

Greater Yellowstone Network

RESOURCE BRIEF

National Park Service
U.S. Department of the Interior

Intermountain Region
Inventory & Monitoring Program



Amphibian and Wetland Monitoring

Globally, wetlands are ranked among the habitats most threatened by climate change.¹ Wetland-dependent organisms, including amphibians, are vulnerable to wetland loss. Amphibians have already exhibited large declines globally² and regionally from a combination of wetland drying and other diverse factors. Amphibian declines have even been noted in national parks³ and in other highly protected landscapes. In Grand Teton and Yellowstone national parks, amphibians depend on limited wetland habitat where quiet, shallow waters are used for egg laying and tadpole development. Wetland inundation patterns are strongly tied to annual snowpack and in recent decades, the snowpack throughout the northern Rocky Mountains has declined.⁴

Long-term Monitoring

Long-term monitoring of wetlands in Grand Teton and Yellowstone national parks is vital to understanding population trends for amphibians and other wetland-dependent species. The Greater Yellowstone Network (GRYN), along with federal, university, and nongovernmental organization (NGO) scientists, has been monitoring amphibian populations and wetland habitats since 2005 following GRYN's cooperative amphibian monitoring protocol.⁵ Comprehensive monitoring of amphibians requires surveying and revisiting hundreds of wetlands and potential breeding sites annually.

The overall goal of the long-term monitoring program is to characterize changes in wetland condition and estimate occupancy rates for breeding native amphibian species. Annual monitoring is used to track and quantify changes in the number and quality of potentially suitable breeding sites. Our monitoring is combined with other Amphibian Research and Monitoring Initiative (ARMI; see inset) regional and national monitoring efforts to better understand trends in amphibian populations. The four native amphibian species that are regularly observed in Grand Teton and Yellowstone national parks include: the Columbia spotted frog (*Rana luteiventris*), the boreal chorus frog (*Pseudacris maculata*), the barred tiger salamander (*Ambystoma mavortium*), and the boreal toad (*Anaxyrus boreas boreas*).



NPS/GRYN

Boreal chorus frog (*Pseudacris maculata*) adult; chorus frog calls are among the most common sounds of springtime in Grand Teton and Yellowstone national parks.

Status and Trend

GRYN's monitoring results show that variations in annual snowpack and total precipitation influence the number of wetland breeding sites available to amphibians annually. Reduced snowpacks in 2007 and 2012 resulted in a reduction in wetland size and the unavailability of approximately 40% and 25% of all visited wetlands. In contrast, significant snowpacks in 2011 produced flooding sufficient to inundate all but 4% of monitored wetlands (Figure 1).

A recent analysis completed by the U.S. Geological Survey's ARMI documented that North American amphibian populations are declining at an average rate of approximately 4% annually. The study summarized monitoring data from 2002 to 2012 using the most comprehensive dataset on amphibian trends in the U.S. Amphibian species described as endangered, threatened, or vulnerable declined >11% annually, a rate far higher than the average, and declines were well documented on federally managed lands. Importantly, ARMI's analysis also indicated that some of the greatest declines in amphibian occupancy were observed on National Park Service lands.³ While the reason for amphibian declines on the nation's most protected lands varies, these trends are capturing the attention of scientists and federal land managers alike.

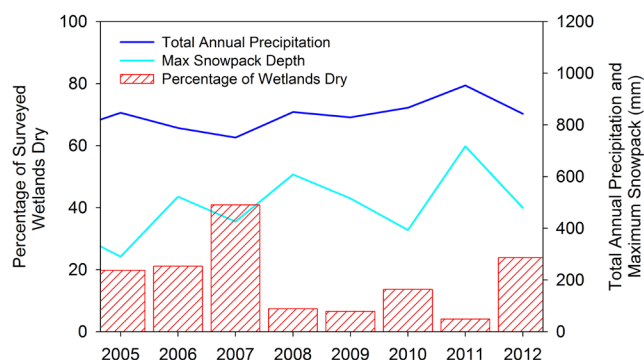


Figure 1. Percentage of surveyed wetland breeding sites that are dry annually. Dry wetlands are related to maximum annual snowpack and total annual precipitation. Note that 2005 was a pilot year for GRYN's Amphibian and Wetland Monitoring Program and results do not reflect monitoring of all long-term wetland sites.

Watershed-level occupancy estimates suggest that amphibian populations in monitored watersheds (larger landscape units) of Yellowstone and Grand Teton national parks are relatively stable among years.⁶

Occupancy estimates at individual wetland sites suggest modest declines for Columbia spotted frogs (*Rana luteiventris*) may have occurred since monitoring began in 2005. This finding is consistent with a recent analysis of Columbia spotted frog breeding in the Northern Rockies.⁷

The total number of surveyed wetlands with boreal chorus frog (*Pseudacris maculata*) breeding declined from 2011 (wet year) to 2012 (dry year) by a total of 30 sites (Figure 2). Chorus frogs rely on shallow, ephemeral wetlands for breeding. Increases in temperature and decreases in snowpack will disproportionately affect ephemeral wetlands.

Next Steps

GRYN's amphibian and wetland monitoring efforts are:

- documenting information about the dynamics of wetlands and helping identify drivers of wetland loss;
- revealing which amphibian species are most vulnerable to climate-driven changes in wetland habitat;

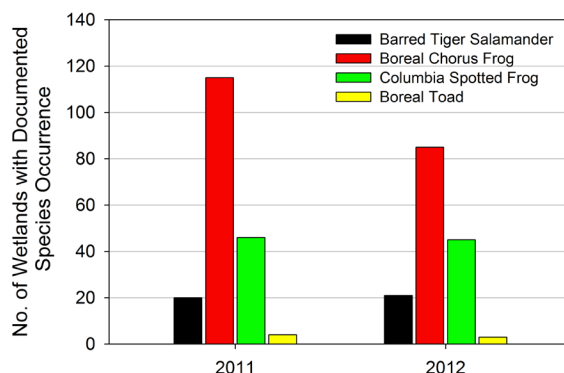
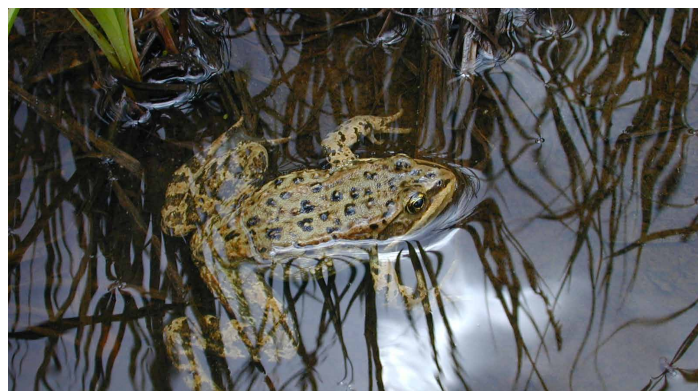


Figure 2. Total number of wetlands where each species was observed in 2011 and 2012. The survey efforts in 2011 and 2012 were roughly equivalent. The reduction in observations of boreal chorus frogs in 2012 resulted from the unavailability of breeding sites following a reduced snowpack.

- highlighting the importance of long-term amphibian monitoring datasets;
- aiding the understanding of amphibian trends along a transect from Glacier National Park and extending to Rocky Mountain National Park, and across North America;
- forming new partnerships in the Greater Yellowstone Ecosystem and transferring protocols to monitoring efforts outside of GRYN parks; and
- exploring the use of innovative, DNA-based monitoring tools.



Columbia spotted frog (*Rana luteiventris*) adult at a breeding site.

¹ Intergovernmental Panel on Climate Change. 2008. Climate change and water, B. Bates, Z. Kundzewicz, S. Wu, and J. Palutikoff, editors. Technical paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva.

² Stuart, S. N., et al. 2004. Status and trends of amphibian declines and extinctions worldwide. *Science* 306:1783-1786.

³ Adams, M. J., et al. 2013. Trends in amphibian occupancy in the United States. *PLoS ONE* 8(5):e6437.

⁴ Pederson, G. T., et al. 2011. The unusual nature of recent snowpack declines in the North American Cordillera. *Science* 333:332-335.

⁵ Bennetts, R., et al. 2013. Cooperative amphibian monitoring protocol for the Greater Yellowstone Network: narrative, version 1.0. Natural Resource Report NPS/GRYN/NRR—2013/654. National Park Service, Fort Collins, Colorado.

⁶ Gould, W. R., et al. 2012. Estimating occupancy in large landscapes: evaluation of amphibian monitoring in the Greater Yellowstone Ecosystem. *Wetlands* 32:379-389.

⁷ Hossack, B., et al. *In press*. Roles of patch characteristics, drought frequency, and restoration in long-term trends of a wide-spread amphibian. *Conservation Biology*.