# Inventory of Rare Plants and Noxious Weeds Along the Snake River Corridor in Hells Canyon—Weiser, Idaho, to the Salmon River

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## Abstract

Idaho Power Company (IPCo) is currently in the process of relicensing three hydroelectric dams (Brownlee, Oxbow, and Hells Canyon) with the Federal Energy Regulatory Commission. As part of the relicensing application, IPCo is required to provide a description of the natural resources of the project area and its vicinity, including downstream reaches affected by the project. In order to address rare plants and noxious weeds, IPCo has commissioned a study of these resources within the project vicinity. The study has been completed, and the results are the subject of this report.

For the purposes of this study, ‘noxious weeds’ were defined as those on either Idaho or Oregon’s state noxious weed lists. In addition, four invasive riparian species were also considered. In consultation with the various affected agencies, IPCo developed a list of rare plant species to be targeted by this investigation. These were typically riparian species which were of special concern to the agencies involved, and which were known, or suspected, to occur in the Hells Canyon study corridor.

The study area took in both shores of the Snake River and Reservoir complex, from the confluence of the Salmon River upstream to Weiser, Idaho (a distance of approximately 262 river kilometers). The lateral extent of the study area was 50 meters from the mean high water mark. A subsampling scheme was used for this study which surveys one quarter-mile segment in every shoreline mile, for a total of 405 survey units (approximately 25% of the total corridor).

Field crews conducted surveys in the area from August 4 through September 28, 1998, and from April 19 through June 3, 1999. Data on habitat preferences, disturbance factors, distribution, phenology, and other parameters were collected for each weed and rare plant population found.

A total of 1,905 populations of weed species of concern were recorded for the project. Of the 405 total units surveyed, 397 (or 98%) contained at least one weed population. The unimpounded reach below Hells Canyon Dam had the lowest average number of different weed species per unit (2.4 species/unit), while the Oxbow Reservoir reach had the highest (8.4 species/unit). *Onopordum acanthium* (Scotch thistle) was found in the most units (226), followed by *Amorpha fruticosa* (false indigo) (195 units), *Cynoglossum officinale* (common houndstounge) (156 units), and *Hypericum perforatum* (St. John’s wort) (145 units). *Taeniatherum caput-medusae* (medusahead wildrye) populations covered the greatest net area within the units surveyed, averaging 300 square meters per unit.

Forty-seven previously unreported populations of six rare plant species of concern were located during the investigation: *Cyperus schweinitzii* (Schweinitz flatsedge) – 21 sites; *Carex hystricina* (porcupine sedge) – 10 sites; *Bolandra oregana* (Oregon bolandra) – 8 sites; *Leptodactylon pungens* ssp. *hazeliae* (Hazel’s prickly phlox) – 6 sites; *Mimulus patulus* (stalk-leaved monkey flower) – 1 site; and *Teucrium canadense* var. *occidentale* (American wood sage) – 1 site. No rare plant populations were found on the two southernmost reaches (Brownlee Reservoir and Weiser reaches).

# PART 1: INTRODUCTION

## 1.1 OVERVIEW

### 1.1.1 Project Description

Idaho Power Company (IPCo) is in the process of conducting studies in support of its application to relicense Brownlee, Oxbow, and Hells Canyon Dams with the Federal Energy Regulatory Commission (FERC). These projects are collectively referred to as the Hells Canyon Complex (FERC Project Number 1971). The dams are located on the Snake River along the Idaho-Oregon border. FERC requires the relicensing documents to include a description of the natural resources of the project and its vicinity, including downstream areas affected by the dams. As part of IPCo's fulfillment of this requirement, the company has commissioned an investigation of rare plants and noxious weeds in the project vicinity. This study has been completed, and the results are the subject of this Technical Report.

The noxious weed portion of this investigation was designed to provide descriptive as well as predictive data on a variety of plant species considered to be noxious weeds by the States of Idaho and Oregon. In addition, several species known to be invasive riparian associates were considered during the course of this study. Data were collected for a number of descriptive parameters aimed at characterizing the distribution, habitat requirements, and phenology of noxious weed species within the project area. In addition, information was recorded to allow for the determination of the likely factors that influence the growth and spread of these species.

The rare plant portion of this investigation was designed to provide similar descriptive data on a selected group of riparian plant species listed as, or considered potential candidates for listing as, endangered, threatened, or sensitive by one or more agencies of the Federal Government, the State of Idaho, and/or the State of Oregon. Data were collected, at the population level, for a number of descriptive parameters aimed at characterizing the distribution, habitat requirements, and phenology of rare plant species within the project area.

### 1.1.2 Study Area

For the purposes of this investigation, the study area consists of approximately 262 river kilometers (km) along both shores of the Snake River, from the confluence of the Salmon River to Weiser, Idaho (Figure 1 on page 69). In addition, approximately 14 river km of the Powder River arm of Brownlee Reservoir are also included as part of the study area. To facilitate discussion and analysis, the study area has been broken into five reaches: an unimpounded reach above the existing reservoir complex (Weiser reach), three reservoir reaches (Brownlee, Oxbow, and Hells Canyon Reservoir reaches), and an unimpounded downstream reach (Hells Canyon Downstream reach). The Weiser reach extends approximately 19 km, from river mile (RM) 351.2 to 339.2. The Brownlee Reservoir reach extends approximately 90 km, from RM 339.2 to 283.7 (including the segment along the Powder River arm of the reservoir). The Oxbow

Reservoir reach extends approximately 23 km, from RM 283.7 to 269.5. The Hells Canyon Reservoir reach extends approximately 35 km, from RM 269.5 to 247.5. The Hells Canyon Downstream reach extends approximately 95 km, from RM 247.5 to the confluence of the Salmon River at RM 188.2. In most cases, the surveyed area extended laterally approximately 50 meters (m) beyond the Mean High Water Mark (MHWM). However, for 63 units surveyed during the 1998 field season, the lateral extent was 50 m beyond the current shoreline. In addition, the entire flow zone (defined as the exposed area below the MHWM), and any zone of emergent vegetation, were also included in the lateral extent of the study area.

### 1.1.3 Environmental Setting

The topography of the project area is generally rugged, as the Snake River winds northward through progressively deeper canyon country. Steep, incised slopes with abundant rock outcrops make up the majority of the study area along the Hells Canyon Downstream reach and the three reservoir reaches. In contrast, the Weiser reach is flat and relatively cobble-free as the river leaves the northwestern tip of the Snake River Plain.

Elevations in the study area range from approximately 268 m above mean sea level at the confluence with the Salmon River to approximately 640 m at Weiser, Idaho. Most of the elevation gain takes place in the northern half of the study area.

The region is complex geologically, as the Snake River cuts through the boundary between several exotic terranes and the ancient North American continent. In the four northernmost reaches of the study area, Cenezoic Columbia River flood basalts cap numerous formations of Mesozoic and late Paleozoic igneous and sedimentary rocks. In addition, metamorphism of the older rocks has added to the area’s geologic diversity (Vallier 1998). Soils in these four reaches tend to be shallow and rocky. At the south end of the study area, the Weiser reach is dominated by semi-consolidated Cenezoic sediments, which have produced deep sandy loam and silt loam soils (Rasmussen 1976).

Two weather reporting stations are located in the project vicinity, representing the climate at roughly the middle and southern end of the study area. The Brownlee Dam station is located slightly south of the middle of the study area, and reports an average annual maximum temperature of 19° Celsius (C), and an average minimum of 7°C. The average total annual precipitation is 46 centimeters (cm), and the average total annual snowfall is also 46 cm (WRCC 1998*a*). The Weiser 2 SE Station is located at the southern end of the study area. The station reports an average annual maximum temperature of 18°C, and an average minimum of 2°C. Average total annual precipitation is 28 cm, and the average total annual snowfall is 48 cm (WRCC 1998*b*).

Natural upland vegetation in the study area is typified by bunchgrass and shrub-steppe communities. Common associates include *Agropyron spicatum* (bluebunch wheatgrass), *Hordeum jubatum* (foxtail barley), *Achillea millefolium* (common yarrow), *Artemisia ludoviciana* (prairie sage), *Celtis reticulata* (hackberry), and *Purshia tridentata* (bitter-brush). In many places, these communities have been degraded by intensive livestock grazing (as well as other disturbance factors) to the point where relatively few native species remain. The disturbed communities are in an early seral condition, dominated by non-native annual grasses such as *Bromus* spp. (brome), *Poa bulbosa* (bulbous bluegrass), and *Taeniatherum caput-medusae* (medusahead wildrye). Introduced forbs such as *Verbascum* spp. (mullein), *Sisymbrium altissimum* (Jim Hill mustard), and *Dipsacus sylvestris* (teasel) are also common associates in disturbed areas.

Vegetative communities adjacent to the Snake River and the reservoirs are diverse. In many places the upland vegetation grows directly along the shoreline. However, various riparian assemblages do occur, although most form a relatively narrow band between the river and the dry upland habitats. Common riparian associates include native species such as *Rosa woodsii* (Wood's rose) and *Salix* spp. (willow), as well as non-natives such as *Amorpha fruticosa* (false indigo), *Phalaris arundinacea* (reed canarygrass), *Elaeagnus angustifolia* (Russian olive), *Ulmus* spp. (elm), and *Fraxinus* spp. (ash).

### 1.1.4 Subsampling Scheme

Because of the large size of the project area, a subsampling scheme was employed to select a representative proportion of the project area for survey. Shoreline miles were delineated on both sides of the river using the IPCo Geographic Information System (GIS). For the study, the miles were numbered beginning with Shoreline Mile (SM) 10 at the confluence of the Salmon River. Each shoreline mile was numbered consecutively upstream to the other end of the study area at Weiser, Idaho, ending with SM 194 on the East (or Idaho) side of the river, and SM 214 on the West (or Oregon) side. The 20 mile difference in the two shoreline lengths was primarily due to the inclusion of the Powder River Arm on the Oregon side of Brownlee Reservoir.

Each shoreline mile was broken into four, quarter-mile segments and numbered from one to four. For example, the third quarter-mile segment in SM 119 on the Oregon side of Brownlee Reservoir is designated as Unit 119-3W. Units on the Idaho side of the river are designated with an 'E' (*e.g.* Unit 119-3E). One segment from each shoreline mile was then randomly selected as a unit for field survey, (a total of 390 quarter-mile survey units).

In addition, a number of islands are present in the study area, primarily at the upper end of the Brownlee Reservoir reach and throughout the Weiser reach. Quarter-mile survey units were randomly selected for all islands longer than 400 m. Starting at the downstream end of each island, quarter-mile segments were delineated around the perimeter, and numbered consecutively in a counterclockwise direction. Segments were then randomly chosen for survey, selecting approximately one quarter-mile segment for every mile. Each island longer than 400 m was assigned at least one survey unit. Islands are referred to by the codes IPCo uses for other vegetation sampling studies in the area. For example, there are two islands in the Darrows Island complex. The first is referred to as DARA and the second is referred to as DARB. Because the second quarter-mile segment was randomly selected for survey on the first Darrows Island, the survey unit was designated as DARA-02.

There are a total of 15 island survey units within the project area: one within the Hells Canyon Reservoir reach, four at the upper end of the Brownlee Reservoir reach, and the remaining nine within the Weiser reach. These 15 island units, and the 390 shoreline survey units, combine for a total of 405 survey units within the study area (approximately 25% of the corridor area). The total number of survey units within each reach is as follows: Hells Canyon Downstream reach - 126 units; Hells Canyon Reservoir reach - 54 units; Oxbow Reservoir reach - 26 units; Brownlee Reservoir reach - 166 units; and Weiser reach - 33 units.

# PART 2: NOXIOUS WEEDS

## 2.1 METHODS

### 2.1.1 Prefield Review

In consultation with agency personnel, IPCo developed a list of species which were to be considered during the study. For the purposes of this investigation, 'noxious weeds' were defined as those species contained on either Idaho or Oregon's state noxious weed lists (Oregon Department of Agriculture 1996, State of Idaho 1996). In addition, four invasive riparian species were added to the final list for consideration during this study, although they are not deemed 'noxious weeds' by either Idaho or Oregon. These are: *Amorpha fruticosa* (false indigo), *Elaeagnus angustifolia* (Russian-olive), *Phalaris arundinacea* (reed canarygrass), and *Tamarix* spp. (tamarisk). From this list of 101 species, 41 were known, or highly suspected, to occur in the study area. These 41 species were the focus of this study, although data were collected on any of the 101 noxious weed species when they were found in the field. Table 1 (on page 47) gives a complete listing of those species considered to be noxious weeds for the purposes of this investigation. Although some of these species are considered to be noxious weeds in only Oregon, or only Idaho, data were collected for all populations of these species encountered in either State.

Prior to the field surveys, a review of available literature and other sources was conducted to gain information on the noxious weed species potentially located within the project area. Taxonomic keys (Hitchcock *et al.* 1955-1969, Hitchcock and Cronquist 1973, Hickman 1993), reports from previous studies in the area (Burton 1993*a*,*b*), species guides (Whitson *et al.* 1992), and plant lists (US Forest Service 1994, Eagle Cap Consulting Inc. 1998) were collected and reviewed to provide distribution, identification, and habitat information regarding the species of concern.

### 2.1.2 Field Investigation

Field surveys of the project area were conducted over two field seasons. Starting August 4, 1998, crews began surveying Oxbow Reservoir and lower Brownlee Reservoir, moving down to Hells Canyon Reservoir by the later half of August. Two raft trips took place August 31 through September 14 to survey sections of the Hells Canyon Downstream reach. Also during September, crews inventoried sections on upper Brownlee Reservoir and the Weiser reach. Of the total 405 units within the study area, 266 (65.7%) were surveyed for noxious weeds during the 1998 field season. The remaining 139 units (34.3% of the total) were surveyed from April 19 through June 3, 1999. Crews completed work on the Brownlee Reservoir and Weiser reaches during this time. In addition, two raft trips were conducted between May 3 and May 23 to complete the survey of units on the Downstream reach.

Units were accessed either by foot or by boat. Where foot access was used, the surveyor (or surveyors) began by walking the length of the unit, making either written or mental notes on the location of any noxious weed species present. Special care was taken to search all high probability weed habitats thoroughly (*e.g.* roadsides, flow zones, trails). If noxious weeds were found, the surveyor(s) then returned to each population to fill out a Noxious Plant Observation Form (Figure 2 on page 70). For the units that were accessed by boat, the procedure was similar, differing only in the initial search phase. The surveyors began by making one pass in the boat, cruising slowly along the shoreline of the unit. As they moved along, they visually searched the unit (with binoculars in most instances), noting any noxious weeds or high probability weed habitat. Then, if necessary, the boat was beached so that the habitat could be surveyed by foot and any noxious weed populations located could be recorded.

### 2.1.3 Data Collection

The Noxious Plant Observation Form (Figure 2 on page 70) was used for all field data collection. A description of the data collected and the methods used in obtaining these data are presented below.

**Common Name, Scientific Name, Species Code:** The authority used for most species names was *Flora of the Pacific Northwest* (Hitchcock and Cronquist 1973). Updated taxonomy was also referenced in *The Jepson Manual* (Hickman 1993). Species codes were based on IPCo's species code book dated March 6, 1998.

**Site Mapped:** This box was checked when mapping of the unit was complete. Each population was mapped in the field with a sketch map drawn on the back of the data sheet. In the evening, populations were also mapped onto copies of US Geological Service (USGS) 7.5" Quadrangle maps. Where populations extended out of the unit (either up the slope or at either end), arrows were drawn on the sketch map to indicate continuance.

**Tentative Site Number:** Each site was numbered with an 11 character code (*e.g.* RKM04089802). The first three characters are the initials of the botanist recording the population. The next six digits are the date of collection (DDMMYY). The final two digits are the consecutive population number for that recorder on that day of the year.

**Recorder(s):** The initials of each botanist collecting data for the population, with the recorder's initials first.

**Date, Time:** Date format was (DDMMYY), and the time was recorded in military time to the nearest 15 minute interval.

**Photo and Roll Number:** One color slide photograph was taken at a representative location for each population. Each photograph was identified by a seven character code (*e.g.* RKM01-03). The first three characters are the initials of the surveyor taking the photograph. The following four-number sequence corresponds to the consecutive roll and individual photo numbers, respectively, taken by that surveyor.

**Quad Name:** USGS 7.5" quadrangle map name.

**Slope:** The slope at each site was measured using a clinometer or was estimated visually.

**GPS File, UTM Coords, Elev.:** For each site, a Global Positioning System (GPS) point was recorded at the approximate center of the population using Trimble® GeoExplorer GPS tracking units. On a periodic basis this information was downloaded to a portable computer, and the files were differentially corrected using base data obtained from either the McCall, Idaho base station, or the Burns, Oregon base station. After correction, the UTM coordinates and elevation above mean sea level (derived from the GPS unit) were entered in these fields. In certain instances, the data were not correctable. In these cases the uncorrected UTM coordinates were recorded. In situations where the GeoExplorer units were unable to track sufficient satellites, Garmin® 12XL GPS units were used to record uncorrected data. Occasionally, when GPS data were missing for a population, the UTM coordinates were derived from the USGS quad sheets. In all cases where UTM data were not differentially corrected, an appropriate note was recorded in the **Comment** field explaining the source of the UTM coordinates.

**Asp:** The general aspect of the population was recorded at each site. Where the aspect changes throughout a population, the dominant aspect was recorded.

**Max El, Min El, Max Dist, Min Dist:** The minimum and maximum elevations and distances from the MHWM for the population were recorded at each site. The MHWM was located by visually inspecting the top of the flow zone for evidence of previous (or current) water presence (*e.g.* marks on cliffs, abrupt vegetation changes, etc.). The elevations were recorded in 15 cm height classes (*i.e.* Class 1 = 0 to 15 cm, Class 2 = 16 to 30 cm, Class 3 = 31 to 45 cm etc., or Class -1 = -1 cm to -5 cm, Class -2 = -16 cm to -30 cm, etc.). Height above (or below) MHWM was determined using a sight level and a pole graduated in 15 cm height classes. In some cases visual estimation was used to determine elevation. Where elevation was above 20 height classes (3 m) or below -20 height classes, the number 99 (or -99) was recorded in the appropriate field. The minimum and maximum horizontal distances were determined using a hip chain or pacing for populations located on low slope ground, and visually estimated for high slope units. Where lateral distance was greater than 50 m either above or below the MHWM, the number 99 or -99 was recorded in the appropriate field.

**Distance from MHWM to Current WSE:** The approximate vertical distance from the MHWM to the current Water Surface Elevation was recorded for all populations. The elevation was measured using a graduated pole and a sight level. In instances where the water level was extremely low the elevation was estimated visually.

**Location:** The location of the site was described in general terms to a level that would allow a person looking at a map of the area to find the general vicinity of the site (*e.g.,* “Approximately ½ mile upstream from the mouth of Pine Creek on the Oregon side of the river”).

**Habitat:** A short description of the habitat was recorded (*e.g.*, “Dry, rocky slope”). This field was intended to give a general description of the habitat type. More specific habitat variables were recorded in other fields.

**Physiography:** The general physiography of the site was recorded. A 'wash' was considered to be a shallow ravine or creek with abundant alluvial deposits. A 'drainage' was considered to be a steep ravine or creek with few alluvial deposits.

**Moisture:** The moisture level of the soil at the time of survey was estimated for each population. Visual inspection of the soil's characteristics and the associated plant community was used to classify the site into one of five categories: Inundated, Saturated, Moist, Dry-Mesic, and Dry-Xeric.

**Disturbance Type:** A subjective assessment of each of the disturbance types influencing each site was recorded. The disturbance types assessed were: Alluvial (disturbance from sediment erosion and/or deposition resulting from sources other than the Snake River or its reservoirs); Flow zone (flooding disturbance in the zone between low and high water levels along the Snake River and reservoirs); Livestock (trampling or grazing by livestock); Mining (mining structures or activity); Fire (evidence or implication of past fire); Road Corridor (presence of road); Recreation (camping, boating, fishing, etc.); Trail (human foot traffic trail); Industrial (buildings, structures, commercial facilities); Residential (dwellings and associated buildings); Off-Road Vehicle (ORV) Use (all-terrain vehicles, motorcycles, 4x4's, etc.); Undisturbed; and Other (railroad tracks, slumping of soil, flood, etc.). Disturbance levels were recorded based on the following designations: 1 = None (no disturbance evident); 2 = Slight (some light disturbance on parts of the site); 3 = Moderate (a fair amount of disturbance over the majority of the site); 4 = Heavy (a substantial amount of disturbance over most of the site); and 5 = Extreme (an excessive amount of disturbance over nearly all of the site).

It is important to note that ratings were based on implied, as well as observed, disturbance levels. For example, although direct evidence of disturbance from fire was lacking in many populations, a rating of 2 (slight) or higher was often assigned based on the assumption that fires had periodically disturbed the site in the past, and would do so again in the future. This assumption was made based on general fire frequency patterns in the area, and the site's susceptibility to fire (*e.g.*, amount of vegetation, proximity to natural fire breaks, proximity to ignition sources). Similarly, recreational activities were considered to be a disturbing factor for many populations along the shoreline of the heavily used reservoirs, even though direct evidence of recreational disturbance may not have been currently visible within a particular population.

**Surface Substrate:** General surface substrate percentages were recorded based on visual estimation using the following categories: fine sediment, coarse w/fines, coarse w/o fines, and bedrock.

**Total # of individuals in pop., What was counted?:** The total number of plants in the population (within the boundaries of the unit) was either estimated or counted. The appropriate box 'Genets' or 'Ramets' was checked. Species such as *Phalaris arundinacea* (reed canarygrass) were usually counted by clumps, and the 'Genets' box was checked.

**Phenology, Pop. age class:** Appropriate percentages were recorded to describe the distribution of age and phenology of the population.

**Gross pop. area, Net pop. area:** The gross population area is the entire extent of the population, within the unit, including interstitial spaces not occupied by individuals. The net population area is the summed canopy coverages of the individual plants in the population (not including the interstitial spaces). Populations were defined at the point where no more individuals of the species occurred for a distance of 100 m.

**Vigor:** A subjective assessment of the vigor of the entire population was recorded using the following categories: excellent, good, fair, and poor. The rating was based on the professional judgement of the recorder, and included such factors as individual plant health, size of the population, and size of the individual plants.

**Percent Cover, Cover Type, Plant Association:** The percent cover for each life form category was recorded, including bare soil and rock. The cover type was recorded, by number, based on IPCo's vegetation classification codes. The plant association was derived based on the dominant species in the vicinity.

**Noxious Plant Dominance Rating:** The Noxious Plant Dominance Rating was recorded based on the following designations: 0 = Historically reported, no longer present; 1 = can be found by searching in and around other species (not obvious); 2 = can be seen only by moving through the site or by searching for it while standing in one place (a patch pattern observed while moving through the site rates a '2'); 3 = easily seen by standing in one place and glancing around but not an obvious dominant (in a mixed stand, several species may fall within this category); 4 = at least a co-dominant (shares dominance relative to cover or slightly subordinate); 5 = dominates the site (provides essentially total cover when viewed casually).

It should be noted that because this rating system relies partially on the observability of the individual plants, populations of the smaller, less visible species may be rated lower on this scale than those of the larger, more prominent species. For this reason, caution should be exercised when comparing noxious plant dominance ratings between species.

**Apparent trend of population:** A subjective assessment of the trend of the population was recorded (declining, stable, increasing, unknown). Because there was no evidence of trend at most sites, and these were primarily first-time visits, the trend was usually recorded as 'unknown'.

**Abundant Species, Common Species, Rare Species:** Associated species were recorded for the site.

**Comments:** Any additional relevant information was recorded in this section of the form. This includes information on other disturbance types associated with the population.

### 2.1.4 Statistical Analyses

Two types of statistical analyses were conducted to determine whether weed species found during the survey were associated with particular types and levels of disturbance, with particular reaches, or with relation to the MHWM (*i.e.*, above or below the MHWM). First, logistic regressions were used to determine whether the presence or absence of a weed species was associated with the presence of a disturbance type, a reach, and/or the MHWM. Multiple logistic regression identifies the effect of change in each predictor variable on the probability of an event (presence or absence of a weed species, in this case) while holding the other predictors constant. Therefore, disturbance factors identified as significant have a significant effect across all reaches and all elevational categories. Second, to determine whether population size was affected by disturbance, proximity, or reach, ANCOVAs (General Linear Models) were conducted for each species on a reduced data set that included only sites at which the species of interest was located.

Several variable codings were common to both types of analyses. First, elevation was regarded as a categorical variable. Elevation class 7 (~1 m above MHWM) was chosen as an arbitrary reference line above which flow zone influence is minimal, and below which the effects of proximity to the water are likely to be felt. Each population was coded as "below the reference line" (maximum elevation < elevation class 7), "above the reference line" (minimum elevation > elevation class 7) or "crosses the reference line" (minimum elevation<elevation class 7, and maximum elevation > elevation class 7). Second, a particular disturbance type was regarded as "present" when it was recorded as moderate, heavy, or extreme, and "absent" when it was recorded as slight or none. All disturbance types that occurred at sites in which the species of interest was found were included in the analysis for that species when sample sizes were large enough (see below).

The large number of predictor variables (disturbance types), and the relatively few populations recorded for certain species created two limitations to these analyses. First, only main effects were tested in both types of tests, and not interactions between predictors. Second, as a rule of thumb, a sample size of seven positive observations per predictor variable is needed to obtain statistically robust results when conducting logistic regressions. Some species, therefore, had too few occurrences to conduct a logistic regression including all disturbance types. In these cases, if sample sizes were large enough (n => 17), and the distribution of predictors was sufficiently diverse, a reduced analysis, including only flow zone disturbance, reach, and elevational category was conducted (since these are the primary variables of interest).

Two logistic regressions were conducted. The first examined the effect of the occurrence of disturbance factors, in addition to proximity and reach, on the presence of the weed. A second logistic regression was then conducted to determine whether the level of disturbance (*i.e.*, none, slight, moderate, heavy, or extreme) was associated with the presence of the weed species. Because these tests involved multiple analyses with the same data set, a Bonferroni correction was used. Because the Bonferroni correction is a conservative correction, an alpha-level of 0.10 was used. For 20 tests at this alpha-level, p-values less than or equal to 0.005 were regarded as significant.

Next, using only the data from those sites where a particular species was found, multiple regressions were conducted to determine whether the size of a weed population varied with the presence or absence of disturbance types, reach, and/or proximity to the water, as well as with levels of disturbance. Net area was used as the most reliable estimate of population size. Net area was log transformed in order to fit the assumption of normal distribution of the residuals. No Bonferroni correction was needed for these analyses because data for each species were independent of those of the other species. For these size tests, p-values less than 0.05 were regarded as significant.

Before these analyses were conducted, two “quality-control” analyses were performed. First, highly correlated variables (correlation coefficient >0.90) are not statistically distinguishable, and one should be removed from the analysis. Therefore, predictor variables (all disturbance types and elevation) were tested for autocorrelation. Second, a chi-square analysis was conducted to determine if the distribution of disturbance types was similar across all reaches. If a disturbance type is concentrated in one or two reaches, the effect of "reach" might overshadow the effect of the disturbance, or vice versa.

Statistical analyses were conducted on a total of 1,911 records, which included 6 records for population extensions which were discovered during the second field season. All analyses were conducted using the software package Statview ® 5.0.

In addition to the above statistical analyses, a comparison of disturbance type frequencies was made for each of the species that had too few populations to allow for a full regression analysis. For each of these species, the distribution of disturbance types was compared to the average distribution of disturbance types for all species recorded. Where a particular disturbance was present in a species’ populations at more than twice the average for all species, this fact is noted in the text. It is important to remember, however, that although a higher than average distribution of a particular disturbance may indicate a positive association between that species and the disturbance, the apparent association may be due to chance. This is particularly true for those species with only a few recorded populations.

## 2.2 RESULTS AND DISCUSSION

### 2.2.1 General Considerations

It should be noted that no botanical field survey methodology suitable for large study areas can guarantee that 100% of the target populations will be found. In the case of this project, it is likely that undiscovered weed populations exist in some of the units surveyed, even though the units were thoroughly searched. This is more likely to be the case with the less visible species (such as *Taeniatherum caput-medusae*), than with the larger, more visible species (such as *Onopordum acanthium* [Scotch thistle]).

Certain elements of the data collection protocol require the investigator to make subjective judgements about various factors. The disturbance type ratings, the noxious plant dominance rating, the vigor assessment, and the assessment of the apparent trend of the population are all subject to considerable individual interpretation. The investigators met on a regular basis during the field season to discuss these issues in an attempt to standardize data collection for the project. While this minimizes investigator bias, some differences in interpretation inevitably remain.

When interpreting the results of the logistic regressions, it is important to remember that no data were collected at sites lacking weed species. The analysis therefore assesses the difference between the distribution of disturbances at sites where a particular weed species was found, and the distribution of disturbances at sites where all other weed species were found (rather than disturbances at sites where no weeds were found). If, for example, all weeds tend to be found in areas of road disturbance, this association will not be detected because areas without road disturbance would not tend to be sampled. Similarly, if most weed species are strongly associated with fire disturbance, a species that is moderately associated with fire will appear to lack this association in this comparison, but might not in comparison with sites where no weeds were found. A lack of association between a weed species and a particular disturbance type may therefore only mean that other weed species are more strongly associated with that disturbance, or that nearly all weed species are associated with that disturbance. Fortunately, in sampling such a wide variety of weed species, a large range of habitats was also sampled, providing an important measure of control, thereby strengthening the statistical results.

### 2.2.2 Prefield Review Results

Only one weed study specific to the project area was found. This was a five-day undesirable plant survey conducted by the Wallowa-Whitman National Forest in 1993 along the Snake River from Hells Canyon Dam downstream to Cache Creek (Burton 1993*a*,*b*). Although this inventory covered all of the Hells Canyon Downstream reach (and more), it was limited in intensity and in the amount of data collected. The surveyors used a jet boat, searching the shore and upland areas visually. Pedestrian surveys also occurred, primarily at recreation and camping sites. Data collection was limited to general distribution information mapped on Forest Service topographic maps. Although this Forest Service study alone does not provide sufficient detail for IPCo's relicensing requirements, general distribution data were helpful in planning and executing the IPCo noxious weed surveys along the Hells Canyon Downstream reach.

Other sources investigated during the prefield review were helpful in resolving taxonomic questions regarding the species of concern. Additional taxonomic keys and species guides were particularly helpful in developing the surveyors' search images for those species of concern not addressed by the primary taxonomic authority, *Flora of the Pacific Northwest* (Hitchcock and Cronquist 1973).

### 2.2.3 Field Investigation Results

In total, 1,905 separate weed populations were recorded in the 405 units surveyed. Table 2 (on page 50) shows the total number of populations recorded for each weed species. Of the 405 surveyed units, 397 (or 98%) contained at least one population. Although the average number of populations per unit was 4.8 (standard deviation [abbreviated as *s*] =3.3), some units had as many as 16 populations. The average number of weed species per unit was 4.4 (*s*=2.9), ranging from 0 to 14. Table 3 (starting on page 52) lists the weed species of concern found within the project area, and the number of units in which they occur.

Breaking the study area into reaches, the Hells Canyon Downstream reach had an average of 2.4 different weed species present per unit (range 0-8; *s*=1.5); the Hells Canyon Reservoir reach had an average of 5.7 per unit (range 0-13; *s*=3.5); the Oxbow Reservoir reach had the highest average, with 8.4 weed species per unit (range 2-14; *s*=2.6); the Brownlee Reservoir reach had an average of 4.4 species per unit (range 0-11; *s*=2.2); and the Weiser reach had an average of 6.7 species per unit (range 2-12; *s*=2.4).

The data also allow for an analysis of weed prevalence based on canopy coverage. Table 4 (beginning on page 54) ranks the study area weeds by their total net population areas. Net population area, rather than gross population area, was chosen for this analysis because it gives a truer estimate of the area actually covered by a particular species. *Taeniatherum caput-medusae* (medusahead wildrye) had the greatest average net area within the units surveyed (300 $m^2$), followed by *Lepidium latifolium* (broadleaved pepperweed) at 200 $m^2$.

Appendix 1 provides lists (grouped by reach) of all plant species observed during the surveys. Appendix 2 contains all 1,905 Noxious Plant Observation Forms, under separate cover in five volumes. Appendix 3 contains USGS topographic quadrangle maps, under separate cover, showing the locations of all weed populations found.

### 2.2.4 Correlation of Predictors

All disturbance factors are significantly correlated with at least one other disturbance factor (Appendix 4). In particular, alluvial, flow zone, and recreation disturbance are all highly correlated with each other. In fact, flow zone disturbance is significantly correlated with all disturbance types except mining, other, and industry. However, many of these correlations are negative; disturbance from livestock, fire, roads, trails, and agriculture increase as flow zone disturbance decreases. In spite of this high degree of correlation, all disturbance types were used in the analysis, as the largest correlation coefficient was 0.409, making all predictors statistically separable.

This distribution of disturbance categories across reaches is highly significantly skewed ($\chi^2$ = 1162.759, df = 36, $p < 0.0001$). Agricultural disturbance is limited to the Brownlee, Downstream, and Weiser reaches, and is almost entirely concentrated in the Weiser reach (Appendix 5). Undescribed disturbance (‘other’) was concentrated on the Brownlee Reservoir reach. A substantial lack of road disturbance was present on the Downstream reach and Brownlee Reservoir, compared to expected frequencies. Because of this considerable skew, some care should be taken when interpreting significant associations with these reaches. An association with the Weiser reach, for instance, may indicate an association with agricultural disturbance that cannot be detected because there is virtually none on other reaches.

### 2.2.5 Statistical Findings Summary

Three species (*Amorpha fruticosa*, *Lepidium latifolium*, and *Phalaris arundinacea*) were significantly and positively associated with flow zone disturbance (Table 5 on page 56). Conversely, three others (*Cirsium vulgare*, *Cynoglossum officinale*, and *Taeniatherum caput-medusae*) were significantly and negatively associated with flow zone disturbance. Livestock disturbance was significantly correlated with *Taeniatherum caput-medusae* (positively) and

*Tribulus terrestris* (negatively). Three species were significantly associated with fire disturbance, one positively (*Hypericum perforatum*), and two negatively (*Convolvulus arvensis* and *Tribulus terrestris*). Road disturbance was significantly correlated with *Tribulus terrestris* (positively) and *Cynoglossum officinale* (negatively). Recreation disturbance was positively associated with two species (*Amorpha fruticosa* and *Tribulus terrestris*), and negatively associated with one (*Hypericum perforatum*). Finally, *Onopordum acanthium* was significantly and positively correlated with the 'other' disturbance type. Disturbance types also affect the population size of several weed species, either positively or negatively (Table 6 on page 58).

Many species are associated with particular elevational categories (Table 5). Species significantly associated with areas below (or crossing) the reference line include *Amorpha fruticosa*, *Hypericum perforatum*, *Lepidium latifolium*, *Phalaris arundinacea*, and *Tamarix* spp. Conversely, *Onopordum acanthium* and *Taeniatherum caput-medusae* are more likely to occur above the reference line, out of the flow zone area.

Species also varied in the probability with which they would occur across reaches. These associations are summarized in Table 5 and in the following species accounts. Maps showing the locations of all recorded noxious weed locations are contained in Figure 3 through Figure 21 beginning on page 71. Photos of selected sites are contained in Figure 22 through Figure 27 beginning on page 90.

### 2.2.6 Species Analysis

***<u>Onopordum acanthium</u>* <u>(Scotch thistle):</u>** (Map: Figure 3 on page 71, Photo: Figure 26 on page 92) This species was the most abundant weed found based on total number of populations (238), and units occupied (226) (Table 2 and Table 3). Most often the species was found growing in the drier, upland habitats, but occasionally plants, especially seedlings, extended into the riparian zones. Populations were often extensive, and continued up and out of the 50 m study corridor.

Elevational category was a significant predictor for the presence of this species ($\chi^2 = 30.383$, df = 2, $p < 0.0001$), with populations of *O. acanthium* significantly more likely to be located in areas entirely above or crossing the reference line than below it (Appendix 6). Populations were most likely to be present on the Brownlee reach, although differences between all reaches were not significant (Appendix 6). The presence of 'other' disturbance was also significantly associated with *Onopordum* ($\chi^2 = 10.368$, $p = 0.0013$).

The size of *Onopordum acanthium* populations is significantly affected by a variety of factors. First, population size varies among reaches ($F = 2.669$, df = 4, $p = 0.0332$) and among elevational categories ($F = 15.059$, df = 2, $p < 0.0001$). Specifically, populations are largest on the Weiser reach, though only significantly larger than those on the Downstream reach (Table 6, Appendix 6). Populations that cross the reference line are significantly larger than those that occur entirely above or below that point. Population size increases significantly as disturbance increases from the flow zone ($F = 4.072$, df = 1, $p = 0.0448$) and mining ($F = 8.958$, df = 1, $p = 0.0031$). There is a trend for population size to increase with several less common disturbance types, although these correlations are not significant.

***Amorpha fruticosa* (false indigo):** (Map: Figure 4 on page 72, Photo: Figure 23 on page 90) *Amorpha fruticosa* was the second most common species recorded based on both total populations (219), and on the number of units it was present in (195) (Table 2 and Table 3). Of note, however, is the relative scarcity of the species on the Hells Canyon Downstream reach and the Weiser reach. It occurs in only 8% of the units in the Downstream reach, and 36% of the units on the Weiser reach. By contrast, on the three reservoir reaches, the species is found in over 65% of the units. *A. fruticosa* usually was found at, or very near, the MHWM.

This species appears to be strongly associated with the flow zone. In particular, *Amorpha fruticosa* was significantly associated with the presence of flow zone disturbance ($\chi^2 = 17.734$, $p < 0.0001$), and with increasing levels of flow zone disturbance, across all reaches ($\chi^2 = 28.631$, $p < 0.0001$). This species was also significantly associated with elevational category ($\chi^2 = 140.453$, df = 2, $p < 0.0001$). Populations were significantly associated with sites located entirely below the reference line (below vs. above, $\chi^2 = 31.550$, $p < 0.0001$; below vs. cross, $\chi^2 = 40.427$, $p < 0.0001$). In addition, the presence of this species was significantly associated with the presence and level of recreational disturbance, as well as with increasing levels of fire disturbance (Appendix 6).

Population size of this species was also affected by a variety of factors (Appendix 6). The presence of agricultural disturbance had a significant, positive effect on population size ($F = 7.911$, df = 1, $p = 0.0054$), as did the presence of livestock disturbance ($F = 4.072$, df = 1, $p = 0.0449$). Population size also increased as the agricultural disturbance increased (Appendix 6). Increasing levels of trail and flow zone disturbance also had a slight, but significant positive effect on population size (Appendix 6).

***Cynoglossum officinale* (common houndstounge):** (Map: Figure 5 on page 73) *Cynoglossum officinale* was found in 156 units throughout all reaches, except the Weiser reach (Table 3). A total of 171 populations were recorded, making this species the third highest in total number of populations (Table 2). The plants usually were found well above the MHWM in disturbed upland habitat, however, occasional concentrations of plants were found in drier riparian areas.

*Cynoglossum officinale* appears to be associated with areas outside the flow zone. It is strongly and negatively associated with the presence ($\chi^2 = 28.750$, $p < 0.0001$) and the level ($\chi^2 = 29.122$, $p < 0.0001$) of flow zone disturbance (Appendix 6). Increasing levels of road disturbance are also negatively correlated with the presence of this species ($\chi^2 = 8.181$, $p = 0.0042$). The weed's absence from the Weiser reach is responsible for the significant effect of reach on its distribution ($\chi^2 = 41.783$, df = 4, $p <0.0001$).

Several factors affect the size of *C. officinale* populations. Populations crossing the reference line are significantly larger than populations entirely above or below it (Appendix 6). Populations on the Downstream reach are significantly smaller than those on the Oxbow and Hells Canyon Reservoir reaches (Appendix 6). Larger populations are found in areas of heavier agricultural disturbance ($F = 4.762$, df = 1, $p = 0.0306$), heavier fire disturbance ($F = 5.514$, df = 1, $p = 0.0201$), and heavier ORV disturbance ($F = 7.409$, df = 1, $p = 0.0072$).

***Hypericum perforatum* (St. John's wort):** (Map: Figure 6 on page 74) *Hypericum perforatum* was recorded from 145 units (151 populations) (Table 2 and Table 3). The Hells Canyon Downstream reach showed the greatest abundance, with the species occurring in 110 units (87%). The Hells Canyon Reservoir and Oxbow Reservoir reaches showed moderate infestations, with occurrences in 21 (39%) and 12 (46%) units respectively. The Brownlee Reservoir reach showed comparatively low abundances for *H. perforatum*, with occurrences in only 2 (1%) units. Although the populations occasionally extended down into the upper portions of the flow zone, the majority of the plants were found in upland sites.

The presence of *H. perforatum* was significantly associated with both elevational category ($\chi^2$ = 40.940, df = 2, p < 0.0001) and reach ($\chi^2$ = 262.982, df = 4, p < 0.0001). This species is most likely to be found on the Downstream reach (Appendix 6), and was not found at all on the Weiser reach. It is significantly associated with sites crossing the reference line (Appendix 6). This weed is also significantly associated with increasing levels of fire disturbance ($\chi^2$ = 10.126, p = 0.0015). Finally, it is associated with lower levels of recreational disturbance ($\chi^2$ = 8.851, p = 0.0029).

The size of *H. perforatum* populations was affected by several factors. It varied significantly between reaches (F = 13.327, df = 3, p < 0.0001) and between elevational classes (F = 3.697, df = 2, p = 0.0273). Populations that crossed the reference line were significantly larger than populations entirely below it (p = 0.0033), and marginally larger than populations entirely above it. Populations on the Downstream reach were significantly larger than populations on the Hells Canyon Reservoir and Brownlee Reservoir reaches, but not significantly larger than populations on the Oxbow Reservoir reach (Appendix 6). No disturbance factors affected population size.

***Lepidium latifolium* (broadleaved pepperweed):** (Map: Figure 7 on page 75) *Lepidium latifolium* was found in dense patches and scattered populations throughout all reaches except the Hells Canyon Downstream reach. A total of 149 populations in 145 units were recorded (Table 2, Table 3). The plants are usually concentrated in the riparian areas, but often extend up onto the dry slopes.

The distribution of *Lepidium latifolium* is affected by disturbance type, elevation, and reach; and appears to be associated with the flow zone. This species is significantly associated with the presence of flow zone disturbance ($\chi^2$ = 24.848, p =< 0.0001), and with the level of flow zone disturbance. In addition, populations are significantly associated with sites crossing the reference line (Appendix 6).

Only reach (F = 13.431, df = 3, p < 0.0001) and elevational category (F = 10.229, df = 2, p < 0.0001) significantly affect population size in this weed. Populations that cross the reference line, and those on the Weiser reach are the largest (Appendix 6).

***Convolvulus arvensis* (field bindweed):** (Map: Figure 8 on page 76) *Convolvulus arvensis* was found in 128 populations scattered among 113 units throughout all reaches (Table 2 and Table 3). The plants were found growing both well above and well below the MHWM (sometimes within the same population).

Reach has a significant effect on the presence of this species ($\chi^2$ =24.317, df = 4, p<0.0001). *Convolvulus arvensis* is most likely to be present at sites on the Downstream reach, but not all differences between reaches are significant (Appendix 6). There is a significant, negative relationship between this species' presence and increasing levels of disturbance from fire ($\chi^2$ = 9.637, p = 0.0019).

Although proximity to the reference line is not a significant predictor of the presence of *C. arvensis*, populations of this species that cross it are significantly larger than populations that occur entirely below it (Appendix 6), possibly due to this species' tolerance of a broad range of habitat characteristics. In addition, populations of this species tend to increase in size with increasing disturbance from trails (F = 7.012, p = 0.0093).

***Taeniatherum caput-medusae* (medusahead wildrye):** (Map: Figure 9 on page 77) *Taeniatherum caput-medusae* was found in 119 units (totaling 119 populations) (Table 2 and Table 3). Many of the populations were extensive, containing thousands of individuals. Because of this, the average total net area for this species was greater than for any other species. The populations were most often found on dry, upland slopes, but often extended down to the MHWM.

*Taeniatherum caput-medusae* appears to be strongly associated with areas outside the flow zone. Populations of this species are significantly more likely to be found above or crossing the reference line than below it (Appendix 6). The species is negatively associated with the presence of flow zone disturbance ($\chi^2$ = 12.845, p = 0.0003), and the probability that it will occur decreases with increasing levels of flow zone disturbance ($\chi^2$ = 20.594, p <0.0001).This species is also significantly associated with livestock disturbance ($\chi^2$ = 19.057, p < 0.0001), and with increasing levels of livestock disturbance ($\chi^2$ = 24.824, p < 0.0001). Finally, although distribution of this weed did not vary significantly among the reaches on which it was found, no populations were located on the Downstream reach (Appendix 6). With the large number of populations of this species that were located elsewhere, this absence may be significant.

Elevational category had a significant effect on population size of this species (F = 9.336, df = 1, p = 0.0002). Populations that crossed the reference line were significantly larger than those that occurred entirely above that point (Appendix 6). In addition, of the reaches on which this species was found, populations were largest on the Oxbow and Brownlee reaches. Populations significantly decreased in size as flow zone disturbance increased (F = 4.255, df = 1, p = 0.0417), and as the level of ‘other’ disturbance increased (F = 4.561, df = 1, p = 0.0351).

***Phalaris arundinacea* (reed canarygrass):** (Map: Figure 10 on page 78, Photo: Figure 27 on page 92) *Phalaris arundinacea* was found in 105 total units on all five reaches (although the Hells Canyon Downstream and Oxbow Reservoir reaches together contained only four populations) (Table 2 and Table 3). The species was usually found below the MHWM, but occasionally extended above the MHWM up into the riparian vegetation, especially along side creeks.

*Phalaris arundinacea* was significantly associated with elevational class ($\chi^2$ = 28.804, df = 2, p < 0.0001) and with the presence and level of flow zone disturbance (presence: $\chi^2$ = 35.825, p <

0.0001; level: $\chi^2 = 26.106$, p<0.0001). This species was most likely to be found below the reference line (Appendix 6), indicating a strong association with the flow zone. It is also significantly associated with reach ($\chi^2 = 31.645$, df = 4, p < 0.0001), and is most likely to be found on the Weiser reach (Appendix 6).

Populations of this species were largest on the Weiser reach (Appendix 6), and increased with the presence, and increasing levels, of agricultural disturbance. Population size decreased with the presence, and increasing levels, of 'other' disturbance. Although flow zone is an important predictor of the presence of this weed, it did not have an effect on population size.

***Tribulus terrestris* (puncturevine):** (Map: Figure 11 on page 79) *Tribulus terrestris* was found in 88 total units, along all five reaches (although few populations were found on the Hells Canyon Downstream and Weiser reaches) (Table 2 and Table 3). The plants were often found along roadsides and other heavily disturbed areas. Some populations were also found growing in the exposed flow zone areas.

Several factors were significantly associated with the presence of this weed. *Tribulus terrestris* is significantly associated with the presence of road ($\chi^2 = 15.625$, p <0.0001), and recreational disturbance ($\chi^2 = 14.545$, p = 0.0001), as well as increasing levels of those disturbance types (Appendix 6). However, the presence of livestock disturbance ($\chi^2 = 9.654$, p=0.0019), and increasing levels of fire disturbance are negatively associated with the presence of this weed ($\chi^2$= 10.152, p = 0.0014). Neither reach nor elevational category significantly affected the probability of this species occurring.

Population size increased significantly with increasing levels of fire disturbance (F = 4.760, df =1 , p = 0.0321), but decreased with the presence of alluvial disturbance (F = 4.520, df = 1, p = 0.0367). In addition, populations crossing the reference line were larger than populations in the other two elevational categories (Appendix 6) No other factors were associated with an increase in population size for this species.

***Conium maculatum* (poison hemlock):** (Map: Figure 12 on page 80, Photo: Figure 24 on page 91) *Conium maculatum* was found in a total of 86 units along all reaches (although only one population was located on the Hells Canyon Downstream reach) (Table 2 and Table 3). The species was most often found growing in riparian habitats, but also extended up dry slopes.

No disturbance factors or elevational categories were significantly associated with the presence of *Conium maculatum*. However, this weed was significantly associated with reach ($\chi^2 = 38.651$, df = 4, p < 0.0001). In particular, this species was more likely to be found on the Weiser, Oxbow, and Brownlee reaches than on the Hells Canyon Reservoir or Downstream reaches (Appendix 6).

Several factors affected the size of *C. maculatum* populations. Populations of this species varied significantly between reaches (F = 6.288, df =4, p = 0.0002) and elevational classes (F = 3.808, df = 2, p = 0.0267). Populations that crossed the reference line were significantly larger than populations located either entirely below it (p = 0.0006) or entirely above it (p = 0.0228). Populations on the Weiser reach were significantly larger than those on the Oxbow and Brownlee Reservoir reaches. Since only one population was found on the Downstream reach, comparisons with this reach are not valid. In addition, the presence of road disturbance is associated with larger population sizes (F = 4.499, df = 1, p = 0.0373) (Appendix 6).

***Cirsium vulgare* (bull thistle):** (Map: Figure 13 on page 81) Eighty-one populations of *C. vulgare* were found in 72 units scattered throughout all reaches (Table 2 and Table 3). In general, most populations contained few individuals and, consequently, the total net area for the species is low (average of 0.8 $m^2$/unit). The plants were usually found well above the MHWM on the dry upland slopes.

Several factors were associated with the presence of *Cirsium vulgare*. The distribution of populations between reaches varied significantly ($\chi^2 = 25.710$, df = 4, p<0.0001), with populations most likely to be present on the Downstream reach and least likely to be present on Brownlee Reservoir, although not all differences between reaches were significant (Appendix 6). This species was also strongly and negatively associated with the presence and level of flow zone disturbance, in comparison with other weed species (presence: $\chi^2 = 20.977$, p < 0.001; level: $\chi^2 = 19.648$, p <0.0001).

Population size in this species varied significantly between reaches (F = 3.537, df = 4, p = 0.0113) and elevational categories (F = 3.148, df = 2, p = 0.0496). Populations on the Oxbow Reservoir were largest, but differences between reaches were not significant (Appendix 6). In addition, populations that crossed the reference line were the largest, although all comparisons were not significant (Appendix 6).

***Cardaria draba* (whitetop):** (Map: Figure 14 on page 82) *Cardaria draba* was found in 51 units on all reaches except the Hells Canyon Reservoir reach (Table 2 and Table 3). Several of the populations are extensive and contain thousands of individuals. The species is associated primarily with upland habitats. It should be noted that *C. draba* was well past its flowering period by the time of the late summer survey, and detection was difficult.

A reduced analysis (looking only at flow zone disturbance, reach, and elevational category) was conducted on *C. draba* because there were not enough data points to analyze all disturbance factors noted at sites where this species was found. The presence of whitetop was not significantly associated with either elevational category, or the presence or level of flow zone disturbance (Appendix 6). However, this species was significantly associated with reach. Whitetop was most likely to be found on the Brownlee Reservoir.

Population size was significantly affected by elevational category (F = 7.943, df = 2, p = 0.0010). Populations found below the reference line were significantly smaller than populations that crossed it (p = 0.0019). No other factors significantly affected population size (Appendix 6).

A greater proportion of *C. draba* populations than average had moderate or greater agricultural, livestock, and residential disturbance (Appendix 7). Although these three disturbance factors could not be statistically tested due to the small sample size, this distribution suggests that there may be an association between these disturbances and this weed species.

***Cirsium arvense* (Canada thistle):** (Map: Figure 15 on page 83) A total of 47 units contained *C. arvense* populations, with the majority (43 units) occurring on the Brownlee Reservoir and Weiser reaches (Table 2 and Table 3). Most often the plants were found growing in upland habitats.

Because of the relatively small sample size, a reduced analysis was conducted on *C. arvense*. Neither relation to the reference line nor the presence or level of flow zone disturbance was significantly associated with this weed (Appendix 6). However, the distribution of populations of this species varied significantly between reaches ($\chi^2 = 68.636$, df = 4, $p < 0.0001$). In particular, populations of Canada thistle were significantly more likely to be found on the Weiser reach than on any other reach (Appendix 6).

Population size in this species was not associated with reach, elevation, or flow zone disturbance (Appendix 6).

Agricultural and 'other' disturbance types were recorded across all *Cirsium arvense* sites at more than twice their expected averages (Appendix 7). While these associations could not be tested due to the small sample size, this may indicate that the presence of this species is associated with these two disturbance factors.

***Tamarix* sp. (tamarisk):** (Map: Figure 16 on page 84) Forty-five populations of *Tamarix* sp. were found in 45 units, most at the upper end of Brownlee Reservoir or on the Weiser reach (Table 2 and Table 3). The plants were usually found growing in riparian habitats at the MHWM or below.

A reduced analysis was conducted on *Tamarix* sp. due to the relatively low number of populations found. The species is significantly associated with both reach ($\chi^2 = 49.794$, df = 4, $p<0.0001$), and relation to the reference line ($\chi^2= 25.710$, df = 2, $p<0.0001$) (Appendix 6). It is also significantly more likely to be found below the reference line than in the other elevational categories (Appendix 6). This combination of factors suggests that this species is associated with the flow zone. *Tamarix* sp. was only found on the Brownlee and Weiser reaches.

No factors were significantly associated with population size in this species (Appendix 6).

Both flow zone and ORV disturbance occurred in *Tamarix* sp. populations at more than twice the averages observed across all recorded populations (Appendix 7). Although these disturbance factors could not be tested due to the small sample size, this distribution suggests that there may be an association between these two disturbance types and this weed species.

***Ambrosia artemisiifolia* (annual ragweed):** (Map: Figure 16 on page 84) The Hells Canyon Reservoir and Oxbow Reservoir reaches contained the majority of the *Ambrosia artemisiifolia* populations (31 out of 33 total) (Table 2 and Table 3). The plants were found growing in a variety of habitats. It should be noted that *A. artemisiifolia* blooms very late in the summer, making detection during the spring survey difficult.

A reduced analysis was conducted on *A. artemisiifolia* because of the relatively small sample size. This species did not have a significant association with elevational category or presence of flow zone disturbance. However, the distribution of populations between reaches varied significantly ($\chi^2 = 65.287$, df = 4, $p < 0.0001$). Populations were more likely to be present on the Oxbow Reservoir reach than on the other reaches. This difference was significant between the Oxbow Reservoir reach and the Brownlee Reservoir and Downstream reaches, but not between Oxbow and the Hells Canyon Reservoir reaches (Appendix 6). Populations were also significantly more likely to be present on Hells Canyon Reservoir than on Brownlee Reservoir. The Weiser reach had no populations of this species.

Reach was also the only factor to affect the size of *A. artemisiifolia* populations (F = 7.292, df = 3, p = 0.0011). Significantly larger populations of this weed were found on Oxbow Reservoir than were found on Hells Canyon Reservoir or the Downstream reach (Appendix 6).

Residential disturbance was present in the *A. artemisiifolia* populations much more often than the average across all species (Appendix 7). Because of the small sample size, however, this possible correlation could not be checked statistically.

***Elaeagnus angustifolia* (Russian olive):** (Map: Figure 16 on page 84) Twenty-four populations of *E. angustifolia* were recorded across all reaches except the Hells Canyon Downstream reach (Table 2 and Table 3). Mature trees were typically found just above the MHWM, while seedlings tended to grow in the flow zone below the MHWM.

The number of populations of Russian olive populations located, allowed for only a reduced analysis. Neither flow zone disturbance nor elevational category had a significant effect on the presence of this species (Appendix 6). However, the probability of finding *Elaeagnus angustifolia* varied significantly among reaches ($\chi^2 = 34.931$, df = 4, $p < 0.0001$). This species was most likely to occur on the Weiser reach, and did not occur at all on the Downstream reach.

None of the three factors tested (reach, elevational category, or flow zone disturbance) significantly affected population size in this species (Appendix 6).

The *E. angustifolia* populations showed a high proportion (relative to the average) of both agricultural and residential disturbance (Appendix 7). While these suggested associations could not be tested, due to the small sample size, they may indicate a correlation between *E. angustifolia* and these two disturbance types.

***Potentilla recta* (erect cinquefoil):** (Map: Figure 17 on page 85) *Potentilla recta* was found in 18 units, all on the Hells Canyon Downstream reach (Table 2 and Table 3). The plant was located primarily in upland habitats.

Although 21 populations of *P. recta* were found, the distribution of predictor factors did not allow for a reduced logistic analysis. All populations but one were located entirely above the reference line. Only one site had slight flow zone disturbance; the remaining sites had none. This combination of factors indicates that this weed may be associated with areas outside the flow zone.

Trail disturbance was recorded in the *P. recta* populations much more often than the average across all species (Appendix 7). Because of the small sample size, however, this possible correlation could not be checked statistically.

***Linaria dalmatica* (Dalmatian toadflax):** (Map: Figure 17 on page 85, Photo: Figure 25 on page 91) Nineteen populations of *L. dalmatica* were recorded from 19 units (Table 2 and Table 3). The populations were primarily found in upland areas.

A reduced analysis was conducted on the 19 populations of this species. None of the three factors tested (reach, elevation, or flow zone) had a significant effect on the presence of *L. dalmatica* (Appendix 6). However, the species was not found on the Weiser or Oxbow reaches. No factors had a significant effect on population size for *L. dalmatica* (Appendix 6).

Although the analysis could not include all disturbance factors, a high proportion of sites, compared to all other species, had road, trail, ORV, and 'other' disturbance (Appendix 7).

***Chondrilla juncea* (rush skeletonweed):** (Map: Figure 17 on page 85) Six populations of *C. juncea* were found on the Hells Canyon Downstream reach, and eleven populations were found on the Brownlee Reservoir reach (Table 2 and Table 3). Most of the populations were small (none contained more than 50 estimated plants), and all were in upland habitats.

A reduced analysis was conducted on the 17 populations of rush skeleton-weed found. Flow zone disturbance was not significantly associated with this weed, however the species showed significant association with reach ($\chi^2$ = 23.269, p =0.0001) (Appendix 6).

No factors except elevational category affected population size in *C. juncea*. Populations that crossed the reference line were significantly larger (p = 0.0312) than populations restricted to the area above the reference line (Appendix 6).

Although a complete analysis was not possible due to the small sample size, sites where this species were found show more than twice the average rate of livestock disturbance (Appendix 7), indicating that this disturbance type may be associated with this species.

***Kochia scoparia* (kochia):** (Map: Figure 18 on page 86) Most of the 14 populations (contained in 15 units) of *K. scoparia* are located at the upper end of Brownlee Reservoir and the Weiser reach (Table 2 and Table 3). Most of the sites are in upland habitats.

Logistic regression was not conducted on this species due to the sample size of 14 populations. None of these populations were found on the Downstream reach or Hells Canyon Reservoir reach, and none were located entirely below the reference line. A very high proportion, compared with the average, occurred in locations with heavy or extreme 'other' disturbance, suggesting that there may be an association between this species and the disturbance (Appendix 7). This is especially true if the several instances all result from the same cause. In addition, a high proportion of sites where this species was found also had fire disturbance.

***Lythrum salicaria* (purple loosestrife):** (Map: Figure 18 on page 86) *Lythrum salicaria* was found in sparsely scattered locations in 13 units, along all reaches except the Hells Canyon

Downstream reach. It was usually found growing below the MHWM, often near the shoreline. The plants were often emergent.

No statistical analyses were conducted on this species because only 13 populations were located. All but one of the populations were located entirely below the reference line; the remaining population crossed it. In addition, 92 percent of the sites at which this species was found had moderate or heavy flow zone disturbance (Appendix 7). This suite of traits suggests that this weed is associated with the flow zone.

***Cuscuta* sp. (dodder):** (Map: Figure 18 on page 86) Ten populations of *Cuscuta* sp. were found in 10 units (Table 2 and Table 3). The plants were growing along roadsides, and down into the flow zone.

Due to the small sample size, statistical analyses were not conducted on *Cuscuta* sp. No populations were located on the Oxbow Reservoir or Downstream reach. A relatively high proportion of sites where *Cuscuta* sp. was found (60%) have moderate or greater road corridor disturbance. While this is twice the average proportion (Appendix 7), and may indicate an association with this type of disturbance, the high proportion may also be due to the small sample size.

***Salvia aethiopis* (Mediterranean sage):** (Map: Figure 19 on page 87) Ten populations of *S. aethiopis* were found on the Oxbow and Hells Canyon Reservoirs (Table 2 and Table 3). The populations were usually found in upland habitats. Only one occurred entirely below the reference line; the other populations either crossed, or were located above, the reference line. None of the sites had flow zone disturbance. These factors suggest that the species may be associated with areas outside the flow zone.

***Equisetum arvense* (common horsetail):** (Map: Figure 19 on page 87) *Equisetum arvense* was only found in 8 units (Table 3). No statistical analyses were conducted for the nine populations that were located (Table 2). All populations were on the Downstream reach, and all but one were found below the reference line (the one remaining population extended from below the MHWM to 1.4 m above the MHWM.) All populations occupied sites with heavy flow zone disturbance, and a greater proportion than average (across all species) occupied areas with heavy alluvial disturbance (Appendix 7). This suite of factors suggests that this species may be associated with the flow zone. In addition, a higher proportion of *E. arvense* populations had trail disturbance (relative to the average across all species) (Appendix 7).

***Agropyron repens* (quackgrass):** (Map: Figure 19 on page 87, Photo: Figure 22 on page 90) A total of seven populations of *A. repens* were found within the study area, on all of the reaches except for the Weiser reach (Table 2 and Table 3). The populations are located in a variety of habitats.

Due to the small sample size, no statistical analyses were performed for this species. It was found in all elevational categories. A higher than average proportion of sites where it was found had moderate or greater fire, trail, residential, ORV, and ‘other’ disturbance (Appendix 7).

***Cyperus esculentus* (yellow nut sedge):** (Map: Figure 20 on page 88) No statistical analyses were performed on the seven populations of *Cyperus esculentus* that were found. All populations but one were found on the Downstream reach, and all were below the reference line. In addition, all sites where this species was found had heavy flow zone disturbance. This combination of factors suggests that *C. esculentus* may be associated with proximity to the flow zone, and/or flow zone disturbance itself. Finally, a relatively high proportion of sites where this species was found, in comparison with other species, had alluvial disturbance (Appendix 7).

***Centaurea diffusa* (diffuse knapweed):** (Map: Figure 20 on page 88) Only six populations of *C. diffusa* were located, so no statistical analyses were performed. All six populations were located on the Hells Canyon Reservoir and none were located below the reference line. In addition, all populations were found in areas with moderate, heavy or extreme road disturbance. This is a greater proportion of populations than the average with this type of disturbance, suggesting that there may be an association between road corridors and the presence of this weed (Appendix 7).

***Aegilops cylindrica* (jointed goat grass):** (Map: Figure 20 on page 88) No statistical analyses were conducted on *A. cylindrica*, as it was found at only three sites. However, all three sites had heavy to extreme road and recreational disturbance. This proportion (100%) is well above the average proportion of sites with road and recreational disturbance (Appendix 7), indicating that there may be an association between these disturbances and the presence of this species. With such a small number of populations, however, this association could be due to chance. All populations were located on the Oxbow and Hells Canyon Reservoir reaches, entirely above the reference line.

***Euphorbia esula* (leafy spurge):** (Map: Figure 21 on page 89) Three populations of *E. esula* were located on the Brownlee Reservoir and Weiser reaches. No statistical conclusions can be made from this small sample, but all populations were located in areas of heavy or extreme flow zone disturbance, and alluvial, fire, and agriculture disturbances were present in a higher proportion of *E. esula* sites than the average for all species.

***Crupina vulgaris* (common crupina):** (Map: Figure 21 on page 89) *Crupina vulgaris* was found in one location, on the Downstream reach. The population was entirely above the reference line and was in an area of moderate livestock damage. No inferences can be drawn.

***Daucus carota* (wild carrot):** (Map: Figure 21 on page 89) No statistical inferences can be drawn from the single population of *D. carota*, found on the Brownlee Reservoir. It was located above the reference line in an area of moderate livestock disturbance.

***Polygonum cuspidatum* (Japanese knotweed):** (Map: Figure 21 on page 89) One population of *P. cuspidatum* was found on the Hells Canyon Reservoir, crossing the elevational reference line, in an area of heavy recreational disturbance. No statistical inferences can be drawn.

### 2.2.7 Interpretation of Results

An overview of the data shows that noxious weed species (and other invasive plants), as a group, are common and abundant throughout the entire study area. Weed species were absent from only

2% of the 405 units surveyed, and most units contained multiple populations. There are likely a number of factors which contribute to this concentration of weeds near the river and reservoirs.

First, a larger variety of upland and wetland habitats exist along rivers and reservoirs compared to the general surrounding landscape. All of the units within the study area contained both upland and riparian habitats, usually spanning the moisture range from inundated to dry-mesic or dry-xeric. This range of habitats provides opportunities for the occurrence of a wide variety of plant species. This range can be seen in many of the units which contained strictly upland species such as *Taeniatherum caput-medusae*, while at the same time containing wetland associates such as *Lythrum salicaria*.

Another contributing factor would be the higher general levels of disturbance, from a number of different factors, along rivers and reservoirs. These areas typically receive greater levels of disturbance from recreation, flooding, animal use, road building, and a host of other activities and natural phenomena, than do the surrounding upland areas. Although disturbance levels within the study area were not quantified with respect to other nearby areas, it is reasonable to assume that disturbance levels are generally higher along the river and reservoirs. This would account, perhaps in large part, for the high weed concentrations recorded in the study area. However, it is difficult to attribute the high weed concentrations to individual disturbance factors, because most of the factors are interrelated. For example, the presence of a road at a site may increase recreation access, which in turn may increase fire frequency, which may affect grazing pressure in the area.

Weed concentrations within the study area are also likely high due to the effect that the river corridor can have on the transport and dispersal of plant seeds and parts. Weed seeds and living plant material are likely to be transported along the river corridor quicker, and in greater concentrations, than in surrounding upland areas. Weed material can float downstream, be carried by animals using the river as a migration corridor, or be transported along the river corridor in a number of other ways. These all result in higher concentrations of weed populations within river corridors, than the surrounding uplands.

### 2.2.8 Summary of Findings

Table 7 (on page 60) presents a brief summary of the findings of this study and is designed to complement the more extensive written text and supporting tables. The results of this study indicate that weed distribution within the Hells Canyon Complex study area is influenced by a number of interrelated factors. For some species, it is possible to separate out particular associative factors (such as the presence of flow zone disturbance or proximity to the MHWM). These results are useful in the development of resource management strategies which limit the establishment and spread of weed populations, and aid in the maintenance of native plant communities.

# PART 3: RARE PLANTS

## 3.1 METHODS

### 3.1.1 Prefield Review

In consultation with agency personnel, IPCo developed a list of special status plant species to be considered during the study. Rare species were included on this list if they were known to be associated with the river or reservoirs, possibly impacted by IPCo's operations in the area, or of special cultural significance.

Once the initial list was compiled, it was divided into two groups. The first group, consisting of eight species, was the focus of the special status plant investigation. That is, the survey methods and timing were constructed with the specific habitats and identification periods of these species in mind. The focus species were chosen based on their classification by the Oregon Natural Heritage Program and the Idaho Conservation Data Center. The species which were listed by these two organizations as being the most highly imperiled, were placed on the focus list for this investigation. The second group, also consisting of eight species, was defined as incidental to the planning of the study. Data were recorded regarding populations of these species, if encountered, but their habitats and identification periods were not specifically targeted. These species were the remaining species left once the focus species were chosen. They represent those rare species that are considered to be less imperiled than the focus group. Table 8 (on page 61) gives the complete list of plant species of concern for the purposes of this investigation.

Prior to the field surveys, a review of available literature and other sources was conducted to gain information on special status plant species potentially located within the project area. Taxonomic keys (Hitchcock *et al.* 1955-1969, Hitchcock and Cronquist 1973, Hickman 1993, Brooks *et al.* 1991, Meinke [No date]) and plant lists (US Forest Service 1994, Eagle Cap Consulting Inc. 1998) were collected and reviewed to provide distribution, identification, and habitat information regarding the species of concern.

### 3.1.2 Field Investigation

Summer field surveys of the project area began on August 4, 1998. Crews started working on Oxbow Reservoir and lower Brownlee Reservoir, moving down to Hells Canyon Reservoir by the later half of August. Two raft trips took place August 31 through September 14 to survey portions of the Hells Canyon Downstream reach. Finally, from September 18 through 28, crews inventoried sections on upper Brownlee Reservoir and the Weiser reach. Of the total 405 units within the study area, 266 (65.7%) were surveyed for special status plants during the late summer survey.

The spring field surveys took place from April 19 through June 4, 1999. Crews began work on upper Brownlee Reservoir and the Weiser reach, progressing north to lower Brownlee, Oxbow and Hells Canyon Reservoirs by the beginning of June. At the same time, two raft trips were conducted between May 3 and May 23 to survey the Downstream reach.

Units were accessed either by foot or by boat. Once in the unit, the surveyor(s) walked the entire length, searching all habitats present. Special care was taken to intensively search all high-probability special status plant habitats encountered (*e.g.* riparian zones, wet meadows, vernal seeps, rock outcrops and cliffs, etc.). If any rare plant species of concern were found, the surveyor(s) collected extensive data on the population using the Rare Plant Observation Form (see Section 3.1.3 below).

In addition to the 405 units thoroughly searched, the field crews also surveyed selected high-probability habitats between the units. These supplementary surveys occurred when the investigators saw habitats between the units which appeared to contain high potential for the occurrence of the target species. Unlike the areas within the survey units, only the high probability habitats were searched between units. No attempt was made to completely survey the areas between the units. These habitats were searched during the course of the spring-season surveys. The final days of the spring survey were devoted exclusively to surveying these habitats between the units.

### 3.1.3 Data Collection

The Rare Plant Observation Form (Figure 28 on page 93) was used for all data collection in the field. A description of the data collected, and the methods used in obtaining these data, are presented below.

**Scientific Name:** The authority used for most species names was *Flora of the Pacific Northwest* (Hitchcock and Cronquist 1973). Updated taxonomy was referenced in *Sensitive Plants of the Malheur, Ochoco, Umatilla, and Wallowa-Whitman National Forests* (Brooks *et al.* 1991). (Species codes, used occasionally for shorthand notation on maps, etc., were based on IPCo's Species Codes book dated March 6, 1998).

**Site Number:** Each site was numbered with either an eleven or twelve character code (*e.g.*, LLM05059901 or RKM040898102). The first three characters are the initials of the botanist recording the population. The next six digits are the date of observation (DDMMYY). The final two or three digits are the consecutive plant population number for that recorder on that day of the year.

**Recorder(s):** The name of each botanist collecting data for the population, with the recorder's name first.

**Address, Phone:** Contact information for Eagle Cap Consulting Inc. (the consultant performing the surveys).

**Date, Time:** Date format was (DDMMYY), and the time was recorded in military time to the nearest 15 minute interval.

**Elevations:** Approximate low and high elevations for the special status plant population, in meters.

**Landowner:** Name of landowner.

**Quad Name:** USGS 7.5" quad map name.

**Slope:** The approximate slope at each site was measured using a clinometer or was estimated visually.

**GPS File, UTM Coords, Elev.:** For each site, a Global Positioning System (GPS) point was recorded at the approximate center of the population using Trimble® GeoExplorer GPS tracking units. On a periodic basis this information was downloaded to a portable computer and the files were differentially corrected using base data obtained from either the McCall, Idaho base station, or the Burns, Oregon base station. After correction, the UTM coordinates and elevation above mean sea level (derived from the GPS unit) were entered in these fields. In certain limited instances, the data were not correctable. In these cases the uncorrected UTM coordinates were recorded. In situations where the GeoExplorer units were unable to track sufficient satellites, Garmin® 12XL GPS units were used to record uncorrected data. Occasionally, when GPS data were missing for a population, the UTM coordinates were derived from the USGS quad sheets, or with a GIS computer application. In all cases where UTM data were not differentially corrected, an appropriate note was recorded in the **Comment** field explaining the source of the UTM coordinates.

**Township, Range, Section, ¼ Section:** The legal location of the special status plant population was recorded, if available.

**Asp:** The general aspect of the population was recorded at each site. Where the aspect changed throughout a population, the dominant aspect was recorded.

**Max El, Min El, Max Dist, Min Dist:** The approximate maximum and minimum elevations and distances from the MHWM for the population were recorded at each site. The MHWM was located by visually inspecting the top of the flow zone for evidence of previous (or current) water presence (*e.g.,* marks on cliffs, abrupt vegetation changes, etc.).The elevations were recorded in 15 cm height classes (*i.e.* Class 1 = 0 to 15 cm, Class 2 = 16 to 30 cm, etc., or Class -1 = -1 cm to -15 cm, Class -2 = -16 cm to -30 cm, etc.). Height above or below the MHWM was determined using a sight level and a graduated pole. In some cases visual estimation was used to determine elevation. Where elevation was above 20 height classes (3 m) or below -20 height classes, the number 99 or -99 was recorded in the appropriate field. The maximum and minimum lateral distances were recorded in meters. These were determined using a hip chain or pacing for populations located on low slope ground, or visually estimated for high slope units. Where lateral distance was greater than 50 m either above or below the MHWM, the number 99 or -99 was recorded in the appropriate field.

**Distance from MHWM to Current WSE:** The approximate vertical distance from the Mean High Water Mark to the current Water Surface Elevation was recorded for all populations. The elevation was measured using a graduated pole and a sight level. In instances where the water level was extremely low the elevation was estimated visually.

**County:** County name.

**New Site?:** This box was checked if the special status plant population had not been previously recorded.

**EO#:** Element Occurrence number for previously recorded special status plant populations.

**Survey Intensity:** Surveys of special status plant populations were thorough unless access was especially difficult (*e.g.*, steep cliffs, etc.).

**Location:** The location of the site was described in general terms to a level that would allow a person looking at a map of the area to find the general vicinity of the site (*e.g.*, "Approximately ½ mile upstream from the mouth of Pine Creek on the Oregon side of the river").

**Habitat:** A short description of the habitat was recorded (*e.g.*, "Dry, rocky slope"). This field was intended to give a general description of the habitat type. More specific habitat variables were recorded in other fields.

**Physiography:** The general physiography of the site was recorded. A 'wash' was considered to be a shallow ravine or creek with abundant alluvial deposits. A 'drainage' was considered to be a steep ravine or creek with few alluvial deposits.

**Moisture:** The moisture level of the soil at the time of survey was estimated for each population. Visual inspection of the soil's characteristics and the associated plant community was used to classify the site into one of five categories: Inundated, Saturated, Moist, Dry-Mesic, and Dry-Xeric.

**Disturbance Type:** A subjective assessment of each of the disturbance types influencing each site was recorded. The disturbance types assessed were: Alluvial (disturbance from sediment erosion and/or deposition from sources other than the Snake River and its reservoirs); Flow zone (flooding disturbance in the zone between low and high water levels along the Snake River and reservoirs); Livestock (trampling or grazing by livestock); Mining (mining structures or activity); Fire (evidence or implication of past fire); Road Corridor (presence of road); Recreation (camping, boating, fishing, etc.); Trail (human foot traffic trail); Industrial (buildings, structures, commercial facilities); Residential (dwellings and associated buildings); Off-Road Vehicle (ORV) Use (all-terrain vehicles, motorcycles, 4x4's, etc.); Undisturbed; and Other (railroad tracks, slumping of soil, flood, etc.). Disturbance levels were recorded based on the following designations: 1 = None (no disturbance evident); 2 = Slight (some light disturbance on parts of the site); 3 = Moderate (a fair amount of disturbance over the majority of the site); 4 = Heavy (a substantial amount of disturbance over most of the site); and 5 = Extreme (an excessive amount of disturbance over nearly all of the site).

It is important to note that ratings were based on implied, as well as observed, disturbance levels. For example, although direct evidence of disturbance from fire was lacking in many populations, a rating of 2 (slight) or higher was often assigned based on the assumption that fires had periodically disturbed the site in the past, and would do so again in the future. This assumption was made based on general fire frequency patterns in the area, and the site's susceptibility to fire (*e.g.*, amount of vegetation, proximity to natural fire breaks, proximity to ignition sources). Similarly, recreational activities were considered to be a disturbing factor for many populations along the shoreline of the heavily used reservoirs, even though direct evidence of recreational disturbance may not have been currently visible within a particular population.

**Surface Substrate:** General surface substrate percentages were recorded based on visual estimation using the following categories: fine sediment, coarse w/fines, coarse w/o fines, and bedrock.

**Total # of individuals in pop., What was counted?:** The total number of plants in the population was either estimated or counted. The appropriate box 'Genets' or 'Ramets' was checked. Species such as *Carex hystricina* were usually counted by clumps, and the 'Genets' box checked.

**Phenology, Pop. age class:** Appropriate percentages were recorded to describe the age distribution and phenologic stages of the population.

**Gross pop. area, Net pop. area:** The gross population area was the entire extent of the population, including interstitial spaces not occupied by individuals. The net population area was the summed canopy coverages of the individual plants, not including the interstitial spaces. Both of these measurements were visually estimated by the surveyor(s). Populations were defined at the point where no more individuals of the species occurred for a distance of approximately 100 m.

**Vigor:** A subjective assessment of the vigor of the entire population was recorded using the following categories: excellent, good, fair, and poor. The rating was based on the professional judgement of the recorder, and included such factors as individual plant health, size of the population, and size of the individual plants.

**Percent Cover, Cover Type, Plant Association:** The percent cover for each life form category was recorded, including bare soil and rock. The cover type was recorded, by number, based on IPCo's vegetation classification system. The plant association was derived based on the dominant species in the vicinity.

**Apparent trend of population:** A subjective assessment of the trend of the population was recorded (declining, stable, increasing, unknown). Because there was no evidence of trend at most sites, and these were primarily first-time visits, the trend was usually recorded as 'unknown'.

**Overall Site Quality:** A subjective assessment of the quality of the entire site.

**Abundant Species, Common Species, Uncommon Species:** Associated species were recorded for the site.

**Threats:** Potential threats to the survival of the rare plant population were recorded. These were based on the professional judgement of the investigator(s) who recorded the site. No attempt was made to standardize these threats from investigator to investigator.

**How was ID made?:** The taxonomic key used to identify the rare plant.

**Other knowledgeable individuals:** Individuals other than the recorder(s) who can provide information about the rare plant site.

**Photo and Roll Number:** Color slide photographs were taken to record both the special status plant(s) and the site in general. Each photograph was identified by a seven character code (*e.g.*, RKM01-03). The first three characters are the initials of the surveyor taking the photograph. The following four-number sequence corresponds to the consecutive roll and individual photo numbers, respectively, taken by that surveyor.

**Collection ID:** If a specimen was taken from the population, its collection identification number was recorded.

**Herbarium:** If a specimen was taken from the population, the herbarium where it is located was recorded.

**Comments:** Any additional relevant information was recorded in this section of the form. This includes the reach name and the number of the unit that the special status plant population was found in or near, as well as information on other disturbance types associated with the population, etc.

**Site Map:** A sketch map of the special status plant site was drawn in the field on the back of the Observation Form. Later, the population was mapped onto a USGS 7.5” Quad map, and a photocopy of the appropriate section was attached to the Observation Form.

## 3.2 RESULTS

### 3.2.1 Prefield Review

Table 8 (on page 61) shows the complete list of plant species of concern compiled for this investigation. Other sources investigated during the prefield review were useful in resolving taxonomic questions regarding the species of concern. Additional taxonomic keys were particularly helpful in developing the surveyors’ search images for those species of concern not addressed by the primary taxonomic authority, *Flora of the Pacific Northwest* (Hitchcock and Cronquist 1973).

### 3.2.2 Field Investigation

Six species of special status plants, in a total of 47 previously unknown populations, were found in the project area. Of the eight focus species of concern, four were found: *Cyperus schweinitzii* (Schweinitz flatsedge), *Leptodactylon pungens* subspecies (ssp.) *hazeliae* (Hazel's prickly phlox), *Mimulus patulus* (stalk-leaved monkey-flower), and *Teucrium canadense* variety (var.) *occidentale* (American wood sage). Of the eight incidental species of concern, two were found: *Bolandra oregana* (Oregon bolandra) and *Carex hystricina* (porcupine sedge). Table 9 (on page 64) summarizes the special status plant populations found during the investigation. Table 10 (on page 65) lists each rare plant population found.

Sixteen populations of *Haplopappus radiatus* (Snake River golden weed) were also located during the investigation. This is an upland species that was not included as a species of concern for this particular study, but because it is endemic to the Snake River area and surrounding hills, the species is nevertheless of interest to various agencies and the botanical community in general. The *H. radiatus* sites were marked on USGS quadrangle maps, but no further information was recorded.

The Rare Plant Observation Forms and associated USGS quad map sections for all 47 special status plant sites are attached separately in Appendix 8. The locations of the sites, as well as other significant features, are shown on the maps in Figure 29 through Figure 32 beginning on page 94. Photos of the species are shown in Figure 33 through Figure 43 beginning on 98. Complete lists of all plant species encountered during the surveys are included in Appendix 1.

#### 3.2.2.1 *Cyperus schweinitzii* (Schweinitz flatsedge)

*Cyperus schweinitzii* is a rhizomatous perennial flatsedge of the Cyperaceae (sedge) family (Figure 33 on page 98). Triangular culms reach a height of one to seven decimeters (dm), with several elongate leaves one to four millimeters (mm) wide attached near the base of the plant. Inflorescences, which form by midsummer, are composed of several elongate, unequal involucral bracts subtending one to several subcapitate spikes. The terminal spike is sessile, and additional spikes are attached at the ends of slender rays up to seven cm long. The numerous linear, flattened spikelets are composed of well-spaced, conspicuously-nerved individual scales which fall at maturity. Achenes are dark and trigonous. *Cyperus schweinitzii* is found in sandy-soiled valley and lowland habitats in the eastern and southwestern United States (U.S.), as well as southeastern Canada, northern Idaho, and Mexico (Hitchcock *et al.* 1969).

*Cyperus schweinitzii* is currently on the Oregon Natural Heritage Program's (ONHP) "List 2". This classification indicates that the species is "…threatened, endangered or possibly extirpated from Oregon, but … stable or more common elsewhere." (ONHP 1998). *Cyperus schweinitzii* was designated as one of the eight focus species of concern for the purposes of this rare plant investigation.

Twenty-one populations of *Cyperus schweinitzii* were found in the study area, all during the 1998 summer survey (Figure 29 on page 94). The populations were 75% to 100% in fruit. All populations were located on the Hells Canyon Downstream reach. Fifteen of the twenty-one populations (71%) are on the Oregon side of the Snake River, and six (29%) are on the Idaho side of the river. The *C. schweinitzii* sites on the Oregon side are distributed over a distance of approximately 37 km, from Roland Creek (SM 26W) upstream to a point between Little Bar Rapids and High Bar Rapids (SM 50W). The sites on the Idaho side of the river are scattered over a distance of approximately 17 km, from just north of Lookout Rapids (SM 31E) upstream to Cat Gulch (SM 42E). Although one *C. schweinitzii* population (on the Oregon side of the river at Camp Creek [SM 33W]) had been tentatively located prior to this investigation, it is included here as a new occurrence because of the previous uncertainty in identification. Otherwise, there were no previously-known occurrences of *C. schweinitzii* in the project vicinity.

The *Cyperus schweinitzii* populations were situated near the river on dry, coarse, sandy loam soils of gentle to moderate slope (generally ranging from three to twenty degrees slope). The majority of the *C. schweinitzii* sites (17 out of 21, or 81%) did not extend below the MHWM into the river's flow zone. Of those that did, three sites extended laterally two m or less below the MHWM, and only one site was situated entirely within the flow zone. Most populations (19 of 21, or 90%) extended horizontally away from the river for 20 or more meters, and surpassed the 20 height-class mark at their highest elevation. The two populations which stayed close to the river (10% of the total) include the one entirely within the flow zone mentioned above, and one which extended laterally only three meters to a maximum of five height classes above the MHWM.

Fifteen of the twenty-one *C. schweinitzii* populations (71%) contained more than five hundred individuals (with most numbering in the thousands). Of the smaller populations, four contained an estimated 150 to 450 individuals, and two contained approximately 30 or fewer individuals. In addition, most of the *C. schweinitzii* sites (13 of 21, or 57%) were estimated to cover a gross area of 2,000 square meters ($m^2$) or more, with the two largest sites estimated near 50,000 $m^2$. Six of the smaller sites covered approximately 100 to 800 $m^2$, and the remaining site was estimated at 45 $m^2$.

*Cyperus schweinitzii* plants were primarily found growing in upland shrub savanna communities dominated by *Celtis reticulata* and various grasses such as *Agropyron spicatum*, *Aristida longiseta* (red three-awn), and *Bromus* spp. (Figure 34 on page 98). The communities also contained a variety of weedy forbs (including *Verbascum* spp., *Hypericum perforatum* [common St. John's wort], *Melilotus alba* [white sweet-clover], and *Physalis longifolia* [long-leaved ground cherry]), as well as other species of shrubs (primarily *Rhus* spp. [sumac; poison ivy]).

Recreation, fire, and livestock were the major disturbance types reported for the *Cyperus schweinitzii* populations. Recreational uses were judged to create slight levels of disturbance at ten sites (48%), moderate levels of disturbance at another ten sites (48%), and a heavy level of disturbance at one site (5%). Disturbance from fire was ranked as slight for nine populations (43%), moderate for eight populations (38%), and heavy for two populations (10%). Disturbance from livestock grazing was determined to be slight at eight sites (38%) and moderate at ten sites (48%).

Trail, alluvial, and flow zone disturbances were also reported for some of the 21 *C. schweinitzii* populations. Disturbance from man-made trails was ranked as slight for five populations (24%) and moderate for four populations (19%). Disturbance from alluvial erosion and/or deposition was judged to be slight at five sites (24%), moderate at two sites (10%), and heavy at one site (5%). Flow zone disturbance was reported as slight for four populations (19%), moderate for one population (5%), and heavy for one population (5%).

#### 3.2.2.2 *Leptodactylon pungens* ssp. *hazeliae* (Hazel's prickly phlox)

*Leptodactylon pungens* ssp. *hazeliae* is a dwarf perennial shrub of the Polemoniaceae (phlox) family (Figure 35 on page 99). Plants are finely stipitate glandular overall, freely branched from the base, and grow in sprawling or mounded form one to two dm tall. Numerous sessile palmate leaves are divided into sharply pointed yet pliable segments 12 to 18 mm long and 0.2 to 0.6 mm wide. The lower leaves are alternate, and the upper leaves are opposite. From April through June, numerous white to lilac flowers two to three cm long are produced in groups of one to three at the ends of herbaceous stems. *Leptodactylon pungens* ssp. *hazeliae* is endemic to dry rock outcrop and talus habitats along the Snake River and lower Salmon River Canyons (Brooks *et al.* 1991, Moseley 1989).

*Leptodactylon pungens* ssp. *hazeliae* is ranked as a "Species of Concern" by the U.S. Fish and Wildlife Service (ICDC 1997, ONHP 1998). This designation signifies that, pending additional supporting data, the species is being reviewed for consideration as a Candidate for listing as Threatened or Endangered under the Endangered Species Act (ONHP 1998). The U.S. Forest Service (USFS) Region 4 classes *L. pungens* ssp. *hazeliae* as "Sensitive", a classification reserved for taxa for which viability is a concern (ICDC 1997). The Bureau of Land Management (BLM) also ranks *L. pungens* ssp. *hazeliae* as "Sensitive". The BLM definition of "Sensitive" includes "[t]axa (1) that are under status review by U. S. Fish and Wildlife Service…, (2) whose numbers are declining so rapidly that federal listing might become necessary, (3) with typically small and widely dispersed populations, or (4) inhabiting ecological refugia or other specialized unique habitats" (ICDC 1997).

The Idaho Conservation Data Center (ICDC) gives *L. pungens* ssp. *hazeliae* a rank of "G5/T1", meaning that over its entire range the species is "[d]emonstrably widespread, abundant, and secure", but that the subspecies *hazeliae* is "[c]ritically imperiled because of extreme rarity…"(ICDC 1997). The ONHP places *L. pungens* ssp. *hazeliae* on "List 1", indicating that the subspecies is "…endangered or threatened throughout [its] range." (ONHP 1998). Finally, the Oregon Department of Agriculture (ODA) classes *L. pungens* ssp. *hazeliae* as a "Candidate" species, (*i.e.*, a native plant species that needs further study to determine its conservation status) (ONHP 1998). *Leptodactylon pungens* ssp. *hazeliae* was designated as one of the eight focus species of concern for the purposes of this special status plant investigation.

Six populations of *Leptodactylon pungens* ssp. *hazeliae* were found in the study area during the 1999 spring survey (Figure 30 on page 95). One vegetative population was located on the Hells Canyon Downstream reach, and five flowering populations were located on the Hells Canyon Reservoir reach. Five populations (83%) are on the Oregon side of the Snake River, and one

(17%) is on the Idaho side of the river. The *L. pungens* ssp. *hazeliae* site on the Downstream Reach is located at Pleasant Valley Rapids (SM 37W), approximately 53 km north of the other five sites. These five populations are scattered over a distance of approximately three km along both shores of Hells Canyon Reservoir, from just south of Thirty-two Point Creek, to just south of Squaw Creek (SM 77W to SM 79W).

There are seven previously-known *Leptodactylon pungens* ssp. *hazeliae* populations in the vicinity of the project. From approximately 1.3 km downstream of the five new sites on the Hells Canyon Reservoir, a large known occurrence extends north on the Idaho side of the reservoir to Eagle Bar; across the river on the Oregon side are two more small populations. All three of these sites lie at least partially within the 50 m study corridor. Four additional known occurrences are scattered along the Downstream reach as far north as the confluence of the Imnaha River. Two of these sites are located within the 50 m study corridor. All new occurrences lie within the range reported for this species.

All *Leptodactylon pungens* ssp. *hazeliae* populations were found growing on dry, steep to vertical cliffs above the MHWM. Three of the six sites (50%) came to within two height-classes above the MHWM, but the other three began above the 20 height-class mark, and all sites extended well past this elevation. Lateral distance from the river varied, but 50% of the populations were located within zero to nine meters of the MHWM. Two populations (33%) were situated at a distance of 30 or more meters from the MHWM, and one population (17%) spanned the entire lateral width of the study corridor. In addition, all of the *L. pungens* ssp. *hazeliae* populations found were small. Fifty percent consisted of approximately 24 to 48 individuals, and the remaining 50% contained only three to ten individuals. Likewise, four of the six sites covered a gross area of 200 $m^2$ or less; the remaining two sites covered approximately 3,000 and 8,000 $m^2$.

Since all of the *Leptodactylon pungens* ssp. *hazeliae* plants found were growing on cliffs, 75% to 90% of the surrounding area consisted of bare rock, with the remaining space inhabited by a sparse upland community of small shrubs, grasses and mixed forbs (Figure 36 on page 99). Dominant associated species included *Gutierrezia sarothrae* (broom snakeweed), *Glossopetalon nevadense* (spiny green-bush), *Agropyron spicatum*, *Bromus tectorum* (cheatgrass), *Penstemon* spp. (penstemon), and *Verbascum thapsus* (common mullein).

The cliff habitats of *L. pungens* ssp. *hazeliae* were found to be relatively undisturbed. Two sites (33%) contained no observable disturbances.

Three sites showed only slight disturbance in one category: one population showed slight disturbance from recreational activities, another population was reported to contain slight flow zone disturbance, and a third population showed slight disturbance from fire. An additional *L. pungens* ssp. *hazeliae* population was determined to contain slight disturbance in both the flow zone and residential activity categories.

### 3.2.2.3 *Mimulus patulus* (stalk-leaved monkey-flower)

*Mimulus patulus* is a slender annual forb of the Scrophulariaceae (figwort) family. Simple or few-branched glandular puberulent stems grow to a height of five to twenty centimeters. Cordate to ovate leaf blades five to twelve millimeters long have toothed edges and petioles one to two times longer than the blades. From May through August, small yellow flowers are produced which average seven to ten millimeters in length, and which are subtended by uniformly-toothed calyces six to seven millimeters long. *Mimulus patulus* is found on damp ground, wet cliffs, and roadcuts from the east slope of the Cascades in Oregon, through Lake and Wallowa Counties to the Snake River Canyon, Idaho (Brooks *et al.* 1991, Peck 1961, Meinke [no date]).

*Mimulus patulus* is ranked as a “Species of Concern” by the USFWS (ICDC 1997, ONHP 1998). The USFS classes *M. patulus* as “Sensitive” (ICDC 1997, ONHP 1998). The ICDC gives *M. patulus* a rank of “G2Q/S1”, meaning that the species is “[i]mperiled because of rarity or because other factors make it demonstrably vulnerable to extinction…” throughout its range, and “[c]ritically imperiled because of extreme rarity…” within the state of Idaho (ICDC 1997). The “Q” ranking indicates that some taxonomic uncertainty exists regarding this species. Within the state of Oregon, the species is ranked S3 meaning that the species is, “Rare, uncommon or threatened, but not immediately imperiled.” (ONHP 1998). The ONHP also places *M. patulus* on “List 4”, indicating that the species is “of conservation concern but [is] not currently threatened or endangered.” (ONHP 1998). Finally, the ODA classes *M. patulus* as “Threatened”, meaning that the species is “likely to become endangered within the foreseeable future” (ONHP 1998). *Mimulus patulus* was designated as one of the eight focus species for the purposes of this rare plant investigation.

One population of *Mimulus patulus* was found in the study area during the 1999 spring survey, on the Oxbow Reservoir reach (Figure 31 on page 96). The population was 25% vegetative and 75% in flower. The site is located on the Oregon side of the reservoir, approximately 2.3 km southeast of Sheep Mountain (SM 105W). There are four previously-known occurrences of *M. patulus* in the vicinity of the project: two on the Idaho side of Oxbow reservoir, approximately 4.8 km and 5.6 km north of the 1999 population; one on the Oregon side of the river approximately 35 km north, on Thirty-two Point Creek (identification tentative); and one approximately 98 km north, near the confluence of Cow Creek and the Imnaha River in Oregon. None of these known occurrences is located within the 50 meter-wide survey corridor.

The *Mimulus patulus* population found during this investigation was growing on gently-sloping, damp, rocky ground in a road cut adjacent to State Route 71. The site is located well above the 20-height-class mark, at a lateral distance of approximately 20 m from the MHWM. An estimated 50 individuals are scattered within an area of approximately nine square meters. Eighty percent of the site consists of bare soil and rock (including a concrete retaining wall), and a community of primarily weedy grasses and forbs make up the vegetative layer (Figure 37 on page 100). Dominant associates include *Bromus tectorum, Poa bulbosa, Artemisia ludoviciana* (prairie sage), *Helianthus annuus* (common sunflower), and *Verbascum thapsus*.

Disturbance from the road corridor is recorded as extreme for this site (although a retaining wall does separate the population from the road). Disturbance from recreation, livestock, and alluvial erosion and/or deposition is recorded as slight.

#### 3.2.2.4 *Teucrium canadense* var. *occidentale* (American wood sage)

*Teucrium canadense* var. *occidentale* is a rhizomatous perennial forb of the Lamiaceae (mint) family (Figure 38 on page 100). Plants reach two to ten decimeters in height, and are covered with spreading pubescence, including many glandular hairs. The opposite leaves have short petioles and lance-ovate or lance-oblong serrate blades three to ten centimeters long. Hairs of the upper leaf surface are often appressed. Terminal glandular-hairy bracteate spikes of crowded, irregularly-shaped purplish flowers bloom from June through August. The spikes range from five to twenty centimeters tall, and the flowers are eleven to eighteen millimeters long. *Teucrium canadense* is widespread on stream banks and moist bottomland habitats throughout most of the U.S. and adjacent parts of Canada and Mexico; the variety *occidentale* occurs in the western part of this range (Hitchcock *et al.* 1959, Hitchcock and Cronquist 1973)

The BLM ranks *Teucrium canadense* var. *occidentale* as “Sensitive” (ICDC 1997). The ICDC classes *T. canadense* var. *occidentale* as “G5/T4/S1”, meaning that over its entire range the species is “[d]emonstrably widespread, abundant, and secure”, and that the variety *occidentale* is “[n]ot rare and apparently secure, but with cause for long-term concern…”; however, within Idaho *T. canadense* var. *occidentale* is “[c]ritically imperiled because of extreme rarity…” (ICDC 1997). *Teucrium canadense* var. *occidentale* was designated as one of the eight focus species for the purposes of this rare plant investigation.

One population of *Teucrium canadense* var. *occidentale* was found in the study area during the 1998 summer survey (Figure 31 on page 96). Plants were 95% vegetative and 5% in fruit. The population is located on the Oregon side of the Hells Canyon Downstream reach, approximately 0.4 km south of the mouth of Temperance Creek (SM 48W). There are three previously-known occurrences of *T. canadense* var. *occidentale* in the project vicinity, all to the south of the 1998 population. The first is approximately 21 km south, near the mouth of Three Creek in Idaho. The second is approximately 26 km south, between Bull Creek and Wild Sheep Creek in Oregon. And the third is approximately 150 km south, near the mouth of the Weiser River in Idaho. Only one of these occurrences is located within the 50 meter-wide survey corridor.

The *Teucrium canadense* var. *occidentale* population found during this investigation was growing on gently-sloping, moist, rocky ground along the shoreline of the Snake River. Plants spanned the MHWM, from one height-class above, to five height-classes below. Horizontal distance from the MHWM ranged from one decimeter above, to two meters below. An estimated fourteen *T. canadense* var. *occidentale* individuals are scattered within an area of approximately six square meters. The site is located within a riparian community dominated by *Acer negundo* (box-elder) and *Spartina pectinata* (prairie cordgrass) (Figure 39 on page 101). Flow zone disturbance is recorded as heavy for this site; recreational disturbance is recorded as slight.

### 3.2.2.5 *Bolandra oregana* (bolandra)

*Bolandra oregana* is a perennial forb of the Saxifragaceae (saxifrage) family (Figure 40 on page 101). Plants are weakly glandular pubescent, and the generally single stems grow to an average height of two to four decimeters. The notched, reniform leaf blades are three to seven centimeters wide, and have petioles up to fifteen centimeters long. Stipules are small near the base of the plant, but become larger and more leaflike towards the inflorescence. Remotely-branched, spreading panicles of one to seven small flowers with linear, purplish-brown petals are produced from May through June. *Bolandra oregana* is found in wet, rocky habitats in the Snake River Canyon and the Columbia River Gorge, as well as along the Imnaha-Snake Divide, and the lower Willamette River in Oregon (Hitchcock *et al.* 1961, Brooks *et al.* 1991).

*Bolandra oregana* is ranked as “Sensitive” by the USFS and the BLM. The ONHP places *B. oregana* on “List 4” (ONHP 1998). The ODA classes *B. oregana* as a “Candidate” (ONHP 1998). *B. oregana* was designated as one of the eight incidental species of concern for the purposes of this rare plant investigation.

Eight populations of *Bolandra oregana* were found during the 1999 spring survey (Figure 31 on page 96). Plants were entirely in fruit at one site, but ranged from 50% to 80% vegetative and 20% to 50% in flower at the remaining seven sites. Four populations were located on the Hells Canyon Downstream reach, one population on the Hells Canyon Reservoir reach, and three on the Oxbow Reservoir reach. Six of the eight populations are on the Oregon side of the Snake River, and the remaining two are on the Idaho side of the river. The four *B. oregana* sites on the Downstream reach are distributed over a distance of approximately 3.7 km along both banks of the river, from Brush Creek Rapids to the mouth of Hells Canyon Creek (SM 69W to 72E). Approximately 34 km to the south, the four sites on the Hells Canyon Reservoir and Oxbow Reservoir reaches are scattered along approximately 16 km of the Oregon shoreline, from near Oxbow Dam, to the mouth of the Wildhorse River (SM 99W to 111W). There are four previously-known populations of *Bolandra oregana* in the vicinity of the project area, all on the Oregon side of the Snake River. Two are located just north of Brownlee Dam, one is on Hells Canyon Creek, and one is northeast of the confluence of Cow Creek and the Imnaha River. None of these sites is situated within the 50 meter-wide survey area.

All *Bolandra oregana* populations were found growing on moist to wet, steep to vertical cliffs above the MHWM. Two of the eight sites (25%) came to within seven and nine height-classes of the MHWM, but most sites (75%) began above the twenty-height-class mark, and all sites extended well past this elevation. Lateral distance from the river varied, but the majority of the populations (six populations or 75%) were located 25 or more meters from the MHWM. The remaining two populations (25%) came to within three meters of the MHWM.

The size of the *Bolandra oregana* populations varied, but 50% contained 200 or more individuals (with the largest estimated at 1,100 individuals). One population (13%) contained an estimated 85 individuals, and the remaining three populations (38%) consisted of only three to twenty-four individuals. Fifty percent of the *B. oregana* sites covered a gross area of 200 $m^2$ or more, with the largest estimated at 1,000 $m^2$. The other 50% of the sites ranged in size from 0.5 $m^2$ to 120 $m^2$.

Since all of the *Bolandra oregana* populations found were growing near seeps or streams in cliffs, much of the surrounding area consisted of bare rock. For five of the eight populations (63%), 50 to 95 percent of the site was bedrock. The remaining space was inhabited by a mixed community of upland shrubs and herbs, as well as a number of riparian species in the wetter areas (Figure 41 on page 102). Dominant associated species include *Rhus radicans* (poison ivy), *Amelanchier alnifolia* (western serviceberry), *Mimulus guttatus* (yellow monkey-flower), *Artemisia ludoviciana, Cystopteris fragilis* (bladder-fern), and *Poa* spp. (bluegrass).

All four *Bolandra oregana* sites on the Downstream reach (50% of the total) contained no observable disturbances. In contrast, the four sites on Hells Canyon and Oxbow Reservoirs were found to be subject to a variety of disturbance types.

Alluvial disturbance was recorded as slight for two of these populations (25% of the total number of *B. oregana* populations found), and extreme for one population (12%). Disturbance from recreational activities was judged to be slight at two sites (25%) and moderate at one site (12%). Road corridor disturbance was reported as slight at two sites (25%) and extreme at one site (12%). In addition, the smallest population of *B. oregana* also contained slight disturbance from livestock grazing, fire, and off-road vehicle use, as well as extreme disturbance from recent bulldozing and brush removal activities.

#### 3.2.2.6 *Carex hystricina* (porcupine sedge)

*Carex hystricina* is a rhizomatous perennial sedge of the Cyperaceae (sedge) family (Figure 42 102). Culms average three to six decimeters in height, with elongate, generally septate nodulose leaves three to nine millimeters wide. Inflorescences, which form from May through June, consist of one erect terminal staminate spike two to four centimeters long, and several pistillate spikes of about the same length, spreading-ascending or nodding on slender peduncles. The lowermost spike is subtended by a well-developed leaf blade. The leaves subtending other spikes are much reduced or wanting. The numerous, crowded, slightly inflated perigynia of the pistillate spikes are subtended by short, hyaline scales one to two millimeters long, with prominent awns two to six millimeters long. Achenes are trigonous. *Carex hystricina* is found in wet riparian habitats throughout much of the U.S. (Hitchcock *et al.* 1969).

*Carex hystricina* is currently placed on "List 2" by the ONHP (1998). The species was designated as one of eight incidental species of concern for the purposes of this special status plant investigation.

Ten populations of *Carex hystricina* were found during the 1998 and 1999 survey seasons (Figure 32 on page 97). Plants were 90% vegetative at two sites, 100% in flower at five sites, and 75% to 100% in fruit at three sites. Three populations were located on the Hells Canyon Downstream reach, and seven were located on the Oxbow Reservoir reach. Six of the ten populations are on the Oregon side of the Snake River, and four are on the Idaho side. The northernmost *C. hystricina* site, on the Downstream reach, is located just upstream from the mouth of Dry Creek, Idaho (SM 55W). Approximately 42 km to the south, the other two Downstream reach sites are located within approximately 5 km of each other, from just north of

Yreka Creek, Oregon (SM 53W) to between Pony and Rush Creeks, Oregon (SM 55W). Approximately 61 km further south, the seven *C. hystricina* sites on the Oxbow Reservoir reach are distributed over a distance of approximately 16 km on both sides of the river, from just south of Oxbow Dam (SM 100W), to the mouth of the Wildhorse River (SM 111W).

There are two previously known occurrences of *Carex hystricina* in the vicinity of the project. The first is on Hells Canyon Reservoir, just south of Homestead, Oregon, and the second is on Oxbow Reservoir, across from the mouth of Warm Springs Creek. Both sites are located in Oregon and are within the 50 meter-wide survey corridor.

The *Carex hystricina* populations were generally found growing in wet, fine to cobbly silt loam soils on low to moderate slopes of zero to fifteen degrees. Four of the populations (40%) were situated entirely below the MHWM along the Snake River, to a minimum elevation of minus three height-classes, and a maximum lateral distance of minus one and one-half meters. The remaining six (60%) were located along tributary drainages, 27 or more meters in lateral distance above the river's MHWM, and well above the twenty-height-class mark in elevation. Two of these tributary populations also extended onto steeper slopes, including one population which contained plants growing in bedrock at the base of a waterfall.

Nine of the ten *Carex hystricina* populations consisted of 50 individuals or fewer. Of these, two were represented by only one plant. The remaining population was estimated at 100 individuals. In addition, 80% of the sites covered 20 $m^2$ or less. The two larger sites were estimated at 800 $m^2$ and 2,000 $m^2$.

*Carex hystricina* plants were found growing in either relatively bare flow zone areas, or relatively lush riparian communities (Figure 43 on page 103). A wide variety of riparian and upland forbs and shrubs were present, including *Iris pseudacorus* (yellow flag), *Mimulus guttatus, Dipsacus sylvestris, Rumex crispus* (curly dock), *Rhus radicans*, and *Celtis reticulata.* Generally these communities contained relatively few graminoid species other than *C. hystricina.*

Seven of the ten *Carex hystricina* sites showed evidence of disturbance in three or more categories. Disturbance from livestock grazing was slight at four sites, moderate at one site, heavy at two sites, and extreme at one site. Disturbance from alluvial erosion and/or deposition was recorded as slight at one site, moderate at four sites, heavy at one site, and extreme at one site. Flow zone disturbance was heavy at one site, and extreme at four sites. Disturbance from recreational activities was slight at four sites and moderate at one site. Slight levels of disturbance by fire were observed at four sites. Disturbance from road corridors was slight at two sites. One site showed heavy impacts from pack trail use, and another site showed slight impacts from non-native weedy species. Finally, one site sustained slight disturbance from off-road vehicle use, as well as extreme disturbance from recent bulldozing and brush removal activities.

## 3.3 DISCUSSION

### 3.3.1 General Considerations

The rare plant portion of this investigation was intended to provide a general representation of the targeted rare plant species within the project area, and not to locate every rare plant population present. The investigators thoroughly surveyed one-quarter of the length of the shoreline within the study area, and performed targeted surveys between units in likely habitat. Because parts of the shoreline in between units were not thoroughly surveyed, it is likely that undiscovered populations of rare plant species exist within the study area. The results of this investigation should be interpreted in this light. If ground disturbing activities are planned within the study area, additional site-specific surveys would be needed to assess potential project-related impacts to rare plant species.

Certain elements of the data collection protocol require the investigator to make subjective judgements about various factors. The disturbance type ratings, the vigor and site quality assessment, the assessment of the apparent trend of the population, and the assessment of the potential threats to the survival of the population are all subject to considerable individual interpretation. The investigators met on a regular basis during the field season to discuss these issues in an attempt to standardize data collection for the project. While this minimizes investigator bias, some differences in interpretation inevitably remain, and this should be remembered when interpreting the results.

### 3.3.2 Potential Impacts to Species of Concern

It is difficult to predict impacts to special status plant populations based on observed disturbance levels within the populations. Little is known about how these species respond to various disturbances, and which habitat factors promote or inhibit the survival of the populations. It is possible that certain of the recorded disturbances (for example Fire or Alluvial) may have a beneficial effect on some of the species of concern. Other disturbances (such as ORV Use or Livestock) may have a detrimental effect. Although these effects have not been quantified in the literature, certain general assumptions can be made.

It can be assumed, for instance, that permanent or long-term seasonal inundation of non-emergent plant populations would likely result in the eradication of those populations. With the possible exception of *Carex hystricina*, all of the six special status species found during this investigation fall into this non-emergent category, and would likely be adversely affected if water levels permanently rise and inundate populations.

Conversely, a long-term drying of the soil would be expected to have an adverse effect on those species requiring moist habitats to survive. Of the special status species found, *Bolandra oregana*, *Carex hystricina*, *Mimulus patulus*, and *Teucrium canadense* var. *occidentale* are all associated with riparian habitats. As expected, all of the populations of the above four species found during this investigation were growing where the soil was moist, saturated, or (in a few cases) inundated at the time the data were recorded. For all four of these species, significant long-term lowering of soil moisture levels within the site would likely have a detrimental effect on the viability of the population.

Specific to the river and reservoirs, eight of the forty-seven populations of special status plant species found during the investigation were located partly or completely below the MHWM, which may place these populations at risk if changes are made to river or reservoir water levels. These eight populations include one population of *Teucrium canadense* var. *occidentale*, three populations of *Cyperus schweinitzii*, and four populations of *Carex hystricina*. While these species do survive occasional flooding when water levels are highest, they are not found in fully aquatic habitats. Therefore it must be assumed that permanently elevated water levels would eventually kill any fully submerged plants.

Impacts to these eight populations from permanently lowered water levels would vary. *Cyperus schweinitzii* is a vigorous species which grows in a variety of habitats. Were the river level to fall and remain low indefinitely, it is likely that the *C. schweinitzii* populations (both above and below the MHWM) would suffer few if any negative impacts, and would perhaps even colonize the newly exposed riverbank. Impacts to *T. canadense* var. *occidentale* and *C. hystricina* would depend on how far the water level dropped. If the soil remained moist throughout the year, these populations would likely be able to survive. But if the soil became permanently drier, it is possible that these populations would be eradicated.

The remaining 39 rare plant populations that were situated entirely above the MHWM can be expected to be negatively impacted only by permanently elevated water levels. In such a situation, as mentioned above, fully submerged plants would eventually die. Lowered river or reservoir levels would likely not affect these populations, because they already grow in dry habitats, or because they grow along tributary seeps or streams which would continue to flow independent of the river or reservoir level.

As mentioned above, the effect that changes in other disturbance levels would have on special status plant populations is difficult to predict. It can be assumed, however, that severe ground disturbance within a population, resulting from such activities as road construction, agricultural clearing, recreational facility development, or other ground or vegetation modifying activities, would adversely affect the population. This is more likely to be a factor on the Hells Canyon Reservoir, Oxbow Reservoir, and Weiser reaches where human activity levels are highest. In many cases, where these intensive ground disturbing activities are proposed, pre-construction impact assessment studies, coupled with project-specific mitigation efforts, will reduce effects on rare plants significantly.

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# Tables

## Table 1: Noxious Weeds and Other Invasive Species Considered During the Study

| | Scientific Name | Common Name | IPCo Code[1] | ID List[2] | OR List[3] |
|---|---|---|---|---|---|
| | *Abutilon theophrasti* | velvetleaf | | | X |
| | *Acaena novae-zelandiae* | biddy-biddy | | | X |
| * | *Aegilops cylindrica* | jointed goatgrass | AECY | X | X |
| | *Aegilops ovata* | ovate goatgrass | | | X |
| | *Aegilops tauschii* | Tausch's goatgrass | | | X |
| | *Aegilops triuncialis* | barbed goatgrass | | | X |
| | *Aegilops ventricosa* | bulbed goatgrass | | | X |
| * | *Agropyron repens* | quackgrass | AGRE | | X |
| | *Alhagi pseudalhagi* | camelthorn | | | X |
| | *Ambrosia artemisiifolia* | ragweed | | | X |
| | *Ambrosia tomentosa* | skeletonleaf bursage | | X | X |
| * | *Amorpha fruiticosa* | false indigo | AMFR | | |
| * | *Cardaria draba* | whitetop | CADR | X | X |
| * | *Carduus nutans* | musk thistle | | X | X |
| | *Carduus pycnocephalus* | Italian thistle | | | X |
| | *Carduus tenuiflorus* | slender-flowered thistle | | | X |
| | *Carthamus baeticus* | smooth distaff thistle | | | X |
| | *Carthamus lanatus* | woolly distaff thistle | | | X |
| | *Carthamus leucocaulos* | whitestem distaff thistle | | | X |
| | *Carthamus oxycantha* | wild safflower | | | X |
| | *Centaurea calcitrapa* | purple starthistle | | | X |
| * | *Centaurea diffusa* | diffuse knapweed | CEDI | X | X |
| | *Centaurea iberica* | Iberian starthistle | | | X |
| | *Centaurea macrocephala* | big-headed knapweed | | | X |
| * | *Centaurea maculosa* | spotted knapweed | CEMA | X | X |
| | *Centaurea nigrescens* | short-fringed knapweed | | | X |
| | *Centaurea pratensis* | meadow knapweed | | X | X |
| * | *Centaurea repens* | Russian knapweed | | X | X |
| * | *Centaurea solstitialis* | yellow starthistle | CEST | X | X |
| | *Centaurea trichocephals* | feather-headed knapweed | | | X |
| | *Centaurea virgata* | squarrose knapweed | | | X |
| * | *Chondrilla juncea* | rush skeletonweed | CHJU | X | X |
| * | *Cirsium arvense* | Canada thistle | CIAR | X | X |
| * | *Cirsium vulgare* | bull thistle | CIVU | | X |
| * | *Conium maculatum* | poison hemlock | COMA4 | X | X |
| * | *Convolvulus arvensis* | field bindweed | COAR | X | X |
| * | *Crupina vulgaris* | common crupina | | X | X |
| * | *Cuscuta spp* | dodder | CUSCU | | X |
| * | *Cynoglossum officinale* | houndstongue | CYOF | | X |
| | *Cyperus esculentus* | yellow nutsedge | | | X |
| | *Cyperus rotundus* | purple Nutsedge | | | X |
| | *Cytisus monspessulanus* | French broom | | | X |

| | Scientific Name | Common Name | IPCo Code[1] | ID List[2] | OR List[3] |
|---|---|---|---|---|---|
| | *Cytisus scoparius* | Scotch broom | | X | X |
| | *Cytisus striatus* | Portuguese broom | | | X |
| * | *Daucus carota* | wild carrot | | X | |
| | *Elodea densa* | South American waterweed | | | X |
| * | *Elaeagnus angustifolia* | Russian-olive | ELAN | | |
| | *Equisetum arvense* | western horsetail | | | X |
| | *Equisetum telmateia* | giant horsetail | | | X |
| | *Euphorbia dentata* | toothed spurge | | X | |
| * | *Euphorbia esula* | leafy spurge | EUES | X | X |
| | *Halogeton glomeratus* | halogeton | | | X |
| | *Helianthus ciliaris* | Texas blueweed | | | X |
| | *Hemizonia pungens* | spikeweed | | | X |
| | *Heracleum auranthiacum* | orange hawkweed | | X | |
| | *Heracleum mantegazzianum* | giant hogweed | | | X |
| | *Heracleum pratense* | yellow hawkweed | | X | |
| | *Hydrilla verticillata* | hydrilla | | | X |
| * | *Hyoscyamus niger* | henbane | | X | |
| * | *Hypericum perforatum* | St. Johnswort (Klamath weed) | HYPE | | X |
| * | *Isatis tinctoria* | dyers woad | ISTI | X | X |
| * | *Kochia scoparia* | kochia | KOSC | | X |
| * | *Lepidium latifolium* | perennial pepperweed | LELA | X | X |
| | *Lepyrodiclis holosteoides* | lepyrodiclus | | | X |
| * | *Linaria dalmatica* | dalmatian toadflax | LIDA | X | X |
| * | *Linaria vulgaris* | yellow toadflax | | X | X |
| * | *Lythrum salicaria* | purple loosestrife | LYSA | X | X |
| | *Milium verale* | milium | | X | |
| | *Myriophyllum spicatum* | Eurasian watermilfoil | | | X |
| | *Nardus stricta* | matgrass | | | X |
| * | *Onopordum acanthium* | Scotch thistle | ONAC | X | X |
| | *Panicum milicaeum* | wild proso millet | | | X |
| | *Peganum harmala* | African rue | | | X |
| * | *Phalaris arundinacea* | reed canarygrass | PHAR | | |
| * | *Polygonum cuspidatum* | Japanese knotweed | | | X |
| | *Polygonum polystachyum* | Himalayan knotweed | | | X |
| | *Polygonum sachalinense* | giant knotweed | | | X |
| * | *Potentilla recta* | sulfur cinquefoil | PORE | | X |
| | *Pueraria lobata* | kudzu | | | X |
| | *Rorippa sylvestris* | creeping yellow cress | | | X |
| * | *Salvia aethiopis* | Mediterranean sage | SAAE | | X |
| * | *Senecio jacobaea* | tansy ragwort | | X | X |
| | *Silybum marianum* | milk thistle | | | X |
| * | *Solanum elaegnifolium* | silverleaf nightshade | | X | X |
| * | *Solanum rostratum* | buffaloburr | | X | X |
| * | *Sonchus arvensis* | perennial sowthistle | | X | |
| | *Sorghum halepense* | Johnsongrass | | X | X |

| | Scientific Name | Common Name | IPCo Code[1] | ID List[2] | OR List[3] |
|---|---|---|---|---|---|
| | *Spartina alterniflora* | smooth cordgrass | | | X |
| | *Spartina anglica* | spartina | | | X |
| | *Spartina densiflora* | spartina | | | X |
| | *Spartina patens* | spartina | | | X |
| | *Spartium junceum* | Spanish broom | | | X |
| | *Sphaerophysa salsula* | Austrian peaweed | | | X |
| * | *Taeniatherum caput-medusae* | medusahead rye | TACA | | X |
| * | *Tamarix* spp. | salt cedar | | | |
| * | *Tribulus terrestris* | puncturevine | TRTE | X | X |
| | *Tussilago farfara* | coltsfoot | | | X |
| | *Ulex europaeus* | gorse | | | X |
| * | *Xanthium spinsosum* | spiny cocklebur | | | X |
| | *Zygophyllum fabago* | Syrian bean-caper | | X | X |

The 41 species which have been flagged with an asterisk (*) are known or highly suspected to occur within the project area and are the focus of the investigation. However, data was collected on any of the species on this list when encountered within the study area.

**IPCo Code[1]** = 1998 species code used as shorthand to describe plant species during IPCo vegetation studies. Not all species on this list have been assigned codes by IPCo.

**ID List[2]** = Those species listed on the State of Idaho's Noxious Weed List (State of Idaho 1996)

**OR List[3]** = Those species listed on the State of Oregon's Noxious Weed List (Oregon Department of Agriculture 1996)

## Table 2: Total Number of Weed Populations Found

| | | No. of weed populations recorded | | | | | |
|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **HC Down-stream** | **HC Res.** | **Oxbow Res.** | **Brownlee Res.** | **Weiser** | **All reaches** |
| *Onopordum acanthium* | Scotch thistle | 38 | 29 | 21 | 119 | 31 | 238 |
| *Amorpha fruticosa* | false indigo | 11 | 47 | 23 | 124 | 14 | 219 |
| *Cynoglossum officinale* | common houndstounge | 48 | 47 | 24 | 52 | 0 | 171 |
| *Hypericum perforatum* | St. John's wort | 112 | 25 | 12 | 2 | 0 | 151 |
| *Lepidium latifolium* | broadleaved pepperweed | 0 | 33 | 21 | 64 | 31 | 149 |
| *Convolvulus arvensis* | field morning glory | 22 | 18 | 13 | 72 | 3 | 128 |
| *Taeniatherum caput-medusae* | medusahead wildrye | 0 | 24 | 23 | 61 | 11 | 119 |
| *Phalaris arundinacea* | reed canarygrass | 3 | 20 | 1 | 62 | 27 | 113 |
| *Tribulus terrestris* | puncturevine | 4 | 34 | 15 | 39 | 3 | 95 |
| *Conium maculatum* | poison hemlock | 1 | 6 | 11 | 42 | 32 | 92 |
| *Cirsium vulgare* | bull thistle | 28 | 26 | 12 | 9 | 6 | 81 |
| *Cardaria draba* | whitetop | 4 | 0 | 3 | 39 | 9 | 55 |
| *Cirsium arvense* | Canada thistle | 2 | 1 | 1 | 20 | 26 | 50 |
| *Tamarix* sp. | tamarisk | 0 | 0 | 0 | 31 | 14 | 45 |
| *Ambrosia artemisiifolia* | annual ragweed | 1 | 15 | 16 | 1 | 0 | 33 |
| *Elaeagnus angustifolia* | Russian olive | 0 | 1 | 3 | 6 | 14 | 24 |
| *Potentilla recta* | erect cinquefoil | 21 | 0 | 0 | 0 | 0 | 21 |
| *Linaria dalmatica* | dalmatian toadflax | 3 | 7 | 0 | 9 | 0 | 19 |
| *Chondrilla juncea* | rush skeletonweed | 6 | 0 | 0 | 11 | 0 | 17 |
| *Kochia scoparia* | kochia | 0 | 0 | 1 | 8 | 5 | 14 |
| *Lythrum salicaria* | purple loosestrife | 0 | 1 | 3 | 5 | 4 | 13 |
| *Cuscuta* sp. | dodder | 0 | 6 | 0 | 2 | 2 | 10 |

| Scientific Name | Common Name | No. of weed populations recorded: HC Down-stream | HC Res. | Oxbow Res. | Brownlee Res. | Weiser | All reaches |
|---|---|---|---|---|---|---|---|
| *Salvia aethiopis* | Mediterranean sage | 0 | 7 | 3 | 0 | 0 | 10 |
| *Equisetum arvense* | common horsetail | 9 | 0 | 0 | 0 | 0 | 9 |
| *Agropyron repens* | quackgrass | 1 | 1 | 1 | 4 | 0 | 7 |
| *Cyperus esculentus* | yellow nut sedge | 6 | 0 | 0 | 1 | 0 | 7 |
| *Centaurea diffusa* | diffuse knapweed | 0 | 6 | 0 | 0 | 0 | 6 |
| *Aegilops cylindrica* | jointed goatgrass | 0 | 1 | 2 | 0 | 0 | 3 |
| *Euphorbia esula* | leafy spurge | 0 | 0 | 0 | 1 | 2 | 3 |
| *Crupina vulgaris* | common crupina | 1 | 0 | 0 | 0 | 0 | 1 |
| *Daucus carota* | wild carrot | 0 | 0 | 0 | 1 | 0 | 1 |
| *Polygonum cuspidatum* | Japanese knotweed | 0 | 1 | 0 | 0 | 0 | 1 |
| | **Totals** | **321** | **356** | **209** | **785** | **234** | **1905** |

This table gives the total number of populations recorded for a particular species. For example, 4 populations of *Agropyron repens* were found within the Brownlee Reservoir reach, and 7 populations of the species were found in all of the units surveyed (405 units). Note that where two units are adjoining (*e.g.* units 040-4E and 041-1E), a single population may span the dividing line and be located in both units.

## Table 3: Weed Species Presence by reach

| | | -----------No. of Units in which Species is Present (% of surveyed units)--------- | | | | | |
|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **HC Down-stream** | **HC Res.** | **Oxbow Res.** | **Brownlee Res.** | **Weiser** | **Total** |
| *Onopordum acanthium* | Scotch thistle | 35 (28%) | 27 (50%) | 23 (88%) | 110 (66%) | 31 (94%) | 226 (56%) |
| *Amorpha fruticosa* | false indigo | 10 (8%) | 39 (72%) | 22 (85%) | 112 (67%) | 12 (36%) | 195 (48%) |
| *Cynoglossum officinale* | common houndstounge | 41 (33%) | 44 (81%) | 22 (85%) | 49 (30%) | 0 | 156 (39%) |
| *Hypericum perforatum* | St. John's wort | 110(87%) | 21 (39%) | 12 (46%) | 2 (1%) | 0 | 145 (36%) |
| *Lepidium latifolium* | broadleaved pepperweed | 0 | 28 (52%) | 22 (85%) | 64 (39%) | 31 (94%) | 145 (36%) |
| *Taeniatherum caput-medusae* | medusahead wildrye | 0 | 22 (41%) | 24 (92%) | 63 (38%) | 10 (30%) | 119 (29%) |
| *Convolvulus arvensis* | field morning glory | 21 (17%) | 15 (28%) | 13 (50%) | 61 (37%) | 3 (9%) | 113 (28%) |
| *Phalaris arundinacea* | reed canarygrass | 2 (2%) | 17 (31%) | 1 (4%) | 59 (36%) | 26 (79%) | 105 (26%) |
| *Tribulus terrestris* | puncturevine | 4 (3%) | 29 (54%) | 16 (62%) | 36 (22%) | 3 (9%) | 88 (22%) |
| *Conium maculatum* | poison hemlock | 1 (1%) | 6 (11%) | 10 (38%) | 37 (22%) | 32 (97%) | 86 (21%) |
| *Cirsium vulgare* | bull thistle | 25 (20%) | 20 (37%) | 12 (46%) | 9 (5%) | 6 (18%) | 72 (18%) |
| *Cardaria draba* | whitetop | 3 (2%) | 0 | 3 (12%) | 36 (22%) | 9 (27%) | 51 (13%) |
| *Cirsium arvense* | Canada thistle | 2 (2%) | 1 (2%) | 1 (4%) | 19 (11%) | 24 (73%) | 47 (12%) |
| *Tamarix* sp. | tamarisk | 0 | 0 | 0 | 31 (19%) | 14 (42%) | 45 (11%) |
| *Ambrosia artemisiifolia* | annual ragweed | 1 (1%) | 11 (20%) | 16 (62%) | 1 (1%) | 0 | 29 (7%) |
| *Elaeagnus angustifolia* | Russian olive | 0 | 1 (2%) | 3 (12%) | 6 (4%) | 13 (39%) | 23 (6%) |
| *Linaria dalmatica* | dalmatian toadflax | 3 (2%) | 7 (13%) | 0 | 9 (5%) | 0 | 19 (5%) |
| *Potentilla recta* | erect cinquefoil | 18 (14%) | 0 | 0 | 0 | 0 | 18 (4%) |
| *Chondrilla juncea* | rush skeletonweed | 5 (4%) | 0 | 0 | 10 (6%) | 0 | 15 (4%) |
| *Kochia scoparia* | kochia | 0 | 0 | 1 (4%) | 9 (5%) | 5 (15%) | 15 (4%) |
| *Lythrum salicaria* | purple loosestrife | 0 | 1 (2%) | 3 (12%) | 5 (3%) | 4 (12%) | 13 (3%) |
| *Cuscuta* sp. | dodder | 0 | 6 (11%) | 0 | 2 (1%) | 2 (6%) | 10 (2%) |

| | | -----------No. of Units in which Species is Present (% of surveyed units)--------- | | | | | |
|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **HC Down-stream** | **HC Res.** | **Oxbow Res.** | **Brownlee Res.** | **Weiser** | **Total** |
| *Salvia aethiopis* | Mediterranean sage | 0 | 6 (11%) | 3 (12%) | 0 | 0 | 9 (2%) |
| *Equisetum arvense* | common horsetail | 8 (6%) | 0 | 0 | 0 | 0 | 8 (2%) |
| *Agropyron repens* | quackgrass | 1 (1%) | 1 (2%) | 1 (4%) | 4 (2%) | 0 | 7 (2%) |
| *Cyperus esculentus* | yellow nut sedge | 6 (5%) | 0 | 0 | 1 (1%) | 0 | 7 (2%) |
| *Centaurea diffusa* | diffuse knapweed | 0 | 6 (11%) | 0 | 0 | 0 | 6 (1%) |
| *Euphorbia esula* | leafy spurge | 0 | 0 | 0 | 1 (1%) | 2 (6%) | 3 (1%) |
| *Aegilops cylindrica* | jointed goatgrass | 0 | 1 (2%) | 2 (8%) | 0 | 0 | 3 (1%) |
| *Crupina vulgaris* | common crupina | 1 (1%) | 0 | 0 | 0 | 0 | 1 (0%) |
| *Daucus carota* | wild carrot | 0 | 0 | 0 | 1 (1%) | 0 | 1 (0%) |
| *Polygonum cuspidatum* | Japanese knotweed | 0 | 1 (2%) | 0 | 0 | 0 | 1 (0%) |

This table lists the number of quarter-mile units that contain a given species. The value given in parentheses is the percentage of the total surveyed units, (in that particular reach or in the project area as a whole), that contain the given species. For example, *Agropyron repens* was found in 3 of the units surveyed on the Brownlee Reservoir reach, which is 4% of the total units surveyed for that reach. Further, out of the 405 units surveyed on all 5 reaches, *Agropyron repens* was found in 7 units, or 2% of the total. Note that where two units are adjoining (*e.g.* units 040-4E and 041-1E), a single population may span the dividing line and be located in both units.

Total units surveyed for each reach are as follows:

Hells Canyon Downstream reach: 126
Hells Canyon Reservoir reach: 54
Oxbow Reservoir reach: 26
Brownlee Reservoir reach 166
Weiser reach: 33
Total: 405

## Table 4: Average Total Net Area Occupied By Weed Populations Per Unit Surveyed

| | | Average Total Net Area Per Unit ($m^2$) | | | | | |
|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **HC Down-stream** | **HC Res.** | **Oxbow Res.** | **Brownlee Res.** | **Weiser** | **Avg. for all units surveyed** |
| *Taeniatherum caput-medusae* | medusahead wildrye | 0 | 300 | 2000 | 400 | 40 | 300 |
| *Lepidium latifolium* | broadleaved pepperweed | 0 | 6 | 40 | 200 | 1000 | 200 |
| *Conium maculatum* | poison hemlock | 0.008 | 10 | 70 | 40 | 800 | 90 |
| *Hypericum perforatum* | St. John's wort | 200 | 7 | 200 | 0.008 | 0 | 80 |
| *Onopordum acanthium* | Scotch thistle | 30 | 100 | 70 | 90 | 200 | 80 |
| *Tamarix* sp. | tamarisk | 0 | 0 | 0 | 200 | 40 | 80 |
| *Cardaria draba* | whitetop | 7 | 0 | 2 | 100 | 30 | 70 |
| *Phalaris arundinacea* | reed canarygrass | 0.2 | 9 | 0.2 | 80 | 300 | 60 |
| *Amorpha fruticosa* | false indigo | 0.7 | 40 | 40 | 40 | 7 | 20 |
| *Convolvulus arvensis* | field morning glory | 1 | 50 | 30 | 20 | 5 | 20 |
| *Cynoglossum officinale* | common houndstounge | 8 | 20 | 100 | 4 | 0 | 20 |
| *Elaeagnus angustifolia* | Russian olive | 0 | 0.2 | 3 | 2 | 200 | 20 |
| *Kochia scoparia* | kochia | 0 | 0 | 0.06 | 4 | 70 | 8 |
| *Cirsium arvense* | Canada thistle | 0.2 | 0.1 | 0.2 | 5 | 60 | 7 |
| *Linaria dalmatica* | dalmatian toadflax | 0.1 | 5 | 0 | 10 | 0 | 7 |
| *Tribulus terrestris* | puncturevine | 0.1 | 30 | 20 | 5 | 0.8 | 7 |
| *Ambrosia artemisiifolia* | annual ragweed | 0.002 | 10 | 50 | 0.02 | 0 | 5 |
| *Potentilla recta* | erect cinquefoil | 20 | 0 | 0 | 0 | 0 | 5 |
| *Salvia aethiopis* | Mediterranean sage | 0 | 3 | 40 | 0 | 0 | 3 |
| *Cuscuta* sp. | dodder | 0 | 20 | 0 | 0.009 | 0.09 | 2 |
| *Crupina vulgaris* | common crupina | 8 | 0 | 0 | 0 | 0 | 2 |
| *Euphorbia esula* | leafy spurge | 0 | 0 | 0 | 0.005 | 20 | 2 |

| | | Average Total Net Area Per Unit ($m^2$) | | | | | |
|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **HC Down-stream** | **HC Res.** | **Oxbow Res.** | **Brownlee Res.** | **Weiser** | **Avg. for all units surveyed** |
| *Polygonum cuspidatum* | Japanese knotweed | 0 | 7 | 0 | 0 | 0 | 1 |
| *Cirsium vulgare* | bull thistle | 1 | 1 | 4 | 0.05 | 0.7 | 0.8 |
| *Agropyron repens* | quackgrass | 0.004 | 0.7 | 1 | 1 | 0 | 0.6 |
| *Centaurea diffusa* | diffuse knapweed | 0 | 4 | 0 | 0 | 0 | 0.6 |
| *Aegilops cylindrica* | jointed goatgrass | 0 | 4 | 0.6 | 0 | 0 | 0.5 |
| *Equisetum arvense* | common horsetail | 2 | 0 | 0 | 0 | 0 | 0.5 |
| *Lythrum salicaria* | purple loosestrife | 0 | 0.009 | 0.08 | 0.8 | 0.8 | 0.4 |
| *Chondrilla juncea* | rush skeletonweed | 0.7 | 0 | 0 | 0.3 | 0 | 0.1 |
| *Cyperus esculentus* | yellow nut sedge | 0.2 | 0 | 0 | 0.09 | 0 | 0.08 |
| *Daucus carota* | wild carrot | 0 | 0 | 0 | 0.002 | 0 | 0.0007 |

This table lists the average net area occupied by a given species per quarter-mile unit (averaged among all units in the reach including those without any populations of the given species). For example, *Cirsium vulgare* averages a net area of 1 $m^2$ per quarter-mile unit for all units in the Hells Canyon Downstream reach (54 units). Further, the species averages 0.8 $m^2$ per quarter-mile unit for all surveyed units in all five reaches (405 units).

## Table 5: Factors Affecting the PRESENCE of Weed Species

| Species | Alluvial | Flow-zone | Live-stock | Mining | Fire | Road | Rec. | Trail | Ind. | Ag. | Res. | ORV | Other | Relation to Reference Line | Reach | Flow zone Association? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Aegilops cylindrica* | | | | | | x | x | | | | | | | (above) | | (NO) |
| *Agropyron repens* | | | | | x | | | x | | | x | x | x | | | |
| *Ambrosia artemisiifolia* | | | | | | | | | | | x | | | | Oxbow<br>HC Res. | |
| *Amorpha fruticosa* | | XX | | | | | XX | | | | | | | below | | YES |
| *Cardaria draba* | | | x | | | | | | | x | x | | | | Brownlee<br>Weiser | |
| *Centaurea diffusa* | | | | | | x | | | | | | | | | (HC Res.) | |
| *Chondrilla juncea* | | | x | | | | | | | | | | | | Brownlee<br>Downstream | |
| *Cirsium arvense* | | | | | | | | | | x | | | x | | Weiser | |
| *Cirsium vulgare* | | OO | | | | | | | | | | | | | Downstream<br>Oxbow<br>HC Res. | NO |
| *Conium maculatum* | | | | | | | | | | | | | | | Weiser<br>Oxbow<br>Brownlee | |
| *Convolvulus arvensis* | | | | | OO | | | | | | | | | | Downstream<br>Brownlee | |
| *Crupina vulgaris* | | | | | | | | | | | | | | | | |
| *Cuscuta sp.* | | | | | | x | | | | | | | | | | |
| *Cyperus esculentus* | x | x | | | | | | | | | | | | (below) | | (YES) |
| *Cynoglossum officinale* | | OO | | | | OO | | | | | | | | | HC Res.<br>Oxbow<br>Brownlee<br>Downstream | NO |
| *Daucus carota* | | | | | | | | | | | | | | | | |
| *Elaeagnus angustifolia* | | | | | | | | | | x | x | | | | Weiser | |
| *Equisetum arvense* | x | x | | | | | | x | | | | | | (below) | (Downstream) | (YES) |
| *Euphorbia esula* | x | x | | | x | | | | | x | | | | | | |
| *Hypericum perforatum* | | | | | XX | | OO | | | | | | | crosses | Downstream | |
| *Kochia scoparia* | | | | | x | | | | | | | | x | (above) | | (NO) |

| Species | Alluvial | Flow-zone | Live-stock | Mining | Fire | Road | Rec. | Trail | Ind. | Ag. | Res. | ORV | Other | Relation to Reference Line | Reach | Flow zone Association? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Lepidium latifolium* | | XX | | | | | | | | | | | | crosses | Oxbow<br>Weiser<br>HC Res.<br>Brownlee | YES |
| *Linaria dalmatica* | | | | | | x | | x | | | | x | x | | HC Res.<br>Brownlee<br>Downstream | |
| *Lythrum salicaria* | | x | | | | | | | | | | | | (below) | | (YES) |
| *Onopordum acanthium* | | | | | | | | | | | | | XX | crosses<br>above | Brownlee | NO |
| *Phalaris arundinacea* | | XX | | | | | | | | | | | | below | Weiser | YES |
| *Polygonum cuspidatum* | | | | | | | | | | | | | | | | |
| *Potentilla recta* | | | | | | | | x | | | | | | (above) | Downstream | (NO) |
| *Salvia aethiopis* | | | | | | | | | | | | | | (above) | (HC Res.)<br>(Oxbow) | (NO) |
| *Taeniatherum caput-medusae* | | OO | XX | | | | | | | | | | | crosses<br>above | Oxbow<br>Brownlee<br>HC Res. | NO |
| *Tamarix* sp. | | x | | | | | | | | | | x | | below | Downstream<br>HC Res.<br>Oxbow | YES |
| *Tribulus terrestris* | | | OO | | OO | XX | XX | | | | | | | | | |

For disturbance factors: XX = significant positive effect. OO = significant negative effect. x = number of populations too small to analyze, but distribution suggests there may be an association between the weed and the factor (*i.e.*, the disturbance type was recorded more than twice as often in populations of that particular species than across all the populations of all species). In the "Reach" and "Relation to Reference Line" columns, the reach(es) or elevational category(ies) with which the species is most strongly associated are listed. See text and  for full details. Entries in these columns in parentheses indicate that too few populations were found to conduct statistical analyses, but that the distribution suggests that the factor may play a role. Species were determined to have an association with the flow zone, if flow zone disturbance was a positive predictor of weed presence, and/or if the species was significantly associated with the elevational categories "crosses" or "below" reference line. Species with no association with the flow zone are those for which flow zone disturbance is a negative, significant predictor of presence and/or the species is associated with areas above the reference line. Species with no classification in this column did not clearly fall into either category. Entries in the flow zone association column in parentheses indicate that too few populations were found to conduct statistical analyses, but that the distribution of factors suggests that the the stated association (either YES or NO) is valid.

# Table 6: Factors Affecting the SIZE of Weed Populations

| Species | Alluvial | Flow-zone | Live-stock | Mining | Fire | Road | Rec. | Trail | Ind. | Ag. | Res. | ORV | Other | Relation to Reference Line | Reach |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Aegilops cylindrica* | | | | | | | | | | | | | | | |
| *Agropyron repens* | | | | | | | | | | | | | | | |
| *Ambrosia artemisiifolia* | | | | | | | | | | | | | | | Oxbow |
| *Amorpha fruticosa* | | XX | XX | | | | | XX | | XX | | | | | |
| *Cardaria draba* | | | | | | | | | | | | | | crosses | |
| *Centaurea diffusa* | | | | | | | | | | | | | | | |
| *Chondrilla juncea* | | | | | | | | | | | | | | crosses | |
| *Cirsium arvense* | | | | | | | | | | | | | | | |
| *Cirsium vulgare* | | | | | | | | | | | | | | crosses | Oxbow |
| *Conium maculatum* | | | | | | XX | | | | | | | | crosses | Weiser |
| *Convolvulus arvensis* | | | | | | | | XX | | | | | | crosses | |
| *Crupina vulgaris* | | | | | | | | | | | | | | | |
| *Cuscuta sp.* | | | | | | | | | | | | | | | |
| *Cyperus esculentus* | | | | | | | | | | | | | | | |
| *Cynoglossum officinale* | | | | | XX | | | | | XX | | XX | | crosses | Oxbow<br>HC Res.<br>Brownlee |
| *Daucus carota* | | | | | | | | | | | | | | | |
| *Elaeagnus angustifolia* | | | | | | | | | | | | | | | |
| *Equisetum arvense* | | | | | | | | | | | | | | | |
| *Euphorbia esula* | | | | | | | | | | | | | | | |
| *Hypericum perforatum* | | | | | | | | | | | | | | crosses | Downstream |
| *Kochia scoparia* | | | | | | | | | | | | | | | |
| *Lepidium latifolium* | | | | | | | | | | | | | | crosses<br>above | Weiser |
| *Linaria dalmatica* | | | | | | | | | | | | | | | |
| *Lythrum salicaria* | | | | | | | | | | | | | | | |
| *Onopordum acanthium* | | XX | | XX | | | | | | | | | | crosses | Weiser |
| *Phalaris arundinacea* | | | | | | | | | | XX | | | OO | | Weiser |
| *Polygonum cuspidatum* | | | | | | | | | | | | | | | |
| *Potentilla recta* | | | | | | | | | | | | | | | |

| Species | Alluvial | Flow-zone | Live-stock | Mining | Fire | Road | Rec. | Trail | Ind. | Ag. | Res. | ORV | Other | Relation to Reference Line | Reach |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Salvia aethiopis* | | | | | | | | | | | | | | | |
| *Taeniatherum caput-medusae* | | OO | | | | | | | | | | | OO | crosses | Oxbow<br>Brownlee |
| *Tamarix* sp. | | | | | | | | | | | | | | | |
| *Tribulus terrestris* | OO | | | | XX | | | | | | | | | crosses | |

XX = significant positive effect. OO = significant negative effect. In the “Reach” and “Proximity” columns, the reaches, or elevational categories are shown when the effect is significant. The category in which populations of the weed is largest is shown first, and the smallest is shown last. Categories into which no populations of a species fell are not shown.

## Table 7: Summary of Noxious Weed Findings

**Total Number of Populations Found:** 1,905 (32 different species)
**Number of Units with at Least One Weed Population:** 397 (or 98% of 405 units surveyed)

**Average Number of Different Weed Species Per Unit**

| | |
|---|---|
| Hells Canyon Downstream reach (126 total units surveyed) | 2.4 spp./unit |
| Hells Canyon Reservoir reach (54 total units surveyed) | 5.7 spp./unit |
| Oxbow Reservoir reach (26 total units surveyed) | 8.4 spp./unit |
| Brownlee Reservoir reach (166 total units surveyed) | 4.4 spp./unit |
| Weiser reach (33 total units surveyed) | 6.7 spp./unit |
| All reaches (405 total units surveyed) | 4.4 spp./unit |

**Species Which Show a Significant (*) or Suggested Association with Flow zone Areas**

* *Amorpha fruticosa* (false indigo)
*Cyperus esculentus* (yellow nut sedge)
*Equisetum arvense* (common horsetail)
* *Lepidium latifolium* (common pepperweed)
*Lythrum salicaria* (purple loosestrife)
* *Phalaris arundinacea* (reed canarygrass)
* *Tamarix* sp. (tamarisk)

**Species Which Show a Significant (*) or Suggested Association with Non-Flow zone Areas**

*Aegilops cylindrica* (jointed goat grass)
* *Cirsium vulgare* (bull thistle)
* *Cynoglossum officinale* (common houndstounge)
*Kochia scoparia* (kochia)
* *Onopordum acanthium* (Scotch thistle)
*Potentilla recta* (erect cinquefoil)
*Salvia aethiopis* (Mediterranian sage)
* *Taeniatherum caput-medusae* (medusahead wildrye)

**Species Which Show a Significant Positive (+) or Negative (-) Association with a Particular Disturbance Type**

| | |
|---|---|
| *Amorpha fruticosa* (false indigo) | flow zone (+); recreation (+) |
| *Cirsium vulgare* (bull thistle) | flow zone (-) |
| *Convolvulus arvensis* (field morning glory) | fire (+) |
| *Cynoglossum officinale* (common houndstounge) | flow zone (-); road (-) |
| *Hypericum perforatum* (common St. John's wort) | fire (+); recreation (+) |
| *Lepidium latifolium* (common pepperweed) | flow zone (+) |
| *Onopordum acanthium* (Scotch thistle) | other (+) |
| *Phalaris arundinacea* (reed canarygrass) | flow zone (+) |
| *Taeniatherum caput-medusae* (medusahead wildrye) | flow zone (-); livestock (+) |
| *Tribulus terrestris* (puncturevine) | livestock (-); fire (-); road (+); recreation (-) |

*Signficant associations are based on multiple regression analysis. Suggested associations are based on the distribution of predictor variables for a particular species compared to the average distribution across all species.*

## Table 8: Plant Species of Concern for the Rare Plant Investigation

| **SPECIES THAT WERE THE FOCUS OF THIS INVESTIGATION** | | | |
|---|---|---|---|
| **Name** | **Status** | **Habitat** | **ID Period** |
| *Allium geyeri* var. *geyeri* | ONHP: 2<br>USFS: S<br>BLM: S | Low meadows; riparian zones; basaltic shelves; vernally wet scabs | April-June |
| *Cyperus schweinitzii* | ONHP: 2 | Sandy places (wet or dry); in valleys and lowlands | June-Aug. |
| *Leptodactylon pungens* ssp. *hazeliae* | Federal: SOC<br>Idaho CDC: G5/T1<br>ONHP: 1<br>ODA: C<br>USFS: S<br>BLM: S | Rock outcrops and talus slopes | April-June |
| *Mimulus hymenophyllus* | Federal: SOC<br>Idaho CDC: G1/S1<br>ONHP: 1<br>ODA: C<br>USFS: S | Moist cracks in basalt cliffs; steep canyon walls | April-Aug. |
| *Mimulus patulus* | Federal: SOC<br>Idaho CDC: G2Q/S1<br>ONHP: 4<br>ODA: LT<br>USFS: S | Damp ground; wet cliffs; roadcuts. | May-Aug. |
| *Mimulus washingtonensis* ssp. *ampliatus = M. ampliatus* | Idaho CDC: G1/S1<br>BLM: S | Vernal seeps in FEID/POSE grasslands; rock crevices; seeps along streams | June-July |
| *Spiranthes diluvialis* | Federal: LT<br>Idaho CDC: G2/S? | Springs; wet meadows; riparian zones | Aug.-Sept. |
| *Teucrium canadense* var. *occidentale* | Idaho CDC: G5/T4/S1<br>BLM: S | Wet meadows and riparian zones. | Late July-Aug. |
| **SPECIES FOR WHICH DATA WERE COLLECTED IF ENCOUNTERED INCIDENTALLY** | | | |
| *Bolandra oregana* | BLM: S<br>ONHP: 4<br>ODA:C<br>USFS: S | Moist rocky seeps; springs; waterfalls; wet road banks | May-June |
| *Carex backii* | ONHP: 2 | Moist woods or thickets | June-Aug. |
| *Carex hystricina* | ONHP: 2 | Wet ground near streams | June-Aug. |
| *Cicuta bulbifera* | Idaho CDC: G5/S2<br>ONHP: 2X<br>BLM: S<br>USFS: S | Wet places or standing water | July-Aug. |

| Name | Status | Habitat | ID Period |
|---|---|---|---|
| *Epipactis gigantea* | Idaho CDC: G4/S3<br>BLM: S<br>USFS: S | Streambanks; lakes; springs | July-Aug. |
| *Lobaria scrobiculata* | -- | Tree bases; mossy rocks; soil | May-Sept. |
| *Myriophyllum sibiricum* | ONHP: 3 | Ponds; ditches; streams; lakes | June-Sept. |
| *Trifolium douglasii* | ONHP: 1 | Meadows and streambanks | June-Sept. |

**Federal Ranking:**

LE = Listed Endangered. Taxa in danger of extinction throughout all or a significant portion of their range.

LT = Listed Threatened. Taxa likely to be classified as Endangered within the foreseeable future throughout all or a significant portion of their range.

PE = Proposed Endangered. Taxa proposed to be listed as Endangered (formal rulemaking in progress).

PT = Proposed Threatened. Taxa proposed to be listed as Threatened (formal rulemaking in progress).

SC = Species of Concern. Available information supports tracking the status and threats to species because of one or more of the following factors: negative population trends have been documented; habitat is declining or threats to the habitat are known; subpopulations or closely related taxa have been documented to be declining; competition or genetic implications from introduction/stocking of exotic species; identified as a species of concern by agencies or professional societies; or in combination with any of the other criteria, information is needed on status or threats to the species

**Idaho CDC and ONHP Ranking Categories:**

G = Global rank indicator; denotes rank based on rangewide status.
T = Trinomial rank indicator; denotes rangewide status of infraspecific taxa.
S = State rank indicator; denotes rank based on status within Idaho.
1 = Critically imperiled because of extreme rarity or because some factor of its biology makes it especially vulnerable to extinction (typically 5 or fewer occurrences).
2 = Imperiled because of rarity or because other factors demonstrably make it very vulnerable to extinction (typically 6 to 20 occurrences).
3 = Rare or uncommon but not imperiled (typically 21 to100 occurrences).
4 = Not rare and apparently secure, but with cause for long-term concern (usually more than 100 occurrences).
5 = Demonstrably widespread, abundant, and secure.

E = Exotic or introduced.
U = Unknown.
H = Historical occurrence (i.e., formerly part of the native biota with the implied expectation that it might be rediscovered).
X = Presumed extinct or extirpated.
Q = Indicates uncertainty about taxonomic status.
? = Not yet ranked.

**ODA (Oregon Department of Agriculture) Ranking**

LE = Listed Endangered. Endangered species are any native plant species determined by the director of the ODA to be in danger of extinction throughout all or any significant portion of its range.

LT = Listed Threatened. Threatened species are any native plant species the director determines is likely to become endangered within the foreseeable future throughout all or any significant portion of its range.

C = Candidate. Candidate species are any plant species designated for study by the director whose numbers are believed low or declining, or whose habitat is sufficiently threatened and declining in quantity and quality, so as to potentially qualify for listing as a threatened or endangered species in the foreseeable future.

**BLM and USFS Ranking:**

S = Sensitive Species. Both the BLM and the USFS maintain a list of sensitive species which are thought to be in need of protection on agency lands

## Table 9: Rare Plant Species Located

| Species | Total Pops. | Individuals per Pop. | Gross Area m² | Net Area m² | Located in Which Reach(es) |
|---|---|---|---|---|---|
| *Bolandra oregana*<br>(Oregon bolandra) | 8 | avg: 300<br>min: 3<br>max: 1,000 | avg: 300<br>min: 0.5<br>max: 1000 | avg: 6<br>min: 0.3<br>max: 20 | Hells Canyon Downstream; Hells Canyon Reservoir; Oxbow Reservoir |
| *Carex hystricina*<br>(porcupine sedge) | 10 | avg: 30<br>min: 1<br>max: 100 | avg: 300<br>min: 0.2<br>max: 2000 | avg: 7<br>min: 0.2<br>max: 20 | Hells Canyon Downstream; Oxbow Reservoir |
| *Cyperus schweinitzii*<br>(Schweinitz flatsedge) | 21 | avg: 2,000<br>min: 20<br>max: 10,000 | avg: 7,000<br>min: 40<br>max: 50,000 | avg: 200<br>min: 2<br>max: 1,000 | Hells Canyon Downstream |
| *Leptodactylon pungens* ssp. *hazeliae*<br>(Hazel's prickly phlox) | 6 | avg: 20<br>min: 3<br>max: 50 | avg: 3,000<br>min: 0.3<br>max: 10,000 | avg: 10<br>min: 0.3<br>max: 50 | Hells Canyon Downstream; Hells Canyon Reservoir |
| *Mimulus patulus*<br>(Stalk-leaved monkey-flower) | 1 | 50 | 9 | 0.5 | Oxbow Reservoir |
| *Teucrium canadense* var. *occidentale*<br>(American wood sage) | 1 | 14 | 6 | 1 | Hells Canyon Downstream |

**Individuals per Pop.** = total number of individuals per population (average/minimum/maximum); **Gross Area** = area per population, including interstitial spaces, (average/minimum/maximum); **Net Area** = area per population, excluding interstitial spaces not occupied by individuals of the rare species, (average/minimum/maximum). Figures are given to 1 significant digit for **Individuals per Pop.**, **Gross Area**, and **Net Area**.

## Table 10: Rare Plant Populations Found Within the Study Area

| Species | Site Number | Date | Side of River | Gross Area | Individ. | Elev. max/min | Dist. max/min | Disturbance Types | Associated spp. |
|---|---|---|---|---|---|---|---|---|---|
| *Bolandra oregana* | SML07059903 | 06-May-99 | Oregon | 120 | 1,100 | 99/99 | 35/25 | Rec(3); Road(2) | MOPE, GAAP, COMA4, MOSS |
| | PGW15059903 | 15-May-99 | Idaho | 1,000 | 500 | 99/7 | 30/3 | Undisturbed(5) | MIGU, ROCK |
| | PGW15059901 | 15-May-99 | Idaho | 400 | 85 | 99/9 | 8/3 | Undisturbed(5) | MIGU, ROCK |
| | RKM16059902 | 16-May-99 | Oregon | 1,000 | 200 | 99/99 | 60/45 | Undisturbed(5) | MIGU, ROCK |
| | RKM16059901 | 16-May-99 | Oregon | 200 | 200 | 99/99 | 30/25 | Undisturbed(5) | MIGU, ARLU, RHRA, ROCK |
| | MEV03069901 | 03-Jun-99 | Oregon | 45 | 24 | 99/99 | 99/99 | Alluvial(2) | CACU,CERE,PHLE,MIGU,RHRA |
| | SML04069902 | 04-Jun-99 | Oregon | 0.5 | 3 | 99/99 | 45/45 | Alluvial(5); Other(5); Livestock(2); Fire(2); Road(2); Rec(2); ORV(2) | SALIX, RHRA |
| | SML04069903 | 04-Jun-99 | Oregon | 2 | 15 | 99/99 | 25/25 | Road(5); Alluvial(2); Rec(2) | BROMU,CLCO,MIGU, ROWO,PRVI |
| *Carex hystricina* | BJD060998101 | 06-Sep-98 | Oregon | 2,000 | 50 | 99/99 | 99/99 | Alluvial(4); Livestock(2); Fire(2) | RONA,LASE,MEAL,URDI,MEOF |
| | RKM07059904 | 07-May-99 | Idaho | 15 | 100 | 99/99 | 45/40 | Livestock(4); Alluvial(3); Road(2) | RUCR, MIGU, CAHY |
| | RKM19059901 | 19-May-99 | Oregon | 50 | 40 | 99/99 | 45/30 | Alluvial(3); Livestock(2); Fire(2); Rec(2) | MIGU, DISY, RUCR |
| | RKM20059901 | 20-May-99 | Oregon | 10 | 25 | 99/99 | 30/27 | Livestock(4); Trail(4); Alluvial(3); Rec(3); Fire(2) | CAHY, MIGU, DISY |
| | LLM01069901 | 01-Jun-99 | Oregon | 4 | 3 | -1/-2 | -0.1/-1.5 | Flow zone(5) | |
| | SML04069901 | 04-Jun-99 | Oregon | 20 | 30 | 99/99 | 45/40 | Alluvial(5); Livestock(5); Other(5); Fire(2); Road(2); Rec(2); ORV(2) | RHRA, SOLID, VERON, MESA |
| | MEV04069901 | 04-Jun-99 | Oregon | 20 | 24 | 99/99 | 50/40 | Alluvial(3); Other(2) | CAHY, CACU, RHRA, MIGU |
| | LLM04069901 | 04-Jun-99 | Idaho | 800 | 25 | -1/-3 | -0.1/-1.5 | Flow zone(5); Alluvial(3); Livestock(2); Rec(2) | BARE, IRPS, CAVU |
| | LLM04069902 | 04-Jun-99 | Idaho | 0.25 | 1 | -3/-3 | -1/-1 | Flow zone(5); Livestock(2) | RHRA, IRPS, BARE, MESA |
| | LLM04069903 | 04-Jun-99 | Idaho | 0.25 | 1 | -3/-3 | -0.75/ -0.75 | Flow zone(5); Livestock(3); Rec(2) | BARE, MESA |
| *Cyperus schweinitzii* | RKM030998101 | 03-Sep-98 | Oregon | 100 | 150 | 99/99 | 20/15 | Fire(2); Rec(2) | BRTE, VETH, LASE |
| | RSK030998101 | 03-Sep-98 | Idaho | 45,000 | 10,000 | 99/5 | 99/2 | Livestock(3); Fire(3); Alluvial(2); Rec(2); Trail(2) | CERE, SPCR, ARLO, BRCO, BRTE |
| | BJD030998102 | 03-Sep-98 | Oregon | 250 | 250 | 99/99 | 30/25 | Livestock(2); Fire(2); Rec(2) | LASE, BRTE |
| | RSK030998102 | 03-Sep-98 | Idaho | 100 | 750 | 99/99 | 35/24 | Fire(3); Alluvial(2); Livestock(2); Rec(2) | BRTE, CERE, SPCR |

| Species | Site Number | Date | Side of River | Gross Area | Individ. | Elev. max/min | Dist. max/min | Disturbance Types | Associated spp. |
|---|---|---|---|---|---|---|---|---|---|
| *Cyperus schweinitzii* (continued) | BJD030998101 | 03-Sep-98 | Oregon | 250 | 150 | -6/-8 | -3/-8 | Alluvial(4); Flow zone(4); Rec(3); Livestock(2) | |
| | BJD040998102 | 04-Sep-98 | Oregon | 3,000 | 600 | 99/-3 | 30/-2 | Livestock(2); Fire(2); Rec(2); Trail(2) | VETH, VEBL, AGSP |
| | RSK040998104 | 04-Sep-98 | Oregon | 16,000 | 4,000 | 99/1 | 20/0.5 | Livestock(3); Fire(3); Alluvial(2); Flow zone(2); Rec(2) | CERE, SPCR, ARLO, BRCO |
| | RSK040998102 | 04-Sep-98 | Oregon | 800 | 450 | 99/1 | 21/0.2 | Livestock(3); Fire(3); Rec(3); Alluvial(2); Flow zone(2); Trail(2) | CERE, AGSP, BRTE |
| | RSK040998103 | 04-Sep-98 | Idaho | 2,000 | 1,000 | 99/-2 | 40/-0.5 | Livestock(3); Fire(3); Alluvial(2); Flow zone(2); Rec(2) | CERE, AGSP, SPCR, BRTE |
| | BJD040998101 | 04-Sep-98 | Oregon | 10,000 | 1,000 | 99/2 | 40/1.5 | Rec(3); Livestock(2); Fire(2); Trail(2) | ARLO, AGSP, MEAL |
| | RSK040998101 | 04-Sep-98 | Oregon | 2,000 | 1,000 | 99/4 | 35/2.5 | Alluvial(3); Livestock(3); Fire(3); Rec(3); Trail(2) | CERE, BRTE, AGSP |
| | RKM100998102 | 10-Sep-98 | Oregon | 5,000 | 4,000 | 99/2 | 30/2 | Fire(4); Livestock(3); Rec(3); Trail(3) | ARLO, MEAL, VETH |
| | RKM100998101 | 10-Sep-98 | Oregon | 4,000 | 4,000 | 99/99 | 40/7 | Fire(4); Livestock(3); Rec(3); Trail(3) | SEVI, ARLO |
| | BJD110998101 | 11-Sep-98 | Idaho | 50,000 | 8,000 | 99/2 | 99/1 | Flow zone(2); Livestock(2); Fire(2); Rec(2) | SPCR, ARLO, AGSP |
| | RKM110998101 | 11-Sep-98 | Oregon | 3,000 | 2,500 | 99/10 | 25/5 | Fire(3); Rec(2) | AGSP, VETH, ARLO, SEVI |
| | RKM110998102 | 11-Sep-98 | Oregon | 45 | 30 | 99/4 | 20/3 | Livestock(3); Rec(3); Trail(3); Fire(2) | MEAL |
| | RKM110998103 | 11-Sep-98 | Oregon | 8,000 | 3,000 | 99/3 | 99/3 | Livestock(3); Rec(3); Trail(3); Fire(2) | AGSP, BRST, BRTE, PASC, PACA, SEVI |
| | RKM120998101 | 12-Sep-98 | Idaho | 2,000 | 2,000 | 99/99 | 35/5 | Rec(4); Livestock(3); Fire(3); Road(2) | ARLO, SEVI, VEBL |
| | RKM120998102 | 12-Sep-98 | Idaho | 100 | 17 | 5/-2 | 3/-1 | Alluvial(3); Flow zone(3); Rec(3) | BARE |
| | RKM130998101 | 13-Sep-98 | Oregon | 3,500 | 7,000 | 99/99 | 40/7 | Rec(3); Livestock(2); Fire(2) | ARLO, AGSP, PASC, MEAL |
| | BJD130998101 | 13-Sep-98 | Oregon | 500 | 800 | 99/99 | 40/20 | Livestock(2); Fire(2); Rec(2) | VETH, PASC, MEAL |

| Species | Site Number | Date | Side of River | Gross Area | Individ. | Elev. max/min | Dist. max/min | Disturbance Types | Associated spp. |
|---|---|---|---|---|---|---|---|---|---|
| *Leptodactylon pungens* ssp. *hazeliae* | RKM03059901 | 03-May-99 | Oregon | 60 | 3 | 99/99 | 30/30 | Fire(2) | ROCK, CERE, AGSP, GLNE |
| | CWB06059901 | 06-May-99 | Oregon | 8,000 | 48 | 99/2 | 50/0 | Undisturbed(5) | ROCK |
| | CWB06059902 | 06-May-99 | Oregon | 100 | 5 | 99/99 | 9/7 | Undisturbed(5) | ROCK |
| | CWB06059903 | 06-May-99 | Oregon | 200 | 24 | 99/99 | 50/45 | Rec(2) | ROCK |
| | SML07059902 | 07-May-99 | Oregon | 3,000 | 40 | 99/2 | 3/0.5 | Flow zone(2); Residential(2) | ROCK, CLEMA, CEANO, CERE, BRTE |
| | SML07059901 | 07-May-99 | Idaho | 150 | 10 | 99/2 | 5/0.1 | Flow zone(2) | ELEMU, CEANO, LOMAT |
| *Mimulus patulus* | SML03059905 | 03-May-99 | Oregon | 9 | 50 | 99/99 | 24/20 | Road(5); Alluvial(2); Livestock(2); Rec(2) | ARLU, TRIFO, BRTE, POBU, HEAN |
| *Teucrium canadense* var. *occidentale* | BJD100998101 | 10-Sep-98 | Oregon | 6 | 14 | 1/-5 | 0.1/-2 | Flow zone(4); Rec(2) | SPPE |

**Date** = date the population was recorded; **Gross Area** = total area of the population (including interstitial spaces); **Individ.** = total number of individuals (estimated or actual) in the population); **Elev. (max/min)** = maximum and minimum elevations, in 15 cm height classes, above or below the MHWM (99 or -99 is entered where the height class is above or below 20); **Dist. (max/min)** = maximum and minimum horizontal distances, in meters, from the MHWM (99 or –99 is entered where the distances are greater than 50 m; **Disturbance Types** = All recorded disturbances for the population (number in parenthesis is the level of disturbance); **Associated spp.** = the most common associated species.

# Figures

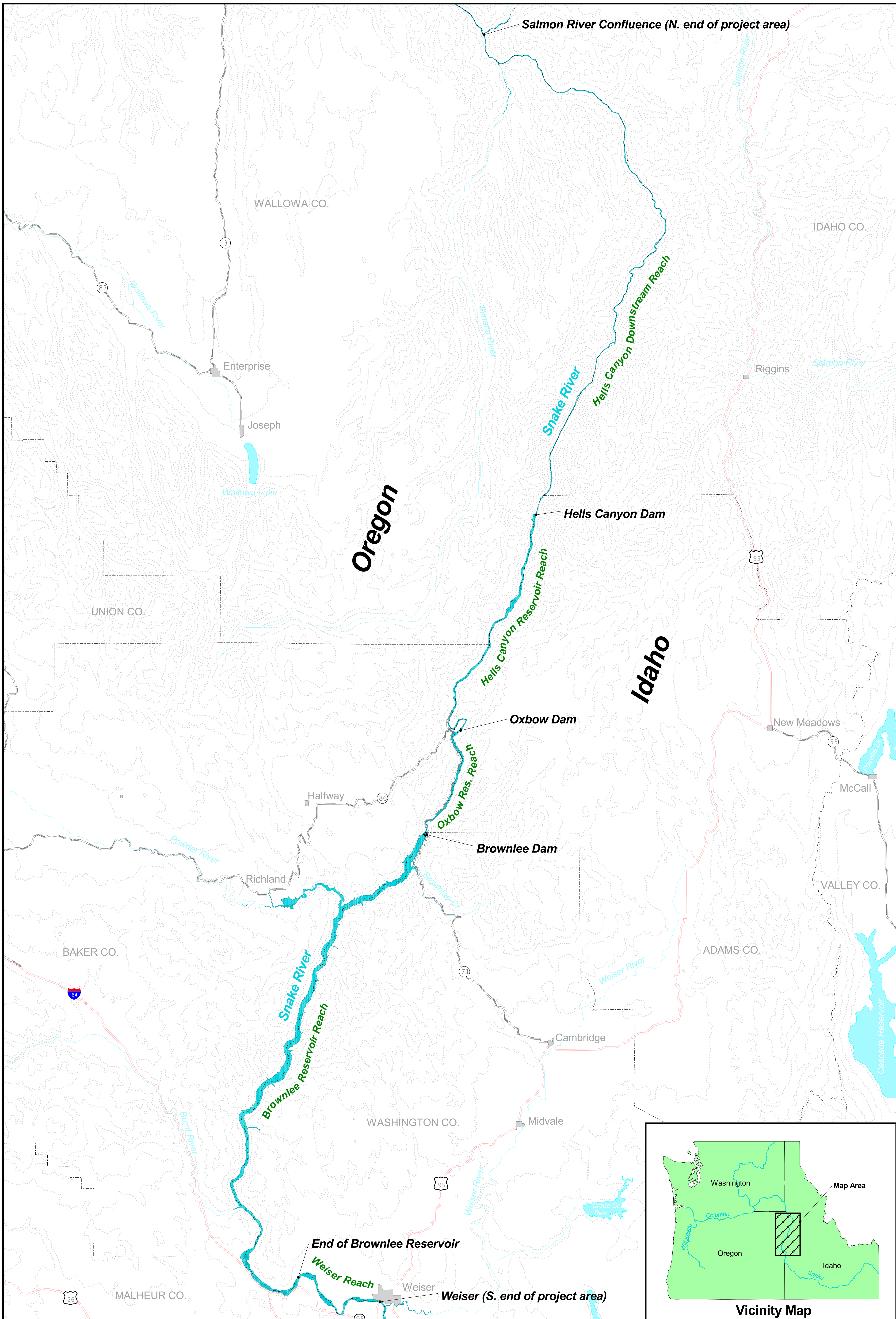


**Figure 1: Project Area Map**

N

Scale 1:500,000

Kilometers

10 0 10 20

Primary Roads

Secondary Roads

County Lines

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November 10, 1999

## Figure 2: Noxious Weed Data Collection Form

### NOXIOUS PLANT OBSERVATION FORM

**IPCo Office Use**
**SITENO:** ____________________
**On Final Maps:** ________

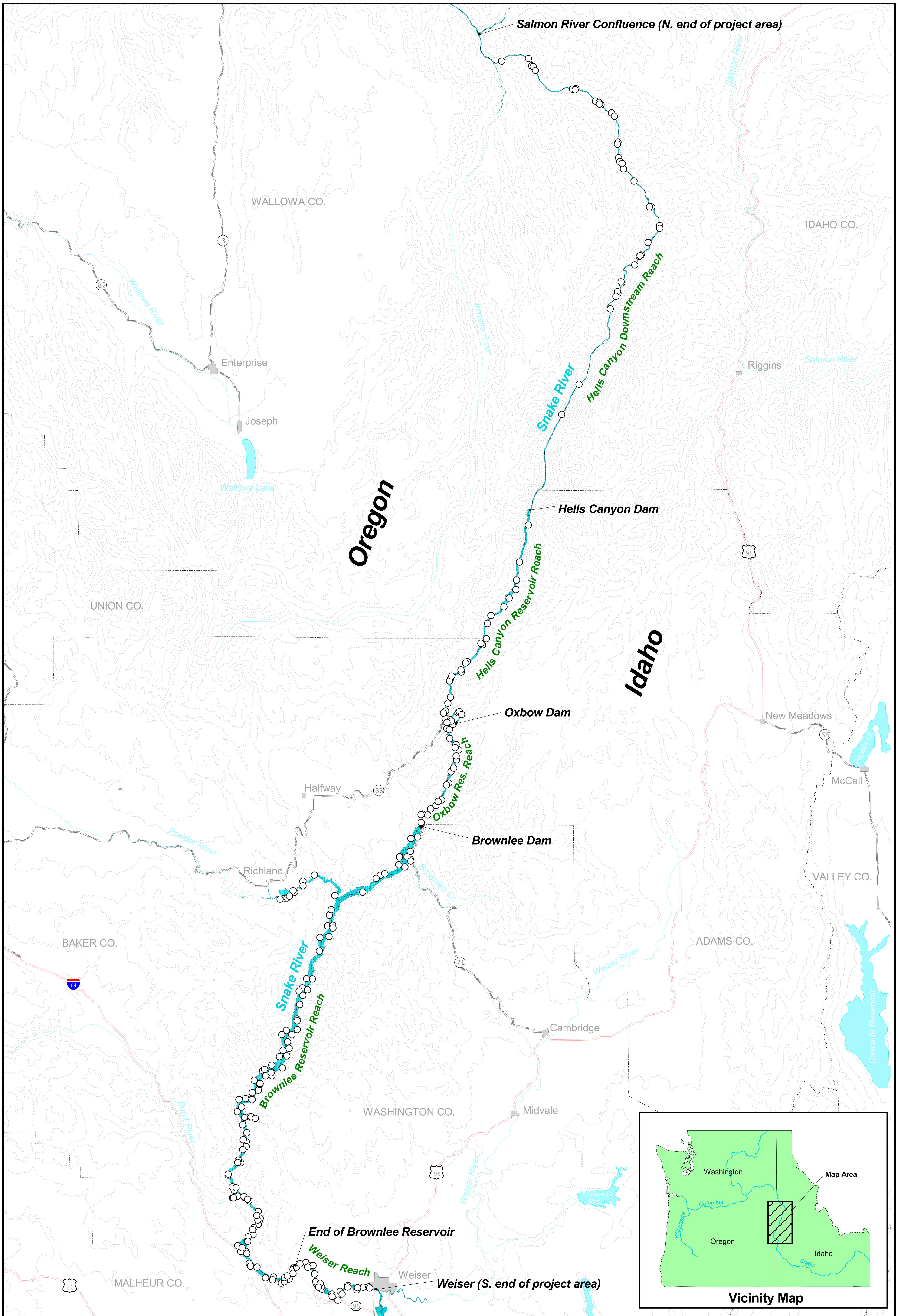
**Common Name:** ______________________________________________
**Sci. Name:** ____________________________ **Sp. Code:** __________
**Site Mapped:** ☐ **Tentative Site Number:** ________________________
**Recorder(s):** ____________________________________
**Date:** _______________ **Time:** _______________ **Photo Roll and No.:** ____________________
**Quad Name:** ______________________________________________ **Slope (degrees):** ______________
**GPS File:** ______________ **UTM Coord.:** ____________N ____________E ____________Elev.
**Asp: Flat N NE E SE S SW W NW Max El ______ Min El ______ Max Dist ______m Min Dist ______m**
**Distance From MHWM to Current WSE:**____________m
**Location:** ______________________________________________________________
______________________________________________________________________
______________________________________________________________________
**Habitat:** ______________________________________________________________
______________________________________________________________________
______________________________________________________________________

| Physiography: | Moisture: | Disturbance Type | | Dist. Level |
|---|---|---|---|---|
| ☐ Wash | ☐ Inundated (hydric) | ______Alluvial | ______Trail | 5=Extreme |
| ☐ Drainage | ☐ Saturated (wet/mesic) | ______Flow Zone | ______Industrial | 4=Heavy |
| ☐ Ridge | ☐ Moist (mesic) | ______Livestock | ______Agricultural | 3=Moderate |
| ☐ Flats | ☐ Dry-Mesic | ______Mining | ______Residential | 2=Slight |
| ☐ Slope | ☐ Dry (xeric) | ______Fire | ______ORV Use | 1=None |
| | | ______Road Corridor | ______Undisturbed | |
| | | ______Recreation | ______Other | |

**Surface Substrate (%):** ______fine sediment ______coarse w/fines ______coarse w/o fines ______bedrock
**Total # of individuals in pop.:**______________actual ______________estimated
**What was counted?** ☐Genets (genetically distinct individuals) or ☐Ramets (stems of a clonal plant)
**Phenology (% of pop.):** ________Vegetative ________Flower ________Fruit ________Dormant
**Pop. age class (%):** _____Seedlings _____Immature _____Mature _____Senescent _____Unknown
**Gross pop. area** __________m² **Net pop. area:** __________m² **Vigor: Excellent Good Fair Poor**
**Percent Cover:** ______Trees ______Shrubs ______Forbs ______Grasses ______Litter ______Bare
**Cover Type:** ____________ **Plant Association:** ______________________________________
**Noxious Plant Dominance Rating: 0 1 2 3 4 5**
**Apparent trend of population: Declining Stable Increasing Unknown**

| Abundant Species | | | Common Species | | | Rare Species | | |
|---|---|---|---|---|---|---|---|---|
| ________ | ________ | ________ | ________ | ________ | ________ | ________ | ________ | ________ |
| ________ | ________ | ________ | ________ | ________ | ________ | ________ | ________ | ________ |
| ________ | ________ | ________ | ________ | ________ | ________ | ________ | ________ | ________ |

**Comments:** ______________________________________________________________
______________________________________________________________________
______________________________________________________________________




## Figure 3: Scotch Thistle Populations

Scale 1:500,000

Kilometers

10 0 10 20

Primary Roads

Secondary Roads

County Lines

Scotch Thistle

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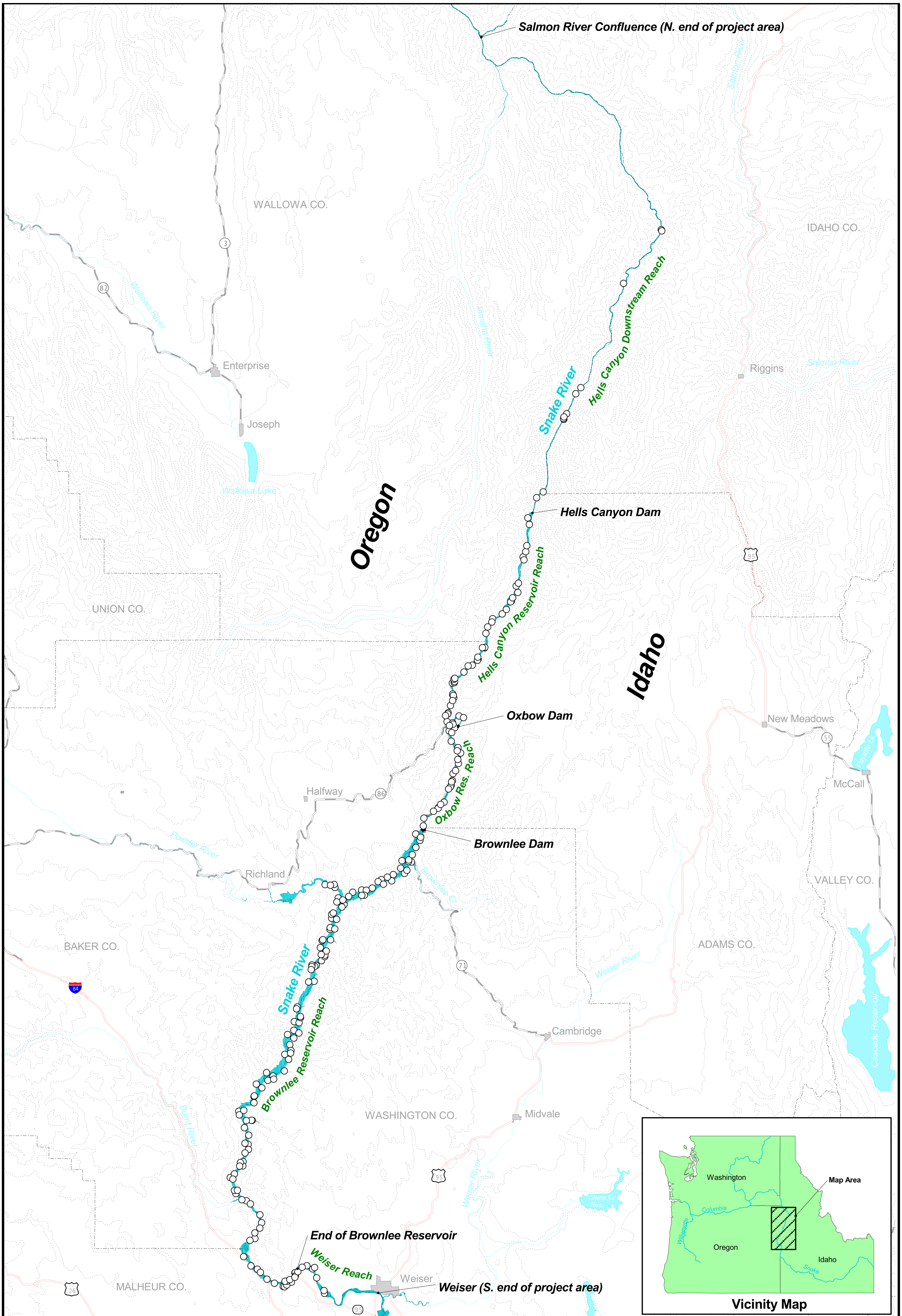


**Figure 4: False Indigo Populations**

N

Scale 1:500,000

Kilometers

10 0 10 20

Primary Roads

Secondary Roads

County Lines

○ False Indigo

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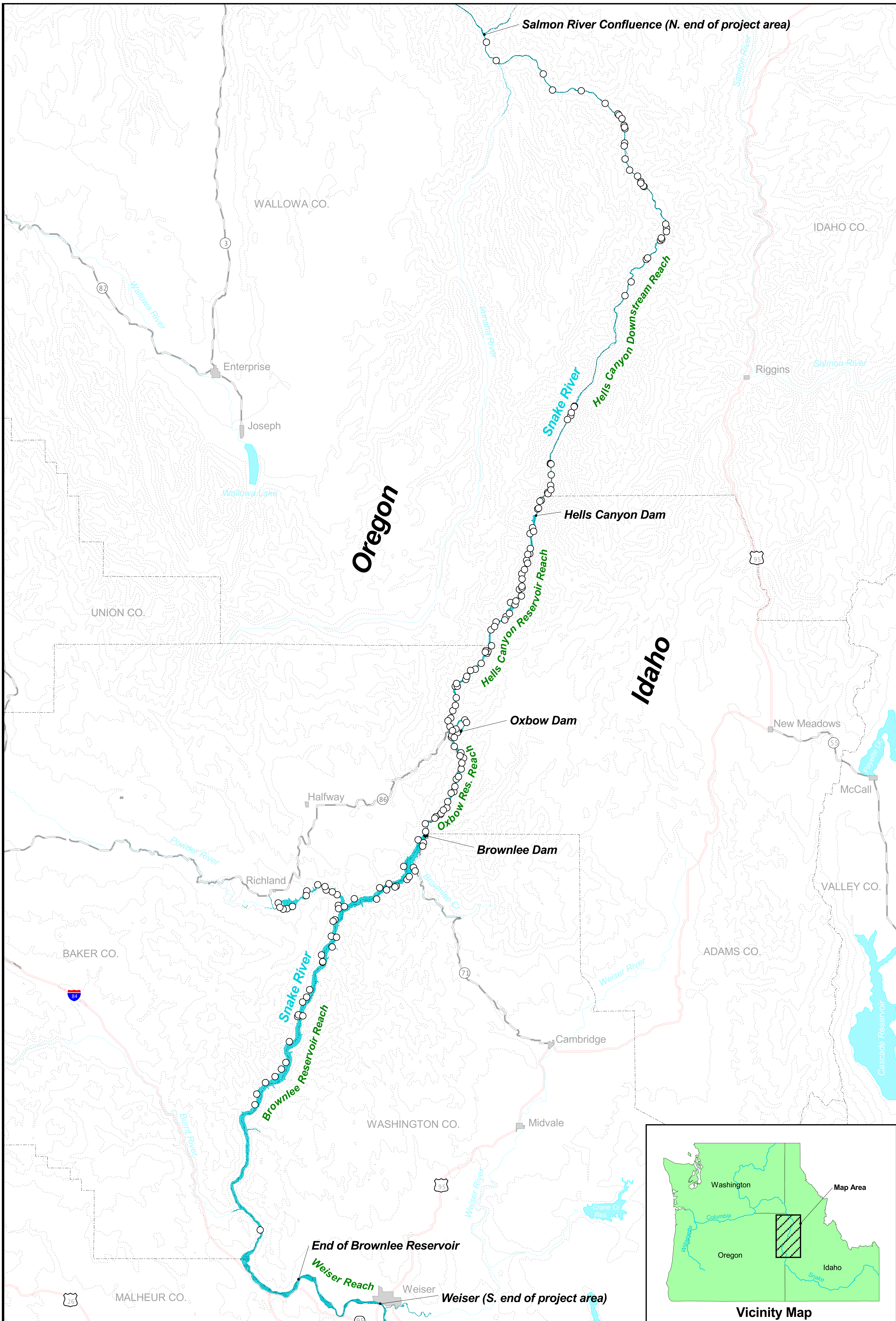


## Figure 5: Common Houndstounge Populations

N

Scale 1:500,000

Kilometers

10 0 10 20

Primary Roads

Secondary Roads

County Lines

○ Common Houndstoungue

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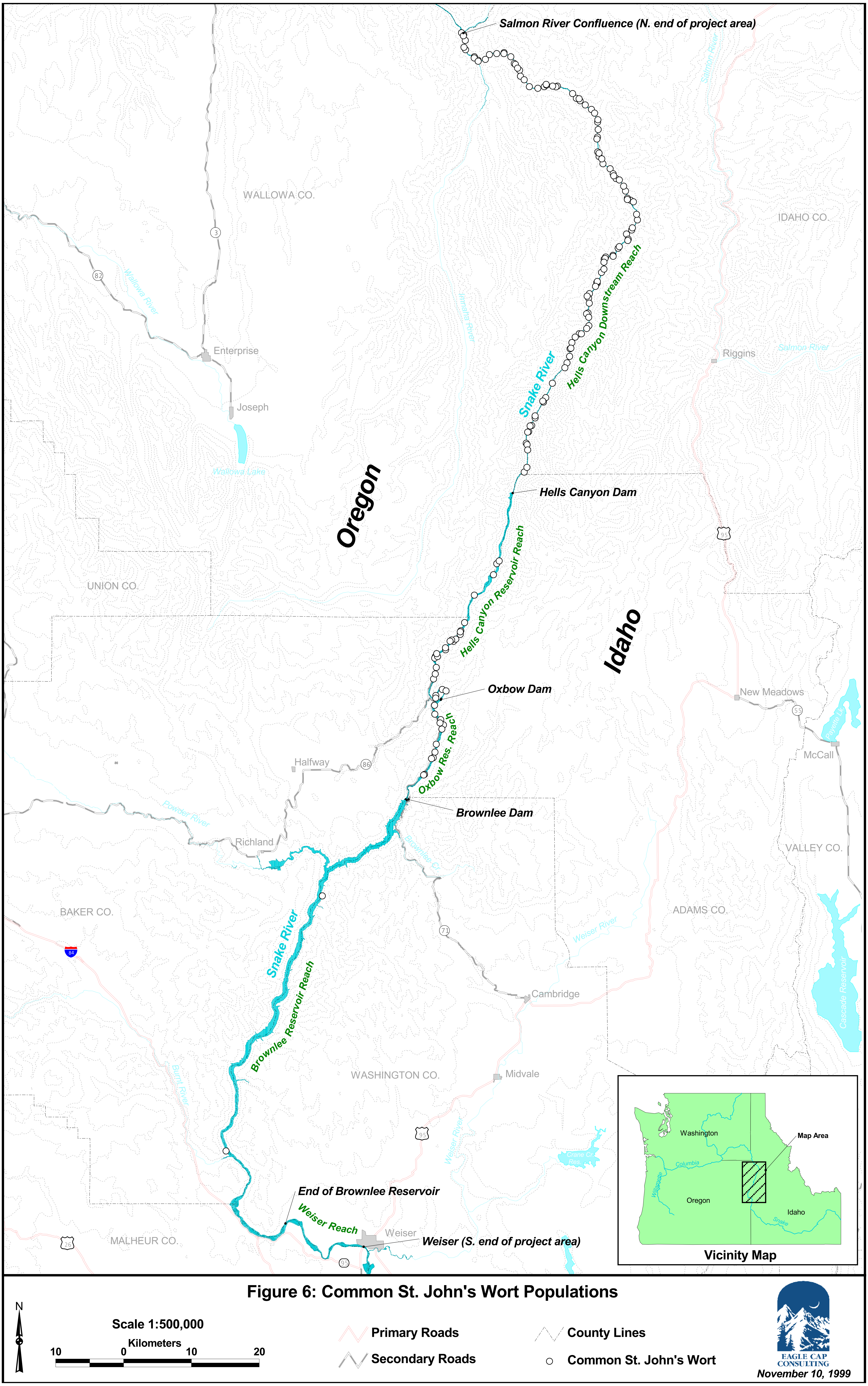



**Figure 6: Common St. John's Wort Populations**

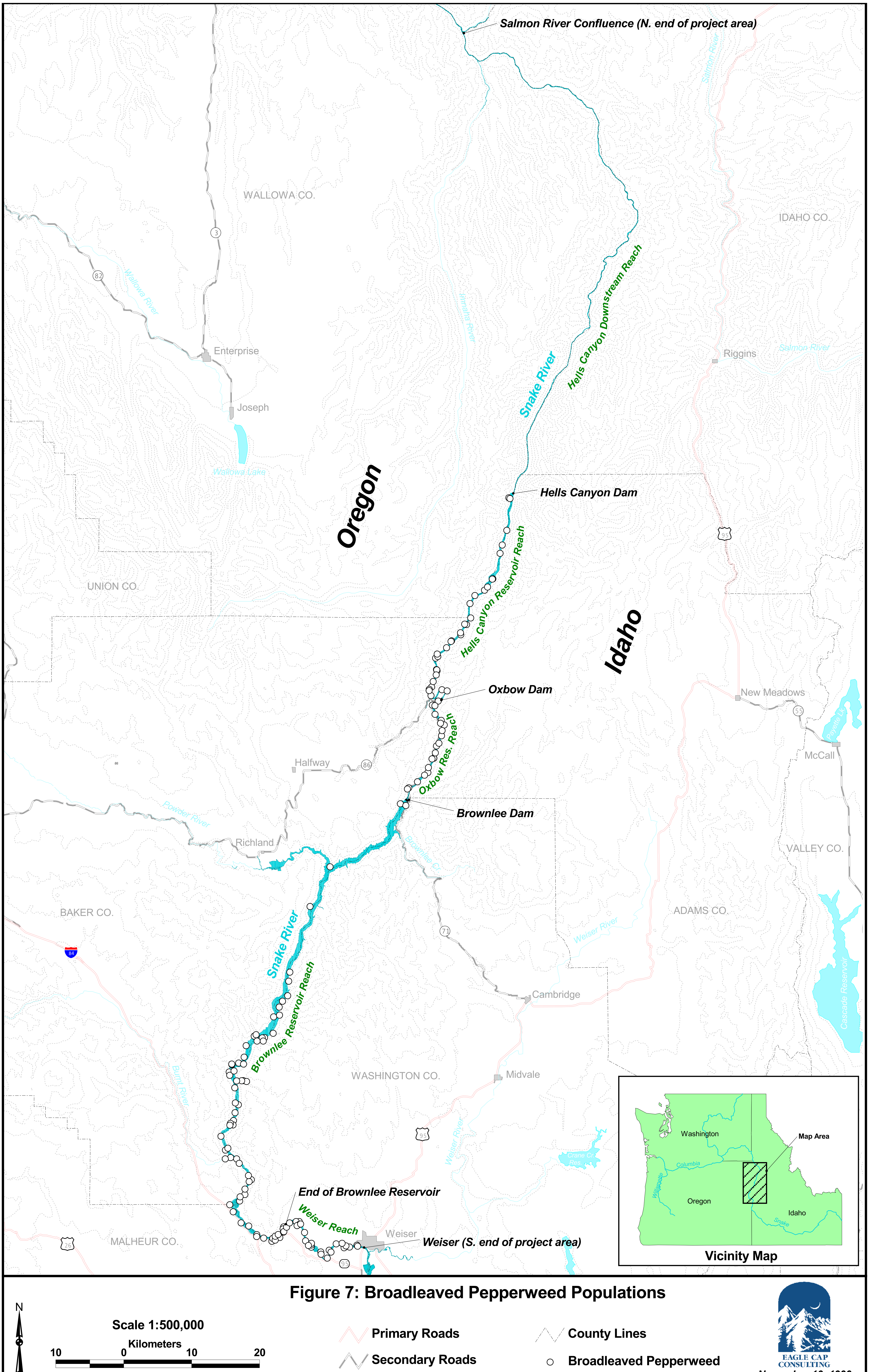
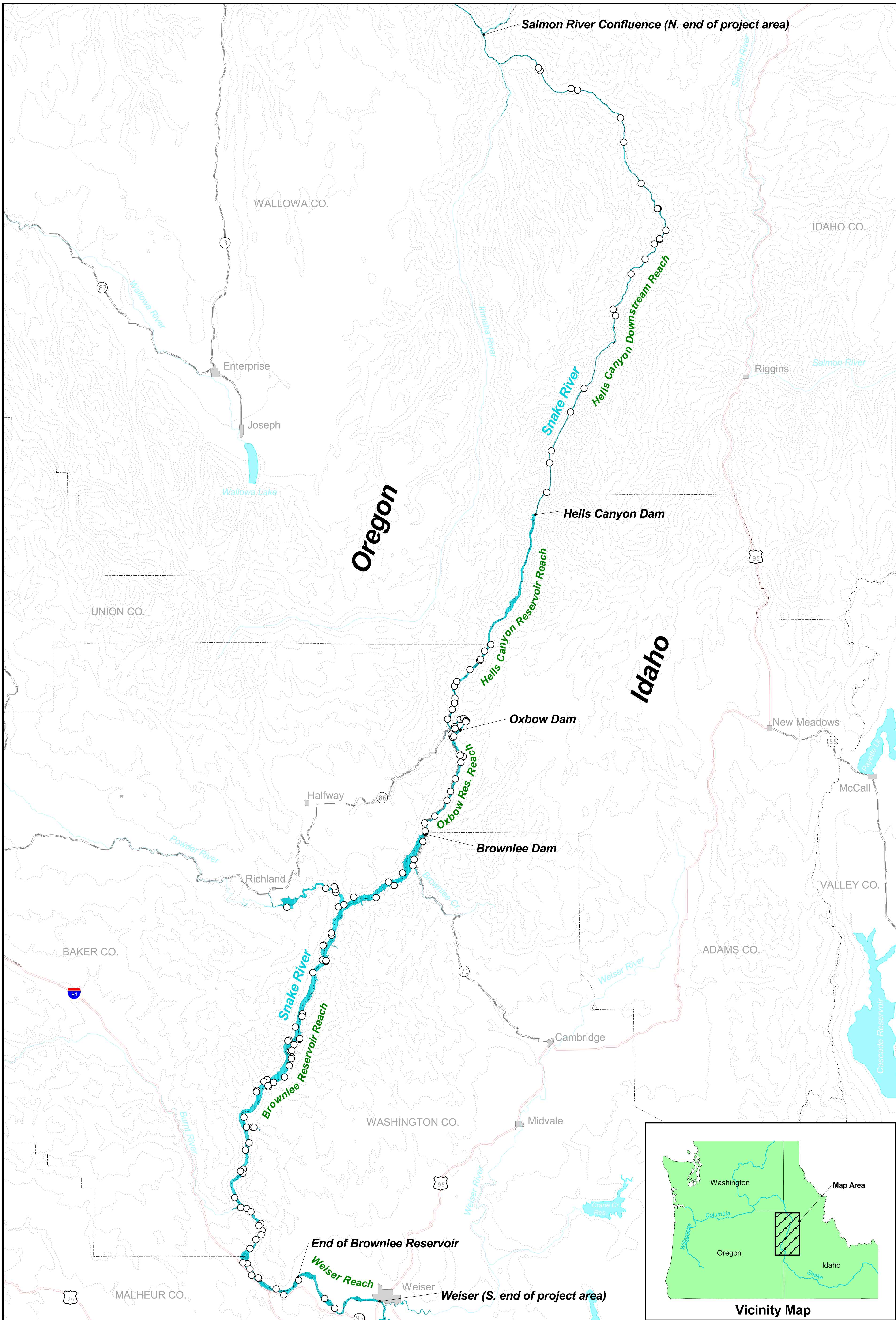



**Figure 7: Broadleaved Pepperweed Populations**




# Figure 8: Field Morning Glory Populations

N

Scale 1:500,000

Kilometers

10 0 10 20

Primary Roads

Secondary Roads

County Lines

○ Field Morning Glory

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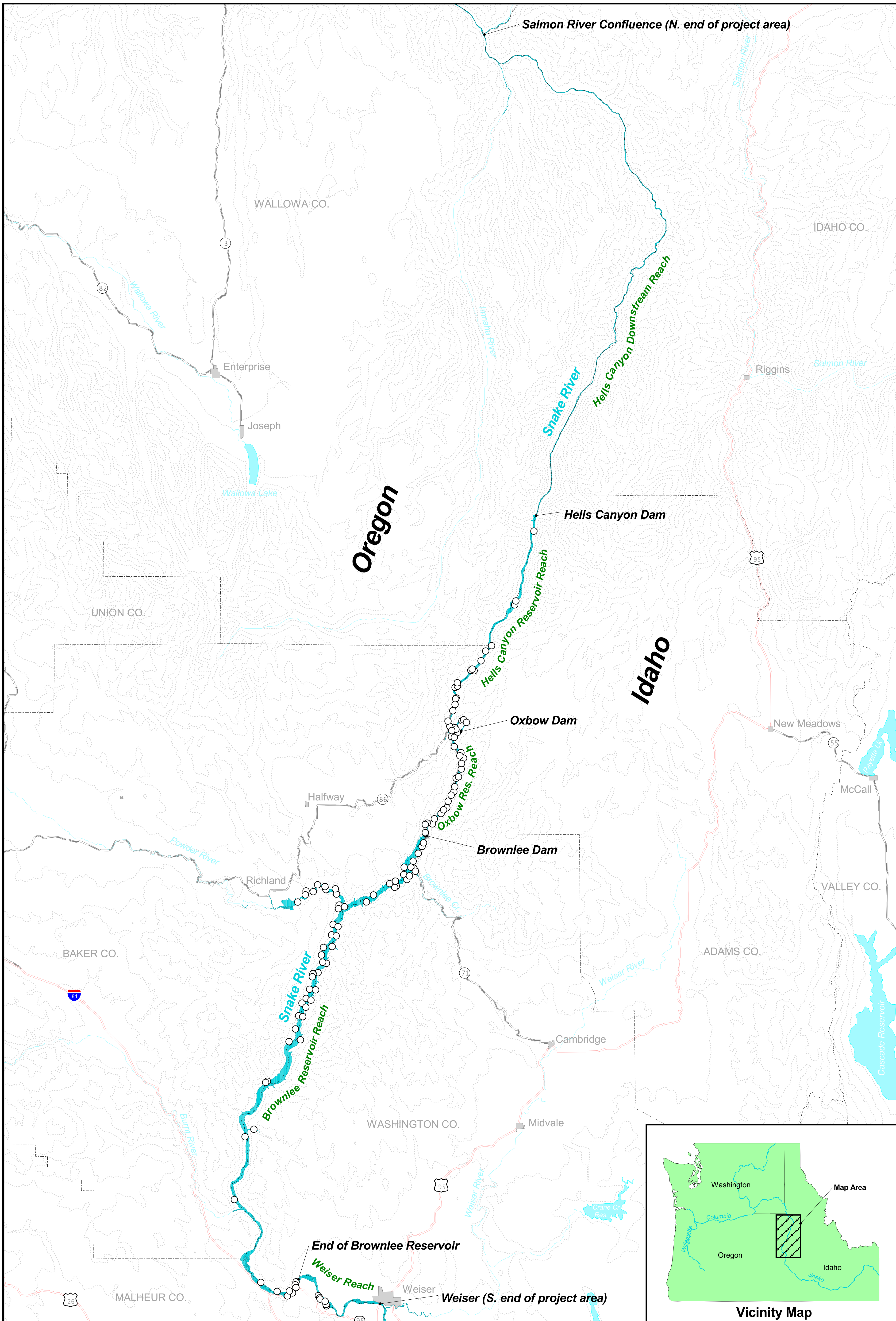


## Figure 9: Medusahead Wildrye Populations

Scale 1:500,000

Kilometers: 10 0 10 20

N

Primary Roads

Secondary Roads

County Lines

○ Medusahead Wildrye

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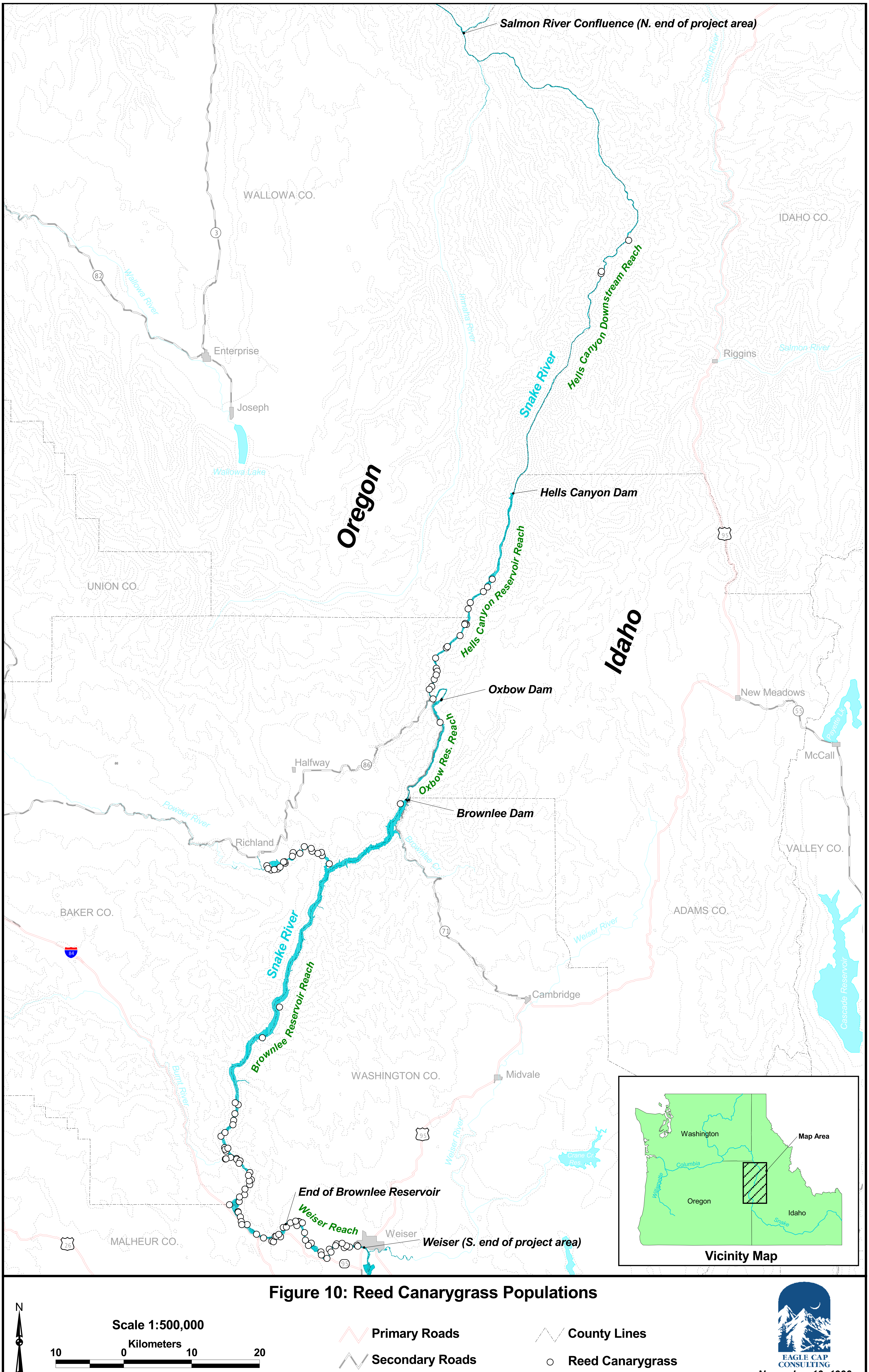
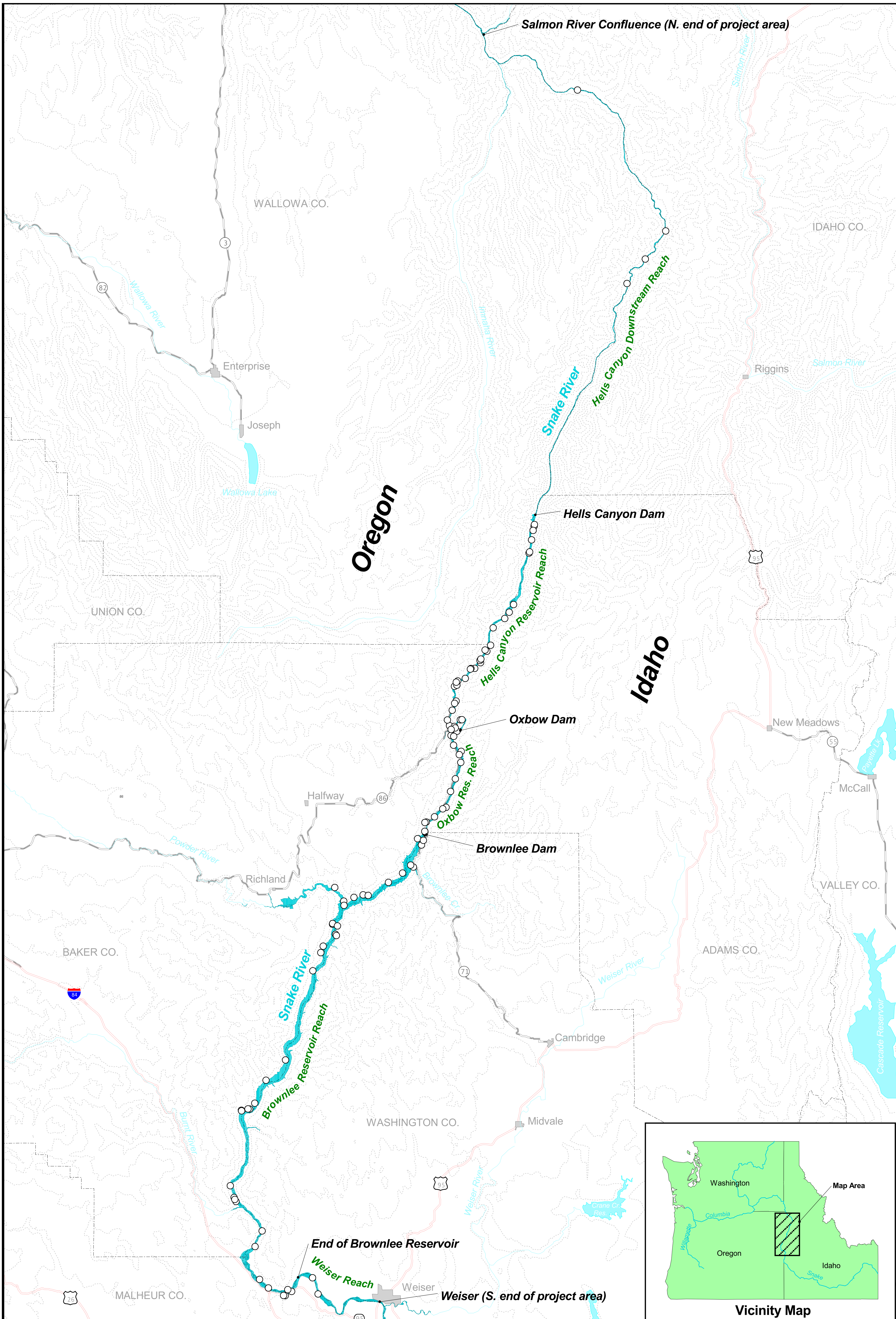



**Figure 10: Reed Canarygrass Populations**




## Figure 11: Puncturevine Populations

N

Scale 1:500,000

Kilometers

10 0 10 20

Primary Roads

Secondary Roads

County Lines

Puncturevine

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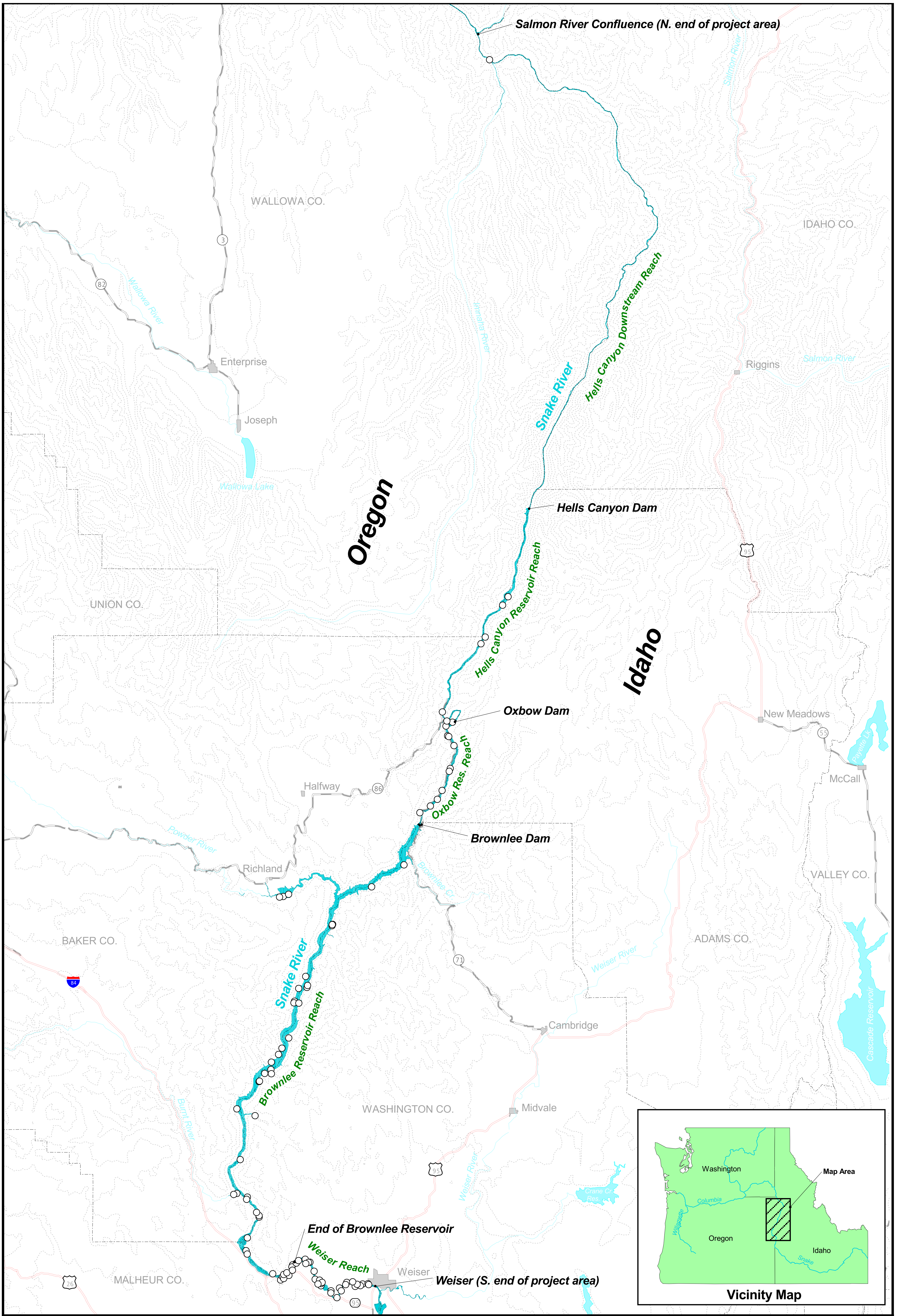


## Figure 12: Poison Hemlock Populations

N

Scale 1:500,000

Kilometers

10 0 10 20

Primary Roads

Secondary Roads

County Lines

Poison Hemlock

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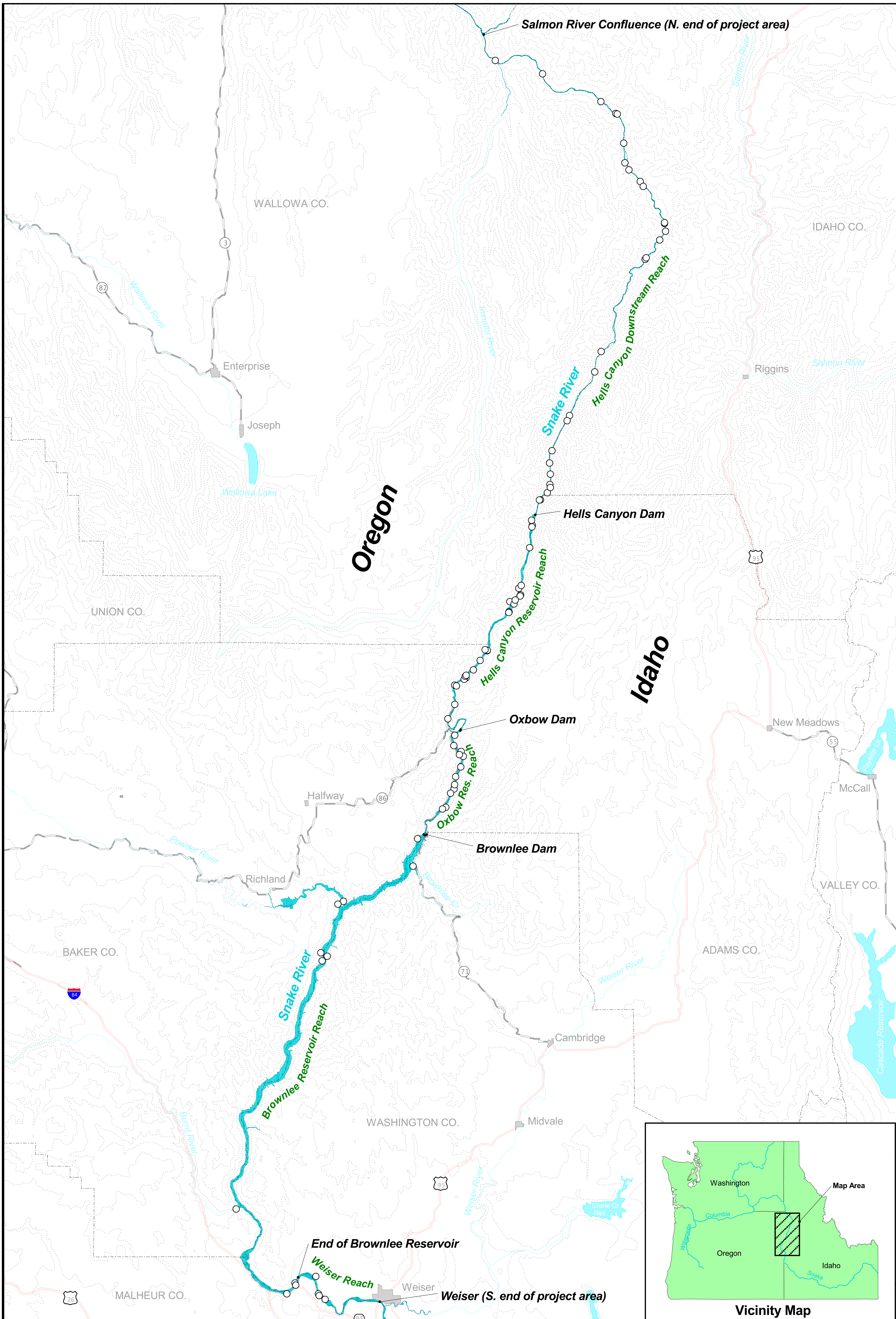


## Figure 13: Bull Thistle Populations

N

Scale 1:500,000

Kilometers

10 0 10 20

Primary Roads

Secondary Roads

County Lines

○ Bull Thistle

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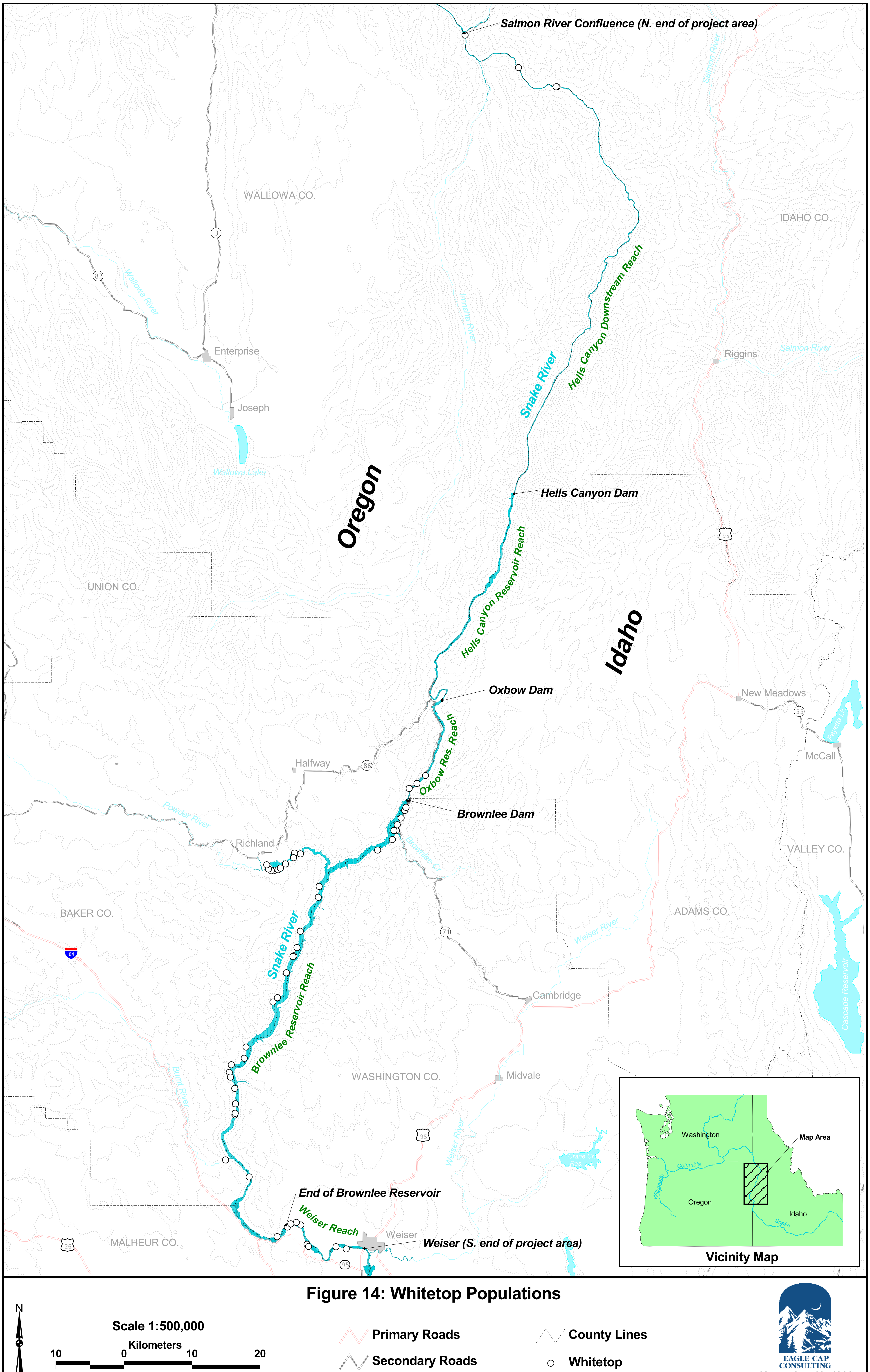
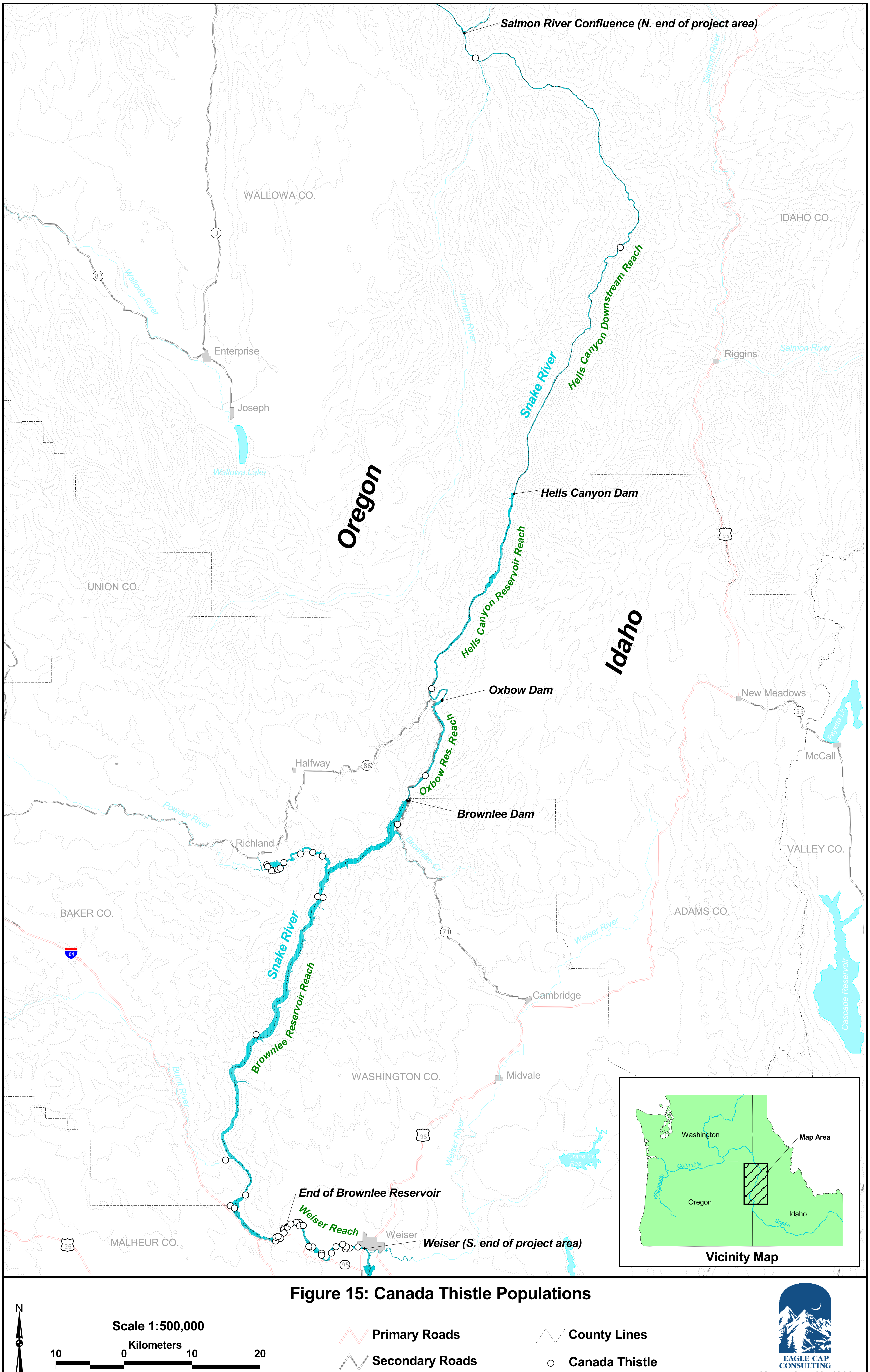
*November 10, 1999*




## Figure 14: Whitetop Populations




## Figure 15: Canada Thistle Populations

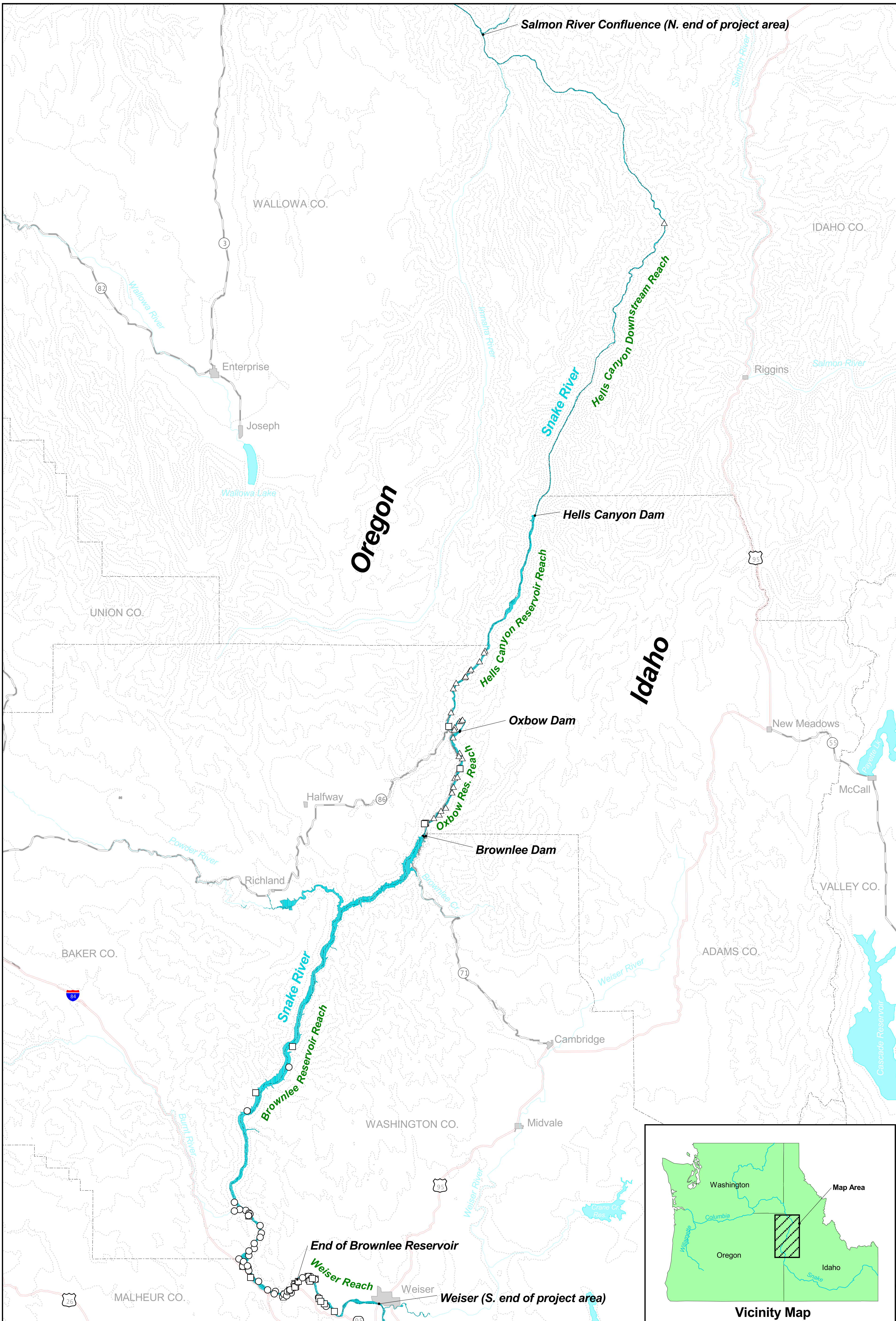



**Figure 16: Tamarisk/Annual Ragweed/Russian Olive Populations**



November 10, 1999

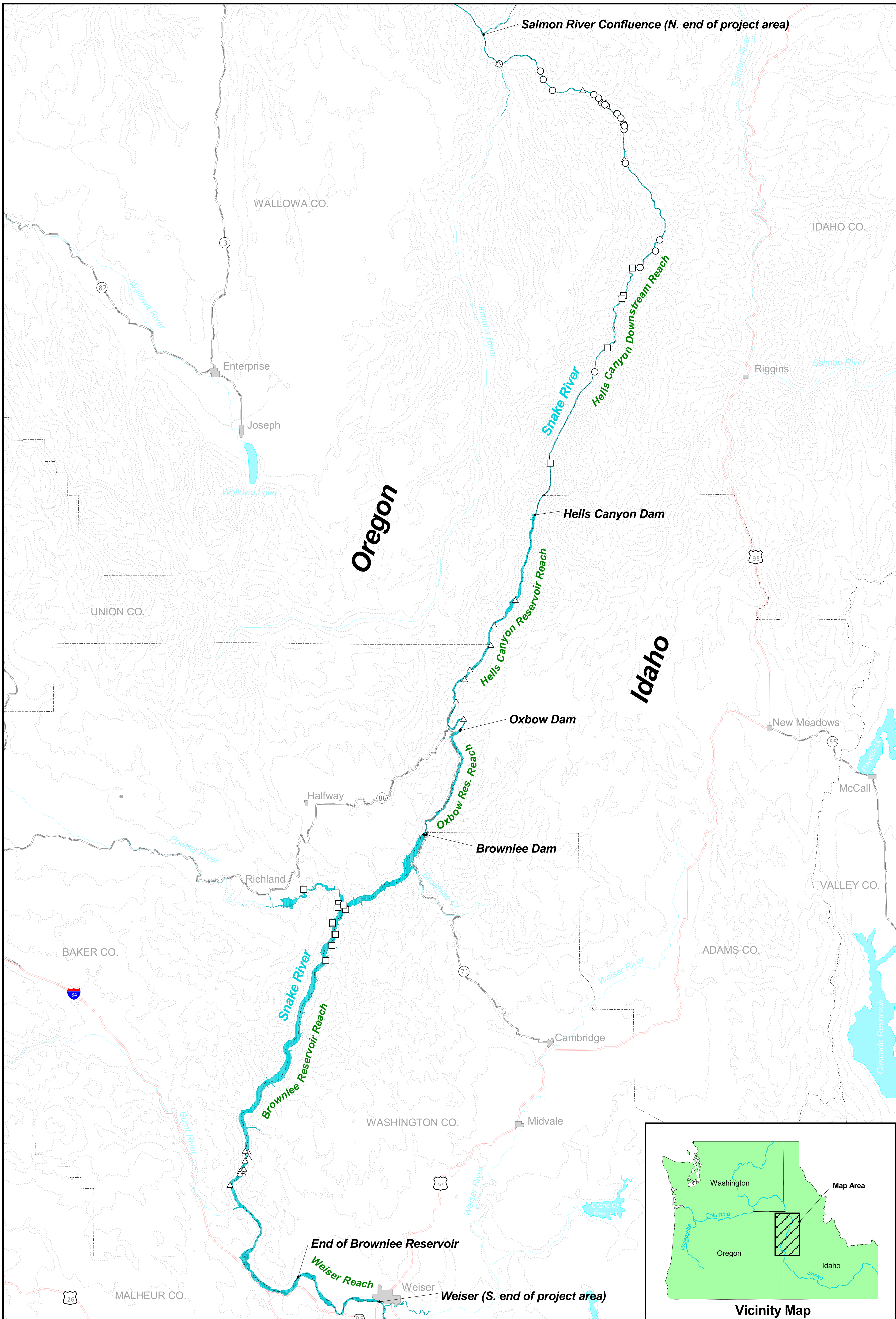



**Figure 17: Erect Cinquefoil/Dalmatian Toadflax/Rush Skeleton-weed Populations**

N

Scale 1:500,000

Kilometers

10 0 10 20

Primary Roads

Secondary Roads

County Lines

Erect Cinquefoil

Dalmatian Toadflax

Rush Skeleton-weed

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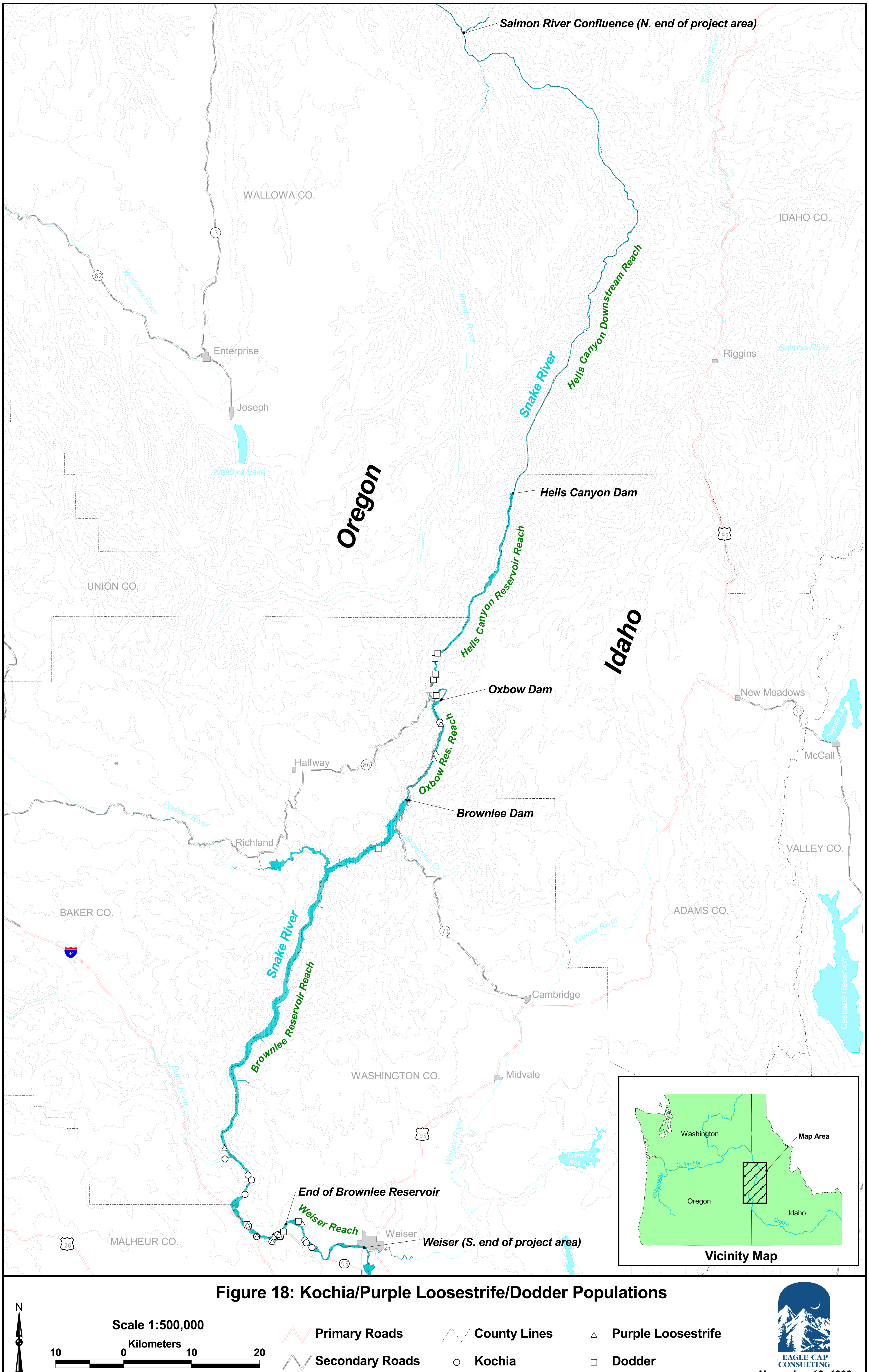


Figure 18: Kochia/Purple Loosestrife/Dodder Populations

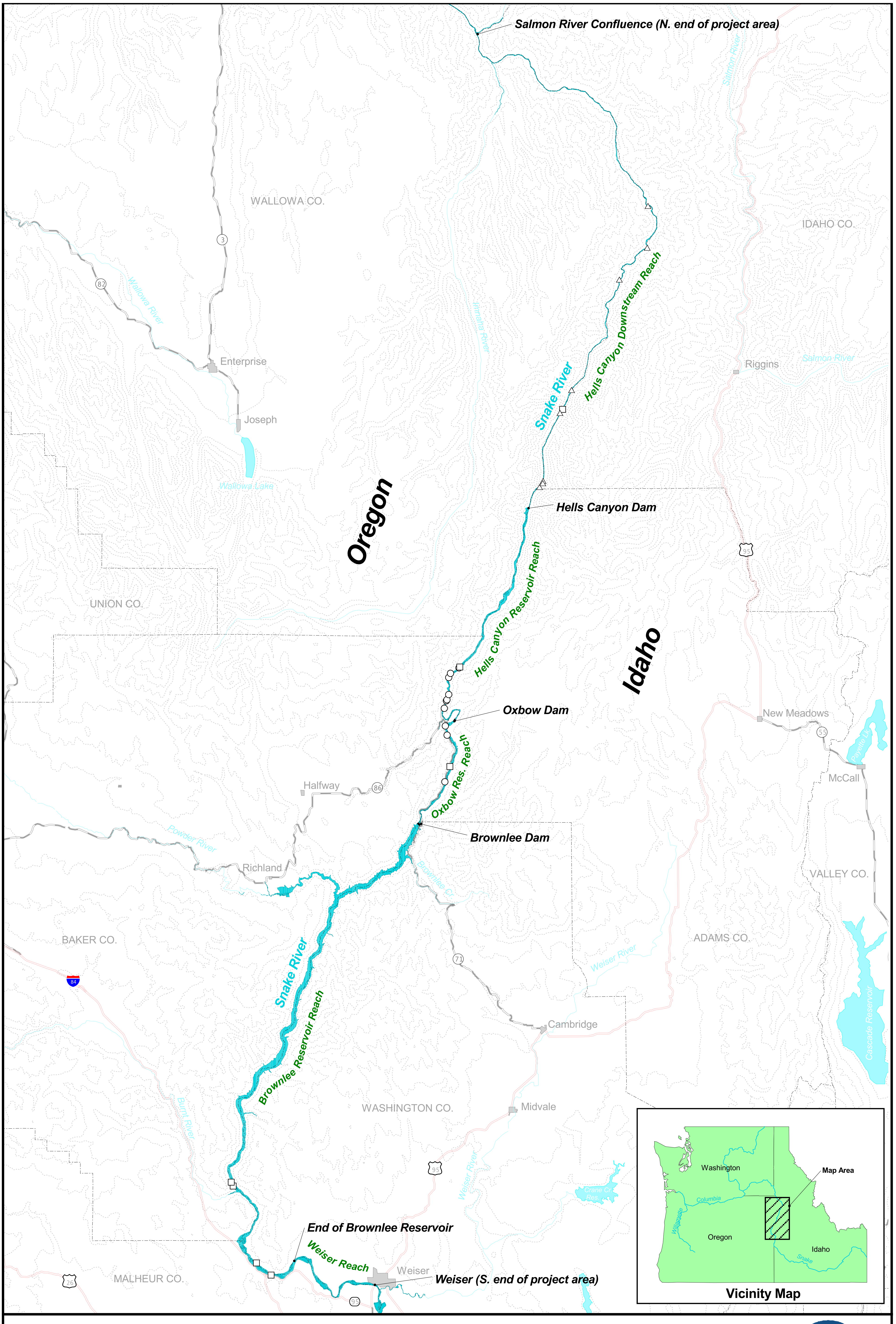


**Figure 19: Mediterranean Sage/Common Horsetail/Quackgrass Populations**

Scale 1:500,000

Kilometers

10 0 10 20

Primary Roads
Secondary Roads
County Lines
Mediterranean Sage
Common Horsetail
Quackgrass

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November 10, 1999

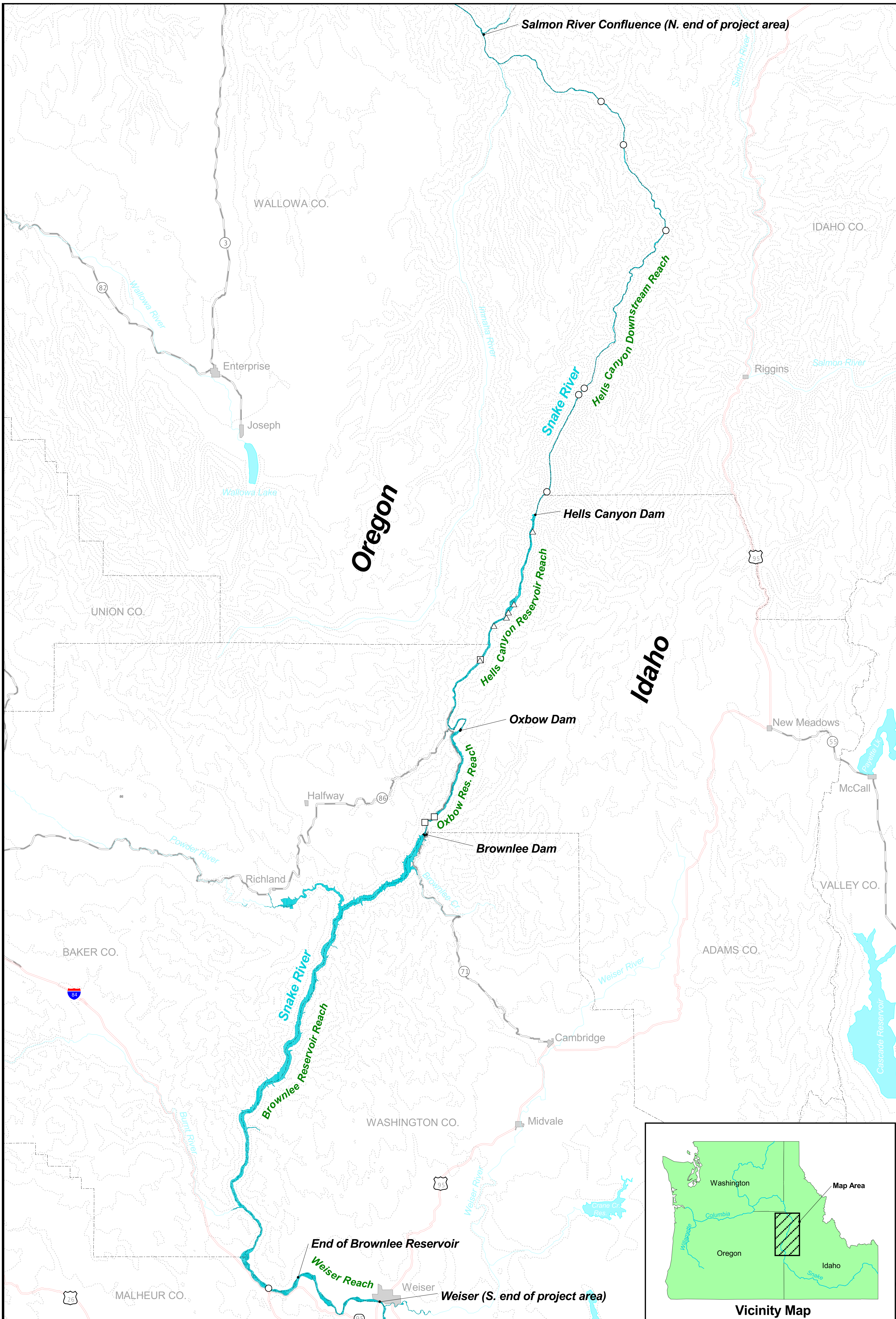


**Figure 20: Yellow Nut Sedge/Diffuse Knapweed/Jointed Goatgrass Populations**

Scale 1:500,000

Kilometers: 10, 0, 10, 20

Primary Roads
Secondary Roads
County Lines
Yellow Nut Sedge
Diffuse Knapweed
Jointed Goatgrass

EAGLE CAP CONSULTING
November 10, 1999

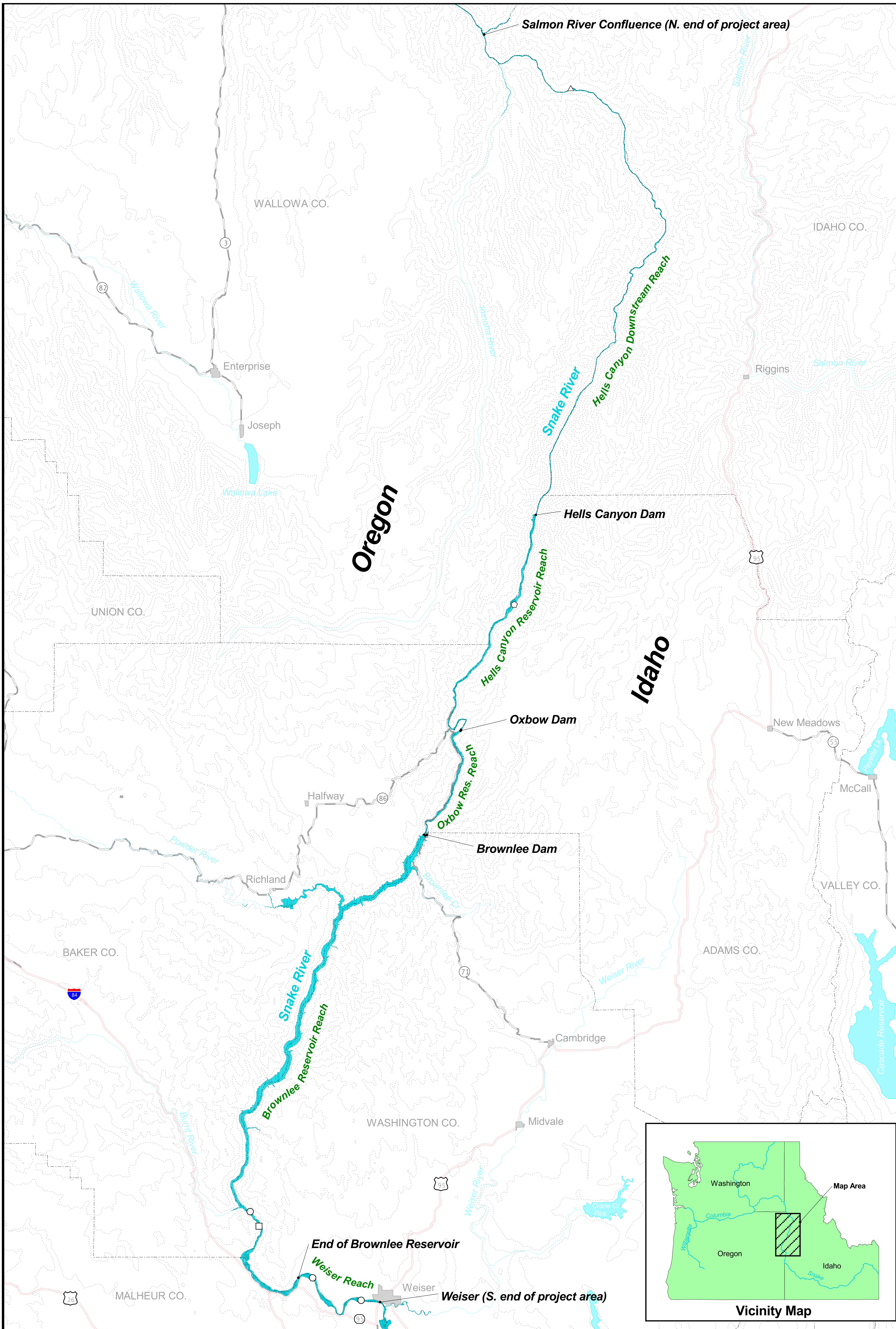


**Figure 21: Leafy Spurge/Common Crupina/Wild Carrot/Japanese Knotweed**

N

Scale 1:500,000

Kilometers

10 0 10 20

Primary Roads

Secondary Roads

Japanese Knotweed

Leafy Spurge

Common Crupina

Wild Carrot

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**Figure 22: Photo of Quackgrass in Unit 181-1E**

**Figure 23: Photo of False Indigo in Unit 108-3E**

**Figure 24: Photo of Poison Hemlock in Unit 081-4E**

**Figure 25: Photo of Dalmatian Toadflax in Unit 090-3E**

**Figure 26: Photo of Scotch Thistle in Unit 106-1E**

**Figure 27: Photo of Reed Canarygrass in Unit 103-3W**

## Figure 28: Rare Plant Data Collection Form

### RARE PLANT OBSERVATION FORM

**Sci. Name:** ____________ **Site Number:** ____________ **Date:** ________

**Recorder(s):** ____________ **Phone:** ________ **Time:** ________

**Address:** ____________

**Elevations:** ______m (low) to: ______m (high) **Landowner:** ____________

**Quad Name:** ____________ **Slope (degrees):** ________

**GPS File:** ________ **UTM Coord.:** ________N ________E ________Elev.

**T:** ____ **R:** ____ **S:** ____ ____¼ of the ____¼; **T:** ____ **R:** ____ **S:** ____ ____¼ of the ____¼

**Asp: Flat N NE E SE S SW W NW** **Max El** ____ **Min El** ____ **Max Dist** ____m **Min Dist** ____m

**Distance From MHWM to Current WSE:** ________m **County:** ____________

**New Site?** ☐ **EO#:** ________ **Survey intensity (circle one)? Thorough or Cursory**

**Location:** ____________

____________

____________

**Habitat:** ____________

____________

**Physiography:**
- ☐ Wash
- ☐ Drainage
- ☐ Ridge
- ☐ Flats
- ☐ Slope

**Moisture:**
- ☐ Inundated (hydric)
- ☐ Saturated (wet/mesic)
- ☐ Moist (mesic)
- ☐ Dry-Mesic
- ☐ Dry (xeric)

**-------------Disturbance Type-------------**

| | | |
|---|---|---|
| ____Alluvial | ____Road Corridor | ____Residential |
| ____Flow Zone | ____Recreation | ____ORV Use |
| ____Livestock | ____Trail | ____Undisturbed |
| ____Mining | ____Industrial | ____Other |
| ____Fire | ____Agricultural | |

**Surface Substrate (%):** ____fine sediment ____coarse w/fines ____coarse w/o fines ____bedrock

**Total # of individuals in pop.:**________actual ________estimated

**What was counted?** ☐Genets (genetically distinct individuals) or ☐Ramets (stems of a clonal plant)

**Phenology (% of pop.):** ____Vegetative ____Flower ____Fruit ____Dormant

**Pop. age class (%):** ____Seedlings ____Immature ____Mature ____Senescent ____Unknown

**Gross pop. area** ______m² **Net pop. area:** ______m² **Vigor: Excellent Good Fair Poor**

**Percent Cover:** ____Trees ____Shrubs ____Forbs ____Grasses ____Litter ____Bare

**Cover Type:** ________ **Plant Association:** ____________

**Pop. Trend: Declining Stable Increasing Unknown** **Overall Site Quality: Excellent Good Fair Poor**

| Abundant Species | Common Species | Uncommon Species |
|---|---|---|
| ____ ____ ____ | ____ ____ ____ | ____ ____ ____ |
| ____ ____ ____ | ____ ____ ____ | ____ ____ ____ |

**Threats:** ____________

**How was ID made?** ____________

**Other knowledgeable individuals:** ____________

**Photo Roll and No.:** ________ **Collection ID:** ________ **Herbarium:** ________

**Comments:** ____________

____________

____________

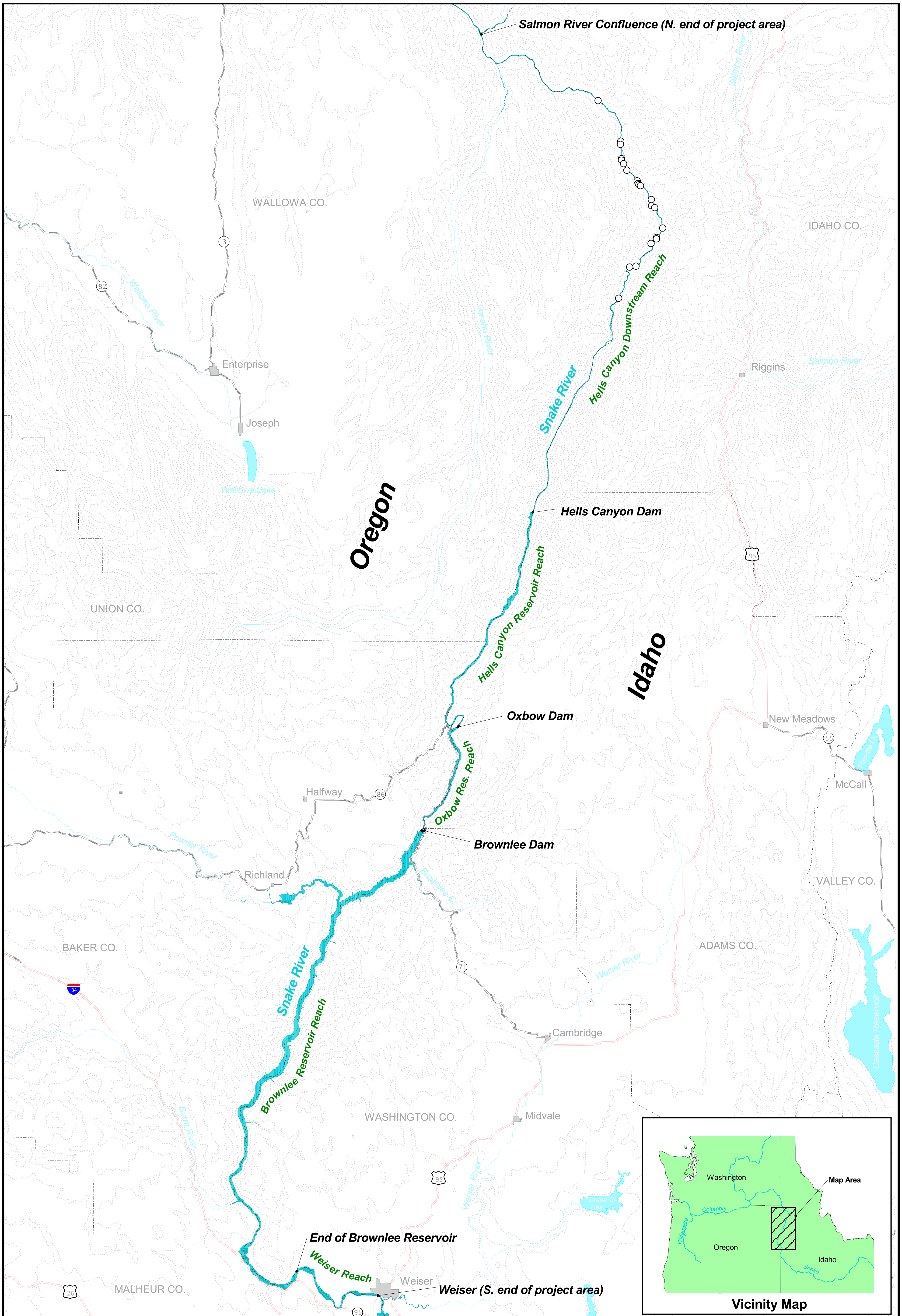


**Figure 29: Schweinitz Flatsedge Populations**

N

Scale 1:500,000

Kilometers

10 0 10 20

Primary Roads

Secondary Roads

County Lines

○ Schweinitz Flatsedge

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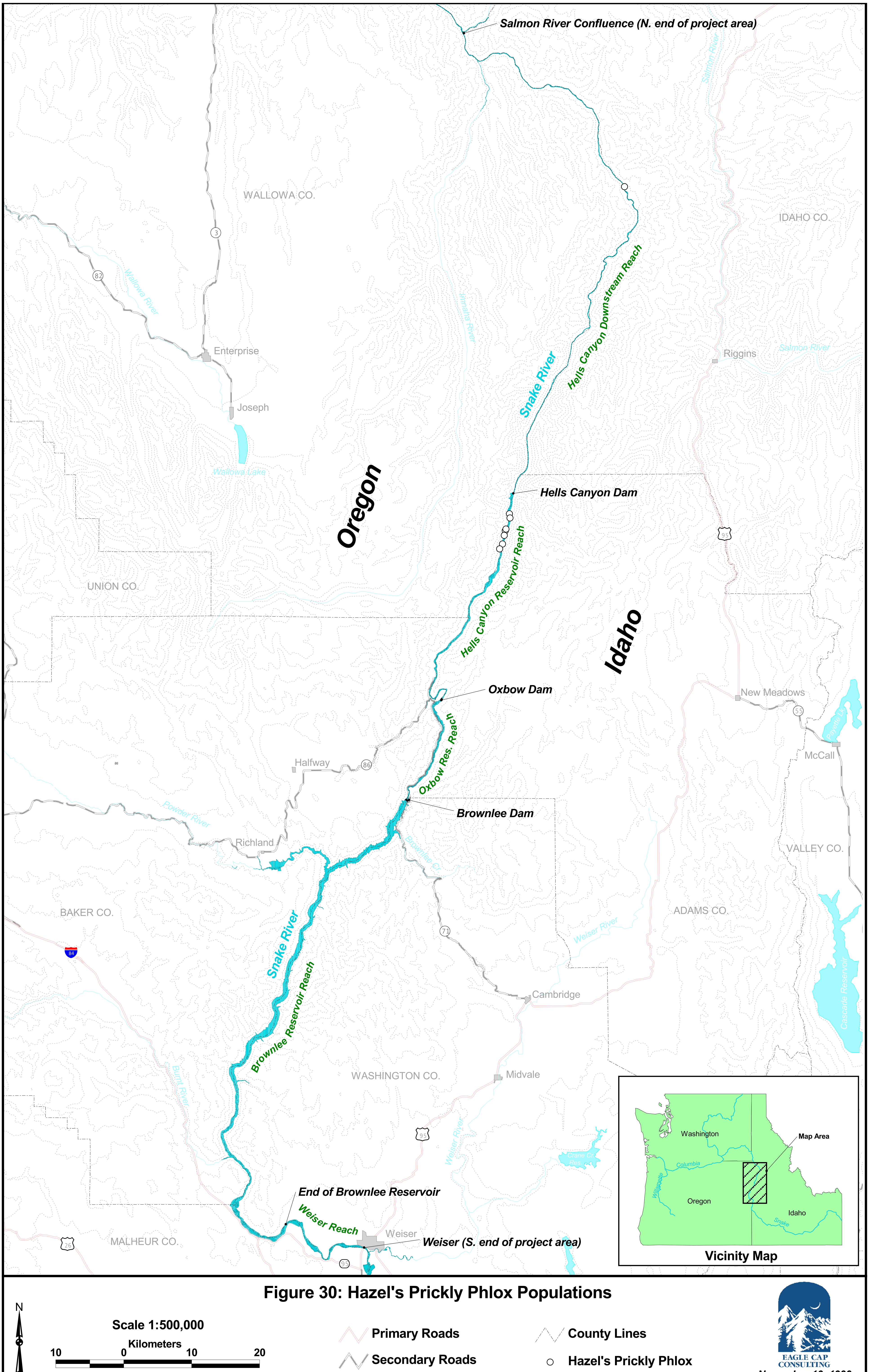



**Figure 30: Hazel's Prickly Phlox Populations**

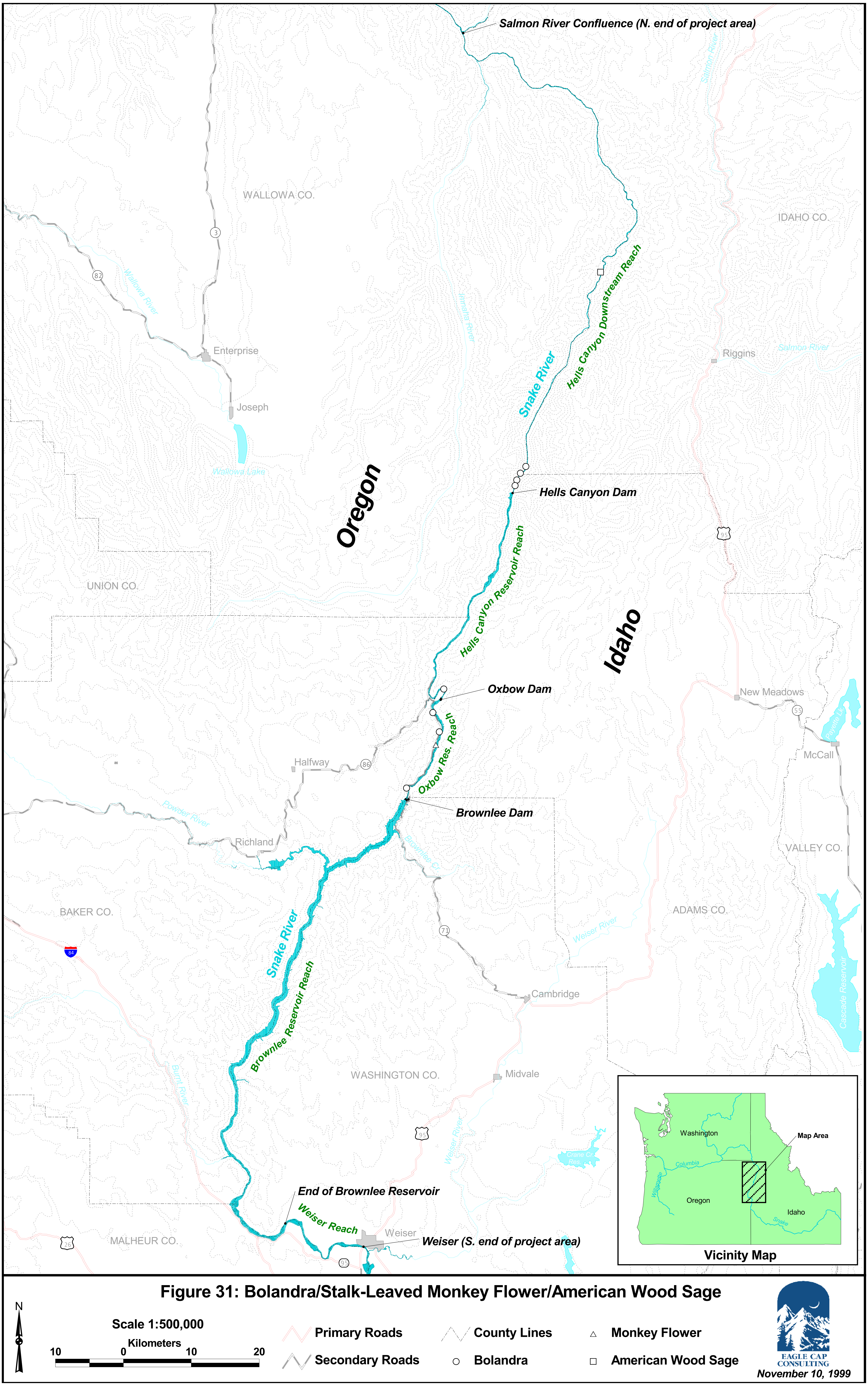
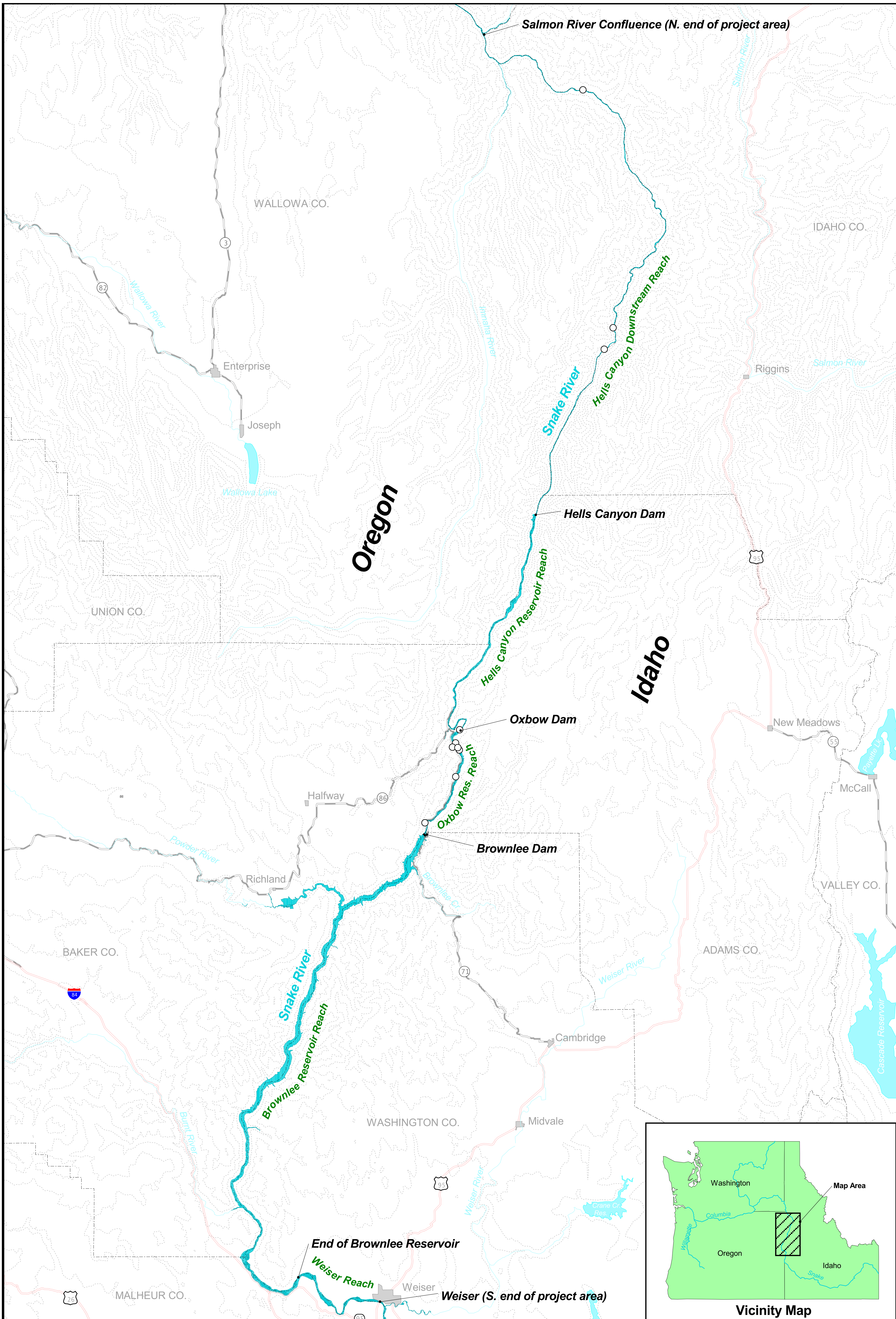



**Figure 31: Bolandra/Stalk-Leaved Monkey Flower/American Wood Sage**




## Figure 32: Porcupine Sedge Populations

N

Scale 1:500,000

Kilometers

10 0 10 20

Primary Roads

Secondary Roads

County Lines

○ Porcupine Sedge

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**Figure 33: Photo of Schweinitz Flatsedge**

**Figure 34: Photo of Schweinitz Flatsedge Habitat**

**Figure 35: Photo of Hazel's Prickly Phlox**

**Figure 36: Photo of Hazel's Prickly Phlox Habitat**

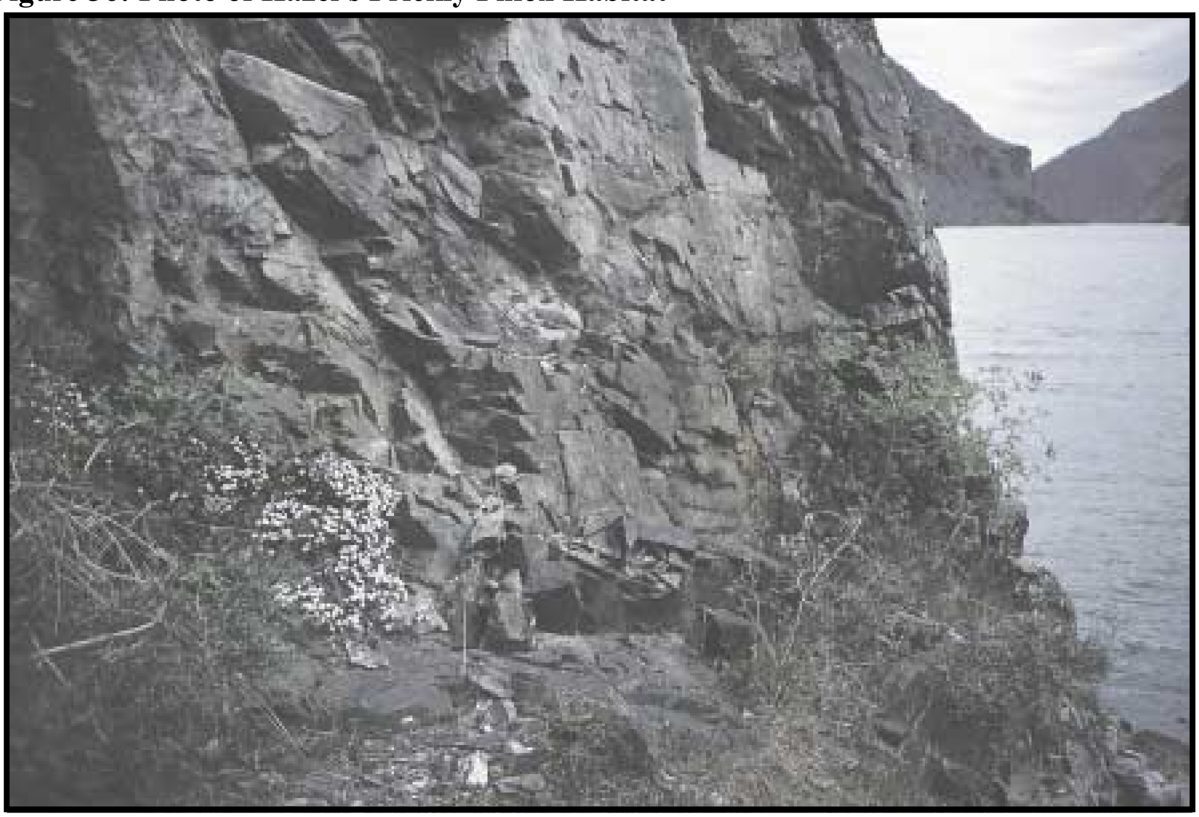

**Figure 37: Photo of Stalk-Leaved Monkey Flower Habitat**

**Figure 38: Photo of American Wood Sage**

**Figure 39: Photo of American Wood Sage Habitat**

**Figure 40: Photo of Oregon Bolandra**

**Figure 41: Photo of Oregon Bolandra Habitat**

**Figure 42: Photo of Porcupine Sedge**

**Figure 43: Photo of Porcupine Sedge Habitat**

# Appendices

## Appendix 1: Cumulative Plant Species Lists

## Vascular Plant Species
## Hells Canyon Rare Plant and Weed Survey - Hells Canyon Downstream Reach
Survey Date(s): 8/31/98 through 5/30/99

*Botanical nomenclature follows "Flora of the Pacifc Northwest" (Hitchcock and Cronquist 1973) and "The Jepson Manual" (Hickman 1993)*

** = introduced plants*

| Family | Scientific Name | Common Name |
|---|---|---|
| AIZOACEAE | *Mollugo verticillata* | carpetweed |
| AMARANTHACEAE | *Amaranthus albus* | tumbleweed |
| ANACARDIACEAE | *Rhus glabra* | smooth sumac |
| | *Rhus radicans* | poison ivy |
| APIACEAE | * *Anthriscus scandicina* | bur chervil |
| | *Cicuta douglasii* | western water-hemlock |
| | *Cicuta sp.* | water hemlock |
| | * *Conium maculatum* | poison-hemlock |
| | *Ligusticum filicinum* | fern-leaf lovage |
| | *Lomatium dissectum* | fern-leaved lomatium |
| APOCYNACEAE | *Apocynum cannabinum* | common dogbane |
| ASCLEPIADACEAE | *Asclepias speciosa* | showy milkweed |
| ASTERACEAE | *Achillea millefolium* | common yarrow |
| | *Ambrosia acanthicarpa* | annual burweed |
| | *Ambrosia artemisiifolia* | annual ragweed |
| | *Antennaria alpina var. media* | alpine pussy-toes |
| | *Artemisia ludoviciana* | prairie sage |
| | *Balsamorhiza sagittata* | arrow-leaf balsamroot |
| | * *Chondrilla juncea* | rush skeleton-weed |
| | * *Cichorium intybus* | wild succory |
| | * *Cirsium arvense* | Canada thistle |
| | *Cirsium utahense* | Utah thistle |
| | * *Cirsium vulgare* | bull thistle |
| | * *Conyza canadensis* | horseweed |
| | * *Crupina vulgaris* | crupina |
| | *Erigeron compositus* | compound-leaved fleabane |
| | *Erigeron subtrinervis var. conspicuus* | three-veined fleabane |
| | *Gnaphalium palustre* | lowland cudweed |

| | | |
|---|---|---|
| ASTERACEAE | *Grindelia squarrosa* | resin-weed |
| | *Haplopappus resinosus* | gnarled goldenweed |
| | *Haplopappus sp.* | goldenweed |
| | *Helianthus annuus* | common sunflower |
| | * *Lactuca serriola* | prickly lettuce |
| | * *Onopordum acanthium* | scotch thistle |
| | *Solidago canadensis* | Canadian goldenrod |
| | *Solidago occidentalis* | western goldenrod |
| | *Stephanomeria tenuifolia* | narrow-leaved skeletonweed |
| | * *Taraxacum officinale* | common dandelion |
| | * *Tragopogon dubius* | salsify |
| | *Xanthium strumarium* | common cocklebur |
| BETULACEAE | *Alnus incana var. occidentalis* | mountain alder |
| | *Alnus rhombifolia* | white alder |
| | *Alnus sp.* | alder |
| BORAGINACEAE | *Amsinckia retrorsa* | rigid fiddleneck |
| | *Amsinckia sp.* | fiddleneck |
| | * *Asperugo procumbens* | madwort |
| | * *Cynoglossum officinale* | common hounds-tongue |
| BRASSICACEAE | *Arabis hirsuta* | hairy rockcress |
| | *Arabis microphylla* | littleleaf rockcress |
| | *Cardaria draba* | heart-podded hoarycress |
| | *Descurainia pinnata* | western tansymustard |
| | * *Lepidium campestre* | fieldpeppergrass |
| | * *Lepidium perfoliatum* | clasping peppergrass |
| | * *Sisymbrium altissimum* | Jim Hill mustard |
| | *Stanleya pinnata* | bushy stanleya |
| CACTACEAE | *Opuntia polyacantha* | Prickly-pear cactus |
| CAPRIFOLIACEAE | *Sambucus cerulea* | blue elderberry |
| | *Symphoricarpos sp.* | snowberry |
| CARYOPHYLLACEAE | * *Arenaria serpyllifolia* | thyme-leaf sandwort |
| | * *Lychnis alba* | white campion |
| | * *Lychnis coronaria* | rose campion |
| | * *Saponaria officinalis* | bouncing bett |
| | *Stellaria jamesiana* | sticky chickweed |
| CELASTRACEAE | *Glossopetalon nevadense var. stipuliferum* | spiny green-bush |
| CHENOPODIACEAE | *Chenopodium album* | lamb's quarters |

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|---|---|---|
| CHENOPODIACEAE | * *Salsola kali* | Russian thistle |
| CONVOLVULACEAE | * *Convolvulus arvensis* | field bindweed |
| CORNACEAE | *Cornus stolonifera* | red-osier dogwood |
| CRASSULACEAE | *Sedum lanceolatum* | lance-leaved stonecrop |
| CYPERACEAE | *Carex hystricina* | porcupine sedge |
| | *Cyperus esculentus* | yellow nut-grass |
| | *Cyperus schweinitzii* | Schweinitz flatsedge |
| | *Cyperus strigosus* | straw-colored flatsedge |
| DIPSACACEAE | * *Dipsacus sylvestris* | teasel |
| EQUISETACEAE | *Equisetum arvense* | common horsetail |
| | *Equisetum laevigatum* | smooth scouring-rush |
| EUPHORBIACEAE | *Euphorbia glyptosperma* | corrugate-seeded spurge |
| | *Euphorbia serpyllifolia* | thyme-leaf spurge |
| FABACEAE | * *Amorpha fruticosa* | false indigo |
| | *Astragalus purshii* | woolly-pod milk-vetch |
| | *Glycyrrhiza lepidota* | licorice |
| | *Lotus purshianus* | Spanish clover |
| | * *Medicago lupulina* | hop clover |
| | * *Medicago sativa* | alfalfa |
| | * *Melilotus alba* | white sweet-clover |
| | * *Melilotus officinalis* | common yellow sweet-clover |
| | *Vicia americana* | American vetch |
| GERANIACEAE | * *Erodium cicutarium* | filaree |
| | *Geranium bicknellii* | Bicknell's geranium |
| GROSSULARIACEAE | *Ribes velutinum var. gooddingii* | Goodding's gooseberry |
| HYDRANGEACEAE | *Philadelphus lewisii* | mockorange |
| HYDROPHYLLACEAE | *Phacelia heterophylla* | varileaf phacelia |
| | *Phacelia linearis* | threadleaf phacelia |
| HYPERICACEAE | * *Hypericum perforatum* | common St. Johnswort |
| IRIDACEAE | * *Iris pseudacorus* | yellow flag |

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|---|---|---|
| JUGLANDACEAE | * *Juglans nigra* | black walnut |
| | | |
| LAMIACEAE | *Agastache urticifolia var. urticifolia* | nettle leaved horse mint |
| | * *Marrubium vulgare* | horehound |
| | *Mentha arvensis* | field mint |
| | * *Nepeta cataria* | catnip |
| | *Prunella vulgaris var. lanceolata* | self-heal |
| | *Scutellaria angustifolia* | narrow-leaved skullcap |
| | *Teucrium canadense var. occidentale* | American wood sage |
| | | |
| LILIACEAE | *Allium acuminatum* | tapertip onion |
| | *Brodiaea douglasii* | wild hyacinth |
| | *Calochortus macrocarpus* | sagebrush mariposa |
| | *Zigadenus venenosus* | meadow death camas |
| | | |
| LOASACEAE | *Mentzelia laevicaulis* | blazing-star mentzelia |
| | | |
| MALVACEAE | *Malva neglecta* | dwarf mallow |
| | | |
| MORACEAE | * *Morus alba* | white mulberry |
| | | |
| OLEACEAE | * *Fraxinus sp.* | ash |
| | | |
| ONAGRACEAE | *Epilobium paniculatum* | tall annual willow-weed |
| | *Gaura parviflora* | small-flowered gaura |
| | *Oenothera strigosa* | common evening primrose |
| | | |
| PINACEAE | *Pinus ponderosa* | ponderosa pine |
| | | |
| PLANTAGINACEAE | * *Plantago lanceolata* | ribwort |
| | *Plantago patagonica* | Indian-wheat |
| | | |
| POACEAE | * *Agropyron repens* | quackgrass |
| | *Agropyron spicatum var. spicatum* | blue-bunch wheatgrass |
| | *Aristida longiseta* | red threeawn |
| | * *Bromus brizaeformis* | rattlesnake brome |
| | * *Bromus commutatus* | hairy chess |
| | * *Bromus japonicus* | Japanese brome |
| | * *Bromus sterilis* | barren brome |
| | * *Bromus tectorum* | cheatgrass |
| | *Cenchrus longispinus* | bur-grass |
| | * *Dactylis glomerata* | orchard grass |
| | *Deschampsia danthonioides* | annual hairgrass |

| | | |
|---|---|---|
| POACEAE | * *Digitaria sp.* | crabgrass |
| | * *Echinochloa crusgalli* | large barnyard-grass |
| | *Elymus cinereus* | giant wildrye |
| | *Elymus glaucus* | western rye-grass |
| | * *Eragrostis cilianensis* | stinkgrass |
| | *Festuca idahoensis var. idahoensis* | Idaho fescue |
| | *Hordeum jubatum* | foxtail barley |
| | *Panicum capillare* | common witchgrass |
| | *Panicum scribnerianum* | Scribner witchgrass |
| | *Phalaris arundinacea* | reed canarygrass |
| | * *Poa bulbosa* | bulbous bluegrass |
| | *Poa pratensis* | Kentucky bluegrass |
| | *Poa secunda* | Sandberg's bluegrass |
| | * *Setaria viridis* | green bristlegrass |
| | *Spartina pectinata* | prairie cordgrass |
| | *Sporobolus cryptandrus* | sand dropseed |
| POLEMONIACEAE | *Collomia linearis* | narrow-leaf collomia |
| | *Gilia aggregata var. aggregata* | skyrocket; scarlet gilia |
| | *Leptodactylon pungens ssp. hazeliae* | Hazel's prickly phlox |
| | *Phlox colubrina* | Snake River phlox |
| POLYGONACEAE | *Eriogonum niveum* | snow buckwheat |
| | *Eriogonum ovalifolium* | oval-leaved eriogonum |
| | *Polygonum coccineum* | water smartweed |
| | * *Polygonum convolvulus* | climbing bindweed |
| | *Polygonum sp.* | knotweed |
| | * *Rumex crispus* | curly dock |
| POLYPODIACEAE | *Cystopteris fragilis* | bladder-fern |
| PORTULACACEAE | *Montia perfoliata* | miner's lettuce |
| | * *Portulaca oleracea* | common purslane |
| RANUNCULACEAE | *Clematis columbiana var. columbiana* | Columbia clematis |
| | *Clematis ligusticifolia* | western clematis |
| RHAMNACEAE | *Rhamnus purshiana* | cascara |
| ROSACEAE | *Amelanchier alnifolia* | western service berry |
| | *Holodiscus discolor* | oceanspray |
| | *Potentilla concinna* | early cinquefoil |
| | * *Potentilla recta* | erect cinquefoil |
| | *Prunus virginiana* | chokecherry |
| | *Rubus bartonianus* | Bartonberry |

| | | |
|---|---|---|
| ROSACEAE | * *Rubus discolor* | Himalayan blackberry |
| | *Rubus sp.* | bramble |
| RUBIACEAE | *Galium triflorum* | sweet-scented bedstraw |
| SALICACEAE | *Salix exigua* | river-bank willow |
| SAXIFRAGACEAE | *Bolandra oregana* | bolandra |
| | *Lithophragma parviflora* | prairiestar |
| SCROPHULARIACEAE | * *Linaria dalmatica* | dalmatian toadflax |
| | *Mimulus guttatus* | yellow monkey-flower |
| | *Penstemon triphyllus* | whorled penstemon |
| | *Tonella floribunda* | large-flowered tonella |
| | * *Verbascum blattaria* | moth mullein |
| | * *Verbascum thapsus* | common mullein |
| | * *Veronica arvensis* | common speedwell |
| SELAGINELLACEAE | *Selaginella sp.* | lesser-clubmoss |
| SOLANACEAE | *Physalis longifolia* | long-leaved ground-cherry |
| | * *Solanum dulcamara* | bittersweet |
| ULMACEAE | *Celtis reticulata* | hackberry |
| URTICACEAE | *Urtica dioica* | stinging nettle |
| VALERIANACEAE | *Plectritis macrocera* | long-horn plectritis |
| VERBENACEAE | *Verbena bracteata* | bracted verbena |
| ZYGOPHYLLACEAE | * *Tribulus terrestris* | puncture vine |

# Vascular Plant Species
## Hells Canyon Rare Plant and Weed Survey - Hells Canyon Reservoir Reach

Survey Date(s): 8/17/98 through 8/25/98

*Botanical nomenclature follows "Flora of the Pacifc Northwest" (Hitchcock and Cronquist 1973) and "The Jepson Manual" (Hickman 1993)*

** = introduced plants*

| Family | Scientific Name | Common Name |
|---|---|---|
| ACERACEAE | * *Acer negundo* | box-elder |
| AIZOACEAE | *Mollugo verticillata* | carpetweed |
| ANACARDIACEAE | *Rhus glabra* | smooth sumac |
| | *Rhus radicans* | poison ivy |
| APIACEAE | * *Anthriscus scandicina* | bur chervil |
| | * *Conium maculatum* | poison-hemlock |
| | *Lomatium dissectum* | fern-leaved lomatium |
| APOCYNACEAE | *Apocynum cannabinum* | common dogbane |
| ASCLEPIADACEAE | *Asclepias speciosa* | showy milkweed |
| ASTERACEAE | *Achillea millefolium* | common yarrow |
| | *Ambrosia acanthicarpa* | annual burweed |
| | *Ambrosia artemisiifolia* | annual ragweed |
| | *Anaphalis margaritacea* | common pearly-everlasting |
| | *Artemisia arbuscula* | low sage |
| | *Artemisia dracunculus var. dracunculus* | tarragon |
| | *Artemisia ludoviciana* | prairie sage |
| | *Balsamorhiza sagittata* | arrow-leaf balsamroot |
| | *Bidens vulgata* | tall beggar-ticks |
| | * *Centaurea diffusa* | diffuse knapweed |
| | *Chrysothamnus nauseosus* | gray rabbit-brush |
| | * *Cichorium intybus* | wild succory |
| | * *Cirsium arvense* | Canada thistle |
| | *Cirsium utahense* | Utah thistle |
| | * *Cirsium vulgare* | bull thistle |
| | * *Conyza canadensis* | horseweed |
| | *Erigeron strigosus* | daisy fleabane |
| | *Eriophyllum lanatum* | common eriophyllum |
| | *Gnaphalium palustre* | lowland cudweed |

| | | |
|---|---|---|
| ASTERACEAE | *Grindelia squarrosa* | resin-weed |
| | *Gutierrezia sarothrae* | broom snakeweed |
| | *Helenium autumnale* | sneezeweed |
| | *Helianthus annuus* | common sunflower |
| | * *Lactuca serriola* | prickly lettuce |
| | *Lagophylla ramosissima* | slender hareleaf |
| | *Machaeranthera canescens* | hoary aster |
| | * *Onopordum acanthium* | scotch thistle |
| | *Solidago missouriensis* | Missouri goldenrod |
| | *Solidago occidentalis* | western goldenrod |
| | * *Sonchus oleraceus* | common sow-thistle |
| | * *Tragopogon dubius* | salsify |
| | *Xanthium strumarium* | common cocklebur |
| BETULACEAE | *Alnus incana var. occidentalis* | mountain alder |
| | *Alnus sinuata* | Sitka alder |
| BORAGINACEAE | *Amsinckia intermedia* | ranchers fiddleneck |
| | * *Cynoglossum officinale* | common hounds-tongue |
| | *Lithospermum ruderale* | Columbia puccoon |
| BRASSICACEAE | * *Alyssum alyssoides* | pale alyssum |
| | * *Lepidium latifolium* | pepperwort |
| | * *Sisymbrium altissimum* | Jim Hill mustard |
| | *Thelypodium sp.* | thelypody |
| CAPPARIDACEAE | *Polanisia trachysperma* | clammy-weed |
| CAPRIFOLIACEAE | *Sambucus cerulea* | blue elderberry |
| | *Symphoricarpos sp.* | snowberry |
| CARYOPHYLLACEAE | * *Lychnis alba* | white campion |
| | * *Saponaria officinalis* | bouncing bett |
| | * *Vaccaria segetalis* | cowcockle |
| CELASTRACEAE | *Glossopetalon nevadense var. stipuliferum* | spiny green-bush |
| CHENOPODIACEAE | * *Chenopodium botrys* | Jerusalem oak |
| | * *Salsola kali* | Russian thistle |
| CONVOLVULACEAE | * *Convolvulus arvensis* | field bindweed |
| CORNACEAE | *Cornus stolonifera* | red-osier dogwood |

| | | |
|---|---|---|
| CRASSULACEAE | *Sedum lanceolatum* | lance-leaved stonecrop |
| CUSCUTACEAE | *Cuscuta sp.* | dodder |
| CYPERACEAE | *Carex hystricina* | porcupine sedge |
| | *Carex rostrata* | beaked sedge |
| | *Carex vulpinoidea* | fox sedge |
| | *Cyperus strigosus* | straw-colored flatsedge |
| | *Scirpus pallidus* | pale bulrush |
| | *Scirpus validus* | tule |
| DIPSACACEAE | * *Dipsacus sylvestris* | teasel |
| ELAEAGNACEAE | * *Elaeagnus angustifolia* | Russian olive |
| EUPHORBIACEAE | *Eremocarpus setigerus* | turkey-mullein |
| | *Euphorbia glyptosperma* | corrugate-seeded spurge |
| FABACEAE | * *Amorpha fruticosa* | false indigo |
| | *Glycyrrhiza lepidota* | licorice |
| | *Lotus purshianus* | Spanish clover |
| | * *Medicago sativa* | alfalfa |
| | * *Melilotus alba* | white sweet-clover |
| | * *Melilotus officinalis* | common yellow sweet-clover |
| | * *Robinia pseudo-acacia* | robinia |
| | * *Trifolium pratense* | red clover |
| GERANIACEAE | * *Erodium cicutarium* | filaree |
| GROSSULARIACEAE | *Ribes aureum* | golden currant |
| HYDRANGEACEAE | *Philadelphus lewisii* | mockorange |
| HYDROPHYLLACEAE | *Phacelia hastata* | silverleaf phacelia |
| HYPERICACEAE | * *Hypericum perforatum* | common St. Johnswort |
| IRIDACEAE | * *Iris pseudacorus* | yellow flag |
| JUGLANDACEAE | * *Juglans nigra* | black walnut |
| | * *Juglans regia* | English walnut |
| JUNCACEAE | *Juncus balticus* | Baltic rush |
| | *Juncus tenuis* | slender rush |

| | | |
|---|---|---|
| JUNCACEAE | *Juncus torreyi* | Torry's rush |
| LAMIACEAE | *Lycopus asper* | rough bugleweed |
| | * *Marrubium vulgare* | horehound |
| | * *Nepeta cataria* | catnip |
| | *Prunella vulgaris* | heal-all |
| | * *Salvia aethiopis* | Mediterranean sage |
| LOASACEAE | *Mentzelia laevicaulis* | blazing-star mentzelia |
| LYTHRACEAE | *Lythrum hyssopifolia* | hyssop loosestrife |
| | * *Lythrum salicaria* | purple loosestrife |
| MALVACEAE | *Iliamna rivularis* | streambank globemallow |
| MORACEAE | * *Morus alba* | white mulberry |
| OLEACEAE | * *Fraxinus pennsylvanica* | green ash |
| ONAGRACEAE | *Epilobium paniculatum* | tall annual willow-weed |
| | *Epilobium watsonii* | Watson's willow-weed |
| | *Gaura parviflora* | small-flowered gaura |
| | *Oenothera strigosa* | common evening primrose |
| PINACEAE | *Pinus ponderosa* | ponderosa pine |
| | *Pseudotsuga menziesii* | Douglas-fir |
| PLANTAGINACEAE | * *Plantago lanceolata* | ribwort |
| | *Plantago patagonica* | Indian-wheat |
| POACEAE | * *Aegilops cylindrica* | jointed goatgrass |
| | * *Agropyron cristatum* | crested wheatgrass |
| | * *Agropyron intermedium* | intermediate wheatgrass |
| | * *Agropyron repens* | quackgrass |
| | * *Agropyron sp.* | wheatgrass |
| | *Agropyron spicatum var. spicatum* | blue-bunch wheatgrass |
| | * *Bromus brizaeformis* | rattlesnake brome |
| | * *Bromus commutatus* | hairy chess |
| | * *Bromus japonicus* | Japanese brome |
| | * *Bromus sterilis* | barren brome |
| | * *Bromus tectorum* | cheatgrass |
| | * *Dactylis glomerata* | orchard grass |
| | *Deschampsia danthonioides* | annual hairgrass |
| | * *Echinochloa crusgalli* | large barnyard-grass |
| | * *Eragrostis cilianensis* | stinkgrass |

| | | |
|---|---|---|
| POACEAE | *Hordeum jubatum* | foxtail barley |
| | *Koeleria cristata* | prairie junegrass |
| | *Leersia oryzoides* | cutgrass |
| | *Panicum capillare* | common witchgrass |
| | *Phalaris arundinacea* | reed canarygrass |
| | * *Phleum pratense* | timothy |
| | * *Poa bulbosa* | bulbous bluegrass |
| | *Poa pratensis* | Kentucky bluegrass |
| | *Poa secunda* | Sandberg's bluegrass |
| | * *Polypogon monspeliensis* | rabbitfoot polypogon |
| | *Sitanion hystrix* | bottlebrush squirreltail |
| | *Sporobolus cryptandrus* | sand dropseed |
| | *Stipa sp.* | needlegrass |
| | * *Taeniatherum caput-medusae* | medusahead wildrye |
| POLEMONIACEAE | *Collomia linearis* | narrow-leaf collomia |
| | *Collomia sp.* | collomia |
| | *Leptodactylon pungens ssp. hazeliae* | Hazel's prickly phlox |
| POLYGONACEAE | *Eriogonum compositum* | northern buckwheat |
| | *Eriogonum heracleoides* | Wyeth's buckwheat |
| | *Eriogonum niveum* | snow buckwheat |
| | *Eriogonum strictum* | strict buckwheat |
| | *Eriogonum umbellatum* | sulfur buckwheat |
| | *Eriogonum vimineum* | broom buckwheat |
| | *Polygonum aviculare* | doorweed |
| | * *Polygonum convolvulus* | climbing bindweed |
| | * *Polygonum cuspidatum* | Japanese knotweed |
| | *Polygonum majus* | wiry knotweed |
| | *Polygonum persicaria* | spotted ladysthumb |
| | *Polygonum sp.* | knotweed |
| | * *Rumex acetosella* | field sorrel |
| | * *Rumex crispus* | curly dock |
| | *Rumex sp.* | dock |
| POLYPODIACEAE | *Cystopteris fragilis* | bladder-fern |
| | *Pteridium aquilinum var. pubescens* | bracken |
| PORTULACACEAE | *Montia perfoliata* | miner's lettuce |
| | * *Portulaca oleracea* | common purslane |
| RANUNCULACEAE | *Clematis ligusticifolia* | western clematis |
| | *Ranunculus sp.* | buttercup |
| RHAMNACEAE | *Ceanothus sp.* | buckbrush |

| | | |
|---|---|---|
| RHAMNACEAE | *Rhamnus purshiana* | cascara |
| ROSACEAE | *Amelanchier alnifolia* | western service berry |
| | *Crataegus columbiana* | Columbia hawthorn |
| | *Crataegus douglasii var. douglasii* | black hawthorn |
| | *Physocarpus malvaceus* | mallow ninebark |
| | *Potentilla glandulosa* | sticky cinquefoil |
| | * *Prunus armeniaca* | apricot |
| | * *Prunus cerasifera* | cherry plum |
| | *Prunus emarginata* | bittercherry |
| | *Prunus sp.* | cherry |
| | *Prunus virginiana* | chokecherry |
| | *Purshia tridentata* | bitter-brush |
| | *Rosa nutkana* | Nootka rose |
| | *Rosa woodsii* | Wood's rose |
| | * *Rubus discolor* | Himalayan blackberry |
| | *Rubus leucodermis* | black raspberry |
| RUBIACEAE | *Galium aparine var. echinospermum* | bedstraw; goose-grass |
| SALICACEAE | *Populus trichocarpa* | black cottonwood |
| | *Salix exigua* | river-bank willow |
| | *Salix sp.* | willow |
| SANTALACEAE | *Comandra umbellata* | bastard toad flax |
| SAXIFRAGACEAE | *Bolandra oregana* | bolandra |
| | *Heuchera sp.* | alumroot |
| | *Lithophragma bulbifera* | bulbiferous fringecup |
| SCROPHULARIACEAE | * *Linaria dalmatica* | dalmatian toadflax |
| | *Mimulus guttatus* | yellow monkey-flower |
| | *Penstemon deustus* | hot-rock penstemon |
| | *Penstemon triphyllus* | whorled penstemon |
| | * *Verbascum blattaria* | moth mullein |
| | * *Verbascum thapsus* | common mullein |
| SIMAROUBACEAE | * *Ailanthus altissima* | tree-of-heaven |
| SOLANACEAE | *Physalis longifolia* | long-leaved ground-cherry |
| ULMACEAE | *Celtis reticulata* | hackberry |
| | * *Ulmus sp.* | elm |
| VERBENACEAE | *Verbena bracteata* | bracted verbena |

| | | |
|---|---|---|
| VITACEAE | * *Vitis sp.* | grape-vine |
| ZYGOPHYLLACEAE | * *Tribulus terrestris* | puncture vine |

# Vascular Plant Species
## Hells Canyon Rare Plant and Weed Survey - Oxbow Reservoir Reach
Survey Date(s): 8/4/98 through 5/3/99

*Botanical nomenclature follows "Flora of the Pacifc Northwest" (Hitchcock and Cronquist 1973) and "The Jepson Manual" (Hickman 1993)*

** = introduced plants*

| Family | Scientific Name | Common Name |
|---|---|---|
| AMARANTHACEAE | *Amaranthus albus* | tumbleweed |
| ANACARDIACEAE | *Rhus glabra* | smooth sumac |
| | *Rhus radicans* | poison ivy |
| APIACEAE | * *Anthriscus scandicina* | bur chervil |
| | * *Conium maculatum* | poison-hemlock |
| | *Lomatium dissectum* | fern-leaved lomatium |
| ASCLEPIADACEAE | *Asclepias fascicularis* | Mexican milkweed |
| | *Asclepias speciosa* | showy milkweed |
| ASTERACEAE | *Achillea millefolium* | common yarrow |
| | *Ambrosia acanthicarpa* | annual burweed |
| | *Ambrosia artemisiifolia* | annual ragweed |
| | * *Anthemis cotula* | mayweed chamomile |
| | *Artemisia ludoviciana* | prairie sage |
| | *Aster sp.* | aster |
| | *Balsamorhiza sagittata* | arrow-leaf balsamroot |
| | *Bidens vulgata* | tall beggar-ticks |
| | * *Cichorium intybus* | wild succory |
| | * *Cirsium arvense* | Canada thistle |
| | *Cirsium utahense* | Utah thistle |
| | * *Cirsium vulgare* | bull thistle |
| | * *Conyza canadensis* | horseweed |
| | *Erigeron divergens var. divergens* | diffuse fleabane |
| | *Erigeron strigosus* | daisy fleabane |
| | *Gnaphalium palustre* | lowland cudweed |
| | *Grindelia squarrosa* | resin-weed |
| | *Helianthella uniflora* | Rocky Mountain helianthella |
| | *Helianthus annuus* | common sunflower |
| | * *Lactuca serriola* | prickly lettuce |
| | *Lagophylla ramosissima* | slender hareleaf |
| | * *Onopordum acanthium* | scotch thistle |

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|---|---|---|
| ASTERACEAE | *Solidago occidentalis* | western goldenrod |
| | *Stephanomeria tenuifolia* | narrow-leaved skeletonweed |
| | * *Taraxacum officinale* | common dandelion |
| | * *Tragopogon dubius* | salsify |
| | *Xanthium strumarium* | common cocklebur |
| BETULACEAE | *Alnus rhombifolia* | white alder |
| | *Alnus sinuata* | Sitka alder |
| BORAGINACEAE | *Amsinckia intermedia* | ranchers fiddleneck |
| | *Amsinckia retrorsa* | rigid fiddleneck |
| | *Cryptantha sp.* | cryptantha |
| | *Cynoglossum occidentale* | western hound's-tongue |
| | * *Cynoglossum officinale* | common hounds-tongue |
| BRASSICACEAE | * *Alyssum alyssoides* | pale alyssum |
| | *Cardaria draba* | heart-podded hoarycress |
| | * *Lepidium campestre* | fieldpeppergrass |
| | * *Lepidium latifolium* | pepperwort |
| | * *Rorippa nasturtium-aquaticum* | water-cress |
| | * *Sisymbrium altissimum* | Jim Hill mustard |
| CAPPARIDACEAE | *Polanisia trachysperma* | clammy-weed |
| CAPRIFOLIACEAE | *Sambucus cerulea* | blue elderberry |
| CARYOPHYLLACEAE | * *Silene antirrhina* | sleepy cat |
| | * *Vaccaria segetalis* | cowcockle |
| CHENOPODIACEAE | *Chenopodium album* | lamb's quarters |
| | * *Chenopodium botrys* | Jerusalem oak |
| | * *Kochia scoparia* | kochia |
| | * *Salsola kali* | Russian thistle |
| CONVOLVULACEAE | * *Convolvulus arvensis* | field bindweed |
| CORNACEAE | *Cornus stolonifera* | red-osier dogwood |
| CYPERACEAE | *Carex hystricina* | porcupine sedge |
| | *Carex sp.* | sedge |
| | *Carex stipata* | sawbeak sedge |
| | *Carex vulpinoidea* | fox sedge |
| | *Cyperus strigosus* | straw-colored flatsedge |
| | *Scirpus sp.* | bulrush |

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|---|---|---|
| DIPSACACEAE | * *Dipsacus sylvestris* | teasel |
| ELAEAGNACEAE | * *Elaeagnus angustifolia* | Russian olive |
| EQUISETACEAE | *Equisetum laevigatum* | smooth scouring-rush |
| EUPHORBIACEAE | *Eremocarpus setigerus* | turkey-mullein |
| | *Euphorbia glyptosperma* | corrugate-seeded spurge |
| FABACEAE | * *Amorpha fruticosa* | false indigo |
| | *Astragalus sp.* | locoweed |
| | *Lotus purshianus* | Spanish clover |
| | * *Medicago sativa* | alfalfa |
| | * *Melilotus alba* | white sweet-clover |
| | * *Melilotus officinalis* | common yellow sweet-clover |
| | * *Trifolium repens* | white clover |
| GERANIACEAE | * *Erodium cicutarium* | filaree |
| GROSSULARIACEAE | *Ribes aureum* | golden currant |
| HYDRANGEACEAE | *Philadelphus lewisii* | mockorange |
| HYDROPHYLLACEAE | *Phacelia linearis* | threadleaf phacelia |
| HYPERICACEAE | * *Hypericum perforatum* | common St. Johnswort |
| IRIDACEAE | * *Iris pseudacorus* | yellow flag |
| JUGLANDACEAE | * *Juglans regia* | English walnut |
| JUNCACEAE | *Juncus acuminatus* | tapered rush |
| | *Juncus confusus* | Colorado rush |
| | *Juncus effusus* | common rush |
| | *Juncus sp.* | rush |
| | *Juncus tenuis* | slender rush |
| LAMIACEAE | *Lycopus asper* | rough bugleweed |
| | * *Marrubium vulgare* | horehound |
| | * *Nepeta cataria* | catnip |
| | * *Salvia aethiopis* | Mediterranean sage |
| LILIACEAE | *Camassia cusickii* | Cusick's camas |

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|---|---|---|
| LOASACEAE | *Mentzelia dispersa* | small-flowered mentzelia |
| | *Mentzelia laevicaulis* | blazing-star mentzelia |
| LYTHRACEAE | * *Lythrum salicaria* | purple loosestrife |
| MALVACEAE | *Malva neglecta* | dwarf mallow |
| OLEACEAE | * *Fraxinus sp.* | ash |
| ONAGRACEAE | *Epilobium paniculatum* | tall annual willow-weed |
| | *Epilobium watsonii* | Watson's willow-weed |
| | *Gaura parviflora* | small-flowered gaura |
| | *Oenothera boothii ssp. boothii* | Booth's evening-primrose |
| | *Oenothera strigosa* | common evening primrose |
| PINACEAE | *Pinus ponderosa* | ponderosa pine |
| PLANTAGINACEAE | * *Plantago lanceolata* | ribwort |
| | *Plantago major* | common plantain |
| | *Plantago patagonica* | Indian-wheat |
| POACEAE | * *Aegilops cylindrica* | jointed goatgrass |
| | * *Agropyron repens* | quackgrass |
| | * *Agropyron sp.* | wheatgrass |
| | *Agropyron spicatum var. spicatum* | blue-bunch wheatgrass |
| | *Aristida longiseta* | red threeawn |
| | * *Avena fatua* | wild oat |
| | * *Bromus brizaeformis* | rattlesnake brome |
| | * *Bromus commutatus* | hairy chess |
| | * *Bromus japonicus* | Japanese brome |
| | * *Bromus sterilis* | barren brome |
| | * *Bromus tectorum* | cheatgrass |
| | *Cenchrus longispinus* | bur-grass |
| | *Cinna latifolia* | woodreed |
| | * *Digitaria sanguinalis* | hairy crabgrass |
| | *Elymus canadensis* | canada wildrye |
| | *Elymus cinereus* | giant wildrye |
| | * *Eragrostis cilianensis* | stinkgrass |
| | * *Eragrostis pilosa* | India lovegrass |
| | *Festuca scabrella* | rough fescue |
| | *Hordeum jubatum* | foxtail barley |
| | *Panicum capillare* | common witchgrass |
| | *Phalaris arundinacea* | reed canarygrass |
| | * *Phleum pratense* | timothy |

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|---|---|---|
| POACEAE | * *Poa bulbosa* | bulbous bluegrass |
| | *Poa compressa* | Canadian bluegrass |
| | *Poa pratensis* | Kentucky bluegrass |
| | * *Polypogon monspeliensis* | rabbitfoot polypogon |
| | * *Setaria viridis* | green bristlegrass |
| | *Sporobolus cryptandrus* | sand dropseed |
| | *Stipa sp.* | needlegrass |
| | * *Taeniatherum caput-medusae* | medusahead wildrye |
| POLEMONIACEAE | *Collomia sp.* | collomia |
| POLYGONACEAE | *Eriogonum compositum* | northern buckwheat |
| | *Eriogonum heracleoides* | Wyeth's buckwheat |
| | *Eriogonum niveum* | snow buckwheat |
| | *Eriogonum strictum* | strict buckwheat |
| | *Eriogonum umbellatum* | sulfur buckwheat |
| | *Eriogonum vimineum* | broom buckwheat |
| | *Polygonum aviculare* | doorweed |
| | * *Polygonum convolvulus* | climbing bindweed |
| | *Polygonum douglasii* | Douglas' knotweed |
| | * *Polygonum hydropiper* | smartweed |
| | *Polygonum majus* | wiry knotweed |
| | *Polygonum persicaria* | spotted ladysthumb |
| | *Polygonum sp.* | knotweed |
| | * *Rumex acetosella* | field sorrel |
| | * *Rumex crispus* | curly dock |
| | *Rumex sp.* | dock |
| POLYPODIACEAE | *Cystopteris fragilis* | bladder-fern |
| PORTULACACEAE | * *Portulaca oleracea* | common purslane |
| PRIMULACEAE | *Dodecatheon conjugens* | desert shooting-star |
| RANUNCULACEAE | *Clematis columbiana var. columbiana* | Columbia clematis |
| | *Clematis ligusticifolia* | western clematis |
| | * *Ranunculus testiculatus* | hornseed buttercup |
| RHAMNACEAE | *Rhamnus purshiana* | cascara |
| ROSACEAE | *Amelanchier alnifolia* | western service berry |
| | *Crataegus columbiana* | Columbia hawthorn |
| | *Crataegus douglasii var. douglasii* | black hawthorn |
| | *Prunus americana* | wild plum |
| | * *Prunus armeniaca* | apricot |

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|---|---|---|
| ROSACEAE | *Prunus emarginata* | bittercherry |
| | *Prunus sp.* | cherry |
| | *Prunus virginiana* | chokecherry |
| | *Purshia tridentata* | bitter-brush |
| | * *Pyrus malus* | cultivated apple |
| | *Rosa sp.* | rose |
| | *Rosa woodsii* | Wood's rose |
| | * *Rubus discolor* | Himalayan blackberry |
| | *Sorbus scopulina* | mountain-ash |
| RUBIACEAE | *Galium aparine var. echinospermum* | bedstraw; goose-grass |
| | *Galium triflorum* | sweet-scented bedstraw |
| SALICACEAE | *Salix exigua* | river-bank willow |
| | *Salix lasiandra var. caudata* | whiplash willow |
| | *Salix sp.* | willow |
| SAXIFRAGACEAE | *Bolandra oregana* | bolandra |
| SCROPHULARIACEAE | *Collinsia sp.* | blue-eyed mary |
| | *Mimulus guttatus* | yellow monkey-flower |
| | *Mimulus patulus* | stalk-leaved monkey-flower |
| | *Penstemon deustus* | hot-rock penstemon |
| | * *Verbascum blattaria* | moth mullein |
| | * *Verbascum thapsus* | common mullein |
| | *Veronica anagallis-aquatica* | water speedwell |
| | *Veronica peregrina* | purslane speedwell |
| SOLANACEAE | *Physalis longifolia* | long-leaved ground-cherry |
| | * *Solanum dulcamara* | bittersweet |
| TYPHACEAE | *Typha latifolia* | cat-tail |
| ULMACEAE | *Celtis reticulata* | hackberry |
| | * *Ulmus sp.* | elm |
| URTICACEAE | *Urtica dioica* | stinging nettle |
| VALERIANACEAE | *Plectritis macrocera* | long-horn plectritis |
| VERBENACEAE | *Verbena bracteata* | bracted verbena |
| | *Verbena stricta* | hoary verbena |
| ZYGOPHYLLACEAE | * *Tribulus terrestris* | puncture vine |

# Vascular Plant Species
## Hells Canyon Rare Plant and Weed Survey - Brownlee Reservoir Reach
Survey Date(s): 8/7/98 through 6/4/99

*Botanical nomenclature follows "Flora of the Pacifc Northwest" (Hitchcock and Cronquist 1973) and "The Jepson Manual" (Hickman 1993)*

** = introduced plants*

| Family | Scientific Name | Common Name |
|---|---|---|
| ACERACEAE | * *Acer saccharinum* | silver maple |
| AIZOACEAE | *Mollugo verticillata* | carpetweed |
| AMARANTHACEAE | *Amaranthus albus* | tumbleweed |
| | *Amaranthus powellii* | Powell's amaranth |
| | * *Amaranthus retroflexus* | rough pigweed |
| | *Amaranthus sp.* | amaranth |
| ANACARDIACEAE | *Rhus glabra* | smooth sumac |
| | *Rhus radicans* | poison ivy |
| APIACEAE | * *Anthriscus scandicina* | bur chervil |
| | * *Conium maculatum* | poison-hemlock |
| | *Lomatium dissectum* | fern-leaved lomatium |
| | *Lomatium grayi* | Gray's desert-parsley |
| | *Lomatium nudicaule* | pestle parsnip |
| | *Lomatium sp.* | desert-parsley |
| | *Lomatium triternatum* | nine-leaf lomatium |
| APOCYNACEAE | *Apocynum cannabinum* | common dogbane |
| ASCLEPIADACEAE | *Asclepias fascicularis* | Mexican milkweed |
| | *Asclepias speciosa* | showy milkweed |
| ASTERACEAE | *Achillea millefolium* | common yarrow |
| | *Ambrosia acanthicarpa* | annual burweed |
| | *Ambrosia artemisiifolia* | annual ragweed |
| | *Artemisia dracunculus var. dracunculus* | tarragon |
| | *Artemisia ludoviciana* | prairie sage |
| | *Artemisia rigida* | stiff sagebrush |
| | *Artemisia tridentata* | big sagebrush |
| | *Aster sp.* | aster |
| | *Balsamorhiza sagittata* | arrow-leaf balsamroot |

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|---|---|---|
| ASTERACEAE | *Bidens vulgata* | tall beggar-ticks |
| | *Chaenactis douglasii* | hoary chaenactis |
| | * *Chondrilla juncea* | rush skeleton-weed |
| | *Chrysothamnus nauseosus* | gray rabbit-brush |
| | *Chrysothamnus viscidiflorus* | green rabbit-brush |
| | * *Cichorium intybus* | wild succory |
| | * *Cirsium arvense* | Canada thistle |
| | *Cirsium utahense* | Utah thistle |
| | * *Cirsium vulgare* | bull thistle |
| | * *Conyza canadensis* | horseweed |
| | *Crepis occidentalis* | western hawksbeard |
| | *Gnaphalium palustre* | lowland cudweed |
| | *Grindelia squarrosa* | resin-weed |
| | *Gutierrezia sarothrae* | broom snakeweed |
| | *Haplopappus radiatus* | Snake River goldenweed |
| | *Helianthus annuus* | common sunflower |
| | *Iva axillaris* | poverty weed |
| | *Iva xanthifolia* | tall marsh-elder |
| | * *Lactuca serriola* | prickly lettuce |
| | *Lagophylla ramosissima* | slender hareleaf |
| | *Machaeranthera canescens* | hoary aster |
| | *Matricaria matricarioides* | pine-apple weed |
| | * *Onopordum acanthium* | scotch thistle |
| | *Solidago missouriensis* | Missouri goldenrod |
| | *Solidago occidentalis* | western goldenrod |
| | *Stephanomeria tenuifolia* | narrow-leaved skeletonweed |
| | * *Taraxacum officinale* | common dandelion |
| | * *Tragopogon dubius* | salsify |
| | *Xanthium strumarium* | common cocklebur |
| BETULACEAE | *Betula occidentalis* | water birch |
| BORAGINACEAE | *Amsinckia intermedia* | ranchers fiddleneck |
| | *Amsinckia retrorsa* | rigid fiddleneck |
| | *Amsinckia tessellata* | tessellate fiddleneck |
| | * *Asperugo procumbens* | madwort |
| | *Cryptantha sp.* | cryptantha |
| | * *Cynoglossum officinale* | common hounds-tongue |
| | *Lithospermum ruderale* | Columbia puccoon |
| | * *Myosotis arvensis* | field forget-me-not |
| BRASSICACEAE | * *Alyssum alyssoides* | pale alyssum |
| | * *Camelina microcarpa* | littlepod falseflax |
| | *Cardaria draba* | heart-podded hoarycress |
| | * *Chorispora tenella* | blue mustard |
| | *Descurainia pinnata* | western tansymustard |

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|---|---|---|
| BRASSICACEAE | * *Descurainia sophia* | flixweed |
| | *Draba verna* | spring whitlow-grass |
| | * *Lepidium latifolium* | pepperwort |
| | * *Lepidium perfoliatum* | clasping peppergrass |
| | *Physaria oregana* | Oregon twinpod |
| | *Rorippa sp.* | yellowcress |
| | * *Sisymbrium altissimum* | Jim Hill mustard |
| | *Thelypodium laciniatum* | thickleaved thelypody |
| | * *Thlaspi arvense* | fanweed |
| CAPRIFOLIACEAE | *Sambucus cerulea* | blue elderberry |
| CARYOPHYLLACEAE | * *Arenaria serpyllifolia* | thyme-leaf sandwort |
| | * *Silene antirrhina* | sleepy cat |
| | * *Vaccaria segetalis* | cowcockle |
| CELASTRACEAE | *Glossopetalon nevadense var. stipuliferum* | spiny green-bush |
| CHENOPODIACEAE | *Atriplex patula* | orache |
| | *Chenopodium album* | lamb's quarters |
| | *Chenopodium glaucum* | glaucous goosefoot |
| | * *Kochia scoparia* | kochia |
| | * *Salsola kali* | Russian thistle |
| | *Sarcobatus vermiculatus* | greasewood |
| CONVOLVULACEAE | * *Convolvulus arvensis* | field bindweed |
| CORNACEAE | *Cornus stolonifera* | red-osier dogwood |
| CUPRESSACEAE | *Juniperus occidentalis* | western juniper |
| CUSCUTACEAE | *Cuscuta sp.* | dodder |
| CYPERACEAE | *Carex lanuginosa* | woolly sedge |
| | *Carex vulpinoidea* | fox sedge |
| | *Cyperus aristatus* | awned flatsedge |
| | *Cyperus esculentus* | yellow nut-grass |
| | *Eleocharis sp.* | spike-rush |
| | *Scirpus acutus* | hardstem bulrush |
| DIPSACACEAE | * *Dipsacus sylvestris* | teasel |
| ELAEAGNACEAE | * *Elaeagnus angustifolia* | Russian olive |

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|---|---|---|
| EQUISETACEAE | *Equisetum laevigatum* | smooth scouring-rush |
| EUPHORBIACEAE | * *Euphorbia esula* | leafy spurge |
| | *Euphorbia glyptosperma* | corrugate-seeded spurge |
| | *Euphorbia serpyllifolia* | thyme-leaf spurge |
| FABACEAE | * *Amorpha fruticosa* | false indigo |
| | *Astragalus cusickii* | Cusick's milk-vetch |
| | *Astragalus purshii* | woolly-pod milk-vetch |
| | * *Daucus carota* | Queen Anne's lace |
| | *Glycyrrhiza lepidota* | licorice |
| | *Lupinus caudatus* | tailcup lupine |
| | *Lupinus laxiflorus var. calcaratus* | spurred lupine |
| | *Lupinus leucophyllus* | velvet lupine |
| | *Lupinus sp.* | lupine |
| | * *Medicago lupulina* | hop clover |
| | * *Medicago sativa* | alfalfa |
| | * *Melilotus alba* | white sweet-clover |
| | * *Melilotus officinalis* | common yellow sweet-clover |
| | *Petalostemon ornatum* | western prairie-clover |
| | * *Robinia pseudo-acacia* | robinia |
| | *Trifolium sp.* | clover |
| GERANIACEAE | * *Erodium cicutarium* | filaree |
| GROSSULARIACEAE | *Ribes aureum* | golden currant |
| HYDRANGEACEAE | *Philadelphus lewisii* | mockorange |
| HYDROPHYLLACEAE | *Hydrophyllum capitatum* | ball-head waterleaf |
| | *Phacelia hastata* | silverleaf phacelia |
| | *Phacelia linearis* | threadleaf phacelia |
| HYPERICACEAE | * *Hypericum perforatum* | common St. Johnswort |
| IRIDACEAE | * *Iris pseudacorus* | yellow flag |
| JUNCACEAE | *Juncus acuminatus* | tapered rush |
| | *Juncus balticus* | Baltic rush |
| LAMIACEAE | * *Lamium amplexicaule* | common dead-nettle |
| | *Lycopus asper* | rough bugleweed |
| | * *Marrubium vulgare* | horehound |
| | *Mentha arvensis* | field mint |
| | * *Nepeta cataria* | catnip |

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|---|---|---|
| LEMNACEAE | *Lemna minor* | water lentil |
| LILIACEAE | *Allium acuminatum* | tapertip onion |
| | * *Asparagus officinalis* | asparagus |
| | *Brodiaea douglasii* | wild hyacinth |
| | *Smilacina stellata* | star-flowered Solomon's-seal |
| LOASACEAE | *Mentzelia laevicaulis* | blazing-star mentzelia |
| LYTHRACEAE | * *Lythrum salicaria* | purple loosestrife |
| MALVACEAE | *Malva neglecta* | dwarf mallow |
| | *Sida hederacea* | alkali-mallow |
| ONAGRACEAE | *Boisduvalia densiflora* | dense spike-primrose |
| | *Epilobium angustifolium* | common fireweed |
| | *Epilobium paniculatum* | tall annual willow-weed |
| | *Epilobium watsonii* | Watson's willow-weed |
| | *Gaura parviflora* | small-flowered gaura |
| | *Oenothera boothii ssp. boothii* | Booth's evening-primrose |
| | *Oenothera strigosa* | common evening primrose |
| PLANTAGINACEAE | * *Plantago lanceolata* | ribwort |
| | *Plantago major* | common plantain |
| | *Plantago patagonica* | Indian-wheat |
| POACEAE | * *Agropyron cristatum* | crested wheatgrass |
| | * *Agropyron repens* | quackgrass |
| | *Agropyron spicatum var. spicatum* | blue-bunch wheatgrass |
| | *Alopecurus aequalis* | shortawn foxtail |
| | *Aristida longiseta* | red threeawn |
| | * *Avena fatua* | wild oat |
| | * *Bromus brizaeformis* | rattlesnake brome |
| | * *Bromus commutatus* | hairy chess |
| | * *Bromus japonicus* | Japanese brome |
| | * *Bromus tectorum* | cheatgrass |
| | * *Dactylis glomerata* | orchard grass |
| | * *Digitaria sanguinalis* | hairy crabgrass |
| | * *Echinochloa crusgalli* | large barnyard-grass |
| | *Elymus cinereus* | giant wildrye |
| | *Festuca idahoensis var. idahoensis* | Idaho fescue |
| | *Glyceria sp.* | mannagrass |
| | *Glyceria striata* | fowl mannagrass |
| | *Hordeum jubatum* | foxtail barley |

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|---|---|---|
| POACEAE | * *Hordeum leporinum* | charming barley |
| | *Panicum capillare* | common witchgrass |
| | *Phalaris arundinacea* | reed canarygrass |
| | *Phragmites communis* | common reed |
| | * *Poa bulbosa* | bulbous bluegrass |
| | *Poa nevadensis* | Nevada bluegrass |
| | *Poa pratensis* | Kentucky bluegrass |
| | *Poa scabrella* | pine bluegrass |
| | *Poa secunda* | Sandberg's bluegrass |
| | * *Polypogon monspeliensis* | rabbitfoot polypogon |
| | *Sitanion hystrix* | bottlebrush squirreltail |
| | *Sporobolus cryptandrus* | sand dropseed |
| | * *Taeniatherum caput-medusae* | medusahead wildrye |
| POLEMONIACEAE | *Collomia grandiflora* | large flowered collomia |
| | *Collomia linearis* | narrow-leaf collomia |
| | *Collomia sp.* | collomia |
| | *Phlox longifolia* | long-leaf phlox |
| POLYGONACEAE | *Eriogonum compositum* | northern buckwheat |
| | *Eriogonum niveum* | snow buckwheat |
| | *Eriogonum ovalifolium* | oval-leaved eriogonum |
| | *Eriogonum umbellatum* | sulfur buckwheat |
| | *Polygonum coccineum* | water smartweed |
| | * *Polygonum convolvulus* | climbing bindweed |
| | *Polygonum persicaria* | spotted ladysthumb |
| | * *Rumex crispus* | curly dock |
| | *Rumex sp.* | dock |
| POLYPODIACEAE | *Cystopteris fragilis* | bladder-fern |
| PORTULACACEAE | *Montia perfoliata* | miner's lettuce |
| | * *Portulaca oleracea* | common purslane |
| RANUNCULACEAE | *Clematis hirsutissima* | sugarbowls |
| | *Clematis ligusticifolia* | western clematis |
| | *Ranunculus flabellaris* | yellow water-buttercup |
| ROSACEAE | *Amelanchier alnifolia* | western service berry |
| | *Crataegus douglasii var. douglasii* | black hawthorn |
| | *Prunus virginiana* | chokecherry |
| | *Purshia tridentata* | bitter-brush |
| | *Rosa woodsii* | Wood's rose |
| | * *Rubus discolor* | Himalayan blackberry |

| | | |
|---|---|---|
| RUBIACEAE | *Galium aparine var. echinospermum* | bedstraw; goose-grass |
| | *Galium triflorum* | sweet-scented bedstraw |
| SALICACEAE | * *Populus deltoides var. occidentalis* | Great Plains cottonwood |
| | *Populus trichocarpa* | black cottonwood |
| | * *Salix alba var. vitellina* | golden willow |
| | *Salix exigua ssp. exigua* | slender willow |
| | *Salix lasiandra var. lasiandra* | red willow |
| | *Salix sp.* | willow |
| SCROPHULARIACEAE | *Collinsia parviflora* | blue-eyed mary |
| | * *Linaria dalmatica* | dalmatian toadflax |
| | *Mimulus cusickii* | Cusick's monkey-flower |
| | *Mimulus guttatus* | yellow monkey-flower |
| | *Penstemon deustus* | hot-rock penstemon |
| | *Penstemon glandulosus var. glandulosus* | glandular penstemon |
| | * *Verbascum blattaria* | moth mullein |
| | * *Verbascum thapsus* | common mullein |
| | *Veronica americana* | American brooklime |
| | *Veronica peregrina* | purslane speedwell |
| SOLANACEAE | *Physalis longifolia* | long-leaved ground-cherry |
| TAMARICACEAE | * *Tamarix pentandra* | tamarisk |
| TYPHACEAE | *Typha latifolia* | cat-tail |
| ULMACEAE | *Celtis reticulata* | hackberry |
| | * *Ulmus americana* | American elm |
| URTICACEAE | *Urtica dioica* | stinging nettle |
| VALERIANACEAE | *Plectritis ciliosa* | long-spurred plectritis |
| VERBENACEAE | *Verbena bracteata* | bracted verbena |
| ZYGOPHYLLACEAE | * *Tribulus terrestris* | puncture vine |

## Vascular Plant Species
## Hells Canyon Rare Plant and Weed Survey - Weiser Reach

Survey Date(s): 9/11/98 through 6/4/99

*Botanical nomenclature follows "Flora of the Pacifc Northwest" (Hitchcock and Cronquist 1973) and "The Jepson Manual" (Hickman 1993)*

** = introduced plants*

| Family | Scientific Name | Common Name |
|---|---|---|
| ACERACEAE | * *Acer negundo* | box-elder |
| | * *Acer saccharinum* | silver maple |
| | *Acer sp.* | maple |
| AMARANTHACEAE | *Amaranthus albus* | tumbleweed |
| | *Amaranthus powellii* | Powell's amaranth |
| | * *Amaranthus retroflexus* | rough pigweed |
| | *Amaranthus sp.* | amaranth |
| APIACEAE | * *Conium maculatum* | poison-hemlock |
| APOCYNACEAE | *Apocynum cannabinum* | common dogbane |
| ASCLEPIADACEAE | *Asclepias speciosa* | showy milkweed |
| ASTERACEAE | *Achillea millefolium* | common yarrow |
| | *Ambrosia psilostachya* | western ragweed |
| | *Artemisia ludoviciana* | prairie sage |
| | *Artemisia tridentata* | big sagebrush |
| | *Bidens frondosa* | leafy beggar-ticks |
| | *Chrysothamnus nauseosus* | gray rabbit-brush |
| | * *Cirsium arvense* | Canada thistle |
| | * *Cirsium vulgare* | bull thistle |
| | * *Conyza canadensis* | horseweed |
| | *Grindelia squarrosa* | resin-weed |
| | *Helenium autumnale* | sneezeweed |
| | *Helianthus annuus* | common sunflower |
| | * *Lactuca serriola* | prickly lettuce |
| | * *Onopordum acanthium* | scotch thistle |
| | *Solidago occidentalis* | western goldenrod |
| | * *Taraxacum officinale* | common dandelion |
| | * *Tragopogon dubius* | salsify |
| | *Xanthium strumarium* | common cocklebur |

| | | |
|---|---|---|
| BORAGINACEAE | *Amsinckia retrorsa* | rigid fiddleneck |
| | *Amsinckia sp.* | fiddleneck |
| BRASSICACEAE | * *Capsella bursa-pastoris* | shepherd's-purse |
| | *Cardaria draba* | heart-podded hoarycress |
| | *Draba verna* | spring whitlow-grass |
| | * *Lepidium latifolium* | pepperwort |
| | * *Lepidium perfoliatum* | clasping peppergrass |
| | * *Sisymbrium altissimum* | Jim Hill mustard |
| CHENOPODIACEAE | *Atriplex patula* | orache |
| | *Chenopodium album* | lamb's quarters |
| | *Chenopodium glaucum* | glaucous goosefoot |
| | * *Kochia scoparia* | kochia |
| | * *Salsola kali* | Russian thistle |
| | *Sarcobatus vermiculatus* | greasewood |
| CONVOLVULACEAE | * *Convolvulus arvensis* | field bindweed |
| CUCURBITACEAE | *Echinocystis lobata* | wild cucumber |
| CUSCUTACEAE | *Cuscuta sp.* | dodder |
| CYPERACEAE | *Cyperus aristatus* | awned flatsedge |
| | *Cyperus erythrorhizos* | red-rooted flatsedge |
| | *Cyperus strigosus* | straw-colored flatsedge |
| DIPSACACEAE | * *Dipsacus sylvestris* | teasel |
| ELAEAGNACEAE | * *Elaeagnus angustifolia* | Russian olive |
| EQUISETACEAE | *Equisetum laevigatum* | smooth scouring-rush |
| EUPHORBIACEAE | * *Euphorbia esula* | leafy spurge |
| | *Euphorbia glyptosperma* | corrugate-seeded spurge |
| FABACEAE | * *Amorpha fruticosa* | false indigo |
| | * *Medicago sativa* | alfalfa |
| | * *Melilotus alba* | white sweet-clover |
| GERANIACEAE | *Geranium sp.* | geranium |
| GROSSULARIACEAE | *Ribes aureum* | golden currant |
| | *Ribes cereum* | squaw or wax currant |

| | | |
|---|---|---|
| IRIDACEAE | * *Iris pseudacorus* | yellow flag |
| LAMIACEAE | * *Lamium amplexicaule* | common dead-nettle |
| | * *Nepeta cataria* | catnip |
| LILIACEAE | *Allium acuminatum* | tapertip onion |
| | * *Asparagus officinalis* | asparagus |
| | *Smilacina stellata* | star-flowered Solomon's-seal |
| LYTHRACEAE | * *Lythrum salicaria* | purple loosestrife |
| MALVACEAE | *Malva neglecta* | dwarf mallow |
| | *Sida hederacea* | alkali-mallow |
| MORACEAE | * *Morus alba* | white mulberry |
| OLEACEAE | * *Fraxinus pennsylvanica* | green ash |
| ONAGRACEAE | *Circaea alpina* | enchanter's nightshade |
| | *Epilobium paniculatum* | tall annual willow-weed |
| | *Gaura parviflora* | small-flowered gaura |
| PLANTAGINACEAE | *Plantago major* | common plantain |
| POACEAE | *Agropyron spicatum var. spicatum* | blue-bunch wheatgrass |
| | *Alopecurus aequalis* | shortawn foxtail |
| | * *Bromus commutatus* | hairy chess |
| | * *Bromus japonicus* | Japanese brome |
| | * *Bromus tectorum* | cheatgrass |
| | * *Echinochloa crusgalli* | large barnyard-grass |
| | *Elymus cinereus* | giant wildrye |
| | * *Eragrostis cilianensis* | stinkgrass |
| | *Hordeum jubatum* | foxtail barley |
| | *Panicum capillare* | common witchgrass |
| | *Phalaris arundinacea* | reed canarygrass |
| | * *Poa bulbosa* | bulbous bluegrass |
| | * *Taeniatherum caput-medusae* | medusahead wildrye |
| POLYGONACEAE | *Polygonum coccineum* | water smartweed |
| | *Polygonum hydropiperoides* | waterpepper |
| | * *Polygonum lapathifolium* | willow weed |
| | * *Rumex crispus* | curly dock |

| | | |
|---|---|---|
| PORTULACACEAE | *Montia perfoliata* | miner's lettuce |
| RANUNCULACEAE | * *Ranunculus testiculatus* | hornseed buttercup |
| ROSACEAE | *Purshia tridentata* | bitter-brush |
| | *Rosa sp.* | rose |
| | *Rosa woodsii* | Wood's rose |
| RUBIACEAE | *Galium aparine var. echinospermum* | bedstraw; goose-grass |
| | *Galium triflorum* | sweet-scented bedstraw |
| SALICACEAE | *Salix exigua* | river-bank willow |
| | *Salix sp.* | willow |
| SCROPHULARIACEAE | * *Verbascum thapsus* | common mullein |
| TAMARICACEAE | * *Tamarix pentandra* | tamarisk |
| ULMACEAE | * *Ulmus americana* | American elm |
| URTICACEAE | *Urtica dioica* | stinging nettle |
| ZYGOPHYLLACEAE | * *Tribulus terrestris* | puncture vine |

## Appendix 2: Noxious Weed Data Forms

(This appendix is contained in five separate volumes. If you wish to review this appendix, please contact Gary Holmstead at Idaho Power Company.)

## Appendix 3: Topographic Maps Showing Weed Populations

(This appendix is contained in a separate volume. If you wish to review this appendix, please contact Gary Holmstead at Idaho Power Company.)

# Appendix 4: Correlation Matrix of Disturbance Types For Weed Investigation

Correlation matrix of disturbance types. Numbers above the diagonal are correlation coefficients. Numbers below the diagonal are Pearson r to z p-values. P-values in bold indicate a significant correlation; those in italics indicate a negative correlation.

| | Alluvial | Flowzone | Livestock | Mining | Fire | Road | Rec. | Trail | Industry | Ag. | Res. | ORV | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Alluvial** | | 0.2210 | 0.0420 | -0.0060 | -0.1500 | -0.0670 | 0.1790 | -0.0900 | -0.0380 | -0.0970 | -0.0470 | -0.0120 | -0.0540 |
| **Flowzone** | **<.0001** | | -0.1710 | -0.0010 | -0.4090 | -0.1380 | 0.1000 | -0.1050 | -0.0070 | -0.0570 | 0.0720 | 0.0770 | -0.0020 |
| **Livestock** | 0.0650 | ***<.0001*** | | 0.0190 | 0.3250 | 0.0450 | -0.0130 | 0.0650 | -0.0460 | -0.0480 | 0.0570 | 0.1050 | 0.0200 |
| **Mining** | *0.8062* | *0.9759* | 0.4128 | | -0.0090 | 0.0350 | -0.0110 | 0.0030 | 0.2770 | -0.0250 | -0.0180 | 0.0250 | -0.0160 |
| **Fire** | ***<.0001*** | ***<.0001*** | **<.0001** | 0.6871 | | 0.0830 | 0.0900 | 0.1200 | -0.0440 | -0.0730 | 0.0210 | -0.0400 | 0.0930 |
| **Road** | ***0.0033*** | ***<.0001*** | 0.0501 | 0.1268 | **0.0003** | | 0.3570 | -0.0140 | 0.0860 | -0.0960 | 0.1010 | 0.1730 | 0.0500 |
| **Recreation** | **<.0001** | **<.0001** | *0.5776* | 0.6357 | **<.0001** | **<.0001** | | 0.2380 | 0.0100 | -0.2480 | -0.0190 | 0.0470 | 0.0480 |
| **Trail** | ***<.0001*** | ***<.0001*** | **0.0046** | *0.9085* | **<.0001** | *0.5326* | **<.0001** | | -0.0210 | -0.0070 | 0.0770 | 0.1460 | -0.0600 |
| **Industry** | *0.0994* | *0.7433* | ***0.0458*** | **<.0001** | *0.0550* | **0.0002** | 0.6578 | *0.3541* | | 0.0420 | -0.0090 | 0.0290 | -0.0200 |
| **Agriculture** | ***<.0001*** | ***0.0121*** | ***0.0355*** | *0.2817* | ***0.0015*** | ***<.0001*** | ***<.0001*** | *0.7688* | 0.0652 | | 0.2090 | -0.0190 | -0.0610 |
| **Residential** | ***0.0391*** | **0.0015** | **0.0128** | *0.4321* | 0.3581 | **<.0001** | 0.4027 | **0.0008** | *0.6875* | **<.0001** | | -0.0100 | -0.0450 |
| **ORV** | *0.5960* | **0.0007** | **<.0001** | 0.2793 | *0.0789* | **<.0001** | **0.0410** | **<.0001** | 0.2114 | *0.4144* | *0.6476* | | 0.0890 |
| **Other** | ***0.0180*** | *0.9403* | 0.3942 | *0.4932* | **<.0001** | **0.0273** | **0.0370** | ***0.0090*** | *0.3925* | ***0.0075*** | *0.0510* | **0.0001** | |

# Appendix 5: Contingency Table Analysis of Distribution of Disturbance Across Reaches

Contingency table analysis of distribution of disturbance types across reaches. Disturbance types "industry," "mining," and "ORV" were removed from this analysis, because they had expected frequencies less than 5 in at least one cell.

I. Summary Table for Entire Contingency Table

| | |
|---|---|
| DF | 36 |
| Chi Square | 1162.759 |
| Chi Square P-Value | <.0001 |

II. Observed Frequencies for Reach, Disturbance

| | Agriculture | Alluvial | Fire | Flowzone | Other | Recreation | Residential | Road | Stock | Trail | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Brownlee** | 29 | 181 | 91 | 442 | 51 | 416 | 24 | 217 | 305 | 38 | 1794 |
| **Downstream** | 20 | 47 | 36 | 67 | 1 | 129 | 6 | 15 | 121 | 46 | 488 |
| **HCR** | 0 | 112 | 15 | 112 | 1 | 218 | 11 | 158 | 29 | 21 | 677 |
| **Oxbow** | 0 | 50 | 5 | 67 | 1 | 151 | 4 | 105 | 87 | 16 | 486 |
| **Weiser** | 110 | 31 | 30 | 88 | 6 | 25 | 18 | 27 | 43 | 6 | 384 |
| **Totals** | 159 | 421 | 177 | 776 | 60 | 939 | 63 | 522 | 585 | 127 | 3829 |

III. Expected Values for Reach, Disturbance, if Reach and Disturbance types are independent

| | Agriculture | Alluvial | Fire | Flowzone | Other | Recreation | Residential | Road | Stock | Trail | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Brownlee** | 74.496 | 197.251 | 82.930 | 363.579 | 28.112 | 439.949 | 29.517 | 244.572 | 274.090 | 59.503 | 1794.000 |
| **Downstream** | 20.264 | 53.656 | 22.558 | 98.900 | 7.647 | 119.674 | 8.029 | 66.528 | 74.557 | 16.186 | 488.000 |
| **HCR** | 28.113 | 74.436 | 31.295 | 137.203 | 10.609 | 166.023 | 11.139 | 92.294 | 103.433 | 22.455 | 677.000 |
| **Oxbow** | 20.181 | 53.436 | 22.466 | 98.495 | 7.616 | 119.184 | 7.996 | 66.255 | 74.252 | 16.120 | 486.000 |
| **Weiser** | 15.946 | 42.221 | 17.751 | 77.823 | 6.017 | 94.170 | 6.318 | 52.350 | 58.668 | 12.736 | 384.000 |
| **Totals** | 159.000 | 421.000 | 177.000 | 776.000 | 60.000 | 939.000 | 63.000 | 522.000 | 585.000 | 127.000 | 3829.000 |

IV. Post Hoc Cell Contributions for Reach, Disturbance. Cells in bold are significantat the 0.05 level (i.e.the occurrence of this disturbance type is different than would be expected if disturbance and reach were independent.) Negative cells represent a disturbance that is less frequent than expected on the given reach.

| | **Agriculture** | **Alluvial** | **Fire** | **Flowzone** | **Other** | **Recreation** | **Residential** | **Road** | **Stock** | **Trail** |
|---|---|---|---|---|---|---|---|---|---|---|
| **Brownlee** | **-7.385** | -1.682 | 1.245 | **6.318** | **5.968** | -1.803 | -1.405 | **-2.602** | **2.782** | **-3.889** |
| **Downstream** | -.064 | -1.031 | **3.102** | **-3.846** | **-2.594** | 1.050 | -.773 | **-7.277** | **6.256** | **8.068** |
| **HCR** | **-5.969** | **5.086** | **-3.287** | **-2.656** | **-3.277** | **5.118** | -.046 | **8.111** | **-8.764** | -.344 |
| **Oxbow** | **-4.911** | -.533 | **-4.038** | **-3.804** | **-2.586** | **3.590** | -1.525 | **5.482** | 1.720 | -.032 |
| **Weiser** | **25.364** | -1.930 | **3.138** | 1.362 | -.007 | **-8.650** | **4.941** | **-3.975** | **-2.343** | **-2.024** |

# Appendix 6: Statistical Results - Arranged by Weed Species

**Statistical results, arranged by species.**

This appendix contains the results of statistical analyses conducted to determine associations between weed presence and predictors (elevational category, reach, disturbance factors), and to determine association between predictors and population size. All possible comparisons between levels of categorical variables are presented only when that predictor was significant, and for either the test of levels of disturbance or the test of presence of disturbance, but not both. For logistic regression, the baseline value is listed first in the comparison. Note also for logistic regression, levels of categorical variables that were not present in the species cannot be compared, and comparisons are not included. In multiple regression tables, coefficients are reported for significant predictors only. Post-hoc tests of predictors with multiple levels are presented when significant; the baseline value, listed first in comparisons is subtracted from the comparison value. An "S" in the last column of a comparison indicates that the difference is significant.

*I. Ambrosia artemisiifolia*

A. Tests for association between predictors and presence of weed species

1. Test for effects of PRESENCE of disturbance types on weed presence/absence

Logistic Model Coefficients Table for AMAR

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -2.906 | .562 | -5.171 | 26.742 | <.0001 | .055 |
| Disturbance factors | | | | | | |
| Flow zone | .181 | .529 | .343 | .117 | .7319 | 1.199 |
| Reach | | | | | | |
| Oxbow - Hells Can. Res. | -.589 | .376 | -1.566 | 2.451 | .1174 | .555 |
| Oxbow-Brownlee | -4.183 | 1.039 | -4.025 | 16.204 | <.0001 | .015 |
| Oxbow-Downstream | -3.200 | 1.049 | -3.051 | 9.307 | .0023 | .041 |
| Hells Can.-Brownlee | -3.594 | 1.042 | -3.449 | 11.897 | .0006 | .027 |
| Hells Can.-Downstream | -2.611 | 1.042 | -2.506 | 6.280 | .0122 | .073 |
| Brownlee-Downstream | .983 | 1.430 | .687 | .472 | .4919 | 2.673 |
| Elevation | | | | | | |
| below-above | .248 | .627 | .395 | .156 | .6927 | 1.281 |
| below-crosses | .709 | .544 | 1.304 | 1.701 | .1922 | 2.033 |

Logistic Whole Model Fit Table for AMAR

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 7 | 69.402 | <.0001 |

Logistic Likelihood Ratio Tests Table for AMAR

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Reach | 4 | 65.287 | <.0001 |
| Elevation | 2 | 2.247 | .3251 |

2. Test of effect of LEVEL of disturbance on weed presence/absence.

Logistic Model Coefficients Table for AMAR

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -3.187 | .772 | -4.130 | 17.060 | <.0001 | .041 |
| Reach | | | | | | |
| Oxbow - Hells Can. Res. | -.600 | .377 | -1.591 | 2.530 | .1117 | .549 |
| Oxbow-Brownlee | -4.255 | 1.050 | -4.053 | 16.428 | <.0001 | .014 |
| Oxbow-Downstream | -3.214 | 1.049 | -3.064 | 9.390 | .0022 | .040 |
| Elevation | | | | | | |
| below-above | .393 | .657 | .598 | .358 | .5499 | 1.481 |
| below-crosses | .801 | .543 | 1.475 | 2.175 | .1403 | 2.229 |
| Disturbance factors | | | | | | |
| Flow zone | .130 | .204 | .640 | .409 | .5223 | 1.139 |

Logistic Whole Model Fit Table for AMAR

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 7 | 69.692 | <.0001 |

B. Tests for effect of predictors on population size

1. Test for effect of PRESENCE of disturbance types on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 3 | 50.691 | 16.897 | 7.292 | .0011 |
| Elevation | 2 | 13.624 | 6.812 | 2.940 | .0706 |
| Flow zone | 1 | 3.135 | 3.135 | 1.353 | .2553 |
| Residual | 26 | 60.244 | 2.317 | | |

Scheffe for ln net area
Effect: Reach

| | Mean Diff. | Crit. Diff. | P-Value | |
|---|---|---|---|---|
| Oxbow, Hells Canyon Res. | 2.109 | 1.634 | .0075 | S |
| Oxbow, Brownlee | 2.571 | 4.688 | .4569 | |
| Oxbow, Downstream | 5.056 | 4.688 | .0307 | S |
| Hells Canyon Res., Brownlee | .462 | 4.697 | .9932 | |
| Hells Canyon Res., Downstream | 2.947 | 4.697 | .3397 | |
| Brownlee, Downstream | 2.485 | 6.431 | .7235 | |

Scheffe for ln net area
Effect: Elevation

| | Mean Diff. | Crit. Diff. | P-Value |
|---|---|---|---|
| below, above | -.039 | 1.815 | .9984 |
| below, cross | -.798 | 1.688 | .4812 |
| above, cross | -.759 | 1.636 | .4941 |

2. Effect of LEVELS of disturbances on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 3 | 54.306 | 18.102 | 7.937 | .0006 |
| Elevation | 2 | 14.600 | 7.300 | 3.201 | .0572 |
| Flow zone | 1 | 4.078 | 4.078 | 1.788 | .1927 |
| Residual | 26 | 59.301 | 2.281 | | |

II. *Amorpha fruticosa*

A. Tests for association between predictors and presence of weed species

1. Test for effects of PRESENCE of disturbance types on weed presence/absence

Logistic Model Coefficients Table for AMFR

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -2.346 | .384 | -6.112 | 37.353 | <.0001 | .096 |
| Reach | | | | | | |
| Oxbow - Hells Can. Res. | .392 | .336 | 1.168 | 1.365 | .2427 | 1.480 |
| Oxbow-Brownlee | .136 | .288 | .474 | .224 | .6357 | 1.146 |
| Oxbow-Downstream | -.558 | .436 | -1.279 | 1.635 | .2009 | .572 |
| Oxbow-Weiser | .068 | .433 | .158 | .025 | .8748 | 1.071 |
| Elevation | | | | | | |
| below-above | -3.135 | .558 | -5.617 | 31.550 | <.0001 | .044 |
| below-crosses | -3.823 | .601 | -6.358 | 40.427 | <.0001 | .022 |
| above-crosses | -.688 | .781 | -.881 | .775 | .3785 | .503 |
| Disturbance factors | | | | | | |
| Alluvial | -.124 | .196 | -.632 | .399 | .5274 | .883 |
| Flow zone | 1.207 | .287 | 4.211 | 17.734 | <.0001 | 3.343 |
| Livestock | .072 | .234 | .307 | .095 | .7585 | 1.075 |
| Fire | .263 | .473 | .556 | .309 | .5781 | 1.301 |
| Road | -.302 | .260 | -1.162 | 1.350 | .2454 | .740 |
| Recreation | .757 | .197 | 3.834 | 14.699 | .0001 | 2.132 |
| Trail | -.432 | .439 | -.984 | .968 | .3252 | .649 |
| Industrial | 1.642 | 1.304 | 1.259 | 1.584 | .2082 | 5.164 |
| Agriculture | -.812 | .585 | -1.387 | 1.925 | .1653 | .444 |
| Residential | .353 | .589 | .600 | .360 | .5486 | 1.424 |
| ORV | -.337 | .693 | -.486 | .236 | .6269 | .714 |
| Other | -.317 | .665 | -.476 | .227 | .6340 | .729 |

Logistic Whole Model Fit Table for AMFR

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 18 | 477.915 | <.0001 |

Logistic Likelihood Ratio Tests Table for AMFR

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Reach | 4 | 6.588 | .1594 |
| Elevation | 2 | 140.453 | <.0001 |

2. Test of effect of LEVEL of disturbance on weed presence/absence.

Logistic Model Coefficients Table for AMFR

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -3.485 | .952 | -3.661 | 13.406 | .0003 | .031 |
| Reach | | | | | | |
| Oxbow - Hells Can. Res. | .231 | .346 | .668 | .446 | .5041 | 1.260 |
| Oxbow-Brownlee | -.077 | .304 | -.253 | .064 | .7999 | .926 |
| Oxbow-Downstream | -.600 | .444 | -1.353 | 1.830 | .1761 | .549 |
| Oxbow-Weiser | -.231 | .451 | -.513 | .264 | .6076 | .793 |
| Elevation | | | | | | |
| below-above | -3.128 | .556 | -5.620 | 31.590 | <.0001 | .044 |
| below-crosses | -3.819 | .601 | -6.356 | 40.401 | <.0001 | .022 |
| Disturbance factors | | | | | | |
| Alluvial | .004 | .077 | .054 | .003 | .9570 | 1.004 |
| Flow zone | .482 | .090 | 5.351 | 28.631 | <.0001 | 1.620 |
| Livestock | -.106 | .115 | -.922 | .851 | .3564 | .899 |
| Fire | .661 | .171 | 3.867 | 14.952 | .0001 | 1.937 |
| Road | -.147 | .105 | -1.400 | 1.959 | .1616 | .863 |
| Recreation | .393 | .115 | 3.430 | 11.763 | .0006 | 1.482 |
| Trail | -.216 | .171 | -1.268 | 1.609 | .2047 | .806 |
| Industrial | .165 | .547 | .301 | .091 | .7635 | 1.179 |
| Agriculture | -.041 | .193 | -.213 | .045 | .8314 | .960 |
| Residential | -.159 | .240 | -.661 | .437 | .5087 | .853 |
| ORV | -.193 | .286 | -.674 | .454 | .5005 | .825 |
| Other | -.297 | .225 | -1.319 | 1.741 | .1870 | .743 |

Logistic Whole Model Fit Table for AMFR

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 18 | 490.995 | <.0001 |

B. Tests for effect of predictors on population size

1. Test for effect of PRESENCE of disturbance types on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 4 | 21.857 | 5.464 | 2.157 | .0752 |
| Elevation | 2 | 2.218 | 1.109 | .438 | .6461 |
| Alluvial | 1 | 8.097 | 8.097 | 3.197 | .0753 |
| Flow zone | 1 | 8.016 | 8.016 | 3.164 | .0768 |
| Livestock | 1 | 10.314 | 10.314 | 4.072 | .0449 |
| Fire | 1 | .527 | .527 | .208 | .6488 |
| Road | 1 | 4.149 | 4.149 | 1.638 | .2021 |
| Recreation | 1 | .044 | .044 | .017 | .8953 |
| Trail | 1 | 5.484 | 5.484 | 2.165 | .1428 |
| Industrial | 1 | 1.509 | 1.509 | .596 | .4412 |
| Agriculture | 1 | 20.040 | 20.040 | 7.911 | .0054 |
| Residential | 1 | 3.418 | 3.418 | 1.349 | .2468 |
| ORV | 1 | .808 | .808 | .319 | .5729 |
| Other | 1 | 1.771 | 1.771 | .699 | .4041 |
| Residual | 200 | 506.642 | 2.533 | | |

ANOVA Coefficients Table for ln net area

| | Coef | Std. Error | t-Test | P-Value |
|---|---|---|---|---|
| Alluvial | -.471 | .263 | -1.788 | .0753 |
| Flow zone | .719 | .404 | 1.779 | .0768 |
| Livestock | .603 | .299 | 2.018 | .0449 |
| Agriculture | 2.713 | .965 | 2.813 | .0054 |

2. Effect of LEVELS of disturbances on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 4 | 25.107 | 6.277 | 2.632 | .0355 |
| Elevation | 2 | 4.025 | 2.013 | .844 | .4315 |
| Alluvial | 1 | .362 | .362 | .152 | .6974 |
| Flow zone | 1 | 13.572 | 13.572 | 5.691 | .0180 |
| Livestock | 1 | 2.702 | 2.702 | 1.133 | .2884 |
| Fire | 1 | .339 | .339 | .142 | .7066 |
| Road | 1 | 5.549 | 5.549 | 2.327 | .1287 |
| Recreation | 1 | 2.227 | 2.227 | .934 | .3351 |
| Trail | 1 | 15.841 | 15.841 | 6.643 | .0107 |
| Industrial | 1 | 5.353 | 5.353 | 2.245 | .1356 |
| Agriculture | 1 | 24.285 | 24.285 | 10.184 | .0016 |
| Residential | 1 | 2.883 | 2.883 | 1.209 | .2728 |
| ORV | 1 | 2.089 | 2.089 | .876 | .3504 |
| Other | 1 | .442 | .442 | .185 | .6674 |
| Residual | 200 | 476.923 | 2.385 | | |

Scheffe for ln net area

Effect: Reach

| | Mean Diff. | Crit. Diff. | P-Value |
|---|---|---|---|
| Oxbow, Hells Canyon Res. | -.017 | 1.222 | >.9999 |
| Oxbow, Brownlee | -.057 | 1.090 | >.9999 |
| Oxbow, Downstream | 1.207 | 1.760 | .3402 |
| Oxbow, Weiser | .735 | 1.628 | .7413 |
| Hells Canyon Res., Brownlee | -.041 | .822 | >.9999 |
| Hells Canyon Res., Downstream | 1.224 | 1.608 | .2355 |
| Hells Canyon Res., Weiser | .751 | 1.462 | .6359 |
| Brownlee, Downstream | 1.265 | 1.510 | .1529 |
| Brownlee, Weiser | .792 | 1.354 | .5094 |
| Downstream, Weiser | -.473 | 1.935 | .9654 |

III. *Cardaria draba*

A. Tests for association between predictors and presence of weed species

1. Test for effects of PRESENCE of disturbance types on weed presence/absence

Logistic Model Coefficients Table for CADR

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -5.081 | .728 | -6.978 | 48.687 | <.0001 | .006 |
| Reach | | | | | | |
| Oxbow-Brownlee | 1.578 | .609 | 2.593 | 6.722 | .0095 | 4.848 |
| Oxbow-Downstream | -.409 | .781 | -.524 | .275 | .6002 | .664 |
| Oxbow-Weiser | 1.103 | .671 | 1.644 | 2.703 | .1002 | 3.012 |
| Brownlee-Downstream | -1.988 | .550 | -3.615 | 13.066 | .0003 | .137 |
| Brownlee-Weiser | -.476 | .371 | -1.282 | 1.642 | .2000 | .621 |
| Downstream-Weiser | 1.512 | .605 | 2.499 | 6.245 | .0125 | 4.535 |
| Elevation | | | | | | |
| below-above | 1.320 | .512 | 2.580 | 6.657 | .0099 | 3.745 |
| below-crosses | 1.260 | .472 | 2.670 | 7.131 | .0076 | 3.524 |
| above-crosses | -.061 | .316 | -.193 | .037 | .8473 | .941 |
| Disturbance factors | | | | | | |
| Flow zone | -.857 | .398 | -2.155 | 4.643 | .0312 | .424 |

Logistic Whole Model Fit Table for CADR

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 7 | 69.974 | <.0001 |

Logistic Likelihood Ratio Tests Table for CADR

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Reach | 4 | 50.179 | <.0001 |
| Elevation | 2 | 9.196 | .0101 |

2. Test of effect of LEVEL of disturbance on weed presence/absence.

Logistic Model Coefficients Table for CADR

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -4.778 | .797 | -5.997 | 35.959 | <.0001 | .008 |
| Reach | | | | | | |
| Oxbow- Brownlee | 1.575 | .608 | 2.589 | 6.702 | .0096 | 4.831 |
| Oxbow- Downstream | -.423 | .780 | -.542 | .294 | .5877 | .655 |
| Oxbow-Weiser | 1.112 | .671 | 1.657 | 2.747 | .0974 | 3.040 |
| Elevation | | | | | | |
| below-above | 1.295 | .528 | 2.452 | 6.011 | .0142 | 3.653 |
| below-cross | 1.260 | .476 | 2.645 | 6.998 | .0082 | 3.526 |
| Disturbance factors | | | | | | |
| Flow zone | -.261 | .129 | -2.025 | 4.102 | .0428 | .771 |

Logistic Whole Model Fit Table for CADR

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 7 | 69.371 | <.0001 |

B. Tests for effect of predictors on population size

1. Test for effect of PRESENCE of disturbance types on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 3 | 13.891 | 4.630 | 1.187 | .3243 |
| Elevation | 2 | 61.968 | 30.984 | 7.943 | .0010 |
| Flow zone | 1 | .726 | .726 | .186 | .6681 |
| Residual | 49 | 191.128 | 3.901 | | |

Scheffe for ln net area
Effect: Elevation

| | Mean Diff. | Crit. Diff. | P-Value | |
|---|---|---|---|---|
| below, above | -2.034 | 2.142 | .0660 | |
| below, cross | -3.185 | 2.132 | .0019 | S |
| above, cross | -1.150 | 1.425 | .1361 | |

2. Effect of LEVELS of disturbances on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 3 | 14.113 | 4.704 | 1.209 | .3165 |
| Elevation | 2 | 63.731 | 31.865 | 8.186 | .0009 |
| Flow zone | 1 | 1.116 | 1.116 | .287 | .5947 |
| Residual | 49 | 190.738 | 3.893 | | |

IV. *Chondrilla juncea*

A. Tests for association between predictors and presence of weed species

1. Test for effects of PRESENCE of disturbance types on weed presence/absence

Logistic Model Coefficients Table for CHJU

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -20.109 | 947.539 | -.021 | 4.504E-4 | .9831 | 1.849E-9 |
| Reach | | | | | | |
| Brownlee-Downstream | -.871 | .539 | -1.617 | 2.614 | .1059 | .419 |
| Elevation | | | | | | |
| below-above | 2.169 | 1.287 | 1.686 | 2.841 | .0919 | 8.750 |
| below-crosses | .323 | 1.364 | .237 | .056 | .8129 | 1.381 |
| Disturbance factors | | | | | | |
| Flow zone | -1.493 | 1.273 | -1.173 | 1.376 | .2408 | .225 |

Logistic Whole Model Fit Table for CHJU

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 7 | 41.761 | <.0001 |

Logistic Likelihood Ratio Tests Table for CHJU

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Reach | 4 | 23.269 | .0001 |
| Elevation | 2 | 9.026 | .0110 |

2. Test of effect of LEVEL of disturbance on weed presence/absence.

Logistic Model Coefficients Table for CHJU

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -18.778 | 953.624 | -.020 | 3.877E-4 | .9843 | 6.999E-9 |
| Reach | | | | | | |
| Oxbow-Brownlee | 15.236 | 953.623 | .016 | 2.553E-4 | .9873 | 4137509.136 |
| Oxbow-Downstream | 14.351 | 953.623 | .015 | 2.265E-4 | .9880 | 1708931.901 |
| Oxbow-Weiser | -.101 | 1303.349 | -7.720E-5 | 5.960E-9 | >.9999 | .904 |
| Elevation | | | | | | |
| below-above | 1.593 | 1.282 | 1.243 | 1.545 | .2138 | 4.920 |
| below-crosses | -.069 | 1.353 | -.051 | .003 | .9590 | .933 |
| Disturbance factors | | | | | | |
| Flow zone | -.739 | .474 | -1.559 | 2.430 | .1190 | .478 |

Logistic Whole Model Fit Table for CHJU

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 7 | 43.414 | <.0001 |

B. Tests for effect of predictors on population size

1. Test for effect of PRESENCE of disturbance types on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 1 | .001 | .001 | .001 | .9761 |
| Elevation | 2 | 11.585 | 5.792 | 4.562 | .0336 |
| Flow zone | 1 | .343 | .343 | .270 | .6127 |
| Residual | 12 | 15.236 | 1.270 | | |

Scheffe for ln net area
Effect: Elevation

| | Mean Diff. | Crit. Diff. | P-Value | |
|---|---|---|---|---|
| below, above | -.590 | 3.251 | .8813 | |
| below, cross | -3.198 | 3.847 | .1087 | |
| above, cross | -2.609 | 2.374 | .0312 | S |

2. Effect of LEVELS of disturbances on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 1 | .001 | .001 | .001 | .9761 |
| Elevation | 2 | 11.585 | 5.792 | 4.562 | .0336 |
| Flow zone | 1 | .343 | .343 | .270 | .6127 |
| Residual | 12 | 15.236 | 1.270 | | |

V. *Cirsium arvense*

A. Tests for association between predictors and presence of weed species

1. Test for effects of PRESENCE of disturbance on weed presence/absence.

Logistic Model Coefficients Table for CIAR

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -5.400 | 1.054 | -5.122 | 26.237 | <.0001 | .005 |
| Reach | | | | | | |
| Oxbow - Hells Can. Res. | -.646 | 1.419 | -.455 | .207 | .6491 | .524 |
| Oxbow-Brownlee | 1.879 | 1.030 | 1.823 | 3.324 | .0683 | 6.544 |
| Oxbow-Downstream | -.046 | 1.235 | -.038 | .001 | .9700 | .955 |
| Oxbow-Weiser | 3.235 | 1.025 | 3.156 | 9.960 | .0016 | 25.415 |
| Hells Can.-Brownlee | 2.524 | 1.032 | 2.447 | 5.986 | .0144 | 12.479 |
| Hells Can.-Downstream | .599 | 1.229 | .487 | .237 | .6261 | 1.820 |
| Hells Can.-Weiser | 3.881 | 1.023 | 3.793 | 14.385 | .0001 | 48.467 |
| Brownlee-Downstream | -1.925 | .762 | -2.527 | 6.386 | .0115 | .146 |
| Brownlee-Weiser | 1.357 | .314 | 4.318 | 18.647 | <.0001 | 3.884 |
| Downstream-Weiser | 3.282 | .745 | 4.407 | 19.424 | <.0001 | 26.624 |
| Elevation | | | | | | |
| below-above | .583 | .420 | 1.390 | 1.931 | .1646 | 1.791 |
| below-crosses | -.003 | .430 | -.006 | 3.525E-5 | .9953 | .997 |
| Disturbance factors | | | | | | |
| Flow zone | -.577 | .378 | -1.527 | 2.330 | .1269 | .562 |

Logistic Whole Model Fit Table for CIAR

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 7 | 74.196 | <.0001 |

Logistic Likelihood Ratio Tests Table for CIAR

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Reach | 4 | 68.636 | <.0001 |
| Elevation | 2 | 3.205 | .2014 |

2. Test of effect of LEVEL of disturbance on weed presence/absence.

Logistic Model Coefficients Table for CIAR

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -5.418 | 1.094 | -4.954 | 24.546 | <.0001 | .004 |
| Reach | | | | | | |
| Oxbow - Hells Can. Res. | -.653 | 1.419 | -.460 | .212 | .6453 | .520 |
| Oxbow-Brownlee | 1.854 | 1.031 | 1.799 | 3.235 | .0721 | 6.387 |
| Oxbow-Downstream | -.056 | 1.235 | -.046 | .002 | .9635 | .945 |
| Oxbow-Weiser | 3.223 | 1.026 | 3.141 | 9.867 | .0017 | 25.103 |
| Elevation | | | | | | |
| below-above | .706 | .436 | 1.621 | 2.627 | .1051 | 2.026 |
| below-crosses | .091 | .433 | .210 | .044 | .8338 | 1.095 |
| Disturbance factors | | | | | | |
| Flow zone | -.105 | .120 | -.874 | .765 | .3819 | .900 |

Logistic Whole Model Fit Table for CIAR

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 7 | 72.558 | <.0001 |

B. Tests for effect of predictors on population size

1. Test for effect of PRESENCE of disturbance types on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 4 | 17.450 | 4.362 | 1.825 | .1414 |
| Elevation | 2 | 10.474 | 5.237 | 2.191 | .1241 |
| Flow zone | 1 | 1.069 | 1.069 | .447 | .5073 |
| Residual | 43 | 102.766 | 2.390 | | |

2. Effect of LEVELS of disturbances on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 4 | 17.076 | 4.269 | 1.774 | .1516 |
| Elevation | 2 | 10.100 | 5.050 | 2.099 | .1350 |
| Flow zone | 1 | .370 | .370 | .154 | .6968 |
| Residual | 43 | 103.464 | 2.406 | | |

VI. *Cirsium vulgare*

A. Tests for association between predictors and presence of weed species

1. Test for effects of PRESENCE of disturbance on weed presence/absence.

Logistic Model Coefficients Table for CIVU

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -1.414 | .460 | -3.074 | 9.452 | .0021 | .243 |
| Reach | | | | | | |
| Oxbow-Hells Can. Res. | -.069 | .397 | -.173 | .030 | .8627 | .934 |
| Oxbow-Brownlee | -1.727 | .490 | -3.524 | 12.417 | .0004 | .178 |
| Oxbow-Downstream | .045 | .432 | .103 | .011 | .9176 | 1.046 |
| Oxbow-Weiser | -1.004 | .638 | -1.574 | 2.477 | .1155 | .366 |
| Hells Can. Res.-Brownlee | -1.659 | .443 | -3.743 | 14.013 | .0002 | .190 |
| Hells Can. Res.-Downstream | .113 | .338 | .335 | .112 | .7377 | 1.120 |
| Hells Can. Res.-Weiser | -.936 | .584 | -1.602 | 2.565 | .1093 | .392 |
| Brownlee-Downstream | -1.948 | .782 | -2.491 | 6.204 | .0127 | .142 |
| Brownlee-Weiser | .883 | .416 | 2.120 | 4.496 | .0340 | 2.418 |
| Downstream-Weiser | 2.831 | .795 | 3.561 | 12.682 | .0004 | 16.970 |
| Elevation | | | | | | |
| Below-above | -.561 | .366 | -1.534 | 2.354 | .1250 | .571 |
| Below-crosses | -1.093 | .420 | -2.605 | 6.785 | .0092 | .335 |
| Disturbance factors | | | | | | |
| Alluvial | .760 | .291 | 2.615 | 6.837 | .0089 | 2.139 |
| Flow zone | -1.878 | .410 | -4.580 | 20.977 | <.0001 | .153 |
| Livestock | -.638 | .323 | -1.975 | 3.900 | .0483 | .528 |
| Fire | -.718 | .636 | -1.129 | 1.275 | .2587 | .488 |
| Road | -.750 | .369 | -2.035 | 4.142 | .0418 | .472 |
| Recreation | -.061 | .295 | -.208 | .043 | .8351 | .941 |
| Trail | .145 | .447 | .325 | .106 | .7452 | 1.156 |
| Agriculture | -.558 | .729 | -.765 | .585 | .4443 | .572 |
| Residential | .192 | .779 | .246 | .061 | .8054 | 1.212 |
| Other | 1.304 | .684 | 1.906 | 3.631 | .0567 | 3.685 |

Logistic Whole Model Fit Table for CIVU

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 16 | 94.476 | <.0001 |

Logistic Likelihood Ratio Tests Table for CIVU

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Reach | 4 | 25.710 | <.0001 |
| Elevation | 2 | 7.154 | .0280 |

2. Test of effect of LEVEL of disturbance on weed presence/absence.

Logistic Model Coefficients Table for CIVU

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -.464 | .937 | -.495 | .245 | .6209 | .629 |
| Reach | | | | | | |
| Oxbow-Hells Can. Res. | .032 | .409 | .079 | .006 | .9367 | 1.033 |
| Oxbow-Brownlee | -1.533 | .475 | -3.225 | 10.401 | .0013 | .216 |
| Oxbow-Downstream | .020 | .433 | .047 | .002 | .9625 | 1.021 |
| Oxbow- Weiser | -.888 | .629 | -1.412 | 1.994 | .1579 | .411 |
| Elevation | | | | | | |
| below-above | -.558 | .397 | -1.407 | 1.980 | .1594 | .572 |
| below-cross | -1.081 | .432 | -2.500 | 6.249 | .0124 | .339 |
| Disturbance factors | | | | | | |
| Alluvial | .273 | .105 | 2.605 | 6.784 | .0092 | 1.314 |
| Flow zone | -.678 | .153 | -4.433 | 19.648 | <.0001 | .508 |
| Livestock | -.201 | .156 | -1.289 | 1.662 | .1974 | .818 |
| Fire | -.047 | .248 | -.189 | .036 | .8498 | .954 |
| Road | -.359 | .134 | -2.676 | 7.163 | .0074 | .699 |
| Recreation | .040 | .163 | .243 | .059 | .8084 | 1.040 |
| Trail | -.062 | .190 | -.330 | .109 | .7416 | .939 |
| Agriculture | -.190 | .218 | -.871 | .758 | .3840 | .827 |
| Residential | .122 | .273 | .446 | .199 | .6553 | 1.130 |
| Other | .222 | .223 | .997 | .993 | .3190 | 1.249 |

Logistic Whole Model Fit Table for CIVU

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 16 | 92.312 | <.0001 |

Logistic Likelihood Ratio Tests Table for CIVU

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Reach | 4 | 22.052 | .0002 |
| Elevation | 2 | 6.720 | .0347 |

B. Tests for effect of predictors on population size

1. Test for effect of PRESENCE of disturbance types on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 4 | 26.119 | 6.530 | 3.537 | .0113 |
| Elevation | 2 | 11.621 | 5.811 | 3.148 | .0496 |
| Alluvial | 1 | 1.323E-4 | 1.323E-4 | 7.165E-5 | .9933 |
| Flow zone | 1 | .055 | .055 | .030 | .8640 |
| Livestock | 1 | 2.954 | 2.954 | 1.600 | .2104 |
| Fire | 1 | 1.910E-4 | 1.910E-4 | 1.035E-4 | .9919 |
| Road | 1 | .690 | .690 | .374 | .5431 |
| Recreation | 1 | .029 | .029 | .015 | .9014 |
| Trail | 1 | .339 | .339 | .184 | .6698 |
| Agriculture | 1 | 1.207 | 1.207 | .654 | .4217 |
| Residential | 1 | .949 | .949 | .514 | .4761 |
| Residual | 65 | 119.998 | 1.846 | | |

Scheffe for ln net area
Effect: Reach

| | Mean Diff. | Crit. Diff. | P-Value |
|---|---|---|---|
| Oxbow, Hells Canyon Res. | 1.010 | 1.503 | .3482 |
| Oxbow, Brownlee | 1.615 | 1.900 | .1363 |
| Oxbow, Downstream | .519 | 1.486 | .8727 |
| Oxbow, Weiser | .471 | 2.154 | .9749 |
| Hells Canyon Res., Brownlee | .605 | 1.666 | .8559 |
| Hells Canyon Res., Downstream | -.491 | 1.173 | .7790 |
| Hells Canyon Res., Weiser | -.539 | 1.951 | .9418 |
| Brownlee, Downstream | -1.096 | 1.651 | .3604 |
| Brownlee, Weiser | -1.144 | 2.270 | .6372 |
| Downstream, Weiser | -.048 | 1.938 | >.9999 |

Scheffe for ln net area
Effect: Elevation

| | Mean Diff. | Crit. Diff. | P-Value |
|---|---|---|---|
| below, above | -.562 | .860 | .2693 |
| below, cross | -1.006 | 1.203 | .1199 |
| above, cross | -.444 | 1.106 | .6055 |

2. Effect of LEVELS of disturbances on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 4 | 26.857 | 6.714 | 3.752 | .0084 |
| Elevation | 2 | 14.081 | 7.040 | 3.934 | .0245 |
| Alluvial | 1 | 1.910 | 1.910 | 1.068 | .3054 |
| Flow zone | 1 | 1.430 | 1.430 | .799 | .3746 |
| Livestock | 1 | .005 | .005 | .003 | .9571 |
| Fire | 1 | 3.237 | 3.237 | 1.809 | .1834 |
| Road | 1 | 4.338 | 4.338 | 2.424 | .1244 |
| Recreation | 1 | 3.114E-8 | 3.114E-8 | 1.740E-8 | .9999 |
| Trail | 1 | 1.883 | 1.883 | 1.052 | .3088 |
| Agriculture | 1 | 1.601 | 1.601 | .895 | .3477 |
| Residential | 1 | .414 | .414 | .231 | .6323 |
| ORV | 1 | .237 | .237 | .133 | .7168 |
| Residual | 64 | 114.523 | 1.789 | | |

VII. *Conium maculatum*

A. Tests for association between predictors and presence of weed species

1. Test of PRESENCE of disturbance types on weed presence/absence.

Logistic Model Coefficients Table for COMA4

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -2.880 | .437 | -6.587 | 43.388 | <.0001 | .056 |
| Reach | | | | | | |
| Oxbow-Hells Can. Res. | -1.335 | .531 | -2.516 | 6.328 | .0119 | .263 |
| Oxbow-Brownlee | -.153 | .370 | -.413 | .170 | .6799 | .858 |
| Oxbow-Downstream | -3.143 | 1.068 | -2.942 | 8.657 | .0033 | .043 |
| Oxbow-Weiser | .405 | .454 | .893 | .798 | .3717 | 1.500 |
| Hells Can. Res.-Brownlee | 1.182 | .472 | 2.505 | 6.277 | .0122 | 3.262 |
| Hells Can. Res.-Downstream | -1.808 | 1.098 | -1.647 | 2.712 | .0996 | .164 |
| Hells Can. Res.-Weiser | 1.741 | .516 | 3.373 | 11.375 | .0007 | 5.700 |
| Brownlee-Downstream | -2.990 | 1.030 | -2.903 | 8.427 | .0037 | .050 |
| Brownlee-Weiser | .558 | .326 | 1.714 | 2.937 | .0866 | 1.747 |
| Downstream-Weiser | 3.548 | 1.039 | 3.415 | 11.661 | .0006 | 34.753 |
| Elevation | | | | | | |
| Below-above | .437 | .350 | 1.247 | 1.555 | .2124 | 1.548 |
| Below-crosses | .798 | .297 | 2.682 | 7.193 | .0073 | 2.220 |
| Disturbance factors | | | | | | |
| Alluvial | -.063 | .304 | -.206 | .042 | .8370 | .939 |
| Flow zone | .076 | .280 | .271 | .073 | .7865 | 1.079 |
| Livestock | -.239 | .272 | -.877 | .769 | .3804 | .787 |
| Fire | .033 | .390 | .085 | .007 | .9326 | 1.034 |
| Road | -.271 | .313 | -.865 | .748 | .3870 | .763 |
| Recreation | -.343 | .293 | -1.172 | 1.374 | .2411 | .709 |
| Trail | -.485 | .638 | -.761 | .579 | .4467 | .616 |
| Industrial | .325 | 1.098 | .296 | .088 | .7671 | 1.385 |
| Agriculture | .326 | .346 | .943 | .888 | .3459 | 1.385 |
| Residential | .947 | .444 | 2.133 | 4.550 | .0329 | 2.577 |
| Other | .416 | .513 | .811 | .657 | .4176 | 1.515 |

Logistic Whole Model Fit Table for COMA4

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 17 | 82.271 | <.0001 |

Logistic Likelihood Ratio Tests Table for COMA4

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Reach | 4 | 38.651 | <.0001 |
| Elevation | 2 | 7.531 | .0232 |

2. Test of effect of LEVEL of disturbance on weed presence/absence.

Logistic Model Coefficients Table for COMA4

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -2.837 | .882 | -3.217 | 10.350 | .0013 | .059 |
| Reach | | | | | | |
| Oxbow- Hells Can. Res. | -1.343 | .536 | -2.503 | 6.267 | .0123 | .261 |
| Oxbow-Brownlee | -.189 | .371 | -.509 | .259 | .6107 | .828 |
| Oxbow-Downstream | -3.040 | 1.067 | -2.850 | 8.120 | .0044 | .048 |
| Oxbow-Weiser | .473 | .444 | 1.064 | 1.131 | .2875 | 1.604 |
| Elevation | | | | | | |
| Below-above | .445 | .361 | 1.231 | 1.516 | .2182 | 1.560 |
| Below-crosses | .768 | .301 | 2.550 | 6.503 | .0108 | 2.156 |
| Disturbance factors | | | | | | |
| Alluvial | .085 | .107 | .795 | .632 | .4267 | 1.089 |
| Flow zone | .035 | .093 | .377 | .142 | .7062 | 1.036 |
| Livestock | -.067 | .121 | -.552 | .305 | .5809 | .935 |
| Fire | -.026 | .189 | -.137 | .019 | .8909 | .974 |
| Road | -.038 | .101 | -.374 | .140 | .7081 | .963 |
| Recreation | -.310 | .151 | -2.047 | 4.191 | .0406 | .734 |
| Trail | -.159 | .268 | -.593 | .352 | .5531 | .853 |
| Industrial | .094 | .385 | .246 | .060 | .8060 | 1.099 |
| Agriculture | .054 | .107 | .501 | .251 | .6162 | 1.055 |
| Residential | .314 | .164 | 1.912 | 3.657 | .0558 | 1.368 |
| Other | .172 | .160 | 1.077 | 1.159 | .2817 | 1.188 |

Logistic Whole Model Fit Table for COMA4

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 17 | 83.059 | <.0001 |

B. Tests for effect of predictors on population size

1. Test for effect of PRESENCE of disturbance types on population size.

ANOVA Table for ln net area
Inclusion criteria: COMA4 from Analnox4.svd

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 4 | 106.905 | 26.726 | 6.288 | .0002 |
| Elevation | 2 | 32.375 | 16.187 | 3.808 | .0267 |
| Alluvial | 1 | 2.266 | 2.266 | .533 | .4676 |
| Flow zone | 1 | 13.701 | 13.701 | 3.223 | .0767 |
| Livestock | 1 | .102 | .102 | .024 | .8773 |
| Fire | 1 | 9.069 | 9.069 | 2.134 | .1483 |
| Road | 1 | 19.123 | 19.123 | 4.499 | .0373 |
| Recreation | 1 | 8.564 | 8.564 | 2.015 | .1600 |
| Trail | 1 | 2.082 | 2.082 | .490 | .4862 |
| presind | 1 | 1.982 | 1.982 | .466 | .4969 |
| Agriculture | 1 | .344 | .344 | .081 | .7767 |
| Residential | 1 | 5.318 | 5.318 | 1.251 | .2670 |
| Other | 1 | 3.685 | 3.685 | .867 | .3548 |
| Residual | 74 | 314.539 | 4.251 | | |

ANOVA Coefficients Table for ln net area

Inclusion criteria: COMA4 from Analnox4.svd

| | Coef | Std. Error | t-Test | P-Value |
|---|---|---|---|---|
| Flow zone | .917 | .511 | 1.795 | .0767 |
| Road | 1.537 | .725 | 2.121 | .0373 |

Scheffe for ln net area
Effect: Reach

| | Mean Diff. | Crit. Diff. | P-Value | |
|---|---|---|---|---|
| Oxbow, Hells Canyon Res. | -.768 | 3.306 | .9691 | |
| Oxbow, Brownlee | .613 | 2.212 | .9421 | |
| Oxbow, Downstream | 3.078 | 6.803 | .7279 | |
| Oxbow, Weiser | -2.512 | 2.268 | .0216 | S |
| Hells Canyon Res., Brownlee | 1.381 | 2.847 | .6732 | |
| Hells Canyon Res., Downstream | 3.846 | 7.035 | .5640 | |
| Hells Canyon Res., Weiser | -1.744 | 2.891 | .4635 | |
| Brownlee, Downstream | 2.465 | 6.593 | .8440 | |
| Brownlee, Weiser | -3.125 | 1.523 | <.0001 | S |
| Downstream, Weiser | -5.590 | 6.612 | .1411 | |

Scheffe for ln net area
Effect: Elevation

| | Mean Diff. | Crit. Diff. | P-Value | |
|---|---|---|---|---|
| below-above | -.680 | 1.430 | .4972 | |
| below-cross | -2.129 | 1.313 | .0006 | S |
| above-cross | -1.449 | 1.283 | .0228 | S |

2. Effect of LEVELS of disturbances on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 4 | 101.695 | 25.424 | 5.640 | .0005 |
| Elevation | 2 | 28.690 | 14.345 | 3.183 | .0472 |
| Alluvial | 1 | 1.903 | 1.903 | .422 | .5179 |
| Flow zone | 1 | 8.619 | 8.619 | 1.912 | .1709 |
| Livestock | 1 | .754 | .754 | .167 | .6838 |
| Fire | 1 | 1.861 | 1.861 | .413 | .5225 |
| Road | 1 | 6.953 | 6.953 | 1.543 | .2181 |
| Recreation | 1 | .741 | .741 | .164 | .6864 |
| Trail | 1 | .178 | .178 | .039 | .8430 |
| Industrial | 1 | 1.764 | 1.764 | .391 | .5335 |
| Agriculture | 1 | .598 | .598 | .133 | .7167 |
| Residential | 1 | 3.189 | 3.189 | .708 | .4030 |
| Other | 1 | .790 | .790 | .175 | .6768 |
| Residual | 74 | 333.550 | 4.507 | | |

VIII. *Convolvulus arvensis*

A. Tests for association between predictors and presence of weed species

1. Test of PRESENCE of disturbance types on weed presence/absence.

Logistic Model Coefficients Table for COAR

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -3.034 | .410 | -7.402 | 54.791 | <.0001 | .048 |
| Reach | | | | | | |
| Oxbow - Hells Can. Res. | -.112 | .389 | -.288 | .083 | .7735 | .894 |
| Oxbow-Brownlee | .527 | .334 | 1.580 | 2.497 | .1141 | 1.694 |
| Oxbow-Downstream | .842 | .407 | 2.069 | 4.282 | .0385 | 2.322 |
| Oxbow-Weiser | -1.526 | .726 | -2.102 | 4.419 | .0355 | .217 |
| Hells Can.-Brownlee | .639 | .297 | 2.150 | 4.624 | .0315 | 1.895 |
| Hells Can.-Downstream | .954 | .363 | 2.628 | 6.907 | .0086 | 2.597 |
| Hells Can.-Weiser | -1.414 | .697 | -2.029 | 4.115 | .0425 | .243 |
| Brownlee-Downstream | .315 | .295 | 1.068 | 1.140 | .2857 | 1.371 |
| Brownlee-Weiser | -2.053 | .660 | -3.111 | 9.680 | .0019 | .128 |
| Downstream-Weiser | -2.368 | .683 | -3.469 | 12.032 | .0005 | .094 |
| Elevation | | | | | | |
| below-above | -.729 | .355 | -2.053 | 4.213 | .0401 | .482 |
| below-crosses | -.493 | .276 | -1.786 | 3.191 | .0740 | .611 |
| Disturbance factors | | | | | | |
| Alluvial | -.192 | .237 | -.810 | .657 | .4178 | .826 |
| Flow zone | .550 | .283 | 1.941 | 3.766 | .0523 | 1.733 |
| Livestock | -.308 | .245 | -1.255 | 1.574 | .2096 | .735 |
| Mining | 1.549 | 1.228 | 1.261 | 1.591 | .2072 | 4.708 |
| Fire | -1.814 | .738 | -2.459 | 6.045 | .0139 | .163 |
| Road | .675 | .250 | 2.700 | 7.292 | .0069 | 1.965 |
| Recreation | .327 | .221 | 1.477 | 2.182 | .1397 | 1.387 |
| Trail | -.519 | .452 | -1.147 | 1.317 | .2512 | .595 |
| Industrial | -.247 | 1.177 | -.210 | .044 | .8335 | .781 |
| Agriculture | .807 | .473 | 1.707 | 2.912 | .0879 | 2.242 |
| Residential | -.483 | .634 | -.761 | .580 | .4464 | .617 |
| ORV | -.671 | .771 | -.870 | .757 | .3842 | .511 |
| Other | -1.392 | 1.031 | -1.351 | 1.824 | .1768 | .249 |

Logistic Whole Model Fit Table for COAR

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 19 | 87.784 | <.0001 |

Logistic Likelihood Ratio Tests Table for COAR

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Reach | 4 | 24.317 | <.0001 |
| Elevation | 2 | 5.041 | .0804 |

2. Test of effect of LEVEL of disturbance on weed presence/absence.

Logistic Model Coefficients Table for COAR

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -2.164 | .981 | -2.206 | 4.866 | .0274 | .115 |
| Reach | | | | | | |
| Oxbow - Hells Can. Res. | -.393 | .398 | -.986 | .973 | .3239 | .675 |
| Oxbow-Brownlee | .064 | .340 | .188 | .035 | .8511 | 1.066 |
| Oxbow-Downstream | .563 | .405 | 1.389 | 1.930 | .1648 | 1.756 |
| Oxbow-Weiser | -1.978 | .755 | -2.620 | 6.864 | .0088 | .138 |
| Elevation | | | | | | |
| below-above | -.310 | .371 | -.836 | .699 | .4033 | .734 |
| below-crosses | -.169 | .289 | -.584 | .341 | .5593 | .845 |
| Disturbance factors | | | | | | |
| Alluvial | -.151 | .089 | -1.705 | 2.908 | .0881 | .859 |
| Flow zone | .261 | .097 | 2.687 | 7.218 | .0072 | 1.298 |
| Livestock | -.092 | .115 | -.802 | .644 | .4223 | .912 |
| Mining | .017 | .543 | .031 | .001 | .9750 | 1.017 |
| Fire | -.611 | .197 | -3.104 | 9.637 | .0019 | .543 |
| Road | .134 | .091 | 1.477 | 2.182 | .1397 | 1.143 |
| Recreation | .173 | .118 | 1.469 | 2.159 | .1418 | 1.189 |
| Trail | -.228 | .186 | -1.230 | 1.513 | .2188 | .796 |
| Industrial | .059 | .363 | .162 | .026 | .8711 | 1.061 |
| Agriculture | .149 | .171 | .873 | .762 | .3828 | 1.161 |
| Residential | -.036 | .202 | -.178 | .032 | .8585 | .965 |
| ORV | .045 | .268 | .168 | .028 | .8664 | 1.046 |
| Other | -.252 | .223 | -1.130 | 1.278 | .2583 | .778 |

Logistic Whole Model Fit Table for COAR

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 19 | 91.848 | <.0001 |

B. Tests for effect of predictors on population size

1. Test for effect of PRESENCE of disturbance types on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 4 | 30.902 | 7.725 | 2.122 | .0830 |
| Elevation | 2 | 57.719 | 28.859 | 7.927 | .0006 |
| Alluvial | 1 | 4.212 | 4.212 | 1.157 | .2845 |
| Flow zone | 1 | 2.074 | 2.074 | .570 | .4520 |
| Livestock | 1 | 2.777 | 2.777 | .763 | .3844 |
| Fire | 1 | .371 | .371 | .102 | .7503 |
| Road | 1 | 3.037 | 3.037 | .834 | .3631 |
| Recreation | 1 | 1.053 | 1.053 | .289 | .5918 |
| Trail | 1 | 15.478 | 15.478 | 4.252 | .0416 |
| Agriculture | 1 | 1.399 | 1.399 | .384 | .5366 |
| Residential | 1 | 1.114 | 1.114 | .306 | .5813 |
| Industrial | 1 | 2.775 | 2.775 | .762 | .3845 |
| Other | 1 | 3.891 | 3.891 | 1.069 | .3035 |
| ORV | 1 | 1.709 | 1.709 | .469 | .4947 |
| Residual | 108 | 393.169 | 3.640 | | |

ANOVA Coefficients Table for ln net area
Inclusion criteria: COAR from Analnox4.svd

| | Coef | Std. Error | t-Test | P-Value |
|---|---|---|---|---|
| Trail | 1.817 | .881 | 2.062 | .0416 |

Scheffe for ln net area
Effect: Reach

| | Mean Diff. | Crit. Diff. | P-Value | |
|---|---|---|---|---|
| Oxbow, Hells Canyon Res. | .557 | 2.177 | .9577 | |
| Oxbow, Brownlee | .810 | 1.804 | .7393 | |
| Oxbow, Downstream | 2.414 | 2.092 | .0142 | S |
| Oxbow, Weiser | .151 | 3.830 | >.9999 | |
| Hells Canyon Res., Brownlee | .253 | 1.578 | .9925 | |
| Hells Canyon Res., Downstream | 1.857 | 1.901 | .0592 | |
| Hells Canyon Res., Weiser | -.406 | 3.729 | .9983 | |
| Brownlee, Downstream | 1.604 | 1.459 | .0227 | S |
| Brownlee, Weiser | -.659 | 3.525 | .9866 | |
| Downstream, Weiser | -2.264 | 3.680 | .4500 | |

Scheffe for ln net area
Effect: Elevation

| | Mean Diff. | Crit. Diff. | P-Value | |
|---|---|---|---|---|
| below, above | -.859 | 1.111 | .1636 | |
| below, cross | -2.066 | 1.049 | <.0001 | S |
| above, cross | -1.208 | 1.317 | .0798 | |

2. Effect of LEVELS of disturbances on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 4 | 27.735 | 6.934 | 1.879 | .1194 |
| Elevation | 2 | 46.289 | 23.144 | 6.273 | .0027 |
| Alluvial | 1 | .004 | .004 | .001 | .9732 |
| Flow zone | 1 | 4.353 | 4.353 | 1.180 | .2799 |
| Livestock | 1 | .020 | .020 | .005 | .9417 |
| Fire | 1 | 6.775 | 6.775 | 1.836 | .1783 |
| Road | 1 | 2.070 | 2.070 | .561 | .4555 |
| Recreation | 1 | 9.931 | 9.931 | 2.692 | .1038 |
| Trail | 1 | 25.872 | 25.872 | 7.012 | .0093 |
| Agriculture | 1 | 3.856 | 3.856 | 1.045 | .3090 |
| Residential | 1 | .126 | .126 | .034 | .8537 |
| ORV | 1 | .146 | .146 | .039 | .8429 |
| Mining | 1 | .362 | .362 | .098 | .7546 |
| Industrial | 1 | .478 | .478 | .130 | .7196 |
| Other | 1 | 1.554 | 1.554 | .421 | .5177 |
| Residual | 107 | 394.801 | 3.690 | | |

IX. *Cynoglossum officinale*

A. Tests for association between predictors and presence of weed species

1. Test of PRESENCE of disturbance types on weed presence/absence.

Logistic Model Coefficients Table for CYOF

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -1.903 | .370 | -5.138 | 26.395 | <.0001 | .149 |
| Reach | | | | | | |
| Oxbow - Hells Can. Res. | .148 | .295 | .500 | .250 | .6169 | 1.159 |
| Oxbow-Brownlee | -.364 | .285 | -1.278 | 1.634 | .2012 | .695 |
| Oxbow-Downstream | -.255 | .323 | -.790 | .625 | .4293 | .775 |
| Hells Can. Res.-Brownlee | -.512 | .251 | -2.040 | 4.163 | .0413 | .599 |
| Hells Can. Res.-Downstream | -.403 | .269 | -1.497 | 2.241 | .1344 | .668 |
| Brownlee-Downstream | .109 | .252 | .432 | .187 | .6657 | 1.115 |
| Elevation | | | | | | |
| Below-above | .655 | .317 | 2.065 | 4.264 | .0389 | 1.926 |
| Below-crosses | .303 | .315 | .962 | .925 | .3362 | 1.354 |
| Disturbance factors | | | | | | |
| Alluvial | .344 | .214 | 1.610 | 2.593 | .1073 | 1.411 |
| Flow zone | -1.920 | .358 | -5.362 | 28.750 | <.0001 | .147 |
| Livestock | .331 | .197 | 1.680 | 2.823 | .0929 | 1.393 |
| Fire | -.388 | .331 | -1.173 | 1.375 | .2410 | .678 |
| Road | -.547 | .234 | -2.337 | 5.463 | .0194 | .578 |
| Recreation | -.195 | .202 | -.966 | .933 | .3341 | .822 |
| Trail | .180 | .317 | .567 | .322 | .5706 | 1.197 |
| Agriculture | -.119 | .525 | -.227 | .052 | .8201 | .887 |
| Residential | .371 | .489 | .760 | .577 | .4474 | 1.450 |
| ORV | -.590 | 1.057 | -.558 | .311 | .5770 | .554 |

Logistic Whole Model Fit Table for CYOF

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 16 | 186.419 | <.0001 |

Logistic Likelihood Ratio Tests Table for CYOF

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Reach | 4 | 41.783 | <.0001 |
| Elevation | 2 | 5.566 | .0618 |

2. Test of effect of LEVEL of disturbance on weed presence/absence.

Logistic Model Coefficients Table for CYOF

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -.602 | .812 | -.741 | .549 | .4586 | .548 |
| Reach | | | | | | |
| Oxbow-Hells Can. Res. | .203 | .303 | .672 | .451 | .5018 | 1.225 |
| Oxbow-Brownlee | -.374 | .282 | -1.327 | 1.760 | .1846 | .688 |
| Oxbow-Downstream | -.378 | .324 | -1.166 | 1.360 | .2436 | .685 |
| Elevation | | | | | | |
| Below-above | .493 | .338 | 1.460 | 2.130 | .1444 | 1.637 |
| Below-crosses | .218 | .322 | .676 | .458 | .4987 | 1.244 |
| Disturbance factor | | | | | | |
| Alluvial | .139 | .082 | 1.699 | 2.886 | .0893 | 1.149 |
| Flow zone | -.672 | .125 | -5.396 | 29.122 | <.0001 | .511 |
| Livestock | .202 | .105 | 1.936 | 3.748 | .0529 | 1.224 |
| Fire | .023 | .175 | .132 | .017 | .8952 | 1.023 |
| Road | -.244 | .085 | -2.860 | 8.181 | .0042 | .784 |
| Recreation | -.148 | .117 | -1.263 | 1.594 | .2067 | .862 |
| Trail | .111 | .129 | .866 | .750 | .3863 | 1.118 |
| Agriculture | -.078 | .189 | -.413 | .171 | .6793 | .925 |
| Residential | .124 | .189 | .654 | .428 | .5132 | 1.132 |
| ORV | -.548 | .508 | -1.077 | 1.160 | .2814 | .578 |

Logistic Whole Model Fit Table for CYOF

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 16 | 198.127 | <.0001 |

B. Tests for effect of predictors on population size

1. Test for effect of PRESENCE of disturbance types on population size.

ANOVA Table for ln net area
Inclusion criteria: CYOF from Analnox4.svd

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 3 | 30.322 | 10.107 | 3.674 | .0136 |
| Elevation | 2 | 29.854 | 14.927 | 5.426 | .0053 |
| Alluvial | 1 | 5.587 | 5.587 | 2.031 | .1561 |
| Flow zone | 1 | .455 | .455 | .165 | .6848 |
| Livestock | 1 | 1.804 | 1.804 | .656 | .4193 |
| Fire | 1 | 6.840 | 6.840 | 2.487 | .1169 |
| Road | 1 | .861 | .861 | .313 | .5766 |
| Recreation | 1 | 2.386 | 2.386 | .867 | .3532 |
| Trail | 1 | 1.092 | 1.092 | .397 | .5295 |
| Agriculture | 1 | 9.004 | 9.004 | 3.273 | .0724 |
| Residential | 1 | .650 | .650 | .236 | .6277 |
| ORV | 1 | 10.789 | 10.789 | 3.922 | .0494 |
| Residual | 154 | 423.623 | 2.751 | | |

ANOVA Coefficients Table for ln net area

| | Coef | Std. Error | t-Test | P-Value |
|---|---|---|---|---|
| Agriculture | 1.450 | .801 | 1.809 | .0724 |
| ORV | 3.489 | 1.762 | 1.980 | .0494 |

Scheffe for ln net area
Effect: Reach

| | Mean Diff. | Crit. Diff. | P-Value | |
|---|---|---|---|---|
| Oxbow, Hells Canyon Res. | .557 | 1.176 | .6176 | |
| Oxbow, Brownlee | .851 | 1.160 | .2358 | |
| Oxbow, Downstream | 1.640 | 1.172 | .0019 | S |
| Hells Canyon Res., Brownlee | .294 | .948 | .8572 | |
| Hells Canyon Res., Downstream | 1.082 | .962 | .0201 | S |
| Brownlee, Downstream | .789 | .943 | .1380 | |

Scheffe for ln net area
Effect: Elevation

| | Mean Diff. | Crit. Diff. | P-Value | |
|---|---|---|---|---|
| below-above | -.158 | .982 | .9239 | |
| below-cross | -1.416 | 1.076 | .0060 | S |
| above-cross | -1.258 | .723 | .0002 | S |

2. Effect of LEVELS of disturbances on population size.

ANOVA Table for ln net area
Inclusion criteria: CYOF from Analnox4.svd

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 3 | 29.811 | 9.937 | 3.756 | .0122 |
| Elevation | 2 | 29.599 | 14.800 | 5.594 | .0045 |
| Alluvial | 1 | 4.879 | 4.879 | 1.844 | .1765 |
| Flow zone | 1 | .405 | .405 | .153 | .6962 |
| Livestock | 1 | 4.710 | 4.710 | 1.780 | .1841 |
| Fire | 1 | 14.590 | 14.590 | 5.514 | .0201 |
| Road | 1 | .813 | .813 | .307 | .5802 |
| Recreation | 1 | .604 | .604 | .228 | .6335 |
| Trail | 1 | .576 | .576 | .218 | .6416 |
| Agriculture | 1 | 12.598 | 12.598 | 4.762 | .0306 |
| Residential | 1 | 2.254 | 2.254 | .852 | .3574 |
| ORV | 1 | 19.604 | 19.604 | 7.409 | .0072 |
| Residual | 154 | 407.462 | 2.646 | | |

ANOVA Coefficients Table for ln net area
Inclusion criteria: CYOF from Analnox4.svd

| | Coef | Std. Error | t-Test | P-Value |
|---|---|---|---|---|
| Fire | .765 | .326 | 2.348 | .0201 |
| Agriculture | .656 | .301 | 2.182 | .0306 |
| ORV | 2.256 | .829 | 2.722 | .0072 |

X. *Elaeagnus angustifolia*

A. Tests for association between predictors and presence of weed species

1. Test of PRESENCE of disturbance types on weed presence/absence.

Logistic Model Coefficients Table for ELAN

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -4.562 | .713 | -6.395 | 40.901 | <.0001 | .010 |
| Reach | | | | | | |
| Oxbow - Hells Can. Res. | -1.525 | 1.160 | -1.315 | 1.728 | .1887 | .218 |
| Oxbow-Brownlee | -.777 | .720 | -1.079 | 1.163 | .2808 | .460 |
| Oxbow-Weiser | 1.525 | .651 | 2.345 | 5.498 | .0190 | 4.597 |
| Hells Can. Res.-Brownlee | .749 | 1.088 | .688 | .473 | .4915 | 2.114 |
| Hells Can. Res.-Weiser | 3.050 | 1.041 | 2.930 | 8.588 | .0034 | 21.124 |
| Brownlee-Weiser | 2.302 | .507 | 4.540 | 20.616 | <.0001 | 9.993 |
| Elevation | | | | | | |
| below-above | -.531 | .673 | -.788 | .622 | .4304 | .588 |
| below-crosses | .538 | .492 | 1.095 | 1.198 | .2736 | 1.713 |
| Disturbance factors | | | | | | |
| Flow zone | .520 | .469 | 1.109 | 1.230 | .2674 | 1.682 |

Logistic Whole Model Fit Table for ELAN

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 7 | 41.095 | <.0001 |

Logistic Likelihood Ratio Tests Table for ELAN

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Reach | 4 | 34.931 | <.0001 |
| Elevation | 2 | 3.651 | .1611 |

2. Test of effect of LEVEL of disturbance on weed presence/absence.

Logistic Model Coefficients Table for ELAN

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -4.543 | .783 | -5.801 | 33.653 | <.0001 | .011 |
| Reach | | | | | | |
| Oxbow - Hells Can. Res. | -1.525 | 1.160 | -1.314 | 1.728 | .1887 | .218 |
| Oxbow-Brownlee | -.768 | .729 | -1.053 | 1.110 | .2922 | .464 |
| Oxbow-Downstream | -13.572 | 492.370 | -.028 | .001 | .9780 | 1.276E-6 |
| Oxbow-Weiser | 1.522 | .654 | 2.327 | 5.414 | .0200 | 4.580 |
| Elevation | | | | | | |
| below-above | -.627 | .675 | -.930 | .865 | .3523 | .534 |
| below-crosses | .465 | .490 | .950 | .903 | .3420 | 1.592 |
| Disturbance factors | | | | | | |
| Flow zone | .108 | .153 | .701 | .491 | .4833 | 1.114 |

Logistic Whole Model Fit Table for ELAN

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 7 | 40.348 | <.0001 |

B. Tests for effect of predictors on population size

1. Test for effect of PRESENCE of disturbance types on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 3 | 2.150 | .717 | .150 | .9283 |
| Elevation | 2 | 3.145 | 1.572 | .329 | .7242 |
| Flow zone | 1 | .523 | .523 | .109 | .7448 |
| Residual | 17 | 81.268 | 4.780 | | |

2. Effect of LEVELS of disturbances on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 3 | 1.834 | .611 | .128 | .9420 |
| Elevation | 2 | 2.695 | 1.347 | .283 | .7574 |
| Flow zone | 1 | .719 | .719 | .151 | .7025 |
| Residual | 17 | 81.072 | 4.769 | | |

XI. *Hypericum perforatum*

A. Tests for association between predictors and presence of weed species

1. Test of PRESENCE of disturbance types on weed presence/absence.

Logistic Model Coefficients Table for HYPE

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -3.562 | .556 | -6.404 | 41.008 | <.0001 | .028 |
| Reach | | | | | | |
| Oxbow- Hells Can. Res. | .288 | .387 | .743 | .552 | .4574 | 1.334 |
| Oxbow-Brownlee | -3.245 | .788 | -4.118 | 16.959 | <.0001 | .039 |
| Oxbow-Downstream | 2.315 | .407 | 5.686 | 32.334 | <.0001 | 10.126 |
| Hells Can. Res.-Brownlee | -3.567 | .769 | -4.639 | 21.524 | <.0001 | .028 |
| Hells Can. Res.-Downstream | 2.040 | .324 | 6.288 | 39.542 | <.0001 | 7.687 |
| Brownlee-Downstream | 5.561 | .742 | 7.494 | 56.167 | <.0001 | 259.961 |
| Elevation | | | | | | |
| Below-above | .721 | .475 | 1.519 | 2.308 | .1287 | 2.056 |
| Below-crosses | 2.069 | .451 | 4.586 | 21.031 | <.0001 | 7.919 |
| Above-crosses | 1.367 | .270 | 5.057 | 25.576 | <.0001 | 3.923 |
| Disturbance factors | | | | | | |
| Flow zone | -.358 | .395 | -.907 | .823 | .3643 | .699 |
| Livestock | -.155 | .246 | -.631 | .398 | .5280 | .856 |
| Mining | 1.709 | 1.193 | 1.432 | 2.052 | .1520 | 5.525 |
| Fire | .746 | .378 | 1.974 | 3.898 | .0483 | 2.109 |
| Road | -.247 | .325 | -.759 | .577 | .4476 | .781 |
| Recreation | -.519 | .260 | -1.997 | 3.989 | .0458 | .595 |
| Trail | .397 | .338 | 1.175 | 1.382 | .2398 | 1.487 |
| Agriculture | -.424 | .609 | -.696 | .484 | .4865 | .654 |
| Residential | -.154 | .696 | -.221 | .049 | .8248 | .857 |
| Alluvial | -.110 | .309 | -.355 | .126 | .7227 | .896 |
| ORV | -.251 | 1.319 | -.190 | .036 | .8493 | .778 |

Logistic Whole Model Fit Table for HYPE

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 17 | 411.618 | <.0001 |

Logistic Likelihood Ratio Tests Table for HYPE

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Reach | 4 | 262.982 | <.0001 |
| Elevation | 2 | 40.940 | <.0001 |

2. Test of effect of LEVEL of disturbance on weed presence/absence.

Logistic Model Coefficients Table for HYPE

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -3.254 | .935 | -3.478 | 12.100 | .0005 | .039 |
| Reach | | | | | | |
| Oxbow-Hells Can. Res. | .252 | .399 | .631 | .398 | .5281 | 1.286 |
| Oxbow-Brownlee | -3.378 | .792 | -4.267 | 18.204 | <.0001 | .034 |
| Oxbow-Downstream | 2.197 | .400 | 5.496 | 30.207 | <.0001 | 8.997 |
| Elevation | | | | | | |
| Below-above | .227 | .499 | .455 | .207 | .6491 | 1.255 |
| Below-crosses | 1.685 | .456 | 3.692 | 13.631 | .0002 | 5.393 |
| Disturbance factors | | | | | | |
| Alluvial | .005 | .113 | .041 | .002 | .9670 | 1.005 |
| Flow zone | -.178 | .155 | -1.152 | 1.326 | .2495 | .837 |
| Livestock | -.083 | .131 | -.636 | .404 | .5249 | .920 |
| Mining | .423 | .380 | 1.113 | 1.239 | .2656 | 1.527 |
| Fire | .701 | .220 | 3.182 | 10.126 | .0015 | 2.015 |
| Road | -.083 | .122 | -.681 | .464 | .4957 | .920 |
| Recreation | -.499 | .168 | -2.975 | 8.851 | .0029 | .607 |
| Trail | .110 | .144 | .767 | .589 | .4429 | 1.117 |
| Agriculture | -.045 | .235 | -.192 | .037 | .8481 | .956 |
| Residential | -.219 | .266 | -.826 | .683 | .4087 | .803 |

Logistic Whole Model Fit Table for HYPE

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 16 | 424.554 | <.0001 |

B. Tests for effect of predictors on population size

1. Test for effect of PRESENCE of disturbance types on population size.

ANOVA Table for ln net area
Inclusion criteria: HYPE from Analnox4.svd

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 3 | 142.401 | 47.467 | 13.327 | <.0001 |
| Elevation | 2 | 26.337 | 13.168 | 3.697 | .0273 |
| Alluvial | 1 | 1.505 | 1.505 | .423 | .5167 |
| Flow zone | 1 | 5.275 | 5.275 | 1.481 | .2257 |
| Livestock | 1 | 8.634 | 8.634 | 2.424 | .1218 |
| Mining | 1 | 8.781 | 8.781 | 2.465 | .1187 |
| Fire | 1 | 4.276 | 4.276 | 1.201 | .2752 |
| Road | 1 | 3.227 | 3.227 | .906 | .3429 |
| Recreation | 1 | 6.359 | 6.359 | 1.785 | .1837 |
| Trail | 1 | 7.794 | 7.794 | 2.188 | .1414 |
| Agriculture | 1 | .041 | .041 | .011 | .9149 |
| Residential | 1 | 1.299 | 1.299 | .365 | .5470 |
| ORV | 1 | 2.743 | 2.743 | .770 | .3817 |
| Residual | 135 | 480.831 | 3.562 | | |

Scheffe for ln net area
Effect: Reach

| | Mean Diff. | Crit. Diff. | P-Value | |
|---|---|---|---|---|
| Oxbow, Hells Canyon Res. | 1.451 | 1.876 | .1927 | |
| Oxbow, Brownlee | 3.481 | 4.081 | .1254 | |
| Oxbow, Downstream | -1.304 | 1.622 | .1644 | |
| Hells Canyon Res., Brownlee | 2.030 | 3.926 | .5452 | |
| Hells Canyon Res., Downstream | -2.756 | 1.181 | <.0001 | S |
| Brownlee, Downstream | -4.786 | 3.811 | .0070 | S |

Scheffe for ln net area
Effect: Elevation

| | Mean Diff. | Crit. Diff. | P-Value | |
|---|---|---|---|---|
| below-above | -1.500 | 1.560 | .0622 | |
| below-cross | -2.242 | 1.606 | .0033 | S |
| above-cross | -.742 | .805 | .0779 | |

2. Effect of LEVELS of disturbances on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 3 | 112.315 | 37.438 | 10.277 | <.0001 |
| Elevation | 2 | 28.881 | 14.440 | 3.964 | .0212 |
| Alluvial | 1 | 4.571 | 4.571 | 1.255 | .2646 |
| Flow zone | 1 | .021 | .021 | .006 | .9390 |
| Livestock | 1 | 1.981 | 1.981 | .544 | .4622 |
| Mining | 1 | 4.928 | 4.928 | 1.353 | .2468 |
| Fire | 1 | .417 | .417 | .114 | .7356 |
| Road | 1 | 1.440 | 1.440 | .395 | .5306 |
| Recreation | 1 | 1.147 | 1.147 | .315 | .5757 |
| Trail | 1 | .032 | .032 | .009 | .9252 |
| Agriculture | 1 | .719 | .719 | .197 | .6576 |
| Residential | 1 | .575 | .575 | .158 | .6917 |
| ORV | 1 | 5.221 | 5.221 | 1.433 | .2333 |
| Residual | 135 | 491.780 | 3.643 | | |

XII. *Lepidium latifolium*

A. Tests for association between predictors and presence of weed species

1. Test of PRESENCE of disturbance types on weed presence/absence.

Logistic Model Coefficients Table for LELA

| | Coef | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|
| Constant | -3.028 | -8.639 | 74.634 | <.0001 | .048 |
| Reach | | | | | |
| Oxbow - Hells Can. Res. | -.089 | -.281 | .079 | .7789 | .915 |
| Oxbow-Brownlee | -.719 | -2.456 | 6.032 | .0141 | .487 |
| Oxbow-Weiser | -.045 | -.116 | .014 | .9073 | .956 |
| Hells Can. Res.-Brownlee | -.631 | -2.393 | 5.727 | .0167 | .532 |
| Hells Can. Res.-Weiser | .043 | .125 | .016 | .9003 | 1.044 |
| Brownlee-Weiser | .674 | 2.214 | 4.903 | .0268 | 1.962 |
| Elevation | | | | | |
| below-above | -.152 | -.450 | .203 | .6526 | .859 |
| below-crosses | 1.260 | 5.525 | 30.524 | <.0001 | 3.525 |
| above-crosses | 1.412 | 4.794 | 22.981 | <.0001 | 4.104 |
| Disturbance factors | | | | | |
| Alluvial | .038 | .173 | .030 | .8623 | 1.039 |
| Flow zone | 1.178 | 4.985 | 24.848 | <.0001 | 3.247 |
| Livestock | -.382 | -1.611 | 2.595 | .1072 | .683 |
| Fire | .475 | 1.417 | 2.007 | .1566 | 1.607 |
| Road | -.317 | -1.335 | 1.783 | .1818 | .728 |
| Recreation | .094 | .418 | .175 | .6760 | 1.098 |
| Trail | .008 | .019 | 3.701E-4 | .9847 | 1.008 |
| Industrial | -.105 | -.098 | .010 | .9222 | .900 |
| Agriculture | .330 | .960 | .922 | .3370 | 1.391 |
| Residential | .553 | 1.348 | 1.818 | .1776 | 1.738 |
| ORV | 1.114 | 2.004 | 4.015 | .0451 | 3.045 |
| Other | .804 | 1.877 | 3.525 | .0605 | 2.234 |

Logistic Whole Model Fit Table for LELA

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 18 | 150.194 | <.0001 |

Logistic Likelihood Ratio Tests Table for LELA

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Reach | 4 | 46.317 | <.0001 |
| Elevation | 2 | 46.195 | <.0001 |

2. Test of effect of LEVEL of disturbance on weed presence/absence.

Logistic Model Coefficients Table for LELA

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -4.310 | .774 | -5.570 | 31.019 | <.0001 | .013 |
| Reach | | | | | | |
| Oxbow - Hells Can. Res. | -.112 | .319 | -.353 | .124 | .7243 | .894 |
| Oxbow-Brownlee | -.682 | .295 | -2.313 | 5.351 | .0207 | .506 |
| Oxbow-Weiser | -.012 | .392 | -.032 | .001 | .9748 | .988 |
| Elevation | | | | | | |
| below-above | -.230 | .343 | -.669 | .448 | .5033 | .795 |
| below-crosses | 1.138 | .232 | 4.895 | 23.963 | <.0001 | 3.119 |
| Disturbance factors | | | | | | |
| Alluvial | .084 | .081 | 1.037 | 1.076 | .2996 | 1.087 |
| Flow zone | .321 | .077 | 4.148 | 17.203 | <.0001 | 1.379 |
| Livestock | -.174 | .107 | -1.631 | 2.661 | .1029 | .841 |
| Fire | .182 | .155 | 1.175 | 1.382 | .2398 | 1.200 |
| Road | -.069 | .082 | -.837 | .700 | .4028 | .934 |
| Recreation | .072 | .113 | .640 | .410 | .5221 | 1.075 |
| Trail | .092 | .152 | .605 | .366 | .5452 | 1.096 |
| Industrial | -.196 | .390 | -.502 | .252 | .6156 | .822 |
| Agriculture | .130 | .109 | 1.198 | 1.434 | .2311 | 1.139 |
| Residential | .092 | .148 | .622 | .387 | .5337 | 1.097 |
| ORV | .454 | .225 | 2.022 | 4.090 | .0431 | 1.575 |
| Other | .191 | .135 | 1.418 | 2.012 | .1561 | 1.211 |

Logistic Whole Model Fit Table for LELA

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 18 | 140.253 | <.0001 |

B. Tests for effect of predictors on population size

1. Test for effect of PRESENCE of disturbance types on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 3 | 111.923 | 37.308 | 13.431 | <.0001 |
| Elevation | 2 | 56.828 | 28.414 | 10.229 | <.0001 |
| Alluvial | 1 | .431 | .431 | .155 | .6942 |
| Flow zone | 1 | .961 | .961 | .346 | .5574 |
| Livestock | 1 | .206 | .206 | .074 | .7859 |
| Fire | 1 | 1.360 | 1.360 | .490 | .4854 |
| Road | 1 | 9.073 | 9.073 | 3.266 | .0730 |
| Recreation | 1 | 2.309 | 2.309 | .831 | .3636 |
| Trail | 1 | .312 | .312 | .112 | .7382 |
| Agriculture | 1 | 2.080 | 2.080 | .749 | .3885 |
| Residential | 1 | .269 | .269 | .097 | .7563 |
| Industrial | 1 | 3.291 | 3.291 | 1.185 | .2784 |
| ORV | 1 | 2.636 | 2.636 | .949 | .3318 |
| Other | 1 | 6.070 | 6.070 | 2.185 | .1417 |
| Residual | 131 | 363.887 | 2.778 | | |

ANOVA Coefficients Table for ln net area
Inclusion criteria: LELA from Analnox4.svd

| | Coef | Std. Error | t-Test | P-Value |
|---|---|---|---|---|
| Road | -.719 | .398 | -1.807 | .0730 |

Scheffe for ln net area
Effect: Reach

| | Mean Diff. | Crit. Diff. | P-Value | |
|---|---|---|---|---|
| Oxbow, Hells Canyon Res. | 1.468 | 1.318 | .0220 | S |
| Oxbow, Brownlee | -1.447 | 1.187 | .0095 | S |
| Oxbow, Weiser | -3.446 | 1.334 | <.0001 | S |
| Hells Canyon Res., Brownlee | -2.915 | 1.012 | <.0001 | S |
| Hells Canyon Res., Weiser | -4.914 | 1.181 | <.0001 | S |
| Brownlee, Weiser | -1.998 | 1.033 | <.0001 | S |

Scheffe for ln net area
Effect: Elevation

| | Mean Diff. | Crit. Diff. | P-Value | |
|---|---|---|---|---|
| below, above | -2.115 | 1.143 | <.0001 | S |
| below, cross | -2.612 | .727 | <.0001 | S |
| above, cross | -.496 | 1.107 | .5418 | |

2. Effect of LEVELS of disturbances on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 3 | 113.903 | 37.968 | 13.539 | <.0001 |
| Elevation | 2 | 59.024 | 29.512 | 10.524 | <.0001 |
| Alluvial | 1 | .032 | .032 | .011 | .9150 |
| Flow zone | 1 | 2.563 | 2.563 | .914 | .3409 |
| Livestock | 1 | 3.710 | 3.710 | 1.323 | .2522 |
| Fire | 1 | .001 | .001 | 3.311E-4 | .9855 |
| Road | 1 | 9.306 | 9.306 | 3.318 | .0708 |
| Recreation | 1 | 1.216 | 1.216 | .434 | .5113 |
| Trail | 1 | .067 | .067 | .024 | .8770 |
| Agriculture | 1 | .245 | .245 | .087 | .7681 |
| Residential | 1 | .172 | .172 | .061 | .8046 |
| Industrial | 1 | 2.011 | 2.011 | .717 | .3987 |
| ORV | 1 | .408 | .408 | .145 | .7035 |
| Other | 1 | 4.126 | 4.126 | 1.471 | .2273 |
| Residual | 131 | 367.369 | 2.804 | | |

XIII. *Linaria dalmatica*

A. Tests for association between predictors and presence of weed species

1. Test of PRESENCE of disturbance types on weed presence/absence.

Logistic Model Coefficients Table for LIDA

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -6.068 | 1.227 | -4.947 | 24.473 | <.0001 | .002 |
| Reach | | | | | | |
| Hells Can. Res.-Brownlee | -.123 | .533 | -.230 | .053 | .8181 | .885 |
| Hells Can. Res.-Downstream | -1.073 | .702 | -1.529 | 2.336 | .1264 | .342 |
| Brownlee-Downstream | -.950 | .707 | -1.345 | 1.809 | .1787 | .387 |
| Elevation | | | | | | |
| below-above | 2.729 | 1.219 | 2.238 | 5.009 | .0252 | 15.318 |
| below-crosses | 2.088 | 1.162 | 1.797 | 3.231 | .0723 | 8.068 |
| Disturbance factors | | | | | | |
| Flow zone | -.106 | .769 | -.138 | .019 | .8899 | .899 |

Logistic Whole Model Fit Table for LIDA

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 7 | 25.254 | .0007 |

Logistic Likelihood Ratio Tests Table for LIDA

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Reach | 4 | 13.464 | .0092 |
| Elevation | 2 | 7.024 | .0298 |

2. Test of effect of LEVEL of disturbance on weed presence/absence.

Logistic Model Coefficients Table for LIDA

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -5.755 | 1.424 | -4.041 | 16.332 | <.0001 | .003 |
| Reach | | | | | | |
| Hells Can. Res.-Brownlee | -.097 | .532 | -.182 | .033 | .8560 | .908 |
| Hells Can. Res.-Downstream | -1.064 | .702 | -1.516 | 2.298 | .1295 | .345 |
| Elevation | | | | | | |
| below-above | 2.528 | 1.254 | 2.015 | 4.061 | .0439 | 12.525 |
| below-crosses | 1.954 | 1.178 | 1.658 | 2.748 | .0974 | 7.054 |
| Disturbance factors | | | | | | |
| Flow zone | -.111 | .267 | -.416 | .173 | .6773 | .895 |

Logistic Whole Model Fit Table for LIDA

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 7 | 25.416 | .0006 |

B. Tests for effect of predictors on population size

1. Test for effect of PRESENCE of disturbance types on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 2 | 1.191 | .596 | .136 | .8744 |
| Elevation | 2 | 10.412 | 5.206 | 1.186 | .3387 |
| Flow zone | 1 | .184 | .184 | .042 | .8411 |
| Residual | 12 | 52.657 | 4.388 | | |

2. Effect of LEVELS of disturbances on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 2 | 1.313 | .656 | .150 | .8623 |
| Elevation | 2 | 9.654 | 4.827 | 1.103 | .3633 |
| Flow zone | 1 | .320 | .320 | .073 | .7914 |
| Residual | 12 | 52.521 | 4.377 | | |

XIV. *Onopordum acanthium*

A. Tests for association between predictors and presence of weed species

1. Test of PRESENCE of disturbance types on weed presence/absence.

Logistic Model Coefficients Table for ONAC

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -3.345 | .345 | -9.691 | 93.909 | <.0001 | .035 |
| Reach | | | | | | |
| Oxbow - Hells Can. Res. | -.227 | .317 | -.715 | .512 | .4744 | .797 |
| Oxbow-Brownlee | .617 | .276 | 2.234 | 4.992 | .0255 | 1.854 |
| Oxbow-Downstream | -.104 | .329 | -.315 | .099 | .7529 | .902 |
| Oxbow-Weiser | .052 | .377 | .138 | .019 | .8903 | 1.053 |
| Hells Can.-Brownlee | .844 | .252 | 3.347 | 11.199 | .0008 | 2.325 |
| Hells Can.-Downstream | .123 | .298 | .413 | .170 | .6798 | 1.131 |
| Hells Can.-Weiser | .278 | .341 | .816 | .666 | .4145 | 1.321 |
| Brownlee-Downstream | -.721 | .237 | -3.039 | 9.234 | .0024 | .486 |
| Brownlee-Weiser | -.565 | .285 | -1.985 | 3.942 | .0471 | .568 |
| Downstream-Weiser | .155 | .308 | .504 | .254 | .6143 | 1.168 |
| Elevation | | | | | | |
| below-above | 1.381 | .268 | 5.161 | 26.637 | <.0001 | 3.978 |
| below-crosses | 1.091 | .248 | 4.394 | 19.308 | <.0001 | 2.977 |
| above-crosses | -.290 | .175 | -1.653 | 2.732 | .0984 | .748 |
| Disturbance factors | | | | | | |
| Alluvial | .310 | .194 | 1.595 | 2.543 | .1108 | 1.363 |
| Flow zone | -.536 | .220 | -2.437 | 5.939 | .0148 | .585 |
| Livestock | .339 | .166 | 2.048 | 4.194 | .0406 | 1.404 |
| Mining | .271 | 1.214 | .223 | .050 | .8235 | 1.311 |
| Fire | .066 | .232 | .286 | .082 | .7748 | 1.069 |
| Road | .243 | .194 | 1.252 | 1.568 | .2106 | 1.275 |
| Recreation | -.136 | .183 | -.744 | .554 | .4568 | .873 |
| Trail | .357 | .285 | 1.251 | 1.564 | .2111 | 1.429 |
| Industrial | .490 | .855 | .573 | .329 | .5665 | 1.633 |
| Agriculture | .609 | .277 | 2.202 | 4.848 | .0277 | 1.839 |
| Residential | .236 | .364 | .650 | .422 | .5157 | 1.267 |
| ORV | .916 | .444 | 2.064 | 4.261 | .0390 | 2.499 |
| Other | 1.012 | .314 | 3.220 | 10.368 | .0013 | 2.751 |

Logistic Whole Model Fit Table for ONAC

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 19 | 149.226 | <.0001 |

Logistic Likelihood Ratio Tests Table for ONAC

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Reach | 4 | 18.024 | .0012 |
| Elevation | 2 | 30.383 | <.0001 |

2. Test of effect of LEVEL of disturbance on weed presence/absence.

Logistic Model Coefficients Table for ONAC

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -4.938 | .710 | -6.952 | 48.337 | <.0001 | .007 |
| Reach | | | | | | |
| Oxbow - Hells Can. Res. | -.213 | .319 | -.667 | .445 | .5046 | .808 |
| Oxbow-Brownlee | .622 | .271 | 2.294 | 5.264 | .0218 | 1.862 |
| Oxbow-Downstream | -.148 | .324 | -.457 | .209 | .6476 | .862 |
| Oxbow-Weiser | .023 | .376 | .062 | .004 | .9505 | 1.024 |
| Elevation | | | | | | |
| below-above | 1.348 | .279 | 4.831 | 23.341 | <.0001 | 3.851 |
| below-crosses | 1.090 | .253 | 4.306 | 18.544 | <.0001 | 2.973 |
| Disturbance factors | | | | | | |
| Alluvial | .128 | .073 | 1.768 | 3.125 | .0771 | 1.137 |
| Flow zone | -.206 | .076 | -2.709 | 7.340 | .0067 | .814 |
| Livestock | .169 | .079 | 2.147 | 4.608 | .0318 | 1.184 |
| Mining | -.039 | .419 | -.094 | .009 | .9249 | .961 |
| Fire | .009 | .128 | .069 | .005 | .9449 | 1.009 |
| Road | .016 | .066 | .245 | .060 | .8062 | 1.016 |
| Recreation | -.005 | .095 | -.053 | .003 | .9579 | .995 |
| Trail | .106 | .116 | .916 | .839 | .3596 | 1.112 |
| Industrial | .347 | .263 | 1.320 | 1.743 | .1867 | 1.415 |
| Agriculture | .195 | .088 | 2.204 | 4.857 | .0275 | 1.215 |
| Residential | .172 | .127 | 1.346 | 1.812 | .1783 | 1.187 |
| ORV | .312 | .191 | 1.636 | 2.675 | .1019 | 1.366 |
| Other | .339 | .100 | 3.399 | 11.553 | .0007 | 1.403 |

Logistic Whole Model Fit Table for ONAC

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 19 | 149.259 | <.0001 |

B. Tests for effect of predictors on population size

1. Test for effect of PRESENCE of disturbance types on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 4 | 40.767 | 10.192 | 2.669 | .0332 |
| Elevation | 2 | 114.994 | 57.497 | 15.059 | <.0001 |
| Alluvial | 1 | 11.268 | 11.268 | 2.951 | .0872 |
| Flow zone | 1 | 2.456 | 2.456 | .643 | .4235 |
| Livestock | 1 | 3.396 | 3.396 | .889 | .3467 |
| Fire | 1 | .222 | .222 | .058 | .8096 |
| Road | 1 | .029 | .029 | .008 | .9304 |
| Recreation | 1 | 1.445 | 1.445 | .378 | .5391 |
| Trail | 1 | .971 | .971 | .254 | .6146 |
| Agriculture | 1 | .011 | .011 | .003 | .9571 |
| Residential | 1 | 14.702 | 14.702 | 3.851 | .0510 |
| Industrial | 1 | 7.496 | 7.496 | 1.963 | .1626 |
| ORV | 1 | 4.614 | 4.614 | 1.208 | .2729 |
| Other | 1 | .145 | .145 | .038 | .8456 |
| Mining | 1 | 31.101 | 31.101 | 8.146 | .0047 |
| Residual | 218 | 832.359 | 3.818 | | |

ANOVA Coefficients Table for ln net area

| | Coef | Std. Error | t-Test | P-Value |
|---|---|---|---|---|
| Alluvial | -.608 | .354 | -1.718 | .0872 |
| Mining | 5.740 | 2.011 | 2.854 | .0047 |

Scheffe for ln net area
Effect: Reach

| | Mean Diff. | Crit. Diff. | P-Value | |
|---|---|---|---|---|
| Oxbow, Hells Canyon Res. | .389 | 1.739 | .9750 | |
| Oxbow, Brownlee | .158 | 1.437 | .9983 | |
| Oxbow, Downstream | .574 | 1.651 | .8834 | |
| Oxbow, Weiser | -.968 | 1.716 | .5470 | |
| Hells Canyon Res., Brownlee | -.231 | 1.257 | .9880 | |
| Hells Canyon Res., Downstream | .185 | 1.497 | .9974 | |
| Hells Canyon Res., Weiser | -1.357 | 1.568 | .1286 | |
| Brownlee, Downstream | .416 | 1.131 | .8606 | |
| Brownlee, Weiser | -1.126 | 1.224 | .0896 | |
| Downstream, Weiser | -1.542 | 1.469 | .0339 | S |

Scheffe for ln net area
Effect: Elevation

| | Mean Diff. | Crit. Diff. | P-Value | |
|---|---|---|---|---|
| below, above | -.326 | .985 | .7178 | |
| below, cross | -1.828 | 1.015 | <.0001 | S |
| above, cross | -1.502 | .674 | <.0001 | S |

2. Effect of LEVELS of disturbances on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 4 | 38.535 | 9.634 | 2.615 | .0362 |
| Elevation | 2 | 116.839 | 58.420 | 15.855 | <.0001 |
| Alluvial | 1 | 13.591 | 13.591 | 3.689 | .0561 |
| Flow zone | 1 | 15.004 | 15.004 | 4.072 | .0448 |
| Livestock | 1 | 1.342 | 1.342 | .364 | .5468 |
| Fire | 1 | 10.165 | 10.165 | 2.759 | .0982 |
| Road | 1 | .473 | .473 | .128 | .7205 |
| Recreation | 1 | .579 | .579 | .157 | .6923 |
| Trail | 1 | 1.907 | 1.907 | .518 | .4726 |
| Agriculture | 1 | .035 | .035 | .010 | .9222 |
| Residential | 1 | 11.712 | 11.712 | 3.179 | .0760 |
| Industrial | 1 | 10.809 | 10.809 | 2.934 | .0882 |
| ORV | 1 | 9.776 | 9.776 | 2.653 | .1048 |
| Other | 1 | .010 | .010 | .003 | .9582 |
| Mining | 1 | 33.004 | 33.004 | 8.958 | .0031 |
| Residual | 218 | 803.230 | 3.685 | | |

ANOVA Coefficients Table for ln net area
Inclusion criteria: ONAC from Analnox4.svd

| | Coef | Std. Error | t-Test | P-Value |
|---|---|---|---|---|
| Alluvial | -.252 | .131 | -1.921 | .0561 |
| Flow zone | .265 | .131 | 2.018 | .0448 |
| Fire | .366 | .220 | 1.661 | .0982 |
| Residential | .381 | .214 | 1.783 | .0760 |
| Industrial | .748 | .437 | 1.713 | .0882 |
| Mining | 1.881 | .628 | 2.993 | .0031 |

XV. *Phalaris arundinacea*

A. Tests for association between predictors and presence of weed species

1. Test of PRESENCE of disturbance types on weed presence/absence.

Logistic Model Coefficients Table for PHAR

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -5.957 | 1.095 | -5.440 | 29.588 | <.0001 | .003 |
| Reach | | | | | | |
| Oxbow - Hells Can. Res. | 2.581 | 1.048 | 2.464 | 6.071 | .0137 | 13.213 |
| Oxbow-Brownlee | 2.287 | 1.022 | 2.238 | 5.008 | .0252 | 9.847 |
| Oxbow-Downstream | 1.046 | 1.176 | .889 | .790 | .3740 | 2.846 |
| Oxbow-Weiser | 3.364 | 1.060 | 3.175 | 10.078 | .0015 | 28.907 |
| Hells Can.-Brownlee | -.294 | .309 | -.950 | .903 | .3420 | .745 |
| Hells Can.-Downstream | -1.535 | .652 | -2.355 | 5.547 | .0185 | .215 |
| Hells Can.-Weiser | .783 | .394 | 1.989 | 3.955 | .0467 | 2.188 |
| Brownlee-Downstream | -1.241 | .616 | -2.014 | 4.055 | .0440 | .289 |
| Brownlee-Weiser | 1.077 | .326 | 3.309 | 10.947 | .0009 | 2.936 |
| Downstream-Weiser | 2.318 | .654 | 3.543 | 12.555 | .0004 | 10.158 |
| Elevation | | | | | | |
| below-above | -1.634 | .500 | -3.267 | 10.674 | .0011 | .195 |
| below-crosses | -1.605 | .377 | -4.257 | 18.119 | <.0001 | .201 |
| above-crosses | .029 | .562 | .052 | .003 | .9587 | 1.030 |
| Disturbance factors | | | | | | |
| Alluvial | -.491 | .273 | -1.802 | 3.247 | .0716 | .612 |
| Flow zone | 2.528 | .422 | 5.985 | 35.825 | <.0001 | 12.527 |
| Livestock | -.281 | .337 | -.833 | .693 | .4050 | .755 |
| Fire | -.390 | .762 | -.511 | .262 | .6091 | .677 |
| Road | -.078 | .358 | -.218 | .047 | .8277 | .925 |
| Recreation | -.639 | .254 | -2.517 | 6.334 | .0118 | .528 |
| Trail | .811 | .484 | 1.677 | 2.812 | .0936 | 2.250 |
| Industrial | .938 | 1.209 | .776 | .602 | .4380 | 2.555 |
| Agriculture | .361 | .416 | .867 | .751 | .3862 | 1.434 |
| Residential | -.352 | .679 | -.518 | .269 | .6042 | .703 |
| ORV | -.768 | 1.068 | -.719 | .517 | .4721 | .464 |
| Other | .363 | .674 | .538 | .290 | .5904 | 1.437 |

Logistic Whole Model Fit Table for PHAR

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 18 | 242.389 | <.0001 |

Logistic Likelihood Ratio Tests Table for PHAR

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Reach | 4 | 31.645 | <.0001 |
| Elevation | 2 | 28.804 | <.0001 |

2. Test of effect of LEVEL of disturbance on weed presence/absence.

Logistic Model Coefficients Table for PHAR

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -4.895 | 1.352 | -3.622 | 13.117 | .0003 | .007 |
| Reach | | | | | | |
| Oxbow - Hells Can. Res. | 2.355 | 1.050 | 2.243 | 5.031 | .0249 | 10.534 |
| Oxbow-Brownlee | 1.877 | 1.028 | 1.826 | 3.334 | .0679 | 6.536 |
| Oxbow-Downstream | .769 | 1.177 | .653 | .426 | .5138 | 2.157 |
| Oxbow-Weiser | 3.129 | 1.062 | 2.945 | 8.676 | .0032 | 22.843 |
| Elevation | | | | | | |
| below-above | -1.787 | .489 | -3.651 | 13.327 | .0003 | .167 |
| below-crosses | -1.575 | .378 | -4.163 | 17.333 | <.0001 | .207 |
| Disturbance factors | | | | | | |
| Alluvial | -.166 | .099 | -1.666 | 2.776 | .0957 | .847 |
| Flow zone | .538 | .105 | 5.109 | 26.106 | <.0001 | 1.712 |
| Livestock | -.146 | .136 | -1.075 | 1.156 | .2824 | .864 |
| Fire | -.335 | .223 | -1.504 | 2.261 | .1326 | .715 |
| Road | -.138 | .132 | -1.044 | 1.090 | .2966 | .871 |
| Recreation | -.259 | .140 | -1.854 | 3.438 | .0637 | .772 |
| Trail | .451 | .190 | 2.379 | 5.662 | .0173 | 1.570 |
| Industrial | .266 | .400 | .665 | .442 | .5063 | 1.305 |
| Agriculture | -.054 | .144 | -.372 | .138 | .7099 | .948 |
| Residential | .007 | .218 | .033 | .001 | .9736 | 1.007 |
| ORV | .108 | .300 | .360 | .130 | .7185 | 1.114 |
| Other | .003 | .220 | .014 | 2.084E-4 | .9885 | 1.003 |

Logistic Whole Model Fit Table for PHAR

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 18 | 228.088 | <.0001 |

B. Tests for effect of predictors on population size

1. Test for effect of PRESENCE of disturbance types on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 4 | 46.257 | 11.564 | 3.076 | .0198 |
| Elevation | 2 | 13.460 | 6.730 | 1.790 | .1726 |
| Alluvial | 1 | 4.066 | 4.066 | 1.081 | .3010 |
| Flow zone | 1 | .258 | .258 | .069 | .7941 |
| Livestock | 1 | 13.431 | 13.431 | 3.572 | .0618 |
| Fire | 1 | 2.415 | 2.415 | .642 | .4249 |
| Road | 1 | .434 | .434 | .115 | .7348 |
| Recreation | 1 | 5.639 | 5.639 | 1.500 | .2237 |
| Trail | 1 | 1.117 | 1.117 | .297 | .5870 |
| Agriculture | 1 | 29.319 | 29.319 | 7.798 | .0063 |
| Residential | 1 | 10.001 | 10.001 | 2.660 | .1062 |
| Industrial | 1 | .100 | .100 | .027 | .8710 |
| ORV | 1 | .534 | .534 | .142 | .7071 |
| Other | 1 | 26.954 | 26.954 | 7.169 | .0087 |
| Residual | 95 | 357.188 | 3.760 | | |

ANOVA Coefficients Table for ln net area
Inclusion criteria: PHAR from Analnox4.svd

| | Coef | Std. Error | t-Test | P-Value |
|---|---|---|---|---|
| Livestock | 1.239 | .655 | 1.890 | .0618 |
| Agriculture | 2.037 | .729 | 2.792 | .0063 |
| Residential | -2.143 | 1.314 | -1.631 | .1062 |
| Other | -3.123 | 1.167 | -2.677 | .0087 |

Scheffe for ln net area
Effect: Reach

| | Mean Diff. | Crit. Diff. | P-Value | |
|---|---|---|---|---|
| Oxbow, Hells Canyon Res. | .334 | 6.242 | .9999 | |
| Oxbow, Brownlee | -.921 | 6.141 | .9942 | |
| Oxbow, Downstream | .145 | 7.034 | >.9999 | |
| Oxbow, Weiser | -2.862 | 6.200 | .7169 | |
| Hells Canyon Res., Brownlee | -1.255 | 1.567 | .1851 | |
| Hells Canyon Res., Downstream | -.190 | 3.772 | >.9999 | |
| Hells Canyon Res., Weiser | -3.197 | 1.783 | <.0001 | S |
| Brownlee, Downstream | 1.065 | 3.601 | .9290 | |
| Brownlee, Weiser | -1.942 | 1.387 | .0014 | S |
| Downstream, Weiser | -3.007 | 3.701 | .1733 | |

Scheffe for ln net area
Effect: Elevation

| | Mean Diff. | Crit. Diff. | P-Value | |
|---|---|---|---|---|
| below, above | -1.085 | 2.028 | .4159 | |
| below, cross | -3.349 | 1.601 | <.0001 | S |
| above, cross | -2.264 | 2.490 | .0829 | |

2. Effect of LEVELS of disturbances on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 4 | 31.443 | 7.861 | 2.181 | .0769 |
| Elevation | 2 | 16.524 | 8.262 | 2.292 | .1066 |
| Alluvial | 1 | 5.480 | 5.480 | 1.520 | .2206 |
| Flow zone | 1 | .288 | .288 | .080 | .7782 |
| Livestock | 1 | 1.529 | 1.529 | .424 | .5165 |
| Fire | 1 | 12.029 | 12.029 | 3.337 | .0709 |
| Road | 1 | 1.053 | 1.053 | .292 | .5902 |
| Recreation | 1 | 11.973 | 11.973 | 3.322 | .0715 |
| Trail | 1 | 2.704 | 2.704 | .750 | .3885 |
| Agriculture | 1 | 23.497 | 23.497 | 6.519 | .0123 |
| Residential | 1 | 7.922 | 7.922 | 2.198 | .1415 |
| Industrial | 1 | 4.964E-4 | 4.964E-4 | 1.377E-4 | .9907 |
| ORV | 1 | 12.748 | 12.748 | 3.537 | .0631 |
| Other | 1 | 17.093 | 17.093 | 4.742 | .0319 |
| Residual | 95 | 342.397 | 3.604 | | |

ANOVA Coefficients Table for ln net area

| | Coef | Std. Error | t-Test | P-Value |
|---|---|---|---|---|
| Fire | .607 | .332 | 1.827 | .0709 |
| Recreation | -.488 | .268 | -1.823 | .0715 |
| Agriculture | .764 | .299 | 2.553 | .0123 |
| ORV | 1.374 | .731 | 1.881 | .0631 |
| Other | -.874 | .401 | -2.178 | .0319 |

XVII. *Taeniatherum caput-medusae*

A. Tests for association between predictors and presence of weed species

1. Test of PRESENCE of disturbance types on weed presence/absence.

Logistic Model Coefficients Table for TACA

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -3.212 | .590 | -5.448 | 29.677 | <.0001 | .040 |
| Reach | | | | | | |
| Oxbow- Hells Can. Res. | -.312 | .345 | -.904 | .818 | .3659 | .732 |
| Oxbow-Brownlee | -.178 | .302 | -.588 | .346 | .5562 | .837 |
| Oxbow-Weiser | -.774 | .467 | -1.659 | 2.752 | .0971 | .461 |
| Hells Can. Res.-Brownlee | .134 | .305 | .440 | .194 | .6597 | 1.144 |
| Hells Can. Res.-Weiser | -.462 | .451 | -1.024 | 1.049 | .3058 | .630 |
| Brownlee-Weiser | -.597 | .395 | -1.512 | 2.285 | .1306 | .551 |
| Elevation | | | | | | |
| Below-above | 1.560 | .551 | 2.830 | 8.010 | .0047 | 4.758 |
| Below-crosses | 1.851 | .543 | 3.411 | 11.636 | .0006 | 6.367 |
| Above-crosses | .291 | .218 | 1.339 | 1.792 | .1807 | 1.338 |
| Disturbance factors | | | | | | |
| Alluvial | -.521 | .293 | -1.778 | 3.160 | .0755 | .594 |
| Flow zone | -3.679 | 1.027 | -3.584 | 12.845 | .0003 | .025 |
| Livestock | 1.039 | .238 | 4.365 | 19.057 | <.0001 | 2.825 |
| Fire | .253 | .318 | .795 | .632 | .4267 | 1.288 |
| Road | -.252 | .263 | -.956 | .914 | .3391 | .778 |
| Recreation | -.538 | .266 | -2.020 | 4.079 | .0434 | .584 |
| Trail | .385 | .497 | .774 | .599 | .4389 | 1.469 |
| Industrial | .338 | 1.114 | .304 | .092 | .7613 | 1.403 |
| Agriculture | -1.051 | .583 | -1.803 | 3.252 | .0714 | .350 |
| Residential | -.328 | .761 | -.432 | .186 | .6661 | .720 |
| ORV | -15.570 | 1353.563 | -.012 | 1.323E-4 | .9908 | 1.730E-7 |

Logistic Whole Model Fit Table for TACA

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 17 | 260.802 | <.0001 |

Logistic Likelihood Ratio Tests Table for TACA

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Reach | 4 | 67.795 | <.0001 |
| Elevation | 2 | 17.705 | .0001 |

2. Test of effect of LEVEL of disturbance on weed presence/absence.

Logistic Model Coefficients Table for TACA

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | 13.454 | 985.725 | .014 | 1.863E-4 | .9891 | 696803.354 |
| Reach | | | | | | |
| Reach- HellCanRes. | -.234 | .353 | -.662 | .438 | .5081 | .792 |
| Oxbow-Brownlee | -.222 | .302 | -.737 | .544 | .4609 | .801 |
| Oxbow-Weiser | -.760 | .466 | -1.629 | 2.653 | .1033 | .468 |
| Elevation | | | | | | |
| Below-above | 1.437 | .578 | 2.485 | 6.174 | .0130 | 4.209 |
| Below-crosses | 1.889 | .555 | 3.402 | 11.574 | .0007 | 6.613 |
| Disturbance factors | | | | | | |
| Alluvial | -.337 | .127 | -2.664 | 7.097 | .0077 | .714 |
| Flow zone | -.911 | .201 | -4.538 | 20.594 | <.0001 | .402 |
| Livestock | .597 | .120 | 4.982 | 24.824 | <.0001 | 1.817 |
| Fire | .184 | .214 | .860 | .740 | .3898 | 1.202 |
| Road | -.116 | .092 | -1.253 | 1.571 | .2100 | .891 |
| Recreation | -.222 | .148 | -1.506 | 2.269 | .1320 | .801 |
| Trail | .150 | .212 | .706 | .498 | .4804 | 1.162 |
| Industrial | .230 | .348 | .662 | .438 | .5080 | 1.259 |
| Agriculture | -.238 | .171 | -1.391 | 1.935 | .1642 | .788 |
| Residential | -.332 | .355 | -.935 | .874 | .3497 | .717 |
| ORV | -15.748 | 985.724 | -.016 | 2.552E-4 | .9873 | 1.448E-7 |

Logistic Whole Model Fit Table for TACA

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 17 | 275.739 | <.0001 |

B. Tests for effect of predictors on population size

1. Test for effect of PRESENCE of disturbance types on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 3 | 39.751 | 13.250 | 2.567 | .0586 |
| Elevation | 2 | 96.365 | 48.183 | 9.336 | .0002 |
| Alluvial | 1 | 7.237 | 7.237 | 1.402 | .2391 |
| Flow zone | 1 | .874 | .874 | .169 | .6816 |
| Livestock | 1 | 5.152 | 5.152 | .998 | .3201 |
| Fire | 1 | .711 | .711 | .138 | .7113 |
| Road | 1 | 2.815 | 2.815 | .545 | .4619 |
| Recreation | 1 | 6.698 | 6.698 | 1.298 | .2573 |
| Trail | 1 | .371 | .371 | .072 | .7893 |
| presind | 1 | 1.493 | 1.493 | .289 | .5919 |
| Agriculture | 1 | 4.242 | 4.242 | .822 | .3668 |
| Residential | 1 | 2.719 | 2.719 | .527 | .4696 |
| Other | 1 | 13.871 | 13.871 | 2.688 | .1042 |
| Residual | 101 | 521.245 | 5.161 | | |

Scheffe for ln net area

Effect: Reach

| | Mean Diff. | Crit. Diff. | P-Value | |
|---|---|---|---|---|
| Oxbow, Hells Canyon Res. | 1.953 | 1.885 | .0390 | S |
| Oxbow, Brownlee | .830 | 1.584 | .5312 | |
| Oxbow, Weiser | 3.699 | 2.368 | .0004 | S |
| Hells Canyon Res., Brownlee | -1.123 | 1.560 | .2481 | |
| Hells Canyon Res., Weiser | 1.746 | 2.352 | .2229 | |
| Brownlee, Weiser | 2.870 | 2.118 | .0030 | S |

Scheffe for ln net area
Effect: Elevation

| | Mean Diff. | Crit. Diff. | P-Value | |
|---|---|---|---|---|
| below-above | -.167 | 2.931 | .9900 | |
| below-cross | -2.652 | 2.910 | .0821 | |
| above-cross | -2.484 | 1.063 | <.0001 | S |

2. Effect of LEVELS of disturbances on population size.

ANOVA Table for ln net area
Inclusion criteria: TACA from Analnox4.svd

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 3 | 50.371 | 16.790 | 3.443 | .0196 |
| Elevation | 2 | 106.596 | 53.298 | 10.930 | <.0001 |
| Alluvial | 1 | 8.072 | 8.072 | 1.655 | .2012 |
| Flow zone | 1 | 20.748 | 20.748 | 4.255 | .0417 |
| Livestock | 1 | 1.626 | 1.626 | .333 | .5649 |
| Fire | 1 | .154 | .154 | .032 | .8592 |
| Road | 1 | 1.062 | 1.062 | .218 | .6418 |
| Recreation | 1 | .736 | .736 | .151 | .6985 |
| Trail | 1 | .592 | .592 | .121 | .7282 |
| Industrial | 1 | 2.010 | 2.010 | .412 | .5224 |
| Agriculture | 1 | 3.884 | 3.884 | .797 | .3742 |
| Residential | 1 | .507 | .507 | .104 | .7478 |
| Other | 1 | 22.242 | 22.242 | 4.561 | .0351 |
| Residual | 101 | 492.497 | 4.876 | | |

ANOVA Coefficients Table for ln net area

| | Coef | Std. Error | t-Test | P-Value |
|---|---|---|---|---|
| Flow zone | -.989 | .480 | -2.063 | .0417 |
| Other | -2.040 | .955 | -2.136 | .0351 |

XVII. *Tamarix* sp.

A. Tests for association between predictors and presence of weed species

1. Test of PRESENCE of disturbance types on weed presence/absence.

Logistic Model Coefficients Table for TAMAR

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -3.673 | .528 | -6.953 | 48.339 | <.0001 | .025 |
| Reach | | | | | | |
| Brownlee-Weiser | 1.173 | .362 | 3.239 | 10.493 | .0012 | 3.231 |
| Elevation | | | | | | |
| below-above | -2.786 | 1.058 | -2.633 | 6.931 | .0085 | .062 |
| below-crosses | -2.073 | .619 | -3.350 | 11.221 | .0008 | .126 |
| above-crosses | .714 | 1.172 | .609 | .370 | .5428 | 2.041 |
| Disturbance factors | | | | | | |
| Flow zone | 1.276 | .521 | 2.452 | 6.010 | .0142 | 3.584 |

Logistic Whole Model Fit Table for TAMAR

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 7 | 117.358 | <.0001 |

Logistic Likelihood Ratio Tests Table for TAMAR

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Reach | 4 | 49.794 | <.0001 |
| Elevation | 2 | 25.710 | <.0001 |
| Flow zone | 1 | 7.501 | .0062 |

2. Test of effect of LEVEL of disturbance on weed presence/absence.

Logistic Model Coefficients Table for TAMAR

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -20.309 | 1554.528 | -.013 | 1.707E-4 | .9896 | 1.514E-9 |
| Reach | | | | | | |
| Oxbow-Downstream | .630 | 1970.339 | 3.199E-4 | 1.023E-7 | .9997 | 1.878 |
| Elevation | | | | | | |
| below-above | -2.808 | 1.054 | -2.663 | 7.092 | .0077 | .060 |
| below-crosses | -2.090 | .618 | -3.382 | 11.440 | .0007 | .124 |
| Disturbance factors | | | | | | |
| Flow zone | .374 | .148 | 2.524 | 6.369 | .0116 | 1.454 |

Logistic Whole Model Fit Table for TAMAR

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 7 | 116.982 | <.0001 |

B. Tests for effect of predictors on population size

1. Test for effect of PRESENCE of disturbance types on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 1 | 7.640 | 7.640 | 1.299 | .2612 |
| Elevation | 2 | 20.625 | 10.312 | 1.753 | .1863 |
| Flow zone | 1 | 5.008 | 5.008 | .851 | .3617 |
| Residual | 40 | 235.269 | 5.882 | | |

2. Effect of LEVELS of disturbances on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 1 | 9.485 | 9.485 | 1.622 | .2101 |
| Elevation | 2 | 21.681 | 10.840 | 1.854 | .1698 |
| Flow zone | 1 | 6.401 | 6.401 | 1.095 | .3017 |
| Residual | 40 | 233.876 | 5.847 | | |

XVIII. *Tribulus terrestris*

A. Tests for association between predictors and presence of weed species

1. Test of PRESENCE of disturbance types on weed presence/absence.

Logistic Model Coefficients Table for TRTE

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -4.344 | .510 | -8.521 | 72.614 | <.0001 | .013 |
| Reach | | | | | | |
| Oxbow-Hells Can. Res. | .230 | .353 | .651 | .423 | .5152 | 1.258 |
| Oxbow-Brownlee | .233 | .357 | .654 | .428 | .5129 | 1.263 |
| Oxbow-Downstream | -.823 | .632 | -1.301 | 1.693 | .1932 | .439 |
| Oxbow-Weiser | -.423 | .749 | -.565 | .319 | .5723 | .655 |
| Elevation | | | | | | |
| Below-above | .903 | .398 | 2.268 | 5.146 | .0233 | 2.467 |
| Below-crosses | .204 | .362 | .564 | .318 | .5729 | 1.227 |
| Disturbance factors | | | | | | |
| Alluvial | -.484 | .322 | -1.504 | 2.261 | .1327 | .616 |
| Flow zone | .169 | .357 | .473 | .224 | .6363 | 1.184 |
| Livestock | -.991 | .319 | -3.107 | 9.654 | .0019 | .371 |
| Mining | 1.419 | 1.576 | .901 | .811 | .3677 | 4.134 |
| Fire | -.102 | .394 | -.257 | .066 | .7968 | .903 |
| Road | 1.139 | .288 | 3.953 | 15.625 | <.0001 | 3.123 |
| Recreation | 1.173 | .308 | 3.814 | 14.545 | .0001 | 3.232 |
| Trail | -.792 | .540 | -1.466 | 2.149 | .1427 | .453 |
| Industrial | .337 | 1.049 | .321 | .103 | .7481 | 1.401 |
| Agriculture | -1.110 | 1.124 | -.988 | .976 | .3232 | .329 |
| Other | -.626 | .759 | -.825 | .680 | .4095 | .535 |

Logistic Whole Model Fit Table for TRTE

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 17 | 128.296 | <.0001 |

Logistic Likelihood Ratio Tests Table for TRTE

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Reach | 4 | 5.129 | .2744 |
| Elevation | 2 | 7.496 | .0236 |

2. Test of effect of LEVEL of disturbance on weed presence/absence.

Logistic Model Coefficients Table for TRTE

| | Coef | Std. Error | Coef/SE | Chi-Square | P-Value | Exp(Coef) |
|---|---|---|---|---|---|---|
| Constant | -2.550 | 1.097 | -2.325 | 5.404 | .0201 | .078 |
| Reach | | | | | | |
| Oxbow- Hells CanRes. | -.079 | .374 | -.212 | .045 | .8325 | .924 |
| Oxbow-Brownlee | .123 | .356 | .346 | .120 | .7294 | 1.131 |
| Oxbow-Downstream | -.501 | .632 | -.793 | .629 | .4276 | .606 |
| Oxbow-Weiser | -.279 | .751 | -.372 | .138 | .7100 | .756 |
| Elevation | | | | | | |
| Below-above | .445 | .440 | 1.010 | 1.021 | .3124 | 1.560 |
| Below-crosses | .007 | .392 | .018 | 3.332E-4 | .9854 | 1.007 |
| Disturbance factors | | | | | | |
| Alluvial | -.147 | .120 | -1.225 | 1.501 | .2205 | .863 |
| Flow zone | -.091 | .126 | -.722 | .521 | .4705 | .913 |
| Livestock | -.310 | .154 | -2.014 | 4.058 | .0440 | .733 |
| Mining | .475 | .450 | 1.057 | 1.117 | .2906 | 1.609 |
| Fire | -.731 | .230 | -3.186 | 10.152 | .0014 | .481 |
| Road | .531 | .097 | 5.452 | 29.721 | <.0001 | 1.700 |
| Recreation | .498 | .140 | 3.552 | 12.620 | .0004 | 1.646 |
| Trail | -.400 | .215 | -1.858 | 3.451 | .0632 | .670 |
| Industrial | .125 | .306 | .407 | .166 | .6839 | 1.133 |
| Agriculture | -.803 | .521 | -1.542 | 2.377 | .1232 | .448 |
| Other | -.280 | .230 | -1.218 | 1.483 | .2233 | .755 |

Logistic Whole Model Fit Table for TRTE

| | DF | Chi-Square | P-Value |
|---|---|---|---|
| Likelihood Ratio | 17 | 170.635 | <.0001 |

B. Tests for effect of predictors on population size

1. Test for effect of PRESENCE of disturbance types on population size.

ANOVA Table for ln net area
Inclusion criteria: TRTE from Analnox4.svd

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 4 | 12.661 | 3.165 | .757 | .5564 |
| Elevation | 2 | 14.444 | 7.222 | 1.727 | .1846 |
| Alluvial | 1 | 18.896 | 18.896 | 4.520 | .0367 |
| Flow zone | 1 | .230 | .230 | .055 | .8151 |
| Livestock | 1 | 5.722 | 5.722 | 1.369 | .2456 |
| Mining | 1 | 3.758 | 3.758 | .899 | .3461 |
| Fire | 1 | 9.769 | 9.769 | 2.337 | .1305 |
| Road | 1 | 1.360 | 1.360 | .325 | .5701 |
| Recreation | 1 | .596 | .596 | .143 | .7068 |
| Trail | 1 | .232 | .232 | .055 | .8146 |
| Industrial | 1 | 3.792 | 3.792 | .907 | .3439 |
| Agriculture | 1 | .006 | .006 | .002 | .9689 |
| Other | 1 | 2.612 | 2.612 | .625 | .4317 |
| Residual | 77 | 321.909 | 4.181 | | |

ANOVA Coefficients Table for ln net area

| | Coef | Std. Error | t-Test | P-Value |
|---|---|---|---|---|
| Alluvial | -1.798 | .846 | -2.126 | .0367 |

Scheffe for ln net area
Effect: Elevation

| | Mean Diff. | Crit. Diff. | P-Value | |
|---|---|---|---|---|
| below-above | -1.774 | 1.273 | .0036 | S |
| below-cross | -2.830 | 1.444 | <.0001 | S |
| above-cross | -1.056 | 1.273 | .1244 | |

2. Effect of LEVELS of disturbances on population size.

ANOVA Table for ln net area

| | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|---|---|---|---|---|---|
| Reach | 4 | 13.065 | 3.266 | .802 | .5275 |
| Elevation | 2 | 19.662 | 9.831 | 2.414 | .0961 |
| Alluvial | 1 | 7.153 | 7.153 | 1.756 | .1889 |
| Flow zone | 1 | .283 | .283 | .069 | .7929 |
| Livestock | 1 | 5.926 | 5.926 | 1.455 | .2313 |
| Fire | 1 | 19.385 | 19.385 | 4.760 | .0321 |
| Road | 1 | .203 | .203 | .050 | .8240 |
| Recreation | 1 | 5.915 | 5.915 | 1.453 | .2318 |
| Trail | 1 | .001 | .001 | 1.738E-4 | .9895 |
| Agriculture | 1 | .065 | .065 | .016 | .8994 |
| Industrial | 1 | 2.917 | 2.917 | .716 | .4000 |
| Mining | 1 | 4.646 | 4.646 | 1.141 | .2887 |
| Residual | 78 | 317.631 | 4.072 | | |

ANOVA Coefficients Table for ln net area
Inclusion criteria: TRTE from Analnox4.svd

| | Coef | Std. Error | t-Test | P-Value |
|---|---|---|---|---|
| Fire | .859 | .413 | 2.079 | .0409 |

## Appendix 7: Proportion of Sites for Each Weed Species with Disturbance Types

Proportion of sites for each species with disturbance types.

| Species | Alluvial | Flowzone | Livestock | Mining | Fire | Road | Recreation | Trail | Industrial | Agriculture | Residential | ORV | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Aegilops cylindrica* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Agropyron repens* | 0.29 | 0.14 | 0.29 | 0.00 | 0.43 | 0.57 | 0.86 | 0.14 | 0.00 | 0.00 | 0.14 | 0.14 | 0.14 |
| *Ambrosia artemisiifolia* | 0.24 | 0.30 | 0.27 | 0.00 | 0.03 | 0.48 | 0.76 | 0.09 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 |
| *Amorpha fruticosa* | 0.32 | 0.91 | 0.18 | 0.00 | 0.04 | 0.15 | 0.70 | 0.04 | 0.00 | 0.02 | 0.02 | 0.01 | 0.01 |
| *Cardaria draba* | 0.18 | 0.20 | 0.59 | 0.00 | 0.11 | 0.36 | 0.45 | 0.05 | 0.00 | 0.21 | 0.11 | 0.00 | 0.02 |
| *Centaurea diffusa* | 0.00 | 0.00 | 0.00 | 0.00 | 0.17 | 1.00 | 0.67 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Chondrilla juncea* | 0.29 | 0.06 | 0.59 | 0.00 | 0.18 | 0.00 | 0.41 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Cirsium arvense* | 0.20 | 0.27 | 0.29 | 0.00 | 0.16 | 0.16 | 0.24 | 0.04 | 0.00 | 0.39 | 0.02 | 0.00 | 0.06 |
| *Cirsium vulgare* | 0.30 | 0.16 | 0.20 | 0.00 | 0.04 | 0.17 | 0.42 | 0.09 | 0.00 | 0.04 | 0.02 | 0.00 | 0.04 |
| *Convolvulus arvensis* | 0.23 | 0.66 | 0.23 | 0.01 | 0.02 | 0.31 | 0.61 | 0.05 | 0.01 | 0.05 | 0.02 | 0.02 | 0.01 |
| *Conium maculatum* | 0.17 | 0.41 | 0.28 | 0.00 | 0.11 | 0.23 | 0.32 | 0.03 | 0.01 | 0.24 | 0.09 | 0.00 | 0.05 |
| *Crupina vulgaris* | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Cuscuta sp.* | 0.00 | 0.10 | 0.10 | 0.00 | 0.00 | 0.60 | 0.40 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 |
| *Cyperus esculentus* | 0.43 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.86 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Cynoglossum officinale* | 0.23 | 0.08 | 0.42 | 0.00 | 0.08 | 0.25 | 0.42 | 0.09 | 0.00 | 0.03 | 0.04 | 0.01 | 0.00 |
| *Daucus carota* | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Elaeagnus angustifolia* | 0.08 | 0.54 | 0.21 | 0.00 | 0.04 | 0.21 | 0.29 | 0.00 | 0.04 | 0.25 | 0.04 | 0.00 | 0.00 |
| *Equisetum arvense* | 0.67 | 1.00 | 0.11 | 0.00 | 0.00 | 0.00 | 0.56 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Euphorbia esula* | 0.33 | 1.00 | 0.00 | 0.00 | 0.33 | 0.00 | 0.00 | 0.00 | 0.00 | 0.33 | 0.00 | 0.00 | 0.00 |
| *Hypericum perforatum* | 0.13 | 0.13 | 0.34 | 0.01 | 0.13 | 0.16 | 0.38 | 0.14 | 0.00 | 0.03 | 0.02 | 0.01 | 0.00 |
| *Kochia scoparia* | 0.07 | 0.14 | 0.43 | 0.00 | 0.50 | 0.50 | 0.50 | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 | 0.36 |
| *Lepidium latifolium* | 0.27 | 0.63 | 0.23 | 0.00 | 0.10 | 0.29 | 0.53 | 0.06 | 0.01 | 0.13 | 0.06 | 0.03 | 0.05 |
| *Linaria dalmatica* | 0.21 | 0.16 | 0.42 | 0.00 | 0.16 | 0.68 | 0.63 | 0.11 | 0.00 | 0.00 | 0.00 | 0.21 | 0.11 |
| *Lythrum salicaria* | 0.38 | 0.92 | 0.15 | 0.00 | 0.00 | 0.08 | 0.69 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Onopordum acanthium* | 0.21 | 0.21 | 0.47 | 0.00 | 0.16 | 0.36 | 0.47 | 0.09 | 0.01 | 0.13 | 0.05 | 0.04 | 0.08 |
| *Phalaris arundinacea* | 0.23 | 0.93 | 0.11 | 0.00 | 0.02 | 0.11 | 0.38 | 0.06 | 0.01 | 0.11 | 0.03 | 0.01 | 0.03 |
| *Polygonum cuspidatum* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Potentilla recta* | 0.00 | 0.00 | 0.38 | 0.00 | 0.05 | 0.05 | 0.24 | 0.19 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 |
| *Salvia aethiopis* | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Taeniatherum caput-medusae* | 0.15 | 0.01 | 0.61 | 0.00 | 0.17 | 0.35 | 0.39 | 0.05 | 0.01 | 0.03 | 0.02 | 0.00 | 0.01 |
| *Tamarix pentandra* | 0.29 | 0.89 | 0.07 | 0.00 | 0.02 | 0.11 | 0.33 | 0.02 | 0.00 | 0.09 | 0.00 | 0.09 | 0.04 |
| *Tribulus terrestris* | 0.15 | 0.34 | 0.16 | 0.01 | 0.11 | 0.69 | 0.82 | 0.04 | 0.02 | 0.01 | 0.00 | 0.00 | 0.02 |
| **Average** | **0.20** | **0.35** | **0.29** | **0.00** | **0.10** | **0.29** | **0.49** | **0.05** | **0.00** | **0.07** | **0.02** | **0.02** | **0.03** |

## Appendix 8: Rare Plant Observation Forms

(This appendix is contained in a separate volume. If you wish to review this appendix, please contact Gary Holmstead at Idaho Power Company.)