



Editorial

Tackling on environmental changes in Tibetan Plateau with focus on water, ecosystem and adaptation

Tandong Yao ^{a,b,c}^a Institute of Tibetan Plateau Research, Chinese Academy of Sciences, Beijing 100101, China^b Lanzhou University, Lanzhou 730000, China^c Center for Excellence in Tibetan Plateau Earth Sciences, Chinese Academy of Sciences, Beijing 100101, China

The Tibetan Plateau represents a unique landform with an average elevation that is higher than 4,000 m above sea level. Also known as the roof of the world and the Asian Water Tower, this topography preserves the largest ice mass as the solid water outside the Arctic and Antarctica. The Tibetan Plateau is a natural laboratory for research on multi-sphere interactions and for the study of human-nature relationship. China conducted the first large and longstanding scientific expedition to this area between the 1970s and the 1990s and achieved fruitful scientific results.

The Tibetan Plateau has experienced dramatic environmental changes in the five decades since the first scientific expedition was initiated. Temperatures have increased twice as fast as the global average in this region, making the plateau one of the world's most risky landscapes with respect to its environmental consequences. Warming-induced glacier melt, ice collapse, glacial lake expansion, and glacial lake outburst floods are rapidly destabilizing the Asian Water Tower. Warming-induced asymmetric ecosystem processes are potentially risky. Consequently, the socio-economic progress of more than 3 billion people who live in countries around this region, particularly along the Silk Road, is under threat. Urgent research efforts are required to address the swift changes occurring in glaciers, lakes, rivers, permafrost, snow cover, ecosystems, etc. Scientific understanding can boost regional cooperation against such environmental changes and can help the promotion of mitigation and adaptation policies for the high-quality development of the area.

To understand the processes and mechanisms of environment changes, particularly focusing on water, ecosystem and human activity, the Second Tibetan Plateau Scientific Expedition and Research (STEP) was initiated in 2017 by Chinese Academy of Sciences (CAS) and is now initiating at China's national level. STEP will prioritize environmental changes that have transpired over the last 50 years and will study their impact on human society to strengthen the capacity of the Tibetan Plateau as an ecological buffer. Further, it will attempt to provide science-based solutions for the protection of the Asian Water Tower and for green development. Efforts taking the approach of the Tibetan Plateau Earth System sciences will study the apparent changes in the region and their effects. Such endeavors will focus on the environmental significance of different processes such as the Tibetan Plateau uplift,

the environmental resilience of the region under climate warming, the changes observed in the Asian Water Tower and their impact, the westerly-monsoon interaction, the effects of anthropogenic activities and their modulation, and the prediction, warning, management, and reduction of the risks posed by hazards.

Since STEP was initiated by the CAS, the field expeditions have been also implemented with the support of the CAS Strategic Priority Research Program entitled "The Pan-Third Pole Environment Study for a Green Silk Road (Pan-TPE)." The major achievements of this program in the past two years are as the following: (1) the STEP has found an Asian Water Tower with accelerated melt and imbalanced water storage, accompanied with emerging new disasters, (2) the STEP has detected the greening up of Tibetan Plateau, which accompanies with potential new risks in local agriculture at the same time, (3) the STEP has revealed the history of differential uplift of the Himalayas and proposed biological evolution models of "Out of Tibet" and "Tibet hub of fauna migration".

This special topic of this issue represents some of the accomplishments mentioned above. I am grateful to the authors and reviewers for their contributions and to the journal editorial board for its generous support and its sincere efforts toward the publication process of this special issue.

In 2019, the STEP will be executed at the national level and will cooperate with the Third Pole Environment (TPE) program. This initiative will allow the best-minds of the region and beyond to work together on the Tibetan Plateau Earth System changes and on the adaptation for a sustainable development. We look forward to publishing more results obtained by STEP in *Science Bulletin* in the near future.



Tandong Yao is a member of the Chinese Academy of Sciences. He is also the Honorary Director of the Institute of Tibetan Plateau Research, Chinese Academy of Sciences. He is dedicated to the study of earth system sciences and of environmental changes in the Third Pole region. He is currently the lead scientist of the Second Tibetan Plateau Scientific Expedition and Research and of the Pan-Third Pole Environment Program.

SPECIAL TOPIC: The Second Tibetan Plateau Scientific Expedition and Research (I).
E-mail address: tdyao@itpcas.ac.cn

<https://doi.org/10.1016/j.scib.2019.03.033>

2095-9273/© 2019 Science China Press. Published by Elsevier B.V. and Science China Press. All rights reserved.