

# CONDUCTING COMMUNICATION, RESEARCH, AND EDUCATION FROM CLIMATE CHANGE PERSPECTIVES

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Across the globe, climate warming is projected to lead to decreased water quality and availability. This is due to several factors, including melting glaciers, changing precipitation patterns, and increased evaporation. As a result, water resources will become scarcer and water quality will decline, which will have negative impacts on ecosystems, land use, and human health. Adaptation strategies depend on human behavior shifts and are crucial to combat the climate crisis (Climate change and human behaviour 2022). However, less effort has been made to study, research, and communicate climate change impacts on aquatic ecosystems in the Global South compared to countries in the Global North. A group of five Ph.D. students and early career researchers, connected through the Association for the Sciences of Limnology and Oceanography (ASLO), joined together to discuss the challenges of communication, research, and education from climate change perspectives and develop ideas on how to foster diversity, equity, inclusion, and justice in the aquatic sciences community (Fig. 1). We briefly outline these challenges to communication, research, and education in this introductory Viewpoint, and then discuss each further in separate Viewpoints included in this issue of the *L&O Bulletin*.

## COMMUNICATION

An important part of science is reproducibility and communication to the broader scientific and nonscientific community, especially when we are discussing climate change and the effects it will

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have on our global society. The majority of studies that make claims of global climate change impact do not incorporate regional and local issues from Global South countries (Callaghan et al. 2021), yet climate change disproportionately threatens low-income countries, including many in the Global South (Levy and Patz 2015). We believe that factors contributing to this bias include the lack of Open Access science from the Global South due to language barriers and high publication and translation costs that increase the systemic issues related to diversity and inclusion from underrepresented research groups. To overcome these challenges, we propose solutions, including citing work from scientists in the Global South, outline how international societies can better promote regional journals, and indicate how we can all use social media to better our understanding and connection between research in the Global North and South. It is critical to expand our understanding of climate change across all regions of the world, and learning

from scientists in the Global South will likely support more underrepresented and underfunded researchers.

## RESEARCH

To address the climate-driven challenges facing the globe—both North and South—we need research to understand the effects that are going to manifest in a future world. A promising new technology to monitor species' movement, behavior, and interactions is eDNA. The use of eDNA may be especially beneficial for studying climate change effects on aquatic ecosystems. However, the costs of eDNA monitoring can be prohibitive for underfunded researchers, especially those in the Global South, where the research budget is approximately a third of that of the Global North. For example, the research and development expenditure in Sub-Saharan Africa is only 0.5% of the Gross Domestic Product based on records from the World Bank (<https://data.worldbank.org/indicator/GB.XPD>).



**FIG. 1.** Word cloud in global map presenting the topics of the Viewpoint series about communication, research, and education on climate change.

RSDV.GD.ZS); despite the fact that Niger, Somalia, and Chad are some of the most vulnerable countries to climate change according to the Notre Dame-Global Adaptation Index (<https://gain.nd.edu/our-work/country-index/rankings/>). To address this knowledge gap, we propose that more funding should be allocated to the countries' most vulnerable to the impacts of climate change.

## EDUCATION

Is climate literacy approached the same way across the world? There are many barriers in reaching students, including lack of personal connection and differing religious and cultural beliefs. To reduce these barriers, we suggest more interdisciplinary collaborations should be fostered to expand scientific knowledge and interest around the globe at all levels of education. Sharing existing resources and knowledge between the Global North and South may introduce new discussions in early stages of education and promote climate literacy. Solutions to issues in climate literacy include using university archives to create lessons and to build connections to local communities and sharing generational knowledge. Expanding climate change literacy will only improve capacity for global research.

## SUMMARY

The impacts of climate change on water resources will have negative consequences globally. There is a need for improved communication, research,

and education from climate change perspectives, especially to bridge the gaps between the Global North and South. In the following articles, we describe inequalities in *communicating* climate change impacts and propose solutions to overcome them. We introduce the importance of technology and eDNA in climate change *research* and how to make this promising applied science standardized and useful, especially for countries already impacted by climate warming. Finally, we discuss how to reach students in all stages of *education* and under different cultural and religious backgrounds to build knowledge and information in a climate changing world. The goal of our discussions is to bring attention to important social and scientific aspects of climate change consequences around the world and how to face those challenges.

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