VEGETATION DESCRIPTION, RARE PLANT INVENTORY, AND VEGETATION MONITORING FOR CRAIG MOUNTAIN, IDAHO

by

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SUMMARY

During the 1993 and 1994 field seasons, wildlife, habitat/vegetation, timber, and other resources were systematically inventoried at Craig Mountain to provide Fish and Game managers with information needed to draft an ecologically-based management plan. The results of the habitat/vegetation portion of the inventory are contained in this report. Our field investigations concentrated on, but were not limited to, Bonneville Power Administration (BPA) and Idaho Department of Fish and Game (IDFG) lands.

Our responsibilities for the Craig Mountain project included: 1) vegetation data collection, and vegetation classification, to help produce a GIS-generated vegetation map, 2) to determine the distribution and abundance of rare plant populations and make recommendations concerning their management, and 3) to establish a vegetation monitoring program to evaluate the effects of Fish and Game management actions, and to assess progress towards meeting habitat mitigation goals.

A steep 4000 foot elevational gradient, highly dissected, complex topography, and variable edaphic conditions have created a diverse array of habitats at Craig Mountain. The rolling highlands dominated by conifer forest are sharp contrast to the rugged canyon faces supporting grassland-dominated and associated shrubfield, riparian and woodland vegetation. This diverse landscape provides important habitat for many game and non-game wildlife species. The diverse environmental conditions also provide for high floristic diversity at Craig Mountain.

Vegetation descriptions for Craig Mountain consists of 24 vegetation cover types and are based on extensive field work. The classification is comprised of four main categories - grassland and meadow, shrub and deciduous tree, conifer forest, and mosaic patterns. These cover types will form the basis for mapping units of the still-in-progress Craig Mountain vegetation map. Twenty-nine plant associations have been identified at Craig Mountain; 14 of these are considered conservation concerns in Idaho. The canyon grassland communities at Craig Mountain are some of the best representations known. Craig Mountain's rich flora includes 13 plant species considered rare in Idaho (the status of one other rare plant at Craig Mountain remains uncertain). Eleven of these are known to occur on Bonneville Power Administration and/or Idaho Department of Fish and Game lands. Three of the rare plant species are federal candidates for listing under the Endangered Species Act. This report contains detailed discussions for all of the rare plants occurring at Craig Mountain. Results of our studies highlight some of the important biodiversity values at Craig Mountain.

The proposed vegetation monitoring program established during the 1994 field season is comprised of three related parts. We reestablished permanent monitoring plots at 12 grassland sites originally sampled by Dr. Ed Tisdale (University of Idaho) during research conducted between 1962 and 1981. Permanent vegetation monitoring stations were established at 15 small animal pitfall array trap sites and 28 bird transect points. Vegetation data was collected at an additional 118 bird transect points. We also established three permanent monitoring plots for *Haplopappus liatriformis* (Palouse goldenweed), a federal candidate plant species occurring on BPA and IDFG lands.

We evaluated several areas as possible additions to Idaho's network of Research Natural Areas (RNA's), and make recommendations concerning two of these areas. During the course of our field work we made numerous plant collections and have compiled a vascular plant species list for Craig Mountain.

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INTRODUCTION

The Craig Mountain Wildlife Mitigation Area was purchased by Bonneville Power Administration (BPA) as partial mitigation for wildlife losses incurred with the inundation of Dworshak Reservoir on the North Fork Clearwater River. Upon completion of the National Environmental Protection Act (NEPA) process, it is proposed that title to mitigation lands will be given to the Idaho Department of Fish and Game (IDFG).

Craig Mountain is located at the northern end of the Hells Canyon Ecosystem. It encompasses the plateau and steep canyon slopes extending from the confluence of the Snake and Salmon rivers, northward to near Waha, south of Lewiston, Idaho. The forested summit of Craig Mountain is characterized by gently rolling terrain. The highlands dramatically break into the canyons of the Snake and Salmon rivers at approximately the 4700 foot contour. The highly dissected canyons are dominated by grassland slopes containing a mosaic of shrubfield, riparian, and woodland habitats.

During the 1993 and 1994 field seasons, wildlife, habitat/vegetation, timber, and other resources were systematically inventoried at Craig Mountain to provide Fish and Game managers with information needed to draft an ecologically-based management plan. The results of the habitat/vegetation portion of the inventory are contained in this report.

Our responsibilities for the Craig Mountain project included: 1) vegetation data collection, and vegetation classification, to help produce a GIS-generated Craig Mountain vegetation map, 2) to determine the distribution and abundance of rare plants populations and make recommendations concerning their management, and 3) to establish a vegetation monitoring program to evaluate the effects of Fish and Game management actions, and to assess progress towards meeting habitat mitigation goals.

We also evaluated several areas as possible additions to Idaho's network of Research Natural Areas (RNA's), and make recommendations concerning two of these areas. To document the general flora of Craig Mountain over 500 plant collections were made, and many other species were noted. A list of the vascular flora, with both scientific and common names, is provided (Appendix 1).

This report is divided into five main sections. The first section provides background information about Craig Mountain. Three topics important from a vegetation/habitat standpoint, weed control, livestock grazing, and fire are also discussed in this section. The second section provides descriptions for the 24 vegetation cover types we identified at Craig Mountain. Craig Mountain vegetation mapping units will be largely based on these cover types. We also include a list of the 29 plant associations occurring at Craig Mountain, and brief descriptions of the 14 associations considered conservation concerns in Idaho. Thirdly, we discuss the 14 rare plant species found at Craig Mountain. Information regarding taxonomy, formal conservation status, distribution, demography, land ownership, habitat, population biology, ecology, conservation assessment, and management recommendations is included. Sections containing line drawings, distribution maps, a map of areas searched, and population occurrence records are appended to the end of the report.The fourth section outlines the new RNA's proposed for Craig Mountain, including locations, descriptions and justifications. Finally, the proposed vegetation monitoring program for Craig Mountain is discussed. Objectives, an overview of general methods, protocols for each of the monitoring regimes, recommendations, and other information are included.

THE CRAIG MOUNTAIN ECOSYSTEM

Location

Craig Mountain is located in southern Nez Perce and western Lewis counties, Idaho (Figure 1). The northern edge of Craig Mountain is located about ten miles south of Lewiston, near Waha. Craig Mountain extends south approximately 25 miles to the confluence of the Snake and Salmon rivers. This peninsula-like uplift encompasses the plateau summit and associated steep canyon slopes between the Snake and lower Salmon rivers.

The Craig Mountain study area is bounded on the north by Waha Lake, and part of the Redbird Creek drainage, and to the south by the Snake/Salmon rivers confluence. The Salmon River forms the southeastern perimeter, to Maloney Creek, which forms the study areas eastern edge. The Snake River delineates the western edge (Figure 2).

Land Ownership

The Craig Mountain study area is approximately 125,000 acres in size. BPA mitigation lands comprise roughly 60,000 acres, with canyon grassland and upland forest habitats sharing approximately equal acreage. The Nez Perce tribe (approximately 23,000 acres), Bureau of Land Management (approximately 13,000 acres), Idaho Department of Lands (approximately 7,000 acres), The Nature Conservancy (approximately 12,000 acres), private land (approximately 3,000 acres), and IDFG's Craig Mountain Wildlife Management Area (approximately 16,500 acres) are the other land owners on Craig Mountain.

Physical setting

Ross and Savage (1967) place Craig Mountain within the Tri-State Uplands Section of the Columbia-Intermountain Province. It is considered part of the Blue Mountain Ecoregion of the Pacific Northwest by Omernik and Gallant (1986).

Craig Mountain is an east-sloping uplift, with the highest elevations found along its western margin, reaching a maximum of 5395 feet at the head of the South Fork Captain John Creek. Only a few miles away, elevations along the canyon river bottoms are below 900 feet.

Craig Mountain can be divided into two main areas, the canyon grasslands and the forested uplands. The canyons are formed along the western and southeastern flanks of Craig Mountain by the Snake and Salmon rivers. The two canyons are divided by the highlands, which taper to the south, eventually giving way to the rocky, narrow divide of Wapshilla Ridge. The forested uplands abruptly and dramatically break into the canyons at roughly the 4800-4600 foot contour.

The canyons are steep, highly dissected and underlain by stratified basalt. Tiered palisades and other rocky outcrops and associated talus fields are common along the canyon slopes. Series of moderately sloped benches regularly occur at low- to mid-canyon elevations. The rugged nature of the canyons is most pronounced where near vertical canyon walls rise 1000 feet above much of the Snake and lower five miles of the Salmon river. Dissecting the canyon faces are numerous east-west trending spur ridges on the Snake River side, and west-east trending ridges on the Salmon River side. This results in a preponderance of northerly and southerly aspects, and a diverse mosaic of plant communities in a Figure 1. Craig Mountain location map

Figure 2. Craig Mountain study area map

relatively small area.

In sharp contrast to the canyons, the plateau-like forested highlands are characterized by relatively gentle, rolling terrain. The highlands are headwaters for a number of perennial, as well as intermittent streams that flow into the Snake, Salmon or Clearwater rivers. The divides, slopes, draws and meadows associated with the upper reaches of these various drainages provide the highlands with most of its topography.

Geology

The dominant surface rocks at Craig Mountain are formations of the Columbia River Basalt Group. This series of basalt flows erupted from fissures during an 11 million year period during Miocene (6-17 million years ago) times and covered much of eastern Washington, northern Oregon and adjacent parts of Idaho (Bush and Seward 1992). Craig Mountain lies within a geologic area known as the Clearwater Embayment, the remnant of an irregular-shaped prism of basalt that reached into west-central Idaho. East to northeast trending folds and faults in the basalt, and deep river canyons characterize the Clearwater Embayment in the Lewiston vicinity. The Craig Mountain anticline is one of these major folds and rises to elevations of over 5000 ft. (Bond 1963).

Bond (1963) designated the series of basalt flows that formed the Embayment into two main groups, "Lower" and "Upper" Basalt flows, based on their relative stratigraphic positions. The two groups exhibit noticeably different responses to weathering and erosion. Characterizing the flanks of Craig Mountain are the spectacular canyon faces of the Snake and Salmon rivers. Within the canyons, the "Upper" Basalt is distinguished by its steep, stair-stepped appearance. The "Lower" Basalt forms more rounded, gently sloping surfaces, although prominent colonnades typically form along its base. The abrupt change in topography at the contact zone of the two Basalt groups can be striking. Anyone who has looked up from the canyon bottoms has marveled at this geology.

Besides basalt, other rock types also occur at Craig Mountain. All are considerably older than the basalts. Along the Snake and lower Salmon rivers at the southern end of Craig Mountain, erosion has uncovered metamorphosed rhyolite and pyroclastics related to the Seven Devils volcanics (Hubbard 1956). These give rise to some of the most sheer relief in the area. In the Snake River Canyon, most prominently in the Limestone Point area (across the river from Lime Point), outcrops of calcareous rock belonging to the Martin Bridge Formation are exposed. In places the limestone contains upwards of 90% calcium carbonate (Glerup 1960). Exposures of granodioritic and quartz dioritic rocks of the Idaho batholith are in Captain John, Chimney, and Corral creeks (Glerup 1960). Smaller outcrops occur in a few other places as well.

Soils

The soils of Craig Mountain vary from thin, rocky ridgetop scablands, to deep ash and loess on productive forest sites along the summit. Basalt is the dominant parent material. Within the canyons, most soils have developed from a mixture of residual and colluvial material. Loams are the most common textural class and generally contain a high proportion of gravel and stone (Tisdale 1986). Kettenbach-Gwin complex, Klickson association, Hooverton association, and Limekiln association soil units dominate the canyon slopes at Craig Mountain (Soil Conservation Service 1993).

Soils of the forested uplands are typically deep, well-drained silt loams and commonly contain a mantle of volcanic ash. Shilla complex, Seddow complex, Cramont complex and Larabee complex are the major soil

units of the upland forests (Soil Conservation Service 1993).

Climate

The climate of northern Idaho is influenced primarily by Pacific maritime air. This influence is strongly modified by the Cascades and other intervening ranges, resulting in a climate with many continental characteristics as well. Summers in the canyons are hot, with cloud cover and relative humidity at their year round minimums. Four thousand feet higher, the Craig Mountain highlands experience much more moderate summer temperatures. Rainfall during the summer commonly occurs as convectional storms accompanied by lightning. Prevailing westerly winds from the Pacific result in relatively mild winter conditions. Periodically, the westerly flow is interrupted by cold waves due to a high pressure system and associated low temperatures from the west, or clear, cold continental air from Canada (Campbell 1962; Evans 1967; Johnson and Simon 1987).

Precipitation patterns at Craig Mountain are transitional between the Palouse Prairie to the north and Hells Canyon and its associated plateaus to the south. The main difference between the two patterns is the proportional increase in late spring moisture (May and June) from north to south (Tisdale 1986). Along this transitional gradient, Craig Mountain seems to be more closely aligned with patterns to the south.

The only precipitation gauges at Craig Mountain are those operated by the BLM since 1984 at Wapshilla Ridge (T31N R4W sec 21 NE4) and at the Wapchin Exclosure (T30N R3W sec 7) along the lower Salmon River. The Wapshilla Ridge gauge is at an elevation of 4760 feet, while the Wapchin station is at 1040 feet. At Wapshilla Ridge, precipitation data are available for six years between 1984 and 1993. The annual average for this period is 20.0 inches, with a high of 26.5 inches. Comparatively, the annual precipitation average at Wapchin Exclosure is 13.4 inches, from data available every year except 1991. Yearly precipitation differences between high and low elevations can be significant. For example, from October 1988-October 1989, Wapshilla Ridge recorded 26.5 inches, approximately double the 13.4 inches at Wapchin Exclosure (data on file at BLM, Cottonwood, ID).

In the uplands, most precipitation from late fall to spring falls as snow, while snow is uncommon in the nearby canyon bottoms. It is estimated over 100 inches of snow falls at the higher elevations of Craig Mountain (Barker 1976). Throughout the region, precipitation is minimal during July and August, averaging only 10% of the yearly total. January is the coldest month and July the warmest, throughout the region (Johnson 1978).

Canyon Grasslands -Vegetation

Perennial bunchgrass communities dominate the canyon grasslands, although shrubfields and canyon woodlands are also integral and conspicuous contributors to the landscape. The area's steep elevation gradient, complex topography, and variable edaphic conditions combine to produce a mosaic of plant community types. The vast majority of canyon grassland communities are representative of the bluebunch wheatgrass (*Agropyron spicatum*) and Idaho fescue (*Festuca idahoensis*) habitat type series (Tisdale 1986).

Bluebunch wheatgrass communities are dominated by well-spaced clumps of bluebunch wheatgrass. Foliage cover, litter cover and forb diversity are low, and there is more bare ground compared to most Idaho fescue sites. Bluebunch wheatgrass sites seem to be more susceptible than Idaho fescue sites to

invasion by aggressive weeds such as yellow starthistle (*Centaurea solstitialis)*. At higher canyon elevations or on mesic aspects at lower elevations, grasslands support Idaho fescue-dominated vegetation. Within Idaho fescue communities, bluebunch wheatgrass is still often prominent, but typically takes on a rhizomatous rather than bunchgrass habit. Shrubs are uncommon in these grassland communities. Moss and biotic crust coverage can be high in grassland sites, sometimes greater than 20%. Ridges are frequently very rocky and support open, sparse vegetation.

Other common canyon native grasses are Sandberg's bluegrass (*Poa sandbergii*), prairie Junegrass (*Koeleria cristata*), sand dropseed (*Sporobolus cryptandrus*), and red threeawn (*Aristida longiseta*). Various introduced brome grasses (*Bromus* spp.) are widespread and very common. Kentucky bluegrass (*Poa pratensis*) is common on disturbed, mesic grassland sites.

A few of the more common native grassland forbs include arrowleaf balsamroot (*Balsamorhiza sagittata)*, desert parsleys (*Lomatium* spp.), lupines (*Lupinus* spp.), Snake River phlox (*Phlox colubrina*), harsh paintbrush (*Castilleja hispida*), deerhorn (*Clarkia pulchella*), tall annual willowweed (*Epilobium paniculatum*), cleavers (*Galium aparine*), prickly-pear cactus (*Opuntia polyacantha*), and narrow-leaved skullcap (*Scutellaria angustifolia*).

Disturbances, primarily caused by decades of heavy livestock grazing has fostered invasion of numerous weedy species. Weeds such as yellow starthistle have altered the composition and structure of large areas of grassland habitat at Craig Mountain. Yellow starthistle infestation is patchy, but in some areas it has completely replaced the native vegetation. Grasslands of relatively undisturbed condition are found in places where rugged topography, distance from water, and general inaccessibility combined to limit livestock use.

Within the canyons, conifer stands are restricted to northerly aspects, from 2000 to 4800 feet elevation. Forests on top of Craig Mountain are mostly grand fir (*Abies grandis*) habitat types, while canyon woodlands are dominated by Douglas-fir (*Pseudotsuga menziesii*), mostly belonging to the Douglas-fir/ninebark (*Physocarpus malvaceus*) habitat type (Copper et al. 1987). Areas supporting ponderosa pine (*Pinus ponderosa*) habitat types also occasionally occur. The elevational extent of canyon woodlands decreases proceeding north to south along Craig Mountain. In the Captain John Creek drainage, large conifer stands reach down to near 2000 feet elevation, but further south in Cave Gulch this level is about 3500 feet (see Daubenmire 1980, for discussion of a similar situation in the Palouse Range). Conifer stands are scarce south of the Cottonwood Creek drainage on the Snake River side and Pruitt Draw on the Salmon River side. Canyon woodlands often occur in interrupted, striped series, with forests on northerly, and grasslands on intervening southerly exposures. The grassland-woodland ecotone is often negligible and the sharp demarcation between forest and grassland can be striking.

On mesic aspects, shrubfield communities are interspersed within the grassland matrix and are locally abundant. Shrubfields are often clearly dominated by one species, although in some places patches of several species occur in close spatial relationship to one another. Common shrubfield species are ninebark, snowberry (*Symphoricarpos albus*), rose (*Rosa* spp.), ocean spray (*Holodiscus discolor)*, and smooth sumac (*Rhus glabra*). Additionally, most canyon draws and intermittent watercourses support stringers of mixed shrub species.

Hackberry (*Celtis reticulata*) commonly dominates low-elevation draws. Scattered individual or small clusters of hackberry often provide the only shade in the hot, dry canyon bottoms. The larger drainages,

with year-round flow, support white alder (*Alnus rhombifolia*) riparian communities below 2500 feet elevation. Higher-elevation canyon riparian corridors contain various shrubs, or in some cases conifers.

Canyon Grasslands - Biological Diversity

The Craig Mountain canyon grassland ecosystem has high plant biodiversity value. At the plant community level, the canyons support 14 elements of conservation concern (Natural Heritage Network G1, G2; S1, S2 ranks. These are explained and defined on page 33). Rare or uncommon canyon grassland, shrubfield, woodland and riparian communities all contribute to the diverse vegetation patterns at Craig Mountain. The highly ranked communities are: sand dropseed (*Sporobolus cryptandrus*) - G2S2; bluebunch wheatgrass/prickly pear cactus (*Agropyron spicatum*/*Opuntia polyacantha*) - G3S2; Idaho fescue/common snowberry (*Festuca idahoensis/Symphoricarpos albus)* - G2S1; buckwheat/Oregon bladderpod (*Eriogonum* spp./*Physaria oregana*) - G2S2; rigid sagebrush/Sandberg's bluegrass (*Artemisia rigida/Poa sandbergii*) - G4S2; smooth sumac/bluebunch wheatgrass (*Rhus glabra/Agropyron spicatum*) - G3S2; ninebark/common snowberry (*Physocarpus malvaceus/Symphoricarpos albus*) - G3S2; hackberry/bluebunch wheatgrass (*Celtis reticulata/Agropyron spicatum*) - G3S1; ponderosa pine/ninebark (*Pinus ponderosa/Physocarpus malvaceus*) - G2S1; grand fir/Pacific yew (*Abies grandis/Taxus brevifolia*) - G2S2; white alder/water birch (*Alnus rhombifolia/Betula occidentalis*) - G2S2; white alder/syringa (*Alnus rhombifolia/Philadelphus lewisii*) - G1S1; white alder/Wood's rose (*Alnus rhombifolia/Rosa woodsii*) - G1S1; white alder/hackberry (*Alnus rhombifolia/Celtis reticulata*) - G2S2.

Outstanding representations of several Pacific Northwest bunchgrass communities (Tisdale 1986) occur within the canyons - Idaho fescue-prairie Junegrass (*Festuca idahoensis-Koeleria cristata*), Idaho fescue-bluebunch wheatgrass (*Festuca idahoensis-Agropyron spicatum*), bluebunch wheatgrass-Sandberg's bluegrass/arrowleaf balsamroot (*Agropyron spicatum-Poa sandbergii/Balsamorhiza sagittata*), and bluebunch wheatgrass/prickly-pear cactus (*Agropyron spicatum/Opuntia polyacantha*). Throughout their range these grassland types are subject to disturbance and often in poor ecological condition. The remnants of relatively undisturbed grassland communities at Craig Mountain serve as important ecological benchmarks.

Populations of 13 rare plant species have been documented at Craig Mountain, while the status of one (bank monkeyflower - *Mimulus clivicola*) remains uncertain. Eleven of these occur within the canyon grassland ecosystem. They are, green-band mariposa lily (*Calochortus macrocarpus* var. *maculosus*), broad-fruit mariposa lily (*Calochortus nitidus*), dwarf gray rabbitbrush (*Chrysothamnus nauseosus* ssp. *nanus*), Idaho hawksbeard (*Crepis bakeri* ssp. *idahoensis*), Palouse goldenweed (*Haplopappus liatriformis*), fern-leaved desert-parsley (*Lomatium dissectum* var. *dissectum*), spacious monkeyflower (*Mimulus washingtonensis* ssp. *ampliatus*), Simpson's hedgehog cactus (*Pediocactus simpsonii* var. *robustior*), Spalding's silene (*Silene spaldingii*), and purple thick-leaved thelypody (*Thelypodium laciniatum* var. *streptanthoides*). Three of these, broad-fruit mariposa lily, Palouse goldenweed, and Spalding's silene, are candidates for federal listing under the Endangered Species Act. Dwarf gray rabbitbrush is a former candidate. All but Idaho hawksbeard, spacious monkeyflower and Spalding's silene occur on BPA mitigation land. Idaho hawksbeard occurs on the Craig Mountain WMA, however.

The Craig Mountain canyon grasslands also contain at least 30 plant species endemic to the middle Snake/lower Salmon river canyons, and/or the Palouse Prairie regions. A list of these regional endemics includes: bluebunch wheatgrass-Snake River 'form' (a unique form of *Agropyron spicatum*), cross-haired rockcress (*Arabis crucisetosa)*, Arthur's milkvetch (*Astragalus arthuri*), Cusick's milkvetch (*Astragalus*

cusickii var. *cusickii)*, Sheldon's milkvetch (*Astragalus sheldonii*), Columbia hawthorn (*Crataegus columbiana* var. *columbiana*), Engelmann's daisy *(Erigeron engelmannii* var. *davisii*), rough stickseed (*Hackelia hispida* var. *hispida*), Rollin's desert-parsley (*Lomatium rollinsii)*, Snake River desert-parsley (*Lomatium serpentinum*), lovely penstemon (*Penstemon elegantulus*), shrubby penstemon (*Penstemon fruiticosus* var. *serratus*), whorled penstemon (*Penstemon triphyllus*), Blue Mountain penstemon (*Penstemon venustus*), Snake River phlox (*Phlox colubrina*), sticky phlox (*Phlox viscida*), Oregon bladderpod (*Physaria oregana*), squaw currant (*Ribes cereum* var. *colubrinum*), Gooding's gooseberry (*Ribes velutinum* var. *gooddingii)*, Leiberg's stonecrop (*Sedum leibergii*), large-flowered tonella (*Tonella floribunda*), Douglas' clover (*Trifolium douglasii*), green-band mariposa lily, broad-fruit mariposa lily, dwarf gray rabbitbrush, Idaho hawksbeard, Palouse goldenweed, spacious monkeyflower, Spalding's silene, and purple thick-leaved thelypody.

The complex topography, large and steep relief, and varied edaphic conditions contribute to Craig Mountain's diverse vegetation and rich flora. The Snake and Salmon rivers were probably important plant migration corridors during past climatic fluctuations. These past plant migration patterns juxtaposed against the diverse array of current environmental conditions are all likely factors in the development of the area's rich rare and endemic flora.

This rich flora is known to include at least 650 vascular plant species (Appendix 1), of which approximately 77% are native. Asteraceae (Aster family) is the largest contributor to the flora with a documented 98 species, followed by Poaceae (grass family) with 70 taxa. Several genera are exceptionally well represented, including Carex (sedge) with 17 species, Bromus (bromes; seven non-natives), Lomatium (desert-parsley), Penstemon, Polygonum (knotweed; four non-natives), and Ribes (currant) all with ten species, Trifolium (clover; two non-natives) with nine, and Erigeron (fleabane) with eight species.

Forested Uplands - Vegetation

The plateau-like summit of Craig Mountain supports large blocks of conifer forests. Grand fir series are the dominant upland habitat types (Cooper et al. 1987). Scattered inclusions of Douglas-fir or subalpine fir (*Abies lasiocarpa*) types also occur. Other conifer species found at Craig Mountain are ponderosa pine, western larch (*Larix occidentalis*), lodgepole pine (*Pinus contorta*), Engelmann spruce (*Picea engelmannii)* and Pacific yew (*Taxus brevifolia*). According to some of the local old-timers, white pine (*Pinus monticola*) once occurred at Craig Mountain, but it apparently has been extirpated from the area. A few small, isolated late seral or climax forest stands remain, such as in upper Eagle Creek. The rest of the upland has been logged and/or burned at least once and supports a variety of seral forest communities.

In the past, logging took place in some places with little if any silvicultural consideration or consistency. Excessive and repeated highgrading has resulted in some forest stands bearing little resemblance to naturally occurring seral conditions. The ponderosa pine-dominated, open, park-like forest that probably characterized much of Craig Mountain prior to the arrival of white settlers (Mutch et al. 1993) is now gone.

Interspersed throughout the forests are open meadow habitats. Some of these are naturally occurring wet meadow complexes. Other natural openings occur where the basalt bedrock is at or very close to the surface, and supports scabland or bunchgrass-dominated vegetation. There are also scattered openings related to past logging operations. These are often dominated by introduced pasture grasses.

Forested Uplands - Biodiversity

The grand fir habitat types dominating the Craig Mountain uplands are common and fairly widespread, as are associated understory species. The few remaining pockets of virgin forest are the most important from a biodiversity standpoint. Their fragmented pattern and small size reduces wildlife values, however. A number of interesting plants, including several orchid species, are found within the forest.

Six rare plants are associated with the Craig Mountain uplands. Wolf's currant (*Ribes wolfii)* is a fairly widespread understory shrub along the summit of Craig Mountain. Bank monkeyflower has been reported from forest openings in the Waha area. However, we did not find any during our surveys, and its status at Craig Mountain remains unknown. Interspersed throughout the upland forests are wet meadow habitats supporting plant communities unique on Craig Mountain. The rare plants sticky goldenweed (*Haplopappus hirtus* var. *sonchifolius*) and plumed clover (*Trifolium plumosum* var. *amplifolium*) occur in some of these meadow complexes. Occasionally, rocky, natural forest openings contain small populations of broad-fruit mariposa lily or fern-leaved desert-parsley.

Forest communities exceed the grasslands in fungi and lichen diversity. Cooke (1955) studied the fungi, lichens and mosses in grassland, shrub and forest communities in the Palouse region. The only communities he sampled that do not occur at Craig Mountain are part of the *Thuja-Tsuga* series. Although none of his plots were located at Craig Mountain, overall trends and relationships are still likely applicable. Of the 815 species of fungi collected by Cooke, only 31 occurred in grassland habitats. He also found lichen richness to be much higher in forested versus grassland communities. Moss diversity was more equitable between forest and grassland sites.

Weed Management at Craig Mountain

One of the most difficult management challenges at Craig Mountain is weed control. Large areas of canyon grassland habitat are already infested with noxious (a legal connotation) and other aggressive weeds. Although disturbed areas are commonplace within the upland forests, weed problems are less severe there. Several factors contribute to this difference - most of the weed species at Craig Mountain require more sunlight than available under a conifer canopy, and; deeper, richer soils and more mesic conditions, allow native plants to compete more favorably with weedy species atop Craig Mountain. Baseline information on the distribution of weeds on Craig Mountain is provided by Hyder (1993). Presently, yellow starthistle (*Centaurea solstitialis*) is the most serious threat to the recreation and wildlife habitat mitigation values of Craig Mountain. To varying degrees, many other weeds are also established, and together threaten the long-term ecological integrity of the canyon grassland ecosystem. Of the 650 plant species documented for Craig Mountain, about 150 (23%) are non-natives, including many troublesome weeds.

Vegetation sampling conducted during 1994, shows some habitats at Craig Mountain are more susceptible to noxious weed invasion than others, and that other non-native plant species occur in all habitats. Table 1. summarizes some of this weed vegetation data.

A successful weed management program needs to integrate short- and long-term strategies. The most important focus of any weed control program should be prevention. Weed management should be pursued in the context that undisturbed and relatively undisturbed native forest and grassland communities are fairly resistant to invasion by weeds (Harrod 1994). Without exception, the worst weed infestations at Craig Mountain are areas that have been subjected to many years of chronic

Table 1.

Yellow starthistle (YST) and non-native plant species at selected Craig Mountain habitats

Habitat	% with YST[a]	% low YST[b]	%med. YST[c]	% high YST[d]	% non-native plant spp.[e]
Bluebunch wheatgrass grassland	91%	20%	40%	31%	31%
Idaho fescue/bluebunch wheatgrass grassland	62%	31%	23%	8%	23%
Idaho fescue/prairie junegrass grassland	33%	33%	-	-	20%
Wet Meadow	0%	-	-	-	18%
White alder riparian	11%	11%	-	-	42%
Mix tall shrub	43%	29%	14%	-	45%
Canyon forest (Douglas-fir)	0%	-	-	-	12%
Upland forest (Grand fir)	0%	-	-	-	13%

[a] for each habitat, the % of plots containing YST; [b] the % of plots with YST foliage cover = trace to 10%; [c] the % of plots with YST foliage cover = 11-30%; [d] the % of plots with YST foliage cover = > 30%; [e] the mean % of non-native plant species composition (avg.#spp/avg.#non-native spp.)

disturbance. The most ubiquitous disturbance factor has been intensive livestock grazing. Roadbuilding has also been an important purveyor of weeds. The naturally open structure of the grassland vegetation, soils and related factors, and geographic and climatic factors have likely contributed to the canyon grasslands being somewhat predisposed to weed invasion, especially by species of Mediterranean origin. Weedy species such as the annual bromes (*Bromus* spp.) and yellow starthistle are nearly ubiquitous within the canyon grasslands. Severity and foci for further weed spread

are related to continuing disturbance patterns. To help meet the challenges of controlling weeds at Craig Mountain, we have several recommendations. These recommendations are most applicable to canyon grassland habitats.

1. A weed management plan should be written with the consultation of people familiar with local weed management problems and options. The University of Idaho is one source of expertise. Prevention should be the focus of the weed management plan and priority should be given to areas which are currently weed-free or minimally infested.

2. Domestic livestock should be reduced or removed from the mitigation area. Any livestock remaining on Craig Mountain should be carefully managed. Livestock overgrazing has been a chronic disturbance factor and will jeopardize weed control efforts in many areas. Changing long-standing livestock grazing practices will help control a main vector of weed spread. This will be important in preventing the establishment of weeds not yet occurring on Fish and Game or BPA mitigation lands, such as common crupina (*Crupina vulgaris*) and leafy spurge (*Euphorbia esula*).

3. Roads and trails are important weed dispersal conduits, and access plans should take this concern into account.

4. Ground disturbing proposals, such as new parking or camping areas should evaluate the potential for spread or establishment of weeds. This is especially important in areas where infestations are presently not too severe.

5. Yellow starthistle control efforts should focus on outlying and satellite spot infestations, and along travel routes. Most invasions radiate from multiple, disjunct points, not from a single expanding area. These multiple small foci can increase in size at a quicker rate than a single area. With multiple small foci, more plants are near perimeters, increasing the likelihood of seeds being dispersed into nearby uninfested sites. Control is much more effective if even only 30% of these satellite populations are destroyed (Hill 1993, and references cited within). For all serious weeds, controlling satellite populations will be very important in decreasing the rate and degree of invasion into susceptible, but presently uninvaded habitat. With current technology, it is extremely difficult to reduce infestations once well established in canyon habitats.

Hyder (1993) did not delineate small, satellite populations of yellow starthistle during his weed survey at Craig Mountain. Fish and Game may want to complete a more thorough survey, concentrating on susceptible areas presently thought to be minimally infested. Such areas include grasslands portions of the Wapshilla Ridge complex south of the gate closure, upper Fourth Creek, upper Deer Creek, and upper South Fork Captain John Creek within the mitigation lands; and upper Billy Creek, and mid-slopes of the Gaiser segment within the Craig Mountain WMA.

Satellite populations of spotted knapweed (*Centaurea maculosa*) identified by Hyder (1993), and others discovered in the future should also receive priority.

6. All personnel working at Craig Mountain should learn to identify noxious and other serious weeds they may encounter, including yellow starthistle, spotted knapweed, Russian knapweed (*C. repens*), orange hawkweed (*Hieracium aurantiacum*), common crupina, Canada thistle (*Cirsium arvense*), Scotch thistle (*Onopordum acanthium*), whitetop (*Cardaria draba*), leafy spurge, sulphur cinquefoil (*Potentilla recta*),

and field bindweed (*Convolvulus arvensis*). Pamphlets that discuss each of these weeds, including identification, are available from the Agricultural Publications Office at the University of Idaho. Mounted specimens of these weeds should be kept on file to help teach what they look like. If questions arise concerning the identification of a suspected weed, verification can be obtained from Agricultural Extension Agents or weed specialists associated with the University of Idaho or Washington State University.

7. Weed surveys should be conducted annually along travel routes and at newly disturbed sites. Broader survey efforts should be conducted periodically to note and assess any new invasions. This type of vigilance will be especially important to combat weeds that are not yet well established or known on BPA or IDFG property, such as leafy spurge, common crupina, Russian knapweed or orange hawkweed.

8. If new infestations are discovered they should be controlled immediately. For instance, Hyder (1993) identified a small population of orange hawkweed during his survey work. The best opportunity for eradication is now. The orange hawkweed site should be revisited each year and control measures taken for as long as necessary. Even if no plants are seen one year, surveillance of these sites needs to be continued for several more years.

9. Weed control measures should be conducted annually along roadways, including the Wapshilla Ridge road south of the gate closure.

10. Prescribed burning projects should evaluate the prospects of increased weed invasion, especially in areas where bunchgrass vigor is poor.

11. Biological control agents are unproven for yellow starthistle, yet they are one of our long-term hopes for its control. There are risks involved with biological control measures, most notable is that long-term effects in the environment are usually unknown. Risks should be carefully evaluated when incorporating biological control into the weed management strategy. Towards this end:

> a. Craig Mountain should be evaluated as a test site for release of biological control agents by the Animal and Plant Health Inspection Service (APHIS) and the Agricultural Research Program (ARP). As a test site, control agents are provided free. Savings can be applied to weed survey and other preventive measures.
>
> b. Do not release biological agents at small spot infestations. These agents are natural dispersers and will not remain (Callihan, personal communication).

12. Unless spot infestations are very local, hand pulling is too inefficient and labor intensive to be practical at Craig Mountain. This recognizes that any weed management program will have to carried out by only a few people.

13. Where hand pulling is identified as a viable alternative, community volunteers should be solicited to coordinate and help. The Nature Conservancy has used this approach with some success at the Garden Creek Preserve.

14. Properly chosen and applied herbicides should be used in areas where there is access. Timing is absolutely critical when using herbicides, especially if they are used in conjunction with other management tools such as prescribed burning or reseeding.

15. The sponsorship of a graduate student to more fully evaluate weed control options and make more site specific recommendations should be considered. We also recommend making Craig Mountain available to weed researchers and to solicit weed research compatible with mitigation goals.

16. Other land owners and agencies should be coordinated with when formulating the weed management plan. It will take a coordinated effort for weed control to be efficient and effective.

17. Monitoring should be an integral part of any weed management plan.

18. Information contained in Hyder's (1993) weed survey report, including the extensive summary of reference literature forms the foundation of our information base regarding the distribution of weeds at Craig Mountain. The Nature Conservancy has compiled a proposed weed control and revegetation plan for the Garden Creek Preserve (Hill 1993) that also contains a lot of useful information and ideas.

Livestock Grazing at Craig Mountain

Native grasslands of the Palouse Prairie region evolved without the heavy grazing pressures that occurred in other areas, such as the Great Plains. Palouse grasslands are characterized by bunchgrasses (not sod-forming grasses) and a prominent microbiotic crust, that reflect the absence of large numbers of large-hooved, congregating mammals. The absence of any native dung beetles to the region (whereas numerous species are native to the Midwest) further supports this evolutionary perspective (Mack and Thompson 1982). The lack of intensive grazing pressure by native herbivores (such as bison) has likely been an important factor in the susceptibility of the area's climax bunchgrasses to heavy grazing (Tisdale 1961; Mack and Thompson 1982; Young 1994).

Adding to this historical perspective, at least four other synergistic factors have contributed to the ecological decline of canyon grasslands by domestic livestock. 1) In the past, the number of livestock in a given area has been too great. 2) Grazing distribution has been uneven due to steep local topography, distance from dependable water sources, and problems of difficult access. This poor distribution has been particularly severe for cattle, which tend to graze the flats and gentler slopes, making less use of the more extensive steep slopes. 3) The grazing season, which usually includes heavy use in the late spring and early summer, is during growth stages of bluebunch wheatgrass and Idaho fescue, when they are most vulnerable. 4) The apparent preadaptation of many introduced plant species, especially those of Mediterranean origin such as yellow starthistle, to regional conditions, and the fact that once established, these weeds are extremely difficult to eradicate (Tisdale 1961; Miller et al. 1986; Tisdale 1986).

Horses were initially acquired by the Nez Perce and other local Indian tribes in the mid-1700's, and were grazed on the plateau grasslands during summer and the canyons in winter. This use was probably heavy only in certain localities. European settlement of the region was initiated by the discovery of gold in the Salmon and Snake river valleys in the 1860's. When the Nez Perce War ended, around 1879, the canyons became open range and livestock ranching rapidly developed. At first, cattle predominated, but large losses were incurred during the drought and bitter cold years of 1884-1886. Large bands of sheep were then introduced and remained important until the 1940's, when cattle regained their prominence (Evans 1967; Tisdale 1986). The most intensive use of the regional grasslands appears to have been prior to the 1940's. Livestock grazing continues to be one of the main land uses at Craig Mountain, with several ranches still operating. Remnants of old homesteads and line shacks also occur.

To maximize wildlife mitigation values, changes to livestock grazing practices are recommended for IDFG and BPA mitigation lands at Craig Mountain. The prolonged and intensive use by domestic livestock at Craig Mountain has impacted the area's ecology. Livestock grazing has affected aquatic, riparian, forest, meadow and canyon grassland habitats at Craig Mountain. Water quality, hydrologic regimes, ungulate winter range, recreational opportunities, and rare plant populations have been adversely affected by the direct and indirect consequences of livestock grazing.
Livestock grazing can result in many ecological changes, including, 1) alteration of ecosystem structure - such as abetting the loss of stable vegetation cover and a general decline in habitat conditions, aiding the spread of weeds, changing vegetation stratification, contributing to soil erosion and siltation of streams, decreasing the quality and quantity of water, and in woodlands, removal of highly flammable fuels, which helps to reduce the incidence of ground fires that previously controlled dense tree seedling establishment; 2) disruption of ecosystem functions - such as ecological succession and nitrogen and other nutrient cycling; 3) alteration of composition - such as decreases in species richness, and decreases in the density of individual species (Hall 1977; Fleischner 1994; Oliver et al. 1994).

Domestic livestock grazing may also lead to 1) competition with native herbivores for forage; 2) impacts on predator control efforts; 3) transmission of disease to native animals; and 4) increased fencing, a common livestock management tool that can create obstacles for some native wildlife (Fleischner 1994, and references cited within).

Using livestock grazing as a wildlife management tool has limited applications, mainly because what is beneficial to one species may be detrimental to another. Success or failure as a management practice will depend on which species is the criterion (Hobbs and Huenneke 1992). This limitation may be magnified at Craig Mountain, where IDFG has multiple wildlife objectives.

Roberts (1992) notes three impediments to riparian area improvement related to livestock grazing - institutional and human resistance to change, mixed land ownership, and lack of incentives. These same factors are applicable to the issue of livestock grazing at Craig Mountain.

Concerning the area's vegetation, a change in livestock management at Craig Mountain is important for several reasons. 1) Better livestock management is important for the conservation of remnant habitats still in good to excellent ecological condition. 2) Habitat depletion and the associated serious nature of the weed problem at Craig Mountain, especially in canyon grassland habitats, is related to over a century of heavy livestock use. Altering past grazing practices should be part of a weed control program that emphasizes prevention. 3) To reduce conflicts with the maintenance or enhancement of good condition wildlife habitat, including that for several mitigation target species. 4) Decreased habitat quality of native plant communities is a serious threats to rare plant populations, especially in the canyons. The conservation of rare plants at Craig Mountain is largely dependent on preventing further losses of quality habitat.

If livestock grazing is much reduced or eliminated, the prognosis for improving aquatic, riparian, wet meadow, and forest (in tandem with other proactive forest management practices) habitats at Craig Mountain is good. The prognosis for depleted canyon grasslands is less optimistic. There is little evidence indicating restoration is possible simply by removing livestock (Sanders 1994).

The economics of grazing should also be considered. Some management costs include administration, development and implementation of site specific grazing management plans, monitoring program

establishment and upkeep, fencing and fence maintenance, and enforcement. The effects of livestock grazing on grassland, riparian, meadow, forest and aquatic habitats at Craig Mountain are summarized below.

Grassland Habitats

The most severe impacts of livestock grazing at Craig Mountain have occurred in the canyon grasslands. Vegetation dominated by yellow starthistle and other aggressive weeds, occurs over large tracts heavily grazed in the past (Hyder 1993). These areas are worst case scenarios and highlight the consequences of grazing livestock in plant communities ill adapted to such intensive use. Vegetation data collected during 1994, in disturbed grassland sites, often have yellow starthistle cover values of 50% or greater, with only trace amounts of native plant species.

Besides weed invasion, other changes to the native vegetation often occur in heavily grazed areas. Plant species of low livestock preference increase in abundance, at least initially (these are sometimes referred to as "increasers"). At Craig Mountain, some examples include yarrow (*Achillea millefolium*), curly-gup gumweed (*Grindellia squarrosa*), lupine (*Lupinus* spp.), and tarweed (*Madia* spp.). With continued heavy use, even these species can be largely replaced by weedy annuals (Tisdale 1961).

Riparian Habitats

Livestock use of riparian habitats is cause for conservation concern because they are among the most biologically rich in semi-arid regions, and are easily damaged. Because livestock spend a disproportionate amount of time in and near them (compared to native ungulates), and the importance of these habitats are so great, the impacts of grazing tend to be magnified in riparian habitats (references cited in Fleischner 1994). Our observations and preliminary analysis of vegetation plot data suggests riparian areas at Craig Mountain have been effected by disturbance, most likely by livestock. For example, non-natives comprise 42% (n = 9 plots) of the plant species in white alder, and 45% (n = 7 plots) in mixed tall shrub riparian habitats. These percentages are the highest of any habitats sampled at Craig Mountain. We observed minimal shrub regeneration in riparian and shrubby draw habitats used heavily by livestock. In some cases, such as lower Wapshilla Creek, old, decadent shrubs may be all that remains. Throughout its range in Idaho, hackberry recruitment is reduced in areas subject to intense livestock grazing (DeBolt 1992). This was our observation along river corridors and readily accessible, lower tributary reaches on Craig Mountain.

Livestock can affect several components of riparian systems, including the vegetation, soils, stream channel morphology and bank stability, and water quantity and quality (Fleischner 1994, and references cited within). Most traditional grazing systems have been developed for grassland, not riparian plant species. Some grazing systems, such as deferred or rotation, which may improve upland sites, tend to concentrate livestock use in riparian zones. Riparian habitats require site-specific grazing management plans, and can differ along different stream reach segments (Elmore et al. 1994). This point is very germane to Craig Mountain, where riparian vegetation varies considerably between upper and lower elevations. Regarding riparian restoration, analysis of all practices (including grazing) affecting the watershed need consideration (Elmore et al. 1994).

Meadow Habitats

Hall (1973), in his vegetation study in the Blue Mountains, and Johnson and Simon (1987), in their studies in the Wallowa-Snake Province, comment on being unable to locate any montane meadows that were not degraded. This is the same situation we found for the upland meadows at Craig Mountain. Prolonged and concentrated cattle use of the meadows at Craig Mountain has occurred at least from 1980 through 1994. Season-long use is considered detrimental to riparian meadow habitats (Gillen et al. 1985). Clary and Webster (1989) note that the complex array of factors controlling community dynamics seem to confound the theoretical benefits of various grazing regimes in riparian habitats. Wet meadows are relatively resilient, however. In a study in the foothills of the Wallowa Mountains of eastern Oregon, Boone et al. (1983) report moist meadows where livestock where excluded for three years showed shifts toward a more mesic/hydric plant community. For example, exotics such as meadow timothy and some dry site forbs, were being replaced by native sedges and wet site forbs. Dry meadows excluded from grazing did not show these favorable responses in this same short time period, however.

Soils are generally stable in wet meadow habitats, but disturbances such as heavy livestock grazing can lead to severe damage once gullying starts. This leads to a drop in the water table and associated changes to the vegetation, and at best is difficult to repair (Mueggler 1962). We observed gully formation occurring in meadow portions of upper Deer, West Fork Deer, and Webb creeks. Other problem areas also probably exists.

Fencing is often recommended for riparian systems such as wet meadows, but may not be practical on a broad scale (Gillen et al. 1985). Considering the extent of some of the meadows at Craig Mountain, fencing may have limited applications and be expensive. Economic, aesthetic and other management factors should be considered before fence construction.

Forest Habitats

Overgrazing in forest habitats can change species composition to undesirable annuals and perennials (Mueggler 1962). We found heavily grazed forest habitats at Craig Mountain to often be dominated by compressed bluegrass (*Poa compressa*), an exotic. Relatively open canopy sites may support thistles (*Cirsium* spp.) as well. Overgrazing can also markedly affect tree regeneration (Mueggler 1962). In the Blue Mountains, an area where forests were formerly characterized by open, park-like ponderosa stands, Hall (1977) comments that the removal of highly flammable fuels by livestock, helps to reduce the incidence of ground fires that previously controlled dense tree seedling establishment, and maintained the open forest structure. A similar situation may be part of the forest dynamics at Craig Mountain as well.

Aquatic Habitats

Aquatic habitats are also subject to degradation by excessive livestock use. Streams impacted by cattle are wider, shallower, warmer, have less overhead cover, and have more fine sediments (Platts 1981). Livestock have been shown to decrease water quality of streams (references cited in Fleischner 1994). All of these attributes are detrimental to fisheries (Platts 1981).

Fire at Craig Mountain

In the Blue Mountains of nearby Oregon and Washington, fire has historically been a major process determining vegetation patterns. Low- and mid-elevation forests supported open, park-like stands of ponderosa pine with grassy understories, except on wetter sites, where western larch dominated. Where

ponderosa pine was once a major forest component, fire intervals averaged 10-25 years. Fire played a more variable role in moist, mid-elevation forests. Fire in these habitats left a mosaic of lethally burned, unburned, and nonlethal underburned areas. Fire intervals were longer, probably 40-150 years, but still favored fire-adapted tree species. By the early 1900's, fire suppression efforts were beginning to change the forest ecology of the Blue Mountains (Mutch et al. 1993).

Fire has undoubtedly been an important ecological factor at Craig Mountain as well. Smith (1983) analyzed sediment cores from Blue Lake to reconstruct a 4300 year vegetation, climate and fire history for the area. He found forest community and associated fire frequency intervals to be dynamic over time. Prior to about 1700, Douglas-fir, and mixed Douglas-fir forests dominated the slopes near Blue Lake. Between about 1700 and 1900, the forests were dominated by ponderosa pine. Prior to approximately 1200, fires were infrequent, but large and severe when they occurred. Within the past 700 years, there has been an apparent increase in the frequency of light underburns and no large, destructive fires. Smith attributes much of this increased underburning to human activity, including intentional burning. Less localized fire history analyses for Craig Mountain are lacking.

Before the initiation of logging and fire suppression, much of the Craig Mountain uplands likely supported an open ponderosa pine - Douglas-fir forest. This savanna-like structure was maintained by regular underburning and contained relatively more shrubs than at present. North aspects and other cool/moist microsites were probably dominated by grand fir communities, or more closed forests, such as Douglas-fir thickets. Fires resulted in mixed-severity burns and were less common compared to nearby parklike forest stands. Overall, fires resulted in a patterned landscape, with greater structural diversity and shrub abundance. The extensive grand fir stands now in place are a response to management discriminating against seral forest species (Johnson, pers. comm. 1994).

The Douglas-fir/ninebark canyon forests on Craig Mountain were not subject to frequent, cool underburns, but instead had a relatively longer fire frequency interval (75 years?), resulting in mixed mortality and severity burns. These stand replacement type fires did not occur everywhere, simultaneously; so stand-age diversity was maintained across the landscape (Arno, pers. comm. 1994; Johnson, pers. comm. 1994). Also, there is an elevational, and north to south moisture gradient (from mesic to more xeric conditions) at Craig Mountain. This probably resulted in some underburning conditions within the more xeric habitats, adding further diversity to the canyon forests (Johnson , pers. comm. 1994). Canyon sites where more frequent underburning occurred could possibly have supported ponderosa pine-dominated communities.

Prior to active fire suppression, the natural fire frequency for the canyon grasslands is estimated at 10-25 years (Johnson 1989). The presumed decreased fire frequency in the canyon grasslands has not resulted in major changes to the composition or boundaries of the grassland communities, although minor increases for some shrub types may have occurred (Tisdale 1986).

A 1985 prescribed burn (cool, early spring burn) in the Craig Mountain WMA was judged to be an effective tool for the maintenance, rejuvenation and improvement of bunchgrass big game winter range. The burn resulted in a mosaic of burned and unburned areas. Benefits to wildlife included prolonged green-up flushes, good cover conditions for non-game and upland game species near good forage areas, nutritional alternatives to different big game species occupying the same area, and improved ungulate distribution. Initial investigations also indicated that benefits from burning may be insignificant in four years. Additional investigations suggest that areas grazed by livestock may not always contain sufficient fuel to carry a fire. This is also the case in ungrazed, sparsely vegetated sites (Johnson 1989). Prescribed

burns may be a useful management tool at Craig Mountain. One concern that should be evaluated is the likelihood of increasing establishment of yellow starthistle or other aggressive weeds.

CRAIG MOUNTAIN VEGETATION

Vegetation Map

A Craig Mountain vegetation map is being produced using satellite imagery (LANDSAT TM) data and digital elevation models, in conjunction with field-collected data. In September 1992, Conservation Data Center biologists mapped the vegetation within a portion of the China Creek drainage at Craig Mountain, including grassland, forest, shrubfield and riparian habitats. With the cooperation of the remote sensing staff at the University of Idaho, field mapping units were correlated to unique spectral signatures of the satellite imagery for the China Creek area. A preliminary vegetation map was produced by extrapolating these correlations to the rest of the Craig Mountain study area. Subsequent corrections and a revised draft vegetation map have been based on information collected during the 1993 and 1994 field seasons. Production of the vegetation map is in progress. A separate report will be written in support of the vegetation map. Upon completion, copies of the Craig Mountain vegetation map will be on file at the Natural Resources Policy Bureau, IDFG headquarters in Boise, and the IDFG Region 2 Office in Lewiston.

Vegetation Classification

Based on extensive fieldwork, a classification consisting of 24 vegetation cover types has been produced to describe the vegetation at Craig Mountain. The cover types are divided into four main categories - grasslands and meadows, shrubs and deciduous trees, conifer forests, and mosaic patterns. A revision of this classification will be used for the Craig Mountain vegetation map, where cover types will be the basic mapping unit. Cover types represent the present plant community at a given site. In most cases, cover types are related to a plant association (habitat type) or portions of a series of plant associations. Plant associations represent a sites "potential natural vegetation". From a practical standpoint, comparing the existing vegetation to the "potential" of a site allows certain assessments regarding ecological condition, seral position, and response to management actions, to be made.

Cover value percentages in the descriptions are based on data collected during sampling of vegetation monitoring plots in 1994. A more quantitative analysis of the vegetation will be included in the Craig Mountain vegetation map report.

Wildlife Inventory Habitats

The following six grouping of the 24 cover types will help compare wildlife inventory habitat classes to the vegetation classification. A seventh type, aquatic habitats is not considered in the vegetation classification. Aquatic habitats such as stock ponds and creeks often have a narrow zone of emergent vegetation supporting sedges (*Carex* spp.). Other aquatic vascular plants may be locally common, and algae and aquatic mosses are also sometimes present.

Grasslands

Bluebunch wheatgrass
Idaho fescue
Sand dropseed
Patterned ground
Bluebunch wheatgrass/shrubfield mosaic
Idaho fescue/shrubfield mosaic
Bluebunch wheatgrass/talus garland mosaic
River breaks mosaic
Stiff sagebrush *
Ninebark *
Common snowberry and Rose *
Smooth sumac *

Wet Meadow

Wet Meadow
Dry Meadow

Riparian

Hackberry
White alder

Shrubby draw

Mixed tall shrub

Upland forest

Grand fir
Lodgepole pine
Mixed conifer

Canyon forest

Douglas-fir
Ponderosa pine
Patterned conifer/grassland mosaic
Conifer regeneration/shrubfield mosaic

* inclusions within the grasslands

VEGETATION COVER TYPE DESCRIPTIONS

Grasslands

Bluebunch wheatgrass (*Agropyron spicatum*): Bluebunch wheatgrass communities dominate much of the canyon grassland ecosystem, covering more acreage than any other non-forest type at Craig Mountain. Where disturbance has not strongly altered composition, the vegetation is characterized by well spaced clumps (non-rhizomatous) of bluebunch wheatgrass; with most cover values between 15 and 25%. Forbs can be common, but exhibit low cover, up to approximately 20%, often much less. Except for scattered gray rabbitbrush (*Chrysothamnus nauseosus)* plants in some areas, shrubs are very uncommon or absent. Rock and bare ground are usually conspicuous, commonly with cover values of 50% or more.

Using the classification of Tisdale (1986), the bluebunch wheatgrass cover type is comprised of both the

Agropyron spicatum/Opuntia polyacantha (AGSP/OPPO), and *Agropyron spicatum-Poa sandbergii/Balsamorhiza sagittata* (AGSP-POSA/BASA) habitat types. Foliage, litter, and biotic crust cover are lower, the forb contribution less, and rock/bare ground more abundant in the AGSP/OPPO type - giving it a relatively sparse appearance. The AGSP-POSA/BASA type displays a substantially more vegetated appearance. The AGSP/OPPO type is the less common of the two at Craig Mountain, where it is common only on southerly facing, low- to mid-elevation slopes.

Bluebunch wheatgrass communities in excellent ecological condition are relatively uncommon at Craig Mountain. They usually are found in steep areas with limited livestock accessibility and water availability. A number of weedy species are well established in this type throughout the canyons. The annual brome grasses and yellow starthistle are particularly prevalent. The degree of grassland habitat degradation is variable, ranging from slight to severe. Extensive areas support what can be described as a bluebunch wheatgrass/yellow starthistle mosaic. This is a mosaic of relatively intact bluebunch wheatgrass communities and degraded areas characterized by high cover values (over 50% in many places) of yellow starthistle. At some highly disturbed areas, sites that once supported bunchgrass communities are now completely dominated by yellow starthistle and cheatgrass.

Ridgetops throughout the canyons often support lithic plant communities interspersed with more fully developed bunchgrass communities. The open vegetation of these rocky ridgecrests may support strict buckwheat communities similar to the *Eriogonum strictum/Poa sandbergii* type described by Johnson and Simon (1987), stiff sagebrush (*Artemisia rigida*) , or other depauperate vegetation. These ridgecrest communities are all characterized by a high percentage of bare ground and/or rock.

The occurrence of very widely spaced ponderosa pine trees on steep canyon side slopes within the bluebunch wheatgrass zone is worth noting. This pattern (forest canopy cover is always <10%) most commonly develops on southerly to westerly exposures at upper to middle elevations. It is known from the China, Eagle and Deer creek drainages.

The bluebunch wheatgrass cover type is the matrix throughout which inclusions of several other vegetation map classes are superimposed. Included are other grassland types, cliffs, shrub and mosaic classes.

Vegetation of the bluebunch wheatgrass class at Craig Mountain is related to habitat types described for several other areas in the region. Daubenmire (1970) describes a related *Agropyron spicatum/Poa sandbergii* habitat type in his treatment of the eastern Washington steppe. Basically, all eight plant associations in the bluebunch wheatgrass series of Johnson and Simon (1987) occur at Craig Mountain. Of these, the bluebunch wheatgrass-Sandberg's bluegrass (basalt) is the most common. Hall (1973), Mueggler and Stewart (1980) and Johnson and Clausnitzer (1991) also describe bluebunch wheatgrass communities or habitat types.

Idaho fescue (*Festuca idahoensis*): Canyon vegetation defined by the conspicuous presence of Idaho fescue is the other major grassland type at Craig Mountain. Zonation of the bluebunch wheatgrass versus Idaho fescue vegetation types is strongly influenced by aspect, in conjunction with elevation. At the lowest elevations, bluebunch wheatgrass is dominant on all exposures. Above roughly 1500 ft. elevation, steep, northerly slopes may support Idaho fescue, shrub, or even conifer classes. Bluebunch wheatgrass communities dominate the canyon vegetation to approximately the 3000 ft. contour; then in gradient fashion, become more confined to southerly aspects. By 4000 ft. elevation, bluebunch wheatgrass communities are mostly restricted to steep, rocky, south-facing slopes, with Idaho fescue communities

dominating the higher canyon slopes.

Using the classification of Tisdale (1986), the Idaho fescue cover type is comprised of the *Festuca idahoensis/Agropyron spicatum* (FEID-AGSP) and *Festuca idahoensis/Koeleria cristata* (FEID-KOCR) habitat types. The FEID-AGSP type is distinguished by bluebunch wheatgrass coverage co-dominant or in many places exceeding that of Idaho fescue. The bluebunch wheatgrass may be rhizomatous in these communities. Except for Sandberg's bluegrass other perennial grasses are rare. Forbs are more common than in bluebunch wheatgrass communities, but less compared to FEID-KOCR sites. Native annuals such as deer horn (*Clarkia pulchella)* can be abundant and shrubs are rare. Litter covers much of the ground, but in some places bare ground and rock are common. This type occurs mostly on easterly and northwesterly aspects. More xeric exposures generally contain bluebunch wheatgrass communities. On relatively undisturbed sites, bunchgrasses average approximately 35% cover, and forbs 10-20%.

The most mesic canyon grasslands support FEID-KOCR. It is characterized by a clear dominance of Idaho fescue, the presence of prairie Junegrass (*Koelaria cristata*), the strong tendency for bluebunch wheatgrass to be rhizomatous, a conspicuous and diverse forb component, and minimal bare ground cover. Forbs such as western hawkweed (*Hieracium albertinum*), red besseya (*Besseya rubra*) and elegant mariposa (*Calochortus elegans*) are common only in this habitat type. Shrubs such as snowberry irregularly occur. This type has been observed above about 3500 ft. elevation. It occurs on east to westerly exposures. Northerly aspects at the higher canyon elevations generally support stands of coniferous forest. On relatively undisturbed sites, bunchgrasses average nearly 50% cover, and forbs approximately 20%.

Idaho fescue grassland sites appear much less susceptible to invasion by yellow starthistle, although it and other weedy species are found at disturbed sites. In particular, the weed sulphur cinquefoil (*Potentilla recta*), appears to readily establish at disturbed areas. All FEID-KOCR communities along the gentle topography of the Wapshilla Ridge summit have been degraded by many years of intensive livestock use. In many places this degradation is severe enough that no Idaho fescue remains. Early seral sites are characterized by Kentucky bluegrass being the dominant grass, a preponderance of "increaser" forbs such as sticky gumweed (*Grindelia squarrosa*), yarrow (*Achillea millefolium*), and tarweed (*Madia* spp.), and more bare ground.

In a few places Idaho fescue communities are dotted with well-spaced conifers. This appears to principally occur in the northern half of Craig Mountain.

Besides Tisdale (1986), several other regional classifications describe Idaho fescue communities. Campbell (1962) described *Festuca/Agropyron* and *Festuca/Koeleria* plant communities in his study of Snake River grasslands. The AGSP-FEID habitat described by Daubenmire (1970) contains characteristics similar to Craig Mountain. Interestingly, none of the *Festuca idahoensis* habitat types he describes for the nearby Palouse are applicable to Craig Mountain. Exceptions are a very limited area near Waha, and some other small, scattered sites. At least six of the 14 Idaho fescue plant associations described by Johnson and Simon (1987) occur at Craig Mountain. Their FEID-AGSP-BASA and FEID-KOCR (high elevation) are the two most common. Johnson and Clausnitzer (1991) describe a FEID-AGSP plant association for the Blue and Ochoco Mountains.

Sand dropseed (*Sporobolus cryptandrus*): The perennial bunchgrass sand dropseed is the dominant and sometimes only native grass occurring in this cover type. Red threeawn (*Aristida longiseta*) is the most common associated bunchgrass. Small amounts of needle-and-thread grass (*Stipa comata*), or bluebunch

wheatgrass may also be present. Annual brome grasses, especially cheatgrass are usually abundant. Native forbs are usually present in small amounts, and include Indian-wheat (*Plantago patagonica*), hairy milkvetch (*Astragalus inflexus*), green-band mariposa lily (*Calochortus macrocarpus* var. *maculosus*) and shaggy fleabane (*Erigeron pumilus*). Yellow starthistle is often very abundant in sand dropseed communities along the lower Salmon River. In some places it can be the dominant plant. The degree of infestation is generally variable even in areas within close proximity. The weedy annual forb storksbill (*Erodium cicutarium*) is also often common. Occasional hackberry trees may be interspersed within the sand dropseed communities.

Sand dropseed communities are restricted to alluvial washes, bars, river terraces, and low ridges along and above the Snake and Salmon rivers, mostly below 2000 feet elevation. Soils are mostly very sandy and have poor moisture holding capability. Sites are level to gently sloping. In disturbed places where sand dropseed has probably replaced bluebunch wheatgrass, slopes may be fairly steep.

The climax status of sand dropseed communities are unclear. Daubenmire (1970) described sand dropseed communities as "zootic" climaxes. Tisdale (1986) described it as a "community type" and not a "habitat type", noting past grazing disturbances prevented a clear picture of its climax status. The mean bunchgrass foliage cover reported by Tisdale was approximately 20%. Johnson and Simon (1987) consider it the climax species in their sand dropseed plant association.

Meadows

Wet Meadows: Low gradient, headwater tributaries have formed graminoid-dominated meadow complexes scattered throughout the Craig Mountain highlands. Similar meadow systems do not occur in the canyons. Hydrologic and probably other local environmental factors vary within the meadows. The resulting meadow complex is a heterogenous mix of plant communities, ranging from wet to dry meadow types, all in close spatial association. This mosaic has been lumped together for the wet meadow cover type.

The wet meadows are graminoid-dominated, limited in aerial extent, and surrounded by upland conifer forest. Except for the very wettest places where only a few species of sedge (*Carex*) or spike-rush (*Eleocharis*) dominate, the meadows also support a rich forb component. Bare ground is minimal, except in areas of exceptional disturbance. Trees are rare, although scattered lodgepole pines may be establishing in places. Stumps may be present, indicating that at least portions of the meadow complex were formerly part of the adjacent conifer forest. Graminoid cover averages 70-80%, and forbs approximately 30%. All meadow systems have been heavily grazed by livestock during summer. Tributary channels dissect the flat to very gently sloping topography.

Different portions of the wet meadow complexes at Craig Mountain are similar to the dry meadow and moist meadow plant communities described for the Blue Mountains by Hall (1973). His dry meadows are dominated by tufted hairgrass (*Deschampsia cespitosa*) and Kentucky bluegrass (*Poa pratensis*), and the moist meadows by tufted hairgrass, Kentucky bluegrass, various sedges and bentgrass (*Agrostis* sp.). For the Wallowa-Snake Province, Johnson and Simon (1987) describe tufted hairgrass - moist sedge meadows, and tufted hairgrass - wet sedge meadow types that are similar for Craig Mountain. Portions of the meadow complexes at Craig Mountain are counterpart to the Kentucky bluegrass, beaked sedge (*Carex rostrata*) and California false hellebore (*Veratrum californicum*) community types described by Kovalchik (1987) for parts of central Oregon.

Dry Meadows: Both natural and human-induced clearings, surrounded by coniferous forest, are scattered across the Craig Mountain summit. Openings are usually small, rarely more than a few acres. They occur in areas where soil conditions (usually too shallow) preclude tree establishment, or in disturbed sites where the trees have been removed. Sites are level to very gently sloping, and may be convex in shape.

Meadows are usually dominated by introduced grasses such as timothy (*Phleum pratense*), orchard grass (*Dactylis glomerata*), or others. Very rocky inclusions supporting a Sandberg's bluegrass-dominated community occasionally occur. Forbs do not contribute much coverage. Shrubs such as serviceberry and rose may be scattered.

Shrubs

Stiff sagebrush (*Artemisia rigida*): This is a minor vegetation type at Craig Mountain. It is fairly widespread, but is never very extensive. Areas larger than one acre are rare. Sites are relatively sparsely vegetated and characterized by well spaced stiff sagebrush plants, low growing forbs and Sandberg's bluegrass as the dominant grass. Rock and bare ground are conspicuous, although lichens and moss (mostly *Tortula ruralis*) may cover substantial portions of these substrates. Soils are shallow and rocky, with the basalt bedrock at or near the surface. At Craig Mountain, this type occurs on exposed, flat to gently sloping or undulating ridgecrests, or occasionally in similar types of openings within the upland forest matrix. Small occurrences are interspersed along much of the Wapshilla Ridge rim. The largest example observed at Craig Mountain occurs along the middle reaches of the ridge divide between Billy and Camp creeks. With the exception of one stand of mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) not far from the small town of Forest, stiff sagebrush is the only woody *Artemisia* at Craig Mountain.

The regional classifications of Daubenmire (1970), Hall (1973), Tisdale (1986), and Johnson and Simon (1987) all describe a stiff sagebrush type. The *Artemisia rigida/Poa sandbergii* type of Tisdale seems to best fit these communities at Craig Mountain. At sites he sampled, foliage cover for rigid sagebrush averaged 12%, and bare ground/rock 40%.

Mallow ninebark (*Physocarpus malvaceus)*: Mallow ninebark communities occur in a few different situations at Craig Mountain. The most extensive stands are as an early seral stage on burned canyon slopes that formerly supported a Douglas-fir/ninebark forest community. The ninebark has resprouted and formed dense thickets that are part of the "conifer regeneration-shrubfield mosaic" cover type discussed in more detail under that heading. In some places, especially isolated, mid-elevation stringers along the Snake River side of Craig Mountain, conifer regeneration is meager and the ninebark-dominated shrubfields portray less of the regeneration/mosaic mix. Ninebark also occurs as small fingers that may extend beyond the perimeter and along the fringes of Douglas-fir/ninebark canyon forests. Within the canyon grasslands, ninebark communities are uncommon, small in size and restricted to very steep, northwest to northeast exposures. Ninebark communities seem restricted to above 2000 feet elevation, and occur mostly in the upper third of the canyon slopes.

Ninebark is the dominant species in all these situations. Other shrubs such as common snowberry, serviceberry and oceanspray are common associates. There is usually only a minimal herbaceous or grass layer. Soils are generally deep and not rocky.

Hall (1973), and Johnson and Clausnitzer (1991) describe ninebark and ninebark-common snowberry

associations respectively, for the Blue Mountains. Johnson and Simon (1987) describe a ninebark-common snowberry plant association for the Wallowa-Snake Province which best matches the canyon ninebark communities at Craig Mountain.

Common snowberry (*Symphoricarpos albus)* and Rose (*Rosa woodsii*; also *R. nutkana* ?): Within the canyon grassland complex, common snowberry and rose can form dense thickets containing one or a mix of both species. Most stands are small and localized, but in some places such as the Captain John Creek drainage, can be quite extensive. Scattered small openings within the thickets often occur. Neither shrub, especially the common snowberry, generally attains a height greater than 3 feet. Forbs and grasses are relatively sparse except in more disturbed places. Klamath weed (*Hypericum perforatum*) can be abundant in disturbed communities. A few other shrubs may be widely scattered.

The common snowberry and rose communities are restricted to steep, west- to east- (most commonly northwest to northeast) facing slopes. They are most common at middle to lower canyon elevations, extending down to about 1500 ft. They can occupy upper to lower slope positions often where a slightly convex topography exists. Soils are often deep, and rockiness is highly variable.

Several regional classifications - Daubenmire (1970), Hall (1973), Tisdale (1986), Johnson and Simon (1987), and Johnson and Clausnitzer (1991), describe common snowberry and/or rose communities. The Tisdale (common snowberry series), and Johnson and Simon (common snowberry-rose association) descriptions are much more closely related to the situation at Craig Mountain than the others.

Smooth sumac (*Rhus glabra*): Smooth sumac occurs as discontinuous patches in the lower portions of tributary canyons of the Snake and Salmon rivers. It apparently occurs on all aspects. Stands on southerly aspects may be more open compared to other exposures. It commonly occurs along lower slope and toeslope positions. When these positions are confluent with creek bottoms, smooth sumac often occurs as an irregular strip alongside the riparian vegetation. On alluvial and colluvial fans it occurs in close association with adjoining hackberry communities.

The vegetation is characterized by an open to dense canopy of smooth sumac and a well developed herbaceous layer, especially compared to the other shrub communities. All smooth sumac communities observed at Craig Mountain have been disturbed by livestock grazing. Although some native bunchgrasses such as sand dropseed, red threeawn or bluebunch wheatgrass may be present, the herbaceous understory is usually dominated by weeds such as cheatgrass.

Daubenmire (1970), Horton (1972), Tisdale (1986) and Johnson and Simon (1987) all describe pertinent smooth sumac communities. Tisdale (1986) reports the range of foliage cover of smooth sumac to be 20 to 50 percent, and ground cover to be mainly comprised of litter (65%) and rock (15%).

Mixed Tall Shrub: Characterized by a dense mix of tall shrub species such as ninebark, serviceberry (*Amelanchier alnifolia*), chokecherry (*Prunus virginiana*), bittercherry (*Prunus emarginata*), black hawthorne (*Crataegus douglasii*), oceanspray, rose, syringa (*Philadelphus lewisii*), blue elderberry (*Sambucus cerulea*), smooth sumac and occasionally hackberry (*Celtis reticulata*) and coyote willow (*Salix exigua*). Water birch (*Betula occidentalis*) is a minor component when present. The proportions of any of these can be quite variable from one site to the next, and generally no one species is dominant. This type is restricted to the bottom of draws, ravines and other incisions within the canyon grassland complex. The mixed tall shrub cover type typically occurs as a long, narrow ribbon following ephemeral

watercourses surrounded by steep grassland slopes. It is an intermittent, but regular feature of the dissected canyon topography. At low elevations approaching the Snake and Salmon rivers the mixture is often replaced by stringers dominated by hackberry.

Huschle (1975) described a "heterogenous shrub mixture" vegetation type, containing many of the same species listed above.

Deciduous Trees

Netleaf hackberry (***Celtis reticulata*****):** At Craig Mountain, hackberry stands are confined to the Snake and Salmon river canyons, and the lower reaches of their tributaries. Many alluvial and colluvial outwash fans, alluvial terraces, and toeslopes along the main canyons and tributary mouths support hackberry. In these situations the vegetation takes on the appearance of an open savanna, with scattered small clusters or individuals. The hackberry is generally less than 20 feet tall. Hackberry also occurs as a narrow stringer in low elevation draws, as a relatively narrow band in riparian situations, such as along lower Birch Creek, and along steep, rocky shoreline escarpments. Hackberry cover is generally more complete in these situations. The non-riparian sites are among the hottest and driest sites at Craig Mountain. In many areas, hackberry provides the only shade within the canyon bottoms.

Associated vegetation has been disturbed by many years of livestock use and most of the native bunchgrasses and forbs have been replaced by exotics such as cheatgrass and yellow starthistle. Hackberry is often associated with, but distinct from, adjacent smooth sumac/grassland communities. Other shrubs or trees are not prominent within hackberry stands. Adjacent slopes are usually dominated by degraded bunchgrass communities.

Several regional investigators have classified hackberry communities. Daubenmire (1970) describes a *Celtis douglasii* (a synonym of *C. reticulata*)/*Bromus tectorum* habitat type, and Horton (1972) a hackberry/weed community type. Huschle (1975) describes five hackberry community types, differentiating them mainly on the basis of the dominant understory grass species. Asherin and Claar (1976) describe two open savanna types. Tisdale (1986), and Johnson and Simon (1987) describe a *C. reticulata/Agropyron spicatum* habitat type and plant association respectively. The latter two descriptions match well the situation at Craig Mountain. DeBolt (1993) discusses the ecology of hackberry.

White alder (*Alnus rhombifolia*): A closed to partially open tree canopy of white alder, a diverse, multilayered complex of shrubs in the understory, and a relatively sparse herbaceous component characterize this riparian cover type. Occasional black cottonwoods (*Populus trichocarpa*) may share the tree canopy, often protruding above the white alder. Some common shrub associates include syringa, red-osier dogwood (*Cornus stolonifera*), common snowberry, cascara (*Rhamnus pershiana*) and hackberry. At Craig Mountain, white alder is restricted to the main canyon creek bottoms that have perennial water flow. It is confined to elevations below approximately 2500 feet. Within this elevation zone it is the main riparian community defining the major creeks. Because it is confined to the creek bottoms it occurs as a distinct narrow band. Canyon grassland, conifer woodland, or a mixture of both comprise the adjacent upland vegetation. It often abuts hackberry communities near the creek mouths. Towards the upper elevational limits for white alder, hybridization with thinleaf alder (*Alnus incana*) was observed at Craig Mountain. This has been documented elsewhere as well.

Mean foliage cover values for white alder stands we sampled were approximately 70% for trees, 55% for

shrubs, and 10% or less for forbs, and graminoids.

The most comprehensive regional treatment of white alder is by Miller (1976). During studies of the ecology of white alder he described nine white alder community types. At least four types, white alder/syringa, white alder/hackberry, white alder/water birch, and white alder/rose occur at Craig Mountain. The white alder/syringa seems to be the most prevalent. The white alder/syringa is interesting because we found it in tributaries of the Salmon River. Miller noted its occurrence to be restricted to the Snake River corridor, where it also occurs at Craig Mountain. Huschle (1975) also describes several white alder community types.

Conifer Forest

The conifer forest cover types for Craig Mountain are divided into five main groups - grand fir (*Abies grandis*), Douglas-fir (*Pseudotsuga menziesii*), ponderosa pine (*Pinus ponderosa*), lodgepole pine (*Pinus contorta*), and mixed conifer. The mixed conifer class is reserved for forest communities containing a conglomerate of conifers where no one species is dominant. Areas where conifer canopy coverage is less than 10%, are not classified as forest types.

Grand fir: At Craig Mountain, stands dominated by grand fir are confined to the rolling terrain characterizing its plateau-like summit. It is the climax tree species over virtually the entire Craig Mountain uplands. Years of fire suppression have resulted in what is probably a substantial increase in grand fir compared to historical levels. A history of timber harvest operations, including repeated highgrading, often makes it difficult to determine habitat types in the grand fir series.

Most grand fir stands contain a mix of seral trees. Douglas-fir are the most consistent and common, followed by ponderosa pine. Lodgepole pine, Engelmann spruce, and western larch are other seral species. Local stands of nearly pure grand fir occasionally occur. Understory composition and relative abundances are dynamic, and major shifts can be expected as the tree canopy closure becomes more complete, or is opened. Canopy cover is very variable, both between and among stands, and can range from less than 20% to 100%.

Shrubs are generally an important component of grand fir stands. An exception is under very closed canopy conditions, where mats of twinflower (*Linnaea borealis*) may be the only shrub present. Even in areas of high overall canopy cover there are usually breaks in the overstory supporting patches of shrubs. The shrub layer may be dominated by low-growing, but more often taller shrub species. Common shrub species associated with grand fir forests at Craig Mountain are twinflower, common snowberry, Utah honeysuckle (*Lonicera utahensis*), blue huckleberry (*Vaccinium globula*re), white spiraea (*Spiraea betulifolia*), rose, serviceberry and several currant species.

Forbs and grasses are also well represented in many grand fir stands. Some common forbs are heartleaf arnica (*Arnica cordifolia*), round-leaf violet (*Viola orbiculata*), northern bedstraw (*Galium aparine)*, side-flowered mitrewort (*Mitella stauropetala*), Montana yellow pea (*Thermopsis montana*), windflower (*Anemone piperi*), western meadowrue (*Thalictrum occidentale*) and western goldenthread (*Coptis occidentalis*). Understory grasses include pinegrass (*Calamagrostis rubescens*), Columbia brome (*Bromus vulgaris*), bluegrass species, and elk sedge (*Carex geyeri*). Pasture and other introduced grasses can also be locally common.

Three grand fir habitat types (Cooper et al. 1987) are known from Craig Mountain - grand fir/white spiraea, grand fir/twinflower, and grand fir/blue huckleberry. The grand fir/white spiraea type represents the warm, dry extreme and the grand fir/blue huckleberry the cool extreme in the grand fir series for northern Idaho. Limited stands of subalpine fir (*Abies lasiocarpa*) occur in a few places, such as upper Eagle Creek. These grade into grand fir habitat types.

Grand fir forests occur alongside the major tributary creeks at upper canyon elevations. In a few riparian areas such as in upper Eagle Creek and portions of the South Fork Captain John drainage, grand fir/Pacific yew communities occur. Engelmann spruce and Douglas-fir are also common in these situations. These communities are similar to grand-fir/Pacific yew/queen's cup plant association described by Johnson and Simon (1987).

Douglas-fir: Douglas-fir-dominated communities occur sporadically along the plateau-like summit at Craig Mountain. Other conifer species also occur in varying amounts and stands can have an understory dominated by either shrubs or graminoids. The latter situation most commonly occurs within the scattered, open, Douglas-fir stands near the canyon rims. More commonly, Douglas-fir is one of the main contributors to the seral, mixed conifer stands that dominate the uplands. It is rarely the climax conifer on the uplands. Canopy cover is very variable for the Douglas-fir cover type, ranging from less than 20%, to upwards of 90%.

Within the canyons, except in areas distinguished by post-fire, early seral vegetation, the Douglas-fir cover type dominates the steep, north-facing slopes that abruptly break off from the uplands. Contrasting bunchgrass vegetation occurs on adjacent southerly exposures. Ponderosa pine is the main seral tree in the canyon forests, and scattered grand fir may also be present. In some canyon forest stringers, Douglas-fir can form nearly pure stands. Overstory cover is variable within the canyon forests, but mostly greater than 50%. Large areas of open canopy are infrequent. At Craig Mountain, canyon forest stands are generally dominated by trees less than 18 inches d.b.h., indicative of their relatively young age. The Douglas-fir canyon forests support the Douglas-fir/ninebark habitat type (Cooper et al. 1987). The understory shrub layer is dominated by ninebark. Ocean spray is co-dominant in some places. Other common shrubs are common snowberry, serviceberry, and rose. Forb composition can be very diverse in relatively open stands. Forbs and grass abundance and diversity decrease in areas of high overstory coverage. Common forbs include strawberry (*Fragaria* spp.), heartleaf arnica, mountain sweet-cicely (*Osmorhiza chilensis*), and western meadowrue. Patches of pinegrass can be relatively extensive, but grasses are usually more scattered. Other frequently encountered graminoids are elk sedge, Kentucky bluegrass, western fescue (*Festuca occidentalis*), Idaho fescue, and tall trisetum (*Trisetum canescens*). Douglas-fir/ninebark canyon forests are often transitional to grand fir types at their upper ends. Occasionally, grand fir types reappear in the drainage bottoms at the lower ends of the Douglas-fir stringers.

Douglas-fir/ninebark habitat types have been described by many other investigators beside Cooper et al. (1987), a few include Daubenmire and Daubenmire (1968), and Steele et al. (1981). Successional trends have been described for northern Idaho by Cholewa and Johnson (1983).

Ponderosa pine: Large stands of ponderosa pine are no longer common at Craig Mountain, where it now most commonly occurs as one of several conifers in the mixed conifer class. It is often one of the most important contributors to these upland seral forest communities. Assuming the forests at Craig Mountain were similar to those in the nearby Blue Mountains (Hall 1977; Mutch et al. 1993; Oliver et al. 1994)), open, park-like forests dominated by large ponderosa pine or a mix of pine and Douglas-fir were formerly

widespread. A century of fire suppression has allowed more fire sensitive and shade tolerant conifers such as grand fir and Douglas-fir to establish and replace the ponderosa pine. Extensive selective logging for the large ponderosa pines has also likely contributed to the decline of the parklands.

Ponderosa pine communities are fairly widespread to the north and east of BPA mitigation lands. The Frye point area, Eagle, China and Deer creeks also support areas with the ponderosa pine cover type. Pockets occur on upper canyon slopes off Wapshilla Ridge, but are limited in extent. These communities are characterized by open stands (conifer canopy cover less than 40%) of ponderosa pine and either a bluebunch-wheatgrass or Idaho fescue-dominated understory. Forbs are more abundant where Idaho fescue is the dominant bunchgrass. Shrubs are uncommon. Sites that are too dry for any other conifers to establish are ponderosa pine/bluebunch wheatgrass, or ponderosa pine/Idaho fescue habitat types (Cooper et al. 1987).

In the uplands, the shrub layer for the ponderosa pine cover type is usually relatively sparse and exceeded by bunchgrass coverage. Common snowberry and white spiraea are frequent low-growing shrubs. The ponderosa pine/common snowberry habitat type (Cooper et al. 1987) has been identified at Craig Mountain. The Deer Creek drainage and some other areas near Wapshilla Ridge support this type. In the canyons, especially in areas of post-fire regeneration, shrub cover can be very high.

On some northwest- and northeast-facing canyon slopes, ponderosa pine/ninebark communities can occur as narrow and localized stringers. It is unclear if these are truly ponderosa pine/ninebark habitat types (sensu Cooper et al. 1987) because often there are small amounts of young Douglas-fir present. These sites are characterized by a fairly open ponderosa pine overstory and a shrub layer similar to that described for Douglas-fir/ninebark.

Lodgepole pine: Seral lodgepole pine communities are common along the Craig Mountain uplands, especially in the eastern portion of the study area, centered around Soldiers Meadow Reservoir. All stands are relatively young with trees taller than 40 feet uncommon. The lodgepole class does not occur within the canyon ecosystem. Lodgepole pine is another common member of the mixed conifer class at Craig Mountain. The clear dominance of lodgepole pine, generally of one size class distinguishes this vegetation type. Understory tree layers generally contain a mix of reproducing lodgepole pine, with regenerating Douglas-fir and grand fir.

Canopy cover is very variable, ranging from less than 20%, to 100% in some areas of "doghair" regeneration. In this latter situation, the understory is extremely depauperate. Lodgepole regularly generates a fairly closed canopy, and examples of the open canopy class are uncommon. Common shrubs within the lodgepole cover type include blue huckleberry, snowberry, white spiraea, and kinnickinnick (*Arctostaphylos uva-ursi*). Grasses and forbs can be abundant where the canopy cover is not too high.

Mixed conifer: Conifer stands supporting a mixture of species cover much of the top of Craig Mountain. Stands are characterized by a mix of conifers, including grand fir, Douglas-fir, ponderosa pine, western larch, lodgepole pine, and in some places Engelmann spruce or subalpine fir. No species is clearly dominant, except perhaps very locally. Composition and proportions are variable between and often within stands. Stands range from early to late seral condition. In many places on BPA mitigation land, past logging activities, such as excessive and repeated highgrading, have rendered stands bearing little resemblance to naturally occurring seral communities. Most mixed conifer stands are located on sites that support grand fir habitat types.

Shrubs are usually common, except where canopy closure is nearly complete. Common shrubs are ninebark, several currant species, Scouler's willow (*Salix scouleri*), snowberry, twinflower, blue huckleberry and blue elderberry. Grasses are often introduced species. Elk sedge is locally common. Compressed bluegrass (*Poa compressa*) can dominate where the understory has been disturbed by livestock. The perennial forb, taper-leaved penstemon (*Penstemon attenuatus*) covers relatively large areas in some open understory situations.

Mosaic complexes

Patterned ground: This type occurs as a complex of distinct, raised, mounds separated by scabland or swales. The well-defined mounds average about 2 feet above the adjacent swales. Where disturbance is minimal the mounds are lushly vegetated with bunchgrasses and native forbs. However, at Craig Mountain most sites are disturbed and the mounds have been invaded by various weedy species. The relatively sparsely vegetated swales support a suite of scabland species that may include stonecrop (*Sedum* sp.), desert-parsleys (*Lomatium* spp.), Sandberg's bluegrass, and in some places rigid sagebrush.

Patterned ground is uncommon at Craig Mountain. It occurs in interrupted fashion along portions of Wapshilla Ridge, especially in the Zaza vicinity. Fort Simons Ridge and the Hoover Point area support good examples of patterned ground. Scattered other examples also exist, primarily along ridgetops and associated canyon rims. Patterned ground is also known as biscuit and swale topography or Mima mounds. The origin of this topography is uncertain.

Johnson and Simon (1987) describe an Idaho fescue-prairie Junegrass (mounds) plant association that is applicable to Craig Mountain. The foliage cover of native bunchgrasses averages more than 50%, and forbs greater than 30%, in the late and middle seral sites they sampled.

Patterned conifer/grassland mosaic: This classification represents areas supporting canyon forest regularly interrupted by intervening grassland slopes. This composite vegetation occurs on steep canyon slopes of complex topography, characterized by a main ridge dissected by a fairly regular sequence of secondary, spur ridges. These produce a series of alternating northerly and southerly exposures. Northerly aspects support a conifer woodland, the southerly aspects support canyon grassland communities. Where spur ridges are not prominent, the main slope will have a gently undulating nature with areas of concave topography supporting forest and the intervening convex areas supporting strips of grassland. This patterned mosaic appears striking from a distance.

The canyon forest portion of the mosaic is dominated by Douglas-fir/ninebark (Cooper et al. 1987), and the grassland by either Idaho fescue or bluebunch wheatgrass communities. Within a given strip of Douglas-fir, canopy coverage is often quite variable.

This patterned mosaic is common at Craig Mountain and can cover large areas in the upper canyons. It is more prevalent on the Snake River versus Salmon River side of Craig Mountain.

Conifer regeneration/shrubfield mosaic: Representative of previously forested areas regenerating post-fire and supporting a complex vegetation mosaic. It is restricted to steep canyon slopes and can extend from upper to lower slope positions. It is most common within the upper canyon portions of the China and Eagle creek drainages, where it is extensive.

The vegetation mosaics are comprised of: 1) Ninebark-dominated shrubfields, usually with a Scouler's willow and/or common snowberry component. Other shrubs such as ocean spray, serviceberry and black hawthorne may also be present in varying, subordinate amounts. 2) Scouler's willow dominated shrubfields. These are generally not that common or extensive. An understory of regenerating conifers may be present. 3) Scattered individual or small clumps of Douglas-fir or ponderosa pine trees that survived the fire. 4) Burned snags. 5) Young, regenerating conifers (mostly Douglas-fir) found mainly in draws and other pockets, much less so on the open slopes. 6) Bluebunch wheatgrass or Idaho fescue communities occur on intervening southerly aspects and support minimal shrub or tree cover.

Idaho fescue/shrubfield mosaic: This type is representative of Idaho fescue canyon grassland communities largely interspersed with shrub patches. Common snowberry, rose, ninebark and to a lesser extent serviceberry and oceanspray are the main shrubs. Shrub patches can be fairly large, but more often are small or poorly defined. The various shrub species are usually discrete, but a degree of mixing can occur. Idaho fescue/shrubfield mosaics occur mainly on steep northwest to east aspects, at upper to middle canyon elevations.

Bluebunch wheatgrass/shrubfield mosaic: This type is similar to the Idaho fescue/shrubfield mosaic vegetation cover type except the shrub patches are scattered within a bluebunch wheatgrass community matrix. The grassland communities are more likely to be weedy. Ninebark is less common. This grassland/shrub mosaic is most common on mesic aspects at lower canyon elevations. An exception is when the shrub component of the mosaic is smooth sumac, which can occur on more xeric southerly exposures.

Bluebunch wheatgrass/talus garland mosaic: Some bluebunch wheatgrass canyon grassland slopes contain an extensive series of talus stripes ringed by various shrub communities. Talus garlands are positioned downslope from extensive basalt palisades or other eroding rocky outcrops. The garlands usually occur on upper to middle slope positions. The most common shrubs are syringa, oceanspray, serviceberry and snowberry. At low elevations, hackberry can be present. This pattern seems to occur on all aspects except north, but most commonly on southeast to southwest exposures. Slopes are steep.

Individual or small series of shrub garlands are a fairly regular feature throughout the canyon grassland complex. This vegetation class does not attempt to differentiate these local inclusions, only areas where the shrub garlands are a marked feature of the landscape.

Johnson and Simon (1987) describe a talus garland plant community and note that the shrubs persist only along the margins of the mobile rocky "streams" where talus movement is less.

River breaks mosaic: Along sections of the Snake and confluent lower Salmon river corridors, craggy, near-vertical bluffs rise from the rivers for over 1000 feet. In most places the upper elevations of these river breaks range between 1800 and 2200 feet. Overall, the massive breaks are mostly rock (both metavolcanics and basalt) and support only sparse vegetation. Some areas of developed vegetation occur, however. Bluebunch wheatgrass communities occur on slopes interspersed among the rock faces. Some ravines and draws that dissect the slopes have hackberry or shrub stringers.

Johnson and Simon (1987) described a spiny green-bush/bluebunch wheatgrass (*Glossopetalon nevadense/Agropyron spicatum*) plant association confined to rock outcrops and canyon rims that is applicable to some areas along the river breaks. Large expanses of the river breaks, have little to no soil

development, and the sparse vegetation is unclassified.

SUMMARY OF PLANT ASSOCIATIONS AT CRAIG MOUNTAIN

Based on the descriptions of various published classifications, 29 plant associations have been identified for Craig Mountain. Canyon grassland, meadow, upland shrub, conifer forest, and riparian habitats are listed below, along with corresponding conservation rankings and reference sources.

The Global and State conservation ranks are from Bourgeron and Engelking (1994). The global rank is a numerical assessment of a plant association's relative rarity across its entire range of distribution assigned by the Natural Heritage Network. Global ranks are determined primarily on the number of occurrences and total area of coverage by a plant association. Other factors considered are permanence, intrinsic fragility and vulnerability, historic trend in distribution, threats, geographic range, and number of occurrences protected. The interpretation of global ranks is as follows:

G1 = Critically imperiled globally because of extreme rarity (5 or fewer occurrences) or because of some factor making it vulnerable to extinction.
G2 = Imperiled globally because of rarity (6 to 20 occurrences) or because of other factors demonstrably making it vulnerable to extinction.
G3 = Either very rare and local throughout its range, or found locally in a restricted range, or because of other factors making it vulnerable to extinction (20 to 100 occurrences).
G4 = Widespread, abundant, and apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery (usually more than 100 occurrences).
G5 = Demonstrably widespread, abundant, and secure globally, though it may be quite rare in parts of its range, especially at the periphery.

State ranks follow the same criteria and Natural Heritage Network methodology as the global ranks, except the information assessed for ranking is limited to the individual state, in this case Idaho. Note that G = Global Rank and S = State Rank in the following list. Elements with a 1 or 2 ranking are highlighted in bold.

The references used to classify the vegetation at Craig Mountain are:

1 = Cooper et al. 1987
2 = Daubenmire 1970
3 = Johnson and Simon 1987
4 = Miller 1976
5 = Tisdale 1986

Name	G	S	Ref.
Grassland			
1. Bluebunch wheatgrass/prickly-pear cactus (*Agropyron spicatum/Opuntia polycantha*)	G3	**S2**	5
2. Bluebunch wheatgrass-Sandberg's bluegrass/arrowleaf balsamroot	G3	S3	5

(*Agropyron spicatum-Poa sandbergii/Balsamorhiza sagittata*)			
3. Idaho fescue/bluebunch wheatgrass (*Festuca idahoensis/Agropyron spicatum*)	G4	S3	5
4. Idaho fescue/prairie junegrass (*Festuca idahoensis/Koeleria cristata*)	G3	S3	5
5. Idaho fescue/common snowberry (*Festuca idahoensis/Symphoricarpos albus)*	**G2**	**S1**	2
6. Sand dropseed (*Sporobolus cryptandrus*)	**G2**	**S2**	5
7. Spiny greenbush/bluebunch wheatgrass (*Glossopetalon nevadense/Agropyron spicatum*)	G5	S4	3
8. Buckwheat/Oregon bladderpod (*Eriogonum* spp./*Physaria oregana*)	**G2**	**S2**	3
9. Strict buckwheat/Sandberg's bluegrass (*Eriogonum strictum/Poa sandbergii*)	G4	S3	2
Meadow			
10. Tufted hairgrass (*Deschampsia cespitosa*)	G4	S3	3

Name	G	S	Ref.
Upland Shrub			
11. Rigid sagebrush/Sandberg's bluegrass (*Artemisia rigida/Poa sandbergii*)	G4	**S2**	5
12. Smooth sumac/bluebunch wheatgrass (*Rhus glabra/Agropyron spicatum*)	G3	**S2**	5,3
13. Common snowberry/rose (*Symphoricarpos albus/Rosa* spp.)	G4	S3	3
14. Ninebark/common snowberry (*Physocarpus malvaceus/Symphoricarpos albus*)	G3	**S2**	3

15. Hackberry/bluebunch wheatgrass (*Celtis reticulata/Agropyron spicatum*)	G3	**S1**	5
Conifer Forest			
16. Grand fir/twinflower (*Abies grandis/Linnaea borealis*)	G5	S3	1
17. Grand fir/blue huckleberry (*Abies grandis/Vaccinium globulare*)	G3	S3	1
18. Grand fir/white spirea (*Abies grandis/Spirea betulifolia*)	G3	S3	1
19. Grand fir/Pacific yew (*Abies grandis/Taxus brevifolia*)	**G2**	**S2**	3
20. Douglas-fir/pinegrass (*Pseudotsuga menziesii/Calamagrostis rubescens*)	G5	S5	1
21. Douglas-fir/common snowberry (*Pseudotsuga menziesii/Symphoricarpos albus*)	G5	S4	1
22. Douglas-fir/ninebark (*Pseudotsuga menziesii/Physocarpus malvaceus*)	G5	S5	1
23. Ponderosa pine/Idaho fescue (*Pinus ponderosa/Festuca idahoensis*)	G5	S3	1
24. Ponderosa pine/common snowberry (*Pinus ponderosa/Symphoricarpos albus*)	G5	S3	1
Name	G	S	Ref.
25. Ponderosa pine/ninebark (*Pinus ponderosa/Physocarpus malvaceus*)	**G2**	**S1**	1
Riparian			
26. White alder/water birch (*Alnus rhombifolia/Betula occidentalis*)	**G2**	**S2**	4
27. White alder/syringa (*Alnus rhombifolia/Philadelphus lewisii*)	**G1**	**S1**	4

28. White alder/Wood's rose (*Alnus rhombifolia/Rosa woodsii*)	**G1**	**S1**	4
29. White alder/hackberry (*Alnus rhombifolia/Celtis reticulata*)	**G2**	**S2**	4

The high biodiversity value of Craig Mountain is highlighted in that 14 of the 29 plant associations have a State Rank of 1 or 2, with 10 of these also having Global Ranks of 1 or 2. Most of these uncommon elements occur within the canyon grassland ecosystem. The Hells Canyon grassland ecosystem, of which Craig Mountain is a part, has few counterparts anywhere else. Plant communities that have developed on these steep canyon slopes are a unique part of regional and global vegetation patterns. A brief discussion of each S1 or S2 association follows.

Bluebunch wheatgrass/prickly-pear cactus: Characterized by well-spaced clumps of bluebunch wheatgrass, the complete absence of Idaho fescue, low forb cover and diversity, and high bare ground and/or rock cover. At Craig Mountain it occurs on xeric, southerly exposures at lower to middle elevations in the canyons. It is prone to invasion by annual bromes, yellow starthistle, and other introduced annual forbs. Good examples of this type are found in The Nature Conservancy's Garden Creek Preserve, the Craig Mountain WMA - Gaiser Segment, below Gold Hill, and canyon slopes on the Snake and Salmon rivers off southern Wapshilla Ridge.

Idaho fescue/common snowberry: Characterized by a dense herbaceous layer of Idaho fescue, and dwarf, mainly sterile common snowberry plants. There is also a conspicuous forb component along with other grasses such as prairie Junegrass and the rhizomatous form of bluebunch wheatgrass. This type is more characteristic of the mesic Palouse Prairie grasslands. The Idaho fescue/common snowberry type is rare at Craig Mountain. It is known mostly from around the Waha vicinity. There are other small, scattered occurrences, such as in the Morris Point area in upper Cave Gulch.

Sand dropseed: Sand dropseed is clearly the dominant and sometimes only perennial bunchgrass within this association. Annual bromes are always present, and along the lower Salmon River yellow starthistle is often abundant. This type is most common on level to gently sloping alluvial fans, benches and low ridge crests along the Snake and Salmon rivers. Very few undisturbed sand dropseed communities are known in Idaho, although some good sites are reported on The Nature Conservancy's Garden Creek Preserve. Nearly all sites have been disturbed by years of livestock grazing.

Buckwheat/Oregon bladderpod: The sparse vegetation of this type is characterized by scattered buckwheat (apparently either *Eriogonum compositum* (northern buckwheat) or *E. strictum* (strict buckwheat) at Craig Mountain) and Oregon bladderpod plants. Other herbaceous plants such as desert evening primrose (*Oenothera caespitosa*) and varileaf phacelia (*Phacelia heterophylla*) are also usually present. Soils are very shallow and often have a gravelly surface. The buckwheat/Oregon bladderpod type occurs as isolated small communities on south-facing, low elevation slopes, and is uncommon at Craig Mountain.

Rigid sagebrush/Sandberg's bluegrass: These relatively sparsely vegetated communities are characterized by well-spaced rigid sagebrush plants with Sandberg's bluegrass being the dominant native grass species. Soils are shallow and bare ground or rock cover is high. This type occurs on exposed, flat to gently sloping or undulating ridgecrests, or occasionally similar kinds of openings within the upland

forest matrix. At Craig Mountain, small occurrences are interspersed along much of the Wapshilla Ridge rim and down some spur ridges. The largest example observed at Craig Mountain is along the Billy/Camp creeks divide in the Craig Mountain WMA. Annual bromes and small annual forbs are well established in most communities.

Smooth sumac/bluebunch wheatgrass: Due to their close proximity to water, most smooth sumac sites are badly disturbed by grazing, making classification difficult. The shrub layer is almost entirely smooth sumac, rarely more than eight feet tall. Bromes and other weedy annuals are usually abundant. At Craig Mountain, yellow starthistle seems less common than in adjacent upland grassland sites. Remnant bunchgrasses may or may not be present. Smooth sumac communities generally occur as small, scattered stands at the lower canyon elevations. Lower Madden, Captain John, Banks, Eagle and Corral creeks contain relatively large concentrations of smooth sumac.

Ninebark/common snowberry: Ninebark clearly dominates these communities, with lesser amounts of snowberry. Other shrubs such as rose and serviceberry are also generally present. The herbaceous layer is sparse. At Craig Mountain this type is found on steep, northerly aspects, below lower timberline, and also higher up the canyons. It is uncommon and sites are small at Craig Mountain. Ninebark is more common as an early seral dominant in post-fire forest habitat types.

Hackberry/bluebunch wheatgrass: An open overstory of hackberry and a relatively low cover and diversity of herbaceous species characterize this type. The abundance of annual bromes and other exotics indicates these sites are routinely disturbed. Sites are usually rocky. Hackberry/bluebunch wheatgrass is restricted to lower canyon sites, typically on alluvial terraces, outwash fans and toeslopes along lower canyon walls. At Craig Mountain this type is widespread, but local along the Snake and Salmon river corridors. All sites observed were disturbed, but some local examples in better ecological condition may exist along inaccessible segments of the canyon bottoms.

Ponderosa pine/ninebark: This habitat type is known only from northern Idaho and northeast and southeast Washington. Ponderosa pine is the only conifer occurring in this habitat type. A tall shrub layer is dominated by ninebark and/or oceanspray with other tall shrubs such as serviceberry also present. A lower shrub layer is dominated by common snowberry, with rose and white spiraea. A well represented herbaceous layer is also present. The understory composition is very similar to that found in the Douglas-fir/ninebark habitat type.

Fire in this type tends to eliminate young pines leaving the more resistant older trees. If no larger trees survive the fire then ninebark and the other shrubs quickly fill in. This may be the case at a few places at Craig Mountain, where black snags are the only indication that conifers formerly occupied the site.

At Craig Mountain, ponderosa pine/ninebark communities may actually all be seral to Douglas-fir/ninebark. With the successful fire suppression efforts of recent decades, Douglas-fir seems to be replacing ponderosa pine in these "fire climax" ponderosa pine sites. It remains unclear if there are any "true" ponderosa pine/ninebark sites at Craig Mountain. Classifying these sites must be done with care.

Ponderosa pine/ninebark occurs on northerly aspects of moderate slopes generally at elevations below 3000 feet. At Craig Mountain small strips occur on canyon slopes separated from the larger, more contiguous stands of Douglas-fir/ninebark. Small, widely scattered occurrences of this type have been reported for Craig Mountain, such as lower Deer Creek, and mid-elevations of Cottonwood and Middle

creeks. Horton (1972) reports ponderosa pine/ninebark from Maloney Creek, which is just east of the study area.

Grand fir/Pacific yew: A grand fir overstory and Pacific yew-dominated understory characterize this riparian member. Blue huckleberry, twinflower and currant species are common shrubs. Limited stretches in upper Eagle Creek and portions of the South Fork Captain John Creek support this association on Craig Mountain. Pacific yew is otherwise rare at Craig Mountain.

White alder/water birch: All of the white alder associations described here are restricted to riparian habitats. The white alder/water birch association consists of a mixed white alder and water birch overstory with some interspersed hackberry and black cottonwood. Understory shrubs include black hawthorne, rose and currant species. Riparian segments along Corral Creek and probably other perennial creeks on the Snake River side of Craig Mountain support this association.

White alder/syringa: A white alder overstory and a dominance by syringa within the shrub layer characterizes the vegetation of this riparian community. This is the most common white alder association we observed at Craig Mountain. White alder/syringa was found within tributaries of both the Snake and Salmon (Eagle and China creeks) rivers. This distribution is interesting because Miller (1976) reported it to be restricted to the Snake River corridor.

White alder/Wood's rose: This distinctive, depauperate type has a white alder-dominated overstory with Wood's rose the only shrub and is indicative of very poor stream channel ratings. Neiman (1987) reports a limited amount occurring on The Nature Conservancy's Garden Creek Preserve. We did not observe it elsewhere at Craig Mountain.

White alder/hackberry: This association is comprised of a white alder-dominated overstory and hackberry underneath. A diverse mix of other shrubs are also generally present. Most if not all tributary creeks that support white alder contain segments of this association at Craig Mountain.

RARE PLANTS AT CRAIG MOUNTAIN

Introduction

Rare plant field surveys were conducted at Craig Mountain during May to September, 1993 and 1994. Field investigations concentrated on, but were not limited to, BPA and IDFG lands. This provides a more comprehensive understanding of the conservation status of rare plants at Craig Mountain. Prior to our surveys, extant populations for eight rare plant species were known for Craig Mountain. Three other species were known only from historical collection information. Two of these were confirmed during our investigations. In addition, we discovered three rare plant species previously not known to occur at Craig Mountain. A total of 13 rare plant species are now documented for Craig Mountain, 11 of which are present on BPA and/or IDFG property. The status of one species remains uncertain.

All of the rare plants addressed in this report are tracked by the Conservation Data Center in Boise, and are considered conservation concerns by the Idaho Native Plant Society. Most are also formally recognized by one or more federal agencies, either the U.S. Fish and Wildlife Service, U.S. Forest Service, and/or the Bureau of Land Management.

Except on the Garden Creek Preserve, previous rare plant investigations at Craig Mountain were relatively cursory. Surveys conducted during 1993 and 1994 represent a comprehensive rare plant inventory for the area.

We had five main objectives:

1. Update location and other information regarding known rare plant populations, and survey for new populations.

2. Delineate the distribution of rare plant populations.

3. Characterize habitat conditions.

4. Estimate abundance and collect other population information.

5. Assess threats to the populations and make recommendations based on these assessments.

Rare plant data collected by the BLM, The Nature Conservancy (TNC) and other biologists at Craig Mountain over the years has been synthesized, and is also incorporated into the report.

This section contains detailed information for the 11 rare plant species found on BPA and/or IDFG property at Craig Mountain. Information regarding taxonomy, conservation status, distribution, demography, land ownership, habitat, population biology, ecology, conservation assessment, and management recommendations is included. Less detailed information is provided for the other three rare plants occurring at Craig Mountain, but not on BPA or IDFG lands. Line drawings (Appendix 4), distribution maps (Appendix 5), a map of areas searched (Appendix 3), and population occurrence records (Appendix 6) are provided.

Methods

Prior to the 1993 field season, a list of known and possibly occurring rare plants was compiled using information contained in the Conservation Data Center's data base. Based on this target list a systematic rare plant survey strategy was designed. Rare plant surveys and vegetation mapping responsibilities were conducted simultaneously whenever possible. To gain a comprehensive view of the conservation status of rare plants at Craig Mountain,we focused, but did not limit our searches to BPA and IDFG land. The mixed land ownership pattern at Craig Mountain also made searches limited to BPA or IDFG land impractical. The Nature Conservancy's Garden Creek Preserve is the recipient of ongoing intensive rare plant inventories. For this reason, only minimal time was spent on the Preserve.

A 'Rare Plant Observation Form' (Appendix 2) was completed for each new rare plant population we encountered. Location, directions, habitat, population, assessment of threats and other pertinent information was recorded for each population. Rare plant locations were mapped on USGS 7.5' topographic quadrangles. A similar procedure was employed when previously known populations were updated. Rare plant location information and other attributes were transferred to the IDFG's Geographic Information System (GIS), in Boise.

Discussion

Craig Mountain is a "hotspot" for rare plants in Idaho. Populations of 13 rare plant species are known from Craig Mountain. One other species, bank monkeyflower (*Mimulus clivicola*), is known only from a 100 year old historical collection taken near Lake Waha. It was not relocated during our surveys and the status of bank monkeyflower at Craig Mountain remains uncertain. Ten of the rare plant species have been documented from BPA mitigation lands including, green-band mariposa lily (*Calochortus macrocarpus* var. *maculosus*), broad-fruit mariposa lily (*Calochortus nitidus*), dwarf gray rabbitbrush (*Chrysothamnus nauseosus* ssp. *nanus*), sticky goldenweed (*Haplopappus hirtus* var. *sonchifolius*), Palouse goldenweed (*Haplopappus liatriformis*), fern-leaved desert-parsley (*Lomatium dissectum* var. *dissectum*), Simpson's hedgehog cactus (*Pediocactus simpsonii* var. *robustior*), Wolf's currant (*Ribes wolfii*), purple thick-leaved thelypody (*Thelypodium laciniatum* var. *streptanthoides*), and plumed clover (*Trifolium plumosum* var. *amplifolium*).

One species, Idaho hawksbeard (*Crepis bakeri* ssp. *idahoensis*), occurs on the Craig Mountain WMA, but presently is not known on BPA mitigation land. However, it occurs in close proximity, and in all likelihood occurs on mitigation lands. Three species are not known from either BPA or IDFG lands. The historical bank monkeyflower collection is believed to be from private land near Waha, spacious monkeyflower (*Mimulus washingtonensis* ssp. *ampliatus*) is known from private land, and Spalding's silene (*Silene spaldingii*) from The Nature Conservancy and other private land.

All of the rare plants addressed in this report are tracked by the Conservation Data Center in Boise, and are considered conservation concerns by the Idaho Native Plant Society (INPS - sponsors the annual Idaho Rare Plant Conference and Interagency Rare Plant Meeting. Idaho's rare plants are evaluated, and recommendations for additions, deletions or other changes are made at this time). Most are also formally recognized by one or more federal agencies, either the U.S. Fish and Wildlife Service, U.S. Forest Service, and/or the Bureau of Land Management. A summary of formal conservation status is provided (Table 2.).

Table 2.

The Conservation Status of Rare Plants Occurring at Craig Mountain

Taxon	CDC	USFWS	BLM	USFS	INPS
Green-band mariposa lily	S2			S	S
Broad-fruit mariposa lily	S3	C1		S	
Dwarf gray rabbitbrush	S2	3c			M
Idaho hawksbeard	S1				2
Sticky goldenweed	S1				S
Palouse goldenweed	S1	C2	S		
Fern-leaved desert-parsley	S1		S		S
Bank monkeyflower	S3	3c	S	S	S
Spacious monkeyflower	S1				
2					
Simpson's hedgehog cactus	S3		S		M
Wolf's currant	S1			S	S
Spalding's silene	S1	C2			
Purple thick-leaved thelypody	S1				S
Plumed clover	S2	3c	S		S

CDC=Conservation Data Center, USFWS=U.S. Fish and Wildlife Service, BLM=Bureau of Land Management, USFS=U.S. Forest Service, INPS=Idaho Native Plant Society

CDC

The Conservation Data Center's "S" ranks are explained on page 33.

USFWS

Federal candidate status definitions are as follows:

C1 = Category 1 Taxa for which the U.S. Fish and Wildlife Service currently has substantial information on hand to support the biological appropriateness of proposing to list as Endangered or Threatened. Proposed rules have not been issued, but development and publication of such rules are anticipated.

C2 = Category 2 Taxa for which information now in possession of the U.S. Fish and Wildlife Service indicates that proposing to list as Endangered or Threatened is possibly appropriate, but for which conclusive data on biological vulnerability and threat are not currently available to support proposed rules. Further biological research and field study may be needed to ascertain the status of taxa in this category.

Category 3 Taxa that were once being considered for listing as Threatened or Endangered, but are no longer receiving such consideration. There are three subcategories.

3c - Taxon is more widespread or abundant than previously believed, or is not subject to identifiable threats.

BLM

S = Sensitive Sensitive species are those designated by the state director, usually in cooperation with the state agency responsible for managing the species as sensitive. They are those species 1) that are under status review by the USFWS; or 2) whose numbers are declining so rapidly that federal listing may become necessary; or 3) having typically small and widely dispersed populations; or 4) inhabiting ecological refugia or other specialized or unique habitats.

For Idaho, the Sensitive Plant Species List consists of those taxa known or suspected to occur on BLM lands in Idaho that are: 1) listed as Endangered or Threatened under the Endangered Species Act; 2) category 1 or 2 federal candidate species; 3) listed by the Idaho Native Plant Society as Priority 1, Priority 2, or Sensitive for the state of Idaho.

USFS

S = Sensitive Taxa that are identified by the Regional Forester for which viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density, or significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.

INPS

1 = State Priority 1 Taxa in danger of becoming extinct or extirpated from Idaho in the foreseeable future if identifiable factors contributing to their decline continue to operate; these are taxa whose populations exist only at critically low levels or whose habitats have been degraded or depleted to a significant degree.

2 = State Priority 2 Taxa likely to be classified as Priority 1 within the foreseeable future in Idaho, if factors contributing to their population decline or habitat degradation or loss continue.

S = Sensitive Taxa with small populations or localized distributions within Idaho that presently do not meet the criteria for classification as Priority 1 or 2, but whose populations and habitats may be jeopardized without active management or removal of threats.

M = Monitor Taxa that are common within a limited range, as well as those taxa which are uncommon, but have no identifiable threats.

Note that the INPS does not apply a rank to federally listed or candidate species.

Most of the above species are restricted to habitats of the canyon grassland ecosystem. Exceptions are Wolf's currant, which occurs in forest habitats atop Craig Mountain, and sticky goldenweed and plumed clover which are found in montane meadows. A map depicting the distribution of rare plants at Craig Mountain is provided (Figure 3).

Figure 3. Distribution map for rare plants.

Eight species are Palouse and/or Camas Prairie regional endemics; green-band mariposa lily, broad-fruit mariposa lily, Idaho hawksbeard, Palouse goldenweed, spacious monkeyflower, Spalding's silene, purple thick-leaved thelypody and plumed clover. Two species are disjunct from their main centers of distribution. Fern-leaved desert-parsley is disjunct from points west of the eastern base of the Cascades, and Wolf's currant from the southern Rockies. The regional endemic dwarf gray rabbitbrush is peripheral from its main range in the Blue Mountains and foothills of the Wallowas. Sticky goldenweed is peripheral from its main range which extends from central Washington to northeastern Oregon. Simpson's hedgehog cactus has a much more widespread distribution than any of the other rare plants at Craig Mountain.

Craig Mountain supports the largest known populations in the world for green-band mariposa lily, purple thick-leaved thelypody, and Palouse goldenweed. The great majority of green-band mariposa lily, dwarf gray rabbitbrush, sticky goldenweed, fern-leaved desert-parsley, and purple thick-leaved thelypody in Idaho, are found at Craig Mountain. The conservation of these species in Idaho rests on their conservation at Craig Mountain. Critical populations of Idaho hawksbeard and Palouse goldenweed occur at Craig Mountain. Losses to these populations would seriously jeopardize long-term conservation prospects. Craig Mountain is one of the two strongholds remaining for broad-fruit mariposa lily, and will play an integral role to insure this species long-term conservation. The large populations of Simpson's hedgehog cactus and Wolf's currant at Craig Mountain are important conservation reservoirs. In light of threats elsewhere in its range, the populations of Spalding's silene at the Garden Creek Preserve are very important.

Habitat degradation is the most common and widespread threat to rare plant populations at Craig Mountain. Protection efforts will have to focus on habitat conservation to be successful. Preventing further habitat decline should be the focus of any conservation strategy. In most cases, such a strategy should be compatible with other IDFG management objectives at Craig Mountain. Recommendations regarding a comprehensive weed control program and livestock grazing were given previously. Specific recommendations for rare plants occurring on BPA and IDFG land are included at the end of the respective descriptions for each species.

Based largely on surveys conducted on Craig Mountain, at the 1995, Idaho Rare Plant Conference, we will recommend the state conservation status for fern-leaved desert-parsley, Wolf's currant, and purple thick-leaved thelypody be changed (downgraded) from Sensitive to Monitor. We will also recommend sticky goldenweed be changed (upgraded) from Sensitive to Priority 1.

Special Surveys

An intensive field survey was conducted for Macfarlane's four-o-clock (*Mirabilis macfarlanei*), a federally listed Endangered Species, in late May, 1993. Populations of this species are known from the Snake and Salmon river canyons upriver from Craig Mountain. This survey concentrated on the lower canyon slopes along the lower Salmon River, from near river mile 15 (opposite the mouth of Billy Creek in Idaho County) to its mouth. No Macfarlane's four-o-clock was found, and we believe it does not occur at Craig Mountain.

Surveys using a jetboat were conducted for Hazel's prickly phlox (*Leptodactylon pungens* ssp. *hazeliae*) along the inaccessible canyons of the Snake and lower Salmon rivers. This federal C2 candidate species is known from further upriver in Hells Canyon. Surveys were conducted one day in late May, 1993, and one day in early June, 1994. No populations were discovered at Craig Mountain.

CALOCHORTUS MACROCARPUS Doug. VAR. *MACULOSUS* Nels. & Macbr.

TAXONOMY

Common name: Green-band mariposa lily

Family name: Liliaceae

Common name for family: Lily

Original publication: *Calochortus maculosus* - Nelson and Macbride. 1913. Botanical Gazette 56:471.; *Calochortus macrocarpus* var. *maculosus* - Nelson and Macbride. 1918. Contrib. Gray Herb. N.S. 56:14.

Alternative taxonomic treatments: Ownbey (1969) distinguished two varieties of *C. macrocarpus*, the wide ranging, lavender-flowered var. *macrocarpus*, and the white-flowered var. *maculosus* endemic to the Lewiston, Idaho, area. This varietal distinction was not made in Hitchcock and Cronquist's 1973, Flora of the Pacific Northwest treatment, but its reaffirmation by Reveal (1977) suggests this omission was inadvertent.

History of knowledge of taxon in Idaho: Several collections from the Lewiston area were made in the late 1800's and early 1900's, but apparently very few after this. Heidel (1979) recognized green-band mariposa lily as a possible conservation concern when she discovered a population near Billy Creek, Craig Mountain. In Henderson's (1980) evaluation of this species for the Rare and Endangered Plants Technical Committee of the Idaho Natural Areas Council, he remarked that much of the plants habitat has been lost to cultivation or heavily grazed, and further study and monitoring of population trends was probably justified. He recommended a Federal Watch List status at that time. Recent surveys in the Craig Mountain area have located several large populations.

DESCRIPTION

General non-technical description: Perennial forb from a deep seated bulb averaging 1-2 feet tall. Flower petals are large and showy, white to occasionally light lavender in color, each with a median, longitudinal green stripe and conspicuous, reddish-purple crescent above the gland. Sepals are generally as long, or longer than the petals. Ovularies and fruits are erect and linear shaped, not winged.

Technical description: Stem stout, erect, usually unbranched, often with a basal bulblet, subumbellately 1- to 3-flowered; leaves linear, concave-convex, channeled, reduced upwards, becoming strongly involute and curled at the tip; bracts two or more, linear-attenuate, unequal; flowers erect, white, each petal with a median, longitudinal, green stripe, and sometimes with a reddish purple crescent above the gland.; sepals mostly longer than the petals, narrowly lanceolate, long-attenuate, glabrous; petals oblanceolate, acuminate, moderately bearded above the gland with slender hairs; gland slightly depressed, triangular-oblong, more or less sagittate, surrounded with a broad, usually continuous, fringed membrane, and densely covered with slender processes which are usually somewhat branched distally; anthers linear-lanceolate to linear, obtuse, longer than the filaments; ovary linear, not winged, tapering to a persistent, trifid stigma; fruit linear-lanceolate, acuminate, 3-angled, erect; seeds straw-colored, strongly flattened with loose-fitting coats. N=7 (Ownbey 1940; Ownbey 1969).

Local field characteristics: As a group, the mariposa lilies are distinct and should not be confused with any others. The linear shaped fruits separates green-banded mariposa lily from all other *Calochortus* species occurring in its range. The median, longitudinal, green stripe present on the sepals, and the sepals generally as long, or longer than the petals, are also good diagnostic characters. A line drawing for green-band mariposa lily is provided (Appendix 4).
Similar looking species: *Calochortus macrocarpus* var. *maculosus* is closely related to var. *macrocarpus*. The ranges of the two are not believed to overlap, however, with var. *maculosus* having a much more restricted distribution. The two species can be differentiated on the basis of floral characters. Var. *macrocarpus* has lavender petals with a dark purple band above the gland, as opposed to the predominately white petals with a reddish-purple crescent above the gland for var. *maculosus*.

At Craig Mountain the only similar looking species is *C. nitidus* (broad-fruit mariposa lily), but it has lavender petals, a broadly elliptic, three-winged fruit, and a more broad and flat basal leaf. Another common mariposa lily at Craig Mountain is *C. elegans* (elegant mariposa lily), but is very low-growing, has much smaller flowers and drooping fruits.

LEGAL OR OTHER FORMAL STATUS

National:

U.S. Fish and Wildlife Service: None.

Bureau of Land Management: None.

U.S. Forest Service: Green-band mariposa lily is a Sensitive Species for Region 6 of the Forest Service (Conservation Data Center 1994).

Other current formal status recommendations: Green-band mariposa lily is given a global rank of 2 by the Biodiversity Information Network - the International Association of Natural Heritage Programs and Conservation Data Centers (Conservation Data Center 1994). The G2 rank (on a scale of 1-5) indicates this species is imperiled because of rarity or because of other factors demonstrably making it vulnerable to extinction.

State:

Idaho

Idaho Native Plant Society: Green-band mariposa lily is in the Idaho Native Plant Society Sensitive category, indicating it has small populations or a localized distribution within Idaho that presently do not meet the criteria for classification as Priority 1 or 2, but whose populations and habitats may be jeopardized without active management or removal of threats (Idaho Native Plant Society 1994).

Conservation Data Center: The Biodiversity Information Network state ranking is S2, indicating that in Idaho, green-band mariposa lily is imperiled because of rarity or because of other factors demonstrably making it vulnerable to extinction (Conservation Data Center 1994).

Oregon

Green-band mariposa lily is present on List 3 of the Oregon Natural Heritage Program's compilation of rare plants in the state. List 3 contains species for which more information is needed before status can be determined, but which may be threatened or endangered in Oregon or throughout their range (Oregon Natural Heritage Program 1993).

DISTRIBUTION

Green-band mariposa lily is endemic to the Palouse region of northwestern Idaho, and adjacent southeastern Washington and northeastern Oregon. It is restricted to the canyons of the lower Salmon, lower Clearwater, and middle Snake rivers, centered around Lewiston, Idaho.
A few populations are known from Hells Canyon NRA in Oregon, while no recent information is known about its distribution in Washington. Most known populations of green-band mariposa lily are in Idaho. The persistence of several historical populations around Lewiston are very questionable. Based on the description given for it, the one record for this species in Adams County, Idaho, is likely a misidentification. All other documented occurrences in Idaho are limited to Craig Mountain, plus a single record across the Salmon River in Idaho County.

Craig Mountain:

Craig Mountain is apparently the global core range for green-band mariposa lily, where it occurs from top to bottom within the canyon grasslands of the lower Salmon and adjacent middle Snake river breaks. The largest, and from a conservation perspective, the most important green-band mariposa lily populations known, occur at Craig Mountain.

DEMOGRAPHY - Craig Mountain

Nine occurrences of green-band mariposa lily have been mapped at Craig Mountain (Appendix 5). Five were discovered during 1993-1994 field surveys and extensions were added to most of the others. These range in size from as little as two acres in Upper Captain John Creek (020) to approximately 20 square miles in the Wapshilla Ridge and adjacent canyon grasslands system (013). Population numbers vary from only about 100 (019, 020) to in excess of 50,000 (005, 013) plants. It is estimated that Craig Mountain contains a total of nearly 200,000 plants.

Green-band mariposa lily is most abundant and contiguous in good condition habitats. Field observations indicate a decline in abundance as habitat quality decreases. Because of this relationship, and the fact that nearly all occurrences contain areas of variable habitat quality, the density of green-band mariposa lily is variable within an occurrence. All occurrences contain areas, sometimes extensive, with no green-band mariposa lily. In places, this is partly due to unsuitable habitat conditions. In many other situations, however, this discrepancy is associated with habitat degradation. One widespread symptom of such degradation is the prevalence of aggressive weedy exotics such as yellow starthistle.

Population data for green-band mariposa lily at Craig Mountain is summarized below. Additional population information is contained in the Element Occurrence Records, Appendix 6.

Note: The three digit code preceding each population is the Conservation Data Center occurrence number used as reference (abbreviated as EOR). Occurrences also have a site name attached to help facilitate

referencing. Additional population, location, habitat, elevation, and other information for each occurrence are contained in the appropriate Element Occurrence Record (formatted data base records - Appendix 6). The EO Rank ("EORANK" field in the records) is based on a relative scale, "A" to "D". "A" is the highest and "D" the lowest. An "H" rank indicates a "historical" (has not been observed since pre-1970) occurrence. Ranks are based primarily on above ground population numbers and ecological quality of the site. Secondary considerations include population isolation/habitat fragmentation, and degree and immanency of threats. Refer to this explanation as needed for elsewhere in the report.

Green-Band Mariposa Lily - Population Summary for Craig Mountain

EOR#	Site Name	ca. # plants	ca. size	EO Rank
003	Billy Creek	6000+	>20 acres	B
005	Garden Creek Preserve	50,000	650 acres	A
007	Captain John Creek	3000	>10 acres	B
008	South of Redbird Creek	1000+	0.5 sq. mi.	B
013	Wapshilla Ridge	50,000	20 sq. mi.	A
016	Frye Point South	500	25 acres	B
017	Lower Salmon River Canyon	10,000+	10 miles	B
018	Salmon-Snake Confluence	2000	10 acres	A
019	Frye point Southeast	100	2 acres	C
020	Upper Captain John Creek	100	2 acres	C

LAND OWNERSHIP - Craig Mountain

Nine occurrences of green-band mariposa lily have been documented for Craig Mountain. With a couple of exceptions, these occurrences each cover an extensive area, are comprised of several discontinuous subpopulations, and cross multiple ownership/administration boundaries.

Only one occurrence (016) is solely on BPA mitigation land, while four others (003, 013, 017, 019) have mixed ownership that includes BPA lands. Two occurrences (003, 007) include the Craig Mountain WMA in their mixed ownership. No direct IDFG jurisdiction applies to three (005, 018, 020) occurrences. A summary of land ownership at Craig Mountain is provided.

Land Ownership for Green-Band Mariposa Lily Sites at Craig Mountain

EOR#	Site Name	BPA	IDFG	BLM	USFS	IDL	TNC	PVT
016	Frye Point South	x						
017	Lower Salmon River Cany.	x		x				
019	Frye Point Southeast	x		x				
003	Billy Creek	x	x	x		x		
013	Wapshilla Ridge	x		x		x	x	x
007	Captain John Creek		x			x		x
008	South of Redbird Creek	x					x	
005	Garden Creek Preserve		x			x		
018	Snake-Salmon Confluence			x	x			
020	Upper Captain John Creek.			x				

BPA=Bonneville Power Administration mitigation land, IDFG=Idaho Dept. Fish & Game(Craig Mountain WMA), BLM=Bureau of Land Management, USFS=Wallowa-Whitman NF, IDL=Idaho Dept. of Lands, TNC=The Nature Conservancy's Garden Creek Preserve, PVT=Private land

HABITAT

Green-band mariposa lily is restricted to the open, perennial bunchgrass-dominated canyon slopes of the lower Salmon, lower Clearwater and confluent sections of the Snake rivers. Within these canyon grasslands it is most common in bluebunch wheatgrass-dominated communities, less so in Idaho fescue habitats. Along the river corridors it also occurs in sand dropseed communities.

Following repeated or long-term disturbance, these grassland habitats are susceptible to weed invasion. This has occurred on a widespread scale throughout the species range, including Craig Mountain, and is primarily related to many years of poor grazing management. As a result, to one degree or another, much of green-band mariposa lily habitat is in degraded condition.

Green-band mariposa lily occurs on all slope positions, and along ridges and river terraces. It occurs on all aspects, but is most common on dry, warm, open, southerly slopes. Soils are generally thin, rocky and derived from basalt. Slopes vary from flat to extremely steep. It is known from elevations ranging between 800 to 4800 feet.

Craig Mountain:

Habitat for green-band mariposa lily at Craig Mountain is the same as its rangewide habitat characteristics. It is a regular component of the canyon grasslands at Craig Mountain, although in many areas its abundance has apparently been reduced due to habitat degradation. Habitat types where green-band mariposa lily occurs at Craig Mountain include - *Agropyron spicatum-Poa sandbergii/Balsamorhiza sagittata, Agropyron spicatum/Opuntia polycantha,* and *Festuca idahoensis-Agropyron spicatum,* as well as the *Sporobolus cryptandrus* community type (Tisdale 1986).

POPULATION BIOLOGY

Reproduction is by seed, and because basal bulblets may be produced, perhaps also vegetatively. Plants emerge in the spring and flowering takes place from later spring (mid- May to early June) into the summer (July) depending on elevation and probably some other site characteristics as well. Fruits mature during summer and seeds are usually shed by September. No reproductive or life history studies have been conducted for green-band mariposa lily.

ECOLOGY

Green-band mariposa lily is sensitive to changes in habitat quality. In disturbed ares, its abundance decreases as that of more competitive weeds increases. It is restricted to open grassland habitats and apparently shade intolerant. It is most common on warm, dry aspects and is adapted to seasonal drought. The deep-seated bulb of green-band mariposa lily would survive most fires. It is highly palatable to domestic livestock and for some wildlife too.

CONSERVATION ASSESSMENT

Idaho:

Much of the species grassland habitat has been, and continues to be heavily grazed by domestic livestock. This disturbance has resulted in widespread noxious weed invasion and reduction in habitat quality. Frequently, weedy exotics replace the native vegetation on these disturbed sites and once established are very difficult to control. Yellow starthistle and several annual brome grasses are particularly noteworthy in this regard. Field observations indicate that green-band mariposa lily is always present in reduced numbers or missing were such degraded conditions exist in otherwise suitable habitat. Habitat degradation is the primary threat to the long-term conservation of this species. Some habitat has been lost to cultivation and some populations have been adversely impacted by road building and other developments as well.

Craig Mountain:

Green-band mariposa lily has a very limited geographic range and Craig Mountain supports the largest populations known. The species long-term conservation in Idaho is likely dependant on efforts at Craig Mountain. Unlike privately-owned surrounding lands, the relatively large amount of public land at Craig Mountain, as well as The Nature Conservancy's Garden Creek Preserve, provide more conservation options. Portions of most populations at Craig Mountain occur in native grasslands that are in good ecological condition. In many places these grasslands contain extensive and vigorous populations of green-band mariposa lily. Such grassland sites are relatively inaccessible and subject to a minimum of conflicts.

Loss of high quality canyon grassland habitat is the most serious threat to green-band mariposa lily throughout Craig Mountain. Much of this loss is related to many years of poor livestock management. Off-road-vehicle use along the lower Salmon River is a local threat.

MANAGEMENT RECOMMENDATIONS - Craig Mountain

At Craig Mountain, green-band mariposa lily is restricted to the canyon grasslands. Conservation of this species there is contingent on the conservation of the canyon grassland ecosystem. Reducing and

preventing threats to its grassland habitats are the most important steps that can be taken for the conservation of green-band mariposa lily. As outlined earlier in this report, a weed management program, and management of livestock grazing on Fish and Game land will assist in the conservation of this species.

Ground disturbing activities should be minimized in grassland habitats, and should be avoided in areas of good ecological condition. These ultimately invite invasion by aggressive exotics such as yellow starthistle. Because it was not possible to survey everywhere at Craig Mountain there are undoubtedly gaps in our mapping of its distribution. Therefore, good condition grassland habitats where developments are planned may need to be surveyed for this species.

We recommend establishing a vegetation trend monitoring program along portions of the Lower Salmon River Canyon population (017). This will enable the concurrent monitoring of green-band mariposa lily and its sand dropseed community habitats. Both have been seriously impacted by yellow starthistle invasion. With the reduction or removal of livestock, it will be helpful to document further vegetation changes, including possible recovery rates. This would be a good opportunity to coordinate with the BLM.

CALOCHORTUS NITIDUS Doug.

TAXONOMY

Common name: Broad-fruit mariposa lily

Family name: Liliaceae

Common name for family: Lily

Original publication: Trans. Hort. Soc. Lond. 7:277, pl. 9A. 1828.

Alternative taxonomic treatment: Many authors up to and including Ownbey (1940) have referred specimens of the related species *Calochortus eurycarpus* to *C. nitidus*, causing confusion over the proper application of the latter name. Ownbey (1969) eventually clarified this situation. *C. douglassianus, C. pavonaceus*, and *Cyclobothra nitida* are all pertinent synonyms.

History of knowledge of taxon in Idaho: Most early collection sites were from the Palouse region in areas that have been subsequently converted to croplands.

Broad-fruit mariposa lily was initially recognized as a conservation concern in Idaho when Johnson (1977a), in his evaluation for the Rare and Endangered Plants Technical Committee of the Idaho Natural Areas Council, recommended it for Threatened status, noting that validated collection and field data were urgently needed. Three years later, with the availability of more collection and distribution data, Johnson (1981a) recommended the status of broad-fruit mariposa lily be changed to the Federal Watch List. Broad-fruit mariposa lily was included as a Category 2 Federal candidate species in the December 15, 1980, Notice of Review (U.S. Fish and Wildlife Service 1980). Its status was changed to Category 1 in 1990 (U.S. Fish and Wildlife Service 1990). This species also appeared in the Smithsonian Institute's original list of Threatened species (Ayensu and DeFilipps 1978).

Systematic field investigations for broad-fruit mariposa lily have been completed for the Nez Perce NF (Caicco 1987), including the Hells Canyon NRA (Mancuso and Moseley 1991), The Nature Conservancy's Garden Creek Preserve, and Craig Mountain. Many additional populations have been found during the course of less intensive inventories by Forest Service, BLM and Conservation Data Center biologist.

In order to help prepare a Habitat Management Plan for broad-fruit mariposa lily, a life history and population dynamics study was initiated in 1988 (Caicco 1988b). A Species Management Guide was completed in 1992 (Caicco 1992). Additionally, an action plan for broad-fruit mariposa lily has been proposed for the populations occurring on the Clearwater National Forest (Lorain 1991).

DESCRIPTION

General non-technical description: A perennial herb from a deep seated bulb. Stems are erect, 8-16 inches tall, and usually with a single reduced leaf about midway. There is a single broad (approximately 1 inch wide), flat basal leaf. Flowers are large and showy. Each petal has a deep purple crescent above a triangular to crescent shaped gland. The fruit is an erect capsule, oval to nearly circular in outline, with three distinct wings (Caicco 1988a).
Technical description: Stem erect, 2-4 dm tall, usually with a single reduced cauline leaf about midway, simple, sub-umbellately 1- to 4-flowered; basal leaf flat, 1-3 dm long, 10-25 mm broad, tapering towards both ends, becoming involute, not exceeding the inflorescence; bracts two or more, narrowly lanceolate to linear, long-attenuate, 2-10 cm long, unequal; flowers erect, large and showy, purplish, with a deep purple crescent on each petal above the gland; sepals shorter than the petals, ovate to lanceolate, less ciliate laterally and sparingly invested above the gland with long flexous hairs; gland more or less triangular-lunate, slightly depressed, bounded below with a narrow, deeply fringed membrane and covered with short, thick processes, both processes and membrane fringe densely beset with long papillae; anthers oblong, obtuse, 6-10 mm long, shorter than the filaments; ovary 3-winged, contracted to a short style and a persistent, trifid stigma; fruit elliptic to nearly orbicular, 3-winged, erect; seeds straw-colored. N=20 (Ownbey 1969).

Local field characters: Diagnostic characteristics include the large, showy, lavender petals, each with a deep purple crescent above the gland, the erect, distinctly 3-winged capsules that are oval to nearly circular in outline, and a single, broad, flat basal leaf that has a blue-green color.

Similar looking species: At least five other species of *Calochortus* are known from the range of broad-fruit mariposa lily. Within its range, it can be confused with *C. macrocarpus* var. *macrocarpu*s (green-band mariposa lily), which also has lavender flowers. It can also be confused with the much less widespread and generally white-flowered, var. *maculosus*. The ovaries and fruits of both varieties of *C. macrocarpus* are linear and not winged, however. Additionally, they have sepals generally longer than the petals and a more narrow basal leaf. *C. eurycarpus* (big-pod mariposa lily) is another look alike, except this species has a circular rather than crescent-shaped purple blotch on its generally white-to light lavender-colored petals. Other *Calochortus* species within the range of *C. nitidus* have either non-lavender petals or nodding fruits. At Craig Mountain, the only similar looking species is *C. macrocarpus* var. *maculosus* (green-band mariposa lily). A line drawing appears in Appendix 4.

LEGAL OR OTHER FORMAL STATUS

National:

U.S. Fish and Wildlife Service: Broad fruit mariposa lily is presently a category 1 candidate species for federal listing under the Endangered Species Act. It is party to the out of court settlement regarding the Lujan vs. Fund for Animals, et al. lawsuit (U.S. Fish and Wildlife Service 1992). Among other requirements, this settlement directs the U.S. Fish and Wildlife Service to decide on the listing disposition of all current C1 candidate species by Sept. 30, 1996.

Bureau of Land Management: Broad-fruit mariposa lily currently has no special BLM status.

U.S. Forest Service: Broad-fruit mariposa lily is a U.S. Forest Service Region 1 Sensitive Species for the Clearwater and Nez Perce NFs (U.S. Forest Service 1994).

Other current formal status recommendations: Broad-fruit mariposa lily is given a global rank of 3 by the Biodiversity Information Network - the International Association of Natural Heritage Programs and Conservation Data Centers (Conservation Data Center 1994). The G3 rank (on a scale of 1-5) indicates this species is rare or uncommon, but not imperiled.

State:

Idaho

Idaho Native Plant Society: The Idaho Native Plant Society does not assign rankings to federally listed or candidate species (Idaho Native Plant Society 1994).

Conservation Data Center: The Biodiversity Information Network state ranking of S3 indicates that in Idaho, broad-fruit mariposa lily is rare or uncommon, but not imperiled (Conservation Data Center 1994).

Washington

Broad-fruit mariposa lily is considered possibly extirpated from the State of Washington (Washington Natural Heritage Program 1994). Washington Natural Heritage Program surveys in eastern Washington during the summer of 1994, failed to relocate any historical or new populations. In Washington, broad-fruit mariposa lily is presently known only from old herbarium records.

DISTRIBUTION

Broad-fruit mariposa lily is regionally endemic to the Palouse Prairie and confluent areas of west-central Idaho. In Idaho, it extends eastward in widely scattered populations in the Clearwater River drainage as far as the lower Lochsa River, and southward to the Joseph Plains, Camas Prairie, and Cold Spring Mountains. It occurs in northeastern Latah County at its northern limit. The southern and eastern limits of its range correlate closely with the limits of the flood basalts of the Columbia River Group (Caicco 1992).

Craig Mountain:

At Craig Mountain, populations occur in a discontinuous fashion from the Waha area, south for

approximately 20 air miles to near upper Frenchy Creek, and eastward to the Soldiers Meadow Reservoir and Hoover Point areas. In the northern segment of Craig Mountain, populations occur in scattered, grassy, rocky, upland forest openings, and in upper slope, ridgecrest, and canyon rim grasslands that fringe the upland forest-canyon grassland interface. To the south, populations become restricted to the Wapshilla Ridge complex. Craig Mountain supports some of the largest known populations of broad-fruit mariposa lily.

DEMOGRAPHY - Craig Mountain

There are 12 known, extant occurrences for broad-fruit mariposa lily within the Craig Mountain study area. Eight were discovered during 1993-1994 field work. Additionally, updated information was collected on most of the others. It is estimated these populations support over 60,000 plants. Populations range in size from less than one acre to extending for several miles, along Wapshilla Ridge. Most occurrences are comprised of several subpopulations. Population data and ranking at Craig Mountain are summarized below. Additional information for each occurrence is contained in the appropriate Element Occurrence Record (Appendix 6). Explanations for EOR, Site Name, and EO Rank are given on page 47.

Broad-Fruit Mariposa Lily - Population Summary for Craig Mountain

EOR#	Site Name	ca. # plants	ca. size	EO RANK
001	West Fork Sweetwater Creek	2500	15 acres	C
038	Soldiers Meadow Reservoir	250	0.2 acre	C
050	Benton Meadows	500-1000	5 acres	C
052	S. F. Captain John Creek	5-10,000	10+ acres	A
055	Wapshilla Ridge	7500+	10 miles	B
129	Hoover Point	5000+	2 miles	A
130	Eagle Triangle Point	750	5 acres	B
132	West Fork Deer Creek	5500	1 mile	B
133	Frye Point	2000	15 acres	B
134	Upper Fourth Creek	500	1 acre	A
135	Upper Captain John Creek	15-20,000	10+	A
136	Fort Simons Ridge	10,000	5+	A

LAND OWNERSHIP - Craig Mountain

Of the 12 occurrences at Craig Mountain, only one (134) occurs solely on BPA mitigation lands. Nine others involve mixed ownership that includes BPA mitigation land. Three occurrences are not located on BPA land, one of these (136) occurs on the Craig Mountain WMA, while one other (038) is on private land. Land ownership at Craig Mountain is summarized.

Land Ownership for Broad-Fruit Mariposa Lily Sites at Craig Mountain

EOR#	Site Name	BPA	IDFG	BLM	IDL	NPT	TNC	PVT
134	Upper Fourth Ck.	x						

130	Eagle Triangle Point	x		x					
135	Upper Captain John Ck.	x		x				x	
133	Frye Point	x		x	x				
001	W.F. Sweetwater Ck.	x				x		x	
050	Benton Meadows	x				x		x	
132	West Fork Deer Ck.	x				x		x	
129	Hoover Point	x			x			x	
052	S.F. Captain John Ck.	x	x	x			x		
055	Wapshilla Ridge	x		x	x		x		
136	Fort Simons Ridge		x		x				
038	Soldiers Meadow Reserv.							x	

BPA=Bonneville Power Administration mitigation land, IDFG=Idaho Dept. Fish and Game(Craig Mountain WMA), BLM=Bureau of Land Management, IDL=Idaho Dept. of Lands, NPT=Nez Perce tribal lands, TNC=The Nature Conservancy's Garden Creek Preserve, PVT= private land

HABITAT

Broad-fruit mariposa lily is endemic to the plateau grasslands of the Palouse Prairie, including the adjacent canyon grassland rims and upper slopes, and grassy openings in woodlands bordering the grasslands. The species has generally been extirpated from historical sites on the deep loessal soils of the plateaus because of agricultural conversions. Known plateau sites are generally too steep or rocky to be plowed. Broad-fruit mariposa lily was known historically from wet meadows within the plateau grasslands, but no examples of this type are known to remain. Most extant sites are grassy ridgecrests and upper slopes or openings in dry conifer woodlands. At most sites, soils are shallow and derived from fine-grained basaltic or andesitic bedrock near the surface. Plants occur on flat to gentle or occasionally steep slopes, on all aspects, and mostly between 3500-5500 feet elevation.

Native grasslands in which broad-fruit mariposa lily occurs are dominated by perennial bunchgrasses. On deeper soils, *Festuca idahoensis* (Idaho fescue), *Agropyron spicatum* (bluebunch wheatgrass) and *Koeleria cristata* (prairie Junegrass) are dominant, while bluebunch wheatgrass and *Poa sandbergii* (Sandberg's bluegrass) dominate lithic sites. At a few rocky sites it occurs within *Artemisia rigida* (rigid sagebrush) or *Eriogonum douglasii* (Douglas's buckwheat) communities.

Broad-fruit mariposa lily also occurs in open conifer woodland habitats, especially near the periphery of its range. These are characterized by an open overstory of *Pinus ponderosa* (ponderosa pine) and *Pseudotsuga menziesii* (Douglas-fir). Natural openings in these forests are usually caused by shallow soils closely overlying bedrock (Caicco 1988a; 1992; Mancuso and Moseley 1991).

Grasslands supporting broad-fruit mariposa lily include many habitat types, including, *Festuca idahoensis/Symphoricarpos albus, Agropyron spicatum-F. idahoensis, and Eriogonum douglasii/Poa sandbergii* habitat types (Daubenmire 1969); *F. idahoensis-K. cristata, F. idahoensis-A. spicatum* habitat types (Tisdale 1986); and the *F. idahoensis-K. cristata* (ridgetops), *F. idahoensis-A. spicatum* (ridgetops), *P. sandbergii-Danthonia unispicata*, and *Eriogonum douglasii/Poa sandbergii* plant associations of Johnson and Simon (1987). Woodlands include the *Pinus ponderosa/A. spicatum, P. ponderosa/S. albu*s, and *P. menziesii/F. idahoensis* habitat types of Daubenmire and Daubenmire (1968) and Cooper et al.

(1987). *Artemisia rigida* sites approach the 'high elevation' description outlined in Tisdale (1986).

Craig Mountain:

At Craig Mountain, broad-fruit mariposa lily occurs in grassland habitats associated with canyon rims, ridges and upper slope positions. It also occurs within scattered, natural forest openings, and open ponderosa pine and/or Douglas-fir communities in the forested uplands. Most populations are above 3500 feet elevation, but some sites extend down to 2800 feet. Slopes are usually gentle, but can be steep. Plants occur on all aspect. Soils are derived from basalt and are often rocky.

Canyon grassland sites support either Idaho fescue or bluebunch wheatgrass communities. Beside the perennial bunchgrasses, common canyon associates include *Bromus* spp. (annual brome grasses), *Balsamorhiza sagittata* (arrowleaf balsamroot), *Achillea millefolium* (yarrow), *Hieracium albertinum* (western hawkweed), *Potentilla gracilis* (slender cinquefoil) and *Symphoricarpos albus* (snowberry). Along the canyon rims, broad-fruit mariposa lily commonly occurs within patterned ground topography.

Plateau upland sites often approach scabland conditions, characterized by lithic soils, relatively sparse vegetation cover, and the presence of species such as Sandberg's bluegrass, *Danthonia unispicata* (oatgrass), *Sedum* spp. (stonecrops), *Lomatium* spp. (desert-parsleys) *Polygonum douglasii* (Douglas' knotweed), *Orthocarpus pusillus* (dwarf owl-clover), *Selaginella wallacei* (Wallace's selaginella), and in some places rigid sagebrush. Locations where lithic conditions are not so pronounced are disturbed, and species such as *Poa pratensis* (Kentucky bluegrass), *Grindelia squarrosa* (curly-cup gumweed), *Madia* spp. (tarweeds), and yarrow are abundant associates. In all habitats, sites that are degraded contain reduced abundance and density of broad-fruit mariposa lily.

POPULATION BIOLOGY

Broad-fruit mariposa lily reproduces solely by seed (Ownbey 1940). Mature plants have 1-4 showy flowers. Floral buds commonly open in the first half of July and remain open for 7-10 days. Caicco (1992) states that wind appears to be the primary pollinator, although insects may also be important. This seems contrary to many other showy flower species where insects or some other biotic vector are the main pollinator. Several years of detailed life history and population data have been collected from permanent plots located in the Cold Spring Mountains, northwest of Riggins (Caicco 1988b; 1989). Preliminary investigation into pollination mechanisms suggest some mechanism operating to prevent self-fertilization. Thirty capsules sampled in 1988 produced an average of 55.4 seeds/capsule (Caicco 1988b; 1992). Broad-fruit mariposa lily appears to have a relatively low rate of reproductive success when growing in areas open to livestock grazing. The highest percentage of successful fruit set in grazed situation is about 10% (Caicco 1989).

ECOLOGY

Broad-fruit mariposa lily most commonly occurs in late seral to climax bunchgrass communities. In disturbed sites, broad-fruit mariposa lily, like many other natives, decreases in abundance. It occurs in a wide range of soils conditions, ranging from deep loessal soils to lithic sites. In a few places it occurs under the partial canopy of conifers. It cannot tolerate full shade, however. Its deep seated bulb would

survive most fires. Wildfires were an important ecological feature of grasslands. It does not appear to readily colonize disturbed areas.

CONSERVATION ASSESSMENT

Idaho:

Broad-fruit mariposa lily is believed to be extirpated from the Washington portion of its historical range. It has also been extirpated from large areas in Idaho, this attributable to the largescale conversion of its former Palouse Prairie and Camas Prairie grassland habitats to agricultural uses. Isolated, small, remnant populations occur within these cropland mosaics in locations to rocky to plow, but most of these sites are used for cattle pasture. In many of these isolated populations, plants are present in critically low numbers and their long-term viability is doubtful (Caicco 1988c). Besides actual habitat conversion, other major rangewide threats are habitat degradation, often associated with domestic livestock grazing and to a lesser extent road construction and associated activities. Disturbed areas are especially prone to invasion by weedy exotics, replacing the native vegetation, including broad-fruit mariposa lily. Domestic livestock are known to graze flower buds and fruits, causing substantial loss of reproductive success some years. Herbicide spraying can be a serious threat, principally on private lands. Disturbance from timber harvest activities may also be a concern.

Although the CDC data base contains 119 occurrence records for broad-fruit mariposa lily, over 20 are historical records, including some that have not been relocated despite recent searches. The largest remaining populations of broad-fruit mariposa lily occur along the rims of the Clearwater, Salmon and Snake river canyons to the east and south of the main Palouse Prairie, along the periphery of the species range, including Craig Mountain. Populations with the best long-term viability prospects are concentrated in the Cold Springs Mountains (Hells Canyon NRA and adjacent Nez Perce NF lands) and at Craig Mountain.

Craig Mountain:

Craig Mountain supports some of the largest extant populations of broad-fruit mariposa lily. The habitat for many populations is not as fragmented as elsewhere in the species range. This habitat is in very good ecological condition in some locations. The Idaho fescue habitats where broad-fruit mariposa lily usually occurs are not as prone to invasion by yellow starthistle as more xeric bluebunch wheatgrass types. Invasion or encroachment by yellow starthistle is occurring to some degree at a number of broad-fruit mariposa lily sites at Craig Mountain. Besides invasion and encroachment by yellow starthistle, other aggressive exotics occur at some broad-fruit mariposa lily sites, notably erect cinquefoil (*Potentilla recta*). Other identified threats include herbicide spraying along roadways, and uncontrolled livestock grazing. Grazing not only impacts habitat quality, but direct effects such as the trampling of plants and eating of fruit pods have been observed.

Conservation efforts at Craig Mountain will be valuable to ensure the species long-term persistence. This is especially true considering the fact that in Idaho, the majority of populations occur on private land where management is for other priorities.

MANAGEMENT RECOMMENDATIONS - CRAIG MOUNTAIN

As is the case for all rare plants whose primary habitats are the canyon grasslands, any conservation strategies for broad-fruit mariposa lily must focus on the conservation of the canyon grassland ecosystem. Points related to a weed control program, and management of livestock grazing on Fish and Game managed lands at Craig Mountain will assist in the conservation of this species.

Specific recommendations concerning the conservation of broad-fruit mariposa lily at Craig Mountain include the following:

* Use broad-fruit mariposa lily distribution maps (Appendix 5) in planning to avoid conflicts with management activities.

* Broad-fruit mariposa lily occurs alongside or in close proximity to roads in several places. Road maintenance and related activities should be conducted to avoid destroying plants. This may entail coordination with County roadcrews.

* Populations near roads are potentially subject to inadvertent poisoning from herbicide sprays. Spray applicators should learn how to field identify this species and avoid spraying it.

* Grasslands a few miles west of the main Zaza road, in the vicinity of the Fish and Game access road to the Madden Corrals Parking Area, are in excellent ecological condition and support robust populations of broad-fruit mariposa lily. The access road should be regularly (annually) surveyed for noxious weeds, and if found, controlled as soon as possible to contain weeds in this area. Presently the noxious weed problem along this road is minimal.

* Broad-fruit mariposa lily occurs in natural grassy openings atop Craig Mountain. These openings are usually surrounded by forest. Openings that may be impacted by any timber operations should be checked for this species.

* Coordination with the BLM is recommended if any future monitoring of broad-fruit mariposa lily populations on Fish and Game property is initiated. The BLM is presently monitoring one population on Wapshilla Ridge. Ideally, this monitoring regime should be expanded, but no specific recommendations are made at this time.

CHRYSOTHAMNUS NAUSEOSUS (Pall.) Britt. SSP. *NANUS* (Cronq.) Keck

TAXONOMY

Common name: Dwarf Gray Rabbitbrush

Family name: Asteraceae

Common name for family: Aster; Composite

Original publication: Keck, D. 1958. Taxonomic notes on the California flora. Aliso. 4(1):101-114.

Alternative taxonomic treatments: This taxon is treated at the variety rank by Cronquist (1955), versus the subspecies rank proposed by Keck (1958) and accepted by Anderson (1986). Nesom and Baird (1993) recently transferred the entire *Chrysothamnus nauseosus* complex to the genus *Ericameria*. Under this circumscription, the new name *Ericameria nauseosa* var. *nana*
would apply to dwarf gray rabbitbrush. Regardless of controversies over name, dwarf gray rabbitbrush is recognized as a distinct entity.

History of knowledge of taxon in Idaho: First acknowledged as a possible Idaho conservation concern by Steele (1981) when he recommended it for the Federal Watch List. He cited that in Idaho, it was known only from two old (1927) collections at Craig Mountain, and further field study was needed. It is unclear when dwarf gray rabbitbrush was first cited as a federal candidate species. In the 1985 Notice of Review for federal candidate Threatened or Endangered plants (U.S. Fish and Wildlife Service 1985), it is listed as 3C.

DESCRIPTION

General non-technical description: Dwarf gray rabbitbrush is a low growing shrub, mostly less than 30 cm tall. Twigs are covered with felt-like, whitish, persistent hairs. Leaves are very narrow (1-3 mm wide) and not twisted. The phyllaries (the individual involucral bracts that subtend the flower heads) are 8-9 mm long, with the outer ones pubescent, the inner without pubescence. Heads with disc flowers only, the corolla lobes 1-2.5 mm long. The disc flowers are bright golden-yellow. Achenes (fruits) are densely pubescent.

Technical description: The following description is for *Chrysothamnus nauseosus* - Low (the case for *C. nauseosus* ssp. *nanus*) or tall shrubs; twigs flexible, covered with a close, feltlike, persistent tomentum; leaves 2-7 cm long, 0.5-3 mm wide, 1- to 3-nerved, tomentose to subglabrous, not much twisted; heads in terminal rounded cymose (sometimes somewhat elongate) clustered; involucre 6-13 mm high, its bracts mostly 20-25, obtuse or acute, not green-tipped; disc corollas mostly 6.5-11 mm long (Cronquist 1955).

Local field characteristics: A number of other rabbitbrush taxa overlap the range of *C. nauseosus* ssp. *nanus*. The relatively compact and dwarf habit is fairly distinctive, especially when combined with its restrictive habitat - rocky, very shallow soil, ridges and outcrops. Other diagnostic/differentiating features require close observation of plants in flower, and include, the outer phyllaries pubescent, but the inner ones glabrous, involucres 8-9 mm long, and corolla lobes 1.6-2.5 mm long, and densely pubescent

achenes. The dwarf and compact habit when combined with its specific habitat requirements are generally sufficient for field identification at Craig Mountain. One floral feature, namely, the outer involucral bracts pubescent, but the inner ones glabrous, will confirm the identification. A line drawing of dwarf gray rabbitbrush can be found in Appendix 4.

Similar looking species: There are several rabbitbrush taxa in both the *Chrysothamnus nauseosus* and *C. viscidiflorus* (sticky rabbitbrush) complexes with distributions that overlap the range of dwarf gray rabbitbrush. Mature plants of all these other rabbitbrushes are much taller and with a more diffuse habit than is the case for ssp. *nanus*. Other field characteristics of sticky rabbitbrush that differentiate it are stems not tomentose and its twisted leaves. The other subspecies of *C. nauseosus* most likely to be encountered within the range of ssp. *nanus*, is ssp. *albicaulis*. Besides its taller stature, all of the phyllaries are tomentose in ssp. *albicaulis*. It is also generally restricted to sites with more soil development, and not the rocky ridgeline habitats of ssp. *nanus*. Species of *Haplopappus* should not be confused, as most have ray flowers.

LEGAL OR OTHER FORMAL STATUS

National:

U.S. Fish and Wildlife Service: Dwarf gray rabbitbrush is a federal 3c candidate. Category 3 is reserved for taxa that where once considered for listing as endangered or threatened, but are no longer under such consideration. The subcategory 3c is assigned to species more widespread or abundant than previously believed, or are not subject to identifiable threats (Conservation Data Center 1994).

Bureau of Land Management: None.

U.S. Forest Service: None.

Other current formal status recommendations: Dwarf gray rabbitbrush is given a global rank of 4 by the Biodiversity Information Network - the International Association of Natural Heritage Programs and Conservation Data Centers (Conservation Data Center 1994). The G4 rank (on a scale of 1-5) indicates this taxon is not rare and apparently secure, but with cause for long-term concern.

State:

Idaho

Idaho Native Plant Society: Dwarf gray rabbitbrush is in the Idaho Native Plant Society Monitor category. This category is for species that are common within a limited range as well as those which are uncommon, but have no identifiable threats (Idaho Native Plant Society 1994).

Conservation Data Center: The Biodiversity Information Network state ranking is S2, indicating that in Idaho this species is imperiled because of rarity or because of other factors demonstrably making it vulnerable to extinction (Conservation Data Center 1994).

Washington

Dwarf gray rabbitbrush is on the Washington Natural Heritage Program's Monitor - Group 3 List. The Monitor list consists of taxa of potential concern, but for which no status is currently assigned. Group 3 consists of species more abundant and/or less threatened in Washington than previously assumed (Washington Natural Heritage Program 1994).

Oregon

The Oregon Natural Heritage Program has placed dwarf gray rabbitbrush in its Taxa Considered but Rejected category (Oregon Natural Heritage Program 1993).

DISTRIBUTION

Dwarf gray rabbitbrush is regionally endemic to the Blue and Wallowa mountains of northeastern Oregon and extreme southeastern Washington, where the bulk of its distribution is found. It extends into adjacent Idaho at Craig Mountain, plus one population from further south in the Hitt Mountains.

Craig Mountain:

At Craig Mountain it is restricted to mid-elevation (3800-5200 feet elevation), dry, rocky ridges and outcrops along the Snake/Salmon rivers divide from the Captain John Creek drainage south along Wapshilla Ridge.

DEMOGRAPHY - Craig Mountain

Craig Mountain is the focal point of the species distribution in Idaho with six of the seven known state occurrences. Three were discovered during 1993-1994 field inventories. Updated information was obtained for the other occurrences. Appendix 5 contains a distribution map for Craig Mountain populations. Population information is summarized below. Explanations for EOR, Site Name, and EO Rank are given on page 47.

Dwarf Gray Rabbitbrush - Population Summary for Craig Mountain

EOR#	Site Name	ca. # plants	ca. size		EO Rank
001	Upper China Creek	100-1000	2 acres		A
002	Morris Point	200+	1 acre		A
003	Big Pine Triangle Pt.	10	1 acre	C	
005	Wapshilla Ridge	1500	4 miles		A
006	Upper Camp Creek	200	1 acre	A	
007	Upper Corral Creek	20	<1 acre		B

LAND OWNERSHIP - Craig Mountain

Six occurrences of dwarf gray rabbitbrush are known for Craig Mountain. One occurrence (003) is restricted to BPA mitigation land, while the very extensive Wapshilla Ridge occurrence (005) crosses

several ownerships, including BPA. The Upper Camp Creek (006) population likely extends onto adjacent BPA land in T32N, R4W, Sec. 30, but requires verification. This extension of suitable ridgeline habitat is just south of BLM land. The Upper China Creek population (001) is very close to BPA land and will require agency coordination for its protection. Land ownership at Craig Mountain is summarized below. A few, small, scattered subpopulations likely occur along Wapshilla Ridge near the head of First Creek, but plants were observed too early in the season for positive identification. These would be on BPA land.

Land Ownership for Dwarf Gray Rabbitbrush Sites at Craig Mountain

EOR#	Site Name	BPA	BLM	IDL	TNC	PVT
001	Upper China Creek		x		x	
002	Morris Point			x	x	
003	Big Pine Triangle Pt.	x				
005	Wapshilla Ridge	x	x			x
006	Upper Camp Creek		x			
007	Upper Corral Creek				x	

BPA=Bonneville Power Administration mitigation land, BLM=Bureau of Land Management, IDL=Idaho Dept. of Lands, TNC=The Nature Conservancy's Garden Creek Preserve, PVT=private land

HABITAT

Dwarf Gray Rabbitbrush is restricted to exposed, dry, rocky ridges, outcrops, and associated stable, erosional debris. It also has been observed in the 'swale' portions of biscuit and swale (patterned ground) microtopography. Soils are very shallow, rocky, and often with a gravelly and hard texture approaching an erosional pavement surface. Substrates are all derived from basalt. Sites are sparsely vegetated compared to adjacent grasslands or woodlands with lots of bare ground and very little litter. It commonly occurs on convex ridgecrests where slopes are flat to gentle and aspect inconsequential.

Craig Mountain:

At Craig Mountain, dwarf gray rabbitbrush's ridgeline habitats are centered along the rocky spine dividing the Snake and Salmon river drainages. Suitable habitat is patchy and never extensive at any particular site. Habitat is discontinuous along the divide complex and includes a number of spur ridges that descend toward the Snake River. It does not descend very far into the canyons, however, and, except for Wapshilla Ridge seems restricted to above about 4500 feet elevation. Along the southern reaches of Wapshilla Ridge it is found to around 4000 feet elevation.

A few common associates include *Agropyron spicatum* (bluebunch wheatgrass), *Poa sandbergii* (Sandberg's bluegrass), *Selaginella wallacei* (Wallace's selaginella), *Phlox pulvinata* (cushion phlox), *Lomatium* spp. (desert-parsley's), *Pediocactus simpsonii* var. *robustior* (Simpson's hedgehog cactus), *Penstemon triphyllus* (whorled penstemon) and *Eriogonum strictum* (strict buckwheat).
Dwarf gray rabbitbrush occurs within the *Eriogonum strictum/Poa sandbergii* plant community type, and a more open version of the *Agropyron spicatum/Poa sandbergii* scabland plant community described by

Johnson and Simon (1987). Some sites do not readily fit any published classification.

POPULATION BIOLOGY

Dwarf gray rabbitbrush reproduces by seed. The fruits are wind disseminated. The diversity in the *Chrysothamnus nauseosus* complex is apparently due to a nearly optimal combination of outbreeding and inbreeding. There is no evidence of apomixis in the species (Anderson 1986). It blooms from August to October and is among the last suite of species to flower.

Assuming the following characteristics are similar for ssp. *nanus* as for other related, but better studied taxa, its seed mature from October until the end of December, with over 500,000 cleaned seeds/pound. Also, seed germination is usually quite high and maintain viability for a few years. Related rabbitbrush taxa are easily transplanted in the fall and spring as long as plants are physiologically inactive, moisture conditions are right, and transplants are small.

ECOLOGY

No autecological studies have been completed for dwarf gray rabbitbrush. It is restricted to sparsely vegetated, exposed, rocky, shallow soil sites and does not extend into adjacent, deeper soil, bunchgrass-dominated sites, and may be a poor competitor. It does not have the tendency to invade disturbed sites like some other *C. nauseosus* taxa. It has not been documented from low elevations in the canyons and appears to be restricted to a relatively narrow elevational band. It is unknown if dwarf gray rabbitbrush is resistant to many herbicides like some closely related taxa. It does not appear to be as favored a browse as some closely related taxa. Many subspecies, including ssp. *nanus* are regularly infested with galls. In some cases, certain gall forms are subspecies specific, and therefore of taxonomic significance (McArthur and Welch 1984). Yellow starthistle and the annual bromes generally do not seem to establish well at dwarf gray rabbitbrush sites.

CONSERVATION ASSESSMENT

Idaho:

Dwarf gray rabbitbrush was at one time considered for federal listing as endangered or threatened, but is no longer under such consideration. It is not on any federal agency sensitive species list. The species rocky habitats are generally subject to fewer or less intensive threats than adjacent grassland and woodland areas. Road construction and maintenance, herbicide spraying, and encroachment by yellow starthistle and possibly some other weedy exotics are potential threats some populations face.

Craig Mountain:

Craig Mountain supports nearly all known dwarf gray rabbitbrush populations in Idaho. Some sites (such as 001) are in close proximity to roads and potentially face threats related to herbicide spraying, road maintenance and other related activities. Although a few yellow starthistle plants sometimes can be found with dwarf gray rabbitbrush, there is no evidence it can form the near monocultures observed at nearby grassland sites. Few species are adapted to the difficult environmental conditions characterizing dwarf gray rabbitbrush habitat, and generally, sites are in very good ecological shape. The paucity of forage seems to preclude much livestock or wildlife use at these sites except as travel routes.

Because its habitat is mostly intact and subject to minimal foreseeable conflicts, dwarf gray rabbitbrush populations should be secure at Craig Mountain. Good stewardship and coordination by the various managing agencies at Craig Mountain should be able to insure the conservation of dwarf gray rabbitbrush.

MANAGEMENT RECOMMENDATIONS - Craig Mountain

The rocky ridgecrest habitat of dwarf gray rabbitbrush should not be subject to many management conflicts at Craig Mountain. Distribution maps (Appendix 5) should be consulted and populations avoided during any recreation trail construction or other activities that entail ground disturbance. Portions of the Upper China Creek population (001) occur along the main Wapshilla Ridge road. This area is south of where the County typically maintains the road. Nonetheless, any future road maintenance, realignment or other related activities should avoid disturbing this population. Plants near the road are potentially subject to inadvertent herbicide poisoning. Herbicide applicators should know where plants are located near the road and be able to field identify this species.

***CREPIS BAKERI* Greene SSP. *IDAHOENSIS* Babc. & Stebb.**

TAXONOMY

Common name: Idaho hawksbeard

Family name: Asteraceae

Common name for family: Aster; Composite

Original publication: Babcock, E., and L. Stebbins. 1938. The American species of Crepis. Carneige Inst. Wash. No. 504: 141.

Alternative taxonomic treatments: None. The other two subspecies of *Crepis bakeri* are not known to occur in Idaho.

History of knowledge of taxon in Idaho: Idaho hawksbeard was initially recognized as a possible conservation concern for Idaho in 1980 (Brunsfeld 1980a), when it was recommended for the Federal Watch List by the Rare Plants Technical Committee of the Idaho Natural Areas Council. First collected in Idaho approximately a century ago, for many years it was known only from several historical collections. Idaho Conservation Data Center botanist Chris Lorain discovered seven new populations in 1989 during her field investigations of Palouse endemics. Recently, several additional populations have been found in the Craig Mountains area.

DESCRIPTION

General non-technical description: Idaho hawksbeard is a deeply taprooted perennial forb averaging about 1 foot tall. Stems are often reddish and the herbage is only sparingly hairy. Basal and cauline leaves are mostly 5-10 inches long and shallowly to sometimes more deeply lobed. Heads are yellow and contain only ray flowers. Outer involucre bracts (series of bracts subtending the flower heads) are deltoid-shaped, the longest less than half as long as the inner bracts. The involucral bracts are not, or are only sparingly

beset with bristles.

Technical description: Plants 2.5-3 dm high; caudical leaves 15-18 cm long, 5-5.5 cm wide, shallowly pinnatifid with deltate dentate lobes; cauline leaves similar, the lobes strongly mucronate; inflorescence of 11-22 heads; peduncles conspicuously expanded towards the head; heads large, 18-25-flowered; involucres 18-21 mm long in fruiting heads; outer bracts deltoid, acute or acuminate, the longest one-third to one-half as long as the inner; inner bracts 8-13, lanceolate or linear; achenes chestnut brown, about 8 mm long, rather strongly contracted toward the apex; pappus 12-13 mm long (Babcock 1947).

Local field characteristics: Several characteristics help identify Idaho hawksbeard, but even so, field identification can be tricky. It has leaves that are relatively broad and shallowly lobed, whereas the other *Crepis* species generally have leaves that are more strongly pinnatifid. Plants are generally only a foot or so tall, shorter than the other species. Involucres are glabrous or only sparingly hairy or beset with glandular bristles, and achenes (fruits) are usually brownish versus greenish or yellowish-colored. The more or less deltoid-shaped outer involucre bracts and pappus longer than the achenes are also good diagnostic traits. A line drawing of Idaho hawksbeard is in Appendix 4.

Similar looking species: At least five other species of *Crepis* are known from Craig Mountain. Four of these, *Crepis acuminata* (long-leaved hawksbeard), *C. atrabarba* (slender hawksbeard), *C. barbigera* (bearded hawksbeard), and *C. intermedia* (gray hawksbeard) all occur in similar habitats as Idaho hawksbeard. It is not uncommon to find several species occurring sympatrically. The range of *Crepis runciniata* (meadow hawksbeard) also overlaps that of Idaho hawksbeard, but it is restricted to wet meadow habitats. The conspectus provided should aid in field identification at Craig Mountain.

LEGAL OR OTHER FORMAL STATUS

National:

U.S. Fish and Wildlife Service: None.

Bureau of Land Management: None.

U.S. Forest Service: None. No Idaho hawksbeard is known to occur on Forest Service lands,

Other current formal status recommendations: Idaho hawksbeard is given a global rank of 1 by the Biodiversity Information Network - the International Association of Natural Heritage Programs and Conservation Data Centers (Conservation Data Center 1994). The G1 rank (on a scale of 1-5) indicates this species is critically imperiled because of rarity or because of some other factor of its biology making it especially vulnerable to extinction.

State:

Idaho Native Plant Society: Idaho hawksbeard is in the Idaho Native Plant Society Priority 2 category, indicating that in Idaho, if factors contributing to its population decline or habitat degradation or loss continue, such decline or degradation will reach critical levels (Idaho Native Plant Society 1994).

Conservation Data Center: The Biodiversity information Network state ranking is S1, indicating that in Idaho this species is critically imperiled because of extreme rarity or because of some factor of its biology

making it especially vulnerable to extinction (Conservation Data Center 1994).

Conspectus of *Crepis* taxa found within grassland habitats at Craig Mountain (based on Cronquist 1955; Cronquist 1994a).

	C.bakeri	*C.acuminata*	*C.atrabarba*	*C.barbigera*	*C.intermedia*
Plant height(dm)	1-3	2-7	2-8	3-8	3- 7
Leaf shape	shallowly pinnatifid	pinnatifid	deeply pinnatifid pinnatifid	pinnatifid	
Herbage pubescence	sparingly tomentulose	tomentulose tomentulose	tomentulose	often with	dense-sparse yellow bristles
Involucre length (mm)	18-21	10-18	8-15	9-17	10-16
Involucre pubescence	none or sparse	none or sparse	tomentulose, often with black bristles	tomentulose, beset with gland. bristles	tomentulose, puberulent
Achenes	brown, occ. yellowish	brown or greenish yellowish	olive or brown or	yellowish	yellowish

Glossary: pinnatifid = lobed towards the midrib; tomentulose = sparingly or minutely covered with matted hairs; puberulent = with very short hairs.

DISTRIBUTION

Apparently endemic to Idaho, predominately in Nez Perce County near Lewiston and the adjacent lower Clearwater River drainage and Craig Mountain areas. There is one disjunct population known from a collection along the Snake River in Adams County. Overall, there are nineteen known occurrences for Idaho hawksbeard in Idaho, although one of these from near Boise is almost certainly based on a misidentification. Several occurrences in the Sweetwater area are believed to be extirpated due to yellow starthistle invasion, and nearly all others are threatened. Five of the occurrences are from Craig Mountain.

Craig Mountain:

Craig Mountain is part of the core range for this narrowly endemic species. At Craig Mountain, it is widely scattered within the upper elevations of the canyon grassland complex, from the Red Bird Creek drainage (Craig Mountain WMA area) and Waha vicinities, south to Wapshilla Ridge. Perhaps an artifact of incomplete field surveys, but all known occurrences at Craig Mountain are restricted to the Snake River watershed, none from the Salmon River.

DEMOGRAPHY - Craig Mountain

Craig Mountain supports the largest known populations of Idaho hawksbeard in the world. The larger populations are in areas of relatively intact native grassland habitat, and are very important regarding the species long-term conservation. Idaho hawksbeard is susceptible to habitat degradation. The establishment of yellow starthistle is a widespread problem at degraded sites. At degraded sites the abundance of Idaho hawksbeard is always reduced, or is missing all together.

Eight occurrences of Idaho hawksbeard have been mapped for Craig Mountain (Appendix 5). Six of these are recent discoveries by The Nature Conservancy, BLM, or Conservation Data Center biologists. A summary of population information is provided below. A population at the BLM's Wapshilla Ridge Research Natural Area (Cactus Point - 019) is apparently in good condition, but no specifics are known at this time. Additional information is contained in the appropriate Element Occurrence Record (Appendix 6). Explanations for EOR, Site Name, and EO Rank are given on page 47.

Idaho Hawksbeard - Population Summary for Craig Mountain

EOR#	Site Name	ca. # plants	ca. size	EO Rank
004	Corral Creek	100	<1 ac.	C
008	Lake Waha	200	2 ac.	B
014	Upper Cave Gulch	1500	2+ ac.	A
015	Ft. Simon Ridge Spur	1	1m^2	D
016	South of Redbird Creek	1-2000	25 ac.	A
017	Middle Creek Road	10	10m^2	C
018	Cougar Canyon Ridge	10	10m^2	C
019	Cactus Point	?	?	?

LAND OWNERSHIP - Craig Mountain

Of the nineteen known occurrences for Idaho hawksbeard, eight are from Craig Mountain. None are known to occur on BPA mitigation land, although at the Upper Cave Gulch (014) occurrence, plants approach within a few hundred feet. There are several other instances where suitable habitat occurs on BPA mitigation lands near known Idaho hawksbeard sites on BLM lands. It is likely that in a few places along the Wapshilla Ridge complex, Idaho hawksbeard occurs on BPA mitigation land. The South of Redbird Creek (016) occurrence, the largest of all known Idaho hawksbeard populations, occurs primarily on the Craig Mountain WMA. A summary of land ownership for Idaho hawksbeard at Craig Mountain is given below.

During our survey work another possible population was discovered within the middle reaches of Cottonwood Creek on private land. It was to early in the season for positive identification and no attempt was ever made to return and make a verification. The legal description for this site is T30N, R4W, Sec 8 center.

Land Ownership for Idaho Hawksbeard Sites at Craig Mountain

EOR#	Site Name	IDFG	BLM	IDL	TNC	PVT	
004	Corral Creek					x	
008	Lake Waha						x
014	Upper Cave Gulch			x	x	x	
015	Fort Simons Ridge Spur		x				
016	South of Redbird Creek	x				x	
017	Middle Creek Road					x	
018	Cougar Canyon Ridge					x	
019	Cactus Point			x			

IDFG=Idaho Dept. Fish & Game (Craig Mountain WMA), BLM=Bureau of Land Management, IDL= Idaho Dept. Lands, TNC=The Nature Conservancy, PVT=Private land

HABITAT

Idaho hawksbeard occurs within dry to seasonally mesic, open grassland slopes, benches and ridges. It occasionally extends to near the grassland-forest ecotone. Grasslands are dominated by either *Agropyron spicatum* (bluebunch wheatgrass) or *Festuca idahoensis* (Idaho fescue). Other forbs such as *Balsamorhiza sagittata* (arrowleaf balsamroot) and *Lomatium* spp. (desert-parsleys) are common. Most known sites have a weedy component, including *Centaurea solstitialis* (yellow starthistle) and cheatgrass (*Bromus tectorum*). Aspect can vary, but most are southerly to westerly. Slopes vary from flat to fairly steep. Soils are usually loamy and skeletal.

Craig Mountain:

Habitat for Idaho hawksbeard at Craig Mountain mirrors that outlined above. Habitat types in which it occurs at Craig Mountain are *Agropyron spicatum-Poa sandbergii/Balsamorhiza sagittata* and *Festuca idahoensis-Agropyron spicatum* (Tisdale 1986).

POPULATION BIOLOGY

Idaho hawksbeard is part of a polyploid, apomictic complex, with a base chromosome count of 11 (Babcock 1947; Cronquist 1955). Reproduction is by seed and the plumed fruits are likely wind pollinated. It generally flowers in May.

Idaho hawksbeard has a very deep taproot and immediately after germination the radicle penetrates downward very rapidly to a depth of 1-2 meters (Babcock 1947). It is therefore well adapted to summer drought conditions. Its response to fire is unknown, but its very deep taproot would likely survive at least light burns.

CONSERVATION ASSESSMENT

Idaho:

Idaho hawksbeard is not recognized on any federal, state or agency conservation list. It is recognized as a serious conservation concern by the Idaho Native Plant Society due to its limited distribution, relatively small number of known populations, the fact that many of these populations are themselves small, and widespread habitat loss or degradation. It is sensitive to habitat degradation and increased competition from aggressive weeds. Large portions of the species range have been converted or altered due to agriculture. Much of its remaining grassland habitat has been degraded and weedy exotics often dominate the landscape. Roads and other developments may add to local habitat losses.

Outside of Craig Mountain, most populations of Idaho hawksbeard are comprised of fewer than 100 individuals in one or a few small patches. Nearly all populations are threatened by habitat loss or degradation. Throughout its range, encroachment by aggressive weeds such as yellow starthistle is a grave problem. At least one population (012, Webb site, ca 3 miles south of Sweetwater) is extirpated and the long term viability of several others is in serious doubt. For instance, occurrence 011 (Waha Intersection site, near Webb Road-Waha Road junction) contained only a single Idaho hawksbeard plant when discovered in 1989 in an area being invaded by yellow starthistle. Occurrence 013 (Red Elk Cemetery site, ca 2.5 miles south of Sweetwater) had substantially fewer plants and a worsening yellow starthistle problem in 1993 compared to when it was discovered in 1989. Idaho hawksbeard's membership in a notoriously difficult taxonomic group, questions regarding its distribution, and most populations occurring on private land, are factors probably contributing to the minimal study given this rare species.

To gain a fuller assessment of the conservation status of Idaho hawksbeard in Idaho, inventory needs should be completed in the Palouse region and populations not visited in several years revisited to update their status, especially in light of increased yellow starthistle infestations within its range.

Craig Mountain:

Craig Mountain contains the best remaining populations of Idaho hawksbeard known. Viable habitat and population dynamics conditions still exist at Craig Mountain, which does not seem to be the case at many other known sites. Unless additional protected populations are found elsewhere, Craig Mountain probably represents the last stand for this species. No field investigations have ever been conducted in nearby Washington and Oregon, and areas in Idaho remain unsurveyed. The possibility of additional populations being discovered exists.

Habitat degradation is the most serious threat on Craig Mountain. This reduction in habitat quality is most closely linked to invasion by weeds such as, but not restricted to, yellow starthistle. These invasions are in turn closely linked to disturbance activities, most notably livestock grazing. Ironically, herbicide spraying to control weeds also poses a potential threat unless precautions are taken.

Two populations occur on the existing Craig Mountain WMA. Even though no populations are presently known to extend onto BPA mitigation lands, cooperation by the Idaho Department of Fish and Game will be important for the conservation of Idaho hawksbeard. The Cottonwood District BLM currently monitors one population at Craig Mountain on Wapshilla Ridge.

MANAGEMENT RECOMMENDATIONS - Craig Mountain

The conservation of Idaho hawksbeard at Craig Mountain is contingent on the conservation of the canyon grassland ecosystem. Points related to a weed control program and management of livestock grazing will assist in the conservation of this species. Loss and degradation of high quality habitat is the number one problem facing this species. Sites supporting Idaho hawksbeard should not incur ground disturbing activities, whenever possible.

The South of Redbird Creek population (016) is the only one known to occur on IDFG property. Located within the Gaiser segment of the Craig Mountain WMA, this population deserves the Department's full attention regarding management activities there. The Gaiser segment has been recommended for Research Natural Area status in the past and again in this report. Portions of this population have already been eliminated by past developments, mainly on adjoining private land. Seedings or other habitat manipulations should not occur where there is Idaho hawksbeard. Herbicide spraying or other weed control measures should be carefully timed to not adversely impact Idaho hawksbeard. Five vegetation monitoring plots (Tisdale plots) are located in or adjacent to the Gaiser segment, but none encompass the core area of Idaho hawksbeard. If any habitat manipulations are conducted within or near this population, monitoring with at some photo points, will probably be warranted. Photo points can be completed the same time the Tisdale plots are resampled, special trips will not be necessary. If additional monitoring is deemed necessary, there should be coordination with the BLM. The BLM has a single monitoring station for Idaho hawksbeard on Wapshilla Ridge. Establishment of the proposed Redbird Creek RNA would confer additional protection to the Gaiser segment population.

HAPLOPAPPUS HIRTUS Gray VAR. *SONCHIFOLIUS* (Greene) Peck

TAXONOMY

Common name: Sticky goldenweed

Family name: Asteraceae

Common name for family: Aster; Composite

Original publication: Hall, H. 1928. A Phylogenetic study in the Compositae. Published by Carneige Institute of Washington. 389:125

Alternative taxonomic treatments: When originally described, this taxon was assigned to the genus *Pyrrocoma*. Hall (1928) reduced *Pyrrocoma* to a section of the large genus *Haplopappus*. Cronquist (1955) largely followed Hall's interpretation. A number of recent investigators (e.g. Mayes 1976; and see Cronquist 1994b) now consider *Haplopappus* to consist of several genera, including *Pyrrocoma*. The name *Pyrrocoma hirta* var. *sonchifolia* would follow these new treatments. In his recent treatment for the *Intermountain Flora*, Cronquist (1994) notes that plants from the northern margin of the species range average more robust than to the south, and have often been taken as the separate subspecies or variety *sonchifolius*. It is unclear if Cronquist still supports this distinction. Mayes (1976) notes that var. *sonchifolia* is poorly represented in herbaria, and is based on relatively few specimens. He concludes that it is the weakest of the *P. hirta* varieties, and more extensive study may show the varietal rank to be untenable.

Collections made during recent rare plant field investigations at Craig Mountain need to be evaluated by an expert. Personal observations (Mancuso 1993; 1994) indicate that the stature of sticky goldenweed plants is quite variable at Craig Mountain. A robust form is restricted to wet meadows that remain moist most of the growing season and a smaller form occurs in seasonally wet, rocky meadows or forest openings. Because some of the morphological characteristics used to distinguish var. *sonchifolius* and var. *hirtus* overlap, the distinction between the two is not always clean. Involucral bract measurements and at least a few leaf measurements per plant suggest the material at Craig Mountain is var. *sonchifolius*.

The published range of *Haplopappus hirtus* var. *hirtus* is northeastern California, northern Nevada, eastern Oregon and southwestern Idaho. The range for var. *sonchifolius* is further north and includes northern Idaho (Mayes 1976). This distribution data lends further support to the identification of Craig Mountain material as var. *sonchifolius*.

History of knowledge of taxon in Idaho: Until recent discoveries at Craig Mountain, sticky goldenweed was known in Idaho only from a couple of historical collections from the same area. Pending better information, it was on the Idaho Native Plant Society's Review List for several years. Having verified it is extant in Idaho, and that it is apparently very uncommon and occupies habitats subject to several ongoing and potential threats, its consideration as a conservation concern is warranted. Taxonomic questions regarding sticky goldenweed are apparently not fully resolved. Presently it is regarded as a distinct entity and valid taxon and its status as a conservation concern in Idaho is justified. If future studies alter its taxonomic disposition, then its conservation status will need reevaluation.

DESCRIPTION

General non-technical description: Sticky goldenweed is a herbaceous perennial from a woody taproot. Stems are several, curved-ascending, and up to about 2 feet tall. Stems and generally the herbage are very sticky due to glandular hairs. Leaves are sharply toothed, up to about 2 inches wide, with those at the base largest and tufted, and those along the stem reduced and becoming sessile. Bracts subtending the flower heads (involucre) are prominent. Heads have rather showy yellow flowers that bloom beginning around mid-July.

Technical description: For *H. hirtus*: Perennial with a taproot and often with a slightly branched caudex; stems several, decumbent at the base, mostly 1-4 dm; herbage sparsely to rather densely villous-tomentose with flattened, multicellular hairs, becoming glandular at least in the inflorescence; leaves sharply and irregularly toothed, the basal tufted and petiolate, mostly 3-20 cm long and 6-40 mm wide, the cauline more reduced and becoming sessile; heads several or sometimes solitary, campanulate to hemispheric, the inflorescence tending to be elongate in well developed plants; rays 13-30, 6-12 mm long (Cronquist 1955).

For *H. hirtus* var. *sonchifolius*, Hall (1928) provides this addendum: Stem 3-4.5 dm high in the original collections, but reduced to 1 dm in others; leaves ample, thin, the blade 5-15 cm long 15-40 mm wide, dark green, sparsely short villous as well as glandular; heads few or solitary on each stem; involucre broad-hemispheric, 12-13 mm high, the linear-attenuate bracts nearly alike or the outer ones the longer, greenish almost throughout.

Local field identification: The wet meadow habitat of sticky goldenweed is limited in extent at Craig Mountain. The relatively robust, multi-stemmed, curved-ascending habit of sticky goldenweed is somewhat distinctive in the wet meadow habitats. The sharply toothed leafs and sticky, glandular nature of the plant are very good diagnostic characteristics. The prominent, herbaceous-looking involucre bracts are another good character to help identification. Plants from less mesic sites share these traits, but are not as tall. A line drawing for sticky goldenweed is reproduced in Appendix 4.

Similar looking species: There are many yellow-flowered composites at Craig Mountain, with several growing in the wet meadow complexes, including *Agoseris glauca, Crepis runciniata, Senecio pseudaura and S. spaerocephalus*. The prominent, herbaceous-looking involucre bracts readily separates sticky goldenweed from all others. The large, lance- to elliptic-shaped, and sharply serrated leaves are distinguishing when consideration in combination with the very sticky stem and herbage. None of the several other *Haplopappus* species at Craig Mountain inhabit wet meadows.

Var. *hirtus* is not known to occur at Craig Mountain or nearby regions. Field distinction between var. *sonchifolius* versus var. *hirtus* is not always obvious, and the range of variability in plants found at Craig Mountain can make identification confusing. The following key adapted from Cronquist (1955) and Hall (1928) can be used to help separate the two varieties.

1. Relatively robust plants of mesic habitats, the leaves ample 15-40 mm wide; involucral bracts mostly at least 12 mm high; disk up to 2.5 cm wide . . . . . var. *sonchifolius*

1. Relatively smaller plants of drier habitats, the leaves up to 25 mm wide; involucral bracts up to 11 mm high; disk up to 2 cm wide . . . . . var. *hirtus*

LEGAL OR OTHER FORMAL STATUS

National:

U.S. Fish and Wildlife Service: None.

Bureau of Land Management: None. Sticky goldenweed is not known to occur on any land administered by the BLM.

U.S. Forest Service: None. Sticky goldenweed is not known to occur on any land administered by the Forest Service.

Other current formal status recommendations: Sticky goldenweed is given a global rank of 3 by the Biodiversity Information Network - the Association of Natural Heritage Programs and Conservation Data Centers (Conservation Data Center). The G3 rank (on a scale of 1-5) indicates sticky goldenweed is rare or uncommon but not imperiled.

State:

Idaho

Idaho Native Plant Society: Sticky goldenweed is in the Idaho Native Plant Society Sensitive Category. This category contains species with small populations or localized distributions within Idaho that presently do not meet the criteria as Priority 1 or 2, but whose populations and habitats may be jeopardized without active management or removal of threats (Idaho Native Plant Society 1994).

Conservation Data Center: The Biodiversity Information Network state ranking is S1, indicating that in Idaho, this species is critically imperiled because of extreme rarity or because of its biology making it especially vulnerable to extinction (Conservation Data Center 1994).

Washington

Sticky goldenweed is on the Washington Natural Heritage Program's Monitor - 1 List, indicating it is a species of potential concern, but for which no status is currently assigned. Additional field work is needed before a status can be assigned (Washington Natural Heritage Program 1994).

DISTRIBUTION

The range of sticky goldenweed includes central and southeastern Washington, the Blue and Wallowa Mountains of northeastern Oregon, and adjacent Idaho (Cronquist 1955; Mayes 1976)

Craig Mountain:

At Craig Mountain, sticky goldenweed is known from wet meadows and other seasonally mesic meadow or forest openings. Four sites are known from the upper Deer Creek drainage and one further north in upper Webb Creek. A historical collection from near the hamlet of Forest could not be relocated during surveys in 1994. A number of meadow complexes in the area seem to contain suitable habitat. Most potential habitat has been surveyed at Craig Mountain, but additional small populations may be discovered in the future. Suitable meadow habitat for sticky goldenweed is limited to the northern and northeastern plateau-like summit of Craig Mountain. Craig Mountain represents the known eastern periphery for sticky goldenweed. It is not known elsewhere in Idaho.

DEMOGRAPHY - Craig Mountain

Five occurrences of sticky goldenweed have been mapped for Craig Mountain (Appendix 5). All occurrences are small and local and only a fraction of potentially available habitat is generally occupied. A total of only approximately 200-300 plants have been tallied, with a majority of these known from the Benton Meadows (003) population. All populations were discovered during the 1993-1994 field seasons. Population data for Craig Mountain is summarized below. Additional information for each population is available in the appropriate Element Occurrence Record (Appendix 6). Explanations for EOR, Site Name, and EO Rank is given on page 47.

Sticky Goldenweed - Population Summary for Craig Mountain

EOR#	Site Name	ca. # plants	ca. size	EO Rank
001	Larabee Meadows	10	$25m^2$	D
002	Deer Creek Road	2	$2m^2$	D
003	Benton Meadows	150-250	0.5 acre	C
004	Swamp Creek	1	$1m^2$	D
005	Upper Webb Creek	<50	1 acre	C

LAND OWNERSHIP - Craig Mountain

All five of the known sticky goldenweed occurrences at Craig Mountain are located on BPA mitigation land. One occurrence (005) extends onto adjacent private land. The remaining occurrences are all in close proximity to other land ownerships, primarily Nez Perce tribal land and private land. The meadow systems and associated sticky goldenweed habitat all have multiple ownership. The historical site near Forest was likely on private or perhaps Nez Perce tribal land. A summary of land ownership status for sticky goldenweed at Craig Mountain is provided.

Land Ownership for Sticky Goldenweed Sites at Craig Mountain

EOR#	Site Name	BPA	PVT
001	Larabee Meadows	x	
002	Deer Creek Road	x	
003	Benton Meadows	x	
004	Swamp Creek	x	
005	Upper Webb Creek	x	x

BPA=Bonneville Power Administration mitigation land, PVT=Private land

HABITAT

Mayes (1976) gives the habitat of sticky goldenweed as moist soils of mountain meadows and forest openings between 4000-6000 feet elevation. They are usually inclusions within and surrounded by upland forest. Throughout the range of sticky goldenweed, montane meadows have been impacted by livestock grazing (Hall 1973; Johnson and Simon 1987).

Craig Mountain

Various low gradient, headwater tributaries have formed graminoid-dominated wet and dry meadow complexes within the plateau-like, upland coniferous forests at Craig Mountain. As reported for the nearby Wallowa and Blue Mountains, these meadow systems have been heavily impacted by many years of livestock grazing. Although graminoids dominate, the meadow communities generally have a very rich forb component. Long standing and intense livestock use has greatly increased the forb contribution to the meadows. Hydrologic conditions are variable within the meadows, ranging from areas of season long standing water to sites that are only ephemerally wet in the spring. In some locations, other rocky, graminoid-dominated meadows not necessarily associated with drainage pathways occur as small openings within the upland forest matrix. Soils that are only ephemerally wet prevail at these sites.

Sticky goldenweed occurs in both wet and dry meadows. It does not occur in the wettest portions of the wet meadow systems. Within drier meadows it seems most common in swale or small depression microsites, places that likely retain moisture longer than adjacent sites. Soils are gravelly to rocky, and may have a clay component. Wet meadow site soils are derived from alluvium. Some common associates are *Alopecurus pratensis* (meadow foxtail), *Deschampsia cespitosa* (tufted hairgrass), *Poa* spp. (bluegrass species), *Potentilla gracilis* (cinquefoil), and *Sidalcea oregana* (Oregon sidalcea). Some of the meadow communities are similar to the tufted hairgrass-moist sedge meadow community described by Johnson and Simon (1987), and the dry meadow and wet meadow communities outlined by Hall (1973).

POPULATION BIOLOGY

Plants begin to flower around the middle of July, and at more mesic sites continue to early September. They are probably pollinated by insect vectors. The plumed fruits are most likely wind disseminated. No indications of vegetative reproduction have been observed at Craig Mountain. Reproduction is likely only from seed. Other population biology specifics are unknown.

ECOLOGY

Sticky goldenweed is apparently restricted to mountain meadow habitats. It seems adaptable to a range of hydrologic conditions. It occurs in meadows that are moist most of the growing season, as well as sites wet only part of the season. Many years of livestock grazing and in some cases logging of adjacent forests have probably altered the hydrology within portions of sticky goldenweed's meadow habitats. The small size of most populations suggest sticky goldenweed may be sensitive to some of these changes. Limited observations found no evidence of wildlife or livestock eating sticky goldenweed at Craig Mountain. Specifics regarding the autecology of sticky goldenweed are unknown.

CONSERVATION ASSESSMENT

Idaho:

Sticky goldenweed is apparently at the eastern periphery of its range at Craig Mountain. Outside of Craig Mountain, suitable mid-elevation, wet-meadow habitat is regionally limited in Idaho. No collections are known from the Joseph Plains or further south in the Cold Springs Mountains. Throughout its range, this species is apparently poorly known, and its habitat is subject to impacts from livestock grazing. Because of its rarity in Idaho, loss of high quality habitat, and potential threats, we recommend a status change from State Sensitive to Priority 1.

Craig Mountain:

Craig Mountain supports the only known populations of sticky goldenweed in Idaho. Five small occurrences have recently been documented. One historical population near Forest could not be relocated during 1994 surveys and may be extirpated. Location data accompanying this old collection were vague, however. All populations at Craig Mountain are very localized and contain few plants. Three of the five known occurrences have ten or fewer individuals. The long-term viability of these occurrences is very doubtful, especially the Deer Creek Road (002) and Swamp Creek (004) sites.

All known sites are subject to threats. Indirect impacts of livestock grazing to the meadow habitats of sticky goldenweed are probably the most serious concern. It is speculated that the abundance and distribution of sticky goldenweed has been reduced at Craig Mountain because of adverse cumulative effects to the hydrology and vegetation of its meadow habitats.

A potential concern is the impoundment of the meadow bottomlands for water storage or fish ponds. Housing and other developments on private land potentially threaten part of the Upper Webb Creek (005) occurrence. Other potential concerns include seeding of meadows to pasture grasses, road construction, and ORV use in meadow habitats. The consequences of such small and relatively isolated populations are unknown for sticky goldenweed, but may be another concern for this species.

In summary, sticky goldenweed appears to be barely hanging on in Idaho. The future of sticky goldenweed in Idaho depends on its conservation at Craig Mountain.

MANAGEMENT RECOMMENDATIONS - Craig Mountain

The meadow habitats of sticky goldenweed have been impacted by years of livestock use. Although empirical evidence is missing, the recovery of sticky goldenweed at Craig Mountain probably depends on restoration of its meadow habitat. The most important change will be to better manage livestock grazing.

All populations should be periodically checked. All are small and readily accessible. Because all populations except Benton Meadows (003) contain so few plants, there are serious doubts to their long-term viability.

A monitoring station should be established at the Benton Meadows population. Horses are presently grazed at Benton Meadows, although they do not spend much time in the wetter sites supporting sticky goldenweed. Any future water, road or other projects at Benton Meadows should be sensitive to the presence of sticky goldenweed.

Larabee Meadow supports a small population of sticky goldenweed. Rare plants need to be considered when planning water projects and other land use activities in this area.

HAPLOPAPPUS LIATRIFORMIS (Greene) St. John

TAXONOMY

Common name: Palouse goldenweed

Family name: Asteraceae

Common name for family: Aster; Composite

Original publication: For *Pyrrocoma liatriformis* in: Greene. 1909. Leafl. Bot. Observ. Crit. 2:17. For *Haplopappus liatriformis* in: St. John, H. 1937. Flora of southeastern Washington and of adjacent Idaho. 455.

Alternative taxonomic treatments: A number of recent investigators have considered *Haplopappus*, as treated by Hall (1928) and largely followed by Cronquist (1955), to consist of several genera. The name *Pyrrocoma liatriformis* would follow these new treatments.

History of knowledge of taxon in Idaho: The first collection in Idaho was apparently in 1916. It was collected several previous times in Washington. Throughout its range, collections were rare for many years. Intensive inventory work was conducted during 1990 to support a Palouse goldenweed status report for the U.S. Fish and Wildlife Service (Gamon 1991).

In Idaho, Johnson (1977b; 1981b) recommended Palouse goldenweed for federal status as Threatened because of the species rarity. Palouse goldenweed has been category 2 candidate for federal listing since 1980.

DESCRIPTION

General non-technical description: Palouse goldenweed is a perennial forb up to about 2.5 feet tall, with

1 to several stems from a stout taproot. The stems, leaves, and involucral bracts have hairs which vary from being somewhat long and soft to stiff. The leaves often have a rough texture and are sometimes toothed. The basal leaves are tufted and generally long and narrow. The stem leaves get progressively smaller going up the stem. There are commonly several flower heads in an elongate, rather open inflorescence. Individual flower heads are less than 1 inch across and approximately 0.5 inch high. The involucral bracts are pointed and green-tipped. Ray flowers are yellow and less than 0.5 inch long.

Technical description: Perennial from a stout taproot and often a short, branched caudex; stems several or solitary, 3-7 dm. tall, sometimes curved at the base; herbage and involucre evidently hairy, the pubescence varying from loosely villous-tomentose to rather rough-hirsute (and the leaves often scabrous near the margins as well), often partly deciduous at maturity; leaves entire or with a few sharp teeth, the basal ones tufted, oblanceolate or narrowly elliptic, mostly 7-25 cm. long including the petiole) and 1-3 cm. wide; cauline leaves more or less reduced upwards and becoming sessile, the stems appearing sparsely or moderately leafy; heads several or rather many in an elongate, racemiform or narrowly paniculiform inflorescence, campanulate, smaller than in *H. integrifolius*, the disk seldom over 2 cm. wide; involucre 10-16 mm. high, its firm, pointed bracts herbaceous throughout or prominently green-tipped, subequal or obviously imbricate; rays mostly 13-21 mm. long; disk corollas 7-10 mm. long; style appendages equaling or usually longer than the stigmatic portion; achenes elongate (Cronquist 1955).

Local field identification: Palouse goldenweed flowers later in the summer than many other grassland species and is restricted to mesic, deeper soil, Idaho fescue sites. It is a relatively large plant, up to about three feet tall, although it can be much shorter. Leaves are tufted at the base and get progressively smaller up the stem. The inversely lance-shaped leaves have a rough texture and may be toothed. Stems have hairs. Bracts subtending the flower heads (involucre) are relatively large (ca. 0.5 inch tall), firm, and green. Prominent yellow rays make the flower heads fairly showy. This suite of characters should readily distinguish Palouse goldenweed from the many other yellow-flowered composites found at Craig Mountain. A line drawing of Palouse goldenweed is reproduced in Appendix 4.

Similar looking species: The only other *Haplopappus* known to occur sympatrically with Palouse goldenweed is *H. carthomoides* (Columbia goldenweed). It is shorter, generally less than one foot tall, has larger flower heads, but less conspicuous ray flowers (the ray flowers often missing), and larger, leafy-looking involucral bracts. It often occurs in rocky, thinner soil sites than Palouse goldenweed.

Haplopappus hirtus (sticky goldenweed) also occurs at Craig Mountain. Its very sticky herbage readily distinguishes it from Palouse goldenweed. Sticky goldenweed occurs in meadow, not canyon grasslands habitats.

Helianthella uniflora (Rocky Mountain helianthella) is sympatric with Palouse goldenweed in several places. It can be distinguished by its larger yellow ray flowers and its generally taller, more lanky appearance. Its stems are covered with course hairs. It has a pappus of short awns, whereas Palouse goldenweed has capillary bristles .

LEGAL OR OTHER FORMAL STATUS

National:

U.S. Fish and Wildlife Service: Palouse goldenweed is presently a category 2 candidate species for

federal listing under the Endangered Species Act (U.S. Fish and Wildlife Service 1993). It has been recommended for C1 status by the Idaho Native Plant Society.

Bureau of Land Management: Palouse goldenweed is a BLM Sensitive Species for Idaho (Conservation Data Center 1994).

U.S. Forest Service: None. Palouse goldenweed does not occur on any land administered by the Forest Service.

Other current formal status recommendations: Palouse goldenweed is given a global rank of 2 by the Biodiversity Information Network - the Association of Natural Heritage Programs and Conservation Data Centers (Conservation Data Center 1994). The G2 rank (on a scale of 1-5) indicates Palouse goldenweed is imperiled throughout its range because of rarity or because of other factors demonstrably making it very vulnerable to extinction.

State:

Idaho

Idaho Native Plant Society: The Idaho Native Plant Society does not place a ranking on federally listed or candidate species. The Idaho Native Plant Society has recommended Palouse goldenweed be added (as a substitution for *H. insecticruris*) to the list of federal candidate species party to the Lujan vs. Fund for Animals lawsuit settlement (Idaho Native Plant Society 1994).

Conservation Data Center: The Biodiversity Information Network state ranking is S1, indicating that in Idaho, Palouse goldenweed is critically imperiled because of extreme rarity or because of some factor of its biology making it especially vulnerable to extinction (Conservation Data Center 1994).

Washington

Palouse goldenweed is listed as Threatened in Washington by the Washington Natural Heritage Program (1994). Threatened species are those identified as likely to become Endangered in the state within the near future if factors contributing to population decline or habitat degradation or loss continue.

DISTRIBUTION

Palouse goldenweed is endemic to southeastern Washington and adjacent Idaho. Its range is approximately 120 miles by 40 miles (at it widest point). Most populations are in Idaho, occurring in Latah, Lewis, Idaho and Nez Perce counties. Presently, there are upwards of 35 occurrences known in Idaho, although a few are believed extirpated. In Washington it is known from Spokane and Whitman counties and several populations are considered extirpated (Gamon 1991).

Craig Mountain:

Palouse goldenweed is known from four widely scattered areas at Craig Mountain, west of Waha Lake, the Billy Creek drainage, the Gold Hill area, and very upper Wapshilla Creek. It is suspected to occur on The Nature Conservancy's Garden Creek Preserve, but this needs verification.

The populations at Craig Mountain approach the southern terminus of the species range. Only one site further south is known. The Craig Mountain sites represent a southeastern range extension.

DEMOGRAPHY - Craig Mountain

Six occurrences of Palouse goldenweed have been mapped for Craig Mountain (Appendix 5). These occurrences are estimated to support a total of 5000 plants with an aerial extent of 30 acres. Not all the acreage estimated for a particular occupance supports Palouse goldenweed and plants tend to exhibit a clustered distribution pattern at any one site. Population data for Craig Mountain is summarized below. Additional information for each occurrence is contained in the appropriate Element Occurrence Record (Appendix 6). Explanations of EOR, Site Name, and EO Rank are given on page 47.

Palouse Goldenweed - Population Summary for Craig Mountain

EOR#	Site Name	ca. # plants	ca. size	EO Rank
032	Redbird Ridge	1000	10 acres	A
034	Billy-Camp Creeks Divide	400	4 acres	B
035	Gold Hill	1500	7 acres	A
036	Dough-Chimney Crs. Divide	10	0.5 acre	C
037	Wapshilla Ridge	300	2 acres	C
038	Tepee Peaks	2000	10 acres	A

LAND OWNERSHIP - Craig Mountain

The majority of known sites of Palouse goldenweed in both Idaho and Washington are located on privately owned land. Six occurrences of Palouse goldenweed have been documented at Craig Mountain. All were discovered during field investigations conducted during 1993 by Conservation Data Center biologists. One occurrence (032) likely represents an extension of a population discovered in 1990. Three occurrences (035, 036, 037) occur all, or in part on BPA mitigation land. Portions of four occurrences (032, 034, 035, 038) are on the Craig Mountain WMA. One occurrence (035) is located on both BPA mitigation land and Craig Mountain WMA. The portions of two occurrences (034, 038) on BLM land are located within the boundaries of the Craig Mountain Area of Critical Environmental Concern (ACEC). Except for the very local Dough-Chimney Creeks Divide population (036), all occurrences are comprised of two or more subpopulations. A summary of land ownership at Craig Mountain is provided.

Land Ownership for Palouse Goldenweed Sites at Craig Mountain

EOR#	Site Name	BPA	IDFG	BLM	PVT
032	Redbird Ridge		x		x
034	Billy-Camp Creek Divide		x	x	
035	Gold Hill	x	x		

036	Dough-Chimney Creek Divide	x				
037	Wapshilla Ridge	x			?	
038	Tepee Peaks		x	x		

BPA=Bonneville Power Administration mitigation land, IDFG=Idaho Dept. Fish & Game (Craig Mountain WMA), BLM=Bureau of Land Management, PVT=private

HABITAT

Palouse goldenweed most commonly occupies Palouse Prairie grassland communities and transition zones between prairie and ponderosa pine habitats. Sites are bunchgrass-dominated and often with scattered patches of deciduous shrubs. It generally occurs on the lower to upper portions of moderate slopes (generally <35%). It occurs on a variety of aspects. Elevations range from approximately 2000 to 4800 feet, but mostly below 3600 feet. Soils tend to be productive skeletal silt/loams (loess). In Idaho, it most commonly occurs within the *Festuca idahoensis/Rosa* spp. habitat type described by Daubenmire (1970).

The Palouse Prairie communities that support Palouse goldenweed often support two other rare Palouse endemics, *Silene spaldingii* (Spalding's silene) and *Aster jessicae* (Jessica's aster).

Craig Mountain

In many regards, habitats at Craig Mountain are the same as outlined above. For instance, sites are bunchgrass-dominated, often have scattered patches of shrubs, slopes are gentle to moderate and soils are loamy. A few vegetation differences are apparent though and may reflect the graded changes in moisture patterns between the Palouse Prairie to the north and the Hells Canyon grasslands further south. Topographic and other differences between the Palouse Prairie and Craig Mountain canyon grassland also account for some of the variance. For example, immediately north of Craig Mountain along the Red Bird Road, Palouse goldenweed occurs in Palouse Prairie grassland with scattered *Crataegus douglasii* (hawthorn). Patches of hawthorn extend part way up the northern flank of Craig Mountain, but south of this point it has been observed only in shrubby draws or riparian areas.

At Craig Mountain, Palouse goldenweed is commonly restricted to northerly aspects, except in saddle or ridgeline positions where aspects are nil. This limitation to northerly aspects seems to become more pronounced proceeding north to south. At the southernmost population on Craig Mountain (Wapshilla Ridge 037), plants quickly drop out as the aspect changes from northwest to more southerly. At 4800 feet, this is also the highest elevation of any known Palouse goldenweed site. Interestingly, the Tepee Peaks population (038) in the northern portion of Craig Mountain, descends from 4400 to approximately 2000 feet, which is lower than most, if not all documented sites.

The bulk of several populations occur proximate to ridgecrests and plants are especially common in relatively lush saddle positions, probably where deeper soils allow increased moisture retention. These ridge positions often border conifer forest on the adjacent north-facing slopes. The slopes support Douglas-fir climax, not ponderosa pine climax forest. Ponderosa pine is common along the top edges of these canyon woodlands, however.

Palouse goldenweed occurs in both *Festuca idahoensis-Koeleria cristata* and *F. idahoensis-Agropyron*

spicatum habitat types (Tisdale 1986) at Craig Mountain. A portion of one population occurs within openings of a *Physocarpus malvaceus* (ninebark) shrubfield. A few associate species include *Festuca idahoensis* (Idaho fescue), *Agropyron spicatum* (bluebunch wheatgrass), *Koelaria cristata* (prairie Junegrass), *Poa pratensis* (Kentucky bluegrass), *Symphoricarpos albus* (snowberry), *Achillea millefolium* (yarrow), *Solidago canadensis* (meadow goldenrod), *Geum triflorum* (prairie smoke), *Potentilla gracilis* (cinquefoil), and *Eriogonum heracleoides* (Wyeth buckwheat).

POPULATION BIOLOGY

Flowering begins in mid-July and continues into September. By early September, most plants are in fruit. Palouse goldenweed presumably reproduces by seed and pollination is assumed to be accomplished by insect vectors. Seeds are probably wind dispersed, although some seed movement may be achieved through animal vectors. Plants generally occur as scattered individuals or in small clusters. Apparently suitable habitat is often not occupied, both within and between populations. Grasshopper herbivory has been observed at a number of populations (Gamon 1991).

At Craig Mountain, plants may be subject to insect seed predation, sometimes severe. It is not known if this is a regular or cyclical pattern, what relationship this may have to other site factors, or what effect this may have on population structure.

ECOLOGY

Little is known about the ecology of Palouse goldenweed. The plant communities within which it occurs are generally stable. Heavy grazing can alter these communities, however. This is the case at several Craig Mountain populations where non-native grasses such as Kentucky bluegrass and *Phleum pratense* (timothy) are well established. These disturbed sites are also subject to invasion by exotic weeds and/or a skewed abundance of certain native forbs that increase under grazing pressure. Interspecific competition with non-native weedy species may be an important limiting factor for Palouse goldenweed (Gamon 1991).

The major natural disturbance at Palouse goldenweed sites is fire. Daubenmire (1970) suggested that such grassland sites return to their pre-fire condition within a few years.

CONSERVATION ASSESSMENT

Idaho:

The historic range of Palouse goldenweed has undergone a dramatic change since European settlement. Much of the species suitable Palouse Prairie habitat has ben converted to agricultural and livestock production. This has presumably destroyed most former populations. Herbicide spraying, exotic weed invasion, road construction, and other developments have also likely contributed to a reduction and fragmentation of suitable habitat. As a result, most extant populations occur in small, isolated fragments of native grassland habitat. The majority of known Palouse goldenweed sites occur on private land. Presently, upwards of 50 extant populations of Palouse goldenweed are known in Idaho and Washington. The majority of sites consist of fewer than 50 individuals. At least two historical Idaho sites are believed extirpated. Five historical sites in Washington are thought to be extirpated (Gamon 1991).

Agriculture will undoubtedly remain the primary land use within the range of Palouse goldenweed. Habitat that has been tilled is lost. At remaining populations, habitat quality impacted by livestock grazing and weedy species invasion is probably the most serious threat. It is unknown if livestock eat Palouse goldenweed. Light to heavy grazing has occurred at many Palouse goldenweed sites. Moderate to heavy grazing tends to alter community composition, resulting in the invasion of exotic species and the decline of Palouse goldenweed. Because some populations are small, even relatively minor disturbances such as herbicide spray drift could result in local extirpation (Gamon 1991).

The fragmented pattern of the species' distribution may also be problematic. The genetic effects on small, isolated populations of Palouse goldenweed are not known. Grasshopper herbivory and insect seed predation have been observed, but their conservation significance are unknown. Overall, the future of Palouse goldenweed and the other two rare Palouse endemics remain among the most pressing plant conservation problems in Idaho.

Craig Mountain:

Discounting Craig Mountain, there are only four known populations of Palouse goldenweed supporting up to, or more than 500 individuals. None of these are estimated to contain more than 1000 plants. At Craig Mountain, three populations (032, 035,038) are estimated to have at least 1000 plants, and in two cases, perhaps as many as 2000. Even two smaller populations, (034, 037), with 200-400 individuals, are comparatively large. As is the case with a number of other rare plants discussed in this report, Craig Mountain supports the largest and probably the most secure populations of Palouse goldenweed known. This pattern further highlights the rare plant values on Craig Mountain. Craig Mountain is very important to this federal candidate species' long-term conservation.

All populations at Craig Mountain are threatened by aggressive weeds. The loss of late-seral and climax community grassland habitat to weeds is the primary threat to Palouse goldenweed at Craig Mountain. Yellow starthistle is present within a couple of populations and is well established near all of them. Other weeds such as *Hypericum perforatum* (Klamath weed), *Sisybrium altissimum* (tumbling mustard), and *Vicia villosa* (hairy vetch) are established at particular populations. Livestock grazing has contributed to this decline in habitat conditions. Other current or potential concerns identified at Craig Mountain are herbicide poisoning and ORV use. Logging operations should minimize impacts to Palouse goldenweed populations that occur near forest borders.

MANAGEMENT RECOMMENDATIONS - Craig Mountain

As for several other rare plants at Craig Mountain, the conservation of Palouse goldenweed is intimately related to the conservation of the canyon grassland ecosystem. Towards this end, a weed control program and management of future livestock grazing are the two most important factors. These points are discussed in more detail earlier in this report. Without both, the long-term conservation of Palouse goldenweed is jeopardized.

Populations on BPA and IDFG land should be periodically checked. This can be accomplished when monitoring plots are resampled for three of the populations (032, 037, 038). Fish and Game personnel will probably have to occasionally visit areas near the other populations for one reason or the other. Updated population and habitat condition information can be collected at these times, otherwise special trips should be scheduled. We recommend Palouse goldenweed monitoring plots be incorporated into the overall

proposed vegetation monitoring program on Craig Mountain. No habitat disturbing activities should be allowed at Palouse goldenweed sites.

Any timber harvest activities on lands adjacent to the Craig Mountain WMA should be designed to prevent adverse impacts to Palouse goldenweed at the Redbird Ridge (032) or Tepee Peaks (038) populations. This includes roads, loading decks, etc. A portion of the Redbird Ridge population may be susceptible to ORV use. The series of unmaintained two-tracks around the top of the Madden Creek Road may need to be posted if ORV use becomes prevalent. Presently, this is not a problem. Herbicide spraying on the Craig Mountain WMA/Prince segment needs to be conducted with extreme caution to prevent accidental poisoning of Palouse goldenweed plants. This could result from direct application or herbicide drift. The maps in Appendix 5 should be consulted when planning herbicide application on the WMA, and also elsewhere on Fish and Game managed property.

LOMATIUM DISSECTUM (Nutt.) Math. & Const. VAR. *DISSECTUM*

TAXONOMY

Common name: Fern-leaved desert-parsley

Family name: Apiaceae

Common name for family: Parsley; Carrot; Umbel

Original publication: Mathias and Constance. 1942. Bull. Torrey Club. 69:246.

Alternative taxonomic treatments: None.

History of knowledge of taxon: *Lomatium dissectum* var. *dissectum* was first recognized as a possible conservation concern in Idaho, and recommended for the State Watch List by Brunsfeld (1981b). At that time it was known from only a single population in Idaho, near Lake Waha. Additional populations around Whitebird Hill and especially Craig Mountain have been discovered since then.

DESCRIPTION

General non-technical description: Fern-leaved desert-parsley is a robust, multi-stemmed, perennial forb, 20-80 inches tall. It has a large woody taproot. Stems are without hairs. Leaves are large, with basal leafs the largest, ternate (arranged in three's), then 2-4 pinnately dissected into small, narrow, fern-like segments, and with a spicy fragrance. The inflorescence is an umbel and the flowers are somewhat showy enmass. Individual flowers are small, usually purplish, and some are sterile. Fruits are sessile (without a stalk of any kind) or on very short pedicels (the stalk to a single flower). These pedicels are conspicuously shorter than the pedicels of the sterile flowers. The fruit has corky-thickened wings.

Technical description: Robust perennial from an often very large, woody taproot which may be surrounded by a branching caudex, mostly 5-15(20) dm tall at maturity, the several glabrous stems usually ascending rather than strictly erect; leaves large, basal and cauline, the lower ones the largest, all generally more or less scaberulous, seldom glabrous, ternate-pinnately dissected into small and often narrow ultimate segments up to about 1(2) cm long; rays of the umbel mostly 10-30, equal or unequal, at least the longer ones mostly 4-10 cm long at maturity; flowers yellow or purple, some of them always sterile; involucel of well-developed narrow bractlets; fruit elliptic, 8-17 mm long and 4.5-10mm wide, the lateral wings narrow and more or less cork-thickened, up to about 1 mm wide, the dorsal ribs inconspicuous; oil tubes obscure (Cronquist 1961).

Local field characteristics: Many other species of *Lomatium* occur in Idaho. Fern-leaved desert-parsley is much larger than other *Lomatium* species in the state. An exception is another variety of fern-leaved desert-parsley, *L. dissectum* var. *mutifidum*, which also occurs at Craig Mountain. Both are commonly 4 feet or taller, and height alone is usually sufficient to separate them from other similar species. Other characters useful to distinguish fern-leaved desert-parsley are hairless stems, the small ultimate segments of the fern-like leaves, the leaves slightly scabrous, the large inflorescence, and in var. *dissectum*, sessile fruits. Mature fruits are required for positive identification between the two varieties of fern-leaved desert

parsley. A line drawing is provided (Appendix 4).

Similar looking species: The genus *Lomatium* is well represented in northern Idaho. For instance, at least ten other species are known from Craig Mountain. Fern-leaved desert-parsley is much larger than any of the others, commonly 4-5 feet tall. *Lomatium dissectum* var. *dissectum* and *L. dissectum* var. *multifidum* look very similar and mature fruits are necessary to positively separate them. Var. *dissectum* has fruits which are sessile or nearly so on very short pedicels. These pedicels are conspicuously shorter than the pedicels of the sterile flowers usually intermixed on an inflorescence. The fruits for var. *multifidum* are all borne on well developed pedicels. In addition, the habitats for the two varieties are different in Idaho. Var. *dissectum* is restricted to relatively mesic, Idaho fescue- dominated grassland habitats, extending into adjacent open woodlands and shrubfields. Var. *multifidum* is much more inclined to be found on open, rocky, xeric, often southerly-facing slopes dominated by bluebunch wheatgrass. Var. *multifidum* is much more common in Idaho.
Angelica arguta (sharptooth angelica) and *Heracleum lanatum* (cow-parsnip) are two other large umbel family species that occur at Craig Mountain. At first glance they may look like fern-leaved desert-parsley. At Craig Mountain, both are confined to riparian or other nearby moist habitats.

LEGAL OR OTHER FORMAL STATUS

National:

U.S. Fish and Wildlife Service: None.

Bureau of Land Management: Fern-leaved desert-parsley is a BLM Sensitive Species for Idaho (Conservation Data Center 1994).

U.S. Forest Service: None

Other current formal status recommendations: Fern-leaved desert-parsley is given a global rank of 5 by the Biodiversity Information Network - the International Association of Natural Heritage Programs and Conservation Data Centers (Conservation Data Center 1994). The G5 rank (on a scale of 1-5) indicates that this taxon is demonstrably widespread, abundant and secure.

State:

Idaho

Idaho Native Plant Society: Fern-leaved desert-parsley is in the Idaho Native Plant Society Sensitive category. This category contains species with small populations or localized distributions within Idaho, that presently do not meet the criteria for classification as Priority 1 or 2, but whose populations and habitats may be jeopardized without active management or removal of threats (Idaho Native Plant Society 1994).

Conservation Data Center: The Biodiversity Information Network state ranking is S1, indicating that in Idaho, this species is critically imperiled because of extreme rarity or because of some factor of its biology making it especially vulnerable to extinction (Conservation Data Center 1994).

DISTRIBUTION

Fern-leaved desert-parsley is found chiefly west of the east base of the Cascade Mountains, from southern British Columbia to northern California. It is disjunct in northern Idaho from the Whitebird area, north to Craig Mountain.

Craig Mountain:

Fern-leaved desert-parsley is widespread at Craig Mountain. Populations are known from the Waha vicinity, extending south for approximately 18 air miles to upper Wapshilla Creek, and east to the Hoover Point area. It occurs at upper- to mid-elevation sites, above about 3000 feet elevation. A distribution map is provided (Appendix 5).

DEMOGRAPHY- Craig Mountain

Craig Mountain supports 18 of the known 21 occurrences of fern-leaved desert-parsley in Idaho. All but one of the Craig Mountain populations were discovered during field investigations conducted during 1993 and 1994 by Conservation Data Center or The Nature Conservancy biologists. Craig Mountain appears to be the species' center of distribution in the state. The 18 occurrences total over 30,000 individuals with an aerial extent of over 200 acres. Not all the acreage estimated for a particular occurrence supports fern-leaved desert-parsley. Sites are commonly comprised of a mix of suitable and unsuitable habitat. Population data for Craig Mountain is summarized below. Additional information is contained in the appropriate Element Occurrence Record, Appendix 6. Explanations of EOR, Site Name, and EO Rank terms are given on page 47.

Fern-Leaved Desert Parsley - Population Summary for Craig Mountain

EOR#	Site Name	ca. # plants	ca. size	EO Rank
004	Lake Waha	unknown	unknown	H
006	Deer Creek	3000	7 acres	A
007	Bow Triangulation Point	2000	3 acres	A
008	Hoover Point	1000	5 acres	B
009	Wapshilla Ridge	6600	15 acres	A
010	Upper Cave Gulch	unknown	80 acres	B
012	Upper Deer Creek	2000	2+ acres	B
013	Upper Fourth Creek	1500	5 acres	B
014	Frye Point North	6000	25 acres	A
015	Tepee Peaks	250	<1 acre	B
016	Camp Triangulation Point	200	0.5 acre	B
017	Upper Chimney Creek	300	4 acres	B
018	Corral Creek	1000+	40 acres	A
019	Redbird Ridge	3000	15 acres	A
020	Lake Creek	50	0.5 acre	C
021	Fort Simons Ridge - West	400	2 acres	B
022	Upper Captain John Creek	5000	10+ acres	A

LAND OWNERSHIP - Craig Mountain

Eighteen occurrences of fern-leaved desert-parsley have been documented for Craig Mountain. One occurrence (004) from near Lake Waha is based on a 1896 historical collection. The precise location of this population is unknown, but assumed to be on private land. It is unknown if the population is extant.

With only a couple exceptions, occurrences are comprised of several subpopulations. This results in many occurrences crossing ownership/administration boundaries.

Three occurrences (013, 016, 017) are restricted to BPA land. Another four (006, 009, 012, 022) occur at least partly on BPA land, with the Wapshilla Creek site (009) nearly all BPA land. Portions of three occurrences (015, 019, 021) are on the Craig Mountain WMA. Segments of seven populations are on private land, including three (004, 007, 020) only there. A summary of land ownership at Craig mountain is provided.

Land Ownership for Fern-Leaved Desert-Parsley Sites at Craig Mountain

EOR#	Site Name	BPA	IDFG	BLM	NPT	IDL	TNC	PVT
004	Lake Waha							x
006	Deer Creek	x		x		x		
007	Bow Triangulation Pt							x
008	Hoover Point					x		x
009	Wapshilla Ridge	x						x
010	Upper Cave Gulch						x	
012	Upper Deer Creek	x			x			
013	Upper Fourth Creek	x						
014	Frye Point North			x		x		
015	Tepee Peaks		x	x				
016	Camp Triangulation Pt	x						
017	Upper Chimney Creek	x						
018	Corral Creek						x	
019	Redbird Ridge		x					x
020	Lake Creek							x
021	Fort Simons Ridge - West		x			x		
022	Upper Captain John Ck	x		x				?

BPA=Bonneville Power Administration mitigation land, IDFG=Idaho Dept. Fish & Game (Craig Mountain WMA), BLM=Bureau of Land Management, NPT=NezPerce tribal land, IDL=Idaho Dept. of Lands, TNC=The Nature Conservancy's Garden Creek Preserve, PVT=Private land

HABITAT

In California, its habitat is described as wooded or brushy slopes. In Idaho, fern-leaved desert-parsley occurs in mesic, Idaho fescue-dominated grassland habitats and often extending into adjacent, open conifer and shrubfield communities. The habitat for a number of populations can best be described as the grassland-forest ecotone.

It occurs in *Festuca idahoensis-Koeleria cristata, Festuca idahoensis-Agropyron spicatum*, and rarely in *Agropyron spicatum-Poa sandbergii/Balsamorhiza sagittata* grassland habitat types (Tisdale 1986), and the open fringes of the *Pseudotsuga menziesii/Physocarpus malvaceus* habitat type (Copper et al. 1987). It also occurs in shrubfields, these generally dominated by *Physocarpus malvaceus* (ninebark).

Fern-leaved desert-parsley most often occurs in upper slope, and to a lesser extent ridgeline and downslope positions. Northerly aspects are the most common and support the largest populations, but it occurs on all aspects. Slopes vary from flat to extremely steep. It can be found in full sun or under the partial shade of open conifer communities. Soils tend to be stony or rocky, but include a loamy texture. Populations reported from the Lucille and Grangeville areas occur on exposed, low elevation, xeric, south-facing sites, and are contrary to habitats further north. Their identifications are suspect and need verification.

Craig Mountain:

Habitat at Craig Mountain is the same as described above. A few common associates are *Festuca idahoensis* (Idaho fescue), *Koelaria cristata* (prairie Junegrass), *Agropyron spicatum* (bluebunch wheatgrass), *Balsamorhiza sagittata* (arrowleaf balsamroot), *Eriogonum heracleoides* (Wyeth buckwheat), *Amelanchier alnifolia* (serviceberry), *Physocarpus malvaceus* (ninebark), *Pinus ponderosa* (ponderosa pine), and *Pseudotsuga menziesii* (Douglas-fir).

POPULATION BIOLOGY

The following generalizations pertain both to the genus *Lomatium* as a whole, or to selected species which have been more thoroughly studied, but are probably applicable to fern-leaved desert-parsley. *Lomatium* reproduces by seed. Studies of *Lomatium* have shown that growth rates and sex expression are genetically variable, and that seed masses can vary greatly within a population. Flowers in many *Lomatium* species are either staminate or hermaphroditic. Umbels may have a combination of staminate and hermaphroditic flowers, and this appears to be the case for fern-leaved desert-parsley. Flowers of *L. salmoniflorum*, a species that grows at lower elevations, but in the same region as fern-leaved desert-parsley in Idaho, are pollinated by a wide variety of solitary bees, flies, ants, and beetles (Thompson and Pellmyr 1989).

Lomatium species are subject to insect seed predation. For *L. salmoniflorum*, studies indicate that interactions between the number of flowers, the date of initiation of flowering, seed set, and seed parasitism skew viable seed production to a small subset of plants (Thompson and Pellmyr 1989). Field observation on Craig Mountain indicate that within a population, not all large (mature?) plants are reproductive in a given year.

At Craig Mountain, plants resume growth in the early spring and flowering begins in late spring and early summer. Fruits mature through the summer and seeds are usually shed by late August.

ECOLOGY

Lomatium dissectum var. *dissectum* appears to require more moist conditions than the related var. *multifidum* or any of the other *Lomatium* species found at Craig Mountain. In Idaho, it is restricted to relatively mesic grassland habitats, often bordering and intermixing with adjacent open woodlands. Sites supporting var. *dissectum* were historically subject to periodic burns. It is unknown what role, if any, fire has in the life history of var. *dissectum*.

CONSERVATION ASSESSMENT

Idaho:

The distribution of fern-leaved desert-parsley is limited in Idaho. Recent field surveys have shown it to be locally common at Craig Mountain. As long as Craig Mountain remains the only place it occurs with any abundance in Idaho, fern-leaved desert-parsley should remain a state conservation concern. Reflecting discoveries made at Craig Mountain, we recommend a status change from State Sensitive to Monitor, and a Biodiversity Information Network status change from S1 to S3.

Craig Mountain:

Very little was known regarding fern-leaved desert-parsley in Idaho until recent field investigations at Craig Mountain. At Craig Mountain, populations on The Nature Conservancy's Garden Creek Preserve (010, 018) are presently protected. Portions of two populations occur on specially designated BLM tracts, the Craig Mountain ACEC (015) and the Captain John Creek RNA/ACEC (022). Craig Mountain harbors most of the fern-leaved desert-parsley known in Idaho and is central to the species conservation in the state.

Encroachment by aggressive weedy exotics is the most serious and widespread threat to populations at Craig Mountain. Yellow starthistle has already invaded parts of several populations and is poised to do so at others. The relatively mesic habitats supporting fern-leaved desert-parsley are not as susceptible to yellow starthistle invasion compared to adjacent drier, more open sites. Therefore, threats from yellow starthistle are generally not as pervasive or imminent as for some other rare plants. Livestock grazing has, or continues to occur at most sites and may make the establishment of weeds more likely. Herbicide spraying is a potential threat, especially at sites near roadways.

A number of populations occur within forest fringes or areas bordering forests. Logging and its associated soil disturbing activities pose a potential threat to parts of these populations. In the Swamp Creek area, reseeding with pasture grasses occurred in the vicinity of fern-leaved desert-parsley (012). What effect, if any, this had on the population is unknown. Road construction has impacted a couple of populations. Future road or land clearing activities and herbicide spraying are potential concerns in some places already near roads.

MANAGEMENT RECOMMENDATIONS - Craig Mountain

Points related to a weed control program and livestock management have been outlined earlier in this report. These two actions will help confront the ongoing degradation of fern-leaved desert-parsley's grassland habitats.

Populations occurring along forest fringes or in grassy openings within the forest are potentially threatened

by logging-related activities. Appropriate planning should avoid adverse impacts to fern-leaved desert parsley plants. Portions of the Deer Creek (016), Redbird Ridge (019) and Lake Creek (020) populations occur near roads or powerline right of ways. Herbicide spraying is a concern at these sites.

PEDIOCACTUS SIMPSONII (Engelm.) Britt. & Rose VAR. *ROBUSTIOR* Coult.

TAXONOMY

Common name: Simpson's hedgehog cactus

Family name: Cactaceae

Common name for family: Cactus

Original publication: Britt. and Brown. 1913. Ill. Fl. 2nd ed. 2:570, fig. 2983.

Alternative taxonomic treatments: There are three generally recognized varieties of *Pediocactus simpsonii*, one of which is var. *robustior*. Hitchcock (1961a) states that var. *robustior* is the only one of the three found in the Pacific Northwest, the others being confined to points south and east of Idaho. In their analysis of the *Pediocactus* group, Arp and Rodgers (1970) conclude the varieties are biologically sound. The varieties are not recognized in *A Utah Flora* (Welsh et al. 1987) noting that segregation into varieties seems impractical or even impossible for Utah material.

History of knowledge of taxon in Idaho: In his evaluation for the Rare Plants Technical Committee of the Idaho Natural Areas Council, Steele (1981) recommended Simpson's hedgehog cactus be added to the State Watch List. He remarked that it is widespread in Idaho, but may be exploited by cactus hunters.

DESCRIPTION

General non-technical description: This spiny cactus grows singularly or in clusters. It is depressed to more or less subglobose in shape, with stems up to 5 inches in diameter. Stems are longitudinally ribbed, with the ribs bearing tubercules (small, rounded projections). Plants contain numerous whorls of sharp, stout, whitish to yellowish or reddish-brown spines up to nearly 2 inches long. Flowers are showy, up to 1 inch in diameter, occur in a crowded ring around the top of the plant, and are usually rosy-pink in color, although sometimes yellowish-green or white. Fruits are small, subglobose to cylindric in shape, and splitting when ripe to discharge the large blackish seeds.

Technical description: Stems subglobose to depressed, single to clustered, 7-12 cm thick; tubercles 12-25 mm long, in 8-13 spiral rows; central spines 8-12, straight, yellowish to reddish-brown, 8-25 mm long; marginal spines 10-30, smaller, whitish; flowers 1.5-2 cm long, yellowish-green to purplish; fruits subglobose, 6-8 mm long; seeds black, about 3 mm long (Hitchcock 1961a).

Local field characteristics: Their fleshy, spiny habit mark the cacti as a distinctive group. Simpson's hedgehog cactus is generally distinguishable from other cactus by the following combination of characters - spines that are all straight and up to only 2 inches long, none are hooked; stems that are not jointed, but are longitudinally ribbed; stems up to about 5 inches in diameter, although often considerably less; and

flowers borne in a ring near the top of the plant. A line drawing appears in Appendix 4.

Similar looking species: At Craig Mountain, there are only two cactus species present, Simpson's hedgehog cactus and prickly-pear cactus (*Opuntia polycantha*). Prickly-pear can be quickly identified by its jointed, more or less flattened stems. The flowers of prickly-pear cactus are more solitary and not arranged in a ring at the top of the plant. Finally, in addition to spines, prickly-pear cactus has barbed bristles (glochids), no other cactus in Idaho has this feature.

LEGAL OR OTHER FORMAL STATUS

National:

U.S. Fish and Wildlife Service: Simpson's hedgehog cactus is not a federal candidate.

Bureau of Land Management: Simpson's hedgehog cactus is a BLM Sensitive Species in Idaho (Conservation Data Center 1994).

U.S. Forest Service: None.

Other current formal status recommendations: Simpson's hedgehog cactus is given a global rank of 4 by the Biodiversity Information Network - the International Association of Natural Heritage Programs and Conservation Data Centers (Conservation Data Center 1994). The G4 rank (on a scale of 1-5) indicates that globally, this taxon is not rare and is apparently secure, but with cause for long-term concern.

State:

Idaho

Idaho Native Plant Society: Simpson's hedgehog cactus is in the Idaho Native Plant Society Monitor category. This category contains species that are common within a limited range as well as those which are uncommon, but have no identifiable threats (Idaho Native Plant Society 1994).

Conservation Data Center: The Biodiversity Information Network state ranking is S3, indicating that in Idaho, Simpson's hedgehog cactus is rare or uncommon, but not imperiled (Conservation Data Center 1994).

Nevada

In Nevada, Simpson's hedgehog cactus is protected, along with many other cacti, yucca and Christmas tree species under Nevada State Law NRS 527.060.120. The Nevada Natural Heritage Program gives it a S2 ranking, reserved for taxa imperiled due to rarity or other demonstrable factors (Morefield and Knight 1991).

Oregon

It is on the Oregon Natural Heritage Program's List 4. This list contains taxa which are of conservation concern, but are not currently threatened. They may not require the same active management as more threatened species, but do require monitoring (Oregon Natural Heritage Program 1993).

Utah

In Utah, it appears on the Utah Natural Heritage Program's Special Plant List (Utah Natural Heritage Program 1990).

Washington

The Washington Natural Heritage Program includes Simpson's hedgehog cactus on its Monitor - 3 List. The Monitor list contains taxa of potential concern, but for which no status is currently assigned. Group 3 indicates the species is more abundant and/or less threatened in Washington than previously assumed (Washington Natural Heritage Program 1994).

Throughout its range, overcollecting is considered a potential threat. Habitat destruction, alteration or degradation are also concerns in some places.

DISTRIBUTION

Pediocactus simpsonii var. *robustior*, as interpreted by Hitchcock (1961a), occurs from eastern Washington, south to Nevada. That var. *robustior* is mostly restricted to inland portions of the Pacific Northwest is not universally agreed, and its range is sometimes given for that of the species. This more liberal view would extend the range of var. *robustior* eastward across the western states to Colorado, and southward to northern Arizona and New Mexico.

In Idaho, the majority of Simpson's hedgehog cactus populations occur south of the Snake River Plain, from the Owyhee uplands, eastward to Twin Falls County, the South Hills, the Albion Mountains and onto the Sublette Range of southeastern Idaho. Populations are also known from the Craig Mountain area and one further south in Hells Canyon.

Craig Mountain:

At Craig Mountain, Simpson's hedgehog cactus occurs along the Wapshilla Ridge complex from upper Cottonwood Creek to the breaks above the confluence of the Snake and Salmon rivers. Plants are more common and extend further downslope on the Snake River side of Craig Mountain versus the Salmon River side. This pattern has been observed for a few other species as well.

DEMOGRAPHY- Craig Mountain

Craig Mountain supports the most extensive Simpson's hedgehog cactus populations in northern Idaho. Five more or less distinct occurrences have been mapped for Craig Mountain (Appendix 5). Two populations were discovered during field surveys conducted during 1993-1994. Substantial extensions were made to several other populations. Population data is summarized below. Additional information is contained in the Element Occurrence Records (Appendix 6). Explanations of EOR, Site Name, and EO Rank terms are given on page 47.

Simpson's Hedgehog Cactus - Population Summary for Craig Mountain

EOR#	Site Name	ca. # plants	ca. size	EO Rank
004	Wapshilla Ridge	7000	10+ acres	A
006	Southern Wapshilla Ridge	5,000+	10+ acres	A
007	Frenchy Creek	3500	10+ acres	A
009	Cottonwood Creek	500	2+ acres	A
026	Upper Cottonwood Creek	2500	5+ acres	A

LAND OWNERSHIP - Craig Mountain

Five occurrences of Simpson's hedgehog cactus have been documented for Craig Mountain. Each occurrence consists of several subpopulations, generally representing a series of ridgelines separated by unsuitable canyon grassland habitat. Because of its patchy, but widespread distribution along the Wapshilla Ridge complex, the chosen demarcation of separate occurrences is probably based more on ease of mapping than principles of population biology.

Portions of all occurrences at Craig Mountain are on BPA mitigation land. In most cases this ownership is a majority of the land supporting Simpson's hedgehog cactus. Not every ridgeline that is part of the Wapshilla Ridge complex was surveyed. The full extent of some populations is therefore not known, and it is likely additional subpopulations exist. These are located in inaccessible mid-elevation portions of the Snake and perhaps Salmon river canyons. A summary of land ownership at Craig Mountain is provided.

Land Ownership for Simpson's Hedgehog Cactus Sites at Craig Mountain

EOR#	Site Name	BPA	BLM	USFS	IDL	PVT
004	Wapshilla Ridge	x	x		x	
006	Southern Wapshilla Ridge	x	x	x	x	
007	Frenchy Creek	x	x			
009	Cottonwood Creek	x			x	
026	Upper Cottonwood Creek	x				x

BPA=Bonneville Power Administration mitigation land, BLM=Bureau of Land Management, USFS=Forest Service-Hells Canyon NRA, IDL=Idaho Dept. Lands, PVT=Private land

HABITAT

In Idaho, Simpson's hedgehog cactus occurs in a variety of open, rocky habitats, and across a wide range of elevations, from 1600 to 8500 feet. It is known from canyon ridges, benches and rims at low- to mid-elevations, as well as exposed, mountain ridgecrests. Soils are generally shallow, rocky and well drained. Documented parent materials include basalt, rhyolite and quartzite. Sites also tend to be stable and not subject to migration. Throughout the state it can be associated with a variety of sagebrush, grassland or juniper communities. It occurs on all aspects, although mostly warmer exposures, and from flat to steep slopes.

Craig Mountain:

At Craig Mountain it is restricted to exposed, rocky ridgecrests and associated small rocky outcrops and stabilized scree. If present, soils are lithic, and bedrock is always close to the surface. Substrates are from basalt, occasionally from metavolcanics or granite. Sites are sparsely vegetated compared to adjacent bluebunch wheatgrass or Idaho fescue grassland communities. Elevations range from 4600 feet along the Wapshilla Ridge spine down to about 1600 feet along some spur ridges. Slopes vary from flat to about 30º. Plants occur on all aspects except perhaps north. Some common associates include *Agropyron spicatum* (bluebunch wheatgrass), *Poa sandbergii* (Sandberg's bluegrass), *Bromus* spp. (annual brome grasses), *Phlox pulvinata* (cushion phlox), *Scutellaria angustifolia* (narrow-leaved skullcap),*Opuntia polycantha* (prickly-pear cactus), *Lomatium* spp. (desert-parsleys), *Sedum* spp, (stonecrops), and *Selaginella wallacei* (Wallace's selaginella).

Simpson's hedgehog cactus occurs within a more open version of the *Agropyron spicatum/Poa sandbergii* scabland plant community described by Johnson and Simon (1987). Portions of some subpopulations include an *Artemisia rigida* (rigid sagebrush) component that approaches the *Artemisia rigida/Poa sandbergii* community outlined by Tisdale (1986). Many sites do not readily fit any published classification.

POPULATION BIOLOGY

Plants flower in early to middle spring depending on elevation, and the rather showy blooms are probably pollinated by a variety of larger insects. Seeds are generally dispersed by mid-summer. The tightly clustered habit of some plants indicates some form of vegetative reproduction also can occur.

ECOLOGY

Simpson's hedgehog cactus can tolerate more cold and moisture than most other cacti, and its range does not extend into the hot, lower desert floors where many other cacti are found. Its cold hardening is apparently in response to decreasing day/night temperatures (Nobel 1982). It is intolerant of slope movement, as its root system is not structured to firmly hold the plant in the ground. This may explain finding uprooted plants in areas of cattle use at Craig Mountain. Based on studies in Colorado, Simpson's hedgehog cactus is readily killed by fire and did not resprout even in areas where other succulents such as prickly-pear cactus and yucca resprouted. Also based on studies in Colorado, plant growth seems to occur in the first few weeks of spring (Arp 1972).

CONSERVATION ASSESSMENT

Idaho:

Simpson's hedgehog cactus is recognized as a conservation concern in several western states, including Idaho, where it is widespread south of the Snake River Plain. Potential threats at some populations include overcollecting, and habitat destruction or degradation. Overall, the species future looks secure in Idaho under current land management practices.

Craig Mountain:

In Idaho, Craig Mountain supports nearly all the known Simpson's hedgehog cactus north of the Salmon River. Although relatively local, the Craig Mountain populations are extensive. Their generally inaccessible locations minimize conflicts. These reasons combine to make Craig Mountain an important reservoir for the species long-term conservation in Idaho.

Threats at Craig Mountain are associated with habitat degradation. Weed invasion by yellow starthistle potentially threatens several populations, although it tends not to establish well on Simpson's hedgehog cactus sites. This tendency may change over time, however, as new ecotypes evolve or are introduced. Many years of excessive livestock grazing has impacted portions of some populations, such as near the southern end of Wapshilla Ridge. At places where livestock use is heavy it is not uncommon to find uprooted cactus plants. Future recreational developments along Wapshilla Ridge could also potentially impact Simpson's hedgehog cactus sites.

Like many succulents, Simpson's hedgehog cactus may be subject to wild plant collecting pressures. It is known from the horticultural trade (Daniel and Rowland 1974). Unregulated collecting of this plant should not be allowed on Craig Mountain.

One population occurs on the BLM's Wapshilla Ridge RNA. Portions of all populations occur on either BLM or IDFG managed lands. This will help make management of Simpson's hedgehog cactus easier at Craig Mountain .

MANAGEMENT RECOMMENDATIONS - Craig Mountain

The conservation of Simpson's hedgehog cactus requires a minimum of special management. Recreation trails should not encroach on ridges where Simpson's hedgehog cactus occurs. Continuing south past roads end, populations of several rare plants, including Simpson's hedgehog cactus are interspersed along the main Wapshilla Ridge axis. Developments along this axis are discouraged.

RIBES WOLFII Rothr.

TAXONOMY

Common name: Wolf's currant (sometimes referred to as Rothrock's currant)

Family name: Grossulariaceae

Common name for family: Currant; Gooseberry

Alternative taxonomic treatments: The name *Ribes mogollonicum* Greene is a synonym. Some taxonomist consider the family Grossulariaceae to be part of Saxifragaceae (the saxifrage family).

History of knowledge of taxon in Idaho: First collected in Idaho, in the Seven Devils Mountains, by St. John and Mullen in 1927. Later collections by Bingham and Miller were from the same general vicinity (Bingham 1987). A population was also discovered in the late 1970's, northeast of McCall. Because it was known from so few sites in Idaho, Brunsfeld (1980c) recommended Wolf's currant be added to the State Watch List.

One new population was discovered in 1992 in the Cold Springs Mountains northwest of Riggins (Moseley and Mancuso 1992). Recent field surveys at Craig Mountain have found several new populations, and very likely represent the species northern limit in Idaho.

DESCRIPTION

General non-technical description: Wolf's currant is a thornless shrub, from 1.5 to 10 feet tall. Leaves are bright green on the upper surface and typically have three shallow, main lobes. Leaf margins are toothed, with the teeth rounded at their apex. Flower stalks are glandular, the flowers whitish and bloom in the spring. Fruits are purplish-black, oval-shaped, glandular berry, and like the flowers, are borne on erect stalks that protrude upward through the leaves.

Technical description: Shrubs, 0.5-3 m tall, unarmed; branchlets glabrous or puberlent; leaf blades 1.2-5.7 cm long, 1.2-8 cm wide, orbicular, cordate basally, 3(5)-lobed, the main lobes again lobed and variously 1- or 2-crenate or -dentate, glabrous except for sessile, clear crystalline glands; racemes 8- to 16-flowered, glandular, the axis ca 1-4 cm long; bracts 3-6 mm long, mostly entire; pedicels 1-5(7) mm long; free hypanthium 0.7-1.5 mm long, green, bowl-shaped, glabrous or puberulent; sepals 2-3 mm long, whitish; petals ca 1.5 mm long, white; styles free or united below the middle; berries 6-10 mm long, blackish, not very fleshy, stipate glandular (Welsh et al. 1987)

Local field characteristics: The bright green, rounded, shallowly lobed leaves and erect flower/fruit stalks protruding above the leaves are good, initial field characteristics and readily distinguish Wolf's currant from most other currants at Craig Mountain. Positive identification requires closer inspection. Useful identifiers include the whitish petals attached to a glandular, shallow cup-shaped hypanthium, the glandular flower/fruit stalks, the dark fruits covered with rust-colored, glandular hairs, and thornless habit. At Craig Mountain, most Wolf's currant plants are less than five feet tall and usually grows in clumps. A line drawing of Wolf's currant appears in Appendix 4.

Similar looking species: There are at least eight other *Ribes* species at Craig Mountain. Only *R. hudsonianum* (stinking currant) has erect flower/fruit stalks. Flower and fruit stalks are drooping, usually below the leaves in all the others.

*R. irriguum (*Idaho gooseberry), *R. lacustre* (swamp gooseberry), *R. niveum* (snow gooseberry), and *R. velutinium* var. *gooddingii* (Goodding's gooseberry) all have stems with spines or prickles. Swamp gooseberry, which commonly occurs with Wolf's currant, has more deeply cut and pointed leaf lobes, and its flowers are usually pinkish colored.

Considering the *Ribes* at Craig Mountain without spines or prickles, *R. aureum* (golden currant) has bright yellow flowers, and *R. cereum* (squaw currant) has relatively small, waxy-looking leaves, and its berry is red. Wolf's currant is most likely to be confused with stinking currant or *R. viscossimum* (sticky currant). Both can occur sympatrically with Wolf's currant at Craig Mountain, especially sticky currant. Besides drooping flower/fruit stalks, sticky currant does feel sticky, this due to the dense, glandular and non-glandular hairs on both sides of the leaves. The leaves of sticky currant are generally larger than Wolf's currant, and they tend to be malodorous. The crushed leaves of stinking currant also tend to be malodorous. The yellowish, crystalline glands on the lower leaf surfaces of stinking currant is probably the easiest way to differentiate it from Wolf's currant. Stinking currant is always associated with riparian habitats at Craig Mountain, this is not the case for Wolf's currant.

LEGAL OR OTHER FORMAL STATUS

National:

U.S. Fish and Wildlife Service: None.

Bureau of Land Management: None.

U.S. Forest Service: Wolf's currant is a U.S. Forest Service Sensitive Species for the Nez Perce NF in Region 1 (U.S. Forest Service 1994) and in Region 6 (Conservation Data Center 1994) where it is known from the Umatilla NF in Washington.

Other current formal status recommendations: Wolf's currant is given a global rank of 4 by the Biodiversity Information Network - the International Association of Natural Heritage Programs and Conservation Data Centers (Conservation Data Center 1994). The G4 rank (on a scale of 1-5) indicates that Wolf's currant is not globally rare and apparently secure, but with cause for long-term concern.

State:

Idaho

Idaho Native Plant Society: Wolf's currant is in the Idaho Native Plant Society Sensitive category. This category contains species with small populations or localized distributions within Idaho that presently do not meet the criteria for classification as Priority 1 or 2, but whose populations and habitats may be jeopardized without active management or removal of threats (Idaho Native Plant Society 1994).

Conservation Data Center: The Biodiversity Information Network present state ranking is S1, indicating that in Idaho, Wolf's currant is critically imperiled because of extreme rarity or because of some factor of

its biology making it especially vulnerable to extinction (Conservation Data Center 1994).

Washington

Wolf's currant is on the Washington Natural Heritage Programs Monitor - Group 3 list, indicating it is a species of potential concern, but for which no status is currently assigned because it is more abundant or less threatened than previously assumed (Washington Natural Heritage Program 1994).

DISTRIBUTION

Wolf's currant is primarily distributed in the southwestern United States, in Arizona, New Mexico, Colorado and Utah. Disjunct populations are known from west-central Idaho (Idaho, Nez Perce and Valley counties), and very southeastern Washington (Asotin County). In Idaho, a few populations are known from Craig Mountain, the northern Seven Devils Mountains and adjacent Cold Springs Mountains, and in the western Salmon River Mountains, east of McCall. Washington populations are primarily located in the Asotin Creek and Tucannon River drainages.

Craig Mountain:

Wolf's currant occurs in the northern half of Craig Mountain. Its distribution extends from Lake Creek southward for about 10 miles, to approximately two miles south of Zaza in the China Creek drainage. Appendix 5 provides a distribution map. Populations are centered around the highest elevations at Craig Mountain. Upper reaches of Lake, Captain John, South Fork Captain John, West Fork Deer, Eagle, China and Corral creeks support Wolf's currant.

DEMOGRAPHY - Craig Mountain

There are seven known occurrences for Wolf's currant in Idaho, three of these from Craig Mountain, where they were discovered during 1993-1994 surveys. Populations at Craig Mountain are comprised of several subpopulations, each with scattered clusters of plants. Subpopulations are generally separated by areas of unsuitable habitat, but in some places, suitable habitat appears to be present, but not occupied. The three Craig Mountain occurrences are estimated to support 2600 plants, distributed over approximately 75 acres. All occurrences may contain additional pockets of plants in nearby areas not surveyed. Population data and ranking are summarized below. Additional information is contained in the appropriate Element Occurrence Record (Appendix 6). Explanations of EOR, Site Name, and EO Rank terms are given on page 47.

Wolf's Currant - Population Summary for Craig Mountain

EOR#	Site Name	ca. # plants	ca. size	EO RANK
005	Big Pine Triangle Pt.	425	10 acres	B
006	Lake Creek	100	5 acres	B
007	Upper Eagle Creek	2000	60 acres	A

LAND OWNERSHIP - Craig Mountain

The scattered distribution pattern of Wolf's currant and fragmented land ownerships surrounding its upland forest habitat complicate management. Portions of each occurrence are located on BPA land, as well as other land. A summary of land ownership at Craig Mountain is provided.

Land Ownership for Wolf's Currant Sites at Craig Mountain

EOR#	Site Name	BPA	BLM	NPT	IDL	PVT
005	Big Pine Triangle Pt.	x	x		x	x
006	Lake Creek	x		x	x	?
007	Upper Eagle Creek	x		x	x	x

BPA=Bonneville Power Administration mitigation land, BLM=Bureau of Land Management, NPT=Nez Perce tribal land, IDL=Idaho Dept. of Lands, PVT=Private

HABITAT

In the southern part of its range, the habitat for Wolf's currant is mountain brush, aspen, Douglas-fir and spruce-fir communities, usually in the shade (Welsh et al. 1987). It occurs as an understory shrub within subalpine fir communities in Washington (Brooks et al. 1991). Populations in the Seven Devils Mountains of Idaho, occur under partial shade in open, park-like woodlands in the Douglas-fir, grand fir and subalpine fir zones.

Craig Mountain:

Wolf's currant is primarily associated with the coolest habitats occurring at Craig Mountain. Sites supporting Wolf's currant are among the highest elevations at Craig Mountain, usually above 4700 feet, but down to 4000 feet along some north slopes or in drainages where cool air settles. It occurs within several grand fir and subalpine fir series habitat types (Cooper et al. 1987). It occasionally extends downslope into the adjacent Douglas-fir canyon forest, but apparently never very far. Forest communities are usually in a middle to later seral condition.

Plants typically occur along forest margins and other areas with relatively open canopy cover. It does not seem to occur in denser forested stands and only rarely in places with near full sunlight. Wolf's currant can be found proximate, but not within riparian zones. Sites within the forested plateau uplands are flat to gently rolling. It occurs on all aspects, but mostly northerly exposures towards it lower elevational limit. Soils are mostly loamy and deep, occasionally rocky.

Some commonly associated species include *Abies grandis* (grand fir), *Abies lasiocarpa* (subalpine fir), *Pseudotsuga menziesii* (Douglas-fir), *Picea engelmannii* (Engelmann spruce), *Vaccinium globulare* (globe huckleberry), *Menziesia ferruginea* (fools huckleberry), *Lonicera* spp. (honeysuckle species), *Symphoricarpos albus* (common snowberry), and other *Ribes*, especially *R. lacustre* (swamp currant) and *R. viscosissimum* (sticky currant).

POPULATION BIOLOGY

At Craig Mountain, flowering occurs in May and fruits are ripe by about mid-summer. Although not observed at Craig Mountain, pollination is probably via insect vectors. Birds and mammals are the primary dispersal agents for *Ribes* (U.S.D.A. 1974). Most *Ribes* can be readily propagated from cuttings and some are known to reproduce by layering. Rhizome extension is limited, but species in the genus *Ribes* can sprout from root collars following cutting (Haeussler 1990). It is unclear if Wolf's currant reproduces vegetativly at Craig Mountain.

ECOLOGY

Most *Ribes* species germinate in the spring following dispersal and require a long cold dormancy. Plants are several years old before they produce seed. The best seedbed for *Ribes* seems to be moist mineral soil with ample humus (U.S.D.A. 1948).

Wolf's currant prefers relatively open canopy conditions and like some other *Ribes* species may be expected to temporarily increase following partial canopy removal. Because it generally does not grow in full sun, it may be expected to be lost from a site, at least temporarily, if total canopy removal occurs. It is locally common at Craig Mountain, but generally is not very extensive. It probably does not reach density levels detrimental to conifer regeneration.

Some other, better studied *Ribes* are fairly resistant to fire kill, and sprouting can occur from surviving rhizomes and root crowns if the fire is not to severe (Haeussler 1990). Game and non-game animals are known to use *Ribes* (Haeussler 1990). How much Wolf's currant is used on Craig Mountain is unknown. *Ribes* are hosts for several pathogens including *Cronartium ribicola* (white pine blister rust) and other rusts (Haeussler 1990).

CONSERVATION ASSESSMENT

Idaho:

The northern Seven Devils and Cold Springs Mountains populations are within the Hells Canyon NRA and are relatively secure. Selective additional surveys and monitoring have been recommended (Moseley and Mancuso 1992). Little is known about the population reported east of McCall located on the Payette NF. Recent discoveries at Craig Mountain are significant additions to the conservation of Wolf's currant in Idaho. It remains uncommon in Idaho and several populations are subject to potential threats related to logging, grazing and roading. The long-term outlook for the conservation of Wolf's currant in Idaho is good as long as management activities do not severely alter its habitat. It should remain a conservation concern in Idaho, although its conservation priority ranking can be downgraded from State Sensitive to Monitor, and its Biodiversity Information Network status changed from S1 to S3..

Craig Mountain:

Craig Mountain is one of three areas where Wolf's currant is known to occur in Idaho. Craig Mountain likely represents the northern distributional limit for the species. Populations at Craig Mountain persist in areas that have been both logged and grazed, but only where forest structure remains relatively intact. It

does not occur in areas formerly clearcut and now dominated by lodgepole pine. How much, if any, past logging operations have effected the species' abundance and distribution at Craig Mountain is unknown. The most serious potential threat to Wolf's currant at Craig Mountain is habitat loss or degradation following logging operations. Only silvicultural methods that would remove a large portion of the forest canopy probably pose a significant threat. Roads, loading decks and other disturbances associated with logging operations may prove detrimental on a more local scale. Timber harvest has been and continues to be an ongoing enterprise at Craig Mountain. Wolf's currant is known to occur in the vicinity of State and private lands subject to timber harvest. All populations occur across various land ownership boundaries, complicating the coordination of any conservation management.

MANAGEMENT RECOMMENDATIONS - Craig Mountain

Habitat degradation associated with timber harvest operations are a potential threat to most Wolf's currant populations. Distribution maps (Appendix 5) should be consulted in any timber sale planning. If areas supporting Wolf's currant are to be logged, silvicultural prescriptions should avoid or minimize impacts to Wolf's currant.

THELYPODIUM LACINIATUM (Hook.) Endl. VAR. *STREPTANTHOIDES* (Leiberg) Pays.

TAXONOMY

Common name: Purple thick-leaved thelypody

Family name: Brassicaceae

Common name for family: Mustard; Crucifer

Original publication: Payson. 1922. Annals of the Missouri Botanical Garden. 9:274.

Alternative taxonomic treatments: The treatment of var. *streptanthoides* as a separate entity deserving distinct taxonomic recognition is controversial. In his biosystematic study of the genus *Thelypodium*, Al-Shehbaz (1973) does not recognize it, instead he considers it the same as *T. laciniatum*. He argues that var. *streptanthoides* is very similar to *T. laciniatum* except for the latter's white flower color. Also, other characters said to separate the two often break down within a population. He states that although the purple-flowered form (var. *streptanthoides*) is restricted to the northern portion of the species range, and the more common white-flowered (*T. laciniatum*) is less common in the north, the two forms seem to intergrade in a number of places in northern Oregon and western Idaho. Furthermore, intermediates with various color intensities have been found.

Both Hitchcock (1964) and Hitchcock and Cronquist (1973) recognize var. *streptanthoides* as a valid taxon.

DESCRIPTION

General non-technical description: Purple thick-leaved thelypody is an erect, often multi-branched,

biennial herb. It can range in size from about one foot to over three feet tall. Stems are without hairs. Basal leaves are deeply lobed and large, with the stem leaves numerous and reduced in size upwards. Flowers are purplish-colored. The inflorescence is an elongated, showy, densely flowered raceme. Fruits are narrow, usually 2 or more inches long and spreading.

Technical description: Glabrous and glaucous biennial 3-25 dm tall, the stem often fistulose, usually freely branched; leaves rather fleshy, the basal ovate or deltoid-lanceolate, 1-4.5 dm long, long-petiolate, sharply and deeply lobed, the cauline numerous, reduced upwards, petiolate, subpinnatifid to nearly entire; racemes elongate, the pedicels stout, 2-5 mm long, spreading to erect; calyx tubular-campanulate, the sepals 3.5-7 mm long, greenish-white to purplish, slightly or not at all saccate at the base; petals white [purple in var. *streptanthoides*], 6-20 mm long, linear to narrowly spatulate; filaments shorter than the petals; anthers 1.5-4 mm long, apiculate; siliques very slightly flattened, spreading to erect, straight to strongly arcuate, 3-14 cm long, about 1 mm thick; stipe 1-4 mm long; style (0.5) 1-3 (3.5) mm long; stigma small, not lobed; cotyledons obliquely accumbent (Hitchcock 1964).

Local field characteristics: The tall, leafy habit and elongated, dense inflorescence of purple flowers are distinctive. Later in the season, the numerous, spreading, long and linear-shaped fruits are also distinctive. Plant skeletons from previous years are generally mixed with the present year's cohort of flowering individuals and can be helpful to find and identify populations where most plants are not in flower. Furthermore, purple thick-leaved thelypody is restricted to rock outcrop habitats. A line drawing appears in Appendix 4.

Similar looking species: There are numerous other members of the mustard family that occur at Craig Mountain. The following suite of characteristics will readily differentiate purple thick-leaved thelypody. It is amply leaved, the leaves do not clasp the stem, and the entire plant is essentially without hairs. Flowers are purple and arranged in an elongated, dense inflorescence. Fruits are long and narrow and spreading. The fruits are not strongly ascending or drooping. Its large stature and rock outcrop habitat can also help distinguish it from many other mustards.

Except for its purple flowers, purple thick-leaved thelypody looks like the more common and widespread type species (*T. laciniatum* var. *laciniatum*), which has white flowers. Both occur at Craig Mountain. Therefore, flowers are necessary for positive identification.

Location can also aid in distinguishing the two varieties at Craig Mountain. Recent field investigations found distinct distributions for the two varieties at Craig Mountain. In the Craig Mountain area, var. *streptanthoides* occurs the length of the Snake River canyon and in the very lower Salmon River canyon to about the mouth of Rock Creek (Idaho County). Upriver from about Rock Creek, only var. *laciniatum* occurs. Additionally, var. *laciniatum* was never observed within the Snake River Canyon.

LEGAL OR OTHER FORMAL STATUS

National:

U.S. Fish and Wildlife Service: None.

Bureau of Land Management: None.

U.S. Forest Service: None.

Other current formal status recommendations: Purple thick-leaved thelypody is given a global rank of 4 by the Biodiversity Information Network - the International Association of Natural Heritage Programs and Conservation Data Centers (Conservation Data Center 1994). The G4 rank (on a scale of 1-5) indicates that purple thick-leaved thelypody is not rare and apparently secure, but with cause for long term concern.

State:

Idaho

Idaho Native Plant Society: Purple thick-leaved thelypody is in the Idaho Native Plant Society Sensitive category, indicating it has small populations or a localized distribution in Idaho. It presently does not meet the criteria for classification as Priority 1 or 2, but whose populations and habitats may be jeopardized without active management or removal of threats (Idaho Native Plant Society 1994).

Conservation Data Center: The Biodiversity Information Network state ranking is S1, indicating that in Idaho, this species is critically imperiled because of extreme rarity or because of some factor of its biology making it especially vulnerable to extinction (Conservation Data Center 1994).

DISTRIBUTION

Purple thick-leaved thelypody is regionally endemic to eastern Washington, northeastern Oregon and the adjacent western edge of Idaho. In Idaho, it occurs at Craig Mountain, and one additional population that is known from the Snake River canyon in nearby Idaho County.

Craig Mountain:

At Craig Mountain, purple thick-leaved thelypody is known from the Snake River canyon as far north as Redbird Creek. Scattered populations probably extend further north to the Lewiston vicinity. Within the very lower Salmon River canyon, it occurs downriver from about the mouth of Rock Creek (Idaho County, at approximately river mile 4.5) to the Snake River confluence. Upriver from this point, only the white-flowered var. *laciniatum* has been documented. Within the Snake and Salmon river canyons, it is known from the river bottoms up to about 4000 feet elevation.

DEMOGRAPHY- Craig Mountain

Craig Mountain supports 12 of the 13 occurrences of purple thick-leaved thelypody known in Idaho (Appendix 5). The 12 occurrences total at least 7000 individuals, with the large Salmon River-Snake River Confluence (012) population alone accounting for roughly 5000 plants. Several populations apparently support relatively few plants, often less than 100. At nearly all sites, however, additional, sometimes substantial, unsurveyed potential habitat is present and very likely contains more plants. Population numbers presented below are conservative. Suitable cliff and rock outcrop habitat for purple thick-leaved thelypody is widespread, but often scattered at Craig Mountain. Additionally, much of its habitat is basically vertical and very difficult to survey. For these reasons the full extent of most populations is probably greater than delineated on the distribution maps in Appendix 5.

Many occurrences consist of scattered subpopulations. Generally, plant densities are low and not all habitat at a particular site is occupied. Occurrences range in size from a single rock outcrop to scattered cliffs along several miles of river canyon.

Population data and ranking are summarized below. Approximate size information for a particular population was usually not collected, and is not provided as done for other species. Additional information is contained in the appropriate Element Occurrence Record (Appendix 6). EOR, Site Name and EO Rank terms are explained on page 47.

Purple Thick-Leaved Thelypody - Population Summary for Craig Mountain

EOR#	Site Name	ca. # plants	EO RANK
002	Cottonwood Creek	250	B
003	Captain John Rapids	20	B
004	East of Frenchy Creek	50	B
005	Head of First Creek	20	B
006	Lone Pine Creek	30	B
007	Frenchy Creek West	20	B
008	Tepee Peaks	1	D
009	Corral Creek	>500	A
010	Gold Hill	150	A
011	Lower Madden Creek	10	D
012	Salmon/Snake Rivers Confluence	>5000	A
013	South of Redbird Creek	1000	A

LAND OWNERSHIP - CRAIG MOUNTAIN

Of the twelve occurrences of purple thick-leaved thelypody documented for Craig Mountain, only two were known prior to 1993 and 1994 field surveys. Because some populations are scattered over a relatively large area, they often cross ownership/administrative boundaries.

Two occurrences (005, 007) are restricted to BPA mitigation land. Another four (002, 004, 010, 012) are located at least in part on BPA mitigation lands. Two small occurrences (008, 011) are found solely, and one larger occurrence (003) partly, on the Craig Mountain WMA. The Corral Creek occurrence (009) is on The Nature Conservancy land. All other sites occur across areas of mixed ownership.

Land Ownership for Purple Thick-Leaved Thelypody Sites at Craig Mountain

EOR#	Site Name	BPA	IDFG	BLM	USFS	IDL	TNC	PVT
002	Cottonwood Creek	x		x	x	x		x
003	Capt. John Rapids		x					x
004	East of Frenchy Creek	x		x				
005	Head of First Creek	x						
006	Lone Pine Creek			x	x			
007	Frenchy Creek West	x						
008	Tepee Peaks		x					
009	Corral Creek						x	
010	Gold Hill		x		x			x
011	Lower Madden Creek		x					
012	Salmon/Snake Confluence	x		x	x			
013	S of Redbird Creek		x					x

BPA=Bonneville Power Administration mitigation land, IDFG=Idaho Dept. Fish & Game (Craig Mountain WMA), BLM=Bureau of Land Management, USFS=Wallowa Whitman NF, Hells Canyon NRA, IDL=Idaho Dept. of Lands, TNC=The Nature Conservancy's Garden Creek Preserve, PVT=Private

HABITAT

Throughout its range, purple thick-leaved thelypody grows primarily in crevices of canyon cliffs or other rocky outcrops (Al-Shehbaz 1973).

Craig Mountain:

At Craig Mountain, purple thick-leaved thelypody occurs in cracks, ledges and occasionally talus of canyon cliffs, crags, rims, and other rocky outcrops associated with the Snake and lower Salmon river canyons. Outcrops are relatively sparsely vegetated and surrounded by bluebunch wheatgrass canyon grassland habitats. Purple thick-leaved thelypody occurs on all aspects, but southerly aspects are most common. Slopes are generally steep, often vertical. It occurs in full sunlight or partial shade. Elevations range from 4000 feet, to less than 900 feet along the river corridors. Substrates are basalt, metavolcanics, granite or limestone. Associated species include *Agropyron spicatum* (bluebunch wheatgrass), *Bromus tectorum* (cheatgrass), *Penstemon triphyllus* (whorled penstemon), *Phacelia linearis* (threadleaf phacelia), *Glossopetalon nevadense* (spiny greenbush) and *Opuntia polycantha* (prickly-pear cactus).

POPULATION BIOLOGY

Purple thick-leaved thelypody is a biennial. After the first growing season, plants consist of a basal rosette of leaves. Flowering, seed production and death occur during the second year.

All of the biennial *Thelypodium* species seem to have an obligate cold requirement to induce flowering. Flowering mostly occurs in spring, mainly early May through June. The dense, showy inflorescence likely

contribute to attraction of insects for pollination. The flowers of *Thelypodium* possess certain features that appear to reduce the chances of selfing (Al-Shehbaz 1973). Fruits mature during the summer and seeds are mostly dispersed by the end of summer. Seeds are small and light. Wind and probably water are important dispersal agents.

Al-Shehbaz (1973) notes that various types of isolation, such as seasonal, ecological, reproductive and geographical generally serve to maintain well-defined species in the genus *Thelypodium*.

ECOLOGY

Purple thick-leaved thelypody is restricted to rocky outcrop habitats. Comparing the number of old skeletons (last year's flowering plants) to the number of plants that are flowering at a particular site, it becomes apparent that numbers fluctuate from one year to the next.

CONSERVATION ASSESSMENT

Idaho:

Purple thick-leaved thelypody has a very limited distribution in Idaho. Recent field surveys at Craig Mountain indicate it is locally widespread, but in most places not common. Its distribution may extend further up and down the Snake River canyon than presently known, but this has not been documented. It is not as rare in Idaho as previously believed, and conservation concerns are now much less acute. Nonetheless, as long as Craig Mountain is the only place it is known to occur in any abundance, purple thick-leaved thelypody is worthy of conservation consideration. Reflecting discoveries made at Craig Mountain, we recommend a status change from State Sensitive to Monitor, and Biodiversity Information Network status change from S1 to S3..

Craig Mountain:

Craig Mountain supports all but one of the known purple thick-leaved thelypody populations in Idaho. Although widespread in the Snake and lower Salmon river canyons, it is abundant in only a few places. The canyon walls and other rocky outcrop habitats of purple thick-leaved thelypody are secure from most threats. At a couple of sites, possible competition from cheatgrass has been observed. Throughout the canyon system other aggressive weeds are also potential threats. A few, such as yellow starthistle, common crupina and Klamath weed have been observed sympatric with purple thick-leaved thelypody. Presently, these weeds occur at such sites in low densities and generally do not appear well adapted to the same habitat as purple thick-leaved thelypody. The potential for this adaptability to change over time is unknown. As is the case regarding several other Idaho rare plants, the conservation of purple thick-leaved thelypody in Idaho, rests with its conservation at Craig Mountain.

MANAGEMENT RECOMMENDATIONS - Craig Mountain

No special management recommendations are made for purple thick-leaved thelypody. Its cliff habitats are generally secure from habitat manipulations. A weed control program is the most important element to help the conservation of this species at Craig Mountain.

TRIFOLIUM PLUMOSUM Dougl. VAR. *AMPLIFOLIUM* Martin

TAXONOMY

Common name: Plumed clover

Family name: Fabaceae

Common name for family: Pea; Legume

Original publication: Martin, Bulletin of the Torrey Botanical Club, 73:369. 1946.

Alternative taxonomic treatments: Gillett (1972) treats this taxon at the subspecies rather than the varietal rank. Under this interpretation the taxon's name is *Trifolium plumosum* Dougl. subsp. *amplifolium* (Martin) Gillett.

History of knowledge of taxon: Recommended for federal Threatened status by Johnson (1977c) during the initial evaluation of Idaho's rare flora. In a subsequent evaluation, realizing it was not as rare and probably not as threatened as previously thought, Johnson (1981c) recommended plumed clover be transferred to the State Watch List. In another early evaluation, Heidel (1979) recommended that special BLM management action was not needed for plumed clover, but further study was suggested.

DESCRIPTION

General non-technical description: Plumed clover is a herbaceous perennial. It can vary from 10 to nearly 24 inches tall. Stems are hairy. Leaves are divided into three leaflets which are linear-shaped and finely toothed along the margins. Basal leaflets are 0.3-0.6 inch wide and acutely tipped. The sepals are densely hairy, and the pea-like flowers are whitish with pink to reddish tips and form a large, dense, cylindrical-shaped head.

Technical description: For *Trifolium plumosum*: Strigillose to villous perennial with short rhizomes; stems simple, 2-5 dm tall; stipules lanceolate, 1.5-3 cm long; leaflets 3, linear to linear-elliptic, 5-9 cm long, usually less than 1 cm broad, often folded and more or less falcate, very finely denticulate to entire; heads 50- to 150-flowered, terminal, cylindric, 2-2.5 cm broad, 3-5 cm long, noninvolucrate; peduncles often shorter than the upper 1 or 2 leaves; flowers 14-20 mm long, spreading to nearly erect, nearly sessile, whitish but with pink to reddish tips; calyx usually well over half as long as (often nearly equal to) the corolla, villous-plumose, the teeth acicular, the lowest one much the longest, the tube 20- to 25-veined, from nearly as long to only half as long as the teeth; keel slightly longer than the wings; legume usually 1-seeded (Hitchcock 1961b).

Local field characteristics: The large, cylindrical-shaped flower head of plumed clover is distinctive. Additionally, flowers are white with pink to reddish tips and are erect or slightly spreading, not reflexed. When not in flower, leaflet characteristics can aid field identification. The leaflets are elongate, linear-shaped, acute-tipped, and have finely toothed margins. They do not have dark green chevrons or other noticeable markings. Plumed clover is an erect plant, it does not trail along the ground or form dense mats like a couple of the more common clovers at Craig Mountain. A line drawing for plumed clover appears in Appendix 4.

Similar looking species: The genus *Trifolium* is well represented at Craig Mountain, with ten species documented. The large, cylindrical-shaped, dense flower head of plumed clover is unique among the species on at Craig Mountain. The following combination of characteristics will readily separate plumed clover from all other congenerics at Craig Mountain - leaflets three and linear-shaped, sepals densely pubescent, flower heads pedunculate (with flower stalks), heads cylindric, and flowers erect to spreading, not reflexed.

LEGAL OR OTHER FORMAL STATUS

National:

U.S. Fish and Wildlife Service: Plumed clover is a federal 3c candidate species (Conservation Data Center 1994). Category 3 is reserved for species that were once considered for listing as Threatened or Endangered, but are no longer under such consideration. Category 3c indicates plumed clover is more widespread or abundant than previously believed, or it is not subject to identifiable threats.

Bureau of Land Management: Plumed clover is a BLM Sensitive Species in Idaho (Conservation Data Center 1994).

U.S. Forest Service: None. Plumed clover is not known to occur on lands managed by the U.S. Forest Service.

Other current formal status recommendations: Plumed clover is given a global rank of 2 by the Biodiversity Information Network - the International Association of Natural Heritage Programs and Conservation Data Centers (Conservation Data Center 1994). The G2 rank (on a scale of 1-5) indicates that plumed clover is imperiled because of rarity or because of other factors demonstrably making it very vulnerable to extinction.

State:

Idaho

Idaho Native Plant Society: Plumed clover is in the Idaho Native Plant Society Sensitive category. This category contains species with small populations or localized distributions within Idaho that presently do not meet the criteria for classification as Priority 1 or 2, but whose populations and habitats may be jeopardized without active management or removal of threats (Idaho Native Plant Society 1994).

Conservation Data Center: Plumed clover is endemic to Idaho, so the Biodiversity Information Network state ranking of S2 is the same as its global rank.

DISTRIBUTION

Plumed clover is endemic to west-central Idaho where it is known from southwestern Clearwater, western Idaho, Lewis and Nez Perce counties. The type location, "Salmon Meadows", Washington County is unknown. It is likely this location is actually from further north than present day Washington County; probably in the vicinity of the Salmon River, close to known localities for this species (Gillett 1972).

The closely related subspecies, *T. plumosum* var. *plumosum* is known primarily from the western Blue

Mountains of northeastern Oregon and adjacent Washington. It does not occur in Idaho.

Craig Mountain:

Plumed clover is known from only three sites at Craig Mountain. Historical collections are known from the Lake Waha and Soldiers Meadow Reservoir areas, and one population was discovered during 1993 field investigations at Larabee Meadows, along Deer Creek. Additional populations may occur in meadows around the hamlet of Forest.

DEMOGRAPHY - Craig Mountain

Three occurrences for plumed clover have been mapped for Craig Mountain (Appendix 5). The historical Lake Waha (EOR# 004) and Soldiers Meadow Reservoir (EOR# 021) sites have not been relocated in recent years and their present status is unknown. Also unknown is population, size, or EO Rank information. Most of the meadows, as well as other areas of potential plumed clover habitat at Craig Mountain, received at least cursory surveys during 1993-1994 fieldwork.

The only documented extant site for plumed clover at Craig Mountain, is in Larabee Meadows (EOR# 025). This small (ca. 0.25 acre) population of 50-100 plants occurs on BPA mitigation land and has been given an EO Rank of "C". Appendix 6 contains the Element Occurrence Records for plumed clover at Craig Mountain.

LAND OWNERSHIP - CRAIG MOUNTAIN

The precise locations of the Lake Waha (004) and Soldiers Meadow Reservoir (021) populations remain uncertain. The Lake Waha site is most likely on private land. The Soldiers Meadow Reservoir site is most likely private or Nez Perce tribal land. There is some BPA mitigation land near the reservoir, so that is another, less likely possibility. The Larabee Meadows site (025) along upper Deer Creek occurs on BPA mitigation land, near private and Nez Perce tribal lands.

HABITAT

Plumed clover occurs in grassland, meadow, and open conifer woodland habitats. Of the 25 Idaho occurrences, 15 occur in grassland habitats, with at least six being remnant Palouse Prairie sites. From the sketchy habitat information provided, at least three or four additional sites likely occur on remnant prairie. Three populations are known from dry or mesic meadows. Four populations are restricted to disturbed areas such as roadsides in areas where the native vegetation has been converted to other uses, mainly agricultural. Finally, three populations are known from open forest and/or forest edge habitats.

It is likely that plumed clover is another Palouse and Camas Prairie regional endemic that has undergone a substantial population decline following the largescale conversion of its native grassland habitat to farmland. It apparently has a wider ecological amplitude than the other Palouse endemics (e.g. *Haplopappus liatriformis*) and is able to persist in habitats other than prairie grasslands.

Plumed clover sites are dry to mesic and in most cases open and grass-dominated. It also occurs in open forest stands, where the understory includes both shrubs and grasses. Sites are flat to gently sloping and can be any aspect. Soils are deep to fairly shallow and usually loamy. Most populations are located

between 3000 and 4000 feet elevation, with the range being 1700 to 5000 feet.

Grassland communities are mostly dominated by Idaho fescue, and include the *Festuca idahoensis/Symphoricarpos albus, Agropyron spicatum-Festuca idahoensis* and probably other related habitat types (Daubenmire 1970). Forested communities support ponderosa pine series habitat types (Cooper et al. 1987).

Craig Mountain:

At Larabee Meadows, plumed clover occurs in one small area. Growing season soil moisture varies from mesic to dry. Soils are loamy to gravelly. The site does not include portions of nearby wet meadow areas. The vegetation has been altered by many years of livestock disturbance. Dominant grasses are presently *Stipa occidentalis* (small needlegrass) and *Phleum pratense* (timothy). Other associates are *Potentilla gracilis* (cinquefoil), *Geum triflorum* (prairie smoke) and *Sanguisorba occidentalis* (annual burnet).

Habitat for the Soldiers Meadow Reservoir (021) population is apparently a dry, grassy area. No habitat information is available for the Lake Waha (004) population.

Other suitable grassland, open forest and meadow habitats occur, but plumed clover is apparently rare at Craig Mountain.

POPULATION BIOLOGY

Little is known regarding the population biology of plumed clover. It reproduces by seed and perhaps also by vegetative means. It flowers in the summer, with most collections taken during July.

ECOLOGY

Plumed clover seems able to withstand some disturbance. At what level of disturbance it disappears from a site is unknown, however. During fieldwork related to his taxonomic study of *Trifolium*, Gillett (1972) noted it was fairly common along fence rows. Areas along a fence row probably receive less disturbance than adjacent open areas. Plumed clover occurs in a variety of habitats, from mesic to dry, and a range of soil conditions. It can be found in both climax and early seral grassland communities. This diversity of habitats suggests plumed clover has a relatively wide ecological amplitude.

CONSERVATION ASSESSMENT

Idaho:

Plumed clover is an Idaho endemic. Its range encompasses portions of the Palouse and Camas prairies, both of which have largely been converted to farm or pasture lands. Logging has taken place in most of the private woodlots in the region. This largescale habitat loss and degradation has resulted in an overall downward trend for plumed clover. With few exceptions, known populations are small and contain few plants (often less than 100). Additional populations undoubtedly exist, but these are also likely limited in extent. Many populations are limited to remnant prairie sites or strips of less disturbed vegetation such as along fence rows and roads. Gillett (1972) notes that near Grangeville he found plumed clover to be fairly common along fence rows, where disturbance is minimal. Fragmentation of many populations has likely

taken place over the past century.

There are 25 occurrences for plumed clover in the Conservation Data Center data base. Eleven of these occurrences are pre-1960 and generally have very little, if any, associated population data. Of the 25 known occurrences for plumed clover, 20 occur on private land. Limited conservation options are available on private lands.

Continued habitat loss and degradation are the most serious threats effecting the long-term conservation of plumed clover. Because many sites are in close proximity to agricultural fields, mechanical disturbance and herbicide spraying are frequent potential threats. Roadwork may potentially threaten some populations. Livestock grazing and logging are ongoing or potential threats at several populations.

In view of its limited distribution, small populations, and array of past, present and potential threats, plumed clover should remain a conservation concern in Idaho.

Craig Mountain:

The Larabee Meadows population of plumed clover is one of the few not on private land, lending it added conservation significance. Although less common at Craig Mountain than elsewhere in its range, any long-term conservation plans for plumed clover should include Craig Mountain.

MANAGEMENT RECOMMENDATIONS - Craig Mountain

Only one population of plumed clover was documented from Craig Mountain. The population in Larabee Meadows should be protected from developments such as water development or impoundment projects. Because sticky goldenweed occurs in the same general vicinity, such protection will benefit both species. Years of heavy livestock grazing has adversely impacted the native vegetation at Larabee Meadows. There is no evidence that the recovery of plumed clover is possible as long as livestock use remains heavy in Larabee Meadows. Lesica and Allendorf (1992) suggest that small populations subject to stressful conditions may not be in as poor genetical condition as is often presumed, and should not be discounted in conservation efforts because of these assumptions.

People who will be working in meadow habitats at Craig Mountain should learn this plant and report new locations promptly. Along with a completed Rare Plant Observation Form (Appendix 2), specimens can be sent to the Conservation Data Center in Boise for verification.

OTHER RARE PLANTS AT CRAIG MOUNTAIN

The rare plants, bank monkeyflower (*Mimulus clivicola*), spacious monkeyflower (*Mimulus washingtonensis* ssp. *ampliatus*), and Spalding's silene (*Silene spaldingii*) occur on Craig Mountain, but not on BPA mitigation or IDFG land. The possibility exists they will be found on these lands in the future.

Description, conservation status, habitat, distribution, and information on land ownership at Craig Mountain are summarized below. Reproductions of line drawings for each species are provided (Appendix 4). Additional information for all Craig Mountain populations are contained in their respective Element Occurrence Records (Appendix 6).

MIMULUS CLIVICOLA Greenm.

Common name: Bank monkeyflower

General non-technical description: A small, generally single-stemmed annual. Leaves are opposite and elliptic in shape. Sticky glandular hairs cover the entire plant which also produce a distinctive musky odor. Flowers are pinkish with yellow marks on the throat and tube, and are elevated on short stalks. The flowers are showy and large relative to the plants small stature. Flowering begins in late May and can continue into mid-July.

Similar looking species: Two similar looking monkeyflowers occur at Craig Mountain. Dwarf purple monkeyflower (*Mimulus nanus*) occupies much drier habitats, does not have a strong odor, has petals that are typically a much deeper purple color, and flowers and fruits subsessile. This species is widespread in xeric, shallow soil openings along ridgelines and on grassland slopes. Cusick's monkeyflower (*Mimulus cusickii*) is also confined to more xeric habitats, has broader leaves, and flowers that are a darker purple compared to bank monkeyflower. At Craig Mountain we observed this plant only within very sparsely vegetated, shallow/gravelly textured soil sites at low elevations in the canyons.

Conservation status: Bank monkeyflower is in the federal 3c category, indicating it is no longer under consideration for listing under the Endangered Species Act. Intensive surveys in recent years have found this species to be more widespread and abundant than previously thought. Bank monkeyflower is a Sensitive species for the BLM, and Regions 1, 4, and 6 of the U.S. Forest Service (Conservation Data Center 1994). It is in the Idaho Native Plant Society Priority 2 category, indicating there are still serious conservation concerns for this species in Idaho (Idaho Native Plant Society 1994).

Distribution: Bank monkeyflower is a regional endemic of the interior Pacific Northwest. Its range includes northern to west-central Idaho and adjacent Oregon (Lorain 1993).

Habitat: Moderately dry slopes in grassland or conifer openings, often in pockets of mineral soil.

Land ownership - Craig Mountain: Bank monkeyflower is known from a single historical collection near Lake Waha (Lake Waha 012). The collection was made by Henderson in 1894. We were unable to relocate this population during our 1993-1994 fieldwork. A map with the approximate location of this collection is in Appendix 5. Dwarf purple monkeyflower occurs in the vicinity of Lake Waha. The original collection needs reexamination and its identification verified. There has been a lot of development in the Lake Waha area in the past century and it is possible bank monkeyflower has been extirpated from the area. It is assumed the original collection was made on private land.

MIMULUS WASHINGTONENSIS Gand. ssp. *AMPLIATUS* (Grant) Meinke

Common name: Spacious monkeyflower

General non-technical description: Spacious monkeyflower is a slender, sparsely pubescent annual, up to about eight inches tall. Flowers are yellow with reddish dots on the throat and quite showy. Calyx teeth are about equal in size (one is not noticeably larger than the others). Leaves are egg- to lance-shaped, often with minute serrations. Flowering occurs in late spring.

Similar looking species: Two other species of monkeyflower that occur at Craig Mountain have yellow-flowers. Yellow monkeyflower (*Mimulus guttatus*) occurs in open, wet habitats throughout Craig Mountain. It can be distinguished by having one calyx tooth noticeably larger than the other four. Plants are also generally more robust compared to spacious monkeyflower. Musk monkeyflower (*Mimulus moschatus*) is found in wet meadow or other moist openings within the upland forests. Plants are mostly matted with leaves in a tight basal rosette and are copiously covered with glandular pubescence. Both yellow and musk monkeyflower are perennials, but at times this can be difficult to distinguish in the field.

Conservation status: Spacious monkeyflower is in the Idaho Native Plant Society Priority 2 category because of its rarity in the state, because populations are small and local, and most face some level of threats (Idaho Native Plant Society 1994).

Distribution: Apparently limited to Idaho, in Nez Perce, Lewis and Idaho counties. The location for the single population at Craig Mountain is mapped (Appendix 5) .

Habitat: Seepy basalt outcrops and vernal seeps at low- to mid-elevations.

Land Ownership - Craig Mountain: There is only one known extant population at Craig Mountain near Lake Waha (Lake Waha 002). It is located on private land.

***SILENE SPALDINGII* Wats.**

Common name: Spalding's silene

General non-technical description: A herbaceous perennial 8-24 inches tall. Leaves are broadly lance-shaped, 2-3 inches in length and up to 0.5 inch wide. The foliage is extremely glandular and has a lime-green color. The sepals are fused most of their length forming a flaring tube (the calyx) about 0.5 inch long. Petals are white and have four short appendages. The blade portion of the petal is minute, only 0.08 inch (1-2 mm) long, and barely sticks outside the calyx. Flowers bloom from mid-July into September.

Similar looking species: There are a number of other *Silene* species found at Craig Mountain that look similar. Flowers are sometimes necessary for positive identification. Vegetatively, Scouler's silene (*Silene scouleri*) is the most similar, however, it has bilobate petals with only two appendages and the petal blades are larger. Douglas' silene (*Silene douglasii*) has more slender stems and leaves and is rarely sticky pubescent. The stems of Douglas' silene also tend to be decumbent versus the erect stems of Spalding's silene. The petal blades are deeply 4-lobed and much longer and narrower for Oregon silene (*Silene oregana*). It is also not as glandular as Spalding's silene (Schassberger 1988).

Conservation status: Spalding's silene is a federal C2 candidate for listing under the Endangered Species

Act, indicating listing is possibly appropriate, but conclusive data on biological vulnerability and threat are not currently available to support proposed rules (Conservation Data Center 1994). The Idaho Native Plant Society has recommended the status of this species be changed to Category 1. The Society feels there already exists substantial information to support the biological appropriateness of proposing to list as Threatened or Endangered (Idaho Native Plant Society 1994).

Distribution: Known from the Palouse Prairie grasslands of north-central Idaho, northeastern Oregon and eastern Washington. It also occurs in grasslands in northwestern Montana and barely into adjacent British Columbia (Lorain 1991). Craig Mountain populations are mapped (Appendix 5).

Habitat: In Idaho, Spalding's silene occupies Palouse Prairie grassland communities. It occurs on undisturbed slopes or flats and swales. It also occurs in small undisturbed strips of vegetation surrounded by cultivated fields. These sites often occur along lower treeline or near scattered ponderosa pine trees. Vegetation is dominated by Idaho fescue with numerous perennial herbs and scattered shrubs. Soils are typically silt/loams (loess) that are moderately deep (Lorain 1991)

Land ownership - Craig Mountain: Three populations are known from Craig Mountain, all discovered in 1993. Two of them (Redensky Bowl 011; Redensky Flats 012) are located within The Nature Conservancy's Garden Creek Preserve. The third occurs on private land in upper Buffalo Draw (Redbird Ridge 010) a little east of the Craig Mountain WMA.

RESEARCH NATURAL AREAS - CRAIG MOUNTAIN

Proposal

We propose two areas for Research Natural Area (RNA) designation at Craig Mountain. The proposed Redbird Creek RNA is located within the Craig Mountain Wildlife Management Area (WMA) - Gaiser Segment. This area has been previously nominated for RNA status as the Grahams Landing proposed RNA (Hilty and Moseley 1991). The proposed Wapshilla Ridge - South RNA is located near the southern terminus of Craig Mountain and encompasses land owned by both the BPA and the Idaho Department of Lands (IDL).

Introduction

A Research Natural Area is a designated unit of land where current natural conditions are maintained as much as possible. These conditions are ordinarily achieved by allowing natural physical and biological processes to prevail without human intervention. RNA's are part of a national network of ecological areas dedicated to research, education and maintenance of biological diversity. Specific objectives guiding their establishment that are pertinent to Craig Mountain are to: 1) preserve a representative array of natural ecosystems and their inherent processes as baseline areas, 2) preserve and maintain genetic diversity, 3) serve as reference areas for the study of succession, 4) serve as baseline areas for measuring long-term ecological changes, 5) serve as control areas for comparing results from manipulative research, and 6) monitor effects of resource management techniques and practices.

Planning

We recommended IDFG take the lead, and establishment of the proposed Wapshilla Ridge - South RNA be incorporated into IDFG plans being developed for management of BPA mitigation lands. To maximize wildlife benefits, IDFG pays the grazing lease fee for the State land included in the proposal. A long-term agreement, land exchange, or some other negotiation may be necessary to insure the integrity of this proposed RNA. Two other proposed RNA's, the Triplet Butte proposed RNA in Owyhee County, and the Southwest Lemhi Range proposed RNA in Butte County, are partially located on lands belonging to IDL. Perhaps Craig Mountain could serve as a model for incorporating these other State lands into the RNA system. Regarding the proposed Redbird Creek RNA, establishment may require revisions to the existing Management Plan for the Gaiser Segment.

The Conservation Data Center is actively involved with establishment of RNA's and other Natural Area designations across the state. The Conservation Data Center will help facilitate the establishment of the RNA's at Craig Mountain as needed. Presently, the BLM has conferred RNA status to two areas at Craig Mountain, Captain John Creek ACEC/ RNA and Wapshilla Ridge ACEC/RNA (ACEC = Area of Critical Environmental Concern). A map of the established and proposed RNA's at Craig Mountain is provided (Figure 4).

Figure 4. Locations for RNA's on Craig Mountain

Redbird Creek proposed RNA

Location: The Redbird Creek proposed RNA is located along the Snake River canyon within the Craig Mountain WMA - Gaiser Segment, about 10 air miles south of Lewiston. The area is approximately 500 acres in size. Access is via a short cross-country hike from the IDFG - Gaiser Segment parking area. The legal description for the area is T33N R5W sec 10 unsurveyed. Proposed boundaries are included in Figure 5.

Description: The proposed Redbird Creek RNA encompasses the upper to lower slopes of a west-facing canyon slope. Numerous east-west trending spur ridges dissect this canyon face creating mostly northerly and southerly aspects. The areas geology is comprised of stratified basalt. Unlike much of the surrounding terrain, there are few cliffs present. Grasslands dominate the vegetation. Bluebunch wheatgrass series associations occur on all aspects except on the upper, northerly-facing slopes, where Idaho fescue communities dominate. Patches of shrubs, including snowberry, rose and serviceberry occur in mesic pockets. Hackberry and other shrubs dominate the lower draws. Two springs surrounded by dense golden current stands are located in the proposed area (Hilty and Moseley 1991).

Justification: The proposed Redbird Creek RNA is an opportunity to add exemplary canyon grassland communities near the northern edge of the Hells Canyon ecosystem to the RNA network. There are a few other proposed RNA's (e.g. Lightning Creek) that include low-elevation canyon grasslands in parts of Hells Canyon west of Riggins, but none for the northern section. Most of the grassland habitats within the proposal area are in good to excellent ecological condition. Only scattered weedy patches occur on the steep slopes. Disturbances and concomitant weed invasion is more widespread along the gentle, upper slopes, near adjacent agricultural lands, and down along the Snake River where slopes are much more gentle and accessible. The overall intact nature of the vegetation in the proposal area contrast sharply to extensive stretches of degraded grassland nearby.

Five permanent research plots were established in the proposal area in 1994. They are part of an initial vegetation monitoring program proposed for Craig Mountain. These plots were originally sampled during research conducted in the 1970's and 1980's by Dr. Ed Tisdale of the University of Idaho, and will provide valuable baseline information for Fish and Game managers. The opportunity for additional monitoring exists within the proposed area.

Populations of three rare plant species occur within the proposed Redbird Creek proposed RNA - Idaho hawksbeard, green-band mariposa lily and purple thick-leaved thelypody. The Idaho hawksbeard population is one of the largest known. It is recommended for possible monitoring elsewhere in this report.

Wildlife values for the area are well documented. Designation will not diminish these values, and may provide more impetus for wildlife studies to be conducted in the area. Watershed and recreational values will also be maintained with designation. Livestock grazing, seeding with non-native plant mixtures, and destructive research are generally excluded from RNA's. Management options, limitation, and other recommendations are specified during the Establishment Record process. We consider the viability and defensibility of the site to be excellent.

Figure 5. Location of proposed Redbird Creek RNA

Wapshilla Ridge - South proposed RNA

Location: The proposed Wapshilla Ridge - South RNA is located near the southern terminus of Craig Mountain. It includes portions of the upper First Creek and an unnamed tributary to the Salmon River drainages centered along Wapshilla Ridge, the narrow divide between the Snake and Salmon rivers. Lewiston is located roughly 32 air miles to the north, and the Snake/Salmon rivers confluence 2.5 miles south. The area is not easily accessed, requiring a 6 mile hike from where the Wapshilla Ridge road is gated. The proposal area is approximately 800 acres in size. The legal description for the area includes portions of T30N R4W sec 35 and 36; T29N R4W sec 1 and 2. Proposed boundaries are included Figure 6.

Description: The Wapshilla Ridge - South proposed RNA is characterized by extremely steep topography. An exception is one bowl-shaped area just south of the Birch Creek triangulation station. Wapshilla Ridge is a very narrow, rocky spine along this segment of the divide. All aspects are represented, but easterly and westerly exposures are the most common. The area is underlain by stratified basalt. Slopes have high bare ground and rock cover and rock outcrops are common. In the upper First Creek drainage, an extensive series of talus/shrub garlands occur beneath the seepage fractures of rock walls. The canyon slopes are dominated by bluebunch wheatgrass series associations. Localized Idaho fescue communities occur along the upper slopes of mesic aspects. Dense mixed tall shrub communities occur in most draw positions. Elevations range from 4524 feet to about 2400 feet.

Justification: The proposal area supports the most near-pristine bluebunch wheatgrass grasslands we observed at Craig Mountain. The grasslands are in excellent ecological condition. During a survey of the area in August 1994, no yellow starthistle was observed within the core of the proposed area. It is probably the largest remnant of non-infested bluebunch wheatgrass grassland at Craig Mountain. The areas remoteness, lack of broad ridges for travel corridors, lack of nearby water, and very steep topography have combined to keep livestock or other uses to a minimum over the years. South of the proposed area, at about the 3400 foot contour along Wapshilla Ridge, the topography moderates until it breaks down to the rivers. Along this section livestock use becomes evident again and condition of the grassland deteriorates, including the presence of yellow starthistle and other weeds. The proposed RNA boundaries coincide with the approximate "yellow starthistle free" zone.

The proposed Wapshilla Ridge - South RNA would serve as an excellent ecological benchmark for regional bluebunch wheatgrass canyon grassland communities. The proposal area would be an excellent complement to the BLM's Wapshilla Ridge RNA, 2.5 miles to the north. That RNA is at a higher elevation and the vegetation is dominated by Idaho fescue and to a lesser extent conifer communities. Bluebunch wheatgrass communities occur on south exposures, but have been seriously invaded by yellow starthistle.

Populations of three rare plants, green-band mariposa lily, purple thick-leaved thelypody and Simpson's hedgehog cactus occur within the proposal area. The area also has important wildlife and watershed values. The remoteness of the area should preclude conflicts with other uses. The proposed Wapshilla Ridge - South RNA is worthy of official recognition and protection.

Figure 6. Location of proposed Wapshilla Ridge - South RNA

VEGETATION MONITORING AT CRAIG MOUNTAIN

Introduction

Agreements regarding Craig Mountain, (e.g., Bonneville Power Administration et al. 1992) between the Bonneville Power Administration, Idaho Department of Fish and Game, and Nez Perce Tribe direct State and Nez Perce Tribe wildlife managers to identify mitigation activities and to develop monitoring plans to evaluate the results of these mitigation activities.

In response to this direction, wildlife and vegetation monitoring strategies are proposed for Craig Mountain that complement recent inventory work. Inventory and monitoring are recognized as essential and interrelated components for scientific conservation planning (Kremen et al. 1993).

Established during the 1994 field season, Fish and Game's proposed vegetation monitoring program at Craig Mountain is presently comprised of three related parts.

1) The reestablishment of permanent monitoring plots at 12 grassland sites originally sampled by Dr. Ed Tisdale during research conducted between 1962 and 1981. These plots are sampled using nested plot frequency methods. Seven of these sites are on, or in close proximity to BPA mitigation land, and five sites are on, or in close proximity to the Craig Mountain WMA - Gaiser section.

2) The establishment of permanent vegetation monitoring plots at 15 small animal pitfall trap array sites and 28 bird inventory transect points. These plots include grassland, wet meadow, riparian zone and forest habitats. All are on mitigation land. The plots are sampled using Western Heritage Task Force (WHTF) site and community survey methods (Bourgeron et al. 1992).

3) The establishment of three permanent monitoring plots for the rare plant *Haplopappus liatriformis*, a federal candidate for listing as Threatened or Endangered. These plots are sampled also using nested plot frequency methods. Two sites are on the Craig Mountain WMA, and one on mitigation land.

Several practical criteria have been considered in this proposed vegetation monitoring design. The number of different techniques has been kept to a minimum. This will facilitate training, equipment requirements, the sharing of data with cooperators, data analysis, and probably the accuracy of the data collected.

Objectives, an overview of general methods, protocols for the three monitoring regimes, recommendations, photographic record, and a summary of other vegetation monitoring efforts at Craig Mountain follow.

Objectives

Vegetation monitoring is one of the keys to natural resource management (Bonham 1989). Good stewardship at Craig Mountain will require an understanding of how management decisions, both manipulative and passive, affect the areas vegetation, especially in reference to wildlife habitat. The overall objectives of the proposed vegetation monitoring program are to evaluate the effects and affectivness of IDFG management actions, and to assess progress towards meeting habitat management and mitigation goals. Proposed vegetation monitoring is primarily designed for the collection of trend data. Trend data quantifies direction of change, if any, away or towards specific management objectives.

The proposed vegetation monitoring program is designed to meet four general criteria:

1) Monitor changes in the quality of habitat for designated mitigation species. The habitats of most designated mitigation species are covered in the established forest, riparian and grassland vegetation monitoring plots designed to meet criteria 2, 3, and 4.

2) Characterize and monitor vegetation associated with selected small animal pitfall trap array sites and bird transect study points. Permanent vegetation monitoring plots have been established at 15 pitfall array sites and 28 bird transect study points. Selected habitat data was collected at an additional 118 bird transect points.

3) Assess conditions and monitor trends in grassland communities, probably the most threatened habitat at Craig Mountain. We reestablished as permanent, 12 grassland monitoring plots originally sampled by Dr. Ed Tisdale (University of Idaho) between 1962 and 1981. Of special interest, is that when originally established, none of these plots contained yellow starthistle. Reestablishment and resampling will provide insight into the spread of yellow starthistle.

4) Monitor selected populations of the rare plant Palouse goldenweed (*Haplopappus liatriformis*). To accomplish this, three permanent Palouse goldenweed monitoring stations were established. Data from these plots are comparable to the Tisdale plots and can also be used to assess ecological condition and trend.

Vegetation monitoring regimes that begin to meet these objectives were established during the 1994 field season at Craig Mountain. Future, additional vegetation monitoring plots are suggested to evaluate habitat responses to specific management activities such as weed control, controlled burning, the removal of livestock, or other habitat manipulations.

OVERVIEW OF GENERAL METHODS

Vegetation monitoring at Craig Mountain uses "frequency" (Tisdale plots; *Haplopappus liatriformis* plots), and/or "composition" and "cover" (all permanent plots) data. "Frequency" refers to the presence of a plant species or other measured attributes in a particular sample area. Frequency is related to, but different than density. By comparing the frequencies of plants in the same area at two different periods in time, it is possible to calculate whether a change has occurred. These changes can be used to evaluate trend and changes in vegetation condition (the current status of vegetation relative to the potential of the site to produce a given vegetation unit). Frequency data are reproducible, simple and quick to sample, are less sensitive to natural yearly weather variations, and statistical analysis straightforward.

The Tisdale and Palouse goldenweed plots use a nested plot technique to measure frequency. This technique consists of observing nested plots of various sizes along a transect, and generally follows the protocol outlined in the Bureau of Land Managements' rangeland monitoring booklet (Bureau of Land Management 1985).

"Composition" implies a list of plant species occurring in a particular sample area, and "cover" refers to the vertical projection of vegetation parts onto the ground (Bonham 1989). Both attributes are important when describing or characterizing vegetation. They also aid in the interpretation of frequency data and can be used to evaluate trend and vegetation changes.

The proposed vegetation monitoring strategy is designed to be adaptable to the periodicity of resampling. For instance, if resampling was scheduled for every three years, but for some reason occurred in year four, data interpretation would not necessarily be compromised.

PROTOCOL FOR RESAMPLING TISDALE PLOTS - CRAIG MOUNTAIN

Introduction

Between the early 1960's to early 1980's, Dr. Ed Tisdale and his students conducted several vegetation studies in the canyon grasslands of the middle Snake and lower Salmon rivers. Their sampling included parts of Craig Mountain. The objectives of these studies were to gain an understanding of canyon grassland ecology, describe and classify the area's vegetation (Campbell 1962; Tisdale 1986), and to study the autecology of some important grass species (Evans 1967; Evans and Tisdale 1972).

During the 1994 field season, as part of its overall proposed vegetation monitoring strategy, IDFG reestablished as permanent plots, 12 sites originally sampled during these earlier research efforts (these are referred to as the Tisdale plots). Attached to these sites are baseline vegetation data now 13 to 30 years old. Sampling was originally chosen to represent relatively undisturbed and uniform plant community conditions.

Grassland vegetation of the middle Snake and lower Salmon river canyons and their tributaries are distinctive and relatively limited in geographic extent. A major portion of the Craig Mountain mitigation lands supports canyon grassland vegetation. The grasslands and its associated mosaic of shrublands and canyon woodlands provide seasonal or year-long habitat for many game and non-game wildlife species. These grasslands also have high recreational, watershed and conservation values, including the presence of many regionally endemic and rare plant species. Integrity of the grassland ecosystem faces several threats, most notably invasion by yellow starthistle, annual bromes, and other aggressive weeds. The baseline information provided by the Tisdale plots would be valuable in monitoring IDFG management objectives and activities at Craig Mountain.

Methods

Plot Relocation

Reestablishing the Tisdale plots required being able to relocate the original sites. This was accomplished using site description information and maps graciously provided by Dr. Tisdale. Relocating sites was straightforward in some cases, but more difficult in others. Dr. Tisdale originally marked his plots by painting rocks. No trace of the painted rocks was found at any sites. We were able to relocate the slopes Tisdale originally sampled, but without markers it was impossible to verify if the reestablished plots were on the identical tract of ground or just in close proximity. The latter case is much more likely, and still allows comparisons to be made.

Twelve plots were reestablished, 94MM001 - 94MM012. Five plots (001-005) are located in or near the Gaiser Segment of the Craig Mountain WMA. Three sites (006-008) are located in the vicinity of upper China Creek along Wapshilla Ridge, and four sites (009-012) in the upper Cottonwood Creek drainage near Wapshilla Ridge (Figure 7).

There were reasonable doubts concerning the true location of two of the original plots. After consultation with Dr. Tisdale, it is likely that plots 005 and 010 were not accurately relocated. These plots are still part of the proposed overall monitoring strategy, but direct comparisons to the original Tisdale data will not be done. We believe the other plots are situated sufficiently close to the original locations to allow for analysis. Dr. Tisdale also provided us with his original plot data, the baseline for future comparisons.

Plot Establishment

1. After locating the plot we defined the macroplot borders. Macroplot dimensions are 30x20 m. Plots are permanently marked using a metal fencepost defining one corner of the macroplot. Fencepost tops are painted red and have the appropriate plot identification code etched on it. Plot locations are marked on USGS topographic maps (Appendix 7). Sketches of the plot, directions, and other notes are also recorded for each plot (Appendix 8).

2. A 30 m tape from the fencepost (0,0 point) is extended perpendicular to the slope. This is the plot's baseline.

3. There are five transects per macroplot. Transects are located in the macroplot perpendicular to the baseline and parallel to the slope. Using random numbers, five points (transect foot markers) were selected along the baseline. The baseline forms one of the rectangular-shaped macroplot's long edges. Transects originate at the baseline and run towards the opposite long axis. This is generally from the uphill towards the downhill position.

Transects are placed perpendicular to the baseline with a compass to insure they are parallel and can be relocated and duplicated in the future. To help insure a straight line transect, one can run another tape along the long axis opposing the baseline, then mark the appropriate foot marks along the tape. Having two known points to run the transect will increase accuracy of transect placement. Note that a compass declination of zero degrees is used for all bearings and other directional measurements.

4. Along the baseline, we permanently marked the foot location of each transect with a painted rebar stake. Transect #1 is the lowest random number chosen between 1-29. For example, if the five random numbers are 4,9,19,24,28 - then Transect #1 is at the 4 m mark, Transect #2 at the 9 m mark, and so forth.

5. Transects are 20 m long. There are 10 microplots, 2 m apart, placed along each transect, beginning from the 1 m tick on the tape. Microplot data are therefore recorded at all the odd meter integers between 0-20. This results in a total of 50 micoplots per macroplot.

Plot Metrics

6. We recorded site characteristics on WHTF Form II - Community Survey Form (Appendix 9). Notes regarding plant phenology, weather, insect infestation, etc. are also recorded.

7. Next, we recorded frequency data for each of the four plot sizes within the microplot nested plot

Figure 7. Tisdale plot locations

frame (Appendix 10). The four sizes are 10 x 10 cm, 25 x 25 cm, 25 x 50 cm, and 50 x 50 cm. Special data sheets have been prepared to record the data (Appendix 11).

8. To obtain frequency data, the plot frame is placed along the tape with the 10 x 10 cm corner of the frame flush with the appropriate meter tick mark on the tape. Plot frames are placed on the right side of the tape when facing the long axis opposing the baseline (downhill in most cases). A species or other measured attribute is tallied only for the smallest nested plot size it in which it occurs at any particular transect point. For instance, if individuals of species "x" occurs in nested plot sizes 25 x 25 cm and 25 x 50 cm, it is recorded only for the 25 x 25 cm plot.

Frequency data is calculated for each of the four nested microplot sizes and forms the basis for comparing data collected one year versus another year. Frequency data are collected for all vascular plants in the microplots, as well as for litter, bare ground, gravel, rock, moss and soil lichens.

9. We completed a total vascular plant species list and corresponding cover class values for the macroplot, WHTF Form III - Ocular Plant Species Data (Appendix 12). Assuming plots are read in late spring, plots should be revisited later in the season if possible, to record any later blooming species.

10. Take overview color photographs and label accordingly.

11. We recommend plots be resampled approximately every 5 years.

Rules for nested plot frequency sampling:

1. Plants must be rooted in the plot to be counted.

2. Annual plants are counted whether green or dried.

3. Specimens of unknown plants can be collected for later identification.

4. Shrub data is better interpreted by methods other than nested plot frequency. Therefore, a line intercept method is used for shrub sampling.

Shrub Sampling

Shrubs are sampled using the Line Intercept Canopy Method (e.g., Bonham 1989). This method is a quantitative measurement of shrub cover and is particularly useful in assessing shrub canopy changes over time.

1. Along each transect, centimeters of live canopy cover intercepted above and below the transect line are recorded by shrub species.

2. Canopy cover is computed as follows: total live canopy cover intercepted (cm) / total line intercept length (cm) x 100 = percent cover.

Differences from original Tisdale sampling methods:

1. We use a slightly larger macroplot, 30 x 20 m, versus the 30 x 15 m Tisdale used. This is to more readily accommodate additional microplots, allowing better comparison with sampling being conducted by the BLM and TNC at Craig Mountain, and increased statistical rigor.

2. We have 50 microplots/macroplot, versus 20 done by Tisdale.

3. We have 5 transects/macroplot, versus 2 for Tisdale.

4. We sample using a nested plot method of four sizes (10 x 10, 25 x 25, 25 x 50, 50 x 50 cms), whereas Tisdale used a 20 x 50 cm microplot (a standard Daubenmire frame).

5. Tisdale estimated cover within microplots, and in some instances did production (clipping) estimates. We do neither.

6. We are not duplicating the extensive soil analysis completed by Tisdale at each site.

7. We are establishing the plots as permanent.

None of these differences should have any significant affect regarding the analysis and comparison of the data sets. An initial analysis of the Tisdale plots is pending and will be reported in a separate publication.

PROTOCOL FOR MONITORING PALOUSE GOLDENWEED (*HAPLOPAPPUS LIATRIFORMIS*) POPULATIONS AT CRAIG MOUNTAIN

Introduction

Palouse goldenweed is a perennial forb endemic to the Palouse Prairie of Idaho and adjacent Washington. It occurs in remnant prairie grassland, and grassland-forest border communities. It flowers from mid-July into early September. Palouse goldenweed is a U.S. Fish and Wildlife Service Candidate 2 species (U.S. Fish and Wildlife Service 1993). Several populations occur at Craig Mountain, including some of the largest known. To help document the effects of Idaho Department of Fish and Game's management on Palouse goldenweed populations, baseline data for a proposed long-term monitoring program was collected in August, 1994.

The main objective of the proposed monitoring plan is to provide a quantitative data set for assessing plant community changes and direction of change (trend) at selected Palouse goldenweed sites. Degradation and loss of high quality habitat are recognized as the primary threat to the long-term conservation of Palouse goldenweed throughout its range (Gamon 1991). The focus of the proposed monitoring plan is the grassland habitat containing Palouse goldenweed, it is not designed to be a demographic study.

A nested plot sampling method is used to collect frequency data within subjectively chosen macroplots. Criteria for macroplot site selection included: 1) sites located on IDFG property, or BPA mitigation land; 2) sites are relatively accessible and easy to relocate; and 3) Palouse goldenweed is well represented at the site (Figure 8).

Figure 8. Palouse goldenweed plot locations

In most regards, plot establishment and sampling methods are the same used for the Tisdale plots.

Methods

Plot Establishment

1. We first determined the location and then defined the macroplot borders. Macroplot dimensions are 30 x 20 m. Plots are permanently marked using a metal fencepost defining one corner of the macroplot. Fencepost tops are painted red and have the appropriate plot identification code etched on it. Plot locations are marked on USGS 7.5' topographic maps (Appendix 13). Sketches of the plot, directions, and other notes are also recorded for each plot (Appendix 14).

2. A 30 m tape from the fencepost (0,0 point) was extended perpendicular to the slope. This is the plot's baseline.

3. There are three transects per macroplot. Transects are located in the macroplot perpendicular to the baseline and parallel to the slope. Using random numbers, three points (transect foot markers) were selected along the baseline. The baseline forms one of the rectangular-shaped macroplot's long edges. Transects originate at the baseline and run towards the opposite long axis. This is generally from the uphill towards the downhill position.

Transects are placed perpendicular to the baseline with a compass to insure they are parallel and can be relocated and duplicated in the future. To help insure a straight line transect, one can run another tape along the long axis opposing the baseline, then mark the appropriate foot marks along the tape. Having two known points to run the transect will increase accuracy of transect placement. Note that a compass declination of 20 degrees east is used for all bearings and other directional measurements.

4. Along the baseline, the foot location of each transect was permanently marked with a painted rebar stake. Transect #1 is be the lowest random number chosen between 1-29. For example, if the three random numbers are 4,9,19 - then Transect #1 is at the 4 m mark, Transect #2 at the 9 m mark, and Transect #3 at the 19 m mark.

5. Transects are 20 m long. There are 10 microplots, 2 m apart, placed along each transect, beginning from the 1 m tick on the tape. Microplots are therefore read at all the odd meter integers between 0-20. This results in a total of 30 micoplots per macroplot

Plot Metrics

6. Record site characteristics on WHTF Form II - Community Survey Form (Appendix 9). Notes regarding plant phenology, weather, insect infestation, etc. are also recorded.

7. Frequency data in then recorded for each of the four plot sizes within the microplot nested plot frame (Appendix 10). The four sizes are 10 x 10 cm, 25 x 25 cm, 25 x 50 cm, and 50 x 50 cm. In addition, Palouse goldenweed plants are recorded in a fifth nested plot size - 100 x 100 cm. This is done to increase the probability of sampling Palouse goldenweed, which generally occurs as scattered individuals or in small clusters. The 100 x 100 cm nested plot is obtained by reading the 50 x 50 cm frame on both sides of the transect tape, in affect doubling the frame size. Special data sheets have been prepared to record the

data (Appendix 11).

8. To obtain frequency data, place the plot frame along the tape with the 10 x 10 cm corner of the frame flush with the appropriate meter tick mark. Plot frames are placed on the right side of the tape as one is facing the long axis opposing the baseline (downhill in most cases). A species or other measured attribute is tallied only for the smallest nested plot size it occurs in at any particular transect point. For instance, if individuals of species "x" occurs in nested plot sizes 25 x 25 cm and 25 x 50 cm, it is recorded only for the 25 x 25 cm plot.

Frequency data is calculated for each of the four nested microplots, plus the fifth (100 x 100 cm) size for Palouse goldenweed. Frequency data is collected for all vascular plants present in the microplot, as well as for the classes litter, bare ground, gravel, rock, moss and soil lichens.

9. We completed a total vascular plant species list and corresponding cover class values for the macroplot, WHTF Form III - Ocular Plant Species Data (Appendix 12).

10. Two additional data sheets (*Haplopappus liatriformis* Monitoring Data Sheets #1 and #2) need to be completed in the field. Data sheet #1 provides information on the height, phenology, number of heads, and evidence and degree of herbivory and/or seed predation on the first 15 Palouse goldenweed plants encountered during plot sampling. Data sheet #2 provides additional information regarding reproductive output, and evidence and degree of herbivory and/or seed predation for five randomly selected plants outside the macroplot. See Appendix 15 for reproductions and further explanation of these data sheets.

11. Take overview color photographs and label accordingly.

Notes

1. The rules for nested plot frequency sampling and shrub sampling methods are the same as outlined for the Tisdale plots.

2. Plots were originally established and read in early August, when Palouse goldenweed is in flower/immature fruit. This is a good time to tally Palouse goldenweed, but it is difficult or impossible to accurately identify many of the senescent forbs present in the plots at this time. To rectify this, it is recommended plots be read twice in future resampling years. First, in spring (early-mid June) when the majority of canyon grassland plant species are in flower and most readily identified, and again in early August when the phenology of Palouse goldenweed is best. An updated Form III should be completed for each macroplot based on information collected in the spring.

<u>Sampling differences for Palouse goldenweed plots versus 1994 Tisdale plots:</u>

1. Three transects/macroplot, versus 5 when sampling Tisdale sites.

2. Thirty microplots/macroplot, versus 50 when sampling the Tisdale sites.

3. The addition of a fifth nested plot, 100x100 cm, for tallying Palouse goldenweed plants.

4. Collection of size, phenological, reproductive, herbivory and seed predation information for Palouse

goldenweed. No equivalent information collected for any species at the Tisdale sites.

5. Compass declination of 20 degrees east used for all bearings and other directional measurements. A declination of zero degrees is used at Tisdale sites.

PROTOCOL FOR VEGETATION MONITORING AT SELECTED WILDLIFE STUDY SITES

Introduction

Vegetation monitoring plots were established at wildlife study sites, and will help with the interpretation of associated wildlife data. The study sites are part of a wildlife inventory and monitoring design stratified by habitat and elevation. Depending on the complexity of the vegetation and a persons plant identification skills, it takes two people, one to two hours to establish and complete a plot.

Permanent vegetation monitoring plots were established at 15 small animal pitfall trap array sites and 28 bird transect points at Craig Mountain during 1994.

This portion of the vegetation monitoring program does not use the nested plot methods outlined under the Tisdale and Palouse goldenweed protocols. It does require completion of WHTF Form II - Community Survey Form (Appendix 9), and Form III - Ocular Plant Species Data (Appendix 12). The Form II data sheet provides location, classification, conservation ranking, environmental (e.g., soil, topography, disturbance), and general site description information. Form III entails the identification of plant species in the plot and assigning cover class values to each. Cover value changes are important in tracking vegetation trend. The WHTF Site and Community Survey Manual (Bourgeron et al. 1992) and associated forms were developed by The Nature Conservany ecologists and based on ECODATA methods originally devised by Region 1, U.S. Forest Service (Jensen et al. 1992).

A Craig Mountain Vegetation Data Sheet (Appendix 16), developed by IDFG, is also completed for each plot. It is adapted from bird population and habitat monitoring field methods originally devised by Region 1, U.S. Forest Service (Hutto 1994). The Craig Mountain data sheet incorporates attributes from the black-capped chickadee and pileated woodpecker HEP models as well. Most data concerns forest structure and composition attributes. Collectively, the information recorded to complete Forms II, III and the Craig Mountain Vegetation Data Sheet provide a detailed description of the plot's vegetation and environmental features. The data collected can be used for classification purposes, community type descriptions, site characterization, habitat quality and suitability assessments, determining ecological status, and evaluation of similarities to old growth or other habitats. Changes or trends can be documented when plots are reread in subsequent years.

Methods

1. We randomly placed plots in close proximity to wildlife study sites.

2. Plots are permanently marked using a metal fencepost. Tops of fenceposts are painted red and have the appropriate plot identification code etched on it. Plot locations are marked on 7.5' USGS topographic maps and are contained in the Wildlife Inventory report.

Fenceposts are located at plot center for circular plots and at one corner of the plot for rectangular-

shaped plots used in some narrow riparian areas. The fencepost markers were placed at known GPS points when possible. When this was not practical, the distance and azimuth from the GPS point to the fencepost was noted. All bearings use a compass declination of 20 degrees east.

3. Plots are 1/10 acre in size. Circular plots have a 11.3 m radius. Dimensions for the rectangular plots are 30 x 13 m. Perimeters of plots can be temporarily flagged to help recognize plot boundaries.

4. Complete WHTF Forms II (Appendix 9) and III (Appendix 12), and the Craig Mountain Vegetation Data Sheet (Appendix 16).

5. Take overview color photographs and label accordingly.

Notes

1. Vegetation monitoring plots were established at all 15 pitfall array sites during 1994. Plots included are: IF1,IF2,IF3; DF1, DF2, DF3; WM1, WM2, WM3; AL1, AL2, AL3; YS1, YS2, YS3.

2. Bird transects are comprised of a series of points. One point along each transect series was randomly picked for establishment of a permanent vegetation monitoring plot. These include plots: EO12, EO22, EO32, EO41, EO57, EO65, EO77, E082; 5602, 5609, 5701, 5705, 5709, 5802; 6104, 6207, 7104, 7110, 7204; 7306; ER13, ER26, ER31, ER42, ER52, ER64, ER71, ER82.

3. Craig Mountain Vegetation Data Sheets were completed at all 43 permanent vegetation monitoring sites. Data forms were completed at 118 additional bird transect points. Most of these 118 points are marked on the ground by painted and flagged rebar stakes and GPS determinations have been made. Accordingly, these sites contain attribute information that could be used to monitor vegetation changes over time. However, at this time, the sites are not part of the overall proposed Craig Mountain vegetation monitoring strategy.

MONITORING RECOMMENDATIONS

1. Several opportunities have been identified for possible future vegetation monitoring on Craig Mountain. Opportunities identified include:

a. Bluebunch wheatgrass (*Agropyron spicatum)* communities could be sampled more intensively, especially in relation to their large aerial extent and seriousness of threats. If further monitoring is conducted, coordination with the BLM and TNC is suggested.

b. Sand dropseed (*Sporobolus cryptandrus*) grassland communities could be sampled more intensively. Presently, there is no vegetation monitoring within this community type. All are subject to weed invasion. Coordination with the BLM and TNC may be helpful. There are several places along the lower Salmon River that support fairly extensive sand dropseed communities.

c. The rare plant *Calochortus macrocarpus* var. *maculosus* (green-band mariposa lily) could be monitored at low elevation sites impacted by yellow starthistle. There are several places along the lower Salmon River where this is possible and could be accomplished in

conjunction with sampling sand dropseed communities mentioned above. Several sampling designs options are possible. For example, there is wide variability in the degree of weed infestation, even in adjacent, seemingly identical sites. It would be possible to construct monitoring plots in close proximity across a range of weed cover values.

2. A monitoring plan, including funding, should be a standard part of most IDFG management project plans. Examples may include weed control, controlled burning, and removal of livestock.

3. Lewis and Clark State College (LCSC) has expressed interest in participating in long-term monitoring programs at Craig Mountain. The potential benefits to both LCSC and IDFG are high and options should be fully explored.

4. All future vegetation monitoring plots should have their location documented with GPS.

5. The Conservation Data Center could be the central repository for all Craig Mountain monitoring data, including that generated by the BLM and TNC. Additional copies (hard copies and disk) of the data can be stored at the appropriate agency office.

6. As part of their larger inventory study, Asherin and Claar (1976) conducted riparian vegetation sampling at Craig Mountain in the Snake River Canyon. Plot #42 is located near the mouth of Cottonwood Creek. Plots #47, #48, #49 are located across from the mouth of the Grande Rhond River, near Limestone Point. Plot #55 is situated near the mouth of Captain John Creek. These plots are located on or near IDFG land. It would be interesting to reread these plots and compare data collected in the mid-1970's to present condition. See Asherin and Claar (1976) for full details regarding these plots.

PHOTOGRAPHIC RECORD

Repeat photographs taken over time are a valuable tool for evaluating vegetation changes. Color slide photos were taken for all vegetation monitoring plots in 1994. Photographs for the Tisdale and Palouse goldenweed monitoring plots are on file at the Conservation Data Center in Boise, Idaho. Photographs for monitoring plots associated with wildlife study sites are on file at the IDFG Region 2 office in Lewiston, Idaho.

All slides have location and direction information to facilitate repeat photography. Most also include the fencepost plot marker. All photos use a wide angle (28 mm) lens unless otherwise noted.

PROPOSED RESAMPLING SCHEDULE FOR VEGETATION MONITORING PLOTS

We recommend that vegetation monitoring plots be resampled at regular intervals to compile trend information. All vegetation monitoring plots established in 1994, should be reread within the next five years, and approximately every 5 years, thereafter. This frequency can be adjusted to take into account other vegetation monitoring that may be established in the future. We recommended a subset of the monitoring plots be sampled on a rotational basis. It is estimated, that resampling all plots once every five years will require two people eight to nine days, three of five field seasons. We recommend the Natural Resource Policy Bureau be contracted to resample the vegetation monitoring plots at Craig Mountain.

Vegetation monitoring plots have been organized into blocks that should be resampled during the same year. This will minimize discrepancies due to yearly weather variances between plots located within similar habitats. Blocks grouped together are arranged to minimize travel time between the various plots. Each block is estimated to require 1 full day to resample, unless otherwise noted.

Tisdale Plots - to be reread the same year

94MM001		94MM006		94MM009	
94MM002		94MM007	2 days	94MM010	
94MM003	2 days	94MM008		94MM011	2 days
94MM004				94MM012	
94MM005					

Palouse Goldenweed Plots - to be reread the same year

94MM013, 94MM014, 94MM015 2 days

Pitfall Array Sites - each series of three plots reread the same year

IF 1, 2, 3
WM 1, 2, 3
DF 1, 2, 3 each series of three plots can be done in 1 day
AL 1, 2, 3
YST 1, 2, 3

Bird Transect Points - blocks under each heading reread the same year

Eagle Creek Riparian	China Creek
ER13	5602
ER26	5609
ER31	5701
ER42	5705
ER52	5709
ER64	5802
ER71	
ER82	

Eagle Creek Grassland	Wapshilla Creek	
	7104	
EO12	7110	2 days
EO41	7204	
	7306 (Pruitt Draw)	
EO22		
EO32	Wapshilla Ridge	
EO65		
EO57	6104	
	6207	
EO77		
EO82		

OTHER VEGETATION MONITORING AT CRAIG MOUNTAIN

The BLM and The Nature Conservancy (TNC) have already established some grassland, riparian and rare plant monitoring at Craig Mountain. The vegetation and rare plant monitoring strategy developed by IDFG attempts to complement these existing programs. A cooperative vegetation monitoring program between the IDFG, BLM and TNC offers the opportunity to maximize the extent (coverage), rigor, and diversity of monitoring on Craig Mountain, especially in light of funding constraints. A regional monitoring program based on coordination and cooperation will provide land managers with more cost effective and complete information than otherwise possible. A Memorandum of Understanding between the IDFG, BLM and TNC has been drafted regarding vegetation monitoring at Craig Mountain. It is presently under review.

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APPENDIX 1

Vascular plant species list for Craig Mountain

(This list has been compiled from collections or species list by Michael Mancuso, IDFG; Ken Neiman (1987); and Janice Hill, The Nature Conservancy)

Note: The species list is organized into four main taxonomic groups, the ferns and fern allies, the conifers, the dicots, and the monocots. Within each of these groups, families are arranged alphabetically. Genera and scientific names are listed alphabetically by family. Common names are provided for all species. Taxonomy follows that in *Flora of the Pacific Northwest* (Hitchcock and Cronquist 1973).

The list also denotes the common habitat(s) for each species at Craig Mountain. The habitats are coded as "G" = grassland; "F" = forest; "S" = upland shrubfield; "R" = riparian; and "M" = meadow. Realize that the common habitat is listed, and that a particular species may sometimes occur in a habitat not checked. "Grassland" applies to the canyon grassland complex, including rock outcrops and other inclusions. "Forest" pertains to areas with a conifer tree canopy. "Upland shrubfield" applies to all non-riparian shrubfields, including woody draws. "Meadow" implies both dry and wet meadow complexes associated with the forested uplands. "Riparian" vegetation is associated with various watercourses, and for purposes of this list includes aquatic plants.

VASCULAR PLANT LIST FOR CRAIG MOUNTAIN

SCIENTIFIC NAME	COMMON NAME	G	F	S	R	M
Ferns and allies						
Equisetaceae	**Horsetail family**					
Equisetum arvense	common horsetail				x	
Equisetum hyemale	Dutch rush				x	
Equisetum laevigatum	smooth horsetail				x	
Lycopodiaceae	**Clubmoss family**					
Lycopodium annotinum	stiff clubmoss		x			
Selaginaceae	**Selaginella family**					
Selaginella densa	compact selaginella	x				
Selaginaella wallacei	Wallace's selaginalla	x				
Polypodiaceae	**Common fern family**					
Athyrium filix-femina	lady fern				x	
Cheilanthes feei	Fee's lip-fern	x				
Cysopteris fragilis	brittle bladder-fern	x				
Dryopteris austratica	spreading wood-fern			x		
Gymnocarpium dryopteris	oak-fern		x			
Polystichum munitum	sword-fern		x			
Pteridium aquilinum	bracken-fern		x	x		
Woodsia oregana	Oregon woodsia	x				
Woodsia scopulina	Rocky Mtn. woodsia	x				
Conifers						
Cupressaceae	**Cypress family**					
Juniperus scopulorum	Rocky Mtn juniper	x				
Pinaceae	**Pine family**					
Abies lasiocarpa	subalpine fir		x			
Abies grandis	grand fir		x			
Larix occidentalis	western larch		x			
Picea engelmannii	Engelmann spruce		x			
Pinus contorta latifolia	lodgepole pine		x			
Pinus ponderosa	ponderosa pine		x			
Pseudotsuga menzeisii	Douglas-fir		x			

		G	F	S	R	M
Taxaceae	**Yew family**					
Taxus brevifolia	Pacific yew		x		x	
Forbs, grasses, shrubs, trees						
Dicots						
Aceraceae	**Maple family**					
Acer glabrum	Rocky Mtn. maple		x	x	x	
Aizoaceae	**Carpetweed family**					
Mollugo verticillata	carpetweed	x				
Amaranthaceae	**Amaranth family**					
Amaranthus retroflexus	rough pigweed	x				
Anacardiaceae	**Sumac family**					
Rhus glabra	smooth sumas	x		x	x	
Rhus radicans	poison ivy	x			x	
Apiaceae	**Parsley family**					
Angelica arguta	sharptooth angelica				x	
Anthriscus scandicina	chervil	x			x	
Cicuta douglasii	western water-hemlock			x		
Heracleum lanatum	cow parsnip				x	
Ligusticum canbyi	Canby's lovage	x		x		
Ligusticum verticillatum	verticillate lovage			x		
Lomatium ambiguum	swale desert-parsley	x				
Lomatium cous	cous desert-parsley	x				
Lomatium cusickii	Cusick's desert-parsley	x				
Lom. dissectum dissectum	fern-leaved desert-parsley	x				
Lom. dissectum multifidum	fern-leaved desert-parsley	x				
Lomatium grayi	Gray's lomatium	x				
Lomatium macrocarpum	large-fruit lomatium	x				
Lomatium rollinsii	Rollin's desert-parsley	x				
Lomatium serpentinum	Snake River lomatium	x				
Lomatium triternatum	nine-leaf lomatium	x				
Osmorhiza chilensis	mountain sweet-cicely		x		x	
Osmorhiza occidentalis	western sweet-cicely		x			
Perideridia gairderni	Gairdner's yampah	x	x	x		

			G	F	S	R	M
Apocynaceae	**Dogbane family**						
Apocynum androsaemifolium	spreading dogbane		x				
Asclepiadaceae	**Milkweed family**						
Asclepias cryptoceras	pallid milkweed		x				
Asclepias speciosa	showy milkweed		x				
Asteraceae	**Aster family**						
Achillea millefolium	common yarrow		x				x
Adenocaulon bicolor	pathfinder			x			
Agoseris aurantiaca	orange agoseris		x				
Agoseris glauca dasycephala	pale agoseris		x				x
Agoseris grandiflora	large-flowered agoseris		x				
Agoseris heterophylla	annual agoseris		x				
Ambrosia artemisiifolia	Roman wormwood		x				
Anaphalis margaritacea	pearly-everlasting				x		x
Antennaria dimorpha	low puss-toes		x				
Antennaria luzuloides	wodrush pussy-toes		x				
Antennaria microphylla	rosy pussy-toes			x			
Anthemis arvensis	dogfennel		x				
Arctium minus	common burdock					x	
Arnica cordifolia cordifolia	heartleaf arnica		x	x			
Arnica sororia	twin arnica	x					
Artemisia ludoviciana	Lousiana mugwort		x		x	x	
Artemisia rigida	rigid sagebrush		x				
Art. tridentata vaseyana	mountain big sagebrush						x
Aster campestris	western meadow aster		x				
Aster conspicuus	showy aster		x				
Aster eatonii	Eaton's aster					x	
Aster occidentalis	western mountain aster		x				
Balsamorhiza sagittata	arrowleaf balsamroot		x				
Balsamorhiza serrata	serrate balsamroot		x				
Blepharipappus scaber	blepharipappus		x				
Brickellia microphylla	small-leaved brickellia		x				
Centaurea diffusa	diffuse knapweed		x				
Centaurea maculosa	spotted knapweed		x				
Centaurea repens	Russian knapweed		x				
Centaurea solstitialis	yellow starthistle		x				
Chaenactis douglasii	false yarrow		x				
Chichorium intybus	chickory		x				
Chrysanthemum leucantheum	oxeye-daisy						x
Chrysopsis villosa villosa	hairy goldenaster		x				
Chrysothamnus nauseosus	gray rabbitbrush		x				
Chrysoth. nauseosus nanus	dwarf gray rabbitbrush		x				

		G	F	S	R	M
Chrysothamnus viscidiflorus	green rabitttbrush	x				
Crupina vulgaris	common crupina	x				
Cirsium arvense	Canada thistle			x		x
Cirsium brevistylum	short-styled thistle					x
Cirsium canovirens	gray-green thistle	x				
Cirsium undulatum	wavy leaf thistle					x
Cirsium vulgare	bull thistle	x			x	x
Conzya canadensis	horseweed	x				
Crepis acuminata	long leaved hawksbeard	x				
Crepis atrabarba	slender hawksbeard	x				
Crepis bakeri idahoensis	Idaho hawksbeard	x				
Crepis barbigera	bearded hawksbeard	x				
Crepis intermedia	gray hawksbeard	x				
Crepis runciniata hispidulosa	meadow hawksbeard					x
Erigeron bloomeri	scabland fleabane	x				
Erig. compositus compositus	cut-leaved daisy	x				
Erigeron corybosus	foothill daisy	x				
Erigeron divergens	diffuse fleabane		x			
Erig. engelmannii davisii	Engelmann's daisy	x				
Erigeron pumilis intermedius	shaggy fleabane	x				
Erigeron speciosus	showy fleabane	x				
Erigeron strigosus	branching daisy	x			x	
Eriophyllum lanatum	common eriophyllum	x				
Filago arvensis	field filago		x			
Gailardia aristida	blanket flower	x				
Gnaphalium palustre	lowland cudweed					x
Grindelia nana nana	low gumweed	x				
Grindelia squarrosa	curly-gup gumweed	x				
Guiterrezia sarothrae	matchbush	x				
Haplopappus carthomoides	Columbia goldenweed	x				
Haplo. hirtus sonchifolius	sticky goldenweed					x
Haplopappus lanuginosus	woolly goldenweed	x				
Haplopappus liatriformis	Palouse goldenweed	x				
Haplopappus resinosus	gnarled goldenweed	x				
Helianthella uniflora douglasii	Rocky Mtn. helianthella	x				
Helianthus annuus	common sunflower	x				
Hieracium albertinum	western hawkweed	x				
Hieraceum albiflorum	white hawkweed		x			
Hieraceum aurantiacum	orange hawkweed	x				
Lactuca biennis	tall blue lettuce			x		
Lactuca serriola	prickly lettuce	x				
Lagophylla ramosissima	rabbitleaf	x				
Machaeranthera canescens	hoary aster	x				
Madia exigua	little tarweed	x				
Madia glomerata	clustered tarweed	x				
Madia gracilis	slender tarweed	x				

Matricaria matricariodes	pineapple weed				x	
Onopordum acanthium	Scotch thistle	x				x
		G	**F**	**S**	**R**	**M**
Rudbeckia occidentalis	western coneflower		x			
x						
Senecio canus	woolly groundsel	x				
Senecio integerrimus	western groundsel	x				
Senicio pseudaureus	streambank butterweed					x
Senecio spaerocephalus	mountain marsh butterweed					x
Senecio streptanthifolius	Rocky Mtn. butterweed	x				
Senecio triangularis	arrowleaf groundsel		x		x	
Solidago canadensis	Canada goldenrod	x	x			
Solidago missouriensis	Missouri goldenrod	x				
Tanacetum vulgare	common tansy	x		x		
Taraxacum officinale	common dandelion	x	x			x
Tragopogon dubius	yellow salsify	x				
Wyethia amplexicaulis	northern mule ears					
x						
Xanthium strumarium	common cocklebur				x	
Berberidaceae	**Barberry family**					
Berberis repens	creeping Oregon grape		x			
Betulaceae	**Birch family**					
Alnus incana	thinleaf alder				x	
Alnus rhombifolia	white alder				x	
A. rhombifolia x A. sinuata	alder hybrid				x	
Alnus sinuata	Sitka alder				x	
Betula occidentalis	water birch				x	
Boraginaceae	**Borage family**					
Amsinckia lycopsoides	tarweed fiddleneck		x			
Amsinckia retrorsa	rigid fiddleneck	x				
Asperugo procumbens	madwort	x				
Cryptantha flaccida	weak-stemmed cryptantha	x				
Cryptantha interrupta	bristly cryptantha	x				
Cryptantha torreyana	Torrey's cryptantha	x				
Cynoglossum officinale	common houndstongue	x				x
Hackelia hispida	rough stickseed	x				
Lappula redowskii	western stickseed	x				
Lithospermum ruderale	wayside gromwell	x				

Mertensia longifolia	small bluebells	x				
Mertensia paniculata borealis	tall bluebells				x	x
Myosotis arvensis	field forget-me-not	x				
Myosotis micrantha	blue scorpion-grass	x				
Plagiobothrys scouleri	Scouler's popcorn-flower					x
Brassicaceae	**Mustard family**					
Alyssum alyssoides	yellow alyssum	x				
		G	**F**	**S**	**R**	**M**
Arabis crucisetosa	cross-haired rockcress	x				
Arabis glabra	towermustard	x				
Arabis hirsuta	hairy rockcress	x				
Arabis holbellii	Holboell's rockcress	x				
Arabis lignifera	woody-branched rockcress	x				
Arabis microphylla	small-leaved rockcress	x				
Barbarea orthoceras	western wintercress				x	x
Brassica nigra	black mustard				x	
Camelina microcarpa	hairy falseflax	x				
Cardamine pennsylvanica	Pennsylvanis bittercress				x	x
Capsella bursa-pastoris	shepards purse		x			
x						
Cardaria draba	hoary whitetop	x				
Chorispora tenella	blue mustard	x				
Descurania richardsonii	mountain tansy mustard		x			
Draba cunefolia platycarpa	wedgeleaf whitlow-grass	x				
Draba verna	spring whitlow-grass	x				
Erysimum asperum	rough wallflower	x				
Lepidium perfoliatum	clasping pepperweed	x				
Lepidium virginicum	tall pepperweed		x			
Lesquerella douglasii	Douglas' bladderpod	x				
Physaria oregana	Oregon bladderpod	x				
Rorippa curvisiliqua	western yellowcress				x	
Rorippa nasturium-aquaticum	water-cress				x	
Sisyimbrium altissimum	tumbling mustard	x				
Thelypodium laciniatum lac.	thick-leaved thelypody	x				
T. laciniatum streptanthoides	purple thick-leaved thelypody	x				
Thlaspi arvense	field pennycress	x				
Thlaspi montanum	pennycress					x
Thysanocarpus curvipes	lacepod		x			
Cactaceae	**Cactus family**					
Opuntia polycantha	prickly-pear cactus	x				

Pediocactus simpsonii robust.	Simpson's hedgehog cactus		x			
Campanulaceae	**Harebell family**					
Campanula rotundifolia	bellflower	x				x
Triodanis perfoliata	Venus' looking-glass	x				
Caprifoliaceae	**Honeysuckle family**					
Linnaea borealis	twinflower		x			
Lonicera ciliosa	trumpet honeysuckle		x			
Lonicera involucrata	bearberry honeysuckle		x		x	
		G	**F**	**S**	**R**	**M**
Lonicera utahensis	Utah honeysuckle		x			
Sambucus cerulea	blue elderberry		x	x		
Sambucus racemosa	black elderberry				x	
Symphoricarpos albus	common snowberry	x	x	x	x	
Symphoricarpos oreophilus	mountain snowberry		x	x		
Caryophyllaceae	**Pink family**					
Arenaria aculeata	prickly sandwort	x				
Arenaria congesta	capitate sandwort	x				
Arenaria macrophylla	bigleaf sandwort		x	x		
Arenaria serphyllifolia	thyme-leaf sandwort	x				
Cerastium arvense	field chickweed	x	x			
Cerastium vulgatum	common chickweed	x			x	x
Dianthus armeria	grass pink	x				
Holosteum umbellatum	holosteum	x				
Lychnis alba	white campion	x				
Saponaria officinalis	bouncing bet				x	
Silene antirrhina	sleepy cat	x				
Silene conoidea	conoid cat	x				
Silene dichotoma	forked cat	x				
Silene douglasii	Douglas' campion	x				
Silene oregana	Oregon catchfly	x				
Silene scouleri	Scouler's catchfly	x				
Silene spaldingii	Spalding's silene	x				
Spergularia rubra	red sandspurry	x				
Stellaria longifolia	longleaved starwort	x				
Stellaria longipes longipes	longstalked starwort	x				
Stellaria nitens	shining chickweed					

Vaccaria segetalis	cowcockle	x				
Celastraceae	**Staff-tree family**					
Glossopetalon nevadense	spiny green-bush	x				
Chenopodiaceae	**Goosefoot family**					
Chenopodium album	lambsquarter	x				
Chenopodium botrys	Jerusalem-oak goosefoot	x				
Chenopodium rubrum	red goosefoot					x
Salsola kali	tumbleweed	x				
Convolvulaceae	**Morning glory family**					
Convolvulus arvensis	field bindweed	x				

		G	**F**	**S**	**R**	**M**
Cornaceae	**Dogwood family**					
Cornus stolonifera	red-osier dogwood				x	
Crassulaceae	**Stonecrop family**					
Sedum lanceolatum	lanceleaved stonecrop	x				
Sedum leibergii	Leiberg's stonecrop	x				
Sedum stenopetalum	wormleaf stonecrop	x				
Dipsacaceae	**Teasel family**					
Dipsacus sylvestris	teasel				x	
Ericaceae	**Heath family**					
Arctostapholos uva-ursi	kinikinnick		x			
Chimaphila umbellata	prince's pine		x			
Menziesia ferruginia glabella	fools huckleberry		x			
Monotropa uniflora	Indian pipe		x			
Pyrola secunda	sidebells pyrola		x			
Vaccinium globulare	blue huckleberry		x			
Euphorbiaceae	**Spurge family**					

Euphorbia escula	leafy spurge	x				
Euphorbia glyptsperma	corrugate-seeded spurge	x				
Fabaceae	**Pea family**					
Astragalus arthuri	Arthur's milkvetch	x				
Astragalus canadensis	Canada milkvetch		x			
Astragalus cusickii cusickii	Cusick's milkvetch	x				
Astragalus inflexus	hairy milkvetch	x				
Astragalus sheldonii	Sheldon's milkvetch	x				
Astragalus whitneyi	ballonpod milkvetch	x				
Glycyrrhiza lepidota	licorice-root	x				
Lathyrus nevadensis	Sierrran peavine			x		
Lotus corniculatus	birdsfoot-trefoil		x			
Lotus pershiana	Spanish-clover	x				
Lupinus argenteus argenteus	silvery lupine	x				
Lupinus caudatus	tailcup lupine	x				
Lupinus laxiflorus	spurred lupine	x				
Lupinus lepidus aridus	prairie lupine	x				
Lupinus leucophyllus	velvet lupine					x
Lupinus sericeus	silky lupine	x				
Medicago sativa	alfalfa	x				x
		G	**F**	**S**	**R**	**M**
Medicago lupulina	black medic	x			x	x
Melilotus alba	white sweet-clover	x				
Melilotus officinalis	yellow sweet-clover	x				
Robinia psuedoacacia	black locust				x	
Thermopsis montana	Montana golden-pea		x			
Trifolium douglasii	Douglas' clover				x	
Trifolium eriocephalum	woollyhead clover	x				
Trifolium hybridum	alsike clover	x				x
Trifolium latifolium	twin clover	x				x
Trifolium longipes	long stalked clover	x	x			
Trifolium macrocephalum	big head clover	x				
Tri. plumosum amplifolium	plumed clover					x
Trifolium pratense	red clover	x				x
Trifolium repens	white clover	x	x		x	x
Vicia americana	American vetch	x		x		
Vicia villosa	woolly vetch	x				
Gentianaceae	**Gentian family**					
Frasera albicaulis idahoensis	Idaho frasera	x				

Frasera fastigata	clustered frasera					x
Gentiana amarella	northern gentain					x
Gentiana calycosa obtusiloba	mountain bog gentain	x				
Geraniaceae	**Geranium family**					
Erodium cicutarium	filaree	x				
Geranium carolinianum	Carolina geranium	x				
Geranium molle	dovefoot geranium	x				
Geranium pusillum	small-flowered crane's-bill	x				
Geranium viscosissimum	sticky geranium					x
Grossulariaceae	**Currant family**					
Ribes aureum	golden currant				x	
Ribes cereum colubrinum	squaw currant	x				
Ribes inerme	whitestem gooseberry				x	
Ribes irriguum	Idaho gooseberry		x	x	x	
Ribes hudsonianum petiolare	stinking curant				x	
Ribes lacustre	swamp currant		x		x	
Ribes niveum	snow gooseberry				x	
Ribes velutinum goodingii	Gooding's gooseberry	x				
Ribes viscosissimum	sticky currant		x			
Ribes wolfii	Wolf's currant		x			
Hydrangeaceae	**Hydrangea family**					
Philadelphus lewisii	syringa		x	x		
		G	**F**	**S**	**R**	**M**
Hydrophyllaceae	**Waterleaf family**					
Hesperochiron pumilus	dwarf hesperoochiron					x
Hydrophyllum capitatum	waterleaf woolly breeches		x			
Phacelia heterophylla	varileaf phacelia	x				
Phacelia idahoensis	Idaho phacelia					x
Phacelia linearis	threadleaf phacelia	x				
Hypericaceae	**St. John's wort family**					
Hypericum anagalloides	bog St. John's-wort					x
Hypericum perforatum	common St. John's-wort	x	x			
Lamiaceae	**Mint family**					
Agastache urticifolia	nettle-leaf horse-mint	x		x		

Marrubium vulgare	horehound		x			
Mentha arvensis	field mint				x	
Monardella odoratissima	monardella		x			
Nepeta cataria	catnip					x
Prunella vulgaris	self-heal			x	x	x
Scutellaria angustifolia	narrow-leaved skullcap	x				
Lemnaceae	**Duckweed family**					
Lemna minor	water lentil				x	
Loasaceae	**Blazing star family**					
Mentzelia dispersa	bush mentzelia		x			
Mentzelia laevicaulis	blazing-star		x			
Loranthaceae	**Mistletoe family**					
Arceuthobium sp.	mistletoe			x		
Malvaceae	**Mallow family**					
Illiamna rivularis	streambank globemallow			x	x	
Malva neglecta	common mallow		x			x
Sidalcea oregana	Oregon sidalcea					x
Sphaeralcea munroana	Munro's globemallow		x			
Moraceae	**Mulberry family**					
Humulus lupulus	hops		x			
Morus alba	mulberry				x	

			G	**F**	**S**	**R**	**M**
Onograceae	**Evening primrose family**						
Boisduvalia densiflora	dense spike-primrose					x	
Circaea alpina	enchanter's nighshade				x		
Clarkia pulchella	deer horn		x				
Epilobium angustifolium	fireweed		x		x		
Epilobium glaberrimum	smooth willow-herb					x	x
Epilobium glandulosum	commom willow-herb					x	x
Epilobium paniculatum	tall annual willow-herb		x				
Epilobium watsonii	Watson's willow-herb					x	x
Gaura parviflora	small-flowered gaura		x				
Gayophytum diffusum	spreading groundsmoke		x				

Oenothera caespitosa	desert evening-primrose	x				
Oenothera hookeri	Hooker's evening-primrose		x			
Oenothera subacaulis	long-leaved evening-primrose					x
Orobanchaceae	**Broomrape family**					
Orobanche corymbosa	flat-topped broomrape		x			
Orobanche fasciculata	clustered broomrape		x			
Orobanche uniflora minuta	naked broomrape		x			
Plantaginaceae	**Plantain family**					
Plantago major	common plantain				x	x
Plantago patagonica	Indian-wheat		x			
Plantago lanceolata	English plantain		x			
Polemoniaceae	**Phlox family**					
Collomia grandiflorum	large-flowered collomia	x				
Collomia linerais	narrow-leaf collomia		x			
Collomia tinctoria	yellow-staining collomia		x			
Gilia aggregata	skyrocket		x			
Linanthastrum nuttallii	Nutthall's linanthastrum		x			
Microsteris gracilis humilior	pink microsteris		x			x
Navarretia intertexta	needle-leaf navarretia		x			x
Phlox colubrina	Snake River phlox		x			
Phlox pulvinata	cushion phlox		x			
Phlox speciosa	showy phlox		x			
Phlox viscida	sticky phlox		x			
Polemonium micrathum	annual polemonium		x			

		G	**F**	**S**	**R**	**M**
Polygonaceae	**Buckwheat family**					
Eriogonum compositum	northern buckwheat		x			
Eriogonum heracleoides	Wyeth buckwheat		x			
Eriogonum ovalifolium	oval-leaved buckwheat		x			
Eriogonum strictum	strict buckwheat		x			
Eriogonum umbellatum	sulfur buckwheat	x				

Eriogonum vimineum	wirestem buckwheat	x				
Polygonum amphibium	ladysthumb					x
Polygonum aviculare	prostrate knotweed	x				
Polygonum bistortoides	American bistort					x
Polygonum coccineum	water smartweed					x
Polygonum convolvulus	climbing knotweed				x	
Polygonum cuspidatum	Japaneese knotweed	x				
Polygonum douglasii	Douglas' knotweed	x				
Polygonum persicaria	spotted ladysthumb				x	
Polygonum polygaloides	white margined knotweed	x				
Polygonum sawatchense	sawatch knotweed	x				
Rheum rhubarbaarum	rhubarb	x				
Rumex acetosella	sheep sorrel	x				x
Rumex crispus	curly dock				x	x
Rumex obtusifolius	bitter dock				x	
Rumex salicifolius	willow dock				x	
Rumex venosus	veiny dock	x				

Portulacaceae **Purslane family**

Claytonia lanceolata	spring beauty	x				
Montia cordifolia	broadleaved montia				x	
Montia dichotoma	dwarf montia				x	
Montia linearis	narrowleaved montia				x	
Montia perfoliata	miner's lettuce				x	

Potamogetonaceae **Pondweed family**

Potamogeton berchtoldii	Berchtold's pondweed					x
Potamogeton natans	broad-leaved pondweed				x	
Potamogeton pectinatus	fennel-leaved pondweed					x

Primulaceae **Primrose family**

Dodecatheon conjugens	slimpod shooting star					x
Dodecatheon cusickii	Cusick's shooting star	x				
Dodecatheon pulchellum	dark-throat shooting star					x

		G	**F**	**S**	**R**	**M**

Ranunculaceae **Buttercup family**

Aconitum columbianum	monkshood				x	
Actea rubra	baneberry				x	
Anenome piperi	Piper's anemone			x		
Clematis ligusticifolia	western clematis			x	x	
Coptis occidentalis	western goldthread		x			
Delphinium bicolor	little larkspur	x				
Delphinium burkei	Burke's larkspur					x
Delphinium depauperatum	dwarf larkspur					x
Delphinum nuttallianum	Nutthall's larkspur	x				
Ranunculus aquatilis	water crowfoot			x		
Ranunculus flammula	creeping buttercup					x
Ranunculus glabberimus	sagebrush buttercup	x				
Ranunculus hebecarpus	downy buttercup	x				
Ranunculus orthorhynchus	straightbeak buttercup					x
Ranunculus testiclatus	hornseed buttercup	x				
Ranunculus uncinatus	little buttercup				x	
Thalictrum occidentale	western meadowrue		x			
Trautvettaria carolinensis	false bugbane		x			
Rhamnaceae	**Buckthorn family**					
Ceanothus sanquineus	redstem ceanothus		x	x		
Ceanothus velutinus	buckbrush		x	x		
Rhamnus purshiana	cascara			x		
Rosaceae	**Rose family**					
Amelanchier alnifolia	serviceberry	x	x	x	x	
Cercocarpus ledifolius	curl leaf mountain mahogany	x				
Crataegus columbiana	Columbia hawthorn			x	x	
Crataegus douglasii douglasii	black hawthorn		x	x		
Frageria vesca	woods strawberry		x		x	
Frageria virginiana	blueleaf strawberry		x			
Geum macrophyllum	large-leaf avens				x	x
Geum triflorum triflorum	prairie smoke	x				
Holodiscus discolor	ocean spray	x	x	x	x	
Physocarpus malvaceus	mallow ninebark	x	x	x	x	
Potentilla glandulosa	sticky cinquefoil	x				
Potentilla gracilis	slender cinquefoil	x		x	x	x
Potentilla recta	sulfur cinquefoil	x				
Prunus armencia	apricot	x				
Prunus americana	wild plum	x			x	
Prunus emarginata	bitter cherry	x		x	x	
Prunus mahaleb	Mahaleb cherry	x				
Prunus virginiana	chockecherry	x	x	x	x	
Pyrus communis	cultivated pear	x				

		G	F	S	R	M
Pyrus malus	cultivated apple	x			x	
Rosa canina	dog rose	x				
Rosa gymnocarpa	baldhip rose	x				
Rosa nutkana hispida	Nootka rose	x		x	x	
Rosa nutkana nutkana	Nootka rose	x		x	x	
Rosa woodsii ultramontana	Wood's rose	x		x	x	
Rubus discolor	Himalayan blackberry	x			x	
Rubus laciniatus	evergreen blackberry				x	
Rubus leucodermis	black raspberry			x		
Rubus parviflorus	thimbleberry		x	x	x	
Sanquisorba occidentalis	annual burnet	x				x
Sorbus scopulina	mountain ash		x			
Spirea betulifolia	white spirea	x	x	x		
Rubiaceae	**Madder family**					
Galium aparine	goose-grass cleavers	x		x	x	x
Galium boreale	northern bedstraw					x
Galium multiflorum	shrubby bedstraw	x				
Galium trifidum	small bedstraw					x
Galium triflorum	fragrant bedstraw	x	x			
Salicaceae	**Willow family**					
Populus tremuloides	quacking aspen			x		
Populus trichocarpa	black cottonwood				x	
Salix amigdaloides	peach-leaf willow				x	
Salix bebbiana	Bebb willow				x	
Salix exigua exigua	coyote willow				x	
Salix rigida	Watson willow				x	
Salix scouleriana	Scouler willow		x	x		
Saxifragaceae	**Saxifrage family**					
Heuchera cylindrica	roundleaf alumroot	x				
Heuchera grossulariifolia	gooseberry-leaf alumroot	x				
Heuchera micrantha	small flowered alumroot	x				
Lithophragma bulbifera	bulbiferous prairie star	x				
Lithophragma parviflora	small flowered prairie star	x				
Mitella stauropetala	side-flowered mitrewort	x				
Saxifraga arguta	brook saxifrage			x		
Saxifraga ferruginea	saxifrage				x	
Saxifraga integrifolia	swamp saxifrage					x
Tiarella trifoliata	trefoil foamflower		x			

		G	F	S	R	M
Scrophulariaceae	**Figwort family**					
Besseya rubra	red besseya	x				
Castilleja appelgatei	waxy-leaf paintbrush	x				
Castilleja hispida acuta	harsh paintbrush	x				
Castilleja lutescens	yellow painbrush	x				
Castilleja miniata	scarlet paintbrush	x	x			x
Castilleja viscidula	sticky painbrush	x				
Collinsia parviflora	blue-eyed Mary	x				
Linaria dalmatica	Dalmatian toadflax	x				
Mimulus cusickii	Cusick's monkeyflower	x				
Mimulus guttatus guttatus	yellow monkeyflower				x	
Mimulus moschatus	musk monkeyflower					x
Mimulus nanus	dwarf purple monkeyflower	x				
M. washingtonensis ampliatus	spacious monkeyflower	x				
Orthocarpus pusillus	dwarf owl-clover	x				
Orthocarpus tenuifolius	thinleaf owl-clover		x			
Pedicularis bracteosa	bracted lousewort	x				
Pedicularis contorta	white coiled-beak lousewort		x			
Pedicularis groenlandica	elephants head					x
Pedicularis racemosa	leafy lousewort	x				
P. attenuatus attenuatus	sulphur penstemon	x				
P. attenuatus militaris	sulphur penstemon	x	x			
Penstemon confertus	yellow penstemon					x
Penstemon deustus	hot rock penstemon	x				
Penstemon elegantulus	lovely penstemon		x			
Penstemon glandulosus	sticky penstemon	x				
Penstemon globosus	globe penstemon					x
P. fruiticosus serratus	bush penstemon	x				
Penstemon triphyllus	whorled penstemon	x				
Penstemon venustus	Blue Mtn. penstemon	x				
Synthyris missurica	moutain kittentails		x			
Tonella floribuda	large flowered tonella	x				
Verbascum blatteria	moth mullein	x				
Verbascum thaspus	flannel mullein	x				
Veronica americana	American brooklime				x	
Veronica arvensis	common speedwell	x		x	x	x
Veronica peregrina xalopensis	puslane speedwell				x	
Veronica persica	Persian speedwell					x
Veronica serpyllifolia	thyme-leaved speedwell				x	x
Solanaceae	**Nightshade family**					
Solanum dulcamara	climbing nightshade	x			x	

Ulmaceae	**Elm family**					
Celtis reticulata	netleaf hackberry	x		x	x	
		G	**F**	**S**	**R**	**M**
Urticaceae	**Nettle family**					
Urtica diocia	stinging nettle			x	x	
Valerianaceae	**Valerian family**					
Valeriana occidentalis	western valerian					x
Valerianella locusta	European corn-salad	x			x	
Verbenaceae	**Verbena family**					
Verbena bracteata	bracted verbena	x				
Vitaceae	**Grape family**					
Vitus vinifera	European grape			x		
Violaceae	**Violet family**					
Viola adunca	early blue violet		x		x	x
Viola canadensis rugulosa	western Canadian violet		x		x	
Viola nuttallii	Nutthall's violet	x				
Viola orbiculata	roundleaf violet		x			
Zygophyllaceae	**Caltrop family**					
Tribulus terrestris	puncture vine	x				
Monocots						
Alismataceae	**Water-plantain family**					
Alisma plantago-aquatica	water-plantain				x	
Cyperaceae	**Sedge family**					
Carex amplifolia	big-leaf sedge				x	
Carex aquatilis	water sedge				x	x
Carex athrostachya	slender-beaked sedge					x
Carex brevior	short-beaked sedge				x	
Carex canescens	gray sedge				x	

Carex deweyana	Dewey's sedge					x	
Carex disperma	soft-leaved sedge			x		x	
Carex geyeri	elk sedge			x			
Carex hoodii	Hood's sedge						x
Carex illota	sheep sedge						x
Carex interior	inland sedge						x
Carex lanuginosa	woolly sedge						x

			G	**F**	**S**	**R**	**M**
Carex microptera	small-winged sedge						x
Carex nebrascensis	Nebraska sedge					x	
Carex paysonis	Payson's sedge					x	
Carex rostrata	beaked sedge					x	x
Carex stipata	sawbeak sedge					x	x
Cyperus schweinitzi	Schweinitz flatsedge					x	
Eleocharis acicularis	needle spike-rush						x
Eleocharis palustris	creeping spike-rush					x	x
Eleocharis pauciflora	few-flowered spike-rush					x	x
Scirpus pallidus	pale bulrush					x	x
Iridaceae	**Iris family**						
Iris sp.	Iris						x
Sisyrichium inflatum	purple-eyed grass						x
Juncaceae	**Rush family**						
Juncus balticus	Baltic rush						x
Juncus brachyphylus	shortleaved rush						x
Juncus bufonius	toad rush						x
Juncus confusus	Colorado rush						x
Juncus ensifolius	dagger-leaved rush					x	x
Juncus tenuis	slender rush						x
Luzula campestris	field woodrush			x			x
Liliaceae	**Lily family**						
Allium acuminatum	tapertip onion		x				
Allium fibrillum	fringed onion		x				x
Allium tolmiei tolmiei	Tolmie's onion	x				x	
Brodiaea douglasii	Douglas' brodiaea		x				
Calochortus elegans	cat ear sego lily		x				
Calo. macrocarpus maculosus	green-band mariposa lily		x				
Calochortus nitidus	broad-fruit mariposa lily		x				
Cammasia quamash	common camas					x	

Clintonia uniflora	beadlily		x			
Disporum hookerii	Hooker fairybell		x			
Disporum trachycarpum	Sierra fairybell		x			
Erythronium grandiflorum	dogtooth violet	x				
Fritillaria pudica	yellow bell	x				
Smilacina racemosa	western solomon-plume	x		x		
Smilacina stellata	star-flowered solomon-plume		x		x	
Streptopus amplexifolius	clasping-leaved twisted-stalk		x			
Trillium ovatum	western wake-robin		x			
Veratrum californicum	California false hellebore				x	
Zigadenus venenosus	meadow death camas	x				

		G	**F**	**S**	**R**	**M**
Orchidaceae	**Orchid family**					
Calypso bulbosa	fairy-slipper		x			
Corallorhiza maculata	spotted coral-root		x			
Cypripedium montanum	mountain lady-slipper		x			
Goodyeara oblongifolia	western rattlesnake-plantain		x			
Habenaria dilatata	bog-candle					x
Habenaria unalascensis	Alaska bog-orchid			x		
Listera convallaroides	broad-tipped twayblade	x				
Spiranthes romanzoffiana	ladies-tresses	x				x
Poaceae	**Grass family**					
Agropyron intermedium	intermediate wheatgrass	x				
Agropyron repens	quackgrass				x	x
Agropyron smithii	bluestem wheatgrass	x				
Agropyron spicatum	bluebunch wheatgrass	x				
Agrostis alba stolonifera	redtop				x	x
Agrostis exarata minor	spike bentgrass				x	
Agrostis interrupta	interrupted bentgrass	x				
Agrostis thurberiana	Thurber bentgrass					x
Alopecurus aequalis	shortawn foxtail				x	
Alopecurus genticulatus	water foxtail				x	
Alopecurus pratensis	meadow foxtail				x	
Aristida longiseta	red threeawn	x				
Arrhenatherum elatinus	tall oatgrass				x	
Bromus briazaeformis	rattlesnake brome	x				
Bromus carinatus	mountain brome	x				
Bromus commutatus	hairy brome					x
Bromus inermis	smooth brome					x
Bromus mollis	soft brome	x				

Bromus rigidus	ripgut brome	x				
Bromus secalinus	ryebrome					x
Bromus sterilis	barren brome	x				
Bromus tectorum	cheatgrass	x				
Bromus vulgaris	Columbia brome				x	
Calamagrostis rubescens	pinegrass		x			
Cenchrus longispinus	bur-grass	x				
Cinna latifolia	woodreed				x	
Dactylis glomerata	orchard grass					x
Danthonia intermedia	timber oatgrass				x	
Danthonia unispicata	onespike oatgrass	x				x
Deschampsia cespitosa	tufted hairgrass				x	
Deschampsia danthonoides	annual hairgrass					x
Deschampsia elongata	slender hairgrass				x	
Echinochola crusgalli	barnyard grass	x				
Elymus canadensis	nodding wildrye	x				x
Elymus cinerus	basin wildrye	x				x

		G	**F**	**S**	**R**	**M**
Elymus glaucus	blue wildrye		x			
Eragrostis lutescens	yellow lovegrass				x	
Festuca arundinacea	tall fescue					x
Festuca idahoensis	Idaho fescue	x				x
Festuca megalura	foxtail fescue	x				
Festuca microstachys	small fescue	x				
Festuca occidentalis	western fescue		x			
Glyceria grandis	reed mannagrass				x	
Hordeum jubatum	foxtail barley	x				
Hordeum leporinum	hare barley	x				
Koeleria cristata	prairie junegrass	x				
Lolium multiflorum	Australian ryegrass					x
Melica bulbosa	oniongrass		x			
Panicum occidentale	western witchgrass				x	
Panicum scribnerianum	Scribner's witchgrass				x	
Phalaris arundinacea	reed canarygrass				x	
Phleum alpinum	alpine timothy					x
Phleum pratense	common timothy	x				x
Poa annua	annual bluegrass	x				
Poa bulbosa	bulbous bluegrass	x				
Poa compressa	Canada bluegrass	x	x			
Poa cusickii	Cusick's bluegrass	x				
Poa palustris	fowl bluegrass				x	
Poa pratensis	Kentucky bluegrass	x	x	x	x	x
Poa sandbergii	Sandberg's bluegrass	x				

Poa trivialis	roughstalk bluegrass			x	
Secale cereale	cultivated rye	x			
Polypogon monspaliensis	rabbitfoot polypogon			x	
Puccinellia pauciflora	weak alkaligrass			x	
Sitanion hystrix	squirrel-tail	x			
Sporobolus cryptandrus	sand dropseed	x			
Stipa comata comata	needle-and-thread	x			
Stipa occidentalis minor	western needlegrass	x			x
Stipa occidentalis californica	western needlegrass	x			
Zizania aquatica	wild rice			x	
Sparganiaceae	**Bur-reed family**				
Sparganium angustifolium	narrowleaf bur-reed			x	
Typhaceae	**Cat-tail family**				
Typha latifolia	common cat-tail			x	

APPENDIX 2

Idaho Rare Plant Observation Form

APPENDIX 3

Map of 1993, grassland habitat rare plant survey routes at Craig Mountain

APPENDIX 4

Line drawings of rare plant species occurring at Craig Mountain

Line drawing of *Calochortus macrocarpus* var. *maculosus*
(from Ownbey 1969)

Line drawing of *Calochortus nitidus*
(from Ownbey 1969)

Line drawing of *Chrysothamnus nauseosus* ssp. *nanus*
(from Cronquist 1955)

Line drawing of *Haplopappus hirtus* var. *sonchifolius*
(from Cronquist 1955)

Line drawing of *Haplopappus liatriformis*
(from Cronquist 1955)

Line drawing of *Crepis bakeri* ssp. *idahoensis*
(from Cronquist 1955)

Line drawing of *Lomatium dissectum* var. *dissectum*
(from Cronquist 1961)

Line drawing of *Pediocactus simpsonii* var. *robustior*
(from Hitchcock 1961)

Line drawing of *Ribes wolfii*
(from Brooks et al. 1991)

Line drawing of *Mimulus clivicola*
(from Brooks et al. 1991)

Line drawing of *Mimulus washingtonensis* ssp. *ampliatus*

(from Brooks et al. 1991)

Line drawing of *Thelypodium laciniatum* var. *streptanthoides*
(from Hitchcock 1964)

Line drawing of *Trifolium plumosum* var. *amplifolium*
(from Hitchcock 1961)

Line drawing of *Silene spaldingii*
(from Hitchcock 1964)

APPENDIX 5

Distribution maps for rare plant occurrences at Craig Mountain

(All maps are portions of respective 7.5' USGS quadrangles,
except GIS-produced overall species distribution maps)

Maps 1-20 *Calochortus macrocarpus* var. *maculosus*

Map 1	Overall distribution at Craig Mountain
Map 2	South of Redbird Creek (008); Captain John Rapids quad.
Map 3	Captain John Creek (007); Captain John Rapids quad.
Map 4	Captain John Creek (007), and Upper Captain John Creek (020); Waha quad.
Map 5	Billy Creek (003); Limekiln Rapids quad.
Map 6	Billy Creek (003); Limekiln Rapids quad.
Map 7	Billy Creek (003); Captain John Rapids quad.
Map 8	Garden Creek Preserve (005); Frye Point quad.
Map 9	Garden Creek Preserve (005); Limekiln Rapids quad.
Map 10	Garden Creek Preserve (005); Limekiln Rapids quad.
Map 11	Garden Creek Preserve (005); Jim Creek Butte quad.
Map 12	Wapshilla Ridge (013); Wapshilla Creek quad.
Map 13	Wapshilla Ridge (013); Wapshilla Creek quad.
Map 14	Wapshilla Ridge (013), and Lower Salmon River Cany. (017); Wapshilla Creek quad.
Map 15	Wapshilla Ridge (013), Frye Point South (016), and Lower Salmon River Canyon (017); Wapshilla Creek quad.
Map 16	Frye Point South (016); Frye Point quad.
Map 17	Lower Salmon River Canyon (017); Rattlesnake Ridge quad.
Map 18	Lower Salmon River Canyon (017); Rattlesnake Ridge quad.
Map 19	Frye Point Southeast (019); Hoover Point quad.
Map 20	Snake-Salmon Confluence (018); Deadhorse Ridge quad.

Maps 21-33 *Calochortus nitidus*

Map 21	Overall distribution at Craig Mountain
Map 22	West Fork Sweetwater Creek (001), and Fort Simons Ridge (136); Waha quad.
Map 23	Upper Captain Creek (135); Waha quad.
Map 24	South Fork Captain John Creek (052); Limekiln Rapids quad.
Map 25	South Fork Captain John Creek (052); Frye Point quad.
Map 26	Frye Point (133), and Upper Fourth Creek (134); Frye Point quad.
Map 27	Benton Meadows (050), and West Fork Deer Creek (132); Frye Point quad.
Map 28	Soldiers Meadow Reservoir (038); Winchester West quad.
Map 29	Hoover Point (129); Hoover Point quad.
Map 30	Eagle Triangle Point (130); Hoover Point quad.
Map 31	Wapshilla Ridge (055); Frye Point quad.
Map 32	Wapshilla Ridge (055); Wapshilla Creek quad.
Map 33	Wapshilla Ridge (055); Wapshilla Creek quad.

Maps 34-39 *Chrysothamnus nauseosus* spp. *nanus*

Map 34 Overall distribution at Craig Mountain
Map 35 Upper Camp Creek (006); Limekiln Rapids quad.
Map 36 Upper Corral Creek (007); Frye Point quad.
Map 37 Upper China Creek (001), Morris Point (002), and Big Pine Triangle Point (003); Frye Point quad.
Map 38 Wapshilla Ridge (005); Wapshilla Creek quad.
Map 39 Wapshilla Ridge (005); Wapshilla Creek quad.

Maps 40-47 *Crepis bakeri* ssp. *idahoensis*

Map 40 Overall distribution at Craig Mountain
Map 41 South of Redbird Creek (016); Captain John Rapids quad.
Map 42 Fort Simons Ridge spur (015); Waha quad.
Map 43 Lake Waha (008); Waha quad.
Map 44 Corral Creek (004), and Middle Creek Road (017); Limekiln Rapids quad.
Map 45 Upper Cave Gulch (014); Frye Point quad.
Map 46 Cougar Canyon Ridge (018); Wapshilla Creek quad.
Map 47 Cactus Point (019); Wapshilla Creek quad.

Maps 48-50 *Haplopappus hirtus* var. *sonchifolius*

Map 48 Overall distribution at Craig Mountain
Map 49 Larabee Meadows (001), Deer Creek Road (002), Benton Meadows (003), and Swamp Creek (004); Frye Point quad.
Map 50 Upper Webb Creek (005); Winchester West quad.

Maps 51-56 *Haplopappus liatriformis*

Map 51 Overall distribution at Craig Mountain
Map 52 Redbird Ridge (032); Waha quad.
Map 53 Redbird Ridge (032); Captain John Rapids quad.
Map 54 Billy-Camp Creeks Divide (034), Gold Hill (035), Dough-Chimney Creeks Divide (036), and Tepee Peaks (038); Limekiln Rapids quad.
Map 55 Tepee Peaks (038); Captain John Rapids quad.
Map 56 Wapshilla Ridge (037); Wapshilla Creek quad.

Maps 57-68 *Lomatium dissectum* var. *dissectum*

Map 57 Overall distribution at Craig Mountain
Map 58 Redbird Ridge (019); Waha quad.
Map 59 Redbird Ridge (019); Captain John Rapids quad.
Map 60 Lake Waha (004); Waha quad.
Map 61 Lake Creek (020), Fort Simons Ridge West (021), and Upper Captain John Creek (022); Waha quad.

Map 62 Tepee Peaks (015), Camp Triangulation Point (016), and Upper Chimney Creek (017); Limekiln Rapids quad.
Map 63 Corral Creek (018); Limekiln Rapids quad.
Map 64 Upper Deer Creek (012), Upper Fourth Creek (013), and Frye Point North (014); Frye Point quad.
Map 65 Upper Cave Gulch (010); Frye Point quad.
Map 66 Deer Creek (006); Hoover Point quad.
Map 67 Bow Triangulation Point (007), and Hoover Point (008); Hoover Point quad.
Map 68 Wapshilla Ridge (009); Wapshilla Creek quad.

Maps 69-70 *Mimulus clivicola*

Map 69 Overall distribution at Craig Mountain
Map 70 Lake Waha (012); Waha quad.

Maps 71-72 *Mimulus washingtonensis* ssp. *ampliatus*

Map 71 Overall distribution at Craig Mountain
Map 72 Lake Waha (002); Waha quad.

Maps 73-77 *Pediocactus simpsonii* var. *robustior*

Map 73 Overall distribution at Craig Mountain
Map 74 Cottonwood Creek (009); Wapshilla Creek quad.
Map 75 Wapshilla Ridge (004), and Upper Cottonwood Creek (026); Wapshilla Creek quad.
Map 76 Southern Wapshilla Ridge (006), and Frenchy Creek (007); Wapshilla Creek quad.
Map 77 Southern Wapshilla Ridge (006); Deadhorse Ridge quad.

Maps 78-81 *Ribes wolfii*

Map 78 Overall distribution at Craig Mountain
Map 79 Lake Creek (006), and Upper Eagle Creek (007); Waha quad.
Map 80 Upper Eagle Creek (007); Frye Point quad.
Map 81 Big Pine Triangle Point (005); Frye Point quad.

Maps 82-84 *Silene spaldingii*

Map 82 Overall distribution at Craig Mountain
Map 83 Redbird Ridge (010); Captain John Rapids quad.
Map 84 Redensky Bowl (011), and Redensky Flats (012); Limekiln Rapids quad.

Maps 85-95 *Thelypodium laciniatum* var. *streptanthoides*

Map 85 Overall distribution at Craig Mountain
Map 86 South of Redbird Creek (013); Captain John Rapids quad.
Map 87 Captain John Rapids (003), and Lower Madden Creek (013); Captain John Rapids quad.

Map 88 Captain John Rapids (003), and Gold Hill (010); Limekiln Rapids quad.
Map 89 Tepee Peaks (008); Limekiln Rapids quad.
Map 90 Corral Creek (009); Limekiln Rapids quad.
Map 91 Cottonwood Creek (002), Lone Pine Creek (006), and Frenchy Creek West (007); Wapshilla Creek quad.
Map 92 East of Frenchy Creek (004), and Head of First Creek (005); Wapshilla Creek quad.
Map 93 Salmon/Snake Rivers Confluence (012); Deadhorse Ridge quad.
Map 94 Salmon/Snake Rivers Confluence (012); Cactus Mtn. quad.
Map 95 Salmon/Snake Rivers Confluence (012); Rattlesnake Ridge quad.

Maps 96-99 *Trifolium plumosum* var. *amplifolium*

Map 96 Overall distribution at Craig Mountain
Map 97 Lake Waha (004); Waha quad.
Map 98 Soldiers Meadow Reservoir (021); Waha quad.
Map 99 Larabee Meadows (025); Frye Point quad.

APPENDIX 6

Element Occurrence Records from the Conservation Data Center
for 14 rare plant species at Craig Mountain

Element Occurrence Records for *Calochortus macrocarpus* var. *maculosus*

Element Occurrence Records for *Calochortus nitidus*

Element Occuurence Records for *Chrysothamnus nauseosus* spp. *nanus*

Element Occurrence Records for *Crepis bakeri* spp. *idahoensis*

Element Occurrence Records for *Haplopappus hirtus* var. *sonchifolius*

Element Occurrence Records for *Haplopappus liatriformis*

Element Occurrence Records for *Lomatium dissectum* var. *dissectum*

Element Occurrence Records for *Mimulus clivicola*

Element Occurrence Records for *Mimulus washingtonensis* ssp. *ampliatus*

Element Occurrence Records for *Pediocactus simpsonii* var. *robustior*

Element Occurrence Records for *Ribes wolfii*

Element Occurrence Records for *Silene spaldingii*

Element Occurrence Records for *Thelypodium laciniatum* var. *streptanthoides*

Element Occurrence Records for *Trifolium plumosum* var. *amplifolium*

APPENDIX 7

Locations of Tisdale vegetation monitoring plots at Craig Mountain

Map 1. Tisdale monitoring plots 94MM001 - 94MM005; portion of the 7.5' USGS Captain John Rapids quadrangle.

Map 2. Tisdale monitoring plots 94MM006 - 94MM008; portion of the 7.5' USGS Frye Point quadrangle.

Map 3. Tisdale monitoring plots 94MM009 - 94MM012; portion of the 7.5' USGS Wapshilla Creek quadrangle.

APPENDIX 8

Location, description, layout and comment information for Tisdale plots

APPENDIX 9

WHTF (Western Heritage Task Force) Form II - Community Survey Form

(Explanation of codes and instructions for completing Form II are on file at the Idaho Conservation Data Center, Boise, and the Idaho Department of Fish and Game's Region 2 office, Lewiston.)

APPENDIX 10

Illustration of nested plot frame used for Tisdale and Palouse Goldenweed monitoring plot sampling

APPENDIX 11

Nested plot frequency data sheet

APPENDIX 12

WHTF (Western Heritage Task Force) Form III - Ocular Plant Species Data

(Explanation of codes and instructions for completing Form III are on file at the Idaho Conservation Data Center, Boise; and the Idaho Department of Fish and Game's Region 2 office, Lewiston.)

APPENDIX 13

Locations for Palouse Goldenweed monitoring plots at Craig Mountain

Map 1. Palouse goldenweed monitoring plot 94MM013; portion of the 7.5' USGS Waha quadrangle.

Map 2. Palouse goldenweed monitoring plot 94MM014; portion of the 7.5' USGS Limekiln Rapids quadrangle.

Map 3. Palouse goldenweed monitoring plot 94MM015; portion of the 7.5' USGS Wapshilla Creek quadrangle.

APPENDIX 14

Location, description, layout and comment information for Palouse Goldenweed monitoring plots

APPENDIX 15

Palouse Goldenweed monitoring Data Forms 1 and 2

APPENDIX 16

Craig Mountain Vegetation Monitoring data sheet

(Instructions for completing the Vegetation Monitoring form are on file at the Idaho Conservation Data Center, Boise, and the Idaho Department of Fish and Game's Region 2 office, Lewiston.)