The following is a DRAFT document outlining HABITAT management risks, conservation measures, and monitoring action for sage grouse in the Sheldon Population Management Unit (PMU). This narrative fulfills Goal 1, Objective 3, as decribed on Page 32 of the Nevada Sage Grouse Conservation Strategy. In addition, the preliminary conservation measures and monitoring actions described below will be used to fulfill Objectives 5.2 and 5.4 (page 34). This information has been generated solely for the use of the Washoe-Lassen-Modoc Sage Grouse Working Group. Use of this information is prohibited without the written permission of the Washoe-Lassen-Modoc Sage Grouse Working Group.

The following narratives discuss risk assessments for sage grouse habitat, as completed by the sage grous habitat subgroup. The sage grouse population subgroup has completed the population risk assessment. Once the population and habitat risk assessments have been completed for all five PMUs in the Washoe-Lassen-Modoc area, the conservation measures and monitoring actions discussed in the following narrative will be finalized, combined with those of the other PMUs and prioritized. An implementation schedule and list of funding needs will be developed from the prioritized list.

Sheldon PMU- Habitat Risk Assessment Narrative

Introduction

Sheldon National Wildlife Refuge (Refuge), administered by the United States Fish and Wildlife Service (USFWS), encompasses over 575,000 acres in northern Washoe and Humboldt Counties. Elevations range from 4200 feet on the northeastern boundary to 7300 feet on Catnip Mountain. Yearly precipitation averages between 6 and 13 inches, depending on location. The Refuge was established in the 1930's primarily for the conservation of pronghorn antelope and other species of wildlife. Sage grouse, mule deer, and bighorn sheep also receive high management attention. The primary Refuge objective, as stated in the Sheldon National Wildlife Refuge Renewable Natural Resources Management Plan is to "...manage the Refuge as a representative area of high-desert habitat for optimum populations of native plants and wildlife."

Approximately 83% of the Refuge is included in the Sheldon Population Management Unit (PMU). Salt desert shrub habitats in the northeastern portion of the Refuge, including all of Virgin Valley, are excluded from the PMU because those habitats support few sage grouse. Sagebrush is the dominant plant species on the PMU, accounting for 89% of the vegetation. Low sagebrush, mountain big sagebrush, and Wyoming big sagebrush occur in roughly equal amounts. Scattered tracts of riparian, mountain mahogany, aspen, western juniper, and unvegetated rocky outcrops account for the remaining land cover.

The PMU provides habitat for sage grouse year-round. The sage grouse habitat is relatively intact, with little habitat fragmentation, and range conditions are relatively good. Cheat grass occurs, but in low amounts. Much of the PMU is above the elevation at which cheat grass is highly competitive, and current fire monitoring shows little cheat grass on recently burned areas. In general, sagebrush communities at higher elevations have good understories of native grasses and forb but herbaceous understory is limited in low elevation sagebrush sites. Over 68,000 acres have burned since 1988. Native herbaceous vegetation has recovered quickly on the burns and none are dominated by cheatgrass or other undesirable species. Recovery of sagebrush has been more variable. For purposes of mapping sage grouse restoration habitats, burns, with the exception of Bald Mountain, which is dominated by sagebrush and used by sage grouse, were mapped as R1 habitat.

Cattle grazing ended on the Refuge in 1994 and prescribed fire became the primary habitat management tool. The Refuge has no plans to use livestock grazing as a management tool in the foreseeable future. Cattle grazing was removed to allow restoration of upland and riparian habitats after decades of over-grazing and fire suppression.

The Refuge is home to a growing herd of feral horses. Currently, the Refuge management level for horses is 75-125. During systematic flights over the Refuge, 250 horses were counted in 1993. In 2001, 1050 horses were counted. Refuge staff have determined that horses are increasing at a rate of 17% each year, based on herd composition counts conducted from the

ground. Using this rate of increase, the herd is projected to reach 1681 horses by 2004 and 1967 animals by 2005, if no removal program is initiated.

Money from cattle grazing receipts funded horse gathers prior to 1994. When cattle grazing ended, money for horse gathers was lost and those funds have not been replaced. A limited capture program, using one-time funding, was started in 2000 to remove horses from the 1999 Badger Wildfire area. Over 220 horses were removed, but funding has run out and the capture program has ceased. Funding for further horse removal is being sought. In 2001, the Refuge initiated a monitoring program to track the population and quantify impacts to Refuge habitats.

Research, Monitoring, and Adaptative Management

Interactions between wildlife and their habitat are complex, and there is much about sage grouse habitat use, and sagebrush plant community ecology that is not fully understood. The Refuge has been active in sage grouse and sagebrush plant community research in recent years, initiating and funding several projects. Studies have looked at plant community response to fire, habitat use by sage grouse in relation to fire, and survival of sage grouse chicks. The research conducted by Sheldon/Hart Mountain Refuges is an important conservation measure for sage grouse and information provided by these studies can be used to improve management for sage grouse. General findings may apply to other PMUs and clarify habitat needs and steps to be taken for sage grouse. Specific information gained from following radio-marked birds can be used to fine-tune sage grouse monitoring on Sheldon. For instance, areas that support an unusual number of birds for nesting or wintering might be identified, and could warrant protection from fire or public use. Recent research projects that apply to specific risk factors are identified in the narrative.

Research and monitoring are important aspects of adaptive management. In an adaptive management program, the impacts of short-term actions are scientifically evaluated on a periodic basis. This approach incorporates monitoring, research and evaluation, which allows projects and activities to go forward in the face of some uncertainty regarding ultimate outcomes. Proceeding in this manner allows for accumulation of new information and responses to new data, which can affect direction, time frame, and actions taken in the future. The Refuge plans to use research and monitoring in an adaptive management approach for sage grouse. Examples of adaptive management are highlighted in the narrative by using a different font.

Mapping

The PMU is 476,267 acres. Eighty-nine percent of the PMU is covered by sagebrush plant communities. Following the guidance of The Nevada Sage Grouse Conservation Strategy, vegetation within the PMU was evaluated and classified into the “restoration habitats” provided in the plan.

R1 - 68,039 acres (14% of PMU)

(Areas with potential to produce sagebrush plant communities that have good understory composition of desired grasses and forbs, but lack sufficient sagebrush canopy)

R2 - 85,008 acres (18% of PMU)
(Existing sagebrush plant communities with insufficient desired grasses and forbs in the understory)

R3 - 5740 acres (1% of PMU)
(Areas with potential to produce sagebrush plant communities, that have not crossed the juniper woodland threshold but are in various stages of becoming encroached upon by juniper)

R4 - 0 acres
(Areas with potential to produce sagebrush plant communities, but are dominated by annual grasslands, annual forbs, or bare ground)

R0 (Key sage grouse habitat) - the remaining sagebrush areas in the PMU.

Sage Grouse Habitat Needs

Sage grouse are sagebrush obligates. They cannot live without sagebrush, which is critical to their existence, but herbaceous understory is important as well. Grasses screen nests and chicks from predators, forbs provide food for hens and chicks, and a diverse understory supports insects critical to chick survival. Meadows and other moist areas are important in late summer and fall. Sage grouse habitat needs vary by season. WAFWA guidelines provide information on characteristics of sagebrush rangeland needed for productive sage grouse habitat and are summarized below. Since the entire PMU provides habitat for sage grouse year round, managing sagebrush plant communities for nesting habitat would provide suitable habitat for all seasons.

Nesting:
· sagebrush 40-80 cm tall with canopy cover of 15-25%
· grass/forb community >18cm tall with canopy cover of >15% or >25% if within site potential

Brood-rearing:
· sagebrush 40-80 cm tall with canopy cover 15-25%
· grass/forb community >15% canopy cover

Winter:
· sagebrush 25-35 cm above the snow with canopy cover 10-30%

Habitat Risk Assessment

GROUP 1: HABITAT DEGRADATION RISK FACTORS

Risk 1: Temporary conversion of sagebrush to perennial herbaceous.
Season/habitat affected: breeding, brood-rearing, winter
WAFWA Guidelines: 1, 5, 6, 7, 8, 9, 11, 13, 14, 18, 19, 29, 30, 31, 32, and 33 (SEE APPENDIX 1)
Contributing Management Action (CMA) a): Fire/herbicide on areas with strong native understory - rated: HIGH

This risk occurs when fires burn or herbicide is applied on sagebrush-dominated areas with strong native understory. For this plan, those areas were mapped as "key sage grouse" habitat (R0). Approximately 2/3 of the PMU is R0 habitat. Because of the large portion of the PMU that is R0, this is considered a high risk on Sheldon. Herbicide application is unlikely on the Refuge, but wildfire starts are beyond management control. Since R0, by definition, has a strong native understory, it is assumed that native herbaceous vegetation will dominate after a fire. The conversion from R0 to R1 habitat is temporary, in theory. Sagebrush will recolonize the site naturally, assuming the site does not burn again. Time for recovery of sagebrush is highly variable, from 10 years to many decades, and depends on multiple factors including sagebrush subspecies, elevation, soils, and precipitation. In general, mountain big sagebrush recolonize burned areas more quickly than Wyoming big sagebrush or low sagebrush.

On Sheldon, most burns are dominated by a strong native plant community 1-2 growing seasons after fire. Burned were mapped as R1 habitat and encompass 68,000 acres (14% of the PMU). Sagebrush must recover on the burned sites before they become sage grouse habitat again but shrub recovery on burns is highly variable.

In an effort to better understand how fire affects sagebrush plant communities, the refuge contracted with Dr. Rick Miller, of OSU, to intensively monitor burns on Sheldon. Specific objectives of the study included 1) describing changes in composition and structure in mountain big sagebrush and low sagebrush plant communities following fire, and 2) to describe and evaluate the pattern of mountain big sagebrush and bitterbrush establishment in years following fire. Dr. Miller has completed the first round of his work and the Refuge hopes to repeat the work in 5 to 10 years.

In addition, Refuge staff monitors burns for plant community composition, shrub establishment rates, and presence of undesirable plants such as cheatgrass. Results of these monitoring efforts can be used to guide management of sage grouse habitat. Dr. Miller's research could provide insight on factors that drive vegetation recovery while the refuge monitoring program allows identification of burns where reseeding is necessary to achieve habitat objectives for sage grouse.

Sheldon/Hart Mountain Refuge Complex has also funded and supported studies into the effects of fire on sage grouse habitat and sage grouse use of burned areas. A study on Sheldon compared vegetation components in burned and unburned areas and tracked sage grouse use of burns. A study on Hart used GIS to evaluate sage grouse use and selection of habitat including various ages of burns. Results of these studies can also be used to guide management of sage

grouse habitat.

Lightning is the primary cause of fire on the Refuge, and is beyond management control. Even with the current policy of total suppression of wildfire, fires will occur. Conservation measures to manage this risk should include wildfire suppression, but should also include post-burn management. Priority for wildfire suppression should be given to those areas where more than 35% of the habitat has recently burned. Wildfires should be monitored for shrub, grass, and forb recovery and weed invasion. Management intervention (reseeding) should be taken if monitoring shows natural recovery is unlikely to achieve sage grouse habitat management objectives. Techniques to establish sagebrush on burned sites more quickly should be investigated.

Recent research projects applicable to this risk:

Byrne, M. W. 2002. Habitat use by female greater sage-grouse in relation to fire at Hart Mountain National Antelope Refuge, Oregon. M.S. Thesis, Oreg. State Univ., 50 pp.

Davis, D.M. 2002. Breeding season habitat use and response to management activities by greater sage-grouse on Sheldon National Wildlife Refuge, Nevada. M.S. Thesis, Oreg. State Univ., 134 pp.

Miller, R., J. Rose, D Reinkensmeyer, K. Hopkins, L Ziegenhagen and V. Marr. 2002. Fires Effects on plant communities, birds, small mammals, and butterflies on the Sheldon National Wildlife Refuge. Eastern Oreg. Ag. Research Center, Oreg. State Univ., Final Report. 92 pp.

Conservation Measures: Suppress wildfire. Reseed burns where monitoring shows natural recovery is unlikely to achieve habitat management objectives. Support and apply research on burn recovery and effects of burning on sage grouse. Repeat Rick Miller's monitoring studies.

Responsible Parties: USFWS, OSU

Monitoring: Vegetation monitoring on burns and seeded areas. Track sagebrush recovery. Monitor for cheatgrass and weeds.

Risk 2: Long-term/permanent conversion of sagebrush to perennial herbaceous
season/habitat affected: nesting, brood-rearing, winter
WAFWA Guidelines: 5, 6, 7, 8, 9, 11, 13, 17, 19, 29, 31 and 32
CMA a): Non-native species seedings - NOT A RISK

This risk occurs when non-native species are seeded, replacing native shrub and herbaceous communities. Crested-wheat grass seedings are a prime example. There are no seedings on the Refuge and Refuge policy prohibits seeding with non-native species, therefor this is not a risk in Sheldon PMU.

Risk 3: Conversion of sagebrush to annual herbaceous
season/habitat affected: nesting, brood-rearing, winter
WAFWA Guidelines: 5, 6, 7, 8, 9, 11, 14, 16, 19, 21, 29, 30, 31 and 33
CMA a): Fire on areas with weak understory, usually low elevations - rated: MEDIUM

The contributing management action for this risk is fires on areas with weak understory, which usually occur in low elevations. Areas dominated by cheatgrass after a fire are a prime example. Extensive stands of cheat grass are highly flammable, making the site vulnerable to reburning before sagebrush becomes established. Areas vulnerable to this risk are usually dominated by Wyoming big sagebrush, which takes decades to recover following fire.

Sagebrush dominated areas with weak understory were classified as R2 restoration habitat. Once these sites are converted to cheatgrass, they would be classified as R4 restoration habitat. R2 habitats are more vulnerable to conversion to R4 habitat than R1 habitats.

Approximately 18% of the PMU is estimated to be R2 type, and therefore vulnerable to this risk. The Refuge currently has no areas dominated by cheatgrass. Cheatgrass does occur, scattered in low frequency. The risk was rated medium due to the acreages vulnerable to it and the seriousness of the risk.

Conservation actions include suppression of wildfire. In the event of multiple starts, fires in R2 habitat should receive priority over those in R1 habitat. Other conservation actions include reseeding after fire with plant species appropriate for sage grouse such as sagebrush and native grasses and forbs. Actual species seeding would depend on seed availability and site. If monitoring shows cheat grass or weeds on a burn, then that burn should become high priority for weed control and native vegetation reestablishment.

Conservation Measures: Suppress wildfire. In multiple fire events, give fires in R2 habitat priority for suppression over those in R1 habitats. Reseed with native species appropriate for sage grouse after fires. Research ways to effectively reestablish native vegetation, especially sagebrush
Responsible Parties: USFWS
Monitoring: Vegetation monitoring on burns and seeded areas. Track sagebrush recovery. Monitor for cheatgrass and weeds.

CMA b): Noxious weed invasion - rated: LOW
Noxious weeds occur on the Refuge, but they are currently limited to roadsides and isolated spots. No large areas are dominated by weeds. Therefore, this risk was rated low. Several refuge policies designed to limit weed invasions are in place. Soil-disturbing activities are restricted and horseback riders are required to bring pelletized feed. Known weed sites are treated when time permits. The Refuge should seek partnerships with other agencies for more effective weed monitoring and control.

Conservation Measures: Treat noxious weeds

Responsible Parties: USFWS
Monitoring: Monitor spread of weeds and effectiveness of treatments

Risk 4: Conversion of sagebrush to juniper
season/habitat affected: nesting, brood-rearing, winter
WAFWA Guidelines: 1, 2, 5, 13, 18 and 21
CMA a): Management Action: lack of fire/disturbance - rated LOW TO MEDIUM

Small juniper trees have established on approximately 5700 acres (1% of PMU). Although the acreage is small, it is increasing. The biggest area with juniper expansion is in known sage grouse nesting and brooding habitat near the largest lek on the Refuge. It is most feasible to treat juniper expansion while the trees are small and sagebrush is still a significant part of the plant community. The intent is to reduce juniper before the increasing juniper density begins to reduce species diversity within the sagebrush stands. Prescribed fire and cutting juniper trees are the methods the Refuge could consider for juniper treatment.

In 2001, the Refuge treated 1600 acres of expanding juniper with prescribed fire. Most of this treatment was on the slopes and base of Massacre Rim, where sage grouse use is low. The Refuge plans to cut young juniper on an additional 500-1000 acres, in areas with moderate to high sage grouse use, in the near future.

Juniper treatment with fire must be carefully planned in sage grouse habitats. Individual treatment blocks should not exceed 2000 acres with sagebrush cover left on 50% of the block. At least 75% of a sage grouse use area should be dominated by mature sagebrush communities at any given time. In areas with high sage grouse use, treatment by mechanical means is preferred over prescribed fire. Juniper stands with an understory of sagebrush should be higher priority for treatment than those where the sagebrush canopy is diminishing.

Conservation Measures: Treat areas with small, invading juniper by prescribed fire or mechanical means.
Responsible Parties: USFWS
Monitoring: monitor expansion of juniper using aerial photos and GIS mapping. Monitor effectiveness of juniper treatments.

Risk 5: Loss of sagebrush acres
season/habitat affected: nesting, brood-rearing, winter
WAFWA Guidelines: 6, 7, 8, and 9
CMA a): mining - rated: LOW
CMA b): Management Action: Urban Expansion - NOT A RISK

The Refuge has conducted a mineral withdrawal. Virgin Valley Mining District, the only place on the Refuge new mining claims are allowed, was created during this process. The mining

district is outside the PMU boundary. A few claims exist within the PMU, but none are active now. No new claims are allowed outside the mining district.

Less then 1% of the Refuge is privately-owned. The remaining private parcels are small (all but one are less then 500 acres) and scattered throughout the refuge. The Refuge pursues acquisition of private in-holdings from willing sellers as they become available.

Conservation Measures: Apply mitigation measures for sage grouse in the event an existing mine claim becomes active.
Responsible Parties: USFWS

Risk 6: Conversion of forb meadows to mat grass meadows
season/habitat affected: brood-rearing
WAFWA Guideline: 21
CMA a): underutilization - Rated: NOT A RISK
CMA b): lack of fire - RATED LOW

Because Sheldon is not grazed by livestock, underutilization of meadows used by sage grouse could be a risk. Research conducted in Nevada demonstrated sage grouse favored meadows moderately grazed by cattle over heavily grazed meadows or ungrazed meadows. Sage grouse did not use meadows that had deteriorated to the point they were dominated by upland plants such sagebrush or basin wild rye.

Currently, most meadows on the refuge are not underutilized. Feral horse use of meadows is high, especially on systems that still have water in fall. Since 2001, utilization has been estimated on 35 streams and springs, randomly selected from across the Refuge, that have water in fall. Sixty percent were heavily to severely used while 31% were used moderately. In addition, stubble height transects were established on 8 streams and springs where refuge staff noticed consistent high horse use. Only 1 of these systems had adequate stubble height in September to protect stream banks during high spring flows. Underutilization of meadows is not a risk at this time, however, if horse populations are reduced, the risk could increase.

No livestock grazing occurs on the Refuge at this time. However, the Refuge is in an excellent position to experiment with prescribed fire for management of meadows for sage grouse. The Refuge should burn some meadows, and monitor grouse use and vegetation composition and height before and after the burn.

Conservation Measures: Experiment with fire for managing meadows for sage grouse.
Responsible Parties: USFWS
Monitoring: Monitor vegetation composition and grouse use in managed and unmanaged meadows. Monitor feral horse use of meadows.

Risk 7: Conversion of meadows to bare ground

season/habitat affected: brood-rearing
WAFWA Guideline: 21
CMA a): over utilization, usually associated with water sources - rated MEDIUM

Feral horse populations are currently impacting meadows (see discussion for Risk 6). The Refuge is working to secure funding to reduce populations. If the population is reduced, this risk would lessen. If the horse population were totally removed the risk would disappear. However, if horse populations continue to increase, the risk would increase.

Conservation measures: Reduce feral horse population to current management level. Rest from livestock grazing.
Responsible parties: USFWS
Monitoring: monitor horse utilization and trend in riparian areas across the Refuge.

Risk 8: Conversion of meadows to upland vegetation
season/habitat affected: brood-rearing
WAFWA Guidelines: 21 and 22
CMA a): reduced functionality associated with head cutting, soil alteration, or confinement of flood plain. Rated HIGH (for horse impacts) and LOW (for road impacts)

Feral horse populations are currently impacting meadows (see discussion for Risk 6). The Refuge is trying to secure funding to reduce populations. If the population is reduced, this risk would lessen. If the horse population were totally removed, the risk would disappear. However, if horse populations continue to increase, the risk would increase.

Roads through meadows and next to streams can negatively impact riparian systems. In recent years, several roads that impacted meadows have been closed or re-routed. No new roads are planned.

Conservation measures: Reduce feral horse population to current management level. Close or re-route roads around meadows, where feasible. Conduct law enforcement patrols on closed roads. Prohibit new roads in meadows.
Responsible parties: USFWS
Monitoring: monitor utilization and trend in riparian areas across the Refuge.

Risk 9: Insufficient stubble for successful nesting cover
season/habitat affected: nesting
WAFWA Guidelines: 5 and 10
CMA a): short-term overutilization - rated LOW

No livestock grazing occurs on the refuge. However, the feral horse population is estimated to be over 1000 and is increasing at 17% a year. Refuge staff monitored horse utilization in the

uplands in 2001 and 2002. Most areas received no or slight use, with isolated areas receiving moderate use. Because horse use is dispersed across the nesting areas, the risk is currently rated low. If the horse population continues to increase, higher utilization could be expected and the risk could increase. Conversely, if horse populations were decreased, the risk would decrease as well.

Conservation measures: Reduce feral horse population to current management level.
Responsible Parties: USFWS
Monitoring: Monitor horse utilization in uplands

Risk 10: Low vigor and diversity herbaceous vegetation (poor nesting cover and spring food)
season/habitat affected: nesting, brood-rearing
WAFWA Guidelines: 1, 5, 6, 7, 8, 10, 11, 13, 14, 15, 16, 18, 19, 20, 21, 25, 26, 29, 32 and 33
CMA a): Lack of fire/disturbance in mountain big sagebrush sites - rated LOW

This risk occurs primarily in mountain big sagebrush sites. Long-term overgrazing, coupled with fire suppression, have enabled sagebrush to increase in some areas at the expense of herbaceous understory. Shrub cover exceeds what sage grouse need, but understory is limiting. Treatments to reduce shrub cover often allow understory response.

With no cattle grazing, Refuge habitats are recovering. However, treatment may be needed where sagebrush cover is limiting the understory. Prescribed fire, brush beating, and herbicides are commonly used to reduce shrub canopy. Use of herbicide on the Refuge is restricted and unlikely. Prescribed fire and brush beating are the tools most likely be to used to treat these areas.

Treatment for this risk must be carefully planned to meet the needs of sage grouse. Seventy-five percent of a sage grouse area should be dominated by mature sagebrush communities at any given time. Block sizes for treatment should be <2000 acres with sagebrush cover remaining on 50% of the block after treatment.

Conservation Measures: Prescribed fire or brush beating in mountain big sagebrush sites with dense sagebrush overstory and little understory.
Responsible Parties: USFWS
Monitoring: Vegetation monitoring for shrub, grass, and forb recovery, and weed invasion on treatments.

CMA b): Long term over utilization - rated LOW
CMA c): Annual, long duration spring use - rated LOW
Long term overutilization and annual long-duration spring grazing have contributed to this risk. Cattle grazing was removed from the Refuge to allow uplands to recover, but feral horse use is still high. Higher elevation sites appear to be recovering well, with vigorous grasses noticeable. Even in the absence of horse use, recovery in lower elevation sites will be slow.

This risk was rated low because Refuge habitats still suffer the effects of historic over-grazing, particularly at lower elevations. In addition, feral horses are still using the Refuge season-long and their numbers are increasing. The risks would lessen if horses were removed.

Conservation Measures: Rest from livestock grazing. Reduce feral horse population to current management level.
Responsible Parties: USFWS
Monitoring: Monitor horse use in uplands.

CMA d): Noxious weed/cheatgrass encroachment - rated LOW
See discussion under Risk 3, management action b.

Conservation Measures: Treat noxious weeds
Responsible Parties: USFWS
Monitoring: Monitor spread of weeds and effectiveness of treatments

Risk 11: Lack of understory for nesting cover and spring forage
season/habitat affected: nesting, brood-rearing
WAFWA Guidelines: 1, 5, 6, 7, 8, 10, 11, 13, 14, 15, 16, 17, 19, 21, 25, and 26
CMA a): Lack of fire/disturbance in low elevations - rated MEDIUM
CMA b): Historic over utilization - rated MEDIUM

This risk describes habitats that mapped as R2 (approximately 18% of the PMU). Historic over utilization contributed to loss of the understory in these communities. They often occur at lower elevations dominated by Wyoming big sagebrush. These sites are often vulnerable to cheat grass invasion. Cattle grazing was removed from the Refuge to allow uplands to recover, but feral horse use is still high. Even in the absence of horse use, recovery in lower elevation sites will be slow. Although poor nesting or brood rearing areas, these sites have sufficient sagebrush to be winter habitat.

Recovery from historic overgrazing will be slow on these sites. In many areas grass plants are still lacking, even 8 years after cattle were removed. Feral horses continue to use these areas season-long. This risk was rated medium because of the historic damage, lack of understory, slow recovery rate, and vulnerability to cheatgrass invasion.
In some cases, lack of disturbance, coupled with heavy grazing may have caused sagebrush canopy cover to increase to the point where it inhibits understory growth. In these cases, disturbance of sagebrush may stimulate understory growth. Since these sites still provide winter habitat, the scale of habitat manipulations must be small. Treatment blocks should not exceed 1000 acres with 50% of the shrub cover remaining after treatment. At least 80% of a sage grouse use area should be dominated by sagebrush cover at any given time. Extreme caution must be taken to avoid treating areas which may become dominated by cheatgrass after treatment. Other techniques for restoring native herbaceous understories should be investigated.

Conservation Measures: Consider prescribed fire, experimental brush beating or chemical treatment at a small scale (<1000 acres) to release understory plants. Research techniques for restoring native understories to these sites. Reduce feral horse population to current management level. Rest from livestock grazing.
Responsible Parties: USFWS
Monitoring: Monitor the response of herbaceous understory to lack of livestock grazing in R2 habitats. If habitat treatments are used, monitor the effectiveness of those treatments.

CMA c): Noxious weed/cheat grass encroachment
See narrative for Risk 3, CMA b.

Conservation Measures: Treat noxious weeds
Responsible Parties: USFWS
Monitoring: Monitor spread of weeds and effectiveness of treatments

Risk 12: Low density or lack of appropriate insects for early brood rearing
season/habitat affected: brood-rearing
WAFWA Guidelines: 1, 5, 6, 7, 8, 10, 11, 13, 14, 15, 16, 17 19, 21, 25, and 27
CMA a): Noxious weed/cheat grass encroachment - rated LOW
CMA b): Annual, long duration spring use - rated LOW
CMA c): Long term over utilization - rated LOW

Insects are critical to sage grouse chick survival, but sage grouse rely on a small number of insect families for food (ants, grasshoppers, and beetles). Sage grouse brood areas are characterized by great plant species richness with abundance forbs and insects. Healthy sagebrush systems with strong native understories should provide appropriate insects for sage grouse chicks.

Little is known about habitat needs for insects, but sagebrush plant communities with degraded understories are assumed to have fewer insects sage grouse need. Long duration spring use, long term overutilization and noxious weed/cheat grass encroachment all lead to degraded understories. See Risk 3b, 10b, and 10c for discussion of risk assessment and treatments.

OSU is investigating factors influencing sage grouse chick survival on Sheldon and two other study areas. Researchers are identifying items in chick diets, comparing insect abundance at random and sage grouse use sites, and quantifying vegetation at random and sage grouse use sites. Information from this research may help identify vegetation conditions important for insects heavily used by sage grouse chicks. This information could then be used to guide sage grouse habitat management.

Current research projects applicable to this risk:
Gregg, M.A. In Prep. Survival of sage grouse chicks in the northern Great Basin.

Conservation Measures: Support research on sage grouse chick survival. Treat noxious weeds.

Reduce feral horse population to current management level. Rest from livestock grazing.
Responsible Parties: USFWS
Monitoring: Monitor spread of weeds and effectiveness of treatments. Monitor horse use in uplands.

Risk 13: Lack of access to water
season/habitat affected: nesting, brood-rearing, winter
WAFWA Guidelines: 22, 24, 27 and 28
CMA a): Spring developments that capture all water and are inaccessible to sage grouse - rated LOW
CMA b): Recreational camping at water - rated LOW

This risk applies to wet meadow habitat created by springs. No new spring developments are allowed on the Refuge and in recent years, many spring developments were turned off. The Refuge has plans to remove spring developments after feral horse populations are reduced.

Camping on the Refuge is restricted to established campgrounds although illegal camping occurs, often at springs or meadows. In addition, NDOW regulations prohibit camping at water sources.

Conservation Measures: After feral horse populations are reduced, remove spring developments. Conduct law enforcement for illegal campsites. Modify guzzlers for sage grouse use.
Responsible Parties: USFWS, NDOW

GROUP 2: DISTURBANCE

Risk 14: Human activity during breeding and nesting, or at watering sites.
season/habitat affected: nesting, brood-rearing, winter
WAFWA Guideline: 12
CMA a): mining - rated LOW
See discussion under Risk 5a**.**

CMA b): Roads - rated LOW
Roads allow access to critical sage grouse habitats, especially two-tracks. Sage grouse researchers have not noticed a conflict between recreationalists and sage grouse. In recent years, the Refuge has closed many two-track roads to protect habitat.

CMA c): Urban expansion - NOT A RISK
See discussion under Risk 5b.

CMA d): Recreation - rated LOW
Recreational activity occurs throughout the Refuge during spring, summer, and fall. So far, public viewing at leks is extremely low. The Refuge will monitor this activity and implement

measures to protect leks should it become a problem. In an average or heavy snow year, half the leks on the Refuge are inaccessible.

In summer, recreational use is concentrated at Big Springs Reservoir and Virgin Valley. Virgin Valley is outside the PMU. Use at Big Springs is primarily fishing, and restricted to the Reservoir and immediate area. Other recreation includes hiking, photography, and wildlife viewing, and is generally dispersed throughout the Refuge. Much of the Refuge is inaccessible during the early nesting period and sage grouse researchers have not noticed a conflict between recreationalists and sage grouse broods.

On the Refuge, sage grouse are more likely to be disturbed at watering sites than breeding and nesting areas. Birds congregate at water in late summer and fall, the same period recreational use is highest on the Refuge. Big game hunting occurs throughout the refuge from August through
November. Hunters are required to stay in established campgrounds, but some illegal camping occurs. In addition, NDOW regulations prohibit camping at water sources.

Conservation Measures: Law enforcement patrols for closed roads and illegal camping.
Responsible Parties: USFWS, NDOW

Risk 15: Additional predator perch sites
season/habitat affected: nesting, brood-rearing, winter
WAFWA Guidelines: 3 and 4
CMA a): Juniper encroachment, lack of fire - rated LOW
See discussion under Risk 4.

CMA b): Pasture/Allotment fences, spring exclosures, wells, troughs - rated LOW
The Refuge has an active fence removal program. Since cattle no longer graze on the Refuge, new fences and watering facilities for livestock will not be built.

Conservation Measures: Control juniper expansion (see Risk 4). Continue fence removal program.
Responsible Parties: USFWS, Audubon Society, Sierra Club
Monitoring: Monitor expansion of juniper using aerial photos and GIS mapping. Monitor effectiveness of juniper treatments.
CMA c): Transmission lines, communication sites - NOT A RISK
No transmission lines, and only one communication site occur in the PMU.

Risk 16: Artificially high predator population
season/habitat affected: nesting, brood-rearing, winter
Overall, risk for excessive predation on Sheldon PMU is low. See Population Risk Assessment Narrative.

CMA a): High speed roads/road kill - rated LOW
Highway 140 is the only paved road on the Refuge. 8A and 34A are gravel roads with top speeds of 55 miles per hour. No new roads will be developed on the refuge.

CMA b): Urban expansion - NOT A RISK
See discussion under Risk 5, management action b

CMA c): Agricultural expansion - NOT A RISK
Conversion of Refuge land for agricultural purposes will not occur. The Refuge is to be managed as a representative area of high desert habitat for the benefit of pronghorn antelope and other species of wildlife. Agricultural conversion of the in-holdings is infeasible and not likely to occur.

Risk 17: Human-caused fire
season/habitat affected: nesting, brood-rearing, winter
WAFWA Guideline: 19
CMA a*): Dispersed recreation and roads - rated LOW*
Approximately 10% of fires are on the Refuge are human caused. They typically occur during periods of high fire danger and have a high probability of escape. Fortunately, Refuge fire crews have stopped most human-caused fires, to date.

Recreational use on the Refuge is relatively low and dispersed. Fire restrictions are in force during periods of high fire danger and hunters are informed of the restrictions through a letter they receive from the Refuge. Some lightly-used, overgrown roads have been closed to reduce risk of fire from vehicles. Fire rings have been installed in some campgrounds.

Conservation Measures: Suppress wildfires. Conduct law enforcement patrols for closed roads, illegal camping, and fire restrictions. Consider placement of more fire rings in campgrounds.
Responsible Parties: USFWS