

RARE PLANT AND RIPARIAN VEGETATION INVENTORY
OF THE BOISE FOOTHILLS,
ADA COUNTY, IDAHO

by

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SUMMARY

Several information gaps pertaining to resources in the Boise Foothills have been identified by the Foothills Steering Committee that hinder formulation of comprehensive planning ordinances for this sensitive area. The distribution and abundance of rare plant species and communities were identified as information gaps. Three plant species that are candidates for federal listing as Endangered or Threatened under the Endangered Species Act, as well as rare terrestrial and riparian plant communities, are known to occur in the foothills. The Idaho Department of Fish and Game's Conservation Data Center (CDC) was contracted by Boise City Planning and Zoning to conduct an inventory of the Boise Foothills for the three rare plants and rare communities during Spring, 1992. Overall objectives of the investigation were as follows: 1) compile a complete data base on the distribution and abundance of rare plants and communities in the Boise Foothills, and 2) rank the ecological quality of each rare plant population or community occurrence on a relative scale for planning purposes.

The study area includes the lower Boise Foothills, between Highway 55 on the northwest, Cottonwood Creek on the southeast, the Dry Creek Valley on the north, the geologic contact between the granitics and sediments on the northeast, and the Boise Valley flatlands on the south. Botanists have been exploring the Boise Foothills since the 1860's. We started by compiling these previously-collected data, from which we identified gaps in our knowledge regarding the distribution and abundance of the species and communities and designed a field inventory to fill these gaps. Following the prefield data compilation and gap analysis, we conducted a thorough field inventory for the three species and two communities during late March and April, 1992. We made every attempt to contact landowners and request permission to inventory their land. In several instances we were unable to make contact or were denied permission. In those cases, only rare plant population data generated by pre-1992 sources are presented, although we were able to observe from a distance whether or not these habitats had been destroyed.

In addition to simply delineating boundaries of rare plant populations, we also assessed population size and ecological quality of each population. From these assessments and protocol developed in previous studies we stratified the populations of each species into three categories useful for conservation planning in the Boise Foothills: 1) Primary Populations - The largest populations which would contribute the most to the long-term persistence of the species in the foothills, 2) Secondary Populations - Mid-range populations, large populations on degraded or isolated sites, or small populations on ecologically high quality sites or occurring sympatrically with another rare species, 3) Tertiary Populations - Very small populations and/or those on ecologically degraded sites, where long-term viability is questionable. We also ranked the ecological quality of occurrences of the rare communities.

Following the field inventory, populations of rare plants and occurrences of rare communities were precisely transferred from field maps to topographic base maps. The base maps were digitized and entered into the Boise City Planning and Zoning Geographic Information System (GIS). Attributes entered into the GIS system include the geographic distribution of a rare plant population, species represented by that population, rank of the populations, and location of riparian habitats. The GIS data will be the primary source of information used by the city for planning purposes. For rare plants, information such as population rank, location, numbers, area, and habitat information was entered into the CDC's data base. A compilation of all rare plant population and community occurrences in the study area is included in this report. Field maps, notebooks, unpublished reports and maps, among other types of information, are on file at the CDC office in Boise.

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INTRODUCTION

Over a century of pressure from being adjacent to Idaho's largest city has taken its toll on native habitats in the Boise Foothills. Considerable biological impoverishment has taken place in the foothills since settlement by Europeans. One indication of this decline in ecosystem health is the status of three rare plants and at least two natural communities:

- o **Mulford's milkvetch** (*Astragalus mulfordiae*) - Discovered by Isabel Mulford in the Boise foothills in 1892, this rare member of the pea family is now known from three widely separated areas in southwestern Idaho and adjacent Oregon (Kennison 1980; Moseley 1989). It is, however, declining in all areas, with the destruction of its habitat in the Boise Foothills being particularly acute.
- o **Aase's onion** (*Allium aseae*) - This diminutive wild onion is restricted to steep, sandy slopes in the lower foothills between Boise and Emmett (Moseley and Caicco 1989; Mancuso and Moseley 1991). Botanists have documented the destruction of its habitat by numerous activities, including sand mining, weed invasion, ORV trails, cattle trampling, and housing developments. It is estimated that 5% of the onion populations are destroyed each year by these activities.
- o **Slick-spot peppergrass** (*Lepidium papilliferum*) - This small member of the mustard family was discovered in Canyon County at the turn of the century. It was thought to have gone extinct, however, until its rediscovery in the Boise Foothills in 1972 (Packard and Ertter n.d.). Its is now known to be largely restricted to the western Snake River Plain. Our knowledge of its abundance and distribution is still sketchy, but it is clear that much of its native habitat has been destroyed by agricultural conversions, housing developments, weed invasions, unnatural fire frequencies, and pasture seedings.
- o **Bitterbrush/needle-and-thread grass community** (*Purshia tridentata/Stipa comata*) - This plant community is restricted to the Columbia Basin area of Washington, Oregon and adjacent British Columbia, and is disjunct along the northern edge of the western Snake River Plain (Idaho Natural Heritage Program *et al.* 1986). It has been greatly impacted by human-caused disturbances throughout its range, and occurrences of high ecological quality are rare. Small, ecologically viable stands of this community may still occur in the Boise Foothills.
- o **Riparian/Wetland Vegetation** - This type of vegetation is limited in extent in the foothills and has been greatly impacted by numerous anthropogenic sources over the years. No formal classification has been completed for riparian vegetation in southwestern Idaho. There are probably several riparian community types in the study area, but their identity (*i.e.*, name) will have to await a formal ecological classification.

Due to the rarity and documented decline, each plant species mentioned above is a candidate for federal listing under the Endangered Species Act (U.S. Fish and Wildlife Service 1990). The U.S. Fish and Wildlife Service currently has sufficient information on hand to prepare listing packages for Mulford's milkvetch and Aase's onion, and currently is proceeding to list Mulford's milkvetch as Threatened. Studies of the distribution and abundance of slick-spot peppergrass are currently underway. For more information on legal protection of these plants contact the Boise Field Office, U.S. Fish and Wildlife Service, 4696 Overland Road, Boise, ID, 83705, phone 208/334-1806. No legal protection is directly

afforded to rare communities, but their conservation is of great concern and they should be considered in conservation planning for the Boise Foothills.

Aside from the legal reasons for protecting declining species, there are also many utilitarian and moral arguments for maintaining viable populations of all the earth's biota. It would simply be poor citizenship not to maintain our natural heritage, a heritage that will affect the quality of life for many generations to come. Ethically, the extinction of evolutionary lineages that are millions of years old is morally indefensible, but there are also many utilitarian implications of species extinctions. Human beings have used about 5,000 species of plants as food, but only 150 or so have entered world commerce and less than 20 provide most of the world's food (Reid and Miller 1989). As modern society has decreased the diversity of crops in use, insect and disease problems have increased. Plant biologists have been looking more and more to the genes of related wild plants to infuse new vitality and resistance into existing crops. For instance, Aase's onion flowers and fruits in late winter and early spring. Genes controlling this characteristic may ultimately be useful for increasing the cold tolerance of cultivated onions thereby increasing productivity of this important crop in southwestern Idaho. Most of the world's medicines contain active ingredients extracted from animals and plants or are synthesized using natural chemicals as models. Plants containing toxic compounds that have evolved to limit grazing are of particular interest because many active medical compounds are derived from such toxins. Mulford's milkvetch belongs to a genus of plants that contains toxic compounds known as alkaloids, compounds that are widely used and copied in developing new medicines. Plants also provide major industrial products such as natural rubber, waxes, oils, petrochemicals, fibers, and resins. Slick-spot peppergrass belongs to the mustard family, many species of which contain high quality oils used as lubricants in delicate industrial processes. None of the three rare plants in the Boise Foothills have been screened for utilitarian uses, but their extinction would narrow future options.

While the Boise Foothills offer regionally important opportunities for housing and recreation, the presence of three narrowly distributed and declining plant species makes them globally significant for maintenance of biodiversity. Although future generations have the most at stake, it is our conservative stewardship that will assure that viable populations are maintained over the long term. Private individuals and organizations along with municipal, county, state, and federal agencies must work in concert to assure a positive outcome.

The distribution and abundance of rare plant species and communities were identified by the Boise Foothills Steering Committee as one of several information gaps pertaining to foothills resources that hinder formulation of comprehensive planning ordinances for this sensitive area. The Idaho Department of Fish and Game's Conservation Data Center (CDC) was contracted by Boise City Planning and Zoning to conduct an inventory of the Boise Foothills for the three rare plants and rare communities during Spring, 1992. Overall objectives of the investigation were as follows:

1. Compile a complete data base on the distribution and abundance of rare plants and communities in the Boise Foothills.
2. Rank the ecological quality of each rare plant population or community occurrence on a relative scale for planning purposes.

The CDC is widely recognized as the central clearinghouse for information on rare plants and animals in Idaho. The CDC is part of the network of Natural Heritage Programs and Conservation Data Centers that

now includes more than 100 installations in all 50 states, several Canadian provinces, 13 Latin American and Caribbean countries, as well as a number of national parks, forests and other areas (Master 1991). This worldwide information network, which collects and manages information in a standardized way, was developed by The Nature Conservancy, and is directed toward the conservation of biological diversity. We currently have over 3,000 occurrences of rare plants entered into our data base for Idaho. These data are widely used by federal, state, and municipal agencies, as well as private groups and individuals, for the proactive management and conservation of rare plants in Idaho.

STUDY AREA

Determination of the study area boundary was driven by two factors: 1) area of interest to Boise City, that is, the lower foothills between Lucky Peak Dam and Highway 55, and 2) the known distribution of rare plant species in the foothills, which in turn is influenced by underlying geology. Botanists have been exploring the Boise Foothills since the 1860's. None of the three rare plant species has been documented in the foothills southeast of Cottonwood Creek. With the exception of one species, most of the known populations are in the lower foothills, below the contact between the Cretaceous granitic rocks of the Idaho batholith, which underlie Boise Ridge, and the Tertiary sediments of the lower foothills. The exception is Aase's onion, with a few populations known from granitics on Boise Ridge. We found, however, that these upper-elevation populations were elevationally separated from those found on sediments in the lower foothills by about one thousand feet (Mancuso and Moseley 1991).

The study area is rectangular in shape, oriented northwest to southeast (Figure 1). It is bounded by the Snake River Plain on the southwest, Cottonwood Creek on the southeast, the Dry Creek Valley on the northwest, and the geologic contact between the granitics and sediments on the northeast. The latter-mentioned geologic boundary is roughly parallel with the northwest to southeast trend of the Dry Creek Valley, upstream from its confluence with Carrant Creek.

METHODS

Prefield Data Compilation Botanists have been exploring the Boise Foothills since an Army surgeon named Wilcox collected plants from his post at Fort Boise in the 1860's. We started this project by compiling these previously-collected data, and mapped known populations/occurrences of the rare plant species and communities in the study area on to USGS topographic quadrangles. From these data, we identified gaps in our knowledge regarding the distribution and abundance of the species and communities and designed a field inventory to fill these gaps.

Field Inventory Following the prefield data compilation and gap analysis described above, we conducted a field inventory for the three species and two communities during late March and April, 1992.

We made every attempt to contact landowners and request permission to inventory their land. In several instances we were unable to make contact or were denied permission. In those cases, only rare plant occurrence data generated by pre-1992 sources are presented here. In addition, we were able to observe from adjacent ownerships whether or not these previously-known population habitats

figure 1

were still intact. Based on the distribution of geologic substrates suitable for rare plants (elaborated on in the Results section) and the thoroughness of pre-1992 surveys, we predict that two areas in the foothills where we were denied access have a high probability of containing unreported rare plant occurrences. Figure 2 displays these two high-probability areas for which our survey was incomplete due to lack of access.

Field inventory protocol followed previous studies of Aase's onion (unpublished BLM data; Moseley and Caicco 1989), Mulford's milkvetch (Moseley 1989), and slick-spot peppergrass (unpublished BLM data). All potential habitat in the study area that was accessible was surveyed. We surveyed for Aase's onion in late March, as it flowers approximately one month before the other two. Survey's for Mulford's milkvetch and slick-spot peppergrass were conducted in mid- to late April. Population boundaries were delineated onto USGS topographic maps.

Field inventory for the bitterbrush/needle-and-thread grass community was done in conjunction with the rare plant inventories in March and April. Riparian vegetation was inventoried in late April and early May.

Population and Community Ranking

Rare Plant Populations: In addition to simply delineating boundaries, we also assessed population size and ecological quality of each population. For population size, we counted the number of individuals in small populations or estimated the number of individuals in large populations. The ecological quality assessment was largely based on habitat quality (i.e., disturbed or weedy vs. relatively undisturbed with high percentage of native species) and proximity to ongoing disturbances, and, to a lesser extent, on the degree of isolation in fragmented habitats. From these assessments and protocol developed in previous studies (unpublished BLM data; Moseley 1989; Moseley and Caicco 1989), we stratified the populations of each species into three categories:

Primary Populations/Category A - The largest populations which would contribute the most to the long-term persistence of the species in the foothills. Definitions of primary populations are as follows:

Aase's onion - Populations of greater than 5,000 individuals.

Mulford's milkvetch - Populations of 400 to over one thousand individuals.

Slick-spot peppergrass - Prior to 1992, only three populations of slick-spot peppergrass were known to be extant in the Boise Foothills (one is extinct) and all are very small in number and area. Until more is known of its distribution and abundance in the foothills, any populations found will be significant.

Secondary Populations/Category B - Mid-range populations, large populations on degraded or isolated sites, or small populations on ecologically high quality sites or occurring sympatrically with another rare species. Definitions of secondary populations are as follows:

Aase's onion - 500-5,000 individuals.

Mulford's milkvetch - Populations of approximately 50 to 400 individuals.

Slick-spot peppergrass - See comments under Primary category.

Figure 2

Tertiary Populations/Category C - Very small populations and/or those on ecologically degraded sites, where long-term viability is questionable. Definitions of tertiary populations are as follows:

Aase's onion - Less than 500 individuals.

Mulford's milkvetch - Populations of less than 50 individuals.

Slick-spot peppergrass - See comments under Primary category.

Rare Plant Communities: Rank the ecological quality of occurrences of the rare communities into high and low quality. Rank communities following these guidelines:

Bitterbrush/needle-and-thread stands: Compare species composition and abundance data from foothills stands with stand tables from the literature (Daubenmire 1970; Hironaka et al. 1983; Idaho Natural Heritage Program et al. 1986). Vegetation classifications for shrub-steppe communities in the Pacific Northwest base their classifications on stands considered to be "climax", i.e., undisturbed and in high ecological condition.

Riparian/wetland communities: Little to no published data exist on the species composition and abundance for wetland and riparian communities found in the Boise Foothills. Therefore, it will be very difficult to ecologically rank sites. As a practical matter, however, because these communities are small and localized, anywhere they occur in the foothills will be ecologically significant.

Documentation Following the field inventory, populations of rare plants and occurrences of rare communities were precisely transferred from field maps to topographic base maps. The base maps were digitized and entered into the Boise City Planning and Zoning Geographic Information System (GIS). Attributes entered into the GIS system include the geographic distribution of a rare plant population, species represented by that population, rank of the populations, and location of riparian habitats. For rare plants, information such as population rank, location, numbers, area, and habitat information was entered into the CDC's data base. A compilation of all rare plant population and community occurrences in the study area is included in this report. Field maps, notebooks, unpublished reports and maps, among other types of information, are on file at the CDC office in Boise.

RESULTS

Previous Inventories in the Boise Foothills Botanists have been cataloging plants in the Boise Foothills for nearly 130 years. These botanical specimens were deposited in local, regional, and national herbaria such as the Snake River Plain Herbarium at Boise State University, U.S. Forest Service's Boise Forestry Sciences Laboratory Herbarium, Albertson College of Idaho Herbarium, University of Idaho Herbarium, Marion Ownbey Herbarium at Washington State University, Rancho Santa Ana Botanic Garden Herbarium at Claremont, California, the U.S. National Herbarium in Washington, D.C., plus others. Specimens deposited in these herbaria formed the basis for our knowledge of the distribution of the rare plants in the Boise Foothills. Several recent efforts, listed below, have specifically focused on clarifying the distribution, abundance, threats, and ecological attributes of the three rare plant species.

- 1984-Present **Conservation Data Center (CDC)** - As distribution, abundance, and threat data became available for rare plant populations, they were entered into the CDC data base, which is the central clearinghouse for rare plant and animal occurrence information in the state.
- 1986-1990 **BLM and Unimin Mining Co.** - Conducted life history and habitat ecology studies for Aase's onion. These studies were aimed at developing reintroduction techniques to mitigate the loss of populations destroyed by sand mining (Bolin and Rosentreter 1986; Prentice 1988).
- 1987 **CDC** - Under contract from Ada County Solid Waste Management, botanists from the CDC determined the status and distribution of Aase's onion on Ada County lands in Seaman Gulch (Moseley and Caicco 1989).
- 1988 **BLM** - Intensive and thorough survey for Aase's onion throughout its range, predominantly on BLM land.
- 1988 **CDC** - Botanists conducted a status survey of Mulford's milkvetch throughout its range in Idaho, including the Boise Foothills. This status survey was done for the U.S. Fish and Wildlife Service through Section 6 of the Endangered Species Act (Moseley 1988).
- 1991 **CDC, Idaho Native Plant Society, and Friends of Military Reserve** - Mapped the distribution and abundance of Aase's onion, Mulford's milkvetch, and slick-spot peppergrass in Military Reserve Park.
- 1991 **Idaho Native Plant Society, Wetlands Coalition, and Golden Eagle Audubon** - Mapped the distribution and abundance of Aase's onion, Mulford's milkvetch, and slick-spot peppergrass in lower Hulls Gulch.
- 1991 **Idaho Native Plant Society and CDC** - Mapped the distribution and abundance of Aase's onion and Mulford's milkvetch in Camelsback Park.
- 1991 **CDC** - As a cooperative Challenge Cost-share project with the Boise National Forest, botanists from the CDC conducted a status survey of Aase's onion on the Boise National Forest (Mancuso and Moseley 1991).

During the course of compiling existing information on rare plants and communities in the Boise Foothills, we accumulated several maps that may be of interest to others (Table 1). These maps are available for review or loan from the CDC office.

No detailed information was found concerning plant communities in the foothills. The U.S. Forest Service's Intermountain Research Station laboratory in Boise, has studied grass-like wetland plants of Hulls Gulch, and various planning studies in the 1970's characterized foothills vegetation in a general way.

table 1

Distribution of Rare Plants in the Boise Foothills

A summary of our findings for each of the three species is discussed below. Specific data relating to each rare plant population appear in Appendices 1 through 4. Before explaining the contents of these appendices, an explanation of several terms will aid in their understanding:

POPULATION -- In our study we define a population as a discrete cluster of individuals of a species. This does not necessarily agree with the biological definition of a population, which also accounts for the potential exchange of genes among individuals. We decided upon a rather simplistic use of the term, based on a geographic criterion, instead of possibly confusing things by introducing terms such as subpopulation and metapopulation. Each population was assigned a rank.

OCCURRENCE -- This is a term used in the map, manual, and computer data bases at the CDC to keep track of a population or group of closely arranged populations in a specific geographic area. For example, a group of Aase's onion populations in the small drainage above McCord's in lower Hulls Gulch or Mulford's milkvetch populations on the ridge in Camelsback Park are Occurrences. The arrangement of populations into occurrences in our data base does not necessarily have any biological meaning, but rather it is a convenient methodology for record keeping and communication.

OCCURRENCE RECORD -- A computerized record maintained in our data base for each Occurrence. An Occurrence Record contains numerous fields relating to the location, quality, and habitat features of each Occurrence.

OCCURRENCE NUMBER -- A number assigned to each Occurrence for each species as it is chronologically entered into our data base. It should be noted that each species has a string of Occurrence Numbers beginning with 001 and that Aase's onion Occurrence 013 may not be at all related to Mulford's milkvetch Occurrence 013. Similar to Occurrence, the Occurrence Number is also a convenient standardization for record keeping and communication. It is not a relative ranking. The three digit code following a site name in the following sections refers to the Occurrence Number.

Appendices 1, 2, and 3 contain Boise Foothills Occurrence Records from the CDC data base for Mulford's milkvetch, Aase's onion, and slick-spot peppergrass, respectively. The Occurrence Records are arranged by Occurrence Number in each appendix. Appendix 4 contains maps of the known populations of rare plants in the Boise Foothills, with a rank for each population. Also indicated on the maps is the Occurrence Number for each population or group of populations, which is useful as a cross-reference between the maps and the Occurrence Records for that species in Appendices 1, 2, and 3.

Substrate Specificity

Our original assumption relating to rare plant distribution and geologic substrate distribution, as outlined in the Study Area section, held true. We found no rare plant populations that transcend the important geologic contact in our lower foothills study area between Tertiary sediments and Cretaceous granitics. All populations in the study area occur on the sediments. Further, we found that all rare plant populations

occurred on one of three sand-dominated geologic units in the Boise Foothills: Pierce Gulch Formation Sand, Terteling Springs Formation Sand and Sandstone, and Terteling Springs Formation Sandy Sediments (Beck 1988). No rare plant populations in our study area were found on another widespread substrate in the foothills, the Terteling Springs Formation Claystone and Siltstone. The former, sandy formations coincide with Beck's (1988) Geotechnical Terrain Unit 4, foothill slopes underlain by sand and gravel deposits, while the latter, clayey and silty formation coincides with Beck's Geotechnical Terrain Unit 3, foothill slopes underlain by siltstone and claystone with minor sand layers. One of the difference between these two types of formations is the grain size of the sediments. Substrates underlying rare plant populations are comprised of fine to coarse and gravelly sands while those having no populations are comprised largely of clay- and silt-sized sediments. The geologic unit underlying each Occurrence is indicated in the Occurrence Records in Appendices 1, 2, and 3.

A large majority of the populations occur on three soil mapping units of Beck (1988): Quincy-Lankbush complex, Payette-Quincy complex, and Haw-Lankbush complex. All four soil series included in these complexes are very deep, well drained soils, formed in acid igneous alluvium or lacustrine deposits (Collett 1980). Populations also occur on six other, mostly loam or sandy loam soil units, with only one or two populations on each. These units include Ada gravelly sandy loam, Brent loam, Cashmere coarse sandy loam, Harpt loam, Lankbush-Brent sandy loams, and Searles-Rock outcrop complex (Beck 1988). The soils mapping unit underlying each Occurrence is indicated on the Occurrence Records in Appendices 1, 2, and 3.

Mulford's Milkvetch

Mulford's milkvetch is the rarest and most threatened of the three rare plants we found in the study area. The Boise Foothills are one of three centers of distribution of Mulford's milkvetch, the other two being in Owyhee County and around Weiser on both the Idaho and Oregon sides of the border. Populations have been extirpated and others are declining due to human activities in all three areas. All or parts of three populations have been destroyed in the foothills since 1990. The Boise Foothills contain the highest concentration of populations, although most are small, especially compared to those in the Weiser area. In the foothills, a vast majority of the Mulford's milkvetch populations occur between Stewart Gulch and Cottonwood Creek, directly north of Boise. Surprisingly, we only found eight, very small populations west of Stewart Gulch (Occurrence Numbers 036, 037, and 038), in the Seaman Gulch area, each occurring on just a few square yards and containing a total of 60 plants. Although Mulford's milkvetch occurs on all three sandy geologic units discussed in the previous section, we found that it occurs on finer-textured sands than Aase's onion. It appeared that the Pierce Gulch Formation Sand in the western portion of our study area was considerably coarser than the geologic substrates on the eastern side of the area, possibly limiting its distribution.

Only three Category A populations occur in the study area, at Lower Hulls Gulch - North (032), Camelsback Park (004), and Middle Stewart Gulch (018). All have large vigorous populations and occur in excellent habitats. These three populations are very important to the long term persistence of the species globally, and in the Boise Foothills in particular. These Category A populations should be afforded the greatest possible protection. Many Category B populations occur in the study area and will be important in the conservation of the species in the Boise Foothills due to the small number of Category A sites. On a case by case basis, the City and the development community should work toward the protection of all secondary populations of Mulford's milkvetch to the fullest possible extent. Category C

sites are marginally viable in the long term, due either to very low population numbers, degraded habitats, isolation, or a combination of these three factors. When a comprehensive conservation strategy is in place for the Boise Foothills that assures the protection of all Category A populations and as many Category B populations as possible, the Category C populations could be destroyed. Otherwise these Category C populations remain as important evolutionary reservoirs that must be maintained.

Populations of Mulford's milkvetch occur on public lands managed by Boise City and Ada County. Populations under the jurisdiction of the City include those managed by the Parks and Recreation Department at Military Reserve Park (012, 029, 030, and 031) and Camelsback Park (004), the latter containing one of the three Category A populations. Three small populations (Lower Seaman Gulch 036) occur on the Hidden Hollow Landfill, administered by Ada County Solid Waste Management. Ada County Solid Waste Management and Boise City Parks and Recreation should enter into a pre-listing Conservation Agreement with the U.S. Fish and Wildlife Service for the long term conservation and management of Mulford's milkvetch and other federal candidate plants occurring on lands they administer.

Aase's Onion

Aase's onion populations in the Boise Foothills study area comprise approximately half of the global distribution of the species, in terms of both area and numbers. Virtually all undeveloped, south-facing slopes in the study area underlain by one of the three sandy geologic units contain populations of Aase's onion. Boise Foothills populations can be quite dense but the total area occupied by Aase's onion is relatively small and the numerous threats and documented declines or extirpations of onion populations by human causes makes it vulnerable.

Category A populations occur throughout the study area at the following sites (from east to west): Upper Freestone Creek (012), Lower Hulls Gulch - South (011), Lower Hulls Gulch - North (014), Braemere Ridge (021), Upper Crane Gulch - East (023), Upper Crane Gulch - West (019), Hackberry Divide (008), Middle Stewart Gulch (010), Lower Stewart Gulch (032), Collister Hillside (063), Upper Pierce Gulch (024), Lower Pierce Gulch (066), Pierce - Seaman Divide (036), and Seaman Gulch North (056). These populations are essential to the long-term persistence of the species and should be protected. Category B populations, while somewhat smaller and/or more degraded than Category A populations, are important to long-term conservation and should be maintained and protected to the fullest extent possible within existing development plans on a case-by-case basis.

Aase's onion populations occur on four public ownerships in the Boise Foothills: BLM, Idaho Department of Lands, Ada County, and Boise City. The BLM manages part of Upper Seaman Gulch (026) adjacent to the County landfill in Seaman Gulch. The Idaho Department of Lands manages part of Goose Creek (029), part of Upper Pierce Gulch (024), part of Lower Stewart Gulch (032), all of Upper Miller Gulch (005), part of Corral Trail (013), and part of Upper Crane Gulch - East (023). Hidden Hollow Landfill, managed by Ada County Solid Waste Management, contains part of Upper Seaman Gulch (026), most of Lower Seaman Gulch (027), part of Goose Creek (029), part of Pierce - Seaman Divide (036), all of Seaman Gulch North (056), and all of Middle Seaman Gulch (057). Boise City Parks and Recreation Department manages populations at two city parks: Camelsback (009) and Military Reserve (006, 025, 058, and 059).

The BLM has entered into a pre-listing Conservation Agreement with the U.S. Fish and Wildlife Service that, among other things, calls for the establishment of five reserves containing high quality Aase's onion

populations and habitats. All of these five sites are outside of our Boise Foothills study area. In other words, the western half of the species' distribution appears secure due to BLM actions, leaving the eastern half of its distribution vulnerable. The Idaho Department of Lands, Ada County Solid Waste Management, and Boise City Parks and Recreation should also enter into a Conservation Agreement with the U.S. Fish and Wildlife Service for the long term conservation and management of Aase's onion, and other federal candidate plants occurring on lands they administer. This will help ensure this species viability in the eastern portion of its range.

Slick-spot Peppergrass

Seven small populations of slick-spot peppergrass are now known to occur in the study area. One population is known to have been extirpated in Military Reserve Park, probably by an unsuccessful green-stripping attempt on Veterans Ridge. All extant populations are small and localized, consisting of fewer than 150 individuals in 1991 and 1992, although because of its biennial growth habit this number may vary from year to year depending on climatic patterns. The area occupied by each of these populations is small, ranging from 3 ft² to 600 ft².

The Boise Foothills populations represent a small but important portion of the species distribution. The primary range of slick-spot peppergrass is the western Snake River Plain, where it is known from 32 sites (excluding Boise Foothills populations) in Ada, Canyon, Elmore, Gem, and Payette counties. An additional, disjunct site is known from Bannock County. The Boise Foothills populations represent the northern edge of its distribution and may contain important genetic information necessary for the species' long-term persistence on the landscape. We did not rank any of the foothills populations on the maps in Appendix 4, because all are essentially of equal conservation importance and should be protected.

One extant population remains at Military Reserve Park (Veterans Ridge 012), managed by Boise City Parks and Recreation Department, and three populations occur on the Hidden Hollow Landfill (Goose Creek 038), managed by Ada County Solid Waste Management. These public-land populations will play a large role in the conservation of the species. Ada County and Boise City should enter into a pre-listing Conservation Agreement with the U.S. Fish and Wildlife Service that ensures the long-term viability of these populations.

Riparian Areas in the Boise Foothills

Six drainages on the eastern side of the study area were found to support riparian/wetland vegetation, including Cottonwood Creek, Freestone Creek, Hulls Gulch, Crane Gulch, Stewart Gulch, and Dry Creek. Although all drainages have been disturbed to some degree, and there is generally a large weedy component to the flora, each is of the highest value for maintaining biological diversity in the Boise Foothills and should be protected and restored to the fullest extent possible. No drainage west of Stewart Gulch, including Polecat Gulch, Pierce Gulch, Seaman Gulch and Goose Creek, encompasses large enough watersheds to support riparian vegetation. A compositional and structural characterization of the flora of the six riparian zones appears below. The species lists for each drainage were compiled in the spring and some plants were not fully developed and unidentifiable at that time. Therefore, the following species lists are not complete. Plant nomenclature follows Hitchcock and Cronquist (1973).

Hulls Gulch

The quality of the riparian zone and its associated vegetation along Hulls Gulch is quite variable. The construction of small reservoirs, trails and roads, recreational impacts, and weed invasion have all impacted this fairly narrow riparian area. Weeds are especially bad in the lowest portions of Hulls Gulch and have likely totally replaced several native herbaceous species. In general, the further upstream one goes, the more intact the native vegetation appears, including the retention of a wide array of native species. Water was present in May, 1992.

In the area just upstream of the reservoir in lower Hulls Gulch, the canopy is dominated by *Populus trichocarpa* (black cottonwood). Lesser amounts of the exotics *Acer negundo* (box-elder), *Elaeagnus angustifolia* (Russian olive), *Tamarix parviflora* (tamarisk) and *Ulmus* sp. (elm) also occur in hodgepodge fashion. Very common and dominating the shrub layer are *Salix exigua* (coyote willow), especially in sandy openings, and *Salix lasiolepis* (arroyo willow), which can be nearly arborescent, but is more typically a large shrub. *Ribes aureum* (golden currant) and *Rosa woodsii* (Wood's rose) are also very common shrubs throughout the drainage.

Predominating in the understory are exotic forbs and grasses which have replaced much of the native understory vegetation. *Conium maculatum* (poison hemlock), *Lamium purpureum* (red dead-nettle), *Saponaria officinalis* (bouncing bet), and a number of annual grasses including *Poa bulbosa* (bulbous bluegrass) and *Taeniatherum caput-medusae* (medusahead) are all abundant. The noxious weed, *Lythrum salicaria* (purple loosestrife), has become established in this area. The exotic perennial grass *Agropyron repens* (quack grass), and a native *Poa* sp. are also present. Occurring sparingly on some wetter sites are the sedges *Carex vulpinoidea* (fox sedge) and *C. lanuginosa* (wooly sedge), and the rushes, *Juncus torreyi* (Torrey's rush), *J. tenuis* (slender rush), and others. Additionally, several very wet pockets support nearly pure stands of *Typha latifolia* (cattail).

A little further upstream, the riparian zone narrows, with black cottonwood dominating the overstory, although its cover is not continuous. *Salix amygdaloides* (peach-leaf willow) and a few escaped *Prunus mahaleb* (Mahaleb cherry) are other trees in this area. Additionally, some *Robinia pseudo-acacia* (black locust) and elm occur near the watercourse. The shrubs golden current and Wood's rose are nearly ubiquitous along the length of the Hulls Gulch riparian zone. In some places it appears there is no true riparian zone, as the shrubs *Purshia tridentata* (bitterbrush), *Artemisia tridentata* (sagebrush) and

Chrysothamnus nauseosus (rabbitbrush) grow right to the creek banks.

From where Hulls Gulch meets the 8th Street Road, upstream for approximately 1 mile, there is a narrow ribbon of riparian vegetation dominated by willows and other shrubs. Along approximately 85% of this length, willows and/or other woody riparian species are present, often in mixed stands. Coyote willow is by far the most common shrub, with all size classes represented. Other willows include *Salix lutea* (yellow willow) and arroyo willow. These are typically more scattered than coyote willow, although at least the latter species can form thickets in places. Coyote willow also occurs in some of the overflow channels. Both golden currant and Wood's rose are very common and form dense thickets in places. There is no black cottonwood along this riparian stretch until just west of the section 35/section 36 line. Scattered stands occur upstream from this point, with several size classes usually present. The first occurrences of *Cornus stolonifera* (red-osier dogwood) coincides with where the cottonwoods begin. The dogwood is not scattered, however, and consistently occurs upstream from this point, sometimes forming dense thickets. Other shrubs contributing to the riparian community are *Philadelphus lewisii* (syringa), usually in more open situations, and rarely *Rhus radicans* (poison ivy).

In more open areas where the ribbon-like appearance of the riparian zone is interrupted, vegetation similar to the surrounding uplands closely approaches and in some cases extends to the creek channel. Sagebrush, bitterbrush, and to a lesser extent rabbitbrush are the main shrubs in these situations, occasionally attaining robust size, but not forming a continuous cover. Golden currant and Wood's rose may be intermixed with these shrubs. There is nearly complete grass cover in these more open areas, predominately by the exotics medusahead, bulbous bluegrass and others. Occasional clumps of the native grasses *Agropyron spicatum* (bluebunch wheatgrass) and *Stipa comata* (needle and thread) and *Poa* sp. also occur.

Below the woody canopy, the understory varies from very low to nearly total cover. Grasses dominate in most places, but forbs may dominate where the canopy cover is mostly complete. In areas where the grass cover is very high, forb cover is usually low. There is a mixture of native and exotic species in the understory, with greater cover usually attributable to the exotics except in very shaded places.

Native nonwoody herbs include, *Galium aparine* (cleavers), *Rumex crispus* (curly dock), *Montia perfoliata* (miners lettuce), *Achillea millefolium* (yarrow), *Geranium viscosissimum* (sticky geranium) and occasionally *Potentilla gracilis* (cinquefoil). Cleavers and miners lettuce sometimes occur in small carpet-like colonies. Exotic forbs include *Brassica campestris* (common mustard), *Taraxacum officinale* (dandelion), bouncing bet, poison hemlock and others. The poison hemlock and bouncing bet are particularly common.

A *Poa* sp. (bluegrass) is common beneath the canopy where there is insufficient light for the weedy grasses. Other grass-like plants that occasionally occur include fox sedge, *Juncus articulatus* (jointed rush), *J. bufonius* (toad rush), *Juncus effusus* (soft rush), *J. ensifolius* (dagger-leaf rush), slender rush, and Torrey's rush. More common are the exotics, bulbous bluegrass, medusahead, a *Poa* sp. (bluegrass), *Bromus tectorum* (cheatgrass), *Bromus* sp. (brome), and quackgrass. Bulbous bluegrass is perhaps the most common of these.

Veronica sp. (speedwell) was occasionally observed growing in the creek channel as were several algae species. The moss *Leptobryum pyriforme* is common along the Hulls Gulch riparian zone.

Cottonwood Creek

The following comments pertain to lower Cottonwood Creek from its confluence with Freestone Creek to the archery range. Except for its very lower section, Cottonwood Creek supports a relatively open riparian community. Its channel is relatively wide, and is especially weedy along the banks, which are in poor condition in several places. Contrastingly, the creek's lower section supports a dense vegetation of predominately native species and with less erosion problems. Water was present in May, 1992.

Very lower Cottonwood Creek is much less disturbed and supports an older-aged stand of riparian vegetation than further upstream. Large cottonwoods dominate the overstory in this lower section along with lesser amounts of box elder. Thick stands of golden currant and Wood's rose dominate the shrub layer except for right along the creek channel where coyote willow is most common. *Lonicera* sp. (honeysuckle) also occurs under the cottonwoods. The understory vegetation is relatively sparse and percent litter very high as the canopy cover approaches 100% in places. Cleavers is the most common native forb, and some *Urtica dioeca* (stinging nettle) occurs along the channel where more light is available.

As the vegetation begins to open up the coyote willow becomes even more prevalent, although large stands of it are dead, with only those plants rooted directly in the channel or immediately next to it alive in some places. Cottonwood and occasional peach-leaf willow also occur, but more sporadically. In places, the surrounding sagebrush/bitterbrush/rabbitbrush vegetation extends to the channel banks and even into the creekbed. Forbs include, cleavers, curly dock, montia, and many exotics such as dandelion, *Verbascum thaspus* (wooly mullein), *V. blatteria* (moth mullein), *Cardaria draba* (hoary crest), *Holosteum umbellatum* (jagged chickweed), *Xanthium strumarium* (cocklebur) and others. A native bluegrass and *Elymus* sp., are vastly outnumbered by the exotics bulbous bluegrass, quackgrass, medusahead and others.

Fairly extensive portions of the creek channel contain only a minimal amount of herbaceous cover, with only scattered trees and shrubs present. In general, the riparian zone is significantly wider (estimated average of 50 feet) than found in Hulls Gulch. Portions of the riparian community burned several years ago with a number of cottonwood snags persisting.

Crane Gulch

Crane Gulch supports a narrow riparian community surrounded by sagebrush-bunchgrass vegetation. Lower Crane Gulch escaped the recent fire that consumed much of the riparian and surrounding upland vegetation further upstream. Where the fire occurred, the native riparian vegetation is beginning to reestablish, but many weedy species are also present. In this upstream section, livestock use the riparian and adjacent lower slopes quite extensively. Water was present along most of its length in May 1992.

Nearly all of the riparian vegetation was consumed by a relatively recent fire beginning at approximately the common corner of sections 23, 24, 25 and 26 and continuing upstream for at least one mile. Many of the blackened willow skeletons are resprouting from the base, but few new shoots are taller than one foot yet. The herbaceous layer is generally lush, consisting of both natives and exotics. Miners lettuce is particularly abundant in the burned areas.

Just upstream from the Crane Creek Golf Course the riparian zone is dominated by non-willow shrubs and small trees. Several of these species were observed only very rarely or not at all further upstream, and include *Crataegus douglasii* (black hawthorne), *Alnus incana* (thin-leaf alder), *Betula occidentalis* (water birch), and honeysuckle. Coyote willow soon becomes common a little further upstream. Progressing upstream, the riparian vegetation gives way to sagebrush-bitterbrush vegetation typical of the surrounding uplands, and persists for approximately 0.2 mile except for some scattered arroyo willow, golden currant and Wood's rose. Native bunchgrasses, mainly *Aristida longiseta* (red-three awn), and weedy annuals such as cheatgrass and bulbous bluegrass are very common in this area. More typical riparian species reappear further upstream, with arroyo willow, coyote willow and peach-leaf willow all common. Wood's rose, golden currant, syringa, *Rubus* sp. (an escaped blackberry), and especially red-osier dogwood are also present. Several small pockets of black cottonwood are scattered along the length of Crane Gulch, but no large stands were observed. *Celtis reticulata* (hackberry) and poison ivy are other less common woody species present.

The herbaceous vegetation is a mixture of native and exotic forbs and graminoids. Natives include miners lettuce, cleavers, sticky geranium, curly dock, *Veronica anagallis-aquatica* (water pimpernel), *Amsinkia retrorsa* (fiddleneck), *Mimulus guttatus* (yellow monkeyflower), *Myosotis micrantha* (blue scorpion-grass), *Plagiobothrys* sp. (popcorn flower), *Rorippa nasturtium-aquaticum* (water-cress), *Poa* sp., *Carex douglasii* (Douglas sedge), *C. nebraskensis* (Nebraska sedge), and *Juncus* sp. (rush). Exotics included moth mullein, poison hemlock, cocklebur, dandelion, *Lygodesmia juncea* (rush skeletonweed), *Hypericum perforatum* (Klamath weed), *Trifolium* sp. (clover), and bulbous bluegrass.

Dry Creek

Surrounded by steep slopes of sagebrush-grass vegetation, the narrow riparian zone of upper Dry Creek is fairly lush and dominated by large woody shrubs. Weedy species are less established here than other riparian areas of the study area. Further downstream, the steep slopes give way to a broadening bottomland that has been mostly converted to agricultural uses. Water was present in May, 1992.

Water birch dominates the canopy downstream from Bogus Basin Road. Other woody species include golden currant, Wood's rose, arroyo willow, yellow willow, poison ivy, and lots of red-osier dogwood. Hackberry is common on the slopes just above the narrow riparian zone. Forbs include miners lettuce, cleavers, *Clematis ligusticifolia* (western clematis), and *Poa* spp. Upstream of the road, the channel is wider and arroyo willow replaces water birch as the most common shrub. Red-osier dogwood dominates the secondary shrub layer and forms pure stands in places. Lesser amounts of yellow willow, syringa, water birch, hawthorne, golden currant and Wood's rose also occur. Hackberry occupies lower to mid-slope positions, along with *Prunus virginiana* (chokecherry), but neither were observed in the actual bottomland. The general appearance of the riparian zone changes back to one dominated by water birch further upstream. Additional forbs include sticky geranium, stinging nettle, water pimpernel, cinquefoil, *Equisetum arvense* (common horsetail), Nebraska sedge, *Carex* spp., bluegrass, *Scirpus microcarpus* (small-flowered bulrush) and *Medicago sativa* (alfalfa).

Stewart Gulch

The riparian zone of Stewart Gulch is dominated by a mixture of both native and exotic tree species,

including some of large size. Overall, the riparian vegetation is quite dense. Agricultural use occurs on adjacent land, along with some livestock use of the riparian zone in places.

South (downstream) of where the Cartwright Road crosses Stewart Gulch the riparian zone supports a multi-layered, multi-aged cottonwood woodland, apparently with both black cottonwood and some of the exotic *Populus deltoides* (necklace poplar) mixed together. A few box-elder, peach-leaf willow and black locust trees occur in this woodland. The sparse shrub layer is comprised mainly of golden currant and Wood's rose. Cows use this area mainly for access to water and for shade.

North (upstream) of the Cartwright Road, cottonwoods are rather uncommon, and instead the upper canopy is dominated by box elder and peach-leaf willow. Lesser amounts of arroyo willow and water birch, as well as a few hackberry, Russian olive, and Lombardy poplar trees also occur. Wood's rose, golden currant and especially red-osier dogwood are the major shrub species. There is also a large stand of *Picea pungens* (Colorado blue spruce) that was originally planted as nursery stock. Beneath the spruce, common horsetail is very common, along with *Smilacina stellata* (false Solomon's seal), miners lettuce, cleavers and *Carex* sp. Poison hemlock is common throughout the area, and a few scattered pockets of cattail also occur. The area further upstream was not surveyed, but it appears to be similar to the willow/box-elder vegetation described above.

Freestone Creek

Freestone Creek, in the popular Military Reserve Park, is characterized by its large cottonwood trees. These may form very open, to nearly closed stands. The open stands are generally weedy and with lower diversity than the densely vegetated closed stands. In May, 1992, aboveground water was present in lower Freestone Creek which supports the dense stands of vegetation, but not in the more open portions further upstream.

Downstream, from the north end of Military Reserve Park to near the confluence with Cottonwood Creek, the riparian zone is dominated by cottonwoods (apparently both black cottonwood and necklace poplar). Several size classes for the cottonwoods are represented. Coyote willow forms thickets in places and is common where the cottonwood canopy is absent or minimal. Arroyo willow, yellow willow, Wood's rose, golden currant, and a few Russian olive trees are other woody species present. Sagebrush and rabbitbrush can also be found in parts of the more open riparian community. With a few exceptions, herbaceous cover is generally low. Cheatgrass, *Poa* sp., *Carex* spp., and *Juncus* spp. are all present.

Near the confluence of Freestone Creek with Cottonwood Creek the vegetation changes quite dramatically. The cottonwoods are larger and the overall vegetation becomes much thicker, especially with shrubs, which form a dense thicket in much of this area. Red-osier dogwood, thin-leaf alder and some poison ivy join the Wood's rose and golden currant at this point. Box-elder is mixed with the cottonwoods and peach-leaf willow is also fairly common. A single *Juniperus scopulorum* (Rocky Mountain juniper) is also present. Herbs include common horsetail, water pimpernel, quack grass, bluegrass, and small-flowered bulrush, amongst others.

Bitterbrush/Needle-and-thread Grass Community Type

No stands of the bitterbrush/needle-and-thread grass community large enough to be considered viable occurrences were observed during the course of our survey. Small patches of bitterbrush occur throughout the foothills, generally in association with native and exotic grasses other than needle-and-thread grass. Needle-and-thread grass can be a component of some stands but is generally not the dominant understory species.

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Appendix 1

Occurrence records for Mulford's milkvetch in the Boise Foothills.

INDEX

<u>Occurrence Number</u>	<u>Site Name</u>
004	Camelsback Park
009	Upper Freestone Creek
010	Powderhouse Gulch
011	Resseguie Street Alcove
012	Military Reserve Park - Powderhouse Gulch
015	Lower Hulls Gulch - South
018	Middle Stewart Gulch
019	Boise Hills Village
022	Horse
025	Somerset Ridge
026	Crestline Drive
027	Lower Hulls Gulch - Hulls Ridge
029	Military Reserve Park - Veterans Ridge
030	Military Reserve Park - Cemetery Ridge East
031	Military Reserve Park - Cemetery Ridge West
032	Lower Hulls Gulch - North
034	Winsome Road
035	Dry Creek
036	Lower Seaman Gulch
037	Pierce - Seaman Divide
038	Seaman Gulch South

Appendix 2

Occurrence records for Aase's onion in the Boise Foothills.

INDEX

<u>Occurrence Number</u>	<u>Site Name</u>
004	Polecat Gulch
005	Upper Miller Gulch
006	Military Reserve Park - Cemetery Ridge
007	Boise Hills Village
008	Hackberry Divide
009	Camelsback Park
010	Middle Stewart Gulch
011	Lower Hulls Gulch - South
012	Upper Freestone Creek
013	Corral Trail
014	Lower Hulls Gulch - North
019	Upper Crane Gulch - West
020	Sherman Street Alcove
021	Braemere Ridge
022	Middle Hulls Gulch
023	Upper Crane Gulch - East
024	Upper Pierce Gulch
025	Military Reserve Park - Cottonwood Creek
026	Upper Seaman Gulch
027	Lower Seaman Gulch
028	Old Landfill Vista
029	Goose Creek
030	Miller Gulch - South
032	Lower Stewart Gulch
033	Resseguie Street Alcove
036	Pierce-Seaman Divide
044	Dry Creek
056	Seaman Gulch North
057	Middle Seaman Gulch
058	Military Reserve Park - Tunnel Gulch
059	Military Reserve Park - Veterans Ridge
060	Lower Hulls Gulch - Hulls Ridge
061	Crestline Drive
062	Horse
063	Collister Hillside
064	Upper Stewart Gulch
066	Lower Pierce Gulch

Appendix 3

Occurrence records for slick-spot peppergrass in the Boise Foothills.

INDEX

<u>Occurrence Number</u>	<u>Site Name</u>
012	Military Reserve Park - Veterans Ridge
023	Lower Hulls Gulch - Hulls Ridge
037	Horse
038	Goose Creek

Appendix 4

Mapped distribution of rare plant populations and riparian vegetation in the Boise Foothills.

- Map 1. Portion of the 7.5' Boise South and Boise North USGS quadrangles showing rare plant populations and the extent of riparian zones in the Cottonwood Creek, Freestone Creek, and Hulls Gulch drainage.
- Map 2. Portion of the 7.5' Boise North USGS quadrangle showing rare plant populations and the extent of riparian zones in the Crane Gulch and Miller Gulch drainage and in Stewart Gulch upstream from the Cartwright Road.
- Map 3. Portion of the 7.5' Boise North USGS quadrangle showing rare plant populations and the extent of riparian zones in Stewart Gulch downstream from the Cartwright Road and in Polecat Gulch and upper Pierce Gulch.
- Map 4. Portion of the 7.5' Eagle USGS quadrangle showing rare plant populations in lower Pierce Gulch, Seaman Gulch, and Goose Creek.

MAP KEY

Study Area Boundary =

Riparian Vegetation =

Mulford's Milkvetch Populations:

Small Populations (points) =

Larger Populations =

Aase's Onion Populations:

Small Populations (points) =

Larger Populations =

Slick-spot Peppergrass =

Extirpated Populations =

Population Ranks signified with lower case "a", "b", or "c"

a = Primary Populations/Category A - The largest populations which would contribute the most to the long-term persistence of the species in the foothills. Definitions of primary populations are as follows:

b = Secondary Populations/Category B - Mid-range populations, large populations on degraded or isolated sites, or small populations on ecologically high quality sites or occurring sympatrically with another rare species. Definitions of secondary populations are as follows:

c = Tertiary Populations/Category C - Very small populations and/or those on ecologically degraded sites, where long-term viability is questionable. Definitions of tertiary populations are as follows:

Occurrence Boundary =

NOTE: Each Occurrence boundary is assigned an Occurrence Name and an Occurrence Number for the population (for cross-reference with Appendices 1, 2, and 3). If more than one species occurs at that Occurrence then the abbreviation "Am" signifies the Mulford's milkvetch Occurrence Number, "Aa" the Aase's onion Occurrence Number, and "Lp" the slick-spot peppergrass Occurrence Number.)