

**U.S. AIR FORCE RESPONSE TO PROPOSAL TO LIST
Lepidium papilliferum AS ENDANGERED
 (67 FR 46441)
 Comments on the
 Taxonomic Status of *Lepidium papilliferum***

**By
 Robert Lichvar, Botanist
 ERDC/CRREL**

As part of the listing considerations for *Lepidium papilliferum* (Henderson) A. Nels. & J.F. Macbr. as an Endangered Species under the Endangered Species Act (ESA), a taxonomic evaluation was performed to assure that current taxonomic rankings are scientifically valid. This evaluation included observations of live material in the field, examination of herbarium specimens, and a review of the literature. The validity of the current taxonomic status of the species as cited in the *Federal Register* was assessed by determining the consistency of key morphological features, evaluating their strength in distinguishing this taxa from other closely related species, and reviewing previous taxonomic rankings. The key morphological features evaluated were 1) the occurrence of elator-like trichomes on the stamens, 2) whether or not the leaves were all pinnately divided, and 3) the shape and the wingless nature of the silique.

Observations in support of this assessment were made in the field during a site visit in April 2002. Key features were also observed at the Gray Herbarium (GH) at Harvard University in late May 2002. Relevant literature was obtained both at the GH and from library sources.

Field Observations – A site visit to the Snake River Plains was done in southwestern Idaho in April 2002 to observe the species in flowering condition. Many of these observations were made at Mountain Home Air Force Base. During the site visit, *L. papilliferum* was in early flowering condition. Individuals varied from being in bud to being partially in flower. Both first- and second-year plants were observed. It was assumed that the individuals with a rosette growth form were first-year plants and that the flowering individuals were second-year plants. No effort was made to assess whether any of the flowering individuals may have been first-year plants.

Since many individuals were in flower, it was possible to assess the occurrence of elator-like trichomes on the filaments of the stamens. These elator-like trichomes are single-celled hairs that are flattened and slightly club shaped at the apex. In the field, all flowering individuals in flowering condition had elator-like trichomes on the filaments. Also, all of the flowering individuals observed consistently had pinnately dissected leaves. No notes were made on the basal rosette growth form of the species since the published description of the species was based on either flowering or fruiting material (Rollins 1993).

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Herbarium Assessment – Specimens of several western United States *Lepidiums* were observed at GH. The herbarium visit was deemed critical since Dr. Reed Rollins, a recognized specialist in the Cruciferae, compiled a large herbarium collection of members of this family. Also, both flowering and fruiting material would be available for evaluation. The GH collection included both historical and recent collections of western *Lepidiums*. Additionally, type material for this and other closely related species are housed at GH.

At GH, an assessment of *L. papilliferum* and other related species within the complex were evaluated and compared for morphologic variation, similarities, and distribution patterns. An overview of the current taxonomy status and other variations is presented below.

Taxonomic Status Overview - At GH, observations of all *L. papilliferum* specimens were made in addition to four other species of *Lepidium*. This initial evaluation of the taxonomic status of *L. papilliferum* was based on morphological features, geographic range, and application of typical Cruciferae features and their importance for use in clarify the taxonomy of members of this family as discussed by Rollins (1993). Observations of the 15 herbarium specimens of *L. papilliferum* confirmed consistent elator-like trichomes on the filaments of the stamens and consistent bipinnate leaves. It was noted that a specimen by collected by A. DeBolt (# 1145) and several other collections had a slight wing at the summit of the silique. All other remaining specimens were wingless. The wings observed were approximately 1–2 mm in length and were not strongly expressed.

In evaluating other species and varieties of *Lepidium*, several noteworthy observations were made. The similarity in appearance and technical features to *L. montanum* is striking when compared other western *Lepidiums*. Some of the features appearing most similar are the leaf shape and pattern of dissections, the annual to biennial growth form, and the fruit shape. No elator-like trichomes were observed on the stamens of any collections of *L. montanum*. However, one to several elator-like trichomes were observed on leaves on three of the varieties of *L. montanum*. Rollins (1993) cited the elator-like trichomes as unique to only two taxa within two separate genera of Cruciferae in North America and stated that it is a feature more commonly found in the Turkey-Asiatic species. The elator-like trichomes on *L. montanum* varieties may suggest yet another interpretation that this feature is also shared within the gene pool of North America Crucifers but not as frequently expressed as in its Asiatic counterparts. With the observations of elator-like trichomes on closely related members of *L. montanum* group, it can now be hypothesized that this trichome feature is within the gene pool of the western United States *Lepidium* group and may have become genetically fixed on the filaments of the stamens in *L. papilliferum*.

Attachment 1 (continued). Comments by Dr. Robert Lichvar

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Literature – Several people have expressed concern over the current taxonomic treatment of this taxa as a valid species. This may be a result of the various rankings applied to the species in the past and its list of synonyms. Table 1 provides the previous and current taxonomic rankings applied to this taxa.

Table 1. Synonym and basionym listings of previous and current taxonomic ranking of the treatment of <i>Lepidium papilliferum</i>.	
Synonyms and Basionym	Published Citation
<i>L. montanum</i> Nutt. Ex Torrey & Gray var. <i>papilliferum</i> L. Henderson	<i>Bulletin of the Torrey Botanical Club</i> , 27: 342. 1900
<i>L. papilliferum</i> (Henderson) A. Nels. & J.F. Macbr.	<i>Botanical Gazette</i> , 56: 474. 1913
<i>L. montanum</i> ssp. <i>papilliferum</i> (L. Henderson) C.L. Hitchc.	<i>Madrono</i> , 10: 158. 1950
<i>L. papilliferum</i> (L. Henderson) A. Nels. & J.F. Macbr. (Current name or basionym)	Rollins. 1993. <i>Cruciferae of Continental North America</i> . Stanford University Press. p. 576.

Some of the historical interpretations that place *L. papilliferum* at different levels of taxonomic rankings derive from either limitations of literature and a lack of adequate access to other herbarium specimens or an effort to realign and treat this taxa within the variation of the *L. montanum* group. Henderson (1900), in describing this taxa new to science, discussed his hesitation in treating it at the species level because of variability in leaf shape that varied from pinnate to bipinnate and the silique was variable. He did not weigh heavily the elator-like trichomes on the stamens, as did Rollins. Nelson and Macbride (1913) elevated it to the species based on it being a biennial and its unusual pubescence, but C. L. Hitchcock (1950), in his treatment of the *L. montanum* group, based also on his earlier taxonomic treatments of the genus (Hitchcock, 1936), retained its original placement under *L. montanum* but elevated it to the rank of subspecies. Rollins (1993), in his comprehensive treatment and overview of all North American Cruciferae, retained this taxa at the species level based on the unique elator-like trichomes on the stamen filaments, the pinnately dissected leaves, and the wingless fruits. In doing so he presented the global uniqueness of the stamen trichomes. Also, by using the leaves and fruit design, he supported species ranking by presenting two secondary morphologic features.

The assignment of this taxa to various ranks stems from different weights being placed on the importance of morphological features of this taxa and related species. Previous taxonomic rankings reflect the authors' knowledge of the taxa at the time of the assignment, their comprehensive knowledge of the genus and family, and their efforts to adequately align other closely related species for a comprehensive treatment of western *Lepidium*s. But many of these previous rankings lacked the continental and global interpretation brought forth by Rollins when dealing with these highly variable taxa.

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The various rankings represent an effort to classify and reflect the relationship between taxa. One or several of these treatments may be correct, but that can't be determined without chromosome, greenhouse, and DNA genetic studies specific to the taxonomic question. However, with consistent features lacking overlap within other taxa, *L. papilliferum* is a unique and easily recognizable entity.

Conclusion – This evaluation of the taxonomic status of *L. papilliferum* has shown, using classic morphological features and study of herbarium specimens, that it has distinct features that warrant species recognition. Within *L. papilliferum* the three features cited by Rollins were consistent within the confines of the representative material. But the discovery of elator-like hairs on leaf parts within several *L. montanum* varieties and mildly winged fruits in some *L. papilliferum* specimens clearly show its close relationship to *L. montanum*. Further field and genetic investigations could determine that this species is closely related to *L. montanum* and may indeed be better taxonomically treated within that species group based upon the occurrence of rudimentary wings on the fruit of *L. papilliferum*, the geographic distribution patterns of *L. montanum*, and a striking morphological similarity to *L. montanum*. If it were placed under *L. montanum*, it would no doubt still be recognized at some subspecies level. But whether this taxa is best treat at the species level or submerged under *L. montanum* at this time is not possible to determine without further rigorous investigation. Until a final taxonomic determination is done in the future, Dr. Rollins's decision to place it at the species level makes sense for now.

References Cited

- Henderson, L.F. 1900. New plants from Idaho and from other localities of the Northwest. *Bulletin of Torrey Botanical Club*, 27: 342–359.
- Hitchcock, C.L. 1936. The genus *Lepidium* in the United States. *Madrono*, 3: 265–320.
- Hitchcock, C.L. 1950. On the subspecies of *Lepidium montanum*. *Madrono*, 10: 155–158.
- Nelson, A. and J.F. Macbride. 1913. Western plant studies, II. *Botanical Gazette*, 56: 469–479.
- Rollins, R.C. 1993. *The Cruciferae of North America*. Stanford University Press, Stanford, CA.

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Photo 1a.
Lepidium papilliferum
growing along a road way near the
Air Force's
Juniper Butte
Training Range



Photo 1b. *Lepidium papilliferum* growing along a road way near the Air Force's
Juniper Butte Training Range

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Weight of SSPG Seed

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Bashore Terry L Civ ACC/DORI (A344) Integration Team

From: Kathy Rose

Sent: Monday, June 10, 2002 1:52 PM

To: 'Terry Bashore'

Subject: Weight of SSPG Seed

According to Dr. Susan Meyer's report--100 seeds of SSPG weighs anywhere from .035 to .05 grams. Hope this helps.

Kathy

*AMEC Earth & Environmental
Noise, ID*

Attachment 2. E-mail between Ms. Kathy Rose and Dr. Terry Bashore. Ms Rose contacted Dr. Susan Meyers on 10 June 2002 to inquire about the weight of *Lepidium papilliferum* (SSPG) seeds.

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MEMORANDUM FOR RECORD

3 September 2002

SUBJECT: Technical Review of Proposal to List *Lepidium papilliferum* as Endangered as described in 67 FR 46441-46450 and associated supportive information.

1. Reference 67 FR 46441-46450 and associated supportive information, such as Mancuso 2001 Monitoring Habitat Integrity For *Lepidium papilliferum* (Slickspot Peppergrass): 2000 Results
Moseley 1994 Report on the Conservation Status of *Lepidium papilliferum*.
2. In reviewing the supportive information and monitoring data (Mancuso 2001), it appears that there is extreme variability in number of plants observed at a specific site from one year to the next. For example, at 018A, plant numbers varied from 448 in 1998 to 0 in 1999 to 2517 in 2000 and 018B showed 845 plants in 1998 to 50 plants in 1999 to 402 plants in 2000. With this extreme variability, a larger number of years of monitoring will be required to determine a definite reduction in plant numbers to substantiate the risk of extinction and the need for listing as endangered.
3. The seed bank in the soil apparently is extremely important. Seed germination is extremely variable with seed being viable for up to 12 years. Therefore multi-year monitoring will be required to document reduction in plant populations. Insufficient data and monitoring have been conducted to support listing as endangered at this time.
4. A Habitat Integrity Index was developed to better evaluate plant survivability. Insufficient data have been collected to make a determination of reduced survivability at this time. Scientific peer review of this new approach is required before it can be used for listing endangered species.
5. Data collection (Moseley 1994) appeared to be inconsistent and questionable. Separate observations of extirpated populations have been lumped into single recorded occurrences. Also stated "Some destroyed populations are included as part of occurrences 012 and 020, which are partially extant".
6. Sites of Occurrences as recorded can have an extremely wide variability in plant numbers from 0 to 2517. This variability requires many years of data collection to indicate a reduction in the survivability of the plant species and the risk of extinction. It would be premature to list *Lepidium papilliferum* as endangered at this time.
7. Apparently there are other potential locations where *Lepidium papilliferum* exist that have not been surveyed. These locations should be surveyed to increase the data base with which to make the decision for listing. There is a scarcity of data at present to support listing at this time.
8. In summary, it is premature to list *Lepidium papilliferum* as endangered based on the scarcity of collected data at present. Additional scientific data are required.

Charles R. Lcc, Ph.D, CPSS

Attachment 3. MEMORANDUM FOR RECORD

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Charles R. Lee, Ph.D., CPSS

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U.S. AIR FORCE RESPONSE TO PROPOSAL TO LIST *Lepidium papilliferum* AS ENDANGERED (67 FR 46441)

Bashore Terry L Civ ACC/DORI (A\$44) Integration Team

From: Sabo James A Civ ACC/CEO
Sent: Monday, April 23, 2001 12:38
To: Bashore Terry L Civ ACC/DORI
Subject: FW: Habitat Integrity Index

FOR YOUR INFORMATION

-----Original Message-----

From: Anderson, Mary, Ms, HQAFCEE [mailto:Mary.Anderson@hqafcee.brooks.af.mil]
Sent: Friday, April 13, 2001 3:36 PM
To: Sabo, James, Civ, ACC/CEO
Subject: FW: Habitat Integrity Index

Jin,

this is the first response I have had with U of Idaho being the slowest and largest university in the area. I am waiting to hear back on a couple of other inquiries. I will be out most of next week so hang in there.

PS Kevin will be out of the office for 2-3 weeks, his father passed away last week.

Mary Anderson

-----Original Message-----

From: Steve Bunting [mailto:sbunting@uidaho.edu]
Sent: Friday, April 13, 2001 11:00 AM
To: Anderson, Mary, Ms, HQAFCEE
Subject: Re: Habitat Integrity Index

Ms. Anderson,

I am not familiar with this model. I have slight familiarity with a wildlife habitat suitability model but I think that these are different models. I do not know of anyone here at UoI who has reviewed the habitat integrity index model

Steve Bunting

From: "Anderson, Mary, Ms, HQAFCEE" <Mary.Anderson@hqafcee.brooks.af.mil>
To: "sbunting@uidaho.edu" <sbunting@uidaho.edu>
Subject: Habitat Integrity Index
Date sent: Tue, 10 Apr 2001 15:37:29 -0500

- > Dr. Bunting,
- >
- > I have been asked to research out more information regarding this model
- > especially regarding monitoring of sheepshead peppergrass, *Lepidium*
- > *papilliferum*.
- >
- > Do you know of this model? Know of anyone with experience with this model?
- > Has it been through a peer review by UoI Idaho? anyone? thanks.
- >

Attachment 4. E-mail traffic concerning Habitat Integrity Index.

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> Mary Anderson
> Botanist
> HQ AFCE/EBC
> Brooks AFB
> 21W536-3808 (DSN 340-3808)
> mary.anderson@hqafce.brooks.af.mil
>
>

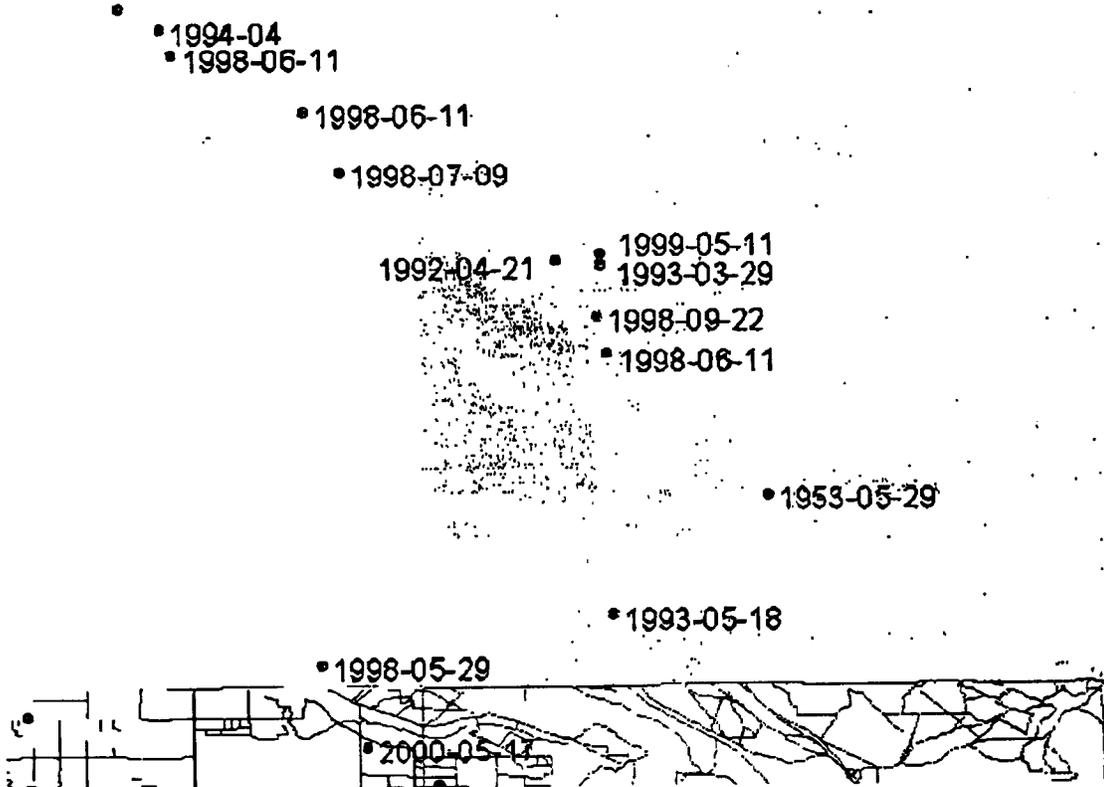
.....
Stephen C. Bunting
Department of Rangeland Ecology and Management
College of Natural Resources
University of Idaho
Moscow, ID 83844-1135

Phone 208-885-7103
Fax 208-885-5190

<http://www.uidaho.edu/range>

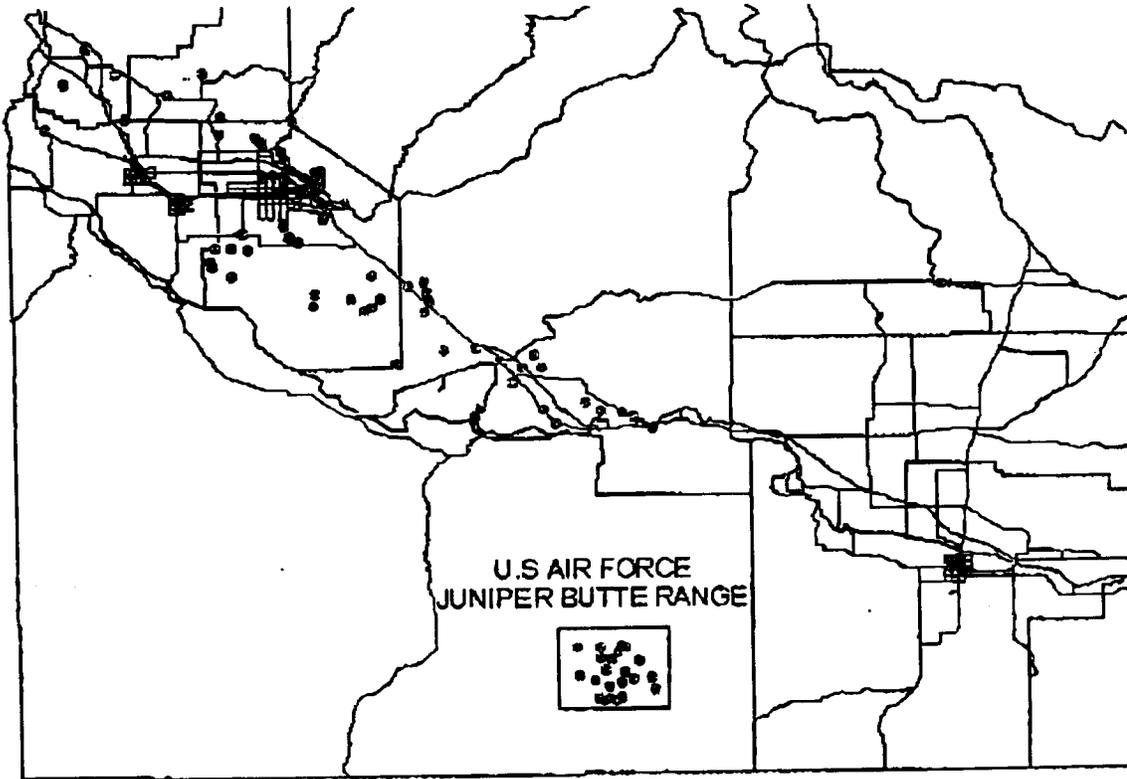
Attachment 4 (continued). E-mail traffic concerning Habitat Integrity Index

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Attachment 5. Locations of *Lepidium papilliferum* occurrences within a 10-mile radius of Boise, Idaho. Only 1 occurrence may qualify as extinct ?

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1 mile (1.6 km)

Attachment 6. Locations of *Lepidium papilliferum* occurrences according to ICDC provided Lat/Long coordinates. Note: not all roads show because of scale.

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Review of the U.S. Fish and Wildlife listing document "Endangered and Threatened Wildlife and Plants; Listing the Plant *Lepidium papilliferum* (slickspot peppergrass) as Endangered, 50 CFR Part 17."

David R. Huff
Associate Professor of Plant Genetics
Department of Crop and Soil Sciences
Pennsylvania State University
University Park, PA 16802
w: 814-863-9805
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e: drh15@psu.edu

SUMMARY:

The listing document argues that *Lepidium papilliferum* (L.p.) is a sensitive species that is threatened by a range of factors including loss of habitat, reduced gene flow thru habitat fragmentation, and reduced numbers via livestock grazing, competition from non-natives, burning, and fire rehabilitation activities.

While I find little to no scientific evidence to support or reject any of these claims, certainly the specialized adaptation of the annual and biennial life forms of the taxon referred to as L.p. presented seems particularly precarious, being only capable of growth and reproduction on a specific soil type generally known to be toxic and unproductive.

REVIEW:

The insufficient amount and low quality level of the available scientific study regarding L.p.'s population dynamics renders any discussion of the relative merits of this proposed listing document to the realm of opinion and emotion. Most instances of claims tend to be based on observational data only, and in one particular case regarding the effects of fire, broad conclusions were based from only a single observation at one location. As may be expected, contradictory observations are also contained within the listing document to many of the claims. Thus, without scientific data and analysis, my only recourse is to render my opinion of the observations contained within the listing document.

Attachment 7. Huff comments

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Obviously, *L.p.* is an early successional species that is apparently solely adapted to the solodized-Solonetz soils commonly referred to as "slick-spots", "scabby-spots" or "deer-species to be in. *L.p.*'s unique specialized adaptation to grow only in solodized-Solonetz soils suggests that any reduction of these specialized soils will imply a reduction of the species' available habitat. Thus, avoiding habitat destruction would certainly seem to be a high priority for preservation of the *L.p.* species. However, the lack of any chemical composition characterization of these habitats, especially as related to precipitation, strongly suggests that simply protecting habitats might not necessarily influence species numbers.

Solodized-Solonetz soils naturally form in arid and semi-arid regions on an irregular basis implying that the habitat of *L.p.* is naturally irregular across the landscape and possibly even subject to successional phases through time. Moreover, "slick-spots" are naturally very unproductive in terms of vegetation growth due to their toxic chemical properties and poor physical condition. Where Solonetz soils occur in imperfectly drained positions it is reasonable to suppose that there may be some variation in the absorbed ions from one season to another. When the water table is high and the weather dry, moderately large quantities of salts will be brought up from the subsoil and deposited in upper horizons. These salts may be rich in sodium or potassium, or they may contain more or less magnesium and calcium. Their content will doubtless have some bearing on the character of the absorption complex. During protracted rainy periods, an abundance of fresh water will tend to remove part of the salt and it is easy to imagine that some salts would be removed more rapidly than others according to their solubilities and strength with which some ion are held by soil colloides. Thus, the wide fluctuations of *L.p.* individuals reportedly observed at any one particular site or among different sites might easily be explained as a function of precipitation and chemical composition of the soil. For example, the numbers of *L.p.* observed by Mancuso (2001) show a correlation coefficient of -0.9706 with the number of fires reported by the BLM in the lower Snake River Basin District in the same years. While some may argue that this is evidence that fire decreases *L.p.* number, I would argue that both are the influence of variable precipitation. Thus, recent observed declines in *L.p.* numbers or occurrence at a particular location might be a result of recent droughts across our western USA.

Enormous areas containing many small spots of these slick-spot soils are known to exist in the Chestnut and Brown soils of the northern Great Plains, and yet, presumably *L.p.* is only known to occur in Idaho (note: the U.S.D.A. GRIN data base lists *L.p.* as only having the common name "Idaho peppergrass"). This begs the question of the species status of *L.p.* Perhaps, *L.p.* is a truly variety or form of *L. montanum*. Clearly, a simple molecular genetic analysis of the involved taxa would immediately shed light on this issue.

Attachment 7 (Continued). Huff comments

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Moreover, apparently there are two life-history strategies operating within L.p.: an annual form and a biennial form. Obviously, management strategies for ensuring the growth and reproduction of each life form would likely be different and not necessarily inclusive. Therefore, more investigation should be performed to understand how altered management activities affect the composition of these life forms with L.p.

Most of the argument in the listing document seems to be focused on the implied detrimental effects of grazing and burning to L.p. numbers. Burning and grazing are a natural part of a grassland ecosystem and therefore, as a native, I would expect L.p. to possess some tolerance of these natural disturbances. Moreover, limited amounts of these natural disturbances might even be important to the survival of the species. Certainly, heavy amounts of animal traffic and grazing will be detrimental to all vegetation, but the listing document suggests that cattle and sheep compact the soil making it difficult for L.p. to grow. However, solodized-Solonetz soils are naturally hard and compacted so this does not seem to be a compelling argument. Perhaps some limited trampling might even aid in enhanced L.p. seed placement, or perhaps help clear the area of undesirable taller plant species, like *Sisymbrium altissimum* (Mancuso, 2000), thus keeping the habitat open for L.p. Moreover, the addition of some organic matter in this toxic "slick-spot" environment, in the way of feces, would only seem to improve the growth and reproduction of L.p. In any event, there is no clear discernable pattern presented in any logical, compelling, scientific way for the effects of limited grazing on the growth and reproduction of L.p.

The effects of burning on L.p. occurrence are even less clear. Most plants of L.p. observed in the Popovich (2001) survey were found in burned, unseeded slick spots. Moseley (1994), on the other hand, suggest that "excellent evidence" for the degrading effects of burning on L.p. are provided from a site that was burned which had no L.p. while an adjacent site that was not burned had L.p. present. This is not science.

The population numbers reported, are at times misleading but are definitely confusing. Mosely (1994) suggests that 21 populations have gone extinct since 1892, or an extinction rate of 2 populations per decade. This rate is propagated throughout subsequent references as "... the fastest extinction rate of Idaho plants" (see Scholten and Bunting, 2001). However, the main listing document states that only 13 populations are known to be extinct. Thus, the actual extinction rate would only be 1 population per decade which may or may not be the fastest extinction rate of Idaho plants. In addition, the numbers of existing sites throughout the documents cited are not consistent, having been reported to be 38 (Mosely, 1994) to 50 (Mancuso, 2000) to 70 sites (Mosley, 1994; Mancuso, 2001) to 112 sites (Popovich, 2001). In any case, there are probably not an

Attachment 7 (Continued). Huff comments

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abundant number of sites and thus, habitat destruction would seem an important step to preservation of *L.p.*

Habitat destruction, while potentially reducing numbers and distribution of the species, might not actually be creating population fragmentation and subsequent reduced gene flow; especially in view of the insect-mediated pollination of the species (Robertson, 2002). In fact, Robertson (2002) observed honey bees to be the principle pollinator of *L.p.* and thus, with flight patterns ranging several miles, might be able to maintain sufficient levels of gene flow among populations. Again, in today's era of molecular biology, it would be an easy and simple enough task to begin assessing the genetic structure, variability, and diversity among existing *L.p.* populations using molecular markers. Such scientific data and analysis would seem imperative to begin to properly protect and manage *L.p.* populations.

The numbers of *L.p.* are highly variable across years within a site and from site to site (Mancuso, 2001). Therefore, the limited data that is available strongly suggests that the widely fluctuating numbers of *L.p.* individuals from year to year (ex. Sites 018A and 066) and from site to site are a natural phenomenon of the taxon. Such variable population dynamics would seem to be extreme difficult to predict given limited observations over short periods of time. Given this variability, more data needs to be collected, including estimates of annual and biennial forms, in order to represent a more confident estimate of taxon status (either population decline or increase).

Lastly, reducing non-native species invasion and eliminating post-fire range restoration activities that utilize non-native species would seem to be an obvious measure for protecting the shrub-steppe habitat as a whole.

CONCLUSION:

Whether *L.p.* is an Endangered species bordering on decline or is a naturally rare species experiencing natural fluctuations in population numbers as a result of climatic conditions or life-form demographics can not be discerned from the available information. Given that *L.p.* is determined to be an Endangered species, I would not be comfortable basing management decisions without first understanding the impact of those decisions on the species and its variable life-history strategies. Certainly some level of protection against habitat destruction would seem warranted.

Attachment 7 (Continued). Huff comments

**U.S. AIR FORCE RESPONSE TO PROPOSAL TO LIST
Lepidium papilliferum AS ENDANGERED
(67 FR 46441)**



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Snake River Basin Office, Columbia River Basin Ecoregion
1117 South Yinnell Way, Room 368
Hwy. 101, Idaho 83719

JUL 16 2002

Dr. Terry Bashore
U.S. Air Force
HQ ACC/DORI
114 Thompson Street
Langley Air Force Base, Virginia 23665

Subject: *Lepidium papilliferum* Peer Review
OALS #02-0864

Dear Dr. Bashore:

On July 15, 2002, the U.S. Fish and Wildlife Service (Service) published a proposal to list *Lepidium papilliferum* as endangered in the Federal Register (67 FR 46441) (Attachment). The Service's policy on peer review in Endangered Species Act activities (59 FR 34270) directs us to solicit the expert opinions of three appropriate and independent specialists regarding pertinent scientific or commercial data and assumptions relating to taxonomy, population models, and supporting biological and ecological information for listing decisions. The Service must base its decision on sound science. Your review as an independent expert is critical to this process.

Specifically, we are requesting that you review the scientific rationale for the decision to list this species as endangered. Endangered status is defined by the Endangered Species Act as any species which is in danger of extinction throughout all or a significant portion of its range.

Our comment period for the proposed rule will be open until September 13, 2002. We would appreciate your comments within this period to allow us to consider them in our final listing decision. Please contact Jeri Wood in our office at (208) 378-5289 if you have further questions.

Sincerely,

Supervisor, Snake River Basin Office

Acting

Attachment 8. U.S. Fish and Wildlife Service Letter

**U.S. AIR FORCE RESPONSE TO PROPOSAL TO LIST
Lepidium papilliferum AS ENDANGERED
(67 FR 46441)**

Review of "Endangered and Threatened Wildlife and Plants;
Listing the Plant *Lepidium papilliferum* (slickspot peppergrass)
as Endangered, 50 CFR Part 17"

submitted to
Dr. Terry Bashore
Director, Natural and Cultural Resources Programs
Range, Airspace, and Air Fields
HQ ACC/DORI
205 Dodd Blvd., Suite 101
Langley AFB, VA 23665-2789

by
Dr. Steven D. Warren
Center for Environmental Management of Military Lands
Colorado State University
Fort Collin, CO 80523-1493

For purposes of review, subheadings under "Supplemental Information" are treated separately. For clarity, paragraphs under each subheading are numbered sequentially and comments are provided for each.

SUPPLEMENTARY INFORMATION:

Background

Paragraph 1. No comment

Paragraph 2. The definition of "occurrence" appears to be arbitrary and uninformative. Is there a maximum distance between slickspots, beyond which a new "occurrence" is constituted? Likewise, "suitable habitat" is undefined. Barring better definitions, an estimate of the amount of "suitable habitat" is not quantifiable. Furthermore, there is no evidence that a systematic, comprehensive survey has ever been conducted either for "suitable habitat" or "occurrences". Hence, conjecture as to the spatial or numerical extent of this species appears to be unjustified. A thorough, systematic survey could potentially increase the amount of "suitable habitat" or number of "known occurrences" by several orders of magnitude. The number of occurrences of *Lepidium papilliferum* cited for its entire range (88) is less than the number of occurrences on a 4,000 acre tract surveyed by Popovich (2001) in the Inside Desert (112).

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Furthermore, Popovich (2001) concludes that "many undocumented occupied sites probably exist . . ." just within the Inside Desert alone.

Paragraph 3. The cited references provide no original or quantitative data to support the claims that various activities threaten slickspot peppergrass. The claim that slickspot peppergrass has the highest know extirpation rate of any Idaho rare plant species is based on flawed, incomplete and unsubstantiated information presented by Moseley (1994). The data presented by Moseley do not account for the potential existence of additional "occurrences" that could be identified by a thorough survey or for new populations that could have arisen during the cited period. Of equal import is that many desert annuals are episodic in appearance, germinating in large numbers only when optimal conditions are met, and germinating in much smaller numbers or sometimes not at all in less favorable years. Hence, it is quite likely that the rate of extirpation estimated Moseley has nothing to do with extirpation and is an artifact of differences in climatic conditions between the sample dates. Furthermore, it has been suggested that slickspots are not stable, i.e., they come and go over time. If that is true, to make conclusions regarding the persistence of a species by resampling habitat patches that may naturally disappear (only to be replaced elsewhere) is not a rational approach.

Paragraph 4. These species descriptions are based on the concept of "morphological species" originated by Charles Darwin and contemporaries. Given the "plasticity" in the phenotype of many species, it seems logical that before spending many thousands of dollars to list and protect *Lepidium papilliferum*, some relatively inexpensive effort should be expended to verify that it is, indeed, a species and not merely a phenotype of *Lepidium montanum* that occurs on slickspots. Has the DNA analysis been done? It appears not.

Paragraph 5. No comment.

Paragraph 6. No comment.

Paragraph 7. It is interesting to note that Fisher et al. (1996) suggest that not all slickspot habitat in the Snake River Plain is currently occupied by *Lepidium papilliferum*. The authors further suggest that there may be "considerable unused habitat for the species within its geographic range." See also comments for paragraph 3 above relative to the episodic nature of germination of many desert annuals.

Paragraph 8. No comment.

Paragraph 9. No comment.

Attachment 9 (Continued). Warren Comments

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Paragraph 10. Much of what this paragraph states is true. Nonnative species have, indeed, displaced some native species in the sagebrush-steppe. Fires have, indeed, become more frequent. Much of the sagebrush-steppe has been converted to nonnative annual grasslands. However, there is no quantifiable evidence that this has had any effect whatsoever on slickspots or *Lepidium papilliferum*. The Rosentreter (1994) reference provides opinion only; no evidence is presented. And even Rosentreter admits that effects, if any, are probably indirect. Based on limited quantitative data, Popovich (2001; pages 10 and 11) suggests that fire may even be beneficial to *Lepidium papilliferum*. And Moseley (1994; page 9) suggests that *Lepidium papilliferum* evolved in the presence of fire. Hence, it stands to reason that it must have some evolutionary traits to compensate for that disturbance.

Paragraph 11. This paragraph misses the mark. It does not appear to be the presence of nonnative perennial forage species that affects *Lepidium papilliferum*. These species will not grow well on the slickspots. Instead, it is the process of establishing the perennial forage species (i.e., drill seeding) that is the likely culprit. During drill seeding, it is uncommon for an equipment operator to avoid slickspots. Hence, slickspots as well as adjacent areas are 'drilled' or physically disturbed. It is more likely this physical disturbance that may affect the nature of the slickspot and hence the survival of *Lepidium papilliferum*, although as noted by Mancuso and Moseley (1998), there is no long-term persistence data available. It is important to note that Popovich (2001) concludes that 'areas' (not slickspots) dominated by exotic bunchgrass 'seedings' (not plants) generally had fewer plants and smaller sites.

Paragraph 12. The integrity index is subjective but may represent a good first approximation. It does not take into account that *Lepidium papilliferum* may be an early successional species that thrives in disturbed conditions. Nor does it account for variable climatic conditions that may create the appearance of fair or poor conditions in suboptimal years.

Paragraph 13. I do not dispute the data. However, only 70 of the known and probable extant 'occurrences' were ranked, while many more may actually exist. (See comments relative to paragraph 2 regarding the probable underestimate of the actual number of extant occurrences.) Can we be sure that the ranked occurrences are representative of the population as a whole? Can we be sure that changes in apparent condition are not due to climatic conditions?

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Attachment 9 (Continued). Warren Comments
Summary of Factors Affecting the Species

Previous Federal Action - no comment on any paragraph in this section.

A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range.

Paragraph 1. That the land degradation exists, and that it continues to degrade the sagebrush steppe, is unquestionable. That the specific forms of degradation affect *Lepidium papilliferum* or its slickspot habitat IS questionable. The cited references are

replete with conjecture and opinion; none provide substantive quantitative evidence to support the stated argument. The Moseley (1994) presents NO credible or quantitative evidence to support the claim that the conversion of sagebrush steppe to annual grasslands has had ANY effect on *Lepidium papilliferum* or its slickspot habitat. And there is NO credible or quantitative evidence that increased fire frequency and the associated invasion of weedy annual plants are threats to the long-term integrity of *Lepidium papilliferum*.

Paragraph 2. Finally, at little bit of real data! However, the interpretation is lacking. No attempt is made to explain the lower ranking for the 8 occurrences where the ranking declined from B to C or D between 1994 to 1998. A cursory look at the data causes one to question whether fire was the reason. Six of the noted sites (Pleasant Valley North, Fivemile Creek, Willow Creek, Flat Draw Reservoir, Post Office Reservoir, and Poison Creek North) apparently burned during the interim, although two of the burns were only patchy (Fivemile Creek and Willow Creek). Two of the sites (Post Office Reservoir and Poison Creek North) also apparently underwent rehabilitation that undoubtedly included drill seeding. The remaining two sites where the rating declined (Woods Gulch-040 and Mountain Home SE) did not burn during the interim, but no rationale is presented to explain the decline in the absence of burning. Notably, two additional sites with B-ratings during 1994 (Kuna Butte SW and Woods Gulch-052) burned during the interim, but their ratings did not decline. One cannot conclude from this data, that fire is a factor in the lower condition ratings.

The two occurrences for which an explanation is provided (Initial Point and Kuna Butte) declined from an A-rating to a D-rating and a C-rating, respectively. The most plausible reason in both cases was the post-fire rehabilitation that undoubtedly included drill seeding (see comments for Paragraph 11 in the Background section).

Paragraph 3. The paper by Belnap et al. (1999) deals with biological soil crusts, not "inorganic crusts", hence the conjecture that livestock impacts are magnified by nonnative plant invasions and altered fire regimes becomes illogical.

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Paragraph 4. I agree that livestock trampling is probably a major disturbance to *Lepidium papilliferum*. However, the data presented do not build the argument. That Mancuso (2001) found significant livestock disturbance on slickspots does not necessarily translate to a loss of *Lepidium papilliferum* or its habitat. That livestock compact the soil and damage vegetation is unquestionable, but, again, that does not translate to a loss of *Lepidium papilliferum* or its habitat. The use of the Belnap et al. (1999) reference is again improper; it is entirely unrelated to the issue.

Paragraph 5. Yes, livestock trampling has been quantitatively and qualitatively linked to the invasion of nonnative annual species in some ecosystems. But there appears to a complete absence of evidence for slickspots. And the fact that nonnative annual species may be present in slickspots has not been shown to affect *Lepidium papilliferum*.

Paragraph 6. The conjecture that livestock add organic debris to slickspots has not been shown. Mancuso (2001) combined livestock hoofprints with dungpats as "livestock sign." Hence it is impossible to make the conclusion that livestock have increase organic debris on the slickspots. On the whole livestock do NOT increase organic debris; they merely redistribute it in the form of feces. The conjecture that the invasion of nonnative species leads to the loss of habitat for *Lepidium papilliferum* is not substantiated.

Paragraph 7. Finally, some logic regarding livestock. Yes, indeed, livestock will trample *Lepidium papilliferum* (not intentionally, of course). As the stocking rate increases, the chances for damage by trampling will increase. That livestock compact the soil and increase the likelihood of invasion by nonnative plants is understood. But whether such factors actually affect *Lepidium papilliferum* is unknown.

Paragraph 8. This is an admission that the extent of the *Lepidium papilliferum* population is unknown.

Paragraph 9. No comment.

Paragraph 10. Kudos to the Air Force for completing an Integrated Natural Resource Management Plan.

Paragraph 11. Kudos removed! Grazing may reduce the biomass of perennials, but as been abundantly shown by years of data, the grazing will increase the fine fuel load of nonnative annual grasses that readily invade areas disturbed by grazing.

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Paragraph 12. False! Wildfire has NOT been shown to be a significant threat to *Lepidium papilliferum* in this document or any other. It has been conjectured, but not proven. There is evidence that wildfire may even enhance the *Lepidium papilliferum* population (see Popovich 2001).

Paragraph 13. The presentation of data is biased. Scholten and Bunting (2001) showed that there were long-term impacts on the density of *Lepidium papilliferum* but an MS Thesis by Scholten showed that there were no statistically significant short-term impacts. Nonetheless, it can be concluded, based on quantitative data, that post-fire rehabilitation that includes drill seeding can be detrimental to *Lepidium papilliferum*.

Paragraph 14. No comment.

Paragraph 15. Was it the *Agropyron cristatum* or the method of planting the seed?

Paragraph 16. Yes, the data are generally conclusive that OUST negatively affects *Lepidium papilliferum*.

Paragraphs 17-25. No comment.

B. Overutilization for Commercial, Recreational, Scientific or Educational Purposes
-No comment

C. Disease or Predation
- No comment

D. Inadequacy of Existing Regulatory Mechanisms
- No comment

E. Other Natural or Manmade Factors Affecting Its Continued Existence

Paragraph 1. There is no compelling evidence to suggest that *Lepidium papilliferum* has not always persisted in fragmented habitat. Indeed, its apparent dependence on slickspot habitat that is high discontinuous indicates that habitat fragmentation is not an issue relative to its continued existence. The apparent loss of

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habitat from agriculture, urbanization, mining, etc. is a much greater threat.

Attachment 9 (Continued). Warren Comments

Paragraph 2. The risks from grazing, trampling, military training, competition from nonnative vegetation, and habitat degradation from frequent fires are overstated given the lack of quantitative evidence to support the claims. Risks from herbicide use, and urban and agricultural development are real.

Paragraph 3. No comment.

Critical Habitat

It seems intuitive that slickspots are the critical habitat. To fail to identify slickspots as the critical habitat may lead to unnecessary protection measures in habitat that is obviously not critical to the survival of the species.

Available Conservation Measures

- No comment

SUMMARY COMMENTS

The first reasonable step prior to proceeding with the listing of *Lepidium papilliferum* should be to perform the necessary genetic work to confirm that it is, indeed, a unique species and not merely a plastic phenotype of *Lepidium montanum* that occupies slickspots. What a tragedy and embarrassment it would be to spend thousands of dollars to get the species listed only to discover that it is not really a species at all.

Lepidium papilliferum, if it really is a species, MAY be endangered. However, based on the data presented herein, the number of actual *Lepidium papilliferum* subpopulations undoubtedly far exceeds that which is reported in the listing document. It appears obvious that slickspots are critical habitat for *Lepidium papilliferum*. Slickspots should be visible in high resolution aerial photographs. Existing imagery software programs can be 'trained' to identify likely slickspot habitats that could easily be sampled in the field. I strongly suggest that a more comprehensive survey be conducted to learn the true distribution and extent of *Lepidium papilliferum* prior to proceeding with its listing as an endangered species.

Known factors that endanger *Lepidium papilliferum* are agricultural and urban development, herbicides, and post-fire rehabilitation that includes soil-disturbing practices such as drill seeding. Other factors suggested by the listing document to negatively affect the survival of *Lepidium papilliferum* are unproven by existing data.

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That fire, grazing, or invasion by nonnative plant species negatively affect *Lepidium papilliferum* is supported only by opinion and conjecture. All three factors may negatively affect *Lepidium papilliferum*, but the existing evidence neither proves or

Attachment 9 (Continued). Warren Comments
disproves that opinion. I strongly suggest the acquisition of definitive supporting data prior to the listing of *Lepidium papilliferum* as an endangered species.

Ample scientific evidence indicates that livestock grazing has had a widespread devastating impact on the ecology and biodiversity of the sagebrush steppe ecosystem. If it can be conclusively demonstrated that livestock grazing along with subsequent nonnative plant invasion and wildfire have a significant impact on *Lepidium papilliferum*, the first logical step in conserving *Lepidium papilliferum* as well as numerous other species and the integrity of the sagebrush ecosystem as a whole should be the removal of livestock. Livestock cause a relatively uniform and repetitive disturbance to an ecosystem that evolved under generally light, non-uniform disturbance by native ungulates. As noted in the listing document and elsewhere, disturbance by livestock grazing has been the primary factor in the spread of cheatgrass and other noxious plants in the sagebrush steppe ecosystem. As cheatgrass becomes established, the frequency and uniformity of wildfires increases with devastating effect to native flora. Hence, the removal of livestock would be a significant step toward eliminating the ills of trampling disturbance, nonnative plant invasion and wildfire.

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[Federal Register: July 15, 2002 (Volume 67, Number 135)]
[Proposed Rules]
[Page 46441-46450]
From the Federal Register Online via GPO Access [wais.access.gpo.gov]
[DOCID:fr15jy02-26]

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

RIN 1018-A150

**Endangered and Threatened Wildlife and Plants; Listing the Plant
Lepidium papilliferum (slickspot peppergrass) as Endangered**

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule and notice of public hearing.

Pg 5. Grazing helps limit the growth of the intermediate wheatgrass into the slickspots.

Another problem has been the use of nonnative perennial species, such as *Agropyron cristatum* and *A. intermedium* (intermediate wheatgrass), to restore or rehabilitate shrub-steppe habitat after a fire event. Although some *Lepidium papilliferum* may temporarily persist in spite of these restoration seedings, most occurrences support small numbers of plants (fewer than five per slickspot) and long-term persistence data are unavailable (Mancuso and Moseley 1998). Habitat degradation, fragmentation, and loss of sagebrush-steppe vegetation have occurred throughout the range of *L. papilliferum*. Popovich (2001) found in his surveys for *L. papilliferum* in the Inside Desert area on BLM land in 2000 that, generally, slickspots dominated by nonnative vegetation had fewer *L. papilliferum* plants than slickspot sites with greater native vegetation retention.

Pg 7. Need to explain how does grazing effect peppergrass? Also, what are the

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weedy annual plants mentioned at the end of paragraph?

A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

Attachment 10. Palazzo Comments

Most sagebrush-steppe habitat that has not been converted to cropland in southwestern Idaho has been degraded by wildfire, livestock grazing and trampling, the invasion of nonnative plant species, and off-road vehicle use; these factors continue to threaten all remaining habitat for *Lepidium papilliferum* (Moseley 1994; Mancuso and Moseley 1998; ICDC 1999; Mancuso 2000). The conversion of the original sagebrush-steppe to annual grasslands has reduced suitable remaining habitat for, and destroyed some, *L. papilliferum*, in addition to fragmenting and isolating extant occurrences (Moseley 1994). Subsequent increased frequency of fire, and the associated invasion of weedy annual plants, are serious range-wide threats to the long-term integrity of *L. papilliferum* habitat and population viability (M. Mancuso, in litt., 1998).

Why will lower quality occurrences not exist in the future when the germination is not annually stable? On the recent wildfires sentence...how many fires? Enough to make a decision? Grazing can control non-natives. Non-natives already exist on this land. Grazing helps to control them. Since they are there how do you deal with the situation of stopping fire and grazing and having the non-natives grow for several years unchecked?

To illustrate the pattern of ongoing habitat degradation for this species, in 1994, 12 *Lepidium papilliferum* occurrences were given a "B" rank (Moseley 1994). By 1998, eight of these occurrences (67 percent) had declined in quality to either a "C" or "D" rank due to the effects of habitat degradation and fragmentation (M. Mancuso, in litt., 1998). Lower quality (i.e., C- and D-ranked) occurrences are not likely to persist in the future. Examples of decline in habitat quality include two *L. papilliferum* occurrences near Kuna Butte on BLM lands. *Lepidium papilliferum* habitat at one site south of Kuna (Initial Point) that received an A-rank in 1994 had declined to a D-rank by 1998. Recent wildfires in the area destroyed the original sagebrush vegetation which has now been largely replaced by nonnative species. Mechanical fire rehabilitation efforts also adversely affected the slickspots; less than 0.04 ha (0.1 ac) of occupied habitat now exists at this site (M. Mancuso, in litt., 1998; ICDC 1999). Another *L. papilliferum* occurrence south of Kuna (Kuna Butte) declined from an A-rank in 1994 to a C-ranking in 1998 due to habitat degradation from fire, post-fire rehabilitation efforts, and the invasion of nonnative species which now dominate the vegetation; occupied *L. papilliferum* habitat at this occurrence is also restricted to less than 0.04 ha (0.1 ac) (ICDC 1999). Both occurrences are now considered to have poor habitat quality.

Pg 7. Last sentence. So what the livestock is attracted...will the peppergrass be harmed.

Livestock effects on unique habitats such as slickspots are magnified in areas

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where nonnative plant invasions and altered fire regimes occur. Arid soils with inorganic crusting are more susceptible to impacts when soils are wet (Belnap et al. 1999). Slickspots are characterized by a near-surface distribution of soluble sodium salts, thin vesicular (small cavity) surface crusts, and shallow well-developed argillic (relating to

Attachment 10 (continued). Palazzo Comments
 clay mineral) horizons (Fisher et al. 1996). Slickspots often contain some surface water in the winter, spring, and after thundershowers (Fisher et al. 1996; James Klott, BLM, pers. comm., 2000). Water that is present for more than a day often will attract livestock to slickspots (J. Klott, pers. comm., 2000).

Pg 7. I do not understand how some cattle trampling can increase soil loss and water runoff? The cattle have been grazing their for years and the plant is still there. Last sentence...a majority of the peppergrass occurrences had evidence of livestock grazing...so the types of damage needs to be defined?

Pg 8. Just because the non-native plant is there does not mean the livestock brought it in?

Livestock trampling of slickspots is one of the main disturbances to slickspot microsites (Mancuso 2001), especially in the spring (approximately April through June) when the soils are moist. Trampling by livestock can physically damage the vegetation that exists there and compact the soil, which greatly accelerates desertification processes (becoming more like a desert) through increased soil loss and water runoff (Moseley 1994; D. Quinney and Jay Weaver, Idaho Army National Guard (IDARNG), pers. comm., 1998; J. Klott, pers. comm., 2000; Popovich 2001). This can also lead to the loss of slickspot integrity, particularly from winter through spring when standing water remains for a longer period of time after a rainfall (Belnap et al. 1999; BLM et al. in litt., 1999; Air Force 2000). A majority (78 percent) of *Lepidium papilliferum* occurrences had evidence of livestock trampling and grazing in a study conducted by Mancuso (2000) that monitored 40 extant sites.

Pg 8. The slickspots have some debris since the water flows into them carrying dead plant material. Not all excess water is contained. Some leaves through the lower side of the slickspot.

Livestock trampling of slickspots can also lead to the invasion or increase of nonnative annual species such as *Bromus tectorum*, *Sisymbrium altissimum*, *Ranunculus testiculatus*, and *Lepidium perfoliatum* into shrub-steppe habitats through transport of the seeds of these species by animals in their feces or hides (Ellison 1960; Pyke 1999). The majority of the 40 extant *Lepidium papilliferum* occurrences being monitored (92 percent of the 40) had invasive annual grasses that either dominated or co-dominated the herbaceous vegetation (Mancuso 2000).

Pg 16. Maybe halting grazing will hurt the habitat?

The primary regulatory effect of critical habitat is the section 7 requirement that

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Federal agencies refrain from taking any action that destroys or adversely modifies critical habitat. While a critical habitat designation for habitat currently occupied by this species would not be likely to change the section 7 consultation outcome because an action that destroys or adversely modifies such critical habitat would also be likely to

Attachment 10 (continued). Palazzo Comments
result in jeopardy to the species, there may be instances where section 7 consultation would be triggered only if critical habitat is designated. Examples could include unoccupied habitat or occupied habitat that may become unoccupied in the future. Designating critical habitat may also produce some educational or informational benefits. Therefore, designation of critical habitat for *Lepidium papilliferum* is prudent.

Pg 16. You will concentrate resources to do what?

However, our budget for listing activities is currently insufficient to allow us to immediately complete all the listing actions required by the Act. Listing *Lepidium papilliferum* without designation of critical habitat will allow us to concentrate our limited resources on higher priority listing actions, while allowing us to put in place protections needed for the conservation of this species without further delay. This is consistent with section 4(b)(6)(C)(i) of the Act, which states that final listing decisions may be issued without critical habitat designations when it is essential that such determinations be promptly published. The legislative history of the 1982 Act amendments also emphasized this point: "The Committee feels strongly, however, that, where biology relating to the status of the species is clear, it should not be denied the protection of the Act because of the inability of the Secretary to complete the work necessary to designate critical habitat. * * * The committee expects the agencies to make the strongest attempt possible to determine critical habitat within the time period designated for listing, but stresses that the listing of species is not to be delayed in any instance past the time period allocated for such listing if the biological data is clear but the habitat designation process is not complete" (H.R. Rep. No. 97-567 at 20 (1982)). We will prepare a critical habitat designation in the future when our available resources and priorities allow.

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