OCCURRENCE UPDATES, FIELD SURVEYS, AND MONITORING FOR SENSITIVE PLANT SPECIES IN THE BEAR RIVER RANGE, CARIBOU-TARGHEE NATIONAL FOREST

By

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February 2003

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Caribou-Targhee National Forest
Idaho Department of Fish and Game
Project Order No. 43-02NM-1-1559

ABSTRACT

A cooperative Challenge Cost-share project between the Idaho Department of Fish and Game's Conservation Data Center and the Caribou-Targhee National Forest was conducted to (1) collect updated conservation information for known populations of Sensitive and other rare plant species; (2) establish permanent, long-term monitoring stations for *Penstemon compactus*, and evaluate the possibly of establishing monitoring stations for botanical resources within the Bloomington Lake Special Emphasis Area; and (3) survey for new populations of Forest Sensitive and other target rare plant species. All previously documented occurrences for *Asplenium trichomanes-ramosum* (green spleenwort), *Musineon lineare* (Rydberg's musineon), and *Penstemon compactus* (Cache penstemon) were revisited and had records updated. No new populations of these Sensitive plant species were discovered, although a few, new, small sites of *Musineon lineare* were found in close proximity to the known occurrence at Bloomington Lake. Permanently marked photo-point monitor stations were established at the six documented *Penstemon compactus* occurrences on the Forest. *Asplenium septentrionale* (forked spleenwort) and *Lesquerella multiceps* (manyhead bladderpod) were two other rare plant species specifically targeted for field investigation. The *Lesquerella* was found to be widespread and common along all the high, rocky ridges surveyed. It does not warrant special conservation concern by the Forest. The one previously known population of *Asplenium septentrionale* was not relocated and no others were discovered. Based on its rarity in Idaho and regionally, this species should be considered for addition to the Caribou-Targhee National Forest Sensitive plant list. No populations of several other target rare plants were discovered during the field investigation. A reconnaissance survey of the Bloomington Lake Special Emphasis Area indicated a formal monitoring program is not warranted at this time because Sensitive plant populations and their rock outcrop habitats in the area appear secure from threats.

ACKNOWLEDGMENTS

I want to thank Rose Lehman, botanist with the Caribou-Targhee National Forest, for providing overall project direction, securing the funding, and helping with portions of the field work associated with this project. Appreciation is also extended to Shelley Cooke with the Idaho Conservation Data Center, who made the maps and provided overall assistance for producing this report.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

INTRODUCTION

The Idaho portion of the Bear River Range is located in very southeastern Idaho and managed by the Caribou-Targhee National Forest (Figure 1.). The area supports a number of vascular plant species that are rare or not found elsewhere in Idaho. Several systematic rare plant inventories have been conducted in the range; however, all these studies are more than a decade ago (Dieffenbach n.d.; Schultz and Schultz 1978; Moseley and Mancuso 1990; Moseley 1991). Based on these past surveys, three Caribou-Targhee NF Sensitive plant species were known from the Idaho portion of the Bear River Range, including, *Asplenium trichomanes-ramosum* (green spleenwort), *Musineon lineare* (Rydberg's musineon), and *Penstemon compactus* (Cache penstemon). Relatively recent, but limited information, indicated *Asplenium septentrionale* (forked spleenwort) and *Lesquerella multiceps* (manyhead bladderpod) were two other rare plant species possibly deserving conservation consideration by the Forest. Several additional rare plant species considered Sensitive on the adjacent Wasatch-Cache NF are known from a few miles south of the Idaho border, in the Utah segment of the Bear River Range. Potentially suitable habitat for these species is known or speculated to occur across the border in Idaho. Therefore, it is reasonable to consider they may also occur in Idaho. Although past inventories provided a good overview of rare plant resources in the Bear River Range, it was clear some of this information was outdated or incomplete.

Conservation status information concerning Forest Service Sensitive and other rare plant species in the Bear River Range is nearly all over ten years old. The Caribou-Targhee NF identified a need for current and accurate information about Sensitive and other rare plant populations for Forest project planning and other management purposes. Several Forest projects specifically identified to benefit from updated conservation information include the Bloomington Canyon Recreation Plan, Highline Trail renovation plan, Bear River Range livestock allotment management plan revisions, and several proposed prescribed burn plans.

In 2001, the Idaho Department of Fish and Game's Conservation Data Center (IDCDC) and the Caribou-Targhee NF entered into a Challenge Cost-share agreement to collect information that would help the Forest meet their stewardship responsibilities regarding rare plant resources in the northern Bear River Range. The project agreement had three main objectives: (1) to collect updated conservation information for known populations of Sensitive and other rare plant species; (2) to establish permanent, long-term monitoring stations for *Penstemon compactus*, and evaluate the possibly of establishing monitoring stations for botanical resources within the Bloomington Lake Special Emphasis Area; and (3) to survey for new populations of Caribou-Targhee NF Sensitive and other target rare plant species.

METHODS

Sensitive plant species updates

Conservation information for previously documented occurrences of *Asplenium trichomanes-ramosum*, *Musineon lineare*, and *Penstemon compactus* located on Caribou-Targhee NF lands in the Bear River Range was updated by revisiting each occurrence site. I collected location, abundance, size, habitat, threat assessment and other conservation information for each occurrence by directly searching as much of the occurrence area as possible. Nearby suitable-looking habitat was also surveyed to document whether or not an occurrence was more extensive than previously mapped. GPS coordinates were obtained to help document the precise location of each occurrence using a navigation grade (Garmin 12X) unit. The information collected in 2002 was used to update the IDCDC Element Occurrence records for

Figure 1.

each of the *Asplenium trichomanes-ramosum*, *Musineon lineare,* and *Penstemon compactus* target occurrences.

Although not on the Forest Sensitive list, it was my intent to collect updated conservation information for previously documented occurrences of *Lesquerella multiceps* and *Asplenium septentrionale* as well. In the case of *Lesquerella multiceps*, I revisited several occurrences, but stopped collecting update information once it became clear to me that this species was much more common than previously thought and would not be added to the Caribou-Targhee NF Sensitive plant list.

Sensitive plant monitoring

Permanently marked photo-point monitor stations were established at all documented *Penstemon compactus* occurrences in 2002. Methods and other background information regarding the monitoring protocol are outlined in a separate "*Penstemon compactus* monitoring" section of this report.

General rare plant inventory

A target list of rare plant species known or suspected to occur on the Caribou-Targhee NF was compiled prior to initiating field work. The target list in Table 1 is comprised of (1) Sensitive plant species known to occur on the Caribou-Targhee NF; (2) species under consideration for inclusion on the Caribou-Targhee NF Sensitive plant list; and (3) species of conservation concern known from nearby areas in Utah, specifically those on the Wasatch-Cache NF Sensitive plant list that could possibly also occur in the Idaho portion of the Bear River Range.

Table 1. Rare plant target list for field inventory in the Bear River Range, Caribou-Targhee NF.

Scientific name	**Common name**	**[1]USFS status**	**[2]Grank**	**Srank (Idaho)**
Arabis lasiocarpa	Wasatch rockcress		G3	-
Asplenium septentrionale	Forked spleenwort		G4/5	S1
Asplenium trichomanes-ramosum	Green spleenwort	Sensitive - C/T NF	G4	S1
Draba maguirei var. maguirei	Maguire draba	Sensitive - W/C NF	G3T2	-
Erigeron cronquistii	Cronquist's daisy	Sensitive - W/C NF	G2	-
Eriogonum brevicaule var. loganum	Logan buckwheat	Sensitive - W/C NF	G4/T2	-
Lesquerella multiceps	Manyhead bladderpod		G3	S2
Musineon lineare	Rydberg's musineon	Sensitive - C/T NF	G2	S1
Stipa viridula	Green needlegrass	Sensitive - C/T NF	G5	S2
Penstemon compactus	Cache penstemon	Sensitive - C/T NF	G2	S2
Primula maguirei	Maguire's primrose	Sensitive - W/C NF	G1	-

1. U.S. Forest Service status: C/T NF = Caribou-Targhee NF; W/C NF = Wasatch-Cache NF.
2.The Global (G) and State (S) conservation ranks listed in Table 1 are assigned by NatureServe (formerly the Association for Biodiversity Information) and its network of Heritage Programs and Conservation Data Centers. The Global Rank applies to the species' conservation status rangewide, while the State Rank applies to its conservation status within Idaho. Definitions for the ranks are as follows: 1 = critically imperiled because of extreme rarity or because of some factor of its biology making it especially vulnerable to extinction; 2 = imperiled because of rarity or because of other factors demonstrably making it vulnerable to extinction; 3 = rare or uncommon, but not imperiled; 4 = not rare and apparently secure, but with cause for long-term concern; 5 = demonstrably widespread, abundant, and secure.

The rare plant inventory was aimed primarily at trying to find new populations of *Asplenium trichomanes-ramosum, Musineon lineare, Penstemon compactus, Lesquerella multiceps*, and *Asplenium septentrionale*. Other species on the target list were looked for opportunistically, while surveying for these five priority species. Most inventory was conducted while enroute to revisit and update known Sensitive plant occurrences, or in areas near known Sensitive plant locations. Inventory protocol included the completion of a rare plant observation form for each new rare plant population discovery. Location, GPS coordinate, population, habitat, threat, and other conservation information is recorded on this form.

RESULTS

Field work for the project was conducted between July 9 and 17, 2002. I relocated and updated conservation information at all seven previously documented *Penstemon compactus* occurrences on the Caribou-Targhee NF. Permanently marked photomonitor stations were established at each of the occurrences as well. The only known *Musineon lineare* occurrence in Idaho is located at Bloomington Lake. I collected updated conservation information for most of the original occurrence, but one portion was inaccessible due to late lying snow cover. Several small additions to the occurrence were also discovered. The location of the previously known *Asplenium trichomanes-ramosum* occurrence at Bloomington Lake was revisited, but I was unable to collect updated population information due to the site being blocked by late lying snow. I did not discover any new populations of *Penstemon compactus, Musineon lineare,* or *Asplenium trichomanes-ramosum* during the field investigation. Reconnaissance of the Bloomington Lake area indicated a formal monitoring protocol was not needed for the area's special botanical resources at this time.

I also revisited several previously documented *Lesquerella multiceps* occurrences. This species was found to be common and widespread along all of the rocky, subalpine ridges surveyed. *Asplenium septentrionale* was not found during my survey east of the one known, original collection site, which was not revisited. It was not found elsewhere in the Bear River Range. No populations of other six target rare plant species were discovered during the field investigation. Maps showing my field survey routes are in Appendix 1. Summaries of my results for the occurrence update portion of the field investigation are provided below by species.

<u>Sensitive plant species</u>

Penstemon compactus (Cache penstemon)

No new populations of *Penstemon compactus* were found during the field investigation. In Idaho, this species was known from seven previously documented occurrences on the Caribou-Targhee NF (Moseley and Mancuso 1990). I revisited each of the previously known occurrences. Six of them contained *P. compactus* in numbers comparable to initial estimates made in 1990. No *P. compactus* was found at the Cub Point occurrence (007). Review of the voucher specimen collected at this occurrence in 1990 suggests it was originally misidentified. The voucher specimen appears to really be *Penstemon cyananthus* (Wasatch penstemon), a common species in the Cub Point area. The Cub Point occurrence will remain in the IDCDC database pending verification of the identification of the 1990 voucher specimen by an expert in the *Penstemon* group. The record will be deleted from the database if verified the voucher collection was originally misidentified. The Caribou-Targhee NF will be contacted when disposition of the occurrence becomes clarified.

Idaho occurrences of *P. compactus* contain between approximately 150 to >500 individuals, and range in size from roughly 5 to less than 1 acre. Wilderness Peak (001) is the largest occurrence documented in the State, even though only about half as many plants were observed in 2002 compared to the1990 estimate. It is unclear if there has been an actual decline in *P. compactus* at this site. I suspect either an overestimate was made in 1990, and/or many plants (especially those without flowers) were simply missed during my 2002 visit. All of the documented occurrences have excellent or good estimated long-term persistence under current conditions. *P. compactus* occurrence abundance, size, and EO rank information has been summarized in Table 2. Mapped locations for each occurrence are in Appendix 2. IDCDC Occurrence Records are included in Appendix 3.

Table 2. *Penstemon compactus* occurrence information.

EO #	Name	Abundance		Size (acres)	[1]EO Rank
		1990	**2002**		
001	Wilderness Peak	1000-2000	500+	5	A
002	Upper Hodge Nibley Creek	ca 400	ca 500	5	A
003	Upper Crooked Creek	ca 200	100+	2	B
004	Gibson Basin	ca 400	ca 500	3	A
005	White Canyon	ca 200	ca 200	0.3	B
006	West of Franklin Basin	ca 75 (1 subpop.)	ca 150 (2 subpops.)	0.2	B

1. As part of the occurrence update process, all occurrences were assigned Element Occurrence (EO) ranks. EO ranks provide an assessment of the likelihood of an occurrence persisting for a defined period of time (25-100 years) if current conditions prevail. The ranks represent the relative value of an occurrence with respect to other occurrences for the species. EO ranks are defined as follows: A = excellent estimated viability; B = good estimated viability; C = fair estimated viability; D = poor estimated viability.

Musineon lineare (Rydberg's musineon)

One new subpopulation and small additions to two previously known subpopulations were discovered in 2002 at the previously documented Bloomington Lake occurrence (001). No new *Musineon lineare* occurrences were found elsewhere during the field investigation, and suitable habitat in the Idaho portion of the Bear River Range appears very limited for this species.

The occurrence at Bloomington Lake is comprised of four scattered subpopulations, located from near the lake, to the top of the cirque, between approximately 8,200 and 9,000 feet elevation. A total of approximately 500 plants were observed at the four subpopulations in 2002. They support a conservative estimate of 50 to 250 plants each and cover approximately two acres. The occurrence has an EO Rank = A. Additional *M. lineare* plants very likely occur in suitable, shaded, steep-walled, but inaccessible portions of the Bloomington Lake cirque. Part of one subpopulation, which co-occurs with *Asplenium trichomanes-ramosum*, was not observed in 2002, due to late-lying snow covering the subpopulation area. A map showing the location of the Bloomington Lake occurrence is included in Appendix 2. The IDCDC Occurrence Record is in Appendix 3.

Asplenium trichomanes-ramosum (Green spleenwort)

Searching for *Asplenium trichomanes-ramosum* plants at the previously documented Bloomington Lake cirque occurrence (001) was impaired by deep blocks of snow in the protected headwall positions where this species was observed in 1990. The snow either covered or blocked views of the majority of the rock wall habitat occupied by this species. As a result, I did not observe any *A. trichomanes-ramosum* in 2002. Habitat comparable to the protected cirque headwall above Bloomington Lake is rare or possibly non-existent elsewhere within the Idaho portion of the Bear River Range. As a result, it was not a surprise that no other, new *A. trichomanes-ramosum* populations were discovered during the field investigation.

In 1990, the *A. trichomanes-ramosum* at Bloomington Lake cirque was estimated to have approximately 40 plants scattered in three small areas in close proximity to one another (Moseley and Mancuso 1990). Portions of the headwall are sheer and inaccessible, and additional *A. trichomanes-ramosum* plants may occur in the area. Overall, general habitat conditions for the occurrence appeared similar to those reported in 1990. In addition, I did not observe any anthropogenic-related disturbances around the occurrence area. I assume the occurrence is still extant, but this should be verified by future surveys conducted after snowmelt when access to the headwall chutes is unimpaired. The occurrence has an EO Rank = B. A map showing the location of the Bloomington Lake occurrence is included in Appendix 2. The IDCDC Occurrence Record is in Appendix 3.

Other rare plant species

Asplenium septentrionale (Forked spleenwort)

In 1995, *Asplenium septentrionale* was collected in the upper Hodge Nibley drainage, less than one mile north of the Utah border. The collection represents the only known location for this species in Idaho. Except for its location, very little was known about this population. My attempt to relocate the occurrence failed when I took the wrong spur ridge leading to the site. I was able to survey similar habitat on an adjacent ridge, but did not find any *A. septentrionale,* despite a thorough survey. I ran out of time to re-trace my way back to the ridge where the 1995 collection was made. I suspect this difficult to find species occurs on white slickrock outcrops along both ridges, and assume the population is extant. A map showing the location of the upper Hodge Nibley Creek occurrence is in Appendix 2. The IDCDC Occurrence Record for this site is in Appendix 3. Insufficient information is known about the upper Hodge Nibley Creek occurrence (001) to confidently provide an EO Rank.

Lesquerella multiceps (Manyhead bladderpod)

Prior to 2002, *Lesquerella multiceps* was known in Idaho from a total of seven occurrences, all based on herbarium collections made between the 1920s and 1980s in the Bear River Range. My 2002 investigation represented the first systematic field survey for this species in Idaho. I found *L. multiceps* to be widespread and common along all rocky, high elevation ridges and upper slopes surveyed. It was found to occur in a variety of habitats between approximately 7,000 and 9,300 feet elevation, including (1) both calcareous and occasionally non-calcareous parent rock; (2) open, fully exposed, as well as wooded, partially shaded sites; (3) flat ridgecrests to steep slope positions; and (4) fractured bedrock, rock outcrops and crevices, to gravelly, zonal soil pockets. It apparently persists well in areas that have been subject to many years of sheep trailing or grazing. I stopped collecting occurrence update information once it

became clear to me this species was much more common than previously thought and would not be recommended as an addition to the Caribou-Targhee NF Sensitive plant list.

DISCUSSION

Sensitive plant species

Penstemon compactus

Penstemon compactus is a low, stout, perennial with a compact, few-flowered inflorescence of large, showy, clear-blue flowers. It is endemic to the northern part of the Bear River Range in Cache County, Utah and adjacent Franklin County, Idaho. *P. compactus* occurs on bedrock slabs, rock outcrops, cliff bands, or gravelly, shallow soil habitats. It occurs on various aspects along high elevation ridgecrests and associated summit or upper slopes areas, ranging from flat to moderately steep. All Idaho populations of *P. compactus* occur on carbonate substrate, either St. Charles Limestone or Fish Haven Dolomite (Mitchell and Bennett 1979), between about 8,600 to 9,400 feet elevation. The dry, open sites tend to be dominated by low herb and/or low-shrub subalpine plant communities near the fringe of, or fingering into, *Pseudotsuga menziesii* (Douglas-fir) and *Pinus flexilis* (limber pine) woodlands. Rock and bare soil cover is high. Commonly associated species include *Symphoricarpos oreophilus* (mountain snowberry), *Eriogonum umbellatum* (sulphur buckwheat), *Leucopoa kingii* (spike fescue), *Castilleja applegatei* (wavyleaf Indian paintbrush), *Lesquerella multiceps*, and *Lomatium graveolens* (king desert parsley).

High quality habitat conditions characterized each of the *P. compactus* occurrences and disturbance evidence was absent or minimal at all sites. In addition, no evidence of imminent or high magnitude threat factors were observed at or near any of the occurrences. No disturbances related to motorized or non-motorized recreation, or to recent livestock use were observed at the occurrences. Some *P. compactus* plants would likely be destroyed and injured if a hot wildfire were to pass through woodland habitats in close proximity to all occurrences.

In the Wilderness Peak (001) area motorcyclists have blazed a trail part way up the slopes from Gibson Lakes, but the trail does not approach the summit ridge or occurrence at this time. It is possible snowmobilers ride the summit ridge, but direct adverse impacts to *P. compactus* would be minimal, if any, under most winter conditions. Present management of the Wilderness Peak occurrence appears to be compatible with the long-term persistence of *P. compactus* in the area. However, ORV traffic has the potential to damage *P. compactus* plants and its habitat if allowed to gain access to the Wilderness Peak summit ridge complex. The Forest should consider monitoring to ensure this access does not occur.

Musineon lineare

Musineon lineare is a low, slender, glabrous, perennial forb with leaves having several pairs of narrow lateral leaflets, and lax stems terminated by small clusters of small white flowers. It is endemic to the Bear River Range, mostly in Cache County, Utah, but also known from a single occurrence in Idaho at Bloomington Lake, in Franklin County. At Bloomington Lake, *M. lineare* occurs on ledges and in rock cracks and crevices on steep cliffs or smaller rock outcrops protected from long periods of direct, full summer sun. These sites are either northerly-facing or well-shaded by conifers or other rock outcrops and provide a relatively moist micro-environment. At Bloomington Lake, it is restricted to calcareous rock of the Laketown Dolomite Formation; being absent from nearby bands of Swan Peak quartzite (Mitchell and Bennett 1979). Rock

outcrops with *M. lineare* are located in the open, along the fringe of ridgecrest conifer woodlands, or within cliff-shelf conifer communities. Associated species include *Pseudotsuga menziesii*, *Pinus flexilis*, *Picea engelmannii* (Engelmann spruce), *Pachystima myrsinites* (pachystima), *Juniperus communis* (mountain juniper), *Leucopoa kingii*, *Petrophytum caespitosum* (mat rockspirea), *Erigeron leiomerus* (smooth daisy), *Heuchera* spp. (alumroot), and *Pellaea breweri* (Brewer's cliff-brake).

I did not observe any anthropogenic threats to *M. lineare* at Bloomington Lake. In some places, plants would likely be killed if a wildfire passed through the area. Conifer mortality and loss of their protective shade would probably contribute to more *M. lineare* mortality than direct fire effects. Bloomington Lake receives a high level of non-motorized recreational use. None of this use is likely to impact *M. lineare* even though one unmaintained trail passes directly by a boulder containing upwards of 50 plants. No signs of disturbance from livestock or motorized recreation were observed along the ridges or upper slopes near *M. lineare* sites. Snowmobilers ride up the headwall chute site shared with *Asplenium trichomanes-ramosum.* No readily discernable adverse impacts from this activity were observed, but it is unknown if other, more subtle negative impacts may be affecting this subpopulation. Some level of monitoring will be required to address this question.

Asplenium trichomanes-ramosum

Asplenium trichomanes-ramosum is a small, somewhat evergreen, soft-textured fern with long-persistent petiole bases and few to many pairs of roundish, coarsely-toothed pinnae. It has a circumboreal distribution, including scattered locations in the northwestern United States. It is known from only two occurrences in Idaho, both on the Caribou-Targhee NF. One is at the Bloomington Lake cirque in the Bear River Range, the other in the Snake River Range north of Swan Valley. Elevations for these two sites are approximately 8,500 and 6,400 feet, respectively. *A. trichomanes-ramosum* grows in rock crevices and cliffs on limestone and other basic substrates in cool, mesic microsites. Associated species at the Bloomington Lake cirque population include *Cystopteris fragilis* (brittle bladderfern), *Pellaea breweri*, *Lloydia serotina* (lloydia), *Musineon lineare*, and *Synthyris pinnatifida* (cutleaf synthyris).

The Bloomington Lake area receives high levels of recreation use. The steep, rocky sites supporting *A. trichomanes-ramosum* would be off-limits to all but the most adventuresome hiker. However, snowmobilers ride up the headwall chutes where plants were previously documented. No readily discernable adverse impacts from this activity were observed, but it is unknown if other, more subtle negative impacts may be affecting plants along the chute walls. Some level of monitoring will be required to address this question.

<u>Other target rare plant species – known to occur in Idaho</u>

Asplenium septentrionale

Asplenium septentrionale is a fern with a tufted habit from numerous, crowded, slender, glabrous leaves 5-15 cm tall. Petioles are more or less erect, very slender, and usually 2-5 times longer than the blade. Leaf blades are irregularly forked with a few, entire or slender-toothed segments. A single compound sorus occurs on the underside of each segment. *A. septentrionale* resembles a tuft of grass and can be easily overlooked in the field. It has an interruptedly circumboreal distribution and is known from most states in the western United States. However, in most states it has been documented from only a few, widely scattered stations. It typically occurs in rock crevices or other outcrop/cliff habitats (Cronquist et al. 1972;

Flora of North America Editorial Committee 1993). The Intermountain Flora (Cronquist et al. 1972) has a good line drawing of *A. septentrionale*.

A. septentrionale was apparently not known to occur in Idaho until Dr. Michael Windham (Utah Museum of Natural History, Salt Lake City) collected it in the Bear River Range, just north of the Utah border, in 1995. He collected it in the upper Hodge Nibley Creek drainage at about 8,700 feet elevation. This remains the only known site for *Asplenium septentrionale* in Idaho, as no additional populations were discovered during my 2002 field inventory.

A. septentrionale is a difficult species to look for in the field. It would not come as a great surprise to me if a few additional populations were discovered in the Bear River Range or elsewhere on the Caribou-Targhee NF. For example, a population is known from Teton County, Wyoming, not too far east of the Idaho border. *A. septentrionale* is rare in Idaho and should be considered for addition to the Region 4 Sensitive plant list for the Caribou-Targhee NF. *A. septentrionale* has a NatureServe rank of S1 or S2 for the four other Intermountain/Pacific Northwest states (California, Oregon, Utah, Wyoming) where it is known to occur (NatureServe 2002), indicating it is rare regionally, not just in Idaho.

Lesquerella multiceps

Lesquerella multiceps is a slender, prostrate, yellow-flowered perennial in the mustard family. Other field characteristics include the largely entire, densely hairy basal leaves; the reverse lance-shaped, non-auriculate stems leaves; the roundish-shaped fruits with appressed hairs and a prominent style; the loosely arranged siliques on sigmoid pedicels; and the sprawling, many fruited, elongated infructescences. It is regionally endemic to the Bear River Range and adjacent mountain ranges in northern Utah and adjacent southeastern Idaho and western Wyoming. It occurs among rocks on ridges and open slopes, on limestone or other calcareous substrates (Rollins 1993).

The IDCDC became aware of *L. multiceps* as a possible conservation concern in Idaho when an old (1923) collection of this species from the Snake River Range was brought to our attention in 1995. At the time it was the only known record of this species in Idaho. As a result, *L. multiceps* was added to the Idaho Native Plant Society's (INPS) rare plant list as a Review category species (Idaho Native Plant Society 1995). A subsequent search at the New York Botanical Garden herbarium in 2000 revealed several other Idaho collections, all from the Bear River Range. *L. multiceps* was moved to the INPS Global Priority 3 category (Idaho Native Plant Society 2000) and became a consideration for addition to the Caribou-Targhee NF Sensitive plant list based on this new information. This species is on the BLM Sensitive species list for Wyoming, but not considered rare in Utah (NatureServe 2002).

Based on observations made during this field investigation, *Lesquerella multiceps* does not warrant special conservation concern by the Caribou-Targhee NF, nor by the INPS. It is common in the Idaho portion of the Bear River Range, and occupies habitats secure from any discernable largescale or high magnitude threats. Its long-term persistence on Forest lands seems assured under current management practices.

Stipa viridula (Green needlegrass); Synonym = *Nassella viridula*

Stipa viridula is a widespread species occurring mostly east of the Continental Divide, especially in the northern Great Plains region. Idaho populations are at the species' western periphery. One of the few occurrences known for Idaho is located at the northern end of the Bear River

Range, near the town of Alexander, and within about one mile of the Caribou-Targhee NF. *S. viridula* was not encountered during the field investigation. Surveys were conducted at high elevations and in habitats probably not suitable for this species. Future botanical surveys at lower elevations would have a better chance of finding *S. viridula* on the Caribou-Targhee NF.

Other target rare plant species – not known to occur in Idaho

Arabis lasiocarpa (Wasatch rockcress)

This species is endemic to northern Utah in the central and northern Wasatch Mountains, Wellsville Mountains, and Bear River Range. It is on the Utah rare plant Watch list (Utah Division of Wildlife Resources 1998). It occurs in sagebrush, mountain brush, aspen, and spruce-fir communities from middle to high elevations in the mountains (Welsh et al. 1987). *A. lasiocarpa* was not found during the field investigation, but was not specifically searched for either. It has not yet been documented to occur in the Idaho portion of the Bear River Range, but may be found in the future as potential habitat does occurs.

Draba maguirei var. *maguirei* (Maguire draba)

Draba maguirei var. *maguirei* is endemic to the Bear River Range in Cache County, Utah. Plants from the northern Wasatch and Wellsville mountains are now recognized as D. *maguirei* var. *burkei*. *D. maguirei* var. *maguirei* occupies talus slopes and rocky outcrops between roughly 5,500 and 8,800 feet elevation and flowers during May-June (Atwood et al. 1991). It is known from within approximately two miles of the Idaho border in the Bear River Range, but has not yet been documented from the State. *D. maguirei* var. *maguirei* was searched for on an opportunistic basis, but not encountered during the field investigation. It would not be surprising if future botanical surveys conducted earlier in the season when plants are in flower discover this species in Idaho on the Caribou-Targhee NF.

Erigeron cronquistii (Cronquist's daisy)

Erigeron cronquistii is a Bear River Range endemic, but presently known only from Utah. It occurs on calcareous cliffs, talus, and rock crevices at mid- to high-mountain elevations. Floristic investigations in the Bear River Range in 1990 and 1991 (Moseley and Mancuso 1990; Moseley 1991) discovered several populations of the closely related, but more common and widespread *Erigeron tener* (slender fleabane). Similarly, I encountered *E. tener*, but not *E. cronquistii* during my 2002 field investigation. Although *E. cronquistii* is known in Utah within a few miles of the state line, it apparently does not extend northward into Idaho.

Eriogonum brevicaule var. *loganum* (Logan buckwheat)

Eriogonum brevicaule var. *loganum* is endemic to northern Utah, in Cache, Morgan, and Rich counties where it occurs in sagebrush-bunchgrass, rocky outcrop, or clay bluff communities between approximately 4,800 and 7,800 feet elevation (Utah Division of Wildlife Resources). It was not found during the field investigation and has yet to be documented from Idaho.

The low growing, pubescent, yellow to whitish-flowered buckwheat I encountered in open, high elevation, exposed bedrock communities during the field investigation keys to the closely related *E. brevicaule* var. *nanum*. This species has been reported to be another Utah endemic, and apparently differs only superficially from *E. brevicaule* var. *loganum* (Welsh et al. 1987). Specimens I collected during the field investigation in 2002 document the occurrence of *E.*

brevicaule var. *nanum* in Idaho. It appears the Bear River Range in Idaho represents the northern periphery of this species' distribution. It was observed in intermittent populations along the high ridge separating the Logan and Cub river drainages, from north of Wilderness Peak, south to the Utah border. The largest population was around Point 9316 at the head of White Canyon, less than 0.2 mile north of the Utah state line. *E. brevicaule* var. *nanum* was also observed in the upper St. Charles Creek drainage. The full distribution and abundance of this species in Idaho is unresolved, but it may be limited to Caribou-Targhee NF lands in the Bear River Range.

The few populations documented during the field investigation occur in areas subject to little disturbance or threats other than those associated with occasional sheep grazing. *E. brevicaule* var. *nanum* may be worthy of a Forest "Watch" status due to its apparently limited distribution and abundance in Idaho. A full assessment of this species' conservation status on the Forest will require future field surveys that target this species more specifically than work conducted in 2002.

Primula maguirei (Maguire's primrose)

Primula maguirei is listed as Threatened by the U.S. Fish and Wildlife Service (Atwood et al. 1991). It is narrowly endemic to Logan Canyon in Cache County, Utah, and to date, has not been found in nearby portions of Idaho. *P. maguirei* occurs on damp, shaded rock crevices and ledges along lower canyon walls in mixed conifer/aspen communities between approximately 5,000 and 6,000 feet elevation. It is found mainly on north- and east-facing, mossy, calcareous rock cliffs (Atwood et al. 1991; Moseley 1991). Habitat matching this description at appropriate elevations is very limited on Caribou-Targhee NF lands in the Bear River Range. *P. maguirei* flowers in the spring (April and May). Surveys for this species on the Caribou-Targhee NF need to be conducted during the springtime when plants are in flower. My field investigation was conducted too late in the season to search for this species, and it was not encountered.

Monitoring

The Caribou-Targhee NF recently designated Bloomington Lake as a Special Emphasis Area due to the area's unique geologic, ecological, botanical, and zoological resource values (U.S. Forest Service 2002). Management guidelines associated with the Special Emphasis Area designation include the protection of Sensitive plant species located at Bloomington Lake. This designation should help ensure the long-term persistence of *Asplenium trichomanes-ramosum*, *Musineon lineare*, and other botanical resources in the area.

One of the field investigation objections was to evaluate the necessity and feasibility of establishing a formal monitoring program for Sensitive plant populations in the Bloomington Lake Special Emphasis Area. A reconnaissance survey of the designated area and its associated rare plant populations indicated such a program is not warranted at this time because Sensitive plant populations and their rock outcrop habitats in the area appear secure from anthropogenic threats. A possible exception is the headwall chutes where subpopulations of both *A. trichomanes-ramosum* and *M. lineare* occur. The chutes were blocked by snow in 2002 and could not be adequately surveyed. Monitoring stations at the chutes may be warranted to assess the effects, if any, of snowmobiles using the chutes during the winter. At a minimum, the chutes should be revisited in the near future after the snow has melted. This will verify whether or not *A. trichomanes-ramosum* and *M. lineare* still occur at the site, and permit their associated occurrence records to be updated.

PENSTEMON COMPACTUS MONITORING

The Caribou-Targhee NF identified a need to develop a monitoring program for *Penstemon compactus* to help ensure their management and actions remained consistent with the species' long-term conservation on the Forest. Establishing a monitoring program for *P. compactus* is a pro-active management step. Previous field surveys (Moseley and Mancuso 1990) for this species suggested it was not subject to any imminent, pervasive, or high magnitude threats on the Forest. For this reason, a monitoring program that focused on habitat trend and assessment at the occurrence scale, rather than the collection of intensive demographic data, was deemed adequate. The *P. compactus* monitoring protocol instituted in 2002 consisted of three components: (1) establishing photo-monitor stations; (2) collecting quantitative plant community information; and (3) updating conservation information for each occurrence. If necessary, a more intensive monitoring approach can be instituted in the future. Repeat photo-monitoring for *P. compactus* should be conducted on a periodic basis in the future. Once every 5-7 years is recommended. Monitoring may have to be done on a more frequent basis if a major disturbance affects one or more occurrences. Monitoring methods and results are discussed below.

Photo monitoring

A photo-point monitor station was established at all known *P. compactus* occurrences on the Caribou-Targhee NF during July 2002. The putative occurrence at Cub Peak (007) was not included in the monitoring program because it is probably an erroneous record. Photo points are landscape or feature photographs retaken over time from the same spot and filling the same frame so that differences between years can be documented and compared (Elzinga et al. 1998). The photo points were established to provide an occurrence-based repeat photo monitoring protocol. Repeat photo monitoring is useful to document site-specific change or lack of change in vegetation, soil, and other landscape attributes of interest (Hall 2001). The objective of the *P. compactus* photo point protocol is to document and monitor occurrence habitat conditions, particularly changes in plant cover, composition, and structure; weed invasion; and disturbance factors. Photographs taken in 2002 represent baseline conditions against which future repeat photos will be compared.

One photo-monitor station was established at each *P. compactus* occurrence. The location of the monitor station was subjectively chosen after completing a reconnaissance survey of the entire occurrence. The stations were selected to provide good overall views of the occurrence; to sample the most dense portion of the *P. compactus* population; and to be representative of habitat conditions in general. The location of each monitor station was permanently marked using a red-pained rebar stake hammered into the ground. Locations were mapped on a 7.5' USGS topographic quadrangle. In addition, an associated location form was completed with directions and a sketch of landmarks and bearings to help relocate the monitor stations in the future. The location form includes GPS coordinate information obtained using a navigation grade (Garmin 12XL) unit. Map locations and copies of the location forms are in Appendix 4.

The rebar stake marking the monitoring station served as the reference point for taking the repeat photographs, which were taken standing immediately adjacent to the marker stake. A minimum of four photo-point photographs were taken at each station – 0^0, 90^0, 180^0, and 270^0. A declination of 16^0 was used for these and all other recorded compass bearings. Additional photographs were taken at each occurrence when needed to show specific landscape, habitat, or other occurrence details. The array of photos provides a good overall view of the surrounding landscape and general habitat characteristics of the occurrence. Photographs were taken using a SLR camera, ASA 100 color print film, and wide angle (28^0) lens.

Plant community information

Quantitative plant community information was collected at each photo monitor station to augment and provide descriptive details to the photographic material. Plant community data will be useful to corroborate habitat changes suggested by repeat photographs. Community habitat data were collected using a 1/10th acre circular plot and methods outlined in Bourgeron et al. (1992). The rebar stake marking the photo-monitor station serves as the reference location point for the plant community plot as well. Plant community information is based on ocular estimates of cover class values for all vascular plant species occurring in the plot. Changes in the species list or associated cover class values from one sampling period to the next are used to monitor changes in the plant community. In addition, cover class estimates are made for several ground cover categories, including soil, gravel, rock, wood, litter, moss/lichen, and basal vegetation. Because this sampling method has an acceptable accuracy standard of +/- one cover class, an increase or decrease of two or more cover classes is required to be indicative of a measurable change. Cover classes used for this monitoring program are:

1 = <1%	30 = 25 - 34.9%	70 = 65 - 74.9%
3 = 1 - 4.9%	40 = 35 - 44.9%	80 = 75 - 84.9%
10 = 5 - 14.9%	50 = 45 - 54.9%	90 = 85 - 94.9%
20 = 15 - 24.9%	60 = 55 - 64.9%	98 = 95 - 100%

Two forms were completed for each plot: (1) a “Community Survey Form” that includes location, description, and other general information about the plot site; and (2) an “Ocular Plant Species Data Form” that lists the estimated percent cover for each plant species in the plot.

Occurrence updates

Updated occurrence information was collected by walking all of the occurrence area. Location, size, population, habitat, threat, and other conservation attributes were all updated. Plant abundance numbers were estimated or counted. Habitat conditions were evaluated paying special attention to disturbance impacts or other potential threat factors. Copies of the updated *P. compactus* IDCDC occurrence records are included in Appendix 3.

Photo monitoring - results

The entire photo set has been provided to the Caribou-Targhee NF as part of this report. A duplicate set will remain on file at the IDCDC office in Boise. Information to help replicate photo-point and plant community plot portions of the monitoring protocol is summarized in Appendix 5.

Plant community information - results

Copies of the completed Community Survey and Ocular Plant Species Data forms for each occurrence are in Appendix 6. Plant community information collected in 2002 represents baseline vegetation conditions at each photo point. Table 3 summarizes plant community information for the six *Penstemon compactus* monitoring sites. The six plots contained a total of 81 vascular plant species. Forbs were the most diverse group with 62 taxa. Only 5 (6%) species, plus *Penstemon compactus,* occurred in vegetation plots at all six occurrences. In comparison, 32 species (40%) were found in only one plot. The number of species/plot ranged from a low of 20 at upper Hodge Nibley Creek (002), to a high of 40 at Wilderness Peak (001). Lichens and bryophytes were absent or rare at all plots, with ground cover tending to be dominated by rock, gravel, and bare soil.

Table 3. Plant community plot data for 2002 *Penstemon compactus* monitoring stations. Cover values are explained in the text.

	Occurrence						
Species	**001**	**002**	**003**	**004**	**005**	**006**	**Constancy (%)**
Trees							
Pinus flexilis	3		3	10	1	1	83
Pseudotsuga menziesii	3		3	3		3	67
Shrubs							
Acer glabrum	3		3			10	50
Artemisia arbuscula	3		20				33
Artemisia tridentata				3	1		33
Berberis repens			1	3			33
Juniperus communis			3		3		33
Monardella odoratissima	1	1			1	1	67
Pachystima myrsinites		3	1	3	1		67
Ribes cereum			1				17
Ribes montiguem	3						17
Symphoricarpos oreophilus	3		1	3	3	1	83
Graminoids							
Agropyron trachycaulum	1	1	1	1	3	1	100
Bromus carinatus	1						17
Elymus sp.	1						17
Leucopoa kingii	3	1	3	3	3	1	100
Poa fendleriana					1		17
Poa sp.			1	1			33
Stipa columbiana		1	1	1	1	1	83
Forbs							
Achillea millefolium	1	1		1	1	1	83
Agastache urticifolia						3	17
Arabis glabra					1		17
Arabis holboellii					1	1	33
Arabis sp.	1		1				33
Arenaria congesta		1		1	1		50
Artemisia dracunculus						1	17
Artemisia ludoviciana	1						17
Aster perelegans						1	17
Balsamorhiza incana						1	17
Balsamorhiza sagittata	1			1			33
Castilleja applegatei	1	3	1	1	1	1	100
Chaenactis douglasii	1	1	1				50
Crepis acuminata	1		1	1	1		67
Cymopterus hendersonii			1				17
Cystopteris fragilis	1				1		33
Delphinium sp.	1						17
Draba sp.			1				17
Species	**001**	**002**	**003**	**004**	**005**	**006**	**Constancy (%)**

Erigeron compositus			1				17
Erigeron eatonii			1				17
Erigeron speciosus	1			1	1	3	67
Erigeron tener			1			1	33
Eriogonum brevicaule nanum	3		1				33
Eriogonum umbellatum	1	3	1	3	1	1	100
Erysimum asperum				1		1	33
Erythronium grandiflorum					1	1	33
Frasera speciosa					1		17
Geranium viscosissimum	1					3	33
Hackelia micrantha	1					1	33
Helianthella uniflora						1	17
Heuchera rubescens (?)			1		1		33
Ivesia gordonii	1						17
Lesquerella multiceps	1	1	1	1	1		83
Linanthastrum nuttallii		10		10			33
Linum kingii		1					17
Linum perenne				1			17
Lithospermum ruderale				1			17
Lomatium graveolens	3	3	1	20	1	20	100
Lupinus argenteus	1						17
Machaeranthera canescens				1	1	1	50
Mertensia oblongifolia (?)	1		1		1	1	67
Microseris sp.	1						17
Orthocarpus tolmiei			1	1			33
Osmorhiza occidentalis						1	17
Oxytropis campestris	1						17
Pellaea breweri				1		1	33
Penstemon compactus	1	1	1	1	3	3	100
Penstemon cyanantheus	1			1			33
Penstemon humilis	1				1		33
Penstemon leonardii		1	1	1		1	67
Petradoria pumilus				1			17
Petrophytum caespitosum			1		3		33
Phacelia hastata		3			1	1	50
Sedum lanceolatum	1		1		1		50
Senecio streptanthifolius	1	1		1		1	67
Silene scouleri (?)	1	1		1	1		67
Solidago simplex				1			17
Stellaria jamesiana						1	17
Streptanthus cordatus				1			17
Synthyris pinnatifida	1				1		33
Valeriana occidentalis					1		17
Valeriana sitchensis	1						17
Ground cover							
Basal vegetation	3	3	?	3	3	3	-
Gravel	40	3	?	10	10	3	-
Species	**001**	**002**	**003**	**004**	**005**	**006**	**Constancy (%)**

Litter	10	3	?	10	3	3	
Moss/lichen	-	-	?	-	-	1	-
Rock	30	50	?	30	50	60	-
Soil	20	40	?	50	40	30	-
Wood	-	3		3	1		-

REFERENCES

Atwood, D,. J. Holland, R. Bolander, B. Franklin, D. House, L. Armstrong, K. Thorne, and L. England. 1991. Utah – threatened, endangered, and sensitive plant field guide. Cooperatively published by the Forest Service, Intermountain Region, Ogden, UT and seven other entities.

Bourgeron, P.S., R.L. DeVelice, L.D. Engeling, G. Jones, and E. Muldavin. 1992. Western Heritage Task Force site and community survey manual. Version 92B. Western Heritage Task Force, Boulder, CO. 24 p.

Cronquist, A., A. Holmgren, N.H. Holmgren, and J.L. Reveal. 1972. Intermountain flora. Vascular plants of the Intermountain West, USA. Volume 1. Published for The New York Botanical Garden by Hafner Publishing Company, Inc., N.Y. 270 p.

Dieffenbach, T. no date. Plant survey of the Caribou Mountain area. Unpublished Forest Service contract report by Idaho State University. 60 p.

Elzinga, C., D.W. Salzer, and J.W. Willoughby. 1998. Measuring and monitoring plant populations. BLM Technical Reference 1730-1. Bureau of Land Management, National Business Center, Denver, CO. 477 p.

Flora of North America Editorial Committee. 1993. Flora of North America, north of Mexico. Volume 2. Oxford University Press, New York. 475 p.

Hall, F.C. 2001. Ground-based photographic monitoring. General Technical Report PNW-GTR-503. United States Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, OR 340 p.

Idaho Native Plant Society 1995. Results of the eleventh annual rare plant conference, February 1995. Unpublished results of the conference by the Idaho Native Plant Society. Available at www.idahonativeplants.org.

Idaho Native Plant Society 2000. Results of the sixteenth annual rare plant conference, February 2000. Unpublished results of the conference by the Idaho Native Plant Society. Available at www.idahonativeplants.org.

Mitchell, V.E. and E.H. Bennett. 1979. Geologic map of the Preston quadrangle, Idaho. The Geologic Map Series (2^0 quadrangle). Idaho Bureau of Mines and Geology, Moscow, Idaho.

Moseley, R.K. 1991. Threatened, endangered, and sensitive plant inventory of the Bear River Range, Caribou National Forest: second year results. Cooperative Challenge Cost-share Project. Caribou National Forest and Idaho Department of Fish and Game, Conservation Data Center, Boise, ID. 20 p., plus appendices.

Moseley, R.K. and M. Mancuso. 1990. Threatened, endangered, and sensitive plant inventory of the Bear River Range, Caribou National Forest. Cooperative Challenge Cost-share Project. Caribou National Forest and Idaho Department of Fish and Game, Conservation Data Center, Boise, ID. 25 p., plus appendices.

NatureServe. 2002. NatureServe Explorer: an online encyclopedia of life [web application]. Version 1.6. Arlington, Virginia, USA: NatureServe. Available: http://www.natureserve.org/explorer.

Rollins, R.C. 1993. The Cruciferae of continental North America. Systematics of the mustard family from the Arctic to Panama. Stanford University Press, Stanford, California. 976 p.

Schultz, J.S. and L. M. Schultz. 1978. Report on the botanical survey of endangered and threatened plants, Caribou National Forest. Unpublished Forest Service contract report. Contract No. 53-84M8-8-410, U.S. Forest Service, Ogden, UT. 114 p.

U.S. Forest Service. 2002. Prescription 2.1.1(e) - Bloomington Lake Special Emphasis Area (draft version dated 9/2002), Caribou Draft Forest Plan. Caribou-Targhee National Forest. Idaho Falls, ID.

Utah Division of Wildlife Resources. 1998. Inventory of sensitive species and ecosystems in Utah. Endemic and rare plants of Utah: An overview of their distribution and status. Report prepared for Utah Reclamation Mitigation and Conservation Commission and the U.S. Dept. of Interior.

Welsh, S.L., N.D. Atwood, S. Goodrich, and L.C. Higgins. 1987. A Utah Flora. Great Basin Naturalist Memoirs, Number 9. Brigham Young University, Provo, Utah. 894 p.

Appendix 1.

Survey routes for 2002 rare plant field surveys in the Bear River Range.

Appendix 2.

Map locations for *Asplenium septentrionale*, *Asplenium trichomanes-ramosum, Musineon lineare,* and *Penstemon compactus* in the Bear River Range, Caribou-Targhee National Forest.

Appendix 3.

Element Occurrence Records for *Asplenium septentrionale*, *Asplenium trichomanes-ramosum, Musineon lineare,* and *Penstemon compactus* in the Bear River Range, Caribou-Targhee National Forest.

Appendix 4.

Map locations and photo-monitor point location forms for *Penstemon compactus*.

Appendix 5.

Penstemon compactus monitoring information.

Wilderness Peak (001)

Directional photos: 0^0, 90^0, 180^0, 270^0
Other photos: 1. photo of small rock cairn marking summit of peak. The photo-point marker stake is located beneath the cairn. 2. view of ridge leading to summit and northern extent of occurrence.
Plant community plot: rebar stake marks the top (uphill; east) edge of plot.

Upper Hodge Nibley Creek (002)

Directional photos: 0^0, 45^0, 90^0, 125^0, 180^0, 225^0, 270^0
Other photos: 1. photo of marker stake near base of snag.
Plant community plot: rebar stake marks the uphill edge of plot (plot center located 11.7 m downhill @ 125^0 from stake).

Upper Crooked Creek (003)

Directional photos: 0^0, 90^0, 180^0, 270^0
Other photos: 1. standing ca 10' below marker stake looking north across steep west-facing upper slope with *Penstemon compactus*.
2. standing ca 10' east of marker stake looking north at very upper east-facing slope with no *Penstemon compactus*.
Plant community plot: rebar stake marks center of plot.

Gibson Basin (004)

Directional photos: 0^0, 45^0, 90^0, 180^0, 225^0, 300^0
Other photos: 1. close-up of marker stake.
Plant community plot: rebar stake marks the uphill edge of plot (plot center located 11.7 m downhill @ 120^0 from stake).

White Canyon (005)

Directional photos: 0^0, 45^0, 90^0, 180^0, 225^0, 270^0, 315^0
Other photos: 1. marker stake location.
Plant community plot: rebar stake marks center of plot.

West of Franklin Basin (006)

Directional photos: 0^0, 90^0, 180^0, 210^0, 270^0
Other photos: 1. photo of rock outcrop with *Penstemon compactus*.
Plant community plot: rebar stake marks center of plot.

Appendix 6.

Copies of the *Penstemon compactus* monitoring 2002 field forms.