

U.S. and China Assess Ecosystem Effects of a Fading Cryosphere

Impacts of a Changing Cryosphere on Lakes and Streams in Mountain Regions: US-China Collaborative Workshop at Qinghai Lake; Qinghai, China, 21–27 August 2017



Participants in the U.S.-China cryosphere workshop transit the shores of Qinghai Lake, 3,260 meters above sea level, near China's Bird Island preserve. The lake's shoreline habitats serve as a key breeding ground for many species, including the famous bar-headed goose that migrates over the Himalayas each year. Credit: Jim Elser

By [Alia L. Khan](#) © 13 February 2018

Global climate change produces cascading effects on ecosystems. The cryosphere—the frozen-water domain—of high mountain regions is especially vulnerable to these changes, and the effects extend to downstream aquatic ecosystems. Glaciers and snowpack, the key cryospheric components of high mountain systems, are sensitive to increases in temperature, shifting atmospheric circulation patterns, and varying amounts and forms of precipitation.

Losses of glacial ice (<https://eos.org/scientific-press/new-greenland-maps-show-more-glaciers-at-risk>) and permanent snowpack (<https://eos.org/opinions/defining-snow-drought-and-why-it-matters>) as well as thawing (<https://eos.org/editors-vox/thawing-permafrost-monitored-quantified-predicted>), permafrost are widespread and complex; they affect key aspects of alpine lakes and streams that include temperature, water discharge, and nutrient supply. Documenting (<https://eos.org/research-spotlights/how-does-snow-affect-the-intensity-of-mountain-precipitation>), understanding, and forecasting these effects are challenging and require broad interdisciplinary collaboration.

To address these global challenges, the U.S. National Science Foundation (NSF (<https://www.nsf.gov>)) and National Natural Science Foundation of China (NSFC (<http://www.nsfc.gov.cn/publish/portal1/>)) jointly funded a workshop (<https://renzedyk.wixsite.com/us-china-workshop>) that brought together experts in limnology (<https://limnology.org/what-is-limnology/>), aquatic biogeochemistry, atmospheric science, glaciology, and hydrology from the United States and China. The workshop focused on linking these fields to better understand how changes observed in the cryosphere affect lakes and streams in mountain regions.

Participants discussed the downstream aquatic biological effects of a changing cryosphere as they walked on the salt beds of a shallow lake.

Upon arriving at Qinghai Lake (<https://www.chinahighlights.com/xining/attraction/qinghai-lake.htm>), participants attended a welcome event that included remarks from the co-organizers and NSF and NSFC dignitaries. The second day of the workshop featured talks from U.S. and Chinese participants that addressed cutting-edge issues of ecology in the cryosphere. These issues included topics such as the formation of “new” proglacial lakes, the effect of glacier runoff on downstream aquatic ecosystems, and emerging techniques to detect microbial life (<https://eos.org/scientific-press/algae-reduce-reflectivity-enhance-greenland-ice-sheet-melting>) in the cryosphere. Later that evening, the group hiked around a local Tibetan monastery while discussing scientific topics such as the processing and degradation of organic carbon in the cryosphere.

On the third day, U.S. and Chinese team members traveled to Chaka Lake, a large salt lake in Qinghai Province. Participants continued their scientific discussions surrounding the downstream aquatic biological effects of a changing cryosphere as they walked on the salt beds of the shallow lake. One topic of discussion was the algal blooms in Qinghai Lake, which are relatively unprecedented for this region.

The fourth day was mostly spent in three breakout groups: climate, cryosphere, and ecology. Each group summarized major patterns, themes, and contrasts of the changing cryosphere across Asia and North America. Participants debated existing open research questions in the field of ecology in high mountain systems to generate iterations of a conceptual diagram.

The consensus-driven view that emerged from sharing data related to cryosphere dynamics was needed to enhance U.S.-China collaborations.

The last day was spent linking the respective breakout groups through discussions and the finalization of a conceptual diagram that depicts the group's key conclusions. The diagram relates the effects of a changing cryosphere on the ecology of lakes and streams in high mountain regions. It shows global drivers that affect climate at high elevations, followed by the consequences for snow cover and glacier mass balance (<https://eos.org/research-spotlights/human-actions-affect-greenland-ice-sheet-surface-mass-balance>) (which then affect more specific physical characteristics in the cryosphere, such as albedo and the production of aeolian dust). It also includes the ecological responses to these drivers, such as changes to algal and microbial communities.

This consensus-driven view, which emerged from sharing data related to cryosphere dynamics, was needed to enhance U.S.-China collaborations. A farewell banquet solidified newfound collaborations and friendships across the U.S. and Chinese teams.

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