Results of 2010 *Astragalus asotinensis* surveys

With notes on floristics of Hells Canyon, Idaho, Oregon and Washington

Report prepared for the U.S. Fish & Wildlife Service

Region 1

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Abstract

Surveys in May and June, 2010 were conducted to search for new populations of *Astragalus asotinensis* along the length of Hells Canyon and along major tributaries. This milkvetch was first described as a new species in 2006 based on plants from a single population on calcareous substrates at the northern end of Hells Canyon in Washington and Idaho. No individuals of *A. asotinensis* were observed on the surrounding siliceous substrates, despite additional searches in subsequent years, so the species was deemed to be an edaphic endemic. The present study sought new populations of *A. asotinensis* on other "islands" of calcareous substrates along the length of Hells Canyon and adjacent tributary canyons, as well as to conduct more extensive searches in and around the known population to 1) more accurately determine the geographical range extent and area of occupancy, 2) confirm the species' dependence on calcareous soils, 3) establish baseline demographic data, 4) better describe the ecological setting preferred by *A. asotinensis*, and 5) determine more accurately any ecological factors that could threaten the continued existence of the species. No new populations were detected anywhere else in the Hells Canyon Ecosystem, confirming that *A. asotinensis* is a narrow endemic limited to Asotin County, Washington and Nez Perce County, Idaho. The total area of geographical extent was expanded to no more than 7 square km, and within that area, the population is patchy, corresponding to mostly SW-W-NW aspects on steep slopes in grasslands dominated by bunchgrasses, sparse forbs and small shrubs. Of the thousands of individuals of *A. asotinensis* observed during the surveys and in previous years, only a single cluster of eight individual plants has ever been found on soils without a purely calcareous component, while all others observed occur on purely calcareous substrates. Much of the grassland in the area occupied by the population is dominated by invasive plant species, which are likely to continue to spread, especially with further overgrazing and other disturbances. Reductions in the population would likely occur due to continued spread of weeds. Weed control measures are needed, but only those that avoid secondary damage to *A. asotinensis*. General floristic observations of vascular plants and cryptogams were made throughout most of the study area. In total, 958 plant and lichen taxa were found during the surveys, including 5 liverworts, 225 lichens, 46 mosses, 164 nonnative vascular plants and 518 native vascular plants. Records were made of 107 noteworthy native vascular plant, moss and lichen species, including the detection of 18 taxa that require further study as possible species new to science, significant range extensions of a large number of lichen and plant species, and 8 lichen species not previously known to occur in North America. The floristic results confirm the role of the greater Hells Canyon Ecosystem as a center of plant endemism, and emphasize the importance of calcareous substrates in diversity of plants and lichens, including many that are rare or endemic.

Introduction

Astragalus asotinensis was first described as a species by Björk and Fishbein (2006), although the first collection was made in 1925 and incorrectly identified as *Astragalus arthurii*. The species was known as of 2009 only from a four square km area at the northern end of Hells Canyon at the confluence with the Grande Ronde River in Asotin County, Washington and across the Snake River in Nez Perce County, Idaho. This single composite population was estimated at several thousand individuals. The species had been observed to be an edaphic endemic, limited to limestone and shale-derived soils on the Limekiln Formation. No plants had been observed on the nearby basalts or other non-calcareous rocks. Searches on other limestone outcrops up to 2009 yielded no new populations of *A. asotinensis*.

Astragalus asotinensis was known from relatively steep slopes, on all aspects, between 400 and 900 m in elevation. Especially in Idaho, much of the potential habitat of *A. asotinensis* is dominated by nonnative, invasive plants, and so it appeared that a significant portion of naturally suitable habitat within the known population has been made uninhabitable by *A. asotinensis* due to human-caused spread of invasives.

The 2010 *Astragalus asotinensis* surveys were initiated by the U.S. Fish & Wildlife Service in order to 1) more accurately determine the geographical range extent and area of occupancy, 2) confirm the dependence on soils derived from calcareous substrates, 3) establish baseline demographic data within any previously known or newly discovered population, 4) better describe the habitat required, and 5) determine more accurately any ecological factors that could threaten the continued existence of *A. asotinensis*.

Methods

General search methods The surveys aimed to locate any new populations of *Astragalus asotinensis* on calcareous substrates throughout Hells Canyon and major tributaries (Figure 1). Geological maps were consulted to detect locations of calcareous substrates. However, these maps generally do not specify rock type, but rather they map geological formations of specific age, often clustering disparate rock types into a single map unit. In the available geological mapping for Hells Canyon, mapped units of formations including sedimentary rocks usually do not reveal exact localities of limestone, shale or other strongly calcareous rocks, but indicate the presence of such substrates within a matrix of sedimentary and/or metamorphic rock types. Some specific information on locations of calcareous outcrops was garnered from the accounts of Hells Canyon's geology by Vallier & Hooper (1976) and Vallier (1998). Additional mapping of calcareous surface rock types was studied (Mills 1962, Morrison 1964, Grant 1980, Reidel et al. 1992, Alt & Hyndman 2004, 2005, Kauffman et al. 2009). Also, limestone and shale, given their stratification, erosional patterns and usually pale color, can have a distinctive appearance in satellite imagery compared with basalt, andesite and other non-calcareous rocks, so GoogleEarth (2010) was also used to detect possible calcareous outcrops. Thirdly, vantage points were sought that would provide best views of the project area, and again, the distinctive appearance of most calcareous rock outcrops allowed the detection of target calcareous sites from these viewpoints.

Surveys occurred throughout the major portion of the proposed project area, in Baker and Wallowa Counties, Oregon, Adams and Nez Perce Counties, Idaho, and Asotin County, Washington. The extremely wet May and June 2010 weather presented accessibility problems such that the surveys had to be extended over a span of two months. All target calcareous substrates were surveyed except (due to washed out roads, saturated soils and slope instability) along the Wildhorse River in Idaho, and some minor limestone outcrops were not accessed in central and southern portions of Hells Canyon. Additionally, a target calcareous outcrop could not be surveyed in the lower Imnaha Canyon, owing to lack of access across private land. Otherwise, large areas of calcareous substrate were searched throughout the project area, usually by short forays from roads and trails onto suitable habitat. Non-calcareous areas were also surveyed to confirm the absence of *Astragalus asotinensis* there.

Inventory methods Upon finding any occurrences of *Astragalus asotinensis*, the geographical outline of the (sub)population was sought to the best accuracy possible using a wandering path to the apparent edge then switch-backing across to the opposite apparent edge. Along these within-(sub)population routes, GPS (Garmin Etrex) waypoints were accompanied by a record of the number of presumed seedling, juvenile (non-reproductive), reproductive adult, and dormant or deceased (only with the previous year's stems) individuals visible around the waypoint. The next waypoint was then taken where the previously furthest forward-visible plants noted became out of view backward along the path travelled. Mapping of these waypoints uses NAD83 data. Search routes are shown in Appendix 1, and waypoints are given in Appendix 2.

These baseline demographic data are intended to provide comparisons with future years, possibly correlating to annual weather conditions, fire, weed invasions or human-caused disturbance. They are also intended to provide a means of estimating a number of individuals present in the global population, and any (sub)populations found.

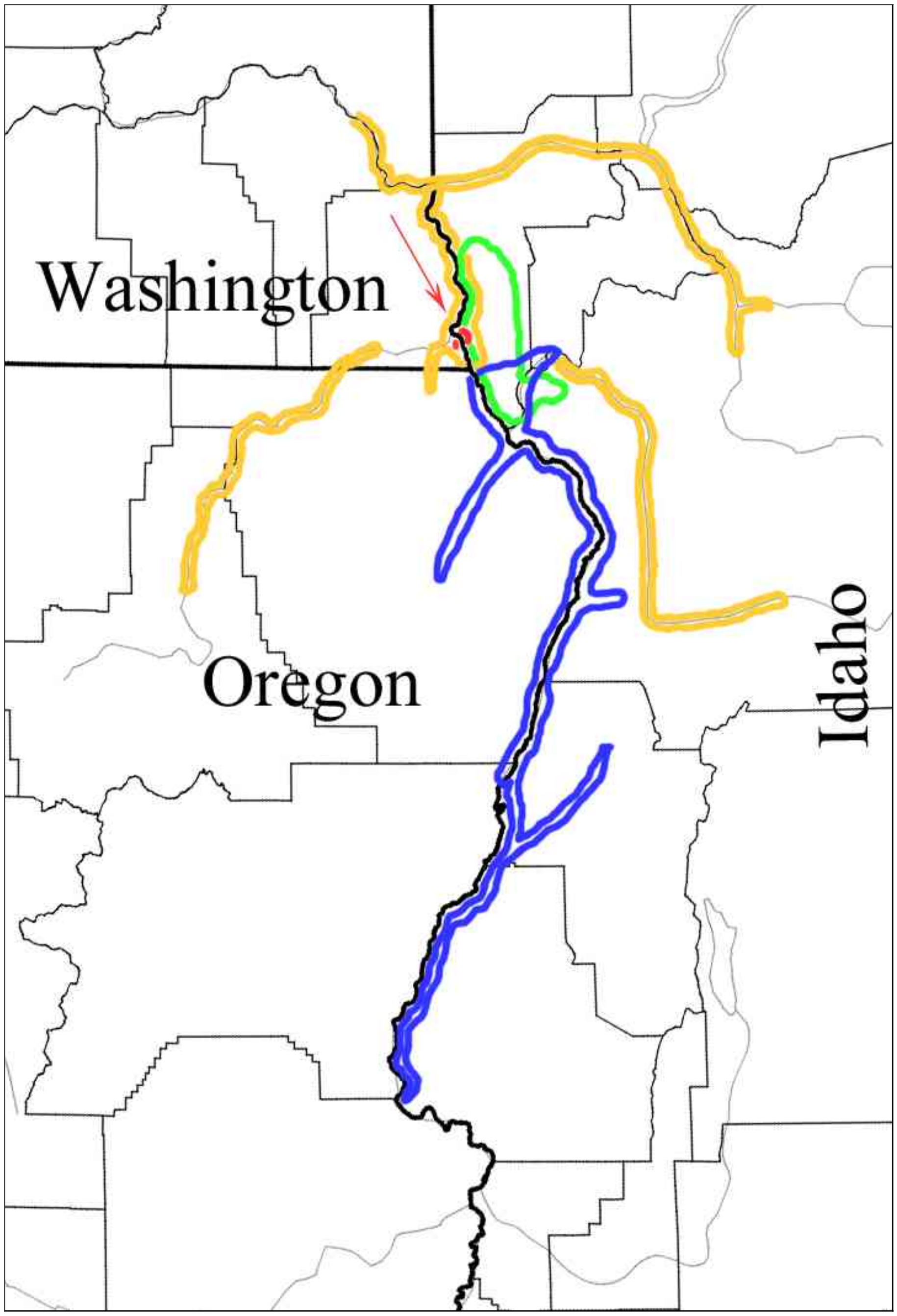

Figure 1. Map of the project area. The red arrow and polygons show the area known as of 2009 to be occupied by *Astragalus asotinensis*. The amber outline shows low elevation canyon habitats previously searched by the author. The blue and green outlines show the 2010 project search area as proposed in 2009. The green outline highlights the area covered in cooperative searches with botanists of the Idaho Conservation Data Center, while the blue outline shows the area covered solely by the author.

General ecological data (density and dominant species of associated vegetation, presence of invasive plants, any apparent herbivory or seed predation, slope, aspect and soil characteristics) were recorded for whole (sub)populations. Since the originally discovered subpopulation at Lime Hill, Asotin County, Washington is best studied, the detailed demographic and ecological inventory focused only on the Nez Perce County, Idaho subpopulations, and would apply to any newly discovered (sub)populations elsewhere. However, the Lime Hill subpopulation was visited in 2010 to detect any major changes to the subpopulation or its habitat since the last visits there by the investigator in 2005.

Digital photographs were taken of *Astragalus asotinensis* individuals and habitats. Other photographs taken document habitat quality, landscape characteristics and major weed invasions within *A. asotinensis* (sub)populations. Sighting forms with standard rare plant habitat, population and threat data documenting occurrences of *A. asotinensis* will be submitted to relevant state natural heritage programs.

Floristic studies Hells Canyon is, in general, extremely steep and of difficult access, so prior botanical exploration has been insufficient in portions of the project area. Hence, the opportunity was taken to conduct general floristic surveys along some of the search routes. Species lists were compiled and were intended to be as complete as time allowed. Any taxa possibly new to science were sought, including vascular plants, bryophytes and lichens. Populations of taxa previously known to be new to science were sought in order to aid taxonomic studies that could lead to their publication and result in a clearer view of their distribution and abundance. New populations were sought of any plant or lichen taxa already given conservation status at the state and federal level, and any new populations of the high conservation-priority Hells Canyon Snail (*Oreohelix idahoensis*) were sought as well.

Specimens were gathered of incidental noteworthy finds. Vascular plants will be deposited with unicates to ID (Stillinger Herbarium, University of Idaho, Moscow). Bryophyte and Lichen unicates will be deposited at UBC (University of British Columbia, Vancouver). Locations of any conservation-priority species were noted using GPS waypoints. Sighting forms will be submitted to relevant Natural Heritage Programs in Idaho, Oregon and Washington. Sighting forms will be submitted for both state or federal listed species, as well as those species not listed but suggested for consideration as state or global conservation priorities. Digital photographs were taken to document incidental noteworthy plant, lichen or animal discoveries.

Results and Discussion

Astragalus asotinensis was found in and near the previously known population, but no new populations were found elsewhere in the Hells Canyon Ecosystem. The southern edge of the occurrence at Lime Hill is the southern limit of the species. The northern geographical limit occurs on an unnamed drainage about half way between Billy Creek and Captain John/Madden Creeks on Craig Mountain, Nez Perce County, Idaho. The Idaho and Washington localities join to form a composite population along an 8.6 km SSW-NNE axis of about 0.5-0.8 km wide (Figure 2). This makes the total geographical extent no more than 7 square km.

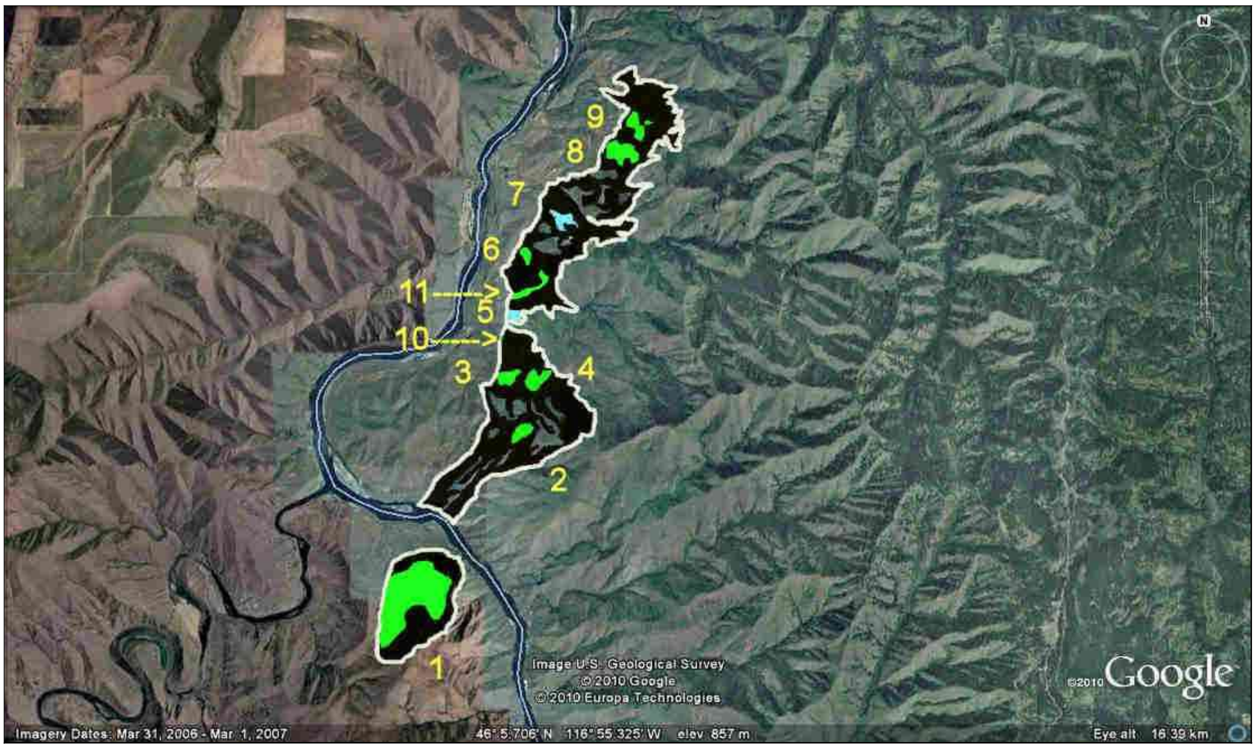

Figure 2 Google Earth image showing the surveyed geographical extent of *Astragalus asotinensis* (areas in green (subpopulations 1, 2, 3, 4, 6, 8, 9, 10 and 11) and blue (5 and 7), which were surveyed by the author or by the Idaho Natural Heritage Program, respectively). The area outlined in white includes calcareous bedrock and its sediments, with Hurwal Formation rocks in the north (subpopulations 5, 6, 7, 8, 9, 11), and the remainder on Martin Bridge Formation Rocks. The areas in black are those on calcareous substrates found not to have had *A. asotinensis* in 2010, and/or which are poor habitat for the species. Areas not colored within the white outline are potential *A. asotinensis* habitat remaining to be surveyed.

The population is interrupted by gaps of habitat unsuitable in soil chemistry (basalt- or andesite-derived), slope and aspect, dominance by invasive species or other, undetected factors. The interruptions along this axis are not demonstrably great enough (maximum 2 km from northern part of Lime Hill to the southernmost Idaho subpopulation, with some likelihood of occurrences between) to merit defining individual populations out of the whole, but subpopulations can be defined. At this point, eleven subpopulations are definable, ten of them in Idaho, and one in Washington. The cumulative area of all known Idaho subpopulations may not equal that of the Washington subpopulation.

Occurrences of *Astragalus asotinensis* were found on limestone and shale, almost exclusively. In fact, even some narrow (about 5-10 m) bands of shale are occupied by *A. asotinensis* while the alternating bands of siliceous rock (quartz diorite?) are not. The limestones are of the Martin Bridge formation, and the shale is part of both the Martin Bridge and Hurwal formations (Valier 1998). The northernmost six subpopulations occur on Hurwal shales, and the southernmost five occur on the Martin Bridge formation.

Not all calcareous substrates are occupied by *Astragalus asotinensis* within the composite population. Calcareous soils that are too south-facing and steep had little or no occupancy, as did steep north or east facing slopes. Some other areas having calcareous soils are converted to heavy cover of nonnative plants, apparently to the exclusion of *A. asotinensis*. Within the *A. asotinensis* population, some areas having apparently suitable slope, aspect and associated vegetation were found to lack *A. asotinensis*. However, the occurrences of *A. asotinensis* became easily predicted with some practice. These tended to occur on SW-W-NW slopes of about 20-30 degrees steepness, in high-quality vegetation with little or no significant cover of nonnative plants.

A single cluster of eight plants was found on siliceous soils (basalt-derived in greater part). But this was on landslide material of a slump that originated in part from a shale slope, and the position of this subpopulation was on the mapped edge of a calcareous bedrock unit. These plants may have traveled with the slump rather than establishing from seed on relatively siliceous soil. Alternately, the plants may have germinated locally, but the soil there may be derived in part from calcareous rocks. All other individuals of *A. asotinensis* were found on purely calcareous soils.

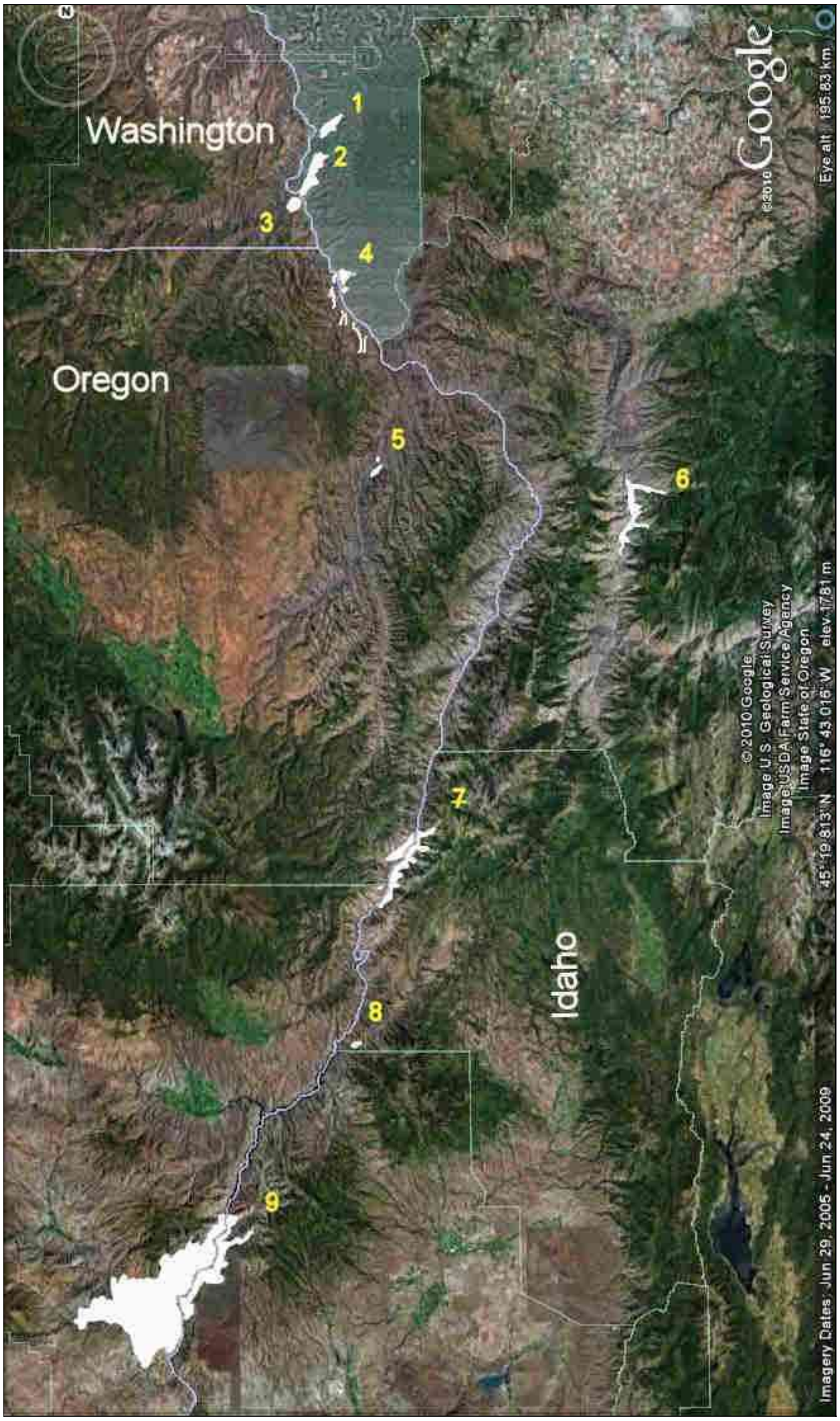

Figure 3 Occurrences of low elevation calcareous surface rock types in the HellsCanyon Ecosystem. As they are poor habitat for *A. asotiensis,* high elevation calcareous rocks are not highlighted. The surrounding rock types are siliceous.

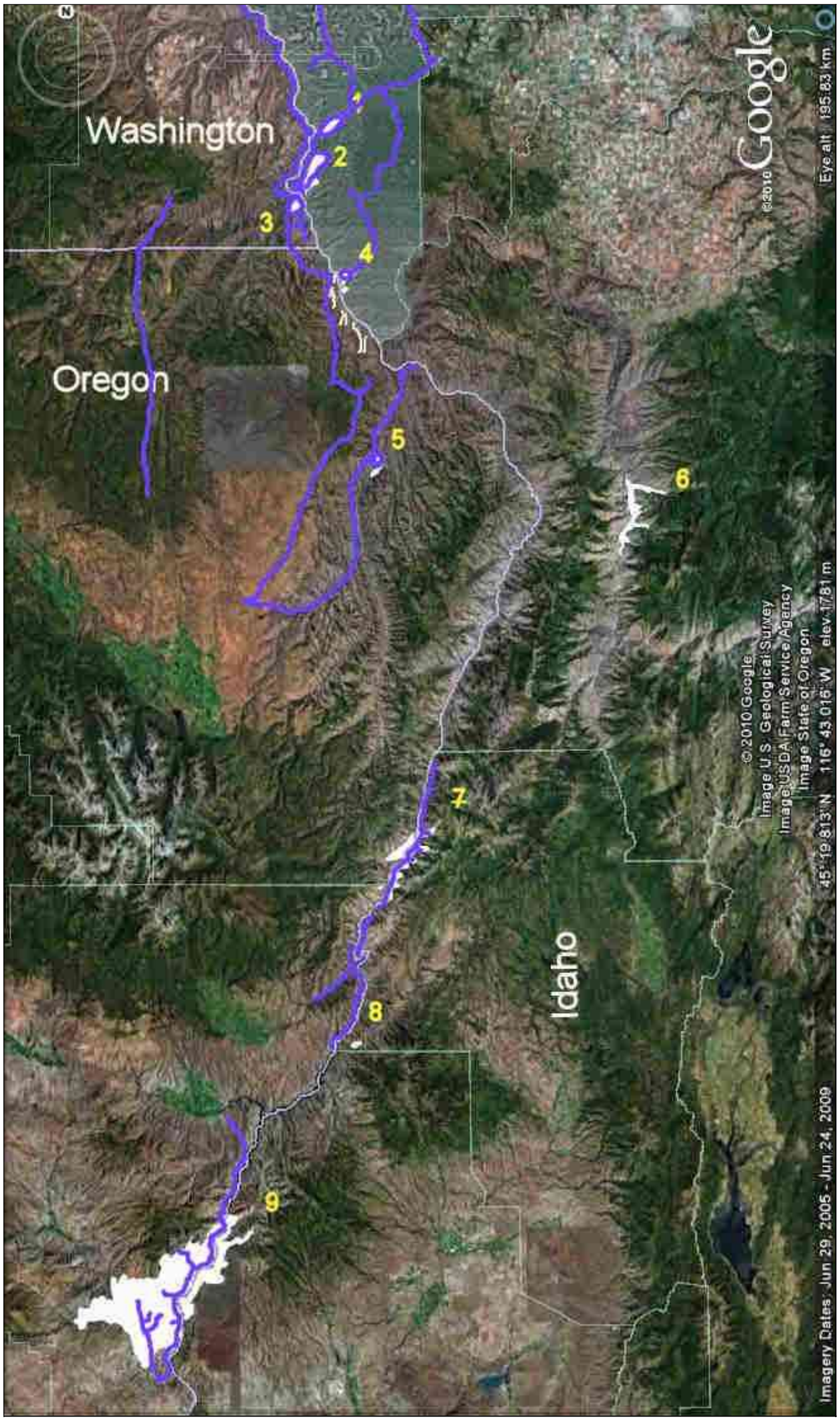

Figure 4 Google Earth image of routes surveyed in 2010 (shown in purple), overlaid on major areas of calcareous surface rock types (shown in white). Not shown are previous years' survey routes, as in the Salmon River Canyon (unit 6).

Searches for *Astragalus asotinensis* elsewhere in the Hells Canyon Ecosystem

Most of the length of Hells Canyon was surveyed, at least along vehicle travel routes. In areas surveyed from a vehicle, periodic stops were made to search for *Astragalus asotinensis*. Areas of high-quality habitat were surveyed more intensively over larger areas on foot. The following is an account of calcareous units surveyed, with the unit number corresponding to those in Figure 3. Surveys on non-calcareous substrates are not listed here. See Figure 4 for the total area surveyed.

Unit 9 In the southernmost portion of Hells Canyon, the extensive area of limestone, shale and other calcareous rock types (unit 9, Figures 3 and 5) has grassland vegetation that is sometimes similar in its natural state to those around the known population of *Astragalus asotinensis*. However, much of that landscape is converted to dense stands of *Bromus tectorum* and other invasive and "revegetation" introduced species. Also, those grasslands are at higher elevation than those surrounding *A. asotinensis* at the northern end of Hells Canyon, and the local climate is drier, and more subject to cold, drying, continental-type winters as compared with the more Mediterranean-climate (milder, more humid, rainy winters) of the northern end of Hells Canyon. Searches in higher quality habitats yielded many rare and noteworthy species, but no *A. asotinensis*. Further surveys are needed in that landscape to better study the putative species new to science discovered there during searches in the present study. This unit was surveyed on foot over four days, with additional roadside surveys made on periodic stops. Most of the area in unit 9 is easily accessed by road and short on-foot forays.

Unit 8 Lower Wildhorse River Canyon. Not surveyed due to lack of access during flash-flood conditions.

Unit 7 Higher quality calcareous landscapes are clustered in the central portions of Hells Canyon, south of the Hells Canyon Dam (unit 7, Figures 3 and 6). These limestone and shale slopes still maintain widespread wild habitat of native grassland and woodland plants, at least at some distance from disturbance loci as roads and campgrounds. The vegetation of this central part of Hells Canyon suggests the climate there is wetter in general than the northern and southern segments. The open grasslands in this segment are more punctuated by woodland and scrub vegetation than in the region surrounding *Astragalus asotinensis*, and dryland species are more limited to south-facing slopes, scree, and rock outcrops.

Figure 5 Slopes near the southern end of Hells Canyon (near Sugarloaf Peak, Oregon, unit 9). The opposing (south-facing) slopes in the view are dominated by the invasive nonnative *Bromus tectorum*.

Despite the relatively pristine condition of the vegetation in this segment and searches in habitats similar to those of *A. asotinensis*, the searches were unsuccessful. However, a number of noteworthy and rare finds were made in this segment, especially of lichens. Additionally found here was the only population of an undescribed *Micranthes* species. More work is needed in this area to better document the flora, particularly of the lichens, and to study the *Micranthes* in the field. This area was surveyed on foot for one day, and a roadside survey along the length of the calcareous substrates was also made, with periodic stops to foray up the slopes from the road. Access is easy for this unit, via a paved road.

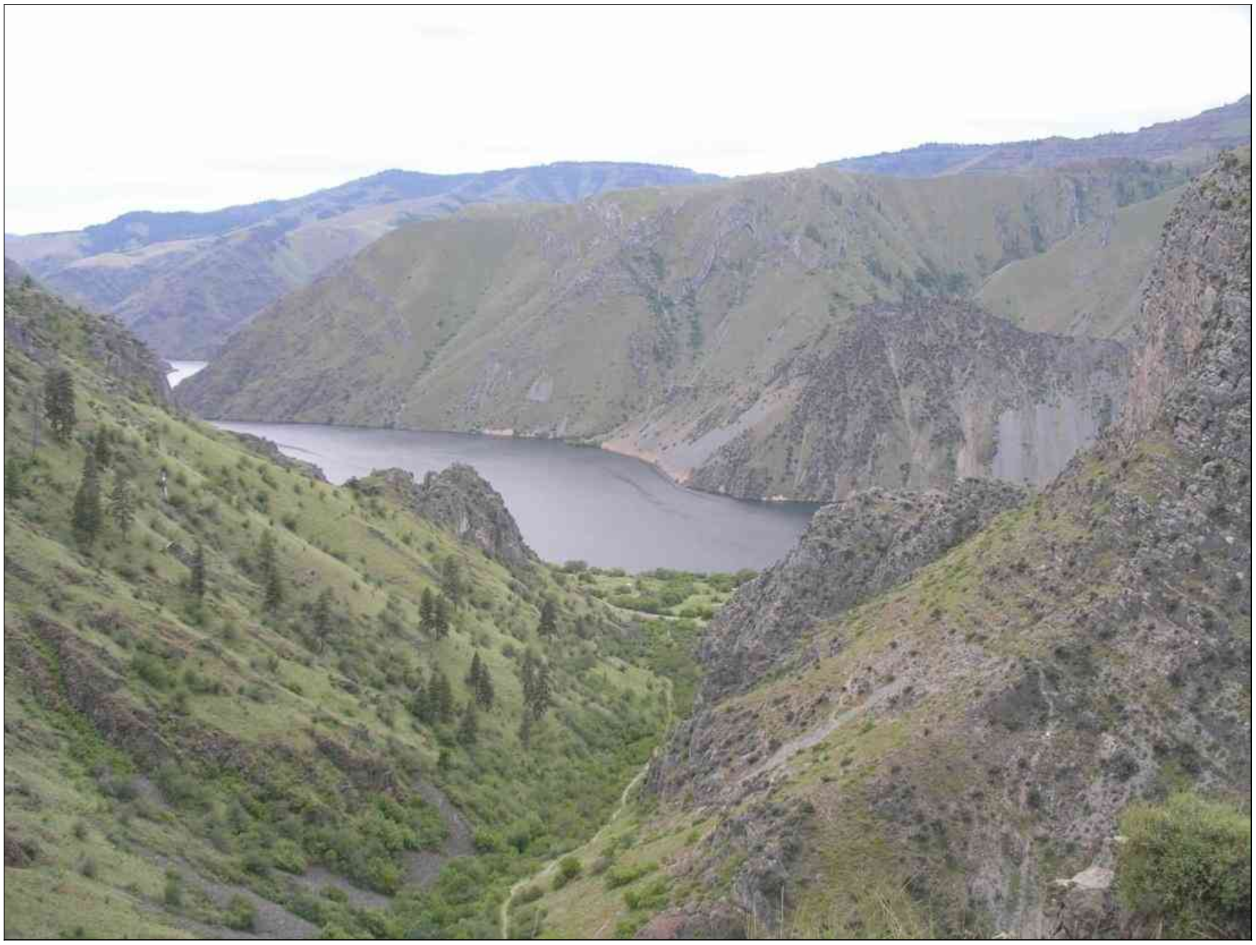

Figure 6 Limestone landscape shortly south of the Hells Canyon Dam, unit 7. Though no *Astragalus asotinensis* was found here, the vegetation of this unit is in relatively pristine condition compared to calcareous landscapes near the southern end of Hells Canyon.

Unit 6 This unit occurs not in Hells Canyon, but to the east over the Seven Devils Mountains in the Salmon River Canyon, north of the town of Riggins. The limestone in this unit is easily accessible from Highway 95, so it had been well surveyed for *Astragalus asotinensis* in years before the present study. Extensive areas of suitable habitat on the east side of the Salmon River have been searched without finding any new *A. asotinensis* populations.

Unit 5 This is a small unit occurring not in Hells Canyon proper, but to the west in the lower Imnaha Canyon. The greater portion of limestone in this unit was found to be inaccessible across the Imnaha River, and by a number of private land holdings along the long access from near the town of Imnaha. However, a small amount of limestone-derived soils were surveyed for about one hour on the roaded side of the river. No *Astragalus asotinensis* was found in this area. The habitat did not appear suitable, having only very thin soil over the limestone, and being predominately volcanic rocks, with only a very small area of calcareous soils. The larger, inaccessible limestone outcrop on the opposite slopes appeared also to be poor habitat (steep, cliffy and north-facing). The vegetation in the area surveyed was badly impacted by invasive species. No rare species were found in this unit.

Unit 4 This small occurrence of limestone and shale in Hells Canyon is best expressed on the east side of the Snake River, along Cottonwood Creek shortly uphill from its confluence with the Snake River. The limestone outcrops on the west side of the Snake River are relatively narrow bands between siliceous rock layers. The vegetation on the calcareous rocks is in mostly very good condition, with few weeds. Old sheep holds on the ridge tops above the calcareous substrates bear dense cover of invasive plants, and some south-facing slopes on the calcareous substrates have locally heavy cover of invasives, especially in proximity to the ridge tops. Despite the abundance of high quality habitat, and grasslands of a species composition similar to those surrounding *Astragalus asotinensis*, no occurrences of the target species were found in this unit after a full day's search. However, a number of rare and noteworthy lichen species were found, and a possibly previously undocumented population of *Oreohelix idahoensis* was found on the calcareous substrates here.

Unit 3 Lime Hill, Asotin County, Washington. Two visits over three days were made to the limestones in this unit. The intent of these visits was not intensive surveys of the known *Astragalus asotinensis* subpopulation, but rather to check on the condition of the plants after five years' absence by the surveyor. Along the western and northern flanks of Lime Hill, only about one fifth to one tenth of the density of *A. asotinensis* was observed compared to prior years' surveys there. Most of the plants had fewer stems than in past years, and many of the plants were vegetative only (no buds, flowers or fruits). The comparatively poor showing of the Lime Hill subpopulation may be due to the weather conditions of 2010, which were unseasonably cold in spring of that year (Roger Ferriel, pers. com.). This assumes that *A. asotinensis* is capable of dormancy for one or more years. Alternately, drought years between 2005 and 2010 might have caused dormancy or death of so much of the population.

Figure 7 View of the calcareous rocks (limestone in foreground) over Cottonwood Creek in unit 4. The grasslands in this area are mostly in very good condition.

The Rogersburg Fire of 2002 burned a portion of the grasslands on Lime Hill (along the northwestern to northern flanks). The visits made by the surveyor in 2003 and 2005 revealed no noticeable reduction in the *Astragalus asotinensis* population in the area burned compared to results of surveys prior to 2002. Nor has there been any significant spread of invasive plants into the population in the portion surveyed in 2010. No evidence of heavy grazing was apparent in 2010, and no other disturbance was apparent that could have caused the population reduction between 2005 and 2010. Monitoring surveys in 2011 and onward are needed to determine whether 2010 was an anomalous year, and it needs to be determined whether *A. asotinensis* can remain dormant through a growing season or whether population fluctuations are due only to death and reestablishment by seeds.

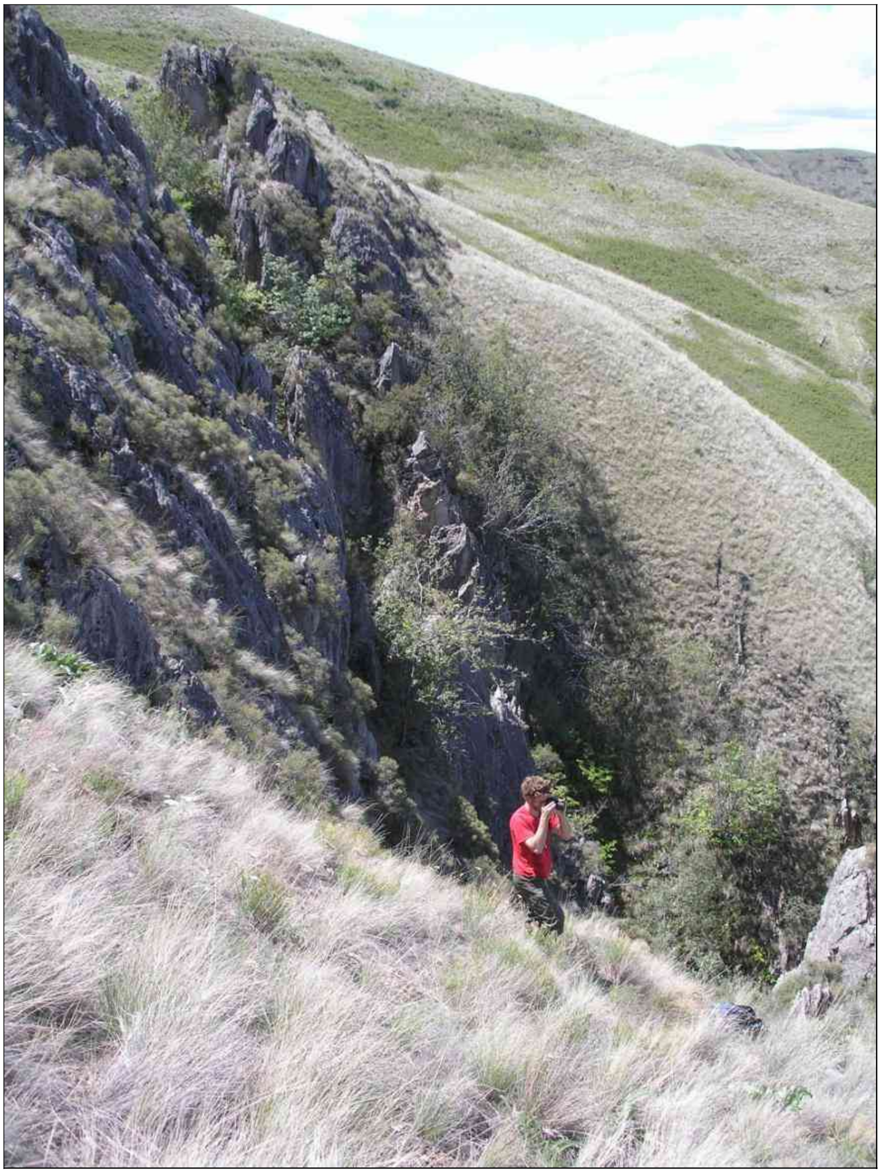

Figure 8 View within the *Astragalus asotinensis* population on Lime Hill, Asotin County, Washington (unit 3). In past years, plants of *A. asotinensis* would have been conspicuously visible in the foreground, but few plants were evident in 2010.

Unit 2 Most of the survey effort for *Astragalus asotinensis* focused on this unit, with a total search effort of two weeks. Prior knowledge of *A. asotinensis* in this unit was limited to three subpopulations. The first-found subpopulation is the southernmost (subpopulation 2, Figure 2), near Gold Hill, found in 2003. The other two (subpopulations 5 and 7, Figure 2) were found by botanists for the Idaho Conservation Data Center (now Idaho Natural Heritage Program) in 2005 (Karen Gray, pers. comm.). The 2010 surveys revealed seven new subpopulations in this unit (See *Population Data Section* below). All subpopulations in unit 2 are smaller in geographical extent than the Lime Hill subpopulation in unit 3 (Asotin County, Washington). Even collectively, they may produce a smaller area of occupancy than the Lime Hill subpopulation.

Figure 9 Image from within unit 2, showing a slope having *Astragalus asotinensis* observed in 2010. This area of grassland was nearly free of nonnative plants.

Astragalus asotinensis appears to have somewhat narrower ecological amplitude in unit 2 compared with unit 3, at least as compared across survey years. The Lime Hill plants are common not only in loamy grassland on SW-W-NW slopes, as in unit 2, but they also commonly occupy scree and loamy or gravelly N-NE-E slopes. A major fire burned in 2007 across large portions of unit 2. Some of the burned vegetation has returned to natural condition, while large portions have grown back in moderately to severely weedy condition. *Astragalus asotinensis* appears to be lacking entirely from such weedy vegetation in unit 2.

Unit 1 Despite the proximity to unit 2, this unit was found to have no *Astragalus asotinensis*. This may be due in part to the very weedy vegetation over much of the unit, though relatively pristine grassland was surveyed that appeared to be suitable habitat. It is possible that the 2 km gap between the calcareous substrates of units 1 and 2 has been sufficient to prevent dispersal into unit 1. The seeds of *A. asotinensis* have no apparent long-distance dispersal mechanisms, being smooth and lacking any aril or other obvious accessory structures attractive to potentially vectoring animals. The curved or hooked, sharply pointed, rather firm and long-lasting fruits could cause vectoring by animals. However, the fruits open so widely at both their proximal and distal ends as to allow the seeds to tumble out easily. So even if the fruits were carried over distances, the seeds may not.

Given the highly invaded vegetation and historic overgrazing in unit 1, *Astragalus asotinensis* may have grown there until recently. The fires that burned through that area in 2007 might also have caused directly or indirectly the extirpation of any subpopulation of *A. asotinensis*. Indirect harm to *A. asotinensis* is likely with revegetation that converts native grassland vegetation over to nonnative and invasive species. However, some of the areas that burned in unit 2 during the same fire event in 2007 retain native vegetation and populations of *A. asotinensis*.

Figure 10 View within unit 1, showing shale slopes of the Hurwal Formation. Most of the area shown on both the foreground and opposing slopes bears heavy cover of invasive plants. The yellow-green patches on the opposing slope are mostly *Anthriscus caucaulis*, while the grayer green color on the drier slopes is mostly *Centaurea solstitialis*.

Population Data

In unit 2, seven subpopulations were found, and surveyed in detail for baseline demographic data. Three additional subpopulations are known in this unit. Subpopulations 5 and 7 were surveyed by the Idaho Natural Heritage Program, and subpopulation 2, found in 2003, was not revisited in the 2010 surveys. Demographic data for subpopulations 3, 4, 6, 8, 9, 10, and 11 are summarized in Table 1. See also Appendix 2 for waypoint data with counts of seedling, vegetative adult, flowering, fruiting and dead/dormant individuals.

Subpop.	Total	Veg	%veg	Frt	%frt	Fl	%fl	D/D	%d/d	Sd	%sd
3	260	176	68	84	32	0	0	0	0	0	0
4	345	307	89	38	11	0	0	0	0	0	0
6	152	112	74	4	3	0	0	36	24	0	0
8	329	165	50	164	50	0	0	0	0	0	0
9	44	35	80	8	18	1	2	0	0	0	0
10	8	4	50	4	50	0	0	0	0	0	0
11	361	258	71	101	28	0	0	0	0	2	0.6
Totals:	**1499**	**1057**	**71**	**403**	**27**	**1**	**0.07**	**36**	**2**	**2**	**0.1**

Table 1 Population count totals from surveyed subpopulations in unit 2 (Nez Perce County, Idaho) of observed individuals of *Astragalus asotinensis* noting numbers and percent in the vegetative (Veg), fruiting (Frt), flowering (Fl), dead or dormant (D/D) and seedling categories (Sd).

Almost 1,500 individuals were counted among the subpopulations surveyed in 2010. The greatest numbers of plants were counted in subpopulations 4, 8, and 11, though these populations were not of particularly large area. This suggests that at least in 2010, these populations would have been denser than the others observed.

Of the plants observed in the surveys in unit 2, the great majority (71%) were adult plants in vegetative condition only. The surveys were conducted in mid to late June, so there is little likelihood of these plants coming into flower later in summer after the surveys. *Astragalus asotinensis* blooms as the leaves emerge in March-June, depending on the year, but never later. Only a single plant remained in late flowering condition during the surveys. Of the total plants observed, 27% were fruit-bearing. Fruiting plants were found to have mostly abortive seeds in the 2010 surveys. Many of the fruits showed signs of seed predation, with what appeared to be remains of insect larvae within. Seed-set success could not be assessed reliably however during the surveys, as viable seeds may have already dispersed from some or most of the fruits by that time. Regardless, few viable-appearing (plump, well shaped) seeds were found on the surveyed plants. A fruit cache was found once during the surveys. This was most likely assembled by a rodent (Figure 11).

Figure 11 A cache of *Astragalus asotinensis* fruits. This was the only indication found of possible fruit predation, though indications were found of possible seed predation within fruits.

Only 2% of the counted plants (all of them in subpopulation 6) were dead or dormant, as evidenced by the presence of only the previous year's senesced stems, with no living material found. The vegetative and fruiting plants in this subpopulation also appeared to have fewer stems on average than plants in other subpopulations.

Though seedling-stage plants were sought throughout the survey area in unit 2, only two plants were presumed to be seedlings, both of them in subpopulation 11. These are assumed to have been *Astragalus asotinensis* based on their general appearance (see Figure 12), as well as the shape and size of their leaves and leaflets, pubescence type, and their proximity to only *A. asotinensis* adult plants. Assignment of these two plants to the seedling category is only tentative, as no cotyledons or remnants of cotyledons were visible on the plants. It is possible that these both were only extremely depauperate shoots arising from adult rootstocks.

Figure 12 The two presumed *Astragalus asotinensis* seedlings found in the 2010 surveys.

Subpopulation 8 was in particularly fecund condition (50% of observed plants) in 2010. Subpopulation 10 had the same percentage in fruit, but only 8 plants were found in this subpopulation, making the statistical confidence interval on this percentage too broad to be taken as characteristic. Perhaps complementary to the high percentage of dead/dormant plants in subpopulation 6 was the very low percentage (3%) of plants in fruiting condition in this subpopulation. No obvious differences in environmental factors would explain the differences between vigorous and weak subpopulations. Subpopulation 6 occupied an area of similar slope, aspect and associated vegetation with the other subpopulations in unit 2.

Given the estimate in 2010 of only 1/5 to 1/10 the normal population density of *Astragalus asotinensis* observed in the Lime Hill population (subpopulation 1) compared with observations up to 2005, the numbers of plants observed and percentage of plants reproductive may have been anomalously low in subpopulations 3, 4, 6, 8, 9, 10, and 11 in 2010. It is even conceivable that some subpopulations were entirely dormant and hence undetected in that year.

If it is the case that the numbers of *Astragalus asotinensis* plants counted in the subpopulations of unit 2 were anomalously low in 2010, then these numbers may serve to produce a lower-limits estimate of total population size in that unit. Assuming that no subpopulations or individuals went undetected in unit 2 in 2010, then a lower population size limit would be roughly 1,500 individuals. However, it is much more likely that the footpath through each subpopulation missed a majority of above-ground (i.e., living, non-dormant) plants in 2010. Given the survey coverage of suitable habitat within each subpopulation, which was perhaps 10-20%, the estimate of population size apparent in 2010 would be brought up to 7,500-15,000 individuals in unit 2.

Additionally, it is likely that additional subpopulations exist or that the known subpopulations could be larger in area than currently mapped, as not all suitable habitat (slopes of about 20-35˚ on calcareous soils on SW-W-NW aspects in non-weedy condition) was surveyed in unit 2. Figure 2 illustrates areas of potential habitat that were not surveyed shown as areas within the white outlines that are not filled in with blue, green or black. The area of potential habitat not surveyed is about equal to that surveyed with positive results. However, some of these areas were not surveyed due to the appearance of these areas as somewhat less suitable habitat compared with the areas selected for survey. Accordingly, if the assumption is made that 30-40% of the most suitable habitat remained unsurveyed in unit 2, the estimate of population size for this unit would come up to a lower range of 9,750-10,500 individuals, and an upper range of 19,500-21,000 individuals. Thus, a range of estimated population size in unit 2 of living, non-dormant plants in 2010 would be roughly 10,000-20,000 individuals.

Threats to *A. asotinensis*

Nonnative plants The most immediate and serious threat to the continued existence of *Astragalus asotinensis* is likely from invasive nonnative plants. Throughout the area surveyed in the *A. asotinensis* population, there was an obvious and abrupt negative relationship between cover of nonnative species and *A. asotinensis*. Even moderately weedy grassland habitat had few or no individuals of *A. asotinensis*, and almost all individuals were recorded in vegetation without any significant cover of nonnatives.

Centaurea solstitialis has been the most aggressive weed to spread into dry/warm slopes, while *Anthriscus caucalis* has spread rapidly into moist/cool slopes. These two species have become perhaps the most common and widespread conspicuous plants, native or nonnative, in the northern part of Hells Canyon. *Crupina vulgaris* has spread rapidly in a wide variety of habitats in the vicinity of the *Astragalus asotinensis* population, and has potential to become a problem as threatening as *C. solstitialis* and *A. caucalis*. Some areas of canyon ecosystems to the northeast of Hells Canyon have seen spread of this species to the point of nearly complete cover. Additional particularly serious invasive species threats are from *Bromus tectorum, Bromus rigidus, Lactuca serriola, Potentilla recta, Taeniatherum caput-medusae* and various species intentionally seeded for revegetation.

Very large portions of the Craig Mountain Grasslands that have been subjected to post-fire revegetation efforts now suffer heavy and probably permanent cover of *Bromus inermis, Elymus repens, Medicago sativa, Poa pratensis, Thinopyrum intermedium* cultivars, and likely introduced forms of *Elymus wawawaiensis*. The seeded, post-fire vegetation also has dense cover of certain species that are scarce or absent in non-burned vegetation, such as *Lactuca serriola*, and *Galium cf. aparine* (nonnative form). Given this distribution, it is possible that these highly invasive species were introduced as seed contamination in revegetation mixes.

The use of revegetation seed mixes should be applied with caution. Most contain primarily nonnative species, which are potentially very damaging. The more abundant these species become in the landscape, the more likely they are to become noxious weeds. Critical mass thresholds (e.g., a certain level of population density and/or extent of spread) can give a previously innocuous nonnative species the capability to begin increase exponentially. Also, during the period of time when a nonnative species is present, but not invasive in a new landscape, it can undergo evolutionary selection of characters best suited to its new surroundings, after which it can become more invasive (Mack et al. 2000).

By contrast, the areas of Lime Hill that burned in 2002 have returned to native vegetation. No increase in cover of nonnatives has been apparent in the burned area since the fire, though in some grassland areas on the non-calcareous substrates nearby, *Centaurea solstitialis* patches have shown obvious spread in this time.

Herbicide drift Directly related to threats to *Astragalus asotinensis* by nonnative plants is the threat from herbicide drift. Herbicides sprayed on populations of noxious weeds could spread in the wind into populations of *A. asotinensis*, and herbicide sprayers may not know to avoid spraying within these populations.

Direct spot-spraying, if herbicides are seen as necessary, is preferable to aerial spraying in order to reduce herbicide drift damage. However, even spot-spraying from the ground can result in drift damage, as seen on a wide variety of native plants in units 1, 2 and 3 of the surveys. Herbicide-damaged plants observed during the surveys include dozens of native species, including rare and regionally endemic species such as *Calochortus maculosus* and *Pyrrocoma scaberula*.

It should also be noted that damage to native vegetation was commonly observed resulting from off-road vehicle use. All-terrain vehicles were used to carry herbicides to stands of noxious weeds, resulting in trampled vegetation. Such damage to wild vegetation is commonly followed by further spread of invasive plants, which can be vectored by vehicle travel and find germinable conditions in the tire tracks, and which are generally favored by disturbance.

Grazing The extreme weediness of such large portions of the Hells Canyon Ecosystem is probably due originally and above all to historic and recent livestock grazing. The canyon grasslands did not evolve with heavy grazers. Bison were rare to uncommon west of the Rocky Mountains, and the elk herds that now are a common sight in northern Hells Canyon are cultivated herds maintained at artificial numbers for the benefit of hunters. Thus these species would not have been a significant cause of natural selection there. Otherwise, the plants of the Hells Canyon grasslands would have evolved with light grazers (deer and bighorn sheep).

Cattle are heavy grazers, with a plodding gate that disturbs the soil more than the lighter steps of deer and bighorn sheep. Soil disturbance and vectoring of nonnative plant seeds can quickly result in conversion to nonnative vegetation in grasslands that require minimal soil disturbance for the maintenance of ecosystem health.

Most invasive species in grasslands are adapted to soil disturbance, and have thousands of years of evolutionary history associated with and selected by heavy grazing. Indeed, most invasive plants of the inland northwest U.S. originated in areas of the Old World with the oldest history of intensive grassland livestock grazing (the Mediterranean Basin and western portions of central Asia).

While cattle grazing can reduce cover of nonnative plants in weedy landscapes, the benefits of grazing are seen mostly east of the Rocky Mountains, not on the Pacific slope grasslands, and these benefits can be only temporary. In many grasslands of the Pacific slope, livestock grazing generally has immediate negative effects on native species, and immediate facilitating effects on nonnative plants.

Elk herds could become an indirect threat to *Astragalus asotinensis* if they continue to be cultivated at artificially large numbers in the Hells Canyon Ecosystem (by maintenance of watering troughs and salt licks in the grasslands, and by continued logging and resultant browse-rich clearcuts on the adjacent highlands). Very large herds have been seen on Lime Hill, with dozens of individuals. These herds often rest on the old sheep holds on ridge tops on and near Lime Hill. These sheep holds are major loci of invasive plant species. Animal use of sheep holds could cause accelerated seed vectoring, in the case that elk leave these weed loci carrying seeds in their hooves and fur, spreading them into native vegetation elsewhere. Salt licks were found to be still present (and of frequent use by wildlife) in sheep holds on Lime Hill during the 2010 surveys.

Fire Some nonnative plants that have spread over so much of the area in and around the *Astragalus asotinensis* population can increase the frequency and intensity of ground fires. *Bromus tectorum* has been noted to burn more intensely than native vegetation (Knapp 1996), and other nonnative plants with a growth habit and population density different from native species may have this same effect, as with perhaps *Anthriscus caucalis* and *Sisymbrium altissimum*, in particular. Native grassland vegetation in the Hells Canyon Ecosystem is dominated at the lower elevations and on warmer/drier slopes by sparse bunchgrasses and forbs, which would not usually burn intensely or over large areas owing to the wide spacing of the plants and resultant lower fuel load. The highest-elevation grasslands have denser native vegetation, but these cooler, moister upper elevation grasslands would normally burn at lower intensity simply due to the local microclimates.

Changes to fire frequency and intensity caused by nonnative species can, in turn, favor the nonnative species themselves, owing to the preference of these species for disturbance for their germination and seedling establishment, causing a cycle that may result in accelerated loss of native vegetation and increasing loss of habitat for *Astragalus asotinensis*.

Results of floristic studies

A total of 958 plant and lichen taxa was documented throughout the search area of 2010, among all the areas where on-foot surveys were conducted. This total includes 682 vascular plants. Among the vascular plants are 164 that are nonnative in the project area (including 3 that are questionably native), and 518 that are native (without uncertainty as to provenance). Among cryptogams (a total of 276), were 5 liverwort, 46 moss, and 225 lichen species, all of them native.

The high number of newly discovered taxa hypothetically new to science (18, not including undescribed taxa already known prior to 2010) may seem at first astonishing. But considering the ruggedness and remoteness of most of the Hells Canyon Ecosystem, large portions of the project area have not been intensively surveyed by botanists. The high rate of endemism among species already discovered and named is high in the Hells Canyon/Blue Mountain/west-central Idaho region, so given the poorly explored status of this area already recognized as a hotspot of endemism, new discoveries are perhaps not surprising.

Newly discovered putative new species to science include the vascular plant genera *Allium, Amelanchier, Boechera* (two species)*, Cyperus, Drymocallis, Eriogonum, Glossopetalon, Mertensia, Micranthes, Opuntia,* and *Packera* (see taxonomic notes under these species in Appendix 3). One moss species appears to be so anomalous as to merit taxonomic investigation as a new species, in the genus *Gemmabryum*. Lichens found during the surveys that may represent new species are of the genera *Acarospora, Bacidina, Castapyrenium* sensu stricto, *Endocarpon,* and *Leptogium*. Additionally, several populations were found during the surveys that appear to be morphologically anomalous, but for which too little is yet known to determine whether they also may represent undescribed taxa (brief notes on these appear in Appendix 3).

Much more work is needed to study some of these taxa in the field and herbarium. For some, molecular systematics methods are needed to test whether DNA sequences corroborate the distinctness based on morphological data. For some of the lichens, chemical analysis is needed to compare with the chemical constituents (so-called lichen substances) of possibly related taxa.

It is hoped that the discoveries of these putative new taxa will highlight the great need for more botanical surveys throughout Hells Canyon. These results, as well as the large number of already known endemic taxa, the overall high species richness, unique habitats and long list of conservation-listed species should also underscore the desperate need to protect the native vegetation of the Hells Canyon Ecosystem from further invasion by nonnative plants, and conservation efforts should aim to protect this spectacular flora from further human-caused disturbance.

Conclusions

Astragalus asotinensis has been found to be truly a narrow endemic, found almost exclusively on calcareous substrates in two small units of limestone and shale of the Hurwal and Martin Bridge Formations at the northern end of Hells Canyon in Nez Perce County, Idaho and Asotin County, Washington. The total global geographical extent of this composite population is no more than 7 square km. Within this area, eleven subpopulations are defined. An estimate of the Idaho portion of the population of living, non-dormant plants evident in 2010 was made at roughly 10,000 to 20,000 individuals. Only about one quarter of these were found to have produced fruits in 2010. However, many of these fruiting individuals may have failed to produce viable seed that year. The subpopulation on Lime Hill (Asotin County, Washington) was found to be only about 1/5 to 1/10 the density of individuals compared to previous survey years. The cold weather conditions in spring of 2010 may have caused widespread dormancy of *A. asotinensis*. However, the possibility that a large portion of the Lime Hill population has died is not ruled out. Assuming 4/5-9/10 of the plants at Lime Hill were indeed dormant in 2010, then the same may have been true in the Idaho portion of the population, making it possible that the

2010 estimate of numbers of individuals there may increase by as much as ten times in a normal year. The entire population of *A. asotinensis* could be threatened with extinction in the long term given the continued spread of invasive nonnative plants. Other threats to the existence of the species are also identified in the form of herbicide drift and human-caused disturbance such as livestock grazing and artificially large elk populations.

A total of 958 taxa of plants and lichens was observed among all survey areas in 2010. This is by no means the total flora of the Hells Canyon Ecosystem. The project area encompasses large areas that have seen little attention from botanists and lichenologists. Perhaps accordingly, a large number of noteworthy taxa was found, including many that should be considered for conservation listing, and a number that require investigation as possible taxa new to science. Much more survey work is needed throughout the Hells Canyon Ecosystem to better understand the flora, detect any additional undiscovered taxa, better clarify taxonomically critical species, and identify areas of particularly high biodiversity and ecosystem quality that require conservation attention.

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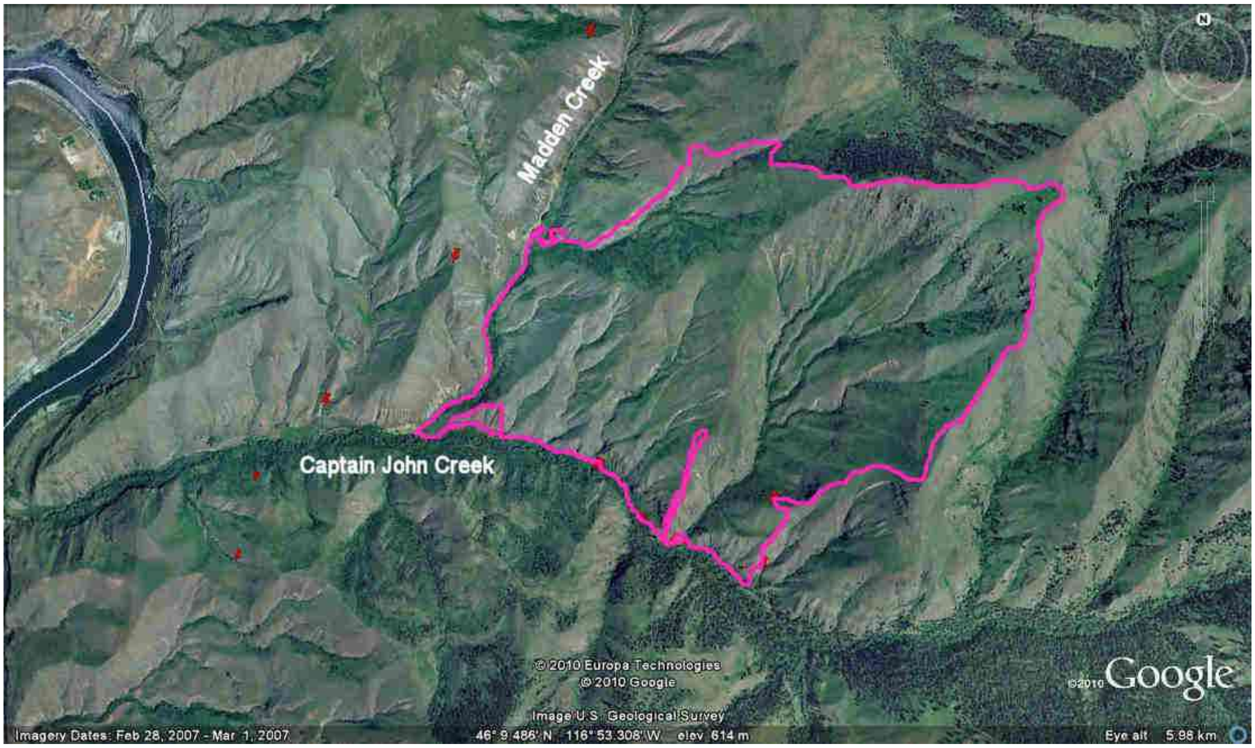
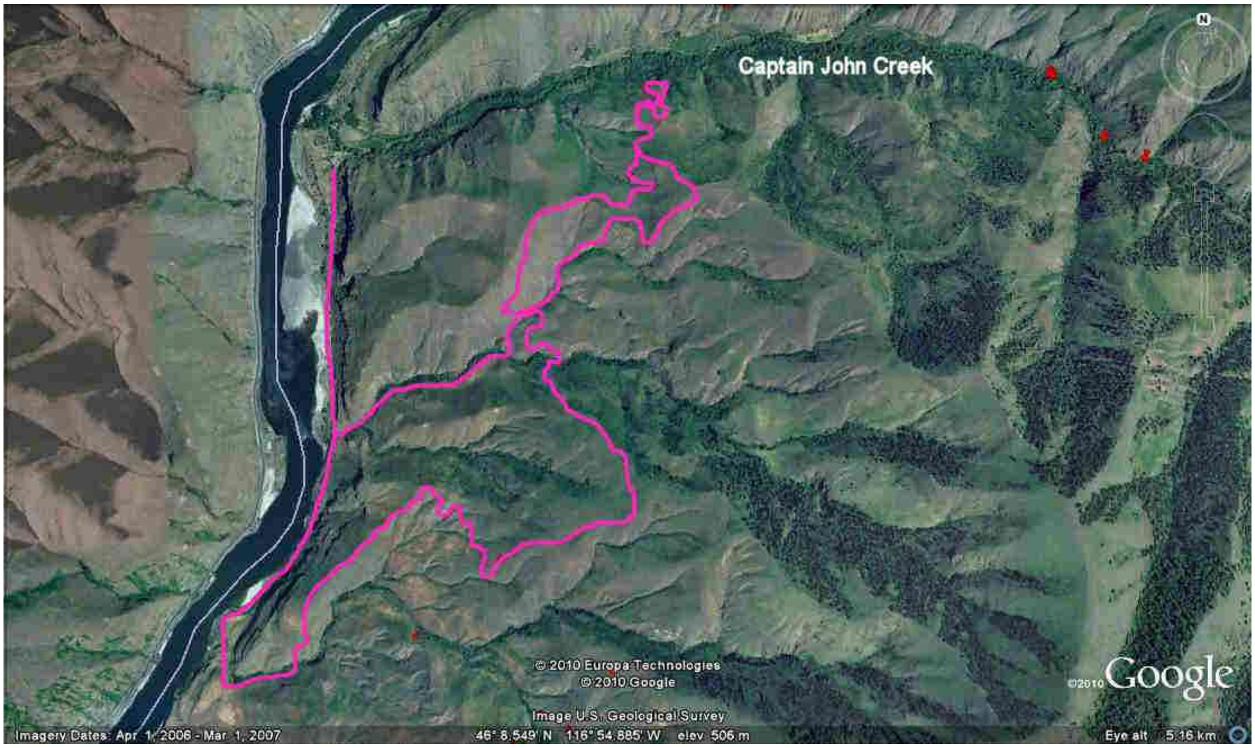
Appendix 1

Surveyed areas in and near the known population of *Astragalus asotinensis* (units 1, 2 and 3)

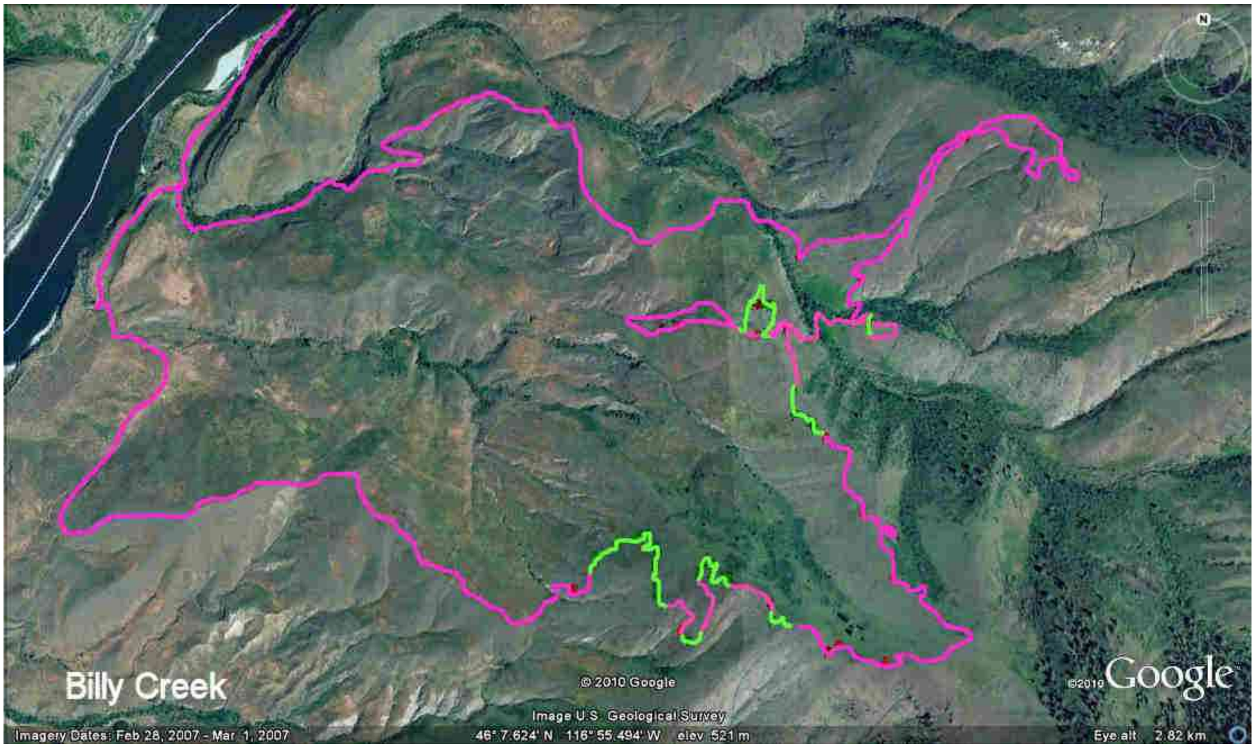
Appendix 1A Linear survey footpath along Madden Creek and slopes to the north in 2010, Craig Mountain, Nez Perce County, Idaho (unit 1). Major rock types surveyed include shale and dolomite of the Hurwal Formation, as well as basalt and andesite, within elevations of 250 to 1290 m. No *Astragalus asotinensis* was found in this area. Large areas along this path are covered in dense *Centaurea solstitialis, Crupina vulgaris* and other invasive nonnative plants. Note that north is to the upper right corner in the image.



Appendix 1B Linear survey footpath along Captain John Creek and the divide between Madden and Captain John Creeks in 2010, Craig Mountain, Nez Perce County, Idaho (unit 1). Major rock types surveyed include slate and shale of the Hurwal Formation, as well as siliceous metamorphic rock and basalt, within elevations of 380 to 1280 m. No *Astragalus asotinensis* was found in this area. At lower elevations, large areas along this path are covered in dense *Centaurea solstitialis* and other invasive nonnative plants, and some deeper-soil flats in the northern part of the path are converted to nonnative grasses and various invasive forbs. High quality grasslands are sporadic in this area.

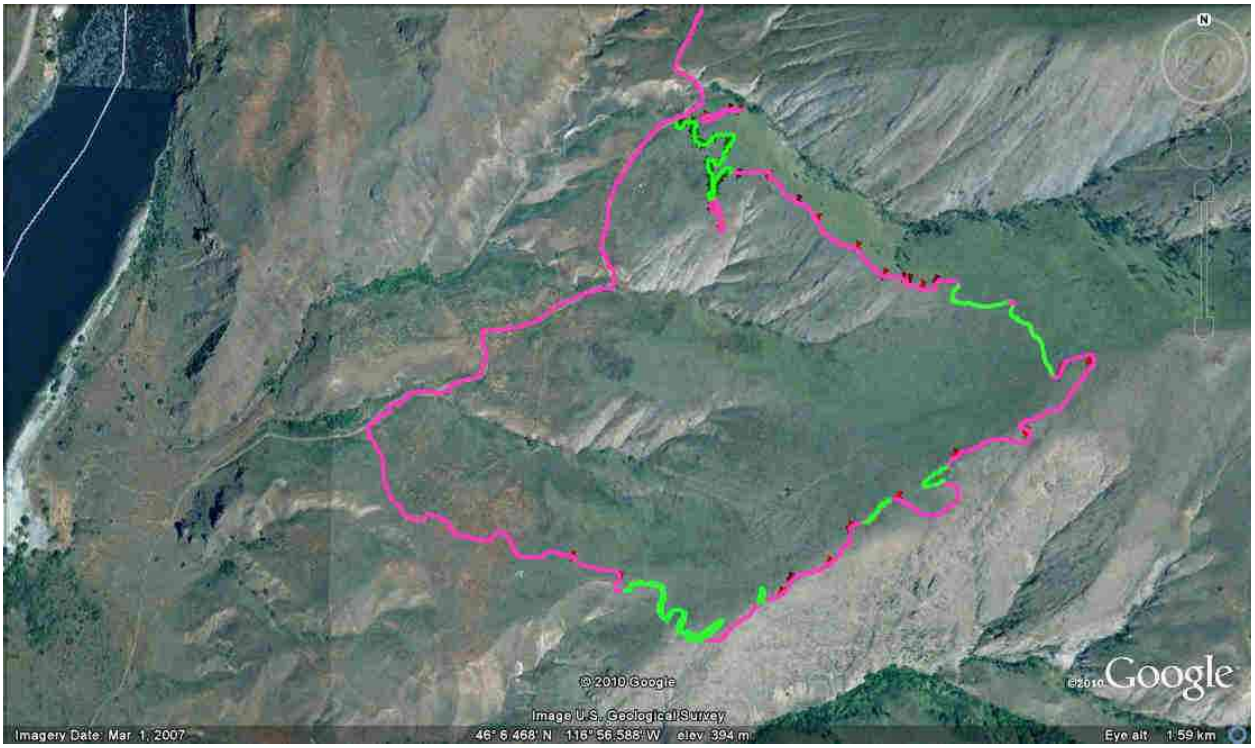


Appendix 1C Linear survey footpath between Captain John Creek and Billy Creek in 2010, Craig Mountain, Nez Perce County, Idaho (unit 1). Major rock types surveyed include shale of the Hurwal Formation, as well as basalt, within elevations of 250 to 650 m. No *Astragalus asotinensis* was found in this area. Little of this area could be considered quality grassland, most of it being dominated by various invasive species.

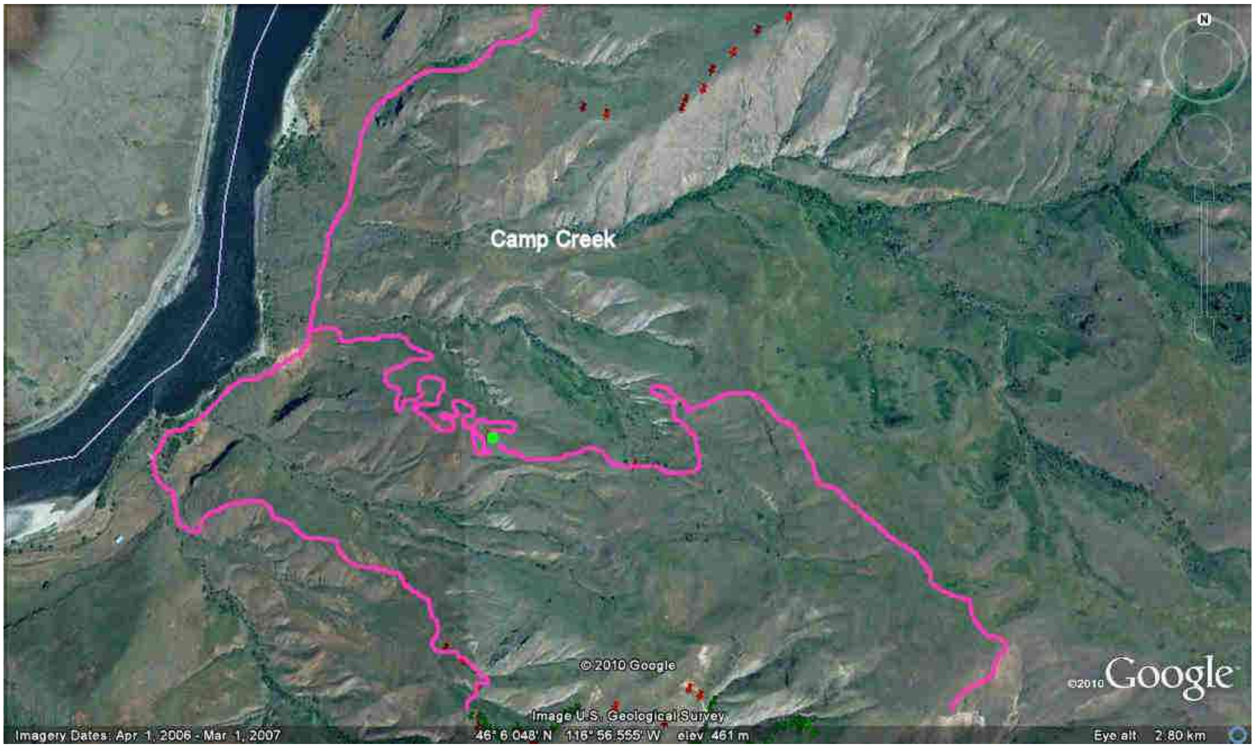


Appendix 1D Linear survey footpath north of Billy Creek in 2010, Craig Mountain, Nez Perce County, Idaho (unit 2). Major rock types surveyed include shale of the Hurwal Formation, quaternary alluvium and basalt, within elevations of 260 to 800 m. *Astragalus asotinensis* was found in the portion of the path marked in green. The grasslands in this survey area are about an equal mix of good and very poor quality, the latter being dominated by invasive plants, especially *Anthriscus caucalis* and *Centaurium solstitialis*.

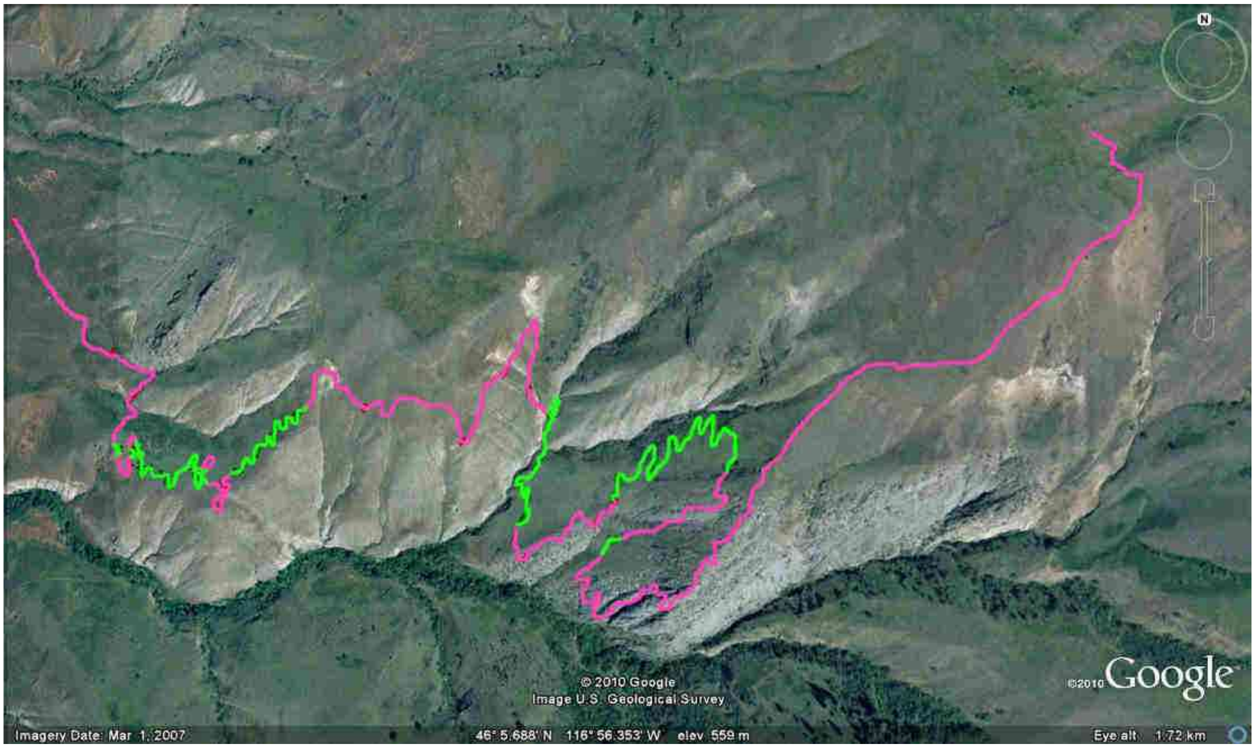
Appendix 1E Linear survey footpath along the road around Billy Creek in 2010, Craig Mountain, Nez Perce County, Idaho (unit 2). Major rock types surveyed include shale of the Hurwal Formation and basalt, within elevations of 250 to 400 m. No *Astragalus asotinensis* was found in this area. Little of this area could be considered quality grassland, most of it being dominated by various invasive species, especially grasses introduced for rangeland improvement. Note that north is to the right in the image.



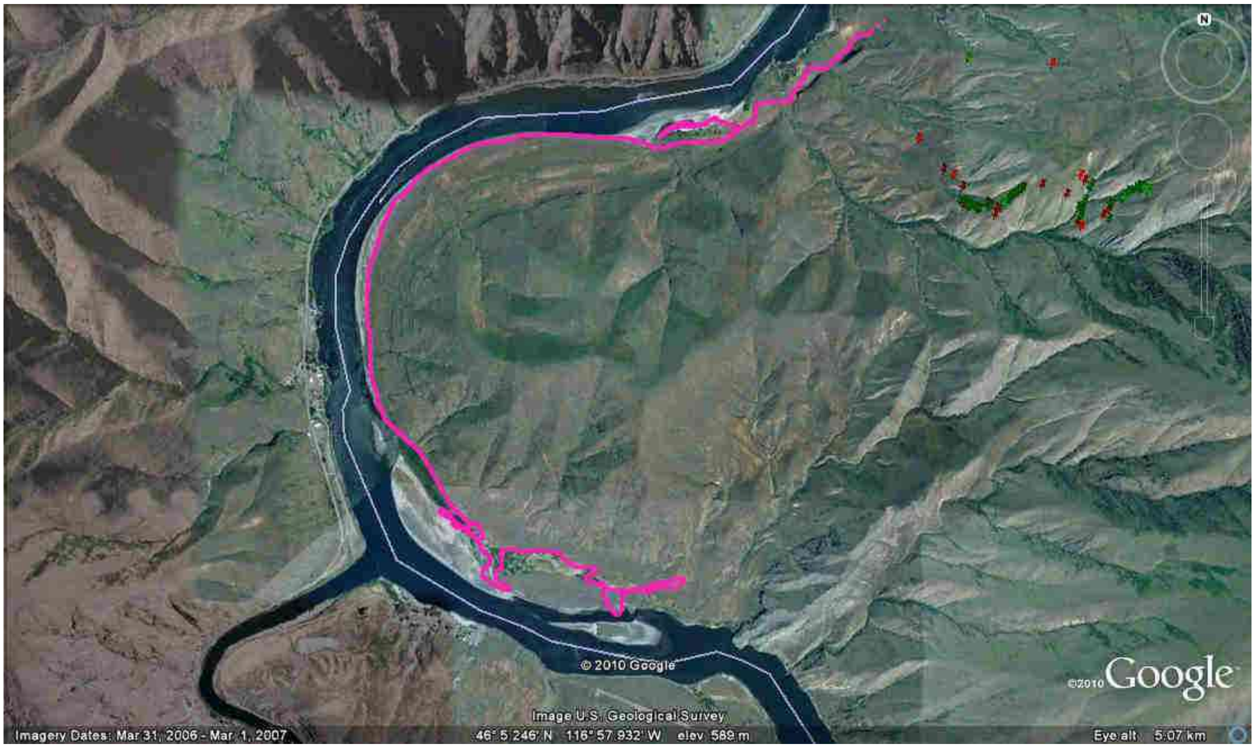
Appendix 1F Linear survey footpath south of Billy Creek in 2010, Craig Mountain, Nez Perce County, Idaho (unit 2). Major rock types surveyed include shale of the Hurwal Formation, quaternary alluvium and basalt, within elevations of 370 to 600 m. *Astragalus asotinensis* was found in the portion of the path marked in green. The grasslands in this survey area are a mix of good and very poor quality, the latter being dominated by invasive plants, especially *Anthriscus caucalis, Bromus tectorum, Centaurium solstitialis*, and various species introduced for rangeland improvement.



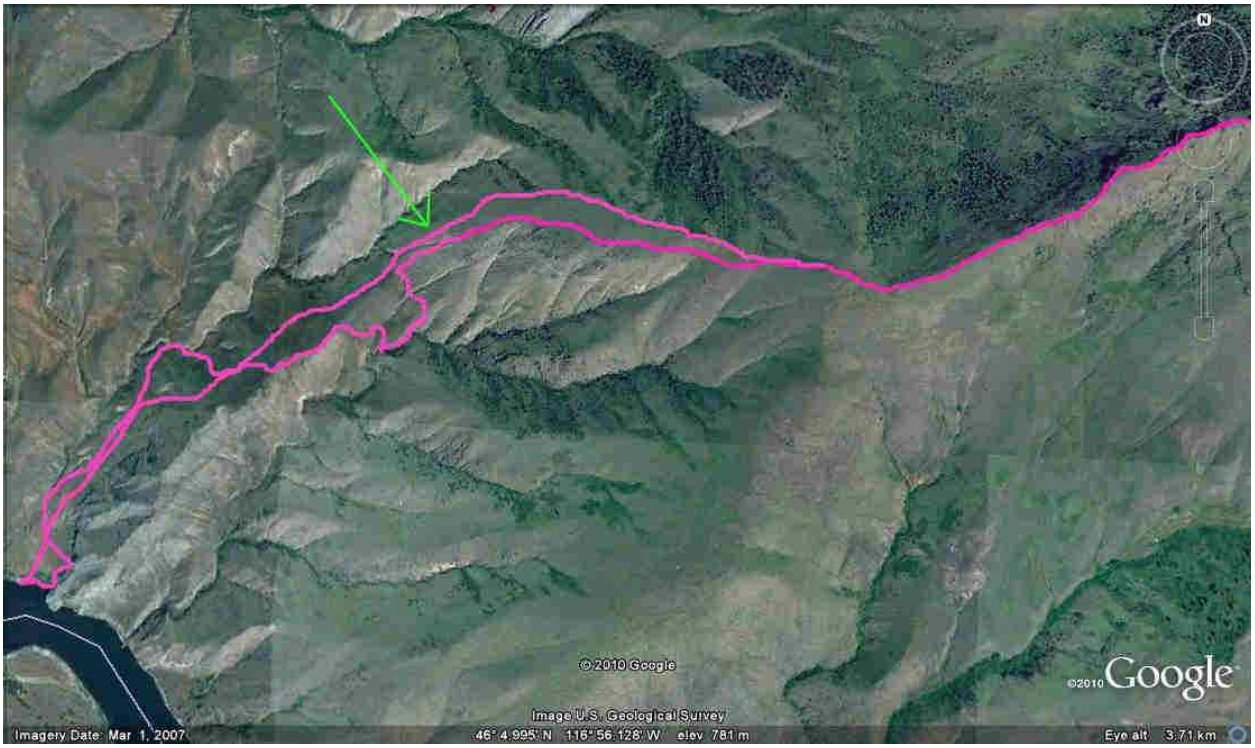
Appendix 1G Linear survey footpath south of Camp Creek in 2010, Craig Mountain, Nez Perce County, Idaho (unit 2). Major rock types surveyed include shale and andesitic rocks of the Martin Bridge Formation, and basalt, within elevations of 250 to 650 m. A solitary small cluster of *Astragalus asotinensis* was found in the portion of the path marked in green (small circle in left side of image). The grasslands in this survey area are about an equal mix of good and very poor quality, the latter being dominated by invasive plants, especially *Anthriscus caucalis, Bromus tectorum* and *Centaurium solstitialis.*



Appendix 1H Linear survey footpath east of Captain Lewis Rapids in 2010, Craig Mountain, Nez Perce County, Idaho (unit 2). Major rock types surveyed include shale, limestone and andesite of the Martin Bridge Formation, and basalt, within elevations of 260 to 800 m. *Astragalus asotinensis* was found in the portion of the path marked in green. The grasslands along this path are mostly of very good quality.



Appendix 1I Linear survey footpath along the Snake River from Captain Lewis Rapids in the north, south toward Limekiln Point in 2010, Craig Mountain, Nez Perce County, Idaho (unit 2). Only basalt and quaternary alluvium were encountered in this portion of the surveys. The surveys spanned elevations of 250 to 270 m. No *Astragalus asotinensis* was found in this area. Most of the grasslands seen upslope from the survey path are of poor to good quality, and the riparian zone along the river in this area is of good to very good condition. The area approaching Limekiln Point (southern terminus of the path) is dominated by invasive species. The green and red markers in the upper right are waypoints from the surveys east of Limekiln Rapids, shown in Appendix 1H.



Appendix 1J Approximate footpath on Gold Hill in 2003, Craig Mountain, Nez Perce County, Idaho (unit 2). The green arrow indicates roughly the location of the observed population of *Astragalus asotinensis*. Rock types observed along this path include shale, limestone, andesite and basalt. Surveys spanned elevations of 260-1000+ m. Most of the area underlain by calcareous substrates at this site is badly affected by invasive plants.

Appendix 1K Approximate outline of the *Astragalus asotinensis* population at Lime Hill, Asotin County, Washington (unit 3). The area shown between the Snake River on the right and the Grande Ronde River on the left has been surveyed intensively since 1999. The area in the outline is densely and more or less evenly occupied by *A. asotinensis*, in a population of thousands or tens of thousands of individuals. No individual of *A. asotinensis* has ever been located on non-calcareous rocks in this area. Note the straight edge of the population on the left, corresponding to the Limekiln Fault, which sharply divides limestone to the right and basalt to the left.

Appendix 2

Waypoint list from unit 2

			Data in NAD 83 (all Zone 11)		Population data					
Unit	**Subpopulation**	**Elev (m)**	**E**	**N**	**Fr**	**Fl**	**Veg**	**D/D**	**Sd**	**Substrate**
2	Negative	750	**506298**	**5107763**						
2	Negative	582	**504579**	**5104368**						Limestone
2	Negative	486	**504566**	**5104390**						Limestone
2	3	425	**504086**	**5104486**	3	0	5	0	0	shale
2	Negative	442	**504102**	**5104465**						
2	Negative		**504105**	**5104488**						
2	3	429	**504109**	**5104487**	0	0	3	0	0	shale
2	3	442	**504116**	**5104466**	10	0	2	0	0	shale
2	3	442	**504117**	**5104472**	5	0	13	0	0	shale
2	3	439	**504118**	**5104479**	7	0	9	0	0	shale
2	3	442	**504119**	**5104458**	3	0	3	0	0	shale
2	3	444	**504124**	**5104464**	10	0	10	0	0	shale
2	3	444	**504133**	**5104465**	0	0	3	0	0	shale
2	3	448	**504147**	**5104459**	6	0	5	0	0	shale
2	3	450	**504154**	**5104451**	7	0	7	0	0	shale
2	3	452	**504159**	**5104454**	0	0	1	0	0	shale
2	3	448	**504160**	**5104445**	1	0	0	0	0	shale
2	3	458	**504185**	**5104468**	3	0	6	0	0	shale
2	3	457	**504192**	**5104475**	3	0	1	0	0	shale
2	3	458	**504193**	**5104463**	0	0	3	0	0	shale
2	3	465	**504196**	**5104458**	1	0	4	0	0	shale
2	Negative		**504199**	**5104465**						
2	3	468	**504202**	**5104454**	1	0	0	0	0	shale
2	Negative	470	**504224**	**5104423**						
2	Negative	482	**504228**	**5104450**						
2	Negative	474	**504234**	**5104443**						
2	3	489	**504247**	**5104465**	6	0	5	0	0	shale
2	3	493	**504255**	**5104468**	5	0	6	0	0	shale
2	3	492	**504270**	**5104478**	1	0	5	0	0	shale
2	3	487	**504271**	**5104478**	0	0	2	0	0	shale
2	3	490	**504273**	**5104486**	1	0	6	0	0	shale
2	3	493	**504275**	**5104488**	1	0	11	0	0	shale
2	3	498	**504276**	**5104494**	3	0	7	0	0	shale
2	3	497	**504287**	**5104501**	0	0	6	0	0	shale
2	3	501	**504292**	**5104505**	1	0	7	0	0	shale
2	3	501	**504298**	**5104514**	0	0	9	0	0	shale
2	3	505	**504309**	**5104519**	2	0	13	0	0	shale
2	3	508	**504311**	**5104521**	2	0	10	0	0	shale
2	3	511	**504322**	**5104530**	2	0	5	0	0	shale
2	3	508	**504323**	**5104528**	0	0	4	0	0	shale
2	3	514	**504324**	**5104528**	0	0	1	0	0	shale
2	3	513	**504326**	**5104529**	0	0	4	0	0	shale
2	Negative	492	**504511**	**5104502**						Shale
2	4	469	**504571**	**5104452**	0	0	7	0	0	Shale
2	4	487	**504575**	**5104410**	0	0	9	0	0	Shale
2	4	484	**504577**	**5104413**	1	0	19	0	0	Shale
2	4	480	**504579**	**5104444**	0	0	18	0	0	Shale

2	4	482	**504581**	**5104420**	0	0	16	0	0	Shale
2	4	480	**504582**	**5104443**	0	0	16	0	0	Shale
			Data in NAD 83 (all Zone 11)		**Population data**					
Unit	**Subpopulation**	**Elev (m)**	**E**	**N**	**Fr**	**Fl**	**Veg**	**D/D**	**Sd**	**Substrate**
2	4	491	**504583**	**5104434**	0	0	10	0	0	Shale
2	4	480	**504583**	**5104436**	0	0	8	0	0	Shale
2	4	486	**504589**	**5104468**	0	0	5	0	0	Shale
2	4	485	**504592**	**5104472**	0	0	7	0	0	Shale
2	4	485	**504597**	**5104481**	0	0	19	0	0	Shale
2	4	488	**504608**	**5104530**	0	0	8	0	0	Shale
2	Negative	514	**504661**	**5104413**						Limestone chips
2	4	526	**504680**	**5104443**	0	0	6	0	0	shale
2	4	513	**504681**	**5104395**	0	0	4	0	0	shale
2	Negative	527	**504682**	**5104437**						Weed patch on saddle
2	4	528	**504683**	**5104464**	1	0	7	0	0	Shale
2	4	523	**504689**	**5104459**	2	0	4	0	0	Shale
2	4	536	**504722**	**5104474**	0	0	3	0	0	Shale
2	4	538	**504728**	**5104480**	0	0	9	0	0	Shale
2	4	538	**504743**	**5104503**	0	0	4	0	0	Shale
2	4	537	**504743**	**5104506**	1	0	3	0	0	Shale
2	4	541	**504758**	**5104508**	0	0	5	0	0	Shale
2	4	564	**504773**	**5104518**	0	0	16	0	0	Shale
2	4	569	**504785**	**5104526**	1	0	22	0	0	Shale
2	4	568	**504786**	**5104507**	3	0	14	0	0	Shale
2	4	555	**504786**	**5104523**	0	0	11	0	0	Shale
2	4	577	**504794**	**5104520**	4	0	13	0	0	Shale
2	4	573	**504803**	**5104520**	10	0	25	0	0	Shale
2	4	575	**504811**	**5104504**	16	0	19	0	0	Shale
2	Negative	530	**504405**	**5104539**						Basalt
2	Negative	500	**504615**	**5104545**						
2	Negative	408	**504100**	**5104550**						Shale
2	Negative	506	**504585**	**5104559**						Shale
2	Negative	530	**504561**	**5104579**						Shale
2	Negative		**504066**	**5104602**						Edge basalt/shale
2	Negative	387	**504026**	**5104627**						Edge basalt/shale
2	Negative	366	**503926**	**5104767**						Edge basalt/shale
2	Negative	567	**504774**	**5105038**						Shale
2	Negative		**504445**	**5105047**						Basalt
2	Negative	534	**504750**	**5105079**						Shale
2	10	420	**504128**	**5105102**	4	0	4	0	0	Basalt
2	Negative	420	**504123**	**5105102**						Shale
2	11	468	**504468**	**5105787**	3	0	8	0	0	Shale

2	11	457	**504445**	**5105789**	1	0	3	0	0	Shale
2	11	460	**504443**	**5105789**	1	0	7	0	0	Shale
2	11	464	**504464**	**5105789**	3	0	8	0	0	Shale
2	11	457	**504462**	**5105792**	1	0	5	0	0	Shale
2	11	477	**504483**	**5105793**	0	0	4	0	0	Shale
2	11	480	**504487**	**5105795**	0	0	3	0	0	Shale
2	11	454	**504444**	**5105796**	2	0	4	0	1	Shale
2	11	453	**504434**	**5105800**	0	0	1	0	1	Shale
2	11	484	**504402**	**5105800**	2	0	5	0	0	Shale
2	Negative	513	**504548**	**5105803**						Shale
			Data in NAD 83 (all Zone 11)		**Population data**					
Unit	**Subpopulation**	**Elev (m)**	**E**	**N**	**Fr**	**Fl**	**Veg**	**D/D**	**Sd**	**Substrate**
2	11	446	**504425**	**5105804**	0	0	1	0	0	Shale
2	Negative	432	**504384**	**5105806**						Edge basalt/andesite
2	11	485	**504528**	**5105814**	1	0	1	0	0	Shale
2	11	498	**504532**	**5105816**	0	0	3	0	0	Shale
2	11	502	**504533**	**5105817**	0	0	1	0	0	Shale
2	11	495	**504534**	**5105818**	0	0	7	0	0	Shale
2	Negative	513	**504555**	**5105819**						Shale
2	Negative	407	**504332**	**5105825**						Basalt
2	Negative	523	**504591**	**5105837**						Shale
2	Negative	529	**504608**	**5105874**						Shale
2	11	544	**504629**	**5105888**	1	0	1	0	0	Shale
2	11	542	**504632**	**5105893**	2	0	2	0	0	Shale
2	11	543	**504633**	**5105894**	3	0	8	0	0	Shale
2	Negative	548	**504651**	**5105905**						Shale
2	11	563	**504676**	**5105927**	3	0	10	0	0	Shale
2	11	566	**504682**	**5105936**	2	0	5	0	0	Shale
2	Negative	569	**504701**	**5105946**						Shale
2	Negative	580	**504763**	**5105968**						Andesite
2	11	575	**504780**	**5106022**	3	0	11	0	0	Shale
2	11	579	**504784**	**5106026**	2	0	2	0	0	Shale
2	Negative	588	**504793**	**5106028**						Shale
2	11	577	**504775**	**5106029**	0	0	2	0	0	Shale
2	11	570	**504775**	**5106032**	7	0	8	0	0	Shale
2	Negative	597	**504818**	**5106034**						Andesite
2	11	566	**504770**	**5106040**	0	0	16	0	0	Shale
2	11	585	**504767**	**5106045**	6	0	12	0	0	Shale
2	11	560	**504767**	**5106048**	3	0	10	0	0	Shale
2	11	560	**504769**	**5106050**	10	0	15	0	0	Shale
2	11	546	**504757**	**5106054**	8	0	16	0	0	Shale
2	11	539	**504749**	**5106075**	2	0	4	0	0	Shale
2	11	545	**504740**	**5106082**	1	0	6	0	0	Shale
2	11	537	**504752**	**5106087**	4	0	10	0	0	Shale
2	11	529	**504743**	**5106091**	5	0	12	0	0	Shale
2	11	527	**504737**	**5106091**	8	0	21	0	0	Shale
2	11	523	**504730**	**5106091**	13	0	18	0	0	Shale

2	Negative	535	**504756**	**5106094**						Shale
2	11	514	**504722**	**5106095**	4	0	7	0	0	Shale
2	11	510	**504707**	**5106103**	0	0	1	0	0	Shale
2	Negative	500	**504689**	**5106110**						Shale
2	Negative	503	**504701**	**5106115**						Shale
2	Negative	499	**504677**	**5106117**						Shale
2	Negative	496	**504671**	**5106119**						Shale
2	Negative	493	**504653**	**5106123**						Shale
2	Negative	482	**504628**	**5106152**						Shale
2	Negative	419	**504492**	**5106183**						Shale
2	Negative	459	**504592**	**5106185**						Shale
2	Negative	416	**504482**	**5106201**						Shale
2	Negative	452	**504573**	**5106206**						Shale
			Data in NAD 83 (all Zone 11)		**Population data**					
Unit	**Subpopulation**	**Elev (m)**	**E**	**N**	**Fr**	**Fl**	**Veg**	**D/D**	**Sd**	**Substrate**
2	Negative	418	**504483**	**5106207**						Shale
2	6	417	**504482**	**5106214**	0	0	2	5	0	Shale
2	6	417	**504488**	**5106218**	0	0	0	2	0	Shale
2	6	414	**504482**	**5106221**	0	0	0	6	0	Shale
2	6	417	**504488**	**5106224**	0	0	0	2	0	Shale
2	6	409	**504481**	**5106228**	0	0	1	4	0	Shale
2	Negative	417	**504493**	**5106233**						Shale
2	Negative	417	**504493**	**5106233**						Shale
2	Negative	436	**504543**	**5106234**						Shale
2	Negative	421	**504511**	**5106236**						Shale
2	6	417	**504497**	**5106237**	0	0	2	0	0	Shale
2	6	410	**504481**	**5106237**	0	0	2	6	0	Shale
2	6	406	**504483**	**5106245**	0	0	3	3	0	Shale
2	6	407	**504493**	**5106249**	0	0	6	0	0	Shale
2	6	413	**504492**	**5106251**	0	0	3	0	0	Shale
2	6	401	**504479**	**5106253**	0	0	2	1	0	Shale
2	6	409	**504498**	**5106263**	0	0	6	0	0	Shale
2	6	410	**504501**	**5106265**	0	0	7	0	0	Shale
2	6	405	**504499**	**5106266**	0	0	5	1	0	Shale
2	6	401	**504500**	**5106273**	0	0	5	0	0	Shale
2	6	395	**504474**	**5106273**	0	0	2	0	0	Shale
2	6	399	**504504**	**5106275**	0	0	2	0	0	Shale
2	6	386	**504469**	**5106276**	0	0	9	2	0	Shale
2	6	400	**504486**	**5106280**	0	0	6	1	0	Shale
2	6	386	**504466**	**5106283**	0	0	1	1	0	Shale
2	6	384	**504466**	**5106288**	0	0	5	0	0	Shale
2	6	378	**504463**	**5106293**	0	0	13	2	0	Shale
2	6	376	**504450**	**5106298**	0	0	5	0	0	Shale
2	6	376	**504455**	**5106300**	0	0	4	0	0	Shale
2	6	376	**504450**	**5106301**	4	0	16	0	0	Shale
2	6	377	**504464**	**5106303**	0	0	5	0	0	Shale
2	Negative	379	**504478**	**5106309**						Shale
2	Negative	409	**504516**	**5106315**						Shale
2	Negative	400	**504505**	**5106316**						Shale
2	Negative	781	**506270**	**5107611**						
2	8	662	**505908**	**5107624**	0	0	2	0	0	Shale

2	Negative	758	**506167**	**5107626**						
2	Negative	770	**506185**	**5107640**						
2	Negative	657	**505892**	**5107646**						
2	8	729	**506066**	**5107678**	6	0	0	0	0	Shale
2	8	736	**506090**	**5107680**	3	0	0	0	0	Shale
2	Negative	566	**505672**	**5107705**						
2	8	649	**505851**	**5107705**	3	0	4	0	0	Shale
2	Negative	722	**506066**	**5107708**						
2	8	649	**505843**	**5107713**	4	0	6	0	0	Shale
2	8	644	**505845**	**5107735**	7	0	3	0	0	Shale
2	8	713	**505984**	**5107754**	1	0	1	0	0	Shale
2	8	685	**505929**	**5107755**	11	0	16	0	0	Shale
2	8	642	**505843**	**5107759**	4	0	2	0	0	Shale
			Data in NAD 83 (all Zone 11)		**Population data**					
Unit	**Subpopulation**	**Elev (m)**	**E**	**N**	**Fr**	**Fl**	**Veg**	**D/D**	**Sd**	**Substrate**
2	8	701	**505955**	**5107759**	4	0	12	0	0	Shale
2	8	711	**505984**	**5107759**	1	0	2	0	0	Shale
2	8	686	**505929**	**5107761**	17	0	12	0	0	Shale
2	8	641	**505842**	**5107766**	9	0	5	0	0	Shale
2	8	682	**505933**	**5107768**	6	0	5	0	0	Shale
2	8	695	**505957**	**5107771**	1	0	9	0	0	Shale
2	8	583	**505721**	**5107772**	0	0	1	0	0	Shale
2	8	685	**505934**	**5107775**	25	0	25	0	0	Shale
2	8	639	**505845**	**5107778**	10	0	5	0	0	Shale
2	8	692	**505956**	**5107778**	1	0	4	0	0	Shale
2	8	684	**505941**	**5107782**	25	0	25	0	0	Shale
2	8	634	**505846**	**5107787**	3	0	7	0	0	Shale
2	8	629	**505850**	**5107793**	3	0	1	0	0	Shale
2	8	630	**505853**	**5107796**	1	0	1	0	0	Shale
2	Negative	616	**505824**	**5107802**						Shale
2	8	622	**505847**	**5107807**	1	0	3	0	0	Shale
2	8	585	**505766**	**5107809**	1	0	0	0	0	Shale
2	8	605	**505806**	**5107821**	1	0	2	0	0	Shale
2	8	606	**505818**	**5107823**	2	0	1	0	0	Shale
2	8	613	**505829**	**5107827**	8	0	8	0	0	Shale
2	8	607	**505821**	**5107828**	5	0	2	0	0	Shale
2	8	608	**505829**	**5107830**	1	0	1	0	0	Shale
2	Negative	712	**506250**	**5107883**						Shale
2	Negative	712	**506250**	**5107883**						
2	Negative		**506190**	**5108024**						
2	9	646	**506170**	**5108043**	0	0	2	0	0	Shale
2	9	639	**506167**	**5108050**	2	0	1	0	0	Shale
2	9	630	**506160**	**5108059**	1	0	1	0	0	Shale
2	9	618	**506135**	**5108070**	0	0	2	0	0	Shale
2	9	618	**506133**	**5108071**	0	0	1	0	0	Shale

2	9	612	**506135**	**5108120**	0	0	1	0	0	Shale
2	Negative		**506064**	**5108233**						
2	9	575	**506079**	**5108237**	1	1	0	0	0	Shale
2	9	590	**506041**	**5108251**	1	0	0	0	0	Shale
2	9	544	**506304**	**5108251**	0	0	2	0	0	Shale
2	Negative		**506125**	**5108252**						
2	Negative		**505867**	**5108253**						
2	Negative	551	**505901**	**5108257**						
2	Negative	545	**506307**	**5108257**						Shale
2	9	549	**506306**	**5108262**	2	0	1	0	0	Shale
2	Negative	533	**506274**	**5108265**						Shale
2	9	584	**506044**	**5108274**	0	0	1	0	0	Shale
2	9	581	**506098**	**5108290**	0	0	11	0	0	Shale
2	9	570	**506097**	**5108294**	0	0	1	0	0	Shale
2	9	581	**506091**	**5108295**	2	0	2	0	0	Shale
2	Negative		**506069**	**5108296**						
2	9	584	**506078**	**5108298**	0	0	1	0	0	Shale
2	Negative		**506057**	**5108300**						
2	9	572	**506089**	**5108318**	0	0	5	0	0	Shale
			Data in NAD 83 (all Zone 11)		**Population data**					
Unit	**Subpopulation**	**Elev (m)**	**E**	**N**	**Fr**	**Fl**	**Veg**	**D/D**	**Sd**	**Substrate**
2	9	570	**506077**	**5108328**	0	0	3	0	0	Shale
2	Negative	559	**506291**	**5108349**						Shale
2	Negative	522	**506167**	**5108404**						Shale
2	Negative	637	**506489**	**5108623**						Basalt
2	Negative	453	**505623**	**5108738**						Shale
2	Negative	530	**506009**	**5109074**						Basalt
3	Negative	556	**509259**	**5110634**						
3	Negative	481	**506596**	**5110711**						
3	Negative	479	**508818**	**5110750**						
3	Negative	470	**508653**	**5110848**						
3	Negative	719	**509297**	**5110972**						
3	Negative	489	**506672**	**5111003**						
3	Negative	417	**508447**	**5111122**						
3	Negative	434	**508431**	**5111132**						
3	Negative	434	**508431**	**5111132**						
3	Negative	378	**507028**	**5111481**						
3	Negative	598	**507744**	**5112193**						
3	Negative	527	**508220**	**5112301**						
3	Negative	527	**508220**	**5112301**						
3	Negative	713	**508432**	**5113255**						
3	Negative	852	**510093**	**5114124**						

Appendix 3

Plant and lichen species encountered during 2010 surveys

Note: Species preceded by an asterisk are nonnative. The number in italics preceding the family name represents collection numbers (all currently *Herbarium Björk* until deposited). Families are not indicated for lichens owing to the currently unstable deep-level taxonomies and large percentage of crust lichens with no family placement. Numbers following the family name are survey sites, as give below. These localities are only where floristic notes and specimens were taken, not whole survey routes.

Site 1: Baker County, Oregon. Along road from town of Huntington to Springs Recreation Site. 11 May.

Site 2: Baker County, Oregon. Ridges between town of Lime and Springs Recreation Site. 12 and 29 May.

Site 3: Wallowa County, Oregon. Along lower Imnaha Canyon from town of Imnaha north to Cactus Mountain and Snake River. 21-22 May.

Site 4: Wallowa County, Oregon. Sled Springs Road, shortly west of Highway 3. 23 May.

Site 6: Wallowa County, Oregon. West rim of northern Oregonian portion of Hells Canyon, from Washington border, along Cold Springs Road south to Buckhorn Overlook, Zumwalt Prairie, and Chesnimnus Creek Road. 25 May.

Site 7: Baker County, Oregon. North of town of Huntington, north of Swede's Landing, shortly south of Beaver Crossing. 30 May.

Site 8: Adams County, Idaho. Kinney Creek/Big Dry Gulch area south of Hells Canyon Dam. 31 May.

Site 9: Baker County, Oregon. Connor Creek and eastern portions of Sugarloaf Mountain. 3 June.

Site 10: Nez Perce County, Idaho. Craig Mountain. Wapshilla Ridge and Cottonwood Creek to Snake River. 5 June.

Site 12: Baker County, Oregon. East of town of Halfway, between Oxbow and Brownlee Dams along west side of Snake River. 29 May.

Site 13: Asotin County, Washington. Lime Hill and the Rock Plume Hills. 24 May and 18-19 June.

Site 14: Nez Perce County, Idaho. Craig Mountain. Across from Rogersburg along east side of Snake River from Camp Creek to Limestone Point. 30 June.

Site 15: Nez Perce County, Idaho. Craig Mountain. Vicinity of Madden Creek, both north and south of creek. 13 and 15 June.

Site 16: Nez Perce County, Idaho. Craig Mountain. Ridges and drainages between Billy Creek and Captain John/Madden Creeks. 14 June.

Site 22: Nez Perce County, Idaho. Craig Mountain. South of Madden Creek along the Snake River.

Site 23: Nez Perce County, Idaho. Craig Mountain. Vicinity of Camp Creek north to Billy Creek. 27 June.

Vascular plants

Abies concolor (Gordon & Glendenning) Hildebrand *x grandis* (Douglas ex D. Don) Lindley PINACEAE 4, 9

Abies grandis (Douglas ex D. Don) Lindley PINACEAE 15

Acer glabrum Torrey SAPINDACEAE 8, 9, 10, 13, 15

Acer negundo L. SAPINDACEAE 14 Probably nonnative.

**Acer saccharinum* L. SAPINDACEAE 14

Achillea millefolium L. ASTERACEAE 2, 3, 4, 7, 8, 9, 10, 13, 15

Achnatherum nelsonii (Scribner) Barkw. *ssp. dorei* (Barkw. & J. Maze) Barkw. POACEAE 13

Actaea rubra (Ait.) Willd. RANUNCULACEAE 8

Adenocaulon bicolor Hook. ASTERACEAE 15

**Adonis aestivalis* L. RANUNCULACEAE 10

**Aegilops cylindrica* Host POACEAE 15

Agastache urticifolia (Benth.) Kuntze LAMIACEAE 9, 10, 15

Agoseris glauca (Pursh) Raf. ASTERACEAE 9, 10, 13

Agoseris grandiflora (Nutt.) E. Greene ASTERACEAE 9

Agoseris heterophylla (Nutt.) E. Greene *var. heterosepala* ASTERACEAE 3, 9, 10, 13, 15

**Agropyron cristatum* P. Beauv. POACEAE 15

Agrostis gigantea Roth POACEAE 10, 15

**Ailanthus altissima* (Mill.) Swingle SIMAROUBIACEAE 9, 15

Allium acuminatum Hook. ALLIACEAE 8, 9

Allium fibrillum M.E. Jones ex Abrams ALLIACEAE 4, 10

Allium parvum Kellogg ALLIACEAE 9

Allium cf. parvum Kellogg *20434* ALLIACEAE 15 Similar in all regards to *A. parvum,* except the bulb coat is conspicuously reticulate throughout, and the population is somewhat out of the geographical range of *A. parvum*; the bulb coat reticulation cells are bent-rectangular in vertical rows, each cell is transversely elongated.

Allium tolmiei Baker *var. platyphyllum* (Tidestr.) Ownbey ALLIACEAE 4, 6

Allium tolmiei Baker *var. tolmiei* ALLIACEAE 10, 15

Alnus rhombifolia Nutt. BETULACEAE 8, 15

**Alyssum desertorum* Stapf BRASSICACEAE 2, 4, 7, 9, 10, 13, 15, 16

**Amaranthus albus* Thunb. AMARANTHACEAE 22

**Amaranthus graecizans* L AMARANTHACEAE 22

Ambrosia sp. ASTERACEAE 15

Amelanchier basalticola Piper ROSACEAE 10 Should be tracked as possibly a rare species. Said to be endemic to lower elevations of the Snake River Canyons. Possibly just random individuals of *A. cusickii* having small flowers, small and paler leaves. However, different blooming periods (as much as two weeks' difference) has been observed in mixed populations by the surveyor in past years.

Amelanchier cusickii Fern. ROSACEAE 3, 7, 8, 9, 10, 13, 15

Amelanchier florida Lindl. ROSACEAE 6, 8, 10, 13, 15 First report for ID and interior northwest U.S. A specimen review is needed to determine whether *A. florida* is truly distinct from *A. alnifolia* sensu stricto, and if so, whether the latter truly occurs west of the Rockies in the U.S.

Amelanchier pumila Nuttall ex Torr. & A. Gray ROSACEAE 2, 4

Amelanchier sp. nov. 20371 ROSACEAE 7 Like *A. alnifolia*, but leaves strongly coriaceous, darker green, sharply to bluntly acute at the tip rather than rounded to truncate, and elliptic-oblong rather than ovate to suborbicular; the leaf abaxial surface is persistently and evenly appressed-pubescent, the hairs not clearing in patches; *A. alnifolia* sensu stricto may not occur so far west.

**Amorpha fruticosa* L. FABACEAE 15

Amsinckia menziesii (Lehmann) Nels. & Macbr. *var. intermedia* (Fisch. & C.A. Mey.) Ganders BORAGINACEAE 7

Amsinckia menziesii (Lehmann) Nels. & Macbr. *var. menziesii* BORAGINACEAE 2, 3, 10, 13, 15, 16

Amsinckia tessellata A. Gray BORAGINACEAE 9

Anaphalis margaritacea (L.) Benth. & Hook. ASTERACEAE 9

Anemone piperi Britton ex Rydb. RANUNCULACEAE 10

Angelica arguta Nutt. APIACEAE 9

Antennaria anaphaloides Rydb. ASTERACEAE 10, 13

Antennaria dimorpha (Nutt.) Torr. & A. Gray ASTERACEAE 2, 4, 6, 9

Antennaria luzuloides Torr. & A. Gray ASTERACEAE 4, 10

Antennaria rosea E. Greene *ssp. rosea* ASTERACEAE 13

Antennaria umbrinella Rydb. ASTERACEAE 2

**Anthriscus caucalis* M. Bieb. APIACEAE 3, 8, 10, 13, 15

**Apera interrupta* (L.) P. Beauv. POACEAE 13, 15, 16

Apocynum androsaemifolium L. *var. pumilum* A. Gray APOCYNACEAE 8, 9, 15

Apocynum cannabinum L. APOCYNACEAE 8, 9

**Arabidopsis thaliana* (L.) Heynh. BRASSICACEAE 3, 13, 15

Arabis crucisetosa Constance & Rollins *20418* BRASSICACEAE 13 Listed Threatened by the Washington Natural Heritage Program.

Arabis eschscholtziana Andrz. BRASSICACEAE 13

**Arctium lappa* L. ASTERACEAE 8, 9, 10, 15

**Arenaria serpyllifolia* L. CARYOPHYLLACEAE 3, 4, 8, 9, 10, 13, 14, 15, 16

Aristida purpurea Nutt. *ssp. longiseta* (Steud.) Vasey POACEAE 3, 13, 15, 16

Arnica cordifolia Hook ASTERACEAE 8, 9, 10, 15

Arnica fulgens Pursh ASTERACEAE 15

Arnica sororia E. Greene ASTERACEAE 8, 10, 13, 15, 16

**Artemisia cana* Pursh ASTERACEAE 14 Native to Idaho, but locally introduced and probably not occurring naturally in the Hells Canyon ecosystem. Found in a recent burn along a jeep track, where likely introduced as part of a revegetation effort.

Artemisia dracunculus L. ASTERACEAE 2, 3, 7, 9, 10, 13, 15

Artemisia lindleyana Bess. ASTERACEAE 5, 13, 15

Artemisia ludoviciana Nutt. *ssp. atomifera* (Piper) comb. ined. ASTERACEAE 3, 8, 9, 13, 15 An overlooked taxon requiring resurrection and recombination under *A. ludoviciana*. Found only in the Greater Hells Canyon Ecosystem and the Owyhee Plateau. Differs from other subspecies in having shoots arising from previous year's semi-woody stems, late-season leaves sclerophyllous and widely spreading, tightly cespitose habit, and distinctive scent and leaf lobing pattern.

Artemisia ludoviciana Nutt. *ssp. incompta* (Nutt.) Cronq. ASTERACEAE 9, 10

Artemisia ludoviciana Nutt. *ssp. ludoviciana* ASTERACEAE 15

Artemisia rigida (Nutt.) A. Gray ASTERACEAE 2, 4, 13, 15

Artemisia tridentata Nutt. *ssp. tridentata* ASTERACEAE 2, 7, 9, 10

Asclepias cryptoceras S. Wats. *ssp. davisii* (Woodson) W. Baker APOCYNACEAE 7, 13 Listed Threatened by the Washington Natural Heritage Program.

Asclepias speciosa Torr. APOCYNACEAE 7, 9, 13, 15, 16

**Asperugo procumbens* L. BORAGINACEAE 3, 9, 13, 15

Astragalus arthurii M.E. Jones FABACEAE 10, 13, 15, 16, 23 Listed Sensitive by the Washington Natural Heritage Program.

Astragalus asotinensis Björk & Fishbein FABACEAE 13, 15, 16 Listed GP1 by the Idaho Natural Heritage Program, and Threatened by the Washington Natural Heritage Program.

Astragalus canadensis L. FABACEAE 10

Astragalus collinus Dougl. *var. collinus* FABACEAE 15

Astragalus cusickii A. Gray *var. cusickii* (northern, small-flowered form with most terminal leaflets confluent with the rachis) FABACEAE 10, 13 Listed Threatened by the Washington Natural Heritage Program (irrespective of form).

Astragalus cusickii A. Gray *var. cusickii* (southern, large-flowered form with all leaflets jointed to the rachis) *20324, 20374, 20378* and others FABACEAE, 2, 7, 8, 9

Astragalus inflexus Dougl. FABACEAE 2, 10, 13, 15, 16

Astragalus obscurus S. Wats. *20320* FABACEAE 2, 7

Astragalus purshii Hook. *var. glareosus* (Dougl. ex Hook.) Barneby FABACEAE 2, 7, 8, 9, 10, 13, 15

Astragalus sheldonii (Rydb.) Barneby FABACEAE 15

Astragalus vallaris M.E. Jones FABACEAE 2, 8, 9

**Avena sativa* L. POACEAE 15

Balsamorhiza incana Nutt. ASTERACEAE 6

Balsamorhiza sagittata (Pursh) Nutt. sensu stricto ASTERACEAE 3, 6, 7, 8, 9, 10, 13, 15, 16

Balsamorhiza sagittata (Pursh) Nutt. *20319* ASTERACEAE 2 Sticky, greener form with outer phyllaries much longer than the inner, and rays longer and more attenuating distally. This form is common in a region from Hells Canyon and central and southwestern Idaho. Some of its characters suggest hybridization with *Balsamorhiza macrophylla*.

Balsamorhiza serrata Nels. & Macbr. ASTERACEAE 6, 10

Berberis repens Lindl. BERBERIDACEAE4, 9, 10, 15

Betula piperi (Britt.) C.L. Hitchc. BETULACEAE 8, 9, 10, 15

Blepharipappus scaber Hook. ASTERACEAE 2, 3, 9, 10, 13, 15

Boechera atrorubens (Suksd. ex E. Greene) Windham & Al-Shehbaz *20413* BRASSICACEAE 9, 10, 13 This species was hitherto unreported from the Hells Canyon Ecosystem, being otherwise known only from the east slopes of the Cascades in Washington and Oregon. However, it is common in the Blue Mountains, northern Hells Canyon, and upland regions of west-central Idaho, north to Spokane County, Washington and Kootenai County, Idaho.

Boechera cusickii (S. Wats.) Windham & Al-Shehbaz BRASSICACEAE 4, 6, 15

Boechera microphylla (Nutt.) Dorn BRASSICACEAE 2, 7, 8, 10

Boechera pauciflora (Nutt.) Windham & Al-Shehbaz BRASSICACEAE 9, 10

Boechera retrofracta (Graham) Á. Löve & D. Löve BRASSICACEAE 1, 9 (including possible *B. polyantha* at site 9, the plants too immature to verify).

Boechera suffrutescens (S. Wats.) Dorn BRASSICACEAE 9

Boechera sp. nov. A 20349 BRASSICACEAE 9 Plants with sparse but woody caudex, lower leaves spatulate, purple-tinged, abruptly transitioning to lanceolate, green cauline leaves; cauline leaves auriculate; fruits ascending to horizontal, 0.5-0.8 mm wide; all hairs on lower stem branched, many with 2-3 short branches or spurs, but none unbranched; petals 7-10 mm long, lavender-pink; sepals with branched, stalked hairs; pollen spherical, plants likely apomictic; stems multiple per caudex terminus (but only two whole plants gathered, so this may not be consistent); plants up to about 40 cm tall; similar to *Boechera fernaldiana*, which differs in having elliptical pollen, and usually one stem per caudex branch, the stems are less erect, and the basal leaves are narrower (1-4 mm wide). The character of purplish, spatulate basal leaves abruptly transitioning to green, lanceolate cauline leaves also occurs in a group of species including *B. fernaldiana* and *B. pallidifolia*, all of which are found much further south (Great Basin-Colorado Basin; unreported populations of *B. fernaldiana* occur in southern Idaho); similar also to the *Boechera sp. nov*. from Lime, Oregon, but that species has short, broad, whitish petals with short cilia, single stems per caudex terminus, broader, stiffly ascending fruits, and shorter stems with both basal and cauline leaves purple-tinged.

Boechera sp. nov. B 20327 BRASSICACEAE 2 Fruits stiffly ascending at a steep angle, but not erect, petals white or whitish, all hairs branched, with longer hairs on the stems and along leaf margins; stem leaves auriculate; stems less than 20 cm; fruits 1-1.5 mm wide, all leaves purplish-tinged. No similar species are near in geographical range except the *sp. nov.* from near Sugarloaf Mountain, Oregon, see notes under that species.

Bolandra oregana S. Wats. *var. imnahaensis* (M. Peck) M. Peck SAXIFRAGACEAE 8

Brickellia grandiflora (Hook.) Nutt. ASTERACEAE 8, 13, 15

Brickellia microphylla (Nutt.) A. Gray ASTERACEAE 3, 7, 9, 13

**Bromus briziformis* Fisch. & C.A. Mey. POACEAE 7, 8, 10

Bromus carinatus Hook. & Arnott POACEAE 9, 10, 13

**Bromus commutatus* Schrad. POACEAE 15

**Bromus hordeaceus* L. POACEAE 2, 3, 4, 7, 8, 9, 13, 15

**Bromus inermis* Leyss. POACEAE 10, 13, 15

**Bromus japonicus* Thunb. POACEAE 7, 10, 13, 15

**Bromus rigidus* Roth POACEAE 8, 9, 10, 15

**Bromus riparius*? Rehmann POACEAE 13, 15 The populations observed are perennial, shortly rhizomatous, clump-forming, up to about 80 cm tall in stature, and have lemmas rounded over the back. The only species in the North American flora that would account for this morphology is the introduced *B. riparius*, of the section *Bromopsis*. However that species should have narrower, acute lemmas. The general appearance of the plant, despite its perennial growth form, suggests section *Bromus*, which consists of annual species having broad lemmas that are mostly rounded at the tips. The species observed is assumed to be nonnative given that its floral morphology is like that of section *Bromus* (all of which are nonnative in northwest North America). Numerous populations of this species are known to me from various regions of the northwest U.S., mostly in sedge-fringe vegetation or other riparian habitats.

**Bromus secalianus* L. POACEAE 22

**Bromus tectorum* L. POACEAE 2, 3, 8, 9, 10, 13, 14, 15, 16

**Bryonia alba* L. CUCURBITACEAE 15

**Buglossoides arvensis* (L.) I.M. Johnst. BORAGINACEAE 2, 3, 7, 8, 9, 15, 16

Calamagrostis rubescens Buckl. POACEAE 8, 9, 10, 15

Calochortus elegans Pursh *var. elegans* LILIACEAE 8, 9, 10, 15

Calochortus macrocarpus Dougl. LILIACEAE 2, 3, 7, 8, 9, 10

Calochortus maculosus Nels. & Macbr. LILIACEAE 13, 15, 16 Listed GP2 by the Idaho Natural Heritage Program, and Endangered by the Washington Natural Heritage Program, both as *C. macrocarpus var. maculosus*.

**Camelina microcarpa* Andrz. ex DC. BRASSICACEAE 2, 7, 8, 9, 10, 15, 16

**Capsella bursa-pastoris* Moench BRASSICACEAE 8, 15

**Cardamine hirsuta* L. BRASSICACEAE 3, 8, 13

Carex amplifolius Boott CYPERACEAE 22

Carex concinnoides Mack. CYPERACEAE 10

Carex deweyana Schw. CYPERACEAE 15

Carex douglasii Boott CYPERACEAE 13

Carex geyeri Boott CYPERACEAE 4, 10

Carex hoodii Boott CYPERACEAE 10, 15

Carex hystericina Muhl. ex Willd. CYPERACEAE 10

Carex leptopoda Mack. CYPERACEAE 13

Carex rossii Boott CYPERACEAE 10, 15

Carex stipata Muhl. ex Willd. *var. stipata* CYPERACEAE 15

Carex subfusca Boott CYPERACEAE 15

Castilleja applegatei Fern. *var. fragilis* (Zeile) N. Holmgr. OROBANCHACEAE 9

Castilleja cusickii Greenm. OROBANCHACEAE 6

Castilleja hispida Benth. OROBANCHACEAE 7, 8, 9, 10, 13, 15, 16

Castilleja miniata Hook. OROBANCHACEAE 9

Castilleja cf. pallescens (A. Gray) Greenm. OROBANCHACEAE 7

Caulanthus pilosus S. Wats. BRASSICACEAE 7 Listed "Group 4" by the Oregon Biodiversity Information Center.

Ceanothus sanguineus Pursh RHAMNACEAE 8

Ceanothus velutinus Dougl. *var. velutinus* RHAMNACEAE 9

Celtis reticulata Torr. CELTIDACEAE 2, 3, 7, 8, 9, 10, 13, 15

**Centaurea solstitialis* L. ASTERACEAE 10, 13, 15, 16

**Centaurea stoebe* L. ASTERACEAE 8

Cerastium arvense L. CARYOPHYLLACEAE 3, 10, 13, 15, 16

**Cerastium fontanum* Baumg. CARYOPHYLLACEAE 8, 10, 15

**Cerastium inflatum* Link? *20449* CARYOPHYLLACEAE 15 Not previously reported from western North America. No comparison specimens have been available for study; needs to be compared against *C. siculum*, which differs in having non-inflating calyx lobes. The plants observed have a calyx that swells greatly into a subglobose structure with fruit development. Either species would be new for northwest North America. Plants of the population should be hand-pulled to prevent the spread of yet another noxious weed.

Cercocarpus intermontanus (N. Holmgr.) Henrickson & Heuvel ROSACEAE 9

Cercocarpus ledifolius Nutt. ROSACEAE 8

Chaenactis douglasii (Hook.) Hook. & Arn. var. *douglasii* ASTERACEAE 2, 7, 10, 13, 15

Chamaerion angustifolium (L.) Holub ONAGRACEAE 10

Chamaesyce serpyllifolia (Pers.) Sm. EUPHORBIACEAE 10

Cheilanthes feei T. Moore PTERIDACEAE 10, 13, 15 Listed Threatened by the Washington Natural Heritage Program.

**Chenopodium album* L. AMARANTHACEAE 10, 13

**Chondrilla juncea* L. ASTERACEAE 15, 16

**Chorispora tenella* (Pall.) DC. BRASSICACEAE 9, 10, 15

Chrysothamnus viscidiflorus (Hooker) Nuttall *var. lanceolatus* (Nuttall) H.M. Hall & Clements ASTERACEAE 2, 7, 13

Chrysothamnus viscidiflorus (Hooker) Nuttall *var. viscidiflorus* ASTERACEAE 2

**Cichorium intybus* L. ASTERACEAE 8, 10, 15

Circaea alpina L. ONAGRACEAE 8

**Cirsium arvense* (L.) Scop. ASTERACEAE 10, 13, 15

Cirsium brevifolium Nutt. ASTERACEAE 13, 15, 16 Listed GP3 by the Idaho Natural Heritage Program.

Cirsium neomexicanum A. Gray ASTERACEAE 2, 7, 8, 9, 10

Cirsium undulatum (Nutt.) Spreng. ASTERACEAE 7, 10, 13, 15, 16

**Cirsium vulgare* (Savi) Ten. ASTERACEAE 9

Clarkia pulchella Pursh ONAGRACEAE 3, 8, 9, 10, 13, 15

Claytonia arenicola L.F. Henders. MONTIACEAE 8, 10, 13

Claytonia lanceolata Pursh MONTIACEAE 4, 9

Claytonia parviflora Dougl. ex Hook. MONTIACEAE 3, 4, 8, 9, 10, 13, 15

Claytonia perfoliata Donn ex Willd. MONTIACEAE 3, 7, 8, 10, 13, 15

Claytonia rubra (Howell) Tidestr. *ssp. depressa* (A. Gray) J.M. Miller & K.L. Chambers MONTIACEAE 3, 7, 8, 9, 10, 13, 15

Clematis ligusticifolia Nutt. RANUNCULACEAE 2, 8, 9, 10, 13, 15

Clematis occidentalis (Hornem.) DC. *var. occidentalis* RANUNCULACEAE 15

Collinsia parviflora Lindl. PLANTAGINACEAE 2, 4, 8, 9, 10, 15

Collomia grandiflora Lindl. POLEMONIACEAE 7, 8, 9, 10, 13, 15

Collomia linearis Nutt. POLEMONIACEAE 7, 9, 10, 15

Collomia tenella A. Gray POLEMONIACEAE 9

Comandra umbellata (L.) Nutt. *ssp. pallida* (DC.) M.E. Jones COMANDRACEAE 2, 7, 9

**Conium maculatum* L. APIACEAE 8, 9

**Convolvulus arvensis* L. CONVOLVULACEAE 13, 15

Cornus stolonifera Michx. CORNACEAE 8, 9, 10, 15

Crataegus douglasii Lindl. ROSACEAE 8, 10, 13, 15

Crepis acuminata Nutt. ASTERACEAE 3, 7, 8, 9, 13, 15, 16

Crepis atribarba A.A. Heller ASTERACEAE 2, 9, 10

Crepis bakeri E. Greene *ssp. cusickii* (Eastw.) Babc. & Stebb. ASTERACEAE 2

Crepis bakeri E. Greene *ssp. idahoensis* Babc. & Stebb. *20408* ASTERACEAE 3, 13, 15 Listed GP2 by the Idaho Natural Heritage Program, and R1 (Review) by the Washington Natural Heritage Program.

Crepis barbigera Leiberg *20383* ASTERACEAE 8 Perhaps in need of tracking as a conservation priority in Idaho.

Crepis intermedia A. Gray ASTERACEAE 3, 8, 9, 13

Crepis modocensis E. Greene ASTERACEAE 9

Crepis occidentalis Nutt. ASTERACEAE 2, 15

**Cruciata pedemontana* (Bell.) Ehrend. RUBIACEAE 10, 15

**Crupina vulgaris* Pers. ex Cass. ASTERACEAE 15, 16

Cryptantha celosioides (Eastw.) Pays. BORAGINACEAE 7

Cryptantha flaccida (Dougl.) E. Greene BORAGINACEAE 2, 3, 10, 13, 15

Cryptantha hendersonii (A. Nels.) Piper *20335* BORAGINACEAE 8, 9, 10, 13, 16 Usually considered the inland population of *Cryptantha intermedia*, which differs consistently in fruit ornamentation, and in general appearance.

Cryptantha propria (Nels. & Macbr.) Pays. *20322* BORAGINACEAE 2

Cryptantha pterocarya (Torr.) E. Greene BORAGINACEAE 2, 7

Cryptantha torreyana (A. Gray) E. Greene BORAGINACEAE 9, 10

**Cuscuta approximata* Bab. CONVOLVULACEAE 13

Cyclachaena xanthifolia (Nutt.) Fresen. ASTERACEAE 13, 15

**Cynoglossum officinale* L. BORAGINACEAE 3, 7, 8, 9, 10, 13, 15

Cyperus sp. nov. 20391, 20443, 20448 CYPERACEAE 13, 14, 15 Similar to *C. schweinitzii* which has been reported locally, most like to the species reported here, but unlike *C. schweinitzii,* the inflorescence bracts are all obliquely ascending (none erect), culm bases with better developed, globose corms, floral scales with a shorter mucro (0.1-0.2 mm long), and inflorescences more densely capitate. Also similar to *C. lupulinus*, which also has been applied to the Hells Canyon population, but that species has reflexed bracts and ovate-elliptic floral scales (as opposed to oblong-obovate), and is found only east of the Rocky Mountains. From both *C. schweinitzii* and *C. lupulinus*, the populations reported here also differ in having winged spikelet rachillas.

Cystopteris fragilis (L.) Bernh. WOODSIACEAE 4, 8, 10, 13, 15

**Dactylis glomerata* L. POACEAE 8, 10, 15, 16

Dalea ornata Nutt. ex Pursh FABACEAE 3, 13

**Daucus carota* L. APIACEAE 9

Delphinium depauperatum Nutt. RANUNCULACEAE 4, 10

Delphinium nuttallianum Pritz. RANUNCULACEAE 2, 4, 7, 8, 9, 10, 13, 15

Delphinium stachydeum (A. Gray) Tidestr. RANUNCULACEAE 9

Descurainia incana (Fisch. & C. Mey.) Dorn BRASSICACEAE 3, 7, 9, 10

Descurainia incisa (A. Gray) Britton *ssp. incisa* BRASSICACEAE 2, 13, 15, 16

**Descurainia sophia* (L.) Webb ex Prantl BRASSICACEAE 2, 10, 15

**Dianthus armeria* L. CARYOPHYLLACEAE 15

Dicentra uniflora Kellogg PAPAVERACEAE 6

Dichanthelium acuminatum (Sw.) Gould & C.A. Mey. *ssp. fastigiatum* (Torr.) Freckmann & Lelong POACEAE 13

Dichanthelium oligosanthes (Schult.) Gould *ssp. scribnerianum* (Nash) Freckmann & Lelong POACEAE 3, 13, 15

Dieteria canescens (Pursh) Nutt. *var. canescens* ASTERACEAE 3

Dieteria canescens (Pursh) Nutt. *var. incana* (Lindl.) D.R. Morgan & R.L. Hartman ASTERACEAE 2, 9, 13, 15

**Dipsacus fullonum* L. DISPACACEAE 2, 3, 4, 9, 10, 15

Disporum trachycarpum (S. Wats.) Benth. & Hook. f. COLCHICACEAE 8, 15

Dodecatheon conjugens E. Greene *var. viscidum* (Piper) H. Mason & H. St. John PRIMULACEAE 10

Dodecatheon pulchellum (Raf.) Merrill PRIMULACEAE 22, 4, 8, 10, 15

Draba nemorosa L. BRASSICACEAE 13

Draba reptans (Lam.) Fern. BRASSICACEAE 15

**Draba verna* L. BRASSICACEAE 2, 3, 4, 7, 8, 9, 10, 13

Drymocallis convallaria (Rydb.) Rydb. ROSACEAE 3, 4, 8, 10, 15

Drymocallis glandulosa (Lindl.) Rydb. ROSACEAE 15

Drymocallis sp. nov. 20420 ROSACEAE 13, 15 Similar to *D. campanulatum* in having septate, gland-tipped hairs on the stems and pedicels, and in having erect petals and sepals. Differs from *D. campanulatum* in having smaller petals (=to or shorter than sepals, only about 2.5-4.5 mm wide rather than 5-8 mm), basal leaves with (3-) 4-5 (-6) pairs of leaflets (as opposed to (2-) 3-4 (-5)), leaflet bases cuneate rather than rounded, leaflet apices acute not blunt, leaflet teeth double not single

**Dysphania botrys* (L.) Mosyakin & Clements AMARANTHACEAE 15

**Elaeagnus angustifolia* L. ELAEAGNACEAE 7

**Elaeagnus umbellata* Thunb. ELAEAGNACEAE 13

Eleocharis macrostachya Britt. CYPERACEAE 15

Elymus elymoides (Raf.) Swezey POACEAE 2, 7, 9

Elymus glaucus Buckl. *ssp. glaucus* POACEAE 13, 15

Elymus lanceolatus (Scribn. & J.G. Smith) Burtt Davy POACEAE 2

**Elymus repens* (L.) Gould POACEAE 8, 10, 15

Elymus wawawaiensis J. Carlson & Barkw. POACEAE 8, 10, 13, 15, 16

Epilobium brachycarpum Presl ONAGRACEAE 2, 3, 8, 9, 10, 13, 15

Epilobium ciliatum Raf. *ssp. ciliatum* POACEAE 15

Equisetum laevigatum A. Br. EQUISETACEAE 10

Eremogone capillaris (Poir.) Fenzl *var. americana* (Maguire) R.L. Hartman & Rabeler CARYOPHYLLACEAE 4, 9

Eremothera boothii (Dougl.) W.L. Wagner & Hoch *ssp. alyssoides* (Hook. & Arn.) W.L. Wagner & Hoch ONAGRACEAE 7, 13

Ericameria nana Nutt. ASTERACEAE 8, 10

Ericameria nauseosa (Pallas ex Pursh) Nesom *var. nana* (Cronq.) Nesom & Baird ASTERACEAE 10, 13, 15 Listed "M" (Monitored) by the Idaho Natural Heritage Program.

Ericameria nauseosa (Pallas ex Pursh) Nesom *var. oreophila* (A. Nels.) Nesom & Baird ASTERACEAE 9

Ericameria nauseosa (Pallas ex Pursh) Nesom *var. speciosa* (Nutt.) Nesom & Baird ASTERACEAE 2, 7, 9, 15

Erigeron bloomeri A. Gray *var. bloomeri* ASTERACEAE 15

Erigeron chrysopsidis A. Gray *var. austiniae* (E. Greene) G.L. Nesom ASTERACEAE 2

Erigeron compositus Pursh ASTERACEAE 14

Erigeron corymbosus Nutt. ASTERACEAE 2, 8, 9, 10, 13, 15, 16

Erigeron davisii (Cronq.) G.L. Nesom ASTERACEAE 10 A globally rare species that should be tracked throughout its range.

Erigeron disparipilus Cronq. ASTERACEAE 4, 6

Erigeron divergens Torr. & A. Gray ASTERACEAE 15

Erigeron filifolius Nutt. *var. filifolius* ASTERACEAE 2

Erigeron linearis (Hook.) Piper ASTERACEAE 2

Erigeron pumilus Nutt. *var. intermedius* Cronq. ASTERACEAE 3, 8, 10, 13, 15, 16

Erigeron speciosus (Lindl.) DC. ASTERACEAE 15

Eriogonum cespitosum Nutt. POLYGONACEAE 6

Eriogonum compositum Dougl. ex Benth. *var. compositum* POLYGONACEAE 9, 13

Eriogonum heracleoides Nutt. *var. heracleoides* POLYGONACEAE 4, 9, 10, 13, 15

Eriogonum microthecum Nutt. *var. laxiflorum* Hook. POLYGONACEAE 2

Eriogonum niveum Dougl. ex Benth. POLYGONACEAE 9, 10, 13, 14, 15, 16

Eriogonum ovalifolium Nutt. POLYGONACEAE 9

Eriogonum strictum Benth. *var. strictum* POLYGONACEAE 2, 9, 10, 13, 15

Eriogonum umbellatum Torr. (var. unknown, in leaf only) POLYGONACEAE 7, 9

Eriogonum vimineum Dougl. ex Benth. POLYGONACEAE 10, 13

Eriogonum sp. nov. 20365 POLYGONACEAE 7 Somewhat like *E. strictum var. strictum,* but its leaves are larger, oblong-elliptic, abruptly expanded from the longer petioles, and rounded to truncate at the tip. Also, the inflorescence may be larger and more divaricate than that of *E. strictum var. strictum*. *Eriogonum strictum var. strictum* probably never occurs at such low elevations (the elevation range given in the Flora of North America for *var. strictum* is apparently in error, all populations known to me are from montane to lower subalpine elevations of the Blue Mountains and adjacent Idaho). The geographical range for *var. strictum* given in the Flora of North America lists counties where the taxon is known; Baker County, Oregon is not listed (Reveal 2005).

Eriophyllum lanatum (Pursh) J. Forbes *var. integrifolium* (Hook.) J.F. Smiley ASTERACEAE 2, 3, 4, 8, 10, 13, 15

Eriophyllum lanatum (Pursh) J. Forbes *var. lanatum* ASTERACEAE 13

**Erodium cicutarium* (L.) L'Her GERANIACEAE 2, 7, 8, 9, 10, 13, 16

Erysimum capitatum (Dougl.) E. Greene *var. purshii* (Durand) Rollins BRASSICACEAE 3, 8, 9, 10, 13, 15

Erythronium grandiflorum Pursh *var. grandiflorum* LILIACEAE 4, 15

Eurybia conspicua (Lindl.) Nesom ASTERACEAE 8, 9, 10

Euthamia occidentalis Nutt. ASTERACEAE 15

**Fallopia convolvulus* (L.) Á. Löve POLYGONACEAE 15

**Fallugia paradoxa* (D. Don) Endl. ex Torr. ROSACEAE 8 Persistent roadside planting. Found naturally in the American Southwest and northern Mexico.

Festuca campestris Rydb. POACEAE 8, 15

Festuca idahoensis Elmer POACEAE 2, 4, 7, 8, 9, 10, 13, 15, 16

**Festuca rubra* L. *ssp. rubra* POACEAE 15

Festuca rubra L. *ssp. vallicola* (Rydb.) Pavlick POACEAE 2, 3, 8, 10, 13, 15

Floerkia proserpinacoides Willd. LIMNANTHACEAE 4

Fragaria vesca L. ROSACEAE 4, 10, 15

Fragaria virginica Duchesne ROSACEAE 4, 10, 15

Frangula purshiana (DC.) J.G. Cooper RHAMNACEAE 8, 15

Frasera albicaulis var. albicaulis GENTIANACEAE 10, 13, 15, 16

Frasera fastigiata (Pursh) A.A. Heller GENTIANACEAE 4, 10 Listed “Group 3” by the Oregon Biodiversity Information Center.

Frasera speciosa Dougl. GENTIANACEAE 4

**Fraxinus pensylvanica* Marsh OLEACEAE 8, 14 Persistent roadside plantings, and escaping into riparian forests.

Fritillaria affinis (Schultes & Schultes) Sealy LILIACEAE 2, 4

Fritillaria pudica (Pursh) Sprengel LILIACEAE 3, 8, 9, 10, 13, 15

**Fumaria officinalis* L. PAPAVERACEAE 15

Gaillardia aristata Pursh ASTERACEAE 13, 15, 16

Galium asperrimum A. Gray RUBIACEAE 8

Galium bifolium S. Wats. RUBIACEAE 4, 9

Galium boreale L. RUBIACEAE 2, 10, 13

Galium multiflorum Kellogg RUBIACEAE 2, 7, 8, 9, 10, 13

Galium cf. aparine L. RUBIACEAE 2, 3, 7, 8, 9, 10, 13, 15, 16 Plants greener, with diffuse inflorescences, not strictly columnar, flowers white, 4-lobed; somewhat weedy, but native, with rounder leaf tips than typical *G. aparine*.

**Galium cf. aparine* L. RUBIACEAE 22, 25 Plants yellower than other form, narrower through the inflorescences, more strictly columnar, but also scandent/flopping, corollas green, with mostly 3 lobes, otherwise similar to *G. aparine*; weedy and invasive, common in agricultural fields in the inland northwest U.S.

Galium cf. spurium L. RUBIACEAE 22 Plants smaller than either form of *G. aparine*, with short, acicular, stiffer leaves, corollas larger, inflorescence more distinctly corymbose. Not at all weedy.

**Geranium carolinianum* L. GERANIACEAE 13

**Geranium dissectum* L. GERANIACEAE 13, 15

**Geranium molle* L. GERANIACEAE 3, 8, 10, 13, 15

Geranium viscosissimum Fisch. & C.A. Mey. *var. viscosissimum* GERANIACEAE 4, 15

Geum aleppicum Jacq. ROSACEAE 15

Geum macrophyllum Willd. ROSACEAE 15

Geum triflorum Pursh *var. ciliatum* (Pursh) Fassett ROSACEAE 4, 13, 15

Glossopetalon spinescens A. Gray *var. aridum* M.E. Jones CROSSOSOMATACEAE 2, 3, 8, 10, 13, 22

Glossopetalon spinescens A. Gray *var. nov. 20337* CROSSOSOMATACEAE 9 Plants smaller than the lower range of *G. spinescens var. aridum* or the other varieties (10-25 cm tall). Its leaves are small, like those of *var. microphyllum* (found only in Arizona, Nevada and Utah), the stipules have their free portion absent or poorly developed, when present, less than 0.5 mm long (on the stipules of *var. aridum* the free portion is well developed, 0.5-1.2 mm long). In the observed population, the twigs remain green through the first year, but with some small red-brown zones on otherwise green twigs forming the second or third year, then eventually with a gray necrotic cortex (the twigs of *var. aridum* turn yellow-brown for one or more years before turning gray and necrotic). The population reported here has 5-7 stamens of more or less equal length, while those of *var. aridum* are 6-10 in two series of distinctly unequal length. The population observed is isolated from *var. aridum*, the only other variety known to occur in the Hells Canyon Ecosystem, by elevation (*var. aridum* occurs at lower elevations), and possibly also geographically (no populations of *var. aridum* observed closer than near the town of Lime, Oregon). *Variety microphyllum* differs in being a taller shrub (at least 25 cm tall at maturity), with twigs that change from green to orangish brown in the first year, a longer, well developed free portion of the stipules, and more numerous stamens.

Glyceria striata (Lam.) C.L. Hitchc. POACEAE 9

Glycyrrhiza lepidota Pursh FABACEAE 13, 15

Grayia spinosa (Hook.) Moq. AMARANTHACEAE 7

Grindelia nana Nutt. *var. integrifolia* Nutt. ASTERACEAE 15, 16, 25

Grindelia squarrosa (Pursh) Duval ASTERACEAE 2, 3, 7, 8, 9, 10, 15

Gutierrezia sarothrae (Pursh) Britt. & Rusby ASTERACEAE 10, 13, 16

Hackelia cronquistii J.L. Gentry *20326* BORAGINACEAE 2 Listed Threatened by the Oregon Department of Agriculture, and “List 1” by the Oregon Biodiversity Information Center; federal Species of Concern.

Hackelia hispida (A. Gray) I.M. Johnston *var. hispida* BORAGINACEAE 8

Hackelia micrantha (Eastw.) J. Gentry BORAGINACEAE 4, 9

Helianthella uniflora (Nutt.) Torr. & A. Gray ASTERACEAE 9, 10, 15

Helianthus annuus L. ASTERACEAE 2, 3, 8, 9, 10, 13, 15, 16

Heracleum lanatum Michx. APIACEAE 9, 10, 15

Hesperochiron pumilus (Griseb.) Porter BORAGINACEAE 4, 6

Hesperostipa comata (Trin. & Rupr.) Barkw. POACEAE 13, 14, 15

Heterocodon rariflorum Nutt. CAMPANULACEAE 8, 13

Heterotheca villosa (Pursh) Shinners *var. foliosa* (Nutt.) V.L. Harms ASTERACEAE 3, 13, 15

Heuchera cylindrica Dougl. ex Hook. *var. cylindrica* SAXIFRAGACEAE 3, 13, 15

Heuchera cylindrica Dougl. ex Hook. *var. glabella* (Torr. & A. Gray) W.E. Wheelock SAXIFRAGACEAE 10

Heuchera grossulariifolia Rydb. *var. grossulariifolia* SAXIFRAGACEAE 8

Heuchera parvifolia Nutt. ex Torr. & A. Gray SAXIFRAGACEAE 2, 9, 10

Hieracium scouleri Hook. *var. albertinum* (Farr) G.W. Douglas & G.A. Allen ASTERACEAE 15

Hieracium scouleri Hook. *var. griseum* (Rydb.) A. Nels. ASTERACEAE 8, 9, 10, 13, 15, 16

Holodiscus discolor (Pursh) Maxim. ROSACEAE 3, 8, 9, 10, 15

**Holosteum umbellatum* L. CARYOPHYLLACEAE 2, 3, 7, 8, 9, 10, 13, 15

**Hordeum murinum* L. POACEAE 3, 10, 13, 15

Hosackia americana (Nutt.) Piper FABACEAE 13, 14

Hydrophyllum capitatum Dougl. BORAGINACEAE 2, 4, 8, 9, 10, 15

Hydrophyllum fendleri (A. Gray) A.A. Heller BORAGINACEAE 15

**Hypericum perforatum* L. HYPERICACEAE 3, 4, 10, 13, 15, 16

Iliamna rivularis (Dougl.) E. Greene MALVACEAE 10, 15

Ipomopsis aggregata (Pursh) V. Grant *var. aggregata* POLEMONIACEAE 3, 5, 9

Ipomopsis aggregata (Pursh) V. Grant *var. attenuata* (A. Gray) V. Grant & A.D. Grant POLEMONIACEAE 15

**Iris germanica* L. IRIDACEAE 13, 15

Iva axillaris Pursh ASTERACEAE 13, 15

**Juglans regia* L. JUGLANDACEAE 8, 9, 14, 15

Juncus acuminatus Michx. JUNCACEAE 2, 13

Juncus balticus Willd. JUNCACEAE 13

Juncus bufonius L. *var. bufonius* JUNCACEAE 15

Juncus dudleyi Wieg. sensu lato JUNCACEAE 10, 15

Juncus tenuis Willd. JUNCACEAE 10, 15

Juniperus occidentalis Hook. CUPRESSACEAE 2, 4, 5, 7, 9, 15

Koeleria macrantha (Ledeb.) J.A. Schultes POACEAE 4, 8, 9, 10, 13, 15, 16

**Lactuca serriola* L. ASTERACEAE 2, 3, 9, 13, 15, 16

Lagophylla ramosissima Nutt. *var. ramosissima* ASTERACEAE 15

**Lamium purpureum* L. LAMIACEAE 10

Lappula occidentalis (S. Wats.) E. Greene *var. cupulata* (A. Gray) Higgins BORAGINACEAE 8, 10, 13, 15, 16

Lappula occidentalis (S. Wats.) E. Greene *var. occidentalis* BORAGINACEAE 2, 13

Lathyrus nevadensis S. Wats. *var. cusickii* (S. Wats.) Broich FABACEAE 9, 13

Lathyrus parkeri H. St. John FABACEAE 15

Lathyrus pauciflorus Fern. *var. utahensis* (Jones) Peck FABACEAE 8

Lemna sp. ARACEAE 9

**Lepidium campestre* (L.) Ait. BRASSICACEAE 15

Lepidium densiflorum Scrad. BRASSICACEAE 3, 8, 13

**Lepidium draba* L. BRASSICACEAE 2, 10, 15, 16

**Lepidium latifolium* L. BRASSICACEAE 22

**Lepidium perfoliatum* L. BRASSICACEAE 7, 10, 13, 15

Lewisia rediviva Pursh *var. rediviva* MONTIACEAE 2, 4

Leymus cinereus (Scribn. & Merr.) Á. Löve (blue form) POACEAE 2, 7, 10, 15

Leymus cinereus (Scribn. & Merr.) Á. Löve (green form) POACEAE 7

Linanthus pungens (Torr.) J.M Porter & L.A. Johnson *ssp. hazelae* (M.E.Peck) comb. ined. *20338* POLEMONIACEAE 9 Not listed in Oregon due to its not having been recognized in recent taxonomic work on the Polemoniaceae. However, no recent (last 20 years) published systematic study employing morphological or molecular methods have put the taxonomic status of *ssp. hazelae* to scientific question *per se*. The field research of Meinke (1988) and Moseley (1989) found that *ssp. hazelae* is distinct based on several unambiguous characters, and is not sympatric with any other form of *L. pungens*. Unless systematic methods are re-applied to this question, the subspecies should be maintained.

**Linaria dalmatica* (L.) Miller PLANTAGINACEAE 8

Linum lewisii Pursh *var. lewisii* LINACEAE 2, 13, 15

Linum lewisii Pursh *var. alpicola* Jeps. LINACEAE 9

Lithophragma glabrum Nutt. SAXIFRAGACEAE 2, 4, 8, 9, 10, 15

Lithophragma parviflorum (Hook.) Torr. & A. Gray SAXIFRAGACEAE 2, 3, 4, 8, 9, 10, 13, 15

Lithospermum ruderale Dougl. ex Lehm. BORAGINACEAE 2, 8, 9, 10, 13, 15, 16

**Logfia arvensis* (L.) Holub ASTERACEAE 8, 10, 13, 15

Lomatium ambiguum (Nutt.) Coult. & Rose APIACEAE 2, 6, 10, 13, 15

Lomatium bicolor (S. Wats.) Coul. & Rose *ssp. leptocarpum* (Torr. & A. Gray) Schlessman APIACEAE 4, 6, 10

Lomatium cous (S. Wats.) Coult. & Rose APIACEAE 4, 6, 10

Lomatium dissectum (Nutt.) Math. & Const. *var. dissectum* APIACEAE 15

Lomatium dissectum (Nutt.) Math. & Const. *var. multifidum* (Torr. & A. Gray) Math. & Const. APIACEAE 2, 3, 6, 7, 8, 9, 10, 13, 15

Lomatium grayi Coult. & Rose APIACEAE 3, 4, 6, 7, 8, 9, 13, 14, 15

Lomatium macrocarpum (Nutt. ex Torr. & A. Gray) Coult. & Rose APIACEAE 2, 3, 8, 9, 10, 13, 15, 16

Lomatium nudicaule (Pursh) Coult. & Rose APIACEAE 9

Lomatium rollinsii Math. & Const. APIACEAE 3, 13, 15 Listed Threatened by the Washington Natural Heritage Program, and "List 3" by the Oregon Biodiversity Information Center.

Lomatium serpentinum (M.E. Jones & Const.) APIACEAE 10, 15

Lomatium triternatum (Pursh) Coult. & Rose APIACEAE 2, 7, 8, 9, 10, 13, 15

Lonicera ciliosa (Pursh) Poir. ex DC. CAPRIFOLIACEAE 15

Lonicera utahensis S. Wats. CAPRIFOLIACEAE 10

Lupinus arbustus Lindl. FABACEAE 7, 9, 10

Lupinus burkei S. Wats. FABACEAE 10

Lupinus caudatus Kellogg FABACEAE 2, 8, 9

Lupinus laxiflorus Dougl. ex Lindl. FABACEAE 4, 5, 13

Lupinus pseudoparviflorus Rydb. FABACEAE 15

Lupinus saxosus Howell? FABACEAE 2

Lupinus sericeus Pursh *var. sericeus* FABACEAE 2, 9, 10, 13, 15, 16

**Lycium barbarum* L. SOLANACEAE 15

Madia gracilis (Smith) Keck ASTERACEAE 4, 15

Maianthemum racemosum (L.) Link RUSCACEAE 8, 9, 13, 15

Maianthemum stellatum (L.) Link RUSCACEAE 9, 10, 15

**Malus domestica* Borkh. ROSACEAE 15

**Malva neglecta* Wallr. MALVACEAE 15

**Marrubium vulgare* L. LAMIACEAE 10, 15

**Matricaria discoidea* DC. ASTERACEAE 10, 15

**Matricaria sp.* ASTERACEAE 15

**Medicago lupulina* L. FABACEAE 3, 8, 9, 10, 13, 15

**Medicago sativa* L. FABACEAE 8, 15

Melica bulbosa Geyer ex Porter & Coulter *var. bulbosa* POACEAE 9

**Melilotus officinalis* (L.) Lam. FABACEAE 2, 7, 8, 9, 10, 13, 15

**Mentha spicata* L. LAMIACEAE 10

Mentzelia albicaulis Dougl. LOASACEAE 2, 7, 10, 13, 15

Mentzelia dispersa S. Wats. LOASACEAE 7, 9, 15

Mentzelia laevicaulis (Dougl.) Torr. & A. Gray *var. laevicaulis* LOASACEAE 3, 7, 9, 10, 13, 15

Mertensia longiflora E. Greene BORAGINACEAE 4

Mertensia oblongifolia (Nutt.) G. Don BORAGINACEAE 2, 6

Mertensia sp. nov. 20352 BORAGINACEAE 9 Similar to *M. oblongifolia* in having ropy roots and a woody caudex, usually with more than one stem per plant, and basal leaves present at flowering time (though these are much smaller than the lower cauline leaves). The species here reported differs in having cauline leaves 1.2-3 x long as broad, and with a corolla tube 2-3 x long as the limb. Similar also to *M. longiflora*, but with ropy roots and a caudex, cauline leaves broader, basal leaves present at flowering time; differs from both of these species in having a corolla limb more widely flared from the base (more broadly campanulate, and the corollas are mostly bicolored, with the limb usually paler than the tube); perhaps also distinct in having 1) lobes of the corolla limbs broadly ovate, with an abrupt narrowing to a short claw, the sinuses between which are rounded and prominent, and 2) coriaceous bumps along the margins of the leaves and calyx lobes, these bumps sometimes elongating into teeth on the calyx lobes), and 3) the leaves are white-punctate.

Micranthes nidifica (E. Greene) Sm. SAXIFRAGACEAE 4, 8, 10, 15

Micranthes occidentalis (S. Wats.) Sm. SAXIFRAGACEAE 10

Micranthes sp. nov. 20384 SAXIFRAGACEAE 8 Carpels in anthesis about half inferior or slightly superior; petals shorter than the sepals, sepals spreading, not reflexed; inflorescence open and diffuse, flowers individually borne, not in glomerules; leaf blade faces glabrous (but margins ciliate at base), petioles much longer than the blade; plants growing in a patch from firm caudices with bulbils; *Micranthes nidifica* has petioles shorter than the leaf blade, slightly to moderately hairy leaf surfaces, reflexed sepals, congested inflorescences with flowers in glomerules, and ovaries more decidedly inferior; *Micranthes fragosa* has petals longer than the sepals and a more condensed inflorescence with flowers in glomerules, longer leaf blades about equal in length to the petioles, ovary more decidedly inferior, leaf surfaces slightly to moderately hairy, and slender rhizomes without firm caudices or bulbils.

Microseris nutans (Hook.) Schultz-Bip. ASTERACEAE 2, 3, 8, 9, 10, 13, 15

**Microthlaspi perfoliatum* (L.) F.K. Mey. BRASSICACEAE 15

Mimulus guttatus DC. PHRYMACEAE 3, 8, 10, 15

Mimulus patulus Pennell *20441* PHRYMACEAE 15 Listed GP3 by the Idaho Natural Heritage Program.

Mimulus washingtonensis Gandoger PHRYMACEAE 12

Mitella stauropetala Piper SAXIFRAGACEAE 10

Moehringia lateriflora (L.) Fenzl CARYOPHYLLACEAE 15

Montia linearis (Dougl. ex Hook.) E. Greene MONTIACEAE 4, 15

**Morus alba* L. MORACEAE 13, 15 (black-fruited form)

Mulgedium pulchellum (Pursh) G. Don ASTERACEAE 2, 13, 15, 16

**Myosotis discolor* Pers. ex Murray BORAGINACEAE 15

Myosotis laxa Lehm. BORAGINACEAE 15

**Myosotis micrantha* Pall. ex Lehm. BORAGINACEAE 3, 4, 7, 8, 9, 10, 13, 15

**Nasturtium officinale* W.T. Ait. BORAGINACEAE 2, 9, 10, 15

Nemophila breviflora A. Gray BORAGINACEAE 9, 13

Nemophila kirtleyi L.F. Hend. BORAGINACEAE 2, 9

Nemophila parviflora Benth. *ssp. austiniae* (Eastw.) Brand BORAGINACEAE 4, 9

**Nepeta cataria* L. LAMIACEAE 3, 8, 10, 15

Nothocalais troximoides (A. Gray) E. Greene ASTERACEAE 2, 8, 9, 10, 13, 15

Oenothera cespitosa Nutt. *var. marginata* (Hook. & Arn.) Munz ONAGRACEAE 2, 3, 7, 9, 13, 15, 16 Listed Threatened by the Washington Natural Heritage Program.

Oenothera curtiflora W.L. Wagner & Hoch (syn. *Gaura parviflora*) ONAGRACEAE 9, 10, 13, 15

Oenothera strigosa (Rydb.) Mack. & Bush ONAGRACEAE 2

Olsynium douglasii (A. Dietr.) Bickn. var. *inflatum* (Suksd.) Chelowa & D.M. Hend. IRIDACEAE 4

**Onobrychis viciifolia* Scop. FABACEAE 15

**Onopordum acanthium* L. ASTERACEAE 2, 3, 7, 8, 9, 10, 13, 15, 16

Opuntia columbiana Griffiths CACTACEAE 3

Opuntia polyacantha Haw. *var. nov.* CACTACEAE 3, 10, 13, 15 *Opuntia polyacantha var. erinacea* has been applied to the Hells Canyon plants, but that variety has 8-14 areoles per diagonal row across the stem midline and stem segments about half the size of the Hells Canyon plants, and that variety is known only from the southern Great Basin and Mojave Desert--also, the flowers of *var. erinacea* may be more or less consistently of brighter petal colors (deeper yellow to magenta as opposed to sulfur or greenish yellow). *Opuntia columbiana* also has been applied to the common Hells Canyon prickly pear, but that species has smaller, broadly obovate to orbicular pads, more pronounced areoles, paler glochids, and shorter, more terete spines. Only one presumed population of *O. columbiana* was found during the surveys, though those plants should be reexamined to understand whether they may represent depauperate individuals of *O. polyacantha*.

Orobanche californica Cham. & Schldl. *ssp. grayana* (G. Beck) Heckard *20446* OROBANCHACEAE 15 New for Idaho, though the name was previously misapplied to specimens of other *Orobanche* species from the state (*O. pinetorum* and *O. fasciculata*, specimens at the Stillinger Herbarium, University of Idaho).

Orobanche fasciculata Nutt. OROBANCHACEAE 7, 13, 15

Orobanche uniflora L. OROBANCHACEAE 4, 8, 13

Orogenia linearifolia S. Wats. APIACEAE 4, 9

Orthocarpus tenuifolius (Pursh) Bentham OROBANCHACEAE 10, 15, 16

Osmorhiza berteroi DC. APIACEAE 8, 9, 15

Osmorhiza depauperata Phil. APIACEAE 9

Osmorhiza occidentalis (Nutt.) Torr. APIACEAE 9

**Oxalis dillenii* Jacq. OXALIDACEAE 15 (Possibly native)

Packera cana (Hook.) W.A. Weber & Á. Löve ASTERACEAE 8, 10

Packera cf. cana (Hook.) W.A. Weber & Á. Löve ASTERACEAE 13 Plants larger, leaves green, glabrate on the adaxial surface, all (even basalmost) leaves deeply lyrate-pinnatifid. Similar to *Packera eurycephala var. lewisrosei* of California, but that taxon has only a single stem per caudex and leaves with two orders of lobing. Trock (2006) indicates that *P. cana* is “relatively uniform” throughout its range. No other population known to me bears this morphology. *Packera cana* elsewhere in Hells Canyon is sharply dissimilar.

Paeonia brownii Dougl. ex Hook. PAEONIACEAE 4, 6

Parietaria pensylvanica Muhl. ex Willd. URTICACEAE 2, 3, 8, 10, 13, 15

**Pastinaca sativa* L. APIACEAE 15

Pellaea breweri D.C. Eat. PTERIDACEAE 9

Penstemon attenuatus Dougl. *var. attenuatus* PLANTAGINACEAE 9, 10, 15

Penstemon deustus Dougl. ex Lindl. *var. deustus* PLANTAGINACEAE 7, 8, 9, 10

Penstemon eriantherus Pursh *var. eriantherus* PLANTAGINACEAE 13, 15, 16

Penstemon fruticosus (Pursh) E. Greene *var. serratus* (Keck) Cronquist PLANTAGINACEAE 6, 10, 13

Penstemon glandulosus Dougl. ex Lindl. *var. glandulosus* PLANTAGINACEAE 7, 8, 9, 10, 13, 15, 16

Penstemon speciosus Dougl. ex Lindl. sensu lato *20323* PLANTAGINACEAE 2

Penstemon triphyllus Dougl. PLANTAGINACEAE 3, 8, 10, 13, 15

Penstemon venustus Dougl. PLANTAGINACEAE 9, 10, 13, 15

Perideridia bolanderi (A. Gray) Nels. & Macbr. APIACEAE 2, 6, 9

Perideridia montana (Blank.) Dorn APIACEAE 8, 9, 10, 13, 15

Persicaria amphibia (L.) A. Gray POLYGONACEAE 13

Persicaria punctata (Ell.) Sm. POLYGONACEAE 10

Phacelia hastata Lehm. BORAGINACEAE 2, 3, 7, 8, 9, 10, 15

Phacelia heterophylla Pursh BORAGINACEAE 2, 9, 10, 13, 15

Phacelia linearis (Pursh) Holz. BORAGINACEAE 2, 9, 10, 13, 15

Phacelia ramosissima Lehm. BORAGINACEAE 9

**Phalaris arundinacea* L. POACEAE 15

Philadelphus lewisii Pursh HYDRANGEACEAE 2, 3, 8, 9, 10, 13, 15

**Phleum pratense* L. POACEAE 8, 10

Phlox colubrina Wherry & Const. POLEMONIACEAE 3, 8, 10, 13, 15, 16

Phlox douglasii Hook. POLEMONIACEAE 2

Phlox gracilis (Hook.) E. Greene POLEMONIACEAE 2, 9, 10, 15

Phlox longifolia Nutt. POLEMONIACEAE 2, 7, 13, 15, 16

Phlox mollis Wherry POLEMONIACEAE 6, 10, 13

Phlox pulvinata Hook. POLEMONIACEAE 2, 7, 9, 10

Phlox speciosa Pursh POLEMONIACEAE 10, 15

Phlox viscida E. Nels. POLEMONIACEAE 2

Phoenicaulis cheiranthoides Nutt. BRASSICACEAE 4

**Physalis longifolia* Nutt. SOLANACEAE 3, 13, 15 (Perhaps native)

Physaria douglasii (S. Wats.) O’Kane & Al-Shehbaz BRASSICACEAE 13

Physaria occidentalis (S. Wats.) O’Kane & Al-Shehbaz? BRASSICACEAE 9

Physaria oregana S. Wats. BRASSICACEAE 2, 3, 7, 10, 13, 16

Physocarpus malvaceus (E. Greene) Kuntze ROSACEAE 8, 9, 10, 15

Pinus contorta Dougl. ex Laudon PINACEAE 10

Pinus ponderosa Dougl. ex Lawson & C. Lawson PINACEAE 4, 8, 10, 15

Piperia unalascensis (Spreng.) Rydb. ORCHIDACEAE 9

Plagiobothrys cognatus (E. Greene) I.M. Johnst. BORAGINACEAE 6

Plagiobothrys cusickii (E. Greene) I.M. Johnst. BORAGINACEAE 4

**Plantago lanceolata* L. PLANTAGINACEAE 15

Plantago patagonica Jacq. PLANTAGINACEAE 3, 10, 13, 15

Plectritis macrocera Torr. & A. Gray VALERIANACEAE 2, 3, 7, 10, 13

**Poa annua* L. POACEAE 15

**Poa bulbosa* L. POACEAE 2, 7, 8, 9, 10, 15

**Poa compressa* L. POACEAE 10, 13, 15

Poa cusckii Vasey POACEAE 3, 8, 9, 13

Poa glauca Vahl *ssp. rupicola* (Nash ex Rydb.) Weber POACEAE 9

Poa gracillima Vasey POACEAE 2, 8, 10, 13, 15

Poa incurva Scribn. & Will. POACEAE 9

Poa juncifolia Scribn. POACEAE 7, 10, 15, 16

**Poa palustris* L. POACEAE 15

**Poa pratensis* L. POACEAE 3, 8, 9, 10, 13, 15

Poa sandbergii Vasey POACEAE 2, 3, 9, 13, 15

Poa scabrella (Thurb.) Benth. POACEAE 2, 4, 7, 8, 9, 10, 13, 15, 16

Poa wheeleri Vasey POACEAE 9, 10

Polemonium micranthum Benth. POLEMONIACEAE 9, 10

Polygonum austiniae E. Greene *20405* POLYGONACEAE 13 Listed Threatened by the Washington Natural Heritage Program.

**Polygonum aviculare* L. POLYGONACEAE 15

Polygonum douglasii E. Greene POLYGONACEAE 4, 8, 15

Polygonum engelmanii E. Greene POLYGONACEAE 9, 13, 15

Polygonum majus (Meisn.) Piper POLYGONACEAE 13, 14, 15

**Polypogon monspeliensis* L. (Desf.) POACEAE 22

**Populus alba* L. SALICACEAE 15

Populus tremuloides Michx. SALICACEAE 9, 10

Populus trichocarpa Torr. & A. Gray ex Hook. SALICACEAE 8, 9, 10

Potentilla biennis E. Greene ROSACEAE 10

Potentilla gracilis Dougl. ex Hook. *var. fastigiata* (Nutt.) S. Wats. ROSACEAE 10, 13, 15

Potentilla gracilis var. flabelliformis (Lehm.) Nutt. ex Torr. & A. Gray ROSACEAE 15

**Potentilla recta* L. ROSACEAE 8, 10, 13, 15

Poteridium occidentale Rydb. ROSACEAE 4, 10, 15

**Poterium sanguisorba* L. ROSACEAE 10

Prunella vulgaris L. LAMIACEAE 4, 15

**Prunus armeniaca* L. ROSACEAE 15

Prunus emarginata (Dougl. ex Hook.) Dietr. ROSACEAE 8, 9, 15

**Prunus mahaleb* L. ROSACEAE 15

**Prunus persica* (L.) Batsch ROSACEAE 8, 15

Prunus virginiana L. ROSACEAE 2, 8, 9, 10, 13, 15

**Psathyrostachys juncea* (Fisch.) Nevski POACEAE 15, 25

Pseudoroegneria spicata (Pursh) Á. Löve POACEAE 2, 3, 4, 7, 8, 9, 10, 13, 15, 16

Pseudotsuga menziesii (Mirbel) Franco PINACEAE 4, 8, 9, 10, 15

Pteridium aquilinum (L.) Kuhn *var. pubescens* L. Underwood DENNSTAEDTIACEAE 15

Pteryxia terebinthina (Hook.) J.M. Coult. & Rose *var. foeniculacea* (Torr. & A. Gray) Math. APIACEAE 3, 7, 8, 9, 13

Purshia tridentata (Pursh) DC. ROSACEAE 2, 9

Pyrrocoma carthamoides Hook. *var. cusickii* (A. Gray) Kartesz & Gandhi ASTERACEAE 4, 15

Pyrrocoma radiata Nutt. ASTERACEAE 2, 7 Listed Endangered by the Oregon Biodiversity Information Center, federal Species of Concern.

Pyrrocoma scaberula E. Greene ASTERACEAE 13, 15, 16 Listed R2 (monitored, taxonomic questions) in Washington. Given the recent publications on this species supporting its segregation from *P. liatriformis*, the R2 status is to be removed, and Sensitive status is proposed.

Ranunculus glaberrimus Hook. RANUNCULACEAE 2, 4, 9, 10, 15

**Ranunculus repens* L. RANUNCULACEAE 15

Ranunculus scleratus L. RANUNCULACEAE 10

**Ranunculus testiculatus* Crantz RANUNCULACEAE 2, 7

Ranunculus uncinatus D. Don RANUNCULACEAE 15

Rhus glabra L. ANACARDIACEAE 8, 9, 10, 15

Ribes aureum Pursh GROSSULARIACEAE 2, 9, 15

Ribes cereum Dougl. *var. colubrinum* C.L. Hitchc. GROSSULARIACEAE 2, 8, 9, 10, 15 Listed “Group 4” by the Oregon Biodiversity Information Center.

Ribes cereum Dougl. *var. cereum* GROSSULARIACEAE 9

Ribes niveum Lindl. GROSSULARIACEAE 8, 10, 15

Ribes oxyacanthoides L. *ssp. cognatum* (E. Greene) Sinnott GROSSULARIACEAE 8, 15

Ribes velutinum E. Greene *var. gooddingii* (M.E. Peck) C.L. Hitchc. GROSSULARIACEAE 10

**Robinia pseudoacacia* L. FABACEAE 9, 15

**Rosa canina* L. ROSACEAE 10, 15

Rosa nutkana Presl *ssp. macdougalii* (Holz.) Piper ROSACEAE 2, 8, 9, 10, 15

Rosa woodsii Lindl. *ssp. ultramontana* (S. Wats.) Taylor & Macbr. ROSACEAE 13

**Rubus allegheniensis* T.C. Porter ROSACEAE 13, 15

Rubus bartonianus M.E. Peck ROSACEAE 8 Listed GP2 by the Idaho Natural Heritage Program.

**Rubus discolor* Weihe & Nees ROSACEAE 9, 10, 15

Rubus leucodermis Dougl. ex Torr. & A. Gray ROSACEAE 8, 9, 10, 15

Rubus nigerrimus (E. Greene) Rydb. *20440* ROSACEAE 15 Globally rare. Newly confirmed for Idaho. Most populations of this species do not have the carpel number or pubescence reported in descriptions, as in the Flora of the Pacific Northwest. All other characters appear to be consistent however. As with populations in Washington, the Idaho population has leaves green and glabrous to glabrate adaxially, and carpels scarcely fused and dry and scarcely fleshy at maturity. A globally rare species often treated as a variety or synonym of *R. leucodermis*. However, if a standard of taxonomic refinement used in eastern North America (one of the major centers of *Rubus* diversity) is adopted in western North America, then it seems best to maintain this taxon as a species.

Rubus parviflorus Nutt. ROSACEAE 8, 15

**Rumex cf. obtusifolius* L. POLYGONACEAE 10, 15

**Rumex crispus* L. POLYGONACEAE 9

Rumex venosus Pursh POLYGONACEAE 14

Salix exigua Nutt. SALICACEAE 2, 9, 20, 13, 15

Salix geyeriana Anderss.? SALICACEAE 9, 10

Salix lasiandra Benth. *ssp. caudata* (Nutt.) E. Murray SALICACEAE 15

Salix lasiandra Benth. *ssp. lasiandra* SALICACEAE 9, 10

Salix monochroma C.R. Ball SALICACEAE 15

Salix scouleriana J. Barratt ex Hook. SALICACEAE 4, 8, 9, 10, 13, 15

Salix sp. SALICACEAE 9 Leaves appressed tomentose abaxially, glabrous adaxially, oblanceolate, stipules tiny, fruits glabrous, bracts dark and persistent, styles not observable.

**Salsola tragus* L. AMARANTHACEAE 2, 7, 15

Sambucus caerulea Raf. ADOXACEAE 8, 9, 10, 15

**Saponaria officinalis* L. CARYOPHYLLACEAE 15

Saxifraga mertensiana Bong. SAXIFRAGACEAE 10

**Scleranthus annuus* L. CARYOPHYLLACEAE 15, 23

**Sclerochloa dura* (L.) P. Beauv. POACEAE 15

Scutellaria angustifolia Pursh LAMIACEAE 3, 9, 10, 13, 15, 16

Scutellaria antirrhinoides Benth. LAMIACEAE 10

**Secale cereale* L. POACEAE 15

Sedum borschii (R.T. Clausen) R.T. Clausen CRASSULARIACEAE 6 Previously reported for Oregon by Clausen, but since his monograph on North American *Sedum*, this species has commonly been confused with the dissimilar but related species *S. leibergii*. *Sedum borschii* has not been accepted in checklists of Oregon in recent decades. It should be reviewed for rarity status in the state.

Sedum lanceolatum Torr. *var. lanceolatum* CRASSULARIACEAE 4, 9

Sedum leibergii Britt. CRASSULARIACEAE 3, 8, 10, 13, 15

Sedum stenopetalum Pursh CRASSULARIACEAE 6, 8, 10, 15

Selaginella wallacei Hier. SELAGINELLACEAE 3, 4, 8, 10, 13, 14, 15

Senecio integerrimus Nutt. *var. exaltatus* (Nutt.) Cronq. ASTERACEAE 4, 8, 9, 10, 13, 15 (including an odd form from near Sugarloaf Mountain, Baker County, Oregon, which is unusually short, mat-forming, and with a denser inflorescence).

Senecio serra (Hook.) *var. serra* ASTERACEAE 10, 13, 15

Sidalcea oregana (Torr. & A. Gray) A. Gray *var. procera* C.L. Hitchc. MALVACEAE 15

Silene antirrhina L. CARYOPHYLLACEAE 8, 13, 15

Silene douglasii Hook. *var. douglasii* CARYOPHYLLACEAE 9, 10

**Silene latifolia* Poir. *ssp. alba* (P. Mill.) Greuter & Burdet CARYOPHYLLACEAE 10, 13, 15

Silene oregana S. Wats. CARYOPHYLLACEAE 8

Silene scouleri Hook. *ssp. nov. 20435* (provisionally designated as the type) CARYOPHYLLACEAE 13, 15, 16 Differs from other varieties of *S. scouleri* in having well developed stolons that result in a loosely mat-forming cluster of sterile shoots. Also, the leaves are broader than the inland varieties, being within the range of those of the coastal *var. scouleri*, though in that variety, the leaves are in more numerous pairs along the stem. Also differing from *var. scouleri* is the broadly elliptical to broadly clavate outline of the mature calyx, and fewer flowers per whorl and fewer flower whorls per inflorescence. From *var. hallii*, the only other variety to occur in northwest North America, the local populations further differ in having longer petals, much longer than the stamens and styles, while those of *var. hallii* are more or less equal in length to the stamens and styles. This taxon was known prior to this project, and was first noted to be atypical by Karen Gray, Idaho Department of Fish & Game. It appears to be endemic to the northern end of Hells Canyon, in southern Nez Perce County, Idaho, and southeastern Asotin County, Washington (and probably to northeastern Wallowa County, Oregon). The broad basal leaves are suggestive of the rosette leaves of *Silene spaldingii*. These two species often share habitat, growing in intermixed populations, potentially causing confusion as to the identity of early-season or vegetative individuals.

Silene spaldingii S. Wats. CARYOPHYLLACEAE 22 Federally listed Threatened. Listed GP3 by the Idaho Natural Heritage Program.

**Sisymbrium altissimum* L. BRASSICACEAE 2, 3, 4, 7, 8, 9, 10, 13, 15, 16

**Sisymbrium officinale* (L.) Scop. BRASSICACEAE 13, 15

Solidago gigantea Ait. ASTERACEAE 10, 13

Solidago lepida DC. ASTERACEAE 2, 3, 8, 10, 13, 15, 16

Solidago missouriensis Nutt. ASTERACEAE 3, 10, 13, 15, 16

**Sonchus oleraceus* L. ASTERACEAE 9

Spartina pectinata Link POACEAE 13, 15 Listed Sensitive by the Washington Natural Heritage Program. Not previously known from Idaho.

Sphaeralcea grossulariifolia (Hook. & Arn.) Rydb. MALVACEAE 2

Spiraea lucida Dougl. ROSACEAE 8, 9, 10

Sporobolus compositus (Poir.) Merr. POACEAE 3, 7, 13, 15, 16

Sporobolus cryptandrus (Torr.) A. Gray POACEAE 2, 13, 14, 15

Stanleya viridiflora Nutt. BRASSICACEAE 7

**Stellaria media* (L.) Vill. CARYOPHYLLACEAE 3, 8, 13

Stellaria nitens Nutt. CARYOPHYLLACEAE 15

Stenotus acaulis Nutt. ASTERACEAE 9

Stenotus lanuginosus A. Gray *var. lanuginosus* ASTERACEAE 10

Stephanomeria tenuifolia (Torr.) Hall ASTERACEAE 2, 3, 8, 9, 10, 16

**Strigosella africana* (L.) Botsch. BRASSICACEAE 7

Symphoricarpos albus (L.) S.F. Blake CAPRIFOLIACEAE 4, 8, 9, 10, 13, 15, 16

Symphoricarpos oreophilus A. Gray CAPRIFOLIACEAE 9, 10

Symphyotrichum laeve (L.) Á. Löve & D. Löve *var. geyeri* (A. Gray) Nesom ASTERACEAE 2

Symphyotrichum lanceolatum (Willd.) Nesom *var. hesperium* (A. Gray) Nesom ASTERACEAE 10, 15

Synthyris missourica (Raf.) Pennell PLANTAGINACEAE 10

Synthyris rubra (Dougl. ex Hook.) Benth. PLANTAGINACEAE 4, 10, 13, 15, 16

**Taeniatherum caput-medusae* (L.) Nevski POACEAE 9, 15

**Taraxacum erythrospermum* Andrz. ex Besser ASTERACEAE 15

**Taraxacum officinale* G.H. Weber ex Wiggers ASTERACEAE 8, 9, 10, 13, 15

Tetradymia canescens DC. ASTERACEAE 2, 7, 9

Thalictrum occidentale A. Gray RANUNCULACEAE 15

Thelypodium laciniatum (Hook.) Endl. *var. streptanthoides* (Leiberg) Payson BRASSICACEAE 10, 13, 15 Listed "Monitored" by the Idaho Natural Heritage Program. Not recognized in the recently published Brassicaceae treatment of the Flora of North America, but the subsuming of the varieties was not accompanied by any taxonomic notes, and the varieties were not studied in detail. The varieties appear to be consistent throughout their ranges.

Thermopsis montana Nutt. FABACEAE 10

**Thinopyrum intermedium* (Host) Barkw. & D. Dewey POACEAE 8, 10, 13, 15 (at least three forms)

**Thlaspi arvense* L. BRASSICACEAE 10, 15

Tonella floribunda A. Gray PLANTAGINACEAE 3, 8, 10, 13, 15

**Torilis arvensis* (Huds.) Link APIACEAE 13, 15

Townsendia florifera (Hook.) A. Gray ASTERACEAE 2

Toxicodendron rydbergii (Sm. ex Rydb.) E. Greene ANACARDIACEAE 2, 7, 8, 9, 10, 13, 15

Toxicoscordion venenosum (S. Wats.) Rydb. MELANTHIACEAE 4, 8, 10, 15

**Tragopogon dubius* Scop. ASTERACEAE 2, 3, 8, 9, 10, 13, 15, 16

**Tribulus terrestris* L. ZYGOPHYLLACEAE 22

**Trifolium aureum* Poll. FABACEAE 22

**Trifolium arvense* L. FABACEAE, 15, 13

**Trifolium dubium* Sibth. FABACEAE 13

Trifolium eriocephalum Nutt. *var. cusickii* (Piper) J.S. Martin FABACEAE 4, 6

**Trifolium hybridum* L. FABACEAE 10

Trifolium latifolium (Hook.) E. Greene FABACEAE 6, 10

Trifolium longipes Nutt. *var. longipes* FABACEAE 4

**Trifolium pratense* L. FABACEAE 15

**Trifolium repens* L. FABACEAE 10

Trillium petiolatum Pursh MELANTHIACEAE 4, 6

Triodanis perfoliata (L.) Nieuwl. CAMPANULACEAE 3, 15

Triteleia grandiflora Lindl. THEMIDACEAE 2, 3, 8, 9, 10, 13, 15

Turritis glabra L. BRASSICACEAE 13, 15

**Ulmus americana* L. ULMACEAE 9

Uropappus lindleyi (DC.) Nutt. ASTERACEAE 13, 22 Listed R1 (Review list) by the Washington Natural Heritage Program.

Urtica dioica L. URTICACEAE 8, 9, 10, 15

**Vaccaria hispanica* (Mill.) Rauschert CARYOPHYLLACEAE 7, 9, 15

**Valerianella locusta* Lat. VALERIANACEAE 10, 13, 16

**Ventenata dubia* (Leers) Coss. & Dur. POACEAE 15

**Verbascum blattaria* L. SCROPHULARIACEAE 3, 8, 10, 13, 15

**Verbascum thapsus* L. SCROPHULARIACEAE 3, 8, 9, 10, 13, 15

Veratrum californicum Durand *var. californicum* MELANTHIACEAE 10

Verbena bracteosa Lagasca & J.D. Rodriguez VERBENACEAE 8, 15

Veronica americana (Raf.) Benth. PLANTAGINACEAE 10, 13, 15

**Veronica arvensis* L. PLANTAGINACEAE 3, 10, 13, 15

Veronica peregrina L. *var. peregrina 20392* PLANTAGINACEAE 13 *Variety peregrina* is usually thought to be introduced in western North America. The population reported here may be native, naturally dispersed along the Snake River from its Western Hemisphere core range in central and eastern North America.

**Veronica persica* Poir. PLANTAGINACEAE 9, 10

**Veronica verna* L. PLANTAGINACEAE 8

Vicia americana Muhl. FABACEAE 8, 10, 13

**Vicia tetrasperma* (L.) Schreb. FABACEAE 15

**Vicia villosa* Roth FABACEAE 10, 15, 16

Viola adunca Nutt. *var. adunca* VIOLACEAE 4, 6, 10, 15

Viola adunca Nutt. *var. aspirata* ined. VIOLACEAE 6, 15

Viola canadensis L. VIOLACEAE 15

**Viola odorata* L. VIOLACEAE 15

Viola praemorsa Dougl. *var. flavovirens* (Pollard) Fabijan VIOLACEAE 15

Viola praemorsa Dougl. *var. linguifolia* (Torr. & A. Gray) M. Baker & J. Clausen VIOLACEAE 4, 6, 9

Viola purpurea Kellogg *var. venosa* (S. Wats.) M. Baker & J. Clausen VIOLACEAE 2, 9

Viola vallicola A. Nels. VIOLACEAE 10

**Vitis sp.* VITACEAE 15

Vulpia myuros (L.) Gmel. POACEAE 10, 13, 15

Vulpia octoflora (Walt.) Rydb. POACEAE 8, 10, 13

Woodsia oregana D.C. Eat. WOODSIACEAE 3, 4, 6, 8, 9, 10, 13, 15

Woodsia scopulina D.C. Eat. WOODSIACEAE 3, 8, 10, 15

Xanthium strumarium L. ASTERACEAE 15

Liverworts

Athalamia hyalina (Sommerf.) S. Hatt. CLEVEACEAE 15

Cephaloziella sp. CEPHALOZIELLACEAE 4

Marchantia polymorpha L. MARCHANTIACEAE 15

Porella cordeana (Huebener) Moore PORELLACEAE 8

Riccia beyrichiana Hampe ex Lehm. RICCIACEAE 4

Mosses

Anacolia menziesii (Turner) Paris BARTRAMIACEAE 8

Barbula cf. indica (Hook.) Spreng. POTTIACEAE 2, 8 If verified, would be new for Idaho and Oregon. However, the plants observed are smaller, more julaceous and more cespitose than typical *B. indica*.

Brachythecium holtzingeri (Grout) Grout BRACHYTHECIACEAE 13

Bryum angustirete Kindb. BRYACEAE 8, 10, 13

Bryum lanatum (P. Boiv.) Brid. BRYACEAE 23

Bryum sp. BRYACEAE 6 Leaves not rosulate, somewhat julaceous, cells rectangular in lower 1/3, transitioning upward to shorter and polygonal cells above, no limbidium, margins slightly recurved in the extreme edge, costa percurrent to shortly excurrent, leaves green with a reddish-purple blush in part, on basalt cliff.

Ceratodon purpureus (Hedw.) Brid. DITRICHACEAE 4, 8

Coscinodon calyptratus (Drumm.) C.E.O Jensen GRIMMIACEAE 9, 15

Crossidium seriatum Crum & Steere *21498* POTTIACEAE 15, 23 Verified by Terry McIntosh. New report for Idaho, where likely a rare species.

Crossidium squamiferum (Viviani) Juratz. *21240, 21276, 21415* POTTIACEAE 2, 7, 13 New report for Oregon. Informally reported previously for Washington in an herbarium newsletter, but no peer-reviewed paper citing specimens has reported the species for the state. Probably very rare in Washington, perhaps so in Oregon.

Crumia latifolia (Kindb.) Schofield *21470* POTTIACEAE 12

Dicranella schreberiana (Hedw.) Hilf. ex Crum & Anderson DICRANACEAE 8

Dicranum tauricum Sapehin DICRANACEAE 13

Didymodon norrisii Zander POTTIACEAE 2, 7, 12, 23 This species was recently published, and upon publication, it was known from only four sites. Despite a few newly discovered localities, it remains as a conservation-priority species. However, its discovery reported here from four new localities in Hells Canyon suggests that it may be much more common than currently thought. In the present study, it was found only on calcareous substrates, but it also occurs on siliceous substrates elsewhere.

Didymodon rigidulus Hedw. POTTIACEAE 8, 23 New report for Idaho, but probably very common there, as this species is abundant and widespread in sagebrush steppe in Oregon, Washington and British Columbia.

Distichum capillaceum (Hedw.) Bruch & Schimp. DISTICHACEAE 8

Ditrichum flexicaule (Schwaegr.) Hampe DITRICHACEAE 8

Encalypta mutica I. Hagen ENCALYPTACEAE 13 New report for Idaho, otherwise known in North America only in Canada and Alaska.

Encalypta rhabdocarpa Schwägr. ENCALYPTACEAE 13

Encalypta vulgaris Hedw. ENCALYPTACEAE 13

Eurynchium pulchellum (Hedw.) Jennings BRACHYTHECIACEAE 13

Funaria hygrometrica Hedw. FUNARIACEAE 15

Gemmabryum sp. 21419 BRYACEAE 13 Similar to *G. klinggraeffii* and *G. violaceum*, but plants blackish, medial leaf cells short-rectangular to isodiametric, tubers dark purple, with bulging cells.

Grimmia anodon Bruch & Schimp. GRIMMIACEAE 8

Grimmia crinitoleucophaea Card.? GRIMMIACEAE 23 If confirmed, would be a new report for Idaho.

Grimmia elatior Bruch ex Bals. & De Not. GRIMMIACEAE 9

Grimmia montana Bruch & Schimp. GRIMMIACEAE 6

Grimmia ovata (Hedw.) Lindb. GRIMMIACEAE 13, 15

Homalothecium aeneum (Mitten) E. Lawton BRACHYTHECIACEAE 8

Homalothecium nevadense (Lesq.) Ren. & Card. BRACHYTHECIACEAE 13

Hypnum pallescens (Hedw.) P. Beauv. HYPNACEAE 13

Hypnum vaucheri Lesq. HYPNACEAE 8, 9, 13

Orthotrichum cupulatum Hoffm. & Brid. ORTHOTRICHACEAE 8

Plagiomnium insigne (Mitten) T. Koponen MNIACEAE 13

Plagiomnium venustum (Mitten) T. Koponen MNIACEAE 8, 13

Polytrichum juniperinum Hedw. POLYTRICHACEAE 4, 13

Pseudoleskeela tectorum (Funck ex Brid.) Kindb. ex Broth. LESKEACEAE 9, 10

Rhytidiadelphus triquetrus (Hedw.) Warnst. HYLOCOMIACEAE 15

Schistidium atrichum (C. Müller Hal. & Kindb.) W.A. Weber GRIMMIACEAE 9, 23 Previously known from Idaho, but this species is rarely found throughout its range (T. McIntosh, pers. comm.).

Schistidium flaccidum (De Not.) Ochyra GRIMMIACEAE 2, 7, 23 New report for Oregon. Previously known from Idaho, where possibly a rare species.

Scleropodium touretii (Brid.) L. Koch *21358* BRACHYTHECIACEAE 8

Syntrichia ruralis (Hedw.) Weber & D. Mohr POTTIACEAE 4, 8, 13, 23

Timmia austriaca Hedw. TIMMIACEAE 13

Tortella tortuosa (Hedw.) Limpr. *var. fragilifolia* (Juratz.) Limpr. POTTIACEAE 10 New report for Idaho.

Tortella tortuosa (Hedw.) Limpr. *var. tortuosa* POTTIACEAE 8

Tortula brevipes (Lesq.) Broth. POTTIACEAE 23

Lichens

Acarospora elevata H. Magn. CRUST LICHEN, 8 Probably new for Idaho, but not likely to be a rare species.

Acarospora glaucocarpa (Ach.) Körb. CRUST LICHEN 13, 23

Acarospora rosulata (Th. Fr.) H. Magn. CRUST LICHEN 1, 2, 7, 15

Acarospora schleicheri (Ach.) A. Massal. CRUST LICHEN 1, 10, 15

Acarospora sp. nov. 21466 CRUST LICHEN 15 Areoles round and dispersed, complicatedly cracked (radially and concentrically), white, but with rhizocarpic acid, UV+ orange, cortex K-, C-, but medulla K-, C+ yellowish), apothecia minute, most areoles with more than one hymenium or pore, spores 4-4.5 x 2.5-2.8 microns, paraphyses <2 microns wide.

Agonimia tristicula (Nyl.) Zahlbr. CRUST LICHEN 8, 10

Anaptychia elbursiana (Szatala) Poelt FOLIOSE LICHEN 2, 7 Seldom reported, but probably not rare in Oregon.

Anaptychia ulotrichoides (Vain.) Vain. FOLIOSE LICHEN 8 Perhaps rare in Idaho.

Anema decipiens (A. Massal.) Forssell GEL LICHEN 8 New report for North America.

Anema nummularium (Dufour) Nyl. *21338* GEL LICHEN 5, 8, 10 New report for North America.

Anema tumidulum Henssen ined. GEL LICHEN 23 New report for North America.

Aspicilia "*artemisiicola*" ined. CRUST LICHEN 7 A common and widespread species in dry regions of Idaho, Oregon and Washington, especially on bark of *Artemisia*, but also on *Amelanchier, Celtis, Eriogonum* and *Juniperus*. Thallus sublobate, the lobes with disintegrating margins that yield soredia.

Aspicilia calcarea (L.) Körb. CRUST LICHEN 2, 7, 8, 13, 23

Aspicilia contorta (Hoffm.) Körb. CRUST LICHEN 7

Aspicilia sp. unknown CRUST LICHEN 10 Sublobate-areolate, the areoles almost bullate, white.

Aspicilia sp. unknown CRUST LICHEN 10 White, on clods of calcareous soil, one of the "smothering" species, almost without areoles.

Aspicilia sp. unknown CRUST LICHEN 8 Slightly lobate, on rock, sorsidiate along margins of areoles & lobes.

Aspicilia sp. unknown CRUST LICHEN 13 White, cortex K+ slow bright yellow, paraphyses not moniliform, spores 8, areoles polygonal and clustered.

Bacidia bagliettoana (A. Massal. & De Not.) Jatta *21356* CRUST LICHEN 8 New report for Idaho.

Bacidina sp. nov.? *21405* CRUST LICHEN 15 Upper hymenium dark aeruginose, pigmentation in paraphysis walls, outer excipular hyphae of rounded cells in numerous layers, hypothecium pale brown, spores about 25 x 2 microns, vermiform, pycnidia stalked with a dense waxy white conidial l mass, conidia 8-13 x 1.3-1.5 microns, pycnidial wall dark green.

Bryoria fremontii (Tuck.) Brodo & D. Hawksw. FRUTICOSE LICHEN 4, 13

Buellia elegans Poelt *21505, 20509* CRUST LICHEN 23 New report for Idaho. Possibly rare in the state. Perhaps globally imperiled, but more likely to be more widespread than currently known (especially in calcareous portions of the Rocky Mountains and Great Plains, and in central Asia).

Buellia epigaea (Hoffm.) Tuck. *21403, 20510* CRUST LICHEN 23 Previously known in Idaho, but possibly rare.

Buellia terricola A. Nordin *21262* CRUST LICHEN 6 Previously reported from a single site in Oregon (McCune & Rosentreter 2007).

Buellia venusta (Körb.) Lettau *21275* CRUST LICHEN 7 Perhaps rare in Oregon.

Calicium viride Pers. PIN LICHEN 4

Caloplaca atroalba (Tuck.) Zahlbr. *21420* CRUST LICHEN 13 Previously mentioned for Washington in an unpublished checklist (Ryan 1988).

Caloplaca atrosanguinea (G. Merr.) I.M. Lamb CRUST LICHEN 15

Caloplaca biatorina (Trevis.) J. Steiner CRUST LICHEN 1, 2, 3,8, 15 New report for Idaho and Oregon.

Caloplaca cerina (Ehrh. ex Hedw.) Th. Fr. CRUST LICHEN 13

Caloplaca citrina (Hoffm.) Th. Fr. CRUST LICHEN 9

Caloplaca crenulatella (Nyl.) H. Olivier CRUST LICHEN 2, 7 Likely a new report for Oregon.

Caloplaca decipiens (Arnold) Blomb. & Forssell *21274, 21350* CRUST LICHEN 7, 8 New report for Oregon?

Caloplaca flavorubescens (Huds.) J.R. Laundon CRUST LICHEN 7

Caloplaca jungermanniae (Vahl) Th. Fr. CRUST LICHEN 4

Caloplaca pyracea (Ach.) Th. Fr. CRUST LICHEN 7

Caloplaca saxicola (Hoffm.) Nordin CRUST LICHEN 9

Caloplaca subsoluta (Nyl.) Zahlbr. *21325, 21329, 21371, 21462* CRUST LICHEN 8, 10 New report for Idaho.

Caloplaca tominii Savicz CRUST LICHEN 2, 23

Candelaria concolor (Dicks.) Arnold FOLIOSE LICHEN 3, 15

Candelariella antennaria Räsänen CRUST LICHEN 2, 7, 8

Candelariella aurella (Hoffm.) Zahlbr. CRUST LICHEN 9, 15

Candelariella efflorescens R.C. Harris & W.R. Buck CRUST LICHEN 15 New report for Idaho.

Candelariella rosulans (Müll. Arg.) Zahlbr. CRUST LICHEN 2, 8

Candelariella spraguei (Tuck.) Zahlbr. *21476* CRUST LICHEN 23 New report for northwestern North America.

Candelariella vitellina (Ehrh.) Müll. Arg. CRUST LICHEN 13

Catapyrenium sp. nov.? *21296* MESOLICHEN 8 Attached directly to limestone rock faces, squamules dense and somewhat imbricate, forming rather large, cracked mounds; cells of upper cortex 5-7.5 microns long, the cortex distinct but with gradation into algal medulla, the barrier intruded by algae; medulla formed of round-blocky to rectangular cells; perithecial wall medium brown above; squamule cross section shows cortex dark all around the margins; the lower surface sits on a weft of pale, crystal-coated rhizohyphae; paraphyses partly disintegrating by the time of spore maturity; asci clavate; spores 11-12 x 8-10.5.

Cladonia cariosa (Ach.) Spreng. FRUTICOSE LICHEN 5

Cladonia chlorophaea (Flörke ex Sommerf.) Spreng. FRUTICOSE LICHEN 3, 13

Cladonia macrophyllodes Nyl. FRUTICOSE LICHEN 3, 4, 10

Cladonia pocillum (Ach.) O.J. Rich FRUTICOSE LICHEN 8, 10, 15

Collema coccophorum Tuck. *21391* GEL LICHEN 10 Previously reported from Idaho in an unpublished study without specimen citation.

Collema crispum (Huds.) Weber ex F.H. Wigg. *21469* GEL LICHEN 8, 12, 15 New report for Idaho.

Collema cristatum (L.) Weber ex F.H. Wigg. *var. marginale* (Huds.) Degel. *21492* GEL LICHEN 8, 10, 13, 15, 23 New report for Idaho.

Collema furfuraceum Du Rietz GEL LICHEN 3

Collema polycarpon Hoffm. GEL LICHEN 10 Previously reported from Idaho in an unpublished study without specimen citation.

Collema tenax (Sw.) Ach. *var. diffractoareolatum* (Schaer.) Degel. *21242* GEL LICHEN 2 First report for the U.S.

Collema tenax (Sw.) Ach. *var. tenax* sensu lato GEL LICHEN 8, 10, 13, 15, 23

Collema undulatum Laurer ex Flot. GEL LICHEN 8, 10

Cyphelium inquinans (Sm.) Trevis. CRUST LICHEN 4

Dermatocarpon intestiniforme (Körb.) Hasse FOLIOSE LICHEN 15 New report for Idaho.

Dermatocarpon reticulatum H. Magn. FOLIOSE LICHEN 13, 15

Diploschistes muscorum (Scop.) S. Sant. CRUST LICHEN 4, 10, 15

Endocarpon adsurgens Vain. *21503* MESOLICHEN 23 New report for Idaho.

Endocarpon loscosii Müll. Arg. *21499* MESOLICHEN 23 New report for Idaho.

Endocarpon pallidum (Nyl.) Nyl. MESOLICHEN 2 Apparently a new report for Oregon.

Endocarpon pulvinatum Th. Fr. MESOLICHEN 3 New report for Idaho, though there is also an unpublished record from Kootenai County. Possibly also new to the flora of Oregon.

Endocarpon pusillum Hedw. MESOLICHEN 10, 15

Endocarpon sp. nov. 21501 MESOLICHEN 23 Upper surface grayish white, with a thick upper cortex that cracks into pyramidal segments, with a thin brown-pigmented cortical layer below that, and another clear layer below that then the algal medulla; perithecial wall dark brown throughout, the uppermost portions with pale-walled, much narrower cells that fan out and merge into the cortical cells on one side and the periphyses on the other; spores pale, 30-38 x 18-22 microns; hymenial algae subspherical, 5.5-7 x 5-6 microns, mostly solitary or with a daughter bud; medulla of large rounded cells with periodic vertical strands 1-2 hyphae wide; lower surface not clearly seen; a single squamule present.

Fulgensia bracteata (Hoffm.) Räsänen *21494* MESOLICHEN 15, 23 New report for Idaho, though reported in a non-peer reviewed, unpublished study, without specimen citation.

Fulgensia desertorum (Tomin) Poelt *21401, 21506* MESOLICHEN 23 Previously reported from Idaho, but not in a peer-reviewed publication, and without specimen citation.

Fulgensia subbracteata (Nyl.) Poelt *21511* MESOLICHEN 15, 23 New report for Idaho.

Fuscopannaria mediterranea (Tav.) P.M. Jørg. MESOLICHEN 8

Fuscopannaria praetermissa (Nyl.) P.M. Jørg. group MESOLICHEN 6

Glypholecia scabra (Pers.) Müll. Arg. *21246* FOLIOSE LICHEN 2, 7 A globally rare species, not previously known from Oregon. nearest known populations represented by an unpublished report from Lemhi County, and in central British Columbia. New genus for Oregon.

Heppia lutosa (Ach.) Nyl. *21251* GEL LICHEN 4 Probably a rare species in Oregon, apparently not previously known from the state, in which case it would probably be a new genus for the state.

Hypocenomyce scalaris (Ach. ex Lilj.) M. Choisy MESOLICHEN 4

Hypogymnia imshaugii Krog FOLIOSE LICHEN 4, 9, 13

Hypogymnia physodes (L.) Nyl. FOLIOSE LICHEN 4

Kaernefeltia merrillii (Tuck.) A. Thell & Goward FRUTICOSE LICHEN 4

Lecania albariella (Nyl.) Müll. Arg. *21468* CRUST LICHEN 15 New report for North America.

Lecania turicensis (Hepp) Müll. Arg. *21282* CRUST LICHEN 7 New report for Oregon.

Lecanora carpinea (L.) Vain. CRUST LICHEN 6

Lecanora chlarotera Nyl. sensu lato CRUST LICHEN 4, 8, 13

Lecanora densa (Śliwa & Wetmore) Printzen CRUST LICHEN 4

Lecanora dispersa (Pers.) Röhl. CRUST LICHEN 7, 9, 10 Apparently not previously reported for Idaho, but not likely a rare species.

Lecanora flowersiana H. Magn. *21493* CRUST LICHEN 9, 23 Apparently not previously reported from Oregon. Not likely rare.

Lecanora hagenii (Ach.) Ach. CRUST LICHEN 6

Lecanora "idahoa" ined. *21367* CRUST LICHEN 8 An undescribed species that is very common in the southern interior Wetbelt region. Similar to *L. confusa*.

Lecanora muralis (Schreb.) Rabenh. CRUST LICHEN 10, 13, 23

Lecanora pulicaris (Pers.) Ach. CRUST LICHEN 4, 15

Lecanora schizochromatica Pérez-Ortega & T. Sprib. CRUST LICHEN 4, 13, 15

Lecanora subrugosa Nyl. CRUST LICHEN 15

Lecanora xanthostoma Wedd. ex Cl. Roux *21278* CRUST LICHEN 7, 8 New report for Idaho and Oregon.

Lecidea atrobrunnea (DC.) Schaer. CRUST LICHEN 13, 15

Lecidea berengeriana (A. Massal.) Nyl. *21270* CRUST LICHEN 5 Often place, erroneously, in *Mycobilimbia*, with which it shares nothing except a commonly muscicolous habit.

Lecidea sp. CRUST LICHEN 15 Large apothecia, Porpidia-like, expansive thalli; an unknown, but common and widespread species.

Lecidea sp. 21288 CRUST LICHEN 8 Thallus inconspicuous but surficial, C-, K-, KC-, I-, apothecia with a thick persistent rim, hypothecium dark purplish brown, exciple dark brownish purple, upper hymenium dark brownish gray, spores about 13x8 microns, appearing roughened over the surface, but possibly just due to immature stage; not a very good specimen, cannot be resolved without better collections.

Lecidella euphorea (Flörke) Hertel CRUST LICHEN 4, 6

Lecidella sp. CRUST LICHEN 9 On limestone, thallus areolate to squamulose, bright white, waxy, K- cortex, K+ yellow medulla, C- throughout; apothecia with thick but not very prominent, persistent rim; upper hymenium brownish purple dark, hypothecium pale brownish, exciple interior brownish purple; spores about 15.5 x 10.5 microns.

Lempholemma cladodes (Tuck.) Zahlbr. GEL LICHEN 8 New report for Idaho. Likely rare.

Lempholemma polyanthes (Bernh.) Malme *21362* GEL LICHEN 8 New report for Idaho.

Lempholemma sp. GEL LICHEN 8 Fruticose from early in development (i.e., lacking a squamulose developmental stage), branches terete or somewhat irregular, sulcate and with a stretched look when dry, with second- and third-order branching, dark (not blackish) brown, on limestone; differs from *L. degelianum* in being completely fruticose, lacking a squamulose early developmental stage, and in occurring on dry rock faces rather than in seasonally wet depressions.

Lepraria membranacea (Weiss) A.L. Sm. CRUST LICHEN 10, 13

Lepraria vouauxii (Hue) R.C. Harris CRUST LICHEN 10 New record for Idaho, but probably not rare.

Leprocaulon subalbicans (I.M. Lamb) I.M. Lamb & A.M. Ward MESOLICHEN 3

Leptochidium albociliatum (Desm.) M. Choisy GEL LICHEN 3, 8

Leptogium gelatinosum (With.) J.R. Laundon GEL LICHEN 3, 8, 10, 15

Leptogium lichenoides (L.) Zahlbr. GEL LICHEN 3, 4, 8, 10, 15, 23

Leptogium palmatum (Huds.) Mont. GEL LICHEN 3

Leptogium plicatile (Ach.) Leight. GEL LICHEN 8, 10 New report for Idaho.

Leptogium pulvinatum (Hoffm.) Otálora *21373* GEL LICHEN 8, 10 New report for North America, but not at all rare. Widely confused with *Leptogium lichenoides*.

Leptogium schraderi (Bernh.) Nyl. *21489* GEL LICHEN 10 New report for Idaho.

Leptogium subaridum P.M. Jørg. & Goward GEL LICHEN 6, 8, 10

Leptogium turgidum (Ach.) Cromb. *21372, 21386, 21396* GEL LICHEN 8, 10 New report for Idaho.

Leptogium sp. nov.? GEL LICHEN 8 On limestone; plicatile group, tiny thalli of almost granular units, scarcely lobed, apothecia subglobose ("fisheye" type), perhaps just depauperate *L. plicatile*, but the fish-eye apothecia are not normal for that species.

Letharia columbiana (Nutt.) J.W. Thompson FRUTICOSE LICHEN 4, 9, 10, 15

Letharia vulpina (L.) Hue FRUTICOSE LICHEN 4, 9, 10, 15

Lichinaceae unknown genus *21483* GEL LICHEN 23 Growing over moss on limestone; thallus of black, glossy, imbricate, vermiform lobules in mounds, globose pycnidia present, with filiform, curved to sigmoid conidia about 25 x 1 microns; photobiont chroococcales with colorless, K- sheaths and small, mostly solitary cells; thallus interior formed of netted short to long hyphae, no central strand seen; descriptions of the Lichinaceae don't allow for filiform conidia, only oblong-elliptic to bacilliform.

Lichinodium sirosiphoideum Nyl. GEL LICHEN 3 Apparently a new record for Oregon, possibly a new genus for the state.

Lobothallia alphoplaca (Wahlenb.) Hafellner MESOLICHEN 13, 15

Lobothallia praeradiosa (Nyl.) Hafellner MESOLICHEN 15

Massalongia microphylliza (Nyl. ex Hasse) Henssen MESOLICHEN 10 New record for Idaho.

Megaspora verrucosa (Ach.) Hafellner & V. Wirth CRUST LICHEN 8, 13

Melanelixia subargentifera (Nyl.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch FOLIOSE LICHEN 3

Melanelixia subaurifera (Nyl.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch FOLIOSE LICHEN 12, 14

Melanohalea exasperatula (Nyl.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch FOLIOSE LICHEN 3, 4, 10

Melanohalea subolivacea (Nyl.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch FOLIOSE LICHEN 8

Myxobilimbia lobulata (Sommerf.) Hafellner *21384, 21413* CRUST LICHEN 13 New genus for Idaho, though an unpublished report exists. The verity of that report needs to be checked. Often classified as a *Mycobilimbia*, to which genus this species has nothing in common other than an often muscicolous habit.

Neofuscelia verruculifera (Nyl.) Essl. FOLIOSE LICHEN 3, 8, 13

Ochrolechia szatalaensis Verseghy *21514* CRUST LICHEN 14 Odd form, with a thickly bullate thallus with a somewhat zonate margin. Resembles *O. africana*, but has the spot test reactions of *O. szatalaensis*.

Ochrolechia upsaliensis (L.) A. Massal. CRUST LICHEN 15

Parmelia barrenoae Divakar, M.C. Molina & A. Crespo FOLIOSE LICHEN 3 New report for WA and the northwest interior.

Parmelia saxatilis (L.) Ach. FOLIOSE LICHEN 8

Parmelia sulcata Taylor FOLIOSE LICHEN 4, 9, 15

Parmeliopsis ambigua (Wulf.) Nyl. FOLIOSE LICHEN 9

Parmeliopsis hyperopta (Ach.) Vain. FOLIOSE LICHEN 9

Peltigera canina (L.) Willd. FOLIOSE LICHEN 8

Peltigera kristinssonii Vitik. FOLIOSE LICHEN 13

Peltigera malacea (Ach.) Funck FOLIOSE LICHEN 3, 4, 8, 9

Peltigera ponojensis Gyeln. FOLIOSE LICHEN 4

Peltigera praetextata (Flörke ex Sommerf.) Vain. FOLIOSE LICHEN 8, 13

Peltula cf. bolanderi (Tuck.) Wetmore *21225* MESOLICHEN 3 Generally assumed to be *P. euploca*, and often growing intermixed with it. However, unmixed populations of this and typical *P. euploca* occur in northwest North America, and in the mixed populations, the two morphologies retain their distinctions. *Peltula bolanderi* is very similar in being blackish-brown, smaller, and complicatedly undulate, differing only in that it is consistently no larger than about half the size of the species reported here. They may however be conspecific.

Peltula euploca (Ach.) Poelt ex Ozenda & Clauzade *21222, 21423* MESOLICHEN 3, 13 Listed in Oregon, but newly discovered populations are easily found in southwest, south-central, north-central and eastern portions of the state. Should be delisted in favor of listing rarer, currently unlisted species with identifiable threats.

Phaeophyscia ciliata (Hoffm.) Moberg FOLIOSE LICHEN 6 Possibly a new report for Oregon, but probably not rare.

Phaeophyscia constipata (Norrl. & Nyl.) Moberg FOLIOSE LICHEN 8, 10, 13 Not previously reported for Idaho, but not rare in the state, particularly in the canyons of the west-central counties.

Phaeophyscia decolor (Kashiw.) Essl. FOLIOSE LICHEN 3

Phaeophyscia nigricans (Flörke) Moberg FOLIOSE LICHEN 7, 8

Phaeophyscia sciastra (Ach.) Moberg FOLIOSE LICHEN 8 No published records exist for Idaho, but it is unlikely to be a rare species in the state.

Physcia adscendens (Fr.) H. Olivier FOLIOSE LICHEN 3, 12

Physcia alnophila (Vain.) Loht., Moberg, Myllys & Tehler FOLIOSE LICHEN 15

Physcia caesia (Hoffm.) Hampe ex Fürnr. FOLIOSE LICHEN 3

Physcia dimidiata (Arnold) Nyl. FOLIOSE LICHEN 2, 9

Physcia phaea (Tuck.) J.W. Thomson FOLIOSE LICHEN 3, 8, 15

Physcia stellaris (L.) Nyl. FOLIOSE LICHEN 6

Physcia tribacia (Ach.) Nyl. (large form) FOLIOSE LICHEN 8 New report for Idaho, though the population reported here may not be typical *P. tribacia*.

Physciella chloantha (Ach.) Essl. FOLIOSE LICHEN 2

Physciella melanchra (Hue) Essl. FOLIOSE LICHEN 12

Physconia enteroxantha (Nyl.) Poelt FOLIOSE LICHEN 3, 6, 8

Physconia muscigena (Ach.) Poelt FOLIOSE LICHEN 3, 8, 10, 15

Physconia perisidiosa (Erichsen) Moberg FOLIOSE LICHEN 8, 15 No published reports exist for Idaho, but this is a common species in the state.

Placynthium nigrum (Huds.) Gray MESOLICHEN 8, 10

Placynthium sp. 21287, 21404, 21495 MESOLICHEN 2, 7, 15, 23 Apparently equals *P. pulvinatum* Øvst. ined. (as described in Jørgensen (2007)). No North American species known so far could account for the populations encountered, which are terricolous on calcareous soil. They lack a prothallus, have vermiform lobes that remain strongly convex to the tips, and form thick pulvinate mounds piled up as much as 10 mm thick and several centimeters across. Thus far, *Placynthium pulvinatum* ined. is known only from arctic and subarctic regions.

Placynthium subradiatum (Nyl.) Arnold *21307* MESOLICHEN 8 New report for Idaho.

Pleopsidium flavum Körb. CRUST LICHEN 2, 15 New report for Idaho, but a very common species in the state.

Polychidium muscicola (Sw.) Gray GEL LICHEN 3

Polysporina simplex (Taylor) Vězda CRUST LICHEN 2, 7, 8, 9

Psilolechia lucida (Ach.) M. Choisy CRUST LICHEN 8 New report for Idaho, probably not rare.

Psora decipiens (Hedw.) Hoffm. MESOLICHEN 10, 15, 23

Psora globifera (Ach.) A. Massal. MESOLICHEN 2, 13

Psora himalayana (C. Bab.) Timdal MESOLICHEN 7

Psora montana Timdal MESOLICHEN 15

Psora nipponica (Zahlbr.) Gotth. Schneid. MESOLICHEN 13

Psora tuckermanii R.A. Anderson MESOLICHEN 10, 15

Psorotichia columnaris Henssen & Büdel GEL LICHEN 8 Not previously reported from North America north of Mexico. Thought to be a globally rare species otherwise known only from Baja California and the Canary Islands (Schultz 2007), but it may be widely overlooked owing to its small size.

Ramalina farinacea (L.) Ach. FRUTICOSE LICHEN 13

Rhizocarpon cookeanum H. Magn. CRUST LICHEN 2 Apparently a new record for Oregon, but probably very common in the northeastern Counties.

Rhizocarpon lecanorinum Anders CRUST LICHEN 6 Apparently a new record for Oregon, but likely a common and widespread species.

Rhizocarpon cf. postumum (Nyl.) Arnold CRUST LICHEN 13 Spores larger than reported for *R. postumum*; also differs in the positioning of the apothecia directly on the prothallus between the areoles.

Rhizocarpon viridiatrum (Wulfen) Körb. *21273* CRUST LICHEN 7 Parasitic on *Aspicilia*. Apparently a new record for Oregon.

Rhizoplaca chrysoleuca (Sm.) Zopf FOLIOSE LICHEN 10

Rhizoplaca melanophthalma (DC.) Leuckert FOLIOSE LICHEN 2, 7

Rhizoplaca peltata (Ramond) Leuckert & Poelt FOLIOSE LICHEN 7, 10, 13, 15, 23

Rinodina badiexcipula Sheard *21264, 21268* CRUST LICHEN 6 Not previously known from non-coastal regions. Otherwise known only from the California Floristic Province.

Rinodina bischoffii (Hepp) A. Massal. CRUST LICHEN 8, 10, 13 New report for Idaho, but probably common.

Rinodina castanomelodes H. Mayrhofer & Poelt CRUST LICHEN 2 New report for Oregon.

Rinodina luridata Körb.) H. Mayrhofer, Scheid. & Sheard *21345* CRUST LICHEN 8 New report for Idaho.

Rinodina terrestris Tomin CRUST LICHEN 13

Rinodina sp. CRUST LICHEN 7 (Sub *Rhizocarpon viridiatrum*) Thallus creamy tan, slightly lobed, about 8 mm wide, apothecia adnate-rimmed but somewhat projecting; spores bischoffii-type, about 14 x 8 microns, thallus K-, KC-; thallus similar to the terricolous species *Phaeorrhiza nimbosa*, but saxicolous, and with spores bischoffii-type and smaller; vaguely similar to *Dimelaena oreina*, but with small, convex, very short lobes, a non-radiating thallus, and a different spore type.

Sarcogyne regularis Körb. *21461* CRUST LICHEN 8, 10, 13 Previously known from Idaho only in an unpublished report. Probably not rare. However, the specimen collected is not *S. regularis* sensu stricto, but is instead either *var. decipiens* or *var. intermedia*.

Staurothele clopimoides (Bagl. & Carestia) J. Steiner CRUST LICHEN 13 New report for Washington.

Staurothele drummondii (Tuck.) Tuck. CRUST LICHEN 2, 8, 9, 10

Staurothele elenkinii Oxner CRUST LICHEN 7 Apparently a new report for Oregon.

Synalissa ramulosa (Bernh.) Körb. *21347* GEL LICHEN 7, 8, 10, 13 New report for the northwestern U.S., though already known from both north and south of the region. Confusion remains over whether *S. symphorea* is the correct name for this species

Thallinocarpon nigritellum (Lettau) P.M. Jørg. GEL LICHEN 8, 10, 13 New genus for Idaho, though unpublished records exist.

Thyrea confusa Henssen *21318, 21482* GEL LICHEN 8, 13 New genus for Idaho.

Toninia candida (Weber) Th. Fr. MESOLICHEN 10, 13 New record for Idaho and Washington, though unpublished records exist.

Toninia sedifolia (Scop.) Timdal MESOLICHEN 8, 10, 13, 15, 23 New report for Washington, but given the abundance of this common and widespread species in all regions surrounding Washington, it's not likely rare there.

Toninia tristis (Th. Fr.) Th. Fr. MESOLICHEN 10, 13 (unknown subspecies)

Toninia tristis (Th. Fr.) Th. Fr. *ssp. scholanderi* (Lynge) Timdal MESOLICHEN 23 New report for Idaho.

Tuckermanopsis chlorophylla (Willd.) Hale FOLIOSE LICHEN 9

Tuckermanopsis platyphylla (Tuck. ex Riddle) Hale FOLIOSE LICHEN 4, 15

Umbilicaria hyperborea (Ach.) Hoffm. FOLIOSE LICHEN 15

Umbilicaria krascheninnikovii (Savicz) Zahlbr. FOLIOSE LICHEN 15

Umbilicaria phaea Tuck. *var. phaea* FOLIOSE LICHEN 3, 8, 15

Usnea lapponica Vain. FRUTICOSE LICHEN 4, 15

Verrucaria cinereorufa E.A. Schaer. *21393* CRUST LICHEN 10 New report for North America.

Verrucaria compacta (A. Massal.) Jatta *21297* CRUST LICHEN 8, 9 New report for North America.

Verrucaria geophila Nyl. *21402* CRUST LICHEN 15 New report for North America. No terricolous *Verrucaria* species have been known for the northwestern U.S. previously.

Verrucaria hydrela Ach. CRUST LICHEN 8 New report for Idaho, but not rare.

Verrucaria mimicrans Servít CRUST LICHEN 8 New report for Idaho.

Verrucaria nigrescens Pers. CRUST LICHEN 13

Verrucaria sp. 1 CRUST LICHEN 10 Conical shaped perithecia with 2-4 short grooves radiating from the ostiole, perithecial wall glossy, spores about 32 x 12 microns, thallus immersed, inconspicuous, on limestone.

Verrucaria sp. 2 CRUST LICHEN 13 Immersed crust, perithecia sessile, with thalline cover to near top, involucrellum complete below exciple, spores about 30 x 13 microns, on limestone.

Verrucaria sp. 3 CRUST LICHEN 23 Thin crust in calc soil, exciple dark brown/opaque, no involucrellum apparent, perithecial chamber a bit deeper than the substrate, in warts, spores 18-22 x 12-14 microns, colorless. Terricolous *Verrucaria* have not been previously reported from northwestern North America.

Vulpicida canadensis (Räsänen) J.-E. Mattsson & M.J. Lai FOLIOSE LICHEN 4, 15

Xanthomendoza borealis (R. Sant. & Poelt) Søchting, Kärnefelt &S.Y. Kondr. *21229* FOLIOSE LICHEN 2 Requires verification by Louise Lindblom, who monographed *Xanthoria* sensu lato of North America (Lindblom 1997). The collection compares well with specimens examined at CANL (Ottawa), annotated by Lindblom. In the specimen, the lobes are revolute as in *X. borealis* and *X. mendozae*. Unlike the latter of these two species, the lobes have a deeper orange, waxy, non-pruinose upper surface, waxy (moderately glossy), pale lower surface, and large, subcorticate, firm soredia. These characters match *X. borealis*, which is also distinguished from *X. mendozae* by having immersed pycnidia appearing as reddish spots on the lobes. Unfortunately, the collection lacks pycnidia. The habitat is that of *X. borealis*, not *X. mendozae,* occurring on a rain-splash exposed surface of a rock pinnacle used frequently by perching birds (*X. borealis* is a guano-dependent species). By contrast, the common and widespread *X. mendozae* occurs mostly on underhangs of cliffs where sheltered from rain-spalsh, and is not a guano-dependent species. *Xanthomendoza borealis* was reported for Oregon when the species was first described (Poelt & Petutschnig 1992), but the Oregon reports turned out to be the earlier described *X. mendozae*, a species that was apparently unknown to Poelt and Petutschnig (Lindblom 1997). *Xanthomendoza galericulata* is also similar, but has more hood-shaped soralia, thinner lobes, and occurs on wood and bark. In North America, *Xanthomendoza borealis* has hitherto been known only from arctic and northern boreal localities from few, widely scattered sites in Alaska, the Northwest Territories and Nunavut.

Xanthomendoza fallax Søchting, Kärnefelt &S.Y. Kondr. FOLIOSE LICHEN 3, 12, 15

Xanthomendoza fulva (Hoffm.) Søchting, Kärnefelt &S.Y. Kondr. FOLIOSE LICHEN 14, 15

Xanthomendoza mendozae (Räsänen) S.Y. Kondr. & Kärnefelt FOLIOSE LICHEN 8, 12 No published records exist of this species from Idaho, but it is common and widespread in the state.

Xanthoparmelia coloradoensis (Gyeln.) Hale group FOLIOSE LICHEN 3, 8, 13, 15

Xanthoparmelia plittii (Gyeln.) Hale FOLIOSE LICHEN 3, 8, 15

Xanthoria elegans (Link) Th. Fr. FOLIOSE LICHEN 8, 15

Xanthoria polycarpa (Hoffm.) Rieber FOLIOSE LICHEN 13

Xanthoria sorediata (Vain.) Poelt FOLIOSE LICHEN 15