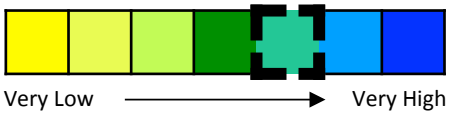
Mountain Yellow-Legged Frogs

Climate Change Vulnerability, Adaptation Strategies, and Management Implications

General Information:

There are two species of mountain yellow-legged (MYL) frogs in the Sierra Nevada (referred to collectively as "mountain yellow-legged frogs"). The MYL frog (*Rana muscosa*) is endemic to the southern Sierra Nevada, and has two distinct population segments (north and south). The Sierra Nevada MYL frog (*Rana sierrae*) is endemic to the northern and central Sierra Nevada. Existing MYL frog populations occur mostly on national park and national forest lands and are generally restricted to mid- to high-elevation (1370-3660 m; 4495-12,008 ft) aquatic habitat, such as lakes, seeps, springs, slow-moving streams, and meadows. Prior to the 1970s, MYL frogs were abundant in Sierra Nevada aquatic ecosystems, however significant declines have led to the disappearance of MYL frogs from between 70-90% of their historic localities. A number of factors are thought to have contributed to their decline, including introductions of non-native fishes, pesticides, pollutions, pathogens, livestock grazing, and recreational activities. Effective June 30, 2014, the Sierra Nevada MYL frog and the northern distinct population segment of MYL frogs are considered endangered species.

Species Vulnerability: Moderate-High



Mountain yellow-legged (MYL) frogs depend on perennial water for breeding and prolonged larval development. They are sensitive to any climate or climate-driven changes that affect habitat hydrology, water quality, and/or predator-prey relationships, including altered precipitation volume and timing, shifts in snowmelt volume and timing, altered stream flows, and increased air and water temperatures. For example, earlier habitat desiccation and/or flooding as a result of hydrological shifts could negatively impact MYL frog fitness. MYL frogs are also sensitive to non-climate stressors that can compound climate-driven impacts, such as fish stocking, agrochemical contamination, and fungal infections. For example, stocked non-native trout have already reduced MYL frog populations and can severely limit breeding habitat by forcing MYL frogs into smaller, desiccation-prone ponds.

Projected Climate and Climate-Driven Changes	Impacts on Mountain Yellow-Legged Frog Habitat	Impacts on Mountain Yellow-Legged Frogs
Increased air temperature (+2.4 to +3.4˚C), with largest increases during summer	• Increased potential evaporation • Elevated water temperatures and decreased cold water habitat	• Altered development rates • Altered susceptibility to pathogen infection
Changes in precipitation and snowpack: – Decreased summer and fall precipitation – Decreased snowpack (-64% to -87%), especially in northern range – Earlier snowmelt	• Decreased mean annual flow (northern Sierra) • Runoff timing changes (south-central Sierra) • Longer low flow periods (central Sierra) • Shorter duration of cold water input and exacerbated temperature trends • Increased drying of lake habitat, especially smaller lakes	• Reduced recruitment success (i.e., lower egg mass counts, fewer successful metamorphs)

Mountain yellow-legged frogs likely have a limited ability to adapt to climate change due to their diminished populations and dependency on perennial water in high-elevation habitats. While they are able to disperse to new habitats, dispersal will likely not ameliorate MYL frog exposure to non-climate stressors.

Mountain yellow-legged frogs in the southern Sierra Nevada may be less vulnerable due to lower projected snowpack changes

Adaptation Strategies for Mountain Yellow-Legged Frogs

Adaptation Strategy	Specific Management Actions
Remove non-native fish populations to reduce overall stress on amphibians and increase their ability to cope with climate change	• Electroshock or gillnet aquatic invasive fish species • Conduct public outreach to prevent establishment of invasive species
Prevent establishment of predators/competitors that could amplify climate impacts on native amphibians	• Maintain and improve fish barriers in fishless systems to prevent invasion and establishment in MYL frog habitat • Public outreach to prevent stocking in fishless areas
Protect existing populations from climate and non-climate stressors	• Monitor populations for disease outbreaks • Treat animals when infected (in field or captivity)
Reintroduce MYL frogs to areas where they have been extirpated that could be viable frog habitat in the future	• Focus reintroductions in areas that have been restored
Focus management activities in areas identified as climate refugia	• Identify and protect climate refugia for MYL frogs • Prioritize locations for action (e.g., existing populations in unique sites, future suitable habitat)

Reducing non-climate stressors may help MYL frogs be more resilient to climate and climate-driven changes

Management Implications

This information can be used in a variety of ways:

✔ Forest Plan Revisions

✔ U.S. Forest Service Climate Change Performance Scorecard: Element 6 - "Assessing Vulnerability" and Element 7 - "Adaptation Actions"

✔ National Park Service Resource Stewardship Strategies, Fire and Fuel Management Plans, General Management Plans, Strategic Plans, and Wilderness Stewardship Plans

Further information and citations can be found in source reports, *A Climate Change Vulnerability Assessment for Focal Resources of the Sierra Nevada* and *Climate Change Adaptation Strategies for Focal Resources of the Sierra Nevada*, available online at the EcoAdapt Library: http://ecoadapt.org/library.

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