2005 HABITAT INTEGRITY AND POPULATION MONITORING OF SLICKSPOT PEPPERGRASS (*LEPIDIUM PAPILLIFERUM*) AT THE ORCHARD TRAINING AREA

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ABSTRACT

Slickspot peppergrass (*Lepidium papilliferum*) is a rare annual or biennial forb endemic to sagebrush steppe in southwestern Idaho. Slickspot peppergrass is currently a proposed endangered species while the U.S. Fish and Wildlife Service reconsiders its 2004 decision to not list the species. The objectives of this report were to report to following at the Orchard Training Area: 1) performance metrics and triggers addressed by the Candidate Conservation Agreement; and 2) slickspot peppergrass abundance, slickspot and habitat integrity, anthropogenic and non-anthropogenic disturbance, and plant community trends. In 2005, the habitat integrity and population monitoring protocol was used to collect a second year of monitoring data at 14 HIP transects at the Orchard Training Area. The HIP monitoring protocol developed in 2004 was used to monitor and assess slickspot peppergrass abundance, habitat integrity, and disturbance, for the purpose of evaluating and improving management actions implemented by the Candidate Conservation Agreement. The plant community data were analyzed with Sorensen classification and nonmetric multidimensional scaling ordination. Slickspot and plant community data results were summarized by HIP transect, EO, and for all Orchard Training Area HIP transects. Slickspot peppergrass abundance was greater in 2005 than 2004, likely because of the higher spring precipitation in 2005. However, total livestock trampling was also greater in 2005 than 2004. No triggers occurred at the Orchard Training Area in 2005. The big sagebrush component continues to be very high at the Orchard Training Area HIP transects compared to HIP transects rangewide. Most MA 7 HIP transects also were relatively unfragmented compared to HIP transects rangewide. The intact big sagebrush component and relatively low fragmentation at the MA 7 HIP transects means that MA 7 has some of the best quality slickspot peppergrass habitat remaining. This report represents a second year of monitoring using the HIP protocol and provides information to adaptively manage threats to slickspot peppergrass and objectively measure trends in future years.

KEY WORDS

Slickspot peppergrass, Lepidium papilliferum, sagebrush-steppe, monitoring, habitat, abundance, rare plant conservation, Idaho.

SUGGESTED CITATION

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INTRODUCTION

Slickspot peppergrass (*Lepidium papilliferum*) is a rare annual or biennial forb endemic to sagebrush steppe in southwestern Idaho (Moseley 1994). The <4 dm (<16 in) tall plant is in the mustard family (Brassicaceae) and has multi-flowered inflorescences terminating on highly divided branches. The flowers are small, white, and 4-petaled and the fruits are flattened and orbicular. Slickspot peppergrass is distinctive from similar species by the presence of clavate to elatorate trichomes on the stamen filaments, pinnately or bi-pinnately divided leaves, and ovate to orbicular siliques (Rollins 1993, Moseley 1994). Pollination is necessary for seed production, and the main pollinators include bees, flies, and some beetle species (Robertson and Klemash 2003). High quality slickspot peppergrass habitat is characterized by intact sagebrush steppe, low abundance of non-native species, and low levels of anthropogenic disturbances (Moseley 1994, U.S. Fish and Wildlife Service 2003; Colket et al. 2006).

Slickspot peppergrass is highly specific to slickspots that have developed on remnant Pleistocene surfaces (Fisher et al. 1996). Slickspots, also known as mini-playas or natric sites, are defined as small soil inclusions with a silt loam surface crust, a restrictive hardpan, and a subsurface argillic horizon (high clay content; Sandoval et al. 1959, Lewis and White 1964, Fisher et al. 1996). Slickspots are associated with shrub interspaces in sagebrush steppe and are visually distinct, due to their high albedo and sparsely vegetated surface (Fisher et al. 1996). Penetration (and compaction) through the surface crust to the argillic horizon decreases slickspot integrity and potentially reduces slickspot peppergrass viability (P. Seronko, pers. comm. 2004). Penetrating anthropogenic disturbances include livestock prints, drill seeding, fire-fighting activities (e.g., fire lines), and off-highway motorized vehicle (OHV) tracks. Repeated and severe penetrating disturbances, especially during saturated soil conditions during the spring, may be precursors to slickspot invasion by non-native species, further reducing slickspot integrity (U.S. Fish and Wildlife Service 2003).

Degradation of slickspot peppergrass habitat has been attributed to large, uncharacteristic wildfires, conversion of sagebrush steppe to non-native annual grasslands, excessive livestock grazing, and former rangeland rehabilitation practices (e.g., drill seeding; Whisenant 1990, Peters and Bunting 1994, Moseley 1994, Noss et al. 1995, Lesica and DeLuca 1996, U.S. Fish and Wildlife Service 2003, Colket 2005). Habitat loss and degradation, fragmentation, and population isolation may correspondingly result in the loss of genetic fitness (Moseley 1994, Reed and Frankham 2003). Many slickspot peppergrass element occurrences (EOs) occur in fragmented sagebrush steppe or non-native annual grasslands and are highly susceptible to reduced genetic diversity and gene flow (Robertson and Klemash 2003, Robertson 2004). An EO is a specific geographic location where “a species or natural community is, or was, present“(NatureServe 2002:10).

Concern for declining slickspot peppergrass trends in abundance and habitat quality led to slickspot peppergrass being a proposed endangered species in 2002 (U.S. Fish and Wildlife Service). In January 2004, the U.S. Fish and Wildlife Service withdrew the proposed rule based on “the lack of strong evidence of a negative population trend, and the conservation efforts contained in formalized plans [that] have sufficient certainty

they will be implemented and will be effective such that the risk to the species is reduced to a level below the statuary definition of endangered or threatened" (U.S. Fish and Wildlife Service 2004:1). These formalized plans are described in the "Candidate Conservation Agreement for slickspot peppergrass" (2003), a legally binding agreement between the Bureau of Land Management (BLM), the state of Idaho, Idaho Army National Guard (IDARNG), and non-governmental cooperators. The Candidate Conservation Agreement addresses cooperative management actions to eliminate or reduce threats to slickspot peppergrass that would warrant future listing of the species under the Endangered Species Act (ESA). In August 2005, Judge Mikel H. Williams reversed the U.S. Fish and Wildlife Service 2004 decision to withdraw the proposal to list slickspot peppergrass. Slickspot peppergrass remains a proposed endangered species while the U.S. Fish and Wildlife Service reconsiders its 2004 decision. The objectives of this report were to report to following at the Orchard Training Area for the IDARNG: 1) performance metrics and triggers addressed by the Candidate Conservation Agreement; and 2) slickspot peppergrass abundance, slickspot and habitat integrity, anthropogenic and non-anthropogenic disturbance, and plant community trends.

STUDY AREA

The Orchard Training Area is located in the lower Snake River Plain, approximately 28 km south of Boise, ID (Figs. 1 and 2). Elevation ranges from 896-1004 m and mean annual temperature and precipitation are 11°C (51°F) and 211 mm (8.3 in), respectively. There are 2 main peaks of annual precipitation that typically occur during December and May (Fig. 3; J. Weaver, pers. comm. 2006). Prevailing winds are northwesterly during April-August and southeasterly during September-March. Soils within the study area are predominantly Argids, defined as Aridisols having an argillic horizon (Fisher et al. 1996). Military activities are managed by the IDARNG and livestock grazing is managed by the BLM.

Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*) forms the dominant vegetative structure within higher quality habitat. Native perennial grass species include Sandberg bluegrass (*Poa secunda*), bottlebrush squirreltail (*Elymus elymoides*), basin wildrye (*Leymus cinereus*), and Thurber needlegrass (*Achnatherum thurberianum*). Native forb species occur in low abundance. Non-native species are abundant and often include cheatgrass (*Bromus tectorum*), clasping leaf pepperweed (*Lepidium perfoliatum*), Russian thistle (*Salsola tragus*), and bur buttercup (*Ceratocephala testiculata*). See Appendix D for a complete list of plant species. All plant nomenclature is from the U.S. Department of Agriculture (2006).

METHODS

In 2005, the habitat integrity and population (HIP) monitoring protocol was used to collect a second year of monitoring data at 14 HIP transects at the Orchard Training Area (Management Area 7; MA 7). The HIP monitoring protocol was developed in 2004 to monitor and assess slickspot peppergrass abundance, habitat integrity, and disturbance, for reporting on management actions implemented by the Candidate

Conservation Agreement (2003; Colket 2005, Colket 2006). The HIP monitoring protocol replaced the habitat integrity index (HII) monitoring protocol (Mancuso and Moseley 1998, Mancuso et al. 1998, Mancuso 2000:2003) to provide more replicable data specific to the needs of the Candidate Conservation Agreement. The HIP monitoring protocol consists of the following procedures: 1) establish and permanently mark HIP transects, 2) record location information, 3) take photographs, 4) measure abundance, habitat, and disturbance attributes at selected slickspots, 5) measure plant community attributes, and 6) analyze and describe the results.

HIP transect establishment

No additional HIP transects were established at MA 7 in 2005. One or more HIP transects were established within all MA 7 slickspot peppergrass EOs in 2004 (Colket 2005), before EOs were updated using standardized EO specifications (Colket et al. 2006). HIP transects were numbered and named based on the numerical identification code (e.g., 067) and survey site name of the associated EO, respectively (Appendix C). After updating the EOs, the numbers often did not correspond with the HIP transect numbers (Colket et al. 2006). Both the HIP transect numbers and updated EO numbers are presented in the attached tables and appendices to facilitate cross-walking between EO and HIP transect numbers. Multiple HIP transects were established within larger EOs/sub-EOs (>1 km^2; 250 ac) consisting of multiple, discrete subpopulations. Transects established as part of the HII monitoring program were used as much as possible for HIP transects to allow some comparisons between years. Differences in methodology before 2004 preclude comparisons of 1998-2005 data as powerful as those of 2004-2005 data, except for 2002 slickspot peppergrass abundance data at permanently marked slickspots.

The HIP transect location was determined after surveying the EO and locating slickspots inhabited by slickspot peppergrass. The HIP transects were arbitrarily located and permanently marked within the EOs to ensure sampling was initiated in an area capable of supporting slickspot peppergrass plants, and to facilitate assessing future and current population trends. The beginning of each HIP transect was permanently marked with a red “potato digger” stake. The first 10 slickspots encountered within approximately 10 m of the HIP transect azimuth were permanently marked with a metal stake and a nail attached to a metal tag labeled with the EO 3-digit identification code and slickspot number (1-10). HIP transects with few or widely-spaced slickspots had slickspots located >10 m from the HIP transect azimuth.

The locations of the red “potato digger” stake and the 10th (or last) slickspot were recorded with a GPS unit (Appendix C). The azimuths (always using 0° declination) and step counts were recorded between the red “potato digger” stake and the 1st slickspot, the 1st and the 2nd slickspot, and so on, to help relocate the slickspots during future sampling years (Appendix B). Driving directions to the red “potato digger” stake and triangulation azimuths from this point to prominent landscape features were also recorded to help relocate the HIP transect (Appendix I). Five landscape view photographs were taken from the red “potato digger” stake, looking towards the azimuth directions of 0°, 90°, 180°, 270°, and the HIP transect. Photographs were also taken of slickspots where the livestock trigger was exceeded (Candidate Conservation

Agreement 2003). Care was taken to ensure that each photograph was horizontally oriented, and that the horizon and sky were visible in each photograph to assist future photo point relocation (Elzinga et al. 1998).

HIP protocol—Slickspots

The "Habitat integrity and population monitoring field form" (Appendix A) was used to measure attributes within each slickspot along the HIP transect. Attributes were selected to measure the effectiveness of conservation measures implemented by the Candidate Conservation Agreement (2003), to allow for limited comparison between HII and HIP transect data, and to address additional concerns specified by the slickspot peppergrass technical committee before the 2005 field season. Unless otherwise noted, the following Daubenmire cover class scale was used to estimate attribute cover: 0=0%, 1=<1%, 2=1-4.9%, 3=5-9.9%, 4=10-24.9%, 5=25-49.9%, 6=50-74.9%, 7=75-94.9%, and 8=95-100% (Bonham 1989).

HIP transects were monitored using the same methods as 2004 (Colket 2005), with some modifications as described below (Appendix A). In 2004, slickspot peppergrass plant abundance was recorded in absolute terms or using categories (counted number up to 50, 51-100, 101-300, 301-500, and >500 plants). In 2005, the protocol was modified so the absolute number of plants were recorded at every slickspot. In 2004, the counted number of livestock prints were recorded as definite, probable, or possible. In 2005, only definite and probable livestock prints were counted to eliminate the ambiguity associated with possible livestock prints. In 2005, the proximity of residential and commercial development, agricultural lands, and cumulative landscape disturbance (defined as fire history, residential and commercial development, and agricultural lands) were also evaluated. In 2005, livestock trailing (as defined as an actual livestock trail) was measured in slickspots and for the general occurrence area (GOA).

In addition, there have been issues about the methodology used to categorize livestock prints as penetrating or non-penetrating in both 2004 and 2005. Penetrating livestock prints were defined as "breaking of the restrictive layer underneath the silt surface area during saturated conditions exposing the clay layer of the slickspot" according to the Candidate Conservation Agreement (2003:9). In 2004, livestock prints with a reddish coloration (due to the exposed clay layer) were classified as penetrating livestock prints. This method worked well except in the Jarbridge Management Area (MA 11) and/or when soils were wet or drying (Colket 2005).

In spring 2005, the Technical Team evaluated the silt crust method during a series of meetings and field trips with BLM soil scientist Paul Seronko. The silt crust method involved measuring the depth from the slickspot surface to the restrictive layer using a thin metal rod. This measurement was taken at 3 locations in every slickspot, and close to slickspot peppergrass plants, if present. Any livestock print deeper than the mean silt crust depth for the slickspot was defined as penetrating. The Technical Team recommended this method to the Conservation Committee at a field trip in mid-May 2005, with the intention that it be used during the imminent field season. In late-May 2005 (after commencement of the field season), select members of the Conservation Committee reconvened and recommended that a penetrating livestock print be defined

as any livestock print greater than 3 in (7.6 cm) deep. In 2005, the field crew used the silt crust depth method for the entire field season. In addition, the 3-in deep method was used for the entire field season after July 4, 2005. All results reported in this report are based on the silt crust method, although data for both the silt crust method and 3-in deep method are located in Appendices F and G. The different methodology for assessing penetrating livestock trampling in 2004 and 2005 means that they can not be directly compared with each other.

HIP protocol—Vegetation transects

Vegetation sampling was included in the HIP monitoring protocol to measure plant community composition and structural changes that may occur over time. Three slickspots were randomly selected to have an associated 10-m vegetation transect. Each vegetation transect was established by starting from the metal stake at each slickspot and measuring towards a randomly selected azimuth until the measuring tape was 2 m outside of the slickspot. A metal stake was hammered at this point to permanently mark the vegetation transect start point. From this start point, the measuring tape was extended 10 m in the same direction, and another metal stake was used to mark the end point of the vegetation transect. This information was recorded and summarized for future relocation of the vegetation transects (Appendix B). One landscape view photograph was taken of the vegetation transect from the metal stake at the slickspot. A second photograph was taken of the slickspot from the vegetation transect start point. Photographs were also taken of all slickspots not already photographed from the vegetation transect, from the south so that the entire slickspot was in the photograph.

In 2004, live shrub cover was estimated along vegetation transects using the line-interception method (Canfield 1941). In 2005, dead shrub cover was also estimated along the vegetation transects. A plumb bob was used to estimate shrub cover to the nearest centimeter on the metric tick (left) side of the tape. Canopy breaks in the cover of an individual shrub were not included in the cover estimate. Overlapping canopy cover of multiple individuals of the same species was measured as a continuous unit (i.e., from the start point of the first intercepting shrub to the end point of the last intercepting shrub). Herbaceous (grasses and forbs) and ground cover (i.e. crust, bare ground, rock, litter) were estimated along each vegetation transect using 20 x 50-cm modified Daubenmire cover quadrats on the metric tick side of the tape (Bonham 1989, Coulloudon et al. 1999). There were 5 quadrats per vegetation transect, spaced 2 m apart, starting and ending at the 2- and 10-m marks, respectively. The long side of the quadrat was aligned perpendicular to the vegetation transect and a plumb bob was used as needed for accurate alignment. All plant cover extending into the quadrat was counted, regardless if it were rooted within the quadrat. Plant inflorescences were not counted during vegetation sampling for both sampling methods described above.

Data analysis

All slickspot peppergrass abundance data from 1998-2005 were reported to reflect the use of categorical values in the past. If categorical values had been used in 2004 (often at just 1 or 2 slickspots), the categorical value midpoint was used for data analysis. Abundance in 2004 and 2005 was compared using the Wilcoxon signed-rank test for

each HIP transect and for all MA 7 HIP transects. In 2002, slickspots were permanently marked at most HII transects located within MA 7, and are the same ones used in 2004 and 2005 at HIP transects 027A:E, 028A:B, 053B, and 059A. Due to the replicability of these HIP transects, the 2002 abundance data were also compared with 2004 and 2005 data using the Wilcoxon signed-rank test.

Data were summarized and analyzed based on the midpoint of modified Daubenmire cover classes by EO and MA. In Colket (2005:2006) and in this report, all slickspot data were expressed in absolute terms. In Colket (2005), all vegetation data were relativized for all tables and figures throughout the report. In this report and Colket (2006), all vegetation data (for both 2004 and 2005) were expressed in absolute terms to show actual coverage throughout the report, except for the ordination and community classification analyses. As in Colket (2005), the ordination and community classification analyses were relativized by their maximum. Summarized absolute and relativized data for both 2004 and 2005 are located in Appendix G of this report. Mean non-native species and livestock disturbance cover within slickspots in 2004 and 2005 were compared rangewide using Wilcoxon signed-rank test. PC-ORD version 4.25 was used to classify and ordinate absolute plant cover data from vegetation transects at all HIP transects rangewide in Colket (2006; McCune and Mefford 1999, McCune and Grace 2002). See Colket (2006) for an explanation of these analyses.

Triggers were evaluated using HIP data collected in 2004 and 2005. Habitat quality decline for a HIP transect with predominantly native cover was defined as when one or more of the following occurred: 1) change in dominant 2 species comprising plant community resulting in loss of native perennial species; 2) transition in HIP transect from higher quality to lower quality class (determined used classification analyses; and/or 3) partial or complete burning, drill seeding, or other major, documented disturbance resulting in plant community change. Photographs were not used in the analysis, but are included in Appendix E.

RESULTS

Background

HIP transects were re-sampled at 027A, 027B, 027C, 027D, 027E (EO 100), 028A (EO 71), 028B (EO 71), 035A, 041A (EO 35), 053B, 059A, 067, 071A, and 071B (Fig. 2). No new HIP transects were established. HIP transects 027D and 071A are on state land and the rest are on BLM land.

Slickspot peppergrass

In 2005, 6542 slickspot peppergrass plants were observed at all MA 7 HIP transects, more than the 2806-3896 plants observed at the same 14 HIP transects in 2004 ($p=0.0303$; Table 1). At the same 10 HII/HIP transects, 203 plants were observed in 2002, 2096-3186 plants were observed in 2004, and 4941 were observed in 2005. Even though there were differences found between 2004 and 2005 based on the 14 HIP transects, there were not differences between 2002, 2004, and 2005 based on the 10 HIP transects sampled all 3 years. At HIP transect 027A, there were more plants

observed in 2004 (431-976) and 2005 (1816) than in 2002 (30; both p=0.0089). At HIP transect 027C, there were also more plants observed in 2004 (318-566) and 2005 (632) than in 2002 (29; 2002-2004 p=0.0088; 2002-2005=0.0318). Similarly, HIP transect 027D also had more plants in 2004 (1108-1307) and 2005 (1615) than in 2002 (78; both p=0.0127). At HIP transect 053B, there were more plants in 2005 (785) than 2004 (176-274; p=0.0318), and more plants in 2004 than 2002 (0; p=0.0317). HIP transect 067 had more plants in 2005 (433) than in 2004 (101; p=0.0127). HIP transect 071B also had more plants in 2005 (903) than in 2004 (314; p=0.0068). Overall, there were more plants in 2005 than 2004 at HIP transects 053B, 067, and 071B. HIP transects 027A, 027C, 027D, and 053B all had more plants in 2004 and 2005 compared to 2002.

Slickspots

Mean slickspot size was 47 m^2 in MA 7 (Table 2), large compared to the rest of the Consideration Zone. Mean biological soil crust within slickspots was 40% in MA 7, also high compared to the rest of the Consideration Zone (Colket 2006). No evidence of recent OHV tracks (including military training and activities), drill seeding or other restoration activities, or firefighting disturbances were observed at the MA 7 HIP transects (Table 2). No MA 7 HIP transects had a 5% increase in total non-native species cover within slickspots between 2004 and 2005 (Table 3). Clasping-leaf pepperweed and bur buttercup, followed by cheatgrass, were the dominant non-native species within slickspots at MA 7 HIP transects (Table 3 and Fig. 4). Bur buttercup and total unseeded weed cover with slickspots were both less in 2005 than 2004 (p=0.0109 and p=0.0258, respectively; Fig. 4). No other non-native plant species changed coverage between 2004 and 2005.

No livestock trampling was observed at HIP transects 041A (EO 35), 053B (EO 53), or 059A (EO 59). Six MA 7 HIP transects had 5-10% penetrating livestock trampling (HIP transects 027A, 027D, 027E (EO 100), 028A (EO 71), 028B (EO 71), and 071A; Table 4). In addition, HIP transects 027B, 027C, 035A, 067, and 071B all had 1-5% penetrating trampling within slickspots. Both penetrating and total livestock trampling within slickspots increased in 2005 compared to 2004 (p=0.0020 and p=0.0054, respectively), but non-penetrating livestock trampling did not change. Different methods were used to assess penetrating livestock trampling between years, but total livestock trampling was consistently measured between years. All livestock disturbance was attributed to cattle. Wildlife use was typically low at the MA 7 HIP transects, predominantly comprised of trails and rodent activity (Table 2). Trace cover of pronghorn prints were observed within slickspots at HIP transects 027A, 027B, 027C, 027D, 027E (EO 100), 041A (EO 35), 059A, and 067.

Plant community

None of the MA 7 HIP transects underwent a classification change between 2004 and 2005 (Table 6). All MA 7 HIP transects except 041A (EO 35) were in Class A/B (n=13). HIP transect 041A (EO 35) was in Class C/D, burned and dominated by native perennial grasses. No noxious or aggressive species were observed at any of the MA 7 HIP transects (Table 3).

Fragmentation

HIP transects 027A, 027C, 027D, 027E (EO 100), 028A (EO 71), 028B (EO 71), 071A, and 071B all had zero burned areas, commercial or residential development, or agricultural lands within 500 m (Table 5). HIP transect 027B was predominantly burned at all landscape scales within 250 m, and was partially burned between 250 and 500 m away. HIP transect 041A (EO 35) was completely burned at all landscape scales and had development (military buildings) within 65 m. HIP transect 053B itself was unburned, but predominantly unburned to predominantly burned within 500 m. HIP transect 053 also has development within 65 m. HIP transect 059A (EO 59) was also unburned itself, but was partially burned within 65 m. HIP transect 067 was unburned within 65 m predominantly unburned between 65 to 500 m.

Triggers

- No triggers occurred within MA 7 HIP transects in 2005.

DISCUSSION

The higher slickspot peppergrass abundance in 2005 was likely influenced by the high precipitation that occurred between February and June (Meyer 2005, Meyer et al. 2005, Palazzo et al. 2005). Non-native species cover within slickspots was similar between years, with the exception that bur buttercup cover was lower in 2005. Non-native unseeded species cover within slickspots was 25-50% at one HIP transect 027B slickspot, but not more than 5-10% cover within slickspots at any other MA 7 HIP transect. No seeded species cover within slickspots was observed at any MA 7 HIP transects. Except for HIP transect 027B, non-native unseeded species cover was relatively low compared to HIP transects rangewide (Colket 2006).

Due to different methods being used to assess penetrating livestock trampling (Colket 2006), it is better to compare total livestock trampling than penetrating livestock trampling between 2004 and 2005. Both 2004 and 2005 data are shown in this report (Fig. 4), but total livestock trampling is emphasized because it was measured the same way each year. Only 3 of the 14 MA 7 HIP transects had zero livestock trampling in 2005. In 2004, most (8/14) had zero livestock trampling. The total cover of livestock trampling in 2005 was also typically much greater than in 2004. For example, MA 7 only had 1 HIP transect with more than 1-5% total livestock trampling within any slickspot in 2004 (Colket 2005). In 2005, 43% (6/14) of the HIP transects had more than 1-5% total livestock trampling within any slickspot (Table 4). This increase did not result in any livestock triggers being tripped (Table 4), but correspondence with IDARNG personnel indicates that livestock trampling continued to occur at some MA 7 HIP transects after they had already been monitored (M. McHenry, pers. comm. 2005).

All but one of the MA 7 HIP transects were classified as A/B, indicating most MA 7 HIP transects are unburned and dominated by big sagebrush. The one exception, HIP transect 041A (EO 35), was burned and dominated by native perennial grasses (Table 6). The big sagebrush component was very high at the MA 7 HIP transects compared to HIP transects rangewide (Colket 2006). In 2005, 59% of all EOs rangewide were in

Class A/B compared to 93% at all MA 7 HIP transects (Colket 2006). Most MA 7 HIP transects also were relatively unfragmented compared to HIP transects rangewide. Eighty-six percent of the MA 7 HIP transects were completely unburned, and 43% were completely unburned within 500 m. Rangewide, 51% of the HIP transects were completely unburned, and 16% were completely unburned within 500 m. The intact big sagebrush component and relatively low fragmentation at the MA 7 HIP transects means that MA 7 has some of the best quality slickspot peppergrass habitat remaining.

MANAGEMENT IMPLICATIONS

Slickspot peppergrass abundance was greater in 2005 than 2004, likely because of higher spring precipitation in 2005. Total and penetrating livestock trampling were also greater in 2005 than 2004. It is unclear whether this was attributed to greater livestock use or greater impact associated with the higher spring precipitation. There may have been more penetrating livestock trampling detected because a more sensitive method was used in 2005 compared to 2004. Future monitoring years will use the 2004 protocol to ensure long-term consistency between years and with the Candidate Conservation Agreement trigger thresholds (2003; Colket 2006).

Management of military activities by the IDARNG continues to protect slickspot peppergrass from associated impacts. This is supported by the absence of any disturbance from military activities at any of the Orchard Training Area HIP transects in 2004 and 2005. The IDARNG has promoted the conservation of slickspot peppergrass at the Orchard Training Area for decades by protecting this species from the land use activities over which it has authority. This report represents a second year of monitoring using the HIP protocol and provides information to adaptively manage threats to slickspot peppergrass and objectively measure trends in future years.

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Table 1. Slickspot peppergrass plant abundance at habitat integrity index (HII; 1998-2002) and habitat integrity and population (HIP) transects (2004-2005) at the Orchard Training Area (MA 7). Unshaded values indicate abundance values based on the same permanently marked slickspots (2004, 2005, and 2002). The Wilcoxon signed-rank test was used to evaluate abundance pairwise at transects with permanently marked slickspots (2002, 2004, and 2005) and overall (2004 and 2005 only). Abundance that was significantly different between years is indicated by different superscript letters (e.g., [a] vs. [b]). Absence of superscript letters for 2002, 2004, and 2005 data indicates abundance is not different between years (unshaded values only).

HII/HIP#	EO/SUB-EO#	1998	1999	2000	2001	2002	2003	2004	2005
027A	27	>1842	114	>125	70	30[a]	-	431-976[b]	1816[b]
027B	27	0	0	0	0	5	-	0	0
027C	27	-	-	-	112	29[a]	-	318-566[b]	632[b]
027D	27	-	-	-	124	78[a]	-	1108-1307[b]	1615[b]
027E	100	-	-	-	36	16	-	38	30
028A	71	1365	125	755-855	56	7	-	25	63
028B	71	550	220	306	104	0	-	0	0
035A	35	175	38	10-100	0	34	-	23	67
041A	35	2	0	0	0	4	-	0	0
053B	53	0	3	-	0	0[a]	-	176-274[b]	785[c]
059A	59	-	-	-	15	0	-	0	0
67	67	-	-	-	-	-	-	101[a]	433[b]
071A	71	-	-	-	-	-	-	272	198
071B	71	-	-	-	-	-	-	314[a]	903[b]
SUM		**>3934**	**500**	**>1196**	**517**	**203**	**-**	**2806-3896[a]**	**6542[b]**

Table 2. 2005 slickspot attributes, slickspot peppergrass abundance, wildlife use, off-highway vehicle (OHV) use, firefighting, and restoration attributes at Orchard Training Area (MA 7) habitat integrity and population (HIP) transects.

Land unit			Attributes			Population			Wildlife use				OHV use			Firefighting		Restoration		
Management Area (MA)	EO	HIP transect	M SS silt crust depth (cm)	M SS size (m²)	SS - M biological soil crust cover	Total # plants	% Rosettes*	% Reproductive*	SS - M% wildlife use cover	SS - M% Non-L UNG print cover	SS - M% rodent activity cover	SS - M% trail cover	FREQ of SS w/ OHV tracks	OHV tracks in GOA (#24)**	Recent or older?	Firefighting disturbance in GOA (#25)**	Recent or older?	FREQ of drill seeded SS	Drill seeded SS in GOA (#26)**	Recent or older?
7	27	027A	0.8	83	56.3	1816	84	16	1.5	0.1	0.8	0.1	0	a	NA	a	NA	0	a	NA
	27	027B	0.6	34	29.0	0	0	0	1.7	0.2	0.1	0.0	0	a	NA	a	NA	0	a	NA
	27	027C	0.8	57	41.3	632	88	12	1.2	0.2	0.0	0.0	0	b	O	a	NA	0	a	NA
	27	027D	0.7	87	25.5	1615	74	26	1.5	0.3	0.4	0.6	0	a	NA	a	NA	0	a	NA
	100	27E	0.8	78	54.3	30	23	77	1.6	0.1	0.0	0.0	0	a	NA	a	NA	0	a	NA
	71	028A	1.0	25	17.2	63	86	14	2.0	0.0	0.0	0.0	0	a	NA	a	NA	0	a	NA
	71	028B	1.0	17	5.4	0	0	0	2.2	0.0	0.0	0.8	0	a	NA	a	NA	0	a	NA
	35	035A	0.7	51	43.3	67	18	82	6.9	0.0	0.4	5.6	0	-1	-1	-1	-1	0	-1	-1
	35	041A	0.9	21	38.8	0	0	0	2.7	0.1	2.1	0.0	0	a	NA	a	NA	0	a	NA
	53	053B	0.8	15	19.6	785	61	39	1.5	0.0	0.0	0.9	0	a	NA	a	NA	0	a	NA
	59	059A	0.8	39	45.8	0	0	0	3.2	0.1	0.4	1.7	0	a	NA	a	NA	0	a	NA
	67	067	0.6	39	63.0	433	70	30	1.2	0.1	0.4	0.0	0	a	NA	a	NA	0	a	NA
	71	071A	0.7	67	68.5	198	87	13	3.1	0.0	0.1	2.0	0	a	NA	a	NA	0	a	NA
	71	071B	0.6	44	45.5	903	87	13	5.9	0.0	0.7	3.9	0	a	NA	a	NA	0	a	NA
	MEAN		**0.8**	**47**	**39.5**	**467**	**48**	**23**	**2.6**	**0.1**	**0.4**	**1.1**	**0**					**0**		

Abbreviations are: SS=slickspot, GOA=general occurrence area, FREQ=frequency, M=mean, R=recent, O=older, NA=not applicable, L=livestock, UNG=ungulate. *Mean % rosette and reproductive values are based on HIP transect values, and not population totals. **Number in parentheses refers to Appendix I: Habitat Integrity and Population Monitoring Field Form.

Table 3. Absolute non-native species cover in slickspots and absolute functional group cover in adjacent community at Orchard Training Area (MA 7) habitat integrity and population (HIP) transects.

Land unit			Weeds								Functional groups						Substrate		
Management Area (MA)	EO	HIP transect	SS - M% unseeded non-native species	SS - M% BROTEC	SS - M% LEPPER	SS - M% CERTES	SS - M% seeded non-native species	SS - M% AGRCRI	SS - M% KOCPRO	Noxious or aggressive species in GOA (#29)**	Non-native annuals	Non-native perennial grasses	Native forbs	Shrubs	Native perennial grasses	Native annual grasses	Bare ground	Litter	Biological soil crust
7	27	027A	1.3	0.0	0.4	1.3	0.0	0.0	0.0	NA	3.1	0.0	0.1	27.8	5.1	0.8	29.2	9.4	42.0
	27	027B	5.4	0.5	3.7	0.8	0.0	0.0	0.0	NA	12.1	0.0	0.0	14.5	1.2	0.0	19.5	32.5	9.3
	27	027C	1.3	0.1	0.2	1.0	0.0	0.0	0.0	NA	1.4	0.0	0.0	30.2	8.7	0.6	22.4	14.4	43.4
	27	027D	0.5	0.1	0.2	0.5	0.0	0.0	0.0	NA	1.3	0.0	0.3	30.7	9.5	0.4	18.4	30.2	25.5
	100	27E	2.5	1.3	1.0	0.1	0.0	0.0	0.0	NA	3.1	0.0	0.2	17.3	5.1	2.3	23.3	30.2	20.9
	71	028A	1.9	0.0	0.2	1.4	0.0	0.0	0.0	NA	6.3	0.0	0.4	32.2	6.8	0.0	22.3	27.1	17.2
	71	028B	2.9	0.0	0.1	3.0	0.0	0.0	0.0	NA	8.1	0.0	0.5	27.4	9.3	0.8	22.1	24.7	13.1
	35	035A	0.7	0.3	0.6	0.3	0.0	0.0	0.0	NA	0.6	0.0	0.5	14.1	11.9	1.0	33.4	17.0	27.7
	35	041A	3.4	0.5	2.9	0.5	0.0	0.0	0.0	NA	5.0	0.0	1.8	0.0	16.9	0.4	7.2	42.8	19.0
	53	053B	1.0	0.0	0.0	0.5	0.0	0.0	0.0	NA	2.5	0.0	0.7	39.5	0.5	0.1	35.8	36.8	12.2
	59	059A	3.2	2.0	1.7	0.3	0.0	0.0	0.0	NA	2.5	0.0	0.6	37.1	4.0	1.2	6.2	14.9	58.0
	67	067	1.3	0.5	0.2	1.0	0.0	0.0	0.0	NA	0.7	0.0	0.0	29.4	6.0	8.2	9.8	30.2	31.5
	71	071A	1.5	0.1	0.7	0.8	0.0	0.0	0.0	NA	2.5	0.0	0.1	38.2	5.0	1.1	13.0	24.3	43.8
	71	071B	2.5	0.0	0.6	1.3	0.0	0.0	0.0	NA	5.8	0.0	1.7	33.2	1.2	0.7	13.2	37.1	27.5
	MEAN		**2.1**	**0.4**	**0.9**	**0.9**	**0.0**	**0.0**	**0.0**		**3.9**	**0.0**	**0.5**	**26.6**	**6.5**	**1.3**	**19.7**	**26.6**	**27.9**

Abbreviations are: SS=slickspot, GOA=general occurrence area, M=mean, and NA=not applicable. *Six-letter plant codes are referenced in Appendix D.

Table 4. Livestock use attributes at Orchard Training Area (MA 7) habitat integrity and population (HIP) transects.

Land unit			Livestock use																	
Management Area (MA)	EO	HIP transect	M% PEN LPC in SS	M% non-PEN LPC in SS	M% total LPC in SS	M% L feces cover in SS	FREQ SS w/ >10% PEN LPC	FREQ SS w/ >5% PEN LPC	FREQ SS w/ >1% PEN LPC	FREQ SS w/ >0% PEN LPC	FREQ SS w/ >10% non-PEN LPC	FREQ SS w/ >5% non-PEN LPC	FREQ SS w/ >1% non-PEN LPC	FREQ SS w/ >0% non-PEN LPC	FREQ SS w/ >10% TOT LPC	FREQ SS w/ >5% TOT LPC	FREQ SS w/ >1% TOT LPC	FREQ SS w/ >0% TOT LPC	SS w/ definite PEN LPC in GOA (#17)**	Recent or older?
7	27	027A	3.9	0.5	4.4	0.0	0	2	10	10	0	0	0	9	0	3	10	10	c	R
	27	027B	2.5	0.0	2.5	0.3	0	0	8	10	0	0	0	0	0	0	8	10	c	R
	27	027C	2.5	0.4	2.8	0.1	0	0	8	10	0	0	0	7	0	0	9	10	c	R
	27	027D	2.6	0.1	2.6	1.0	0	2	5	8	0	0	0	1	0	2	5	8	b	R
	100	027E	2.7	0.0	2.7	0.1	0	2	5	10	0	0	0	0	0	2	5	10	b	R
	71	028A	1.8	0.3	1.8	0.1	0	1	4	7	0	0	0	5	0	1	4	6	b	R
	71	028B	2.0	0.2	2.0	0.1	0	1	5	5	0	0	0	3	0	1	5	5	c	R
	35	035A	0.8	0.1	0.8	0.1	0	0	2	5	0	0	0	1	0	0	2	5	-1	-1
	35	041A	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	a	NA
	53	053B	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	a	NA
	59	059A	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	a	NA
	67	067	1.6	0.2	1.9	0.3	0	0	5	7	0	0	0	3	0	0	6	7	b	R
	71	071A	1.3	0.1	1.3	0.1	0	1	2	6	0	0	0	2	0	1	2	6	b	O
	71	071B	1.4	0.1	1.4	0.1	0	0	4	8	0	0	0	2	0	0	4	8	c	R
	MEAN		**1.6**	**0.1**	**1.7**	**0.1**	**0**	**1**	**4**	**6**	**0**	**0**	**0**	**2**	**0**	**1**	**4**	**6**		

Abbreviations are: SS=slickspot, GOA=general occurrence area, FREQ=frequency, M=mean, L=livestock, LPC=livestock print cover, PEN=penetrating, TOT=total, R=recent, and O=older. **Number in parentheses refers to Appendix A: Habitat Integrity and Population Monitoring Field Form.

Table 5. Landscape disturbance pattern attributes at Orchard Training Area (MA 7) habitat integrity and population (HIP) transects.

Land unit			Fire history				Residential & commercial development				Agriculture				Cumulative landscape disturbance			
Management Area (MA)	EO	HIP transect	At HIP transect (#17A)**	Within 65 m (#17B)**	Within 250 m (#17C)**	Within500 m (#17D)**	At HIP transect (#19A)**	Within 65 m (#19B)**	Within 250 m (#19C)**	Within500 m (#19D)**	At HIP transect (#20A)**	Within 65 m (#20B)**	Within 250 m (#20C)**	Within500 m (#20D)**	At HIP transect (#21A)**	Within 65 m (#21B)**	Within 250 m (#21C)**	Within500 m (#21D)**
7	27	027A	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	27	027B	2	2	2	3	1	1	1	1	1	1	1	1	2	2	2	3
	27	027C	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	27	027D	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	100	27E	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	71	028A	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	71	028B	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	35	035A	1	1	2	3	1	1	1	1	1	1	1	1	1	1	2	3
	35	041A	5	5	5	5	1	3	3	3	1	1	1	1	5	5	5	5
	53	053B	1	2	3	4	1	2	2	2	1	1	1	1	1	2	3	4
	59	059A	1	3	3	3	1	1	1	1	1	1	1	1	1	3	3	3
	67	067	1	1	2	2	1	1	1	1	1	1	1	1	1	1	2	2
	71	071A	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	71	071B	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

**Number in parentheses refers to Appendix A: Habitat Integrity and Population Monitoring Field Form. Data values correspond to questions in Appendix A, where 1=undisturbed, 2=predominantly undisturbed, 3=roughly equal areas of undisturbed and disturbed lands, 4=predominantly disturbed, and 5=completely disturbed.

Table 6. Dominant plant communities and plant community trends at Orchard Training Area (MA 7) habitat integrity and population (HIP) transects (2004-2005). Sorenson distance measures were used to classify HIP transects into the following 4 classes: A/B=unburned and dominated by big sagebrush (*Artemisia tridentata*; ARTTRI); C/D= transitional class in between other 3 classes; E=burned and dominated by cheatgrass (*Bromus tectorum*; BROTEC); and F=burned and dominated by crested wheatgrass (*Agropyron cristatum*; AGRCRI; modified from Table 2 in Colket 2005). Plant species represented by 6 letter codes are in Appendix D. Abbreviations are nc=no change in class.

EO/SUB-EO#	HIP#	Plant community		Class		Change
		2004	2005	2004	2005	
	027A	ARTTRI/CERTES	ARTTRI/POASEC	A/B	A/B	nc
	027B	ARTTRI/LEPPER	ARTTRI/BROTEC	A/B	A/B	nc
	027C	ARTTRI/POASEC	ARTTRI/POASEC	A/B	A/B	nc
27	027D	ARTTRI/POASEC	ARTTRI/POASEC	A/B	A/B	nc
	035A	POASEC/ARTTRI	ARTTRI/POASEC	A/B	A/B	nc
35	041A	LEYCIN/POASEC	ELYELY/LEYCIN	C/D	C/D	nc
53	053B	ARTTRI/LITPAR	ARTTRI/CERTES	A/B	A/B	nc
59	059A	ARTTRI/TETGLA	ARTTRI/TETGLA	A/B	A/B	nc
67	067	ARTTRI/VULOCT	ARTTRI/VULOCT	A/B	A/B	nc
	028A	ARTTRI/CERTES	ARTTRI/POASEC	A/B	A/B	nc
	028B	ARTTRI/POASEC	ARTTRI/POASEC	A/B	A/B	nc
	071A	ARTTRI/POASEC	ARTTRI/POASEC	A/B	A/B	nc
71	071B	ARTTRI/CERTES	ARTTRI/CERTES	A/B	A/B	nc
100	027E	ARTTRI/POASEC	ARTTRI/POASEC	A/B	A/B	nc

Figure 1. Map of slickspot peppergrass Management Areas (MAs) and habitat integrity and population (HIP) transects within the Consideration Zone.

SPATIAL DATA NOT SHOWN.

Figure 2. Map of Orchard Training Area (MA 7). HIP transect labels are in white and EO labels are in black.

SPATIAL DATA NOT SHOWN.

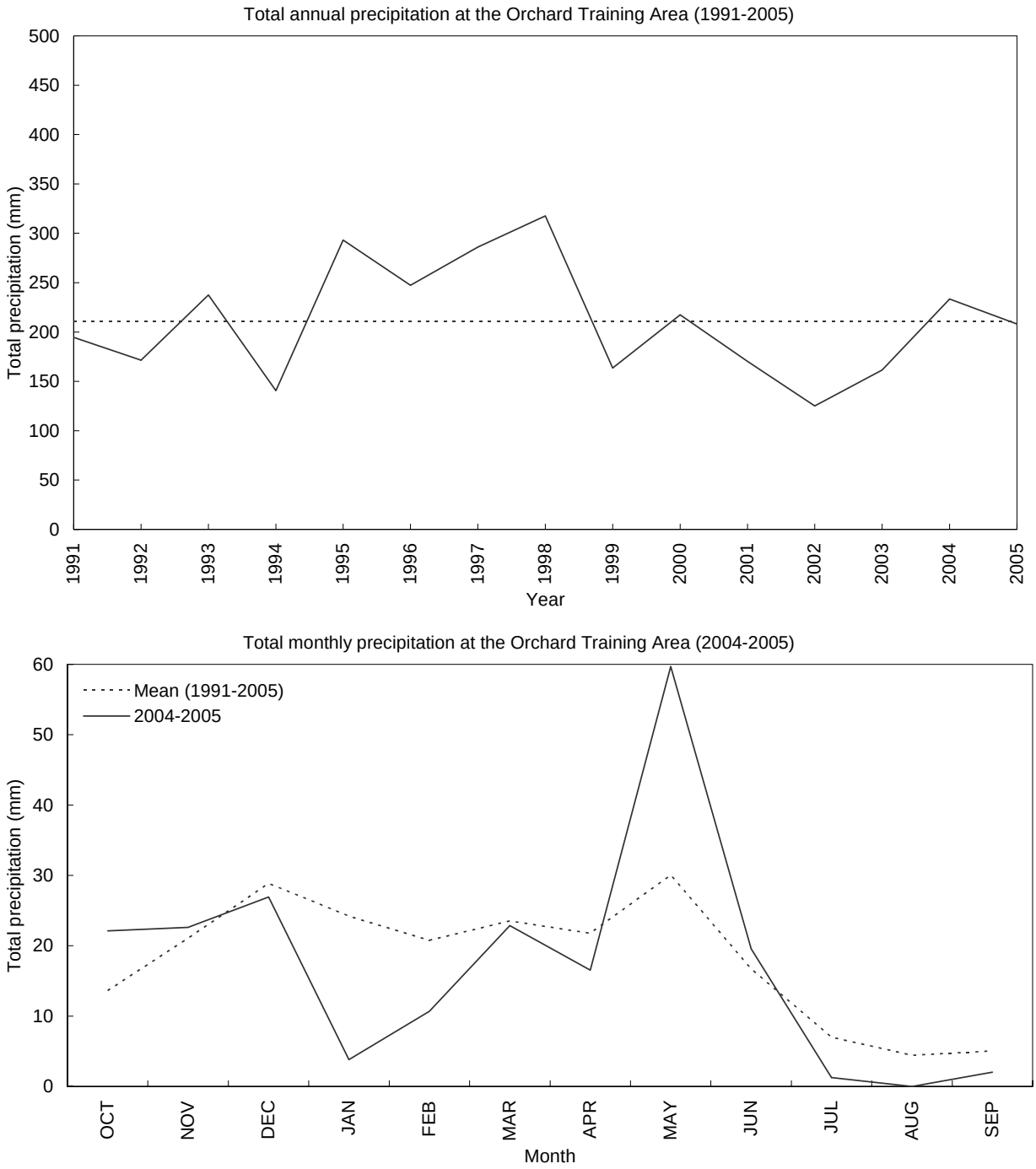

Figure 3. Total annual (October-September; 1991-2005; above) and monthly water-year precipitation at the Orchard Training Area (2004-2005; below). The horizontal dashed line (above) represents total mean annual water-year precipitation at the Orchard Training Area (1991-2005). Weather data were accessed from J. Weaver, pers. comm. (2006).

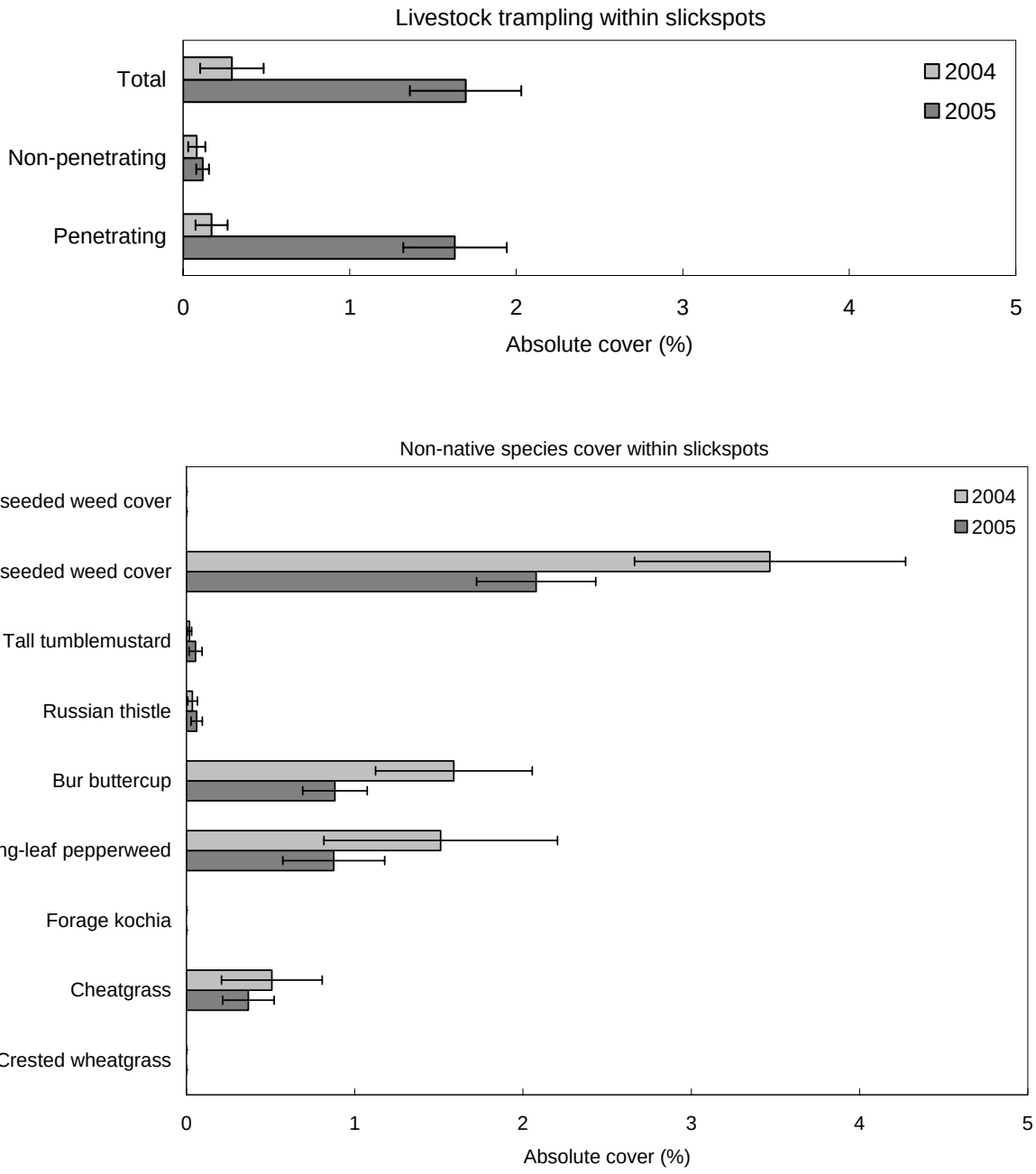

Figure 4. Mean absolute livestock trampling and non-native species cover within slickspots at Orchard Training Area (MA 7) habitat integrity and population (HIP) transects in 2004 and 2005 (n=14). The Wilcoxon signed-rank test was used to evaluate significance of HIP transect data based on 2004 and 2005 data.

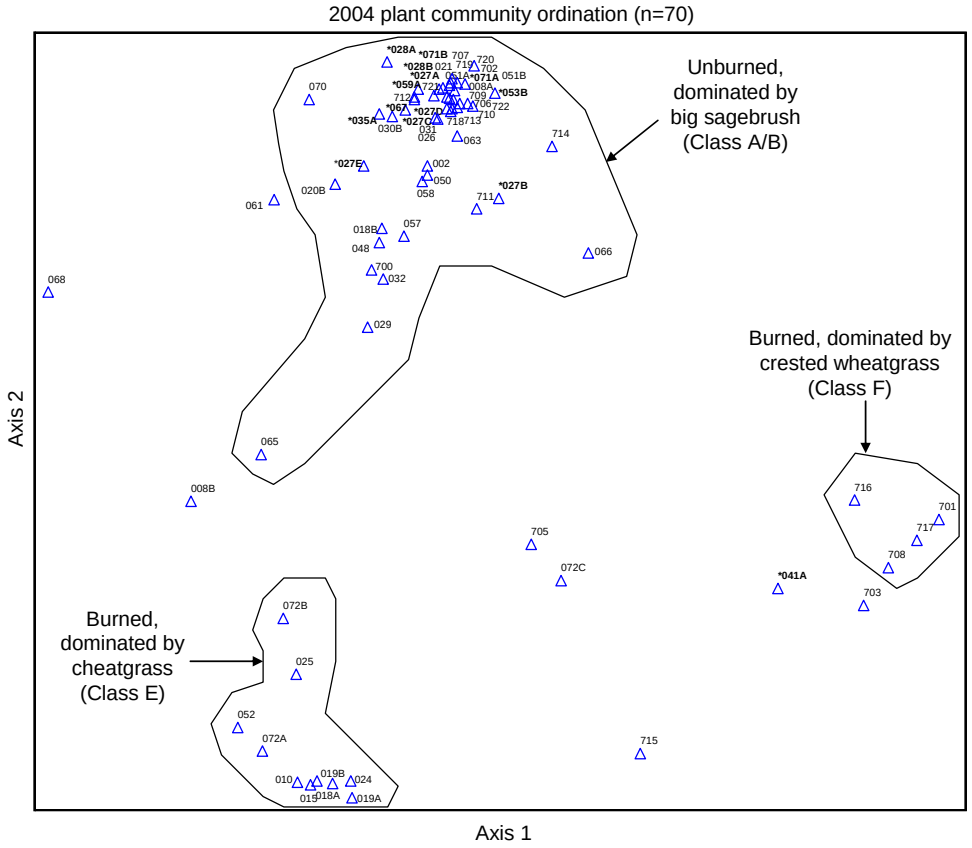

Figure 5. Nonmetric multidimensional scaling (NMS) community ordination of 2004 habitat integrity and population (HIP) transects (n=70). HIP transects at the Orchard Training Area are proceeded by an asterisk. Data are based on mean relative Daubenmire cover quadrat and line-interception values. Sorenson distance measures were used to classify HIP transects into the following 4 classes: A/B=unburned and dominated by big sagebrush (*Artemisia tridentata*; ARTTRI); C/D= transitional class in between other 3 classes; E=burned and dominated by cheatgrass (*Bromus tectorum*; BROTEC); and F=burned and dominated by crested wheatgrass (*Agropyron cristatum*; AGRCRI; modified from Table 2 in Colket 2005). All HIP transects not located within 1 of the 3 polygons are in Class C/D. Plant species represented by 6 letter codes are in Appendix D. Figure is adapted from Colket (2006).

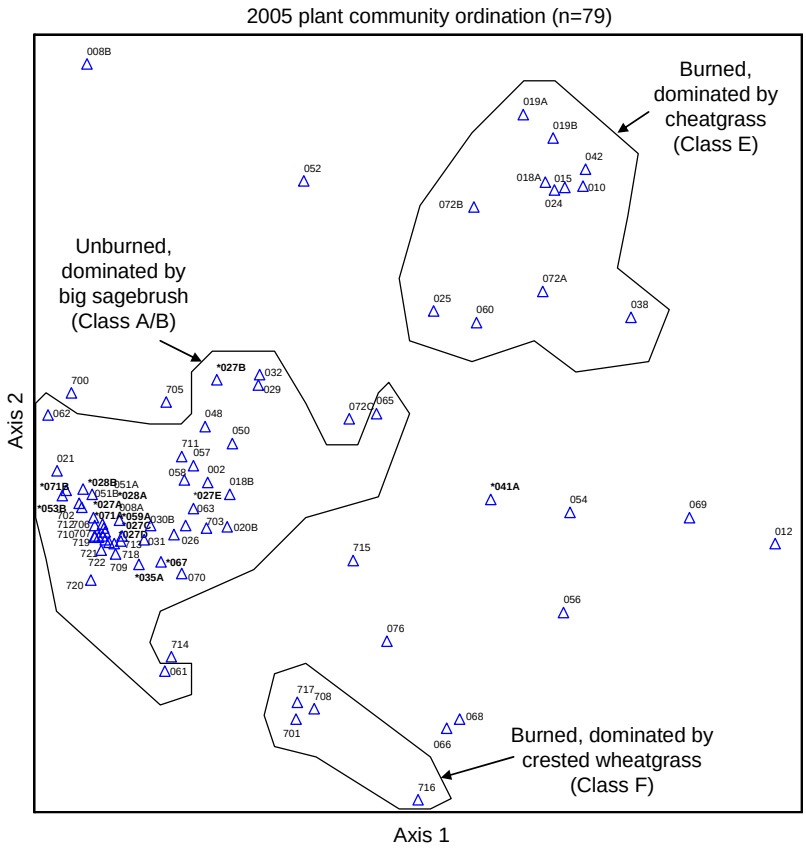

Figure 6. Nonmetric multidimensional scaling (NMS) community ordination of 2005 habitat integrity and population (HIP) transects (n=79). HIP transects at the Orchard Training Area are proceeded by an asterisk. Data are based on mean relative Daubenmire cover quadrat and line-interception values. Sorenson distance measures were used to classify HIP transects into the following 4 classes: A/B=unburned and dominated by big sagebrush (*Artemisia tridentata*; ARTTRI); C/D= transitional class in between other 3 classes; E=burned and dominated by cheatgrass (*Bromus tectorum*; BROTEC); and F=burned and dominated by crested wheatgrass (*Agropyron cristatum*; AGRCRI; modified from Table 2 in Colket 2005). All HIP transects not located within 1 of the 3 polygons are in Class C/D. Plant species represented by 6 letter codes are in Appendix D. Figure is adapted from Colket (2006).

Appendix A. Lepidium papilliferum Habitat Integrity and Population (HIP) monitoring field form (revised 05/02/05). Unless noted otherwise, use the following cover class scale for scoring attributes: 0=0%, 1=<1%, 2=1-4.9%, 3=5-9.9%, 4=10-24.9%, 5=25-49.9%, 6=50-74.9%, 7=75-94.9%, and 8=95-100%.

Silt crust depth

1. What are the 3 silt crust depth measurements at the slickspot (SS)?
A) _____ B) _____ C) _____

Slickspot attributes

2. What are the approximate slickspot dimensions (i.e. length x width, in square meters)? _____ x _____

3. What percentage of the slickspot is disturbed by wildlife activity (i.e. ants, deer, elk, badgers, ground squirrels, other)? State animal type, appropriate cover class, and whether wildlife prints are penetrating.
A) _____ B) _____ C) _____ D) _____ E) _____

4. How much microbiotic crust cover is in the slickspot (including "bathtub" rim)? _____

5. List weed and seeded species and associated cover class (as applicable):
A) _____ B) _____ C) _____ D) _____ E) _____

6. A) Total weed cover class value = ____ B) Total seeded species cover class value = ____

Slickspot peppergrass

7. A) # of rosettes _____ B) # of reproductive plants _____ 8. Total # of plants _____

9. Total # of plants trampled by livestock _____

OHV use

10. Class of vehicle: _____

11. Answer the following questions using the appropriate cover classes:
   A) How much of the slickspot is disturbed by vehicle tracks that are broken through to the slickspot clay layer? _____
   B) How much of the slickspot is disturbed by vehicle tracks that are not broken through to the slickspot clay layer? _____
   C) What is the total area (%) of the slickspot disturbed by vehicle tracks (A + B)? _____

Restoration activities

12. How much of the slickspot has been disturbed by drill seeding or other restoration activities (i.e. chaining, raking)? _____

Livestock use

13. Class of livestock: _____

14. Answer the following questions using the appropriate cover classes:
   A) How much of the slickspot is disturbed by livestock tracks that are broken through to the slickspot clay layer?
   B) How much of the slickspot is disturbed by livestock tracks that are not broken through to the slickspot clay layer?
   C) What is the total area (%) of the slickspot disturbed by livestock tracks (A + B)?
   D) How much of the slickspot is covered by livestock feces?

15. Answer the following questions using the following categories:
   A) How many tracks within the slickspot are clearly attributable to livestock?
   B) How many of the definite livestock tracks are broken through to the slickspot clay layer?
   C) How many tracks were likely caused by livestock, but lack sufficient definition to be 100% certain?
   D) How many of these probable livestock tracks are broken through to the slickspot clay layer?

16. How much of the slickspot has been disturbed by livestock trailing?

Landscape pattern (recorded at slickspot station 5)

Describe the stated landscape attributes using the following scales (#15-19):
   A) Immediately adjacent to the monitoring transect
   B) Scale of surrounding 3 acres (ca 65 m radius)
   C) Scale of surrounding 3-50 acres (ca 250 m radius)
   D) Scale of surrounding 50-200 acres (ca 500 m radius)

17. What is the fire history pattern depicted by the vegetation at the 4 landscape scales?
   (1) Unburned
   (2) Predominantly unburned except for a few scattered, small burned islands
   (3) Distinct burned and unburned areas, roughly equal parts of each
   (4) Predominantly burned except for a few, scattered, small sagebrush islands
   (5) Completely burned

Appendix A (Continued)

18. A) and B) How long ago did fire occur at landscape scales A and B?
    (1) Burned <12 months ago
    (2) Burned >12 months ago
    (3) Not sure
    (4) Not applicable

19. What is the proportion of residential and/or commercial development at the 4 landscape scales?
    (1) No development
    (2) Predominantly undeveloped
    (3) Distinct developed and undeveloped areas, roughly equal parts of each
    (4) Predominantly developed
    (5) Completely developed

20. What is the proportion of agricultural lands at the 4 landscape scales?
    (1) No agricultural lands
    (2) Small proportion of agricultural lands
    (3) Roughly equal proportions of agricultural lands and non-agricultural lands
    (4) Predominantly agricultural lands
    (5) Completely agricultural lands

21. What is the cumulative proportion of anthropogenic-disturbed lands (i.e., fire, development, agriculture) at the 4 landscape scales?
    (1) No disturbance
    (2) Predominantly undisturbed
    (3) Roughly half disturbance
    (4) Predominantly disturbed
    (5) Completely disturbed

General occurrence area (5 minute walk around occurrence area using slickspot station 5 as a reference center)

22. Are there other slickspots in the general occurrence area with definite livestock tracks that have broken through to the clay layer? Indicate if livestock tracks are recent (R) or older (O).
    a) No slickspots with livestock tracks that have broken through to the clay layer
    b) <10% of slickspots encountered have livestock tracks broken through to the clay layer
    c) >10% of slickspots encountered have livestock tracks broken through to the clay layer

23. Is there livestock trailing in the general occurrence area? Indicate class unless livestock class is cattle.
    a) No livestock trailing
    b) Light to moderate trailing (low density, widely scattered trails)
    c) Heavy trailing (multiple crisscrossing tracks)

24. Is there evidence OHVs or other vehicles go off-road in cross-country fashion within the general occurrence area? Indicate if ORV disturbance is recent (R) or older (O).
    a) No evidence
    b) Light to moderate use (low density, widely scattered individual tracks)
    c) Heavy use (multiple crisscrossing tracks)

25. Is there evidence of fire-fighting disturbances within general occurrence area? Indicate if fire-fighting disturbances are recent (R) or older (O).
    a) No evidence
    b) Some evidence (<10%; i.e. one or only a few minor fires lines, or other related disturbances)
    c) Greater evidence (>10%; i.e. multiple or large fire lines, or widespread related disturbances)

26. Is there evidence of post-fire seeding or other restoration-related disturbances at other slickspots within the general occurrence area? Indicate if these disturbances are recent (R) or older (O).
    a) No evidence
    b) Yes, and <10% slickspots disturbed
    c) Yes, and >10% slickspots disturbed

27. The grass layer in the general occurrence area is dominated by:
    a) A mix of native bunchgrass species
    b) Poa secunda and with little or no other native bunchgrasses
    c) A mix of native bunchgrasses and exotic annual grasses
    d) Seeded grasses, with varying, subordinate amounts of native bunchgrass cover and little or no exotic annual grass cover
    e) A mix of seeded and exotic annual grasses
    f) Exotic annual grasses having at least twice the cover of native bunchgrasses
    g) Exotic annual grasses; native bunchgrasses reduced to remnant status or largely extirpated

28. Weedy forb species in the general occurrence area are:
    a) Sparse or absent
    b) Patchy, but not widespread
    c) Widespread but with low (<10%) cover
    d) Widespread and abundant

29. List noxious or other aggressive exotic weed species observed within the occurrence area and note relative abundance (as applicable).

Appendix B. Slickspot (SS) and vegetation transect (VT) relocation at habitat integrity and population (HIP) transects. SPATIAL DATA NOT SHOWN.

HIP#	EO/SUB-EO#	Main HIP	Stake-SS1*	SS1-SS2*	SS2-SS3*	SS3-SS4*	SS4-SS5*	SS5-SS6*	SS6-SS7*	SS7-SS8*	SS8-SS9*	SS9-SS10*	VT1**	VT2**	VT3**
027A	27														
027B	27														
027C	27														
027D	27														
027E	100														
028A	71														
028B	71														
035A	35														
041A	35														
053B	53														
059A	59														
067	67														
071A	71														
071B	71														

Declination is 0º. *SS relocation information is in the format of xx/yyyº, where xx=# of steps and yyy=azimuth from originating to targeted location. ** VT re-location information is in the format of x/yyyº/z.z m, where x= SS number, yyyº=azimuth of VT, and z.z m=distance between metal stake in slickspot to VT start point

Appendix C. GPS location of habitat integrity and population (HIP) transects. SPATIAL DATA NOT SHOWN.

HIP#	EO/ SUB-EO#	EO Name	Location	Date	GPS Accuracy	Easting NAD83 IDTM	Northing NAD83 IDTM	Easting NAD83 UTM	Northing NAD83 UTM
027A	27	Orchard Training Area	start	7/13/2004	PDA/PDOP<5/30 pts.				
027A	27	Orchard Training Area	end	6/2/2005	PDA/PDOP<5/30 pts.				
027B	27	Orchard Training Area	start	7/27/2004	PDA/PDOP<5/30 pts.				
027B	27	Orchard Training Area	end	7/27/2004	PDA/PDOP<5/30 pts.				
027C	27	Orchard Training Area	start	6/2/2005	PDA/PDOP<5/30 pts.				
027C	27	Orchard Training Area	end	6/2/2005	PDA/PDOP<5/30 pts.				
027D	27	Orchard Training Area	start	DNE	OLD NAD83				
027D	27	Orchard Training Area	end	7/13/2004	PDA/PDOP<5/30 pts.				
027E	100	Orchard NE	start	7/27/2004	PDA/PDOP<5/30 pts.				
027E	100	Orchard NE	end	7/27/2004	PDA/PDOP<5/30 pts.				
028A	71	Christmas Mountain NE	end	6/14/2004	PDA/PDOP<5/30 pts.				
028A	71	Christmas Mountain NE	start	6/14/2004	PDA/PDOP<5/30 pts.				
028B	71	Christmas Mountain NE	start	6/14/2004	PDA/PDOP<5/30 pts.				
028B	71	Christmas Mountain NE	end	6/14/2004	PDA/PDOP<5/30 pts.				
035A	35	Orchard SW	start	8/8/2005	PDA/PDOP<5/30 pts.				
041A	35	Orchard SW	start	7/7/2005	PDA/PDOP<5/30 pts.				
041A	35	Orchard SW	end	7/7/2005	PDA/PDOP<5/30 pts.				
053B	53	Christmas Mountain	start	7/5/2005	PDA/PDOP<5/30 pts.				
053B	53	Christmas Mountain	end	7/5/2005	PDA/PDOP<5/30 pts.				
059A	59	Fake Raptor Rock	start	7/7/2005	PDA/PDOP<5/30 pts.				
059A	59	Fake Raptor Rock	end	7/7/2005	PDA/PDOP<5/30 pts.				
067	67	N edge of OTA	start	8/3/2004	PDA/PDOP<5/30 pts.				
067	67	N edge of OTA	end	8/3/2004	PDA/PDOP<5/30 pts.				
071A	71	Christmas Mountain NE	start	6/28/2004	PDA/PDOP<5/30 pts.				
071A	71	Christmas Mountain NE	end	6/28/2004	PDA/PDOP<5/30 pts.				
071B	71	Christmas Mountain NE	end	7/1/2004	PDA/PDOP<5/30 pts.				
071B	71	Christmas Mountain NE	start	7/1/2004	PDA/PDOP<5/30 pts.				

Appendix D. Plant species at habitat integrity and population (HIP) transects. A "-1" indicates information is unknown.

Scientific name	Common name	Life form	Origen	Growth form	Code
Achnatherum thurberianum	Thurber needlegrass	perennial	native	grass	achthu
Artemisia tridentata	big sagebrush	perennial	native	shrub	arttri
Bromus tectorum	cheatgrass	annual	introduced	grass	brotec
Ceratocephala testiculata	bur buttercup	annual	introduced	forb	certes
Cryptantha scoparia	Pinyon Desert cryptantha	annual	native	forb	crysco
Descurainia pinnata	western tansymustard	annual	native	forb	despin
Descurainia sophia	herb sophia	annual	introduced	forb	dessop
Draba verna	spring draba	annual	introduced	forb	draver
Elymus elymoides	bottlebrush squirreltail	perennial	native	grass	elyely
Halogeton glomeratus	halogeton	annual	introduced	forb	halglo
Lactuca serriola	prickly lettuce	annual	introduced	forb	lacser
Lepidium perfoliatum	clasping leaf pepperweed	annual	introduced	forb	lepper
Leymus cinereus	basin wildrye	perennial	native	grass	leycin
Phlox gracilis	slender phlox	annual	native	forb	phlgra
Poa secunda	Sandberg bluegrass	perennial	native	grass	poasec
Pseudoroegneria spicata	bluebunch wheatgrass	perennial	native	grass	psespi
Salsola tragus	prickly Russian thistle	annual	introduced	forb	salkal
Sisymbrium altissimum	tall tumblemustard	annual	introduced	forb	sisalt
Tetradymia glabrata	littleleaf horsebrush	perennial	native	shrub	tetgla
Vulpia octoflora	sixweeks fescue	annual	native	grass	vuloct