

FIELD SURVEY FOR
THREE RARE PLANT SPECIES IN THE
RAFT RIVER MOUNTAINS, UTAH



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ABSTRACT

This report summarizes our surveys for three rare plant species endemic to the Great Basin region of the Intermountain West. Grouse Creek rockcress (*Arabis falcatoria*), Cottam's cinquefoil (*Potentilla cottamii*), and rock violet (*Viola lithion*) are all on the U.S. Forest Service, Region 4 Sensitive plant list. Fewer than ten occurrences have been documented for each of these species. Sawtooth National Forest land in the Raft River Mountains of northwestern Utah is known to support several Cottam's cinquefoil occurrences. It is also reported to have one or two occurrences of Grouse Creek rockcress. Rock violet has never been documented from the Sawtooth NF, but occurs in close proximity to Cottam's cinquefoil at a site in Nevada, and the two species habitat requirements overlap to a large degree. In a cooperative project with the Sawtooth National Forest, the Idaho Conservation Data Center conducted a field survey for these three rare plant species in the Raft River Mountains in 2003. Two new occurrences of Cottam's cinquefoil were discovered, including a possible new elevational low. In addition, updated conservation information was collected at two previously documented Cottam's cinquefoil occurrences. A third previously documented occurrence was not relocated. Grouse Creek rockcress and rock violet were not found and potential habitat for these two species appears to be limited on Sawtooth National Forest land.

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INTRODUCTION

The focus of this study was a field survey for three rare plant species on lands administered by the Sawtooth National Forest (NF) in the Raft River Mountains, in northwestern Utah. Grouse Creek rockcress (*Arabis falcatoria*), Cottam's cinquefoil (*Potentilla cottamii*), and rock violet (*Viola lithion*) are Great Basin endemics, known only from a few populations in Nevada and Utah. Of the three species, only Cottam's cinquefoil has been confidently documented to occur on Sawtooth NF lands in the Raft River Mountains. Two occurrences of Grouse Creek rockcress have been reported from the Sawtooth NF, but each has issues making the reports suspect. Rock violet has never been documented from the Sawtooth NF, but occurs in close proximity to Cottam's cinquefoil at a site in Nevada, and the two species habitat requirements overlap to a large degree. For these reasons it was also included in our list of target species. Unsurveyed habitat potentially suitable for all three species was known or suspected to occur on Sawtooth NF land in the Raft River Mountains. All three species are conservation concerns due to the small number of known populations, small population sizes, and restricted distributions. In 2003, the Sawtooth NF contracted the Idaho Conservation Data Center (IDCDC) to conduct a field investigation in the Raft River Mountains to: 1) update distribution and abundance information for known Cottam's cinquefoil occurrences, and search for new populations; and 2) survey for Grouse Creek rockcress and rock violet to determine whether or not they occur on the Sawtooth NF.

SPECIES INFORMATION

Grouse Creek Rockcress

Grouse Creek rockcress is a perennial herb, 1-3 dm tall, distinguished by its bow-shaped siliques and large, coarse, forked to few-branched trichomes on the basal leaves. Another diagnostic feature is the anthers, which noticeably exceed the calyx in length and may signify an unusual pollination mechanism Rollins (1993). Grouse Creek rockcress flowers in May-June.

Grouse Creek rockcress is known from one occurrence in Elko County, Nevada, and from as many as six occurrences in Utah. Rollins (1993) predicted it may also be found in adjacent Idaho and Oregon. The six Utah occurrences are located in the Goose Creek, Grouse Creek, and Raft River mountains complex in Box Elder County, Utah. Two occurrences are reported to be located on Sawtooth NF land in the Raft River Mountains. However, the occurrence reported for Clarks Basin (Utah Element Occurrence 004) is based on imprecise location information, while the occurrence reported for northeast of George Peak near Cabin Spring (Utah Element Occurrence 006) is considered "questionable" by the Utah Natural Heritage Program (B. Franklin, Utah Natural Heritage Program botanist, pers. comm.) due to uncertainty of its identification.

The total number of individuals from known occurrences is uncertain, but is thought to be low. Holland (1998a) estimated a total of 250 individuals at Mitchell Creek (Nevada Element Occurrence 001) in the Ruby Mountains, Nevada, and that population size at other occurrences was "apparently rather small." Conservation ranks for Grouse Creek rockcress are listed in Table 1. Rock Creek rockcress Utah Element Occurrence records from the Raft River Mountains and surrounding areas are in Appendix 1.

Rockcress (*Arabis*) is a large, complex genus which includes 80 species in North America (Rollins 1993). Grouse Creek rockcress was described in 1982 in a publication that also includes a technical description for the species (Rollins 1982). The taxon at the species level is

	Conservation Ranking		
	Grouse Ck rockcress	Cottam's cinquefoil	Rock violet
US Forest Service Region 4	Sensitive	Sensitive	Sensitive
BLM (Nevada)	Special Status Species	Special Status Species	Special Status Species
BLM (Utah)	Sensitive Species	Sensitive Species	Sensitive Species
US Fish and Wildlife Service	None (Former C2)	None (Former C2)	None (Former C2)
NatureServe	G1, S1	G1, S1	G1, S1
State of Nevada	None	Sensitive	None
Nevada Native Plant Society	Watch	Sensitive	Sensitive

Table 1. Conservation ranks for Grouse Creek rockcress, Cottam's cinquefoil, and rock violet. See Appendix 2 for definition of ranks.

not fully accepted by all taxonomists. In contrast with the first two editions of *A Utah Flora* (Welsh et al. 1987, Welsh et al. 1993), Grouse Creek rockcress is recognized in the third edition (Welsh et al. 2003). Nevertheless, as in past editions, the authors question the validity of the taxon at the species level. They argue "the few specimens available for examination are hardly convincing that the species deserves taxonomic status." Holland (1998a) reported that Holmgren has only "tentatively retained" Grouse Creek rockcress in his draft treatment of the rockcress genus (*Arabis*) for the *Intermountain Flora* project.

Grouse Creek rockcress is typically found in mountain mahogany (*Cercocarpus ledifolius*), pinyon/juniper (*Pinus edulis/Juniperus* spp.), and mountain brush zones on windswept ridges between approximately 5,500-8,600 feet elevation. Individuals are commonly found growing from crevices or in the shelter of larger plants in rocky habitats, including quartzite, limestone, mineralized, and marble chip substrates. These habitats are common and widespread in the Great Basin and past surveys for Grouse Creek rockcress have targeted only a small fraction of this potential habitat over the years. No associated species have been shown to predict its presence. We based our scope of potential habitat on features characterizing the known Grouse Creek rockcress occurrence located near Dove Creek Pass, approximately two miles south of the Sawtooth NF boundary. Open, windswept ridges and slopes with white- to gray-colored bedrock near or at the surface, and sparse, low-growing vegetation was considered potential habitat for purposes of our field survey

Four similar-looking rockcress species occur within the Mountains of Grouse Creek rockcress and occupy similar rocky habitats. They include nodding rockcress (*A. demissa*), Cusick's rockcress (*A. cusickii*), sicklepod rockcress (*A. sparsiflora*), and rabbitear rockcress (*A. pendulina* var. *russeola*). Rollins' (1982) discussion of character differences between these species is summarized in Table 2.

Cottam's cinquefoil

Cottam's cinquefoil is a low, perennial, mat-forming forb known from the peaks of only four mountain ranges in the Great Basin. Holland (1999) noted that populations occur in the four highest mountain ranges surrounding glacial Lake Bonneville. Prior to our survey, Cottam's cinquefoil was documented from eight occurrences rangewide. In Utah, the Deep Creek, Stansbury, and Pilot Mountains each contain one known occurrence, and the Raft River Mountains four occurrences. The Pilot Mountains of Utah extend into Nevada and are the site of Nevada's one occurrence. These mountain ranges are separated by 112 - 177 km (70 - 110 mi).

	Fruit (siliques)	Pubescence	Habit	Cauline leaves
Grouse Creek rockcress (GCR)	widely spreading, bow-shaped	coarse, but not as hispid as in Cusick's rockcress	low growing, caespitose; caudex simple	few, remote
Nodding rockcress	shorter than GCR; pendulous, narrow and straight	similar to GCR	caudex simple or branched	few, much shorter than internodes
Cusick's rockcress	similar in shape to GCR	Hispid	caudex branched	many and overlapping
Sicklepod rockcress	similar in shape to GCR	glabrous or pubescent with appressed or spreading hairs	tall, scarcely caespitose	many and overlapping
Rabbitear rockcress	shorter than GCR, pendulous	completely unlike GCR	similar to GCR	N/A

Table 2. Morphological characteristics of similar-looking rockcress species.

Cottam's cinquefoil is known only from small occurrences (4 - 50 individuals). Before our survey, roughly 300 individuals plants had been documented from the eight known occurrences (based on Utah and Nevada Natural Heritage Program Element Occurrence information). The actual number of plants is likely higher, but difficult access to its cliff habitat makes finding and counting plants problematic. Peak flowering for Cottam's cinquefoil occurs in July. Figures 1 and 2 contain photos of the plant and its habitat. Conservation ranks for Cottam's cinquefoil are listed in Table 1. Cottam's cinquefoil Utah Element Occurrence records are in Appendix 1.



Figure 1. Close-up of Cottam's cinquefoil plant at new Rosevere Point occurrence. Photo by M. Mancuso, July 14, 2003.



Figure 2. Cottam's cinquefoil habitat at new Rosevere Point occurrence. White arrow points to plant location. Photo by M. Mancuso, July 14, 2003.

Cottam's cinquefoil was first collected in 1929 by Walter P. Cottam at Pilot Peak in Nevada, but this species was not described until 1987 (Holmgren 1987). There are no alternative taxonomic treatments or synonyms for this taxon. A technical description for Cottam's cinquefoil can be found in Holmgren (1987). The closest relative of Cottam's cinquefoil is likely snow cinquefoil (*P. nivea*). The most morphologically similar species are arctic cinquefoil (*P. nana* = *P. hyparctica*) and dwarf mountain cinquefoil (*P. robbinsiana*). However, the distributions of these three species do not overlap with that of Cottam's cinquefoil (Holmgren 1987). Franklin (1994) pointed out, that ten other cinquefoil species occur in the Raft River Mountain complex. Cottam's cinquefoil differs from these species in its trifoliate leaf and low, tufted growth habit. The species most resembling Cottam's cinquefoil are sibbaldia (*Sibbaldia procumbens*), and wedge-leaf cinquefoil (*Potentilla diversifolia*). Table 3 summarizes character differences between sibbaldia, wedge-leaf cinquefoil, and Cottam's cinquefoil.

Cottam's cinquefoil is a high elevation species with occurrences known from between 2652 - 3627 m (8,700 - 11,900 ft) elevation prior to our survey. This elevation range excludes the 1929 Cottam record (Utah Element Occurrence 001), which is based on suspect label location data. Attempts to relocate this occurrence have failed and it is suspected that some of the original location information, including the elevation, is erroneous. Southerly populations of Cottam's cinquefoil are found at higher elevations compared to sites further north. Cottam's cinquefoil occurs in cliff cracks and crevices of quartzite, schist, and less commonly granite outcrops, often shaded from direct midday sunlight by a northerly aspect.

Species	Stem	Leaves	Inflorescence	Sepals	Petals
Cottam's cinquefoil	decumbent to finally spreading or prostrate, 0.5-1.3 (1.7) dm long	mainly basal, 3-foliate, the terminal leaflet (0.3) 0.5-1.2 cm long, 0.3-1.3 cm wide, obovate to rhombic, toothed mainly below the middle; cauline leaves 1 or 2	much reduced, 1- to 4 flowered, the flowers not especially showy	2.4-3.2 mm long ovate or deltoid lanceolate	yellow, (2) 3-4 mm long
Sibbaldia	low, mat-forming, flowering stem 0.4-1.4 dm tall	2-12 cm long; 3 leaflets oblanceolate to obovate, 3 (rarely 5) -toothed apically; terminal leaflet 11-32 mm long, 7-18 mm broad	leafy-bracted cyme; flowers inconspicuous	2.5-5 mm long	yellow, 1.5-3 mm long
Wedge-leaf cinquefoil	ascending to erect, 0.6-3.2 dm tall	mainly basal, palmately to less commonly pinnately (3) 5 to 7 foliate, the terminal leaflet 1.2-4 cm long, 0.3-1.8 cm wide, obovate to oblanceolate, toothed mainly above the middle; cauline leaves 1-3	several flowered, the flowers showy	5-6.5 mm long, triangular to triangular attenuate	yellow, 5.6-9.5 mm long

Table 3. Morphological characteristics of similar-looking cinquefoil species. Compiled from Franklin (1994), Welsh et al. (1993), and Baird (1991).

Rock violet

Rock violet is a perennial, caulescent herb, 5-15 cm tall, with blue to violet flowers. In the type description, Holmgren (1992) notes that North American violets are generally found in the deeper soils of shady woods and seasonally moist meadows. In contrast, rock violet is found growing in the crevices of rocky outcrops and the surrounding talus. The specific epithet of rock violet is well-suited: the Greek *lithos*, for rock or stone, and *ion*, for violet.

Rock violet is known from five high elevation occurrences in Nevada and one in Utah. In Nevada, it is found in the White Pine and Pilot Mountains, in Elko, Nye, and White Pine counties. In Utah, it has been documented from the Pilot Mountains in western Box Elder County. The Nevada Natural Heritage Program (2001) estimates the total population size to be approximately 20,000 individuals. Holmgren (1992) postulates that its distribution on high mountain peaks is related to post-glacial climate change. Conservation ranks for rock violet are listed in Table 1. The one Utah Element Occurrence record for rock violet is in Appendix 1.

A technical description for rock violet can be found in Holmgren (1992). Its closest relatives are believed to be the allopatric Olympic violet (*V. flettii*) and Canadian white violet (*V. canadensis*) (Holmgren 1992). There are no alternative taxonomic treatments or synonyms for rock violet. Morphologically similar species do not occur within its known range. Flowering varies from June to August depending on elevation and perhaps other site factors.

Rock violet has been collected on dolomite, limestone, quartzite, and granite substrates. Associated species noted at one or more occurrences include mountain snowberry (*Symphoricarpos oreophilus*), mountain gooseberry (*Ribes montigenum*), red alumroot (*Heuchera rubescens*), rock columbine (*Aquilegia scopulorum*), Fendler's meadowrue (*Thalictrum fendleri*), limber pine (*Pinus flexilis*), and quaking aspen (*Populus tremuloides*). However, none of these associated species have been shown to consistently predict the presence of rock violet.

Little is known about the population biology or ecology of rock violet. Holland (1998b) listed habitat features common to the Nevada occurrences, including:

- It is found in shady crevices of steep rock outcrops receiving only a few hours of daylight during the summer;
- It is restricted to steep, northeast facing snow avalanche chutes;
- It grows in dark, loamy soil accumulated in cracks over bedrock, although scattered plants can be found in the deposition zones at the bottom of avalanche chutes;
- It occurs in the subalpine zone from 2390 - 3194 m (7,840 - 10,480 ft) elevation, near timberline, where avalanche chutes traverse stands of limber pine
- It is tolerant of and perhaps dependent upon avalanche disturbance.

The combination of these features was only rarely encountered in the Raft River Mountains during our survey.

METHODS

Cottam's cinquefoil was our primary target species during the field survey. We spent only a limited amount of time searching for Grouse Creek rockcress because at the time of our survey we were unaware of the two occurrences reported to be located on the Sawtooth NF. We were only aware of occurrences located near, but south or west of the Sawtooth NF boundary. We

did not target any specific areas for rock violet, instead we searched for this species opportunistically while surveying for Cottam's cinquefoil. Areas containing potentially suitable habitat for Grouse Creek rockcress and Cottam's cinquefoil were selected using topographic maps, proximity to known occurrences, and our previous knowledge of the survey area.

Surveys were conducted by walking meandering transects through each of our survey areas. In the cliff face habitats potentially supporting Cottam's cinquefoil and rock violet, our searching was limited to ledges, chutes, and other portions of the rock walls accessible in a safe manner. We visited the known Cottam's cinquefoil occurrence at Bull Lake West (Utah Element Occurrence 004) before initiating surveys to reacquaint ourselves with this species and its habitat. While some southerly exposures were surveyed, our searches for Cottam's cinquefoil focused on steep cliff faces and other rock outcrops having a northerly aspect. A Grouse Creek rockcress occurrence located near Dove Creek Pass was also visited before beginning our survey to better familiarize ourselves with this species and its habitat. This site is south of, but within two miles of the Sawtooth NF boundary. We were unable to relocate Grouse Creek rockcress at this site.

Our field investigation was conducted during July, 2003. Habitat and vegetation information for each of our survey areas was recorded in field notebooks. Our survey areas were delineated as polygons on USGS 7.5' topographic quadrangles. GPS coordinates were recorded for all target species locations we discovered or updated. Population, size, habitat, threat, and other conservation information was summarized on a standard Idaho rare plant observation form for each occurrence we discovered or updated. Photographs and plant specimens were collected as opportunity allowed. Plant nomenclature used in this report follows the PLANTS database (Natural Resources Conservation Service 2004).

RESULTS

Grouse Creek rockcress

Sawtooth NF land in the vicinity of Clarks Basin was searched for Grouse Creek rockcress. Only a few, small outcrops of potential Grouse Creek rockcress habitat were encountered. Extensive areas of potential habitat characterized by windswept, sparsely vegetated, white-colored ridge tops and upper slopes were observed in the Clarks Basin area south of the Sawtooth NF boundary. We did not discover any populations of Grouse Creek rockcress. Areas we surveyed were mapped as polygons (Appendix 3). The maps also show the locations of the two Grouse Creek rockcress occurrences reported for the Sawtooth NF.

A drive-by reconnaissance along the southern front of the Raft River Mountains revealed additional potential habitat for Grouse Creek rockcress to be largely limited to areas south of the Sawtooth NF boundary. From a distance, potential habitat was spotty at best in the Mahogany Peaks area. Some potential habitat was observed on private lands in the south-central portion of the Raft River Mountains known as the "Black Hills". More extensive areas containing potential habitat appeared to exist in the canyons of Pine Creek north of Rosette. However, all or most of this potential habitat appeared to be located below the Sawtooth NF boundary. Overall, our survey found large blocks of potential Grouse Creek rockcress habitat to be absent from lands administered by the Sawtooth NF.

Cottam's cinquefoil

We surveyed nine areas for Cottam's cinquefoil, including revisits to three of the four previously known occurrences in the Raft River Mountains. We relocated and updated occurrence information for the previously documented occurrences at Bull Lake West (Utah Element

Occurrence 004) and Bull Lake Basin (Utah Element Occurrence 005). Our attempt to relocate the known occurrence at Pine Creek Spring (Utah Element Occurrence 002) was unsuccessful. We did not try to relocate the George Peak (Utah Element Occurrence 003) occurrence. Two new Cottam's cinquefoil occurrences were discovered during our field survey. One was located near Rosevere Point, the other at the head of East Fork Rice Creek. Maps showing the location of the new occurrences are in Appendix 4. Rare plant observation forms completed for both the two new, and the two relocated occurrences are in Appendix 5. We concentrated most of our survey work in areas not previously searched for Cottam's cinquefoil. However, one of the newly discovered occurrences was found in an area previously surveyed by the Utah Natural Heritage Program (Franklin 1994). Areas we surveyed were mapped as polygons (Appendix 3). The maps also show the location of all Cottam's cinquefoil occurrences on the Sawtooth NF. Information for the updated and new occurrences is summarized below.

Bull Lake West (Utah Element Occurrence 004): A total of 11 Cottam's cinquefoil genets were observed at this occurrence. Plants occurred at, and immediately below the Elba quartzite canyon rim.

Bull Lake Basin (Utah Element Occurrence 005): A total of six Cottam's cinquefoil genets were observed at this occurrence. Plants occurred in crevices over an approximately 3 m² area on a north-facing cliff face of Elba quartzite rock. Additional plants may occur in the vicinity.

Rosevere Point: A total of 50 Cottam's cinquefoil genets were counted at this new occurrence. Four plants were observed on boulders emerging from talus at the canyon rim. All other plants occurred on near vertical, northwest-facing cliff ledges and crevices on reddish-colored Elba quartzite. Plants occurred over an approximately 400 m² area. Additional plants may occur in the vicinity.

Head of East Fork Rice Creek: A total of nine Cottam's cinquefoil genets were counted at this new occurrence, consisting of two groupings of separated by approximately 15 m (50 ft) horizontally. The eastern grouping had five genets, a western grouping four genets. Both occupied only a few square meters. Plants were restricted to crevices on a near vertical cliff face of Elba quartzite. Additional plants may occur in the vicinity.

Rock violet

We searched for rock violet in the same places and at the same time as for Cottam's cinquefoil. No rock violet populations were located during our field survey. Marginal rock violet habitat was observed in a few places (Cottam's cinquefoil Survey Polygons 2 and 4, see Appendix 4). However, most of the areas we searched did not have more than one or two of the habitat features listed by Holland (1998b).

SURVEY AREA DESCRIPTIONS

A brief description and habitat assessment for each of our survey areas is provided below. Maps showing the location of Grouse Creek rockcress survey polygon are in Appendix 3, and in Appendix 4 for Cottam's cinquefoil.

Grouse Creek rockcress

Survey Polygon #1: The ridgecrest and upper slopes of this polygon were dominated by sagebrush-steppe or mountain brush vegetation. Only a few, small, scattered outcrops of broken or unbroken quartzite bedrock supporting sparsely vegetated low sagebrush (*Artemisia*

arbuscula) or fringed sagebrush (*Artemisia frigida*) communities were observed. No potential Grouse Creek rockcress habitat was observed in long, clear views to the north.

Survey Polygon #2: Most of this area was dominated by sagebrush-steppe vegetation. A quarry zone along the top of a knoll in the middle of the polygon supported a sparsely vegetated inclusion of low sagebrush on shallow soil over quartzite. This was one of the few small pockets of potential Grouse Creek rockcress habitat observed in the area.

Survey Polygon #3: The slopes above Clarks Basin were dominated by mountain sagebrush (*Artemisia tridentata* ssp. *vaseyana*) communities and a few aspen patches. Graminoid-dominated meadows characterized the basin bottomlands. A rock outcrop area with low sagebrush north of Clarks Basin Spring was the only place intensively surveyed. No potential Grouse Creek rockcress habitat was observed in long, clear views to the north and east.

Survey Polygon #4: The survey area, as well as the surrounding slopes were dominated by mountain sagebrush communities with interspersed deciduous shrub patches. No potential Grouse Creek rockcress habitat was observed in long, clear views to the north, east, and west.

Cottam's cinquefoil

Survey Polygon #1: This survey area encompasses the Cottam's cinquefoil occurrence at Bull Lake West (Utah Element Occurrence 004). Cottam's cinquefoil was associated with scattered high elevation species such as opposite stonecrop (*Sedum debile*), alpine mountain sorrel (*Oxyria digyna*), brittlefern (*Cystopteris fragilis*), Parry's primrose (*Primula parryi*), and smooth fleabane (*Erigeron leiomeris*) on the cliff face.

Survey Polygon #2: This survey area encompasses the Cottam's cinquefoil occurrence at Bull Lake Basin (Utah Element Occurrence 005). Scattered opposite stonecrop, red alumroot, and Louisiana wormwood (*Artemisia ludoviciana*) were associated species with Cottam's cinquefoil along the steep cliff face. The sheer quartzite and schist cirque wall at Bull Lake Basin drops hundreds of feet to Bull Lake. It contains extensive segments of potential habitat that cannot be readily searched without technical climbing gear. We were able to survey only a fraction of the potential habitat in the area.

Survey Polygon #3: A new Cottam's cinquefoil occurrence was discovered in this survey area near Rosevere Point. The survey area consisted of a steep north- to northeast-facing cliff complex. Broken portions with chutes and ledges were searched, but some sections of potential habitat were not accessible due to intervening vertical faces. It is possible additional pockets of Cottam's cinquefoil occur in the area. Cliff face species associated with Cottam's cinquefoil included opposite stonecrop, red alumroot, smooth yellow fleabane, draba (*Draba* spp.), and Henderson's wavewing (*Pteryxia hendersonii*).

Survey Polygon #4: A new Cottam's cinquefoil occurrence was discovered at the head of East Fork Rice Creek, approximately 0.5 miles northwest of Hidden Spring. The area consisted of a series of steep to moderately steep northerly-facing rock outcrops. Outcrop species associated with Cottam's cinquefoil included Henderson's wavewing, western yarrow (*Achillea millefolium*), cobwebby goldenbush (*Ericameria macronema*), fescue spp. (*Festuca* spp) and spike fescue (*Leucopoa kingii*). We were able to search the majority of this outcrop area. The polygon overlaps an area previously searched in 1993 without success (Franklin 1994).

Survey Polygon #5: This survey area includes the rocky knob just north of Hidden Spring. The knob area was searched due to its geologic and vegetation similarities to the George Peak

occurrence (Utah Element Occurrence 003). No Cottam's cinquefoil was found on the shaded quartzite outcrops representing the best of the limited potential habitat in the area. Limber pine, mountain snowberry and mountain currant occurred in the area.

Survey Polygon #6: This polygon lies in the cirque at the head of the North Fork Indian Creek, near Hidden Spring. The east to southerly cliff exposures did not appear to provide adequate shade for Cottam's cinquefoil, and none were found at this site.

Survey Polygon #7: This survey area is located at the head of Left Hand Fork Dunn Canyon, approximately 0.7 miles northeast of Dunn Point. The southeast- to southwest-facing cliff exposures did not appear to provide adequate shade for Cottam's cinquefoil, and none were found at this site.

Survey Polygon #8: This survey area is located just east of Dunn Point, along the west face of the upper Left Hand Fork Dunn Canyon. The rocky, east-facing, dark schist cliff wall and associated upper slopes did not appear to provide adequate shade for Cottam's cinquefoil, and none were found at this site.

Survey Polygon #9: This survey area encompasses the Cottam's cinquefoil occurrence at Pine Creek Spring (Utah Element Occurrence 002). Most of this area was relatively accessible and we intensively searched it, but were unable to relocate Cottam's cinquefoil. The rocky, quartzitic, shaded, east-facing cliff and ledges appeared to be good Cottam's cinquefoil habitat. Plant species observed in the area included Douglas-fir (*Pseudotsuga menziesii*), mountain gooseberry, mountain snowberry, mountain spray (*Holodiscus dumosus*), opposite stonecrop, smooth fleabane, stemless goldenweed (*Stenotus acaulis* = *Haplopappus acaulis*), Drummond's rockcress (*Arabis drummondii*), slender buckwheat (*Eriogonum microthecum*), and red alumroot. There were approximately 25 cattle present in the spring area during our survey.

DISCUSSION AND RECOMMENDATIONS

Grouse Creek rockcress

We were unaware of the two putative Grouse Creek rockcress occurrences reported for Sawtooth NF land in the Raft River Mountains until our field work was completed. The identification and precise location of the occurrence reported for near Cabin Spring (Utah Element Occurrence 006) remains unresolved. The specimen upon which this occurrence is based is at the Intermountain Herbarium (UTC), in Logan, Utah. The Element Occurrence database record from the Utah Natural Heritage Program states, "collection gives elevation as 7800 feet; which is too low for the legal description. EO elevation of 8800 feet is approximate, based on directions and legal description." We recommend a review of the specimen stored at UTC to verify its proper identification. If confirmed to be Grouse Creek rockcress, than an attempt to relocate and obtain population size and related information would be beneficial to help the Sawtooth NF asses the conservation status of this occurrence.

The location and status of the occurrence reported for Clarks Basin (Utah Element Occurrence 004) is also unresolved. Although reported to be on Sawtooth NF land, our field survey suggests it is much more likely to be located on nearby lands south of the Sawtooth NF boundary where extensive outcrops of open, sparsely vegetated, light-colored substrate are exposed. Mining or quarrying operations were active south of the Sawtooth NF boundary at the time of our field survey. It is unknown to what degree, if any, these operations may be impacting Grouse Creek rockcress and its habitat. Quarry operations have disturbed potential Grouse Creek rockcress habitat at one site near Clarks Basin on Sawtooth NF land. Overall, suitable habitat for this

species appears limited on the Sawtooth NF. We recommend any future surveys for Grouse Creek rockcress be conducted earlier in the season, ideally that window of time when plants are both flowering to help finding them, and with fruits to allow confident identification.

Cottam's cinquefoil

The new occurrence at the head of East Fork Rice Creek occurs at 2,560 m (8,400 ft) elevation. This is probably the lowest elevation recorded for this species. Prior to our survey, the elevational low for this species was 2,652 m (8,700 ft) at Pine Creek Spring (Utah Element Occurrence 002). The Pilot Peak occurrence (Utah Element Occurrence 001) is reported to be at 2,286m (7,500 ft), but collection label and record accuracy problems outlined by Franklin (1994), Holland (1999), and Holmgren (1987) make this elevation claim very suspect.

The 2,560 m (8,400 ft) contour can probably be viewed as the lower elevation boundary for potential Cottam cinquefoil habitat in the Raft River Mountains. The crest of the range above this elevation runs generally west to east in a narrow, linear shape for approximately 18.7 km (11.6 mi). The Cottam's cinquefoil occurrence at George Peak roughly marks the western edge of the crest above 2,560 m (8,400 ft), and the new East Fork Rice Creek occurrence the eastern extent above this elevation. The other four documented occurrences are fairly regularly distributed between these western and eastern points. In his survey report for Cottam's cinquefoil Franklin (1994) states, "More occurrences of *Potentilla cottamii* could be discovered in the Raft River Mountains, due to the large expanse of potential habitat there." High elevation, northerly-facing cliff habitat is nearly continuous between Bull Lake West (Utah Element Occurrence 004) and the new occurrence we discovered near Hidden Spring. We were able to survey only a portion of potential habitat in this area, and like Franklin (1994), also feel additional Cottam's cinquefoil occurrences await discovery.

Our survey illustrated two points which make surveying for Cottam's cinquefoil challenging. Its steep cliff habitat prevents all potential habitat from being safely surveyed. Our population count for the new location southeast of Rosevere Point likely underestimates the true number of plants because the near vertical terrain prevented us from climbing further down the cliff. In addition, this species can be inconspicuous and easily overlooked. The area supporting the new occurrence at the head of East Fork Rice Creek had already been searched once before by an experienced botanist (Franklin 1994). During our survey in this area, one observer hiked within a few meters of several plants without noticing them, due to their location higher on the sheer rock face.

We did not observe anthropogenic disturbances or threats at any of the Cottam's cinquefoil occurrences we revisited or discovered. Cattle were regularly observed near known occurrences, but they do not venture onto the rocky outcrops where Cottam's cinquefoil occurs. Cattle-related disturbances have altered plant community composition in the alpine meadows occurring along the crest of the Raft River Mountains, but these changes have not adversely impacted Cottam's cinquefoil. No weedy species were observed in Cottam's cinquefoil habitat.

We recommend periodic visits to known occurrences approximately every three years to ensure Sawtooth NF conservation objectives for Cottam's cinquefoil are being met. The full extent of this species in the Raft River Mountains will not be known until additional segments of potential habitat on both public and private land are surveyed in the future.

Rock violet

Prime rock violet habitat appears to be limited in the Raft River Mountains. Holland (1998b) notes that four of the five Nevada rock violet occurrences are found on limestone and dolomite. Only one occurs on quartzite. Limestone and dolomite do occur in the Raft River Mountains, but the majority of the outcrops at suitably high elevations are quartzite and schist (Hintze 1988, Stokes 1961-1963). Areas we surveyed appeared all to be either quartzite or schist parent material.

Rock violet at Pilot Peak in Nevada is found only 60 m (200 ft) from a Cottam's cinquefoil population (Holland 1998b; 1999). A floristic study for the Raft River Mountains by Dixon (2001) does not list rock violet, but the species was not specifically searched for in that study. In two areas (Survey Polygons #2 and #4) our searching was confined to upper cliff faces and did not include the talus and avalanche chutes which extended into limber pine further downslope. These two areas would benefit from additional surveys for rock violet.

Other rare plant species

Kruckeberg's sword-fern (*Polystichum kruckebergii*) is on the Idaho Native Plant Society's rare plant list for Idaho (Idaho Native Plant Society 2004). It is not on the Forest Service, Region 4 Sensitive plant list. A population of Kruckeberg's sword-fern was found on the steep, east-facing rock wall located at the head of North Fork Indian Creek (Cottam's cinquefoil/rock violet survey polygon #6). A map showing the location of this occurrence is included in Appendix 3. A rare plant observation form for the occurrence is in Appendix 6. No disturbances or threats were observed at the site. One other location is known for this species in the Raft River Mountains, near Pine Creek Spring (Dixon 2001). Similar habitat which may support this species occurs in the Right Hand Fork Pine Creek and Fisher Creek Canyon.

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