OREGON DEPARTMENT OF AGRICULTURE

NATIVE PLANT CONSERVATION PROGRAM

Preventing the listing of *Pleuropogon oregonus*, Oregon's rarest grass – large scale outplanting in protected sites: Year 1 (2011)

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Introduction

The Oregon semaphore grass, *Pleuropogon oregonus*, is not only one of the rarest grasses in North America, but also one of the most endangered plants in Oregon (Figure 1). This species survives only in two precariously small natural populations, which are isolated from one another by a great distance. This wetland grass is found at a single site in Lake County and a small population complex in Union County, separated by a distance of approximately 230 miles (370 km) (Figure 2). Not only is *P. oregonus* faced with genetic limitations inherent in small reproductively isolated populations, but it is also confronted with issues that threaten native habitat across much of eastern Oregon. Development and agricultural conversion have led to the loss of many natural areas and the degradation of habitat quality in many others. Additionally, the spread of non-native species threatens to permanently alter many local plant communities (Gisler and Meinke 2003, Amsberry and Meinke 2004). The majority of both remaining natural populations of *P. oregonus* occur on private land and are not protected by state legislation. Due to these factors, *P. oregonus* is exceedingly vulnerable to local extirpation, or even extinction. For that reason the Oregon Department of Agriculture Native Plant Conservation Program (ODA) listed this species as Threatened in 1995; it may be considered for an upgrade to Endangered in the near future. The Heritage Rank for this species is G1, S1, it is included in Oregon Biodiversity Information Center's List 1, and is a U.S. Fish and Wildlife Species of Concern (ORBIC 2010a).

Figure 1. The inflorescence of Oregon semaphore grass resembles a one-sided signaling flag, or semaphore.

Like the other four members of its genus, *P. oregonus* is a hydrophilous grass. The two sites from which this obligate wetland species is known are both mid-montane wetland/bog habitats with similar soil chemistry, soil moisture, and associated vegetation (Gisler and Meinke 2003). Although there are numerous locations in eastern Oregon with apparently suitable habitat, searching these sites for new populations by both amateur and professional botanists has proved fruitless. Due to the low likelihood that other healthy populations exist, and due to the imminent threats posed to existing populations on private land, action must be taken to reduce the possibility of *P. oregonus*' extinction. Cultivation, and the subsequent use of cultivated plants to establish healthy populations on administratively protected public lands, is the best option for initiating the recovery of this species.

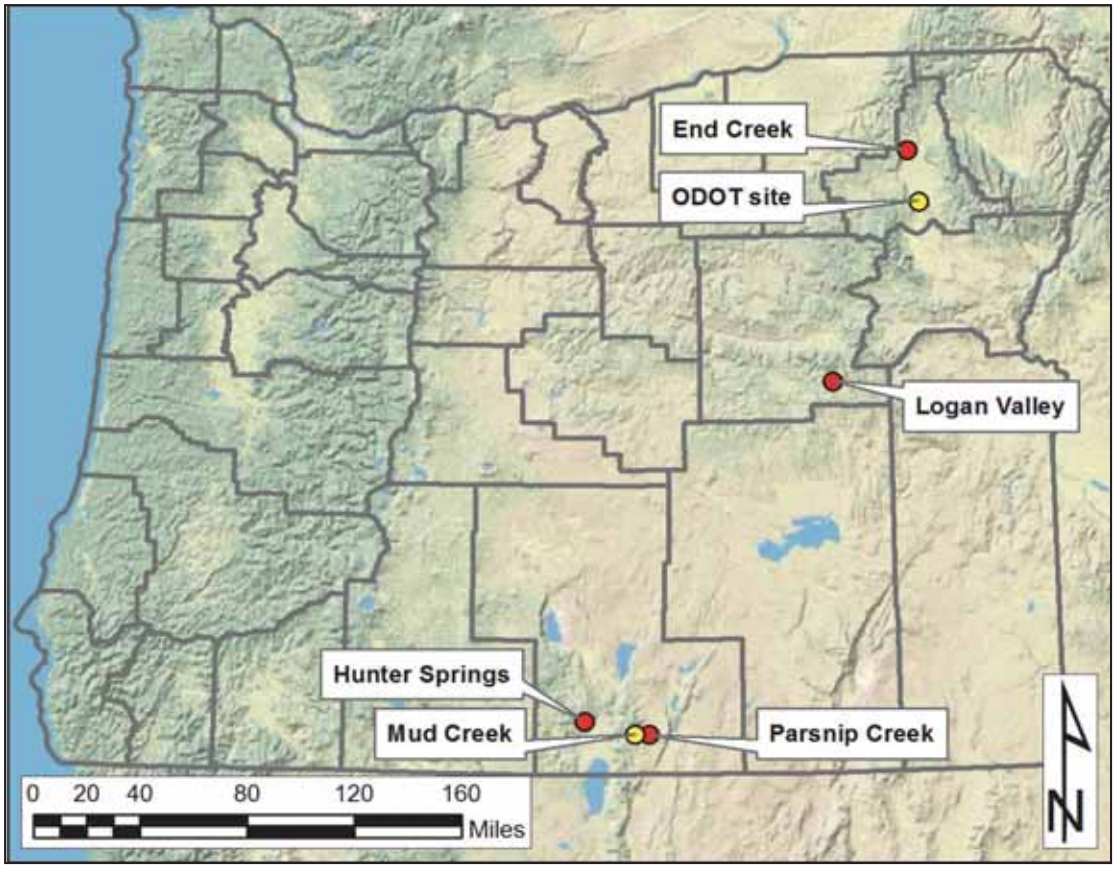

Figure 2. The extant natural population centers of *P. oregonus* (yellow dots) are separated by approximately 230 miles. Plant material was collected at both sites for use in cultivating transplants used to create populations (red dots) across the species' range. Creating a population at the End Creek site is planned for 2012.

The Oregon semaphore grass is an obligate wetland species, but beyond this general classification, there is little information available regarding its ecological roles. The extent of the historic range of this species is also a bit of a mystery. Since grazing at high stocking rates can decrease diversity (Milchunas et al. 1988, Hobbs and Huenneke 1992), the prevalence of *P. oregonus* in eastern Oregon wetlands may have decreased since the introduction of livestock. Populations may previously have occurred between the two disjunct sites known today.

Wetlands have been heavily impacted across Oregon, and restoration of this type of habitat is a high priority task throughout the state. In eastern Oregon, many projects aimed at restoring healthy riparian and wetland communities in degraded areas have been successfully completed on both public and private land. Because *P. oregonus* is rhizomatous and occurs in dense patches, incorporation of this species into restored wetlands might help to exclude opportunistic weedy species that commonly colonize created habitats of this type. By including *P. oregonus* in restoration, the diversity of the restored native plant community would increase, benefiting productivity and ecosystem functionality (Hector et al. 1999, Hector et al. 2001, Srivastava and Vellend 2005). Many opportunities to include *P. oregonus* in restoration projects currently exist, with more potentially available if stock of this species becomes readily obtainable. Because *P. oregonus* in not currently federally listed, incorporation of this species into ongoing wetland restoration is not regulated, reducing the potential complications of including this rare species in this type of project.

Like its only other native Oregon congener (*P. refractus,* known from British Columbia to California), *P. oregonus* is a rhizomatous perennial. The Oregon semaphore grass is only 15-95 cm tall, while *P. refractus* is decidedly taller; growing to between 100-160 cm tall (But 1977). All *Pleuropogon* species have soft culms and leaves with closed sheaths. Their inflorescences are terminal racemes of linear spikelets, with 5-20(30) florets, all oriented to one side so as to give the appearance of a semaphore (one-sided signaling flag, Figure 1) (But 1994, Gisler and Meinke 2003). Additional descriptions of the genus *Pleuropogon* can be found in Benson (1941), Hitchcock (1951), and But (1977).

In 2002, ODA staff conducted a study to better inform the development of biogeographically-based introduction protocols (Gisler and Meinke 2003). One aspect of the study focused on morphometric and cytological comparisons as surrogates for evaluating genetic differences between the two allopatric populations. This was necessary in order to determine if the two populations warranted treatment as different taxanomic entities, or merely recognition as genetically distinct conservation units. The morphometric analysis documented consistent variability between plants from the two sites. There were significant differences between the two extant *P. oregonus* populations for 9 of the 17 traits measured (see Gisler and Meinke 2003 for details). Since the plants used in the analysis were grown from site-specific seed collections and were exposed to the same greenhouse growth conditions, the observed differences suggest that the two isolated populations are genetically differentiated. Given the geographic separation of the two populations, the documented genetic variation is not unexpected. Documentation of differences in plants from the two sites supports the practice of treating each population as a genetically distinct conservation unit, especially with regard to nursery cultivation for outplanting. Keeping ecotypes separate during cultivation avoids the potential for outbreeding depression, and helps maintain locally adapted gene complexes.

Project Overview

The ultimate goal of this project is to mitigate threats to the viability of *P. oregonus*, reduce the probability of its extinction, and preclude the need for Federal listing of this species as Threatened or Endangered. The 2011 season is the first year of a two year project focused on large scale outplanting of *P. oregonus* to create new populations on protected lands. This work immediately follows the completion of a three year project focused on off-site cultivation of *P. oregonus*. Knowledge gained from the previous research and outplanting informed every aspect of current project work, from the collection and cultivation of wild plants, to the outplanting site selection and the planting itself. (See Gisler and Meinke 2001, Gisler and Meinke 2003, Amsberry and Meinke 2004, Currin and Meinke 2006, Brown et al. 2011, Brown et al. 2012 for details of previous work.) Previously created populations were also monitored during the course of this work, and as always, gauging their success provided insight for future recovery work.

Project Accomplishments in 2011 (Year 1)

Transplant Stock Increases

Previously collected stock continued to be cultivated in plastic pools in the OSU nursery yard. As part of our plant propagation and maintenance during the 2011 growing season, plants were kept well watered and competition from weeds was kept to a minimum. In March, after rhizome masses had been divided to promote growth, weekly doses of liquid 18-18-18 fertilizer were applied. In June, plants were divided to provide space for clonal expansion. New accessions of plants collected from the wild in July and September were divided up and planted in plastic pools and fertilized upon arrival at the OSU nursery (Figure 3). Efforts were made to prevent the fungal infections prevalent during previous years (Brown et al. 2011), and fortunately no evidence of the fungi present in 2008 was observed. By the end of the growing season, the pools held approximately 6,000 tillers.

Figure 3. During cultivation the rhizome masses of *P. oregonus* are divided and replanted, as shown here, to allow room for growth and expansion throughout the season.

Collection of New Union County Stock

Due to the logistical difficulties and potential risks of collecting rare plant material from private land, no new stock of *P. oregonus* from Union County had been collected recently. Fortunately, a portion of a recently rediscovered *P. oregonus* population in Union County occurs on public land managed by the Oregon Department of Transportation (ODOT; Figure 2) making it a prime candidate for inclusion in conservation efforts. At the end of July, *P. oregonus* plants were collected from this site (referred to as the ODOT site) by digging up blocks of native soil containing intact rhizomes (Figure 4). Approximately 50 tillers were collected during the first visit and another approximately 50 tillers were collected during a subsequent visit in September. These portions of "sod" were transported back to the OSU nursery yard for further cultivation.

Major disturbance of the ODOT site apparently occurred between our July and September visits (Figure 5). In September, many *P. oregonus* plants had been subjected to heavy trampling and physical damage due to the lack of a fence protecting the population from cattle grazing on adjacent land. The collection and off-site cultivation of plants from this site will help preserve a portion of this population. Also, this latest in a series of successive collections not only increased the genetic diversity represented in our stock, but incorporated temporally varied collections - another level of diversity. Plants collected from multiple years potentially represent a series of genotypes that flourish in the range of annually varying conditions that occurred during that time period (Brown and Briggs 1991).

Figure 4. During July 2011 new stock was collected from the recently rediscovered *P. oregonus* population that falls on ODOT land in Union County.

Figure 5. Unrestricted access for cattle resulted in major disturbances of the *P. oregonus* population at the ODOT site, as seen here during the September 2011 visit.

Monitoring

In 2011, the Hunters Springs and Logan Valley sites were monitored and counts of all vegetative as well as reproductive tillers were recorded (Figure 6, 7, and 8). The Upper Parsnip Creek site was not monitored in 2011 because no *P. oregonus* plants were found in the site during the previous year. Results at the Hunters Springs site (planted in 2009 and 2010) continued to be disappointing, with only seven vegetative shoots present in one plot, and no reproductive tillers.

Monitoring in 2011 again documented that the created population at the Logan Valley site is the most successful to date. Monitoring was conducted on July 21, 2011 with the gracious help of two Burns Paiute Natural Resource Department (BPNRD) biologists, Kyle Heinrick and assistant Sara Hawley. Upon inspection it was apparent that the planted areas had changed significantly since the outplanting in late summer of 2010. Large areas had been scoured and partially cleared of vegetation by high water flows of the previous winter (Figure 9). The total of 917 vegetative and 198 reproductive culms found on site in 2011 is down from the 1,098 vegetative and 289 reproductive culms recorded in 2010 (Figure 6). Although some losses occurred, several patches of *P. oregonus* persist and remain stable in size.

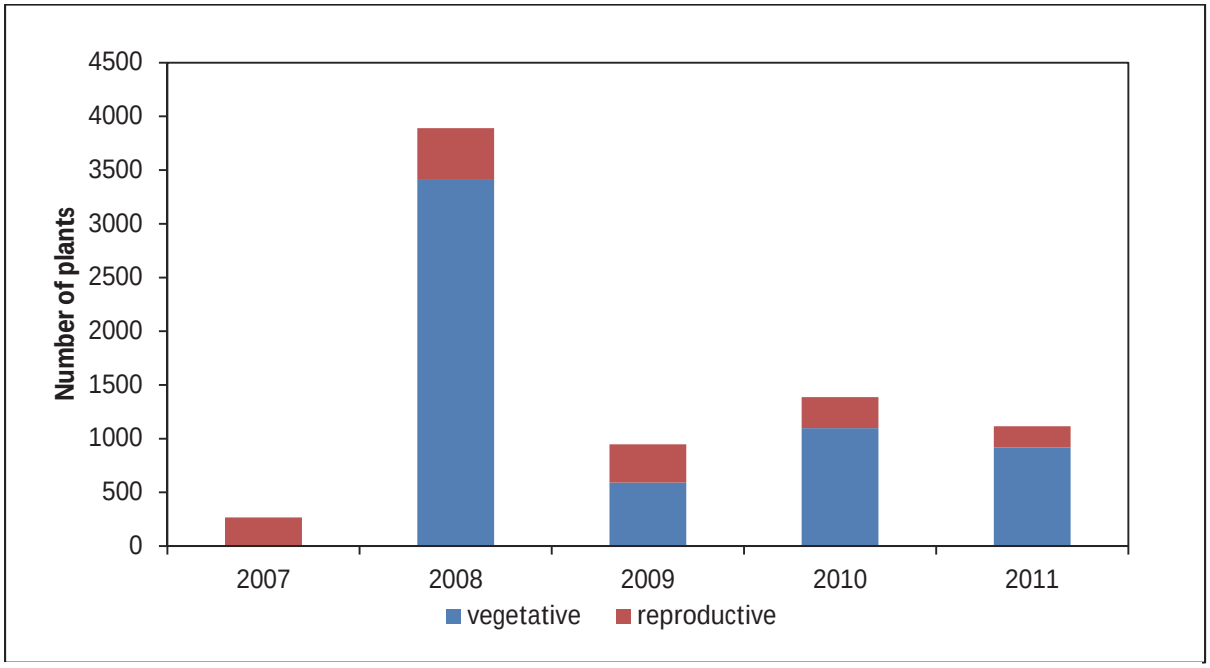

Figure 6. Logan Valley monitoring results. Vegetative plants were not counted in 2007.

Microsite 1 (containing plots 1-10; planted in 2002) was previously the most prolific outplanted patch of *P. oregonus*. In 2011, numbers dropped somewhat with 301 vegetative and 108 reproductive tillers observed. The patch in microsite 2 (containing plots 11-20; planted in 2002) exhibited a substantial increase in size this year, with the number of vegetative tillers almost doubling, reaching a total of 413 tillers. The number of reproductive culms decreased this year to 43, although flowers in both microsites appeared to be producing fruit. (For detailed locations of microsites 1, 2 and 3, see Appendix B.)

Figure 7. Monitoring at the apparently suitable Hunter Springs showed that only a very small number of transplants survived.

Microsite 3 (plot numbers 21-30) was visited, but this site remains inundated due to beaver activity and could not be monitored. The plots planted in 2009 (numbered 31-35) continue to support a dwindling number of plants, with a total of only five vegetative and one reproductive culm found. *Pleuropogon oregonus* was present in one of these plots in 2010, but in 2011 this plot was empty and *P. oregonus* plants were discovered in an adjacent plot where they were absent the previous year. Although the explanation for these dynamics is unclear, transplants can go undetected for a year of more after transplanting, then suddenly emerge in a formerly "empty" plot. Future monitoring will provide a better picture of the potential for success in these areas.

Plants in plots installed in 2010 showed variable survival. Plot 40 was the most promising, with 136 vegetative and 42 reproductive culms present. Plot 41 held 23 surviving vegetative and 3 reproductive culms, while plot 43 held 39 vegetative plants and only one reproductive culm. Plot 42 was planted with stock sourced from Lake County. Interestingly, no plants survived in this plot.

Figure 8. Monitoring at the Logan Valley was once again a cooperative effort between ODA and the Burns Paiute Tribe Natural Resource Department.

The loss of transplants due to altered hydrologic conditions, such as inundation of microsite 3 at the Logan Valley site, and apparent water reduction at Upper Parsnip Creek (Brown et al. 2011), exemplify the often unpredictable fluctuations characteristic of wetlands. Major changes to sites can take place both between years or over longer time frames. It is this unpredictable dynamic that makes reliable identification of sites suitable for introductions so difficult, especially for the long term (Zedler 1996).

Figure 9. During monitoring this season large areas at the Logan Valley site appeared scoured and partially cleared of vegetation, likely the result of major hydrologic disturbance.

Methods for Identifying Sites for Future Outplantings

Selecting suitable sites for the introduction of rare plants is one of the most crucial aspects of population creation projects, and it is often one of the most difficult (Fiedler and Laven 1996). Rare plants often exhibit narrow habitat specificities, and these habitats are not always easily recognizable (Rabinowitz 1981). To help define the habitat suitable for *P. oregonus*, Gisler and Meinke (2003) compiled the habitat attributes that characterize each of the two extant populations of this species. The list of attributes common to both sites could then be used to identify new areas that would presumably support transplants. These researchers state "The results of the habitat analyses indicate that both population sites are consistent in soil texture, soil moisture, and the majority of analyzed chemical attributes including pH."

The analyzed soil texture and chemical attributes did not suggest any edaphic uniqueness associated with *P. oregonus*. However, soil moisture appears to be a deciding factor in its distribution. Soil moisture is significantly lower immediately outside the occupied habitat than it is inside the occupied zone, and high soil moisture in the summer is probably of particular importance for this species. Plants appear to require a very specific hydrologic regime. They do not grow in overly inundated areas (which comprise the majority of the few sites that remain wet during summer) but still require adequate sub-surface soil moisture during the drier months.

Associated species information is particularly useful in identifying suitable outplanting habitat. Specific species may be positively correlated with establishment and survival of rare plants in outplanting sites, and can serve as indicators of desirable site conditions (Amsberry 2001). In Gisler and Meinke's work, the four most frequent and abundant associated species common to both naturally occurring sites were *Alopecurus pratensis* (meadow foxtail), *Carex nebrascensis* (Nebraska sedge), *Epilobium ciliatum* ssp. *ciliatum* (fringed willowherb), and *Montia linearis* (narrowleaf minerslettuce).

Selection of New Sites

In 2011, United States Forest Service (USFS) and Bureau of Land Management (BLM) botanists were consulted regarding potential outplanting sites in Lake County, but neither agency had available sites with suitable habitat, so no new sites were selected. Due to the low success rate at the Hunters Springs site, no additional planting was planned there.

At Logan Valley, five new planting sites were selected according to similarity and proximity to previously successful planting sites. The establishment of *P. oregonus* at the Logan Valley site has provided the opportunity to identify additional species associated with successful planting site selection. Two sedge species, *Carex nebrascensis* (Nebraska sedge) and *C. utriculata* (Northwest Territory sedge), occur within both successful sites in Logan Valley and the presence of these two species was again used as a guide for identifying potentially successful outplanting sites. (See Appendices for specific site locations).

A new site in relatively close proximity to the recently rediscovered population at the Union County ODOT site was also evaluated for potential planting in the future. This new candidate site, called the End Creek Wetland Restoration Project site (hereafter referred to as End Creek) is protected through a conservation easement held by the Blue Mountains Conservancy. The entire property, approximately 550 acres, encompasses restored wetlands and grassland that constitute the only natural floodplain at the north end of the Grand Ronde Valley (Antell 2010). We toured the site with Karen Antell, a representative of the Blue Mountains Conservancy, identifying several potential planting areas (Figure 10). To allow for observations of the wet season hydrology before final planting areas are selected, these areas were marked for a revisit in the spring of 2012. Blue Mountains Conservancy's goals for the project at End Creek were discussed, and development of a Management Plan for populations to be established was initiated.

Figure 10. Karen Antell of the Blue Mountains Conservancy showed us potentially suitable *P. oregonus* planting areas on the End Creek Wetland Restoration Project site. This site is protected through an easement held by the Blue Mountains Conservancy.

Outplanting at Logan Valley

This season's outplanting took place at the Logan Valley sites on September 21, 2011 (Figure 11 and 12). A total of approximately 2,500 culms were harvested from the Union County stock maintained by ODA at the OSU greenhouses. These plants were harvested two days before the outplanting occurred, and the culms were cleaned and packaged for transport in coolers. The outplanting was a cooperative effort of ODA and the BPNRD; specifically with invaluable assistance from Jason Kesling and Kyle Heinrick. With their help, culms were transplanted into five separate plots spread across the Logan Valley site. To utilize the best habitat available, culms were not restricted to square plots, but were planted in irregular arrays that were marked with PVC stakes at the boundaries to facilitate relocation and monitoring. Groups of culms were placed in holes 5-10 cm deep and were watered after transplanting. The BPNRD staff contributed the use of an ATV equipped with a watering reservoir which saved substantial time and energy by transporting the culms and water to each of the new planting sites. Three plots were established near microsite 1 and plot 40 (which was the most successful new plot from 2010). Two other plots were established down the drainage channel to the south of microsite 2.

Figure 11. Planting at the Logan Valley was expedited by using an ATV provided by BPNRD for transporting the plants (left) and the help planting from their staff (right).

Figure 12. The *P. oregonus* was planted as small "plugs", or clusters of culms (left), that were watered (right) to help minimize transplant shock.

Discussion

Exceptionally high levels of precipitation fell at the Logan Valley site between the end of 2010 and beginning of the 2011 growing season (Figure 13; PRISM 2013). The disturbance observed at the site, along with some of the overall losses to the *P. oregonus* population, are due, at least in part, to flooding associated with high levels of precipitation. Drainage channels at the Logan Valley site showed signs of deep scouring along the banks as well as heavy sediment deposition. The higher waters and swift currents that were responsible for these changes likely damaged many of the culms that may have otherwise persisted through the winter and emerged in spring. As deposition occurred during the winter, the rhizomes may have been buried too deep to allow for emerging culms to reach the surface in spring. Spring deposition may have buried or injured the delicate emerging plants to the point they could not reach their growth potential this season. The soil deposition has the potential to impact the population of *P. oregonus* at the Logan Valley site positively by creating new habitat and reducing competition, or negatively by burying and injuring plants. Monitoring in 2012 may help clarify the long term effects of this disturbance.

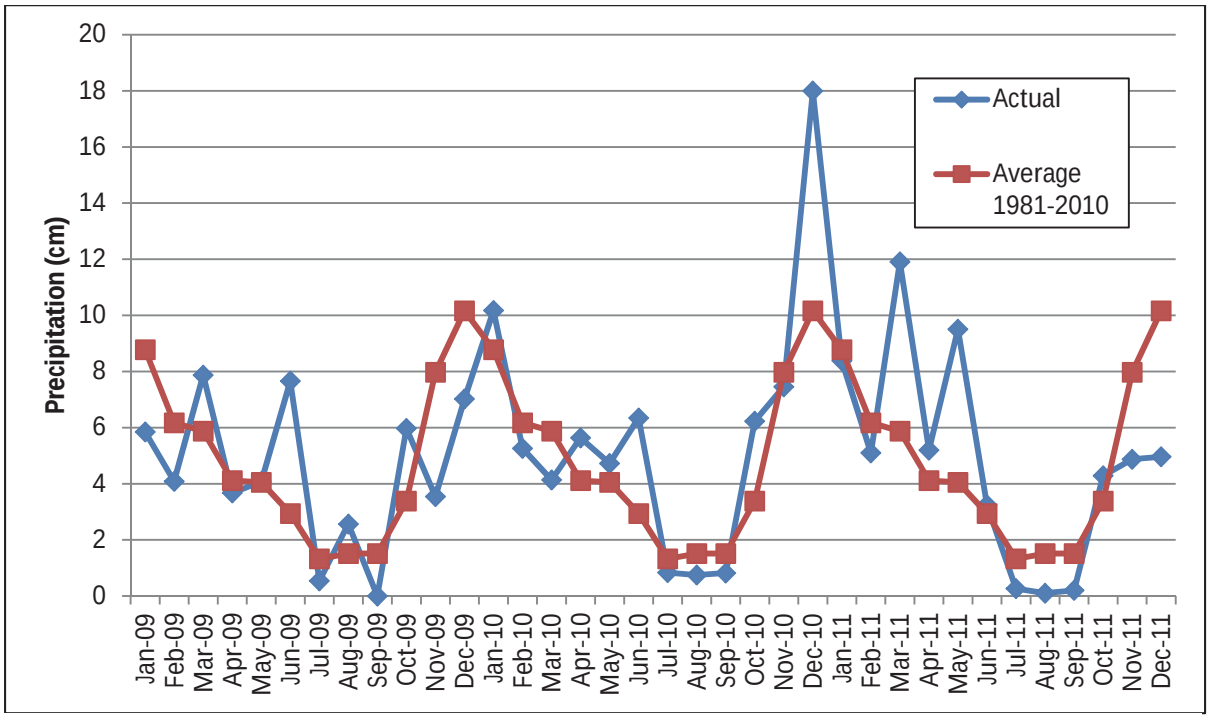

Figure 13. The precipitation at the Logan Valley site was abnormally high, and much greater than the 30 year average, at the end of 2010 and start of 2011.

The proportion of plants lost (or gained) between the 2010 and 2011 monitoring dates differed between planting areas. Microsite 2, which is located in a relatively dry creek bed, has generally been one of the drier sites, often noticeably drier than microsite 1. Under normal conditions, the generally wetter microsite 1 supported more vegetative and reproductive culms than the drier microsite 2. However, when the Logan Valley site is subjected to high water flows, the excess water may be detrimental for plants situated along the drainage channels, where swift currents can serve as strong forces of disturbance. Microsite 1 is situated along the banks of a drainage channel and was exposed to such conditions, resulting in the decreased vegetative presence of *P. oregonus* observed there this year. Microsite 2, which is generally drier, exhibited a surge in numbers of vegetative culms this season, perhaps as a result of increased water availability in an area that is generally lacking sufficient moisture. Continued monitoring of the sites will help determine whether this year's changes in plant numbers are a temporary response to the unusual conditions in 2011 or a long term trend.

Failure of the Lake County transplants could be due to several factors. Plants may be poorly adapted to the Logan Valley conditions, they may be inbred and inherently unfit, or the site selected for them may be one that experienced detrimental effects from the high water in 2011. Further studies comparing success of the two genotypes are planned.

Conditions that may be detrimental at one microsite (or patch) could have no effect, or even be beneficial at another site. At the Logan Valley site, distinct patches of *P. oregonus* have established, forming a metapopulation of interacting populations. A metapopulation model based on the effects of stochastic environmental processes (such as unpredictable high water flows) within a heterogeneous landscape, may help explain the dynamics we observed. In order for the metapopulation to persist, adequate space with appropriate site conditions, as well as sufficient reproductive output are needed. Plant must be able to migrate and establish in new suitable areas as they are extirpated from others (Menges 1990).

A metapopulation model can help guide the planning and establishment of many rare species and may be particularly applicable to *P. oregonus*. A surviving metapopulation requires

multiple patches of plants, that are situated in varying (appropriate) microhabitat types within a heterogeneous site, and that these patches maintain the ability to reproduce and re-colonize. This strategy relies on the fact that patches of plants are distributed such that some will withstand the disturbances manifested within their dynamic landscape, thereby maintaining the population for periodic re-establishment into sites where plants have been temporarily extirpated (Menges 1990). This overall population is able to "hedge its bets" and survive in the face of disturbance.

Throughout the course of ODA involvement at the Logan Valley site, several thousand *P. oregonus* culms have been introduced. This year, even in the wake of a site-altering disturbance, a total of 1,115 culms were observed. The transplants have established in a variety of sites within the mosaic of habitats that comprise the Logan Valley property. Establishing *P. oregonus* in numerous areas of varying habitat types will help create a metapopulation structure and maximize the resilience of the population. Therefore, outplanting efforts should continue, with monitoring, in order to better understand the ecosystem dynamics and further strengthen a thriving *P. oregonus* population.

Discussion of Listed Status

After careful review of data available on *P. oregonus* for this report, we believe that reconsideration of the status of this species by U.S. Fish and Wildlife is needed. Both ODA and ORBIC consider this species to be threatened with extinction (see Introduction). Despite our work to promote the recovery of this species, *P. oregonus* appears to be in danger of becoming extinct within the foreseeable future throughout its range, thereby qualifying it for endangered status. There are three main factors contributing to the risk of extinction, the first being the small size and low number of extant populations. The second concern is that the vast majority of known natural populations are on private rangeland, and not under active conservation management. Finally, our observations suggest that habitat alteration may deleteriously affect persistence of this species, but no data are available with which to evaluate the potential magnitude of this threat.

No comprehensive surveys of *P. oregonus* populations have been conducted since the mid-1980's. At that time, the sub-populations in the Union County complex were isolated from one another and very small, and there is no reason to expect an increase in size or viability in recent years. Although several historic records exist in the vicinity of the known populations, these have not been located recently. The portion of the naturally occurring Lake County population at Mud Creek that was managed by The Nature Conservancy continues to persist at an apparently healthy size. However, previous observations indicate that population numbers can fluctuate significantly in this site, and the bulk of the population previously occurred north of the Highway 140, in a privately owned grazed pasture (ORBIC 2010b). Although the portion of the Union County population managed by ODOT is administratively protected, this population is bisected by an ownership boundary with the majority of plants occurring in the adjacent, heavily grazed field. The exceedingly small occupied range of this species, along with the lack of information on the status of extant populations, suggests that *P. oregonus* may in be more of a precarious situation than we know. Review of the current administrative status of these populations, combined with outreach to landowners to encourage conservation, is needed. Land management without consideration of *P. oregonus* increases the risk of extinction for this species.

No information on the prevalence of specific threats (such as grazing, hydrological alteration or weed invasions) in extant populations is available. The Union County subpopulation used in our early studies is now grazed, so a current review of this site might provide information on population persistence under livestock grazing. Our initial plantings in the grazed Camas Creek site did not establish (Amsberry and Meinke 2004), but the lack of success in this site may have been due to poor hydrology rather than damage from grazing. Since wetland habitats are often heavily grazed, further evaluation of the effect of grazing on *P. oregonus* should be a priority for the future.

Hydrological alteration appears to deleteriously affect populations of *P. oregonus*, although no studies to date have focused on evaluating these effects. Naturally occurring hydrological alteration by beavers prohibited transplants from establishing at one microsite in Logan Valley, insufficient summer moisture may have contributed to transplant mortality at Camas

Creek, and altered hydrology may be the cause of the ultimate failure at Upper Parsnip Creek. More information is needed in order to assess and mitigate for hydrological changes associated with agriculture, road improvements, or development on populations of *P. oregonus.*

Many wetlands associated with grazing or agriculture have been invaded with non-native weeds. Weed infestations appeared to increase at the Upper Parsnip Creek site during the duration of our work, although no quantitative data on weed cover were collected, and the effect of weeds on transplant mortality here are not known. The Logan Valley site has very few weeds, especially in riparian areas along the main streambed – this lack of invasives may contribute to the success of transplants at this site. Since the effect of competition from weeds on populations of *P. oregonus* has not been determined, and the extent to which wetland habitats of this species have been colonized by non-natives has not been documented, the magnitude of this potential threat to its viability cannot be evaluated.

Although we have been successful in establishing a new population of *P. oregonus*, this process should not be considered a substitute for conservation of existing sites. Although we can cultivate transplants, we do not currently have sufficient information to reliably identify suitable sites for reintroduction, nor do we know the effects of hydrological alteration, grazing, or weed infestations on newly created populations. Additionally, very few potentially suitable sites are available on publically managed lands, and conservation-based management practices are not in place on appropriate private sites. Continued study of *P. oregonus* ecology is needed in order to better direct management of existing sites and successful creation of new ones. Outreach to private landowners of existing populations and sites for potential outplanting is also a priority. Listing of this species as Threatened or Endangered by USFWS would increase its profile and help initiate the tasks needed to promote recovery.

Work Plan for 2012 (Year 2)

- Create a new *P. oregonus* population at the End Creek site using plants cultivated from Union and Lake County collections.
- Transplant additional plants at the Burns Paiute Tribe's Logan Valley site
- Monitor all created population sites
- Collect additional material from Lake and Union County sites
- Cooperate with Blue Mountains Conservancy to manage created populations

Potential Future Work

- Conduct outreach to citizens with *P. oregonus* on their property.
- Using historical records, visit all reported locations and record number of *P. oregonus* plants, area occupied by the population, an estimate of reproduction and apparent threats.
- Evaluate the effects of grazing, as well as competing vegetation and weeds, on the population trends of *P. oregonus*.
- Compile a formal re-evaluation of the status of *Pleuropogon oregonus*.

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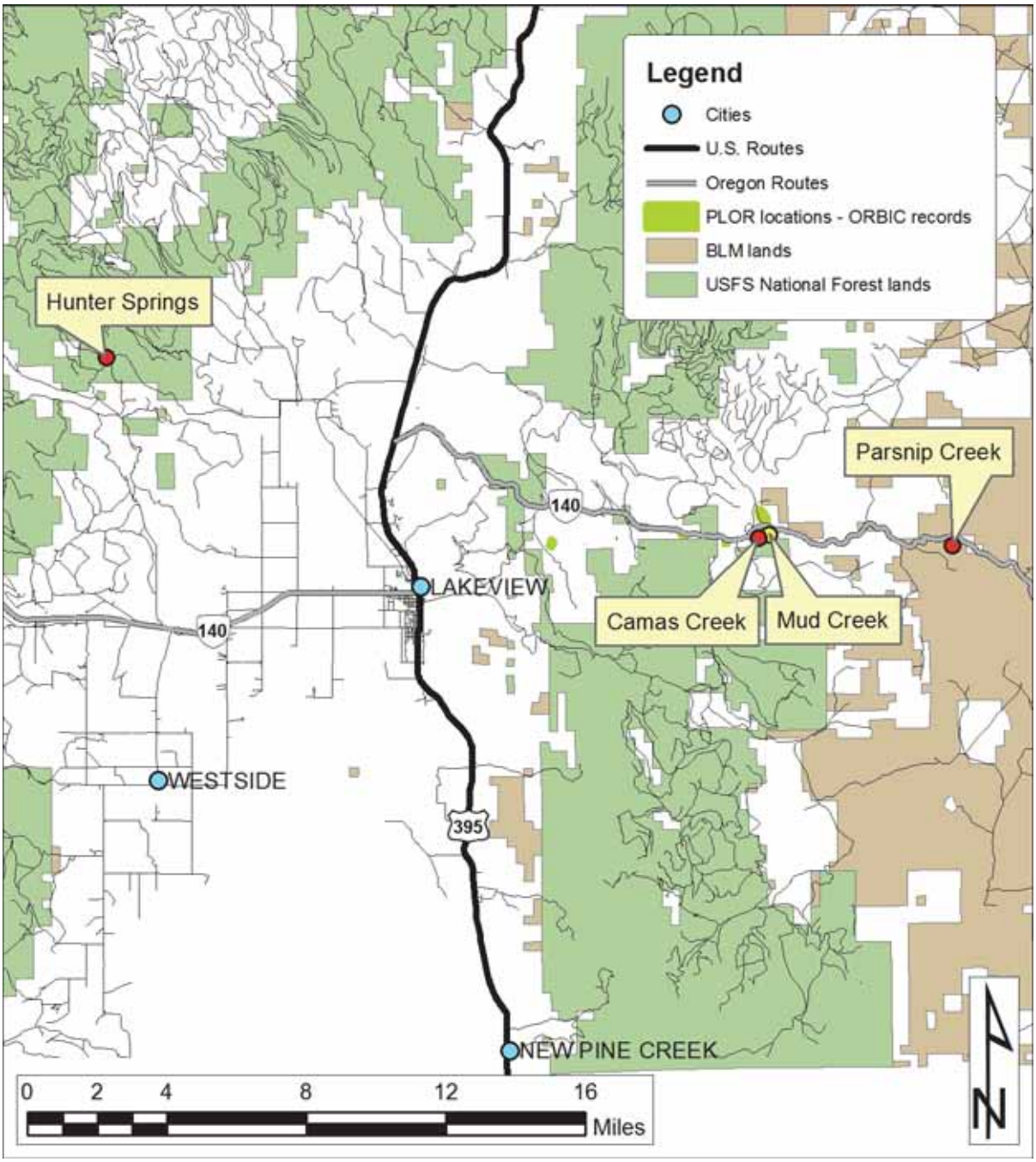
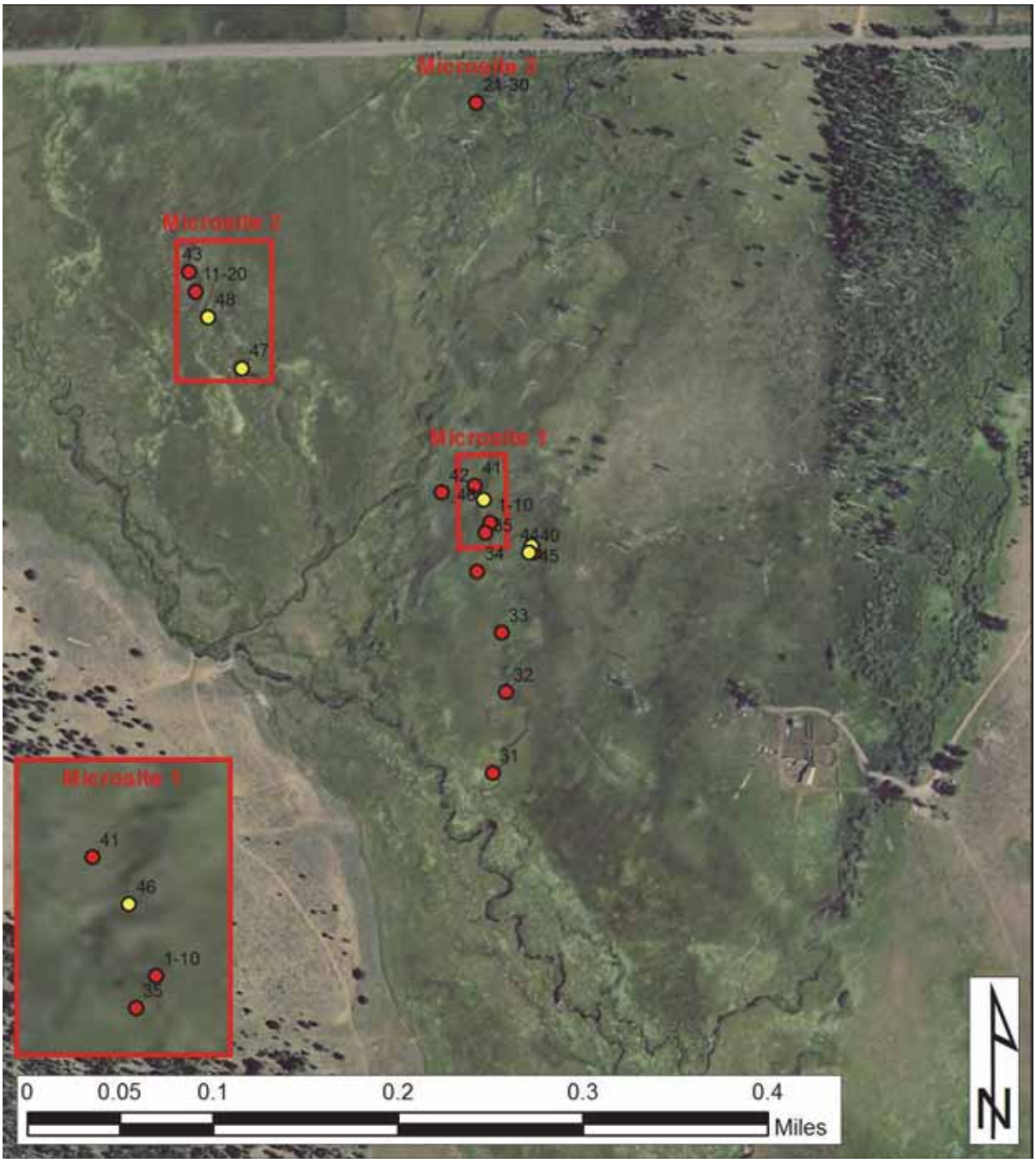
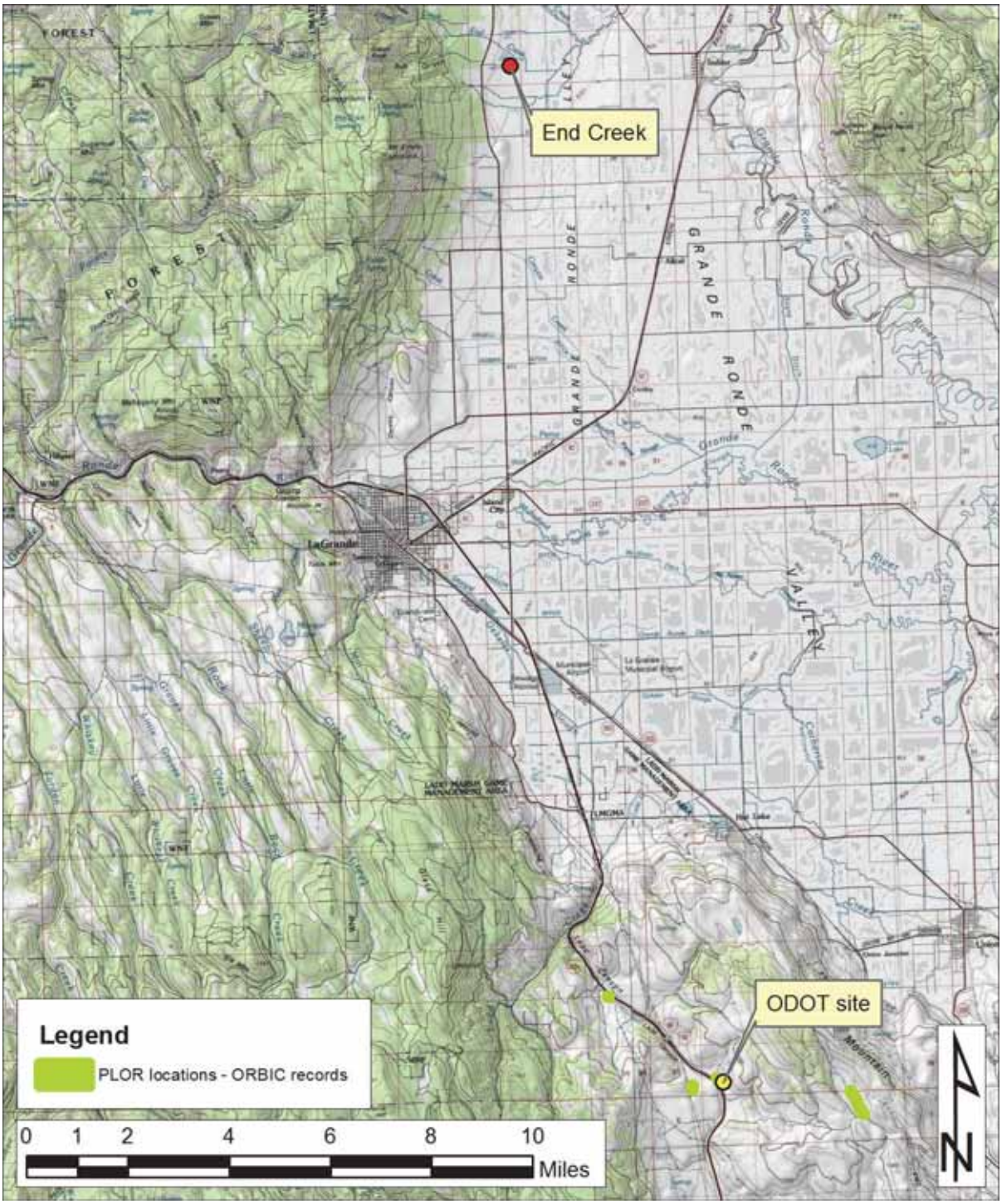
Appendices



Appendix A. The natural *P. oregonus* population at the Mud Creek site was used for plant material collections and the Camas Creek site was one of the original trial outplantings in 2002. The Parsnip Creek site was originally planted in 2002 with additional transplants added to the adjacent Upper Parsnip Creek site in 2003, 2004, and 2006. The Hunter Springs site was planted in 2009 and 2010. See previous reports for additional planting and location information for Lake County sites.



Appendix B. Location of transplant plots at the Logan Valley site with plots 44 – 48, planted in 2011, shown in yellow and earlier transplant plots shown in red. The groupings of plots comprised by microsites 1, 2, and 3 are outlined and labeled. The site is located in Grant County; Logan Valley West OR quadrangle.



Appendix C. The recently rediscovered *P. oregonus* population at the ODOT site in Union County (part of a historic population complex that occured on private land) is in relatively close proximity to the End Creek Wetland Restoration Project site, which is scheduled for planting in 2012.