

William R. Gould, wgould@nmsu.edu, 575 649-3129

William R. Gould¹, Andrew M. Ray^{2,3}, Charles B. Yackulic⁴, and Mike Tercek⁵

¹ Applied Statistics Program, New Mexico State University, Box 30001/MSC 3CQ, Las Cruces, NM, USA.

² National Park Service, Greater Yellowstone Network, Bozeman, MT, USA.

³ National Park Service, Southern Plains Network, Pecos, NM, USA.

⁴ Southwest Biological Science Center, U.S. Geological Survey, 2255 North Gemini Drive, Flagstaff, Arizona, USA.

⁵ Walking Shadow Ecology, Gardiner, MT, USA.

Title: Forecasting wetland and amphibian breeding dynamics in the Greater Yellowstone Ecosystem under climate change

Abstract: Amphibian population declines in response to climate change have been well documented. Declines in protected areas are particularly alarming as they suggest that setting aside lands may not be sufficient to protect species sensitive to climate change, disease, and other stressors. In the northern portion of Yellowstone National Park, wetland desiccation and amphibian population declines were documented in the early 1990s and the mid-2000s suggesting that even common amphibian species within Yellowstone National Park were likely to decline further. Here, we analyze wetland inundation and amphibian breeding dynamics for two widespread anurans between 2006-2019. Using a cluster sampling design encompassing Yellowstone and Grand Teton national parks, we characterize spatio-temporal variation in multistate occupancy dynamics in response to interannual variation in snowmelt runoff. Hindcasts to the aforementioned smaller study area and short-term forecasts suggest agreement of predicted data with observed sample data. Forecasts to mid-century informed by climate change predictions of runoff suggest declines in the number of permanent and semi-permanent ponds and increases in the number of ephemeral and permanently dry ponds. The changes are expected to lead to turnover in which wetlands are used by either species for breeding, however overall rates of breeding occupancy are forecasted to remain steady or decline only modestly. Drying of wetlands and declines in breeding occupancy are expected to be greatest in the Northern and lower elevation portions of both national parks, but may be offset by increased breeding by both species in other portions of the ecosystem.

Contributed Topics: Native Fish and Wildlife Status, Trends and Habitat Needs (first choice); Climate Change Adaptation (If this category is not restricted to Wildland Fire topics-otherwise perhaps Resource Data and Assessments -I am uncertain as to what this topic entails) (second choice)