

Pacific Southwest Research Station

Sierra Nevada Research Center

Impacts of year-year variations of precipitation (snowpack and rainfall) on amphibian recruitment and survival

The Research:

Year to year variation in snowpack (20-200% of the average of predicting the effect of climate change) and summer rain create large fluctuations in the volume of water in ponds and small lakes of the higher elevation (>3000 m) Sierra Nevada. These water bodies are critical habitat for the imperiled mountain yellow-legged frog, *Rana muscosa*, which has decreased in abundance by up to 90% during the past century, due in part to the loss of suitable habitat and introduction of a fish predator (trout, *Oncorhynchus* spp.). Climate change is predicted to reduce the amount of snowpack, potentially impacting amphibian habitats throughout the Sierra Nevada by further reducing the lake and pond water levels and resulting in drying of small lakes during the summer.

Mountain yellow-legged frogs are closely tied to water during all life stages, and are unique in having a three- to four-year tadpole phase. Thus, tadpole survival and future recruitment of adult frogs requires adequate water in lakes and ponds throughout the year, but larger lakes are populated with fish that prey on frogs and tadpoles. Most successful frog breeding occurs in warm, shallow, fishless ponds that undergo wide fluctuations in volume. These water bodies would be most susceptible to the potential climate change effects of reduced snowpack, possibly resulting in lower tadpole survival.

Objectives:

This study explores the link between the changes in water availability – including complete pond drying – and the abundance and recruitment of mountain yellow-legged frogs in Dusy Basin, Kings Canyon National Park, California, USA. We propose using the low-snowpack years (1999, 2002, 2004) as comparative case studies to higher snowpack years to predict future effects of climate change on aquatic habitat availability and amphibian abundance and survival.



Photo: Kathleen Matthews



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Our Mission:

Sierra Nevada Ecosystems are complex and our knowledge of them is incomplete. As a result, the long term outcome of any given land and resource management strategy is uncertain. We will provide assistance to land managers and policy makers by addressing this management dilemma through targeted research, emphasizing an integrated, ecoregional approach to examine particular physical, ecological, and socio-economic issues, across a range of appropriate spatial and temporal scales specific to each issue.

This unit will represent the collective research expertise and interests of scientists located in Fresno, Davis and Albany as well as other scientists within the Pacific Southwest Research Station. With a full spectrum of research, from long term, fundamental research to short-term, tactical applications, this Center is intended to support conservation, restoration, and sustainable utilization of the lands within the Sierra Nevada ecoregion.



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Application of Research Results:

Our preliminary results suggest that more frequent summer drying of small ponds – as may be induced by climate change – will severely reduce frog recruitment. When combined with the invasive fish that prevent frog breeding in larger lakes, such effect of climate change may cause loss of local frog populations, and push the entire species towards extinction. While additional work is necessary to quantify the link between summer drying and frog recruitment, the results suggest that restoration efforts for mountain yellow-legged frogs include adequate fish-free larger water bodies that do not undergo periodic drying.



Photo: Igor Lacan

Location:

Dusy Basin, Kings Canyon National Park



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