Element occurrence review and update for slickspot peppergrass (*Lepidium papilliferum*)

Idaho Conservation Data Center

Idaho Department of Fish and Game
PO Box 25
Boise, Idaho
83707

Beth Colket
Shelley Cooke
Michael Mancuso

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ABSTRACT

Slickspot peppergrass (*Lepidium papilliferum*) is a rare annual or biennial mustard species endemic to southwestern Idaho. Slickspot peppergrass has been a high priority conservation concern in Idaho for many years. The Idaho Conservation Data Center (IDCDC) manages spatial and tabular data pertaining to slickspot peppergrass using element occurrences (EOs). The objectives of this project were to apply the following tasks to all slickspot peppergrass EOs in the IDCDC Database: 1) update and review EO specifications and EO rank specifications; 2) update spatial data; 3) delineate EOs using EO specifications; 4) update and review tabular data; and 5) apply EO ranks based on EO rank specifications. EO specifications and EO rank specifications were developed and applied to all slickspot peppergrass EOs and sub-EOs. After application of the EO specifications and EO rank specifications, there are 101 EOs with the following ranks: B=16, BC=1, C=26, C?=5, D=19, D?=1, E=8, F=9, H=7, X=5, and X?=4. Changes to EOs and EO ranks are summarized. This report establishes a standard for slickspot peppergrass EOs and EO ranks.

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INTRODUCTION

Slickspot peppergrass (*Lepidium papilliferum*) is a rare annual or biennial mustard species endemic to southwestern Idaho (Moseley 1994). Slickspot peppergrass is highly specific to slickspots associated with shrub interspaces in sagebrush steppe communities. Large, uncharacteristic wildfires have resulted in the conversion of a large portion of its range from sagebrush steppe to introduced annual grasslands. Post-fire rangeland rehabilitation practices have also resulted in the destruction of slickspots through drill seeding and seeding of prostrate kochia (*Kochia prostrata*), an aggressive slickspot colonizer. Slickspot peppergrass habitat has also been lost and/or fragmented due to agricultural conversion and commercial and residential development. Excessive livestock grazing has degraded slickspot peppergrass habitat via trampling slickspots and grazing the native herbaceous species in the surrounding slickspot matrix (Whisenant 1990, Noss et al. 1995, Lesica and DeLuca 1996, U.S. Fish and Wildlife Service 2003). Slickspot peppergrass has been a high priority conservation concern in Idaho for many years. Slickspot peppergrass has a conservation rank of G2/S2, meaning that it is imperiled globally, because it is only found in southwestern Idaho, and at the state level.

The Idaho Conservation Data Center (IDCDC) manages spatial and tabular data pertaining to slickspot peppergrass using element occurrences (EOs). An EO is defined as "an area of land in which a species is or was present" (NatureServe 2002). Federal and state agencies rely on the IDCDC Database (2005) for planning conservation efforts pertaining to slickspot peppergrass. Reviewing, updating, and applying consistent EO specifications and EO ranks to all the slickspot peppergrass EOs was identified as a high priority project following the development of the Candidate Conservation Agreement for Slickspot Peppergrass in 2003. To that end, the objectives of this project were to apply the following tasks to all slickspot peppergrass EOs in the IDCDC Database: 1) update and review EO specifications and EO rank specifications; 2) update spatial data; 3) delineate EOs using EO specifications; 4) update and review tabular data; and 5) apply EO ranks based on EO rank specifications. EO specifications and EO rank specifications were developed and applied to all slickspot peppergrass EOs and sub-EOs. Completion of these objectives sets a consistent baseline for slickspot peppergrass EOs and EO ranks.

METHODS

EO specifications for delineating slickspot peppergrass EOs were developed using habitat-based delimitation guidance by NatureServe (2004; Appendix A). EO rank specifications were developed using past ranking standards (Moseley 1994), evaluation of extant EOs in Idaho in the IDCDC Database (2005), and the "Element occurrence data standard" (NatureServe 2002).

New spatial and tabular data submissions were added to the IDCDC database, including: 1) 1998-2005 information based on both Habitat Integrity Index (HII) and Habitat Integrity and Population (HIP) monitoring transects (Mancuso and Moseley

1998, Mancuso et al. 1998, Mancuso 2000:2003, Colket 2005); 2) submission of 3,000 GPS points by Bureau of Land Management (BLM) personnel from the Jarbidge Field Office; and 3) submission of other EO update forms from BLM Four Rivers and contractors. Whenever possible, GPS points replaced or were added to EOs for greater spatial accuracy. The uncertainty buffer for EO features based on GPS points was a 25-m radius. The uncertainty buffer for all EO features that had been digitized with 24 quad maps was reduced from a 100-m to 50-m radius. No uncertainty buffer changes were made to EOs with vague location data (i.e. "Caldwell").

EO features were then measured pairwise and edge-to-edge from the uncertainty buffer. EO features ≥1 km apart were delineated as separate EOs. EO features within parent EO 16 >0.75 km apart were delineated as sub-EOs for data management purposes. EO and sub-EO numbers that were deleted were recycled for newly created EOs to minimize skips in the numbering system. After ensuring the EOs and sub-EOs were spatially delimited in accordance with the EO specifications, the associated tabular data were appropriately updated. Data on condition, size, and landscape context were summarized and reviewed to ensure that the rank was consistent with the EO rank specifications.

Land ownership was calculated for all slickspot peppergrass EOs except those with high spatial uncertainty. These were typically H-, X-, and X?-ranked EOs that have large uncertainty buffers that would inaccurately represent land ownership. Land ownership is delineated by private (including city of Boise), state, and federal lands. Point and linear EO features were designated an area of 0.1 acres; and polygon EO features were designated the area within mapped EO feature boundaries before application of an uncertainty buffer in the IDCDC Database (2005). EOs with a BC-rank were summarized with B-ranked EOs; EOs with a C?-rank were summarized with C-ranked EOs; and EOs with D?-ranks were summarized with D-ranked EOs.

EOs were summarized by their location within Management Areas (MAs) 1-12. MAs were developed in the Candidate Conservation Agreement (2003) to prioritize conservation measures in managing slickspot peppergrass.

SLICKSPOT PEPPERGRASS EO SPECIFICATIONS

MINIMUM EO CRITERIA
Element occurrence (EO) features are separate EOs if they are ≥1 km apart. Separation distances between EO features are measured pairwise and edge-to-edge after accounting for locational uncertainty.

EO Separation

SEPARATION DISTANCE – SUITABLE/UNSUITABLE HABITAT
Suitable habitat is characterized by sagebrush steppe containing slickspots that have appropriate soil conditions for supporting slickspot peppergrass plants (Colket 2005, D. Quinney, pers. comm. 2005). Unsuitable habitat is characterized by habitat that does

not meet these criteria. All slickspot peppergrass EO features were separate EOs if they were ≥1 km apart because habitat suitability was generally unknown or undocumented. The separation distance may be extended up to 2 km if more information is known about habitat suitability between the EO features in the future.

ALTERNATE SEPARATION PROCEDURES
The Jarbidge MAs (MAs 11 and 12) had alternate separation procedures to facilitate data management. EO features occurring within parent EO 16 are separate sub-EOs if they are ≥0.75 km apart. The sub-EOs are tracked as separate EOs (>700) so that detailed data can be managed across the Jarbidge MAs (MAs 11 and 12).

SEPARATION JUSTIFICATION

Separation justification for delineating slickspot peppergrass EOs is based on Tier 3 implementation using habitat-based delimitation guidance (Fig. 1 *in* Appendix A).

SLICKSPOT PEPPERGRASS EO RANK SPECIFICATIONS

EO Rank Specs

A SPECS
SIZE: >1000 detectable genets. CONDITION: Native plant community is intact with trace introduced plant species cover. Slickspots have zero or trace introduced weed cover and/or livestock disturbance. Zero or few minor anthropogenic disturbances are present. EO is unburned. LANDSCAPE CONTEXT: Surrounding landscape less than 1 km away has not been fragmented by agricultural lands, residential or commercial development, introduced annual grasslands, or drill seeding projects.

B SPECS
SIZE: 400-999 detectable genets. CONDITION: Native plant community is intact with low introduced plant species cover. Slickspots have low introduced weed cover and/or livestock disturbance. Zero or few minor anthropogenic disturbances present. EO is predominantly unburned. LANDSCAPE CONTEXT: Surrounding landscape less than 1 km away is minimally to partially fragmented by agricultural lands, residential or commercial development, introduced annual grasslands, or drill seeding projects.

C SPECS
SIZE: 50-399 detectable genets. CONDITION: Native plant community is partially intact with low to moderate introduced plant species cover. Slickspots have low to moderate introduced weed cover and/or livestock disturbance. Few or several minimally to moderately severe anthropogenic disturbances are evident. EO has partially burned. Portions of EO may have been drill seeded, but slickspots are largely intact. LANDSCAPE CONTEXT: Surrounding landscape less than 1 km away is partially to predominantly fragmented by agricultural lands, residential or commercial development, introduced annual grasslands, or drill seeding projects.

D SPECS
SIZE: 1-49 detectable genets. CONDITION: Few components of the native plant community remain and introduced plant species cover is high. Slickspots have high introduced weed cover and/or livestock disturbance. Few or several moderately severe anthropogenic disturbances are evident. EO has been predominantly to completely burned. Portions of EO may have been drill seeded, and slickspot soils have been altered by drill seeding. LANDSCAPE CONTEXT: Surrounding landscape less than 1 km away is moderately to completely fragmented by agricultural lands, residential or commercial development, introduced annual grasslands, or drill seeding projects.

E SPECS
Extant: EO has been verified extant, but population size, condition, and landscape context have not been assessed.

F SPECS
Failed to find: EO has been surveyed by experienced individuals who failed to find any slickspot peppergrass individuals, despite searching under conditions appropriate for the element at a location where it was previously recorded. Only one visit is required for this rank designation, but the survey should cover the entire extent of the EO. The F-rank was first standardized by NatureServe (2002) and was not implemented for slickspot peppergrass before this project.

H SPECS
Historical: An EO that has not been observed since 1970. These are historical EOs indicating where slickspot peppergrass was reported, often based on older herbarium records. Location records are typically geographically vague and may be simply indicated by the name of a town.

X SPECS
Extirpated: EO has been extirpated. Extirpation is based on: 1) agricultural conversion, commercial or residential development, or other documented habitat destruction where slickspot peppergrass has been previously recorded, or 2) when an EO has consistently has received an F-rank five times within a 12-year time period.

RANK SPECS JUSTIFICATION
EO rank specifications were developed using past ranking standards (Moseley 1994), evaluation of extant EOs in Idaho in the IDCDC Database (2005), and the “Element occurrence data standard” (NatureServe 2002). Rank factors were weighted based on NatureServe EO data standards for a large patch community pattern type (NatureServe 2002). Rank factors were weighted in the following manner: condition=45%; size=33%; and landscape context=22%. Changes in the number of plants should not be used solely to justify a rank change, unless one or more of the following also occurs: 1) condition and/or landscape context has concurrently changed; 2) the known EO area has been expanded; and/or 3) survey intensity and thoroughness was greater. The weighted rank factors are calculated to verify the most appropriate rank, where A=4, B=3, C=2, and D=1. The output calculation is used to designate the following ranks:

A=3.6-4.0; B=2.6-3.4; C=1.6-2.4; and D=0.0-1.4. A range rank (i.e. BC) is used when the output calculation is 1.5, 2.5, or 3.5. Range ranks can also be used if the EO or rank factors share qualities of multiple ranks. The "?" qualifier is used with the most appropriate rank (i.e. B?) if there is incomplete information about size, condition, and/or landscape context factors. Use E-, F-, H-, and X-ranks when appropriate.

RANK EXAMPLES

The rank factors should be used to objectively designate the rank that has the best overall fit, but may become unclear if an EO has condition attributes of an A-rank and size and landscape context attributes of a D-rank. To ensure future consistency in ranking EOs, refer to the following examples:

Example #1: **New EO Rank Basis:** EO 52 has a green rabbitbrush (*Chrysothamnus nauseosus)/*introduced annual weed community. Slickspots have trace to moderate introduced weed cover. There were 3,728 genets in one subpopulation in 2005. The EO and surrounding landscape is predominantly burned and houses occur within 250-500 m. Condition characterizes a low C-rank because the understory is weedy and has been burned. The presence of shrubs and relatively low weed invasion within slickspots contributes positively to the C-rank; otherwise it would be a D-rank. There are thousands of genets present within the EO, meeting the requirements for the A-rank. The landscape is highly fragmented and disturbed, characteristic of a D-rank. The equation would be RANK = (2 x 45%) + (4 x 33%) + (1 x 22%) = 2.4 = C. **EO Rank Change:** Rank changed from B- to C-rank because of the addition of condition and landscape context in the EO rank specifications. In 1998, EO 52 probably would have had a C-rank instead of an B-rank using the updated EO specifications based on the following EO rank comments: 1) "Most of area has burned in the past, but scattered patches of remnant Wyoming big sagebrush (*Artemisia tridentata wyomingensis)* and antelope bitterbrush (*Purshia tridentata)* remain"; 2) "Slickspots tend to be weedy"; 3) "Early to mid-seral condition"; and 4) "Although cheatgrass (*Bromus tectorum)* is widespread and abundant, so are native bunchgrasses." These EO rank comments indicate that condition would probably have a C-rank because of the weedy slickspots, early to mid-seral condition, and widespread and abundant cheatgrass and native perennial grasses. Landscape context would be a D-rank because most of the area has burned in past.

Example #2: **New EO Rank Basis:** EO 27 includes both Wyoming big sagebrush/Sandberg bluegrass *(Poa secunda)* and big sagebrush/cheatgrass communities; predominantly the former. There were 4,063 genets observed at a subset of the occurrence in 2005, although there are probably >10,000 genets total over the entire 2500 ac occurrence. The EO and surrounding landscape are relatively intact; most of the extensive occurrence is unburned and greater than 500 m from the nearest burned area. Part of the EO is within 65-250 m of nearest burned area. Condition characterizes a BC-rank because it comprises both fair and good condition habitats. The understory is dominated by native associates (e.g., Sandberg bluegrass) in some areas and introduced annual weeds in other areas (e.g., cheatgrass). There are thousands of genets, exceeding the requirements for an A-rank. The surrounding

landscape is predominantly unburned and relatively intact, characteristic of an B-rank. The equation would be RANK = (2.5 x 45%) + (4 x 33%) + (3 x 22%) = 3.1 = B. **EO Rank Change:** Rank changed from A- to B-rank in 2005 because of the addition of condition and landscape context in the EO rank specifications. In 1998, EO 27 probably would have had a B-rank instead of an A-rank using the updated EO specifications based on the following EO rank comments: 1) "Habitat quality varies from very good to poor, with increasing cheatgrass cover in some areas."; and 2) In Wyoming big sagebrush habitat; often associated with Thurber needlegrass (*Achnatherum thurberianum)*, Sand berg bluegrass, and bottlebrush squirreltail (*Elymus elymoides)*, although in some places the understory is dominated by cheatgrass." These EO rank comments indicate that condition would have a B- or C-rank; and landscape context would probably have a B-rank.

Example #3: **New EO Rank Basis:** EO 32 includes both big sagebrush/cheatgrass and big sagebrush/Sandberg bluegrass communities. Slickspots have moderate to high coverage of introduced annual species, up to 50-75% coverage. Condition characterizes a C-rank because the understory is partially dominated by cheatgrass and introduced species cover is moderate to high. There were 488 genets observed at a portion of the occurrence in 2005, although 4,929 genets were observed when the entire EO was surveyed in 1990. A B-rank is most appropriate for representing size until a more comprehensive and recent survey is done across the entire EO, especially because the number of plants at the HII/HIP transect has declined and condition has declined. The EO and surrounding landscape have been partially burned and dominated by introduced annual species, characteristic of a C-rank. The equation would be RANK = (2 x 45%) + (3 x 33%) + (2 x 22%) = 2.3 = C. **EO Rank Change:** Rank changed from an A- to C-rank in 2005 because of declines in condition and landscape context, and possibly size; and also because of the updated EO rank specifications. In 1998, EO 32 probably would have had a B-rank using the updated EO specifications based on the following EO rank comments: "Extensive intact sagebrush habitat in relatively good ecological condition"; and 2) "Large number of plants reported in the past."

RESULTS

Rangewide Overview

After application of the EO specifications and EO rank specifications, there are 101 EOs with the following ranks: B=16, BC=1, C=26, C?=5, D=19, D?=1, E=8, F=9, H=7, X=5, and X?=4. Previously, there were 71 EOs with the following ranks: A=6, B=8, BC=2, C=17, D=18, H=5, and X=13; and 2 EOs were not ranked (Tables 1-13; IDCDC Database 2005).

There were net gains or losses of the number of EOs in the following MAs: MA 1=0, MA 2=+1, MA 3=0, MA 4=-1, MA 5=+1, MA 6=+2, MA 7=-1, MA 8=+4, MA 9=0, MA 10=-1, and MAs 11 and 12=+24 (*see* Tables 1-13 and Figs. 1-7). MAs 2 and 8 each had one new EO created as a result of new locations found. MA 11 also had 14 new EOs

created in 2005 as a result of new locations found. The remainder of the gains and losses are a direct consequence of application of the updated EO specifications.

Eighty-seven percent of slickspot peppergrass EOs (n=85), excluding those with high spatial uncertainty, occur on federal lands (Tables 14 and 15). Private and state lands comprise four and nine percent of slickspot peppergrass EOs (n=85), respectively. Some EOs have mixed land ownership (e.g. federal and private). The total land area for slickspot peppergrass EOs (n=85) is 13,359 ac. Land ownership data can be misinterpreted because it represents EO boundaries that commonly include slickspots and the surrounding slickspot matrix. The EO boundaries may also include large areas of unoccupied habitat, depending upon the method used to map the boundary of the EO. Slickspot peppergrass occupies just a fraction of nearly all EOs, even after excluding the uncertainty buffer. Land ownership and land area information should be used with caution. For example, three EOs (16, 27, and 71) account for 55% of the total acreage of all EOs (n=85; Table 14) but these three EOs do not contain 55% of the occupied habitat nor do they contain 55% of the slickspot peppergrass genets.

The Candidate Conservation Agreement (2003) designated both MAs and priority EOs to prioritize management actions for slickspot peppergrass. Application of the EO specifications has resulted in changes to some priority EOs. All changes to priority EOs and EO ranks are indicated in the following text and Tables 1-13.

New Plymouth/Canyon County Management Area (MA 1)

No EOs were changed in MA 1 (Table 1; Figs. 1 and 2). EO 70 (priority EO) changed from a C- to a B-rank, largely because there were more genets than previously believed, likely due to more thorough surveys.

Boise Foothills/BLM Management Areas (MAs 2A, 2B, and 2C)

MA 2 gained EO 76, discovered in 2005. It received a B-rank (Table 2; Figs. 1 and 2). EOs 39 and 40 both changed to an F-rank because no plants were observed. Slickspot peppergrass plants have not been observed at these EOs since 1992 and 2000, respectively. EO 52 (priority EO) changed from a B- to C-rank, largely due to the addition of condition and landscape context in the EO rank specifications.

Boise Foothills/County Landfill Management Area (MA 3)

No EOs were changed in MA 3 (Table 3; Figs. 2 and 3). EO 65 changed from a C- to a D-rank, primarily based on a decrease in the number of plants observed within this small EO.

Boise Foothills/Private Management Area (MA 4)

EO 43 was deleted and added to EO 23 within MA 4 because they were <1 km apart (Table 4; Figs. 2 and 3). EO 12 was changed to an F-rank because slickspot

peppergrass plants have not been observed since 2001, even though it was visited in 2004 and 2005. EO 36 changed from a C- to D-rank, largely because fewer plants were observed when last visited in 1999.

Boise Management Area (MA 5)

EO 48 (priority EO) was split into EOs 48 and 102 because they were >1 km apart (Table 5; Fig. 4). EOs 48 and 102 were given a C-rank and D-rank, respectively, changing from the original combined B-rank. This rank change would have occurred regardless of being split because of the generally poor to fair condition, size, and landscape context at both EOs, especially EO 102. EO 49 changed from a D- to an F-rank because no plants were observed since 1993, despite surveys in 1998 and 1999. EO 32 (priority EO) changed from an A- to a C-rank, largely because of declines in condition and size. EO 22 did not change from a C-rank, but no observations have been submitted for seven years. Digital orthophoto quads (DOQs) indicate that roughly one-quarter of EO 22 has been converted to agriculture, but this information needs to be ground-truthed.

Kuna Management Area (MA 6)

EO 57 (priority EO) was deleted and added to EO 24 because they were <1 km apart. EO 24 still has a C-rank. EO 25 changed from a D- to C-rank, largely because more plants have been consistently observed in recent years. EO 42 was not previously ranked. It was given an F-rank after thorough surveys EO in 2004 and 2005 failed to find any plants.

EO 19 was split into five EOs (EOs 19, 41, 43, 57, and 58) and several subpopulations were also added to EO 18 (priority EO; Table 6; Fig. 4). EO 19 previously consisted of numerous scattered subpopulations in the Initial Point area. It was split because many of these subpopulations were >1 km apart. In addition, some EO 19 subpopulations were <1 km from EO 18. EO 18 changed from a B- to a C-rank, largely because of the addition of condition and landscape context in the EO specifications. EO 41 changed to an F-rank because no plants have been found since 1990, despite a survey in 1997 after it had burned. New EOs 43 and 58 were given D- and D?-ranks, respectively. New EO 57 (formerly part of EO 19) does not fall within MA 6 boundaries.

Orchard Training Range Management Area (MA 7)

Priority EO 27 was split into EOs 27 and 100 because they were >1 km apart, although most of the area remained in EO 27 (Table 7; Fig. 5). EO 27 changed from an A- to B-rank, largely because of the addition of condition and landscape context in the EO rank specifications; new EO 100 also has a B-rank. EO 41 was deleted and added to EO 35 because they were <1 km apart. EO 53 changed from a D- to C-rank because more plants were observed than previously known. EO 59 changed from a C- to F-rank after not observing any plants in 2002, 2004, and 2005. EO 67 changed from a BC- to B-rank because more plants were observed in 2005 than earlier surveys, likely because

slickspot peppergrass was more thoroughly counted. EO 28 (priority EO) was deleted and added to EO 71 because they were <1 km apart. EO 71 changed from an A- to B-rank, largely because of the addition of condition and landscape context in the EO rank specifications.

Orchard Management Area (MA 8)

MA 8 gained EO 77, discovered in 2005. It received a C-rank (Table 8; Figure 5). EO 72 was split into four EOs (28, 72, 103, and 104) because they were >1 km apart from each other. New EOs 28 and 103 both had D-ranks; and new EO 104 had a C-rank. Priority EO 20 changed from a D- to a C-rank, largely because past EO rank was probably based on single year observation with few genets. Priority EO 30 changed from an A- to B-rank, largely based on the addition of condition and landscape context in the EO rank specifications, and habitat degradation. EO 31 changed from a B- to C-rank, also largely based on the addition of condition and landscape context in the EO rank specifications. EO 54 changed from a D- to an F-rank because slickspot peppergrass has not been observed since 2003, despite surveys in 2004 and 2005.

Mountain Home Management Area (MA 9)

No EO changes occurred within MA 9 (Table 9; Fig. 6). Priority EO 21 changed from an A- to a C-rank, largely based on the addition of condition and landscape context in the EO rank specifications. EO 51 changed from a C- to a BC-rank, largely because more plants were observed than previously known.

Glenns Ferry/Hammett Management Area (MA 10)

Priority EO 58 was deleted and added to priority EO 26 because they were <1 km apart. The new EO 26 rank changed to a B-rank, largely because of the addition of condition and landscape context in the EO rank specifications (Table 10; Fig. 6).

Jarbidge Management Areas (MAs 11 and 12)

Before this project, parent EO 16 was the only EO in MAs 11 and 12, and was comprised of 22 sub-EOs. Parent EO 16 was redrawn to meet the requirements of the updated EO specifications (1 km separation distance; Tables 11 and 12; Fig. 7). Ten new EOs were created from 12 sub-EOs of the parent EO 16. In addition, 14 new EOs that represent new locations found since 2003 were added to MA 11. Most of the newly found EOs have no data other than slickspot peppergrass plants are present, and were given an E-rank. The following are six exceptions of the newly found EOs: EO 73 was given a D-rank; EOs 74, 75, 78, and 79 were given a C?-rank until more data are available; and EO 80 was given a B-rank.

Sub-EO 710 was deleted and turned into EO 84. It changed from a BC- to B-rank because more plants were observed than previously known. Priority sub-EO 706 was deleted and turned into EO 88; and changed from a B- to C-rank because of the

addition of condition and landscape context in the EO rank specifications. Sub-EO 711, previously unranked, was deleted and turned into EO 92 and designated a C-rank. Sub-EO 714, previously unranked, was deleted and turned into EO 93 and designated a D-rank. Sub-EO 719, previously unranked, was deleted and turned into EO 95 and designated a C-rank. Sub-EOs 701 (in part), 720 (in part), and 721, were deleted and turned into EO 96 and designated a B-rank because of application of the EO specifications; only sub-EO 701 had been previously ranked. The other part of sub-EO 720 was deleted and turned into new EO 82; and given a C?-rank. Priority sub-EO 722, previously unranked, was deleted and turned into EO 98 and designated a C-rank. Sub-EO 700 was deleted and turned into EO 99 and changed from a C- to B-rank based on greater number of plants than previously known.

EO 16 is the parent EO for a very large and contiguous block of slickspot peppergrass habitat in the Jarbidge MAs (MA 11 and 12; Table 12; Fig. 7). After applying the alternate separation procedures described in the EO specifications (0.75 km separation distance), there were 29 sub-EOs (700-728) in parent EO 16. Eighteen of the sub-EOs were created as a result of new locations found since 2003. The parent EO 16 sub-EOs have the following ranks: B=2, C=5, C?=2, D=4, and E=16. Most of the newly found sub-EOs do not have any data other than slickspot peppergrass plants are present, and were given an E-rank. The two exceptions were for new sub-EOs 700 and 707, which were given a C-rank.

Most of sub-EO 701 was deleted and added to EO 96 as described above. This smaller version of sub-EO 701 consequentially had a smaller size, and changed from a C- to D-rank. Sub-EO 718 was deleted and added to sub-EO 702, with no rank change. Sub-EOs 705, 709, and 713 were deleted and added to priority sub-EO 704 and given a B-rank largely because of applying the EO specifications. Sub-EO 712 was assigned a B-rank, because of new information submitted. Sub-EOs 715 (priority sub-EO), 716, and 717 were assigned C-, C-, and D-ranks, respectively. Sub-EOs 705 and 720 were both given C?-ranks.

EOs not located within Management Areas

Twenty-two EOs are located outside any MA boundaries (Table 13; Fig. 1 for EOs 4, 6, 7, 9, 11, 13, 17, 33, 47, and 55; Fig. 4 for EOs 3, 5, 57, 64, and 101; Fig. 5 for EO 14; and Fig. 6 for EOs 1, 10, 34, 44, 45, and 61). EO 46 was lumped with EO 45 because their boundaries overlapped. EO 57 was formerly part of EO 19, but did not fall within MA 6. EO 64 was split into EOs 64 and 101, and given C- and D-ranks, respectively. EOs 1 and 55 changed from X- to X?-ranks because of probability of extirpation described in EO records. EOs 3, 34, and 45 changed from X- to H-ranks because of spatial vagueness and historical basis. The spatial vagueness makes it impossible to confidently know the fate of these EOs. EOs 5 and 6 changed from H -to X?-rank because conversion to agricultural, commercial, and residential development probably resulted in their extirpation. EOs 14 and 44 changed from X- to H-ranks even though they are based on 1975 data because they best fit H-rank criteria. EO 47 changed to

an F-rank because slickspot peppergrass has not been observed since 1993, despite surveys in 1998, 1999, and 2000.

DISCUSSION

The EO specifications developed for this project were based on habitat-based delimitation guidance developed by NatureServe (2004; Appendix A), and ensure consistency between slickspot peppergrass EOs. Past EO standards for slickspot peppergrass generally used a 1.0 mi separation distance, but this was inconsistently applied and sometimes as little as 400 m. The 13 new EOs that were created as a consequence of applying the EO specifications do not represent an expansion to the range of slickspot peppergrass. Another 16 new EOs represent new locations found since 2003, predominantly in the Jarbidge MAs (11 and 12). However, data have not been collected for half of these and they need to be revisited before an EO rank can determined.

Twenty percent of previously ranked EOs (n=61), excluding those with an H-, X-, or X?-rank (n=61), now have a lower EO rank partially or completely because of documented negative changes in condition and/or landscape context (EOs 15, 18, 19, 24, 30, 32, 36, 41, 43, 49, 57, and 58). Eight percent of previously ranked EOs (n=61) had a higher EO rank partially or completely because of a recorded increase in size (number of plants; EOs 25, 51, 53, 67, 70), likely the result of the expansion of an EO and/or greater survey intensity. Information about condition and landscape context at slickspot peppergrass EOs were not commonly recorded before 1998, so there may be other EOs that have experienced negative changes since first discovered.

Fifty four percent of previously ranked EOs (n=61) underwent an EO rank change at least partially because of the updated EO specifications and/or addition of condition and landscape context in the EO rank specifications (Tables 1-13). Many of these EO rank changes were influenced both by change in condition, size, and/or landscape context, and the updated EO specifications and/or EO rank specifications. Twenty percent of previously ranked EOs (n=61) underwent an EO rank change completely because of the updated EO specifications and/or EO rank specifications, with no documented changes in condition, size, and/or landscape context.

Earlier EO rank specifications were primarily based on size (number of plants), with little consideration given to habitat and landscape context (Moseley 1994), but this is not necessarily the best descriptor of EO health. The updated EO rank specifications were designed to integrate condition and landscape context with the size standards used in the past. Condition and landscape context are indirect measures of habitat suitability and quality, gene flow, and pollinator availability. As a result of applying the EO rank specifications, some EOs underwent rank changes that may not have occurred if the size was the only rank criteria. No EOs received an overall A-rank, which requires at least 1,000 plants, habitat in excellent condition and a largely undisturbed landscape. A number of EOs that previously had an A-rank based solely on the number of plants continued to meet the criteria of at least 1,000 plants, but did not meet the condition and

landscape context requirements for A-rank and therefore received a lower rank. The EO rank is most useful for assessing the status of EOs if used in conjunction with details provided in the EO record (Appendix C).
The F-rank was also newly applied and useful for indicating absence of plants without designating an X-rank. In order to receive an F-rank, the entire EO must be surveyed. Nine EOs were designated an F-rank. There were several other EOs that could have received an F-rank, but the entire EO was not surveyed. These should be inventoried in order to properly assess EO rank. The F-rank indicates which EOs are most susceptible to extirpation, when combined with documented habitat and/or landscape scale decline. The F-rank will be modified if plants are observed at a later date.

Rapidly occurring changes (e.g., fire, subdivision development) in slickspot peppergrass habitat condition and/or landscape context are relatively easy to detect and document with few observations. These rapidly occurring changes are predominantly negative for condition and landscape context. Changes which occur slowly (e.g., reformation of slickspots, increase in sagebrush canopy, etc.) are more difficult to detect and require many years of monitoring to document. Different temporal scales relating to change should be considered when interpreting changes documented in Tables 1-13 and the EO records (Appendix C).

Much of the known range of slickspot peppergrass was burned by wildfires during the 1980s and 1990s (Whisenant 1990, Peters and Bunting 1994, Rosentreter 1994, Knick 1999). EO records that date before these fires (e.g., EOs 18 and 19) indicate condition and landscape context were much different than what currently exists across the range of slickspot peppergrass. Many slickspot peppergrass EOs were discovered more recently, after major disturbances had already substantially altered occupied habitat. The high prevalence of EOs with C-, D-, and F-ranks is indicative of the widespread habitat and landscape degradation that has occurred over the past 25 years. Although EO ranks are generally low across the range and are lower than previous ranking, the conditions that contribute to the low ranks have been present for some time for many EOs.

HII monitoring was implemented on selected EOs in 1998 and replaced by the more intensive and comprehensive HIP monitoring on a larger sample of EOs in 2004. In addition, there is useful information about slickspot peppergrass EOs, based on data submissions documenting changes to condition and landscape context before 1998. Continuing the HIP monitoring will enhance our ability to evaluate changes to slickspot peppergrass EOs. HIP monitoring is effective for collecting replicable, detailed data about slickspot peppergrass EOs. However, regular inventories are also crucial to attaining comprehensive information about the entire EO. Slickspot peppergrass inventory and monitoring are essential to provide current and accurate information for slickspot peppergrass EOs, and depict the most comprehensive and accurate EO rank. Completion of this project maximizes the usefulness of the IDCDC database for slickspot peppergrass conservation efforts.

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Table 1. Slickspot peppergrass EO and EO rank changes in New Plymouth/Canyon County Management Area (MA 1).

EO#[1]	**66***	**68**	**69**	**70***
Land ownership[2]	F, P	F	F	F
First observation date	1997	2002	2002	2002
HII transect years[3]	1998-2002	-	-	-
HIP transect years[3]	2004-2005	2004-2005	2005	2004-2005
HII/HIP same transect(s)?	yes	-	-	-
HII/HIP#[4]	066	068	069	070
2005 EO changes	-	-	-	-
Original EO rank	C	C	D	C
Date	unknown	2002	2002	2002
Previous EO rank	-	-	-	-
Date	-	-	-	-
2005 EO rank	**C**	**C**	**D**	**B**
Rank factor ratings[5]	C-A-D	D-B?-D	D-D-D	B-A-C
Rank factor change[6]	-	size(-)	-	size(+)
EO rank influenced by EO specifications	-	-	-	-
EO rank influenced by EO rank specifications	-	-	-	-
2005 EO rank changes	-	No rank change, but size decreased from 631-1277 to 9 genets from 2004 to 2005 at one subpopulation; continued reduction in size could justify rank decline in future. Decline in size coincided with severe livestock disturbance event.	-	Rank change is predominantly based on greater number of plants in 2004 and 2005 compared to 2002 and 2003, likely due to more thorough survey.

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 2. Slickspot peppergrass EO and EO rank changes in Boise Foothills/BLM Management Areas (MAs 2A, 2B, and 2C).

EO#[1]	**39**	**40**	**52***	**56**	**76**
Land ownership[2]	F, P	F, P	F, P	F, P	F
First observation date	1992	1992	1993	1994	2005
HII transect years[3]	-	1998-2002	1998-2001	1998-2002	-
HIP transect years[3]	-	-	2004-2005	2005	2005
HII/HIP same transect(s)?	-	-	yes	approximately	-
HII/HIP#[4]	-	-	052	056	076
2005 EO changes	-	-	-	-	New EO
Original EO rank	D	B	B	B	-
Date	1994	1994	1998	1994	-
Previous EO rank	-	C	-	D	-
Date	-	1998	-	1998	-
2005 EO rank	**F**	**F**	**C**	**D**	**B**
Rank factor ratings[5]	D-F-D?	D-F-D	C-A-D	D-D?-D	BC-A-D
Rank factor change[6]	size(-)	condition(-), size(-), landscape context(-)	size(+)	condition(-)	-
EO rank influenced by EO specifications	-	-	-	-	-
EO rank influenced by EO rank specifications	yes	yes	yes	-	-
2005 EO rank changes	Rank changed because no plants were observed during last visit in 1994.	Rank changed because no plants were observed since 2001, despite searching at several subpopulations in 2004.	Rank changed because of overall EO decline and addition of condition and landscape context in EO rank specifications.	-	Baseline rank based on fair to good habitat, excellent size, and poor landscape context.

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 3. Slickspot peppergrass EO and EO rank changes in Boise Foothills/County Landfill Management Area (MA 3).

EO#[1]	**38**	**65**
Land ownership[2]	P	P
First observation date	1991	1998
HII transect years[3]	1998-2001	1998-2001
HIP transect years[3]	2005	2004-2005
HII/HIP same transect(s)?	yes	yes
HII/HIP#[4]	038	065
2005 EO changes	-	-
Original EO rank	D	C
Date	1998	unknown
Previous EO rank	-	-
Date	-	-
2005 EO rank	**D**	**D**
Rank factor ratings[5]	D-C-D	CD-D-D
Rank factor change[6]	condition(-), landscape context(-)	condition(-), landscape context(-)
EO rank influenced by EO specifications	-	-
EO rank influenced by EO rank specifications	-	yes
2005 EO rank changes	-	Rank changed because of overall EO decline and addition of condition and landscape context in EO rank specifications.

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 4. Slickspot peppergrass EO and EO rank changes in Boise Foothills/Private Management Area (MA 4).

EO#[1]	**12**	**23**	**36**
Land ownership[2]	P	P	P
First observation date	1972	1916	1992
HII transect years[3]	1998-2001	-	-
HIP transect years[3]	2005	-	-
HII/HIP same transect(s)?	yes	-	-
HII/HIP#[4]	012	-	-
2005 EO changes	-	Deleted EO 43 and added it to EO 23.	-
Original EO rank	D	D (23; 43)	C
Date	1993	1993 (23); 1994 (43)	1999
Previous EO rank	D	D (23; 43)	-
Date	1998	-	-
2005 EO rank	**F**	**D**	**D**
Rank factor ratings[5]	D-F-D	C-D-D	CD-D-D
Rank factor change[6]	condition(-), size(-)	landscape context(-)	-
EO rank influenced by EO specifications	-	-	-
EO rank influenced by EO rank specifications	yes	-	yes
2005 EO rank changes	Rank changed because no plants were observed in 2004 or 2005.	No rank change, although EO has not been visited since 1998.	Rank primarily changed because of addition of condition and landscape context in EO rank specifications.

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 5. Slickspot peppergrass EO and EO rank changes in Boise Management Area (MA 5).

EO#[1]	**22**	**32***	**48***	**49**	**102***
Land ownership[2]	P, S	F, P	F	F	F, P
First observation date	1989	1990	2000	1993	1993
HII transect years[3]	1998-2000	1998-2002	-	1998-1999	1998-2002
HIP transect years[3]	-	2004-2005	2004-2005	-	-
HII/HIP same transect(s)?	-	yes	-	-	-
HII/HIP#[4]	022A[a], 022B[a]	032	048	049[a]	048[a]
2005 EO changes	-	-	Deleted two southern subpopulations from EO 48* and turned them into new EO 102.	-	Deleted two southern subpopulations from EO 48* and turned them into new EO 102.
Original EO rank	B	A	B	B	B
Date	1994	1998	1998	unknown	1998
Previous EO rank	C	-	-	D	-
Date	1998	-	-	1998	-
2005 EO rank	**C**	**C**	**C**	**F**	**D**
Rank factor ratings[5]	CD-C-D	C-B-C	C-C-C	C-F-C?	D-D-D
Rank factor change[6]	condition(-)	condition(-), landscape context(-)	-	condition(-), size(-)	size(-)
EO rank influenced by EO specifications	-	-	-	-	yes
EO rank influenced by EO rank specifications	-	yes	yes	yes	yes
2005 EO rank changes	No rank change, but no observations have been submitted for 7 years.	Rank changed because of overall EO decline and addition of condition and landscape context in EO rank specifications.	Rank primarily changed because of addition of condition and landscape context in EO rank specifications.	Rank changed because no plants were found at time of last visits in 1998 and 1999, and habitat had degraded since previous visit.	Rank changed because of addition of condition and landscape context in EO rank specifications, and separation from EO 48.

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 6. Slickspot peppergrass EO and EO rank changes in Kuna Management Area (MA 6).

EO#[1]	**18***	**19**	**24***
Land ownership[2]	F, S	F, P	F
First observation date	1989	1989	1990
HII transect years[3]	1998-2001	1998-2001	1998-2001
HIP transect years[3]	2004-2005	2004-2005	2004-2005
HII/HIP same transect(s)?	yes	yes	yes
HII/HIP#[4]	018A, 018B, 019A	019B	024, 057
2005 EO changes	Deleted 10 westernmost subpopulations from EO 19 and added them to EO 18*.	Deleted 15 subpopulations from EO 19 (currently EOs 18*, 19, 41, 43, 57, and 58); two subpopulations remain within EO 19 after the separations.	Deleted former EO 57* and added it to EO 24.
Original EO rank	A (18; 19)	A	A (24); C (57)
Date	unknown	unknown	unknown (24); 1994 (57)
Previous EO rank	B (18); D (19)	D	C (24); B (57)
Date	1998 (18; 19)	1998	1998 (24; 57)
2005 EO rank	**C**	**D**	**C**
Rank factor ratings[5]	C-A-D	D-D?-D	CD-B-D
Rank factor change[6]	condition(-), landscape context(-)	condition(-), size(-), landscape context(-)	condition(-), landscape context(-)
EO rank influenced by EO specifications	yes	-	yes
EO rank influenced by EO rank specifications	yes	-	yes
2005 EO rank changes	Newly defined EO rank based on overall EO decline, EO specifications, and EO rank specifications. The high number of plants and extent help compensate for the poor to fair habitat conditions.	No plants have been observed at subset of occurrence (HII/HIP transect) since 2001; more comprehensive survey(s) may justify F rank.	Newly defined EO changed rank because of overall EO decline and addition of condition and landscape context in EO rank specifications.

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 6. (Continued)

EO#[1]	**25**	**41**	**42**	**43**	**58**
Land ownership[2]	F	F	F	F	F
First observation date	1990	1989	2000	2000	1989
HII transect years[3]	1998-2001	-	-	-	-
HIP transect years[3]	2004-2005	-	2004-2005	-	-
HII/HIP same transect(s)?	yes	-	-	-	-
HII/HIP#[4]	025	-	042	-	-
2005 EO changes	-	Deleted 2 southern subpopulations from EO 19 and turned them into new EO 41.	-	Deleted northernmost subpopulation from EO 19 and turned it into new EO 43.	Deleted easternmost (south) subpopulation from EO 19 and turned it into new EO 58.
Original EO rank	D	A	-	A	A
Date	1998	unknown	-	unknown	unknown
Previous EO rank	-	D	-	D	D
Date	-	1998	-	1998	1998
2005 EO rank	**C**	**F**	**F**	**D**	**D?**
Rank factor ratings[5]	D-B-D	D-F-D	D-F-D	D-D-D	D?-?-D?
Rank factor change[6]	condition(-), size(+)	condition(-), size(-)	size(-)	-	-
EO rank influenced by EO specifications	-	yes	-	-	yes
EO rank influenced by EO rank specifications	-	yes	yes	-	-
2005 EO rank changes	EO rank changed primarily because of larger size observed over consecutive years.	Newly defined EO rank based on no plants observed during most recent survey in 1997.	Baseline rank based on zero plants observed in 2004 or 2005.	-	Newly defined EO rank is probably D based on poor condition and landscape context in general area.

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 7. Slickspot peppergrass EO and EO rank changes in Orchard Training Range Management Area (MA 7).

EO#[1]	**27***	**35**	**53**	**59**
Land ownership[2]	F, P	F	F	F
First observation date	1990	1991	1993	2001
HII transect years[3]	1998-2002 (028A, 028B); 2001-2002 (027C, 027D, 027E)	1998-2002	1998-2001 (053A); 2002 (053B)	2001-2002
HIP transect years[3]	2004-2005	2004-2005	2004-2005	2004-2005
HII/HIP same transect(s)?	yes	partially (035A and 041)	partially (053B)	yes
HII/HIP#[4]	027A, 027B, 027C, 027D	035A, 035B[a], 041	053A[a], 053B	059A
2005 EO changes	Deleted northernmost subpopulation from EO 27* and turned it into new EO 100.	Deleted former EO 41 and added it to EO 35.	-	-
Original EO rank	A	D (35)	D	C
Date	1998	1994	1998	unknown
Previous EO rank	-	B (35); C (41)	-	-
Date	-	1998	-	-
2005 EO rank	**B**	**B**	**C**	**F**
Rank factor ratings[5]	B-A-B	C-A-C	C-B-C	C-F-C
Rank factor change[6]	condition(-), size(-)	size(-)	size(+)	size(-)
EO rank influenced by EO specifications	-	yes	-	-
EO rank influenced by EO rank specifications	yes	yes	-	yes
2005 EO rank changes	Newly defined EO rank change primarily based on addition of condition and landscape context in EO rank specifications.	Newly defined EO rank change primarily based on EO specifications and addition of condition and landscape context in EO rank specifications.	Rank changed primarily based on more plants than previously believed.	Rank changed because no plants have been found in relatively small EO, despite three visits.

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 7. (Continued)

EO#[1]	**67**	**71***	**100***
Land ownership[2]	F	F, S	F
First observation date	2001	1990	2001?
HII transect years[3]	-	1998-2002 (028)	1998-2002
HIP transect years[3]	2004-2005	2004-2005	2004-2005
HII/HIP same transect(s)?	-	partially (028A, 028B)	yes
HII/HIP#[4]	067	028A, 028B, 071A, 071B	027E
2005 EO changes	-	Deleted EO 28* and added it to EO 71.	Deleted northernmost subpopulation from EO 27* and turned it into new EO 100.
Original EO rank	BC	C (28)	A
Date	unknown	1994 (28)	1998
Previous EO rank	-	A (28); B (71)	-
Date	-	1998 (28); 2003 (71)	-
2005 EO rank	**B**	**B**	**B**
Rank factor ratings[5]	B-B-B	B-A-B	B-D-A
Rank factor change[6]	size(+)	-	-
EO rank influenced by EO specifications	-	yes	yes
EO rank influenced by EO rank specifications	-	yes	yes
2005 EO rank changes	Rank change based on greater size recorded; and better and more detailed habitat condition than described in past.	Newly defined EO rank change primarily based on emphasis on condition and landscape context in EO rank specifications.	Newly defined EO was ranked based on separation from the rest of a much larger EO (EO 27). The updated EO rank specifications with its the emphasis on condition and landscape context increased the EO rank higher than it would have been if based on size.

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 8. Slickspot peppergrass EO and EO rank changes in Orchard Management Area (MA 8).

EO#[1]	**15**	**20***	**28**
Land ownership[2]	F, P	F, P	F
First observation date	1983	1980	2003
HII transect years[3]	1998-2001	1998-2001	-
HIP transect years[3]	2004-2005	2004-2005	-
HII/HIP same transect(s)?	yes	partially (020B)	-
HII/HIP#[4]	015	020A[a], 020B	-
2005 EO changes	-	-	Deleted southernmost subpopulation from EO 72 and turned it into new EO 28.
Original EO rank	A	C	C
Date	pre-1996	1994	2003
Previous EO rank	D	D	-
Date	1998	1998	-
2005 EO rank	**D**	**C**	**D**
Rank factor ratings[5]	D-C?-D	C-C-C	D-D-D
Rank factor change[6]	condition(-), size(-), landscape context(-)	size(-), landscape context(-)	-
EO rank influenced by EO specifications	-	-	yes
EO rank influenced by EO rank specifications	-	-	-
2005 EO rank changes	-	EO rank changed because condition, size, and landscape context are consistent with a C-rank. Size alone would have been consistent with a C-rank. EO 20 was probably given D-rank in past based on 1997 observation of a few genets.	Newly defined EO was ranked based on separation from the rest of a much larger C-ranked EO.

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 8. (Continued)

EO#[1]	**30***	**31**	**54**	**60**
Land ownership[2]	F, P	F, P	F	F, P
First observation date	1990	1990	1980	1994
HII transect years[3]	1998-2001	1998-2002	-	1998-2001
HIP transect years[3]	2004-2005	2004-2005	2005	2004-2005
HII/HIP same transect(s)?	yes	yes	-	yes
HII/HIP#[4]	030B	031	054	060
2005 EO changes	-	-	-	-
Original EO rank	B	C	X	D
Date	1994	1994	1994	1994
Previous EO rank	A	B	D	-
Date	1998	1998	2003	-
2005 EO rank	**B**	**C**	**F**	**D**
Rank factor ratings[5]	BC-A?-C	CD-C-D	D-F-D	D-D-D
Rank factor change[6]	condition(-), landscape context(-)	condition(-), landscape context(-)	size(-)	-
EO rank influenced by EO specifications	-	-	-	-
EO rank influenced by EO rank specifications	yes	yes	yes	-
2005 EO rank changes	EO rank change primarily based on addition of condition and landscape context in EO rank specifications. Number of plants throughout occurrence has not been verified since 2000.	EO rank change primarily based on addition of condition and landscape context in EO rank specifications. Size alone would have been consistent with a C-rank. EO 31 was probably given B-rank in past based on 1998 observation of 570 genets, but all other observations (n=5) have been consistent with a C- or D-rank if based on size alone.	Rank changed because no plants were observed despite surveys in 2004 and 2005.	-

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 8. (Continued)

EO#[1]	**72**	**77**	**103**	**104**
Land ownership[2]	F, S	S	F	F
First observation date	2003	2005	2004	2003
HII transect years[3]	-	-	-	-
HIP transect years[3]	2004-2005	-	-	2004-2005
HII/HIP same transect(s)?	-	-	-	-
HII/HIP#[4]	072B, 072C	-	-	072A
2005 EO changes	Deleted 5 subpopulations from EO 72 (EOs 28, 72, 103, and 104); 9 subpopulations remain within EO 72.	New EO	Deleted westernmost subpopulation from EO 72 and turned it into new EO 103.	Deleted 3 eastern subpopulations from EO 72 and turned them into new EO 104.
Original EO rank	C	-	C	C
Date	2003	-	2004	2003
Previous EO rank	-	-	-	-
Date	-	-	-	-
2005 EO rank	**C**	**C**	**D**	**C**
Rank factor ratings[5]	C-B-D	C-C-C	D-C-D	D-A-D
Rank factor change[6]	-	-	-	-
EO rank influenced by EO specifications	-	-	yes	-
EO rank influenced by EO rank specifications	-	-	-	-
2005 EO rank changes	Newly defined EO rank based on fair habitat, good population size, and poor to fair landscape context.	Baseline rank based on fair habitat, size, and landscape context.	Newly defined EO was ranked based on separation from the rest of a much larger C-ranked EO.	-

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 9. Slickspot peppergrass EO and EO rank changes in Mountain Home Management Area (MA 9).

EO#[1]	**2**	**21***	**29**	**50**	**51***	**62**
Land ownership[2]	F	F, P	F	F, P	F	F
First observation date	2000	1989	1990	1993	2000	2000
HII transect years[3]	-	1998-2001	1998-2002	1998-2001	-	-
HIP transect years[3]	2004-2005	2004-2005	2004-2005	2004-2005	2004-2005	2005
HII/HIP same transect(s)?	-	yes	yes	yes	-	-
HII/HIP#[4]	002	021	029	050	051A, 051B	062
2005 EO changes	-	-	-	-	-	-
Original EO rank	C	B	B	C	C	C
Date	unknown	1994	1994	1998	2000	2000
Previous EO rank	-	A	C	-	-	-
Date	-	1998	1998	-	-	-
2005 EO rank	**C**	**C**	**C**	**C**	**BC**	**C**
Rank factor ratings[5]	C-C-C	C-B?-C	C-B-D	C-C-D	C-B-B	C-C-A
Rank factor change[6]	-	landscape context(-)	-	landscape context(-)	size(+)	size(+)
EO rank influenced by EO specifications	-	-	-	-	-	-
EO rank influenced by EO rank specifications	-	yes	-	-	yes	-
2005 EO rank changes	-	EO rank change primarily based on addition of condition and landscape context in EO rank specifications. Plants were last observed in 2004, but entire EO was not surveyed in 2005.	-	-	EO rank change primarily based on addition of condition and landscape context in EO rank specifications, fair quality condition down weighted EO rank.	-

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 10. Slickspot peppergrass EO and EO rank changes in Glenns Ferry/Hammett Management Area (MA 10).

EO#[1]	**8***	**26***	**63**
Land ownership[2]	F, P	F	F
First observation date	1940	1994	1998
HII transect years[3]	1998-2002 (008A); 1998-2001 (008B)	1998-2002 (058)	-
HIP transect years[3]	2004-2005	2004-2005	2004-2005
HII/HIP same transect(s)?	yes	partially (058)	-
HII/HIP#[4]	008A, 008B	026, 058	063
2005 EO changes	-	Deleted former EO 58* and added it to EO 26*.	-
Original EO rank	A	D (58)	D
Date	1994	1994	unknown
Previous EO rank	C; B	B (26, 58); A (26, 58)	-
Date	unknown (C); 2002 (B)	2000 (26, 58); 2002 (28, 58)	-
2005 EO rank	**B**	**B**	**D**
Rank factor ratings[5]	C-A-C	B-A-B	D-C-D
Rank factor change[6]	landscape context(-)	-	-
EO rank influenced by EO specifications	-	-	-
EO rank influenced by EO rank specifications	-	yes	-
2005 EO rank changes	-	Newly defined EO changed rank primarily based on emphasis on condition and landscape context in EO rank specifications.	-

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 11. Slickspot peppergrass EO and EO rank changes in Jarbidge Management Areas (MAs 11 and 12). EO 16 and sub-EO 704 occur in both MAs 11 and 12; the rest occur in MA 11.

EO#[1]	**16***	**73**	**74**	**75**
Land ownership[2]	F, S	F	F	F
First observation date	1993	2003	2003	2003
HII transect years[3]	1998-2002 (702; 708)	-	-	-
HIP transect years[3]	2004-2005	-	-	-
HII/HIP same transect(s)?	partially (702; 708)	-	-	-
HII/HIP#[4]	702, 703, 705, 708, 712, 715, 716, 717	-	-	-
2005 EO changes	See EOs 73-75 and 78-99; and sub-EOs 700-728 for details.	New EO	New EO	New EO
Original EO rank	BC	-	-	-
Date	unknown	-	-	-
Previous EO rank	-	-	-	-
Date	-	-	-	-
2005 EO rank	**B**	**D**	**C?**	**C?**
Rank factor ratings[5]	BD-A-BD	D-C-D	C-D-C?	C?-D-C?
Rank factor change[6]	-	-	-	-
EO rank influenced by EO specifications	-	-	-	-
EO rank influenced by EO rank specifications	yes	-	-	-
2005 EO rank changes	Newly defined EO changed rank primarily based on addition of condition and landscape context in EO rank specifications. Size alone would have been consistent with an A-rank, so former BC-rank probably incorporated habitat and landscape context factors. See EOs 73-75 and 78-99; and sub-EOs 700-728 for details.	Baseline rank based on poor condition and landscape context; fair number of plants.	Baseline rank is questionable until additional information is available on condition and landscape context; rank based on possibly fair to good habitat condition, small size, and possibly fair landscape context.	

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 11. (Continued)

EO#[1]	**78**	**79**	**80**	**81**	**82**	**83**
Land ownership[2]	F	F	F	F	F, S	F
First observation date	2005	2005	2005	2003-2005	2001	2003-2005
HII transect years[3]	-	-	-	-	-	-
HIP transect years[3]	-	-	-	-	-	-
HII/HIP same transect(s)?	-	-	-	-	-	-
HII/HIP#[4]	-	-	-	-	-	-
2005 EO changes	New EO	New EO	New EO	New EO	Deleted former sub-EO 720 (partially) and turned it into new EO 82.	New EO
Original EO rank	-	-	-	-	-	-
Date	-	-	-	-	-	-
Previous EO rank	-	-	-	-	-	-
Date	-	-	-	-	-	-
2005 EO rank	**C?**	**C?**	**E**	**E**	**C?**	**E**
Rank factor ratings[5]	BC-D-?	BC-D-?	BC-B-C	?-?-?	C-D-C?	?-?-?
Rank factor change[6]	-	-	-	-	-	-
EO rank influenced by EO specifications	-	-	-	-	-	-
EO rank influenced by EO rank specifications	-	-	-	-	-	-
2005 EO rank changes	Baseline rank is questionable until additional information is available on condition and landscape context; rank based on possibly fair to good habitat condition, small size, and possibly fair landscape context.		Ranked E because no additional information exists other than plants are present.		Baseline rank is questionable until additional information is available on landscape context; rank based on possibly fair to good habitat condition, small size, and possibly fair landscape context.	Ranked E because no additional information exists other than plants are present.

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 11. (Continued)

EO#[1]	**84**	**85**	**87**	**88***	**89**	**90**	**91**
Land ownership[2]	F	F	F	F	F	F	F
First observation date	1999	2003-2005		1999	2003-2005		
HII transect years[3]	-	-	-	-	-	-	-
HIP transect years[3]	2004-2005	-	-	2004-2005	-	-	-
HII/HIP same transect(s)?	-	-	-	-	-	-	-
HII/HIP#[4]	710	-	-	706	-	-	-
2005 EO changes	Deleted former sub-EO 710 from parent EO 16 to create EO 84.	New EO		Deleted former sub-EO 706* from parent EO 16 to create EO 88.	New EO		
Original EO rank	BC	-	-	B	-	-	-
Date	unknown	-	-	unknown	-	-	-
Previous EO rank	-	-	-	-	-	-	-
Date	-	-	-	-	-	-	-
2005 EO rank	**B**	**E**	**E**	**C**	**E**	**E**	**E**
Rank factor ratings[5]	B-BC-A	?-?-?	?-?-?	B-C-C	?-?-?	?-?-?	?-?-?
Rank factor change[6]	condition(-)	-	-	condition(-)	-	-	-
EO rank influenced by EO specifications	-	-	-	-	-	-	-
EO rank influenced by EO rank specifications	-	-	-	yes	-	-	-
2005 EO rank changes	Rank change based on extension of population, good habitat, and excellent landscape context.	Ranked E because no additional information exists other than plants are present.		Newly defined EO rank change primarily based on addition of condition and landscape context in EO rank specifications. EO 88 had consecutive and severe livestock disturbance in multiple years.	Ranked E because no additional information exists other than plants are present.		

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 11. (Continued)

EO#[1]	**92**	**93**	**94**	**95**	**96**
Land ownership[2]	F	F	F	F	F, S
First observation date	2000	2000	2003-2005	2001	1993
HII transect years[3]	-	-	-	1998 and 2000-2002 (701)	-
HIP transect years[3]	2004-2005	2004-2005	-	2004-2005	2004-2005
HII/HIP same transect(s)?	-	-	-	partially (701)	-
HII/HIP#[4]	711	714	-	701 (HII) = 719 (HIP)	701, 720, 721
2005 EO changes	Deleted former sub-EO 711 from parent EO 16 to create EO 92.	Deleted former sub-EO 714 from parent EO 16 to create EO 93.	New EO	Deleted former sub-EO 719 from parent EO 16 to create EO 95.	Deleted former sub-EOs 701 (partially), 720 (partially), and 721 from parent EO 16 to create EO 96.
Original EO rank	-	-	-	-	B (701)
Date	-	-	-	-	1994
Previous EO rank	-	-	-	-	C (701)
Date	-	-	-	-	1998
2005 EO rank	**C**	**D**	**E**	**C**	**B**
Rank factor ratings[5]	C-A-D	C-D-D	?-?-?	B-C-C	BC-A?-BC
Rank factor change[6]	size(+)	condition(-)	-	-	-
EO rank influenced by EO specifications	-	-	-	-	yes
EO rank influenced by EO rank specifications	-	-	-	-	-
2005 EO rank changes	Baseline rank based on good habitat, small size, and poor landscape context.	Baseline rank based on fair to poor habitat and landscape context; and small size.	Ranked E because no additional information exists other than plants are present.	Baseline rank based on fair to good habitat condition, moderate number of plants, and fair habitat.	Newly defined EO changed rank because of partial separation of sub-EO 701 and addition of sub-EOs 720 and 721.

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 11. (Continued)

EO#[1]	**97**	**98***	**99**
Land ownership[2]	F, S	S	F
First observation date	1996	2001	1995
HII transect years[3]	1999-2002	-	-
HIP transect years[3]	2004-2005	2004-2005	2004-2005
HII/HIP same transect(s)?	yes	-	-
HII/HIP#[4]	707	722	700
2005 EO changes	Deleted former sub-EO 707 from parent EO 16 to create EO 97.	Deleted former sub-EO 722* from parent EO 16 to create EO 98.	Deleted former sub-EO 700 from parent EO 16 to create EO 98.
Original EO rank	C	-	C
Date	1996	-	1995
Previous EO rank	C	-	-
Date	1998	-	-
2005 EO rank	**B**	**C**	**B**
Rank factor ratings[5]	A-C-B	B-D-B	B-D-B
Rank factor change[6]	-	condition(-)	condition(-), size(+)
EO rank influenced by EO specifications	-	-	-
EO rank influenced by EO rank specifications	yes	-	yes
2005 EO rank changes	EO rank change primarily based on addition of condition and landscape context in EO rank specifications. EO rank would have been C if based on size alone, but condition is excellent and landscape context is good.	Baseline rank based on good habitat, small size, and good landscape context.	EO rank change primarily based on addition of condition and landscape context in EO rank specifications. EO rank would have been C if based on size alone, but condition and landscape context are good.

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 12. Slickspot peppergrass sub-EO and sub-EO rank changes in Jarbidge Management Areas (MAs 11 and 12) for parent EO 16.

SUB-EO#[1]	**700**	**701**	**702**	**703**
Land ownership[2]	F	F	F	F, S
First observation date	2003	1993	1996	1996
HII transect years[3]	-	-	1998-2002 (702)	-
HIP transect years[3]	-	-	2004-2005	2004-2005
HII/HIP same transect(s)?	-	-	partially (702)	-
HII/HIP#[4]	-	-	702, 718	703
2005 sub-EO changes	New sub-EO	Deleted most subpopulations from sub-EO 701.	Deleted former sub-EO 718 and added it to sub-EO 702.	-
Original EO rank	-	B	B (702)	B
Date	-	1994	unknown	unknown
Previous sub-EO rank	-	C	C (702)	C
Date	-	1998	1998	1998
2005 sub-EO rank	**C**	**D**	**C**	**D**
Rank factor ratings[5]	BC-D-C?	D-C-D	C-B-C	D-C-D
Rank factor change[6]	-	-	-	-
Sub-EO rank influenced by EO specifications	-	yes	-	-
Sub-EO rank influenced by EO rank specifications	-	-	-	yes
2005 sub-EO rank changes	Newly defined sub-EO ranked C based on fair to good condition and fair landscape context, but very small size.	Newly defined sub-EO changed rank because it was separated from most subpopulations.	-	Sub-EO rank change primarily based on addition of condition and landscape context in EO rank specifications. EO rank would have been C if based on size alone, but condition and landscape context are poor.

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 12. (Continued)

SUB-EO#[1]	**704***	**705**	**706**	**707**	**708**
Land ownership[2]	F, S	F	F	F	F
First observation date	1996	2001	2003-2005	2005	1994
HII transect years[3]	1999-2002 (709)	-	-	-	1998-2002
HIP transect years[3]	2004-2005	-	-	-	2004-2005
HII/HIP same transect(s)?	partially (709)	-	-	-	yes
HII/HIP#[4]	705, 709, 713	-	-	-	708
2005 sub-EO changes	Deleted sub-EOs 705*, 709, and 713* and added them to sub-EO 704.	Deleted part of sub-EO 712 and turned it into sub-EO 705.	New sub-EO	New sub-EO	-
Original EO rank	C (704)	-	-	-	B
Date	unknown	-	-	-	unknown
Previous sub-EO rank	BC (704)	-	-	-	D
Date	2003	-	-	-	1998
2005 sub-EO rank	**B**	**C?**	**E**	**C**	**D**
Rank factor ratings[5]	BC-A-C	C-D-?	?-?-?	C-A-D	D-D-D
Rank factor change[6]	condition(-)	-	-	-	condition(-), size(-), landscape context(-)
Sub-EO rank influenced by EO specifications	yes	-	-	-	-
Sub-EO rank influenced by EO rank specifications	yes	-	-	-	-
2005 sub-EO rank changes	Newly defined sub-EO changed rank based on additions to the sub-EO and the addition of condition and landscape context in EO rank specifications.	Baseline rank is questionable until additional information is available on landscape context; rank based on possibly fair to good habitat condition, small size, and possibly fair landscape context.	Ranked E because no additional information exists other than plants are present.	Baseline rank based on fair condition, high number of plants, and poor surrounding landscape.	-

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 12. (Continued)

SUB-EO#[1]	**709**	**710**	**711**	**712**	**713**	**714**	**715***	**716**	**717**
Land ownership[2]	F	F	F	F	F	F	F	F	F
First observation date	2003-2005			2000	2003-2005		2000	2000	2001
HII transect years[3]	-	-	-	-	-	-	-	-	-
HIP transect years[3]	-	-	-	2004-2005	-	-	2004-2005	2004-2005	2004-2005
HII/HIP same transect(s)?	-	-	-	-	-	-	-	-	-
HII/HIP#[4]	-	-	-	712	-	-	715	716	717
2005 sub-EO changes	New sub-EO			Deleted part of sub-EO 712 and turned it into sub-EO 705.	New sub-EO		-	-	-
Original EO rank	-	-	-	-	-	-	-	-	-
Date	-	-	-	-	-	-	-	-	-
Previous sub-EO rank	-	-	-	-	-	-	-	-	-
Date	-	-	-	-	-	-	-	-	-
2005 sub-EO rank	**E**	**E**	**E**	**B**	**E**	**E**	**C**	**C**	**D**
Rank factor ratings[5]	?-?-?	?-?-?	?-?-?	B-B-B	?-?-?	?-?-?	D-A-D	D-B-D	D-D-D
Rank factor change[6]	-	-	-	condition(-)	-	-	-	-	condition(-)
Sub-EO rank influenced by EO specifications	-	-	-	-	-	-	-	-	-
Sub-EO rank influenced by EO rank specifications	-	-	-	-	-	-	-	-	-
2005 sub-EO rank changes	Ranked E because no additional information exists other than plants are present.			Baseline rank based on good condition and size, and fair to good landscape context.	Ranked E because no additional information exists other than plants are present.		Baseline rank based on poor condition and landscape context; and large and extensive size.	Baseline rank based on poor condition, good size, and poor landscape context.	Baseline rank based on poor habitat condition and landscape context; and small size.

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 12. (Continued)

SUB-EO#[1]	**718**	**719**	**720**	**721**	**722**	**723**	**724**	**725**	**726**	**727**	**728**
Land ownership[2]	F	F	S	S	F	F	F	F	F	F	F
First observation date	2003-2005		2001	2003-2005							
HII transect years[3]	-	-	-	-	-	-	-	-	-	-	-
HIP transect years[3]	-	-	-	-	-	-	-	-	-	-	-
HII/HIP same transect(s)?	-	-	-	-	-	-	-	-	-	-	-
HII/HIP#[4]	-	-	-	-	-	-	-	-	-	-	-
2005 sub-EO changes	New sub-EO		Deleted part of sub-EO 708 and turned it into new sub-EO 720.	New sub-EO							
Original EO rank	-	-	-	-	-	-	-	-	-	-	-
Date	-	-	-	-	-	-	-	-	-	-	-
Previous sub-EO rank	-	-	-	-	-	-	-	-	-	-	-
Date	-	-	-	-	-	-	-	-	-	-	-
2005 sub-EO rank	**E**	**E**	**C?**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**
Rank factor ratings[5]	?-?-?	?-?-?	C?-D-?	?-?-?	?-?-?	?-?-?	?-?-?	?-?-?	?-?-?	?-?-?	?-?-?
Rank factor change[6]	-	-	-	-	-	-	-	-	-	-	-
Sub-EO rank influenced by EO specifications	-	-	-	-	-	-	-	-	-	-	-
Sub-EO rank influenced by EO rank specifications	-	-	-	-	-	-	-	-	-	-	-
2005 sub-EO rank changes	Ranked E because no additional information exists other than plants are present.		Baseline rank is questionable until additional information is available on landscape context; rank based on possibly fair to good habitat condition, small size, and possibly fair landscape context.	Ranked E because no additional information exists other than plants are present.							

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 13. Slickspot peppergrass EO and EO rank changes for EOs not located within any Management Area. None are priority EOs.

EO#[1]	**1**	**3**	**4**	**5**	**6**	**7**	**9**
Land ownership[2]	P	P, S	P, S	P	P, S	P	F, P, S
First observation date	1934	1953	1892	1955	1911	1947	1934
HII transect years[3]	-	-	-	-	-	-	-
HIP transect years[3]	-	-	-	-	-	-	-
HII/HIP same transect(s)?	-	-	-	-	-	-	-
HII/HIP#[4]	-	-	-	-	-	-	-
2005 EO changes	-	-	-	-	-	-	-
Original EO rank	X	X	X	H	H	X	X
Date	1993	1993	1993	unknown	1993	1993	1993
Previous EO rank	-	-	-	-	-	-	-
Date	-	-	-	-	-	-	-
2005 EO rank	**X?**	**H**	**X**	**X?**	**X?**	**X**	**X**
Rank factor ratings[5]	?-?-?	?-?-?	?-?-?	?-?-?	?-?-?	?-?-?	?-?-?
Rank factor change[6]	-	-	-	-	-	-	-
EO rank influenced by EO specifications	-	-	-	-	-	-	-
EO rank influenced by EO rank specifications	-	-	-	-	-	-	-
2005 EO rank changes	Rank changed because of uncertainty that EO is extirpated because of development in Mountain Home.	Rank changed because 1953 herbarium record is spatially vague and includes areas that could support plants; possibly extirpated because habitat is predominantly developed or burned.	-	Rank changed because of probability that EO (based on 1955 herbarium record) has become extirpated because of development in Kuna area.	Rank changed because of probability that EO (based on 1911 herbarium record) has become extirpated because of development in Emmett.	-	-

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 13. (Continued)

EO#[1]	**10**	**11**	**13**	**14**	**17**	**33**	**34**	**44**
Land ownership[2]	F	F, P, S	F, P, S	F, P, S	P, S	F, P, S	F, P, S	F, S
First observation date	1947	1910	1974	1975	1936	1949	1940	1975
HII transect years[3]	1998-2001	-	-	-	-	-	-	-
HIP transect years[3]	2004-2005	-	-	-	-	-	-	-
HII/HIP same transect(s)?	yes	-	-	-	-	-	-	-
HII/HIP#[4]	010	-	-	-	-	-	-	-
2005 EO changes	-	-	-	-	-	-	-	-
Original EO rank	C	X	H	X	X	H	X	X
Date	1994	1993	unknown	1993	1993	unknown	1993	1993
Previous EO rank	D	-	-	-	-	-	-	-
Date	1998	-	-	-	-	-	-	-
2005 EO rank	**D**	**X**	**H**	**H**	**X**	**H**	**H**	**H**
Rank factor ratings[5]	D-D-D	?-?-?	?-?-?	?-?-?	?-?-?	?-?-?	?-?-?	?-?-?
Rank factor change[6]	condition(-)	-	-	-	-	-	-	-
EO rank influenced by EO specifications	-	-	-	-	-	-	-	-
EO rank influenced by EO rank specifications	-	-	-	-	-	-	-	-
2005 EO rank changes	-	-	Herbarium record was collected in 1974 and lacked detailed information. Meets all criteria for H-rank except date.	Rank changed because of uncertainty EO is extirpated. Original rank based on knowledge that nearly entire section had been disked, probably seeded, and/or converted to introduced grasslands. Meets all criteria for H-rank except date.	-	-	Rank changed because 1940-1 herbarium records are spatially vague and may include areas that could support plants; possibly extirpated because habitat is predominantly developed or burned.	Rank changed because of uncertainty EO is extirpated. Meets all criteria for H-rank except date.

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 13. (Continued)

EO#[1]	**45**	**47**	**55**	**57**	**61**
Land ownership[2]	F, P	F	P	F	F
First observation date	1940	1993	1910	2004	1995
HII transect years[3]	-	-	-	-	1998-2002
HIP transect years[3]	-	-	-	-	2004-2005
HII/HIP same transect(s)?	-	-	-	-	yes
HII/HIP#[4]	-	-	-	-	061
2005 EO changes	Lumped EOs 45 and 46 because they overlapped.	-	-	Deleted easternmost (north) subpopulation from EO 19 and turned it into new EO 57.	-
Original EO rank	X (45); H (46)	D	X	A	D
Date	unknown (45); 1993 (46)	1998	1994	unknown	unknown
Previous EO rank	-	-	-	D	C
Date	-	-	-	1998	1998
2005 EO rank	**H**	**F**	**X?**	**D**	**C**
Rank factor ratings[5]	?-?-?	D-F-D	?-?-?	D-D-D	C-C-D
Rank factor change[6]	-	size(-)	-	-	-
EO rank influenced by EO specifications	-	-	-	-	-
EO rank influenced by EO rank specifications	-	yes	-	-	-
2005 EO rank changes	Rank changed because 1940 and 1964 herbarium records are spatially vague and both include areas that could support plants; possibly extirpated because habitat is predominantly developed or burned.	Rank changed because plants were not found in 1998-2000, despite thorough search.	Rank changed because of uncertainty that EO is extirpated because 1910 herbarium record lacked detailed spatial information. EO is probably extirpated due to agricultural conversion.	-	-

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 13. (Continued)

EO#[1]	**64**	**101**
Land ownership[2]	P	P
First observation date	2001	2001
HII transect years[3]	-	-
HIP transect years[3]	-	-
HII/HIP same transect(s)?	-	-
HII/HIP#[4]	-	-
2005 EO changes	Deleted southern subpopulation from EO 64 and turned it into new EO 101.	Deleted southern subpopulation from EO 64 and turned it into new EO 101.
Original EO rank	-	-
Date	-	-
Previous EO rank	-	-
Date	-	-
2005 EO rank	**C**	**D**
Rank factor ratings[5]	C-C-CD	C?-D-D
Rank factor change[6]	-	-
EO rank influenced by EO specifications	-	-
EO rank influenced by EO rank specifications	-	-
2005 EO rank changes	Baseline rank based on fair habitat condition and size, and fair to poor landscape context.	Baseline rank based on small size, possibly fair habitat, and probably poor landscape context.

[1]Updated EOs comprising some or all priority EOs are indicated by an asterisk (*). [2]Land ownership is federal (F), private (P), and state (S). [3]EOs that have been monitored with habitat integrity index (HII) and/or habitat integrity and population (HIP) transects are indicated by monitoring year. [4]HII transects that have been abandoned are indicated by a superscript "a" ([a]). [5]Rank factor rating shows the individual ratings for condition (C), size (S), and landscape context (LC) that were used to develop the overall EO rank. Rank factor ratings are showing in the format C-S-LC. A "?" is used to indicate if not enough data is available to make a rank factor rating. A "-" is used to indicate no data is available to make any rank factor ratings. [6]Rank factor change states whether EO had a documented positive (+) or negative (-) change in condition, size, and/or landscape context since first observed.

Table 14. Land ownership of all slickspot peppergrass EOs, excluding EOs with high spatial uncertainty (n=85). Point and linear EO features were designated an area of 0.1 acres; and polygon EO features were designated the area within mapped EO feature boundaries without an uncertainty buffer. This data can be misinterpreted because polygon EO features are often coarsely mapped, resulting in an EO that appears much larger and more continuously occupied by slickspot peppergrass than occurs in reality.

EO#	EO RANK	Total area (ac)	Land ownership for individual EOs (ac)			Percent land ownership for individual EOs (%)		
			Private	State	Federal	Private	State	Federal
2	C	0.1	0.0	0.0	0.1	0%	0%	100%
8	B	1016.8	24.4	0.0	992.4	2%	0%	98%
10	D	0.2	0.0	0.0	0.2	0%	0%	100%
12	F	0.1	0.1	0.0	0.0	100%	0%	0%
15	D	155.1	36.6	0.0	118.6	24%	0%	76%
16	B	2220.9	0.0	122.2	2098.7	0%	6%	94%
18	C	915.2	0.0	5.6	909.5	0%	1%	99%
19	D	678.3	105.0	3.2	570.1	15%	0%	84%
20	C	0.2	0.1	0.0	0.1	50%	0%	50%
21	C	99.7	38.7	0.0	61.0	39%	0%	61%
22	C	125.7	84.0	41.8	0.0	67%	33%	0%
23	D	0.3	0.3	0.0	0.0	100%	0%	0%
24	C	71.2	0.0	0.0	71.2	0%	0%	100%
25	C	36.6	0.0	0.0	36.6	0%	0%	100%
26	B	692.9	0.0	0.0	692.8	0%	0%	100%
27	B	2564.8	0.0	657.2	1907.5	0%	26%	74%
28	D	0.1	0.0	0.0	0.1	0%	0%	100%
29	C	103.4	0.0	0.0	103.4	0%	0%	100%
30	B	674.6	156.5	0.0	518.0	23%	0%	77%
31	C	71.3	26.8	0.0	44.4	38%	0%	62%
32	C	618.6	20.8	0.0	597.7	3%	0%	97%
35	B	154.5	0.0	0.0	154.5	0%	0%	100%
36	D	0.3	0.3	0.0	0.0	100%	0%	0%
38	D	15.9	15.9	0.0	0.0	100%	0%	0%
39	F	0.1	0.1	0.0	0.1	50%	0%	50%
40	F	0.5	0.1	0.0	0.4	20%	0%	80%
41	F	214.0	0.0	0.0	214.0	0%	0%	100%
42	F	2.1	0.0	0.0	2.1	0%	0%	100%
43	D	0.1	0.0	0.0	0.1	0%	0%	100%
47	F	0.1	0.0	0.0	0.1	0%	0%	100%
48	C	0.2	0.0	0.0	0.2	0%	0%	100%
49	F	0.2	0.0	0.0	0.2	0%	0%	100%
50	C	3.3	0.1	0.0	3.2	2%	0%	98%
51	BC	0.3	0.0	0.0	0.3	0%	0%	100%
52	C	26.3	0.4	0.0	26.0	1%	0%	99%
53	C	38.7	0.0	0.0	38.7	0%	0%	100%
54	F	0.3	0.0	0.0	0.3	0%	0%	100%
56	D	4.9	1.8	0.0	3.1	36%	0%	64%

Table 14. (Continued)

EO#	EO RANK	Total area (ac)	Land ownership for individual EOs (ac)			Percent land ownership for individual EOs (%)		
			Private	State	Federal	Private	State	Federal
57	D	0.1	0.0	0.0	0.1	0%	0%	100%
58	D?	0.1	0.0	0.0	0.1	0%	0%	100%
59	F	3.2	0.0	0.0	3.2	0%	0%	100%
60	D	14.5	7.8	0.0	6.7	54%	0%	46%
61	C	14.7	0.0	0.0	14.7	0%	0%	100%
62	C	0.7	0.0	0.0	0.7	0%	0%	100%
63	D	0.5	0.0	0.0	0.5	0%	0%	100%
64	C	0.3	0.3	0.0	0.0	100%	0%	0%
65	D	0.1	0.1	0.0	0.0	100%	0%	0%
66	C	8.5	1.4	0.0	7.0	17%	0%	88%
67	B	5.5	0.0	0.0	5.5	0%	0%	100%
68	C	6.2	0.0	0.0	6.2	0%	0%	100%
69	D	3.1	0.0	0.0	3.1	0%	0%	100%
70	B	0.9	0.0	0.0	0.9	0%	0%	100%
71	B	2522.4	0.0	421.3	2101.1	0%	17%	83%
72	C	63.8	0.0	0.5	63.3	0%	1%	99%
73	D	30.7	0.0	0.0	30.7	0%	0%	100%
74	C?	0.4	0.0	0.0	0.4	0%	0%	100%
75	C?	0.2	0.0	0.0	0.2	0%	0%	100%
76	B	1.6	0.0	0.0	1.6	0%	0%	100%
77	C	1.1	0.0	1.1	0.0	0%	100%	0%
78	C?	0.2	0.0	0.0	0.2	0%	0%	100%
79	C?	0.2	0.0	0.0	0.2	0%	0%	100%
80	B	2.1	0.0	0.0	2.1	0%	0%	100%
81	E	0.1	0.0	0.0	0.1	0%	0%	100%
82	C?	0.3	0.0	0.2	0.1	0%	67%	33%
83	E	0.1	0.0	0.0	0.1	0%	0%	100%
84	B	0.3	0.0	0.0	0.3	0%	0%	100%
85	E	8.2	0.0	0.0	8.2	0%	0%	100%
87	E	0.1	0.0	0.0	0.1	0%	0%	100%
88	C	3.3	0.0	0.0	3.3	0%	0%	100%
89	E	0.1	0.0	0.0	0.1	0%	0%	100%
90	E	1.0	0.0	0.0	1.0	0%	0%	100%
91	E	2.9	0.0	0.0	2.9	0%	0%	100%
92	C	33.4	0.0	0.0	33.4	0%	0%	100%
93	D	3.6	0.0	0.0	3.6	0%	0%	100%
94	E	0.3	0.0	0.0	0.3	0%	0%	100%
95	C	0.5	0.0	0.0	0.5	0%	0%	100%
96	B	15.6	0.0	0.9	14.7	0%	5%	95%
97	B	7.5	0.0	0.1	7.4	0%	1%	99%
98	C	0.7	0.0	0.0	0.7	0%	0%	100%
99	B	1.1	0.0	0.0	1.1	0%	0%	100%
100	B	0.1	0.0	0.0	0.1	0%	0%	100%

Table 14. (Continued)

EO#	EO RANK	Total area (ac)	Land ownership for individual EOs (ac)			Percent land ownership for individual EOs (%)		
			Private	State	Federal	Private	State	Federal
101	D	0.1	0.1	0.0	0.0	100%	0%	0%
102	D	0.2	0.1	0.0	0.1	50%	0%	50%
103	D	0.1	0.0	0.0	0.1	0%	0%	100%
104	C	90.4	0.0	0.0	90.4	0%	0%	100%

Table 15. Summary of land ownership for all slickspot peppergrass EOs by B-, C-, D-, E-, and F-rank, excluding EOs with high spatial uncertainty (n=85). Point and linear EO features were designated an area of 0.1 acres; and polygon EO features were designated the area within mapped EO feature boundaries without an uncertainty buffer. This data can be misinterpreted because polygon EO features are often coarsely mapped, resulting in an EO that appears much larger and more continuously occupied by slickspot peppergrass than occurs in reality.

EO RANK	Land ownership	Land ownership by rank	
		Land area (ac)	Proportion (%)
B	Private	181.0	2%
	State	1201.7	12%
	Federal	8498.9	86%
	Total	9881.6	
C	Private	172.5	7%
	State	49.2	2%
	Federal	2113.7	91%
	Total	2335.4	
D	Private	168.0	18%
	State	3.2	0%
	Federal	737.1	81%
	Total	908.3	
E	Private	0.0	0%
	State	0.0	0%
	Federal	12.9	100%
	Total	12.9	
F	Private	0.3	0%
	State	0.0	0%
	Federal	220.4	100%
	Total	220.6	
TOTAL	**Private**	**521.7**	**4%**
	State	**1254.1**	**9%**
	Federal	**11583.1**	**87%**
	Total	**13358.9**	

Appendix A: A Habitat-based Strategy for Delimiting Plant Element Occurrences: Guidance from the 2004 Working Group (NatureServe 2004)

The "Element Occurrence" (EO) is a fundamental unit of information in the NatureServe Natural Heritage methodology. NatureServe's Element Occurrence Data Standard[1] (hereafter, EO Data Standard) defines an Element Occurrence (EO) as "an area of land and/or water in which a species or natural community is, or was present." *SubEOs* can be used for tracking information on more localized areas that are part of a single EO.

While EOs are often self-evident for vascular plants, two fundamental questions regularly arise in developing botanical EO data:

a. *Minimum criteria* for an EO – whether an observation, collection, or other report of a plant at a particular place can be considered to be sufficient basis for an EO record.

b. *Separation distances* for nearby EOs – whether two (or more) observations in different but nearby places should be considered different EOs, or combined into a single EO.

The EO Data Standard provides for use of Element Occurrence Specifications ("EO specs") to delineate and differentiate EOs, including both minimum criteria and separation distances. Individually written ("custom") EO specs are of two general kinds. *Element-specific EO Specs* are written for a particular, generally well-known element, drawing on element-specific information on ecology, species biology, threats/vulnerabilities, management needs, etc. *Group EO Specs* are written for a group of related or ecologically similar elements (specified by a list or by a scoping definition), drawing on various considerations broadly applicable to the particular group. Custom EO specs may also be developed to address unusual population structures or dispersal dynamics. Note that custom EO specs may specify shorter as well as longer separation distances when considered appropriate in particular cases.

Minimum EO criteria usually follow generally accepted (although not well-documented) criteria, considering such evidence as successful or potentially successful establishment, presumed naturalness (including deliberate restorations and reintroductions within the element's historical range), and review of reliability of identification and locality information. A single well-established individual plant is often considered to meet the minimum criteria for an EO. The issue of minimum EO criteria is addressed more extensively in the EO Data Standard, and is not further considered here. When necessary, custom EO specifications can be written to identify minimum EO criteria for a particular taxon.

I. The 2004 Plant EO Specs Working Group

For the many thousands of vascular plant species with Element Occurrences tracked by Heritage Programs or Conservation Data Centers, relatively few have individual or group element-occurrence specifications (custom EO specs). However, the default 1 km minimum

[1]NatureServe. 2002. Element Occurrence Data Standard, 6 February 2002. NatureServe, Arlington, Virginia. Accessed at http://whiteoak.natureserve.org/eodraft/index.htm, September 2004.

separation distance provided by the EO Data Standard has often been considered inappropriately small, particularly for riparian plants, plants found in dynamic landscape mosaics such as fire systems or sand dunes, and plants scattered in large areas of apparently suitable habitat. Indeed, the EO Data Standard encourages the use of larger separation distances in such cases.

A working group of Heritage and NatureServe botanists[2] convened in March 2004 to help advance production of EO Specifications (EO specs) for plants. They developed the general strategy presented here for using commonly encountered habitat and landscape situations for delimiting EOs of vascular plants that lack custom EO specs. In this novel strategy, pairs or groups of observations of the element are reviewed to determine whether they are better treated within the same EO or as separate EOs. Since plant taxa may show different habitat relations or distribution patterns in different portions of their geographical ranges, this method can result in different separation distances being applied in different places for the same taxon, and perhaps even within the same EO.

In effect, the group's strategy provides a single, interim alternative separation procedure available for use for any plant element for which more focused individual or group EO specs have not been developed. The group's guidelines should promote standardization across the NatureServe network in the process of thinking through the appropriate occurrence delimitation for particular EOs, as an alternative to use of individually specified range-wide separation distances for elements or groups of elements (as usually provided in custom EO specs) or rigid use of the default 1 km minimum EO separation distance specified in the EO Data Standard.

The group's strategy was developed primarily to provide general guidance for EO separation distances for native North American vascular plants, but can be applied to other plants or regions as well. Of course, element-specific or group specs may always be developed for elements for which these recommendations clearly do not apply, or for which other separation distances based on particular circumstances are more appropriate. Given the group members' limited familiarity with tropical, polar, ocean-island, and marine systems, these guidelines should be used with caution in such circumstances, and more appropriate EO separation distances should be applied (and documented) if necessary.

The working group's draft was circulated broadly to Heritage botanists, data managers, and others for review, discussion, and refinement, resulting in the guidance presented here. This report[3] presents the group's strategy as a decision tree (Figure 1), and provides instructions for its use, along with pertinent background material on botanical and ecological considerations and EO methodology.

The group thanks Kat Maybury (NatureServe's Director of Botany) for convening the March meeting, providing ongoing encouragement, promoting Network-wide discussion, and exploring implementation issues; Geoff Hammerson (NatureServe) for his presentation on zoological EO specs; Jennifer Nichols (NatureServe) for guidance on various methodological

[2] Florence Caplow (Washington Natural Heritage Program, Olympia); P.J. Harmon (West Virginia Natural Heritage Program, Elkins); Phyllis Higman (Michigan Natural Features Inventory, Lansing); Jim Morefield (Nevada Natural Heritage Program, Carson City); Meghan Fellows (NatureServe, Arlington, Virginia); and Larry Morse (NatureServe, Arlington, chair).

[3] Prepared for the group by Larry Morse, Jim Morefield, and Florence Caplow.

questions; Larry Master for coordinating a needed adjustment to the EO Data Standard; and the numerous reviewers whose questions and suggestions have led to improvements and refinements in this presentation.

II. Methodological Considerations for EOs for Plants

The EO Data Standard notes that "An EO should have *practical conservation value* for the Element." Also, an EO should have *biological merit* and *conservation merit* and be *stable* and *practical.* When feasible, EOs should be actual biological populations, with plants within an EO interacting with each other or being be more closely related to each other than with plants in other EOs. (However, for most plant species, there is relatively little information on actual dispersal rates and distances and other aspects of their population or metapopulation dynamics.) In addition, EO separations should be on scales reasonable for conservation; neither immensely large EOs nor numerous tiny nearby EOs would meet this test. EOs should also involve areas and boundaries that are reasonably stable on the landscape over decades on average, and almost certainly over any given 25-year period, without need for frequent remapping and reallocation of data. Finally, for data comparability, EOs for a particular element should be developed by the same criteria throughout the element's distributional range. The degree of aggregation of observations into EOs particularly affects EO ranks, since larger EOs will often have higher EO ranks. Aggregation also focuses attention on the resulting EOs as overall assemblages in conservation planning, habitat management, or environmental review.

The informal term "EO Feature" is used here for any place (from point locality to large area) where a particular plant element has been observed or otherwise documented as being present (currently or historically) with sufficient evidence of naturalness, persistence, etc., to meet the pertinent minimum EO criteria outlined in the EO Data Standard. As discussed in the EO Data Standard, the areal representation of such a Feature is expanded by an appropriate buffer to address any locational uncertainty in the original information. An Element Occurrence (EO) includes one or more such EO Features. In the EO Data Standard and in this guidance, separation distances are always applied to the Basic Feature of the Biotics EO methodology. Note, however, that the differences between Basic Features and final Procedural Features are negligible for these purposes, so Procedural Features may be considered in EO delimitation if already developed.

EO Features based on historical information, including EOs with a rank of "H" (historical), "F" (failed to find), or "X" (extirpated), especially if they have good locational information, may be used to link extant EO Features that would otherwise be considered to belong to different EOs. Use of such historical information may lead to more appropriate EOs since dispersal patterns, habitat dynamics, and metapopulation phenomena may be better represented. The resulting EO may also be a more appropriate unit for EO ranking and for data use. However, many historical observations have poor locational information (i.e., a very high degree of locational uncertainty), and in that case may be inappropriate for linking otherwise distinct EOs or for combining with a new, more precisely located Feature. Determining whether a new observation is or is not the same as an historical EO is a matter of judgment and generally involves a consideration of the original historical description (often an herbarium specimen label), habitat for the element, and historical and current extent of the habitat within the area of the historical EO, including its estimated locational uncertainty.

Many habitats have experienced fragmentation as a result of human activity (such as clear-cut patches, mined areas, residential development, roads, agricultural development). In general, EO separation distances should not be based on consequences of anthropogenic habitat fragmentation, on differences in ownership or management, or on utility in conservation planning. This is because such factors can differ widely across the range of an element and could lead to very inconsistent EOs; such factors are generally not intrinsic to the element itself. EO specs are intended to result in more consistent EO delimitation despite such spatial variation. For habitat fragmentation in particular (whether new or historical), this should be reflected as a decrease in quality (EO Rank) of one or more formerly less-fragmented EOs, and perhaps also as sub-EOs where management or other conservation factors vary widely between fragments, but not as an increase in the number of EOs.

In many cases, a program may want to maintain EO data at a sub-EO level, based on the individual Features that make up the EO. When previously processed EOs are combined, several sub-EOs may need to be created. Whether or not sub-EOs are used, the original polygons that have been combined into one EO should be maintained.

III. Separation Distances for Vascular Plant EOs

Separation distances are a key component to Element Occurrence Specifications (EO specs). The EO Data Standard provides a *Default Separation Distance* of 1 km (~0.62 miles) or greater for plant and animal elements that lack EO specs, noting that situations involving dispersal barriers could involve even shorter distances. When areas (rather than point locations) are known, separations are measured edge-to-edge, not center-to-center, after any locational uncertainty is addressed. While gene flow declines over distance at different rates for different elements, the minimum default EO separation distance of 1 km has been accepted by the Network as the most suitable round-number metric-system approximation broadly applicable to many (but not all) situations.

Some heritage programs use other separation-distance guidance (such as ¼ mile, about 0.4 km) that was developed under a previous EO methodology that did not provide a capability for sub-EOs. These older guidelines tended to encourage use of more numerous but smaller EOs to maintain separate mapped Features and data records for information that can now be tracked at the sub-EO level.

Narrow dispersal barriers are important for many animals, but for vascular plants, there seem to be few cases in which narrow barriers would justify treatment of quite nearby plants in different EOs. Such situations may be addressed in custom EO specs if necessary. However, for most plants, the contrast of suitable and unsuitable habitat is usually more important, with the latter being crossable only in single-generation dispersal events.

While the 1 km default separation distance is generally accepted as a suitable minimum, it has long been recognized by many Network botanists that a standardized 1 km separation distance for all vascular plant EOs lacking custom EO specs seemed inappropriately small in many cases, particularly those in three broad patterns:

- *Riparian corridors*, in which water currents (or at least occasional floods) focus dispersal substantial distances in the water-flow direction. Riparian corridors, seashores, and shores of other large water bodies that have big storm waves often show linear distribution patterns, with a plant species occurring in various places

along the water's edge, or in adjacent habitat affected by floods, storm waves, or other high waters, but not far inland.

- *Dynamic landscape mosaics,* in which particular patches of habitat actively occupied by the element appear and fade on a scale of several years to a few decades, yet the overall habitat area remains relatively fixed in place. Some habitats, for example active sand dunes, fire-dominated systems, and beaver-influenced systems, are mosaic in nature, with the same particular place on the ground unlikely to have the same ecological characteristics over a 50-year period, with recurrent processes continuing to create new habitat patches that subsequently fade.
- *Continuous apparently suitable habitat* in which an irregularly distributed plant is likely to be present (perhaps in a seed bank), or likely to disperse, in places between the currently known observations.

While all such cases could in principle be addressed by custom EO specs, few such specs have been developed to date. Apart from the lack of appropriate information on dispersal and population biology for many elements, custom EO specs can prove difficult to write for wide-ranging plants, since a variety of habitats, dispersal vectors, and population structures may be involved. This is particularly the case for globally common elements that are of conservation concern in only small portions of their range (usually peripheral or disjunct sites).

IV. Novel Strategy: Pairwise Consideration of EO Features Based on Habitat

The working group initially planned to develop various specs groups, based on such factors as habitat characteristics, life history, pollination biology, or seed dispersal strategies. This system would be parallel to the specs groups developed for many animal taxa. However, with discussion, the group encountered three major barriers to the development of specs groups: 1) a lack of knowledge of life history, pollination biology, or seed dispersal strategies for many elements, 2) habitat characteristics that can vary across the elements' ranges, and 3) multiple pollination and dispersal vectors for many elements. For example, seeds of cottonwood *(Populus* spp.) may be mostly wind dispersed, but can also be water dispersed or bird dispersed, and these vectors are going to vary across the range of the element and even among or within populations.

The group soon realized that the practical question at hand instead involves the selection of appropriate separation criteria for nearby observations of the same element, taken as pairs (or groups), not necessarily using a single criterion for an element throughout its entire geographical range. The group's remaining discussion, and the recommendations presented here, follow that novel track, focusing on the possible role of various familiar habitat and landscape patterns in providing useful guidance on EO delimitation.

This resulting strategy recognizes that while there is need for an objective process in implementing scientifically credible EO separations, there is no real need that the same separation be used throughout the range of a particular element, so long as there is a process for deciding whether any given pair of observations are sufficiently far apart (in their habitat/landscape context) to be treated as separate EOs.

Particular attention was given to the contrast in the EO Data Standard between unsuitable and apparently suitable habitat, and to the special cases of dynamic landscape mosaics and riparian/shore systems. The group identified pertinent combinations and recommended guidance for general EO separation distances for each case, using diverse species with which group members had personal expertise as test cases in refining these recommendations. The overall recommendation is presented as a decision tree (Figure 1), defining cases in which separation distances of 1 km, 2 km, 3 km, and 10 km are suitable for general use in delimiting vascular plant EOs that lack custom individual or group specs.

The group agreed that, if custom EO specs are lacking, EO Features over 10 km apart should be separate (if not bridged by intervening EO Features), and those less than 1 km apart should be combined. While these numbers are somewhat arbitrary, they address an overriding need for consistency in delimiting EOs (EO Data Standard), and are in keeping with informal standards already in use.

The group's recommendation, as revised following review, are:

1. The minimum default separation distance is 1 km, as specified in the EO Data Standard, when no other EO specification or guidance applies.
2. Custom EO specs are needed to justify any separation distances <1 km or >10 km that are not otherwise in compliance with the guidance herein.
3. When custom EO specs are available, they should be used if available information permits.
4. *Additional guidance* is provided here for selected general cases involving nearby pairs/groups of EO Features, with separation distances of 1 km, 2 km, 3 km, or 10 km as appropriate to the situation.
    a. Within **stable, apparently suitable habitat not known to be occupied**, two EO Features separated by up to **2 km** are included in the same EO, unless there is a gap of persistently unsuitable habitat 1 km or more wide.
    b. In **dynamic landscape mosaics**, two EO Features separated by up to **3 km** are included in the same EO, unless there is a gap of persistently unsuitable habitat 1 km or more wide.
    c. In certain **riparian/shore water-dispersal systems,** two EO Features separated by up to **10 km** are included in the same EO, unless there is a gap of persistently unsuitable habitat of 3 km or more, with distances measured along the path of water flow.
5. If EOs exceed 20 km in any direction, they may be broken into two or more EOs for practicality if desired.

For convenience, definitions of key terms, with related notes, are presented together as an appendix. The distinction between suitable and unsuitable habitat, and the three special habitat-based cases, are considered further below.

When necessary in unusual cases, the numerical distances provided here may be adjusted upward by 1.33 (4/3) or downward to 0.75 (3/4) of the specified values, with text explanation. Examples include cases of locational uncertainty, minor outliers, or minor narrowing of otherwise substantial gaps (see Table 1 for ranges). These adjustments should be made only when the EO pattern resulting from application of the general guidelines is

unreasonable, and/or when the exact distances on the landscape are uncertain. If more extreme adjustments are needed, element-specific (or group) specs should be written to explain and document the situation.

Table 1. Specified separation distances and acceptable adjustment ranges for habitat-based plant EO delimitation.

Separation (km)	*Range (km)*	*Separation (miles)*	*Range (miles)*
1	0.75–1.33	0.62	0.47–0.83
2	1.50–2.67	1.24	0.93–1.66
3	2.25–4.00	1.86	1.40–2.49
10	7.50–13.33	6.21	4.66–8.28

V. Suitable vs. Unsuitable Habitat

The EO Data Standard's distinction between "apparently suitable habitat not known to be occupied" and "unsuitable habitat" is fundamental to the guidance provided here, since the extent of any intervening persistently unsuitable habitat is considered in determining whether two EO Features should be included in the same EO or considered separate EOs. Examples of such persistently unsuitable habitats include waters or wetlands separating upland habitats, upland habitats separating riparian habitats or vernal pools, or contrasting bedrock types separating isolated areas of locally unusual bedrock (such as granite, serpentine, limestone, or shale). Note that persistently unsuitable habitat may itself be dynamic, rather than stable, so long as it persistently remains unsuitable for the element.

While areas of persistently unsuitable habitat are not necessarily barriers to single local dispersal events, the difficulty of the species surviving there precludes regular involvement of such areas as gap-bridging stepping-stones for multiple-generation incremental dispersal. Therefore, presence of significant areas of such persistently unsuitable habitat, sufficient to reduce effective dispersal, strengthens isolation between two nearby EO Features within an element's local distribution. Intervening areas of persistently unsuitable habitat, being harder for the element to bridge by dispersal, therefore require shorter separation distances between EO Features than do comparable areas of apparently suitable habitat, in keeping with the EO Data Standard. Of course, discovery of the element in habitat previously thought unsuitable (other than as non-established propagules or as chance seedlings unlikely to survive) suggests that reassessment is needed. Failure to locate the element in the intervening habitat despite intensive searches may of course also suggest that the habitat is unsuitable, not merely unoccupied.

VI. Special Case: Continuous Stable Habitats

Most plants, including many substrate-associated rare species, require particular habitats for establishment and maintenance, as well as possible reproduction and further dispersal. In many instances, the pertinent habitat features (such as bedrock outcrops, topographic settings, hydrographic features, or soil or vegetation types) can be considered stable, being

relatively permanent on the landscape, persisting on scales of centuries, millennia, or longer, with a fairly clear (and sometimes remarkably abrupt) boundary between unsuitable and apparently suitable habitat from the perspective of the (presumed) needs of a particular element. Note that habitat here called "stable" nevertheless undergoes many changes, particularly over periods longer than 50 years, and that chance events (such as tree-fall openings) of course occur occasionally within such areas. Seasonal changes and other very frequent disturbance also occur in most "stable" habitats. Examples of species occurring primarily or exclusively in stable habitat include *Trifolium stoloniferum* (running buffalo clover), *Isotria medeoloides* (small whorled pogonia), *Phacelia monoensis* (Mono County phacelia), *Aquilegia barnebyi* (Barneby's columbine), *Trifolium virginicum* (Kate's Mountain clover), *Arabis serotina* (shale-barren rockcress), *Eriogonum anemophilum* (wind-loving buckwheat), *Heuchera alba* (white alumroot), and *Actaea elata* (small bugbane).

The EO Data Standard suggests that stable EOs be delimited using a 25-year timeframe. For purposes of this guidance, habitats are considered stable when, under natural conditions, they are likely to retain their current apparent capacity (or lack of capacity) to support the element in question during any given 50 year period, and certainly so during any given 25 year period. The group accordingly considered habitat or landscape changes recurring every 5–25 years on average, and almost certain to recur within a 50-year period, to indicate the presence of unstable or dynamic habitat (rather than stable habitat) when considering patterns of EO separation distances. However, in distinguishing dynamic habitats, annual or very frequent disturbance should not be considered, nor should disturbance that would be unlikely to occur at a given point in the habitat within a period of 50 years.

For two EO Features separated by 1 km or more, but by less than 3 km (and not in a riparian/shore system), EO delimitation depends first on whether the two EO Features are separated by a substantial area of persistently unsuitable habitat (here specified as being 1 km wide or greater, and expected to lack suitable sites for the element of interest for the next 25 years or more). If the apparently suitable habitat is relatively continuous (without persisting gaps of 1 km or more), EO delimitation next depends on the temporal stability of the habitat. If the habitat is certain (under natural conditions) to remain stable during the next 25 years (for example, mature hardwood, spruce-fir forest, acidic fen, pond or lakes, or highly arid systems), 2 km is the suggested separation distance (see below for a discussion of unstable dynamic systems). This 2 km distance is reasonable because of the need for only one well-centered or two random intervening locations to combine the same element occurrence, as opposed to needing more than one or two patches to bridge a 3 km separation distance.

VII. Special Case: Dynamic Landscape Mosaics

Some plant elements occur in areas of dynamic landscape mosaics, in which patches of disturbed habitat appear and decline cyclically on timescales of several years to several decades. Examples include active sand dune systems, fire-dominated systems, and beaver-influenced systems. In such dynamic habitat mosaics, there are usually particular kinds of plants that thrive in the disturbance patches, but do not thrive as the vegetation matures. Others occur only in mature patches but not in the disturbed patches. Some of these plants can survive in-place between disturbance events as dormant seed (seed banking) or other dormant stages (spore banks, shoot banks, etc.), while other kinds of disturbance-following plants may depend on local dispersal (between different-aged patches within the habitat mosaic) for colonization of freshly opened habitat. In either of these cases, the element is

persistent within the general area of the landscape mosaic, even though more transient (at least as obvious, growing plants) at any particular place. Examples of such species include *Platanthera leucophaea* (eastern prairie white-fringed orchid), *Muhlenbergia torreyana* (Torrey's dropseed), and *Astragalus columbianus* (Columbia milk-vetch).

Treating patches of plants that occur in areas of dynamic landscape mosaics as single EOs rather than the continually changing patches is generally not only more practical, reducing need for frequent re-mapping and re-delimitation of EOs, but also usually makes more sense from both an ecological and a conservation perspective. In the EO Data Standard and in this guidance, dynamic landscape mosaics are given special treatment (leading to greater separation distances) because the general area, over a relatively short time, can be expected to include habitat patches suitable for growth of the element, and may even include seed banks or other inconspicuous dormant plants. Therefore, if the element's habitat is part of a dynamic landscape system, 3 km instead of 2 km is the suggested separation distance across such apparently suitable landscape areas, unless persisting unsuitable gaps of 1 km or more intervene.

Many dynamic landscape mosaics have been altered as a result of human activity, such as increase or decrease in fire frequencies, removal of beaver, or dune stabilization. In many cases, the landscape remains dynamic despite a change in the disturbance event frequency, and so can still be considered dynamic within a 5–25 year average cycle for the purpose of EO delimitation. In other cases, the landscape processes have been halted entirely. In general, EO delimitation should be based on historic and/or potential landscape processes. In situations where the natural disturbance cycle is unlikely to ever occur again, or has been replaced by a new disturbance cycle substantially more frequent than every 5 years, however, it may be more appropriate to use the 2 km stable-habitat separation distance instead.

VIII. Special Case: Riparian/Shore Systems with Water-current Dispersal

Flowing water is a uniquely strong, directionally focused dispersal agent, generally taking quantities of propagules substantially greater distances, on average, than other dispersal agents that over time would spread the same number of propagules shorter average distances radially in many directions. Even occasional storms and floods (such as those at 10-, 30-, or 100-year intervals) can be important plant-dispersing events, considering the persistence capabilities of many kinds of plants, once established. Dispersal between nearby places in the same riparian/shore system is therefore generally more effective (in the direction of water flow) than for comparably spaced upland or quiet-water places.

One can usually assume that water dispersal plays a significant role in species biology if the plant grows somewhere in a riparian corridor (suggested to include up to the 100-year floodplain), along the seashore, or along the shore of some other water body large enough to have large storm waves (such as large lakes). Because dispersal of plant seeds and other propagules in many riparian and shoreline systems is generally relatively linear rather than radial, the effective range of dispersal is greatly elongated along the direction of water flow. Therefore, it is appropriate to include two EO Features along such a riparian or shore system in the same EO even when separated by about three times the distance that would be selected if water currents were not involved. By their nature, riparian/shore systems are usually also dynamic systems as discussed further below, and so the separation distances that apply to upland dynamic systems serve as the starting point for deriving separation distances in

riparian/shore systems. By multiplying these distances by 3, then rounding, the group arrived at 10 km (instead of 3 km) along the path of water flow, with at least 3 km (rather than 1 km) of intervening persisting unsuitable habitat considered a gap. Example species of riparian/shore systems include *Rorippa columbiae* (Columbia yellow-cress), *Rorippa subumbellata* (Tahoe yellow-cress), *Lobelia dortmanna* (water lobelia), *Ptilimnium nodosum* (harperella), *Marshallia grandiflora* (large-flowered Barbara's-buttons), *Micranthemum micranthemoides* (Nuttall's micranthemum), *Plantago cordata* (heart-leaved plantain), *Amaranthus pumilus* (seabeach amaranth), and *Armoracia lacustris* (lake-cress).

Ideally, for inclusion in the same EO over this extended separation distance, one should have evidence that water currents can flow from one of the two EO Features to the other, at least occasionally. However, in the usual lack of such site-specific knowledge, one may generally assume that proximity to the same water body indicates capability for sharing of water flow, for example single shores or riparian areas that are less than 1 km wide. If there is evidence that two EO Features within a riparian/shore system are not connected by water flow, even occasionally within a 50 year period, the water-current separation distances should not be used. For example, two EO Features on different upstream river tributaries, or two EO Features directly across from one another on a wide river, are not usually directly connected by water flow, and the non-riparian/shore guidance would apply to them instead. On the other hand, even on a wide river, there is likely to be propagule movement from one shoreline to the other shoreline well downstream (generally assumed when the downstream distance is at least 3 times the width of the flow).

Within riparian/shore dispersal-pattern systems, separation distance depends on whether appropriate sites for the element are continuous or discontinuous in the areas along the water-flow direction. For example, a system of gravel bars may extend for 20 km along a particular river. At any one time clusters of plants may be observed in specific portions of the gravel bars, but over the course of time one might find plants almost anywhere along the entire 20 km. This is a classic metapopulation dynamic, described for *Pedicularis furbishiae* by Menges[4]. Most riparian systems will not have "continuous" habitat in any one year, but when considered over 25 years, floods and other disturbances are likely to move gravel bars and other riverine landscape components, or at least move plants among them. Such a system may still be considered continuous even if it includes persisting discontinuities (habitat that is unlikely to become suitable within 50 years, and certainly not within 25 years) less than 3 km along the path of water flow. Therefore, in a continuous riparian/shore system, EO Features may be separated as much as 10 km along the flow path and still be part of the same element occurrence. However, if there is a gap of at least 3 km of persistently unsuitable habitat along the flow path, then they will be separate element occurrences.

IX. Using the Decision Tree

The group's recommendations are summarized in a decision tree (Figure 1), used to determine whether two nearby EO Features of an element should be included in the same Element Occurrence, or treated as separate EOs. In this strategy, the size and nature of the gaps between EO Features are considered to determine the appropriate separation distance (1 km, 2 km, 3 km, or 10 km) for particular situations (approximately 0.6, 1.25, 2, and 6

[4]Menges, E. S. 1988. Conservation biology of Furbish's lousewort: Final report to Region 5, U.S. Fish and Wildlife Service. Holcomb Research Institute, Butler Univ., Indianapolis, Indiana. 55 pp.

miles, respectively). If custom element-specific or group EO specs exist, these should of course be applied instead when available data permit.

The tree may be used when one has two (or more) observations of the same element at different but nearby places. The EO Features being considered with the decision tree must each independently meet the minimum EO criteria for the element – the only question addressed here, and in the decision tree, is whether the two places belong to the same EO, or to two different EOs. Multiple nearby EO Features should be considered pairwise and aggregated into EOs as appropriate.

The decision tree provides an easy, readily referenced method of documenting the process for why a particular separation distance was used in assigning two (or more) EO Features to a single EO or to different EOs. While this tree is designed to be simple to use, it is based on many assumptions or inferences (patch dynamics, metapopulation dynamics, unsuitable or apparently suitable habitat, and dispersal mechanisms). When information on which to base such inferences or assumptions is completely lacking, the decision tree leads to the default 1 km separation distance.

In using the decision tree, distances between EO Features are measured edge-to-edge, if the extent of the element's presence within the EO Features is known, rather than center-to-center, after locational uncertainty has been addressed. In the context of the Biotics EO Methodology, such measurements should be made between Basic Features when available, although Procedural Features may also be used. Any two EO Features closer than 1 km would ordinarily be included in the same EO, and any EO Features more distant than 10 km would ordinarily be included in different EOs (unless additional intervening EO Features bridge the gap). As noted above, these and other distance numbers in the decision tree may be adjusted slightly in individual cases if needed (see Table 1), with an explanation of the need for the adjustment noted in the pertinent EO records.

In cases where persistently unsuitable habitat occurs as isolated patches within a relatively continuous matrix of apparently suitable habitat (whether stable or dynamic), distances between EO Features should be measured along a path through the apparently suitable habitat that avoids or minimizes the width of intervening unsuitable habitat. For the special case of riparian or shore systems, distance measurements should follow the general path of water flow, rather than take a direct path across such areas as upland habitat, broad wetlands, or wide water bodies. In other habitats, distances should be measured along paths that minimize gaps in apparently suitable habitat, as well as along straight lines, and the two observation sites should be included in the same EO if that result is reached by either means.

Minor incidental presence of generally upland elements in riparian/shore situations may be ignored if water-current dispersal can be considered to have negligible effect on the element's overall local distribution. Similarly, for elements generally characteristic of stable habitats, minor incidental presence in adjacent dynamic landscape mosaics may be ignored if the dynamic system does not involve the element's more characteristic local habitats.

Where EOs become very large, exceeding 20 km in any direction (as might happen along major rivers), they may be split arbitrarily into two or more EOs if preferred for data management or conservation planning purposes. However, such splitting is not required, and should not change EO rank or Element rank.

X. Tiered Implementation

The EO separation distances used throughout the Network vary widely, and the practical conversion of plant EOs to a single standard (this habitat-based strategy when custom EO specs are not available) may take several years. To support and track the progress of member subnational programs during this process, the following tiered system of implementation will be used. Tier 3 is the goal; Tiers 1 and 2 are considered in temporary compliance only. Network members will always use the highest implementation tier practicable as their Program-wide default tier, both for new EOs and retrospectively for existing EOs, and will use tiers lower than 3 only temporarily and as a last resort, until Tier 3 can be achieved.

- **Tier 1:** Continue to use a previously adopted, single, consistent separation distance LESS THAN 1 km (such as ¼ mile [~0.4 km] for California), so that EOs can be aggregated automatically via software to generate Tier-2 implementation when necessary.
- **Tier 2:** Use a 1 km separation distance for all plant EOs.
- **Tier 3:** Use custom EO specs when available for an Element, and otherwise use full habitat-based delimitation guidance, to extent supporting information is available.

The attached decision tree (Figure 1) presents Tier 3 implementation.

For elements for which EOs are being tracked by more than one member subnational program, and especially for globally rare elements that are most likely to be the object of multijurisdicational data requests, programs should coordinate implementation levels for those elements, with the help of NatureServe if necessary, and should ideally all use the same, highest practicable implementation level for each such shared element.

The EO delimitation strategy used will be documented in Biotics at least on an element-by-element basis, and preferably at the element-occurrence level, by each subnational program. Programs may also choose and specify the highest default tier they are able to implement program-wide at a particular point in time, but the effects of this choice must still be documented for each element or occurrence (which can be done through “batch” database updates).

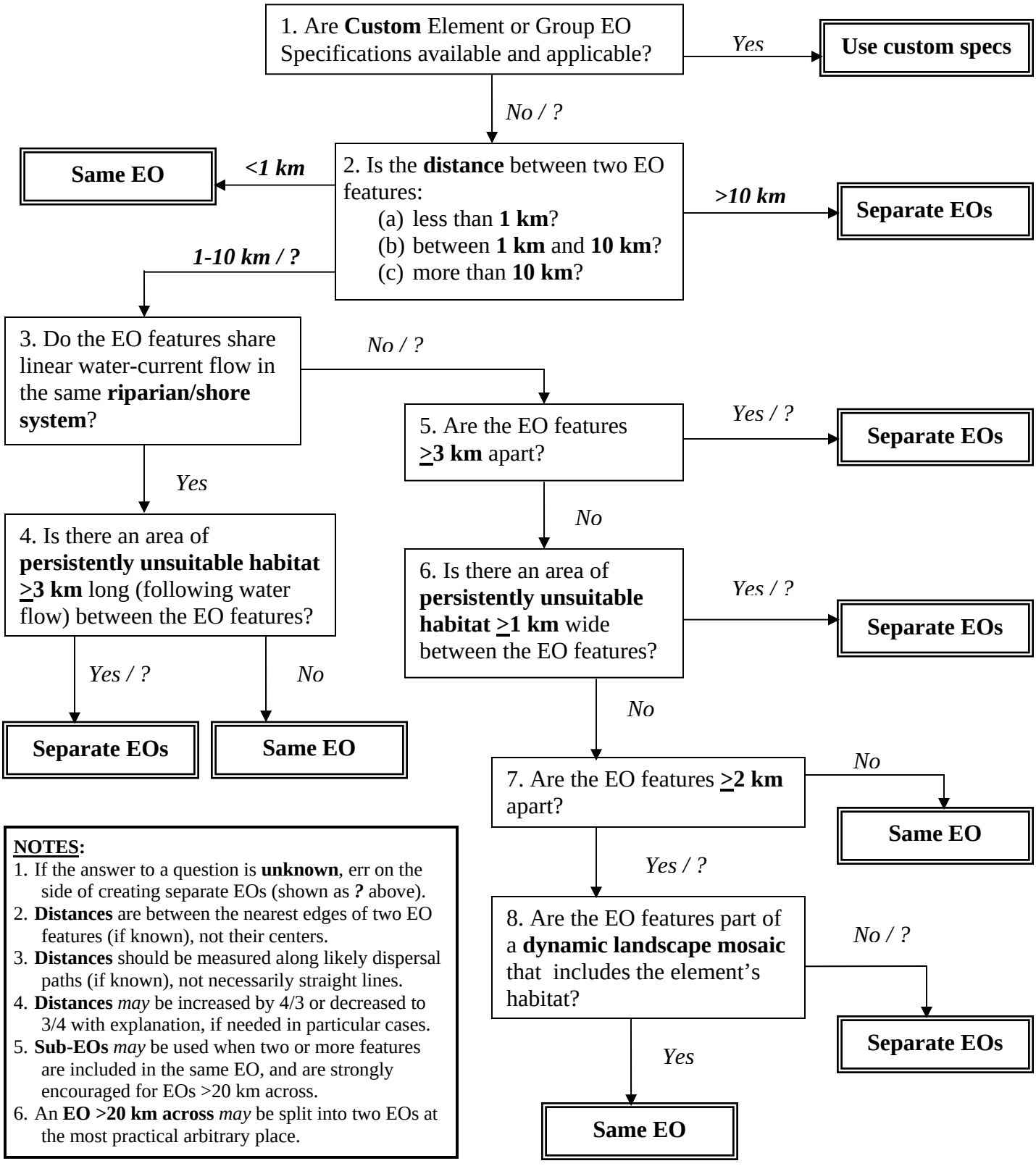
This tiered system is intended for the internal use of NatureServe and its member programs, in supporting and tracking members at various stages of implementation. Individual programs with data at Tier 1 and Tier 2 implementation levels are at least temporarily in compliance with EO specification standards and can inform external clients as such, explaining that "in accordance with data standards, we separate occurrences by .... (whatever your *default Tier 1 or Tier 2* criteria are) .... except when otherwise specified for particular taxa."

Appendix I. Decision Tree and Definitions Summary for Habitat-based Plant EO Delimitation Guidance (2004)

Figure 1. Habitat-based Plant Element Occurrence Delimitation Guidance, 1 October 2004. [Decision tree]

Notes and Definitions for Plant EO Delimitation Guidance, 1 October 2004

Figure 1. Habitat-based Plant Element Occurrence Delimitation Guidance, 1 October 2004



NOTES:

1. If the answer to a question is **unknown**, err on the side of creating separate EOs (shown as **?** above).
2. **Distances** are between the nearest edges of two EO features (if known), not their centers.
3. **Distances** should be measured along likely dispersal paths (if known), not necessarily straight lines.
4. **Distances** *may* be increased by 4/3 or decreased to 3/4 with explanation, if needed in particular cases.
5. **Sub-EOs** *may* be used when two or more features are included in the same EO, and are strongly encouraged for EOs >20 km across.
6. An **EO >20 km across** *may* be split into two EOs at the most practical arbitrary place.

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Notes and Definitions for Habitat-based Plant EO Delimitation Guidance, 1 October 2004

EO Features – This Habitat-based Plant Element Occurrence (EO) Delimitation Guidance addresses whether two separate observations of the same element belong to the same EO, or to two different EOs, in the absence of more specific guidance (for example, element or group custom EO specifications). In the context of the Biotics EO Methodology, Basic Features should be compared, to assure consideration of locational uncertainty. (However, note that the differences between Basic and final Procedural Features are negligible here.) Each observation must independently meet the minimal EO criteria (see EO Data Standard) for that element prior to comparison.

Persistently unsuitable habitat – Surveyed or unsurveyed areas that, under natural conditions, are virtually certain to remain incapable of supporting viable individuals of an element during the next 25 years or more. Such areas are neither *apparently suitable habitat* nor parts of a *dynamic landscape mosaic* that includes the element (see definitions below). The potential for rare or highly irregular events (such as tornadoes, unusual hurricanes, earthquakes, 300-year floods, rare fires, or catastrophic volcanism) may be ignored. Similarly, incremental effects of long-term phenomena (such as slow erosion or deposition, climate change, or sea-level rise) may usually be ignored on the timescale of interest here; over longer times, almost everything changes.

Apparently suitable habitat – Surveyed or unsurveyed areas not known to be occupied by an element, but which appear capable (under natural conditions) of supporting viable individuals of that element, based on one or more observed or mapped factors (soils, geology, hydrology, vegetation, topography, aspect, elevation, etc.) known to delimit or predict other occurrences (current or historical) of the same element.

Dynamic landscape mosaics – Landscape or habitat mosaics (other than *linear riparian/shore systems*; see below) in which an area of potentially suitable habitat includes natural disturbance patches (or similar phenomena) which are produced and subsequently fade in various places within the area, with a natural disturbance return interval of about 5-50 years, considering both past and expected future conditions. Elements in such areas typically grow in (or are excluded from) the dynamic disturbance patches, persisting as seed (or other dormant stages) in patches not currently suitable for growth, or dispersing readily among suitable patches. Examples include many chaparral- or pine-dominated fire systems, dune blowouts, and beaverdam wetlands. Note that such habitats as intermittent wetlands, in which the conditions appropriate for growth (or exclusion) of an element may not be met every year, are still considered stable if their locations and extents remain generally constant for 25 years or more.

Linear riparian/shore systems – Systems dominated by water-current dispersal in a linear zone generally <1 km wide (riparian corridors, shores, and similar narrow systems), including those with dispersal by occasional events (major floods, storm waves, etc.) with significant potential to occur during the next 25 years. Examples include many "100-year" riparian floodplains, coastal shorelines, shorelines of big lakes with large waves, estuarine shorelines and tidal zones, and floodplains of small streams or dry drainages subject to frequent flash floods. Small, quiet ponds and lakes, as well as wide marshes or backwater swamps, generally would not be included here. EO features are assumed to share linear flow if they are aligned in a reasonable flow direction along a river, stream, shore, etc., unless contrary data exist. This is usually not the case with upstream EO features on different tributaries, or with EO features on opposite shores of rivers >1 km wide; however, such features may be indirectly connected if they each share flow with a common downstream EO feature. For an aquatic element inhabiting open water of a river, assume connection by water-current flow unless evidence suggests that this is unlikely.

IDAHO DEPARTMENT OF FISH AND GAME

Submitted by: _____

Beth Colket, Botanist
Idaho Conservation Data Center

Approved by: _____

Kevin E. Church, Program Coordinator
Idaho Conservation Data Center