U.S. Fish & Wildlife Service

Recovery Outline for *Lepidium papilliferum* (Slickspot Peppergrass)

September 2011

Photo by Idaho Army National Guard

Listing and Contact Information

Scientific Name	*Lepidium papilliferum*
Common Name	Slickspot peppergrass
Listing Classification	Threatened rangewide
Effective Listing Date	Threatened; October 8, 2009 (74 FR 52014)
Lead Agency, Region	U.S. Fish and Wildlife Service, Region 1
Lead Field Office	Idaho Fish and Wildlife Office 1387 South Vinnell Way, Suite 368 Boise, Idaho 83709 (208) 378-5243

Purpose of the Recovery Outline

This document lays out a preliminary course of action for the survival and recovery of *Lepidium papilliferum* (slickspot peppergrass). It is meant to serve as interim guidance to direct recovery efforts and inform consultation and permitting activities until a comprehensive draft recovery plan has been completed. Recovery outlines are intended primarily for internal use by the U.S. Fish and Wildlife Service (Service), and formal public participation will be invited upon the release of the draft recovery plan. For more information on Federal survival and recovery efforts for *L. papilliferum*, or to provide

additional comments, interested parties may contact the Idaho Fish and Wildlife office for this species at the above address and telephone number.

Scope of Recovery and Available Information

The scope of this effort is for the single species, *Lepidium papilliferum*. It provides a general overview of the available information concerning *L. papilliferum*, presents a recovery goal and recovery objectives, and identifies immediate and longer-term actions, along with a tentative timeline for the recovery actions. Some uncertainty and information gaps exist for this species. For example, estimating trends in the abundance of *L. papilliferum* over time is complicated by multiple factors. Since individuals of the species may act as either an annual or a biennial, in any given year there will be varying numbers of plants acting as spring-flowering annuals versus overwintering rosettes. The relative proportions of these two life history forms can fluctuate annually depending on a variety of factors, including precipitation, temperature, and the abundance of rosettes produced the previous year. *L. papilliferum* also has a long-lived seed bank (a reserve of dormant seeds, generally found in the soil), likely as an adaptation to unpredictable conditions, in which years of good rainfall favorable for germination and survival may be followed by periods of drought. As a result, only a small percentage of *L. papilliferum* seeds germinate annually, further complicating the ability to estimate trend and abundance.

In addition, restoration of *Lepidium papilliferum*'s native sagebrush-steppe ecosystem is considered one of the greatest restoration challenges in the Great Basin (Bunting *et al*. 2003, pp. 82-84). Maintaining or restoring the native sagebrush-steppe which once occurred throughout the Great Basin is an essential biological and physical requirement of *L. papilliferum*, and habitat restoration within and around populations will likely be essential to the recovery of this species. A relatively intact native *Artemisia tridentata* ssp. *wyomingensis* (Wyoming big sagebrush) vegetation community (represented by native bunchgrasses, shrubs, and forbs) is likely to buffer slickspots and *L. papilliferum* from wildfire, slow the invasion of slickspots by invasive nonnative plant species, and provide habitats for pollinators. However, techniques to restore highly degraded sagebrush-steppe habitats are not currently well-known, making it difficult to recommend specific habitat restoration measures at this time. It is anticipated that restoration will require long-term and intensive adaptive management.

Uncertainties and information gaps associated with this species will be clarified to the extent possible through the course of the recovery process as information is gathered or new information is generated. Modifications to the recovery plan will likely occur over time as any new information regarding recovery strategies becomes available.

I. Overview

A. BIOLOGICAL ASSESSMENT

1. Species Description and Life History

Lepidium papilliferum is a herbaceous and relatively low-growing member of the mustard family (Brassicaceae), which averages 5 to 20 centimeters (cm) (2 to 8 inches (in)), but can reach up to 40 cm (16 in) in height. It is an intricately branched, tap-rooted plant, with numerous, small, white, four-petalled flowers. Fruits (siliques) are round in outline, flattened, and two-seeded (Moseley 1994, pp. 3, 4; Holmgren *et al*. 2005, p. 260). The species occurs in specialized habitats known as slickspots, which are mini-playas or natric (high sodium soil) sites that are found dispersed throughout the sagebrush-steppe ecosystem in southwest Idaho. The restricted distribution of *L. papilliferum* is likely due to its adaptation to the specific conditions within these slickspot habitats.

Lepidium papilliferum is monocarpic (it flowers once and then dies), and displays two different life history strategies, an annual form and a biennial form. The annual form reproduces by flowering and setting seed in its first year, and dies within one growing season. The biennial life form initiates growth in the first year as a vegetative rosette, but does not flower and produce seed until the second growing season. The proportion of annuals versus biennials in a population can vary greatly (Meyer *et al*. 2005, p. 15), but in general annuals appear to outnumber biennials (Moseley 1994, p. 12). Biennial plants normally produce a much greater number of seeds than annual plants. For example, average seed output for annual plants at the Idaho Army National Guard (IDARNG) Orchard Training Area (OTA) during 2 years was 125 seeds and 46 seeds per plant, respectively, while seed production of biennials averaged 787 and 105 seeds per plant, respectively.

Like many short-lived plants growing in arid environments, above-ground numbers of *Lepidium papilliferum* individuals can fluctuate widely from one year to the next, depending on seasonal precipitation patterns (Mancuso and Moseley 1998, p. 1; Meyer *et al*. 2005, pp. 4, 12, 15; Palazzo *et al*. 2005, p. 9; Menke and Kaye 2006a, p. 8; Menke and Kaye 2006b, pp. 10, 11; Sullivan and Nations 2009, p. 44). Mancuso and Moseley (1998, p. 1) note that sites with thousands of above-ground plants one year may have none the next, and vice versa. Above-ground plants represent only a portion of the population; the seed bank contributes the other portion, and in many years constitutes the majority of the population (Mancuso and Moseley 1998, p. 1).

Lepidium papilliferum is primarily an outcrossing species requiring pollen from separate plants for more successful fruit production; it exhibits low seed set in the absence of insect pollinators (Robertson 2003, p. 5; Robertson and Klemash 2003, p. 339; Robertson and Ulappa 2004, p. 1707; Billinge and Robertson 2008, pp. 1005–1006). *L. papilliferum* is capable of self-pollinating, however, with a selfing rate (rate of self-pollination) of 12 to 18 percent (Billinge 2006, p. 40; Robertson *et al*. 2006a, p. 40). Known *L. papilliferum* insect pollinators include several families of bees (Hymenoptera), including Apidae, Halictidae, Sphecidae, and Vespidae; beetles (Coleoptera), including Dermestidae, Meloidae, and Melyridae; flies (Diptera), including Bombyliidae, Syrphidae, and Tachinidae; and others (Robertson and Klemash 2003, p. 336; Robertson *et al*. 2006b, p. 6). Seed set does not appear to be limited by the abundance of pollinators (Robertson *et al*. 2004, p. 14). However, studies have shown a strong positive correlation between insect diversity and the number of *L. papilliferum* flowering at a site (Robertson and Hannon 2003, p. 8).

2. Historical and Current Population Status

Lepidium papilliferum is endemic to southwest Idaho and is known only from the Snake River Plain and its adjacent northern foothills, which represents an area 145 by 40 kilometers (km) (90 by 25 miles (mi)), with a smaller disjunct population on the Owyhee Plateau, representing an area of approximately 18 by 19 km (11 by 12 mi). The plant occurs at elevations ranging from approximately 670 meters (m) (2,200 feet (ft)) to 1,645 m (5,400 ft) within the three physiographic regions (the Snake River Plain, the Boise Foothills, and the Owyhee Plateau) in Ada, Canyon, Gem, Elmore, Payette, and Owyhee Counties (Figure 1).

The distribution of *Lepidium papilliferum* is broadly described by the Idaho Natural Heritage Program (INHP) through the use of element occurrences (EOs) (Colket *et al*. 2006, entire). The INHP defines EOs of *L. papilliferum* by grouping occupied slickspots that occur within 1 km (0.6 mi) of each other; all occupied slickspots within a 1 km (0.6-mi) distance of another occupied slickspot are aggregated into a single EO. The definition of a single EO is based on the distance over which individuals of *L. papilliferum* are believed to be capable of genetic exchange through insect-mediated pollination (Colket and Robertson 2006, pp. 1-2). The INHP also assigns rankings to each EO based on measures of habitat quality and species abundance. Each EO for *L. papilliferum* is given a ranking of A, B, C, D, E, F, H, or X, with higher rankings (the highest rank would be an ‘‘A’’) indicating sites with greater habitat quality and larger population sizes. Currently, no *L. papilliferum* EOs are ranked A. Rankings of B, C, and D indicate a decreasing continuum of detectable plants, native plant community, habitat condition, and overall landscape context within 1 km (0.6 mi) of occupied slickspots, with a B ranking signifying a greater number of plants and better habitat conditions and a

D ranking signifying few plants and poor conditions. Areas ranked E are those records with confirmed *L. papilliferum* presence but for which no additional habitat information is available. Areas ranked H indicate historical occurrences (old location information is too vague to allow the EO to be found again), X rankings connote extirpated occurrences, and F rankings indicate areas where no *L. papilliferum* individuals were found when last visited by a qualified surveyor.

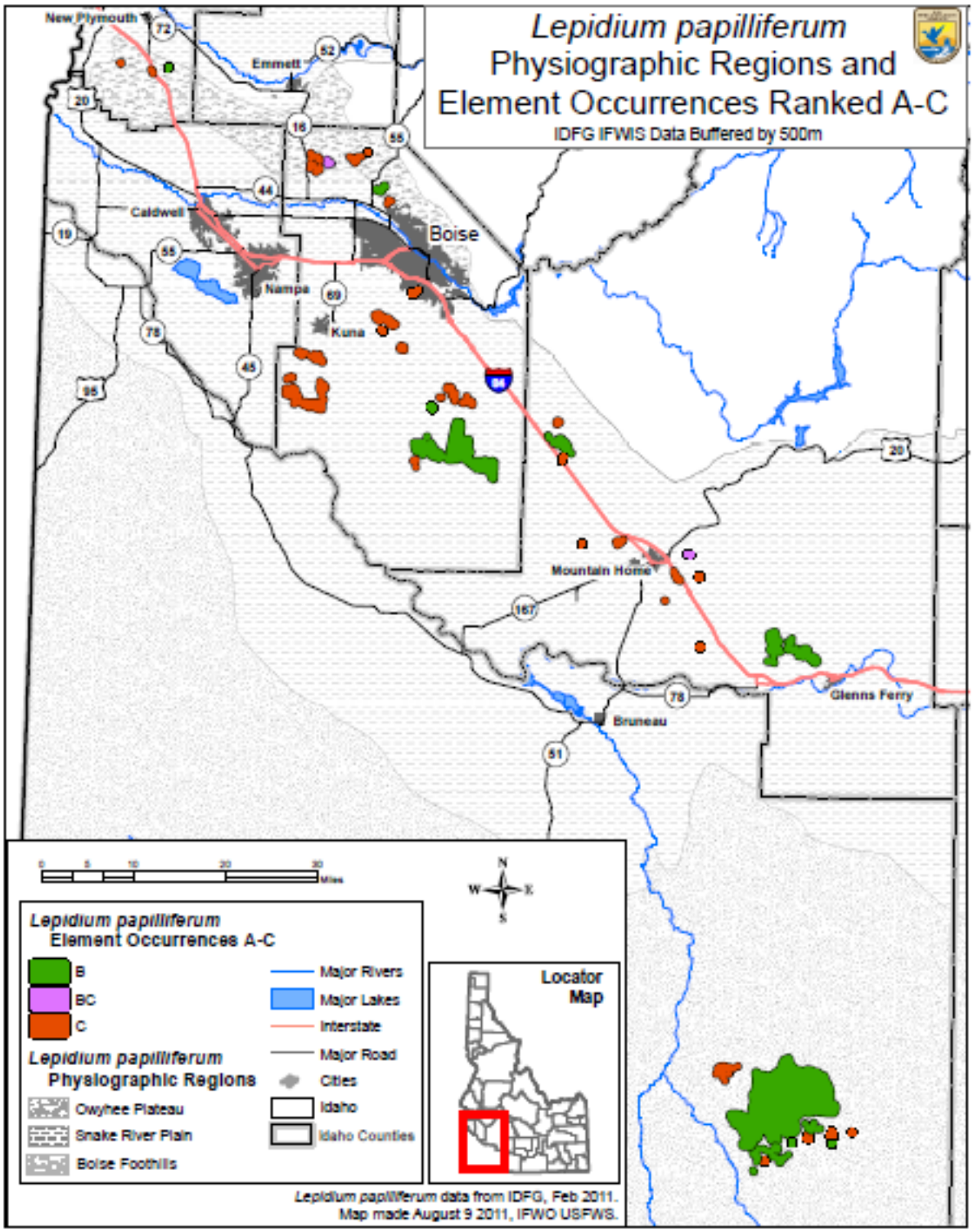
As of February 2009, there were 80 extant Element Occurrences (EOs) that collectively comprise approximately 6,394 hectares (ha) (15,801 acres (ac)). The area actually occupied by *L. papilliferum* is only a small fraction of this total acreage, since the majority of slickspots are not occupied by *L. papilliferum* and slickspots occupy only a small percentage of the landscape. In addition to the 80 extant EOs, there are 9 EOs ranked as extirpated or probably extirpated, and 7 EOs that are considered historical. All nine extirpations were former verified locations from old herbarium collections, the most recent from 1955, where the habitat has been completely developed or converted to agricultural lands.

3. Habitat Description and Landownership

Rangewide, *Lepidium papilliferum* occurs within semiarid sagebrush-steppe habitats in southwestern Idaho in visually distinct microsites known as slickspots. Slickspots are characterized by soils with high sodium content and distinct clay layers; they tend to be highly reflective and relatively light in color, making them easy to detect on the landscape (Fisher *et al.* 1996, p. 3). Slickspots are distinguished from the surrounding sagebrush matrix as having the following characteristics: microsites where water pools when rain falls (Fisher *et al*. 1996, pp. 2, 4), sparse native vegetation, distinct soil layers with a columnar or prismatic structure, higher alkalinity and clay content and natric properties (Fisher *et al*. 1996, pp. 15-16; Meyer and Allen 2005, pp. 3-5, 8; Palazzo *et al*. 2008, p. 378), and reduced levels of organic matter and nutrients due to lower biomass production (Meyer and Quinney 1993, pp. 3, 6; Fisher *et al*. 1996, p. 4). Most slickspots are between 1 square meter (m^2) and 2 m^2 (10 square feet (ft^2) and 20 ft^2) in size, although some are as large as 10 m^2 (110 ft^2).

It is not known how long slickspots take to form, but it is hypothesized to take several thousands of years (Nettleton and Peterson 1983, p. 193; Seronko 2006, in litt.). Climate conditions that allowed for the formation of slickspots in southwestern Idaho are thought to have occurred during a wetter Pleistocene period. Holocene additions of wind-carried salts (often loess deposits) produced the natric soils characteristic of slickspots (Nettleton and Peterson 1983, p. 191; Seronko 2006, in litt.). It may take several hundred years to alter or lose slickspots through natural climate change or severe

Figure 1. Distribution of A-C ranked *Lepidium papilliferum* EOs in southwest Idaho, within the three physiographic regions of the Snake River Plain, Boise Foothills, and Owyhee Plateau.



natural erosion (Seronko 2006, in litt.). Some researchers hypothesize that, given current climatic conditions, new slickspots are no longer being created (Nettleton and Peterson 1983, pp. 166, 191, 206). As slickspots appear to have formed during the Pleistocene and new slickspots are not being formed, the loss of a slickspot is apparently a permanent loss.

Some slickspots subjected to light disturbance in the past may apparently be capable of re-forming (Seronko 2006, in litt.). Disturbances that alter the physical properties of the soil layers, however, such as deep disturbance and the addition of organic matter, may lead to destruction and permanent loss of slickspots. Slickspot soils are especially susceptible to mechanical disturbances when wet (Rengasmy *et al*. 1984, p. 63; Seronko 2004, in litt.). Such disturbances disrupt the soil layers important to *Lepidium papilliferum* seed germination and seedling growth, and alter hydrological function. Meyer and Allen (2005, p. 9) suggest that if sufficient time passes following the disturbance of slickspot soil layers, it is possible that the slickspot soil layers may regain their pre-disturbance configuration, yet not support the species. Thus, while the slickspot appears to have regained its former character, some essential component required to sustain the life history requirements of *L. papilliferum* has apparently been lost, or the active seed bank is no longer present.

Approximately 95 percent of the occupied *Lepidium papilliferum* habitat occurs on Federal lands (Bureau of Land Management (BLM), U.S. Air Force, Bureau of Reclamation). The remaining occupied habitat is in State of Idaho ownership or privately owned.

B. THREATS ASSESSMENT

1. Listing Factors/Primary Threats to the Species

A detailed discussion of the threats to *Lepidium papilliferum* can be found in the final listing rule published in the **Federal Register** on October 8, 2009 (74 FR 52014). As identified in the final rule, the primary threat factors that affect the habitat and survival of *L. papilliferum* in southwest Idaho include increased fire frequency and the invasion of nonnative plant species, particularly nonnative annual grasses, such as *Bromus tectorum* (cheatgrass). In addition, residential and agricultural development can directly affect *L. papilliferum* through the destruction of populations and loss of slickspot microsites. The loss of slickspots is a permanent loss of habitat for *L. papilliferum*, since the species is specifically adapted to these unique microsite habitats that were formed during the Pleistocene. Once lost, slickspots cannot be recreated. Livestock use also poses a secondary threat to *L. papilliferum*, primarily through mechanical damage to

individual plants and slickspot habitats, although current livestock management conditions and associated conservation measures address this threat such that it does not appear to pose a significant risk to the species at this time. A description of each of these threats is presented below.

a. The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range (Listing Factor A)

Wildfire and Invasive Nonnative Plant Species

The current wildfire regime (i.e. increasing frequency, size, and duration) and invasive nonnative plant species were cited in the final listing rule as the primary cause for the decline of *Lepidium papilliferum*. The conversion of sagebrush-steppe habitat to nonnative annual grasslands over the past several decades has reduced or degraded suitable habitat for *L. papilliferum*, in addition to fragmenting and isolating extant occupied areas. Nonnative annual grasses, such as *Bromus tectorum* and *Taeniatherum caput-medusae* (medusahead) can impact *L. papilliferum* directly through competition, but also act indirectly on the species by providing continuous fine fuels that contribute to the documented increased frequency and extent of wildfires. Frequent wildfires ultimately result in the conversion of the sagebrush-steppe habitat to nonnative annual grasslands, with consequent losses of native species diversity and natural ecological function. This creates a positive feedback loop between nonnative annual grasses and fire, which makes it difficult to separate out the effects of each of these threats independently to *L. papilliferum*. Controlling fire and managing invasive nonnative plant species in habitats currently occupied by *L. papilliferum* represents a significant management challenge for recovery efforts. The potential for enhancement, restoration, and connectivity of sagebrush-steppe habitats are important considerations for developing appropriate recovery measures for *L. papilliferum*.

Development

Residential and agricultural development can directly affect *Lepidium papilliferum* through the destruction of populations and loss of slickspot microsites. Development can also have indirect impacts on *L. papilliferum* by contributing to nonnative plant invasions, particularly along associated utility lines and roads, which act as corridors for 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, presumably by increasing the area of the urban-wildland interface (e.g., 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 *L. papilliferum* by creating barriers in the landscape that prevent effective genetic exchange between populations (Robertson *et al.* 2004, pp. 2-4).

Development may also have indirect effects on *Lepidium papilliferum* by negatively impacting the native insect populations that the species depends on for pollination and genetic exchange. *L. papilliferum* is primarily an outcrossing species and depends upon a diversity of insect pollinators for more successful fruit production and to maintain genetic variability by genetic exchange with distant populations. 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 *L. papilliferum* 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 *et al.* 2004, p. 1705).

Past residential and agricultural development has been responsible for five documented extirpations and four probable extirpations of *Lepidium papilliferum* (Colket *et al*. 2006, p. 4). The long-term viability of *L. papilliferum* on private land on the Snake River Plain and adjacent Boise foothills is questionable due to the continuing residential and urban development in and around Boise (Moseley 1994, p. 20).

Livestock

In addition to the primary threats described above, livestock use poses a secondary threat to *Lepidium papilliferum*, primarily through mechanical damage to individual plants and slickspot habitats. Livestock trampling can disrupt the soil layers of slickspots, altering slickspot function (Seronko 2004, in litt.; Colket 2005, p. 34; Meyer *et al*. 2005, pp. 21–22). Trampling when slickspots are dry can lead to mechanical damage to the slickspot soil crust, potentially resulting in the invasion of nonnative plants and altering the hydrologic function of slickspots. In water-saturated slickspot soils, trampling by livestock can break through the restrictive clay layer; this is referred to as penetrating trampling (State of Idaho *et al*. 2006, p. 9). Trampling that alters the soil structure and the functionality of slickspots (Rengasamy *et al*. 1984, p. 63; Seronko 2004, in litt.) likely impacts the suitability of these microsites for *L. papilliferum*. Trampling can also negatively affect the seed bank by pushing seeds too deeply into the soil for subsequent successful germination and emergence. Although there is potential for negative impacts to *L. papilliferum* populations and slickspots that may result from seasonal, localized trampling events, current livestock management conditions and

associated conservation measures address this threat such that it does not appear to pose a significant risk to the species at this time.

b. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes (Listing Factor B)

We have no data indicating that overutilization for commercial, recreational, scientific, or educational purposes is a threat to *Lepidium papilliferum*.

c. Disease or Predation (Listing Factor C)

Herbivory in the form of seed predation by Owyhee harvester ants (*Pogonomyrmex salinus*), which was only recently discovered, has the potential to become a significant threat to *Lepidium papilliferum*. Other insect or mammal herbivory does not appear to pose a threat to *L. papilliferum*. Likewise, we have no data indicating that disease poses a threat to this species.

Owyhee Harvester Ants

The Owyhee harvester ant was recently identified as a potentially important seed predator of *Lepidium papilliferum*. A native species, the harvester ants appear to favor areas dominated by nonnative annual grasses, such as *Bromus tectorum*, and in the wake of disturbance factors such as wildfire, these ants are beginning to colonize areas that were historically not suitable for nesting. This expansion is increasingly bringing them into contact with *L. papilliferum*, which experiences high rates of seed predation by the ants with potential negative consequences for the seed bank and recruitment. Evidence suggests that significant levels of seed predation associated with increased abundance and range of Owyhee harvester ants has the potential to pose a significant threat to *L. papilliferum* in the future (White and Robertson 2009, p. 511). However, our current understanding of how pervasive harvester ant colonies have become within the range of *L. papilliferum*, and their overall significance on the long-term viability of the species, is limited due to the short-term nature of the research so far.

d. The Inadequacy of Existing Regulatory Mechanisms (Listing Factor D)

The inadequacy of existing regulatory mechanisms does not appear to pose a threat to *Lepidium papilliferum*.

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

Other Natural or Manmade Factors inluding climate change, and habitat fragmentation and isolation of small populations alone do not reach the level of threat posed to *Lepidium papilliferum* 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 are considered threats to the viability of *L. papilliferum* throughout its range.

Current climate-change models predict future climatic conditions within the range of *Lepidium papilliferum* will favor further invasion by *Bromus tectorum*. These models also project that fire frequency will continue to increase and that the extent and severity of wildfires may increase as well. Thus, the projected consequences of climate change would act to exacerbate the primary threats of frequent wildfire and invasive nonnative plant species to *L. papilliferum* throughout its range.

Habitat fragmentation due to wildfires and various forms of development is occurring throughout the range of *Lepidium papilliferum*, and is expected to increase in the future. Habitat fragmentation that results from wildfires and development may result in the separation of *L. papilliferum* populations beyond the distance that its insect pollinators can travel, and likely limits the ability for seeds to travel between populations as well. Limited genetic exchange due to fragmentation can result in reduced seed production for this species, as well as a loss of genetic diversity. Small, isolated populations with lowered genetic diversity are at increased risk of local extinction.

C. CONSERVATION ASSESSMENT

1. Conservation Efforts

Currently, there are four formalized plans that contain conservation measures for *Lepidium papilliferum*. These include: (1) the Candidate Conservation Agreement for Slickspot Peppergrass with the State of Idaho, Bureau of Land Management (BLM), Idaho Army National Guard, and nongovernmental cooperators (private landowners who also hold livestock grazing permits on BLM lands) (State of Idaho *et al*. 2003, 2006); (2) the Idaho Army National Guard Integrated Natural Resource Management Plan for Gowen Field/Orchard Training Area (OTA) (IDARNG 2004); (3) the U.S. Air Force

Integrated Natural Resource Management Plan for the Juniper Butte Range (Mountain Home Air Force Base) (U.S. Air Force 2004); and (4) the U.S. Bureau of Land Management and U.S. Fish and Wildlife Service Conservation Agreement (CA) (U.S. Bureau of Land Management 2009). In addition, Ada County is currently working with the Service to develop a conservation agreement to replace an agreement that expired in 2006 (USFWS 1996, in litt.); this agreement will cover activities on County lands for *Allium aasea* (Aase's onion), *Astragalus mulfordiae* (Mulford's milkvetch) and *L. papilliferum*.

The Service's latest evaluation of planned conservation efforts (as described in the final listing rule (74 FR 52014) indicates that not all of the measures identified in the conservation plans have been implemented and most have not been demonstrated to effectively reduce or eliminate the most significant threats (wildfire and invasive nonnative plants) to the species.

Many of these conservation efforts are limited in their ability to effectively reduce the long-term habitat degradation and destruction occurring within *Lepidium papilliferum* habitats from the effects of a changed wildfire regime and nonnative plant invasions. In many cases, effective control measures for these threats are not yet known, financially or technically feasible, or logistically possible to implement on the scale that would be necessary to successfully ameliorate the threat throughout the range of *L. papilliferum*. Ongoing conservation efforts that have been demonstrated to be effective, such as the IDARNG's efforts to control the effects of wildfire on *L. papilliferum* habitats at the OTA through the reduction of standing fuels and weeds and planting of fire-resistant vegetation in areas with a higher potential for ignition sources such as along roads (U.S. Air Force 2004, p. 6-55), are a positive step toward the conservation of *L. papilliferum*. A few, such as those designed to reduce the impact of ground disturbances caused by livestock, have likely reduced the severity of some threats to the species. However, the conservation efforts in place at this time are not sufficient to offset the degree of threats posed to *L. papilliferum* across the range of the species.

Provided below are brief descriptions of the four existing formalized conservation plans for *Lepidium papilliferum*.

State of Idaho Candidate Conservation Agreement (CCA)

The majority of the individual conservation efforts being implemented for *Lepidium papilliferum* are contained in the State of Idaho CCA, which was originally drafted in 2003, and updated in 2006; it is scheduled to expire in 2013. The CCA includes rangewide efforts that are intended to address the need to: maintain and enhance

L. papilliferum habitat; reduce intensity, frequency, and size of natural- and human-caused wildfires; minimize loss of habitat associated with wildfire-suppression activities; reduce the potential for invasion of invasive nonnative plant species from wildfire; minimize the loss of habitat associated with rehabilitation and restoration techniques; minimize the establishment of nonnative species; minimize the degradation or loss of habitat from off-road vehicle (ORV) use; mitigate the negative effects of military training and other associated activities on the OTA; and minimize the impact of ground disturbances caused by livestock during periods when soils are saturated. As a signatory of the CCA, the BLM is the primary land management agency implementing conservation efforts for *L. papilliferum* on their lands.

Idaho Army National Guard – Gowen Field/ Orchard Training Area

The Idaho Army National Guard (IDARNG), another signatory to the CCA, also implements conservation efforts for *Lepidium papilliferum* through its Integrated Natural Resource Management Plan (INRMP) (IDARNG 2004, Chapter 4.4.2). The IDARNG's Gowen Field/ Orchard Training Area (OTA) on the Snake River Plain contains 2,919 ha (7,213 ac) of occupied *L. papilliferum* habitat, 2,899 ha (7,163 ac) of which represents some of the highest-quality occupied *L. papilliferum* habitat in the Snake River Plain region. The INRMP, which has been in place since 1997 and was updated in 2004, provides a framework for managing natural resources. Conservation measures included in the INRMP avoid or minimize impacts on *L. papilliferum*, slickspot microsites, and sagebrush-steppe habitat while allowing for the continued implementation of the IDARNG's mission.

The INRMP addresses wildfire and invasive nonnative plant species; for example, the INRMP includes objectives for maintaining and improving *Lepidium papilliferum* habitat and restoring areas damaged by wildfire. The plan specifies that the OTA will use native species and broadcast seeding, collecting, and planting small amounts of native seed not commercially available, and will monitor the success of seeding efforts (IDARNG 2004, p. 72–73). Since 1991, the OTA has restored several areas using native seed and vegetation that was present prior to past wildfires. Many of the conservation efforts, such as prohibiting military training activities within areas reserved for conservation of *L. papilliferum*, have been implemented by the IDARNG for more than 18 years and have been demonstrated to be effective in minimizing impacts to the species.

Mountain Home Air Force Base – Juniper Butte Range

The U.S. Air Force (Air Force), Mountain Home Air Force Base, which includes the Juniper Butte Range (JBR) in the Owyhee Plateau region, has an INRMP in place that provides conservation benefits for *Lepidium papilliferum*. This INRMP has been in place for this military training facility since 2004. The Air Force manages 810 ha (2,030 ac) of occupied *L. papilliferum* habitat within the JBR. The INRMP contains specific measures developed to minimize the impacts from military training and the associated indirect effects from wildfire, invasive nonnative plant species, and livestock use on *L. papilliferum*, slickspot microsites, and sagebrush-steppe habitat, while allowing for the continued implementation of the Air Force mission.

For example, the Air Force has a number of ongoing efforts to address wildfire suppression on the entire 4,611 ha (11,393 ac) JBR. Wildfire prevention is addressed through reducing standing fuels and weeds, planting fire-resistant vegetation in areas with a higher potential for ignition sources such as along roads, and using wildfire indices to determine when to restrict military activities when the wildfire hazard rating is extreme (U.S. Air Force 2004, p. 6–55). As a result, the threat from wildfire to *Lepidium papilliferum* associated with Air Force training activities is expected to be reduced within the JBR.

Bureau of Land Management and Fish and Wildlife Service Conservation Agreement

The Conservation Agreement (CA) between the BLM and the Service was finalized on August 22, 2006, and updated in 2009 (U.S. Bureau of Land Management 2009). This CA provides for the conservation of *Lepidium papilliferum* related to programs within existing Idaho BLM land use plans (LUPs) which are used in the implementation of individual project level activities. The conservation measures outlined in the CA describe desired recovery and conservation objectives with corresponding implementation actions and have been analyzed in the associated Biological Assessment; the Service completed the Biological Opinion in November 2009.

Current Research Projects

Several research projects are currently underway. Research designed to examine the relationship between livestock trampling and *Lepidium papilliferum* was initiated in 2003 by the University of Idaho and the State of Idaho in cooperation with the Service (State of Idaho *et al*. 2006, p. 119) and is still on-going. The Service has recently funded three additional studies. The first is a post-fire assessment of *L. papilliferum* populations in Ada County. The second, which is being conducted by Boise State University (BSU),

is a long-term monitoring program designed to assess the abundance, longevity, and spatial distributions of Owyhee harvester ant (*Pogonomyrmex salinus*) colonies, which will help gauge the threat posed by increased seed predation within *L. papilliferum* populations (Robertson 2010, entire). The third study is a multi-phased, cooperative project between the Service, BLM, and INHP designed to ultimately investigate appropriate restoration treatments for *L. papilliferum* habitat within the Morley Nelson Snake River Birds of Prey National Conservation Area (NCA). The Service provided funding to begin the first phase, which is to develop a pilot sampling strategy to help assess restoration potential and site prioritization for restoration within the NCA.

The IDARNG is also funding several research projects for *Lepidium papilliferum*. For example, with funding from IDARNG, BSU is conducting additional harvester ant studies investigating ant abundance and distribution on the OTA, as well as, diet selection by harvester ants (Robertson and Schmasow 2010, entire). IDARNG has also funded BSU to conduct *L. papilliferum* pollination studies (Robertson and Schmasow 2010, entire). In addition to these research projects, monitoring of *L. papilliferum* is conducted annually by the INHP through funding provided by the BLM and IDARNG (Kinter *et al*. 2010, entire). This monitoring is conducted across its range, with the exception of populations located on JBR, which are monitored by the Mountain Home Air Force Base.

II. Preliminary Recovery Strategy

A. RECOVERY PRIORITY NUMBER

Recovery priority numbers range from 1C (highest) to 18 (lowest; the "C" indicates the potential for conflict with human economic activities). *Lepidium papilliferum* is assigned a recovery priority number of **11C** indicating that: 1) *L. papilliferum* 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 final rule (74 FR 50214), best available information indicates *Lepidium papilliferum* populations are trending downward. The moderate degree of threat reflects its two primary threat factors: invasive nonnative plant species and modified wildfire regime. 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 right-of-ways and livestock use, although the degree of conflict is not currently known and will be re-evaluated during the recovery planning process.

B. RECOVERY GOAL AND OBJECTIVES

Lepidium papilliferum is listed as threatened throughout its range. The goal of the recovery effort is to develop and implement proactive conservation measures that reduce the threats to *L. papilliferum* 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). Recovery efforts will focus primarily on Federal land, and some state and municipal lands, since over 95% of the populations occur on these lands. Recovery objectives include:

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 (Boise Foothills, Snake River Plain, and Owyhee Plateau)**

The primary focus of recovery efforts will be to ensure stable and successfully reproducing populations throughout the range of *Lepidium papilliferum* by protecting, maintaining, and restoring habitat in existing populations with an emphasis on promoting large, functioning populations to support long-term population viability. The long-term conservation of *L. papilliferum* is dependent upon the maintenance or improvement of ecological function of the higher quality (A- through C-ranked) EOs rangewide, including maintaining or improving connectivity within and between EOs (Figure 1). This may involve the maintenance or enhancement of currently lower ranked EOs (D- through F-ranked) as necessary to facilitate pollinator activity, the maintenance of genetic diversity, and limiting the establishment of invasive nonnative plant species (and thus, wildfire potential). Short term conservation of populations will require prioritization of the A- through C-ranked EOs to ensure that the EOs in greatest need of protection are addressed in a timely manner and the limited resources available are utilized most effectively.

2. **Maintenance of ecological function of the sagebrush-steppe vegetation within these populations, including preserving the integrity of the slickspot soils and connectivity within and between populations in close geographic proximity to one another (to facilitate pollinator activity)**

Lepidium papilliferum survival and recovery depends on maintaining and restoring *Artemisia tridentata* ssp. *wyomingensis* sagebrush-steppe habitat and the slickspot microsites located within this ecosystem in southwestern Idaho. Acceptable levels of connectivity between populations and subpopulations are also needed to ensure pollinator movement and gene flow. Likewise, a diversity of native plants whose blooming times overlap to provide flowers for foraging throughout the seasons and nesting and egg-laying sites, appropriate nesting materials, and sheltered, undisturbed places for hibernation and overwintering of pollinator species are necessary.

3. **Minimizing major habitat-disturbing threats, including the establishment of invasive nonnative plant species and frequent wildfire**

Key to maintaining quality habitat includes avoiding or minimizing adverse effects of frequent wildfire and invasive nonnative plants, such as *Bromus tectorum* and *Taeniatherum caput-medusae*, as well as other potential ground disturbing threats. In order to attain recovery, threats must be sufficiently understood and abated to ensure this species is not in danger of extinction within the foreseeable future.

To determine whether the overall recovery strategy is effective and to monitor whether the recovery criteria have been met, it will be necessary to support a rangewide population monitoring program as part of the recovery plan.

C. INITIAL ACTION PLAN

Recovery needs for *Lepidium papilliferum* include: 1) protection of populations from direct and indirect threats; 2) protection and restoration of habitat including pollinator habitat and corridors to provide connectivity; 3) a current assessment of all EOs in order to more accurately describe population conditions; 4) continuation and expansion of the rangewide monitoring program to track species trend, abundance, and threats; 5) additional surveys to accurately document the distribution of the species; and 6) continuation of current research and initiation of new studies to obtain threat information necessary to develop effective recovery actions.

Existing conservation plans will represent an essential foundation for the recovery strategy for *Lepidium papilliferum*. Currently, a wide range of conservation measures designed to address threats to *L. papilliferum,* such as wildfire and invasive nonnative plant species, are included in BLM's CA, the State of Idaho CCA, and the IDARNG and U.S. Air Force INRMPs. Recovery planning will integrate those actions that have demonstrated effectiveness at promoting protection and recovery of this species in order to bolster existing efforts and encourage a more widespread approach to implementation of those actions with known positive effects on *L. papilliferum* and its associated habitat. Additional conservation measures will be integrated where necessary to create a comprehensive, rangewide strategy.

The main focus of the initial phase of recovery will be to maintain the known distribution of *Lepidium papilliferum* through the protection of the highest priority A – through C- ranked extant populations and by surveying and monitoring populations on public lands. The primary threats to be addressed through this initial recovery strategy include invasive nonnative plant species and wildfire. Specific actions that will be initiated early in the process include the following:

Protection of Extant Populations and Habitat

- Work with land management agencies to:
    - Identify and prioritize the EOs in greatest immediate need of protection;
    - Locate and map potentially critical population connectivity corridors;
    - Select populations that require immediate habitat protection, set protection priorities, and establish and implement protective measures for these populations; and
    - If necessary, develop site-specific management plans for high priority populations.

- Coordinate with land management agencies early in the planning process to help limit the effects of current or future projects that have Federal involvement.
- Encourage land management agencies to:
    - Establish vegetation management goals and objectives that are compatible with *L. papilliferum* recovery;
    - Continue implementation of conservation measures and associated monitoring identified in existing conservation plans to ensure potential impacts of ground disturbing activities, such as livestock use, are avoided or minimized;
    - Provide rapid response to wildfire in known populations;
    - Allocate adequate resources to reduce the wildfire risk in remaining high quality sagebrush stands; and
    - Conduct post-wildfire restoration with native plant species and avoid the use of plant species that may invade slickspots and compete with *L. papilliferum* when developing fuel breaks, emergency stabilization and rehabilitation plans, or habitat restoration seedings in areas that support the *L. papilliferum*.

Surveys and Evaluation of Population Status

- Re-evaluate the status of extant populations to reflect the current population and habitat quality of *Lepidium papilliferum*, which will enable more accurate prioritization of conservation efforts.
- Support the BLM's effort to conduct comprehensive surveys in areas previously designated as "potential habitat" throughout the species' range to more accurately identify the species range and distribution.

Monitoring

- Expand the current monitoring program to include a larger and more representative sample of occupied sites in an effort to better document rangewide population trends and threats, and to include an adaptive management–based approach that uses feedback from implemented, site-specific recovery tasks to inform future *Lepidium papilliferum* recovery activities.

Conservation Agreements and Technical Teams

- Continue to support existing conservation agreements and actively participate on the *Lepidium papilliferum* Technical Team.
- Secure conservation or management agreements for populations on state and county lands (i.e., continue to work with Ada County toward the development of the Boise Foothills Conservation Agreement).

Research

- Continue current research of Owyhee harvester ant seed predation impacts on *Lepidium papilliferum* reproduction and long-term viability.
- Encourage research and projects to restore sagebrush-steppe habitat within the range of *L. papilliferum*.
- Conduct research on flight patterns of pollinators specific to *L. papilliferum* and other similar studies to identify what is necessary to conserve genetic diversity and gene flow among populations of *L. papilliferum*.
- Increase support and funding for research on elimination and control of invasive nonnative plant species in sagebrush-steppe habitats.
- Determine if there is a need to establish additional populations, and if so:
    - Identify potential reintroduction sites,
    - Develop effective propagation methods,
    - Develop and implement outplanting protocol, and
    - Manage and monitor reintroduced populations.

Seed Banking

- Store genetic material in the form of seed in an appropriate repository to provide a back-up supply of genetic stock that represents as much of the available genetic diversity within the species as possible.

III. Preplanning Decisions

A. PLANNING APPROACH

A recovery plan will be prepared for *Lepidium papilliferum* pursuant to section 4(f) of the Endangered Species Act. The recovery plan will include objective, measurable criteria which, when met, will result in a determination that the species be removed from the Federal List of Endangered and Threatened Wildlife and Plants. Recovery criteria should address all threats meaningfully impacting the species. The recovery plan also should estimate the time required and the cost to carry out those measures needed to achieve the goal for recovery and delisting. The scope of the plan will be a single species. Plan preparation will be under the stewardship of the Idaho Fish and Wildlife Office. Other Service personnel involved with the species will be integrally involved in the planning effort. Our field office biologists will coordinate with the Regional endangered species office as planning proceeds. The Service believes that the appointment of a recovery team is not warranted for the development of the *L. papilliferum* recovery plan. A *L. papilliferum* Technical Team is currently assembled and is comprised of technical experts and other knowledgeable stakeholders. Recovery planning will be coordinated with this existing group, which will provide technical expertise for a scientifically sound recovery approach. This will involve periodically conducting meetings with the group to share information and ideas about *L. papilliferum* recovery.

B. INFORMATION MANAGEMENT

General: All information relevant to recovery of *Lepidium papilliferum* will be housed in administrative files found at the Idaho Fish and Wildlife Office in Boise, Idaho. The lead botanist will be responsible for maintaining a full administrative record for the recovery planning and implementation process for the species. Copies of new study findings, survey results, records of meetings, comments received, and other relevant information should be forwarded to this office (see *Listing and Contact Information* section on page 1). Species occurrence boundaries and available trend data continue to be maintained by the Idaho Natural Heritage Program.

Reporting requirements: Information needed for annual accomplishment reports, the Recovery Report to Congress, expenditures reports, and implementation tracking should be forwarded by all individuals and offices involved in the *Lepidium papilliferum* recovery effort to the Idaho Fish and Wildlife Office (see *Listing and Contact Information* section on page 1). Copies of the completed reports can then be disseminated to all contributors upon request.

C. RECOVERY PLAN SCHEDULE

The Recovery Plan schedule is provided below:

Public Review Draft	anticipated release of draft is in the fall of 2013
Public Comment Period	60 days following release of draft plan
Final Recovery Plan	1 year after release of public review draft

D. STAKEHOLDER INVOLVEMENT

Key stakeholders:

- U.S. Bureau of Land Management
- The U.S. Air Force, Mountain Home Air Force Base
- Idaho Army National Guard, Gowen Field/Orchard Training Area
- U. S. Bureau of Reclamation
- Idaho Natural Heritage Program
- University of Idaho
- Boise State University
- Idaho Governor's Office of Species Conservation

E. STAKEHOLDER INVOLVEMENT STRATEGY

Early in the recovery planning process, a meeting will be held with the Technical Team to exchange status information and identify recovery issues. The information gathered from this discussion will provide the initial platform for proceeding with public outreach and recovery planning and help shape the initial draft of the recovery plan. Subsequent meetings and/or conference calls will be held as needed to discuss particular issues. Additional stakeholders will be invited to participate as warranted and all stakeholders will have an opportunity to review and comment on a draft of the recovery plan in conformance with the Endangered Species Act through public notice and comment. Stakeholders will be integral in the implementation of the recovery plan, and therefore an emphasis will be placed on creating strong working relationships with agency partners, species experts and stakeholders.

Approved:

Acting Regional Director, Region 1
U.S. Fish and Wildlife Service

Sept 26, 2011
Date

Citation

U.S. Fish and Wildlife Service. 2011 Recovery Outline for *Lepidium papilliferum*. Portland, Oregon. 28 pp.

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