CHEHALIS BASIN STRATEGY

# OREGON SPOTTED FROGS

## Study Goals and Objectives

Oregon Spotted Frogs (OSF) are an ASRP indicator species and currently the only federally-listed species under the ASRP. Within the Chehalis Basin, to the best of our knowledge OSF are restricted to the Black River drainage. The species requires year-round aquatic wetland habitat of various depth for breeding, larval rearing, summer foraging, and overwinter. This year-round aquatic habitat requirement increases the potential for geographic isolation from other subpopulations and increases their overall susceptibility to local extirpation, especially with climate change which may limit aquatic connectivity between sites. Beyond altered hydrological regimes and water availability due to land use and climate change, OSF habitats are heavily impacted by invasive reed canary grass and predators like American Bullfrogs. With the trajectory of habitat change and interrelated conditions that threaten the species, OSF are not expected to recover without some intervention.

The best way to monitor OSF populations is through egg mass surveys. For the Status & Trends portion of this project we survey three locations yearly that have longer term data sets and where WDFW is the primary leads for those surveys: West Rocky Prairie on Beaver/Allen Creeks, Salmon Creek @ Littlerock Rd, and The Forbes site on Dempsey Creek. Two other sites are also monitored yearly due to active restoration activities: the Rogers Property off Allen Creek and DFW's Mima Creek Unit. In addition to focal Status & Trends sites, regional biologists survey every three years known OSF habitats on private properties that are not part of active restoration.

This project also contributed the Black River OSF tissue samples for a range-wide genomic analysis by the Funk Lab at Colorado State University. The goals of this genomic work are to expand on previous molecular genetics work from 2015 which split the Black River populations into distinct population groups based on their known distribution. However, additional sites have been found and new molecular methods will help determine OSF genetic structure and health.

We are also conducting PIT tagging efforts at West Rocky Prairie. This PIT tag work will augment the current habitat enhancements at WRP and inform further restoration actions aimed at improving aquatic conditions throughout the year. Because the frogs rely on year-round water for seasonal migrations, our PIT-tag movement data is being joined with hydrological data collection – and ideally a model – to optimize the best locations for restoration actions aimed at improving year-round hydrological conditions.

## Methods / Study Design

*Visual Encounter Egg Mass Surveys*

The visual encounter survey (VES) is the standard technique for detecting aquatic breeding amphibian egg masses because egg masses are immobile, readily visible at the water's surface, and easily identified to species (Hayes et al. 2019). Visual encounter surveys are conducted in all wetted areas with a water depth up to 1 m (~3 ft). Ideally, egg mass surveys are conducted a minimum of three times each winter/spring (February-May), separated by approximately 7-10 days. We end surveying once no new egg masses have been identified or all frog activity has disappeared.

The sampling in 2022 is part of the statewide sampling program which dictates that all sites with landowner access permissions are monitored every three years, unless under active management. If a site is under active habitat management, the site is surveyed yearly for egg masses. In 2023, biologists only surveyed where restoration efforts are ongoing and engaged in landowner outreach to survey new areas.

To help us monitor movements throughout the west area of West Rocky Prairie, we have been tagging frogs >25mm in length since 2019. Those frogs are captured through visual surveys, minnow trapping, and dipnetting. Six sets of pit tag arrays are installed within the channels the frogs use for movement between breeding and summer habitat areas (**Figure 1**). Solar arrays power the system year-round and modems allow us remote access for offloading data.

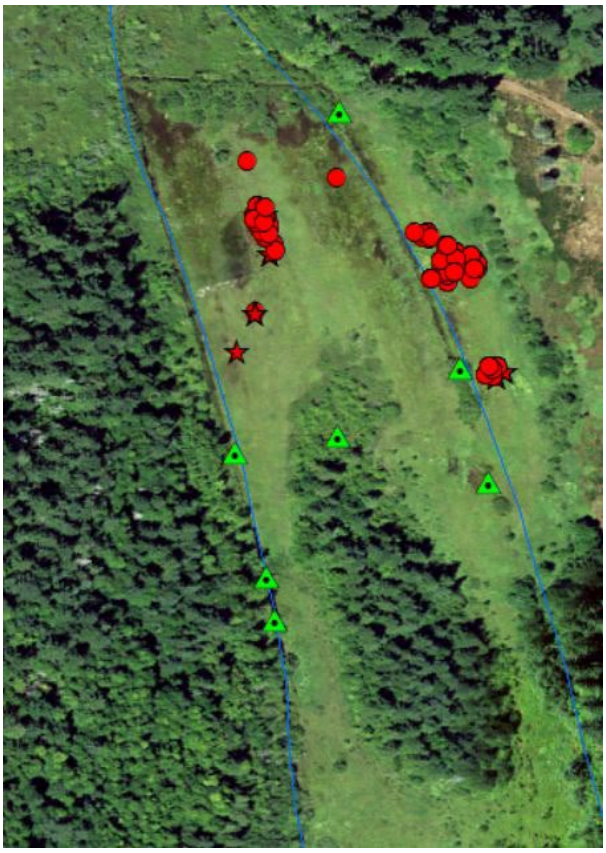

**Figure 1**. PIT tag arrays in watered ditches around the West Area of WRP (green triangles along blue streamlines). The solar control panel is the green triangle in center of photo. Red dots and stars are OSF oviposition areas documented since 1999.

## Summary of Results

*Black River Watershed Monitoring – WDFW Biologists*

WDFW Regional Biologists surveyed all known locations in the Black River (under our monitoring jurisdiction) and collected genetic samples from each subpopulation for the genomics project in 2022 (**Figure 2**). Data from regional biologist efforts in 2023 has not been included in this report as it is still being validated but it will be included in future reporting. Below we report on the three sites with long term datasets that are part of the Status & Trends monitoring.

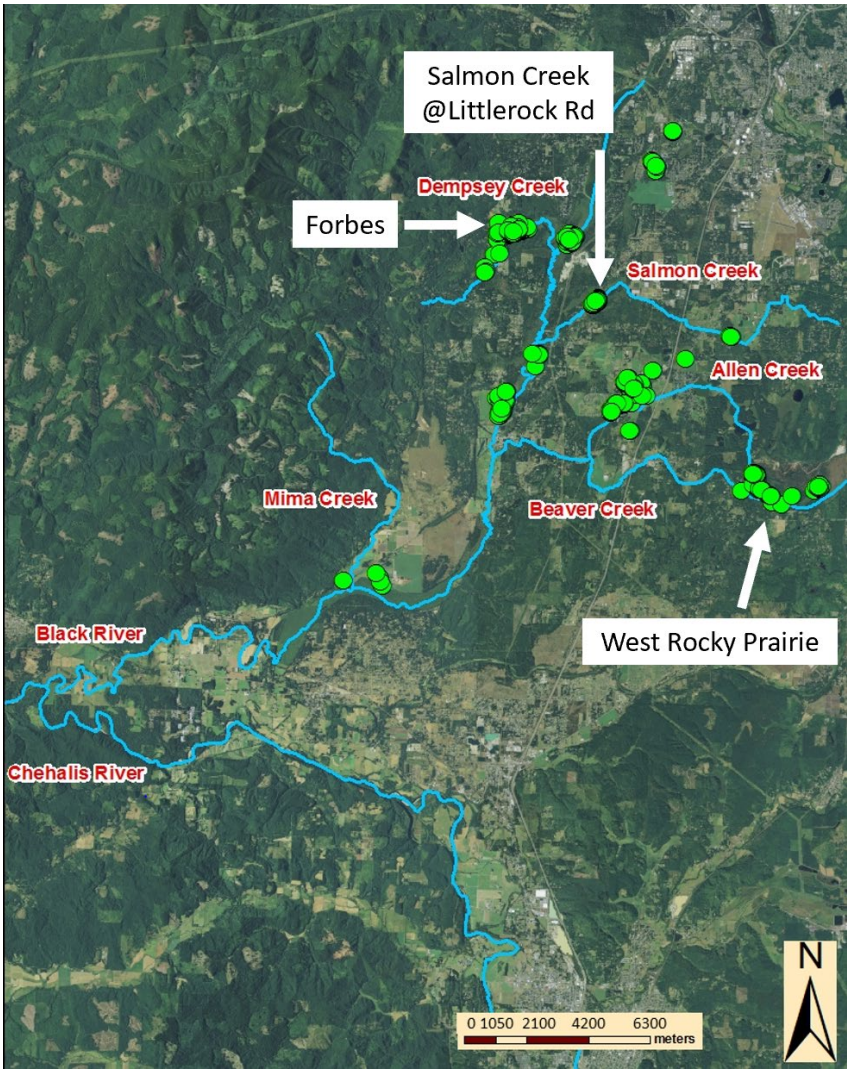


**Figure 2**. Known OSF locations in the Black River Basin. Labeled are the three ASRP Status & Trends sites.

*Forbes Property Monitoring – WDFW Wildlife Program Diversity Division*

The Forbes Property is now owned by USFWS and is adjacent to Dempsey Creek**.** This property is under active grazing management to control RCG and annual OSF egg mass monitoring by DFW has occurred since 1995 when first discovered resulting in 27 years of egg mass counts (**Figure 3**). Egg mass counts show substantial oscillations ever few years with a pronounced decline starting in 2010, a rebound in 2016 above the prior average, and a second decline to a low in 2020. The past two years of data suggest population recovery is ongoing. Data from a prior genetic analysis indicated that the Dempsey Creek OSF population appears to be a stronghold for all the Black River subpopulations because of its high genetic diversity, no evidence of a demographic bottleneck, and high functional connectivity (exchange of migrants) with other Black River populations including those in Allen Creek (Goldberg and Brinkmeyer 2015). The long-term egg mass dataset is also important because it has captured the first day of OSF breeding in the Black River for twenty-four of the last twenty-seven years. These breeding initiation data provide an opportunity to understand breeding phenology trends over time and may provide information about how climate change is impacting OSF.

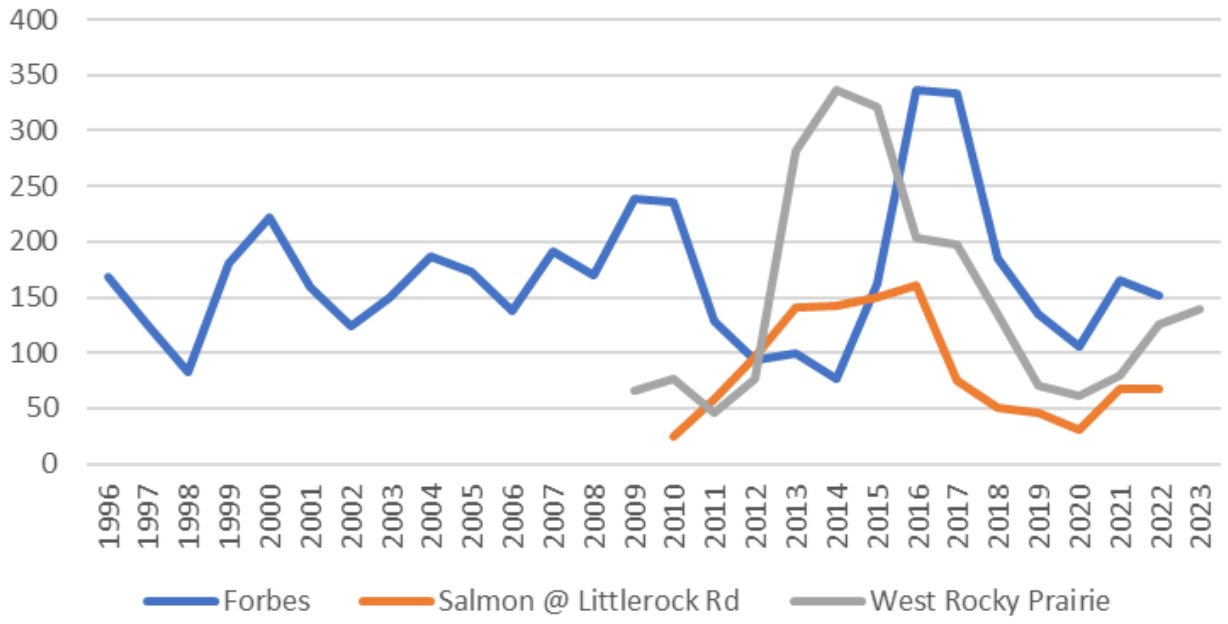


**Figure 3**. Egg mass trend lines at the Forbes, Salmon, and West Rock Prairie site from 1996-2022. 2023 data have not been finalized for Forbes and Salmon yet.

*Salmon Creek @ Littlerock Rd Monitoring*

Salmon Creek is a privately-owned property with a pending conservation easement. WDFW implements active restoration efforts to enhance OSF habitat at this site. This OSF breeding site was discovered in 2010 and is one of only two known populations in the Salmon Creek drainage. Since its discovery, it has been the focus of restoration activities including mowing maintenance for invasive reed canary grass. Thirteen years of egg mass data from 2010-2022 show population growth to a peak in 2016, similar to Forbes but at less than half the population size (**Figure 3**). As with Forbes, we observed a decline to a low in 2020 and a slow recovery the past two years.

*West Rocky Prairie Monitoring*

The West Rocky Prairie Unit (WRP) is owned by WDFW and represents the furthest east subpopulation in the Black River. This unit was the first location where OSF were discovered in the Black River basin in the early 1990's and, to date, is the only known population along Beaver Creek. In addition to Beaver Creek, one of the breeding areas is in the headwaters of Allen Creek. The main habitat challenges at WRP are reed canary grass, woody vegetation succession (willows, hardhack, etc.), and maintaining hydrological connections among waterbodies and hydroperiod permanence.

There are four main breeding areas within the unit (**Figure 4**) and, according to previous genetic work, there is gene flow occurring between each area and with other Black River subpopulations in the basin (Goldberg and Brinkmeyer 2015). WRP has been monitored inconsistently for egg masses since 1999, with consistent yearly monitoring of the West and East Areas since 2009 when restoration activities began. This has resulted in 15 years of data for those two areas, and less consistent data dating back to 1999 for the Unit. This yearly egg mass dataset is invaluable for status and trend assessments (**Figure 3**). West Rocky Prairie shows a similar population maximum in 2014, though two years earlier, reaching a similar size as the Forbes Property and declining to

levels intermediate to Forbes and Salmon Creek in 2020. The past three years have shown a continuous increase in the population since the recent low point.


**FIGURE 4**. West Rocky Prairie Unit. The orange boxes indicate the four known breeding areas.

Importantly, if we separate out the two larger breeding areas (East and West), it is clear that the breeding areas at either end of West Rocky Prairie are behaving independently (**Figure 5**). The West Area – where most OSF occur – follows the similar oscillation seen at Forbes and Salmon Creek. However, the East Area has seen relatively low but steady breeding since 2009. However, we see relatively pronounced growth in the East Area over the past three years. Although West Rocky Prairie represents a single property with a connected OSF population, these patterns highlight the value of assessing the two main breeding areas separately rather than as an aggregated population.

In addition to egg mass monitoring our tagging of frogs as young as metamorphs (>25mm in length), is filling in site movement and habitat usage information critical for optimizing the best location for restoration efforts tailored for specific lifestages and overall population health and longevity at WRP. The data is also showing us possible lifespans, age to maturity and reproduction, site fidelity, movement between seasons and much more.

To date we have tagged 267 frogs across all WRP, with 241 of those centered in the West Area where the arrays are located. We find that OSF show a high degree of interindividual differences in movement with some making large seasonal movements of >460m between summer/winter habitats to breed whereas others move less than 150m throughout the year. When water is available, the ditches are used as corridors between adjacent habitats. When the water recedes to deeper summer wetted areas, the frogs cease movement beneath the ditch arrays until the water returns in the fall. These patterns emphasize how reliant OSF are for year-round water to move across this landscape in comparison to semi-aquatic amphibians which can make overland migrations.

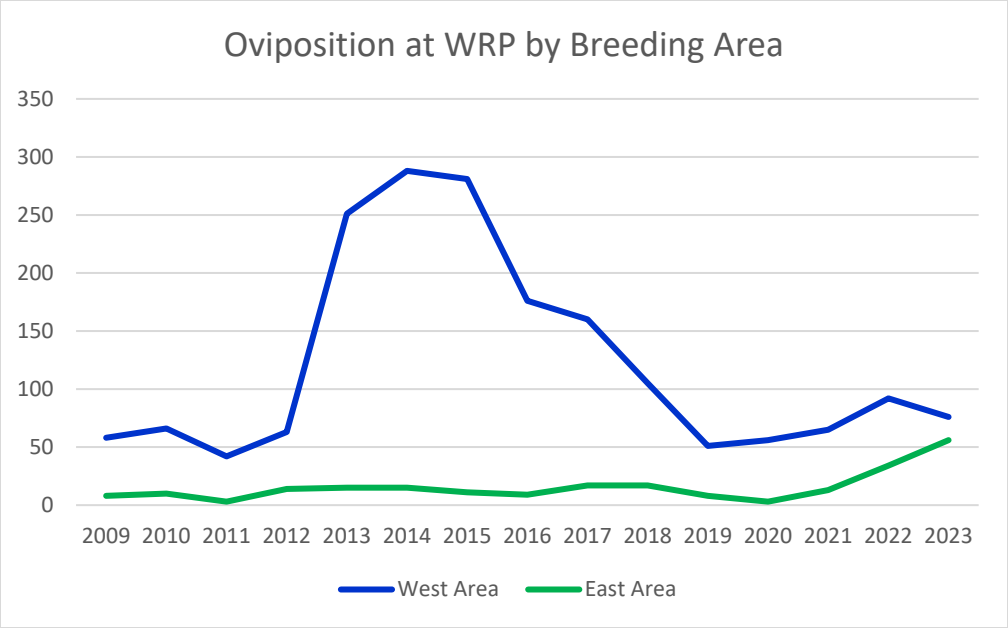


**FIGURE 5**. Trend line for egg mass totals for West and East breeding areas only at WRP from 2009-2023.

## Discussion

Our OSF surveys underscore the value of consistent status and trends monitoring. The data we present for three long-term OSF sites illustrate interannual variation in population sizes. Interestingly, these cross-site comparisons suggest a relatively high degree of population synchrony in their fluctuations which could suggest a strong shared response to climatic conditions. We are expanding on this observed synchrony with a formal analysis using a broader array of population data from the Black River drainage from external partners as well as data from throughout the range. Such an analysis will be instrumental in determining background fluctuations in OSF population size and the impacts of restoration efforts as well as ongoing threats from land use, climate change, and invasive species.

In the West Area of West Rocky Prairie, we began mowing reed canary grass to maintain breeding habitat. This approach made it clear that frogs preferred laying eggs in mowed plots rather than unmowed areas. By 2013, our egg mass counts increased considerably, including a proportionally greater increase than seen at Salmon Creek or Forbes over the same time frame. We initially concluded three years after this work that we had identified a lasting solution to enhance OSF habitat and population resiliency if the invasive reed canary grass is mowed. However, ongoing monitoring demonstrated that the population collapsed to pre-restoration numbers (like Forbes and Salmon Creek), even with continued mowing. This demonstrates that invasive vegetation management in breeding areas is only one component of an integrated OSF restoration plan and that continued research on and management for hydrological, climatic, and invasive species impacts is paramount to successfully restoring local populations to a self-sustaining status.

Our PIT tag monitoring continues to emphasize the importance of permanent water for migration among winter/summer and breeding habitats. With climate changes and legacy and ongoing land use challenges that threaten water availability, it will continue to be a challenge to maintain

sufficient wetland habitat for OSF across life stages and phenological time points. Such consistent population and migration monitoring is essential for siting restoration efforts to benefit this species. We have attempted to acquire additional funding over the past biennium to develop an integrated hydrological model but have been unsuccessful. Such a model integrates ground and surface water data over the past decade, processes it under multiple climate and land use scenarios, and determines which interventions (e.g., beaver dam analogs, pond excavation) and their placement would best meet the needs of the species. The migration data we have are critical to informing that siting as well to ensure the proper habitats are created and connected.

Overall, status and trends monitoring continues to be an essential component of understanding and managing for this sensitive species under the ASRP in addition to other co-occurring aquatic and semi-aquatic species.

## Adaptive Management

This work is already informing Steering Committee decision making around adaptive management. Because of the challenges of sustaining OSF habitat, our data has led to two Steering Committee-facilitated studies. One is assessing the effectiveness of the herbicide imazapyr on maintaining suitable breeding habitat for OSF. This study is leveraging knowledge of OSF occupancy and existing egg mass data. The second is aimed at determining the biological and social feasibility of translocating OSF within the Chehalis Basin. This second study emerged from recognizing that OSF-occupied habitats are hard to manage in support of resilient OSF populations and that there may be value in considering moving OSF to new, potentially suitable habitats in the future, particularly to advance the goal of producing more OSF populations in the Chehalis. Further, our hydrological monitoring data coupled with our long-term egg mass surveys is feeding into important discussions under the ASRP around developing a hydrological model, as described earlier, for West Rocky Prairie that would be adaptable to other OSF sites within the Chehalis Basin. This modeling and the surrounding conversations would be impossible and uninformed without the status and trends monitoring data we have accumulated for years. Further, this model would be adaptable to other sites in the Chehalis Basin that have fewer data to inform restoration.

Continued status and trends monitoring for OSF is necessary for determining background rates of population changes and the influence of restoration actions and ongoing environmental change. Additional funding support at WDFW's Mima Creek site as well as the Rogers Property would enhance our understanding of the Chehalis Basin OSF population and help inform future sites for habitat enhancement as well as which interventions would be most prudent.