

North Central Region Foothill Yellow-legged Frog (*Rana boylei*) and Habitat Monitoring

2024 Summary

State of California
Department of Fish and Wildlife

Sophia Weinmann
Environmental Scientist, North Central Region (Region 2)



An adult female Foothill Yellow-legged Frog (*Rana boylei*) resting on a large boulder in Sutter Creek in June 2024 (CDFW)

Summary

A summary of California Department of Fish and Wildlife's (CDFW) efforts to monitor *Rana boylei* populations and habitats throughout CDFW's North Central Region (NCR) in 2024.

Introduction and Background

Rana boylei (foothill yellow-legged frog; FYLF) is a stream specialist species that occupies the Sierra Nevada and Coast Range Foothills. It is a climate vulnerable Species of Greatest Conservation Need, is listed as both threatened and endangered under the California Endangered Species Act (CESA) based on genetic clade boundaries within the NCR and is listed as threatened and endangered under the federal Endangered Species Act (ESA) based on distinct population segments within the CDFW NCR (CDFW 2015; CDFW 2020; USFWS 2023). To better understand the impacts of wildfire on FYLF, CDFW continued long-term monitoring of FYLF populations and habitats in 2024. The objective of this monitoring initiative is to document current FYLF distribution and relative abundances of FYLF populations within fire footprints in the CDFW NCR and to understand how populations respond after wildfire.

Overall, objectives and goals:

1. Identify areas of suitable FYLF habitat, both breeding and non-breeding
2. Determine FYLF relative abundances using targeted surveys for egg masses, tadpoles, and post-metamorphic life stages, especially in high-priority watersheds with data gaps and survey/monitoring needs
3. Increase our understanding of habitat associations for all FYLF life stages (egg mass, larva/tadpole, young of year, adult) (**Figure 1**)
4. Monitor changes to FYLF habitats in response to wildfire throughout the year and identify appropriate mitigation measures, as needed



Figure 1: FYLF frog life stages: egg mass, tadpole, young of year (L to R) (CDFW)

Objectives of these monitoring initiatives were completed using a combination of monitoring actions (described below), including general visual encounter surveys (VES) of lotic habitats for FYLF and other non-target herpetofauna species, capture-mark-recapture of individuals using passive integrated transponder (PIT) tags, deployment of trail cameras to record timelapse photos of FYLF habitats to monitor changes in lotic and riparian habitat conditions, and assessing stream soil and sedimentation to evaluate how these habitats may be affected by wildfire.

General Foothill Yellow-Legged Frog Monitoring

Between May 02 and October 17, 2024, an environmental scientist, with intermittent assistance from other CDFW staff members, conducted FYLF population and habitat surveys at locations throughout CDFW's NCR (**Figure 2**). Monitoring generally followed well established FYLF monitoring protocols (Peek et al. 2017). Visual encounter survey (VES), capture-mark-recapture (CMR), and rapid sediment assessment data were all collected via Survey123 data forms. V* (pronounced "V-star") data were collected using a standardized paper form and followed the protocol by Hilton & Lisle (1993).

Throughout the field season, fifty-seven surveys were conducted across thirty-nine locations where FYLF populations had previously been observed or were suspected to occur. The objective was to survey locations three times— a breeding survey to target egg masses, a summer survey to target tadpoles, and a late summer/ early fall survey to target subadults (**Figure 1**). Locations along Camp Creek and Middle Fork (MF) American River were surveyed multiple times in alignment with study objectives to target each life stage. However, other sites were only surveyed once because the habitat was not suitable for FYLF, and no individuals were observed during the initial survey (e.g. MF Cosumnes- Ant Hill and Letts Creek). Other sites were only surveyed once due to safety concerns caused by toxic algae blooms present at the study site (e.g. Cache Creek).

During surveys, other non-target herpetofauna were recorded whenever they were observed. Of note are observations of other at-risk native species e.g., northwestern pond turtle, (*Actinemys marmorata*) as well as non-native species e.g., American bullfrog, (*Lithobates catesbeianus*), which may be of importance for additional future CDFW priority amphibian and reptile conservation work.

All final data were submitted to California Natural Diversity Database (CNDDDB) on February 27, 2025, and approved by Brian Acord. This is a summary of monitoring efforts between May 02 and October 17, 2024.

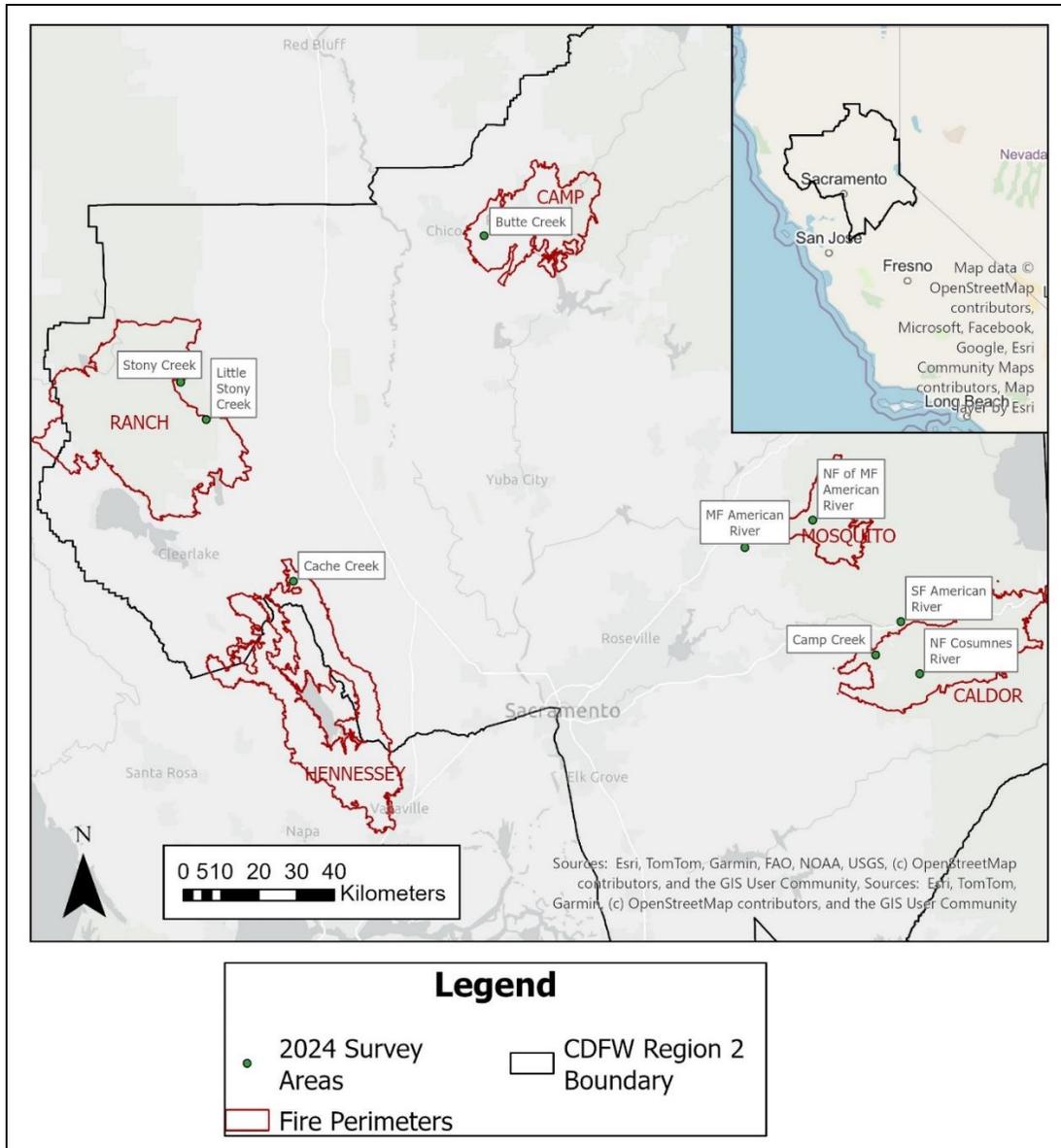


Figure 2. Overview of watersheds and fire footprints throughout CDFW Region 2 where FYLF monitoring occurred in 2024. Detailed maps of survey sites for the Caldor, Hennessey, Ranch and Mosquito Fires are included below.

Caldor Fire: Camp Creek & Cosumnes River

The Cosumnes River watershed, including Camp Creek as well as the North Fork Cosumnes River and Middle Fork Cosumnes River watersheds, have few recent FYLF observations (CNDDDB 2025). Although this may be due to a lack of sustained FYLF populations, thorough survey efforts have been lacking. In 2021 the Caldor Fire burned extensively through these watersheds and within the geographic range of FYLF, increasing the need to continue and expand survey efforts for FYLF to better understand their current distribution and how the Caldor Fire may affect any existing

populations. This population is listed as endangered by both the ESA and CESA.

A potentially small but persistent FYLF population exists at survey sites Camp Creek 01 and Camp Creek 02. This population has been monitored by CDFW Region 2 staff since 2022, and evidence of breeding was observed at both locations in 2022 and 2023. No FYLF were observed during surveys at additional sites farther upstream in either 2022 or 2023. [CDFW, unpublished data, available by request]

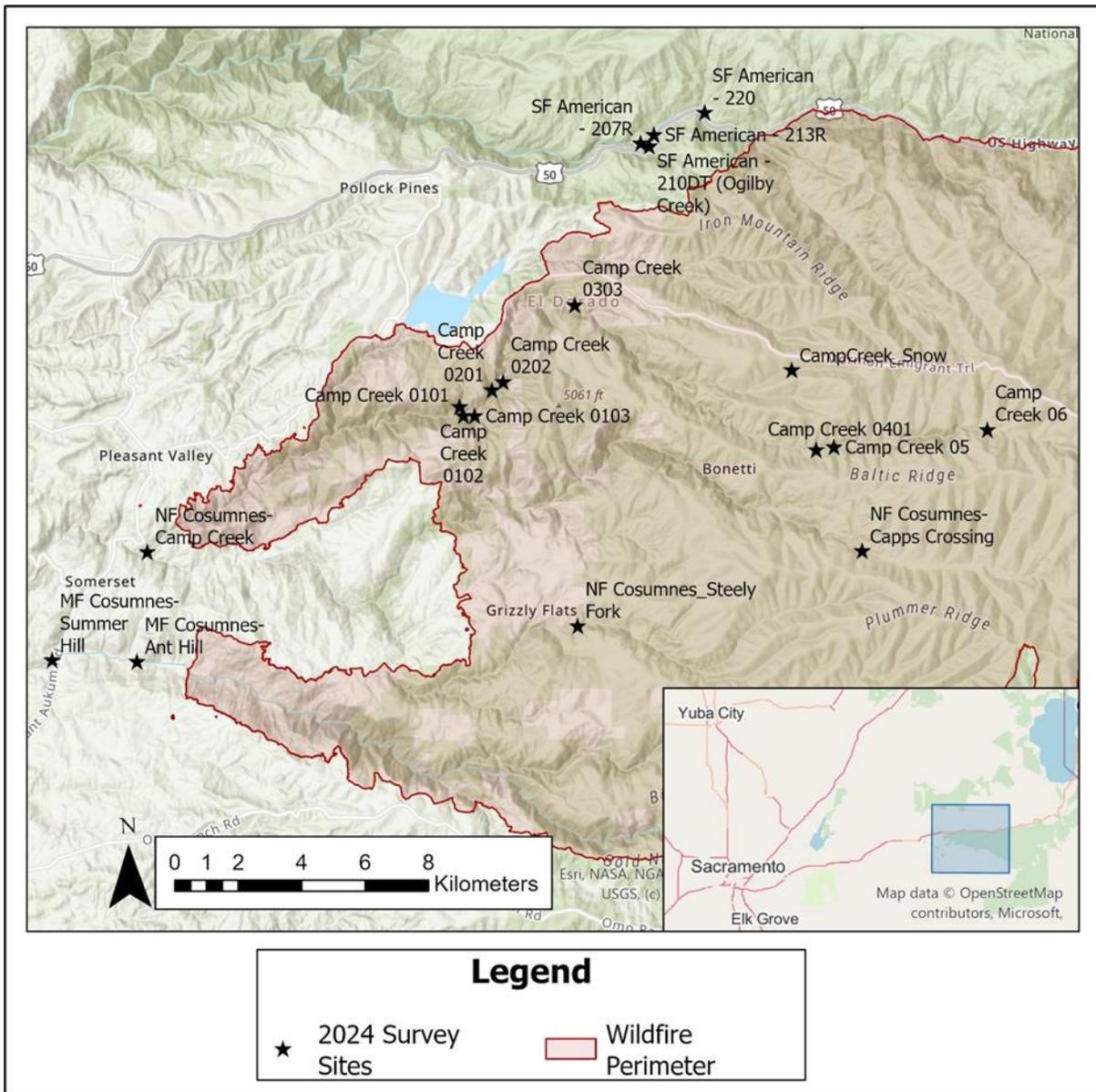


Figure 3. 2024 survey locations within and adjacent to the Caldor Fire footprint

In 2024, surveys were conducted at six focal areas along Camp Creek (**Figure 3**). FYLF were again only observed in the area below Fleming Meadow: Camp Creek 01 and Camp Creek 02 (**Table 1**). Camp Creek 01 and Camp Creek 02 are divided into 500-

meter sub-reaches; for example, Camp Creek 0101 is the first sub-reach of Camp Creek 01 and Camp Creek 0102 is the second sub-reach of Camp Creek 01. Egg masses, tadpoles, young of year (YOY), and adults were all observed at Camp Creek 01 (**Figure 4**). At Camp Creek 02, no egg masses were observed, but the presence of tadpoles and YOY indicates successful reproduction. Adult frogs were also observed in this reach. To gain a better understanding of the size and movement of the Camp Creek population, adult frogs were PIT tagged for future capture-mark-recapture (CMR) studies. In total, two adults were PIT tagged.

Surveys were conducted farther upstream at three reaches in Camp Creek and one in Snow Creek, but FYLF were not observed despite seemingly suitable habitat. Surveys were also conducted near CNDDDB records of FYLF observations on the North, Middle, and Steeley Forks of the Cosumnes River that occurred in 1994 and 2003 (CNDDDB 2025). No FYLF were observed, and habitat was not optimal for FYLF due to human disturbance at Camp Creek 06 including heavy recreation use with evidence of persistent camping use outside of designated locations, widespread trash deposition, and stream flow manipulation including the creation of dams for recreational use.



Figure 4. Foothill yellow-legged frog survey sites along Camp Creek (L to R) at Camp Creek 03 on April 24, 2024, and Camp Creek 01 on October 23, 2024 (CDFW)

During their surveys in 2024, Eldorado National Forest (ENF) staff observed FYLF farther downstream in Camp Creek near the confluence with Sly Park Creek. Beginning in 2025, CDFW recommends coordinating with ENF to survey downstream of Camp Creek 01 to determine the level of connectivity between these populations and gain a better understanding of how FYLF are utilizing this system. Bullfrogs were not observed at any sites surveyed within the Cosumnes River watershed. However, bullfrogs have been observed by ENF staff near Jenkinson Lake and Sly Park Creek, which creates concern that bullfrogs may enter Camp Creek via Sly Park Creek. The increased potential incursion by non-native aquatic species increases the importance of continued

monitoring of this population.

Table 1. Number of Foothill Yellow-legged Frogs (FYLF; *Rana boylei*) of all life stages observed at Caldor Fire survey sites in 2024. Bullfrog presence or absence is also noted for each site.

2024 Caldor Fire Surveys								
Site Name	Date	<i>R. boylei</i>						Bullfrogs Present?
		Egg Masses	Tadpoles	YOY	Sub-adults	Adults	# PIT Tagged	
Camp Cr. 0103	6/11/24	3	2	0	0	0	0	No
Camp Cr. 0201	6/11/24	0	0	0	0	0	0	No
Camp Cr. 0401	6/12/24	0	0	0	0	0	0	No
Camp Cr.- Snow	6/12/24	0	0	0	0	0	0	No
NF Cosumnes - Steely Fork	6/17/24	0	0	0	0	0	0	No
Camp Cr. 0101	6/18/24	0	27	0	0	0	0	No
Camp Cr. 0102	6/18/24	1	5	0	0	0	0	No
Camp Cr. – Capps	7/9/24	0	0	0	0	0	0	No
Camp Cr. 0301	7/15/24	0	0	0	0	0	0	No
Camp Cr. 05	7/15/24	0	0	0	0	0	0	No
Camp Cr. 0202	7/29/24	0	0	0	0	1	0	No
SF American 207R	7/31/24	0	0	0	0	0	0	No
SF American-210DT (Ogilby Cr.)	7/31/24	0	0	0	0	0	0	No
SF American 213R	7/31/24	0	0	0	0	0	0	No
SF American 220	8/6/24	0	0	0	0	1	0	No
Camp Cr. 0102	8/8/24	0	10	0	0	1	0	No
Camp Cr. 06	8/9/24	0	0	0	0	0	0	No
MF Cosumnes-Ant Hill	8/12/24	0	0	0	0	0	0	No
MF Cosumnes-	8/12/24	0	0	0	0	0	0	No

Summer Hill								
NF Cosumnes-Camp Cr.	8/13/24	0	0	0	0	0	0	No
Camp Cr.-Capps	9/3/24	0	0	0	0	0	0	No
Camp Creek 0201	9/5/24	0	2	18	0	7	1	No
SF American 207R	9/17/24	0	0	0	0	0	0	No
Camp Cr. 0101	9/23/24	0	0	6	0	4	1	No
Camp Cr. 0102	9/23/24	0	0	13	0	0	0	No

Mosquito Fire: Middle Fork American River

The Middle Fork (MF) American River and Rubicon River are home to a population of FYLF that has been regularly surveyed since 2021 as part of Placer County Water Agency’s (PCWA) hydroelectric project on the MF American River (PCWA 2024). This population is listed as threatened under CESA but is not listed under ESA. In 2022, the Mosquito Fire burned through the area. Due to road closures and unsafe conditions, the area was inaccessible to CDFW staff until June 2024.

As PCWA surveys are ongoing on the MF American and Rubicon Rivers, CDFW staff focused their monitoring efforts on reaches outside PCWA’s focal areas. Of note, survey locations on the MF American River are impacted by hydropower operations at Ralston Afterbay. Locations at North Fork of the MF American River, Skunk Canyon, Todd Canyon, and Gas Canyon are not impacted by hydropower operations (**Figure 5**).

A robust breeding population of FYLF was observed at North Fork of the MF American River mile marker 2.3 (hereafter, number designations following the MF American River sites refer to different mile marker points), Circle Bridge, and Skunk Canyon. Although road closures prevented surveys from being conducted early enough in the year to observe egg masses, the presence of young of year indicates successful reproduction occurred. Whenever possible, adults were captured by hand and PIT tagged to better understand population size and movement in the watershed; a total of 15 adults were PIT tagged across these three sites (**Table 2**). FYLF were not observed during CDFW surveys at MF American River 26.2, but PCWA surveys in 2023 observed six adults, one sub-adult, two YOY, and one egg mass across six surveys in this reach (PCWA 2024).

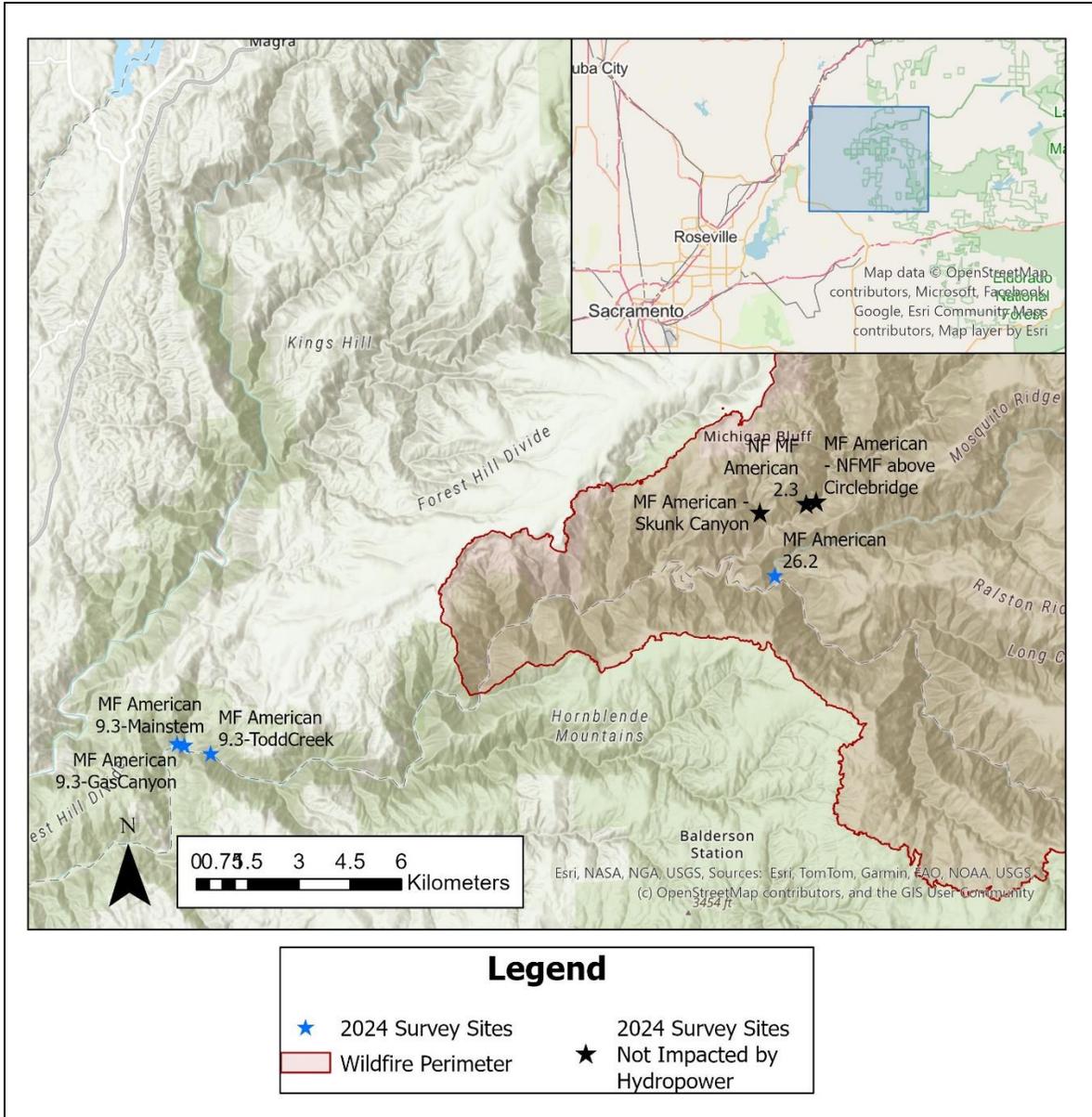


Figure 5. 2024 survey locations within and adjacent to the Mosquito Fire footprint

MF American 9.3 and two tributaries were added as study sites later in the summer when planned surveys were cancelled due to the presence of toxic algae. Todd Canyon was mostly dry and no FYLF were observed. At Gas Canyon, YOY, subadults, and adults were observed, indicating a breeding population, and additional adults were observed in the mainstem at MF American 9.3. No bullfrogs were observed at any survey sites in the Mosquito Fire survey area (**Table 2**).

Table 2. Number of Foothill Yellow-legged Frogs (FYLF; *Rana boylii*) of all life stages observed at Mosquito Fire survey sites in 2024. Bullfrog presence or absence is also noted for each site.

2024 Mosquito Fire Surveys								
Site Name	Date	<i>R. boylii</i>						Bullfrogs Present?
		Egg Masses	Tadpoles	YOY	Sub-adults	Adults	# PIT Tagged	
MF American 26.2	6/14/24	0	0	0	0	0	0	No
MF American 26.2	7/11/24	0	0	0	0	0	0	No
NF MF American 2.3	7/11/24	0	0	0	0	0	0	No
MF American 26.2	8/20/24	0	0	0	0	0	0	No
NF MF American 2.3	8/22/24	0	0	63	4	11	5	No
NF MF American Circle Bridge	9/18/24	0	0	0	3	4	1	No
MF American Skunk	9/24/24	0	1	17	4	19	9	No
MF American 9.3– Todd	10/2/24	0	0	0	0	0	0	No
MF American 9.3	10/2/24	0	0	0	1	4	0	No
MF American 9.3- Gas	10/4/24	0	0	9	4	4	0	No
MF American 9.3	10/4/24	0	0	0	1	2	0	No

Ranch Fire: Stony Creek & Little Stony Creek

A robust population of FYLF is present at Stony Creek; it is not listed under either ESA or CESA. However, long-term monitoring of this population provides a deeper understanding of how listed FYLF populations may respond to wildfire. The insight gained will be utilized in developing management recommendations for listed populations. Survey efforts continued at locations previously surveyed in 2023 along Stony Creek (within Ranch Fire footprint) and Little Stony Creek (southeast of the fire footprint) (**Figure 6**).

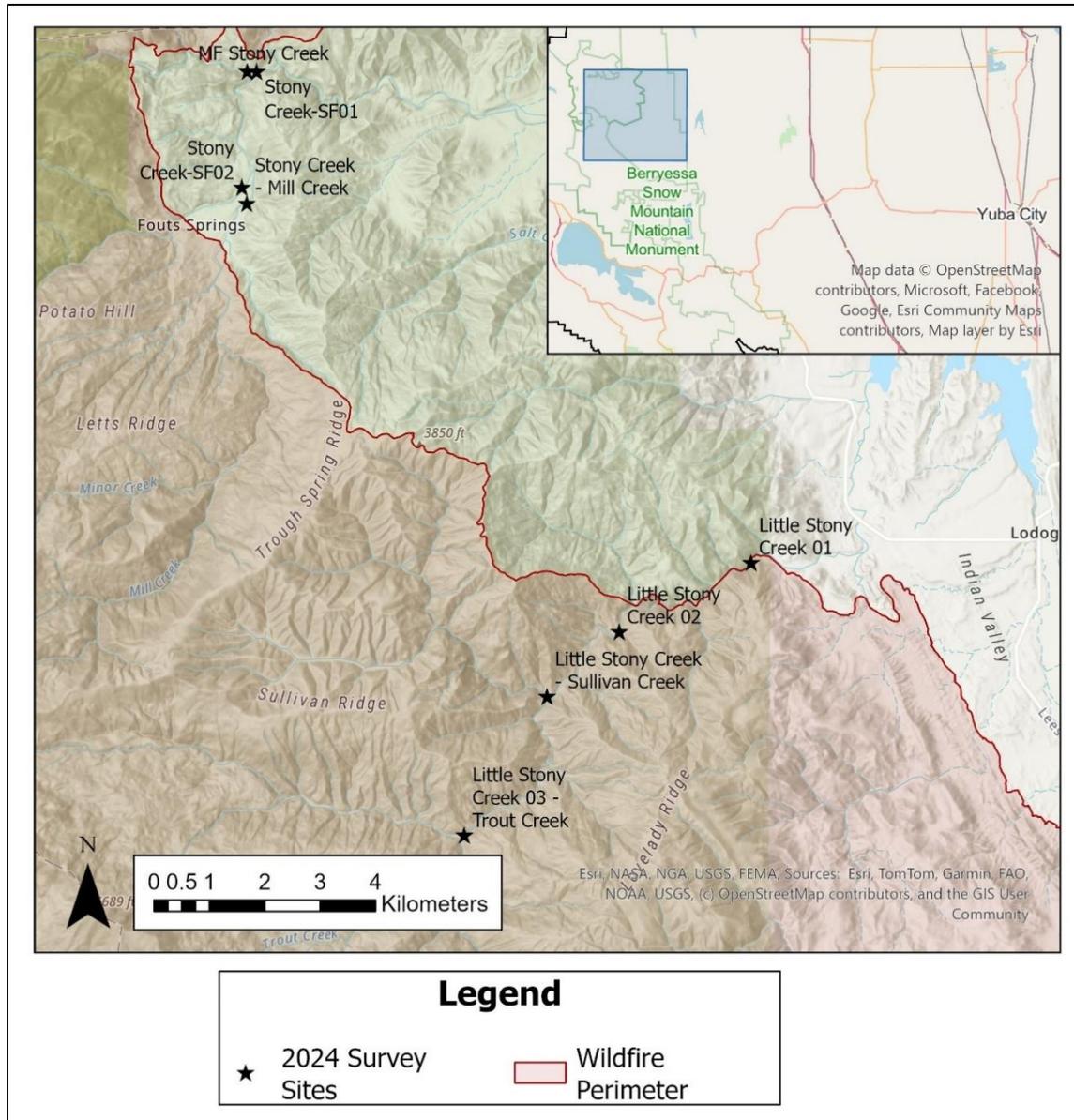


Figure 6. 2024 survey locations within and adjacent to the Ranch Fire footprint

Egg mass surveys were conducted in both streams on May 15 and 16, 2024. Unfortunately, data from three survey reaches on Little Stony Creek were lost when the phone collecting the data was damaged due to water exposure. Although the data was lost, egg masses and adult FYLF were observed in the Little Stony Creek-Sullivan survey site. The only complete data set from the Little Stony watershed for this survey period was at Trout Creek. During this survey >2,000 FYLF early-stage tadpoles were observed (**Table 3**).

Surveys were conducted at two reaches of Stony Creek: South Fork Stony Creek and Mill Creek (**Figure 7**). At South Fork Stony Creek, eight egg masses, two subadults, and one adult female FYLF were observed as was one adult northwestern pond turtle.

In Mill Creek, four egg masses, 100 early-stage tadpoles, one subadult, and four adult FYLF were observed. No bullfrogs were observed at either site.



Figure 7. Survey site at Stony Creek South Fork on October 10, 2024 (CDFW)

Surveys for YOY were conducted at both streams October 9-11, 2024 (**Table 3**). Of note, no bullfrogs were observed in Stony Creek, but a breeding population of bullfrogs was prolific throughout the downstream reaches of Little Stony Creek where no FYLF were observed. There is concern that bullfrogs will continue to move upstream in this system. Bullfrogs have the potential to outcompete or displace the FYLF population in Little Stony Creek. No frogs were PIT tagged at either Stony Creek or Little Stony Creek.

Table 3. Number of Foothill Yellow-legged Frogs (FYLF; *Rana boylei*) of all life stages observed at Ranch Fire survey sites in 2024. Bullfrog presence or absence is also noted for each site.

2024 Ranch Fire Surveys							
Site Name	Date	<i>R. boylei</i>					Bullfrogs Present?
		Egg Masses	Tadpoles	YOY	Sub-adults	Adults	
Little Stony-Trout Cr.	05/15/24	0	>2,000	0	0	0	No
SF Stony Cr. 01	05/16/24	8	0	0	2	1	No
Mill Creek	05/16/24	0	100	0	1	4	No
SF Stony Cr. 02	10/09/24	0	0	16	7	1	No
MF Stony Cr.	10/09/24	0	0	0	0	1	No
Mill Creek	10/10/24	0	0	8	11	1	No
SF Stony Cr. 01	10/10/24	0	0	2	0	0	No
Little Stony Cr.- Sullivan	10/11/24	0	0	2	8	0	Yes
Little Stony Cr. 02	10/11/24	0	0	0	0	0	Yes (500+ tadpoles)
Little Stony Cr. 01	10/11/24	0	0	0	0	0	Yes (20 tadpoles)

Hennessey Fire: Fiske Creek & Cache Creek

Fiske Creek, a tributary to Cache Creek, contains a small but seemingly persistent FYLF population. This population is not listed under either ESA or CESA. However, continued monitoring of this FYLF population may provide valuable insight and management recommendations that can be implemented to support the protected populations.

In 2024, egg mass surveys were conducted in Bear Creek and Fiske Creek on May 2 and May 9, respectively (**Figure 8**). Snorkel detection was not utilized because the surveys were conducted solo. In Bear Creek 03-Brophy Canyon, one adult bullfrog and two garter snakes were observed. No FYLF were observed in Bear Creek.

Two discrete reaches were surveyed in Fiske Creek between the confluence with Cache Creek and the confluence with Bear Canyon. In Fiske Creek 01, ~1,400 early-stage FYLF tadpoles were observed. One adult bullfrog and one hatchling northwestern pond turtle were observed as well. In Fiske Creek 02, five adult FYLF were observed as well as ~400 early-stage tadpoles and ten egg masses. Two northwestern pond turtles (one adult, one hatchling) were also observed. In Bear Canyon, two egg masses, ~300

early-stage tadpoles, one sub-adult, and six adult FYLF were observed. No frogs were PIT tagged at this site.

Additional late summer surveys were scheduled, but unfortunately the surveys could not be completed due to a toxic algae bloom, which closed water access. Due to the unsafe survey conditions present in late summer 2024, it is recommended that designated egg mass and tadpole surveys are prioritized in the future.

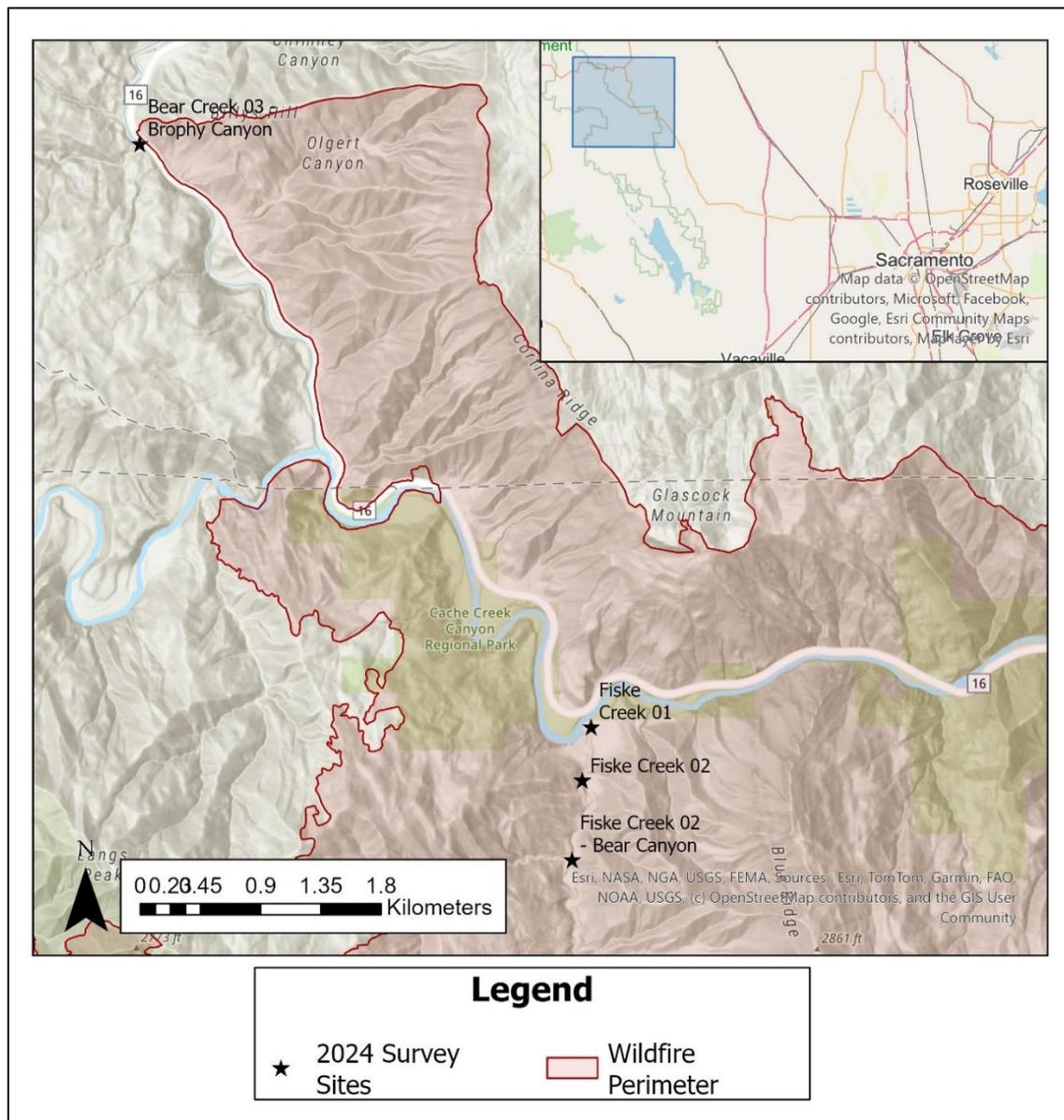


Figure 8. 2024 survey locations within and adjacent to the Hennessey Fire footprint

Camp Fire: Butte Creek

Populations of FYLF had previously been documented at this site, including during PG&E's relicensing surveys in 2006, but there were no records of more recent surveys. On August 9, 2023, a section of the Butte Creek Canal (owned and operated by Pacific Gas & Electric Company), experienced a canal failure. For ten hours, water leaked between the liner of the canal and deposited sediment, rock, and other debris into Butte Creek. The sediment plume, which included fine silt and clay, was observed miles downstream, turning the Butte Creek a brownish-orange color for days after the initial canal failure. In 2024, CDFW established a relationship with the Mechoopda Indian Tribe of Chico Rancheria, and the tribe gave permission for surveys to be conducted on their land at Butte Creek Ecological Preserve (BCEP). To target each life stage, BCEP was surveyed three times in 2024: May 30, July 1, and September 19.

On May 30, three egg masses and ~100 early-stage FYLF tadpoles were observed. One subadult and one adult FYLF were handled and appeared to be in good health. On July 1, two sub-adults and ~20 mid-stage tadpoles were observed. During the September 19 survey, two adults, two subadults, and 22 YOY FYLF were observed. One male FYLF was captured and PIT tagged. During each survey between one and four adult bullfrogs were observed, and during the September 19 survey, a pool with ~150 tadpoles was identified as a primary bullfrog breeding area. Other species observed at this site included California toad (*Anaxyrus boreas halophilus*) and unidentified garter snakes (*Thamnophis* sp.).

This FYLF population is currently listed as threatened by both CESA and ESA and was included in the critical habitat designations proposed by USFWS in 2025 (Unit NF-1: North Feather DPS).

Timelapse Cameras

CDFW continues to deploy timelapse cameras at select FYLF monitoring sites in the NCR, and seven are currently installed. Three cameras are currently installed at long-term monitoring locations in the Camp Creek watershed within the Caldor Fire footprint to record annual changes in stream flow. One camera is installed at MF American River to monitor flow changes due to natural seasonal variation and nearby hydropower activity. One camera is installed along Shirttail Creek in Tahoe National Forest as part of a project to monitor and improve habitat for FYLF. Two cameras are deployed at artificially created wetlands on the Tahoe National Forest in association with a restoration project to benefit California Red-legged Frogs (*Rana draytonii*).

Each camera is checked at least twice per year, and photos are downloaded and catalogued. Photos are also uploaded to the Wildlife Insights website (wildlifeinsights.org) as part of a statewide initiative to monitor stream flows. An additional three cameras will be installed by CDFW during the 2025 field season.

V* and Rapid Stream Soil & Sedimentation Monitoring

To quantify and monitor how FYLF lotic habitats vary and change over time, CDFW staff collected data on pool habitats in larger lotic systems and general habitat conditions in smaller order and headwater streams. Specifically, initial V* monitoring data was collected at four pools in three different watersheds to assess fine sediment accumulation (**Figure 9**). V* surveys were conducted using a standardized protocol (Hilton & Lisle 1993). Staff also utilized CDFW's Rapid Stream Soil and Sedimentation Monitoring protocol to assess sedimentation in six sites in four watersheds.

Temperature and barometric dataloggers were deployed at one location at Camp Creek 01 as a trial. Due to concerns about environmental impacts to the data loggers, protective PVC housing has been developed and will be utilized when additional data loggers are installed during the 2025 field season.

As the team is now familiar with the protocols and will be at full capacity, the goal is to expand the implementation of these protocols to better evaluate how areas with varying levels of disturbance (e.g., burn severity and proportion of watershed burned) are affected by sedimentation inputs and how these inputs may change over time. As a measure of disturbance resilience, these approaches can identify if certain areas are more affected than others by environmental perturbations such as climate change, drought, and wildfire. This information can then be used to assist with current and future management of FYLF and its habitat, along with other taxa utilizing these same habitats.



Figure 9. CDFW staff conducting a V* survey at survey site CampCreek05 (CDFW)

Discussion

During this field season we gained a better understanding of the additional time and thoughtfulness needed when working in fire footprints. This was true both in creating the survey schedule and while conducting the surveys. The large number of dead trees standing throughout fire footprints meant surveys often needed to be completed via day trips rather than camping nearby, so additional hours of work time were spent driving each week. The numerous burned trees also made it difficult to access sites when downed trees closed roads or caused two surveys to be ended early due to safety concerns during high winds. Downed trees further complicated VES by requiring surveyors to repeatedly climb over or go around trees that had fallen into the stream. We will utilize our improved understanding of the complexities of working in fire footprints to work more efficiently by communicating regularly with local project partners about site and road conditions, checking wind forecasts before departing for the field, and grouping site visits together. With a better understanding of the intricacies of conducting VES in fire footprints, we can better plan for future surveying needs.

We recommend continuing annual monitoring of documented populations via VES and/or capture-mark-recapture surveys. This will facilitate greater understanding of how these vulnerable populations respond to wildfire. We also recommend conducting exploratory surveys at sites with historic observations or suitable habitat but no observations to further our understanding of FYLF populations within fire footprints.

Works Cited

- California Department of Fish and Wildlife (CDFW). 2015. California State Wildlife Action Plan, 2015 Update: A Conservation Legacy for Californians. Edited by A.G. Gonzales and J. Hoshi, PhD. Prepared with assistance from Ascent Environmental, Inc., Sacramento, CA. Available from: wildlife.ca.gov/SWAP/Final
- California Department of Fish and Wildlife (CDFW). 2020. California Fish and Game Commission Notice of Findings for Foothill Yellow-Legged Frog (*Rana boylei*). Available from: nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=177905
- CNDDDB California Natural Diversity Database. (2025, March 31). CNDDDB California Natural Diversity Database. Calif. Dept. of Fish and Wildlife. Biogeographic Information and Observation System (BIOS). Retrieved April 28, 2025, from: apps.wildlife.ca.gov/bios6/
- Hilton, S and T. E. Lisle. 1993. Measuring the Fraction of Pool Volume Filled with Fine Sediment. Note PSW-RN-414. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture. Available from: krisweb.com/biblio/gen_usfs_hiltonetal_1993_fraction.pdf
- Peek, R.A., S. M. Yarnell, and A. J. Lind. 2017. Visual Encounter Survey Protocol for *Rana Boylei* in Lotic Environments. Available from: watershed.ucdavis.edu/resources/3591
- Placer County Water Agency. 2024. Placer County Water Agency Middle Fork American River Project (FERC Project No. 2079): 2023 Foothill Yellow-Legged Frog Monitoring Report. Available from: hydropowerelibrary.pnnl.gov/Documents/20240723-5073/3FA57A5A-52A5-C878-8405-90E0AC600000
- United States Fish and Wildlife Service (USFWS). 2023. Special Status Assessment Report of the Foothill Yellow-legged Frog (*Rana boylei*). Available from: ecos.fws.gov/ServCat/DownloadFile/235951