Response of Northern Red-legged Frog (*Rana aurora*) and other amphibians to wetland habitat creation at Wintergreen Farm, Oregon

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Summary.—This project evaluated amphibian use of one original and two newly built ponds at Wintergreen Farm, Long Tom River basin, Oregon. An objective of construction was to provide habitat for aquatic amphibians, including Northern red-legged frog (*Rana aurora*), a species of the concern in the Willamette Valley. Pre-construction sampling in the original farm pond in 2008 detected one native amphibian (Rough skin newt; *Taricha granulosa*) and non-native Largemouth bass, sunfish, and American bullfrogs. A ditch upslope of the original pond was excavated to create two additional ponds in Fall 2008. Post-construction monitoring revealed: 1) at least 4 species of native amphibian have used the constructed ponds, 2 of which remain relatively abundant in the 5th year post-construction; 2) the North new pond holds more substantially more water than the South new pond in late summer and hosts two species linked to permanent water (Northwestern salamander, American bullfrog); 3) abundance of Red-legged frogs has increased across the pond complex and across the post-construction period. This project underscores the value of monitoring to improve understanding of amphibian colonization of constructed habitats and provide insights on design of wetlands to host natives and discourage expansion of nonnative species.

The Long Tom Watershed Council (LTWC) has engaged with private landowners across the basin to restore and create habitat for native biota. This report summarizes results of amphibian monitoring at a habitat creation project on Wintergreen Farm, near Noti, Oregon. A focus of the project was to build wetlands that could serve as breeding sites for native amphibians including Northern Red-Legged Frog (*Rana aurora*). Red-legged frogs are designated 'Sensitive-Vulnerable' around the Willamette Valley (ODFW 2008). Status of Red-legged frogs became a concern in the early 1990's when surveys by Oregon State University and others failed to detect them in some Willamette Valley sites (e.g., Blaustein et al. 1994). Habitat loss and modification, along with introductions of non-native warm water fish and American bullfrogs (*Lithobates catesbeianus*) are implicated in reducing some western amphibians, including Red-legged frogs (Adams 2000, Pearl et al. 2005).

We employed breeding surveys in spring (February, March) and summer trapping (May) to evaluate amphibian use of an original farm pond and two new ponds. Our pre-construction sampling of the original farm pond in 2008 found only Rough skin newts (*Taricha granulosa*). The original pond hosted sizeable populations of three nonnative vertebrate predators: largemouth bass (*Micropterus salmoides*), sunfish (*Lepomis* sp.), and American bullfrogs. Rough skin newts have potent skin toxins and are able to coexist with fish predators better than most other amphibians native to the Pacific Northwest (Pearl et al. 2005, Welsh et al. 2006). Two small ponds were constructed within 30 m of the original farm pond in fall 2008. Post-construction monitoring was done on all 3 ponds in 2011, 2012 and 2013. We also observed basking structures for presence of Western Pond Turtles (*Actinemys marmorata*) in early summer 2013.

Post-construction monitoring confirmed that the new ponds were quickly colonized by native amphibians. This is consistent with other work in the Northwest and elsewhere that show native amphibians can make breeding use of anthropogenic habitats where habitat requirements are met (Monello and Wright 1999, Pearl et al. 2005). It should be noted that amphibian communities in anthropogenic sites can differ from those in comparable naturally occurring wetlands in some study areas (Pechmann et al. 2001, Denton and Richter 2013). The Wintergreen ponds were not monitored in the first 2 years after construction (2009, 2010), but our observations confirmed that both new ponds were used extensively by Red-legged frog and Pacific chorus frog (*Pseudacris regilla*) in years 3, 4 and 5 after construction (Figure 1). Relatively high numbers of larvae of both these species in year 3 suggest that they first found and bred in the new ponds within the first 2 years after construction. Larval Northwestern salamanders (*Ambystoma gracile*) were found in the North new pond in 2011, 2012 and 2013. Their large body size and partial gill resorption when captured in 2011 indicated that they were in their 2nd year and had been laid as eggs in spring of 2010 (the 2nd spring that the ponds were available as potential breeding habitat). Northwestern salamanders in the Willamette Valley typically spend 1 winter as larvae and are thus linked to more permanent waters (Pearl et al. 2005); their life history contrasts with our other lowland native amphibians, which lay eggs in spring and transform and leave ponds by late summer that same year. It is thus probable that 3 native amphibian species found and bred in the new ponds before year 3 after construction. This rapid colonization is noteworthy given that none of these 3 colonizing natives were detected in the original farm pond and inspection of aerial photographs suggests there are few potential source ponds within 2–3 km of our study sites. Data attesting to dispersal distances and colonization dynamics in northwestern amphibians are few. Most of our lowland amphibians are relatively mobile (e.g., Red-legged frogs can move at least 1–2.4 km; Pacific Chorus frogs 1–2 km; Smith and Green 2008). However, understanding dispersal requires more than observing long movements that may represent seasonal migrations (Semlitsch 2008, Smith and Green 2008). There remains a need for details on factors affecting gender and stage bias, navigational cues, frequency, survival, and breeding productivity of potential dispersal movements.

The short-term responses of Red-legged frogs to habitat creation were also noteworthy. The species is known to use anthropogenic habitats and is capable of moving long distances, so we might predict that Red-legged frogs should use these new sites relatively soon if source ponds are in the area. There is no data that I am aware of that quantify the speed of colonization of new sites. Here, we observed them colonizing and building populations within the first several years after construction. The total count of Red-legged frog egg masses in the 2 new ponds show total breeding numbers at the new sites increased in each year of monitoring (Figure 2): 9 (2011), 14 (2012) and 29 (2013). After finding no evidence of use during pre-construction (2008) and our first year of post-construction surveys (2011), Red-legged frogs laid at least 22 and 27 egg masses in the original farm pond in 2012 and 2013, respectively. Total egg counts across the 3-pond complex were 9 (2011), 36 (2012), and 56 (2013).

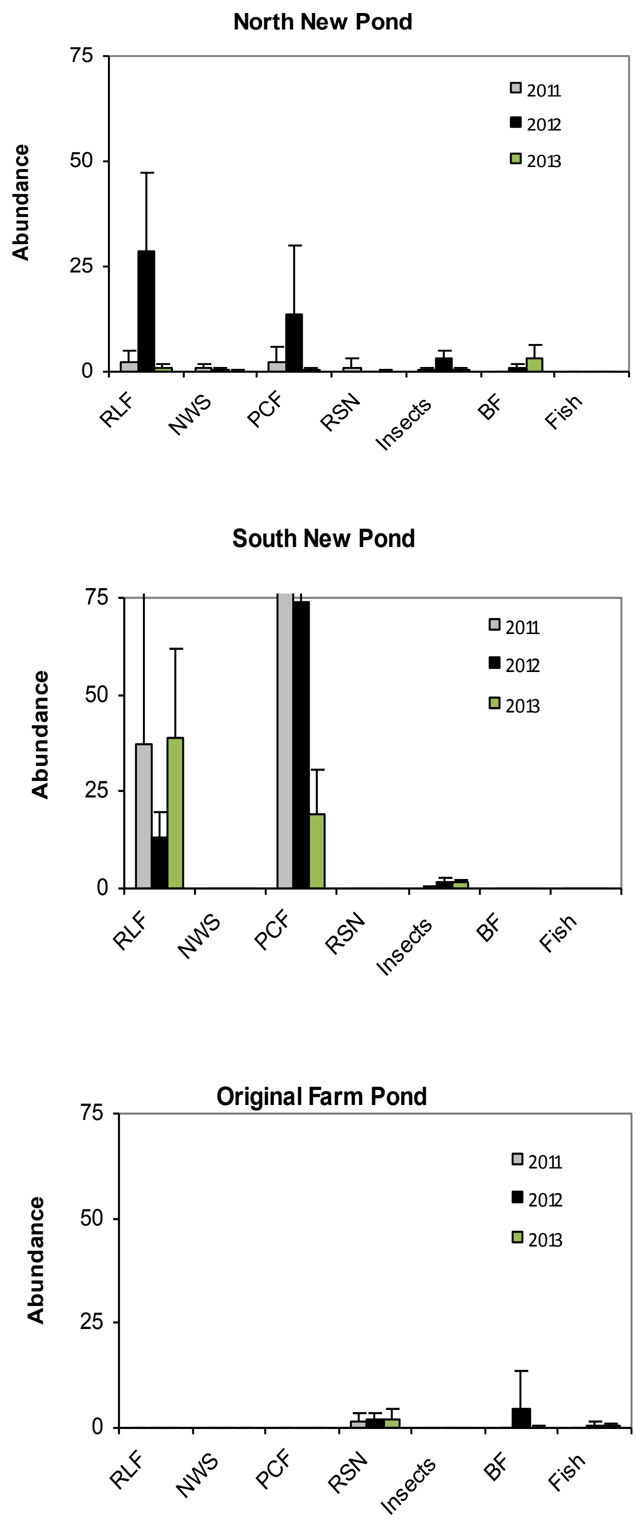

Figure 1. Abundance (# larvae per trap/night) of amphibians and other fauna from the original farm pond and 2 new constructed ponds, 2011-2013, Wintergreen Farm, Oregon. RLF=Red-legged frog; NWS=Northwestern salamander; PCF=Pacific chorus frog; RSN=Rough skin newt (adults); Insects=large predaceous insects; BF=bullfrog (non-native); Fish=warm water fish (non-native).

Our data suggest Red-legged frogs first colonized the 2 new ponds, increased the local population of breeding adults through successful recruitment of frogs from the new ponds, and laid eggs in the original farm pond for the first time in 2012. Trapping data from summer 2011 and 2012 confirmed high densities of Red-legged frog tadpoles in the new ponds. Similar success in 2009 or 2010 (when no surveys were conducted) would have recruited many frogs into the local population, and this could explain the steep increase in total breeding in the area. The population biology of this species is not fully known, but Red-legged frogs are thought to be relatively short-lived (1-5 yrs) and reach breeding age quickly (e.g., within 1 (males) or 2 years (females) after transformation). The attempted 'secondary' colonization of the original farm pond is interesting for several reasons. First, there were clearly red-legged frogs in the area, but they apparently were not using the farm pond prior to the construction of the new ponds. Second, our trapping failed to detect Red-legged frog larvae in the farm pond in any years including the last 2 where we confirmed their laying of an appreciable number of eggs. A lack of Red-legged frog larvae in the farm pond would be consistent with a strong negative effect of fish and/or bullfrogs on survival of Red-legged frog larvae, behavioral modifications by native larvae in the presence of these non-native predators and competitors that reduce their detectability, or a combination of these factors (Kiesecker and Blaustein 1998, Adams 2000, Pearl et al. 2003).

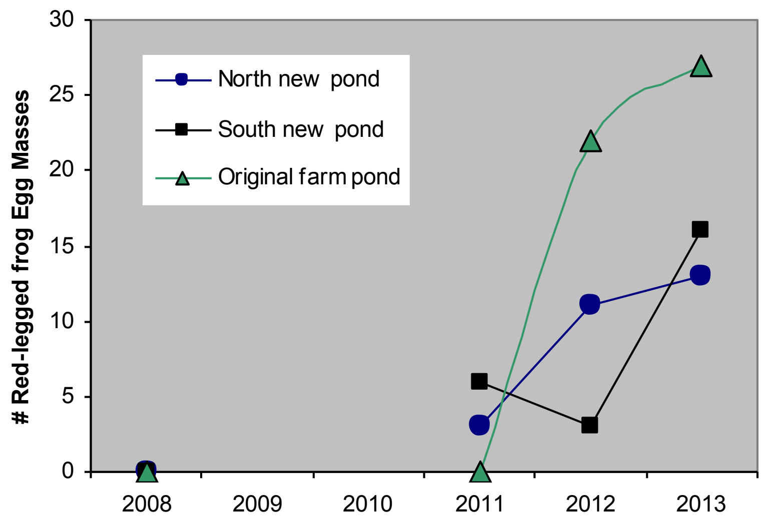

Figure 2. Number of Northern Red-legged frog (*R. aurora*) egg masses found in original farm pond and 2 recently constructed ponds at Wintergreen Farm, Oregon. Pre-construction sampling was in 2008; post-construction sampling was 2011, 2012, and 2013. No sampling was conducted in 2009-2010.

This study only provides a short-term view, but one that is an interesting early glimpse of the assembly of pond communities and the fundamental importance of permanence and predators. The preponderance of that work has been done in eastern North America (e.g., Wellborn et al. 1996); while the generalities apply to all wetland systems, there are fewer illustrations of faunal community assembly in western wetlands. Early results from Wintergreen imply that communities in the 3 ponds are on contrasting trajectories. These differing assembly patterns follow the general predictions of the hydroperiod-predator models. The original farm pond is a large deep site where the main vertebrates are nonnative fish and bullfrogs. These nonnatives are widely distributed around the Valley and typically reduce a ponds' suitability for native amphibians other than Rough skin newts. As of 2013, no fish predators had been detected in the 2 new ponds. Bullfrog larvae were found in the North pond in 2012 and 2013. Their survival there is concurs with the survival of two-year Northwestern salamander larvae, both of which reflect presence of permanent water in the preceding year. The 2 constructed ponds are similar in surface area and position on the hill slope but the North pond has a more consistent source of water (seepage from a spring) and substantially more volume per surface area than the South pond. Arial photographs from 2012 show the North pond retaining water over roughly 50% of its basin in late-August; the South pond is dry except for a very small pool in its center (~10% of basin). The design of the South pond results in most of its surface area being very shallow even during spring high water (ca. 20-35 cm in spring). Pacific chorus frogs do best in temporary waters with few predators, and that is reflected in their high trap rates in South pond. Our sampling in all 3 post-construction years detected 0 vertebrate predators in the South Pond. Larvae of Chorus frogs and Red-legged frogs are both palatable to fish predators (in contrast to newts). Absent fish, Red-legged frogs can persist equally well in permanent and temporary wetlands as long as they can hold water into early summer (Pearl et al. 2005). The proximity of the new ponds to the original farm pond made it predictable that at least adult bullfrogs would use the smaller ponds. We expect they will not be able to breed successfully in the South pond if past drying regimes are the norm. It would be worthwhile to track whether bullfrogs establish consistent breeding in the North pond.

Lastly, two adult turtles that were most likely Western pond turtles (*Actinemys marmorata*) were observed in the original farm pond during 1 early summer visit in 2013. Observations were made from a distance and turtles were skittish and dove quickly from basking logs. Western pond turtles are considered 'Sensitive-Critical' by ODFW (2008) and are a Strategy Species in the Oregon Conservation Plan (ODFW 2006; as are Red-legged frogs in the Valley). Additional sampling could help understand whether these are resident turtles, how many more may be present (detectability is usually low for this species), and if turtles are breeding in the vicinity. The adjacent hill slope has a west-southwestern aspect and includes areas of relatively open, well-drained soil (conditions favorable to turtle nests), so it is possible there is breeding locally. Western pond turtles are thought to have declined in the Willamette Valley by some authors (e.g., Holland 1994). Little is known on the distribution and status of pond turtles in the Coast Range, so additional information on turtles in this and other parts of the upper Long Tom basin may be a valuable contribution.

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