

Slickspot Peppergrass
(Lepidium papilliferum)

**5-Year Review:
Summary and Evaluation**



**U.S. Fish and Wildlife Service
Idaho Fish and Wildlife Office
Boise, Idaho**

5-YEAR REVIEW

Species reviewed: Slickspot peppergrass (*Lepidium papilliferum*)

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5-YEAR REVIEW

Slickspot peppergrass / *Lepidium papilliferum*

GENERAL INFORMATION

Species: Slickspot peppergrass / *Lepidium papilliferum*

Date listed: 10/08/2009; reinstated as threatened 08/17/2016

FR citation(s): 74 FR 52013; reinstated as threatened 81 FR 55058

Classification: Threatened

Critical habitat/4(d) rule/Experimental population designation/Similarity of appearance listing: *There is no 4(d) rule, experimental population designation, or similarity of appearance listing for slickspot peppergrass.* Critical habitat has been proposed for slickspot peppergrass. A chronological history of efforts to designate slickspot peppergrass critical habitat is provided in Appendix A.

Methodology used to complete the review

In accordance with section 4(c)(2) of the Endangered Species Act of 1973, as amended (Act), the purpose of a 5-year review is to assess each threatened and endangered species to determine whether its status has changed and if it should be classified differently or removed from the Lists of Threatened and Endangered Wildlife and Plants. The U.S. Fish and Wildlife Service (Service) evaluated the biology and status of the slickspot peppergrass as part of a Species Status Assessment (SSA) to inform this 5-year review.

The SSA report was developed by Service biologists in the Idaho Fish and Wildlife Office (IFWO), in coordination with a group of 15 external species experts/practitioners (USFWS 2020, entire). This group of external species experts/practitioners was comprised of Federal agency (Bureau of Land Management [BLM], United States Geological Service [USGS], and Mountain Home Air Force Base [MHAFB]); state agency (Idaho Department of Fish and Game [IDFG], Idaho Department of Lands, Idaho Army National Guard [IDARNG], and Idaho Governor's Office of Species Conservation [OSC]); researchers (Boise State University); and private landowner partners familiar with the species, its habitat, and land management practices. The SSA report represents our evaluation of the best available scientific information, including the resource needs and the current and future condition of the species. We developed three future scenarios of environmental and management conditions based on the two primary threats (wildfire and invasives) to the species to predict the viability of the species in the future, which were then evaluated by the group of external species experts/practitioners. Four independent scientific peer reviewers and eight external species experts/practitioners provided review comments on draft versions of the SSA. These scientific peer reviewer and external species expert review comments were incorporated into the final SSA report along with internal IFWO review comments.

We used the February 2020 SSA report as the scientific basis to support our 5-year review decision-making process. The 2020 SSA focused the analyses of current and future condition of slickspot peppergrass on the increased frequency and intensity of wildfire and the introduction and spread of invasive nonnative plants (primarily unseeded invasive nonnative annual grasses

such as cheatgrass [*Bromus tectorum*]), as these were the two primary threats identified in the 2009 and 2016 listing rules. The SSA report summarizes the best available scientific information on the current status and likely future viability of the species in terms of the conservation biology principles of resiliency, redundancy, and representation relative to these two primary threats. Resiliency describes the ability of individuals and populations to withstand environmental or demographic stochasticity. Redundancy describes the ability of the species to withstand catastrophic events in a way that spreads risk and minimizes potential loss of the species, and is characterized as having multiple, resilient populations distributed across the range of the species. Representation describes the ability of a species to adapt to changing environmental conditions over time and is characterized by the breadth of genetic and environmental diversity within and among populations (Smith *et al.* 2018, pp. 7-8).

FR Notice citation announcing the species is under active review: 85 FR 14240 (dated March 11, 2020)

REVIEW ANALYSIS

Updated Information and Current Species Status

Biology and Habitat

Slickspot peppergrass is an annual or biennial member of the mustard family (Brassicaceae) found in Great Basin sagebrush steppe habitats of Ada, Canyon, Gem, Elmore, Payette, and Owyhee counties of southwestern Idaho. This species is known from three geographic areas based on landform: the Foothills geographic area, the Snake River Plain geographic area, and the disjunct Jarbidge geographic area (Figure 1). This intricately branched, tap-rooted plant averages 2 to 8 inches (in) high (occasionally reaching up to 16 in high) with numerous small, white, four-petaled flowers. The primary seed dispersal mechanism for slickspot peppergrass is unknown but is likely to be gravity. Above-ground plants represent only a portion of the population; the seed bank (a reserve of dormant seeds generally found in the soil) contains the other portion of the population and, in many years, constitutes the majority of the population. This persistent seed bank buffers slickspot peppergrass populations from years with unfavorable temperature and precipitation conditions that result in little or no reproduction.

Key resource needs for slickspot peppergrass individual plants include functional slick spot microsites that have relatively low levels of disturbance, sunlight for photosynthesis, and timely precipitation and favorable temperatures for seed germination and plant growth. Presence of native shrubs adjacent to slick spot microsites allow for increased water availability, as well as reduced risk of seed predation by Owyhee harvester ants and minimal competition with invasive and/or encroaching plants. Long-term productivity of slickspot peppergrass populations is maintained by the presence of functional slick spot microsites, intact sagebrush steppe habitat (including native shrubs, grasses, forbs, and biological soil crusts) within populations and the surrounding landscape, the presence of adequate insect pollinators, and a quantity of nectar and pollen from a diversity of flowering shrubs and forbs available across the growing season to support a diversity of insect pollinators. At the species level, slickspot peppergrass needs a sufficient number and distribution of larger populations in high quality sagebrush steppe habitat

to withstand environmental stochasticity (resiliency), biological and physical changes in its environment (representation), and catastrophic events (redundancy).

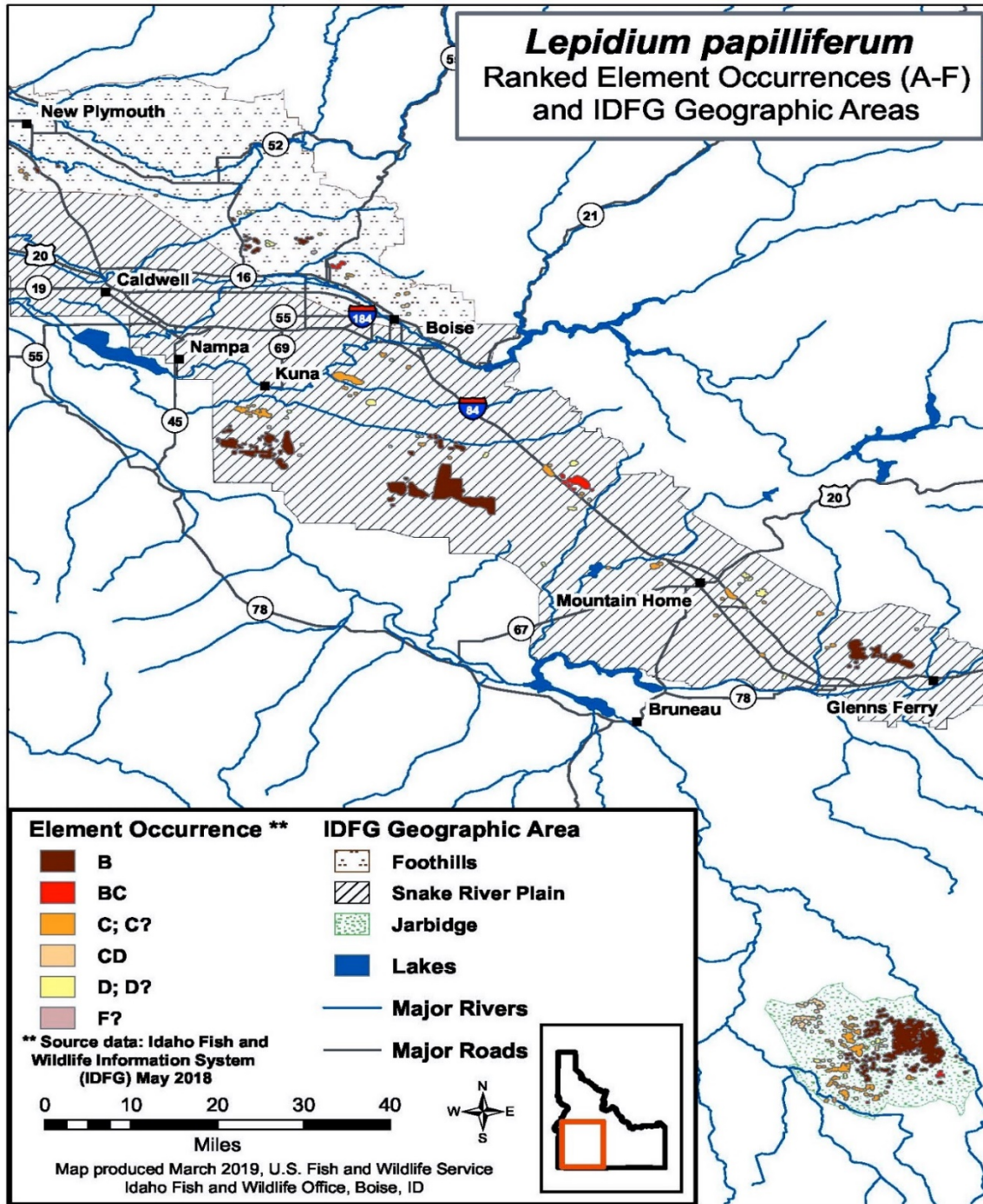


Figure 1. Slickspot peppergrass element occurrence (EO) locations and rankings within the Foothills, the Snake River Plain, and the Jarbidge geographic areas. No EOs are currently ranked as A (excellent viability) or AB (good to excellent viability). A “?” qualifier may be used with the most appropriate rank if there is incomplete information on the EO and subEO Size, EO and subEO Condition, and Landscape Context factors.

The total rangewide extent of known extant Element Occurrences (EOs) and subEOs is approximately 16,269 acres (Figure 1). The area occupied by slickspot peppergrass is only a small fraction of this total rangewide EO acreage, since slick spot microsites occupy only a small percentage of the landscape, and the majority of slick spot microsites are not occupied by slickspot peppergrass.

A recent assessment of 125 EO rankings, conducted by IDFG in 2016, estimated viability of slickspot peppergrass populations using a protocol developed by NatureServe. These EO viability rankings, and their distribution within the range of the species, were used to inform estimates of slickspot peppergrass resiliency, representation, and redundancy. Overall, the species exhibits a relatively high level of population redundancy, as good to fair viability populations (B-, BC-, and C-ranked EOs and subEOs) are well distributed across the range of the species (Figure 1). The majority of the 115 extant populations (66 percent) ranked by IDFG fall within the good to fair viability categories. Furthermore, when considering the combined acreage of ranked populations rangewide, 83 percent (13,402 acres) of slickspot peppergrass EO and subEO acreage is ranked as having good viability (B-ranked). No EOs or subEOs are ranked A (excellent viability) or AB (excellent to good viability).

Our analysis of representation for slickspot peppergrass populations was based on genetic research. Only about 11 percent of the rangewide genetic differentiation resided among slickspot peppergrass populations, which was primarily between the disjunct Jarbidge geographic area populations and the remainder of the range of the species. Eighty-nine percent of genetic differentiation resided within slickspot peppergrass populations (Stillman 2006, p. 22). The majority of current gene flow in the species is thought to occur within populations over relatively short distances. Slickspot peppergrass populations are spatially structured (Robertson and Ulappa 2004, p. 61, Figure 1.5), so neighboring individuals are often more closely related to one another than to distant individuals due to limited pollen flow and seed dispersal. Smaller populations of slickspot peppergrass (defined as sites supporting less than 100 plants) had significantly less genetic diversity than larger populations, particularly in the Snake River Plain geographic area (Stillman 2006, pp. 28-29). The persistent seed bank of slickspot peppergrass may provide an additional source of genetic variation across generations as each seed cohort is viable in the soil for up to 12 years and retains genetic variation over time (Meyer *et al.* 2005, p. 18).

Six groupings of good to fair viability EOs and subEOs, located in relatively close geographic proximity, have been identified within Management Areas (MAs) 1, 6, 7, 10, 11, and 12 (Figure 2). These groupings represent population strongholds and may provide for genetic exchange among populations located within the same grouping. The 27 EOs and 10 subEOs identified as having higher population viability within these six identified groupings increase resiliency to stochastic events, and their genetic variability and distribution across the range of the species contributes to species representation and redundancy. With the exception of the MAs 11 and MA 12 groupings in the Jarbidge geographic area, groupings of higher viability populations are located too distant for insect pollinators to facilitate genetic exchange among the groupings. Some lower viability EOs, either within a grouping or in a more isolated location, may also be important for population representation and redundancy due to their genetic uniqueness or other characteristics.

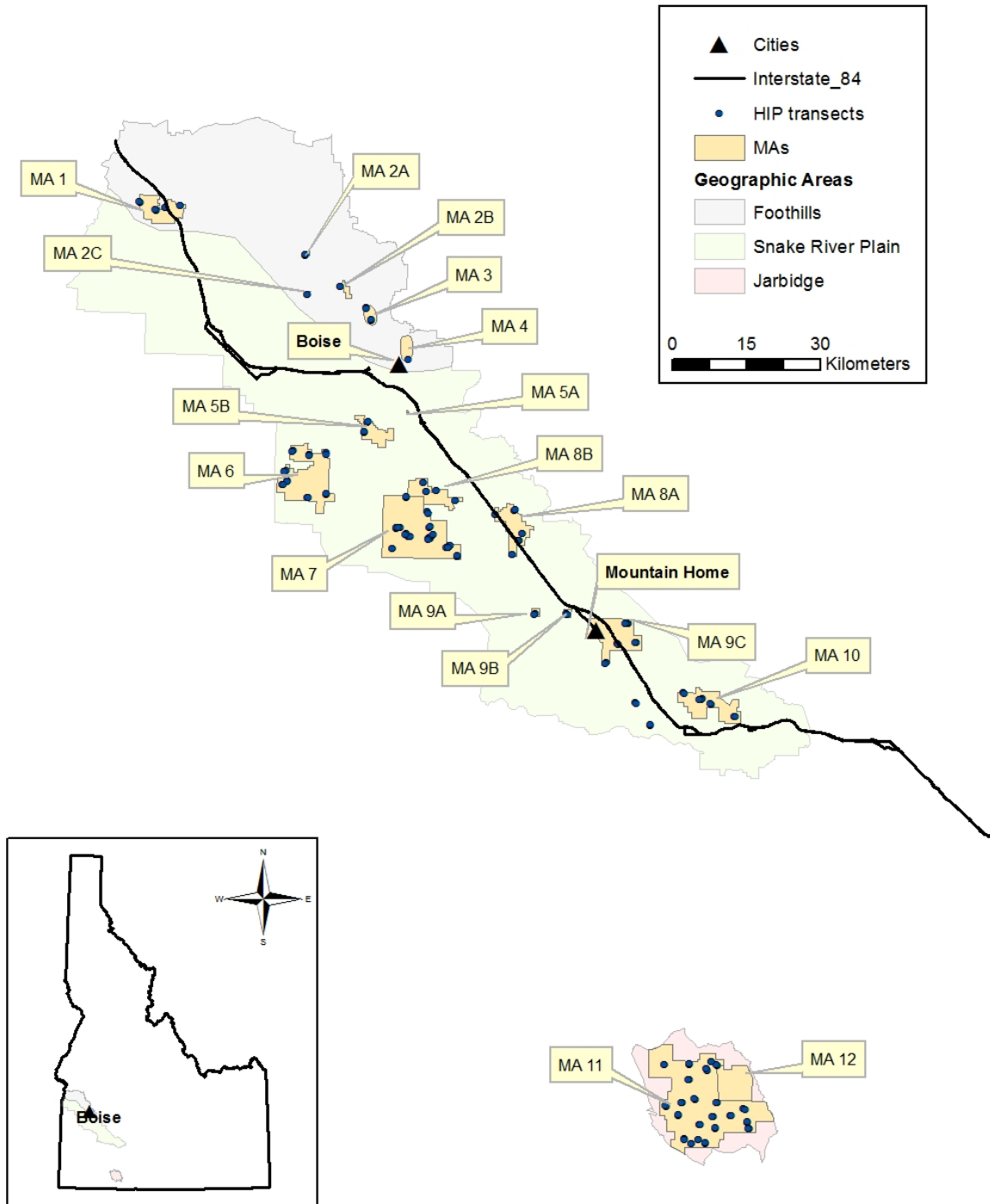


Figure 2. The location of slickspot peppergrass geographic areas, State of Idaho Candidate Conservation Agreement Management Areas (MAs), and Habitat Integrity and Population (HIP) monitoring transects (from Kinter *et al.* 2014, p. 31). MAs 1, 6, 7, 10, 11, and 12 encompass element occurrence groupings identified as slickspot peppergrass stronghold areas.

Based on IDFG's 2016 assessment of slickspot peppergrass populations, 19 EOs and subEOs contained 1,000 or more slickspot peppergrass plants during IDFG assessment field reviews or during annual monitoring in at least one of the six years between 2010 and 2015. The Service considers these 19 EOs and subEOs (17 B-ranked and 2 BC-ranked) to have the highest viability of all slickspot peppergrass populations. Habitat patch sizes for these 19 slickspot peppergrass EOs and subEOs range from about 2 acres to 7,164 acres. Only 6 of these 19 populations are greater than 500 acres in area. The area of the remaining 13 EOs, documented to support 1,000+ plants, range from 2 to 91 acres. Relative to larger acreage populations, these smaller acreage populations are expected to be more vulnerable to stochastic or catastrophic events, such as ground disturbance or wildfire, respectively.

Despite moderate to high population resiliency and relatively high species representation and redundancy for larger EOs and subEOs, slickspot peppergrass population numbers continue to decline across all three geographic areas, with the steepest declines in the Jarbidge geographic area. Twenty-six populations (about 24 percent of the 107 B- through D-ranked EOs and subEOs) scattered across the species' range supported fewer than 50 plants annually over six years of recent monitoring (Kinter and Miller 2016, pp. 3, 57-60, Table 2). Many of these small remnant EOs or subEOs exist within habitat that is substantially degraded by past wildfires and the presence of invasive nonnative plants. These small slickspot peppergrass populations have likely persisted due to their long-lived seed bank, but the potential risk of depleting each population's seed bank with no new genetic input makes their continued persistence uncertain.

Threats Analysis (threats, conservation measures, and regulatory mechanisms)

Current or potential future threats to slickspot peppergrass include increased frequency and intensity of wildfire (Factors A [the present or threatened destruction, modification, or curtailment of its habitat or range] and E [other natural or manmade factors affecting its continued existence]), introduction and spread of nonnative species (Factors A and E), commercial and residential development and agricultural conversion (Factors A and E), habitat fragmentation (Factor E), and climate change (Factor E). An additional concern is the widespread occurrence of native Owyhee harvester ants (*Pogonomyrmex salinus*), an efficient slickspot peppergrass seed predator (Factor C [predation]). Other activities, such as livestock use, wildfire management activities, post-fire stabilization and restoration activities, recreation and off highway vehicle use, and military training have the potential to impact slickspot peppergrass through disturbance (Factor A). These activities were not considered to result in significant impacts that would lead to slickspot peppergrass becoming endangered in the foreseeable future, primarily due to implementation of conservation measures designed to avoid or reduce impacts to slickspot peppergrass associated with these activities. However, livestock use, wildfire management activities, recreation and off highway vehicle use, and military training can increase the occurrence and frequency of wildfire and invasive nonnative plant species. We continue to lack data indicating that overutilization for commercial, recreational, scientific, or educational purposes (Factor B), disease (Factor C), or the inadequacy of existing regulatory mechanisms (Factor D) are threats to the slickspot peppergrass.

Primary threats of increased frequency and intensity of wildfire and the introduction and spread of invasive nonnative plants, as well as the more recently prevalent threat of residential and

commercial development and associated infrastructure in the Foothills and Snake River Plain geographic regions, have resulted in extensive fragmentation and degradation of habitat conditions across the range of the species. Most populations are isolated such that insect-facilitated genetic exchange (pollination) between populations is limited, increasing the risk of future loss of genetic diversity, particularly for small populations. The current and future status of threats associated with Factors A, C, and E are discussed in detail in the SSA report (USFWS 2020, entire), and are briefly described below.

Wildfire (Factors A and E)

The current wildfire regime (i.e., increasing frequency, size, and duration) and invasive nonnative plants were described in the 2009 final listing rule and the 2016 reinstatement rule as the primary causes for the decline of slickspot peppergrass. Frequent wildfires ultimately result in the conversion of native sagebrush-steppe habitat to nonnative annual grassland monocultures, with consequent losses of native species diversity and natural ecological function. This creates a positive feedback loop between invasive nonnative annual grasses and wildfire, which makes it difficult to independently separate out effects of each of these two primary threats to slickspot peppergrass.

Slickspot peppergrass populations continue to be vulnerable to wildfire. In our analysis of future wildfire effects on slickspot peppergrass, we predicted that approximately 80 to 90 percent of the remaining estimated 7,477 acres of slickspot peppergrass EOs and subEOs not yet impacted by wildfire would burn within the next 50 years (by 2065; 81 FR 55058, August 17, 2016). Previously burned EOs and subEOs were also predicted to be at higher risk of re-burn by year 2065. The low ecological resistance to cheatgrass and resilience to disturbance across the vast majority of the range of slickspot peppergrass increases the risk for large, catastrophic wildfires to burn slickspot peppergrass populations. Monitoring data show wildfire suppression thresholds for maximum annual acreages burned within individual MAs (hold 90% of fires to <20 ac [8 ha]) have often been exceeded, and portions of EOs have been burned despite diligent wildfire suppression efforts by BLM and wildfire suppression partners (Kinter *et al.* 2014, p. 24; Kinter *et al.* 2012, p. 23; Kinter *et al.* 2010, p. 37; Colket 2009, pp. 65-66). Wildfire substantially reduces slickspot peppergrass numbers relative to unburned EOs (Bond 2017, p. 12). Currently, the vast majority of EO and subEO acreage rangewide (92 percent [14,715 acres]) are unburned. However, the majority of EOs and subEOs rangewide continue to be vulnerable to wildfire due to their location within low ecological resistance and resilience areas dominated by invasive nonnative plants.

Ongoing and future BLM fuel break projects, as well as increased capacity for rapid response fire suppression, have the potential to reduce wildfire risk within the range of slickspot peppergrass. However, increased fuels management and rapid response fire suppression do not address the co-occurring effects of existing invasive nonnative annual grasses or the conservation need for sagebrush steppe habitat restoration. Additionally, fuel breaks can result in local scale sagebrush steppe habitat loss and facilitate invasive nonnative plant expansion (Shinneman *et al.* 2019, entire). Considering these factors, it is yet to be determined if large fuel break projects and rapid response fire suppression efforts on their own will adequately address threats such that future population viability is maintained or improved.

Invasive Nonnative Plant Species (Factors A and E)

Invasive nonnative plants, especially nonnative invasive annual grasses, are one of the primary causes of reduced quality of habitat for slickspot peppergrass. Invasive nonnative plants can impact slickspot peppergrass through both perpetuation of the wildfire/nonnative plant cycle, as well as through direct competition with individual slickspot peppergrass plants. Invasive nonnative plants may impact slick spot microsite hydrology and increase levels of organic matter in slick spots, making them more vulnerable to increased plant invasion. Some slick spots also appear to be disappearing due to encroachment by invasive nonnative plants, especially cheatgrass. Replacement of invasive nonnative annual grasses with highly competitive seeded nonnative plants can increase the ecological resilience of sites and may reduce the threat of wildfire over the larger landscape, which may benefit slickspot peppergrass. However, highly competitive seeded nonnative plants can compete with native plants, including slickspot peppergrass, and in some cases, replace slickspot peppergrass, posing a threat to future EO viability.

Fifty-four percent (8,627 acres) of EO and subEO acreage rangewide is categorized with moderate to extreme levels of invasive nonnative plant presence. Invasive nonnative plant data include both invasive nonnative unseeded species, such as cheatgrass, medusahead (*Taeniatherum caput-medusae*), and rush skeletonweed (*Chondrilla juncea*), as well as highly competitive nonnative seeded plants, such as crested wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*Thinopyrum intermedium*), and forage kochia (*Bassia prostrata*). Total EO and subEO numbers and acreage data support the suggestion that invasive nonnative plants (inclusive of highly competitive nonnative plants) currently exert a greater influence on the current condition of EOs and subEOs rangewide relative to wildfire.

Maintaining or restoring functional sagebrush-steppe vegetation communities, which once occurred throughout the Great Basin, is an essential biological and physical requirement of slickspot peppergrass, and native habitat restoration within and around priority populations will likely be essential to the recovery of this species. A relatively intact Wyoming big sagebrush vegetation community (represented by perennial bunchgrasses, shrubs, and forbs as well as biological soil crusts) is likely to buffer slick spots and slickspot peppergrass from wildfire, slow the invasion of slick spots by invasive nonnative plant species, and provide habitats for insect pollinators. Habitat restoration for slickspot peppergrass recovery will require long-term and intensive adaptive management within the low ecologically resistant and resilient areas that encompass the vast majority of the range of this species. Landscape-scale techniques to restore highly degraded sagebrush-steppe habitats are currently being developed, although it likely is not logistically or economically feasible to restore all slickspot peppergrass populations exclusively with native plants, particularly in sites that have been converted from native Wyoming big sagebrush vegetation to grasslands dominated by invasive nonnative annual grasses or highly competitive nonnative plants.

Development (Factors A and E)

Residential, commercial, and agricultural development can affect slickspot peppergrass populations through the destruction of populations, loss of slick spot microsites, increased nonnative plant invasions, (Forman and Alexander 1998, p. 210; Gelbard and Belnap 2003, pp.

424-425, 430-431; Bradley and Mustard 2006, p. 1142); increased human-caused ignition of wildfires (Keeley *et al.* 1999, p. 1829; Romero-Calcerrada *et al.* 2008, pp. 341, 351; Syphard *et al.* 2008, pp. 610-611); and increased habitat fragmentation, which can pose problems for slickspot peppergrass by creating barriers in the landscape that prevent effective genetic exchange between populations (Robertson *et al.* 2004, pp. 2-4). Development may negatively impact the native insect populations that the species depends on for pollination and genetic exchange. Changes in native habitat caused by residential or agricultural development, or the conversion of the native plant community to nonnative species, may impact insect pollinator populations by removing specific food sources or habitats required for breeding or nesting (Kearns and Inouye 1997, p. 298; McIntyre and Hostetler 2001, p. 215; Zanette *et al.* 2005, pp. 117-118). In addition, habitat isolation and fragmentation resulting from activities such as development or road construction may result in decreased pollination of slickspot peppergrass from distant sources, possibly resulting in decreased reproductive potential (e.g., lower seed set) and reduced genetic diversity (Stillman *et al.* 2005, pp. 1, 6-8, Robertson and Ulappa 2004, p. 1705).

While our 2009 listing rule and our 2016 reinstatement rule considered development to be a secondary threat, the State of Idaho recently identified development and associated infrastructure as one of the most extreme and widespread disturbances documented to impact the species within the Foothills and Snake River Plain geographic areas (Miller and Kinter 2018, p. 38). Residential, commercial, and agricultural development prior to 1955 has been reported as the cause for 10 extirpations of slickspot peppergrass in the Foothills and Snake River Plain geographic areas (Kinter and Miller 2016, pp. 10, 13, 17-18, 20). Narducci *et al.* (2017, p. 6) project that 20,000 to 44,000 acres of sagebrush steppe will be lost to urbanization across Ada and Canyon County over about the next 80 years. Given that the population of Idaho continues to grow (U.S. Census Bureau 2017, p. 3), the long-term trend of habitat fragmentation and loss could continue if habitat are converted for other uses. Newer land uses, such as solar and wind farms, have impacted additional acreages of sagebrush steppe on the western Snake River Plain and continue to be of concern for species conservation. Development within the Jarbidge geographic area is currently limited to scattered military training facilities and livestock infrastructure (such as fences, water developments, and pipelines).

Though only 20 extant EOs are partly or wholly on private land, slickspot peppergrass populations and habitat on private lands are vulnerable to urban development (IDFG *in litt.* 2018, pp. 3-6). Ongoing and planned development projects within or near slickspot peppergrass EOs could result in losses of slick spot microsites and further fragmentation of slickspot peppergrass habitat, potentially resulting in decreased viability of populations through decreased seed production, reduced genetic diversity, and increased vulnerability of small populations to extirpation. Most recent development effects on slickspot peppergrass have occurred on private lands in the Snake River Plain and Foothills geographic areas, with associated infrastructure effects to the species on private, State, and Federal lands. About 43 percent (45 populations) of the 105 EOs and subEOs with available data were observed to contain some evidence of development (Kinter and Miller 2016, raw data), and populations currently located on the approximately 600 acres of private lands, inclusive of municipal lands, remain vulnerable to partial or complete loss due to development.

Livestock (Factor A)

Livestock use poses a threat to slickspot peppergrass through mechanical damage to individual plants and slick spot habitats (Seronko 2004, *in litt.* entire; Colket 2005, p. 34; Meyer *et al.* 2005, pp. 21–22; Rengasamy *et al.* 1984, p. 63). Livestock trampling effects on slickspot peppergrass may be most detrimental when soils are wet, as well as when plants are actively growing and flowering in the spring, and livestock-related trampling effects are concentrated near waters, salt and supplement sites, or fence corners. High levels of livestock disturbance in slick spot microsites can reduce population resiliency and representation through reduction in biocrust cover and species richness, which facilitates the spread of invasive nonnative annual plants (Root *et al.* 2020, pp. 4-7), and through deep burial of slickspot peppergrass plants and seeds within slick spots such that their potential contribution to the seed bank is lost.

Federal and State lands where slickspot peppergrass occurs (96 percent of the EO and subEO acreage rangewide) are managed for permitted livestock grazing through the BLM, State of Idaho, and MHAFFB. The BLM, MHAFFB, and the State of Idaho continue to implement measures specifically designed to avoid or minimize livestock-related impacts to slickspot peppergrass. These efforts help to reduce impacts to the species from livestock trampling which has been documented through HIP monitoring to indicate decline in livestock hoof print thresholds within slick spot microsites over 14 years of monitoring (Miller and Kinter 2019, p.21; Miller and Kinter 2018, pp. 5-9). Although livestock grazing may result in localized direct impacts and reductions in the quality of habitat for the species, the Service does not consider current livestock management to be a primary threat to slickspot peppergrass due to the continued implementation of conservation measures intended to avoid or minimize potential livestock grazing-related impacts on BLM, MHAFFB, and Idaho Department of Lands managed land. Livestock grazing is being considered as a potential tool for the reduction of fine fuels within the Great Basin to reduce the risk of catastrophic wildfire, including within the range of slickspot peppergrass.

Owyhee Harvester Ants (Listing Factor C)

While effects of herbivory on slickspot peppergrass by mammals and most insects have not been identified as a significant stressor (IDFG *in litt.* 2018, p. 6), in recent years, concern has emerged over potential detrimental effects of seed predation by Owyhee harvester ants (*Pogonomyrmex salinus*), an efficient slickspot peppergrass seed predator. Owyhee harvester ants are a native species that thrive in open grassy areas throughout southwest Idaho, including areas occupied by slickspot peppergrass where shrubs have been lost. These ants consume the seeds of small-seeded species (including slickspot peppergrass) preferentially over large-seeded species such as cheatgrass (Schmasow and Robertson 2016, p. 955). Studies have shown that Owyhee harvester ants can remove up to 90 percent of slickspot peppergrass fruits and seeds from individual plants, either directly from the plant or by scavenging seeds that drop to the ground (White and Robertson 2009, p. 511; Robertson and Crossman 2012, pp. 14-15; Jeffries 2016, entire).

Harvester ant colonies are present within many, if not most, slickspot peppergrass populations. Of the 105 EO and subEOs with available data, 62 populations located across the range of the species contained Owyhee harvester ants (Kinter and Miller 2016, raw data). Density of Owyhee harvester ant colonies is inversely related to sagebrush cover, and positively related to the

amount of non-cheatgrass grasses at a site (Robertson 2015, p. 11). Throughout the Great Basin, increased frequency and intensity of wildfire has caused sagebrush stands to be replaced by grasslands, which may allow harvester ants to colonize areas that historically were unsuitable for nesting by increasing the carrying capacities of those burned sites (Robertson 2015, p. 13). Thus, increased density of Owyhee harvester ant colonies may be linked to the increased frequency and intensity of wildfire within the range of slickspot peppergrass over the past several decades.

Owyhee harvester ant colony expansion into areas adjacent to and within occupied slick spots, and the associated increase in seed predation, has the potential to significantly affect slickspot peppergrass recruitment and the replenishment of the seed bank, which could in turn affect the long-term viability of slickspot peppergrass. Seed predation by Owyhee harvester ants poses a threat to slickspot peppergrass in terms of decreased resiliency through reduced replenishment of the persistent seed bank, which may contribute to the risk of local extinction for smaller populations. Additionally, Brown and Robertson (2020, pp. 488-490) found that EOs that had a lower density of slickspot peppergrass plants tend to have a significantly higher proportion of seeds predated by Owyhee harvester ants than those with a higher plant density, making seed predation a greater threat to smaller populations.

Other Natural or Manmade Factors Affecting its Continued Existence (Listing Factor E)

In the 2009 listing rule, Other Natural or Manmade Factors, such as habitat fragmentation, isolation of small populations, and climate change, were not considered to reach the level of threat posed to slickspot peppergrass by the primary threats of the modified wildfire regime and invasive nonnative plant species. However, when considered in concert with the threats considered in Listing Factor A, these factors were considered threats to the viability of slickspot peppergrass throughout its range.

Habitat Fragmentation and Isolation of Small Populations

Due to its occupancy of spatially distributed slick spots, the habitat of slickspot peppergrass is naturally dispersed regardless of how intact or fragmented sagebrush habitats are across the landscape. However, increases in habitat fragmentation associated with wildfires, increased invasive nonnative plants (especially nonnative invasive annual grasses), and various forms of development (conversion to agriculture, urban development) continue to occur throughout the range of the species and are expected to occur into the future. Further direct and indirect forms of fragmentation of slickspot peppergrass is likely to result in more barriers to genetic exchange on the landscape. Slickspot peppergrass habitats separated by distances greater than the effective range of available pollinating insects (about 0.6 miles) are at a genetic disadvantage and may become vulnerable to effects of loss of genetic diversity in time and experience reductions in fruit set, which would in turn influence seed production. Large scale habitat fragmentation is the primary barrier for pollinators to transfer pollen between populations. As seed dispersal for slickspot peppergrass likely occurs only over short distances, pollinators and pollen dispersal are the primary mechanism for reproductive and genetic exchange between slickspot peppergrass sites. Small, isolated populations with lowered genetic diversity are at increased risk of local extirpation. Despite implementation of existing conservation measures to avoid or reduce threats

to the species, if habitat fragmentation associated with wildfire, nonnative plants, and development continues at current levels, resiliency, representation, and redundancy will decrease into the future.

Climate Change

Due to the uncertainty associated with climate change projections, climate change in and of itself was not considered to represent a significant rangewide threat to slickspot peppergrass in the 2009 listing rule. However, current information suggests that climate change has already played an important supporting role in intensifying the effects of wildfire and invasive nonnative plants on the slickspot peppergrass. The Great Basin region warmed substantially (ranging from 0.6 to 1.1° F) during the 20th century, and current climate change projections are that precipitation will increase in the winter but decrease in the summer months (Chambers 2008, pp. 29-30). Predicted precipitation and temperature shifts in southwestern Idaho as a result of climate change could negatively affect slickspot peppergrass by decreasing the number of first year biennials that survive into the following spring to successfully flower and fruit. Numbers and vigor of annual slickspot peppergrass flowering plants could also be negatively affected if growing season precipitation (February through May) decreases and temperatures increase, as predicted. Reduced numbers of plants that survive to successfully flower would result in fewer viable seeds for replenishment of the seed bank, affecting resiliency of populations. Climate-change related changes in plant phenology in Idaho (Klos *et al.* 2015, p. 249) have the potential to affect resource availability for slickspot peppergrass insect pollinators.

Current climate-change models predict future climatic conditions within the range of slickspot peppergrass will favor further invasion by cheatgrass and that wildfire frequency, extent, and severity will continue to increase. If this prediction is realized, it is expected that slickspot peppergrass survival and reproduction would be reduced through accelerated habitat fragmentation or loss for the species and its insect pollinators. Increased temperatures and carbon levels are likely contributing to current cheatgrass domination within low ecological resistance and resilience areas present throughout the Snake River Plain and are expected to result in future increases in cheatgrass and associated wildfire frequencies across the range of slickspot peppergrass. Through its influence on invasive nonnative annual grass spread, it is likely that climate change has been a factor in the continuing declines in slickspot peppergrass population numbers through the proliferation of wildfire and spread of invasive plants that have been observed over the past decade.

Effects of future climate change are expected to have serious implications for slickspot peppergrass resiliency, representation, and redundancy as historic precipitation and temperature patterns will continue to be modified within the range of slickspot peppergrass. With climate change further accelerating wildfire frequency and intensity and associated invasive nonnative annual grass spread, the number and distribution of slickspot peppergrass EOs and subEOs with good to fair viability may be reduced, resulting in reduced future representation and redundancy of populations from current levels. In addition, EOs and subEOs with fair to poor viability may be lost or reduced to levels that they would effectively be extirpated. Effects of accelerated wildfire and invasive nonnative annual grass spread associated with climate change are anticipated to be most pronounced for populations located in MA 1, where populations are found

on smaller acreages, are currently surrounded by degraded landscape conditions and are located at the lowest elevation extent of the species' range.

Climate change is also predicted to reduce the ability of southern Idaho rangelands to support Wyoming big sagebrush, making post-fire restoration efforts more difficult while increasing the potential for cheatgrass monocultures to further dominate within the range of slickspot peppergrass. The severity and scope of the primary threats of changing wildfire regime and invasive nonnative plants to slickspot peppergrass are expected to be magnified as climate change continues, reducing resiliency, representation, and redundancy of slickspot peppergrass populations rangewide.

Future Condition Analysis

To forecast the species viability into the future, External Species Expert input was elicited and analyses of data from field reviews was performed on the expected future condition of the species under three scenarios, which addressed the primary threats of wildfire and invasive nonnative plants and factored in effects from climate change.

- **Worse than Expected** – No new tools or conservation measures would be available to reduce the risk of wildfire and invasive nonnative plants, and adequate funding to continue currently implemented conservation measures would not be available over the next 50 years.
- **Better than Expected** – New tools to reduce the current risk levels of wildfire and to reduce the current extent of invasive nonnative plant cover would be available and adequately funded over the next 50 years.
- **Status Quo** - The current rate of wildfire and extent of invasive nonnative plant cover and their associated effects on slickspot peppergrass populations, as well as implementation of current conservation measures, would continue to occur unchanged over the next 50 years.

Under both the Status Quo and Worse than Expected scenarios, most External Species Experts indicated that it was unlikely the current downward trend in slickspot peppergrass population numbers and habitat condition rangewide would be slowed, stabilized, or improved over the next 50 years. Thus, resiliency of currently good to fair viability populations (defined as slickspot peppergrass EOs and subEOs with greater slickspot peppergrass plant numbers that are located in more intact sagebrush steppe habitat) under the Status Quo and the Worse than Expected scenarios would be expected to decline, and population representation and redundancy would be reduced such that future species viability would be lower than current levels.

Under the Better than Expected scenario, most External Species Experts expressed that it was likely or there was a medium likelihood that the current downward trend in slickspot peppergrass EO and subEO plant numbers and habitat conditions rangewide would be slowed, stabilized, or improved over the next 50 years. Under the Better than Expected scenario, EOs and subEOs have a reduced risk of loss of resiliency, representation, and redundancy of slickspot peppergrass

such that future viability is anticipated to maintain or improve current viability levels. Although not addressed in the SSA report, the implementation of additional conservation measures to address increased residential and commercial development and agricultural conversions within and adjacent to slickspot peppergrass EOs would further maintain or improve current viability levels of populations within the Foothills and Snake River Plain geographic areas. While we may not be able to change potential future effects from predicted altered precipitation and temperature in southwestern Idaho due to climate change, slickspot peppergrass EOs and subEOs are likely to be maintained or improved relative to current condition through the availability of additional funding as well as implementation of conservation measures and recommended actions beyond current measures.

Recovery Criteria

Recovery Outline: Recovery Outline for *Lepidium papilliferum* (Slickspot Peppergrass). Idaho Fish and Wildlife Office. U.S. Fish and Wildlife Service. September 26, 2011. 28 pp.

There are no established Recovery Criteria for the slickspot peppergrass, because there is no Recovery Plan for the species. The Recovery Outline included a recovery goal to develop and implement proactive conservation measures that reduce the threats to slickspot peppergrass to the point that it no longer requires the protections of the Endangered Species Act and may be removed from the Federal List of Endangered and Threatened Wildlife and Plants (delisted). Three recovery objectives were described under this recovery goal: (1) protection, maintenance, and restoration of extant populations of sufficient quality and viability to ensure stable and successfully reproducing populations throughout its known geographic range; (2) maintenance of ecological function of the sagebrush-steppe vegetation within these populations, including preserving the integrity of the slick spot soils and connectivity within and between populations in close geographic proximity to one another (to facilitate pollinator activity), and (3) minimizing major habitat-disturbing threats, including the establishment of invasive nonnative plant species and frequent wildfire. Recovery efforts were to be focused primarily on Federal lands, and some state and municipal lands, since over 95 percent of the populations occur on these lands.

The initial action plan within the Recovery Outline identified the following recovery needs for slickspot peppergrass: (1) protect populations from direct and indirect threats; (2) protect and restore habitat, including pollinator habitat and corridors to provide connectivity; (3) implement a current assessment of all element occurrences in order to more accurately describe population conditions; (4) continue and expand the rangewide monitoring program to track species trend, abundance, and threats; (5) conduct additional surveys to accurately document the distribution of the species; and (6) continue current research and initiation of new studies to obtain threat information necessary to develop effective recovery actions. The Recovery Outline provided a generalized framework for the development of objective, measurable recovery criteria, and specified that the recovery plan would identify time and cost to carry out measures required for species recovery.

Synthesis

Under the Act, an endangered species is defined as any species that is "in danger of extinction throughout all or a significant part of its range." Representation and redundancy are considered

relatively high for this species as 19 populations currently exist that contain 1,000 or more plants (6 of which are 500 acres or more in size) scattered across the range of the species. Based on the current condition of the slickspot peppergrass described in the SSA report and summarized above in terms of resiliency, redundancy, and representation, we conclude that the current risk of extinction is low, such that the species is not in danger of extinction throughout all or a significant portion of its range. Therefore, we conclude that the slickspot peppergrass does not meet the definition of an endangered species.

Having determined that the slickspot peppergrass is not an endangered species, we next compared the status of the species to the definition of a threatened species under the Act, which states that a species is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The foreseeable future refers to the extent to which the Secretary of the Department of Interior can reasonably rely on predictions about the future in making determinations about the future conservation status of the species. The key statutory difference between a threatened species and an endangered species is the timing of when a species may be in danger of extinction, either now (endangered species) or in the foreseeable future (threatened species).

The future condition of the slickspot peppergrass will depend on the availability of new management techniques and adequate funding to implement those techniques to reduce the continued risk of wildlife and invasive nonnative plant spread within and adjacent to slickspot peppergrass populations. These two primary threats, as magnified by climate change, are expected to continue the decline of this species despite current ongoing conservation efforts by Federal (BLM, MHAFB, Natural Resources Conservation Service), State (Idaho Army National Guard; IDFG; Idaho Department of Lands; Idaho OSC, Boise State University), municipal (Ada County; City of Boise), and private landowner partners to slow the effects of the two primary threats of wildfire and invasive nonnative plants. The threat of population and habitat loss or degradation due to residential, commercial, and agricultural development also must be addressed in the Foothills and Snake River Plain geographic areas. If new techniques and adequate funding for improving current environmental resistance to invasive nonnative plant spread and resilience to wildfire disturbance within the range of slickspot peppergrass are not achieved, the species has the potential to become endangered in the foreseeable future (50 years as of 2016, or by about 2065), and therefore continues to meet the definition of a threatened species. Thus, the continued classification of the slickspot peppergrass as threatened under the Act remains appropriate.

RESULTS

Recommended Classification: After assessing the best available information, we conclude that the slickspot peppergrass is not in danger of extinction throughout all or a significant portion of its range but is likely to become so in the foreseeable future; that is, it is a threatened species throughout all of its range. We recommend that no change in classification is needed.

_____ **Downlist to Threatened**

_____ **Uplist to Endangered**

_____ **Delist** (Indicate reasons for delisting per 50 CFR 424.11):

_____ *Extinction*

____ Recovery
____ Original data for classification in error
 X No change is needed

New Recovery Priority Number: We recommend no change to the 11C Recovery Priority Number identified in the 2011 Recovery Outline for the species.

Brief Rationale: Recovery priority numbers range from 1C (highest) to 18 (lowest; the “C” indicates the potential for conflict with human economic activities). Slickspot peppergrass is assigned a recovery priority number of **11C** indicating that: 1) slickspot peppergrass faces a moderate degree of threat, 2) it has a low potential for recovery, and 3) it is a full species (USFWS 1983a, b). The species rank is elevated by the addition of “C” indicating there is or may be a conflict with construction or other development projects, or other forms of economic activity.

As identified in the 2009 final rule (74 FR 50214), the 2016 reinstatement rule (81 FR 55058), and the SSA report (USFWS 2020, p. 34), best available information indicates slickspot peppergrass populations continue to trend downward. This species has a low recovery potential primarily because the threats to the species existence (i.e., invasive nonnative plant species and frequent wildfire), are pervasive and difficult to alleviate and likely will require long-term and intensive management with an uncertain probability of success. There is also some chance for conflict with "construction or development projects or other forms of economic activity", such as transmission line rights-of-way and efforts to increase livestock use to reduce fine fuel loads in degraded habitats dominated by invasive annual grasses, although the degree of conflict is not currently known and will be re-evaluated during the recovery planning process.

Listing and Reclassification Priority Number, if reclassification is recommended (*see 48 FR 43098, September 21, 1983*): Maintain Listing and Reclassification Priority Number as 11C.

Reclassification (from Threatened to Endangered) Priority Number: _____

Reclassification (from Endangered to Threatened) Priority Number: _____

Delisting (Removal from list regardless of current classification) Priority Number: _____

Brief Rationale: Slickspot peppergrass continues to meet the Act criteria for a threatened species. No change to the current Listing/Reclassification Priority Number of 11C is recommended at this time.

RECOMMENDATIONS FOR FUTURE ACTIONS

Proceed with the development of a Recovery Plan and an associated Recovery Implementation Strategy for the slickspot peppergrass that includes specific, objective, and quantifiable recovery criteria and actions.

- Collaborate with the Slickspot Peppergrass Technical Team and other experts to determine recovery requirements for the species.

- Develop a strategy for maintaining or restoring Wyoming big sagebrush habitat within and adjacent to slickspot peppergrass element occurrences, which emphasizes the use of native shrubs, grasses, and forbs to benefit slickspot peppergrass and its insect pollinators.
- Investigate rangewide population genetics using recent technologies to identify and prioritize conservation of slickspot peppergrass element occurrences essential for maintaining genetic diversity of the species into the future.

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**U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Slickspot Peppergrass**

Current Classification: threatened

Recommendation resulting from the 5-Year Review:

- Downlist to Threatened
- Uplist to Endangered
- Delist (Indicate reasons for delisting per 50 CFR 424.11):
 - Extinction
 - Recovery
 - Original data for classification in error
- No change needed

Appropriate Listing/Reclassification Priority Number, if applicable: No change to the current Listing/Reclassification Priority Number of 11C is recommended.

FIELD OFFICE APPROVAL:

Idaho State Supervisor, U.S. Fish and Wildlife Service

Approve Christopher Swanson Date 10/22/2021

APPENDIX A: HISTORY OF EFFORTS TO DESIGNATE SLICKSPOT PEPPERGRASS CRITICAL HABITAT

- *November 16, 2009*: Idaho Governor C. L. “Butch” Otter, the State of Idaho Governor’s Office of Species Conservation, Theodore Hoffman, Scott Nicholson, and L.G. Davison & Sons, Inc., filed a complaint in the U.S. District Court for the District of Columbia that challenged the 2009 final listing rule under the Administrative Procedure Act and the Endangered Species Act. Subsequently, the issue was transferred to the U.S. District Court for the District Court of Idaho, and the parties involved consented to proceed before a Magistrate Judge.
- *May 10, 2011*: Proposed rule to designate critical habitat for slickspot peppergrass was published in the Federal Register (76 FR 27184).
- *August 8, 2012*: The U.S. District Court of Idaho vacated the 2009 final rule listing slickspot peppergrass as a threatened species under the Act, with directions that the case be remanded to the Service for further consideration consistent with the Court’s opinion (*Otter v. Salazar*, Case No. 1:11-cv-00358-CWD (D. Idaho)). Rulemaking on the proposed critical habitat was suspended following the District Court of Idaho’s ruling vacating the 2009 listing decision. A final rule to designate critical habitat scheduled to be published in the Federal Register that week was pulled due to this court decision.
- *February 12, 2014*: Rulemaking on the proposed rule to designate critical habitat for the species was reopened (79 FR 8416) to incorporate new information that had become available since the May 10, 2011 critical habitat proposal.
- *January 2017*: An update of the critical habitat proposal that included new information and used an updated new mapping method from previous versions (February 12, 2014 and May 10, 2011 proposals) was put on hold for publication in the Federal Register pending review by the new administration. FWS efforts were redirected to the recovery planning and implementation process for slickspot peppergrass. The 2016-2017 critical habitat proposal was not published in the Federal Register or otherwise made available to the public.
- *January 8, 2019*: A notice of intent to sue the FWS was received from the Center for Biological Diversity for failure to make the Act protection decisions for 24 species, including designation of critical habitat for slickspot peppergrass.
- *April 17, 2019*: The Center for Biological Diversity sued the Secretary of the Interior for failure to make Act protection decisions for 24 species, including designation of critical habitat for slickspot peppergrass.
- *August 2019*: FWS entered into a settlement agreement with the Center for Biological Diversity, which included a June 30, 2020 Federal Register publication date for a revised slickspot peppergrass proposed critical habitat rule, with a final critical habitat designation rule to be published in the Federal Register by June 30, 2021.
- *July 23, 2020*: A revised proposed critical habitat rule for slickspot peppergrass that incorporated new information on the species and used an updated geographic information system (GIS)-based mapping methodology was published in the Federal Register (85 FR 44584).