ECOLOGICAL AND FLORISTIC INVENTORY OF BIRCH CREEK FEN, LEMHI AND CLARK COUNTIES, IDAHO

by

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November 1992

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Cooperative Challenge Cost-share Project:
Targhee National Forest
Salmon District BLM
Idaho Department of Fish and Game

Procurement Request No. 15-SO-92-117 (TNF)

ABSTRACT

Wetlands at the head of Birch Creek, located on the Lemhi County - Clark County line, contain unique low-elevation, peatland communities, collectively referred to here as the Birch Creek Fen. One indication of this uniqueness is the presence of seven rare plant species, including the narrow endemic and federal candidate for listing, alkali primrose (*Primula alcalina*). The ownership of the fen is complex with at least three private landowners, as well as the Targhee National Forest, Idaho Department of Fish and Game, and Bureau of Land Management. Recognizing the biological importance of the area, the three public land-managing agencies cooperated on this ecological inventory of Birch Creek Fen.

I first review the physical setting of Birch Creek Fen, including geological, hydrological, paleoecological, and climatic considerations. In the next section I discuss the biological and environmental attributes of the upland, wetland and aquatic communities of the fen. I also review the flora of the area, providing a detailed discussion of the taxonomy and identification, range and habitat, conservation status, and management recommendations for each of the seven rare plants. In the final section, I make general management recommendations for land managed by the three public agencies. Appendices include photographs and drawings of the seven rare species and their habitats, as well as a list of the 90 vascular plants known from the fen.

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INTRODUCTION

The fen at the head of Birch Creek has been of floristic interest for at least 20 years. Around 1970, C. Leo Hitchcock recognized that the *Primula* (primrose) species occurring in the fen was possibly a distinct taxon (Hitchcock and Cronquist 1973). It had been previously identified as *P. incana,* but had a white corolla instead of the usual lavender. Hitchcock retired and passed this taxonomic mystery on to his former student, Doug Henderson, who at the time was the newly appointed Director of the University of Idaho Herbarium. Henderson's floristic investigations of the basins and ranges of east-central Idaho during the 1970's, revealed this plant to be a new species. He and student Anita Cholewa (Cholewa and Henderson 1984) later described it as *P. alcalina* (alkali primrose), in recognition of the highly alkaline soils to which it is restricted.

Up until the mid-1980's, alkali primrose was the major floristic focus at Birch Creek Fen. It became a candidate for federal listing (U.S. Fish and Wildlife Service 1990) and Forest Service and Bureau of Land Management Sensitive Species (Spahr *et al*. 1991; Moseley and Groves 1992). As botanists began exploring Birch Creek Fen more, especially during mid- to late summer, after the primrose was finished flowering, they found several other rare plants. Hoary willow (*Salix candida*) and Kelsey's phlox (*Phlox kelseyi*) were discovered relatively early, but four species, park milkvetch (*Astragalus leptaleus*), meadow milkvetch (*A. diversifolius*), marsh felwort (*Lomatogonium rotatum*), and false mountain willow (*Salix pseudomonticola*) have all been discovered in the fen since 1983.

This high concentration of rare species indicates an environment that is unique in many respects. Most of the rare species are restricted to saturated, organic soils called peat. We have found that statewide, wherever peatland ecosystems occur in low elevation, glaciated or fault-block valleys, there are nearly always from one to several rare plants associated with it. Approximately 12% of Idaho's rare vascular flora is more or less restricted to these low-elevation Valley Peatlands (Bursik and Moseley 1992). Valley Peatlands are always associated with low-gradient, generally spring-fed creeks, such as at Birch Creek Fen, and represent a rare and sensitive ecosystem in Idaho.

Recognizing the sensitivity of the communities and rare plant populations, the three public land-managing agencies at Birch Creek Fen, the Salmon District BLM, Targhee National Forest, and Idaho Department of Fish and Game, are cooperating on this ecological inventory of Birch Creek Fen. The objectives are twofold: (1) conduct a thorough botanical and community inventory of Birch Creek Fen, including delimiting the extent of the peatland ecosystem and rare plant populations; and (2) make recommendations concerning the long-term management of rare plant populations and habitats. I use the name Birch Creek Fen to describe the general area at the headwaters of Birch Creek. As explained in later sections, a large portion of Birch Creek "Fen" is not underlain by a peat substrate and is therefore not a fen. The fen, however, is the ecological highlight and gives the area its unique character, both visually and floristically.

PHYSICAL SETTING

Geology

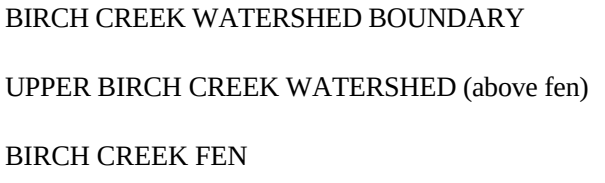
Birch Creek Fen occurs in the center of a large intermontane valley between the Lemhi Range, to the west, and the Beaverhead Mountains, to the east (Figure 1). The Lemhi and Beaverhead massifs contain an assortment of folded and faulted Precambrian, Paleozoic, and Mesozoic sedimentary rocks, all deformed while the northern Rocky Mountains rose during late Cretaceous time. Large thrust plates moved off the granite of the southern part of the Idaho batholith, and came to rest in east-central Idaho. Those movements left the thrust slices stacked on each other to form part of the overthrust belt. Birch Creek Fen lies on the Hawley Creek thrust plate. The Birch Creek Valley is a block of the northern Rocky Mountain overthrust belt that dropped along Basin and Range faults during the last several million years, while the mountains on either side rose. Those movements continue to raise the mountains and drop the valleys. These faults are relatively obvious in the remarkably straight mountain fronts on either side of the valley (Scholten and Ramspott 1968; Skipp and Hait 1977; Alt and Hyndman 1989).

As the mountains were rising, the Birch Creek Valley began accumulating deep deposits of valley-fill sediments, beginning probably in the Pliocene and continuing until the late Pleistocene. The resulting alluvial fans now dominate the landscape of the Birch Creek Valley. They are primarily comprised of sediments derived from carbonate bedrock, the major bedrock type of the surrounding massifs. Funk (1976) concluded that the Birch Creek alluvial fan systems were deposited in a high-energy, braided, stream system characterized by fluctuating water and sediment discharges, high flows and rapid aggradation (filling and raising the level of the stream bed). The alluvial-fan systems of the Birch Creek Valley are inactive under prevailing climatic and hydrologic regimes (Funk 1976).

Pierce and Scott (1982) suggest the following scenario of alluvial-gravel deposition for southeastern Idaho, in general, and Birch Creek, in particular. The Pleistocene and older gravel fans were deposited by streams with sustained seasonal flows probably at least ten times larger than the discharge of present streams. Glacier meltwater is only locally a factor in increased discharge because gravels in unglaciated drainages of the Birch Creek Valley are similar in age and character to those in glaciated drainages of the valley. High flows caused by an increase in precipitation do not seem likely because during glacial times the northern Pacific Ocean, which was the moisture source for southern Idaho, was colder than at present and would probably have provided less moisture to the western U.S. Factors thought to be responsible for markedly increased seasonal discharges are (1) a thicker snowpack resulting from climates much colder than at present, (2) later and more rapid seasonal melt of this snowpack, and (3) surface runoff, rather than ground-water flow, of most of this increase in seasonal discharge. They also suggest that the periglacial conditions of the Pleistocene produced a greater supply of gravelly debris to the streams. In contrast, much of the sediment now transported by streams is derived from erosion of loessal deposits that mantle much of the landscape.

At Birch Creek Fen, the modern creek has now carved an erosional valley into those deposits, leaving remnants of the original basin-fill surface on the high benches on either side of the fen. Rember and Bennett (1979) have mapped the Birch Creek Fen area as stream alluvium surrounded by alluvial fans, all of Quaternary age. Younger basalt flows, associated with the Basin and Range faulting during the late Tertiary and/or early Quaternary, erupted within the last few million years and outcrop in several places in the valley, including at the southern end of Birch Creek Fen (Alt and Hyndman 1989; Rember and Bennett 1979).

Figure 1. General location of Birch Creek Fen in east-central Idaho.



Hydrology

The Birch Creek basin encompasses approximately 370,000 acres, of which approximately 51% (189,000 acres) occurs in the basin upstream from Birch Creek Fen (Figure 1). In this hydrological source area, no streams flow across the alluvial fans to the center of the valley. Many drainages in the bordering massifs have no permanent streams and those that do, sink into the alluvium as they exit the mountains. Pass Creek, a small creek 8.5 miles downstream from Birch Creek Fen, appears to be the only stream that reaches the center of Birch Creek Valley.

Birch Creek, therefore, is almost entirely of spring-fed origin, with nearly all of the springs occurring in Birch Creek Fen. I counted 51 springs in the fen and it appears from the USGS quadrangles (Blue Dome, Eightmile Canyon, Scott Butte) that only two other springs emanate along Birch Creek below the fen. All of the springs emanating in the fen are upstream of a basalt ridge that is oriented perpendicular to the valley. In fact, the downstream limit of Birch Creek Fen coincides with the point where this ridge bisects Birch Creek. The ridge, which has a shallow dip to the north (upvalley) and a steep side to the south (downvalley), probably controls groundwater depth in the upper basin and is responsible for the presence of Birch Creek Fen. Presumably the lower part of the ridge was buried by deep alluvial fill. As the groundwater flows downvalley through the alluvial fans, it encounters the bedrock ridge lying perpendicular to the direction of flow. This forces the aquifer to maintain a higher level than if it were unconstrained by the bedrock dam, resulting in surfaces flows from springs on the upvalley side (Figure 2). This hypothesis is borne out by stream-flow data from two stations on Birch Creek below the fen. The first station is at Blue Dome, approximately 9 miles downstream of the fen, and the second is where the entire flow is diverted into a canal for hydropower and irrigation, eight miles below Blue Dome. Reported flows at the Blue Dome gauge are 75 cfs, while the diversion gauge measures just 29 cfs; a loss of 41 cfs in just eight miles. Also interesting is the depth to the water table at the two gauges; 90 feet deep at Blue Dome and 500 ft deep at the diversion (data from Ted Sorensen *via* Roy Heberger, U.S. Fish and Wildlife Service, Boise). It appears then, that the damming action of the basalt ridge, which forces ground water to the surface, is not only responsible for the presence of Birch Creek Fen, but also for nearly the entire flow of Birch Creek.

Paleoecology

Archeological excavations of a cave at the mouth of Indian Head Canyon, approximately three miles east of Birch Creek Fen in the Beaverhead Mountains, provide a glimpse of the late glacial-early postglacial environment of the Birch Creek Valley (Kurten and Anderson 1972; Sadek-Kooros 1972; Dort 1975). Although human artifacts were found, it is the fossil animal remains found in Jaguar Cave, so called because of the remains of an extinct giant jaguar or Pleistocene lion (*Panthera atrox*), that provide a fine record of the faunas that lived in the area from about 20,000 to about 9,000 years ago.

The earliest remains are termed the "black bone fragments" by Sadek-Kooros (1972) and probably represent the Late Pleistocene or early Holocene, possibly 20,000 to 15,000 years ago (Dort 1975). Species found at this level include American kiang (*Equus conversidens*), large horse (*Equus* sp.), dire wolf (*Canis* sp. *cf. dirus*), Pleistocene marten (*Martes nobilis*), coyote (*Canis latrans*), badger (*Taxidea taxus*), cottontail rabbit (*Sylvilagus nuttallii*), grizzly bear (*Ursus arctos*), and red fox (*Vulpes vulpes*). The first four taxa listed are now extinct.

Figure 2. Conceptual model of the ground-water hydrology framework at Birch Creek Fen.

Qf = alluvial fan

CTv = basalt ridge

BIRCH CREEK FEN

Remains of the Pleistocene marten, western camel (*Camelops* sp. *cf. hesternus*), and collared lemming (*Dicrostonyx torquatus*) were discovered at a higher level of the excavation, and have been radiocarbon-dated at 11,580 +/- 250 years ago. The presence of collared lemming, which presently occurs in the arctic regions of North America and Asia, suggests tundra-like conditions were present in the Birch Creek Valley at that time.

Somewhat higher in the excavations are species such as bighorn sheep (*Ovis canadensis*), American kiang, large horse, Pleistocene marten, western camel, giant jaguar, dire wolf, domestic dog (*Canis familiaris*), coyote, gray wolf (*Canis lupus*), cougar (*Felis concolor*), longtail weasel (*Mustela freneta*), black-footed ferret (*Mustela nigripes*), caribou (*Rangifer tarandus*), spotted skunk (*Spilagale putoris*), badger, and red fox. This level has been dated at 10,370 +/- 350 years ago. Many of these species suggest a landscape with plains or open woodlands, although the caribou suggests that the tundra element was still present.

The highest level of the cave excavations revealed the presence of many of the same species listed for the previous level plus wolverine (*Gulo gulo*), lynx (*Lynx canadensis*), bobcat (*Lynx rufus*), and stripped skunk (*Mephitis mephitis*). This level was not dated. Dort (1975) speculated that the cave closed approximately 9,000 years ago, prior to the warm temperatures experienced during the Altithermal period of the Holocene.

Overall, the fauna from this period is predominantly plains-dwelling (Kurten and Anderson 1972). No younger records or records of plant fossils are known.

Climate

The climate of the Birch Creek Valley area is influenced by moist air masses from the Pacific Ocean and Gulf of Mexico and dry, often cold continental air from Canada. During winter months, either cyclonic storms from the Aleutian low or dry continental air from Canada dominate. Air masses from the Pacific, however, moving through California, Nevada, and Utah, also bring moisture during winter and at other times of the year. In the summer, air masses from the Gulf of Mexico bring moisture. As a result, the weather of eastern Idaho is transitional between areas to the north and west that are affected primarily by moist Pacific air, and to a lesser extent by continental air from Canada, and areas to the east and south that are influenced strongly by moist Gulf of Mexico air. The resulting precipitation in the Birch Creek Valley is relatively uniform throughout the year. The valleys and foothills receive as little as 10 inches of precipitation annually while at the highest elevations, precipitation may exceed 40 inches annually. Average annual temperatures range between 30º and 40ºF, but may approach 45ºF in the lower valleys (USDA Forest Service 1985).

No climatic data are available for the Birch Creek Valley, however, the record for Dubois Experiment Station, Idaho, 40 miles east of Birch Creek Fen and 1,000 feet below its lower boundary gives an indication of climatic trends (Table 1). Precipitation may be somewhat greater and temperatures lower than at Dubois Experiment Station.

Table 1. Climatic Records for Dubois Experiment Station, Idaho, elevation 5452 feet, 1925 -1981 (from NOAA records summarized by Johnson 1981).

Month	Mean Temperature F (C)	Mean Precipitation inches (mm)
January	17.9 (-7.8)	0.75 (19.1)
February	23.6 (-4.7)	0.60 (15.2)
March	29.2 (-1.6)	0.64 (16.3)
April	40.8 (4.9)	1.05 (26.7)
May	51.2 (10.7)	1.73 (43.9)
June	59.2 (15.1)	1.91 (48.5)
July	68.5 (20.3)	1.04 (26.4)
August	66.6 (19.2)	1.00 (25.4)
September	57.2 (14.0)	1.02 (25.9)
October	45.5 (7.5)	0.72 (18.3)
November	31.3 (-0.4)	1.04 (26.4)
December	21.1 (-6.1)	0.91 (23.1)
Mean Annual	42.7 (5.9)	12.41 (315.2)
Mean April-September	57.3 (14.0)	7.75 (196.8)
Mean October-March	28.1 (-2.2)	4.66 (118.4)
Maximum	96.0 (35.6)	17.6 (447.0)
date	July, 1977	1944
Minimum	-27.0 (-32.8)	5.6 (142.2)
date	December, 1963	1926

COMMUNITIES

A majority of the vegetation of the Birch Creek Valley is dominated by sagebrush-steppe, with low (*Artemisia arbuscula*) and black (*A. nova*) sagebrush being the most abundant. These two species dominate large areas of the valley on the well-drained, windswept alluvial fans. Lesser amounts of Wyoming big sagebrush (*A. tridentata* spp. *wyomingensis*) occur where soils are deeper, generally in swales and along drainages. Small stands of mountain mahogany (*Cercocarpus ledifolius*) and Douglas-fir (*Pseudotsuga menziesii*) are scattered throughout the valley on rock outcrops and bedrock ridges. Riparian vegetation along most of the length of Birch Creek is dominated by its namesake, water birch (*Betula occidentalis*). The water birch community begins at the lower edge of the fen and continues downstream to the diversion canal. Three tall willows, Bebb's willow (*Salix bebbiana*), yellow willow (*S. lutea)*, and coyote willow (*S. exigua*), are the only other large woody plants associated with birch along lower Birch Creek.

Although the water birch community dominates below its lower limit, only isolated water birch plants occur in Birch Creek Fen. This lack of birch may be explained by substrate differences between the two

areas. The fen substrates are highly organic (peaty) and anaerobic while they are predominately sand and gravel substrates with better aeration along the lower creek. Another factor may be the presence of a more dynamic hydrologic system below the fen, favoring the establishment and growth of water birch; through the fen, Birch Creek drops approximately 32 ft/mile, while between the fen and the diversion canal it increases to approximately 54 ft/mile. The upstream limit of water birch and the change in gradient coincides with the lower limit of the fen and the previously-mentioned basalt ridge that bisects the creek.

The limits of the Birch Creek Fen are indicated in Figure 3. The upvalley limit of the fen indicates where the highest spring was located, above which no fen vegetation occurred. The downstream limit is where Birch Creek becomes confined to an incised channel in the alluvium, with an abrupt transition from aquatic to upland and no intervening fen communities. Of the three major type of communities present in this 1278 acre area, a majority is upland vegetation that occurs on the higher alluvial terraces between the stream channels. The aquatic community is associated with the flowing water habitats of the springs and creeks. Fen communities generally occur as narrow bands along the creek channels, however, there are several extensive subirrigated wetland areas away from creeks.

Birch Creek Fen is a relatively stable wetland ecosystem. Because the water source for the fen is entirely spring-fed, very little seasonal or annual flow fluctuations occur. This is unlike most wetland and riparian areas of the mountainous west, where high spring flows due to rapid snow-melt runoff are the norm. The stability that characterizes Birch Creek Fen today has probably existed since the Late Pleistocene or Early Holocene. Based on evidence presented in earlier sections, a possible scenario for the early development of Birch Creek Fen follows. The alluvial fans that fill Birch Creek Valley toady were actively being deposited during the late glacial, but became inactive soon after. At the same time, mountain streams emanating from the crests of the Beaverhead Mountains and Lemhi Range began sinking into the alluvium before reaching the center of the valley. The resulting ground-water flow from the upper Birch Creek Valley were constrained by the basalt ridge and surfaced to create a spring-fed Birch Creek. The stream cut through the alluvial fans creating the broad bottomland in which Birch Creek Fen developed; little erosion and downcutting takes place in the drainage today. Paleoecological evidence indicates that during late glacial and early post-glacial, at least, the valley was an open plains with at least some tundra-like attributes.

As the fen developed in the Late Pleistocene and early Holocene, many boreal plant species specifically adapted to peatland conditions were available to colonize this new habitat. Some of them have persisted after the retreat of continental ice sheets and now occur in Idaho as widely disjunct populations from their main range in boreal North America. At Birch Creek Fen three rare species, hoary willow, false mountain willow, and northern felwort, fall into this category, as well as several common species, such as few-flowered spikesedge (*Eleocharis pauciflora*) and northern grass-of-Parnassus (*Parnassia palustris*).

The evolutionary story of alkali primrose also suggests that the fen has been relatively stable throughout the Holocene. Alkali primrose is a diploid, obligate outcrosser (Kelso 1987; 1991). This combination of attributes is more often found in narrowly distributed primroses restricted to a narrow set of ecological conditions and may indicate the lack of ability to adapt to new and changing habitats. Conversely, selfing polyploids are generally more widely distributed and were probably better able to

Figure 3. Map of Birch Creek Fen showing limits of fen habitat, ownership, selected rare plant populations, and location of alkali primrose monitoring plots.
(USGS 7.5' quads Blue Dome and Italian Canyon, reduced 75%)

exploit newly deglaciated areas during the Late Pleistocene (Kelso 1992). *Primrose* section *Aleuritia* contains three narrow endemics that are all diploid: alkali primrose, *P. anvilensis* restricted to the Seward Peninsula, Alaska, and *P. specuicola* of southern Utah and northern Arizona. Most of the remaining North America representatives of this section are relatively widespread polyploids (Kelso 1991). Kelso (1991) suggests that prior to late Quaternary glaciation, a diploid primrose similar to *Primula mistassinica* was widespread across North America in the boreal regions. As the climate became warmer, this formerly widespread taxon was fragmented into disjunct populations. The restricted diploids represent remnants of the Pleistocene distribution of the *P. mistassinica* progenitor.

Upland Community

The upland community described here differs from other upland communities in the upper Birch Creek Valley by occurring on deep, fine-textured alluvium, instead of the coarse alluvial gravels that occur throughout the rest of the area. Although this type of community covers the largest area, it is the most homogenous. It largely consists of gray rabbitbrush (*Chrysothamnus nauseosus*) stands with a grass-dominated understory. On the heavily grazed private land, the understory is dominated by either western wheatgrass (*Agropyron smithii*) or salt grass (*Distichilis spicata*). These rhizomatous species occur in relatively low cover and biomass. There are few herbs in this community. This contrasts sharply with the Targhee NF and Fish and Game parcels that are only lightly grazed by horses in the winter. Basin wildrye (*Elymus cinereus*) codominates many of the rabbitbrush stands here, in some areas with nearly complete cover. Virtually no basin wildrye occurs on private land. Forb diversity also appears higher in these stands.

This community comprises much of the habitat for the rare species, meadow milkvetch, and to a lesser extent, Kelsey's phlox. See Appendix 4 for slides of the upland community at Birch Creek Fen.

Aquatic Communities

I counted 51 springs discharging in Birch Creek Fen, forming at least 22.6 miles of stream channel. These channels coalesce at the lower end of the fen forming the main Birch Creek channel for the rest of its length. Trout and possibly other fish species inhabit the aquatic community of the fen. I observed ospreys, great blue herons, black-crowned night herons, and humans preying on the fish. Vascular plants form thick beds on and in the streams of the fen. *Mimulus guttatus* and *Rorippa nasturtium-aquaticum* form dense beds around springs and smaller creeks, that in places cover the entire water surface. Pondweed (*Potamogeton vaginatus*), and hornwort (*Ceratophyllum demersum*), with lesser amounts of water buttercup (*Ranunculus aquatilis*), form thick mats in the swiftly flowing sections of the larger creeks. The carnivorous species, common bladderwort (*Utricularia vulgaris*) occurs in small pools on the marl surfaces of the few-flowered spikesedge community. In 1992, Fred Rabe collected the moss, *Drepanocladus* sp. *cf. uncinatus*, and three algal species, *Chara* sp., *Cladophora* sp., and *Enteromorpha* sp., in aquatic habitats at Birch Creek Fen. The latter species is a filamentous algae typically found in marine and estuarian habitats, rarely in highly alkaline aquatic habitats of the interior. No rare vascular plants are known from aquatic habitats. See Appendix 4 for slides of the aquatic communities at Birch Creek Fen.

I am not aware of any thorough studies of the invertebrate component of the aquatic community. Apparently, the best studied is the aquatic snail fauna. Terry Frest (personal communication, 1992) recently discovered an undescribed species of *Pyrgulopsis* at Birch Creek Fen. Taylor (1985; Malde 1991) used the presence of three aquatic snails in Birch Creek as evidence that a Birch Creek progenitor once drained to the Snake River before the flow was blocked by eruptions of basalt on the eastern Snake River Plain. The molluscan evidence of this connection includes: a species of *Fontelicella*, of southern

affinity; *Lymnaea hinkleyi*, elsewhere in Idaho known only in the main-stem Snake River and Henry's Fork; and the regional creek and river snail *Lithoglyphus hindsi*. In October 1992, Fred Rabe measured selected water chemistry attributes from water samples taken from springs in Birch Creek Fen. He found that the pH was 8.4, alkalinity was 75 mg/l, and the conductivity was 255 micromhos.

Wetland Communities

Wetlands occur throughout upper Birch Creek, generally as narrow bands on alluvial terraces along the creeks, although extensive subirrigated areas occur in a few places. Wetland cover types or communities generally occur as relatively small areas within a wetland mosaic. The change in dominant species appears to be driven by changes in the groundwater hydrology; just a couple inches in elevation between terraces can result in the soil surface being saturated season-long or dry, at least late in the summer. Many different cover types exist in the wetlands of Birch Creek Fen, but only three cover extensive areas. These are briefly described below. Two communities, short-beaked sedge and few-flowered spikesedge, occur on Histosols, which is the soil order for organic soils (peats or mucks) that generally have greater than 50% organic matter in the upper 32 inches of the profile (USDA Soil Conservation Service 1975). These are the fen or peatland communities from which Birch Creek Fen gets its name. Steve Brunsfeld (unpublished data; Brunsfeld and Johnson 1985) found varying amounts of peat over a layer of saturated, silty muck that was greater than three feet deep in his plots at Birch Creek. All the wetland communities are dominated by graminoids, with varying amount of forbs. Although shrubs are present in all communities, they are generally widely scattered and less than three feet tall. Exceptions include a few, widely scattered Bebb's willows, which are up to 12 feet tall, and shrubby cinquefoil (*Potentilla fruticosa*), which is locally dominant.

***Carex simulata* (short-beaked sedge)**

This community type, dominated by a dense sward of short-beaked sedge occurs on highly organic soils and is saturated to the surface throughout the year. The microtopography is flat, and generally not hummocky. Hairgrass (*Deschampsia cespitosa*), Nebraska sedge (*Carex nebraskensis*), and arrow-grass (*Triglochin maritimum*) are common associates. Alkali primrose, hoary willow, and marsh felwort are rare species that occur in this habitat. See Appendix 4 for slides of the short-beaked sedge community at Birch Creek Fen.

Cattle usually do not enter this community because of the highly unstable peat substrate. There are areas of the fen, however, that receive intense grazing pressure and cattle are forced to travel through or even graze in this community; travel is difficult for a cow because they usually sink 1-2 feet into the substrate with each step. The short-beaked sedge community is widely distributed in the northern and central Rocky Mountains, where it is considered a relatively stable wetland community (Tuhy and Jensen 1982; Youngblood *et al.* 1985; Hansen *et al.* 1988; Padgett *et al.* 1989).

***Eleocharis pauciflora* (few-flowered spikesedge)**

This is the most distinctive community in the fen. Few-flowered spikesedge forms dense monocultures, usually occurring as islands on a very quaky, unstable marl substrate. Marl is a special peat comprised of a mixture of organic matter, clays, and carbonates of calcium and magnesium. The

open marl surface is so unconsolidated and water saturated that it is essentially a colloidal ooze, ranging from several inches to a couple of feet deep. I caution visitors to the fen to step on the vegetated islands and not the open marl. In places, pools have formed on the marl surface. Areas of extensive marl are indicted on Figure 3, but other smaller areas also occur in the fen. Species diversity is very low in this community, although small amounts of short-beaked sedge and the rare species alkali primrose, marsh felwort, and hoary willow occur here. See Appendix 4 for slides of the few-flowered spikesedge community at Birch Creek Fen.

Several studies have described few-flowered spikesedge-dominated communities in the Northern and Central Rocky Mountains, but all have been in circumneutral or acid fens and not the rich, alkaline fen found at Birch Creek (Tuhy and Jensen 1982; Mattson 1984; Hansen *et al*. 1988; Padgett *et al*. 1989).

Juncus balticus **(Baltic rush)**

The Baltic rush community occurs in mineral soil and not peat. The water table fluctuates widely throughout the year in this community and soils are generally not saturated to the surface for very long. The microtopography can be level, gently sloping, or with very large, deep hummocks. Baltic rush forms dense, nearly monotypic stands. In areas of only moderate density of Baltic rush, a diverse forb component occurs, with golden-pea (*Thermopsis montana*) being the most common associate. The rare species, park milkvetch and Kelsey's phlox, are most often found in this community. See Appendix 4 for slides of the Baltic rush community at Birch Creek Fen.

Areas where Baltic rush forms very dense stands are more common in the upper sections of the fen where livestock grazing is and has been very heavy. This community is less common on Targhee NF and Fish and Game portions of the lower fen, which have received less grazing pressure. In the lower fen, areas occurring in a similar landscape position as the Baltic rush community described above are dominated by shrubby cinquefoil. Baltic rush is a common associate of shrubby cinquefoil, along with golden-pea and hairgrass. Hansen *et al*. (1988) found that in stands with palatable species such as hairgrass, it drops out of stands under heavy grazing and is replaced by Baltic rush and *Poa pratensis* (Kentucky bluegrass). This appears to have happened at Birch Creek, although the degradation may be more advanced and shrubby cinquefoil has also dropped out of the heavily grazed stands. Other studies have also documented the grazing-induced nature of the Baltic rush community (Youngblood *et al*. 1985; Padgett *et al*. 1989).

FLORA

Ninety species of vascular plants have been collected in the upland, wetland and aquatic communities at Birch Creek fen (Appendix 3). Ray Davis of Idaho State University, was probably the first to collect at the fen in the 1940's. C. Leo Hitchcock and colleagues associated with the University of Washington were the next group to actively collect plants in the fen in the 1960's. The 1970's saw several collections by Doug Henderson and students from the University of Idaho, as part of their floristic exploration of east-central Idaho. Steve Brunsfeld and Fred Johnson collected plants in the fen in the early 1980's, as part of their treatment of the willows of east-central Idaho. Roger Rosentreter of the BLM briefly visited Birch Creek and made collections in the mid-1980's. Collections by Michael Mancuso and myself in 1992, represent the first time that a thorough catalogue of vascular plants of the fen was attempted and our collections comprise a majority of those cited in Appendix 3.

Rare Species

Following is a discussion of each of the seven rare species known from Birch Creek Fen, including information on their taxonomy and identification, range and habitat, conservation status, and recommendations concerning their management.

Astragalus diversifolius (meadow milkvetch)

Nontechnical Description: Meadow milkvetch plants are solitary or form entangled masses. The stems are procumbent from a thick taproot. It has a few cream-white to light yellow flowers on loose racemes. The calyx is distinctly reddish, with white to mostly black strigulose hairs. Stems are sparsely leafy, with the terminal leaflet of each leaf being longer than the rest. The lateral leaflets are sometimes absent on lower and middle leaves. In general, the leaves look grasslike.

Distinguishing Features and Similar Species: Meadow milkvetch is quite distinctive, but occurs with four other *Astragali* and one *Oxytropis* in the wet meadows and riparian areas of east-central Idaho (Moseley 1991), although not all occur at Birch Creek Fen. The following key, modified from Hitchcock (1961), will help distinguish park milkvetch from similar-looking riparian legumes of east-central Idaho:

A. Keel of the corolla abruptly narrowed to a beaklike point; plants without leafy stems.....
.....*Oxytropis deflexa*

A. Keel of the corolla not abruptly beaked; plants with leafy stems.

- B. Terminal leaflet is confluent (continuous) with the rachis; plants robust with prostrate stems from a taproot; flowers white; calyx red ..... *Astragalus diversifolius*
- B. All leaflets jointed to the rachis, including the terminal one.
  - C. Banner (measured along the curvature of the midvein) over 15 mm long; flowers purple, strongly erect, crowded into ovoid heads; stems arising from a buried rootcrown ..... *A. agrestis*
  - C. Banner not over 15 mm long; flowers not strongly erect or crowded into ovoid heads.
    - D. Keel petals 2.5-6 mm long; herbage dark green; flower deep purple; pods pendulous ..... *A. eucosmus*
    - D. Keel petals over 6 mm long.
      - E. Stipe of the pod 1.4-3.5 mm long, the valves inflexed as a narrow but evident septum 0.2-0.7 mm wide; racemes (5) 7-23-flowered, occurring at the ends of the stems and usually exceeding the leaves; petals lavender..... *A. alpinus*
      - E. Stipe of the pod not over 1.5 mm long, often obscure and reduced to a narrow stipe-like neck, the valves not inflexed; racemes mostly 2-3, rarely 5-flowered, occurring at about the middle of the stem, the leaves far surpassing the raceme; petals white, with purple keel tip ..... *A. leptaleus*

See Appendix 1 for a line drawing and Appendix 4 for slides of meadow milkvetch.

Range: Meadow milkvetch is known from the intermontane valleys of east-central Idaho and the upper Snake River Plain near Springfield, Idaho, and is remotely disjunct at the southwestern edge of the Salt Lake Desert in western Juab and southwestern Toole counties, Utah, and in the Spring Valley in southern White Pine County, Nevada (Barneby 1989). It may also occur in the Green River and Platte River drainages of Wyoming, but these very early collections had vague location data and it has not been found there in recent years. In Idaho, it is known from the Big Lost River Valley, Little Lost River Valley, Lemhi Valley, Pahsimeroi Valley, and the Birch Creek Valley, as well as an historical collection from the Springfield area near American Falls Reservoir.

Only one occurrence is known from the Birch Creek Valley, that being at Birch Creek Fen. This occurrence consists of two widely separated populations in the fen (Figure 3). Both populations consist of only a few individuals, and more populations may be found as additional work is conducted in the area.

Habitat and Associated Species: In Idaho, meadow milkvetch occurs in moist, alkaline, generally hummocky meadows along spring-fed creeks. In Birch Creek Fen it occurs in mesic sites in the upland habitats, generally in areas with high amounts of bare ground, although this habitat differs with known sites elsewhere in Idaho. At Birch Creek, associated species included rabbitbrush, saltgrass, Kelsey's phlox, and greasewood. See Appendix 2 for the element occurrence record from the Conservation Data Center data base, containing additional location and habitat data for the meadow milkvetch occurrence at Birch Creek Fen.

Conservation Status: This species has only recently been considered to be of conservation concern in Idaho. It has no conservation status with the Forest Service or BLM (Moseley and Groves 1992), although it should be added to the Idaho BLM and Intermountain Region Forest Service lists. Meadow milkvetch is an Idaho Native Plant Society Priority 1 species (Idaho Native Plant Society 1992).

Once considered extirpated from Utah (Welsh *et al*. 1975), meadow milkvetch was recently rediscovered there (Barneby 1989) and is now ranked S1 by the Utah Natural Heritage Program. Recently discovered in Nevada (Barneby 1989), it is also ranked S1 by the Nevada Natural Heritage Program (Morefield and Knight 1991).

Management Implications: A more thorough survey of the Birch Creek Fen area needs to be conducted for this species before management recommendations can be made. Only two small populations are known, but much of the 1992 survey work was focused on the wetland communities along the creeks and not the intervening upland habitats. The upstream population occurs on a heavily grazed portion of private land, while the downstream population is on lightly grazed Forest Service land.

Astragalus leptaleus **(park milkvetch)**

Much of the following information is from Moseley (1991).

Nontechnical Description: Park milkvetch is a delicate perennial from a deeply buried taproot and creeping underground caudex. Stems are 2-8 inches long, bearing flowers from near or well below the middle. The flowers are white, with the tip of the keel being purplish. Leaflets 15-27 in number, bright green, thinly hairy, and mostly lanceolate and acute. The pod is 0.5-1 inch long, oblong-ellipsoid in shape and somewhat obcompressed, with thin, black and white hairs (Caicco and Henderson 1981).

Distinguishing Features and Similar Species: Park milkvetch has a delicate habit, with bright green leaflets, and only two or sometimes three white flowers at the middle of the stem. The most distinguishing feature is the slightly obcompressed, one-celled pods that are not visibly stipitate. The stipe, if present, is concealed by the calyx. In our area, park milkvetch is most similar to alpine milkvetch (*Astragalus alpinus*), but at least three other milkvetches and an *Oxytropis* also occur in the riparian communities of the region that could be confusing. See the key in the meadow milkvetch section to help distinguish park milkvetch from similar-looking riparian legumes of east-central Idaho. See Appendix 1 for a line drawing and Appendix 4 for slides of park milkvetch.

Range: Park milkvetch is endemic to the Rocky Mountains, where it occurs sporadically and apparently never in abundance. It is most widespread in Colorado, with several disjunct stations north in the Rockies to western Wyoming, east-central Idaho, western Montana, and reportedly from Alberta (Hitchcock 1961; Barneby 1964; Isley 1985). Field work in the 1980's and 1990's by Steve Caicco of the University of Idaho (Caicco and Henderson 1981; Caicco *et al.* 1983), Caryl Elzinga of the Salmon District BLM, and myself (Moseley 1991) is responsible for our current knowledge of the distribution and abundance of park milkvetch in Idaho. It is currently known from 14 occurrences, plus two historical sites that we were unable to relocate. The center of its distribution is in the upper Big Lost River and adjacent East Fork Salmon River drainages (14 occurrences). Two occurrences are disjunct from this, occurring 50 miles to the east in the Texas Creek and Birch Creek fens in Lemhi and Clark counties.

The outlying occurrence at Birch Creek Fen encompasses six small populations scattered on Targhee NF, Fish and Game, and private property (Figure 3). See Appendix 2 for the element occurrence record, containing additional location and habitat data for the park milkvetch occurrence at Birch Creek Fen. It should be noted that, because park milkvetch has a highly branched caudex (underground stem) and occurs in relatively dense clones or patches, it is difficult to count the number of plants in a population. Therefore, the estimates in Appendix 2 are gross, and areal extent of the population is a better indication of viability. Because it occurs in such small patches, additional populations of park milkvetch may be encountered in the fen.

Habitat and Associated Species: The habitat of park milkvetch is best characterized as being the mesic ecotone between saturated riparian communities and dry, upland sagebrush-steppe. At Birch Creek Fen this habitat is largely the tops and sides of hummocks dominated by shrubby cinquefoil and Baltic rush. The substrate is fine-textured, mineral soil that, in August, was dry at the surface, but somewhat moist just below the surface.

Conservation Status: Although park milkvetch occurs in Wyoming, Colorado, and possibly Alberta, it is of conservation concern only in Montana and Idaho. Park milkvetch was overlooked initially as being of conservation concern in this state. It was Caicco's 1981 "rediscovery" of the species in Idaho, as part of the Challis NF rare plant study, that first focused conservation attention on the species. At that time it was recommended for State Threatened status (Caicco and Henderson 1981; Henderson and Caicco 1983). Park milkvetch is on the Forest Service's Intermountain Region Sensitive Species list for the Challis NF (Spahr *et al.* 1991). It is also on the Idaho BLM Sensitive Species List (Moseley and Groves 1990). The Idaho Native Plant Society has placed park milkvetch in their Sensitive category of Idaho rare plants (Idaho Native Plant Society 1992) and the Conservation Data Center currently ranks park milkvetch as G4 S2 (Moseley and Groves 1992).

Lesica and Shelly (1991) have summarized the conservation status of park milkvetch in Montana. It is

considered Sensitive there, that is, it is a taxon that is known from a limited number of populations in Montana, or that occurs principally in restricted habitats considered vulnerable to man-caused disturbances. These taxa may have a restricted range in Montana, or they may be sparsely distributed over a larger area. The Montana Natural Heritage Program ranks park milkvetch as S1 in Montana. The only collections of park milkvetch within the last 70 years are from Beaverhead County.

Management Implications: The Fish and Game population, which occurs at an isolated spring away from the fen area, is the smallest, most heavily grazed, and appears to have the lowest vigor of any population. Very little flower and fruit production was seen in 1992, possibly resulting from very heavy and constant cattle grazing. If cattle grazing is having an impact on population viability, the effects are subtle in this species that can spread by branching underground stems. Other Idaho populations that are heavily grazed appear dense and vigorous, although few flowers and fruits are produced. The long-term affects of livestock grazing on these populations is unknown, however, research on another rare *Astragalus* (Sugden 1985) found that livestock grazing may have considerable long-term effects on population viability. Long-term viability can be assessed my establishing a population monitoring program on the grazed population and one or more of the ungrazed Forest Service populations.

***Lomatogonium rotatum* (marsh felwort)**

Nontechnical Description: Marsh felwort is a small annual up to about 10 inches tall, with strongly ascending branches. The leaves are opposite, entire, and slightly fleshy. The lower leaves are spatulate, while the upper are linear-lanceolate, sharp-pointed and about 1 inch long. The flowers are borne near the tops of the branches in the leaf axils. The 2 to 5 sepals are similar to the upper leaves, nearly equalling or exceeding the corolla. These are conspicuous features both in flower and fruit. The corolla is spreading, porcelain-blue and conspicuous, approximately 1 inch wide. At Birch Creek, marsh felwort flowers in late July through September. See Appendix 1 for a line drawing and Appendix 4 for slides of marsh felwort.

Distinguishing Features and Similar Species: Marsh felwort is one of the only annual species to occur in the fen. Another annual member of the Gentian Family, northern gentian (*Gentiana amarella*), also occurs in wetland habitats of Birch Creek Fen and also flowers late in the season. The two species are somewhat similar in size and stature, but the corolla of northern gentian is darker purple and a narrow tube with lobes at the end, instead of the larger, widely-spreading petals of marsh felwort.

Range: Marsh felwort has a circumboreal distribution, occurring from Greenland to Alaska in North America, south in the Rocky Mountains to Colorado, and Maine in the east. It is also known from northern Europe and northeastern Asia. In Idaho, it is known only from the same three wetland systems inhabited by alkali primrose, Summit Creek in the Little Lost River Valley, Texas Creek in the Lemhi Valley, and Birch Creek Fen in the Birch Creek Valley. Within Birch Creek Fen, marsh felwort occurs throughout the fen; precise locations were not mapped for this species in Figure 3 because of its widespread distribution. See Appendix 2 for the element occurrence record, containing additional location and habitat data for marsh felwort at Birch Creek Fen.

Habitat and Associated Species: Throughout its range marsh felwort occurs in wet, often saline soil (Hitchcock 1959). In the study area, it occurs in subirrigated, peatland sites, including the few-flowered spikesedge and short-beaked sedge communities, and to a lesser extend the mineral soils of the shrubby

cinquefoil/baltic rush sites.

Conservation Status: Henderson (1981), in reviewing its status as part of the Idaho rare plant project of the Idaho Natural Areas Council, found no evidence that marsh felwort occurred in the state even though Idaho is included within its range by Hitchcock (1959). In 1986, I discovered it at Summit Creek and in 1988, Doug Henderson found it at Birch Creek Fen. Marsh felwort is now considered Sensitive by the Idaho BLM (Moseley and Groves 1992). The Idaho Native Plant Society considers marsh felwort a Priority 1 species (Idaho Native Plant Society 1992), while the Idaho Conservation Data Center currently ranks it as G5 S1 (Moseley and Groves 1992). It has no Forest Service status, although it should be added to the Sensitive Species List for the Intermountain Region due to its presence at Birch Creek.

Management Implications: No long-term population data exist from which to make informed management recommendations, but marsh felwort is locally abundant throughout the fen, under various grazing intensities. Population trend data are needed before and management strategies can be developed.

***Phlox kelseyi* (Kelsey's phlox)**

Nontechnical Description: Kelsey's phlox is a taprooted, caespitose perennial with numerous stems up to approximately 5 inches long. The stems can be crowded and somewhat erect, but are more often looser, elongate, and more or less prostrate. Leaves are somewhat hairy-glandular, stiff and succulent, with thickened margins. Flowers are light blue to white, occurring solitary at the ends of the branches. Flowering peaks in late spring and early summer, although a few flowers are still present in August.

Distinguishing Features and Similar Species: Although several species of phlox occur in the mountains and valleys of eastern Idaho, Kelsey's phlox is the only one inhabiting moist meadows. In addition, it has the most succulent leaves of any eastern Idaho phlox, and is generally larger in all features, especially the leaves and flowers, than others in the region. See Appendix 1 for a line drawing and Appendix 4 for slides of Kelsey's phlox.

Range: Kelsey's phlox is irregularly distributed from Montana to Wyoming, eastern Idaho, and central Colorado, with disjunct populations in White Pine and Eureka counties Nevada, and the Albion Mountains, Cassia County, Idaho (Cronquist 1984). It's range in Idaho is not well understood, but appears to be restricted to valley bottoms in the east-central and southeastern portion of the state, as well as the Albion Mountains. At Birch Creek Fen, it is widely distributed throughout the area and has not been precisely mapped in Figure 3.

Habitat and Associated Species: Throughout its range, Kelsey's phlox occurs in vernally moist, alkaline meadows and seepy alkali flats, as well as around hot springs (Cronquist 1984). In Idaho, Kelsey's phlox occurs in moist alkaline meadows along spring-fed creeks, a very similar habitat to meadow milkvetch. In Birch Creek Fen it occurs in mesic sites dominated by baltic rush and shrubby cinquefoil. To a lesser extent it also occurs in the upland habitats dominated by rabbitbrush. Vegetative cover can range from very dense to very open, with large areas of bare ground. At Birch Creek, associated species include rabbitbrush, saltgrass, elk thistle (*Cirsium scariosum*), blue-eyed grass (*Sisyrinchium idahoense*), and tobacco root (*Valeriana edulis*).

Conservation Status: Kelsey's phlox was only recently considered to be of conservation concern in Idaho. It has no Sensitive status with the Forest Service or BLM (Moseley and Groves 1992). It is an Idaho

Native Plant Society Review species (Idaho Native Plant Society 1992) and is ranked G4 S2 by the Idaho Conservation Data Center (Moseley and Groves 1992).

Management Implications: Kelsey's phlox is very little studied in Idaho, and no long-term population data exist from which to make informed management recommendations. Kelsey's phlox is locally abundant throughout the fen and population trend data are needed before any management strategies can be developed.

Primula alcalina **(alkali primrose)**

Much of this information is summarized from Moseley (1989a).

Nontechnical description: Alkali primrose has an erect, naked scape (flowering stem) 2.5 to 10 inches long, subtended by a rosette of numerous, crinkled leaves that are light green. Leaves are about one inch long, with a generally elliptical blade that gradually narrows to a winged petiole. The umbellate inflorescence has 3 to 10 mostly erect flowers, with farinose calices and white corollas.

Distinguishing Features and Similar Species: No other primroses occur at Birch Creek Fen. The basal rosettes of alkali primrose do appear similar to another member of the primrose family at Birch Creek, few-flowered shooting-star (*Dodecatheon pulchellum*). While the leaves of the rosette are similar in size and shape, shooting-star leaves are not farinose and do not have crenulate margins. See Appendix 1 for a line drawing and Appendix 4 for slides of alkali primrose.

Range: Alkali primrose is known from meadows at the headwaters of three spring-fed creeks in east-central Idaho: Summit Creek in Custer County; Texas Creek in Lemhi County; and Birch Creek in Lemhi and Clark counties. An historical collection is known from meadows near Monida, Montana. The population from which this 1936 collection is made is considered to be extirpated.

In Birch Creek Fen, alkali primrose occurs in the bands of wetland vegetation bordering many of the spring creeks (Figure 3). I estimate that it occurs discontinuously along approximately 11.5 miles, or about half of the 22.6 miles of stream in the fen. Of this total, 1.2 miles are on the Targhee NF, 0.2 miles on BLM land, and the remaining 10.1 miles are on private land. Stream miles are used to estimate population size because of the linear and discontinuous nature of its distribution. It does, however, occur on approximately 34.8 acres of more extensive fen habitat (Figure 3), with 21.1 acres of that total being private, 2.2 acres BLM, 4.1 acres Targhee NF, and 7.4 acres Fish and Game. See Appendix 2 for the element occurrence record, containing additional location and habitat data for alkali primrose at Birch Creek Fen.

Habitat and Associated Species: Alkali primrose occurs in the lowest topographic positions in the meadows, where the soil is saturated to the surface throughout the growing season. These subirrigated, sites include the few-flowered spikesedge and short-beaked sedge communities. Common associates include shrubby cinquefoil, hairgrass, mat muhly (*Muhlenbergia richardsonis*), and alpine meadowrue (*Thalictrum alpinum*). The alluvial soils of these communities are fine-textured and light in color. Soil pH as high as 9.3 has been measured near Kaufman Guard Station (D.M. Henderson, 1986, personal communication).

Alkali primrose appears restricted to the relatively stable habitats existing along spring-fed creeks that

have a relatively constant flow of water and, therefore, little fluctuation in the water table of adjacent meadows. It was never found in meadows along creeks that have any seasonal fluctuations and channel scouring, such as that caused by flooding during spring and early summer snow-melt. Geomorphic processes that take place along streams of this type appear to preclude alkali primrose habitat. Within the meadows containing alkali primrose, however, it appears that a certain degree of small-scale disturbance is necessary to support viable primrose populations. Alkali primrose generally occurs on patches of bare soil within relatively dense graminoid communities. Frost heaving appears to have been the primary process that historically created this small scale disturbance. Grazing by native ungulates probably also contributed to this process. This corresponds well with Kelso's (1987) investigations of North American species of *Primula*, which show a preference for cool, moist, open habitats, often with small-scale disturbance including frost action.

Conservation Status: Alkali primrose is a category 2 candidate for listing under the Endangered Species Act (U.S. Fish and Wildlife Service 1990). The Service has determined that listing may be warranted and has prepared a draft listing package to list alkali primrose as Threatened. It is a Forest Service Sensitive Species for the Intermountain Region (Spahr *et al.* 1991) and is a BLM Sensitive Species for Idaho (Moseley and Groves 1992). The Idaho CDC currently ranks alkali primrose as G1 S1 (Moseley and Groves 1992).

Management Implications: Since no long-term data exist, the effect of past and current management can only be speculated on. The first collection of alkali primrose was made at the heavily grazed portion of upper Birch Creek Fen in 1941. The population in this area is dense and appears viable after 40 years. Presettlement (pre-livestock grazing) population levels of alkali primrose are unknown.

Several studies are currently underway at the three primrose populations, funded by the Salmon BLM, to answer questions about the long-term persistence and management of this rare species. These studies include population monitoring under differing management regimes by ecologists from Oregon State University and the Conservation Data Center (Muir and Moseley 1992), pollination and reproductive biology by Utah State University botanists, and soil and groundwater hydrology by Albertson College of Idaho researchers. The location of the permanently located primrose monitoring plots are indicated in Figure 3. Data from these studies will help in developing management and conservation strategies for this species.

Salix candida **(hoary willow)**

Much of the following has been summarized from Moseley (1989b; 1990) and Moseley *et al.* (1991).

Nontechnical Description: Hoary willow is a low- to medium-sized willow, up to approximately four feet tall. The lanceolate leaves have contrasting upper and lower surfaces. The upper surface is shiny, dark green, while the lower surfaces are covered with a dense, white, felt-like tomentum, comprised of fine, tangled hairs. The catkins are nearly sessile, but may have several, small leafy bracts. See Appendix 1 for a line drawing and Appendix 4 for slides of hoary willow.

Distinguishing Features and Similar Species: Hoary willow is one of our most distinctive willows, due largely to leaf its characteristics. In their study area, which includes Birch Creek Fen, Brunsfeld and Johnson (1985) report that the thinly tomentose early leaves are evidently glaucous beneath, and so, early in the season these plants somewhat resembles short-fruit willow (*Salix brachycarpa*), which is similar in

its habitat, stature and floral morphology. Hoary willow, however, has notably longer and narrower leaves. Other willow species occurring in the fen, including Bebb's willow, planeleaf willow (*Salix planifolia*), false mountain willow, and Geyer's willow (*Salix geyeriana*) (Brunsfeld and Johnson 1985), all have strikingly different leaf and stature characteristics from hoary willow.

Range: Hoary willow is distributed from Labrador to Alaska, south to New Jersey, Iowa, South Dakota, and in the Rocky Mountains to Colorado, Idaho, and southern British Columbia. Cronquist (1964) notes that it is seldom collected in our range. In the Northern Region of the Forest Service, the Ecosystem Classification Handbook (USDA Forest Service 1987) lists it as occurring in Idaho, Montana, North Dakota, and South Dakota. Until 1983, the only known populations of hoary willow in Idaho were in Lemhi and Fremont counties. Johnson and Brunsfeld (1983) reported the discovery of two populations in Boundary County. Hoary willow is now known from eleven, widely scattered populations in Idaho, in Boundary, Caribou, Lemhi, Bonner, Teton, Fremont, and Custer counties.

Within Birch Creek Fen, hoary willow occurs throughout the fen; precise locations were not mapped in Figure 3 for this species because of its widespread distribution. See Appendix 2 for the element occurrence record, containing additional location and habitat data for hoary willow at Birch Creek Fen.

Habitat and Associated Species: Throughout its range, hoary willow occurs in bogs and swampy places (Cronquist 1964). In the study area, hoary willow occurs in subirrigated peatland sites, including the few-flowered spikesedge and short-beaked sedge communities. Associated species include alkali primrose, hairgrass, planeleaf willow, mat muhly, northern grass-of-Parnassus, arrow-grass, and alp meadow butterweed (*Senecio cymbalarioides*).

Conservation Status: The rarity of hoary willow in Idaho was reviewed by Brunsfeld (1983) as part of the Idaho rare plant project of the Idaho Natural Areas Council. He recommended that it be placed on the State Watch List, noting that only four populations were known (then), but that no threats were apparent. Hoary willow is a Sensitive Species in the Intermountain Region of the Forest Service, where it is known from the Targhee NF (Spahr *et al.* 1985), and is Sensitive for the Idaho BLM (Moseley and Groves 1992). The Idaho Native Plant Society considers hoary willow a Sensitive species (Idaho Native Plant Society 1992) and Conservation Data Center currently ranks hoary willow as G5 S2 (Moseley and Groves 1992).

Hoary willow is considered a Sensitive species in Washington, which includes taxa that are vulnerable or declining, and could become endangered or threatened in the state without active management or removal of threats (Washington Natural Heritage Program 1990).

Management Implications: In general, hoary willow appears to be more common on the Forest Service and Fish and Game sections of Birch Creek Fen, and less common in the heavily grazed upper portion of the fen. This needs to be tested further, however. The two communities in which it occurs are generally not used much by cattle because of the very unstable nature of the substrate and general unpalatability of the vegetation. No herbivory of hoary willow was observed at Birch Creek, although it has been observed elsewhere.

***Salix pseudomonticola* (false mountain willow)**

(*S. monticola* in Flora of the Pacific Northwest)

Nontechnical Description: False mountain willow is a rounded shrub from three to 15 feet tall. The twigs

of the season are very scarcely to densely spreading-hairy on dark red to brown second-year twigs. Mature leaves are rather thick and leathery, green and generally shiny above, glaucous beneath, with margins that are coarsely to finely toothed. Expanding leaves are red-tinged and pubescent, but become glabrous at maturity. Stipules are well-developed on most shoots, generally larger than 0.1 inch and up to 0.5 inch on vigorous shoots. Aments are 0.5 to 2 inches long, expanding before the leaves and are sessile or occur on short flowering branchlets that generally do not have bracts. The capsule is glabrous, borne on short stipes subtended by brown to black floral bracts, that are scarcely to densely long hairy on both surfaces and are persistent (Brunsfeld and Johnson 1985).

Distinguishing Features and Similar Species: Yellow willow strongly resembles false mountain willow but differs in having glabrous twigs, which become pale gray with age, smaller stipules, expanding leaves that are not red-tinged, pistillate aments on short, leafing, flowering branchlets, longer stipes, shorter styles, and growing on warmer, better drained sites. Barclay willow (*S. barclayi*) differs in having smaller stipules, aments on long, leafy, flowering branchlets, longer styles, and in occurring in different, generally higher-elevation habitats. Bebb's willow has red-tinged expanding leaves but differs, along with Scouler's willow (*S. scouleriana*), in having entire, pubescent leaves of a different shape, and pubescent capsules (Brunsfeld and Johnson 1985). Color photographs of false mountain willow are on page 86 of Brunsfeld and Johnson (1985).

Range: This willow has been considered conspecific with *S. monticola*, a morphologically similar species of the central and southern Rocky Mountains. Cronquist (1964) chose to treat false mountain willow as synonymous with *S. monticola*. It has since been determined that they are genetically and morphologically distinct. False mountain willow is distributed in the boreal regions of North America from Alaska, east to Labrador and Quebec, south in the Rocky Mountains to Idaho and Wyoming. In Idaho, false mountain willow is known from three areas in eastern Idaho: wetlands at the head of Texas Creek, Lemhi County, the north shore of Henry's Lake, Fremont County, and at Birch Creek Fen.

I did not observe false mountain willow at Birch Creek Fen, but it is treated in Brunsfeld and Johnson (1985). Location data from their Birch Creek specimen (Brunsfeld 2345, at ID) was not specific. Because its distribution in the fen is unknown, it is not included in Figure 3.

Habitat and Associated Species: Habitat information given by Brunsfeld and Johnson (1985) and from herbarium information, indicate that false mountain willow occurs in a range of habitats from wet, quaking, hummocky peat substrates to mesic sites on slightly higher ground with a mineral substrate. At Birch Creek Fen, it occurs in peat habitats with planeleaf willow, Geyer's willow, Bebb's willow, hoary willow, alpine meadow-rue, and shrubby cinquefoil. Most plants occur on raised hummocks and attain a height of three to six feet. Soils in these habitats are highly organic for one foot or more at the surface, below which lies wet silty muck generally more than one three feet deep. The Henry's Lake population also occurs in a peatland, while the Texas Creek population occurs in mineral substrates adjacent to peat.

Conservation Status: The limited distribution of false mountain willow in Idaho only came to my attention while compiling this report. It currently is assigned no conservation status by any agency or organization in the state, but because of it's restricted distribution, deserves consideration by the Forest Service, BLM, and Idaho Native Plant Society for special status.

Management Implications: Little is known of its distribution at Birch Creek Fen, but because my inventory did not pick it up, it must be rather limited. No specific management recommendation can be

made, but an additional inventory should be conducted in the fen to determine the extent of the population.

MANAGEMENT

Birch Creek Fen encompasses approximately 1278 acres, with 86% of that (1098 acres) being private. The remainder is publicly-owned and managed by two federal and one state agency. The Targhee NF manages 118 acres (9%), 31.5 acres (3%) are Idaho Fish and Game property, 29.4 (2%) acres are managed by the Salmon District BLM, and 1 acre (0.1%) is managed by the Idaho Falls BLM District (Figure 3). Although most of the fen is privately owned, the 14% in public ownership will provide most of the opportunities for managing the fen to sustain wetland and aquatic communities and rare species. These opportunities evolve from various laws, regulations, and policies governing land management by the three public agencies.

Current land-use of Birch Creek Fen includes a Forest Service administrative site and winter horse pasture (Kaufman Guard Station), cattle grazing on private and BLM lands, and fishing on all ownerships, especially on Fish and Game and Targhee NF lands. All of these have varying degrees of impacts to the communities of Birch Creek Fen. Cattle grazing is having the greatest impact to the ecosystem by causing soil compaction, streambank instability, and reduction of vegetative cover around springs and streams. Because the distribution of rare plants appears to be sensitive to slight changes in ground-water hydrology, maintaining stream flow and high water quality through the fen should be the primary management focus. If these two attributes can be maintained, then the adjacent wetland and upland communities are usually being managed in a sustainable way. Water diversions anywhere in the fen would be particularly harmful. A small diversion on private land along the eastern edge of the fen appears to have been abandoned for some unknown reason. Private landowners, because of their upstream position, play a crucial role in maintaining the integrity of the fen and should be encouraged to enter into conservation agreements or land exchanges with appropriate agencies.

In areas where fen communities have been degraded, restoration should be the management focus, using the little-disturbed Fish and Game and Targhee NF land as the baseline comparison for setting recovery goals. Weed invasion appears to be minimal. Ongoing studies of the population and reproductive ecology of alkali primrose, as well as hydrologic studies of its fen habitats, will soon begin to provide managers with models to maintain or recover at least that portion of the biological resources of Birch Creek Fen. Other studies of fen ecology may be needed to fill in management information gaps not covered by the primrose studies. Although no long-term ecological data are yet available, certain management recommendations for the three public land managers, the Targhee NF, Idaho Fish and Game, and BLM, are outlined below.

Forest Service

The National Forest Management Act and Forest Service policy require that Forest Service land be managed to maintain populations of all existing native animal and plant species at or above the minimum viable population level. A minimum viable population consists of the number of individuals, adequately distributed throughout their range, necessary to perpetuate the existence of the species in natural, genetically stable, self-sustaining populations. The Forest Service, along with other Federal and State agencies, has recognized the need for special planning considerations in order to protect the flora and fauna on lands in public ownership. Species recognized by these two agencies as needing such considerations are those that (1) are designated under the Endangered Species Act as endangered or threatened, (2) are under consideration for such designation, or (3) appear on a regional Forest Service sensitive species list.

The Targhee NF manages a quarter section of land in the center of the Birch Creek Valley, isolated from other Targhee NF land occurring several miles distant in the Beaverhead Mountains and Lemhi Range. This administrative site was formerly BLM land and is shown as such on the Targhee NF map (1984), although the 1978 BLM Surface-Minerals Management Status (SMMS) Map, Dubois Quadrangle, shows the area as National Forest land. The BLM SMMS map also shows that the Forest Service quarter section is under a Federal Agency Protective Withdrawal, meaning that the land cannot be sold or traded and may not be able to have mineral claims filed on it. The SMMS map also shows that the mineral rights to his parcel are held by the federal government.

The 118 acres of Birch Creek fen managed by the Targhee NF is of extraordinary biological importance, containing at least six of the seven rare plant species known from Birch Creek Fen. Four populations of park milkvetch and one population of meadow milkvetch are known from Forest Service land. Approximately 1.25 miles of streamside wetlands, as well as 4.1 acres of marl, contain alkali primrose (Figure 3). Hoary willow, marsh felwort, and Kelsey's phlox occur throughout the fen on Forest Service land. In addition, permanent plots monitoring primrose demography (Figure 3), as well as study sites of primrose reproductive ecology and fen hydrology are located on Forest Service land.

The area is currently used as an administrative site, with two buildings, an outhouse, and a recently constructed horse barn/shelter comprising Kaufman Guard Station. All these developments are in the upland community or at the wetland - upland interface, and it is not known whether or not they have destroyed any rare plant populations. The entire 180-acre site is fenced and several horses are pastured during the winter. A small amount of fishing takes place on the parcel, especially on the downstream end adjacent to Fish and Game land.

The horse grazing and recreational use of Targhee NF land do not appear to be adversely affecting all but relatively minor amounts of the sensitive wetland habitats and rare plant populations. Horses were left in the pasture later than usual in 1992, well after the vegetation began to green-up and some species began to flower, including alkali primrose. The effects of this early growing-season use on the vegetation and rare plants is unknown, but it is probably better to take them off prior to flowering of alkali primrose to limit the effect of horse grazing on reproductive fitness. Horses also appear responsible for trampling and breaking PVC pipes used a plot markers. Although all plot centers were relocated, it is essential that the markers remain intact. The part of Birch Creek Fen managed by the Forest Service and Fish and Game amounts to only about 12% of the area, but represents the least disturbed part. Additional use over and above what already occurs should not be encouraged.

Fish and Game

The Idaho Department of Fish and Game owns approximately 160 acres, south of the Forest Service land. Of this, approximately 31.5 acres are in Birch Creek Fen, occurring in two areas; most being east of Birch Creek, but also including about one to two acres west of Highway 28 (Figure 3). Although currently used as an access site to provide fishing and camping opportunities along upper Birch Creek, it was originally purchased as a fish hatchery site in 1947. Supposedly the water source for the hatchery was to be the spring on the eastern end of the property, outside the boundary of the fen (Figure 3). The small spring surfaces on the alluvial fan and flows for approximately 50 yards before it uneventfully sinks into the alluvial gravels, well before reaching Birch Creek. Judging from the morphology of the stream channel and alluvial fan surface, this small spring appears to have never had much flow. The only permanent structure on the Fish and Game property is an outhouse and part of the parcel is fenced. Management of the Birch Creek Access site is administered by the Region 6 office in Idaho Falls. The BLM SMMS map shows that the mineral rights to this parcel are held by the federal government.

Even though Fish and Game only manages 3% of Birch Creek Fen, it is some of the most undisturbed and harbors at least five of the seven rare species. The extensive, 7.4-acre area of the few-flowered spikesedge marl community on the east side of Birch Creek contains a thriving alkali primrose population and two permanent monitoring transects (Figure 3). In addition, hoary willow, marsh felwort, and Kelsey's phlox occur throughout the area. Steve Brunsfeld (personnel communication, 1992) indicated that the photos of false mountain willow appearing in his willow guide (Brunsfeld and Johnson 1985, page 86) were taken at the eastern edge of the fen on Fish and Game land below Forest Service Road 298.

A park milkvetch population occurs below the spring on the eastern side of the Fish and Game parcel, outside of the fen (Figure 3). The population is very small and the habitat is extremely heavily grazed by cattle. Although most of the Fish and Game land is fenced and not grazed, the eastern end, including the spring and associated creek is grazed along with adjacent BLM land. Also see recommendations in the park milkvetch section.

The main part of the fen managed by the Department, on the east side of Birch Creek, is very little disturbed. All the development and use at this access site occurs on the west side of the creek, where the alluvial fan steeply descends to the edge of the creek and no fen habitat occurs. Also, anglers can easily cast across Birch Creek negating any need to create paths through the fen on the east side.
There appears to be no need to encourage any increase of use on the east side Birch Creek.

Bureau of Land Management

It is the policy of the BLM to conserve threatened and endangered species and the ecosystems they depend upon primarily by prescribing management for conservation of lands these species inhabit. The primary goals of the Threatened and Endangered Species Program are inventory, monitoring, plan preparation, and plan implementation to insure the maintenance and recovery of these species. It is also BLM policy to carry out management of the conservation of state-listed species, assisting the states in achieving their management objectives for those species. The BLM, along with other Federal and State agencies, has recognized the need for special planning considerations in order to protect the flora and fauna on lands in public ownership. Species recognized by these two agencies as needing such considerations are those that

(1) are designated under the Endangered Species Act as endangered or threatened, (2) are under consideration for such designation, or (3) appear on a state BLM sensitive species list.

The Salmon District BLM manages approximately 29.5 acres of the fen, occurring in four disjunct areas (Figure 3). The two largest areas, 7.7 and 18.6 acres in size, occur on the western edge of the fen, while two smaller areas occur at the northeast corner. The BLM-administered areas of the fen appear to be included in the same pastures as adjacent private land and are heavily grazed by cattle. Approximately 0.15 miles and 2.2 acres of alkali primrose habitat occur on the two larger BLM parcels (Figure 3). Hoary willow, Kelsey's phlox, and marsh felwort also occur on these parcels.

Although no alkali primrose monitoring transects occur on BLM land, they do occur on adjacent private land that has a similar management regime. Results of this study will help determine if the current level of cattle grazing is having any deleterious effects on population viability. At present they appear vigorous. The effect of heavy cattle grazing on water quality and the aquatic and wetland communities, however, should be assessed by the BLM.

The Idaho Falls District BLM manages a small, one acre, portion of the fen adjacent to the Fish and Game property. It contains alkali primrose and probably marsh felwort, hoary willow and false mountain willow. It is currently managed in a similar manner as the Fish and Game property, that is, it is relatively undisturbed. Additional use by livestock or recreationists should not be encouraged.

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Appendix 1

Line drawings of rare plants found in Birch Creek Fen.

Astragalus diversifolius (from Barneby 1989)

Astragalus leptaleus (from Hitchcock 1961)

Lomatogonium rotatum (from Hitchcock 1959)

Phlox kelseyi (from Cronquist 1984)

Primula alcalina (from Cholewa and Henderson 1984)

Salix candida (from Brunsfeld and Johnson 1985)

Salix pseudomonticola (from Brunsfeld and Johnson 1985)

Appendix 2

Occurrence records for rare plants occurring in Birch Creek Fen.

NOTES: *Phlox kelseyi* is an Idaho Native Plant Society Review species and occurrences have not yet been entered into the Conservation Data Center data base, so it is not included here. It was only recently discovered that *Salix pseudomonticola* has a limited distribution in Idaho, and its occurrences have also not been entered into the data base.

Three digit code refers to the species' occurrence number in the Conservation Data Center data base.

Astragalus diversifolius 011

Astragalus leptaleus 015

Lomatogonium rotatum 002

Primula alcalina 001

Salix candida 004

Idaho Conservation Data Center
Element Occurrence Record

ASTRAGALUS DIVERSIFOLIUS
MEADOW MILKVETCH
Occurrence Number: 011

Survey Site Name: BIRCH CREEK FEN

County: Lemhi

USGS quadrangles: BLUE DOME, ITALIAN CANYON

Survey Date: 1992-08-06
Last Observed: 1992-08-06
First Observed: 1992-08-06

Population Data:
1992: ca 20 genets in flower. Very meager populations - low density and with small plants.

Habitat Description:
Level alluvial deposits; white, fine-textured alkaline soil. Soil is moist in the spring, but dries out at the surface later in the season. *Chrysothamnus nauseosus* upland community with *Phlox kelseyi, Agropyron smithii*. Fair overall site quality.

Minimum Elevation: 6400 feet
Maximum Elevation: 6480 feet
Size: >1 acre

Land Owner/Manager:
Targhee NF, Dubois RD; Private.

Comments:
The land in private ownership is heavily grazed and population is depauperate.

Idaho Conservation Data Center
Element Occurrence Record

ASTRAGALUS LEPTALEUS
PARK MILKVETCH
Occurrence Number: 015

Survey Site Name: BIRCH CREEK FEN

County: Lemhi

USGS quadrangles: BLUE DOME, ITALIAN CANYON

Survey Date: 1992-08-06
Last Observed: 1992-08-06
First Observed: 1991-08-10

Population Data:
1991: (one population) dense, robust patch; plants are 10% in flower and 90% in immature fruit. 1992: Five additional populations found. Similar, characteristically dense patches. Phenology similar. Clonal nature makes it difficult to count individuals, but from about 100 to over a thousand stems are discernable in each of the populations.

Habitat Description:
Bottom; flat aspect; 0-3% slope; open light; *Potentilla fruticosa-Juncus balticus* community; saturated organic substrates to somewhat drier mineral substrates; associated with *Zigadenus elegans, Thermopsis montana, Smilacina stellata, Deschampsia cespitosa, Salix planifolia.*

Elevation: 6400 feet
Size: Less than one acre total. Each population is only a few square feet to a few square yards in size.

Land Owner/Manager:
Targhee NF, Dubois RD; Idaho Department of Fish and Game Access Site; Private.

Comments: Lower Targhee NF site possibly threatened by trampling by fishermen. Fish and Game population small and heavily grazed by cattle.

Specimens: Moseley 2434 (ID)

Idaho Conservation Data Center
Element Occurrence Record

LOMATOGONIUM ROTATUM
MARSH FELWORT
Occurrence Number: 002

Survey Site Name: BIRCH CREEK FEN

Counties: Lemhi, Clark

USGS quadrangles: BLUE DOME, ITALIAN CANYON

Survey Date: 1992-08-06
Last Observed: 1992-08-06
First Observed: 1988 08-28

Population Data:
1988: confined to lower area just above water level. 1991: few plants seen, ca 6 in flower, ca 15 in bud; may be more in area. 1992: complete survey of fen; ca. 5,000+ genets widely scattered throughout fen from near northern edge to the southern edge.

Habitat Description:
Saturated (wet-mesic); flat aspect; open light; saturated organic (mostly) substrate; *Potentilla fruticosa/Juncus balticus, Carex simulata,* and *Eleocharis pauciflora* communities; associated with *Astragalus leptaleus, Salix planifolia, Thermopsis montana, Primula alcalina, Salix candida, Dodecatheon pulchellum.*

Elevation: 6560 - 6370 feet
Size: Fen is 1278 acres and marsh felwort is widely scattered throughout, but occupying only a fraction of that total.

Land Owner/Manager:
Targhee NF, Dubois RD; Salmon District BLM, Lemhi RA; Idaho Falls District BLM, Big Butte RA; Idaho Department of Fish and Game Access Site; Private.

Specimens:
D.M. Henderson 7575 (ID)

Idaho Conservation Data Center
Element Occurrence Record

PRIMULA ALCALINA
ALKALI PRIMROSE
Occurrence Number: 001

Survey Site Name: BIRCH CREEK FEN
Counties: Lemhi, Clark
USGS quadrangles: ITALIAN CANYON, BLUE DOME

Survey Date: 1992-08-06
Last Observed: 1992-08-06
First Observed: 1941-05-17

Population Data: 1965: flowers all past bloom and faded to almost pure white. 1988 (lower Birch Creek): occurs in several small subpopulations scattered along creek, ca 2000 individuals. (upper Birch Creek): 1000-2000 plants, meadow is very heavily grazed. 1989 (lower Birch Creek): ca 10,000 individuals in 20 subpopulations. 1991: Long-term demographic monitoring plots established on Fish and Game, Forest Service and Private lands. 1992: Most thorough survey to date - ca. 10,000 individuals concentrated (linearly) in wetlands along 11.5 miles of stream and an additional 34.8 acres of more extensive fen habitat. Of these totals, 1.2 miles are on the Targhee NF, 0.2 miles on BLM land, and the remaining 10.1 miles are on private land. Of the more extensive acreage, 21.1 acres are private, 2.2 acres BLM, 4.1 acres Targhee NF, and 7.4 acres Fish and Game.

Habitat Description: Moist alkaline meadows along Birch Creek in *Carex simulata* and *Eleocharis pauciflora* communities associated with *Valeriana edulis, Dodecatheon pulchellum, Potentilla fruticosa, Salix candida*.

Elevation: 6550 - 6370 feet
Size: Fen is 1278 acres and alkali primrose is widely scattered throughout, but occupying only a fraction of that total.

Land Owner/Manager: Targhee National Forest; Dubois Ranger District; Salmon District BLM, Lemhi RA; Idaho Falls District BLM, Big Butte RA; Idaho Department of Fish and Game Access Site; Private.

Specimens: Henderson and Cates 1372 (holotype: ID; isotype: NY); Rosentreter 4948 (BLM); Bond 20232 (ID); Christ s.n., 51-301 (ID); Cholewa 858 (ID); Davis 3118 (ID); Hitchcock 23860 (RM, WS); Henderson 4221, 6530 (ID)

Idaho Conservation Data Center
Element Occurrence Record

SALIX CANDIDA
HOARY WILLOW
Occurrence Number: 004

Survey Site Name: BIRCH CREEK FEN

Counties: Lemhi
Clark

USGS quadrangles: BLUE DOME, ITALIAN CANYON

Survey Date: 1992-08-06
Last Observed: 1992-08-06
First Observed: 1965 06-06

Population Data:
1965: plants 1 dm tall. 1989: 740+ normal genets, 100% seed dispersing; several other members of this genus occur here. 1992: complete survey of fen; ca. 1,000 to 2,000 genets widely scattered throughout fen from near northern edge to the southern edge.

Habitat Description: Occurs in subirrigated, peatland sites; *Eleocharis pauciflora* and *Carex simulata* communities. Associated with *Primula alcalina, Deschampsia cespitosa, Salix planifolia, S. brachycarpa, Parnassia palustris, Muhlenbergia richardsonis, Senecio cymbalarioides, Triglochin maritima.*

Elevation: 6560 - 6370 feet
Size: Fen is 1278 acres and hoary willow is widely scattered throughout, but occupying only a fraction of that total.

Land Owner/Manager: Targhee NF, Dubois RD; Idaho Falls District BLM, Big Butte RA; Salmon District BLM, Lemhi RA; Idaho Department of Fish and Game Access Site; Private.

Comments: Appears to be more common on the Targhee NF and Fish and Game parcels, possibly due to less grazing pressure.

Specimens: Brunsfeld 2057 (ID, NY); C. L. Hitchcock 23864 (WS); 23865 (NY)

Appendix 3

List of vascular plants in Birch Creek Fen.

PLEASE NOTE: Species are arranged alphabetically by family, genus and species. Nomenclature generally follows Hitchcock and Cronquist (1973), except for *Primula alcalina* (Cholewa and Henderson 1984) and *Salix* (Brunsfeld and Johnson 1985).

Collections are deposited in the University of Idaho Herbarium, Ray J. Davis Herbarium at Idaho State University, University of Washington Herbarium, New York Botanical Garden, Rocky Mountain Herbarium at the University of Wyoming, among others.

APIACEAE
Berula erecta - Moseley 2577

ASTERACEAE
Antennaria microphylla - Moseley 2483
Aster eatonii - Henderson 7576; Moseley 2603
A. occidentalis - Moseley 2562; 2570; 2572
A. pansus - Brunsfeld 2110; Moseley 2571
Chrysothamnus nauseosus - Moseley 2588
Cirsium scariosum - Moseley 2566
Erigeron lonchophyllus - Moseley 2565
Haplopappus uniflorus - Moseley 2474, 2563
Helianthus nuttallii - Moseley 2573
Senecio debilis - Henderson 1043; Moseley 2561; Rosentreter 4339
Solidago canadensis - Moseley 2590
S. nana - Moseley 2548
Taraxacum officinale - Moseley 2484

BETULACEAE
Betula occidentalis - Brunsfeld 2062

BRASSICACEAE
Arabis sp. - Moseley 2476
Rorippa nasturtium-aquaticum - Moseley 2492

CARYOPHYLLACEAE
Stellaria sp. - Moseley 2487

CERATOPHYLLACEAE
Ceratophyllum demersum - Moseley 2608

CHENOPODIACEAE
Chenopodium sp. - Moseley 2545
Sarcobatus vermiculatus - Mancuso 739; Moseley 2583; 2607

CYPERACEAE
Carex aurea - Moseley 2579
C. lanuginosa - Moseley 2555; 2585;
C. nebrascensis - Moseley 2543; 2600
C. oederi - Moseley 2580
C. rostrata - Moseley 2554
C. scirpoidea - Mancuso 731
C. scopulorum - Moseley 2594
C. simulata - Mancuso 732; Moseley 2567; 2569; 2578; 2599
Eleocharis pauciflora - Mancuso 730; Moseley 2436

EQUISETACEAE
Equisetum laevigatum - Mancuso 729; Moseley 2586

FABACEAE
Astragalus diversifolius - not collected due to small populations
A. leptaleus - Mancuso 727; Moseley 2434
A. purshii - Mancuso 728
Thermopsis montana - Moseley 2495

GENTIANACEAE
Gentiana affinis - Moseley 2574
G. amarella - Moseley 2576
Lomatogonium rotatum - Henderson 7575; Moseley 2433, 2564

GROSSULARIACEAE
Ribes setosum - Moseley 2499

IRIDACEAE
Iris missouriensis - Moseley 2496
Sisyrinchium idahoense - Henderson 743; Moseley 2491

JUNCACEAE
Juncus balticus - Mancuso 734; Moseley 2552
J. ensifolius - Mancuso 733; Moseley 2601
J. longistylis - Moseley 2551
J. nodosus - Moseley 2550

JUNCAGINACEAE
Triglochin maritimum - Moseley 2500, 2575
T. palustre - Moseley 2544

LAMIACEAE
Mentha arvense - Moseley 2557

LENTIBULARIACEAE
Utricularia vulgaris - Moseley 2611

LILIACEAE
Smilacina stellata - Moseley 2475
Zigadenus elegans - Henderson 1045; Mancuso 736

LENTIBULARIACEAE
Utricularia vulgaris - Moseley 2611

ONAGRACEAE
Epilobium glandulosum - Moseley 2604
E. watsonii - Moseley 2560

ORCHIDACEAE
Habenaria dilitata - Mancuso 737; Moseley 2591

POACEAE
Agrositanion saxicola - Moseley 2541
Agrostis exarata - Moseley 2542, 2553
A. stolonifera - Moseley 2585
Calamagrostis neglecta - Moseley 2549; 2593
Catabrosa aquatica - Henderson 6531; Moseley 2568
Deschampsia cespitosa - Moseley 2605
Distichilis stricta - Moseley 2581
Muhlenbergia richardsonis - Moseley 2602
Poa juncifolia - Moseley 2584
Puccinellia distans - Moseley 2596

POLEMONIACEAE
Phlox kelseyi - Moseley 2493, 2556
Polemonium occidentale - Mancuso 735; Moseley 2489

POLYGONACEAE
Rumex occidentalis - Moseley 2598

POTAMOGETONACEAE
Potamogeton vaginatus - Moseley 2610

PRIMULACEAE
Dodecatheon pulchellum - Moseley 2490
Primula alcalina - Bond 20232; Christ s.n., 51-301; Cholewa 858; Davis 3118; Henderson 1372, 4221, 6530; Hitchcock 23860; Rosentreter 4948

RANUNCULACEAE
Ranunculus aquatilis - Moseley 2609
R. cymbalaria - Moseley 2488, 2559
R. natans - Moseley 2486, 2547

ROSACEAE
Geum macrophyllum - Moseley 2546
Potentilla fruticosa - Moseley 2497
P. gracilis - Moseley 2592
Rosa woodsii - Moseley 2582

SALICACEAE
Salix bebbiana - Brunsfeld 2060; Moseley 2481
S. brachycarpa - Moseley 2478, 2479
S. candida - Brunsfeld 2057; Hitchcock 23864, 23865; Moseley 2480
S. geyeriana - Brunsfeld 2061; Moseley 2482
S. planifolia - Brunsfeld 2059
S. pseudomonticola - Brunsfeld 2058

SAXIFRAGACEAE
Parnassia palustris - Moseley 2558

SCROPHULARIACEAE
Mimulus guttatus - Moseley 2597
Orthocarpus luteus - Moseley 2589
Veronica americana - Moseley 2498, 2606

VALERIANACEAE
Valeriana edulis - Henderson *s.n.*; Moseley 2494

VIOLACEAE
Viola adunca - Moseley 2485

Appendix 4

Slides of rare plants and communities in Birch Creek Fen.

Slide 1. Upland community (grazed by cattle) - *Chrysothamnus nauseosus* with *Agropyron smithii* and *Distichilis stricta*.

Slide 2. Upland community of Targhee NF (ungrazed by cattle) - Low cover of *Chrysothamnus nauseosus* with high cover of *Elymus cinereus*.

Slide 3. Aquatic community - Thick bed of *Ceratophyllum demersum* in swift water.

Slide 4. Aquatic community - Small spring creek entering main Birch Creek with complete cover of *Rorippa nasturtium-aquaticum* (white flowers) on lower part of creek and *Mimulus guttatus* (yellow flowers in center) around the spring.

Slide 5. *Eleocharis pauciflora* marl community on Fish and Game property.

Slide 6. Detail of *Eleocharis pauciflora* marl; note small pools with *Utricularia vulgaris* (linear, purplish plants) on right.

Slide 7. *Carex simulata* community on low alluvial terrace next to creek. Note lack of hummocks.

Slide 8. *Astragalus diversifolius*.

Slide 9. *Astragalus leptaleus*.

Slide 10. *Lomatogonium rotatum*.

Slide 11. *Phlox kelseyi*.

Slide 12. *Primula alcalina*.

Slide 13. *Salix candida*.