantial declines in lek counts may occur when this proportion exceeds 16 percent; and sage-grouse populations may be extirpated when the proportion exceeds 25–27 percent (Manier *et al*. 2013, p. 30).

Comment [AB3]:

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Conversion of sagebrush into ~~A~~agricultural production ~~conversion~~ also fragments ~~remaining sagebrush~~sage-grouse habitat~~. Habitat fragmentation due to agricultural conversion occurs throughout the species' range, wherever there is an abundance of cultivated land associated with remnant sagebrush rangeland~~ (Connelly~~ et al~~. 2004, p. 7-23; Davies~~ et al~~. 2011, p. 2575; Range-wide Interagency Sage-grouse Conservation Team 2012, p. 7; Knick~~ et al~~. 2013, p. 1~~1~~547; USFWS 2013, p. 48). Fragmentation from agricultural activities influences approximately 49 percent of remaining sagebrush habitat and 84 percent of priority habitats throughout the species' range (Connelly *et al*. 2004, pp. 1-1 and 7-23; Manier *et al*. 2013, p. 30). Agricultural fragmentation precludes sage-grouse movements to traditional seasonal habitats and other landscape movements.~~ For example, agricultural conversion o~~Over the past 30–100 years along the Milk River ~~in northern Montana~~ Aagriculture was~~is~~ ~~likely~~ the largest barrier to sage-grouse migration in the Northern Montana population (Great Plains MZ 1) over the past 30–100 years along the Milk River ~~and a significant contributor to population decline (Bush *et al*. 2011, p. 537). In Washington (MZ VI), sage-grouse are now restricted to two ~~have been reduced to~~isolated ~~two~~ populations, primarily due to the conversion of sagebrush rangeland to cropland (Schroeder and Vander Haegen 2006, pp. 7–8). ~~:~~

In southern Idaho, habitat conversion to croplands and other agricultural practices along the Snake River now precludes sage-grouse movement between populations north and south of the Snake River (Knick and Connelly 2011, p. 211), potentially affecting genetic exchange and adaptions that allow the species to persist in both of the associated ecological conditions. The extent of agricultural disturbance necessary to result in complete loss of movement (such as in the Snake River plain) is not known. Sufficient sagebrush habitats have been retained in the agricultural areas of the Great Plains (MZ I) to support sage-grouse (Knick and Connelly 2011, p. 211), but effects on connectivity within those areas has not been described. ~~In addition to the direct loss of sagebrush habitat due to agricultural conversion, agriculture influences approximately 49 percent of remaining sagebrush habitat and 84 percent of priority habitats throughout the species' range by fragmenting remaining habitat and~~

~~facilitating the movement of predators (Connelly *et al.* 2004, pp. 1-1 and 7-23; Manier *et al.* 2013, p. 30).~~

~~This population is unique because some individuals undertake the longest migratory event observed for the species—more than 120 km (75 mi) one-way—from south-central Saskatchewan and northern Montana during spring and summer to south of the Milk River in Montana for wintering habitat (Tack *et al.* 2012, pp. 65–66, Smith 2013, p. 12). Migratory corridors and winter habitat may be at risk if conversion to agricultural lands continues along the Milk River (Tack *et al.* 2012, p. 67).~~

Sage-grouse may use irrigated croplands, pasture, and Conservation Reserve Program (CRP) lands, particularly during the late brood-rearing period when native plants have matured and dried, but irrigated agricultural lands remain green (Schroder *et al.* 1999, p. 4; Connelly *et al.* 2004, pp. 4-1 and 4-10; Knick *et al.* 2011, p. 211,). Dryland cereal grains are generally not beneficial habitat as they not irrigated and therefore do not provide succulent forb or insect food resources (Swensen et al. 1987, p. ?; Blus et al. 1989, p. ?). However, the value of irrigated croplands to late-summer broods depends on the type of vegetation and the juxtaposition of the modified habitat in relation to adjacent sagebrush habitat (Swensen et al. 1987, p. ?; Blus et al. 1989, p. ?; Connelly *et al.* 2004, p. 4-18). The use of irrigated cropland and pasture may not be beneficial to sage-grouse if it increases exposure to pesticides (Blus *et al.* 1989, pp. 1141–1142), West Nile virus (Walker 2008, p. 184), predation (Connelly *et al.* 2004, p. 7-23), or increases mortality caused by collision with fences (Braun 1998, p. 145; Braun 2006, p. 11). Additionally, disturbance from tillage likely reduces the availability of nesting sites (Holloran et al. 2005, p. ?), and in at least one study nesting sage-grouse and broods avoided areas close to cultivated cropland (Aldridge and Boyce 2007, p. 508).

Irrigation canals necessary for agricultural activities cover 991 km² (383 mi²); approximately 0.1 percent of the land area within the current range of the species (Knick *et al.* 2011, p. 209). Although the footprint is small, irrigation ~~diversion of water from riparian areas~~ may have

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Comment [DMD5]: Need to include additional citations when you are making the distinction between irrigated cropland and other crops. For example, sage-grouse will occasionally use agricultural lands in late summer as late brood-rearing habitat but row crops and dryland cereal grains are generally not beneficial habitat (Swensen et al. 1987, Blus et al. 1989).

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significant negative impacts on broods through canal ~~-~~diversion of water from riparian areas. Additionally, ~~Alternatively, the creation of~~ reservoirs may ~~for irrigation has likely~~ potentially ~~inundat~~inundate ~~ed~~ some riparian habitat ~~used during brood-rearing~~ (Braun 1998, p. 144), ~~and~~ increase ~~may~~ attraction of predators (Donnelly NRCS pub), as well as creating a potential for impacts from West Nile virus (see Disease chapter). ~~**Results of Impact**~~

~~Sage-grouse require large intact areas of sagebrush. The percentage of land in agriculture is almost three-fold higher in extirpated sage-grouse range than in occupied habitat (Wisdom *et al.* 2011, p. 462). In the western portion of the species' historical range (California, Idaho, Nevada, Oregon, Utah, and Washington), less than 2 percent of all leks have more than 25 percent agriculture within a 5-km (3-mi) radius, and 93 percent of all leks have less than 10 percent agriculture within a 5-km (3-mi) radius (Knick *et al.* 2013, p. 6). We expect that agricultural conversion results in similar effects elsewhere in the species' range. Agricultural conversion of sagebrush is especially notable in habitat with deep, fertile soils and higher precipitation rates (Connelly *et al.* 2004, p. 1-1). This loss eliminates the most productive sagebrush rangelands as habitat for the sage-grouse and marginalizes the species onto less productive sagebrush habitat (Manier *et al.* 2013, p. 1). For example, in the Columbia Basin (MZ 6), approximately 75 percent of sagebrush rangelands occurring on deep, loamy soils are converted to agriculture, but only 15 percent are converted on shallow soils (Connelly *et al.* 2004, p. 7-23).~~

~~Several studies assess the impacts to sage-grouse from agricultural conversion:~~

~~In Idaho, decline in the number of males per lek from 1975–1992 was strongly correlated with a 74 percent increase in the amount of land converted to agriculture (Leonard *et al.* 2000, p. 268);~~

~~In Wyoming, the proportion of sagebrush habitat (positive effect) and the proportion of tilled agriculture (negative effect) within 6.4 km (4 mi) was correlated with lek persistence (Walker *et al.* 2007, p. 2650)~~~~In Wyoming, Montana, and Colorado, eliminating 16 percent or more of lands dominated by~~

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~~sagebrush through plowing or spraying herbicide correlated with a 50–100 percent reduction in the number of male sage-grouse occupying leks (Swenson *et al.* 1987, p. 129);~~

~~;~~

~~In North Dakota, the percentage of cultivated land within 4 km (2.5 mi) of active leks was lower than around inactive leks, and the proportion of cultivated land was greater within a region of historically occupied, but currently not occupied habitat, compared to a region where the species still occurred (Smith *et al.* 2005, p. 314)~~In summary, lek-count declines may begin when the proportion of sagebrush converted to agriculture is 1.5–2.5 percent of the landscape; substantial declines in lek counts may occur when this proportion exceeds 16 percent; and sage-grouse populations may be extirpated when the proportion exceeds 25–27 percent (Manier *et al.* 2013, p. 30).

~~;~~

~~In Wyoming, Montana, and Colorado, eliminating 16 percent or more of lands dominated by sagebrush through plowing or spraying herbicide correlated with a 50–100 percent reduction in the number of male sage-grouse occupying leks (Swenson *et al.* 1987, p. 129);~~

~~In Montana, conversion of 30 percent of winter habitat to agriculture in a 200 km² (74 mi²) area resulted in a 73 percent decline in the number of male sage-grouse occupying leks (Swenson *et al.* 1987, p. 130);~~

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~~In Washington, sage-grouse have been reduced to two populations, primarily due to the conversion of sagebrush rangeland to cropland (Schroeder and Vander Haegen 2006, pp. 7–8);~~

~~In Montana, North Dakota, South Dakota, and Canada, the probability of active lek occurrence decreased with increasing proportions of agricultural tillage. Large leks were 4.5 times less likely to occur than small leks when agricultural tillage fragmented 21% of landscapes within 1 km (0.6 mi) of leks (Tack 2009, p. iii);~~

~~In Canada, nesting sage-grouse and broods avoided areas close to cultivated cropland (Aldridge and Boyce 2007, p. 508); and~~

~~Rangewide, few leks occurred in areas where the proportion of agricultural land exceeded 50 percent (Johnson *et al.* 2011, p. 407);~~

~~In summary, lek-count declines may begin when the proportion of sagebrush converted to agriculture is 1.5–2.5 percent of the landscape; substantial declines in lek counts may occur when this proportion exceeds 16 percent; and sage-grouse populations may be extirpated when the proportion exceeds 25–27 percent (Manier *et al.* 2013, p. 30).~~

~~Sage-grouse may use human-modified habitats such as irrigated croplands, pasture, and Conservation Reserve Program (CRP) lands, particularly during the late brood-rearing period when native plants have matured and dried, but agricultural lands remain green (Connelly *et al.* 2004, pp. 4-1 and 4-10; Knick *et al.* 2011, p. 211). However, the value of these modified habitats depends on the type of vegetation and the juxtaposition of the modified habitat in relation to adjacent sagebrush habitat (Swensen et al. 1987, p. ?; Blus et al. 1989, p. ?; Connelly *et al.* 2004, p. 4-18). The use of irrigated cropland and pasture may not be beneficial to sage-grouse if it increases exposure to pesticides (Blus *et al.* 1989, pp. 1141–1142), WNv (Walker 2008, p. 184), or predation (Connelly *et al.* 2004, p. 7-23), or increases mortality caused by collision with fences (Braun 1998, p. 145; Braun 2006, p. 11).~~

Location and Extent

Agricultural conversion has occurred across the specie~~'~~s' range, but the intensity ~~The extent of agricultural conversion is broad in scope, but the intensity of impacts~~ varies between populations (Figure X-1). ~~).~~ The primary agricultural regions within historical sagebrush habitat occur in the Columbia Basin (MZ VI; 32 percent of total area) and the Great Plains (MZ I; 19 percent of total area) (Knick *et al.* 2011, p. 209). Portions of the Snake River Plain (MZ IV~~);~~ 25 percent of Idaho; 10 percent throughout the MZ)

are also heavily affected by agricultural conversion (Connelly- *et al*. 2004, p. 5-55; Knick *et al*. 2011, p. 209). The remaining management zones (Wyoming Basin, Southern Great Basin, Northern Great Basin, and Colorado Plateau; MZs II, III, V, and VII respectively) have less than 5 percent of the land in agriculture (Knick- *et al*. 2011, p. 209; Table X-1).

~~).~~. ~~The U.S. Fish and Wildlife Service (Service) drafted a collaborative report on conservation objectives for the sage-grouse with representatives from 10 states within the current range of the species (U.S. Fish and Wildlife Service 2013, p. ii). This effort is referred to as the Conservation Objectives Team (COT) Report. The following map illustrates the COT report's conclusions regarding the current [redacted] to sage-grouse from agricultural conversion. The Bi-State populations (MZ VIII) are included on maps for representation, but impacts to the Bi-State Distinct Population Segment are not addressed in this analysis.~~

Figure X-~~2~~1. ~~Impacts~~ Assessment of impacts to sage-grouse from agricultural conversion (Knick *et al*. 2011, p. 209; Manier *et al*. 2013, p. 158; U.S. Fish and Wildlife Service 2013, pp. 16–29). ~~The Bi-State populations (MZ VIII) are included on maps for representation, but impacts to the Bi-State Distinct Population Segment are not addressed in this analysis.~~

~~-~~[this map will be swapped out for a new map when available]

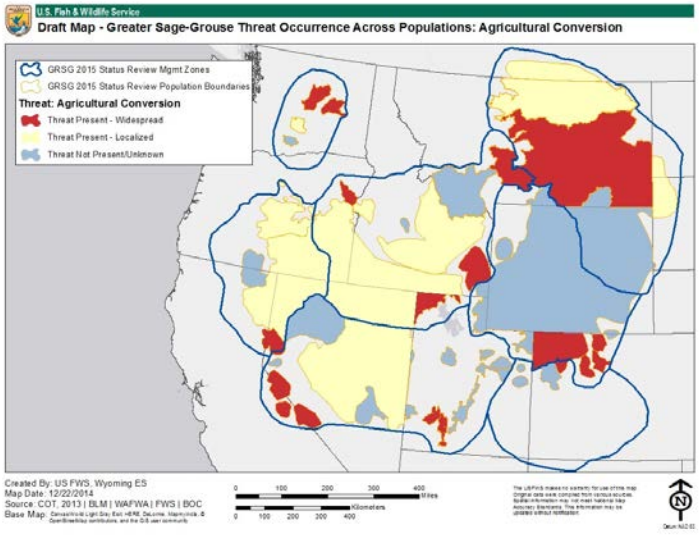

Table X-1: Literature summary of impacts to sage-grouse from agricultural conversion by Management Zone.

Management Zone	Immediacy	Severity[1]	Current Extent of MZ[2]	Notes
Great Plains (MZ I)	Imminent	Moderate	19%/91%	Local impacts in 2/4 populations; widespread impacts in 1/4
Wyoming Basin (MZ II)	Imminent	Minor	4%/70%	Widespread impacts in 4/9 populations
Southern Great Basin (MZ III)	Imminent	Minor	2%/62%	Local impacts in 1/12 populations; widespread impacts in 2/12
Snake River Plain (MZ 4)	Imminent	Moderate	10%/84%	Local impacts in 3/9 populations; widespread impacts in 4/9

[1] Impacts from agricultural conversion are documented at the population level as described in the Notes column.
[2] First percentage is the direct footprint; the second percentage addresses potential indirect effects based on a 6.9 km (4.3 mi) foraging distance for avian predators

Northern Great Basin (MZ 5)	Imminent	Minor	4%/65%	Local impacts in 2/4 populations; widespread impacts in 1/4
Columbia Basin (MZ 6)	Imminent	Moderate	32%/90%	Local impacts in 1/4 populations; widespread impacts in 2/4
Colorado Plateau (MZ 7)	Imminent	Minor	5%/81%	Widespread impacts in 1/2 populations

Agricultural conversion of sagebrush is especially notable in habitat with deep, fertile soils and higher precipitation rates (Connelly *et al*. 2004, p. 1-1; Davies *et al*. 2011, p. 2575). This loss has eliminated the most productive sagebrush rangelands as habitat for the sage-grouse and has marginalized the species onto less productive sagebrush habitat (Manier *et al*. 2013, p. 1). For example, in the Columbia Basin (MZ 6), approximately 75 percent of sagebrush rangelands that occurred~~ing~~ on deep, loamy soils have been~~are~~ converted to agriculture, but only 15 percent have been~~are~~ converted on shallow soils (Connelly *et al*. 2004, p. 7-23). The rate of conversion of sagebrush to agriculture will likely slow as the most productive lands have already been converted (Baker *et al*. 1976, p. 167). New cropland totals within occupied sage-grouse range have decreased for every state except South Dakota since 1982 (U.S. Department of Agriculture 2013, p. 4), likely reflecting, in part, decreasing land suitability for crop production.

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Future Impacts

We were able to develop a model examining the exposure of sage-grouse populations to continued conversion of sagebrush for agricultural purposes based on the capability of soils within the specie~~'~~s' range to support agricultural crops that are currently economically viable (Smith in review). This model allows us to examine the potential for agricultural conversion to continue affecting sage-grouse into the future. ADD A BRIEF DESCRIPTION OF THE MODEL HERE – FROM KEVIN.

PLACEHOLDER FOR MAP OF POPULATION DENSITY AND MAP OF POTENTIAL

The results of this model suggest that future impacts from agricultural conversion are unlikely to have significant impacts on the remaining occupied range of sage-grouse. However, ~~-~~the model considered soil types that are capable of supporting currently economically viable crops. There is a potential that ~~Sagebrush habitat that has already been converted to agriculture will continue to impact sage-grouse in the future through long-term or permanent habitat loss and fragmentation. Additional sagebrush habitat loss and fragmentation from future agricultural conversion also is likely (Knick *et al.* 2013, p. 11). Habitat characteristics such as topography, soils, and climate that historically limited agricultural development on approximately 90 percent of lands dominated by sagebrush no longer present such a barrier to development due to recent~~ economic changes and technological improvements (Knick *et al.* 2011, p. 208) could increase the likelihood of conversion of sagebrush on poor soils. Agricultural lands are typically associated with private or Tribal ownership (Stiver *et al.* 2006, Appendix C-2, pp. 11–13), and those lands have the greatest potential for additional conversion should economic incentives be sufficient. ~~If agricultural activities are ongoing on the landscape and there is an abundance of private lands, the likelihood of further conversion is increased.~~Restrictions proposed on BLM and FS lands will likely restrict any intentional conversion of these lands to seeded pastures.

The model results conflict with previous reports expressing concerns with continuing ~~-~~habitat loss and fragmentation from agricultural conversion (Range- wide Interagency Sage-Grouse Conservation

Team 2012, p. 7; FWS 2013, pp. 16-29). However, this is the first quantitative model we are aware of that examines future agricultural capability (albeit using a relative simple metric). There is no doubt that agricultural conversion played a significant role in shaping the current sage-grouse landscape, resulting in habitat loss and loss of population connectivity, and there are lingering indirect effects (e.g. fragmentation, predators). However, based on the above model results we ~~are~~ do not believe that new areas of conversion will have significant impacts on sage-grouse distribution in the future.

THREAT AMELIORATION

~~Federal and State programs that encourage landowners to conserve or restore sagebrush habitat can benefit sage-grouse. The following programs most commonly benefit the species:~~

The voluntary Conservation Reserve Program (CRP; ~~was~~ authorized in 1985)~~. It is a voluntary program administered by the Farm Service Agency that~~ allows private landowners to receive annual payments in exchange for establishing permanent vegetation on idle or erodible lands that were previously used for growing crops. ~~The purpose of the CRP is to control soil erosion, improve water retention, and provide wildlife habitat.~~ Enrolled lands are set aside for 10–15 years and cannot be grazed except under emergency drought conditions. The enrollment of CRP lands can be detrimental to sage-grouse when sagebrush rangelands are converted to marginal croplands then subsequently converted to grasslands (U.S. Fish and Wildlife Service 2013, p. 48). Conversely, depending on the type of vegetation established and proximity to sagebrush, CRP lands can provide nesting, brood-rearing, and wintering habitat for sage-grouse (Schroeder and Vander Haegen 2006, p. 32; Schroeder and Vander Haegen 2011, pp. 524–528). ~~CRP lands can also benefit the species, as described in the following section. However, the duration of enrollment may limit long-term benefits, unless the land remains retired from cultivation.~~ Enrollment in the CRP has benefited sage-grouse, especially in the Columbia Basin (MZ VI) and Great Plains (MZ I; Knick *et al*. 2011, p. 208). The CRP is currently the largest effort to restore sage-grouse

habitat in the Columbia River Basin (MZ VI), with approximately 109,480 ha (270,322 ac) of former agricultural lands enrolled in CRP in occupied habitat (Stinson 2014, p. 16). The proportion of sage-grouse nests in CRP lands in Washington State increased from 31 percent in 1992–1994 to 50 percent in 1995–1997 (Schroeder and Vander Haegen 2006, p. 4). This increase appeared to be associated with maturation of CRP lands, characterized by increased height and cover of perennial grasses and invasion by sagebrush. Nesting success in CRP lands was comparable to nesting success in native sagebrush (Schroeder and Vander Haegen 2011, p. 525). The sage-grouse population in north-central Washington, an area with abundant CRP lands, was the only population in Washington with increasing population trends (Schroeder and Vander Haegen 2006, p. 6; Schroeder and Vander Haegen 2011, p. 528).

After enrollment in CRP expires (10 to 15 years), landowners may re-enroll lands or convert the land to some other use. Federal funding and economics related to crop prices can affect enrollment, and the long-term effectiveness of the CRP is uncertain. However, in Washington, lands have frequently remained enrolled since the late 1980s—long enough to allow for reestablishment of sagebrush and use by sage-grouse for nesting habitat (Schroeder and Vander Haegen 2011, p. 524). Other areas with abundant CRP lands (northern Utah, southeast Idaho, western Colorado, and eastern Montana) have not been similarly examined (Schroeder and Vander Haegen 2011, p. 529).

The Environmental Quality Incentives Program (EQIP) ~~is~~ a voluntary NRCS program ~~administered by the Natural Resources Conservation Service (NRCS). It~~ provides financial and technical assistance to agricultural producers through 10 year contracts that plan and implement conservation practices. The NRCS is using this program to fund their Sage-grouse Initiative (SGI) and assist producers in improving habitat for sage-grouse (see discussion under Conservation Efforts chapter). Some of the conservation practices in the SGI address farming practices such as conservation crop rotation, critical

area planting on erodible soils, and pasture/hayland planting of forage species compatible with sage-grouse (U.S. Fish and Wildlife 2010, pp. 20–21).

Conservation easements allow private landowners to enter into a voluntary agreement with a land trust (e.g., The Nature Conservancy), the NRCS, or other organizations or agencies that maintain the land in private ownership with development restrictions that are typically permanent. Conservation easements can permanently protect sagebrush habitat from conversion to cropland or subdivision while providing compensation to landowners. The NRCS estimates that since the SGI ~~Sage Grouse Initiative~~ was begun in 2010, 183,013 ha (451,884 ac) have been enrolled in conservation easements in the sage-grouse range (~~Natural Resources Conservation Service~~ 2015, p. 6). Unfortunately many of these easements have occurred in areas with low risk of sage-grouse population exposure to agricultural conversion (Doherty, unpublished data). Highly productive riparian habitats, which are typically privately-owned, are critical to the survival of sage-grouse chicks (Copeland- *et al*. 2013, p. 12). Conserving relatively small parcels of private lands along streams and wet meadows via conservation easements may have a disproportionately large beneficial impact on surrounding ~~sagebrush~~ uplands (Donnelly NRCS paper).

Comment [DMD9]: In 2010, NRCS launched SGI to voluntarily reduce threats facing sage-grouse on private lands. To date 1,129 ranches in 11 western states have participated in SGI, conserving over 4.4 million acres of sage-grouse habitat (NRCS 2015, p. 1).

The number of acres enrolled in conservation easements has increased eighteen-fold under SGI, reducing the threat of urban development and agricultural conversion. Of the 451,884 acres enrolled in easements, over 80 percent occur in occupied habitats and 94 percent provide permanent protection (NRCS 2015, p. 1). Of the over 450,000 acre, 72 percent are targeted to four populations at risk of urbanization (MZ II: Wyoming Basin and Northwest Colorado; MZ IV: Snake/Salmon/Beaverhead) or agricultural conversion (MZ I: Northern Montana) (NRCS 2015, p. 7). In Montana, conservation easements help maintain the longest known sage-grouse migration (e.g., Tack et al. 2012, entire) by reducing the threat of agriculture by one third (NRCS 2015, p. 1). In the Great Basin, where more than 80 percent of brood-rearing habitat is privately owned, easements help conserve these habitats (NRCS 2015, p. 1).

The Farm Bill of 2014 "Sodsaver" provision may directly affect future conversion of sagebrush rangelands to tilled crops in portions of MZ I (Montana, North Dakota, and South Dakota). ~~The Bill includes a policy provision known as "Sodsaver."~~ This provision reduces the Federal crop insurance subsidy available to landowners on any lands they convert to cropland (NRCS 2015, p. 14). This reduces the incentive to convert native rangelands to tilled crops. Unfortunately we have no information on the on-the-ground application of this provision, nor of any benefit to sage-grouse. ~~We address regulatory mechanisms directed at sage-grouse conservation in detail in other chapters.~~

~~Candidate Conservation Agreements (CCAs) and~~ Candidate Conservation Agreements with Assurances (CCAAs) ~~Other voluntary Federal programs~~ entered into~~administered~~ by the Service, a non-

Federal landowner, and potentially other parties, ~~also~~ can also conserve sage-grouse ~~provide~~ habitat for sage-grouse. Similarly, Candidate Conservation Agreements (CCAs) serve a similar purpose, but can be entered into by Federal agencies. ~~Candidate Conservation Agreements (CCAs) between the Service and Federal or private landowners can be used to conserve and restore wildlife habitat. Candidate Conservation Agreements with Assurances (CCAAs) provide assurances to private landowners that if agreed upon conservation measures are undertaken by the landowner, no further requirements will be made of the landowner if, in the future, the species is listed under the Endangered Species Act.~~

O~~NUMBER The CCAs and~~ver 2 million acres of sage-grouse occupied range ~~CCAAs have been developed~~are currently enrolled in 10 sage-grouse CCAAs and over 600,000 acres are currently enrolled in 3 CCAs ~~for sage-grouse~~ (see discussion under ~~Regulatory Mechanisms~~ Conservation Efforts chapter). Lands currently enrolled in GRSG CCAAs and CCAs include restrictions on agricultural conversion, habitat fragmentation, and removing sagebrush. ~~Most often focus on ranching/grazing management practices, but others address ; however, they can also include farm operations as a covered activity (e.g., CCAA for West Central Planning Area of Idaho, proposed CCAA for five Soil and Water Conservation Districts in Oregon).~~ State programs such as State Acres for Wildlife Enhancement (SAFE) may also support sagebrush rangelands if sagebrush conservation is encouraged. The success of these efforts will be enhanced if they are located in areas where sage-grouse populations are at a higher risk of exposure to agricultural conversion.

The following table (Table X-2, Figure X-?) summarizes conservation actions addressing agricultural conversion as collected rough the Conservation Efforts Database (CED). ~~, we collected information relating to conservation actions for the sage-grouse that are completed, in progress, or planned. The following table lists conservation efforts described in the CED, or provided by Service Field Offices, that address impacts from agricultural conversion. Please note that the amount of lands conserved may not be additive for all stressors. For example, conservation easements can protect from both agricultural conversion and exurban development. However, the same lands are being~~

Comment [DP10]: need to get from Angela

Comment [AB11]: These numbers will likely need to be updated, as enrollment is frequently changing.

Comment [acn12]: Should refer reader to CCAA main discussion section.

Comment [DP13]: text added

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~~protected.~~NEED TO ADD A STATEMENT REGARDING THE EFFICACY OF THESE EFFORTS ONCE THEY ARE DISPLAYED SPATIALLY AND COMPARED TO THE POPULATION RISK EXPOSURE MAP.

Table 8-1: List of conservation efforts addressing agricultural conversion

Management Zone	Type of Conservation Effort	Lands Conserved	Number of Actions	Citation
Great Plains (MZ I)	Conservation Easements	26,682 ha/65,881 ac	multiple	NRCS (2015)
Wyoming Basin (MZ II)	Conservation Easements	95,260 ha/235,210 ac	multiple	NRCS (2015)
Southern Great Basin (MZ III)	Conservation Easements	4,532 ha/11,191 ac	multiple	NRCS (2015)
Snake River Plain (MZ IV)	Conservation Easements	39,758 ha/98,167 ac	multiple	NRCS (2015)
Northern Great Basin (MZ V)	Conservation Easements	11,693 ha/28,871 ac	multiple	NRCS (2015)
Columbia Basin (MZ VI)	Conservation Easements	1,769 ha/4,369 ac	multiple	NRCS (2015)
	CRP lands	109,480 ha/270,322 ac	multiple	Stinson (2014)
Colorado Plateau (MZ VII)	Conservation Easements	3,318 ha/8,193 ac	multiple	NRCS (2015)

Comment [DMD14]: Are we able to quantify this?

Management Zone	Type of Conservation Effort	Lands Conserved	Number of Actions	Citation
Bi-State (MZ 8)				Not evaluated

Figure X-?: The following map shows the lLocation of known conservation programs throughout the sage-grouse range.

[INSERT MAP WHEN AVAILABLE – maybe a bi-panel showing area of high risk for conversion?]

Agricultural lands are typically associated with private or Tribal ownership (Stiver *et al.* 2006, Appendix C-2, pp. 11–13). The primary agricultural regions within historical sagebrush habitat occur in the Columbia Basin (MZ VI;32 percent of total area) and the Great Plains (MZ I;19 percent of total area) (Knick *et al.* 2011, p. 209). Portions of the Snake River Plain (MZ IV);25 percent of Idaho; 10 percent throughout the MZ) are also heavily affected by agricultural conversion (Connelly *et al.* 2004, p. 5-55; Knick *et al.* 2011, p. 209). The remaining management zones (Wyoming Basin, Southern Great Basin, Northern Great Basin, and Colorado Plateau; MZs II, III, V, and VII respectively) have less than 5 percent of the land in agriculture (Knick *et al.* 2011, p. 209). In addition to the direct loss of sagebrush habitat due to agricultural conversion, agriculture influences approximately 49 percent of remaining sagebrush habitat and 84 percent of priority habitats throughout the species' range by fragmenting remaining habitat and facilitating the movement of predators (Connelly *et al.* 2004, pp. 1-1 and 7-23; Manier *et al.* 2013, p. 30).

The following table summarizes recent conclusions regarding impacts to sage-grouse from agricultural conversion (Knick *et al.* 2011, p. 209; Manier *et al.* 2013, p. 158; U.S. Fish and Wildlife Service 2013, pp. 16–29). In the column describing extent of management zone impacted, we distinguish between direct impacts caused by habitat loss and the potential extent of indirect effects caused by an associated increase in avian predation.

Comment [DMD15]: A 6.9 km buffer was used to calculate indirect effects – do we need to recalculate the indirect footprint based on SLT recommendations for AOI?

Table 8-1: Impacts to sage-grouse

Management Zone	Immediacy	Severity[3]	Current Extent of MZ[4]	Notes
Great Plains (MZ I)	Imminent	Moderate	19%/91%	Local impacts in 2/4 populations; widespread impacts in 1/4
Wyoming Basin (MZ II)	Imminent	Minor	4%/70%	Widespread impacts in 4/9 populations
Southern Great Basin (MZ III)	Imminent	Minor	2%/62%	Local impacts in 1/12 populations; widespread impacts in 2/12
Snake River Plain (MZ 4)	Imminent	Moderate	10%/84%	Local impacts in 3/9 populations; widespread impacts in 4/9
Northern Great Basin (MZ 5)	Imminent	Minor	4%/65%	Local impacts in 2/4 populations; widespread impacts in 1/4
Columbia Basin	Imminent	Moderate	32%/90%	Local impacts in 1/4 populations; widespread impacts in 2/4

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[3] Impacts from agricultural conversion are documented at the population level as described in the Notes column.

[4] First percentage is the direct footprint; the second percentage addresses potential indirect effects based on a 6.9 km (4.3 mi) foraging distance for avian predators

(MZ 6)				
Colorado Plateau (MZ 7)	Imminent	Minor	5%/81%	Widespread impacts in 1/2 populations
Bi-State (MZ 8)				Not evaluated

PROJECTED FUTURE IMPACTS

Timescale for projecting impacts from agricultural conversion

Habitat loss and fragmentation due to agricultural conversion will continue as long as it remains economically viable. We cannot define an exact time-frame as future agricultural economics and technologic advances that may permit successful agricultural production in currently unsuitable areas are unknown. Therefore, we have to conclude that additional habitat loss and fragmentation due to future agricultural conversion may continue indefinitely.

Comment [DMD16]: But what about conversion/enrollment to CRP?

Comment [DP17]: comment not addressed in text – could use the CRP enrollment time frame but may be a moot point with the inclusion of the population risk model.

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Habitat loss and fragmentation due to agricultural conversion that already occurred within the range of sage-grouse will continue indefinitely. Additional habitat loss and fragmentation due to future agricultural conversion is likely for some populations and will also continue indefinitely (see following section).

Likelihood of Future Impacts

Sagebrush habitat that has already been converted to agriculture will continue to impact sage-grouse in the future through long-term or permanent habitat loss and fragmentation. Additional sagebrush

habitat loss and fragmentation from future agricultural conversion also is likely (Knick *et al.* 2013, p. 11). Habitat characteristics such as topography, soils, and climate that historically limited agricultural development on approximately 90 percent of lands dominated by sagebrush no longer present such a barrier to development due to recent economic changes and technological improvements (Knick *et al.* 2011, p. 208). If agricultural activities are ongoing on the landscape and there is an abundance of private lands, the likelihood of further conversion is increased.

The following populations are at risk from additional agricultural conversion in the future:

Dakotas (Great Plains; MZ I) – widespread [redacted];

Northern Montana (Great Plains; MZ I) – localized [redacted] along Milk River in Valley County;

Yellowstone Watershed (Great Plains; MZ I) – widespread ongoing conversion;

Belt Mountains (Snake River Plain; MZ IV) – widespread potential [redacted];

Meeker-White River Colorado (Colorado Plateau; MZ VII) – widespread [redacted]; and

Crab Creek (Columbia Basin; MZ VI) – at risk of losing acres formerly enrolled in farm programs (U.S. Fish and Wildlife Service 2013, pp. 63–91).

[Discuss Results of Agricultural Conversion Model]

Anticipated Changes from Present

While several literature sources predict that habitat loss and fragmentation due to agricultural conversion will continue into the future, the rate on conversion is limited by the availability of suitable soils that will support economically viable crops. New cropland acreages are declining within the range of sage-grouse, perhaps in part to the limitations posed by local soil and water conditions, suggesting that the rate of habitat conversion may be slowing. Many conservation efforts are providing protection from conversion, particularly on private lands where the continued risk is the greatest. While many of these

programs are not focused in the areas at greatest risk, they are still conserving sage-grouse habitats. Additionally, the population exposure model suggests future areas of conversion will not overlap with most of the remaining sage-grouse occupied range. While the literature strongly supports that agricultural conversion has had significant impacts on sage-grouse distribution and numbers, future direct effects are unlikely to have population level effects. However, indirect effects of agricultural activities (e.g. impacts to brood rearing habitats, potential WNv outbreaks associated with agricultural water) are likely to continue into the future. In 2010 we identified agricultural conversion as one of three major factors contributing to habitat loss and fragmentation. We can no longer state that this factor will be a major cause of future habitat loss and fragmentation based on the minimal exposure of extant populations to areas suitable for crop production. Indirect effects of agricultural activities will likely continue to have negative impacts on sage-grouse near those areas, particularly in MZ I , IV and VI.

~~Sage-grouse will be impacted by agricultural conversion in the foreseeable future due to the ongoing removal and fragmentation of sagebrush within the range of the species. However, we expect that the rate of conversion from sagebrush to agriculture will slow because the most productive lands have largely been converted (Baker *et al.* 1976, p. 167). This conclusion is supported by statewide inventories showing changes in total cropland for every State from 1982–2010 (U.S. Department of Agriculture 2013, p. 4). For each State within the current range of the sage-grouse, with the exception of South Dakota, total cropland statewide on non-Federal lands decreased during this time period. Some conversion of lands currently enrolled in the CRP back into cropland is likely; however, the extent of re-conversion is not known. Agriculture has the broadest spatial extent of impacts to the western landscape from human actions, covering approximately 10 percent of the western United States, exceeding urban areas and roads, the second and third most extensive anthropogenic features (Leu *et al.* 2008, pp. 1126,1130).~~

~~RIPARIAN AMELIORATION~~

Federal and State programs that encourage landowners to conserve or restore sagebrush habitat can benefit sage-grouse. The following programs most commonly benefit the species:

The CRP was authorized in 1985. It is a voluntary program administered by the Farm Service Agency that allows private landowners to receive annual payments in exchange for establishing permanent vegetation on idle or erodible lands that were previously used for growing crops. The purpose of the CRP is to control soil erosion, improve water retention, and provide wildlife habitat. Enrolled lands are set aside for 10–15 years and cannot be grazed except under emergency drought conditions. The enrollment of CRP lands can be detrimental to sage-grouse when sagebrush rangelands are converted to marginal croplands then subsequently converted to grasslands (U.S. Fish and Wildlife Service 2013, p. 48). CRP lands can also benefit the species, as described in the following section. However, the duration of enrollment may limit long-term benefits, unless the land remains retired from cultivation.

The Environmental Quality Incentives Program is a voluntary program administered by the Natural Resources Conservation Service (NRCS). It provides financial and technical assistance to agricultural producers through 10 year contracts that plan and implement conservation practices. The NRCS is using this program to fund their Sage-grouse Initiative (SGI) and assist producers in improving habitat for sage-grouse. Some of the conservation practices in the SGI address farming practices such as conservation crop rotation, critical area planting on erodible soils, and pasture/hayland planting of forage species compatible with sage-grouse (U.S. Fish and Wildlife 2010, pp. 20–21).

Conservation easements allow private landowners to enter into a voluntary agreement with a land trust (e.g., The Nature Conservancy), the NRCS, or other organizations or agencies that maintain the land in private ownership with development restrictions that are typically permanent. Conservation easements can permanently protect sagebrush habitat from conversion to cropland or subdivision while providing compensation to landowners. The NRCS estimates that since the Sage Grouse Initiative was begun in 2010, 183,013 ha (451,884 ac) have been enrolled in conservation easements in the sage-grouse range

(Natural Resources Conservation Service 2015, p. 6). Highly productive riparian habitats, which are typically privately-owned, are critical to the survival of sage-grouse chicks (Copeland *et al.* 2013, p. 12). Conserving relatively small parcels of private lands along streams and wet meadows via conservation easements may have a disproportionately large beneficial impact on surrounding sagebrush uplands.

The Farm Bill of 2014 may directly affect future conversion of sagebrush rangelands to tilled crops in portions of MZ I (Montana, North Dakota, and South Dakota). The Bill includes a policy provision known as "Sodsaver." This provision reduces the Federal crop insurance subsidy available to landowners on any lands they convert to cropland (NRCS 2015, p. 14). This reduces the incentive to convert native rangelands to tilled crops. We address regulatory mechanisms directed at sage-grouse conservation in detail in other chapters.

Other voluntary Federal programs administered by the Service also can provide habitat for sage-grouse. Candidate Conservation Agreements (*CCAs*) between the Service and Federal or private landowners can be used to conserve and restore wildlife habitat. Candidate Conservation Agreements with Assurances (CCAAs) provide assurances to private landowners that if agreed-upon conservation measures are undertaken by the landowner, no further requirements will be made of the landowner if, in the future, the species is listed under the Endangered Species Act. The CCAs and CCAAs developed for sage-grouse often focus on ranching/grazing management practices; however, they can also include farm operations as a covered activity (e.g., CCAA for West Central Planning Area of Idaho, proposed CCAA for five Soil and Water Conservation Districts in Oregon). State programs such as State Acres for Wildlife Enhancement (SAFE) may also support sagebrush rangelands if sagebrush conservation is encouraged.

Through the Conservation Efforts Database (CED), we collected information relating to conservation actions for the sage-grouse that are completed, in progress, or planned. The following table lists conservation efforts described in the CED, or provided by Service Field Offices, that address impacts from agricultural conversion. Please note that the amount of lands conserved may not be additive for all

~~stressors. For example, conservation easements can protect from both agricultural conversion and exurban development. However, the same lands are being protected.~~

~~Table 8-2: List of conservation efforts addressing agricultural conversion~~

~~Management Zone~~	~~Type of Conservation Effort~~	~~Lands Conserved~~	~~Number of Actions~~	~~Citation~~
~~Great Plains (MZ I)~~	~~Conservation Easements~~	~~26,682 ha/65,881 ac~~	~~multiple~~	~~NRCS (2015)~~
~~Wyoming Basin (MZ II)~~	~~Conservation Easements~~	~~95,260 ha/235,210 ac~~	~~multiple~~	~~NRCS (2015)~~
~~Southern Great Basin (MZ III)~~	~~Conservation Easements~~	~~4,532 ha/11,191 ac~~	~~multiple~~	~~NRCS (2015)~~
~~Snake River Plain (MZ IV)~~	~~Conservation Easements~~	~~39,758 ha/98,167 ac~~	~~multiple~~	~~NRCS (2015)~~
~~Northern Great Basin (MZ V)~~	~~Conservation Easements~~	~~11,693 ha/28,871 ac~~	~~multiple~~	~~NRCS (2015)~~
~~Columbia Basin (MZ VI)~~	~~Conservation Easements~~	~~1,769 ha/4,369 ac~~	~~multiple~~	~~NRCS (2015)~~
	~~CRP lands~~	~~109,480 ha/270,322 ac~~	~~multiple~~	~~Stinson (2014)~~
~~Colorado Plateau (MZ VII)~~	~~Conservation Easements~~	~~3,318 ha/8,193 ac~~	~~multiple~~	~~NRCS (2015)~~
~~Bi-State~~				~~Not evaluated~~

Management Zone	Type of Conservation Effort	Lands Conserved	Number of Actions	Citation
(MZ 8)				

The following map shows the location of known conservation programs throughout the sage-grouse range.

[INSERT MAP WHEN AVAILABLE]

Summary

Existing agricultural lands should be managed to avoid or minimize adverse impacts to sage-grouse. Conversion of additional sagebrush habitat to agriculture should be avoided. Enrollment in voluntary conservation programs can protect or restore sage-grouse habitat. Some sage-grouse habitat is currently protected through enrollment in the CRP or other voluntary Federal or State programs, particularly in the Columbia Basin (MZ VI) and Great Plains (MZ I).

Increased enrollment in the CRP has benefited sage-grouse, especially in the Columbia Basin (MZ VI) and Great Plains (MZ I) (Knick *et al*. 2011, p. 208). Depending on the type of vegetation established and proximity to sagebrush, CRP lands can provide nesting, brood-rearing, and wintering habitat for sage-grouse (Schroeder and Vander Haegen 2006, p. 32; Schroeder and Vander Haegen 2011, pp. 524–528). The CRP is currently the largest effort to restore sage-grouse habitat in the Columbia River Basin, with approximately 109,480 ha (270,322 ac) of former agricultural lands enrolled in CRP in occupied habitat (Stinson 2014, p. 16). The proportion of sage-grouse nests in CRP lands in Washington State increased from 31 percent in 1992–1994 to 50 percent in 1995–1997 (Schroeder and Vander Haegen 2006, p. 4). This increase appeared to be associated with maturation of CRP lands, characterized by

increased height and cover of perennial grasses and invasion by sagebrush. Lands may be beneficial to sage-grouse as soon as five years after enrollment (Stinson 2014, p. 9). Nesting success in CRP lands (41 percent) was comparable to nesting success in native sagebrush (35 percent) (Schroeder and Vander Haegen 2011, p. 525). The sage-grouse population in north-central Washington, an area with abundant CRP lands, was the only population in Washington that demonstrated an average rate of increase (Schroeder and Vander Haegen 2006, p. 6; Schroeder and Vander Haegen 2011, p. 528).

After enrollment in CRP expires, landowners may re-enroll lands or convert the land to some other use. Federal funding and economics related to crop prices can affect enrollment, and the long-term effectiveness of the CRP is uncertain. Local sage-grouse working groups in Idaho expressed concerns regarding the loss of CRP lands (Moore 2014, p. 5). . However, in Washington, lands have frequently remained enrolled since the late 1980s – long enough to allow for reestablishment of sagebrush and use by sage-grouse for nesting habitat (Schroeder and Vander Haegen 2011, p. 524). Other areas with abundant CRP lands (northern Utah, southeast Idaho, western Colorado, and eastern Montana) have not been similarly examined (Schroeder and Vander Haegen 2011, p. 529).

ASSESSMENT OF POTENTIAL

The 2010 12-month finding for the sage-grouse (75 FR 13910, March 23, 2010) concluded that agricultural conversion is contributing to the present and [redacted]ened destruction, modification and curtailment of sage-grouse habitat and range. Most sage-grouse populations have steadily declined in recent decades (Connelly *et al*. 2004, p. 6-1; Garton *et al*. 2011, pp. 305–365; Manier *et al*. 2013, pp. 11 and 16; U.S. Fish and Wildlife Service 2013, pp. 63–91). Population declines are attributed to several factors, including agricultural conversion. The impacts to sage-grouse from agricultural conversion are not uniform throughout the species' range (Miller and Eddleman 2000, p. 1). The most widespread impacts from agricultural conversion will likely occur in the following populations:

~~Great Plains (MZ I)—Dakotas and Yellowstone Watershed populations,~~

~~Wyoming Basin (MZ II)—Eagle-South Routt, Middle Park, North Park, and Northwestern Colorado populations,~~

~~Southern Great Basin (MZ III)—Panguitch and Bald Hills populations,~~

~~Snake River Plains (MZ IV)—Baker, East-Central, Belt Mountains, and Box Elder populations,~~

~~Northern Great Basin (MZ V)—Warm Springs Valley population,~~

~~Columbia Basin (MZ VI)—Moses Coulee and Crab Creek populations, and~~

~~Colorado Plateau (MZ VII)—Meeker-White River population.~~

~~Some of the aforementioned populations are considered at high risk of extirpation (Dakotas, Eagle-South Routt, Belt Mountains, and Meeker-White River) (U.S. Fish and Wildlife Service 2013, pp. 63–91).~~

[redacted]