Prepared in cooperation with the Oregon/Washington U.S. Bureau of Land Management and Region 6 U.S. Forest Service Interagency Special Status/Sensitive Species Program (ISSSSP)

Columbia Spotted Frog (*Rana luteiventris*) in Southeastern Oregon: A Survey of Historical Localities, 2009

By Christopher A. Pearl, Stephanie K. Galvan, Michael J. Adams, and Brome McCreary

Open-File Report 2010–1235

U.S. Department of the Interior
U.S. Geological Survey

Cover: Photographs of Oregon spotted frog and pond survey site. Photographs by the U.S. Geological Survey.

Columbia Spotted Frog (*Rana luteiventris*) in Southeastern Oregon: A Survey of Historical Localities, 2009

By Christopher A. Pearl, Stephanie K. Galvan, Michael J. Adams, and Brome McCreary

Prepared in cooperation with the Oregon/Washington U.S. Bureau of Land Management and
Region 6 U.S. Forest Service Interagency Special Status/Sensitive Species Program (ISSSSP)

Open-File Report 2010-1235

U.S. Department of the Interior
U.S. Geological Survey

U.S. Department of the Interior
KEN SALAZAR, Secretary

U.S. Geological Survey
Marcia K. McNutt, Director

U.S. Geological Survey, Reston, Virginia: 2010

For more information on the USGS—the Federal source for science about the Earth, its natural and living resources, natural hazards, and the environment, visit *http://www.usgs.gov* or call 1-888-ASK-USGS.

For an overview of USGS information products, including maps, imagery, and publications, visit *http://www.usgs.gov/pubprod*.

To order this and other USGS information products, visit *http://store.usgs.gov*.

Suggested citation:
Pearl, C.A., Galvan, S.K., Adams, M.J., and McCreary, B., 2010, Columbia spotted frog (*Rana luteiventris*) in southeastern Oregon: A survey of historical localities, 2009: U.S. Geological Survey Open-File Report 2010-1235, 96 p.

Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Although this report is in the public domain, permission must be secured from the individual copyright owners to reproduce any copyrighted material contained within this report.

Contents

Abstract 1
Introduction 1
Methods 2
Developing a Pool of *R. luteiventris* Historical Sites for Surveys 2
Identification of Survey Locations for *R. luteiventris* from Historical Records 2
Field Surveys 3
Landscape Metrics 4
Local Herbicide Applications 5
Results 5
Discussion 7
Summary 8
Acknowledgments 9
References Cited 9
Appendix A. Descriptions of Target, Alternate, and Incidental Surveys 26
Appendix B. Human Footprint Scores for Target Sites 87
Appendix C. Land Use Around Target Sites (Percentage of 2-kilometer Radius Buffer) 88
Appendix D. Definitions for Land Cover Data (from Homer and others, 2004) 90
Appendix E. Distance to Nearest Agriculture for Target Sites 91
Appendix F. Agriculture in Watershed for Target Sites 92
Appendix G. Total Mapped Water within 1-kilometer Radius Buffers for Target Sites 93
Appendix H. Recent Herbicide Applications near Selected Target Sites 94

Figures

Figure 1. Map showing Target and Incidental sites surveyed for *Rana luteiventris* in southeastern Oregon, 2009 12
Figure 2. Map showing Target and Incidental sites surveyed for *Rana luteiventris* around Steens Mountain, 2009 13
Figure 3. Map showing Target and Incidental sites surveyed for *Rana luteiventris* around Silver Creek, 2009 14
Figure 4. Map showing Target and Incidental sites surveyed for *Rana luteiventris* around Upper Malheur tributaries, 2009 15
Figure 5. Map showing Target and Incidental sites surveyed for *Rana luteiventris* around Dry Creek, 2009 16
Figure 6. Graphs showing numbers of *Rana luteiventris* detected at sites in southeastern Oregon, 2009 17
Figure 7. Graph showing elevation at sites with and without detections of *Rana luteiventris* in southeastern Oregon, 2009 18

Tables

Table 1. Attributes of Target and Incidental sites surveyed for *Rana luteiventris* in southeastern Oregon, 2009 ... 19
Table 2. Summary of *Rana luteiventris* detections for Target and Incidental sites, southeastern Oregon, 2009 22
Table 3. Detections of *Rana luteiventris* by habitat type for Target and Incidental sites in southeastern Oregon, 2009 25

Conversion Factors and Datums

Conversion Factors

SI to Inch/Pound

Multiply	By	To obtain
meter (m)	3.281	foot (ft)
kilometer (km)	0.6214	mile (mi)
square meter (m^2)	0.0002471	acre
square meter (m^2)	10.76	square foot (ft^2)
hectare (ha)	2.471	acre

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:
°F=(1.8×°C)+32
Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:
°C=(°F-32)/1.8

Datums

Vertical coordinate information is referenced to the North American Vertical Datum of 1988 (NAVD 88).
Horizontal coordinate information is referenced to the North American Horizontal Datum of 1983 (NAD 83).

Columbia Spotted Frog (*Rana luteiventris*) in Southeastern Oregon: A Survey of Historical Localities, 2009

By Christopher A. Pearl, Stephanie K. Galvan, Michael J. Adams, and Brome McCreary

Abstract

The Columbia spotted frog (*Rana luteiventris*) occupies a large range in western North America and is comprised of at least three genetic units. Concern exists regarding the status of the Great Basin populations in Oregon, Idaho, and Nevada. We surveyed target and nearby alternate sites on public lands in southeastern Oregon where there was evidence that Columbia spotted frogs were historically present. We found the species at 59.5 percent (25 of 42) of target or nearby alternate sites. They were in 15 of 23 permanent streams and 8 of 13 intermittent streams. Our surveys do not provide evidence of widespread population losses in our sites. Interpretation of status of Columbia spotted frogs in this study is limited by a lack of precision in some of the historical locations and by our inability to determine if locations where only adults were indicated in the historical record once had breeding populations. Our results support the need for continued investigation of these populations.

Introduction

The Columbia spotted frog (CSF, *Rana luteiventris*) is one of the most broadly distributed amphibians in the western United States. Recent investigations of genetic structure have identified at least three distinct units within *R. luteiventris* (Bos and Sites, 2001; Funk and others, 2008; U.S. Fish and Wildlife Service, 2009). The bulk of the species range falls within the Northern or Rocky Mountain Distinct Population Segment (DPS), which includes populations in northeastern Oregon, eastern Washington, northern Idaho, western Montana, the Canadian Rocky Mountains, and southern Alaska (Funk and others, 2008). The Great Basin DPS is thought to include *R. luteiventris* populations in southeastern Oregon, southwestern Idaho, and Nevada (Funk and others, 2008). The Great Basin DPS is known to have experienced declines in some portions of its range (Reaser, 2000; Wente and others, 2005) and is a candidate for federal listing under the Endangered Species Act (U.S. Fish and Wildlife Service, 2009).

There were two primary objectives to this study:

1. Assess whether *R. luteiventris* is currently present at historical sites on public lands in southeastern Oregon.
2. Gather and evaluate information that can help assess potential threats to the *R. luteiventris* population at each site.

An additional objective was to collect tissue samples for future analyses of *R. luteiventris* phylogeography and gene flow in southeastern Oregon. This portion of work is ongoing and is not included in this report.

Methods

Our broad goal was to assess *R. luteiventris* presence at publically owned sites in southeastern Oregon where observations suggest the species was historically present. We began by assembling a list of sites with historical records of *R. luteiventris*. We included sites that may be north of the Great Basin DPS. The extent of the Great Basin DPS is not completely understood; it is documented from only four populations in Oregon (Funk and others, 2008). We conducted visual encounter surveys in the summer of 2009 to quantify habitat and biotic variables that could relate to site suitability for the species. For example, we used plots to quantify water depth, vegetation, and evidence of livestock use, and tallied invasive species, beaver (*Castor canadensis*) dams, and reservoirs across and upstream of the survey reach. We also used ESRI® ArcMap 9.3.1 to summarize landscape variables that can be stressors of amphibians. We examined metrics of agricultural land use and habitat isolation from other wetlands. Lastly, we solicited information on herbicide application for any sites near paved or improved unpaved roads.

Developing a Pool of *R. luteiventris* Historical Sites for Surveys

We compiled a list of *R. luteiventris* historical sites primarily from the Oregon/Washington Bureau of Land Management's (BLM) Geographic Biotic Observations database (GeoBOB). GeoBOB is a repository for biological records on BLM and other federal agency lands. The GeoBOB database includes observations by agency biologists, results of formal surveys on federal lands, and species locations verifiable from museum records. The GeoBOB list was supplemented with several reports by other federal biologists.

Our initial list of 48 Target sites was reduced to 42 after excluding sites on private land (n = 2; Cottonwood Creek and North Fork Malheur River #1); sites where access was problematic (n = 3; Twin Juniper Spring, Stinkingwater Creek, and North Fork Malheur River #2); and a site where presence of *R. luteiventris* was confirmed in 2008 (n = 1; South Cottonwood Reservoir). We surveyed habitats for *R. luteiventris* associated with all these 42 records. Results of these surveys are included in tables 1 and 2 and appendix A. We had concerns about the validity of the original records or our survey location relative to the historical record for three of these sites (Big Trout Creek, Hog Creek, Willow Creek Reservoir): those concerns are detailed in their respective site descriptions in appendix A.

Identification of Survey Locations for *R. luteiventris* from Historical Records

Historical records for *R. luteiventris* were used to verify areas to resurvey. Location information, however, was often imprecise. Most records were obtained from streams; other sites were identified by township/range/section localities. We thus had to interpret some locations to generate reaches for revisit surveys. We use the term **"Target"** site to refer to our best estimate of where *R. luteiventris* were located based on information in each historical record. We selected a central Universal Transverse Mercator (UTM) point for each Target site based on our best approximation of the location of the historical record. At times, this information was reasonably well-defined (for example, "confluence of creek X and creek Y" or "creek X at road crossing Y"). When site coordinates were provided in township/range/section format, we mapped the site to the finest resolution available (usually section, but sometimes quarter-section). When available, we used survey notes to further adjust the resolution of the

Target site. If the survey point did not fall on a water body, we repositioned the survey site to the nearest water body shown on USGS National Hydrography Dataset (NHD) flowline and water body maps. We followed a similar procedure with geographic and projected coordinates. A water body was always in close proximity to the mapped coordinates, and there was never more than one water body to choose from.

For the many historical records for sites located on streams, we defined the extent of the Target site to include 250-m upstream and 250-m downstream (total of 500 m) of the central UTM location described above. This Target site also included floodplain wetlands hydrologically associated with the stream. Where private land occurred within the selected reach, we offset the Target site with the goal of including 500 m of stream in the survey. For the few sites that were not located on streams, we surveyed the entire wetland, shoreline, and peripheral shallows of ponds, lakes, or reservoirs.

If *R. luteiventris* was not detected at the Target site, we surveyed potential habitat within 1 km of the center of the Target site ("**Alternate**" sites). Surveys of Alternate sites often resulted in surveying farther upstream or downstream of the Target stream reach. In the case of some small lakes, surveys of Alternate sites resulted in surveys of an inflow or outflow stream. Alternate sites were not surveyed for four Target sites where *R. luteiventris* was not detected. An Alternate site was surveyed for one Target site (Alder Creek) (reach immediately downstream of Target reach) despite detecting *R. luteiventris* at the Target reach.

When time, location, and presence of aquatic habitat allowed, we opportunistically surveyed additional sites on public land that generally were suitable for *R. luteiventris* but where no records of *R. luteiventris* were known. These sites are referred to as "**Incidental"** sites.

Time constraints limited our surveys to one visit per site. However, unfavorable weather conditions (low temperatures, record precipitation events) and safety concerns during the initial survey of three sites prompted us to resurvey those sites later in the summer.

Field Surveys

Field surveys consisted of two- or three-person crews methodically searching flooded and saturated areas within the Target reach. The field surveys were essentially area-constrained (for example, up to 500-m reach for Target sites on streams) visual encounter surveys (VES) that included dip-netting in vegetation for escaping amphibians. Our lack of time precluded estimation of detection probabilities. We used Garmin® GPSMAP 60Cx GPS units (Garmin® International, Olathe, Kansas) to record tracks (UTM points every 15 m or less) that delineate the survey route for each site. During and at the end of surveys for all sites, we assessed habitat and stressor variables that may relate to persistence or abundance of amphibians including *R. luteiventris*. These were assessed at the scale of the whole site:

- Site type (intermittent stream, pool within intermittent stream, lake, marsh/wetland, permanent stream, pond, other)
- Riparian vegetation type (aspen, willow/deciduous shrubs, juniper, Ponderosa pine, sage, other)
- Upland vegetation type (aspen, willow/deciduous shrubs, juniper, Ponderosa pine, sage, other)
- Number of livestock observed in survey reach (0, 1–5, 6–20, greater than 20)
- Presence of road or track (yes/no) within 50 m of a site
- Type of road or track within 50 m [dirt, gravel, paved, two-track (ATV), none]
- Percentage of site with surface water
- Average length of survey site

- Average width of survey site
- Presence of any impoundments (yes/no) and whether impoundments were of anthropogenic or beaver origin
- Beaver sign (beaver sighted, chewed trees, lodge, slide, tail slap)
- Beaver influence (abandoned pond, active pond, none, other)

In addition, we characterized what we could see of the habitat upstream of each survey reach. Crews looked for signs of impoundments (and their approximate size), beaver influence, presence or signs of livestock, and structures (road crossings, culverts, weirs, irrigation systems, etc.).

At Target sites, we used plots to quantify habitat variables that could relate to *R. luteiventris* habitat suitability and that could be reassessed in future comparisons. We characterized these plot-scale variables from 3 to 11 locations evenly distributed over the survey reach or around the perimeter of lentic sites. Each location included one terrestrial plot adjoining one aquatic plot, with the shared side aligned to the land-water interface. Terrestrial and aquatic plots were 7.5 m on a side (5 dip-net lengths). We located the first pair of plots at the beginning of the survey; remaining plot pairs were located after a standard time interval was scaled to the size of the site. This yielded an average of 7.4 ± 1.6 [standard deviation, (SD)] plot pairs per Target site. We assessed the following variables on aquatic plots: wetted width, maximum depth, percentage of plot with vegetation, dominant substrate, and subdominant substrate (next most prevalent). Substrate types were mud, silt, sand, gravel, cobble, bedrock, or other. Variables assessed for terrestrial plots were bank height, number of cow pats, fresh pats (yes/no), disturbance type (soil, vegetation, none, other), disturbance category (cattle trampling, grazed vegetation, flooding, fire, tire tracks, road bed, other), and degree of vegetation and soil disturbance (low, medium, high).

We attempted to capture all amphibians encountered to confirm species identifications and to gather demographic information on *R. luteiventris* (life stage, gender, length, mass). Frogs were photographed, and their locations were recorded by GPS (UTM, datum NAD 83).

Because of the uncertainty associated with locations of a Target site relative to the original observation, we consider a Target site occupied if *R. luteiventris* were detected at that site or at any associated Alternate sites. Appendix A includes narrative descriptions of each Target, Alternate, and Incidental site. We also include a compilation of *R. luteiventris* observations for each site to illustrate their respective survey histories, and summarize the available evidence of *R. luteiventris* occupancy and breeding status. Survey descriptions in appendix A also include counts and life stages of amphibians encountered, discussion of local habitat, and a photograph of the Target site to further illustrate general habitat conditions.

Landscape Metrics

We used ArcGIS 9.3.1 to quantify the composition and intensity of local land use, distance to nearest agriculture, total agriculture in watershed, and amount of nearby aquatic habitat. We used a Human Footprint raster dataset (Leu and others, 2008) to quantify land use within a 2-km radius around each Target site. The Human Footprint dataset covers the western United States in 180-m^2 cells, and represents the synthesis of seven models in which human impact on the landscape is assigned a score based on increasing anthropogenic disturbances ranging from low (1) to high (10). The models and raster scores incorporate data on human habitation, railroads, roads and highways, irrigation canals, power lines, agricultural land, campgrounds, landfills, oil and gas development, and human-induced fires (Leu and others, 2008). This score does not include some potentially widespread stressors on amphibians, such as livestock grazing and pollution (Leu and others, 2008). We calculated an average of

all Human Footprint scores weighted by their proportion of the buffer and used this weighted average as an impact score for each site (appendix B).

We assessed the amount of agriculture near sites in three ways. For each method, we used data from the USGS National Land Cover Database ("NLCD"; Homer and others, 2004) and considered cells to be agricultural if categorized as 'cultivated crops' or 'pasture/hay.' First, we quantified the extent of selected land uses including agriculture as percentages of a 2-km buffer around each site (appendices C and D). Second, we estimated the linear distance from our survey to the nearest agriculturally coded cells (appendix E). Third, we estimated the amount of agricultural land within the watershed immediately upstream of each site (that is, using the site as a "pour point" for the watershed) by overlaying each watershed on land-use data from the NLCD (appendix F). To delineate watershed boundaries upstream of survey sites, we used the NHDPlus dataset (Horizon Systems Corporation), which combines topographical and hydrological data to produce flow direction and accumulation grids.

As a proxy for site isolation, we used the NHD to estimate the amount of mapped aquatic habitat near each site. The total length of all mapped streams and the total surface area of all mapped water bodies within a 1-km radius of each site are shown in appendix G.

Local Herbicide Applications

To compile information on potential herbicide exposure of *R. luteiventris*, we requested records of herbicide applications near the Target sites from the Oregon Department of Transportation (ODOT), BLM, Malheur and Harney Counties, and Malheur National Wildlife Refuge (MNWR; appendix H). We requested that agencies review their records for applications within 1 km of the Target sites over the last 5–10 years.

Results

We conducted surveys at 42 Target sites where historical records of *R. luteiventris* were available (fig. 1, table 1). Most of the Target sites occurred in clusters: Steens Mountain (3 sites at upper elevations, 6 sites toward the valley floor; fig. 2), Silver Creek (5 sites at upper elevations, 2 sites at low elevations; fig. 3), northern tributaries of the Malheur River (6 sites; fig. 4), Dry Creek (6 sites; fig. 5), southern tributaries to the Malheur River (numbers 2, 10, 14, and 38; fig. 1), and in tributaries of the upper Owyhee River (numbers 11, 13, and 45; fig.1)). Four sites were scattered along the mainstem or central tributaries of the Malheur River (numbers 9, 22, 23, and 39; fig.1). The Parsnip Creek site (#33 in fig. 1) is an outlier to the southwest of most of the sites. The Big Trout Creek site (#6 in fig.1) is also isolated from other Target sites. Target sites were on lands managed by the BLM (n = 34 sites), U.S. Fish and Wildlife Service National Wildlife Refuges (n = 4), U.S. Forest Service (n = 2), and the State of Oregon (n = 2). Elevations of Target sites ranged from 902 to 2,351 m above sea level. Incidental sites were on lands managed by the BLM (n = 2) and the U.S. Forest Service (n = 1), and ranged in elevation from 1,110 to 2,220 m above sea level.

R. luteiventris was detected at 25 of 42 sites with historical records. *R. luteiventris* was detected at 65.2 percent (15 of 23) of historical sites where we classified the Target as permanent stream; 61.5 percent (8 of 13) at intermittent streams; 33.3 percent (1 of 3) at lakes/reservoirs; and 33.3 percent (1 of 3) at ponds/wetlands (table 3).

The number of *R. luteiventris* detected varied markedly among sites (0–151 individuals) and we detected < 40 individuals at most sites (fig. 6). We found evidence of reproduction (larvae, metamorphs, or young juveniles) at 20 sites (table 2). We found low numbers of adults (2, 2, and 1 frogs) at three of the other five sites where we found any *R. luteiventris* (Grove Creek, Rough Creek, South Fork of

Malheur River near Crane Creek confluence, respectively). It is possible that breeding was not occurring locally at these sites. Target sites where *R. luteiventris* was detected were similar in elevation to sites where the species was not detected (fig. 7).

Incidental surveys were conducted at three sites, all of which were associated with permanent streams that also had Target sites (McCoy Creek, Dry Creek, and Silver Creek). *R. luteiventris* was detected only at the Silver Creek Incidental site.

Landscape data for the Target sites and buffers are included in appendixes B–G. General landscape conditions were remarkably consistent among sites in the study area. For example, Human Footprint scores were similar and clustered around a mean of 3.2 (± 0.6 SD; range 1.7–4.6). Shrub/scrub (predominantly sage or willow) was the dominant landscape type around survey sites (average percentage of buffer 85.1 ± 17.9 SD; range 28.9–100.0 percent). The only other landscape types with appreciable coverage were Evergreen Forest (average 7.1 ± 13.4 percent; range 0.0–71.1 percent) and Emergent Herbaceous Wetlands (average 3.4 ± 9.3 percent; range 0.0–42.3 percent). Only four sites had appreciable Emergent Herbaceous Wetlands in the buffer, and all these were in the lowlands around MNWR (Bridge Creek, Mud Creek, Page Springs, Silver Creek Lower MNWR).

We received information on herbicide applications from the BLM, ODOT, and Harney County Weed Control (appendix H). These records documented applications within 1 km of eight Target sites and suggested that a subset of sites received regular applications (Calf Creek, Kingsbury Gulch, Rattlesnake Creek). Our understanding from talking with agency staff is that any Target sites not listed in appendix H are on Malheur National Wildlife Refuge land or did not have chemicals applied within 1 km kilometer by Harney County, BLM, or ODOT.

Our results confirm other observations that several, relatively large population complexes persist for *R. luteiventris* in the region we examined. Frog abundance remains high in the Dry Creek system. Monitoring at the site was initiated in 2001 (Engle 2001) and continued by the U.S. Fish and Wildlife Service (USFWS) La Grande Field Office. Data from visual encounter surveys by USFWS suggest that 2009 probably was the most productive recruitment year for *R. luteiventris* in Dry Creek since 2001 (Meyer, 2009). The upper Silver Creek basin also remains a relatively productive area; *R. luteiventris* was detected at five of six sites in the basin. We did not survey another historical breeding site in the upper Silver Creek basin (Delintment Lake; Wente and others, 2005).

Our surveys and other work also identified areas where *R. luteiventris* appears to be locally decreasing or at risk of local extinction. For example, we detected few frogs in Kingsbury Gulch in 2009, and seven years of monitoring has shown an appreciable decrease in captures from high numbers detected in 2000–04 (U. S. Geological Survey, unpub. data). Fish Lake and Slough had a well-documented history of supporting *R. luteiventris* breeding and post-metamorphic stages until around 2002 or 2003. Surveys by Smyth (2004) failed to detect *R. luteiventris* in 2004, and we failed to detect frogs during two surveys at Fish Lake and vicinity in 2009. This lake hosts many game fish, and the area is heavily used for recreation.

The Rail Canyon sites have a well-documented record that identifies direct use of beaver influenced habitats by breeding *R. luteiventris*. We surveyed extensively in that area in 2009 and found neither *R. luteiventris* nor current beaver activity. This is consistent with a growing body of evidence that beaver-engineered habitats can be valuable or essential for both species of spotted frog in arid and semi-arid landscapes (St. John, 1994; Munger and Lingo, 2003; and Smyth, 2004). Further anecdotal support for a potentially positive role of beaver can be found in the Silver Creek basin where frogs persist with beaver in the upper basin, but frogs and active beaver were not found in the two lower basin sites. Additional study of sites with frogs and beaver (for example, Lake Creek, Little Fish Creek) could improve our understanding of the links between the two species.

Both Skull Creek and Dry Creek – King Brown Cabin are sites that have many frogs and heavy grazing. There is no way to know whether grazing at these sites has a positive, negative, or no effect, but the fact that grazing is a prominent land use at these sites suggests that potential effects on *R. luteiventris* need to be considered in future management plans. A possible course of action would be a management experiment to determine how a change in grazing at these sites affects frogs and their habitat.

Parsnip Creek in the Warner Mountains appears to be the westernmost and a particularly isolated population of *R. luteiventris*. Surveys of other sites in the vicinity of Parsnip Creek have not detected spotted frogs (St. John, 1994; Hayes, 1997; Oertley and Frazier, 2006). Road construction affected parts of Parsnip Creek in 2010, so that site appears to be a good candidate for closer monitoring and potential conservation measures.

Discussion

We detected *R. luteiventris* at 55.6 percent of the Target sites. We are aware of only one similar historical site revisit study for *R. luteiventris* (Wente and others, 2005). That study included sites in Nevada and a broader part of Oregon than our study and visited Oregon sites more than once. In that study, *R. luteiventris* was detected at 43.3 percent of 30 sites; when detectability was included, the estimate rose to 52.9 percent (43.5–62.3 percent, 95% confidence interval). Wente and others (2005) detected *R. luteiventris* at 66.7 percent of the 18 sites in Oregon.

Other naïve occupancy estimates (unadjusted for detectability) from historical revisit studies of frogs around the western United States include Oregon spotted frog (*R. pretiosa*, the sister species of *R. luteiventris*) at 39.3 percent of sites in Oregon and California (Hayes, 1997); Northern leopard frog (*R. pipiens*) at 12 percent and Wood frog (*R. sylvatica*) at 69 percent of sites in Colorado (Corn and others, 1989); *R. cascadae* at 34 percent, *R. draytonii* at 32 percent, and *R. muscosa* at 17 percent of sites in California (Davidson and others, 2002).

There are several things to consider when interpreting our results:

1. We may have missed *R. luteiventris* that were present. We conducted single visits (with few exceptions) in a single calendar year. Most of our surveys were appropriately timed with regard to *R. luteiventris* phenology and seasonal surface activity, and conducted when frogs should be active (warm weather and water conditions). However, it is possible we missed *R. luteiventris* at non-breeding sites with small numbers of individuals. Doing multiple visits across more than one calendar year raises the chance surveyors will detect a focal species when it is present in the area (Skelly and others, 2003). Conducting repeat visits also allows an assessment of detectability of focal species, which can help provide a less biased estimate of occupancy.
2. As previously described, many of the historical records included sparse or imprecise location data. We dealt with this by including a sizeable target area and alternate survey sites. We suggest surveyors collect data on UTM locations and life stages to facilitate more detailed revisit studies in the future.
3. Many of the historical records lack information that could help assess whether a breeding population was present. Most records were for a few adult frogs. Failure to detect frogs at a site where only a few adults have been previously observed is less informative than not finding frogs at an historical breeding site (Skelly and others, 2003; Pearl and others, 2009). Adult *R. luteiventris* are thought to reuse breeding sites, and young life stages like eggs and larvae move little in contrast to post-metamorphic stages. Juvenile and adult *R. luteiventris*

are among the most mobile of western ranids and are capable of making extensive moves across terrestrial habitats (Engle, 2001; Pilliod and others, 2002; Funk and others, 2005).

4. Most of the historical records used in this study were relatively recent. For example, 56 percent of the *R. luteiventris* records in GeoBOB were observations since 2000; only 6 percent were prior to 1990. Recent records are not as useful for determining long-term changes in status.

Fundamental questions remain as to how *R. luteiventris* use and persist in dry, high desert landscapes with limited, lentic waters. Little is known about *R. luteiventris* breeding habitats and movement patterns in stream-dominated landscapes. Most research on amphibian population declines has focused on pond-breeding species and primary stressors, such as habitat loss/alteration and invasive species, which are better understood. We know little about stressors acting on species like *R. luteiventris* in stream environments where invasive species appear less prevalent and where habitat alterations differ from those affecting ponds and lakes. A better understanding of *R. luteiventris* ecology in stream-associated habitats is needed (for example, comparative use and recruitment in oxbows, side channels, and beaver impoundments; ability of adult frogs to find breeding sites and ability of populations to persist as habitats are reorganized with floods, changes in beaver structures, irrigation withdrawals, or local livestock grazing). We know that complex hydrological changes, such as changes in beaver use and stream incision are occurring in these habitats, and we lack understanding of the responses of *R. luteiventris* to these changes.

Summary

The Columbia spotted frog (*Rana luteiventris*) has one of the largest native ranges of any North American frog of the family Ranidae. The species is comprised of at least three genetic units. The Great Basin Distinct Population Segment (DPS) is found in Oregon, Idaho, and Nevada, and population declines in this region are suspected. We compiled a list of 42 sites on public lands in southeastern Oregon where there was evidence that Columbia spotted frog were historically present. We used Visual Encounter Surveys at Target and associated Alternate sites in summer 2009 to assess the presence of Columbia spotted frogs. We also quantified a suite of variables that relate to habitat suitability for this and other amphibian species. Columbia spotted frogs were found at 25 sites and 20 of these had evidence of breeding. Columbia spotted frogs were detected at 15 of 23 permanent streams and 8 of 13 intermittent streams. It is possible that we missed frogs at some sites where they were present. Some historical records were imprecise about location or did not provide information sufficient to determine whether a breeding population had existed. For these reasons, the lack of detections at some of the sites on our list does not provide convincing evidence of a decline. The non-detections suggest a need for further study and monitoring of the Great Basin DPS.

Acknowledgments

This work was made possible by a grant from the Interagency Special Status/Sensitive Species Program (ISSSSP). We thank our field crews for their persistence and attention to detail: Jeff Frederick, Ross Hinderer, Amanda Kissell, and Matt Kluber. We extend particular thanks to Matt Obradovich (Bureau of Land Management, BLM Burns District), Michelle Caviness, Martin Espil, and Shaney Rockefeller (BLM Vale District) and their co-workers for logistical support for the field sampling efforts: they were integral to the success of this project, and we greatly appreciate their involvement. We thank Char Corkran, Chris Funk, Matt Obradovich, Al St. John, and Cynthia Tait for sharing their field notes and observations. This report benefitted from information and comments provided by Cynthia Tait, Matt Obradovich, Char Corkran, Wendy Wente, Kelli Van Norman, and Rob Huff. Patricia Haggerty (USGS, Forest and Rangeland Ecosystem Science Center) provided valuable GIS assistance. We thank the following people for information on herbicide application: Jesse Barnes (Harney County Weed Control), Will Lackey (Oregon Department of Transportation), Caryn Meinicke (BLM Burns), and Gary Page (Malheur County Weed/Vector Department).

References Cited

Adams, M.J., Chelgren, N.D., Reinitz, D., Cole, R.A., Rachowicz, L.J., Galvan, S.K., McCreary, B., Pearl, C.A., Bailey, L., Bettaso, J., Bull, E.L., and Leu, M., 2010, Using occupancy models to understand the distribution of an amphibian pathogen, *Batrachochytrium dendrobatidis*: Ecological Applications, v. 20, p. 289-302.

Bangs, B.L., and Jones, K.K., 2009, Distribution of amphibians in wadeable streams and ponds in western and southeast Oregon: Oregon Department of Fish and Wildlife Information Reports Number 2009-02.

Bos, D.H., and Sites Jr., J.W., 2001, Phylogeography and conservation genetics of the Columbia spotted frog (*Rana luteiventris*; Amphibia, Ranidae): Molecular Ecology, v. 10, p. 1499–1513.

Bull, E.L., and Marx, D.B., 2002, Influence of fish and habitat on amphibian communities in high elevation lakes of northeastern Oregon: Northwest Science, v. 76, p. 240–248.

Corn, P.S., Stolzenburg, W., and Bury, R.B., 1989, Acid precipitation studies in Colorado and Wyoming: interim report of surveys of montane amphibians and water chemistry: U.S. Fish and Wildlife Service Biological Report 80 (40.26) Washington, DC, USA, 56 p.

Davidson, C., Shaffer, H.B., and Jennings, M.R., 2002, Spatial tests of the pesticide drift, habitat destruction, UV-B, and climate-change hypotheses for California amphibian declines: Conservation Biology, v. 16, p. 1588-1601.

Engle, J.C., 2001, Columbia Spotted Frog (*Rana luteiventris*) 2001 Monitoring Report, Dry Creek, Oregon. Prepared for the Vale District Bureau of Land Management, 11 p. + appendices.

Funk, W.C., Blouin, M.S., Corn, P.S., Maxell, B.A., Pilliod, D.S., Amish, S., and Allendorf, F.W., 2005, Population structure of Columbia spotted frogs (*Rana luteiventris*) is strongly affected by the landscape: Molecular Ecology, v. 14, p. 483-496.

Funk, W.C., Pearl, C.A., Draheim, H.M., Adams, M.J., Mullins, T.D., and Haig, S.M., 2008, Range-wide phylogenetic analysis of the spotted frog complex (*Rana luteiventris* and *Rana pretiosa*) in northwestern North America: Molecular Phylogenetics and Evolution, v. 49, p. 198-210.

Hayes, M.P., 1997, Status of the Oregon spotted frog (*Rana pretiosa* sensu stricto) in the Deschutes Basin and selected other systems in Oregon and northeastern California with a rangewide synopsis of the species' status: Final report prepared for The Nature Conservancy under contract to U.S. Fish and Wildlife Service, Portland, Oregon, 57 p. + appendices.

Homer, C., Huang, C., Yang, L., Wylie, B., and Coan, M., 2004, Development of a 2001 National Landcover Database for the United States: Photogrammetric Engineering and Remote Sensing, v. 70, p. 829-840.

Leu, M., Hanser, S.E., and Knick, S.T., 2008, The human footprint in the West—A large-scale analysis of anthropogenic impacts: Ecological Applications, v. 18, no. 5, p. 1119-1139.

Meyer, M., 2009, Columbia spotted frog monitoring report, Dry Creek, Oregon: U.S. Fish and Wildlife Service, LaGrande Field Office. LaGrande, Oregon, 39 p. + appendices, accessed September 13, 2010, at *http://www.fws.gov/oregonfwo/FieldOffices/LaGrande/SpottedFrogMonitoring/default.asp*

Munger, J.C., and Lingo, H., 2003, Reintroduction of beaver to aid restoration of the spotted frog population of Stoneman Creek: Report on the FY2001 and FY2002 research funded by a challenge cost share agreement between Boise State University and the Bureau of Land Management, Boise, Idaho, February 10, 2003, 7 p.

Oertley, J., and Frazier, B.D., 2006, Spotted frog inventory of southern Oregon: Combined report for 2005 and 2006: US Forest Service Report for Fremont-Winema National Forest, Klamath Falls, Oregon, 29 p.

Pearl, C.A., Adams, M.J., Bury, R.B., Wente, W.H., and McCreary, B., 2009, Evaluating amphibian declines with site revisits and occupancy models: status of montane anurans in the Pacific Northwest USA: Diversity, v. 1, p. 166-181.

Pilliod, D.S., and Peterson, C.R., 2001, Local and landscape effects of introduced trout on amphibians in historically fishless watersheds: Ecosystems, v. 4, p. 322-333.

Pilliod, D.S., Peterson, C.R., and Ritson, P.I., 2002, Seasonal migration of Columbia spotted frogs (*Rana luteiventris*) among complementary resources in a high mountain basin: Canadian Journal of Zoology, v. 80, p. 1849-1862.

Reaser, J.K., 2000, Demographic analyses of the Columbia spotted frog (*Rana luteiventris*): case study in spatiotemporal variation: Canadian Journal of Zoology, v. 78, p. 1158-1167.

Skelly, D.K., Yurewicz, K.L., Werner, E.E., and Relyea, R.A., 2003, Estimating decline and distributional change in amphibians: Conservation Biology, v. 17, p. 744-751.

Smyth, M., 1998, Final Report B Spotted Frog Survey Project, Contract Order No. 1422H-030-P98-0055: Three Rivers Resource Area, Oregon, Bureau of Land Management, Burns District.

Smyth, M., 2000, Final Report B 2000 Spotted Frog Survey Project: Challenge Cost Share Agreement Order No. HBP000009: Burns District, Oregon, Bureau of Land Management Andrews Resource Area, 11 p.

Smyth, M., 2001, Final Report – 2001 Spotted Frog Survey Project, Work Order No. HBP0000231: Burns District, Oregon, Bureau of Land Management Andrews Resource Area, 12 p.

Smyth, M., 2002, Final Report – 2002 Spotted Frog Survey Project, Contract No. HBP010046: Burns District, Oregon, Bureau of Land Management – Andrews Resource Area, 8 p.

Smyth, M., 2004, Final Report – 2004 Spotted Frog Survey Project, Contract No. HBP040028: Burns District, Oregon, Bureau of Land Management – Andrews Resource Area, 8 p.

St. John, A.D., 1994, The Spotted frog in the Lakeview District of Oregon: Prepared for the Bureau of Land Management Lakeview District Office, Coordinated by The Nature Conservancy Oregon Field Office, 14 p. + Appendices.

U.S. Fish and Wildlife Service, 2009, Species Assessment and Listing Priority Assignment Form for the Columbia spotted frog (*Rana luteiventris*): Sacramento, California, Great Basin DPS, Region 8, 47 p. Available only online at http://ecos.fws.gov/docs/candforms_pdf/r8/D027_V01.pdf.

Wente, W.H., Adams, M.J., and Pearl, C.A., 2005, Evidence of decline for *Bufo boreas* and *Rana luteiventris* in and around the northern Great Basin, western USA: Alytes, v. 22, p. 95-108.

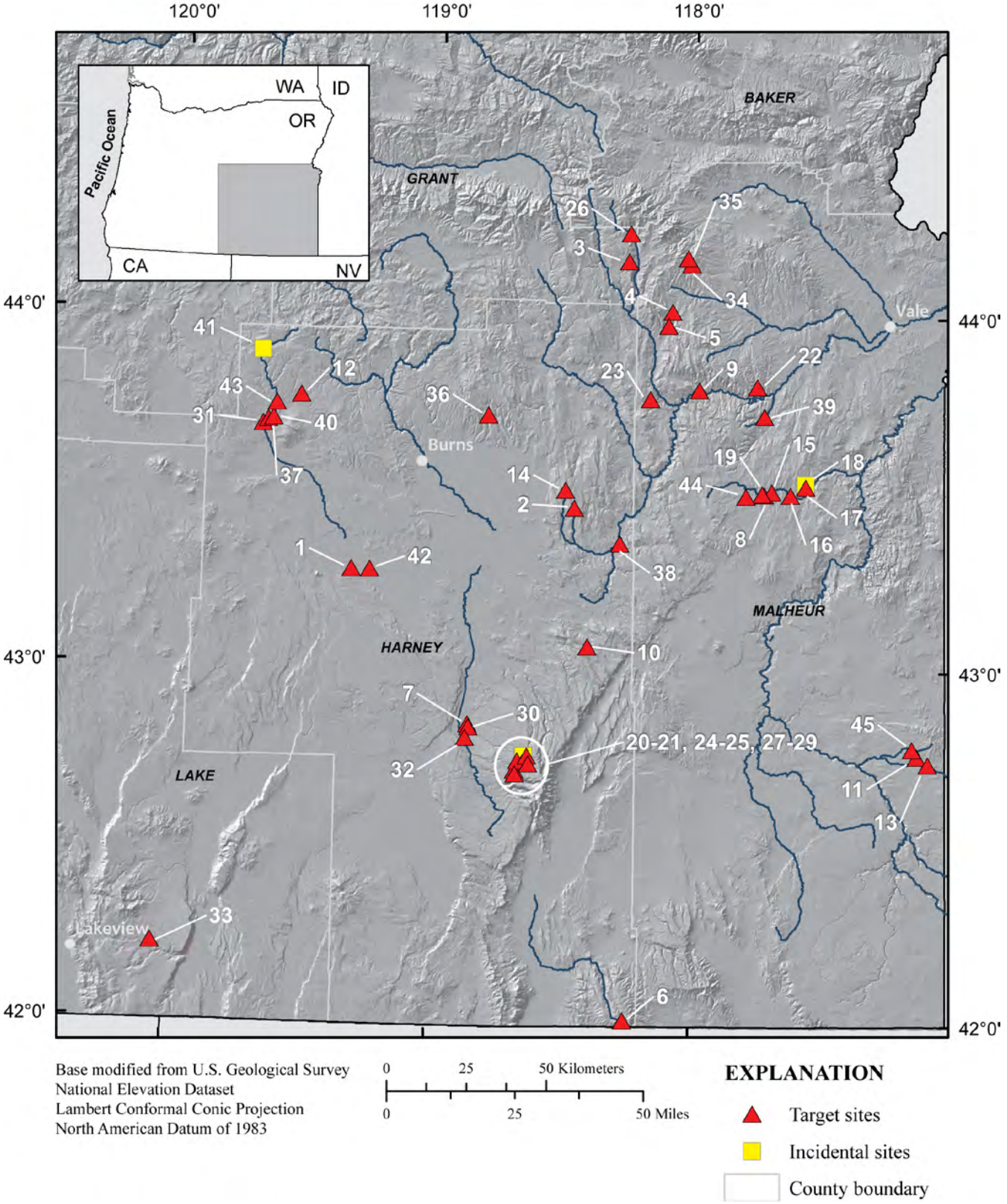

Figure 1. Map showing Target and Incidental sites surveyed for *Rana luteiventris* in southeastern Oregon, 2009. Site numbers correspond to those shown in tables 1 and 2.

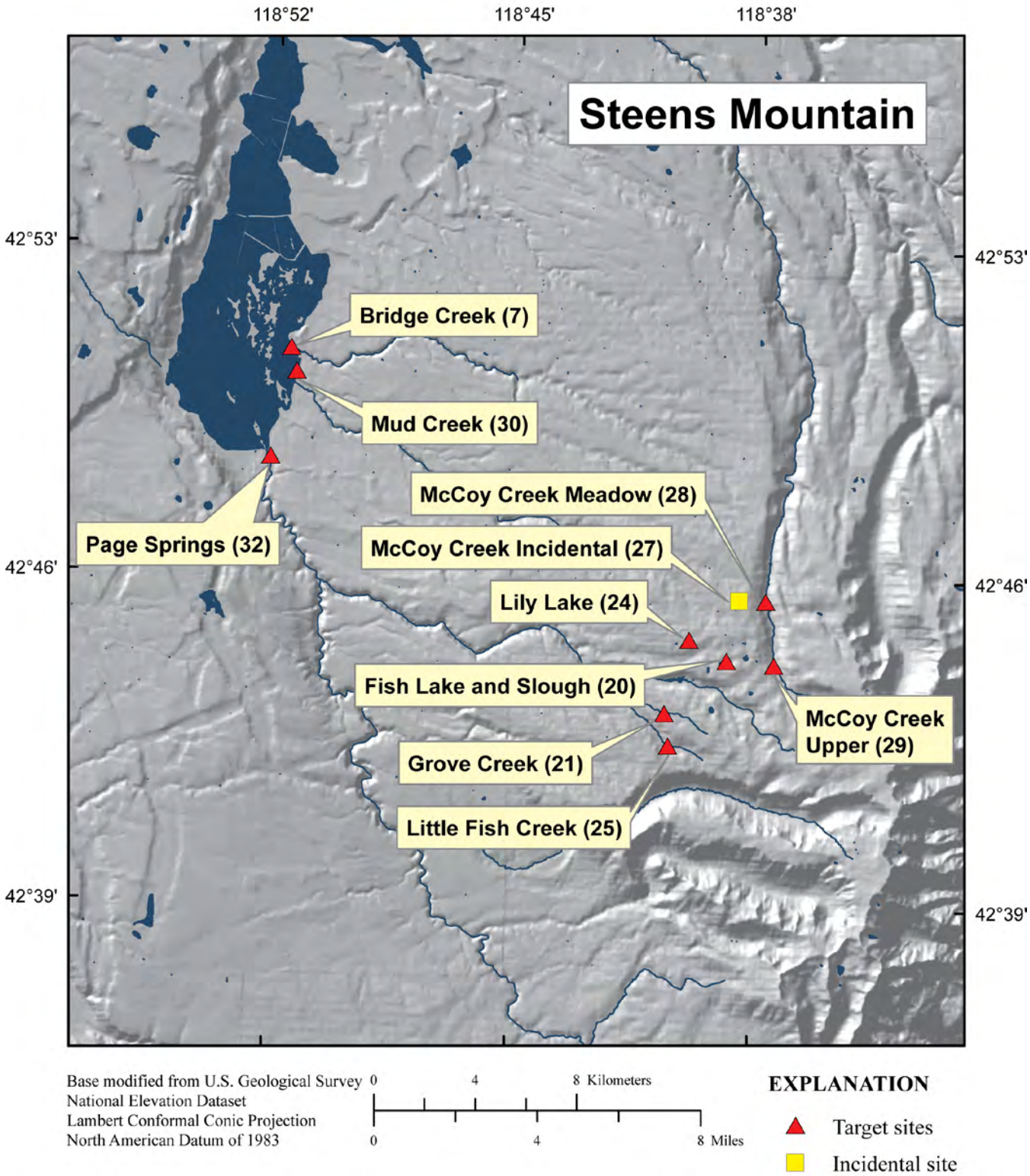

Figure 2. Map showing Target and Incidental sites surveyed for *Rana luteiventris* around Steens Mountain, 2009. Number in parentheses is Site No. shown in tables 1 and 2.

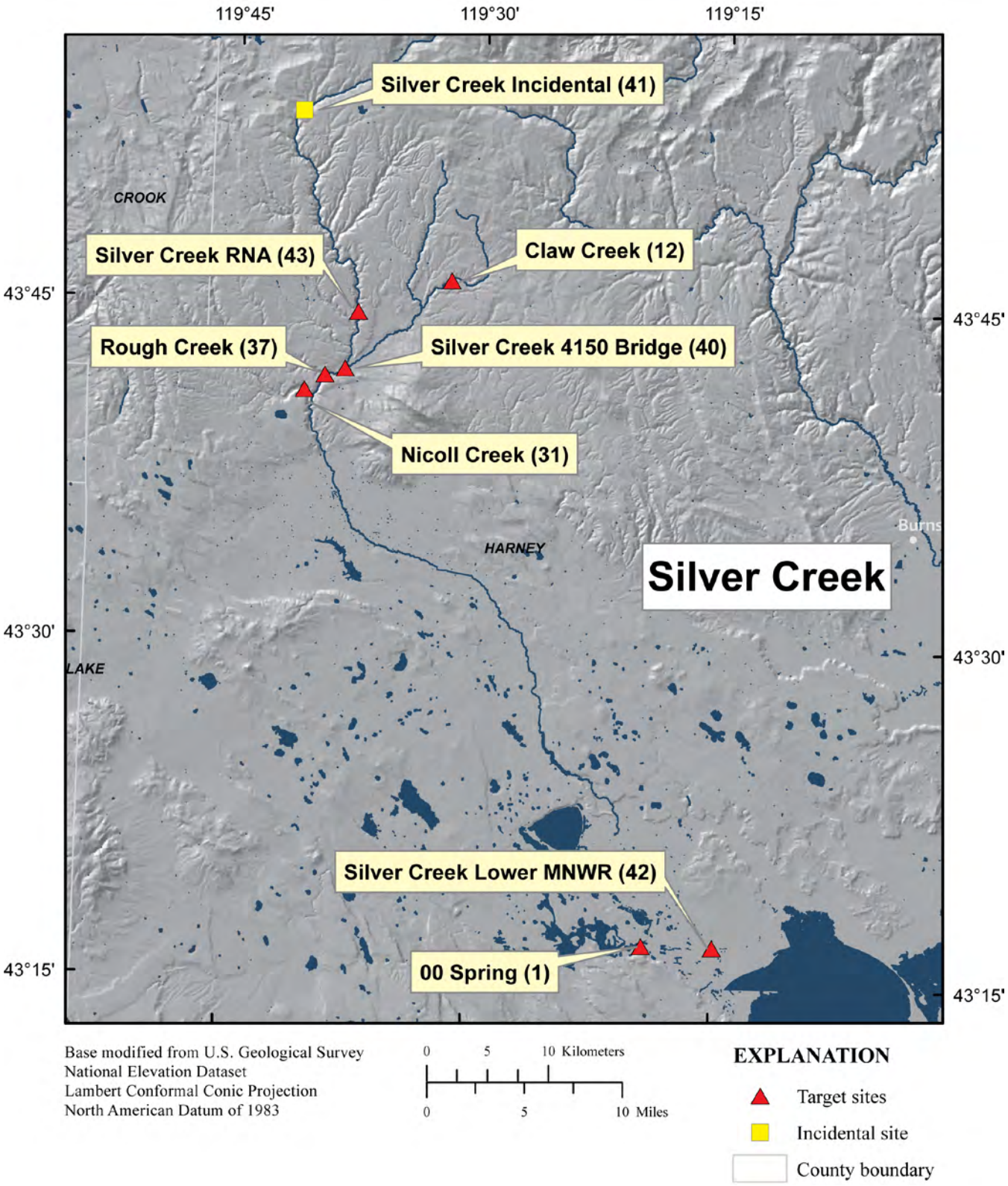

Figure 3. Map showing Target and Incidental sites surveyed for *Rana luteiventris* around Silver Creek, 2009. Number in parentheses is Site No. shown in tables 1 and 2.

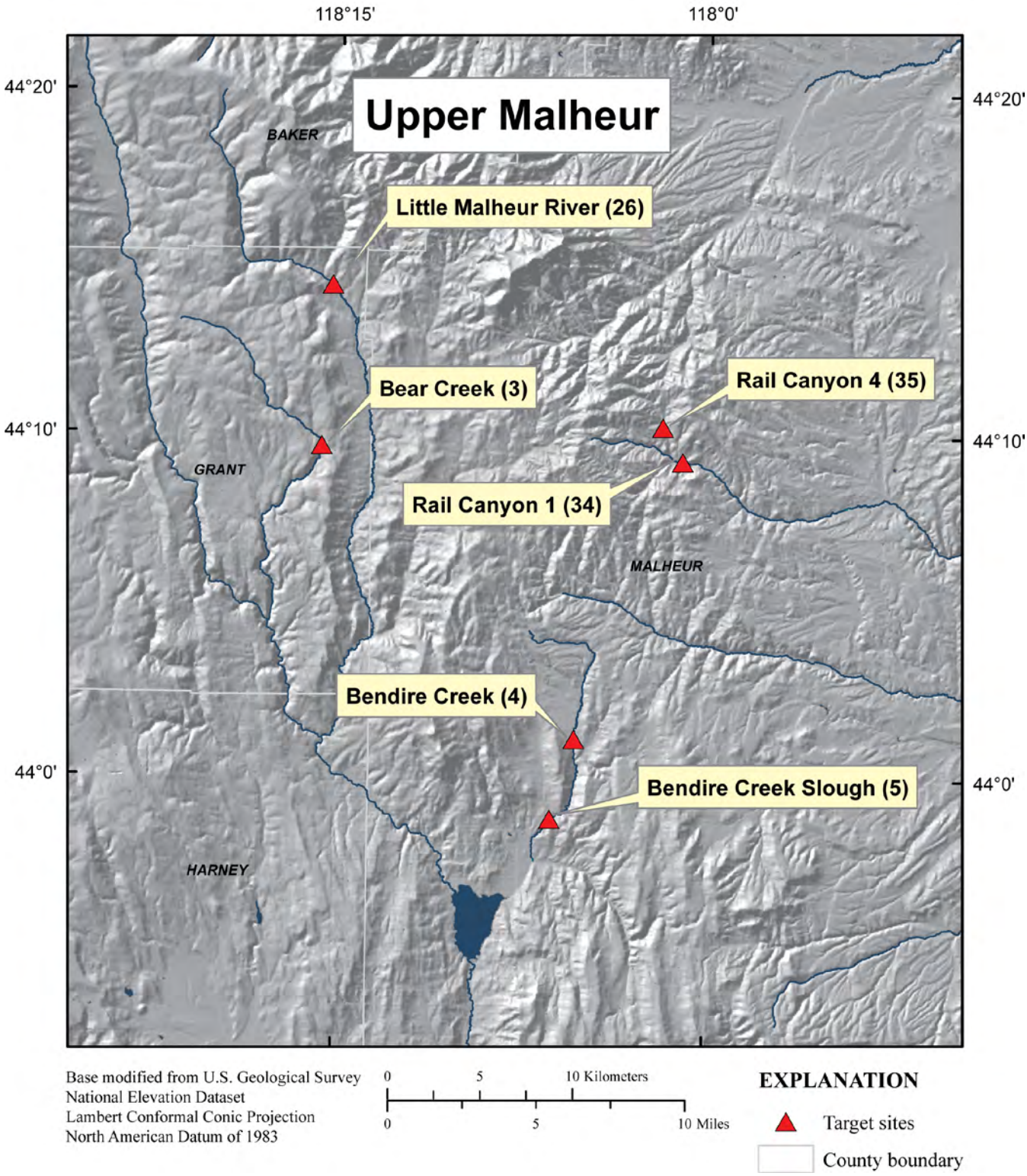

Figure 4. Map showing Target and Incidental sites surveyed for *Rana luteiventris* around Upper Malheur tributaries, 2009. Number in parentheses is Site No. shown in tables 1 and 2.

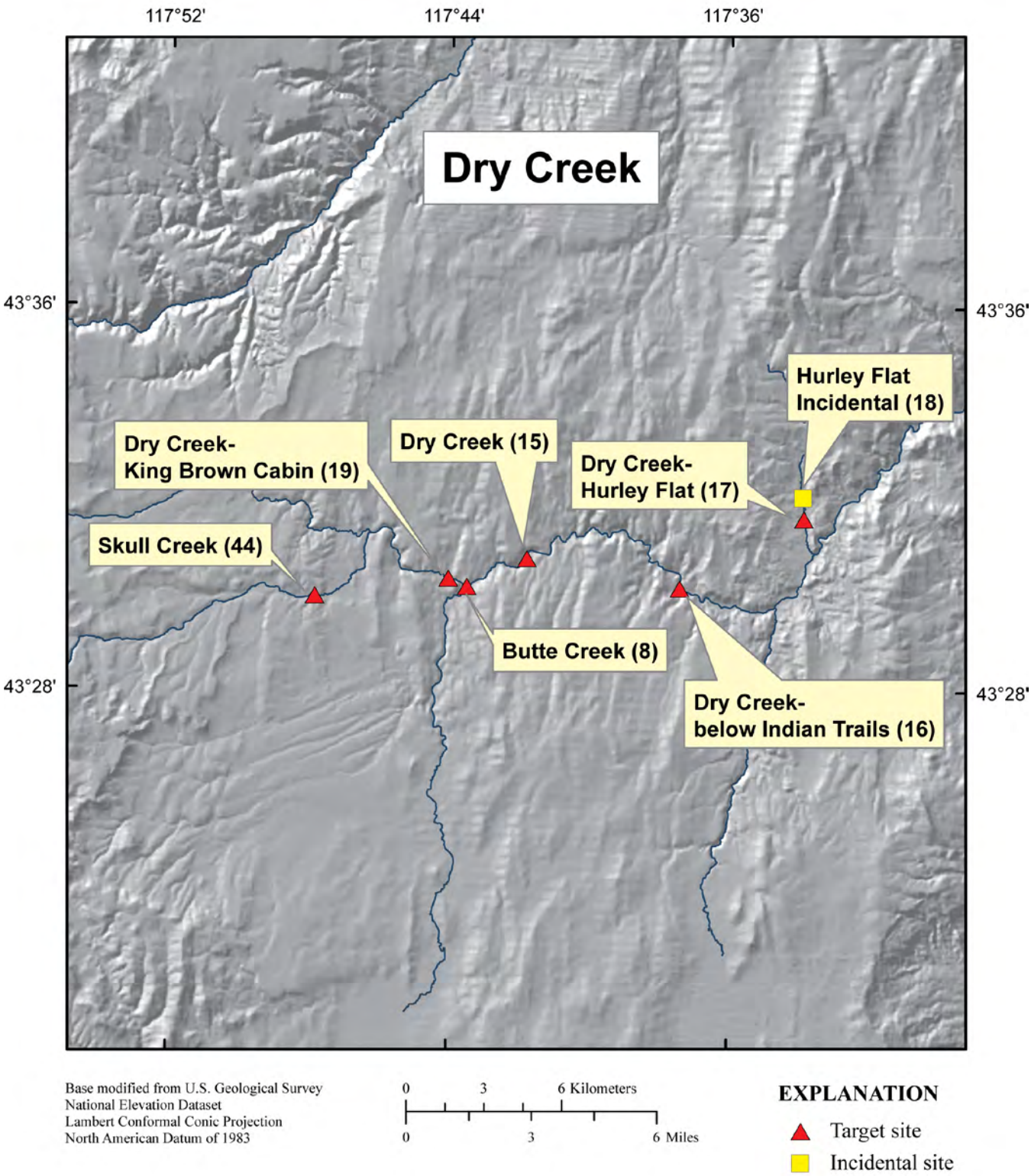

Figure 5. Map showing Target and Incidental sites surveyed for *Rana luteiventris* around Dry Creek, 2009. Number in parentheses is Site No. shown in tables 1 and 2

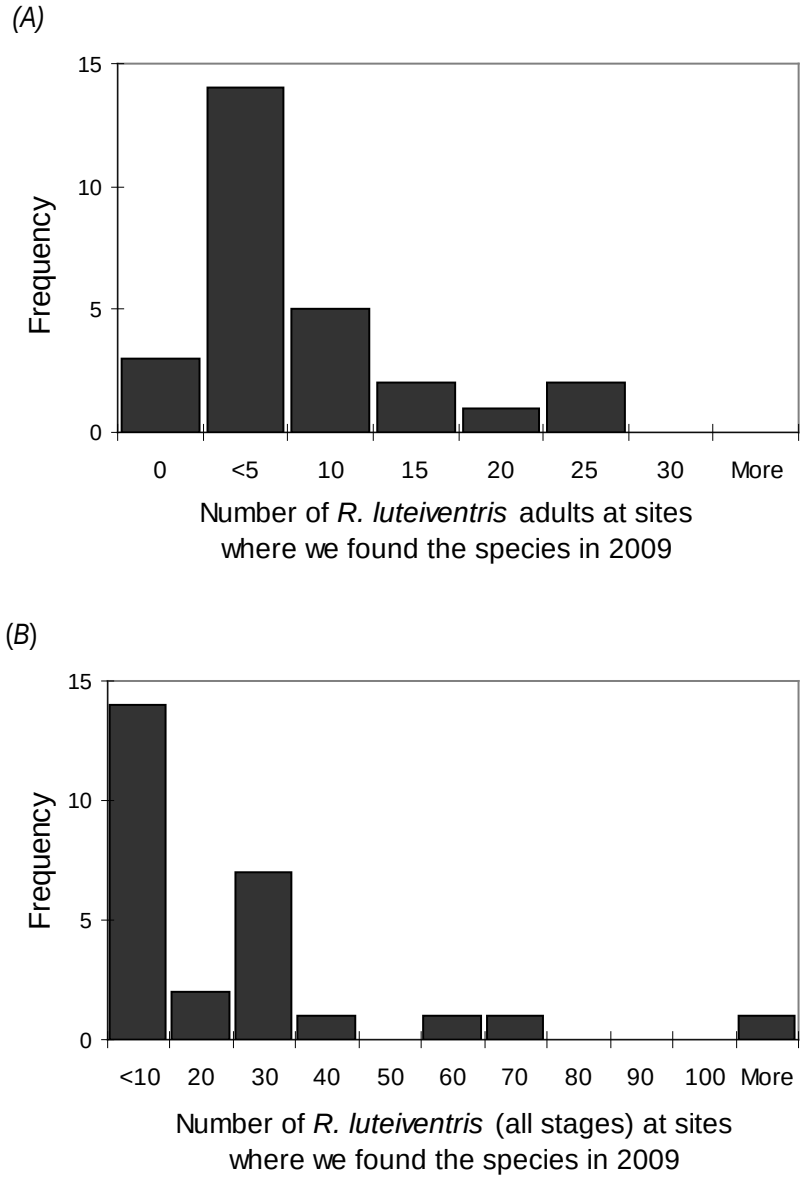

Figure 6. Graphs showing numbers of *Rana luteiventris* detected at sites in southeastern Oregon, 2009: (*A*) adults, (*B*) total of all life stages. Y-axes are numbers of sites within each abundance category.

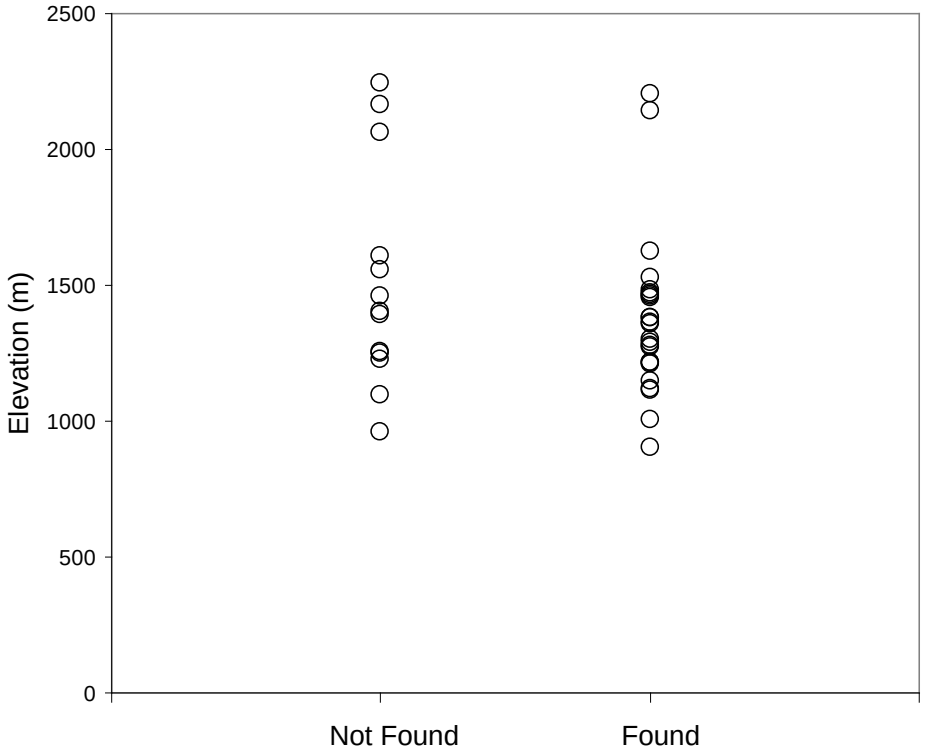

Figure 7. Graph showing elevation at sites with and without detections of *Rana luteiventris* in southeastern Oregon, 2009.

Table 1. Attributes of Target and Incidental sites surveyed for *Rana luteiventris* in southeastern Oregon, 2009.

[Site No.: Site locations are shown in figure 1. Target site ownership: BLM, Bureau of Land Management; USFS, U.S. Forest Service; USFWS, U.S. Fish and Wildlife Service; NWR, National Wildlife Refuge; NF, National Forest; parenthetical text refers to the BLM district, national forest, or national wildlife refuge in which the site is located. Elevation is in meters above sea level. Site coordinates are in the North American 1983 datum]

Site No.	Site name	Number of Alternate sites	Survey type	Target site ownership	County	**Elevation**	UTM East	UTM North	UTM zone	Site type
1	00 Spring	1	target	USFWS (Malheur NWR)	Harney	1,257	311775	4794522	11	permanent stream
2	Alder Creek	2	target	BLM (Burns)	Harney	1,484	381841	4813121	11	marsh/wetland
3	Bear Creek	0	target	USFS (Malheur NF)	Grant	1,528	399121	4890532	11	permanent stream
4	Bendire Creek	1	target	BLM (Vale)	Malheur	1,227	412757	4874599	11	intermittent stream
5	Bendire Creek Slough	0	target	BLM (Vale)	Malheur	1,147	411433	4870269	11	permanent stream
6	Big Trout Creek[1]	1	target	BLM (Burns)	Harney	2,351	396625	4652184	11	permanent stream
7	Bridge Creek	0	target	USFWS (Malheur NWR)	Harney	1,275	348098	4745482	11	intermittent stream
8	Butte Creek	0	target	BLM (Vale)	Malheur	1,210	441383	4816893	11	intermittent stream
9	Calf Creek	0	target	BLM (Vale)	Malheur	902	421063	4849982	11	permanent stream
10	Camp Creek	2	target	BLM (Burns)	Harney	1,557	385724	4769565	11	permanent stream
11	Castro Springs Reservoir	0	target	BLM (Vale)	Malheur	1,460	488979	4734710	11	lake
12	Claw Creek	1	target	BLM (Burns)	Harney	1,474	296333	4849239	11	intermittent stream
13	Coburn Creek	0	target	BLM (Vale)	Malheur	1,457	492374	4732208	11	permanent stream
14	Crane Creek	0	target	BLM (Burns)	Harney	1,608	379061	4818722	11	intermittent stream
15	Dry Creek	0	target	State of Oregon	Malheur	1,218	443708	4817964	11	permanent stream
16	Dry Creek – below Indian Trails	0	target	BLM (Vale)	Malheur	1,111	449592	4816799	11	permanent stream
17	Dry Creek – Hurley Flat	0	target	BLM (Vale)	Malheur	1,097	454385	4819448	11	intermittent stream

Site No.	Site name	Number of Alternate sites	Survey type	Target site ownership	County	**Elevation**	UTM East	UTM North	UTM zone	Site type
18	Dry Creek – Hurley Flat Incidental	0	incidental	BLM (Vale)	Malheur	1,110	454343	4820290	11	cattle trough
19	Dry Creek – King Brown Cabin	0	target	BLM (Vale)	Malheur	1,214	440678	4817220	11	intermittent stream
20	Fish Lake and Slough	3	target	State of Oregon	Harney	2,247	365218	4733049	11	lake
21	Grove Creek	0	target	BLM (Burns)	Harney	2,203	362756	4730986	11	permanent stream
22	Hog Creek [1]	0	target	BLM (Vale)	Malheur	911	439255	4850855	11	permanent stream
23	Kingsbury Gulch	0	target	BLM (Vale)	Malheur	1,007	405768	4847219	11	intermittent stream
24	Lily Lake	2	target	BLM (Burns)	Harney	2,214	363750	4733885	11	pond
25	Little Fish Creek	1	target	BLM (Burns)	Harney	2,143	362907	4729704	11	intermittent stream
26	Little Malheur River	0	target	USFS (Malheur NF)	Grant	1,468	399777	4899217	11	permanent stream
27	McCoy Creek Incidental	0	incidental	BLM (Burns)	Harney	2,220	365713	4735413	11	pond
28	McCoy Creek Meadow	3	target	BLM (Burns)	Harney	2,062	366771	4735384	11	marsh/wetland
29	McCoy Creek Upper	2	target	BLM (Burns)	Harney	2,164	367094	4732861	11	permanent stream
30	Mud Creek	1	target	USFWS (Malheur NWR)	Harney	1,280	348306	4744549	11	permanent stream
31	Nicoll Creek	0	target	BLM (Burns)	Harney	1,359	284209	4840414	11	permanent stream
32	Page Springs	0	target	BLM (Burns)	Harney	1,292	347258	4741191	11	intermittent stream
33	Parsnip Creek	0	target	BLM (Lakeview)	Lake	1,626	743605	4677945	10	permanent stream
34	Rail Canyon 1	1	target	BLM (Vale)	Malheur	1,390	418692	4889554	11	permanent stream
35	Rail Canyon 4	2	target	BLM (Vale)	Malheur	1,460	417613	4891427	11	intermittent stream
36	Rattlesnake Creek	1	target	BLM (Burns)	Harney	1,402	354884	4842465	11	permanent stream
37	Rough Creek	0	target	BLM (Burns)	Harney	1,380	285914	4841598	11	permanent stream
38	SF Malheur near Crane Creek Confluence	0	target	BLM (Burns)	Harney	1,119	395993	4801940	11	permanent stream

Site No.	Site name	Number of Alternate sites	Survey type	Target site ownership	County	**Elevation**	UTM East	UTM North	UTM zone	Site type
39	SF Squaw Creek	1	target	BLM (Vale)	Malheur	958	441461	4841637	11	intermittent stream
40	Silver Creek 4150 bridge	0	target	BLM (Burns)	Harney	1,363	287570	4842115	11	permanent stream
41	Silver Creek Incidental	0	incidental	USFS (Ochoco NF)	Harney	1,514	284253	4863327	11	permanent stream
42	Silver Creek Lower MNWR	2	target	USFWS (Malheur NWR)	Harney	1,252	317583	4794355	11	permanent stream
43	Silver Creek RNA	0	target	BLM (Burns)	Harney	1,382	288643	4846768	11	permanent stream
44	Skull Creek	0	target	BLM (Vale)	Malheur	1,301	435535	4816569	11	intermittent stream
45	Willow Creek Reservoir [1]	0	target	BLM (Vale)	Malheur	1,472	487563	4737015	11	lake

[1]These are sites for which we have concerns about the validity of the original *R. luteiventris* records or the location of our survey relative to the historical record.

Table 2. Summary of *Rana luteiventris* detections for Target and Incidental sites, southeastern Oregon, 2009.

[Site No.: Site locations are shown in figure 1. Target site ownership: BLM, Bureau of Land Management; USFS, U.S. Forest Service; USFWS, U.S. Fish and Wildlife Service; NWR, National Wildlife Refuge; NF, National Forest; parenthetical text refers to the BLM district, national forest, or national wildlife refuge in which the site is located]

					Number of *Rana luteiventris* found[1]			
Site No.	Site name	No. of Alternate sites	Survey type	Target site ownership	Adults	Juveniles	Larvae/ metamorphs	Notes
1	00 Spring	1	target	USFWS (Malheur NWR)	0	0	0	More surveys warranted
2	Alder Creek	2	target	BLM (Burns)	1	0	1	
3	Bear Creek	0	target	USFS (Malheur NF)	18	12	1	Heavy grazing
4	Bendire Creek	1	target	BLM (Vale)	0	0	0	30 frogs here in 1994
5	Bendire Creek Slough	0	target	BLM (Vale)	0	1	0	
6	Big Trout Creek[2]	1	target	BLM (Burns)	0	0	0	
7	Bridge Creek	0	target	USFWS (Malheur NWR)	4	2	0	
8	Butte Creek	0	target	BLM (Vale)	1	8	0	
9	Calf Creek	0	target	BLM (Vale)	21	1	2	
10	Camp Creek	2	target	BLM (Burns)	0	0	0	
11	Castro Springs Reservoir	0	target	BLM (Vale)	3	32	0	Appears isolated
12	Claw Creek	1	target	BLM (Burns)	3	2	0	
13	Coburn Creek	0	target	BLM (Vale)	6	14	0	
14	Crane Creek	0	target	BLM (Burns)	0	0	0	
15	Dry Creek	0	target	State of Oregon	13	138	0	
16	Dry Creek – below Indian Trails	0	target	BLM (Vale)	4	50	0	
17	Dry Creek – Hurley Flat	0	target	BLM (Vale)	0	0	0	Dry
18	Dry Creek – Hurley Flat Incidental	0	incidental	BLM (Vale)	0	0	0	
19	Dry Creek – King Brown Cabin	0	target	BLM (Vale)	7+	63+	0	

Site No.	Site name	No. of Alternate sites	Survey type	Target site ownership	Number of *Rana luteiventris* found[1] Adults	Juveniles	Larvae/ metamorphs	Notes
20	Fish Lake and Slough	3	target	State of Oregon	0	0	0	Many historical records, heavy recreation, fish
21	Grove Creek	0	target	BLM (Burns)	2	0	0	
22	Hog Creek[2]	0	target	BLM (Vale)	0	0	0	
23	Kingsbury Gulch	0	target	BLM (Vale)	1	1	0	
24	Lily Lake	2	target	BLM (Burns)	3	0	0	Frogs 1 km from target site
25	Little Fish Creek	1	target	BLM (Burns)	2	0	~100	Active beaver
26	Little Malheur River	0	target	USFS (Malheur NF)	10	0	0	
27	McCoy Creek Incidental	0	incidental	BLM (Burns)	0	0	0	
28	McCoy Creek Meadow	3	target	BLM (Burns)	0	0	0	Historical breeding
29	McCoy Creek Upper	2	target	BLM (Burns)	0	0	0	Loss of beaver
30	Mud Creek	1	target	USFWS (Malheur NWR)	1	1	1	
31	Nicoll Creek	0	target	BLM (Burns)	13	3	1	
32	Page Springs	0	target	BLM (Burns)	1	4	0	
33	Parsnip Creek	0	target	BLM (Lakeview)	2	5	0	
34	Rail Canyon 1	1	target	BLM (Vale)	0	0	0	Historical breeding, Loss of beaver
35	Rail Canyon 4	2	target	BLM (Vale)	0	0	0	
36	Rattlesnake Creek	1	target	BLM (Burns)	0	0	0	
37	Rough Creek	0	target	BLM (Burns)	2	0	0	
38	SF Malheur near Crane Creek Confluence	0	target	BLM (Burns)	1	0	0	
39	SF Squaw Creek	1	target	BLM (Vale)	0	0	0	Target reach dry
40	Silver Creek 4150 bridge	0	target	BLM (Burns)	8	0	0	
41	Silver Creek Incidental	0	incidental	USFS (Ochoco NF)	7	7	~50	
42	Silver Creek Lower MNWR	2	target	USFWS (Malheur NWR)	0	0	0	

					Number of *Rana luteiventris* found[1]			
Site No.	Site name	No. of Alternate sites	Survey type	Target site ownership	Adults	Juveniles	Larvae/ metamorphs	Notes
43	Silver Creek RNA	0	target	BLM (Burns)	8	20	1	Active beaver
44	Skull Creek	0	target	BLM (Vale)	21	0	0	
45	Willow Creek Reservoir[2]	0	target	BLM (Vale)	0	0	0	Target inaccessible

[1]Numbers include animals found at both the Target and any Alternate sites surveyed.

[2]These are sites for which we have concerns about the validity of the original *R. luteiventris* records or the location of our survey relative to the historical record.

Table 3. Detections of *Rana luteiventris* by habitat type for Target and Incidental sites in southeastern Oregon, 2009.

[See text for definitions of habitat types]

Habitat type	Detected	Not detected	Total
Target sites			
Permanent stream	15	8	23
Intermittent stream	8	5	13
Lake/reservoir	1	2	3
Pond/wetland	1	2	3
Total	25	17	42
Incidental sites			
Permanent stream	1	0	1
Intermittent stream	0	0	0
Lake/reservoir	0	0	0
Pond/wetland	0	2	2
Total	1	2	3

Appendix A. Descriptions of Target, Alternate, and Incidental Surveys

The following descriptions include survey results and other notes from field visits for each Target, Alternate, and Incidental site. Site numbers correspond to those in tables 1 and 2 and figures 1–5.

1. 00 Spring

Site information: USFWS, Malheur National Wildlife Refuge, Harney County, OR; elevation 1,257 m.

Historical Records:

1. 6/29/1939, 1 adult, 3 juvenile, 16 larval *R. luteiventris* collected by R.R. and R.G. Miller (UMMZ # 0 86099).
2. 08/17/1993, 30 adult *R. luteiventris* (observer = Bowers; source = G. Keister, ODFW).

Survey Results: Target and Alternate sites were surveyed on 6/15/09. No *R. luteiventris* were detected at Target or Alternate sites.

We surveyed approximately 500 m along the Target site, which was characterized as a permanent stream impounded with a gravel road and culvert. Riparian vegetation was characterized as willow/deciduous shrub. No livestock was observed during survey. There was no evidence of beaver activity. Fish and crayfish were observed.

We scored habitat variables on nine paired plots; data were not collected from one of the terrestrial plots due to exceedingly dense vegetation. Bank height averaged 0.75 ± 0.17 m (mean ± standard deviation) (range 0.5-1 m). Cow pats were found on three of eight terrestrial plots (averaged 0.4 ± 0.5, range 0-1 per plot). Disturbance on terrestrial plots was of past fire (three plots). Vegetation cover on aquatic plots averaged 23.9 ± 29.9 percent (range 5-100 percent). Wetted width averaged 43.3 ± 24.5 m (range 20-80 m). Maximum water depths on aquatic plots averaged 0.6 ± 0.2 m (0.35-0.8 m). Dominant substrate on eight of nine aquatic plots was silt.

<u>00 Spring, Alternate 1</u>: Alternate site is associated with Barnyard Spring, and is located ca. 1 km southeast of the Target site. The site was an impounded wetland, with exposed mud flats and limited riparian vegetation outside of the area inundated at the time of survey. We did not take pH measurements on site, but the crew wondered whether the site could be saline or alkaline, based on the exposed flats and lack of vegetation. Site was within 50 m of gravel road; no livestock were observed. No *R. luteiventris* found.

Remarks: Target site and surroundings supported dense local stands of bulrush (*Scirpus*). This may have reduced efficiency of visual encounter surveys. There was extensive potential habitat around the Target site that we did not survey; the low topographic relief in this area suggests that the amount and type of wetland habitat may vary significantly with water year.

Because of the extensive habitat in the area, the limited scope of our survey, and the potential difficulties with frog detection in habitats like this, with dense vegetation and deep water, we are hesitant to conclude that this site is unoccupied by *R. luteiventris*. We recommend additional surveys in this area, and inspections for egg masses may be particularly helpful since they precede most vegetation growth.

2. Alder Creek

Site information: Bureau of Land Management (BLM), Burns Resource Area, Harney County, OR, elevation 1,484 m.

Historical Records:

1. 7/31/2004, 1 adult *R. luteiventris* observed at north end of meadow (Smyth, 2004).
2. 8/2/2007, *R. luteiventris* (no count or life stage data) by ODFW fisheries survey (Bangs and Jones, 2009)

Survey Results: Target and Alternate sites were surveyed on 6/27/09. We found 1 *R. luteiventris* tadpole in the target reach of Alder Creek, near an old beaver dam. We found 1 adult female *R. luteiventris* in Alternate 2 (downstream of Target).

Target site was marsh/wetland in a broad floodplain (up to 150 m). Main riparian vegetation was willow/deciduous shrub, and mostly very shallow water (less than 5 cm). Some water impounded behind each of several old beaver dams, but no evidence of current or recent beaver activity was recorded. Livestock (1-5) were observed in the area. No roads were recorded within 0.5 km of site.

We scored habitat variables on three paired plots. Bank heights averaged 0.03 ± 0.06 m (range 0-0.1 m). We recorded no cow pats or disturbance of soil or vegetation on terrestrial plots. Aquatic plots had high coverage of vegetation (average 93.3 ± 11.5 percent; range 80-100 percent). Sedges were the dominant plant on all aquatic plots. Wetted width averaged 2.2 ± 2.2 m (range 0.25-4.5 m). Maximum depth on aquatic plots averaged 0.3 ± 0.2 (range 0.18-0.6 m). Silt was the dominant substrate on all aquatic plots.

Alder Creek Alternate 1: This is the reach of Alder Creek immediately upstream of the Target reach. Habitat was characterized as a narrow intermittent stream (ca. 1-m wide). No evidence of beaver or impounded water reported. Primary riparian vegetation was willow/deciduous shrub. 1-5 livestock observed in area. No roads were recorded within 0.5 km of site. We found no *R. luteiventris*.

Alder Creek Alternate 2: This is the reach of Alder Creek immediately downstream of the Target reach. Habitat was characterized as a narrow permanent stream (ca. 1-m wide). Proximal vegetation was sage. No evidence of beaver or impounded water reported in this reach. 1-5 livestock observed in area. No roads were recorded within 0.5 km of site. We found one adult female *R. luteiventris* (79 mm, 38.6 g) at the site.

Remarks: Our single day survey indicates that there was a small population breeding in the area in 2009. We conducted surveys of alternate sections of the creek because we had time and found only one animal during Target survey.

3. Bear Creek

Site information: USDA Forest Service (Malheur National Forest), Grant County, OR, elevation 1,528 m.

Historical Records:

8/9/2007, *R. luteiventris* (no data on numbers or life stages) detected by ODFW fisheries survey crew (Bangs and Jones, 2009)

Survey Results: Target site surveyed on 7/21/09; we found 18 adult, 12 juvenile, and 1 larval *R. luteiventris*.

Target site was permanent stream (average 2 m width). Riparian vegetation was mainly sage; upland vegetation was mainly Ponderosa pine. No livestock were seen during survey. Target reach was less than 50 m from a dirt road. There were six small log dams in the survey reach, each of which impounded a very small amount of creek. We found no evidence of beaver activity. We did observe fish and garter snakes on the Target reach.

We scored habitat variables on seven paired plots. Bank height averaged 1.2 ± 1.4 m (range 0.2-4 m). Cow pats were present on all seven plots (average 4.3 ± 3.0; range 1-10 per plot). We noted evidence of terrestrial substrate disturbance on four of seven plots (2 trampling, 1 flooding, 1 tire track). Vegetation coverage on aquatic plots averaged 37.9 ± 24.8 percent (range 20-75 percent). Sedges were the dominant cover in six of seven aquatic plots. Wetted width of stream averaged 5.0 ± 4.7 m (range 1.5-15 m). Maximum depth on aquatic plots averaged 0.4 ± 0.1 m (range 0.2-0.6 m). We encountered *R. luteiventris* in two of seven plots.

Remarks: We found *R. luteiventris* relatively evenly spread across the whole survey reach. The abundance of adults and presence of all life stages suggest a relatively robust local population of breeding *R. luteiventris* in 2009. Most of these juvenile frogs were recently transformed.

4. Bendire Creek

Site information: BLM Vale Resource Area, Malheur County, OR, elevation 1,227 m.

Historical Records:

1. 9/1/1994, 15 adult, 8 subadult, and 7 *R. luteiventris* with no stage specified (C. Tait)
2. 7/2/2008, 2 adult male *R. luteiventris* (Funk and others, 2008; USGS unpublished)

Survey Results: Target site and Alternate sites were surveyed on 7/25/09; we found no *R. luteiventris* at Target or Alternate sites.

Habitat was characterized as intermittent stream with cobble and gravel substrate and no impoundments in survey reach. Riparian vegetation was dominated by grasses; upland vegetation was mainly sage. No livestock were seen during survey. The Target reach was within 50 m of a dirt road, which crosses the stream within the survey reach. We saw no evidence of beaver activity in Target reach. Habitat upstream of the survey reach was mostly dry creek bed, with no impoundments or signs of beaver activity.

We scored habitat variables on nine paired plots. Bank height averaged 1.2 ± 1.1 m (range 0.2-4 m). Cow pats were present on all plots (average 6.2 ± 3.8, range 1-13 per plot). Six of nine (66 percent) terrestrial plots had some disturbance, including livestock trampling (3 plots) and flooding (2 plots). Vegetation cover on aquatic plots averaged 37.8 ± 24.9 percent (range 20-100 percent). Sedges were the most common dominant plant (5 plots). Wetted width averaged 1.6 ± 0.5 m (range 0.45-2.3 m). Maximum depths on aquatic plots averaged 0.2 ± 0.1 m (range 0.07-0.28 m). Cobble was the dominant substrate in eight aquatic plots. We found Pacific treefrog (*Pseudacris regilla*) tadpoles (n = 25) and juveniles (~ 25 individuals) in the survey reach. Garter snakes and trout were also seen.

Bendire Creek Alternate 1: We surveyed about 750 m of Bendire Creek immediately downstream of the Target reach. Habitat was characterized as a narrow permanent stream (ca. 1 m wide). The narrow band of riparian vegetation was mainly grass (Poaceae). Upland vegetation was mainly sage. This reach had no impoundments. No roads were recorded within 0.5 km of site. We did not detect livestock or evidence of beaver during the survey. No *R. luteiventris* were found. Pacific treefrogs (*Pseudacris regilla*) were common (~25 each of metamorphic and juvenile stages). We found one garter snake and one gopher snake.

Remarks: There is an additional record of *R. luteiventris* from ca. 3 km east of Bendire Creek near Wilson Spring (C. Tait, 9/1/1994; no life stage specified). That site is associated with Willow Creek, a tributary of Bendire Creek, and was described as "shallow, degraded creek with thick algal mats, no riparian vegetation". The Target reach on Bendire Creek is approximately 5 km north and upstream of the 'Bendire Creek Slough' Target site. Murphy Reservoir occupies approximately 1.2 km of the creek valley between the two Target sites.

5. Bendire Creek Slough

Site information: BLM Vale Resource Area, Malheur County, OR, elevation 1,147 m.

Historical Records:

6/22/1995, 3 juvenile, 3 subadult *R. luteiventris* (C. Tait, L. Hatley).

Survey Results: Target site surveyed on 7/25/09. We found 1 juvenile *R. luteiventris* (38 mm, 4.7 g).

The Target site was specifically identified as the slough at the confluence of Bendire Creek and an unnamed tributary that enters from the west. The Target slough itself was dry. We surveyed approximately 450 m of Bendire Creek (average width 1.5 m) around the location of the slough, but could not get past a rock slide. Riparian vegetation was mainly deciduous shrubs (alder); upland vegetation is mainly sage. We found no impoundments or roads within 50 m of the Target site. No livestock seen during survey.

We scored habitat variables on eight paired plots. Bank height averaged 3.8 ± 3.5 m (range 1-12 m). Cow pats were found on seven plots (average 0.6 ± 1.1 per plot; range 0-3). Evidence of disturbance was noted on three of eight terrestrial plots. Vegetation coverage on aquatic plots averaged 20.6 ± 14.5 percent (range 5-50 percent of plot). Dominant vegetation types were sedges (4 plots) and grasses (3 plots). Wetted width averaged 5.2 ± 3.3 m (range 2-12 m). Maximum depth on aquatic plots averaged 0.6 ± 0.2 m (range 0.2-0.9 m). Cobble was the dominant substrate on seven of eight aquatic plots.

Remarks: This site is south and downstream of the Bendire Creek Target site by approximately 5 km. Murphy Reservoir is ca. 1 km upstream of Target reach. USGS surveys of this area in 2002 and 2003 did not detect *R. luteiventris* (Wente and others, 2005; USGS unpublished). The low numbers of frogs encountered in this area in recent years suggest a low number of breeding adults or that frogs may be moving through this reach from breeding habitat further afield. Additional surveys are needed to identify potential breeding sites and to clarify status of *R. luteiventris* in the vicinity.

6. Big Trout Creek

Site information: BLM (Burns), Harney County, OR, elevation 2,351 m.

Historical Records:
Observation in BLM files from one year between 2003 and 2006**.**

Survey Results: Target and Alternate sites surveyed on 8/22/09. We found no *R. luteiventris.*

Target site is a permanent stream (average width 1 m), with relatively fast flow. Target bounded by private land at upper boundary. Riparian vegetation was mainly sedges; upland vegetation was mainly sage. We observed no impoundments or evidence of beaver activity. No livestock were observed. Target reach was within 50 m of a 2-track (ATV) dirt road. We observed garter snakes and trout in the survey reach. We were not able to assess upstream habitat due to private land.

We scored habitat variables on seven paired plots. Bank height averaged 0.8 ± 0.4 (range 0.4-1.5 m). Cow pats were found on all seven plots (average 3.6 ± 2.1, range 1-8 per plot). Evidence of disturbance was found on two terrestrial plots (tire tracks, grazing/flooding). Vegetation cover on aquatic plots was low (average 7.9 ± 5.7 percent, range 5- 20 percent); sedges were the dominant cover on six of seven plots. Wetted width of stream averaged 1.4 ± 0.9 m (range 0.5-3.1 m). Maximum depth on aquatic plots averaged 0.1 ± 0.1 m (range 0.04-0.15 m). Cobble was the dominant substrate on six plots.

Big Trout Creek Alternate 1: We surveyed ca. 750 m immediately downstream of the Target reach. Habitat was similar to Target reach – stream was permanent, shallow (ca 0.1 m), narrow (ca. 1 m), and cool (~ 18°C), with relatively fast moving water and cobble and boulder substrate. Many trout were present in this reach. There was little vegetation in water other than bases of sedges. We did not observe livestock, impoundments, or signs of beaver activity in this reach. There was a gravel road within 50 m of this reach near its downstream end. We found no *R. luteiventris*.

Remarks: The cold fast-flowing water, high trout density, and lack of warm, still, off-channel habitat makes this reach of Big Trout Creek unfavorable as breeding habitat for *R. luteiventris*. No photographs and few details were available on the historical observation, so it is difficult to confirm that the site was ever occupied by *R. luteiventris*. Biologist M. Obradovich (BLM) indicated this report was an anecdotal observation by a BLM employee before they started work with the agency. A follow-up visit by BLM in 2008 failed to find frogs or habitat that was particularly suitable for *R. luteiventris*.

7. Bridge Creek

Site information: USFWS (Malheur National Wildlife Refuge), Harney County, OR, elevation 1,275 m.

Historical Records:

a. 5/11/02, 1 adult *R. luteiventris* (Wente and others, 2005; USGS, unpublished);
b. 8/12/03, 2 adult, 5 larval *R. luteiventris* (Wente and others, 2005; USGS, unpublished).

Survey Results: Target site surveyed on 6/5/09. We found 4 adult and 2 juvenile *R. luteiventris*.

Target site was characterized as pools within an intermittent stream. Riparian vegetation was mainly deciduous shrub (willows); upland vegetation was mainly sage. No impoundments or livestock in reach during survey. A gravel road parallels the site immediately next to the site for the length of survey reach less than 25 m. There is a canal on other side of road. No evidence of beaver activity.

We scored habitat variables on six paired plots. Bank height averaged 1.1 ± 0.6 m (range 0.5-1.7 m). We found cow pats on one plot (average 0.3 ± 0.8, range 0-2 per plot). Disturbance noted on three terrestrial plots (associated with road or erosion). Vegetation coverage on aquatic plots averaged 55.0 ± 25.9 percent (range 20-90 percent); rushes (*Juncus* sp.) were the dominant plant on six of seven plots. Wetted width averaged 5.8 ± 2.3 m (range 2-7.5 m). Maximum depth averaged 0.3± 0.2 m (range 0.15-0.65 m). The dominant substrate on all six aquatic plots was silt.

Remarks: Air (14-17° C) and water (11-13° C) temperatures were low during our survey, so frog detectability was probably low. This site is within 1 km of Mud Creek (a Target site) and it is likely that *R. luteiventris* adults and juveniles can move within this complex (hydrologically connected, open flat topography, moist soil units). Bridge Creek, Mud Creek, and Page Springs may be the peripheral remnants of a much broader historical population along the western foot of Steens Mountain. Additional surveys in the habitats in between these three sites could improve our understanding of connectivity among them.

8. Butte Creek

Site information: BLM (Vale), Malheur County, OR, elevation 1,210 m.

Historical Records:
7/1/2003, 1 *R. luteiventris* (no life stage provided) (Dick Brainerd)

Survey Results: Target site surveyed on 8/7/09. We found 1 adult and 28 juvenile *R. luteiventris.*

Target site characterized as intermittent stream (average width 1.5 m); approximately 65 percent of Target reach had standing water. Butte Creek flows into Dry Creek near the bottom of the Target reach. Riparian vegetation was mainly grasses and sage; upland vegetation was mainly sage. No livestock in Target reach at time of survey, but evidence of past livestock on and upstream of the reach. We found no impoundments or evidence of beaver in the Target reach. There was a 2-track (ATV) dirt road within 50 m of much of the Target reach. There are mining claims upstream of survey reach where stream bed was completely dry. We observed fish in Target reach but were not able to identify them.

We scored habitat variables on five paired plots. Bank height averaged 0.4 ± 0.2 m (range 0.1-0.7 m). Cow pats (many fresh) were found on all five plots (average 14.4 ± 5.7, range 6-21 per plot). All five terrestrial plots showed grazing and trampling disturbance. Vegetation cover on aquatic plots averaged 51.0 ± 32.1 percent (range 10-85 percent); dominant taxa were algae (2 plots), duckweed (2 plots), and sedges (1 plot). Wetted width (water levels were high, perhaps due to recent rain) averaged 4.2 ±1.5 m (range 1.7-5.5 m). Maximum depth averaged 0.2 ± 0.1 m (range 0.13 –0.45 m). Dominant substrate on four aquatic plots was cobble. We encountered *R. luteiventris* in two plots.

Remarks: None

9. Calf Creek

Site information: BLM (Vale), Malheur County, OR, elevation 902 m

Historical Records:

1. 8/23/77, "Many" *R. luteiventris* recorded during BLM Fisheries Inventory (no counts or life stages provided);
2. 7/12/07, *R. luteiventris* detected (no counts or life stages) by ODFW fisheries survey (Bangs and Jones, 2009)

Survey Results: Target site surveyed on 7/9/09. We found 21 adult (12 female, 9 male), one metamorphic, and two larval *R. luteiventris*.

The Target site was a permanent stream (average width 1.5 m). Riparian vegetation was mainly deciduous shrub. Upland vegetation was mainly sage. We observed no impoundments or signs of beaver activity on Target reach. Livestock were not observed during the survey. Target reach was not within 50 m of road. Our visual inspection of the creek upstream of the Target reach did not reveal any impoundments or sign of beaver activity; the stream channel became a series of disconnected pools. We observed crayfish and Pacific treefrogs (*Pseudacris regilla;* 4 juvenile, 5 larval, 6 adult).

We scored habitat variables on nine paired plots. Bank height averaged 1.6 ± 0.8 m (range 0.25-3.0 m). We recorded cow pats on seven of nine plots (average 2.7 ± 2.3, range 0-6 per plot). Six terrestrial plots showed disturbance by grazing and/or livestock trampling. Vegetation cover on aquatic plots averaged 45.0 ± 32.0 percent (range 5-90 percent); horsetails (*Equisetum* sp.) were dominant on three plots. Wetted width averaged 4.4 ± 5.9 m (range 0.85-20 m). Maximum depth on aquatic plots averaged 0.3 ± 0.2 m (range 0.09- 0.6 m). Cobble was the dominant substrate size on seven of nine plots. We found *R. luteiventris* on two of nine plots.

Remarks: None.

10. Camp Creek

Site information: BLM (Burns), Harney County, OR, elevation 1,557 m

Historical Records:

7/9/2007, *R. luteiventris* (no counts or life stage data) detected during ODFW fisheries survey (Bangs and Jones, 2009).

Survey Results: Target and Alternate sites surveyed on 6/28/09. We found no *R. luteiventris.*

Target site was a permanent stream (average width 1 m). Riparian vegetation was mainly grasses; upland vegetation was mainly sage. No impoundments were found in the Target reach. We observed no livestock during our survey. The Target reach was within 50 m of a dirt road. We found no evidence of beaver activity. We found three larval and one adult *Pseudacris regilla* in the Target reach. The reach immediately upstream of Target was very shallow and rocky (see Alternate Site 1).

We scored habitat variables on six paired plots. Bank height averaged 1.2 ± 0.7 (range 0.5-2 m). Cow pats were detected on five plots (averaged 4.7 ± 5.8, range 0-13 per plot). Disturbance (soil trampling or grazing) was evident on five terrestrial plots. Vegetation cover on aquatic plots averaged 30.0 ± 20.0 percent (range 10-60 percent); algae scored as dominant cover on five of six plots. Wetted width averaged 1.7 ± 0.8 m (range 1-3 m). Maximum depth averaged 0.2 ± 0.1 m (range 0.15-0.23 m). Cobble was the dominant substrate on four of six aquatic plots. We encountered *P. regilla* on two plots.

Camp Creek Alternate 1: We surveyed approximately 330 m of Camp Creek immediately upstream of the Target reach. This reach appeared to have permanent water. Riparian vegetation was mainly grasses; upland vegetation was mainly juniper and sage. We found no impoundments or evidence of beaver activity. No livestock were observed. A dirt road was less than 50 m from this reach. We found no *R. luteiventris*.

Camp Creek Alternate 2: We surveyed approximately 430 m of Camp Creek immediately downstream of Target reach. This reach had permanent water. Riparian vegetation was mainly grasses; upland vegetation was mainly juniper and sage. We found no impoundments or evidence of beaver activity. No livestock were observed. A dirt road was less than 50 m from this reach. We found *P. regilla* throughout the shallow, slower parts of this reach. We found no *R. luteiventris*.

Remarks: We found very little slower, off-channel habitat in these sections of Camp Creek. This site was relatively isolated from our other historical records.

11. Castro Springs Reservoir

Site Information: BLM (Vale), Malheur County, OR, elevation 1,460 m.

Historical Records:

1. 8/15/1995, 2 adult, 1 subadult *R. luteiventris* (C. Tait, A. Bammann)
2. 9/5/1995, 16 adult and juvenile *R. luteiventris* (C. Tait, A. Bammann)
3. 5/8/1996, 7 egg masses and some larvae (C. Tait)
4. 9/06/2000, 2 adult, 10 juvenile *R. luteiventris* (C. Tait)
5. 9/06/2000, 2 adult, 18 juvenile *R. luteiventris* (Wente and others, 2005; USGS, unpubl.)
6. 10/25/2005, 1 adult, 5 metamorphic *R. luteiventris* (Adams and others, 2010)

Survey Results: Target site surveyed on 7/21/09. We found 3 adult and 31 juvenile *R. luteiventris*.

The Target site was a small reservoir (ca. 80 × 50 m). Riparian vegetation was deciduous shrub (willow); upland vegetation was mainly sage. No livestock were observed at the Target site, but several were nearby. The Target was less than 50 m from of a dirt 2-track ATV road. There was at least one pipe in the reservoir, which may feed water from the spring (C. Tait, pers. comm.). We saw no evidence of beaver activity. We found 9 *P. regilla*.

We scored habitat variables on eight paired plots. Bank height averaged 0.8 ± 0.4 m (range 0.5-1.5 m). We found cow pats on seven of eight plots (average 2.3 ± 2.3, range 0-7 per plot). Evidence of disturbance was found on seven of eight plots: most prominent were tire tracks (4 plots) and livestock grazing (3 plots). Vegetation coverage on aquatic plots averaged 83.1 ± 4.6 percent (range 80-90 percent); most frequently noted dominant plants were algae (4 plots) and cattail (3 plots). Maximum depth on all aquatic plots was 1.5 m, indicating consistently steep slope around the basin. The dominant substrate on all aquatic plots was silt.

Remarks: Castro Springs Reservoir, along with Coburn and Willow Creeks, is in the headwaters of Owyhee River basin in the far southeastern corner of Oregon. These sites are distant from the rest of our Target sites. Additional surveys can help clarify the level of isolation from other *R. luteiventris* populations. Rainbow trout were noted as present in surveys by BLM in 1995 and 1996; however, trout were not detected in several site inspections up until 2006 (C. Tait., pers. comm.).

12. Claw Creek

Site Information: BLM (Burns), USFS (Ochoco NF), Harney County, OR, elevation 1,474 m

Historical Records:
8/3/06, 2 *R. luteiventris* (no life stage data) (S. Dowlan, M. Obradovich)

Survey Results: Target and Alternate sites were surveyed on 9/02/09. We found a total of five *R. luteiventris* (3 adult, 1 juvenile, 1 metamorph).

Target site was a dry creek bed at time of survey. We surveyed about 520 m of channel and found no surface water. Riparian vegetation was mainly deciduous shrubs (willows). Upland vegetation was mainly juniper. The Target reach was less than 50 m from dirt road (2-track ATV). No livestock were seen during our survey, but there was evidence of heavy past use (trampling and pats). We did not score data for habitat plots at this site. We found no *R. luteiventris* on the Target reach.

Claw Creek Alternate 1: We surveyed approximately 400 m of Claw Creek immediately downstream of the Target reach. We estimated that 30 percent of that reach of creek bed had surface water. We noted no livestock or evidence of beaver. This reach was not within 50 m of any road. We found three large adult females, one juvenile, and one metamorphic *R. luteiventris*.

We scored habitat variables on five paired plots. Bank height averaged 0.8 ± 0.5 m (range 0.3-1.5 m). We found no cow pats on plots. The only signs of disturbance on the terrestrial plots were from flooding. Vegetation coverage on aquatic plots averaged 21.0 ± 8.9 percent (range 10-30 percent). Wetted width averaged 1.4 ± 0.8 m (range 0.6-2.6 m). Maximum depth on aquatic plots averaged 0.3 ± 0.2 m (range 0.1-0.5 m). Cobble was the dominant substrate on three of five aquatic plots. We encountered one *R. luteiventris* on one plot.

Remarks: Claw Creek is in the upper Silver Creek basin. It flows into Silver Creek near the "Silver Creek 4150 Bridge" Target site (#40).

13. Coburn Creek

Site Information: BLM (Vale), Malheur County, OR, elevation 1,457 m

Historical Records:

1. 05/28/1996, 1 subadult *R. luteiventris* (T. Koch)
2. 5/26/1999, 13 adult, 3 subadult, 20 juvenile *R. luteiventris;* tadpoles seen above the road (C. Tait)
3. Since 1999, two records in GeoBob database documented *R. luteiventris* breeding, but no counts or other specific data (C. Tait)

Survey Results: Target site surveyed on 7/21/09. We found six adult (4 females, 2 males) and 14 metamorphic and new juvenile *R. luteiventris*.

Most of the Target reach was sizeable stream (average width 1.75 m). Approximately 100 m of the creek within the 500-m survey reach lacked surface water. The Target reach had its upstream limit at a fence indicating private property. Riparian and upland vegetation were mainly sage. We did not observe livestock in survey reach but saw seven horses. No impoundments or evidence of beaver were seen in survey reach or immediately upstream. The Target reach was within 50 m of a 2-track ATV road.

We scored habitat variables on seven paired plots. Bank height averaged 1.1 ± 1.1 m (0.1-3.0 m). We found cow pats and grazing disturbance on five of seven terrestrial plots (average 4.3 ± 4.8 per plot, range 0-14). Vegetation coverage on aquatic plots averaged 68.6 ± 12.1 percent (range 60-90 percent); algae were the dominant coverage on four of seven aquatic plots. Wetted width averaged 2.6 ± 1.4 m (range 0.75-5.0 m). Maximum depth on aquatic plots averaged 0.3 ± 0.1 m (range 0.15-0.45 m). Dominant substrates at aquatic plots were a mix of cobble (2 plots), gravel (2 plots), silt (2 plots), and boulder (1 plot).

Remarks: None.

14. Crane Creek

Site Information: BLM (Burns), Harney County, OR, elevation 1,608 m

Historical Records:

6/27/2007, *R. luteiventris* detected during ODFW fisheries survey (Bangs and Jones, 2009). No counts or life stage data provided.

Survey Results: Target site surveyed on 6/25/09. We found no *R. luteiventris*.

We surveyed approximately 100 m along the Target reach (average width 2 m). This reach was intermittent stream, and had water over its whole length at the time of the survey. Riparian vegetation was mainly sage; upland vegetation was mainly juniper. We observed no impoundments and no evidence of beaver in Target reach, or in the reach immediately upstream of Target reach. We observed a few (1-5) livestock on Target reach during our survey. We observed significant trampling along the reach immediately upstream of the Target. A 2-track ATV road was present and located more than 50 m from the Target reach. More than 100 *P. regilla* larvae and greater than 25 garter snakes (*Thamnophis* sp) were observed on the Target reach.

We scored habitat variables on seven paired plots. Bank height averaged 0.8 ± 1.0 m (range 0.2-3.0 m). Trampling disturbance and cow pats were observed on all seven terrestrial plots (average pats 7.7 ± 3.4, range 3-11 per plot). Vegetation cover on aquatic plots averaged 60.0 ± 24.5 percent (range 20 -100 percent); rushes were noted as the dominant cover on all seven plots. Wetted width averaged 3.8 ± 1.5 m (range 2.2-6 m). Maximum depth on aquatic plots averaged 0.3 ± 0.2 m (range 0.1-0.65 m). Silt was the dominant substrate size on all aquatic plots.

Remarks: We found little slower, off-channel habitat that is preferred by *R. luteiventris* for breeding. This site was relatively isolated from our other historical records.

15. Dry Creek

Site Information: State-owned land, Malheur County, OR, elevation 1,218 m

Historical Records:
7/29/1976, 27 *R. luteiventris* recorded (no stage information) (C. Maser)

Survey Results: Target site surveyed on 8/5/09. We found 13 adult (6 females, 7 males) and 138 juvenile and recent metamorphic *R. luteiventris*.

We surveyed approximately 250 m of this permanent stream to the property line/fence. Riparian vegetation was mainly sage; upland vegetation was also mainly sage. We found no impoundments or sign of beaver activity in the Target reach. No roads were within 50 m of Target. No livestock were observed in Target reach, but livestock were present above the fence at the property line. Fish were observed in the creek. Habitat immediately above the fence appeared similar to Target reach (no impoundments or beaver sign observed).

We scored habitat variables on eight paired plots. Bank height averaged 0.8 ± 0.4 m (range 0.3-1.5 m). We found cow pats on seven of eight terrestrial plots (average 4.8 ± 3.3 per plot, range 0-10 per plot). Trampling of soil and vegetation was evident on seven of eight plots. Vegetation coverage on aquatic plots averaged 28.1 ± 14.4 percent (range 5-45 percent). Water parsley (*Oenanthe* sp.) was the dominant cover on four of eight plots. Cobble was the dominant substrate size on seven of eight aquatic plots. We encountered *R. luteiventris* on one plot.

Remarks: This reach of Dry Creek is roughly midway between our upper (Skull Creek) and lower (Hurley Flat) Target sites in the Dry Creek basin. This reach of Dry Creek has also been extensively surveyed in past by Janice Engle and as part of ongoing monitoring by the USFWS La Grande office (Meyer, 2009).

16. Dry Creek – below Indian Trails

Site Information: BLM (Vale), Malheur County, OR, elevation 1,111 m

Historical Records:
6/26/1996, one adult and many larval *R. luteiventris* (C. Tait)

Survey Results: Target site surveyed on 9/04/2009. We found four adult (3 female, 1 male) and 50 juvenile *R. luteiventris*.

Target reach was a permanent stream (average width 2 m). Riparian and upslope vegetation was mainly sage. We found no impoundments and no evidence of beaver activity on the Target reach. Cattle were present on the site and on the drive into the site. There was no road within 50 m of the Target reach. We saw no impoundments or evidence of beaver upstream of the survey reach.

We scored habitat variables on seven paired plots. Bank height averaged 0.7 ± 0.4 (range 0.3-1.3 m). Recent cow pats were found on all seven terrestrial plots (average 17.3 ± 8.8 per plot, range 6-30). All seven plots had evidence of vegetation grazing and soil trampling. Vegetation cover on aquatic plots averaged 54.3 ± 15.9 percent (range 30-75 percent); dominant taxa were unidentified submerged macrophytes and algae. Wetted width averaged 6.0 ± 3.8 m (range 3.4 -12 m). Maximum depth averaged 0.4 ± 0.4 m (range 0.1-1.3 m). Dominant substrate sizes on aquatic plots were silt (3 plots), cobble (3 plots), and gravel (1 plot).

Remarks: None

17. Dry Creek – Hurley Flat

Site information: BLM (Vale), Malheur County, OR; elevation 1,097 m

Historical Records:
6/26/1996, at least one juvenile and one adult *R. luteiventris* (C. Tait)

Survey results: Target and Incidental sites surveyed 9/3/09. No *R. luteiventris* found.

We surveyed the Target site of 500 m and extended this search to the 1000 m buffer. We found no surface water in this reach and did not characterize habitat variables on plots. There is a small area where water can be impounded by road crossing when the channel is flowing. Riparian and upslope vegetation is mainly sage. We saw no livestock during the survey. We found no evidence of beaver activity. This reach is within 50 m of a dirt two-track road.

The channel was dry immediately upstream of our survey reach. We found some standing water farther up the drainage, outside of the 1000 m buffer.

Remarks: This site was the lowest of the six areas we surveyed in the Dry Creek basin. This area is outside of the reach monitored by the USFWS La Grande office (Meyer, 2009).

18. Dry Creek – Hurley Flat Incidental

We conducted an Incidental survey at a pipe-fed cattle tank. It was less than 50 m from the dry stream bed and just beyond the terminus of the Target reach at Dry Creek – Hurley Flat. This pool was approximately 10 × 10 m surface area and had wetland vegetation. We did not find any *R. luteiventris* at this site, but did find approximately 10 Pacific treefrogs (*P. regilla*).

19. Dry Creek – King Brown Cabin

Site Information: BLM (Vale), state-owned land, Malheur County, OR, elevation 1,214 m

Historical record:
4/30/1996, 10 *R. luteiventris* (no stage given) (C. Tait, B. Olson)

Survey results: Target site surveyed 8/7/2009. We found 7 adult and 63 juvenile *R. luteiventris* in first 20 minutes of survey; frogs were found after that but were not tallied**.**

This reach of Dry Creek was characterized as intermittent with pools (average width 2 m). Riparian and upslope vegetation were mainly sage. We found no impoundments and no evidence of beaver activity. No livestock were observed. This reach was within 50 m of a dirt road. Water was present above the Target reach. We found evidence of substantial grazing of the Target survey reach. No impoundments or evidence of beaver were found upstream of the Target reach.

We scored habitat variables on six paired plots. Bank height averaged 0.9 ± 0.5 m (range 0.1 -1.5 m). We found cow pats on all plots (average 6.3 ± 2.8 per plot; range 3-10), and fresh pats on three plots. There was evidence of disturbance on all terrestrial plots (vegetation was grazed on all six plots; livestock trampling was found on three plots). On five aquatic plots (1 was dry), vegetation coverage averaged 53.0 ± 28.4 percent (range 25-90 percent). Dominant vegetation types were a mix of algae, bur reed (*Sparganium* sp.), and sedges (*Carex* sp.). Wetted width averaged 3.6 ± 2.3 m (range 0-5.5 m). Maximum depth on aquatic plots averaged 0.4 ± 0.4 m (range 0-0.37 m). Dominant substrate sizes on aquatic plots were gravel (2 plots), cobble (2 plots), and silt (1 plot). We encountered *R. luteiventris* on one plot.

Remarks: The Dry Creek - King Brown Cabin site is approximately 1 km upstream of the Target site near the confluence of Butte Creek and Dry Creek. Our Dry Creek - King Brown Cabin Target reach represents the upstream terminus of the reaches monitored by USFWS La Grande (Meyer, 2009).

20. Fish Lake and Slough

Site Information: State-owned land, Harney County, OR, elevation 2,247.

Historical record:

1. 6/30/47, *R. luteiventris* specimen in OSU Collection (Acc. # 849; collector R.M. Yancey)
2. 6/27/2000, 2 adult, 12 larval *R. luteiventris* from Fish Lake (Wente and others, 2005; USGS, unpubl.)
3. 8/8/2000, 16 juvenile *R. luteiventris* from Fish Lake (Wente and others, 2005; USGS, unpubl.)
4. 7/7/01, 27 larval *R. luteiventris* from Fish Lake (Wente and others, 2005; USGS, unpubl.)
5. 8/5/01, 4 juvenile, 2 adult, 11 larval *R. luteiventris* from "Fish Lake Slough", noted as 50 × 10 m at time of survey (Wente and others, 2005; USGS, unpubl)
6. 6/18/02, 16 larval *R. luteiventris* from "SW corner of Fish Lake" (Wente and others, 2005; USGS, unpubl.)
7. 8/11/03, 3 adult *R. luteiventris* (2 in marshy inflow; 1 on lake near the side channel [=slough]) (Wente and others, 2005; USGS, unpubl).
8. 7/7/04, No *R. luteiventris* found (Smyth, 2004)

Survey results: Target and Alternate sites surveyed 6/10/09 and 8/18/09. We found no *R. luteiventris* across all sites and visits.

We surveyed the entire perimeter of this small lake on both visits. The 'slough' is a small marshy area on the south side of the lake where an island separates the marsh from open water of the lake. The first visit was during cool early season conditions. Riparian vegetation was mainly deciduous shrub; upland vegetation was mainly aspen. We found no impoundments associated with the lake, and saw no livestock during either survey. The site is within 50 m of a gravel road. Beaver sign was present on the south side of lake (lodge, many chewed trees, slides, cuttings). Evidence of recreational use (camping, fishing) was widespread. We found multiple dead fish along the bank and trash scattered in the water. Fish were seen throughout the site.

We scored habitat variables on nine paired plots during the August survey. Bank height averaged 2.0 ± 1.1 m (0.5-3 m). We did not find cow pats on any plots. We found evidence of disturbance on eight of ten plots: disturbances were human trail (6 plots), erosion (2 plots), and campsite (1 plot). Vegetation coverage on aquatic plots averaged 28.3 ± 28.6 percent (range 5-90 percent); sedges were the dominant cover type on eight plots. Maximum depth on aquatic plots averaged 0.6 ± 0.1 m (range 0.4-0.75 m). Dominant Substrates on aquatic plots were silt (6 plots) and cobble (3 plots).

Fish Lake and Slough Alternate 1: This Alternate survey included the remainder of Fish Lake that was not in Target survey of the slough area. Similar to the Target area, riparian vegetation was mainly deciduous shrub (willow) and upland vegetation was mainly aspen. We observed no livestock. There was infrequent evidence of beaver activity around the lake (a few chewed trees) and an active dam/pond complex was present upstream (Alternate 2). The campground and road crossing/culvert are upstream of the beaver impoundment. We found significant amounts of trash in and around this lake. We also observed live trout as well as several dead fish. We did not find *R. luteiventris*.

Fish Lake and Slough Alternate 2: This Alternate survey started at the confluence of the inflow stream of Fish Lake and extended upstream through the beaver complex approximately 700 m to near its spring origin. As noted above, the stream flows through campground and road/culvert. The beaver complex had active lodge, slides, and recently chewed trees. We did not find *R. luteiventris.*

Fish Lake and Slough Alternate 3: We surveyed approximately 500 m (June) and 414 m (August) of the permanent stream that flows out of Fish Lake. Its average width was ca. 2 m in June and 0.5 m in August. The stream was rocky with fast current, and was braided in some areas. We found no impoundments on the stream below the culvert/road crossing at its egress from Fish Lake. Riparian vegetation was mainly deciduous shrub (willow); upland vegetation was mix of sage and aspen. This reach was within 50 m of a gravel road (upper end of survey reach). We found no evidence of beaver activity in either survey. We did not find *R. luteiventris*.

Remarks: Multiple observations confirm the historical presence of breeding *R. luteiventris* in the Fish Lake complex. Surveys consistently detected *R. luteiventris* between 2000 and 2003. A survey in summer 2004 failed to detect *R. luteiventris* (Smyth, 2004), and none of our 2009 surveys revealed any life stages of *R. luteiventris*. Fish Lake gets intensive recreational use and has stocked trout, which are implicated in reduced *R. luteiventris* in other portions of its range (Pilliod and Peterson, 2001; Bull and Marx, 2002). Further surveys should be conducted to determine whether Fish Lake has lost its breeding population; expanded surveys around the area would be helpful toward evaluating potential for recolonization from other sites. The nearest frogs we found were on Lake Creek (see Lily Lake Alternate site) and it was unclear whether any breeding was present.

21. Grove Creek

Site Information: BLM (Burns), Harney County, OR, elevation 2,203 m

Historical record:
6/28/2001, 2 adult *R. luteiventris* (Smyth, 2001)

Survey results: Target surveyed on 8/21/09. We found 2 adult *R. luteiventris*.

Target reach included permanent water in Grove Creek, as well as multiple braided channels that appeared to hold water only during high flows. The main creek averaged 1-m wide. Riparian vegetation was mainly deciduous shrub (willow); upland vegetation was mainly aspen. We found no impoundments or livestock in the Target reach. There were no roads within 50 m of Target reach. We found no sign of beaver activity. The Target was difficult to survey due to thick willow cover. Note that we did not detect any *R. luteiventris* on the first pass, but found two adults on a second pass near starting point.

We scored habitat variables on seven terrestrial and six aquatic plots (one aquatic plot was inaccessible due to dense willows; the channel was dry at that point). Bank height averaged 0.6 ± 0.4 m (range 0.2-1.5 m). We found no cow pats or signs of grazing disturbance. There were signs of past flooding on three terrestrial plots. Vegetation coverage on aquatic plots averaged 59.2 ± 27.5 percent (range 10-80 percent). Wetted width of the main channel averaged 1.8 ± 0.7 m (range 0.7-2.6 m). Maximum depth on aquatic plots averaged 0.1 ± 0.0 m (range 0.05-0.16 m). Silt was the dominant substrate on five of the six aquatic plots.

Remarks: Both our 2009 survey and the 2001 survey by Smyth (2001) found small numbers of adult frogs. This is a spring-fed system and water temperatures were cool even in late August (10-12° C in morning). Parts of the creek were heavily shaded with willow. Our survey did not find obvious still water breeding habitat on Grove Creek. Our 1-km buffer centered on Grove Creek includes a reach of Little Fish Creek. That site historically and in 2009 supported breeding *R. luteiventris* in a beaver complex. Given their proximity and fact that Grove Creek flows into Little Fish Creek less than 1 km downstream, adults on Grove Creek could be from the Little Fish Creek breeding site. We recommend surveying the lower reach of Grove Creek below our Target site and the reach of Little Fish Creek around and upstream of the confluence with Grove Creek to identify extant or potential *R. luteiventris* breeding habitat.

22. Hog Creek

Site Information: BLM (Vale), Malheur County, OR, elevation 911 m

Historical record:

10/4/77, "many spotted frogs" (M. Crouse, observer; Fisheries Inventory). Record notes "some potential for misID" (C. Tait).

Survey results: Target site surveyed on 7/8/09. We found no *R. luteiventris*.

We surveyed approximately 500 m on this stream (average width 1.5 m). The immediate survey area appeared permanent, but areas upstream and downstream of the Target reach were at least partially intermittent. Riparian vegetation was mainly deciduous shrub (willow); upland vegetation was mainly sage. We found no impoundments, livestock, or signs of beaver activity in the Target reach. There was no road within 50 m of Target reach. Many rainbow trout were seen in the Target reach. We found no impoundments or beaver sign upstream of the Target reach.

We scored habitat variables on nine paired plots. Bank height averaged 3.9 ± 2.4 m (range 1-7 m). We found one cow pat on one plot. The only evidence of ground disturbance on terrestrial plots was past flooding (6 plots). Vegetation coverage on aquatic plots averaged 15.4 ± 12.2 percent (range 2-30 percent). Dominant plants were cattail (*Typha* sp), sedges (*Carex* sp.), dock (*Rumex* sp.), and duckweed. Maximum depth on aquatic plots averaged 0.4 ± 0.3 m (range 0.15-0.95 m). Cobble was the dominant substrate size on eight of nine plots.

Remarks: Hog Creek was in the GeoBob database but our later conversations with Dr. Cynthia Tait lead us to consider the original identification of *R. luteiventris* doubtful or erroneous. Dr. Tait questioned the 1977 observer, Mike Crouse, and came away moderately to highly confident that these were adult Pacific treefrogs (*P. regilla*) (C. Tait, pers. comm., 2010). She also noted that Hog Creek at that time did not appear to be suitable habitat for *R. luteiventris*. Our survey was limited in scope and we did not survey alternate sites associated with Hog Creek.

23. Kingsbury Gulch

Site Information: BLM (Vale), Malheur County, OR, elevation 1,007 m

Historical record:

1. 6/18/2001, 2 juvenile, 11 adult *R. luteiventris* (USGS, unpublished)
2. 10/30/2001, 3 *R. luteiventris*, no life stage information (A. Bammann)
3. 5/16-17/2002, 58 adult, 2 larval *R. luteiventris* (USGS, unpubl.)
4. 6/19, 21/2002, 61 adult, 5 larval *R. luteiventris* (USGS, unpubl.)
5. 7/23/2002, 60 adult *R. luteiventris* (USGS, unpubl.)
6. 8/19/2002, 44 adult *R. luteiventris* (USGS, unpubl.)
7. 4/23/2003, 38 adult *R. luteiventris* (USGS, unpubl.)
8. 9/10/2003, 72 adult, 3 juvenile *R. luteiventris* (USGS, unpubl.)
9. 9/17/2004, 94 adult, 14 juvenile *R. luteiventris* (USGS, unpubl.)
10. 8/31/2005, 84 adult, 2 juvenile *R. luteiventris* (USGS unpubl.)
11. 9/1/2006, 21 adult, 10 juvenile *R. luteiventris* (USGS unpubl.)
12. 8/27, 8/29/2007, 9 adult, 2 juvenile *R. luteiventris* (USGS unpubl.)
13. 8/19, 8/21/2008, 13 adult, 5 juvenile *R. luteiventris* (USGS unpubl.)

Survey results: Target site surveyed on 7/10/2009. We found one adult and one juvenile *R. luteiventris*.

We surveyed approximately 150 m along the channel. Surface water covered less than 40 percent of this reach. Riparian vegetation was mainly deciduous shrub (willow); uplands were mainly sage. We found no impoundments or livestock in the Target reach. We found no evidence of beaver activity. The Target reach was within 50 m of a paved road (OR Hwy 20). Our inspection of the reach upstream of the Target revealed no surface water, signs of beaver activity, or impoundments. The stream channel crosses under the road via culverts at least two times upstream of the Target reach.

We scored habitat variables on five paired plots. Bank height averaged 5.4 ± 5.6 m (range 0.75-15 m). We found no cow pats. We found evidence of past livestock grazing on one plot, and soil erosion on three plots. Vegetation on aquatic plots averaged 85.0 ± 30.8 percent (30-100 percent); cattails were the most commonly noted dominant taxon (2 plots). Wetted width averaged 2.4 ± 1.3 m (range 1-4 m). Maximum depth on aquatic plots averaged 0.1 ± 0.1 m (range 0.02-0.25 m). Silt was the dominant substrate size on all aquatic plots.

Remarks: The two *R. luteiventris* were found in a small pool north of OR Highway 20. Surface water was limited to two pools at the time of our survey. The above photograph shows part of a pool that had surface water during our July visit. The center of the Target reach was a very dense stand of cattails. USGS ARMI Monitoring of this site since 2001 has paralleled a reduction of open water. This reduction in open water has been pronounced at the presumed hibernaculum pool. Depending on year and timing, water can be present in a few pools upstream of the area where we found water in 2009 (USGS, unpublished).

24. Lily Lake

Site Information: BLM (Burns), Harney County, OR, elevation 2,214 m.

Historical record:
1995 (no date), *R. luteiventris* found (no life stage or numbers) (M. Smyth).

Survey results: Surveyed 6/11/2009 and 8/23/09. We found no *R. luteiventris* at Lily Lake and four seasonal ponds nearby. We found three adult *R. luteiventris* at one Alternate site (a beaver pond complex on Lake Creek).

We surveyed Lily Lake proper in both June and August. This site is a shallow, heavily-vegetated lake (approximately 120 × 110 m during the August survey). Riparian vegetation was mainly deciduous shrub (willow); upland vegetation was mainly sage. We found no impoundments, livestock or evidence of beaver activity. There was a gravel road within 50 m of the Target site. We found *P. regilla* adults and larvae. Our surveys did not detect fish, nor did earlier surveys by Smyth (2001, 2004).

We scored habitat variables on six paired plots during the August survey. Bank height averaged 0.5 ± 0.4 m (range 0.01-1.0 m). No cow pats were noted in August survey, but some cattle use has occurred (evidenced by our observation of 3 pats on 2 of 8 plots in June). Evidence of disturbance on terrestrial plots in August was limited to signs of past flooding on five plots and a human trail on one plot. Vegetation cover on aquatic plots averaged 84.2 ± 4.9 percent (range 85- 90 percent); spike rush (*Eleocharis* sp.) was the main dominant plant on four plots. Maximum depth on aquatic plots averaged 0.3 ± 0.1 m (range 0.15-0.55 m). Silt was the dominant substrate on all plots.

Lily Lake Alternate 1: We surveyed four small ponds along the road and adjacent to Lily Lake. In June, the total surface area of habitat in the four ponds was estimated at 100 × 5 m; maximum depth was approximately 0.5 m. These ponds were dry in August. Riparian vegetation was deciduous shrub (willow); upland vegetation was a mix of aspen and sage. No *R. luteiventris* were found.

Lily Lake Alternate 2: In June (but not August), we surveyed approximately 1200 m of Lake Creek below and south of Lily Lake. Lake Creek is the outflow from Fish Lake and is not directly connected to Lily Lake; it is less than 1.0 km away and downhill of Lily Lake. Our June survey of this Alternate site was positioned immediately downstream of the Alternate 3 survey associated with Fish Lake. This site is a permanent stream with multiple seasonally flowing braided channels. Most of this reach is approximately 1-m wide, but there is a sizeable beaver wetland complex (maximum width approximately 40 m) at the lower end of Lily Lake Alternate 2 reach. The beaver complex appeared to be active: it included a lodge and multiple slides and chewed trees. Riparian vegetation was mainly deciduous shrub (willow); upland vegetation was a mix of sage and aspen. We found no livestock during our survey, but there was evidence of past livestock use along the stream. There were no roads within 50 m of this reach.

We found three adult *R. luteiventris* (1 female, 2 males) in the main beaver complex or the slough adjacent to the beaver complex.

Remarks: Lily Lake is probably the most frequently surveyed among our study group. Available information suggests *R. luteiventris* may use it infrequently or sporadically, and there is no data to indicate recent breeding. Lily Lake was apparently surveyed in 1996 by M. Smyth with no *R. luteiventris* found (M. Obradovich, pers. comm); we could not find this report. Smyth (2001) reported finding no *R. luteiventris* at Lily Lake in 2001. USGS crews surveyed Lily Lake each year from 2000-2003 without finding *R. luteiventris* (Wente and others, 2005). From July 2004, Smyth (2004) reported 'a peripheral observation of a juvenile frog, likely spotted frog, was noted at the west end of the lake'. Smyth's (2001, 2004) reports make no mention of earlier *R. luteiventris* sightings at Lily Lake.

During the writing of this report, we learned of a *R. luteiventris* observation by Dr. Chris Funk (Colorado State University; pers comm. 2010), who found and photographed one large adult female *R. luteiventris* at Lily Lake in August of 2006. It appears that the site has not recently hosted *R. luteiventris* breeding, and it is unclear whether it has ever supported breeding. Smyth, Funk, and our 2009 crew all reported an abundance of *P. regilla* spanning the last 10+ years, so the site remains suitable for breeding by that species. Lily Lake is well within movement capability of *R. luteiventris* that might be coming from breeding sites on Lake Creek (0.8 km) or Fish Lake (1.6 km). We recommend resurveys of Lily Lake proper, as well as the beaver complex on lower Lake Creek to better understand potential breeding sites in the vicinity. Due to the dense summer vegetation in Lily Lake, an early season survey for egg masses would complement summer surveys for tadpoles or juvenile frogs.

25. Little Fish Creek

Site Information: BLM (Burns), Harney County, OR, elevation 2,143 m

Historical record:
6/28/2001, 12 adults, 3 juvenile, greater than 400 larval *R. luteiventris* (Smyth, 2001)

Survey results: Target and Alternate sites were surveyed 8/20/2009. We did not find *R. luteiventris* in the Target reach, but documented two adult, two juvenile, and ~100 larval *R. luteiventris* in the reach immediately upstream of the Target.

We surveyed 500 m on the Target reach of this intermittent stream. We estimated that 65 percent of the Target reach had surface water. Riparian vegetation was mainly deciduous shrub (willow); upland vegetation was mainly aspen. We found no impoundments or livestock in the Target reach. There were no roads within 50 m of the Target reach. We observed no evidence of beaver activity. Much of this stream had thick willow canopy that shaded the channel. An active beaver complex upstream of the Target reach included at least one impoundment and a large lodge. This reach was surveyed in the Alternate site (below).

We scored habitat variables on six paired plots. Bank height averaged 1.3 ± 0.5 m (range 0.75-2 m). We found cow pats on two terrestrial plots (overall average 0.7 ± 1.0 per plot). These pats were not fresh, and we did not record ground disturbance on any terrestrial plots. Vegetation cover on aquatic plots averaged 5.8 ± 5.8 percent (range 0-15 percent); aquatic mosses including *Fontinalis* sp. were the most common dominant cover. Wetted width averaged 2.0 ± 0.9 m (range 0.7-3.1 m). Maximum depth on aquatic plots averaged 0.2 ± 0.1 m (range 0.02-0.34 m). Dominant substrate in aquatic plots was cobble (3 plots), silt (1 plot), gravel (1 plot), and bedrock (1 plot).

Little Fish Creek Alternate 1: We surveyed approximately 700 m (average width 2 m) of Little Fish Creek immediately upstream of the Target reach. Riparian vegetation was mainly deciduous shrub (willow); upland vegetation was mainly aspen. There was a beaver complex that included an active pond and several active dams on this stretch of creek. We found chewed trees and sighted a live beaver. The main beaver impoundment was ca. 30 m wide. We observed no livestock during the survey, and no roads were found within 50 m. This section of stream includes areas of very thick willow. We found two adult *R. luteiventris* (not captured) and approximately 100 *R. luteiventris* tadpoles. Many (~ 1000's) *P. regilla* larvae were observed in the main beaver complex.

Remarks: The description of the beaver complex where we found *R. luteiventris* in our 2009 survey matches the description of the original location by Smyth (2001). Both our survey and the one conducted by Smyth (2001) did not detect *R. luteiventris* or other amphibians outside of the beaver complex on Little Fish Creek.

26. Little Malheur River

Site Information: USFS (Malheur NF), Grant County, OR, elevation 1,468 m

Historical record:

1. 8/15/1999, 1 adult *R. luteiventris* (C. Tait)
2. 9/26/2000, 3 adult *R. luteiventris* (A. Bammann)
3. 7/2, 7/15/2008, 3 and 7 adult *R. luteiventris* respectively (Funk and others, 2008; USGS, unpubl)

Survey results: Target was surveyed 7/21/2009. We found nine adult and one juvenile *R. luteiventris*.

We surveyed 500 m of this large permanent stream. Riparian vegetation was mainly deciduous shrub (willow); upland vegetation was mainly Ponderosa pine. We found no impoundments in the Target reach. We found no livestock but there was evidence of past use. There was a gravel road in the vicinity but not less than 50 m from the Target reach. We saw signs of old beaver activity (chewed trees), but it was not fresh and we saw no active beaver structures. Our inspection of the reach immediately upstream of the Target revealed no impoundments or evidence of beaver activity.

We scored habitat variables on seven paired plots. Bank height averaged 0.8 ± 0.3 m (range 0.4-1.1 m). We found cow pats on four plots (average 1.3 ± 1.8 per plot; range 0-5 per plot). Evidence of disturbance to soil or vegetation was found in all seven plots: cattle trampling (2 plots), human camps (2 plots), flooding (2 plots), and fire (2 plots). Vegetation coverage was very sparse on aquatic plots (average cover 1.0 ± 1.0 percent). Wetted width averaged 7.1 ± 2.6 m (range 4.4-12 m). Maximum depth averaged 0.4 ± 0.1 m (range 0.3-0.55 m). Cobble was the dominant substrate size on all plots. We found *R. luteiventris* in one plot.

Remarks: None

27. McCoy Creek Incidental

On 6/12/09, we surveyed a small pond (ca. 50 × 20 m) that was approximately 1 kilometer east of McCoy Creek Meadow and ca. 500 feet higher in elevation. Riparian vegetation was sage and aspen types; upslope vegetation was mainly sage with some aspen. The pond was bisected by a dirt road that impounded part of the pond. We saw no obvious streams or inflows to the pond and it appeared to dry in summer most years. We found no livestock at time of survey but there was evidence of substantial past trampling by cattle. We found no evidence of beaver activity. We found one adult *P. regilla*, but no *R. luteiventris*.

28. McCoy Creek Meadow

Site Information: BLM (Burns), Harney County, OR, elevation 2,062 m

Historical record:

1. 6/23/2001, No *R. luteiventris* (Smyth, 2001)
2. 6/20/2002, 1 juvenile, 1 larval *R. luteiventris* (Smyth, 2002)
3. 7/8/2004, 1 adult *R. luteiventris* (Smyth, 2004)

Survey results: Target and Alternate sites were surveyed 6/12/09. We found no *R. luteiventris* at any of these five sites.

We surveyed this marshy wetland associated with McCoy Creek early in summer soon after snowmelt. The area of inundation was approximately 200 m long and 1-25 m wide. Riparian vegetation was mainly deciduous shrub (willow); upland vegetation was mainly sage. We observed no impoundments or livestock in the Target reach. There were no roads within 50 m of the Target. There was one abandoned beaver pond and a small number of chewed trees, but no sign of active beaver use of this site. We found signs of past livestock use upstream of the Target reach. No impoundments or beaver activity were detected upstream of the Target reach.

We scored habitat variables on six paired plots. Bank height averaged 0.8 ± 0.3 m (Range 0.4-1.3 m). We found cow pats on all terrestrial plots (average 4.7 ± 2.3 per plot; range 3-9). We found cow pats on two aquatic plots. Signs of soil and vegetation disturbance due to trampling were evident on four of six terrestrial plots. Vegetation cover on aquatic plots averaged 56.7 ± 32.7 percent (range 10-80 percent coverage). Grasses were the dominant cover on four plots and sedges on two plots. Wetted width averaged 9.3 ± 6.1 m (range 1.5-20 m). Maximum depth on aquatic plots averaged 0.2 ± 0.2 m (range 0.05-0.55 m). Silt was the dominant substrate on all aquatic plots.

McCoy Creek Meadow, Alternate 1: We surveyed another marshy wetland (ca. 100 × 50 m) associated with McCoy Creek. This wetland was located approximately 200 m downstream (north) of the Target site. The wetland was shallowly flooded (0.1 m maximum depth) and probably dries in most years. Riparian vegetation was mainly grasses and other herbaceous taxa; upslope vegetation was mainly sage. We found no impoundments or sign of beaver activity. We did not see livestock at the time of survey but there was evidence of past heavy cattle grazing/trampling. There were no roads within 50 m of this wetland. We found no *R. luteiventris*.

McCoy Creek Meadow, Alternate 2: We surveyed a marshy wetland (ca. 40 × 20 m) associated with McCoy Creek. Alternate #2 was located almost directly opposite McCoy Creek from the Target site. Water was shallow (0.3 m). Riparian vegetation was mainly deciduous shrub (willow); upslope vegetation was mainly sage. We found no anthropogenic impoundments or signs of current beaver use. Past beaver activity was evidenced by older chewed trees and an abandoned beaver pond: much of this area appears to have been flooded as part of this pond in the past. We did not see livestock during survey but there were abundant cow pats from prior years. There were no roads within 50 m. We found no *R. luteiventris*.

McCoy Creek Meadow, Alternate 3: We surveyed approximately 300 m (average width 1 m) of an intermittent stream that runs parallel to McCoy Creek. This stream had very shallow water (0.4 m maximum depth). Riparian vegetation in the area was a mix of deciduous shrub and sage; upslope vegetation was sage with some aspen. We found no impoundments or evidence of beaver activity. We found no livestock at the time of survey, but there was evidence of past cattle trampling. We found no *R. luteiventris*.

Remarks: McCoy Creek Meadow and Alternate sites are approximately 2.5 km downstream of the McCoy Creek Upper sites (see following Remarks).

29. McCoy Creek Upper

Site Information: BLM (Burns), Harney County, OR, elevation 2,166 m

Historical record:
7/28/1998, 1 *R. luteiventris* (no life stage) (G. Sheeter)

Survey results: Target and Alternate sites were successfully surveyed 8/19/09. We did not find *R. luteiventris* at any of the three sites.

We conducted a full survey (500 m) of this permanent stream on 8/19/09. Riparian vegetation was deciduous shrub (willow) with some aspen; upland vegetation was a mix of sage and aspen. Sections of this Target reach had thick willows on both banks that made it difficult to survey. We found no impoundments or evidence of beaver activity. We did not see livestock on the Target reach during June or August visits. The Target reach was not within 50m of any road. This stream was very rocky with little aquatic vegetation. We initially visited the site on 6/13/09 but water was too high to survey.

We scored habitat variables on nine paired plots. Bank height averaged 2.1± 1.2 m (range 0.5-4.0 m). We found six fresh cow pats on one plot and no cow pats on the other eight plots (overall average 0.7 ± 2.0 per plot, range 0-6). We found evidence of cattle trampling on three plots; no ground disturbance was noted on four plots. Aquatic vegetation was sparse and only noted on two aquatic plots (average coverage 1.1 ± 2.2 percent; range 0-5 percent). Wetted width of the stream averaged 3.3 ± 1.3 m (range 2.2-6.5 m). Maximum depth on aquatic plots averaged 0.2 ± 0.1 m (range 0.13-0.46 m). Bedrock (6 plots) and cobble (3 plots) were the dominant substrates.

McCoy Creek Upper, Alternate 1: We surveyed approximately 750 m (average stream width 0.75 m) of McCoy Creek immediately upstream of the Target reach. This section was permanent water. Riparian vegetation was similar to Target reach – relatively dense deciduous shrub (willow) that was closed over the stream for the distal half of this survey site. Upslope vegetation was mainly aspen. We saw no livestock during surveys, but did hear one cow in the distance. We found no anthropogenic impoundments on this reach, but we did find an abandoned beaver dam and lodge. We found no *R. luteiventris*.

McCoy Creek Upper, Alternate 2: We surveyed about 1000 m of an unnamed tributary of McCoy Creek immediately upstream of the Target reach and to the west of Alternate 1. Average width was approximately 2 m, and the stream appeared to be permanent. Riparian vegetation was mainly deciduous shrub (willow); upland vegetation was mainly aspen. We found no impoundments and no livestock. There were no roads within 50 m of the reach. We found one abandoned beaver lodge, but no evidence of recent activity. This stream was very rocky with little vegetation. We found no *R. luteiventris*.

Remarks: Between Target and Alternate sites for McCoy Creek Meadow and Upper McCoy Creek, we covered a significant portion of the upper basin. There was approximately 2.1 km of stream valley habitat between our two surveys that we did not investigate. Available historical observations suggest small numbers of *R. luteiventris* have been present and breeding as recently as 2002 (Smyth, 2002). However, we found no frogs and very little habitat that could be suitable for breeding in 2009. Repeated surveys in portions of this drainage yielded few (0, 2, 1 *R. luteiventris* in 2001, 2002, 2004, respectively; Smyth 2001, 2002, 2004) or no *R. luteiventris* (0,0,0,0 in 2000-2003; Wente and others, 2005; USGS, unpublished). We found abandoned beaver ponds on three of the seven stream-associated sites in this basin and other evidence of past beaver activities at another of the stream-associated sites. This suggests that there was significantly more potential breeding habitat for *R. luteiventris* in this area in the past. Without beaver ponds, potential breeding habitat for frogs is very limited in this relatively high-gradient, narrow canyon. Given its remoteness and abundance of willows, the McCoy Creek drainage looks like a very suitable site for beaver reestablishment.

Surveys of the reach between our sites would help locate any remaining beaver ponds in this vicinity that could provide breeding habitat for *R. luteiventris*. There are several small ponds south/southeast and upslope of our McCoy Creek Upper Target site. Pate Lake and several ponds west/northwest of the McCoy Creek Upper Target site could also host suitable habitat for *R. luteiventris*.

30. Mud Creek

Site Information: USFWS (Malheur National Wildlife Refuge), Harney County, OR, elevation 1,280 m

Historical record:

1. 8/1/1996. *R. luteiventris* collected by Refuge staff, attributed to MS (presumably M. Smyth). GeoBob database says 'Vouchers'. No data on numbers or stages.
2. 8/15/1996, 10 juvenile *R. luteiventris* found during USFWS survey (G. Lampman, Burns BLM).
3. 5/9/2002, 2 adult, 1 juvenile, 4 larval *R. luteiventris* (Wente and others, 2005, USGS unpubl.)
4. 8/19/2003, 1 adult, 14 larval *R. luteiventris* (Wente and others, 2005, USGS unpubl.)
5. 8/3/2006, 14 juvenile *R. luteiventris* (Adams and others, 2010; E. Materna, USFWS)

Survey results: Target and Alternate sites were surveyed on 6/4/2009. We found no *R. luteiventris* at our Target site, but found one of each sub-adult, juvenile and larval *R. luteiventris* in the adjoining Alternate site.

We surveyed approximately 500 m on the Refuge section of lower Mud Creek. This segment of Mud Creek was partially channelized, relatively wide, low-gradient, and permanent. We surveyed this reach in June when water was high and cold (13-14° C; see photo), and it is likely that these conditions reduced frog activity and detectability. Riparian vegetation was mainly deciduous shrub (willow) with significant coverage by invasive reed canary grass (*Phalaris arundinacea*). Upland vegetation was mainly sage. We saw no livestock during our survey. The Target reach is paralleled by a gravel road (less than 50 m away) and berm immediately west of the creek. We noted one beaver lodge in the Target reach. Both active and inactive beaver dams were present on the Target reach or very close to it on tributaries that enter from the east. Water control structures were present in and above the Target reach: these appear to impound water in summer low flows.

We scored habitat variables on seven paired plots. Bank height averaged 1.2 ± 0.5 m (range 0.5-2 m). We found cow pats on two plots (average 0.6 ± 1.0, range 0-2 per plot). Four plots had soil disturbance in the form of the gravel road. Vegetation cover on aquatic plots averaged 22.9 ± 7.6 percent (range 10 - 30 percent). Reed canary grass was the dominant cover on six plots. Wetted width of the stream averaged 7.6 ± 3.3 m (range 5-14 m). Maximum depth averaged 1.3 ± 0.5 m (range 0.65-2 m). Dominant substrates on aquatic plots were silt (3 plots) and cobble (3 plots).

Mud Creek Alternate 1: We surveyed a small pond (approximately 50 × 20 m) immediately west of the gravel road. This pond receives water from the Target reach of Mud Creek via a culvert/weir beneath the road. Reed canary grass is the dominant vegetation around the pond. Deciduous shrubs are present but lesser cover. We saw no livestock. We did not observe evidence of beaver activity associated with the pond, although activity was evident at multiple locations on the creek. Water temperatures in the pond (up to 22° C) were considerably warmer than the creek. We found one sub-adult, one juvenile, and one larval *R. luteiventris.*

Remarks: The pond is hydrologically connected to the creek. Most of the historical records do not identify the location of breeding sites. The pond habitat was more typical of *R. luteiventris* breeding habitat, and juvenile and adult frogs can easily move to the creek from the pond. It is common for adult *R. luteiventris* to move from breeding ponds to streams in summer.

This site is within 1 km of the Bridge Creek site and likely that *R. luteiventris* adults and juveniles can move throughout this complex (hydrologically connected, open flat topography, moist soil units). Mud Creek, Bridge Creek, and Page Springs may be the peripheral remnants of a much broader historical population along the western foot of Steens Mountain. Additional surveys in the habitats in between these three sites could improve our understanding of connectivity among them.

31. Nicoll Creek

Site Information: BLM (Burns), Harney County, OR, elevation 1,359 m

Historical record:

1. 8/13/1998, 1 *R. luteiventris* (no stage provided) (P. Bowers)
2. 7/18/2004, 1 juvenile *R. luteiventris* (M. Smyth)
3. 7/5/2007, 1 *R. luteiventris* (no stage data) (M. Obradovich)

Survey results: Target surveyed on 7/12/09. We found 13 adult, 3 juvenile, one larval *R. luteiventris*

We surveyed 500 m of this permanent stream in the upper Silver Creek basin. Riparian vegetation was mainly deciduous shrub (willow); upland vegetation was mainly sage. We did not find impoundments or livestock in the Target reach. There was a gravel road within 50 m of the Target. We did not see evidence of any beaver activity. Private property abutted the upstream end of the Target reach. Our visual inspection did not detect impoundments or beaver activity immediately upstream of the Target reach.

We scored habitat variables on eight paired plots. Bank height averaged 1.0 ± 0.9 m (range 0.2-2.5 m). We found cow pats on five plots (average 1.6 ± 2.4, range 0-7 per plot). Two terrestrial plots showed signs of soil disturbance (1 livestock trampling, 1 road). Vegetation cover on aquatic plots averaged 31.9 ± 12.5 percent (range 20-60 percent); dominant cover was a mix of sedge and algae, with lesser amounts of spikerush (*Eleocharis* spp.). Wetted width averaged 2.7 ± 1.6 m (range 1.1-6.5 m). Maximum depth of aquatic plots averaged 0.6 ± 0.5 m (range 0.15-1.7 m). Dominant substrates in aquatic plots were mainly silt (6 plots) with some cobble (2 plots). One *R. luteiventris* (dead) was found on a plot.

Remarks: The 2007 observation was made approximately 1 km downstream of the 2004 sighting. The 2007 *R. luteiventris* observation was on Nicoll Creek just above its confluence with Silver Creek. The Nicoll Creek sites are 4-5 km from the Silver Creek 4150 Bridge and Rough Creek (another tributary of Silver Creek) Target sites.

32. Page Springs

Site Information: BLM (Burns), Harney County, OR, elevation 1,292 m.

Historical record:

1. 6/14/1993, 5 adult *R. luteiventris* (M. Smyth)
2. 6/25/1996, 2 adult *R. luteiventris* (M. Smyth)
3. 8/17/1996, 1 metamorphic, 10 adult/juvenile *R. luteiventris* (M. Smyth)
4. 8/09/2000, 4 adult *R. luteiventris* (Wente and others, 2005; USGS unpublished)
5. 4/18/2001, 16 egg masses, 22 adult and juvenile *R. luteiventris* (Wente and others, 2005; USGS unpubl)
6. 7/15/2002, 1 adult *R. luteiventris* (Page Springs small stream) (M. Obradovich)
7. 3/28/2003, 30 adult *R. luteiventris* and breeding in progress in "Page Springs pond" (M. Obradovich)
8. 4/18/2003, 11 *R. luteiventris* near Page Springs Temp Probe (M. Obradovich)
9. 5/7/2003, ~100 larval *R. luteiventris* at Page Springs pond (M. Obradovich)
10. 5/11/2003, 17 *R. luteiventris* (Wente and others, 2005; USGS unpubl)
11. 6/19/2003, 17 *R. luteiventris* (Wente and others, 2005; USGS unpubl)
12. 8/11/2003, 10 larval, 7 adult *R. luteiventris* (Wente and others, 2005; USGS unpubl)
13. 8/18/2003, 16 larval, 1 adult *R. luteiventris* (Wente and others, 2005; USGS unpubl)

Survey results: Target was surveyed on 6/4/2009. We found one adult and four juvenile *R. luteiventris*.

We surveyed approximately 500 m along this water way below and including Page Springs. This reach flows through Page Springs BLM campground. We considered this reach to be an intermittent stream, but it looks like it can have persistent surface water in some years. It was partially impounded by road crossings and culverts. Riparian vegetation was mainly deciduous shrub (willow); upland vegetation was mainly juniper. Most of the Target reach was within 50 m of the gravel road that runs to the campground. We did not observe livestock during our survey. We did not see any beaver dams, but did observe chewed trees. We found approximately 25 juvenile *P. regilla*.

We scored habitat variables on 9 paired plots. Bank height averaged 1.5 ± 0.4 m (range 0.7-2 m). We did not find any cow pats. Evidence of ground or vegetation disturbance was found on 6 terrestrial plots (mowing on 5; campsite on 1). Vegetation cover on aquatic plots averaged 76.1 ± 30.8 percent (range 15-100 percent). Dominant vegetation on 3 plots was sedge; dominants on the other aquatic plots were a mix of cattail, spike rush, duckweed and reed canary grass. Wetted width averaged 8.6 ± 6.3 m (range 1-17 m). Maximum depth averaged 0.5 ± 0.3 m (range 0.1-0.9 m). Silt was the dominant substrate on all aquatic plots.

Remarks: Available historical data indicate consistent adult and breeding use of the Page Springs area by *R. luteiventris*. Wetlands were historically extensive along the western foot of Steens Mountain northward into Malheur National Wildlife Refuge. This suggests that the populations now referred to as Mud Creek, Bridge Creek, and Page Springs may be the peripheral remnants of a broader historical population. We recommend additional surveys in the habitats in between these three sites to better understand connectivity among them.

33. Parsnip Creek

Site Information: BLM (Lakeview), Lake County, OR, elevation 1,626 m.

Historical record:

1. 6/26/1994, 6 adult, 1 juvenile *R. luteiventris* (St John, 1994)
2. 8/24/2005, 7 *R. luteiventris* (Oertley and Frazier, 2006)
3. 7/8/2006, 20 larval *R. luteiventris* (Adams and others, 2010)

Survey results: Target was surveyed on 6/3/09. We found two adult (1 female, 1 male) and five juvenile *R. luteiventris*.

We surveyed approximately 500 m of this permanent stream, including several smaller side channels that held water. Riparian vegetation was mainly deciduous shrubs (alder); upland vegetation was mainly sage. We did not see livestock at the time of survey, but there was ample evidence of past use (see also St John, 1994). There were no anthropogenic or beaver impoundments on Target reach, but we did encounter trees chewed by beaver (not clear how recent). The Target reach is less than 50 m from Oregon State Highway 140. We found no impoundments or signs of beaver upstream of the Target.

We scored habitat variables on nine paired plots. Bank height averaged 0.8 ± 0.4 m (range 0.3-1.5 m). We found cow pats on six plots (average 1.6 ± 1.7; range 0-4 per plot). Three terrestrial plots showed signs of disturbance (2 were livestock trampling from previous years). Vegetation coverage on aquatic plots averaged 26.1 ± 13.9 percent (range 10-50 percent). Sedges were the dominant cover on eight plots. Wetted width averaged 2.6 ± 1.5 m (range 1.25-6 m). Maximum depth on aquatic plots averaged 0.5 ± 0.1 m (range 0.4-0.76 m). The dominant substrate on five aquatic plots was cobble; gravel was dominant on four plots. We found *R. luteiventris* on two plots.

Remarks: Documentation of spotted frogs at this section of Parsnip Creek dates to surveys conducted by Al St. John in the summer of 1994. That survey found adults and one smaller post metamorphic frog (total of 7 encounters on 3 dates) in a long grassy meadow on BLM land near where we found frogs in 2009. St John's (1994) report mentions that BLM had rested that reach from livestock grazing since 1989. This population appears to be very isolated: surveys by St. John (1994) in eight drainages in the surrounding Warner Mountains and Winter Ridge area failed to find spotted frogs. Surveys by others around that area also failed to detect spotted frogs (Hayes, 1994; Oertley and Frazier, 2006). The nearest known *R. luteiventris* in Oregon are approximately 117 km away. The nearest population in Nevada is approximately 430 km. Road construction affected portions of Parsnip Creek in 2010 (Dr. Chris Funk, pers. comm.). Monitoring could help understand potential effects of this action on *R. luteiventris*.

34. <u>Rail Canyon 1</u>

Site Information: BLM (Vale), Malheur County, OR, elevation 1,390 m

Historical record:

1. 9/11/1998, 1 adult *R. luteiventris* (3") from a beaver pond on Rail Canyon Creek approximately 50 m upstream of its confluence with Clover Creek (C. Tait). This observation was made between our Target reaches of Rail Canyon 1 (which is 550 m downstream of this observation) and Rail Canyon 4 (which is 2000 m upstream of this observation).
2. 9/08/1999, 2 metamorphic *R. luteiventris* (1 in beaver pond, 1 in creek upstream of beaver pond). Same location as 9/11/1998 record (Al Bammann)
3. 9/16/1999, 1 adult, 4 metamorphic *R. luteiventris* "in creek" near the confluence of Clover Creek and South Clover Creek (A. Bammann). This was the center of our Target survey.
4. 9/16/1999, 16 metamorphs in pond, 4 metamorphs nearby in stream from "old beaver pond between South Clover and main Clover Creeks (A. Bammann). This site was approximately 150 m west of the previous record from this date.
5. 5/02/2000, 1 subadult (2"), 1 adult *R. luteiventris* at "Rail Creek and Clover Creek junction, old beaver pond" (Al Bammann). This appears to be similar or same location as 9/11/1998 record above.
6. 4/19/2005, 10 *R. luteiventris* egg masses; calling males also present (no number) at "mouth of S Clover Creek in old beaver pond" (Megan Brown). This is similar or same as the record from 9/16/99 above.

Survey results: Target and Alternate sites were surveyed on 7/23/09. We found no *R. luteiventris*.

We surveyed approximately 500 m on South Clover Creek in this area known as Rail Canyon. Our Target reach included the confluence of Clover Creek and South Clover Creek. Riparian vegetation was mainly deciduous shrubs (alder); upland vegetation was mainly juniper. We found no impoundments on the Target reach. Livestock were present during survey (6-20 head). The Target reach is less than 50 m from a gravel road. Evidence of past beaver use was an old lodge and few chewed trees. We did not find impoundments or signs of beaver use immediately upstream of the Target reach.

We scored habitat variables on six paired plots. Bank height averaged 2.9 ± 1.9 m (range 0.7-5 m). We found cow pats on five plots (average 2.5 ± 2.1; range 0-5 per plot). Some type of soil or vegetation disturbance was evident on all terrestrial plots (grazing 4 plots, trampling 4 plots, erosion 3 plots). Vegetation cover on aquatic plots averaged 16.2 ± 11.9 percent (range 2-30 percent). Dominant cover was a mix of grasses, sedges, horsetails and unidentified vegetation. Wetted width averaged 1.6 ± 0.3 m (range 1.3-2.2 m). Maximum depth on aquatic plots averaged 0.2 ± 0.1 m (range 0.1-0.25 m). Sand was the dominant substrate on four aquatic plots; gravel was secondary substrate on five plots.

Rail Canyon 1, Alternate 1: We surveyed approximately 600 m on Clover Creek (average width 1 m) immediately upstream of the Target reach. Riparian vegetation was mainly deciduous shrub (willow); uplands were mainly juniper. We found no impoundments in this reach. Livestock (1-5 head) were present in area at time of survey. This reach was within 50 m of a gravel road. We found no evidence of active beaver use; there was presence of past activity in several old dams and a few chewed trees. We found no *R. luteiventris*.

Remarks: See comments for Rail Canyon 4.

35. Rail Canyon 4

Site Information: BLM (Vale), Malheur County, OR, elevation 1,460 m.

Historical record:

1. 9/11/1998, 1 adult *R. luteiventris* (3”) from a beaver pond on Rail Canyon Creek approximately 50 m upstream of its confluence with Clover Creek (C. Tait). This record is the same one referenced for Rail Canyon 1 Target reach (see above).
2. 5/2/2000, 1 adult *R. luteiventris* (A. Bammann). This was the center of Rail Canyon 4 Target reach.

Survey results: Target and Alternates were surveyed on 7/23/09. We found no *R. luteiventris*.

We surveyed approximately 500 m on Rail Canyon Creek which appears to be an intermittent stream with some permanent pools. The Target site included an area with thick sedge cover that was dry at the time of survey but probably ponds water earlier in year. Riparian vegetation was a mix of thistle and willow; upland vegetation was mainly juniper. Portions of this area burned several years ago. There was a recently constructed road crossing with culvert that impounds a small area of the stream. We found no evidence of current beaver activity, but there were older chewed trees and an area that appeared to be a senescent beaver pond complex. The Target reach was within 50 m of a gravel road. The habitat upstream of the Target reach (included in Alternate 1) had no impoundments or signs of recent beaver activity. We found one garter snake and one rattlesnake.

We scored habitat variables on seven paired plots. Bank height averaged 1.3 ± 1.0 m (range 0.3-2.5 m). We found cow pats on one plot (average 0.3 ± 0.8; range 0-2 per plot). We noted soil or vegetation disturbance on all terrestrial plots: fire (3 plots), flooding (2 plots), erosion (1 plot), road grade (1 plot), and tire tracks (1 plot). Vegetation cover in aquatic plots averaged 79.3 ± 23.2 percent (range 30-100 percent). Sedges were the most common dominant cover (4 plots). Wetted width averaged 4.9 ± 7.1 m (range 0.3-20 m). Maximum depth on aquatic plots averaged 0.2 ± 0.1 m (range 0.1-0.3 m). Silt was the dominant substrate on all aquatic plots.

Rail Canyon 4, Alternate 1: We surveyed approximately 125 m upstream and north of the Target reach on Rail Canyon Creek Both this reach and the stream channel above it were classified as intermittent; the entire stream bed was dry above 125 m. Riparian vegetation was mainly thistle; upslope vegetation was mainly juniper. We observed no impoundments or beaver activity in the alternate reach or upstream of it. We saw no livestock during the survey. This reach is within 50 m of gravel road. No *R. luteiventris* were found.

Rail Canyon 4, Alternate 2: We surveyed 750 m (average width 0.5 m) of intermittent channel immediately downstream and south of the Target reach on Rail Canyon Creek. Riparian vegetation was mainly deciduous shrubs; upland vegetation was mainly juniper. This area had been intensively grazed and trampled by livestock; there were abundant cow pats and livestock were present (6-20 cattle). There were no impoundments in this reach, and no sign of current beaver use. Several old chewed trees evidenced past beaver activity. This reach is less than 50 m from a gravel road. No *R. luteiventris* found.

Remarks regarding the cluster of Rail Canyon sites: We failed to detect *R. luteiventris* around this area despite surveying more than 2.5 km of riparian habitats. Survey conditions were favorable on both the timing and the dates of field investigation. There is thus the possibility that *R. luteiventris* is no longer present in these reaches. This contrasts markedly with the local historical record which documents broad distribution and considerable breeding in the area within the last 10 – 15 years. Habitat for *R. luteiventris* breeding appears very limited in this area at present. Grazing pressure in this area was considerable. In contrast to the records of where frogs had been found, we found no active beaver impoundments. The historical record for this site is unique among our Target sites in that there were solid records of *R. luteiventris* breeding and use of beaver ponds, as well as descriptions of multiple beaver ponds in this area. Photographs taken during those earlier surveys could be informative and illustrate changes in beaver-associated *R. luteiventris* breeding habitat over time. The thistle invasion in the riparian zones is consistent with fallen water tables (a common by-product of loss of beaver), ground disturbance, and a consistent source of propagules (both of which could be related to intensive livestock).

36. Rattlesnake Creek

Site Information: BLM (Burns), Harney County, OR, elevation 1,402 m

Historical record:
6/8/2000, 4 adult *R. luteiventris* (Smyth, 2000)

Survey results: Target and Alternate sites were surveyed on 7/11/09. We found no *R. luteiventris*.

We surveyed approximately 500 m of this permanent stream. Riparian vegetation was mainly deciduous shrubs (alder); upland vegetation was mainly Ponderosa pine. We found no impoundments or current beaver activity in the Target reach, but did see a few chewed trees as evidence of past activity. A paved road (County Road 102) is within 50 m of the Target reach. We did not observe livestock during our survey. Considerable human use of the area was evidenced by motor oil, soda and beer containers, and used toilet paper along stream. No impoundments or beaver sign was detected upstream of Target reach (see Alternate Site 1). We observed crayfish (*Pacifastacus* sp.) in the stream.

We scored habitat variables on nine paired plots. Bank height averaged 1.4 ± 1.4 m (range 0.2-1.5 m). We found cow pats on five plots (average 1.9 ± 2.7; range 0-8 pats per plot). All terrestrial plots demonstrated signs of disturbance (7 with cattle trampling, 2 with erosion, one with road grade). Vegetation cover on aquatic plots was consistently low (average 10.6 ± 7.7 percent, range 0-20 percent). Grasses other than reed canary grass were the dominant cover on three plots; reed canary grass was dominant cover on one plot. Wetted width averaged 2.9 ± 1.6 m (range 1.9-7 m). Maximum depth on aquatic plots averaged 0.3 ± 0.1 m (range 0.1-0.48 m). Dominant stream substrate was cobble (5 plots) and gravel (3 plots).

Rattlesnake Creek Alternate 1: We surveyed approximately 500 m (average width 1.5 m) of Rattlesnake Creek immediately upstream (north) of the Target reach. Riparian vegetation was mainly deciduous shrubs (alder); upland vegetation was mainly Ponderosa pine. We observed no impoundments or livestock during our survey. There was evidence of heavy livestock trampling along parts of the stream and we found one dead cow along the stream. The survey reach was less than 50 m from a paved road. We found no evidence of current beaver use, but evidence of older use was chewed trees and an old lodge. Heavy trampling extended upstream of the Alternate reach; no impoundments were observed upstream. We found no *R. luteiventris*.

Remarks: A resurvey of this area by the same team that documented *R. luteiventris* in 2000 revealed no frogs in 2004 (Smyth, 2004). The 2000 survey noted the presence of *R. luteiventris* in and near a blown out beaver pond. No beaver pond was noted in the 2004 survey, so it is possible that it had disintegrated beyond functionality and recognition in the intervening years (Smyth 2000, 2004). This reach of Rattlesnake Creek was very rocky with cool water temperatures (11-17° C), cool spring inflows, and significant shading by alder. Signal crayfish (*Pacifastacus* sp.) are often associated with cooler waters with rock substrate. Without beaver impoundments or off channel oxbow sorts of habitat, this reach appeared unsuitable for *R. luteiventris* breeding.

37. Rough Creek

Site Information: BLM (Burns), Harney County, OR, elevation 1,380 m

Historical record:

1. 1998, *R. luteiventris* detected (no date, life stages, or counts) (Smyth, 1998)
2. 6/20/2000, 1 adult, 4 subadult *R. luteiventris* (M. Smyth)
3. 7/1/2000, *R. luteiventris* detected (no life stage or counts) (W. Wente, USGS, unpublished)
4.

Survey results: Target site was surveyed on 6/24/09. We found two adult *R. luteiventris.*

We surveyed approximately 500 m on this permanent stream. Riparian vegetation was a mix of deciduous shrubs and sage; upland vegetation was mix of sage, juniper, and Ponderosa pine. We observed no impoundments or livestock during the survey. There were no roads within 50 m of the Target. We found some old tree chews, but no signs of active beaver presence. We observed no impoundments upstream of Target reach or signs of recent beaver presence. We did see evidence of grazing upstream of the Target reach.

We scored habitat variables on nine paired plots. Bank height averaged 1.4 ± 0.8 m (range 0.4-3 m). We found no cow pats on terrestrial plots, and five terrestrial plots showed no sign of disturbance. Soil disturbance on the other four terrestrial plots was trails (mainly used by wildlife), flooding or erosion (2 plots). Vegetation cover on aquatic plots averaged 27.2 ± 21.5 percent (range 5-60 percent). Sedges were the dominant cover on seven aquatic plots. Wetted width averaged 2.1 ± 1.2 m (range 1.1 -5 m). Maximum depth averaged 0.3 ± 0.1 m (range 0.2-0.45 m). The dominant substrates on aquatic plots were cobble (4 plots) and gravel (4 plots).

Remarks: Our Target reach was relatively near the Nicoll Creek (1.9 km) and Silver Creek 4150 Bridge (1.7 km) Target sites. The Target reach was located based on the 7/1/2000 record, and began ca. 100 m upstream of the confluence with Silver Creek. The other two historical observations were further upstream of our Target reach by 500-1000 m. These observations are consistent with the others across the upper Silver Creek basin and suggest a historically broad distribution of *R. luteiventris* in the area.

38. South Fork Malheur River, near Crane Creek confluence

Site Information: BLM (Burns), Harney County, OR, elevation 1,119 m.

Historical record:
6/19/1998, 1 *R. luteiventris* (no stage) (Smyth, 1998)

Survey results: Target site was surveyed on 6/26/09. We found one adult *R. luteiventris*.

We surveyed approximately 500 m along this large permanent stream. Riparian vegetation was mainly deciduous shrub (willow) with significant cover of grasses; upland vegetation was mainly sage. We found no impoundments on the Target reach and did not observe livestock during survey. We found no evidence of beaver activity. Fish were observed in the Target reach, including probable redside shiners. The Target reach appears to be very productive, with abundant submerged aquatic vegetation and many dragonflies and garter snakes. We found one *P. regilla* egg mass and about 25 *P. regilla* hatchling tadpoles. We did not detect beaver activity or impoundments immediately upstream of Target reach.

We scored habitat variables on nine paired plots. Bank height averaged 1.3 ± 1.1 m (range 0.5-4 m). We found cow pats on five plots (average 1.7 ± 2.2; range 0-6 per plot). Signs of disturbance on terrestrial plots were mainly related to flooding (8 plots); two plots showed signs of grazing and trampling. Vegetation coverage on aquatic plots averaged 56.7 ± 19.4 percent (range 30-90 percent). *Elodea* spp. was most commonly noted dominant vegetation (4 plots); sedges and algae were dominant cover on two plots each. Wetted width averaged 10.2 ± 5.5 m (range 0.55-20 m). Maximum depths on aquatic plots averaged 0.7 ± 0.3 m (range 0.35-1.2 m). Dominant aquatic substrates were boulder (6 plots) and bedrock (3 plots); secondary substrate types were cobble (6 plots) and silt (2 plots).

Remarks: The South Fork Malheur River Target site was relatively isolated from our other Target sites. The nearest Target sites in our 2009 sample were on Alder and Crane creeks (18.1, 24 km straight line distance, respectively), both of which drain into the South Fork Malheur River.

39. <u>South Fork Squaw Creek</u>

Site Information: BLM (Vale), Malheur County, OR, elevation 958 m

Historical record:
8/21/1975, 2 *R. luteiventris* from 'pond; off South Fork of Squaw Creek' (C. Tait)

Survey results: Target and Alternate sites were surveyed on 7/7/09. We found no *R. luteiventris*.

The entire 500 m of the Target reach was dry. We also surveyed approximately 500 m above and 500 m below the Target section of the creek – no surface water was present in this vicinity. We found no surface water until ca. 1 km downstream of the end of our Target reach, near the confluence with North Fork Squaw Creek. Riparian vegetation and upland vegetation are mainly sage. We found no impoundments in the Target reach, but there is an anthropogenic impoundment ca. 500 m upstream of the Target reach (see Alternate 1). The Target reach was within 50 m of dirt road. We observed no signs of beaver activity in Target reach, nor upstream of the Target reach. No habitat plots were evaluated.

<u>South Fork Squaw Creek, Alternate site 1</u>: We surveyed the entire perimeter of Squaw Creek Reservoir. We estimated the surface are of this anthropogenic impoundment was 100 × 60 m. A narrow band of riparian vegetation around the reservoir was mainly deciduous shrub (willow); upland vegetation was mainly sage. We found no livestock during our surveys. This site was within 50 m of a dirt road. We found no evidence of beaver activity. Vegetation was thick and much of the reservoir had steep banks, so our ability to detect frogs may have been reduced. We found no *R. luteiventris*.

40. Silver Creek 4150 bridge

Site Information: BLM (Burns), Harney County, OR, elevation 1,363 m

Historical record:

1. 7/1/2002, *R. luteiventris* detected (no date, numbers, stage) (Wente and others, 2005; USGS, unpubl.)
2. 8/21/2008, 20 juvenile *R. luteiventris* (Funk and others, 2008; USGS, unpubl.)

Survey results: Target was surveyed on 6/23/09. We found four adult male and four sub-adult *R. luteiventris*.

We surveyed approximately 500 m on this permanent stream. Our Target reach was offset approximately 200 m downstream to avoid private land. Riparian vegetation was mainly deciduous shrub (willow); upland vegetation was mix of juniper and sage. We observed no impoundments on the Target reach. The 4150 Road bridge had ample conveyance and does not appear to impound water. Most of the Target reach was greater than 50 m from any road. Fish and garter snakes were observed in Target reach, as was one western rattlesnake. We found no evidence of beaver activity. We saw no impoundments or evidence of beaver upstream of the Target reach.

We scored habitat variables on nine paired plots. Bank height averaged 0.9 ± 0.6 m (range 0.2-2 m). We found cow pats on four plots (average 0.6 ± 0.7; range 0-2 per plot). Disturbance was noted on four terrestrial plots, mostly from a small trail with slight erosion. Vegetation cover on aquatic plots averaged 35.6 ± 16.7 percent (range 10-70 percent). Sedges were the dominant cover on six plots, and spikerush (*Eleocharis*) was dominant on two plots. Wetted width averaged 6.2 ± 3.7 m (range 3.2-14.5 m). Maximum depth averaged 0.6 ± 0.2 m (0.38-0.85 m). The dominant substrate on all aquatic plots was cobble; gravel was secondary on all plots.

Remarks: None.

41. Silver Creek Incidental

We surveyed an Incidental site in the upper Silver Creek basin about 15 km upstream of the Silver Creek RNA and 20 km upstream of the 4150 Bridge Target sites. We surveyed approximately 190 m along Silver Creek just downstream of USFS Road 45 in the Ochoco National Forest. This reach had permanent water and averaged about 1.5 m wide. Riparian vegetation was mainly sage, with Ponderosa pine in surrounding uplands. We found no impoundments on the survey reach, nor did we observe livestock during the survey. Much of the survey reach was within 50 m of a gravel road. We found no evidence of beaver activity on the survey reach or upstream of the survey reach to the road. Small fish were observed in the survey reach. We captured seven adult male *R. luteiventris*, as well as seven juveniles/subadults and eight tadpoles. Another ~50 tadpoles were observed but not captured.

42. Silver Creek, Lower (Malheur National Wildlife Refuge)

Site Information: USFWS (Malheur NWR), Harney County, OR, elevation 1,252 m

Historical record:
7/1/2002, 1 post-metamorphic *R. luteiventris* seen (W. Wente, USGS, unpubl.)

Survey results: Target and Alternate sites were surveyed on 6/14/09. We found no *R. luteiventris*.

We surveyed approximately 500 m of this wetland that had attributes of both pond and permanent stream. Riparian and upland vegetation was mainly sage. Much of the Target reach had dense bulrush (*Scirpus* spp.) on one bank, and little vegetation on the other. We observed no livestock during the survey. This reach was within 50 m of a gravel road. A large volume of water is impounded immediately upstream of the Target reach, above the road crossing and weir that controls water supply in Target reach and lateral canals. We saw no sign of beaver on the Target reach or immediately upstream. Several old oxbow pools were present along the Target reach (Alternate Sites 1 and 2, below). These appeared to be mostly disconnected from the main flow through the Target reach.

We scored habitat variables on 11 paired plots. Bank height averaged 1.5 ± 0.6 m (range 0.8-2.5 m). We found cow pats on seven plots (average 2.2 ± 3.0; range 0-10 per plot). Evidence of disturbance (cattle trampling, road grade, erosion) was found on five terrestrial plots. Vegetation cover on aquatic plots averaged 17.5 ± 14.8 percent (range 0-15 percent). Bulrush was dominant on six plots. Wetted width averaged 14.5 ± 3.2 m (range 7.5-20 m). Maximum depth on aquatic plots averaged 1.3 ± 0.5 (range 0.6-2 m). Silt was the dominant substrate on all aquatic plots.

Silver Creek, Lower, Alternate 1: We surveyed an oxbow pond (50 × 10 m) on the east side of the south-flowing Target reach. The oxbow was less than 50 m from Silver Creek, with no obvious surface water connection to the creek during normal water levels. The surrounding vegetation was mainly sage. We saw no livestock or evidence of beaver activity. This Alternate site was not within 50 m of any roads. We found no *R. luteiventris*.

Silver Creek, Lower, Alternate 2: We surveyed an oxbow pond (40 × 40 m) on the west side of south-flowing Target reach. This oxbow was less than 50 m from Silver Creek, but we saw no obvious surface water connection to creek during normal water levels. Both riparian and upland vegetation was mainly sage. We saw no livestock at the time of the survey, but found evidence of past heavy livestock use. We found no evidence of beaver. This oxbow was not within 50 m of any roads. We found no *R. luteiventris*.

Remarks: None.

43. Silver Creek Research Natural Area (RNA)

Site Information: BLM (Burns), Harney County, OR, elevation 1,382 m

Historical record:

1. 1998, (No date), 9 juvenile *R. luteiventris* (Smyth, 1998)
2. 7/02/2000, 3 adult *R. luteiventris* (Smyth, 2000)
3. 7/18/2004, 5 *R. luteiventris* (Smyth, 2004)

Survey results: Target site was surveyed on 8/9/2009. We found eight adult, twenty juvenile/metamorphic, and one larval *R. luteiventris*. We also surveyed an Incidental site in the upper Silver Creek basin on 7/12/2009 (remarks below), during which we found seven adult, seven juvenile/subadults, and greater than 50 larval *R. luteiventris*.

We surveyed approximately 500 m of this permanent stream. Riparian vegetation was mainly deciduous shrub (*Alnus* spp.); upland vegetation was sage. Beaver were active in the area (many chewed trees, slides, impoundment), including one new dam under construction. Livestock were present at time of survey (1-5 cattle). The Target was not within 50 m of a road. Upstream habitat also had a beaver impoundment.

We scored habitat variables on six paired plots. Bank height averaged 0.9 ± 0.4 m (range 0.4-1.5 m). We found cow pats (n = 4 pats) on one plot. Two of the six terrestrial plots showed evidence of disturbance (cattle trampling, grazing, trail). Vegetation cover on aquatic plots averaged 18.3 ± 12.1 percent (range 5 -35 percent). Sedges (*Carex* sp.) and spikerush (*Eleocharis* sp.) were noted as dominant cover on three plots each. Wetted width averaged 5.6 ± 1.4 m (range 4-7.5 m). Maximum depth on aquatic plots averaged 0.5 ± 0.3 m (range 0.2-0.95 m). Dominant substrates were gravel (3 plots), sand (2 plots), and cobble (1 plot).

Remarks: We found *R. luteiventris* distributed along most of the Silver Creek RNA Target reach, including evidence of local reproduction. Beaver were active in that reach in 2009. Evidence of beaver included a dam that was under construction, a slide, and many chewed trees. Earlier surveys of the same reach noted relatively few frogs (9 juveniles, 1 adult in 1998; 3 adults in 2000; 5 adults/subadults in 2004) and no evidence of local reproduction in 2000 and 2004 (Smyth 2000, 2004). Smyth's 2004 report noted that habitats that may have supported *R. luteiventris* breeding in previous survey years had lost water depth or were gone altogether. Smyth's reports from 2000 and 2004 did not note beaver activity. Descriptions of other sites surveyed by Smyth included documentation of beaver activity, so beaver may be expanding in this reach of Silver Creek in 2009 after years of absence. This could be a useful case study for monitoring relationships between *R. luteiventris* and expanding beaver influence.

44. Skull Creek

Site Information: BLM (Vale), Malheur County, OR, elevation 1,301 m.

Historical record:

1. 5/10/1996, "many age classes (50 animals)" (B. Olson, C. Tait)
2. 7/9/1997, 10 juvenile *R. luteiventris* "in pool (20 × 20 × 1' deep) above the road" (A. Bammann)

Survey results: Target site was surveyed on 8/5/2009. We found 21 adult (17 female, 4 male) *R. luteiventris*.

We surveyed approximately 415 m on this intermittent tributary of Dry Creek. Approximately 280 m of the Target reach were dry. We found no impoundments on the Target reach. Riparian and upland vegetation were mainly sage with some riparian clusters of emergent herbaceous and deciduous shrub vegetation (willows). No livestock were seen during survey on Target reach. The Target reach was within 50 m of a small dirt 2-track road. We saw no evidence of beaver. We found approximately 25 juvenile and 25 larval *P. regilla*. The upstream end of Target reach was at private property boundary; the channel was dry above the property boundary.

We scored habitat variables on six paired plots. Bank height averaged 1.1 ± 0.8 m (range 0.2-2 m). We found cow pats on all terrestrial plots (average 11.2 ± 0.8, range 10-12 per plot). Disturbance was evident on all terrestrial plots: grazed vegetation (5 plots), livestock trampling (4 plots), erosion (1 plot), tire tracks/road grade (1 plot). Vegetation cover on aquatic plots averaged 78.3 ± 22.1 percent (range 35-95 percent). Dominant plant cover was rushes (2 plots), duckweed (2 plots), and algae (1 plot). Wetted width averaged 3.7 ± 2.6 m (range 0 [dry]-7 m). Maximum depth on aquatic plots averaged 0.1 ± 0.1 m (range 0 [dry]-0.3 m). Dominant substrates on aquatic plots were silt (4 plots) and sand (2 plots).

Remarks: The historical records (recorded as 'Skull Spring' and 'Dry Creek at Skull Spring') were from a pond on Skull Creek mapped on USGS Topographic maps as 'Skull Spring'. This site is on private land, so we displaced our surveys upstream ca. 0.7 km to the nearest public land. That public holding lies between two private parcels but was adequate for us to survey almost the desired 500 m length on Skull Creek.

45. Willow Creek Reservoir

Site Information: BLM (Vale), Malheur County, OR, elevation 1,472 m

Historical record:

8/15/1995, 2 juvenile *R. luteiventris* from Willow Creek on the road crossing near Frank Maher Flat (C. Tait). See **Remarks**.

Survey results: Surveyed on 7/22/09. No *R. luteiventris* found.

We surveyed the entire perimeter of Willow Creek Reservoir. The size of the flooded basin at time of the survey was estimated at 450 × 100 m. Riparian vegetation was mainly deciduous shrub (willow); upland vegetation was mainly sage. We found no livestock during the survey. The site is within 50 m of a two-track dirt path. We found no evidence of beaver activity.

We scored habitat variables on eight paired plots. Bank height averaged 1.0 ± 0.7 (range 0.3-2.5 m). We found cow pats on four plots (average 3.4 ± 5.3, range 0-15 per plot). Disturbance was evident on all terrestrial plots: flooding (6 plots) and livestock trampling (5 plots). Vegetation cover on aquatic plots averaged 5.6 ± 1.8 percent (range 5 -10 percent). We did not estimate wetted width due to large size. Most of the reservoir had steep sides: maximum depth on aquatic plots averaged 4.5 ± 1.5 m (range 0.62-5 m). Dominant substrate on aquatic plots was silt (5 plots), gravel (2 plots), and cobble (1 plot).

Remarks: The historical record was along Willow Creek on private land downstream of this reservoir. We displaced our survey upstream approximately 2 km to reach public land to survey, which resulted in our surveying the reservoir rather than creek/riparian habitat. The reservoir had a negligible amount of habitat typically favored by *R. luteiventris* such as vegetated shallows. We did not note fish presence, but large reservoirs usually are stocked with game fish and they can be difficult to detect without sampling directly for them. We were also not able to survey alternate sites: fence lines on both sides of the reservoir were interpreted by our field crew as private property. The distance between the sites, the probability of stocked fish in the reservoir and the contrast in habitat types precludes any conclusion on *R. luteiventris* status on the stream below the reservoir based on a survey above the dam. A fuller understanding of *R. luteiventris* status at this site would benefit from surveying the private land downstream of the reservoir where the historical observations were made.

Appendix B. Human Footprint Scores for Target Sites

Site name	Average (weighted) Human Footprint score within 2-kilometer radius of survey centroid (1–10)
00 Spring	3.6
Alder Creek	4.0
Bear Creek	1.7
Bendire Creek	2.4
Bendire Creek Slough	2.3
Big Trout Creek	3.7
Bridge Creek	3.3
Butte Creek	3.4
Calf Creek	2.9
Camp Creek	3.5
Castro Springs Reservoir	3.5
Claw Creek	3.1
Coburn Creek	3.3
Crane Creek	4.3
Dry Creek	3.4
Dry Creek – below Indian Trails	2.5
Dry Creek – Hurley Flat	3.1
Dry Creek – King Brown Cabin	3.4
Fish Lake and Slough	3.5
Grove Creek	2.6
Hog Creek	2.1
Kingsbury Gulch	4.1
Lily Lake	3.3
Little Fish Creek	3.0
Little Malheur River	2.2
McCoy Creek Meadow	2.9
McCoy Creek Upper	2.9
Mud Creek	3.5
Nicoll Creek	3.1
Page Springs	3.5
Parsnip Creek	4.6
Rail Canyon 1	2.3
Rail Canyon 4	2.3
Rattlesnake Creek	3.7
Rough Creek	3.2
SF Malheur at Crane Creek Confluence	3.0
SF Squaw Creek	3.5
Silver Creek at 4150 Bridge	3.5
Silver Creek Lower MNWR	3.3
Silver Creek RNA	3.5
Skull Creek	3.3
Willow Creek Reservoir	3.7

Appendix C. Land Use Around Target Sites (Percentage of 2-kilometer Radius Buffer)

[Land use descriptions shown in Appendix D.]

Site name	Open Water	Developed, Open Space	Developed, Low Intensity	Barren Land (Rock/Sand/ Clay)	Evergreen Forest	Shrub/ Scrub	Grassland/ Herbaceous	Pasture / Hay	Cultivated Crops	Woody Wet-lands	Emergent Herba-ceous Wetlands
00 Spring	2.0	0.0	0.0	19.4	0.9	66.7	0.3	6.1	0.3	0.1	3.9
Alder Creek	0.0	0.0	0.0	0.0	19.8	79.7	0.0	0.0	0.0	0.0	0.5
Bear Creek	0.0	0.0	0.0	0.0	29.9	70.1	0.0	0.0	0.0	0.0	0.0
Bendire Creek	0.0	0.0	0.0	0.0	0.7	96.3	0.6	0.1	0.0	0.0	2.3
Bendire Creek Slough	0.8	0.0	0.0	0.0	0.1	98.4	0.7	0.0	0.0	0.0	0.0
Big Trout Creek	0.0	0.0	0.0	1.1	8.3	90.6	0.0	0.0	0.0	0.0	0.0
Bridge Creek	0.6	0.0	0.0	0.0	0.7	54.8	0.0	1.4	0.1	0.0	42.3
Butte Creek	0.0	0.0	0.0	0.0	0.0	99.9	0.1	0.0	0.0	0.0	0.0
Calf Creek	0.1	4.5	0.6	0.0	0.1	94.3	0.3	0.0	0.1	0.0	0.0
Camp Creek	0.0	0.0	0.0	0.0	14.6	85.2	0.0	0.0	0.0	0.0	0.2
Castro Springs Reservoir	0.0	0.0	0.0	0.0	0.0	99.7	0.0	0.0	0.0	0.0	0.3
Claw Creek	0.0	0.0	0.0	0.0	22.2	77.8	0.0	0.0	0.0	0.0	0.0
Coburn Creek	0.0	0.0	0.0	0.0	0.0	93.1	0.8	0.0	0.0	0.6	5.6
Crane Creek	0.0	0.0	0.0	0.0	18.2	81.8	0.0	0.0	0.0	0.0	0.1
Dry Creek	0.0	0.0	0.0	0.0	0.1	99.8	0.0	0.0	0.0	0.0	0.0
Dry Creek – below Indian Trails	0.0	0.0	0.0	0.0	0.2	99.2	0.6	0.0	0.0	0.0	0.0
Dry Creek – Hurley Flat	0.0	0.0	0.0	0.7	0.0	91.8	7.5	0.0	0.0	0.0	0.0
Dry Creek – King Brown Cabin	0.0	0.0	0.0	0.0	0.0	99.9	0.1	0.0	0.0	0.0	0.0
Fish Lake and Slough	0.9	0.0	0.0	0.0	9.0	86.7	2.9	0.0	0.0	0.0	0.5
Grove Creek	0.0	0.0	0.0	0.0	14.8	84.6	0.1	0.0	0.0	0.0	0.5
Hog Creek	0.0	0.0	0.0	0.0	0.1	99.6	0.4	0.0	0.0	0.0	0.0
Kingsbury Gulch	0.0	3.4	0.9	0.5	0.0	84.3	10.9	0.0	0.0	0.0	0.0

Site name	Open Water	Developed, Open Space	Developed, Low Intensity	Barren Land (Rock/Sand/ Clay)	Evergreen Forest	Shrub/ Scrub	Grassland/ Herbaceous	Pasture / Hay	Cultivated Crops	Woody Wet-lands	Emergent Herba-ceous Wetlands
Lily Lake	0.5	0.0	0.0	0.0	11.5	87.4	0.2	0.0	0.0	0.0	0.5
Little Fish Creek	0.0	0.0	0.0	0.0	6.5	92.2	0.8	0.0	0.0	0.0	0.5
Little Malheur River	0.0	0.0	0.0	0.0	37.8	32.9	29.3	0.0	0.0	0.0	0.0
McCoy Creek Meadow	0.0	0.0	0.0	0.0	3.6	95.0	1.4	0.0	0.0	0.0	0.0
McCoy Creek Upper	0.3	0.0	0.0	0.0	3.8	92.4	3.4	0.0	0.0	0.0	0.2
Mud Creek	0.6	0.0	0.0	0.0	0.8	60.9	0.1	0.3	0.1	0.0	37.2
Nicoll Creek	0.0	0.0	0.0	0.0	3.7	96.1	0.1	0.0	0.0	0.0	0.0
Page Springs	0.2	0.0	0.0	0.0	1.3	81.0	0.5	0.3	0.2	0.0	16.6
Parsnip Creek	0.0	2.1	0.1	0.0	0.3	96.1	0.2	0.0	0.1	0.0	1.2
Rail Canyon 1	0.0	0.0	0.0	0.0	7.2	92.8	0.0	0.0	0.0	0.0	0.0
Rail Canyon 4	0.0	0.0	0.0	0.0	5.6	91.5	3.0	0.0	0.0	0.0	0.0
Rattlesnake Creek	0.0	0.0	0.0	0.0	71.1	28.9	0.0	0.0	0.0	0.0	0.0
Rough Creek	0.0	0.0	0.0	0.0	3.1	95.6	1.1	0.0	0.0	0.0	0.1
SF Malheur at Crane Creek Confluence	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
SF Squaw Creek	0.0	0.0	0.0	0.4	0.0	67.5	32.1	0.0	0.0	0.0	0.0
Silver Creek at 4150 Bridge	0.0	0.0	0.0	0.0	1.0	88.4	1.9	0.0	0.0	0.1	8.7
Silver Creek Lower MNWR	1.9	0.0	0.0	8.6	0.1	46.4	0.0	13.7	8.4	0.0	20.8
Silver Creek RNA	0.0	0.0	0.0	0.0	1.4	98.0	0.0	0.0	0.0	0.0	0.5
Skull Creek	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Willow Creek Reservoir	0.5	0.0	0.0	0.0	0.0	97.1	0.3	1.6	0.0	0.3	0.2

Appendix D. Definitions for Land Cover Data (from Homer and others, 2004).

Land-use category	Description
Open Water	All areas of open water, generally with less than 25% cover or vegetation or soil
Developed, Open Space	Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes
Developed, Low Intensity	Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-49% of total cover. These areas most commonly include single-family housing units.
Barren Land (Rock/Sand/Clay)	Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.
Evergreen Forest	Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species maintain their leaves all year. Canopy is never without green foliage.
Shrub/Scrub	Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.
Grassland/Herbaceous	Areas dominated by graminoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.
Pasture/Hay	Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20% of total vegetation.
Cultivated Crops	Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20% of total vegetation. This class also includes all land being actively tilled.
Woody Wetlands	Areas where forest or shrub land vegetation accounts for greater than 20% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
Emergent Herbaceous Wetlands	Areas where perennial herbaceous vegetation accounts for greater than 80 % of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

Appendix E. Distance to Nearest Agriculture for Target Sites

Site name	Distance to nearest agriculture (kilometers)
00 Spring	0.12
Alder Creek	4.33
Bear Creek	2.98
Bendire Creek	1.61
Bendire Creek Slough	1.99
Big Trout Creek	7.01
Bridge Creek	0.86
Butte Creek	4.41
Calf Creek	1.33
Camp Creek	4.91
Castro Springs Reservoir	2.85
Claw Creek	15.65
Coburn Creek	3.99
Crane Creek	5.77
Dry Creek	2.06
Dry Creek – below Indian Trails	4.15
Dry Creek – Hurley Flat	2.43
Dry Creek – King Brown Cabin	3.91
Fish Lake and Slough	6.66
Grove Creek	9.81
Hog Creek	7.43
Kingsbury Gulch	5.99
Lily Lake	7.62
Little Fish Creek	10.30
Little Malheur River	5.50
McCoy Creek Meadow	4.37
McCoy Creek Upper	5.00
Mud Creek	0.07
Nicoll Creek	1.91
Page Springs	0.00
Parsnip Creek	0.55
Rail Canyon 1	9.14
Rail Canyon 4	6.86
Rattlesnake Creek	3.75
Rough Creek	3.39
SF Malheur at Crane Creek confluence	3.24
SF Squaw Creek	4.86
Silver Creek at 4150 Bridge	4.39
Silver Creek Lower MNWR	0.19
Silver Creek RNA	9.43
Skull Creek	3.09
Willow Creek Reservoir	0.40

Appendix F. Agriculture in Watershed for Target Sites

Site name	Watershed Area (hectares)	Pasture/hay		Cultivated crops	
		Area (hectares)	Percentage of watershed	Area (hectares)	Percentage of watershed
00 Spring	219,483.5	96.0	0.0	2.1	0.0
Alder Creek	1,546.4	0.0	0.0	0.0	0.0
Bear Creek	3,056.4	0.0	0.0	0.0	0.0
Bendire Creek	4,680.2	0.9	0.0	0.0	0.0
Bendire Creek Slough	10,537.2	3.8	0.0	0.0	0.0
Big Trout Creek	546.0	0.0	0.0	0.0	0.0
Bridge Creek	15,247.1	2.0	0.0	0.6	0.0
Butte Creek	28,807.7	58.9	0.2	0.0	0.0
Calf Creek	7,592.3	1.1	0.0	0.0	0.0
Camp Creek	620.5	0.0	0.0	0.0	0.0
Castro Springs Reservoir	934.8	0.0	0.0	0.0	0.0
Claw Creek	2,208.6	0.0	0.0	0.0	0.0
Coburn Creek	2,727.2	0.5	0.0	11.6	0.4
Crane Creek	783.6	0.0	0.0	0.0	0.0
Dry Creek	49,558.0	59.9	0.1	0.0	0.0
Dry Creek – below Indian Trails	57,692.4	60.4	0.1	0.0	0.0
Dry Creek – Hurley Flat	3,450.8	0.0	0.0	0.0	0.0
Dry Creek – King Brown Cabin	16,472.0	1.0	0.0	0.0	0.0
Fish Lake and Slough	66.3	0.0	0.0	0.0	0.0
Grove Creek	126.5	0.0	0.0	0.0	0.0
Hog Creek	4,746.6	0.0	0.0	0.0	0.0
Kingsbury Gulch	6,431.5	1.4	0.0	0.0	0.0
Lily Lake	22.1	0.0	0.0	0.0	0.0
Little Fish Creek	291.5	0.0	0.0	0.0	0.0
Little Malheur River	8,443.3	0.0	0.0	0.0	0.0
McCoy Creek Meadow	1,955.8	0.0	0.0	0.0	0.0
McCoy Creek Upper	1,203.8	0.0	0.0	0.0	0.0
Mud Creek	-	-	-	-	-
Nicoll Creek	9,540.8	0.0	0.0	0.0	0.0
Page Springs	54,205.5	1.6	0.0	0.0	0.0
Parsnip Creek	1,644.1	0.0	0.0	0.0	0.0
Rail Canyon 1	2,895.6	0.0	0.0	0.0	0.0
Rail Canyon 4	455.6	0.0	0.0	0.0	0.0
Rattlesnake Creek	3,380.8	0.0	0.0	0.0	0.0
Rough Creek	3,530.6	0.0	0.0	0.0	0.0
SF Malheur at Crane Creek confluence	107,680.8	997.8	0.9	413.1	0.4
SF Squaw Creek	1,060.0	0.0	0.0	0.0	0.0
Silver Creek at 4150 Bridge	54,261.2	0.0	0.0	0.0	0.0
Silver Creek Lower MNWR	216,116.2	10,230.0	4.7	1,611.4	0.7
Silver Creek RNA	20,028.6	0.0	0.0	0.0	0.0
Skull Creek	5,021.5	0.0	0.0	0.0	0.0
Willow Creek Reservoir	2,296.7	0.0	0.0	0.0	0.0

Appendix G. Total Mapped Water within 1-kilometer Radius Buffers for Target Sites

[Total stream length refers to the total distance of mapped streams, measured in kilometers, within a 1-kilometer radius of the Target site. Total waterbody area refers to the total surface area of mapped waterbodies, measured in hectares, within a 1-kilometer radius of the Target site.]

Site name	Total stream length (kilometers)	Total waterbody area (hectares)
00 Spring	3.71	44.58
Alder Creek	5.01	7.10
Bear Creek	4.09	0.06
Bendire Creek	4.17	0.00
Bendire Creek Slough	3.62	0.08
Big Trout Creek	6.49	0.00
Bridge Creek	13.56	156.04
Butte Creek	8.20	0.73
Calf Creek	4.41	0.00
Camp Creek	4.58	0.07
Castro Springs Reservoir	4.70	0.56
Claw Creek	4.23	0.00
Coburn Creek	9.49	0.00
Crane Creek	5.41	0.10
Dry Creek	7.61	0.89
Dry Creek – below Indian Trails	5.22	0.00
Dry Creek – Hurley Flat	5.36	0.00
Dry Creek – King Brown Cabin	6.38	0.21
Fish Lake and Slough	2.82	11.96
Grove Creek	3.69	0.00
Hog Creek	9.21	0.00
Kingsbury Gulch	3.54	0.00
Lily Lake	2.81	1.62
Little Fish Creek	2.07	0.00
Little Malheur River	4.54	0.00
McCoy Creek Meadow	4.30	0.00
McCoy Creek Upper	4.72	0.34
Mud Creek	11.82	124.19
Nicoll Creek	7.06	0.00
Page Springs	6.20	16.53
Parsnip Creek	4.04	0.19
Rail Canyon 1	8.00	0.00
Rail Canyon 4	5.22	0.04
Rattlesnake Creek	2.62	0.06
Rough Creek	6.46	0.00
SF Malheur at Crane Creek Confluence	4.74	0.00
SF Squaw Creek	6.17	0.84
Silver Creek at 4150 Bridge	8.41	0.00
Silver Creek Lower MNWR	11.38	1.55
Silver Creek RNA	4.88	0.00
Skull Creek	5.18	0.07
Willow Creek Reservoir	6.83	10.10

Appendix H. Recent Herbicide Applications near Selected Target Sites

[Agency: BLM, Bureau of Land Management; ODOT, Oregon Department of Transportation; HCWC, Harney County Weed Control]

Date	Product sprayed within 1 kilometer of site	Agency
	Alder Creek[1]	
7/8/2008	Dow AgroSciences™ Tordon® 22K and Gordon's Farm® Hi-Dep®	BLM
	Calf Creek	
6/7/2005	2,4 Amine 4 (manufacturer unknown) and Dow AgroSciences™ Tordon® 22K	ODOT
7/18/2005	UAP Timberland Platoon™ and Dow AgroSciences™ Tordon® 22K	ODOT
8/29/2005	UAP Timberland Platoon™ and DuPont™ Telar® DF	ODOT
4/19/2006	DuPont™ Landmark™ MP and Diuron 4L (manufacturer unknown)	ODOT
4/20/2006	DuPont™ Landmark™ MP and Diuron 4L (manufacturer unknown)	ODOT
5/10/2006	Nufarm Weedone® LV4 Solventless and Nichino America Edict®	ODOT
5/11/2006	Nufarm Weedone® LV4 Solventless and Nichino America Edict®	ODOT
5/25/2006	UAP Timberland Platoon™ and Dow AgroSciences™ Tordon® 22K	ODOT
5/25/2006	UAP Timberland Platoon™ and Dow AgroSciences™ Tordon® 22K	ODOT
6/7/2006	DuPont™ Landmark™ MP and Diuron 4L (manufacturer unknown)	ODOT
8/3/2006	UAP Timberland Platoon™, DuPont™ Telar® DF and Dow AgroSciences™ Tordon® 22K	ODOT
8/10/2006	Riverdale® Veteran® 720	ODOT
10/23/2006	UAP Timberland Platoon™ and Dow AgroSciences™ Tordon® 22K	ODOT
4/19/2007	Riverdale® AquaNeat®	ODOT
7/18/2007	UAP Timberland Platoon™ and Dow AgroSciences™ Tordon® 22K	ODOT
4/17/2008	DuPont™ Krovar® I DF and DuPont™ Oust® XP	ODOT
5/5/2008	UAP Timberland Platoon™ and Riverdale® AquaNeat®	ODOT
5/19/2008	Dow AgroSciences™ Tordon® 22K and Nichino America Edict®	ODOT
8/4/2008	UAP Timberland Platoon™, Riverdale® Veteran® 720 and Nichino America Edict®	ODOT
8/5/2008	UAP Timberland Platoon™, Riverdale® Veteran® 720 and Nichino America Edict®	ODOT
8/14/2008	UAP Timberland Platoon™, Riverdale® Veteran® 720 and Dow AgroSciences™ Vista®	ODOT
4/6/2009	DuPont ™ Landmark® XP and Vegetation Manager® Diuron 80 DF	ODOT
5/18/2009	UAP Timberland Platoon™ and Riverdale® AquaNeat®	ODOT
6/1/2009	Riverdale® Veteran® 720	ODOT
6/2/2009	Riverdale® Veteran® 720	ODOT
7/16/2009	Riverdale® Veteran® 720 and Dow AgroSciences™ Tordon® 22K	ODOT
3/11/2010	DuPont™ Landmark® XP and DuPont™ Karmex® XP	ODOT
4/21/2010	DuPont™ Landmark® XP and DuPont™ Karmex® XP	ODOT

Date	Product sprayed within 1 kilometer of site	Agency
4/22/2010	UAP Timberland Platoon™ and Riverdale® AquaNeat®	ODOT
	Crane Creek	
7/11/2007	Gordon's Farm® Hi-Dep® and Riverdale® Diablo®	BLM
7/8/2007	Dow AgroSciences™ Tordon® 22K and Gordon's Farm® Hi-Dep®	BLM
8/11/2009	Gordon's Farm® Hi-Dep® and Dow AgroSciences™ Tordon® 22K	BLM
	Fish Lake and Slough	
8/30/2007	Dow AgroSciences™ Tordon® 22K and Gordon's Farm® Hi-Dep®	BLM
8/14/2008	Dow AgroSciences™ Tordon® 22K and Gordon's Farm® Hi-Dep®	BLM
	Kingsbury Gulch	
6/10/2005	2,4 amine 4 (manufacturer unknown) and Dow AgroSciences™ Tordon® 22K	ODOT
7/6/2005	Riverdale® Veteran® 720	ODOT
4/19/2006	DuPont™ Landmark MP™ and Diuron 4L (manufacturer unknown)	ODOT
4/20/2006	UAP Timberland Platoon™ and Monsanto AquaMaster™	ODOT
6/7/2006	DuPont™ Landmark™ MP and Diuron 4L (manufacturer unknown)	ODOT
6/13/2006	Riverdale® Veteran® 720	ODOT
4/12/2007	Riverdale® AquaNeat®	ODOT
4/19/2007	Riverdale® AquaNeat®	ODOT
6/12/2007	UAP Timberland Platoon™ and Riverdale® AquaNeat®	ODOT
6/13/2007	UAP Timberland Platoon™ and Dow AgroSciences™ Tordon® 22K	ODOT
4/8/2008	DuPont™ Krovar® I DF and DuPont™ Oust® XP	ODOT
5/5/2008	UAP Timberland Platoon™ and Riverdale® AquaNeat®	ODOT
6/18/2008	UAP Timberland Platoon™	ODOT
8/1/2008	Riverdale® Veteran® 720	ODOT
9/25/2008	Riverdale® Veteran® 720	ODOT
3/19/2009	DuPont™ Landmark® XP and Vegetation Manager® Diuron 80 DF	ODOT
5/18/2009	UAP Timberland Platoon™ and Riverdale® AquaNeat®	ODOT
3/10/2010	DuPont™ Landmark® XP and DuPont™ Karmex® XP	ODOT
	Rattlesnake Creek	
6/26/2006	Dow AgroSciences™ Tordon® 22K	BLM
6/27/2006	Dow AgroSciences™ Tordon® 22K	BLM
7/17/2007	Dow AgroSciences™ Tordon® 22K and Nufarm Weedar® 64	BLM
7/17/2007	Dow AgroSciences™ Tordon® 22K and Nufarm Weedar® 64	BLM
5/9/2008	Dow AgroSciences™ Tordon® 22K, Monsanto Roundup Pro® and Nufarm Weedar® 64	BLM
6/9/2008	Dow AgroSciences™ Tordon® 22K and Nufarm Weedar® 64	BLM
7/25/2008	Dow AgroSciences™ Tordon® 22K, Nufarm Weedar® 64 and Riverdale® Diablo®	BLM
4/22/2009	Dow AgroSciences™ Tordon® 22K and Nufarm Weedar ® 64	BLM

Date	Product sprayed within 1 kilometer of site	Agency
5/28/2009	Nufarm Weedar® 64and Dow AgroSciences™ Tordon® 22K	BLM
6/16/2009	Dow AgroSciences™ Tordon® 22K and Nufarm Weedar® 64	BLM
7/1/2009	Dow AgroSciences™ Tordon® 22K, UAP Timberland Platoon™ and Riverdale® Diablo®	BLM
4/22/2009	Dow AgroSciences™ Tordon® 22K and Nufarm Weedar® 64 (also Loveland Industries Phase™ as an adjuvant)	HCWC
5/28/2009	Dow AgroSciences™ Tordon® 22K and Nufarm Weedar® 64 (also Loveland Industries Phase™ as an adjuvant)	HCWC
6/9/2008	Dow AgroSciences™ Tordon® 22K and Nufarm Weedar® 64 (also Loveland Industries Phase™ as an adjuvant)	HCWC
6/10/2009	Dow AgroSciences™ Tordon® 22K and Nufarm Weedar® 64 (also Loveland Industries Phase™ as an adjuvant)	HCWC
6/16/2009	Dow AgroSciences™ Tordon® 22K, Gordon's Farm® Hi-Dep® and Riverdale® Diablo® (also Loveland Industries Phase™ as an adjuvant)	HCWC
7/1/2009	Dow AgroSciences™ Tordon® 22K, UAP Timberland Platoon™ and Riverdale® Diablo® (also Loveland Industries Phase™ as an adjuvant)	HCWC
	SF Malheur near Crane Creek	
8/3/2009	Dow AgroSciences™ Tordon® 22K	BLM
	Silver Creek at 4150 Bridge	
7/14/2008	Gordon's Farm® Hi-Dep® and Dow AgroSciences™ Tordon® 22K	BLM

[1] Gordon's Farm® Hi-Dep® and BASF Clarity® were applied upstream of site on 7/7/2008 and 7/14/2009.

Publishing support provided by the U.S. Geological Survey
Publishing Network, Tacoma Publishing Service Center

For more information concerning the research in this report, contact the
Director, Forest and Rangeland Ecosystem Science Center,
U.S. Geological Survey, 777 NW 9th Street
Corvallis, Oregon 97330
http://fresc.usgs.gov