

**REPORT ON THE CONSERVATION STATUS OF
*LEPIDIUM DAVISII***

by

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*LEPIDIUM DAVISII***

Taxon Name: *Lepidium davisii* Rollins

Common Name: Davis' peppergrass

Family: Brassicaceae

States Where Taxon Occurs: U.S.A.; Idaho, Oregon, Nevada

Current Federal Status: Category 2 Candidate

Recommended Federal Status: Category 1 Candidate

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SUMMARY

Lepidium davisii (Davis' peppergrass) is a regional endemic, known to be extant at 293 sites, and extirpated from at least two others. The populations are scattered throughout an area of southwestern and south-central Idaho, north-central Nevada, and southeastern Oregon that is approximately 180 miles long by 90 miles wide. Within this area, populations occur in six distinct clusters or distribution centers: Mountain Home Desert (Idaho), Bruneau Desert (Idaho), Salmon Falls Creek (Idaho), South Fork Owyhee River (Idaho, Oregon, Nevada), Alvord Desert (Oregon), and Barren Valley (Oregon). Its habitat is a unique wetland community; a vernal lake or playa, that can be filled with water in the spring and dry as hard as concrete in the summer. *Lepidium davisii* populations in the Mountain Home Desert distribution center show a decline and are the most vulnerable to extirpation. The overall cause of the decline is the poor ecological condition of the sagebrush-steppe ecosystem on the western Snake River Plain. There is no reversal in this trend seen in the near future. Populations in the other five distribution centers appear stable.

Due to the documented extirpation and declines in populations and habitat on the Mountain Home Desert, I recommend that *L. davisii* be changed from a category 2 to a category 1 candidate. While it is apparently stable and more or less secure in five of the six distribution centers, one entire disjunct segment of its distribution is in jeopardy. Preliminary evidence indicates that there may be genetic differentiation between populations and distribution centers, and the fact that the Mountain Home Desert populations occupy the elevational and aridity extremes for the species as a whole, makes these populations an important evolutionary unit whose conservation must be addressed. The Idaho Department of Parks and Recreation should pursue a Conservation Agreement with the Lower Snake River District BLM, Idaho Army National Guard, Idaho Department of Lands, and Mountain Home Air Force Base to maintain viable populations of *L. davisii* on the Mountain Home Desert.

Detailed discussions on the taxonomy, distribution, abundance, habitat requirements, conservation status, and recommendations to federal and state agencies are included in this report.

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I. Species Information.

1. Classification and nomenclature.

A. Species.

1. Scientific name.

a. Binomial: *Lepidium davisii* Rollins

b. Full bibliographic citation: Rollins, R.C. 1948. On two perennial caespitose *Lepidium*s of western North America. Madrono 9:162-165.

c. Type specimen: Idaho. Elmore Co: in dried-up pond of lava plain, 0.5 mile north of Snake River canyon, about 14 miles south of Mountain Home, *Davis 4670* (DS). [Site is actually on the rim of the canyon, along an old portion of State Highway 51, near the grade down into the canyon; T5S R6E S17, SE4; CDC occurrence # 028.]

2. Pertinent synonym(s): *Lepidium montanum* Nutt. ssp. *davisii* (Rollins) C.L. Hitchcock.

3. Common name(s): Davis' peppergrass, Davis pepper cress.

4. Taxon codes: PDBRA1M080 (Natural Heritage and Conservation Data Center Network and The Nature Conservancy).

5. Size of genus: More or less 175 species worldwide (Rollins 1993).

B. Family classification.

1. Family name: Brassicaceae

2. Pertinent family synonyms: Cruciferae

3. Common name(s) for family: Mustard

C. Major plant group: Dicotyledonea

D. History of knowledge of taxon: The only vernal lake (hereafter referred to as a playa) containing *Lepidium davisii* that was near a major road was along Idaho state Highway 51 near the edge of the Snake River Canyon, approximately 14 miles south of Mountain Home. All early collections of *L. davisii* were collected from this site, including John Christ in 1940, Ripley and Barneby in 1945 (Hitchcock 1950), Ray Davis in 1945, 1946, and 1947 (Rollins 1948), John Christ again in 1950, C. Leo Hitchcock in 1964, and possibly others. This portion of the highway was subsequently moved when the grade down into the canyon was reconstructed sometime during the last couple of decades. The new route no longer skirts the playa. Rollins (1948) described the species using the 1946 (fruiting) and 1947 (flowering) collections of Davis and for many years this was the only known population (*i.e.*, Davis 1952). This population corresponds

to the Idaho Conservation Data Center (CDC) occurrence number 028 (Appendix 1).

It wasn't until nearly a decade later that additional specimens of *L. davisii*, from Elmore and Owyhee counties, Idaho, and Malheur County, Oregon, were collected by Brown, Smithman, Packard, Grimes, and others. Many playas were found to support *L. davisii* in Idaho during the late 1970's, 1980's, and early 1990's, as a result of exploration and surveys by botanists associated with Albertson College, Idaho and Oregon BLM offices, CDC, and Science Applications International Corporation. During 1995, the CDC and Lower Snake River District BLM launched a massive, systematic, and thorough survey of all playas in southwestern Idaho, using ground, helicopter, and fixed-wing aerial surveys. Our knowledge of the distribution and abundance of *L. davisii* in Idaho is now largely complete. The Tent Creek drainage in extreme southeastern Oregon, and the South Fork Owyhee River drainage in northwestern Elko County, Nevada, remain to be surveyed.

E. Comments on current alternative taxonomic treatment(s): None, although it has been suggested that there is morphological variation within the species that may deserve recognition as infraspecific taxa (*e.g.*, Packard *et al.* 1979; Meinke 1982). Preliminary genetic studies by Yruegas (1991) detected differences in DNA between the Idaho and Oregon plants, but were unable to determine whether this was due to actual genomic DNA differences or differences in the phase of the cell cycle. More specific genetic probes are needed to elucidate this further.

2. Present legal or other formal status

A. International: None.

B. National.

1. Present designation of proposed legal protection or regulation: *Lepidium davisii* is currently recognized as a category 2 candidate for listing under the Endangered Species Act (U.S. Fish and Wildlife Service 1993).

2. Other current formal status recommendation: The Natural Heritage and Conservation Data Center network and The Nature Conservancy rank *Lepidium davisii* G3, a rank that includes taxa that are rare and uncommon but not imperiled (Conservation Data Center 1994).

The Idaho and Oregon BLM both treat *Lepidium davisii* as a Sensitive or Special Status species.

3. Review of past status: *Lepidium davisii* was on the original Smithsonian list as Endangered (Packard 1977) and later treated as a category 1 candidate (U.S. Fish and Wildlife Service 1980). Later, it was treated as a category 2 candidate (U.S. Fish and Wildlife Service 1983a; 1985; 1990).

In her review of the taxon for the Rare and Endangered Plants Technical Committee of the Idaho Natural Areas Council, Pat Packard (1981) recommended federal Threatened status, due to its limited distribution, disturbed habitat, and small number of plants.

C. State.

1. Idaho.

a. Present designation or proposed legal protection or regulation: None.

b. Other current formal status recommendation: The Conservation Data Center state rank (S) equals the global (G) rank (see above; Conservation Data Center 1994).

The Idaho Native Plant Society concurs with the federal C2 status and does not place federal candidates or listed taxa in any state category (Idaho Native Plant Society 1995).

c. Review of past status: None.

2. Oregon.

a. Present designation or proposed legal protection or regulation: *Lepidium davisii* was listed as Threatened in Oregon by the Oregon Department of Agriculture on July 12, 1995.

b. Other current formal status recommendation: *Lepidium davisii* is on List 1 in Oregon, which contains those taxa which are endangered or threatened throughout their range (Oregon Natural Heritage Program 1993).

c. Review of past status: Siddall *et al.* (1979) considered it very rare and endangered in Oregon.

3. Nevada.

a. Present designation or proposed legal protection or regulation: None.

b. Other current formal status recommendation: None. *Lepidium davisii* was only recently discovered in Nevada, in July 1995.

c. Review of past status: None.

3. Description.

A. General nontechnical description: A member of the mustard family, *Lepidium davisii* is a caespitose, deep-rooted perennial forming irregular or regular clumps; stems slender, mostly unbranched or sometimes branched, 4-8 cm tall, pubescent with small, simple hairs; leaves simple, sessile, entire to toothed or pinnately lobed, greenish but often gray with adhering clay, sparingly pubescent to glabrous, 1-2.5 cm long; inflorescence subcorymbose; petals white, 2-3 mm long; siliques crowded, glabrous to sparingly pubescent, slightly notched at apex, 3-5 mm long; style slightly longer than the notch (from Packard 1978; 1979; Meinke 1982).

B. Technical Description: Caespitose, deep-rooted perennial forming clumps; roots thick and

fleshy, 0.5-2 cm across, expanding at summit and divided into numerous caudex branches; caudex corymbose, the apex of the branches partially invested in old-leaf bases; stems slender, numerous, each terminated by an inflorescence, simple or rarely branched, leafy, 4-8 cm high, densely pubescent with minute whitish simple trichomes; leaves sessile, basal and cauline similar, spatulate, obtuse, greenish, sparsely pubescent, much-exceeding the internodes, 1-2.5 cm long, 2-5 mm wide; inflorescence subcorymbose, slightly elongated; sepals broadly oblong, not persistent, greenish with a broad hyaline margin, ca. 1.5 mm long and 1 mm wide, glabrous to very sparsely pubescent near the base; petals white, spatulate, 2-3 mm long, ca. 1 mm wide above; paired stamens only slightly longer than single stamens; infructescence subcorymbose; pedicels divaricate, pubescent, terete, 3-4 mm long; siliques crowded, ovate, glabrous to sparsely pubescent, slightly winged above, flattened contrary to replum, slightly notched at apex, 3-3.5 mm long, 2-2.5 mm wide; styles ca. 0.5 mm long; seeds wingless, one in each locule; cotyledons accumbent (Rollins 1948).

C. Local field characters: Perennial cruciferous plant growing on hard clay bottom playas with no (or a few) associated plants. Differs from *Lepidium papilliferum*, sometimes found in nearby habitats, in having simple leaves (Packard 1979).

D. Identifying characteristics of material which is in interstate or international commerce or trade: No interstate or international trade is known. See above section for differences with a related species.

E. Photographs and/or line drawings: The only line drawing known to me is by Frank Lang, published in Meinke (1982) and reproduced in DeBolt and Rosentreter (1988) and DeBolt (1989). The only published photograph I know of is on a beautiful color poster produced by the State of Idaho, Army National Guard. Other photos occur in slide collections of the Conservation Data Center, Idaho Army National Guard, Lower Snake River District BLM, Idaho, Vale and Burns BLM districts in Oregon, and probably others.

4. Significance.

A. Natural: None known.

B. Human: None known.

5. Geographical distribution.

A. Geographical range: A total of 293 *Lepidium davisii* populations are known to be extant. They are scattered throughout an area of southwestern and south-central Idaho, north-central Nevada, and southeastern Oregon that is approximately 180 miles long (east-west) by 90 miles wide (north-south) (Figure 1). Within this range, populations occur in six distinct clusters or distribution centers, as follows:

Figure 1. Distribution of *Lepidium davisii*.

(1) *Mountain Home Desert* - *L. davisii* occupies playas on the western Snake River Plain between Mountain Home and the Snake River, in Elmore and Ada counties, Idaho. Fifty-four playas are known to be occupied over a 200 square mile area of the plain (approximately 25 miles long by 8 miles wide). One population is known to have been extirpated, as have possibly three others. Elevations of occupied playas on the Mountain Home Desert range from 2920 to 3160 feet. This portion of its range has been thoroughly inventoried.

(2) *Bruneau Desert* - 152 playas are occupied by *L. davisii* on the volcanic plain of the Owyhee Plateau dissected by the Bruneau River and two of its major tributaries, Sheep Creek and the Jarbidge River, Owyhee County, Idaho. One population is known to have been extirpated. This portion of its range encompasses approximately 670 square miles of the plateau (32 miles long by 21 miles wide) and lies 26 miles south of the area occupied by *L. davisii* on the Mountain Home Desert. Elevations of occupied playas on the Bruneau Desert range from 4010 to 5430 feet. Like the Mountain Home Desert, this portion of its range has been thoroughly inventoried.

(3) *Salmon Falls Creek* - *L. davisii* occupies 17 playas scattered over 20 miles along the eastern rim of Salmon Falls Creek canyon in Twin Falls County, between Twin Falls, Idaho, and Jackpot, Nevada. This area lies 42 miles east of the Bruneau Desert portion of its range. Playas range from 4200 to 5120 feet. Playas in this portion of its range have also been thoroughly inventoried.

(4) *South Fork Owyhee River* - Prior to 1993, no *L. davisii* was known from this remote portion of the Owyhee Plateau. Currently, 60 playas are known to be occupied in this corner of Idaho and adjacent portions of Nevada and Oregon. This portion of its range encompasses at least 350 square miles (approximately 27 miles long by 13 miles wide). The Idaho portion of this area has been thoroughly inventoried, but no systematic inventories have been conducted in Nevada or Oregon. During August 1995, I discovered two playas in Malheur County, Oregon, containing *L. davisii* along the road between Star Valley, Idaho, and McDermitt, Nevada (Appendix 4). These are the first observations from this part of Oregon, and during an aerial reconnaissance in July 1995, I observed others playa in the area that appeared to be suitable habitat. I also discovered the first Nevada population during an aerial reconnaissance in July 1995, two miles south of the Idaho border (Appendix 5). Many other suitable-appearing playas occur in this area of Nevada. This distribution center lies 45 miles WSW of the Bruneau Desert portion of its distribution. Elevations of the playas range from 5140 to 5332 feet.

(5) *Alvord Desert* - Five playas are occupied by *L. davisii* in this portion of southern Malheur County, Oregon. These populations lie approximately 50 miles northwest of the South Fork Owyhee River portion of its range. The area has been thoroughly inventoried (U.S. Fish and Wildlife Service 1994). Playas range in elevation from 4180 to 4460 feet.

(6) *Barren Valley* - Five playas are occupied in this portion of its range in central Malheur County, Oregon. These populations are disjunct by approximately 20 miles to the north of the Alvord Desert area. Playas in the vicinity of this distribution center have also been thoroughly surveyed (U.S. Fish and Wildlife Service 1994). Elevations range from 4125 to 4135 feet.

B. Precise occurrences in Idaho.

1. Populations currently or recently known extant: 280 playas are known to support *Lepidium davisii* in Idaho, based on comprehensive 1995 surveys by the BLM and CDC. That's 53% *L. davisii* occupancy of the 530 playas checked in the state (Appendices 2 and 3). The Conservation Data Center data base contains 167 occurrence records for *L. davisii* in Idaho, in some cases lumping two or more neighboring playas into a single occurrence for convenience. Occurrence records for the Idaho occurrences appear in Appendix 1, each one being identified by a three digit code (i.e., 005, 009). Among other things, each record contains information on the county of occurrence, site name, narrative of the location, date of initial discovery, date of most recent observation, pertinent USGS quads, township, range and section, and latitude and longitude. Mapped locations of all the occurrences are on file at the CDC and Lower Snake River District BLM offices, on both USGS 7.5' (1:24,000) quadrangles and Idaho Transportation Department 1:100,000-scale maps.

Following is a breakdown of occurrences by distribution center:

(1) *Mountain Home Desert*: 022-026, 028-029, 033-037, 039, 042-062, 064, 084-085, 087, 089, 106, 125-126, 153.

(2) *Bruneau Desert*: 001-018, 031-032, 038, 040-041, 063, 065-083, 086, 088, 093-094, 107-124, 127-140, 154-167.

(3) *Salmon Falls Creek*: 019-020, 095, 141.

(4) *South Fork Owyhee River*: 021, 027, 030, 090-092, 096-105, 142-152.

2. Populations known or assumed extirpated: At least two, and possibly five populations are known to be extirpated. Four occur on the Mountain Home Desert (occurrence 029 and possibly three of the four playas that comprise occurrence 049) and one on the Bruneau Desert (occurrence 003). Grazing by cattle and halogeton have been implicated in the extirpation of 029 and 003.

3. Historically known populations where current status not known: None.

4. Locations not yet investigated believed likely to support additional natural populations: A comprehensive inventory was conducted in Idaho by the CDC and Lower Snake River District BLM in 1995. The 61 playas that remain to be checked are listed in Appendices 2 and 3.

5. Reports having ambiguous or incomplete locality information: Two herbarium specimens have insufficient location information to precisely map the locations, as follows:

Elmore Co: playa just off Black Sands Road south of Mountain Home, *Grimes, Packard, Smithman, Smithman 1312* (CIC) June 15, 1978 (Packard 1978). [Packard *et al.* (1979) lists the collection as *Packard, Grimes, Smithman, Smithman.*]

Owyhee Co: T13S R46E *Brown 135* (CIC) June 21, 1974 (Packard 1978; 1979; Packard

et al. 1979; Rosentreter 1983). [Could be either R4E or R3E; there is no R46E in Idaho.]

Population represented by these collections have probably been accounted for in the recent, comprehensive surveys that have taken place.

6. Locations known or suspected to be erroneous reports: Packard (1978; 1979) speculated that *Lepidium davisii* may have occurred at Dry Lake, Canyon County, a playa that has been totally converted to agricultural uses. There is no evidence to suggest it ever occurred there, and we now know that there are many undisturbed playas in southwestern Idaho that do not have the species.

DeBolt and Doremus (1990) list four sites on the Mountain Home Desert as having *L. davisii* populations, but for which no other supporting evidence of their existence can be found. The legal locations are as follows: T2S R2E S11, T4S R6E S9, T4S R5E S6, and T4S R5E S18. I consider these to be erroneous reports.

C. Precise occurrences in Oregon.

1. Populations currently or recently known extant: Twelve playas are known to support *Lepidium davisii* in Oregon. The Oregon Natural Heritage Program data base contains nine occurrence records for *L. davisii*, in one case lumping two neighboring playas into a single occurrence 006. Occurrence records for the Oregon occurrences appear in Appendix 4, each one being identified by a three digit code. Among other things, each record contains information on the county of occurrence, site name, narrative of the location, date of initial discovery, date of most recent observation, pertinent USGS quads, township, range and section, and latitude and longitude. The August 1995 occurrences I discovered near the Idaho border have not been processed by the Heritage Program yet, but are shown on a map in Appendix 4. Mapped locations of all occurrences are on file at the Heritage Program and the Burns and Vale BLM offices.

The Oregon occurrences, listed by distribution center, are as follows:

- (1) *Barren Valley*: 002, 006 (2 playas), 007, 008.
- (2) *Alvord Valley*: 001, 003, 004, 005, 009.
- (3) *South Fork Owyhee River*

Tent Creek drainage, between Tent Creek and Star Valley Knoll, 1.5 miles west of Idaho border, ca. 5 miles west of Star Valley, Idaho. Elevation 5332. Vale District BLM land. Star Valley Knoll quadrangle. Discovered August 12, 1995.

Small playa along road between Star Valley, Idaho, and McDermitt, Nevada, Tent Creek drainage, ca. 6.5 miles west of the Idaho border. Vale District BLM land. Lookout Butte quad? Discovered August 13, 1995.

2. Populations known or assumed extirpated: None.

3. Historically known populations where current status not known: None.

4. Locations not yet investigated believed likely to support additional natural populations: Prior to 1995, no populations of *L. davisii* were known from the South Fork Owyhee River (Tent Creek) drainage of Oregon. During an aerial reconnaissance of the area in July 1995, I observed several suitable-appearing playas within a four mile wide strip of Malheur County adjacent to Idaho and south of the East Fork (Main) Owyhee River canyon. The populations I discovered in August 1995 were along the road and within a few miles of the Idaho border. Also, two nearby Idaho populations are within a few feet of the Oregon border. I believe other populations will be discovered in this portion of Malheur County.

Surveys of playas in the Alvord Desert and Barren Valley distribution centers are complete (U.S. Fish and Wildlife Service 1994).

5. Reports having ambiguous or incomplete locality information: None.

6. Locations known or suspected to be erroneous reports: Harney County is occasionally mentioned as having *Lepidium davisii* populations, but this appears to be an error.

D. Precise occurrences in Nevada.

1. Populations currently or recently known extant: *Lepidium davisii* was recently discovered to occur in Nevada. I observed one large playa that supported *L. davisii* during an aerial reconnaissance of the South Fork Owyhee River drainage in 1995. The precise occurrence is as follows:

Elko County: between Calico Creek and (west of) the Little Owyhee River, south of Willow Creek. Elevation 5125'. Elko District BLM land. Star Valley Ridge West quadrangle. Discovered July 1995.

2. Populations known or assumed extirpated: None.

3. Historically known populations where current status not known: The BLM held a *Lepidium davisii* coordination meeting in 1992, where it was suggested that "up to three" populations were known from Nevada. Jim Morefield, Botanist for the Nevada Natural Heritage Program, was not aware of any information regarding historical populations in the state. As far as he knew, the site reported above was the first record for the state (personal communication, September 1995).

4. Locations not yet investigated believed likely to support additional natural populations: I discovered only one playa containing *L. davisii*, but I observed many other suitable-appearing playas during an aerial reconnaissance of the Owyhee Plateau in the South Fork and Little Owyhee River drainages, within 10 miles of the Idaho border. Previous to 1993, no populations were known from the South Fork area in Idaho; currently 60 populations are known. Similarly, ground inventories in Nevada will probably discover that many of the playas observed from the air contain *L. davisii* populations.

5. Reports having ambiguous or incomplete locality information: None.

6. Locations known or suspected to be erroneous reports: None.

E. Biogeographical and phylogenetic history: Largely unknown. There was some argument in the past on whether *Lepidium davisii* was more closely related to the taxonomically isolated *L. nanum*, endemic to northern Nevada, or to several of the perennial infraspecific taxa of the *L. montanum* complex that have entire leaves (Rollins 1948; Hitchcock 1950).

6. General environment and habitat description.

A. Concise statement of general environment: *Lepidium davisii* is restricted to a narrow suite of environmental conditions. It occurs in playas on volcanic plains where the regional vegetation is dominated by *Artemisia tridentata* and, to a lesser extent, *Atriplex confertifolia*. The beds have a hard clay bottom and are commonly referred to as "hard-bottom playas." During springs with average or above precipitation, these playas are inundated with up to a foot of water (although usually only an inch or two). They then dry out during the spring and summer and the lake beds become as hard as a concrete sidewalk. These extreme conditions preclude all but a few other species from growing in the playa. During springs of low precipitation, the playas may have no water in them during the growing season. Elevations of playas occupied by *L. davisii* range from 2950 feet at occurrence 025 on the Mountain Home Desert, to 5430 feet at occurrence 113 on the Bruneau Desert.

B. Physical characteristics.

1. Climate.

a. Koppen climate classification: Populations of *Lepidium davisii* lie in an area classified as Koppen's unit BSk: semiarid climate or steppe climate, with an average annual temperature under 64.4°F (Trewartha and Horn 1980).

b. Regional macroclimate: A general description of the climatic pattern is as follows. The average monthly maximum temperature reaches its highest point during the month of July, a month which also marks the beginning of a pronounced dry season. About 15% of the total annual precipitation falls during the period from July through October. Two periods of peak precipitation occur, one in January and the other in May. The winter precipitation peak is greatest with more than 38% of the mean annual precipitation falling between December and February (Noe 1991).

Mean annual precipitation at Mountain Home, Idaho, which is representative of

populations on the Snake River Plain, is 10.2 inches and the mean annual temperature is 50.6 (Noe 1991). Temperatures are lower and precipitation higher for populations on the Owyhee Uplands and in southeastern Oregon than those on Snake River Plain.

c. Local microclimate: *Lepidium davisii* is a low-growing plant that has no associated species growing with it on the playas. When it is not inundated, and the playa bottom has dried, *L. davisii* plants are exposed to the considerable winds that blow every afternoon during the growing season. Because these playas are internally drained, they do accumulate water, which then perches on the underlying bedrock and doesn't drain into the subsurface. This makes the soils water-logged at times, usually in the winter, spring, and early summer.

2. Air and water quality requirements: Unknown.

3. Physiographic provinces: The entire distribution of *Lepidium davisii* is encompassed by Omernik and Gallant's (1986) Snake River Basin/High Desert Ecoregion. Following Bailey's Ecogeographical classification, nearly all occurrences lie within the Owyhee Uplands Section (342C) of the Intermountain Semi-desert Province (McNab and Avers 1994).

Occurrences of *L. davisii* on the Mountain Home Desert lie within the Mahleur-Boise-King Hill Section of the Columbia-Intermountain Geomorphic Province. Those in the Bruneau Desert, Salmon Falls Creek, and South Fork Owyhee River areas are within the Owyhee Uplands Section of the Columbia-Intermountain Province (Ross and Savage 1967; Wellner and Johnson 1974). Following the Idaho Floristic Regions of Ertter and Moseley (1992), the Mountain Home Desert populations occur in the Mountain Home Unit of the Lower Snake River Plain Division, the Bruneau Desert populations occur in the Bruneau Plateau Unit of the Owyhee Division, and the Salmon Falls Creek and South Fork Owyhee portions of its range lie within the Jarbidge Uplands of the Owyhee Unit. Oregon occurrences all fall in Owyhee Uplands Physiographic Province (Natural Heritage Advisory Council to the State Land Board 1988).

4. Physiographic and topographic characteristics: All populations occur on flat playa beds on flat to gently rolling volcanic plains. Relief is minimal in the vicinity of occupied playas, although occasionally the volcanic plain is abruptly dissected by very steep canyons. Elevation of occupied playas range from 2920 to 5430 feet.

5. Edaphic factors: *Lepidium davisii* occurs in playa bottoms that usually have saturated soils or are totally inundated during the winter, spring and possibly early summer. As the playas dry, the clay soil shrinks and forms polygonal cracks. The individual polygons are either bordered by clay (*i.e.*, are one consistency) or are bordered by cobbles that have been differentially sorted by shrinking and swelling of the clay and/or by freeze-thaw sorting. This arrangement forms polygonal stone nets on the playa bottom. The *L. davisii* plants grow in the cracks between the polygons. As Packard (1978; 1979) pointed out, playas occupied by *L. davisii* do not show deposits of loose white "alkali." Soil of occupied playas that have been measured have a circumneutral pH.

Studies have failed to isolate the edaphic variable(s) responsible for determining why certain

playas are occupied by *L. davisii* and near-by, apparently similar playas are not (Yruegas 1990; 1991). These results may point to dispersal as the limiting mechanism responsible for the current distribution.

6. Dependence of this taxon on natural disturbance: This species is not dependent on large-scale natural disturbances, such as fire. It appears, however, to require smaller-scale disturbance to the soil caused by shrink-swell and/or freeze-thaw cycles that cause cracks in the playa bottom necessary for seedling establishment. The 1995 season was an excellent year for seedlings due to a moist spring and all the seedlings I observed occurred in the cracks between polygons.

7. Other unusual physical features: In the cosmic scheme of things, all the physical characteristics of *L. davisii* habitat are unusual.

C. Biological characteristics.

1. Vegetation physiognomy and community structure: The physiognomy and structure of communities occupied by *L. davisii* are extremely simple; in most cases, *L. davisii* is the sole native member of the community, vascular and nonvascular. Most of the habitat is covered with bare soil or cobbles. Occasionally the playas contain low to relatively high-density populations of the shrub *Atriplex confertifolia*. A couple of other native species occur with *L. davisii* on rare occasions.

2. Regional vegetation type: The regional vegetation surrounding playas occupied by *Lepidium davisii* is mostly dominated by *Artemisia tridentata* ssp. *wyomingensis* and, to a lesser extent, by *Atriplex confertifolia* at the lower elevations. For some reason, possibly related to development of playas on differing types of volcanic substrates, no *L. davisii* populations (and few playas) are known from within the extensive areas of low sagebrush (*Artemisia arbuscula* and *A. longiloba*) that adjoin some distribution centers (e.g., Dickshooter Ridge-Big Springs Butte adjacent to the South Fork Owyhee River center).

3. Frequently associated species:

Native Species: *Atriplex confertifolia*, *Chrysothamnus nauseosus*, *Artemisia cana*, *Sitanion hystrix*, *Astragalus calycosus*, *Allium anceps*, *Iva axillaris*. All these species are at very low densities in *L. davisii* playas.

Alien Species: *Salsola kali* (mostly in Idaho) and *Halogeton glomerata*.

4. Dominance and frequency: The density of *L. davisii* is normally very low, less than 1 plant per m², but can be as high as 20+ plants per m² on rare occasions. The density is usually not even over the entire playa. It is at low density or absent where water stands the deepest in the playas.

5. Successional phenomena: This is not applicable to most populations, as the habitats are maintained in an open state by physical processes. In some cases, however, exotic and

native weeds appear to be invading the playas and negatively impacting the *L. davisii* populations.

6. Dependence on dynamic biotic features: None known.

7. Other endangered species: None.

7. Population biology.

A. General summary: It has been observed that *Lepidium davisii* plants show distinct inter-playa differences in leaf size, leaf shape, and plant phenology. If future studies bear this out, it suggests that *L. davisii* disperses poorly, probably not beyond individual playas, and that there is minimal pollination between neighboring playas. For these reasons, each playa should be defined as a discrete population (U.S. Fish and Wildlife Service 1994).

B. Demography.

1. Known populations: 293 populations (= number of occupied playas) of *Lepidium davisii* are known extant; five are thought to be extirpated. Populations range in size from just a few plants to over 2.5 million estimated for Palomino Lake, Oregon. Many populations contain several thousand individuals. The age class structure appears to be well distributed among immature and mature (reproductive) individuals in most populations. Seedlings are only observed during moist springs, but these long-lived perennials probably only need episodic seedling establishment to maintain long-term viability.

2. Demographic details: Demographic details for each occurrence in Idaho and most in Oregon appear in Appendices 1 and 4, respectively.

C. Phenology.

1. Patterns: Flowers May to August (Meinke 1982).

2. Relation to climate and microclimate: During extremely dry summers, such as in 1994, few viable fruits appear to be produced, although flowering was profuse.

Bob Kinschey, Vale District BLM, has observed that above-ground biomass production of individual plants varies with winter and spring precipitation. His long-term observations of several playas in Oregon suggest that *L. davisii* produces larger plants and more flowers and fruits during high-precipitation years than during low-precipitation years.

D. Reproductive ecology.

1. Type of reproduction: *Lepidium davisii* reproduces only by seed.

2. Pollination.

a. Mechanisms: Little known, but insects are probably the main pollinators. Packard (1978; 1979) did not rule out self pollination. Packard *et al.* (1979) observed great morphological variation between playas (populations), suggesting to her that gene flow may be limited.

b. Specific known pollinators: Unknown.

c. Other suspected pollinators: None known.

d. Vulnerability of pollinators: Unknown, but if insects are the main pollinator, they will be vulnerable to changes in vegetation surrounding the playas inhabited by *L. davisii*. This is of great concern on the Mountain Home Desert portion of its range due to near total conversion of the native sagebrush-steppe vegetation to one dominated by exotic annuals. This may affect population levels of important pollinators. This is less a concern on the Owyhee Uplands, where the other populations occur. More native sagebrush vegetation is intact at these higher, moister elevations, except where purposefully replaced by crested wheatgrass.

3. Seed dispersal.

a. General mechanisms: Unknown, but probably gravity and possibly wind and water are important for the relatively large seeds. The fact that *Lepidium davisii* does not appear to inhabit all suitable habitat in an area, suggests dispersal mechanisms are not highly effective (Packard 1978; 1979). On the other hand, it is distributed over a range with a long axis of over 180 miles.

b. Specific agents: Unknown, but probably gravity is the most important.

c. Vulnerability of dispersal agents and mechanisms: Unknown.

d. Dispersal patterns: Specific details unknown.

4. Seed biology.

a. Amount and variation of seed production: During "good" years, which may coincide with moist springs, seed production is profuse. Other years, possibly related to winter and spring droughts, nearly all fruits appear to abort and seed production is nil (Bernatas and Moseley 1991).

b. Seed viability and longevity: Unknown.

c. Dormancy requirements: See below.

d. Germination requirements: What follows are results of studies conducted by Jennifer Yruegas (1990; 1991), Nyssa High School, on *Lepidium davisii* from three

playas in the two Oregon distribution centers and one from the Mountain Home Desert in Idaho. Seed germination experiments revealed that pre-chilling is not necessary for *Lepidium davisii* and, in fact, reduces germination. Darkness enhanced seed germination. Germination percentages varied between 40 and 80, depending on treatment. Optimum germination took place at a pH between 6 and 7, which correlates with measured soil pH from the same playas.

e. Percent germination: See above.

5. Seedling ecology: No data.

6. Survival and nature of mortality of plants: *Lepidium davisii* is probably a long-lived perennial. The nature of mortality is unknown, but Ann DeBolt, Lower Snake River District BLM Botanist, has observed that, four years after being buried by silt, plants reappeared above ground, probably from surviving rootstocks.

7. Overall assessment of reproductive success: No data.

8. Population ecology.

A. General summary: Little is known regarding the population ecology of *Lepidium davisii*.

B. Positive and neutral interactions: None known.

C. Negative interactions.

1. Herbivores, parasites and diseases: Cattle and wild horses (in Oregon) can have a significant local impact on *Lepidium davisii* plants near a stock watering holes, where livestock are highly concentrated.

Heavy cattle grazing possibly caused the extirpation of *L. davisii* from at least two playas (029 and 003). Occurrence 003 was first observed in 1979 with ca. 200 plants. By 1995, they were gone. At occurrence 029, 16 plants were observed in 1987, and none were present in 1995. Severe cattle trampling during the winter of 1992-1993 is given as the cause of extirpation.

2. Evidence of competition.

a. Intraspecific: Largely unknown. Possibly some intraspecific competition for space and resources in the polygonal crack systems of the playa floors.

b. Interspecific: Largely unknown. Throughout most of its range, there is little or no interspecific competition with any native species because few other natives can establish and survive in these relatively extreme habitats. The native perennial, *Iva axillaris*, is advancing into one playa in Oregon and may present a threat to the *L. davisii* population. Boise State University has been contracted to examine the effect of *Iva axillaris* toxins on the growth and development of *L. davisii* (U.S. Fish and Wildlife Service 1994).

In some cases, playas have become infested with the exotic weeds *Salsola kali* in Idaho, and *Halogeton glomerata* in Idaho and Oregon. In Oregon, at least, *L. davisii* appears to be competitive and resistant to *H. glomerata* invasion.

3. Toxic and allelopathic interactions with other organisms: See above paragraph.

D. Hybridization.

1. Naturally occurring: None known.

2. Artificially induced: Unknown.

3. Potential in cultivation: Unknown.

E. Other factors of population ecology: None.

9. Current land ownership and management responsibility.

A. General nature of ownership: Most populations are on public land managed by the BLM (all Oregon and Nevada populations are on BLM land). The Idaho Department of Lands, is the second largest owner/manager of *Lepidium davisii* populations. A few Idaho populations occur on private land.

B. Specific landowners: Specific landowners/managers are indicated on occurrence records in Appendices 1 and 4. A summary of the number of occurrences managed by each entity is as follows:

1. Idaho.

Lower Snake River District BLM

Bruneau Resource Area - 118 occurrences; 2 are shared with State, 1 with private.

Owyhee Resource Area - 26 occurrences; 1 shared with state.

Jarbidge Resource Area - 9 occurrences

Upper Snake River Districts BLM

Snake River Resource Area - 4 occurrences

Idaho Department of Lands

Southwest Idaho Supervisory Area - 11 occurrences; 1 shared with Mountain Home AFB, 2 with Bruneau RA, 1 with Owyhee RA.

U.S. Air Force

Mountain Home Air Force Base - 3 occurrences; 1 shared with State.

Private - 1 occurrence; shared with Bruneau RA.

2. Oregon.

Vale District BLM

Jordan Resource Area - 9 occurrences

Burns District BLM

Andrews Resource Area - 2 occurrences

3. Nevada.

Elko District BLM - 1 occurrence

C. Management responsibility: For the most part, the ownership outlined above reflects management responsibility. Twelve playas on the Bruneau Resource Area occur on the Orchard Training Area (OTA), a military training facility co-managed by the BLM and the Idaho Army National Guard. Occurrences on the OTA that include these 12 playas are: 022, 029, 035, 055, 056, 058, 060, 061, 062, and 089 (Appendix 1).

D. Easements, conservation restrictions, special designations, etc.: Two playas containing *Lepidium davisii* (occurrences 109 and 020) are included in the Playas Area of Critical Environmental Concern (ACEC) on the Snake River Resource Area, Upper Snake River Districts BLM. Established in January 1988, specifically to protect *L. davisii*, these two 30-acre sites are the only playas having a special protective designation. The ACEC boundary includes the playas and an upland buffer fully surrounding each site.

The Vale District BLM is carrying forward the nomination of Palomino Lake (002) as an ACEC in the Vale District Resource Management Plan (U.S. Fish and Wildlife Service 1994).

10. Management practices and experience.

A. Habitat management.

1. Review of past management and land-use experiences.

a. This taxon: Annual monitoring of Oregon occurrence 003 by Rick Hall, Burns District BLM, revealed that between 1987 and 1995, *Lepidium davisii* had declined slightly. He speculated this was probably due primarily to drought (he saw less mortality during springs with average or above-average precipitation) and possibly to the slow invasion of the native perennial, *Iva axillaris*, which is slowly invading the playa at a rate of about 0.7 ft/yr.

Monitoring at 25 playas on the Lower Snake River District BLM since 1988, revealed a wide variation in above-ground plant numbers from year to year. Taylor-Grant and DeBolt (1995) attributed this variation primarily to invasion of the playas by blowing *Salsola kali* plants, *Halogeton glomerata* competition, and, in one instance, by heavy livestock trampling. Monitoring data also show that there has been a steady decline of *L. davisii* populations on monitored playas in the Mountain Home Desert distribution center,

while monitored populations in the Bruneau Desert center have remained stable. Taylor-Grant and DeBolt (1995) attribute this decline to the abysmal ecological condition of the sagebrush-steppe communities on the western Snake River Plain, a factor also attributed to the decline of another narrowly-distributed congener, *Lepidium papilliferum* (Moseley 1994).

b. Related taxa: N/A

c. Other ecologically similar taxa: N/A

2. Performance under changed conditions: In 1995, John Doremus, Lower Snake River District BLM, found approximately 60 *L. davisii* individuals that had colonized several man-made "playas" along a ditch at the Buster Butte SW occurrence (040). Apparently, soil had been scraped from areas adjacent to the ditch for fill, creating depressions that became suitable habitat. Population vigor was assessed as poor, however. The age of the depressions is unknown, as is the rate and method of colonization. These man-made sites are within about 500 feet of a natural playa containing an excellent population.

3. Current management policies and actions: Two Conservation Agreements between the U.S. Fish and Wildlife Service and the BLM currently guide management of *Lepidium davisii* on Bureau lands. One agreement covers Oregon populations (U.S. Fish and Wildlife Service 1994), and the other populations on the Lower Snake River District BLM in Idaho (U.S. Fish and Wildlife Service 1989). The Idaho BLM agreement is currently under revision (Taylor-Grant and DeBolt 1995).

The purpose and objectives of the Oregon Conservation Agreement are to formally document the intent of the Vale and Burns districts of the BLM and the U.S. Fish and Wildlife Service to protect and conserve *Lepidium davisii* and its habitat on the Burns and Vale districts, BLM, and provide a means to that end. Actions in the agreement are as follows: (1) the BLM must provide annual reports to the Fish and Wildlife Service on conservation activities; (2) collect seeds for *ex situ* conservation activities; (3) continue to pursue establishment of Palomino Lake as an ACEC; (4) prohibit construction or development in playas containing *L. davisii*; (5) close *L. davisii* habitat to vehicular traffic; (6) prepare and implement a management plan to conserve all existing populations in Oregon; and (7) continue population monitoring.

Actions outlined in the Idaho Conservation Agreement, which covers the Lower Snake River District BLM, are as follows: (1) efforts will be made by the BLM to remove the threats facing the species; (2) the BLM will establish representative transects to monitor population density and age structure trends of *L. davisii*; and (3) the Fish and Wildlife Service will review all management plans and status reports and provide comments.

4. Future land use(s): Unknown.

B. Cultivation.

1. Controlled propagation techniques: None known.

2. Ease of transplanting: Unknown.

3. Pertinent horticultural knowledge: None known.

4. Status and location of presently cultivated material.

a. Specimen plants: None known.

b. Stored seed/propagule banks: As part of the Conservation Agreement in Oregon (U.S. Fish and Wildlife Service 1994), the BLM will collect seed and deposit them in a long-term seed storage facility.

11. Evidence of threats to survival.

A. Present or threatened destruction, modification, or curtailment of habitat or range.

1. Past threats: In 1982, the Bruneau Resource Area, Lower Snake River District BLM, proposed building 17 pit-type reservoirs in three allotments, including several in playas containing *Lepidium davisii*. After discussions with the U.S. Fish and Wildlife Service, the BLM decided not build one reservoir and a monitoring program was established for *L. davisii* populations in the others, as spelled out in the first Conservation Agreement (MOU) for the species between the Service and the BLM (U.S. Fish and Wildlife Service 1983b).

2. Existing threats: The threats to the long-term viability of *Lepidium davisii* are best summarized by DeBolt and Doremus (n.d.) and Taylor-Grant and DeBolt (1995) for Idaho and U.S. Fish and Wildlife Service (1994) for Oregon. Much of the discussion that follows is from these summaries, although several other sources were also consulted (Packard 1977; 1978; 1979; 1981; Packard *et al.* 1979; Siddall *et al.* 1979; Rosentreter 1980; 1983; 1986; Meinke 1982; U.S. Fish and Wildlife Service 1983b; 1989; DeBolt and Rosentreter 1988; DeBolt 1989). Known threats are numerous, and include direct disturbance of the plant as well as habitat alteration. Most of the playas that DeBolt and Doremus (n.d.) examined in southwestern Idaho had one or more noticeable impacts. Most threats can be grouped into the following classes:

Livestock use - This occurs on many playas, and the combination of grazing and trampling appears to have at least some detrimental effect on the plant. Cattle grazing has been given as the reason for extirpation of two populations. Grazing is severe only when stock ponds or salt are located in or near the playas. Season of grazing use is an important consideration. It may be that light mechanical disturbance late in summer after seed set would be a time when the plant is more resistant and the habitat less sensitive to grazing, rather than spring when soils are wet and sensitive to trampling. Most livestock impacts are from cattle, but wild horses use some playas in Oregon. This threat is minimal in the South Fork Owyhee River distribution center, and does not appear to be significant in the Barren Valley, Alvord Desert, and Salmon Falls Creek distribution centers. It is probably having the greatest effect on the Bruneau Desert and Mountain Home Desert areas.

Stock pond development - The construction of pit-type water storage ponds in some playas

has caused a decline in affected populations so affected (Pellant 1985), although these have apparently recovered over the next decade (Taylor-Grant and DeBolt 1995). It is believed that the change in drainage patterns resulting from the storage ponds caused the initial decline in *L. davisii* rather than direct grazing impacts. Similar to the previous threat, this disturbance is most common on the Mountain Home Desert and Bruneau Desert areas.

Vehicle use - Vehicle use, including motorcycles, four-wheel drive, and military tanks, is common on many playas. A number of playas have roads crossing through them, while others are used as racetracks, with courses established using old tires. Declines in these populations probably result from mechanical disturbance to the plant as well as from the alteration of the playa bottom. This threat is most prevalent in the Mountain Home Desert.

Rangeland fires - The indirect effects of increased fire frequencies on the Snake River Plain due to overgrazing and subsequent weed invasions may be causing declines in some populations in the Mountain Home Desert distribution center. With depletion of the native plant community, there is evidence of accelerated erosion on several playas. Sedimentation rates of up to 0.5 inch of deposition in a year appear to kill plants (DeBolt and Doremus n.d.), although at least a portion may survive for several years only as below-ground rootstocks and caudices.

An indirect effect of rangeland fires is the subsequent invasion of weeds. In the case of *L. davisii*, *Salsola kali* is of particular concern in Idaho (Taylor-Grant and DeBolt 1995). Although it may be able to invade and compete with *L. davisii*, of greater concern is the deposition of dead plants in playas, especially if a fence is nearby. These, sometimes huge, piles of tumbleweeds physically smother *L. davisii* plants. This has been observed in Idaho at occurrence 028 (type locality) and 084 (Mountain Home Air Force Base), and probably occurs elsewhere as well. As mentioned above, this threat is largely confined to the Mountain Home Desert portion of its range.

Rangeland rehabilitation projects - These projects, especially greenstripping, could have some detrimental effect on populations. DeBolt and Doremus (n.d.) observed two playas adjacent to an unvegetated greenstrip to have undergone some silt deposition, possibly at increased rates. This is a threat only on the Mountain Home Desert.

Herbicide spraying - This is a potential threat. Although it has not been observed, many playas are vulnerable because of the proximity to roads and agricultural land. Probably only a threat on the Mountain Home Desert.

3. Potential threats: See above.

B. Overutilization for commercial, sporting, scientific, or educational use.

1. Past threats: None known.

2. Existing threats: Minimal to no existing threats.

3. Potential threats: Minimal to no potential threats.

C. Disease, predation, or grazing.

1. **Past threats:** None known.
2. **Existing threats:** See Past and Existing Threats.
3. **Potential threats:** See Past and Existing Threats.

D. Inadequacy of existing regulatory mechanisms.

1. **Past threats:** None.
2. **Existing threats:** None.
3. **Potential threats:** None.

E. Other natural or manmade factors.

1. **Past threats:** None.
2. **Existing threats:** None.
3. **Potential threats:** None.

II. Assessment and Recommendations.

12. General assessment of vigor, trends, and status: Taylor-Grant and DeBolt (1995) recently summarized the results of the Lower Snake River District BLM monitoring program, which reflects the overall status and trend of *Lepidium davisii*. What follows is based largely on their summary, embellished by me to include the entire range of the species.

- > *L. davisii* populations in the Mountain Home Desert distribution center show a decline and are the most vulnerable to extirpation. The overall cause of the decline is the poor ecological condition of the sagebrush-steppe ecosystem on the western Snake River Plain. There is no reversal in this trend seen in the near future.
- > Populations appear stable throughout the remainder of the species range in the Salmon Falls Creek, Bruneau Desert, South Fork Owyhee River, Alvord Desert, and Barren Valley distribution centers. Within these portions of its range, livestock-related impacts (reservoir development, herbivory, trampling) are greatest in the Bruneau Desert, where many playas have been gouged to create watering holes. Playas in the South Fork Owyhee River area are entirely undisturbed.
- > Alteration of the playa surface by livestock trampling permits invasion of the normally weed resistant surface by *Halogeton glomerata*, *Salsola kali*, and *Iva axillaris*. This problem is most acute on the Mountain Home Desert.
- > Direct grazing by livestock is not a serious threat to the species. The majority of livestock and

wild horse trampling impacts probably occur during winter and early spring when the playas still contain water and the plants are dormant.

- > National Guard tank maneuvers have stopped on playas occupied by *L. davisii*. Populations are probably little affected by light and intermittent vehicle use, although this use could affect the playa surface in a similar way to cattle grazing and facilitate the invasion of weeds.

13. Recommendations for listing, status change, and/or conservation actions.

A. Recommendations to the U.S. Fish and Wildlife Service: Due to the documented extirpation and declines in populations and habitat on the Mountain Home Desert, I recommend that *L. davisii* be changed from a category 2 to a category 1 candidate. While it is apparently stable and more or less secure in five of the six distribution centers, one entire disjunct segment of its distribution is in jeopardy. Preliminary evidence indicates that there may be genetic differentiation between populations and distribution centers, and the fact that the Mountain Home Desert populations uniquely occupy the elevational and aridity extremes for the species as a whole, makes these populations an important evolutionary unit whose conservation must be addressed.

B. Recommendations to other U.S. Federal Agencies.

1. Bureau of Land Management: The Bureau of Land Management should maintain *L. davisii* as a special status plant in Idaho, where the Mountain Home Desert portion of its range is declining and vulnerable, and in Oregon and Nevada where the species is rare. In Idaho, the Salmon Falls Creek populations appear to be stable but there are only a few scattered populations in this distribution center, making this portion of its range inherently vulnerable. The South Fork Owyhee and, to a lesser extent, those on the Bruneau Desert are relatively secure and stable. The BLM in Nevada and Oregon should conduct thorough surveys in the South Fork Owyhee drainage to determine the full extent of *L. davisii* in this area.

Population monitoring should continue on all populations currently being studied in Oregon and Idaho. The Lower Snake River District should be especially vigilant in monitoring population trends on the Mountain Home Desert.

2. Army Corps of Engineers: Playas occupied by *L. davisii* are jurisdictional wetlands. The Corps should deny all 404 Clean Water Act permits requesting to place fill in occupied playas, including from reservoir construction.

3. Air Force, Mountain Home Air Force Base: Four occupied playas are managed by the Air Force on Mountain Home Air Force Base and the adjacent Small Arms Range. These populations are important to the long-term persistence of *L. davisii* on the Mountain Home Desert. All populations should be protected from all disturbance. One of the playas on the Small Arms Range has been monitored since 1991 (Bernatas and Moseley 1991). This monitoring should be continued, although at a somewhat less intensive level, and expanded to include other occurrences on the base. In addition, areas surrounding playas should be stabilized to prevent high rates of erosion.

C. Other status recommendations.

1. Municipalities): No recommendations.

2. Counties: No recommendations.

3. State(s) (Idaho):

a. Department of Parks and Recreation: The Department should pursue a Conservation Agreement with the Lower Snake River District BLM, Idaho Army National Guard, Idaho Department of Lands, and Mountain Home Air Force Base to maintain viable populations of *L. davisii* on the Mountain Home Desert.

b. Department of Lands, Southwest Idaho Supervisory Area: Eleven playas partly or entirely on state lands are known to have populations of *L. davisii* in the Mountain Home Desert and Bruneau Desert distribution centers. All playas should be off limits to major disturbances. This especially applies to populations on the Mountain Home Desert. Soils surrounding playas on the Mountain Home Desert should be stabilized to prevent high rates of erosion from filing in occupied playas.

c. Army National Guard: The Idaho Army National Guard comanages, along with the BLM, 11 playas that contain *L. davisii* and one that used to contain the plant prior to its extirpation. These include all or part of 11 occurrences (Appendix 1), as follows: 022, 029, 035, 055, 056, 056, 058, 060, 061, 062, 089. All these playas are in the Mountain Home Desert. They should be monitored and protected from all military training activity. Soils surrounding the playas should be stabilized to prevent possible siltation.

d. Idaho Conservation Data Center: I plan on keeping the global and Idaho state Heritage/CDC network rank at G3 S3 due its limited geographic distribution and unique habitat that is vulnerable to disturbance throughout two of this distribution centers.

e. Idaho Native Plant Society: The Idaho Native Plant Society should keep *Lepidium davisii* on its list of recommended candidate species.

4. Other Nations: No recommendations.

5. International Trade, etc.: No recommendations.

14. Recommended critical habitat: All playas on the Mountain Home Desert containing *L. davisii* should be designated as critical habitat, along with an appropriate buffer around each playa that would include habitat for pollinators and that can be stabilized to prevent high rates of erosion. Future research is needed to determine the optimal size needed for a buffer.

15. Conservation/recovery recommendations.

A. General conservation recommendations.

1. Recommendations regarding present or anticipated activities: None.

2. Areas recommended for protection: All playas on the Mountain Home Desert containing *L. davisii* should be protected from disturbance. This action will help stem the decline that is currently taking place in this distribution center. The Lower Snake River District BLM, is applying for reserved water rights on most playas containing *L. davisii* within their jurisdiction, as part of the Snake River water rights adjudication process. At least part of the reason the BLM is applying for water rights in playas is for the protection of natural habitats, therefore benefiting *L. davisii*.

3. Habitat management recommendations: Disturbances to playas and surrounding buffer areas on the Mountain Home Desert should be limited. Soils surrounding playas on the Mountain Home Desert should be stabilized to prevent high rates of erosion from filling in occupied playas.

All fences that traverse playas, or run along their periphery, should be removed. These fences act as drift fences for tumbling *Salsola kali* that can accumulate 4-5 feet deep and extend up to 20 feet or more from the fence if it is oriented perpendicular to the prevailing wind. This is especially true on the Mountain Home Desert, where *S. kali* is prevalent and can roll for miles across flat, shrubless terrain. *Salsola kali* accumulates on some playas on the Mountain Home Desert because they are in depressions. Eradication of deep deposits on playas should be considered in this area, possibly through burning and mechanical means.

4. Publicity sensitivity: None.

5. Other recommendations: None.

B. Monitoring activities and further research recommendations: Population monitoring has been conducted on a number of populations by several agencies.

(1) *Mountain Home Air Force Base* - Population monitoring began in two playas in 1991 (Bernatas and Moseley 1991), and the transects were sampled annually until 1995, the last year of the contract. Monitoring data are currently being analyzed and population trends and modelling results will be summarized in a report by December 1995. CDC occurrence: 084 (Appendix 1).

(2) *Lower Snake River District BLM* - The two Conservation Agreements between the U.S. Fish and Wildlife Service and the BLM (U.S. Fish and Wildlife Service 1983b; 1989) stipulated that a monitoring program be established by the BLM to determine rangeland management effects on *Lepidium davisii* populations. Some monitoring began as early as 1983 (Pellant 1985), with most of the permanent transects established in 1987 and 1988 (Doremus and DeBolt 1987; DeBolt and Doremus 1989; 1990; Taylor-Grant and DeBolt 1995). All populations are being monitored for population trend. In addition, erosion studies have been established at six playas to measure silt loading due to increased fire frequencies on adjacent land (U.S. Fish and Wildlife Service 1989; Doremus and DeBolt 1987). CDC occurrences: 011, 016, 018, 022, 025, 026, 029 (2 playas monitored), 033, 036, 037, 042, 045, 047, 049, 051 (2 playas monitored), 052 (2 playas monitored), 056, 058, 062, 064, 089,

and 126 (Appendix 1).

(3) *Upper Snake River Districts BLM* - Two playas on the Upper Snake River Districts, occurring in Playas ACEC, are being monitored with permanent belt transects. CDC occurrences: 019 and 020 (Appendix 1).

(4) *Vale District BLM* - The Vale District has been monitoring Palomino Lake (Oregon occurrence 002, Appendix 4) since about 1986. Monitoring goals and objectives were recently formalized in a Conservation Agreement (U.S. Fish and Wildlife Service 1994).

(5) *Burns District BLM* - The Burns District is monitoring Oregon occurrences 003 and 009 (U.S. Fish and Wildlife Service 1994; Appendix 4). Occurrence 003 has been monitored specifically in relation to the effect of *Iva axillaris* invasion on *L. davisii* population trends. Transects were established here in 1987, and have been resampled (almost) annually.

16. Interested parties:

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Upper Snake River Districts BLM
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III. Information Sources.

17. Sources of information.

A. Publications.

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2. Other pertinent publications.

a. Technical:

Spencer, S.G., and B.F. Russell, eds. 1979. Bruneau known geothermal resource area: an environmental analysis. EGG-GTH-5004. Prepared for the U.S. Department of Energy, Idaho Operations Office, Idaho Falls, ID. 146 p., plus appendices.

b. Popular: None.

B. Herbaria consulted: All regional and many national herbaria have been consulted several times over the years regarding specimens of Idaho's rare flora (see Moseley 1990). Herbarium specimens of *Lepidium davisii* from Idaho are listed in the appropriate field on the occurrence records in Appendix 1, where herbarium acronyms follow Holmgren et al. (1990), except for local Idaho herbaria, which follow Moseley (1990).

C. Fieldwork: Considerable field time has been spent in the last two decades searching for *Lepidium davisii* populations, first by Pat Packard and others associated with the College of Idaho (now Albertson College) in the mid- and late 1970's. Their early searches were both in Idaho and Oregon (Packard 1978; 1979, Packard *et al.* 1979). Eidemiller (1977) searched unsuccessfully for *L. davisii* on BLM land in the Bennett Hills in the late 1970's. The Lower Snake River District BLM spent considerable time inventorying playas in southwestern Idaho during the 1980's and early 1990's, expanding its known distribution substantially (Rosentreter 1980; 1983; 1986; DeBolt and Rosentreter 1988). The U.S. Air Force inventoried Mountain Home Air Force base for rare plants in 1990 (Thompson 1990).

During 1995, many Lower Snake River District BLM personnel conducted a nearly complete inventory of potential habitat in their area. Gaps in their inventory were filled by the CDC and the Idaho Army National Guard, also during 1995. Playas in the Salmon Falls Creek area were thoroughly surveyed by Jim Tharp, Upper Snake River Districts BLM, in 1994 and 1995. Potential habitat in the Alvord Desert and Barren Valley distribution centers in Oregon were thoroughly surveyed by Vale and Burns District BLM personnel in the 1980's and 1990's (U.S. Fish and Wildlife Service 1994).

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E. Other information sources: None known.

18. Summary of material on file: Color slides, field forms, maps, and most published and unpublished references pertaining to *Lepidium davisii* in Oregon, Nevada, and Idaho are on file at the Idaho Conservation Data Center office. The Lower Snake River, Vale, and Burns BLM District Offices have extensive files and maps pertaining to *L. davisii* in their areas. The Oregon Natural Heritage Program is also a central source of information for the species in Oregon.

IV. Authorship.

19. Initial authorship:

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20. Maintenance of status report: The Idaho Conservation Data Center will maintain current information and update the status report as needed.

V. New information.

21. Record of revisions: Not applicable.

Appendix 1

Idaho Conservation Data Center records for *Lepidium davisii* in Idaho.

Appendix 2

Results of Idaho playa inventory - Mountain Home Desert.

Appendix 3

Results of Idaho playa inventory - Owyhee Uplands.

Appendix 4

Occurrence information for Oregon populations of *Lepidium davisii*.

Appendix 5

Occurrence information for the Nevada population of *Lepidium davisii*.

