Global Change Biology

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OPINION

The Missing Global South in Climate Change Biology: Towards Equitable Knowledge Inclusion for Effective Global Solutions

Wesley Dáttilo[1,2] | Rodrigo Beas-Luna[2,3] | Alma Mendoza-Ponce[2,4] | Angela Nava-Bolanos[2,5] | Angela P. Cuervo-Robayo[2,6] | Carolina Ureta[2,7,8] | Constantino Gonzalez-Salazar[2,8] | Cuauhtemoc Saenz-Romero[2,9] | Daniel Jimenez-Garcia[2,10] | David A. Prieto-Torres[2,11] | Eduardo Cuevas[2,12] | Gabriela Castano-Meneses[2,5] | Gabriela Mendoza-Gonzalez[2,13] | Hibraim A. Perez-Mendoza[2,14] | Jonas A. Aguirre-Liguori[2,15] | Jose Alberto Zepeda-Dominguez[2,3] | Jose Miguel Sandoval-Gil[2,12] | Juan Manuel Dupuy-Rada[2,16] | Julio Campo[2,17] | Lazaro Guevara[2,6] | Leticia M. Ochoa-Ochoa[2,18] | Lorenzo Alvarez-Filip[2,19] | Luis Osorio-Olvera[2,13] | Ornela De Gasperin[1,2] | Pilar Angélica Gómez-Ruiz[2,16] | Pilar Rodriguez[2,4] | Rafael A. Lara-Resendiz[2,20] | Rusby G. Contreras-Diaz[2,21] | Santiago Ramirez-Barahona[2,22] | Tania Garrido-Garduno[2,23] | Tarin Toledo-Aceves[2,24] | Enrique Martinez-Meyer[2,6]

[1]Red de Ecoetologia, Instituto de Ecología AC (INECOL), Xalapa, Veracruz, Mexico | [2]Laboratorio Nacional de Biología del Cambio Climatico, SECIHTI, Ciudad de Mexico, Mexico | [3]Facultad de Ciencias Marinas, Universidad Autonoma de Baja California, Ensenada, Baja California, Mexico | [4]Facultad de Ciencias, Universidad Nacional Autonoma de Mexico, Ciudad de Mexico, Mexico | [5]Unidad Multidisciplinaria de Docencia e Investigacion, Facultad de Ciencias, Campus Juriquilla, Universidad Nacional Autónoma de México, Querétaro, Querétaro, Mexico | [6]Departamento de Zoologia, Instituto de Biología, Universidad Nacional Autonoma de Mexico, Ciudad de Mexico, Mexico | [7]Secretaría de Ciencia, Humanidades, Tecnología e Innovacion (Secihti), Benito Juarez, Ciudad de Mexico, Mexico | [8]Instituto de Ciencias de la Atmosfera y Cambio Climatico, Universidad Nacional Autonoma de Mexico, Ciudad de Mexico, Mexico | [9]Instituto de Investigaciones sobre los Recursos Naturales, Universidad Michoacana de San Nicolas de Hidalgo, Morelia, Michoacan, Mexico | [10]Laboratorio de Biodiversidad, Centro de Agroecología y Ambiente, Instituto de Ciencias, Benemerita Universidad Autonoma de Puebla, Puebla, Puebla, Mexico | [11]Laboratorio de Biodiversidad y Cambio Global (LABIOCG), Facultad de Estudios Superiores Iztacala, Universidad Nacional Autonoma de Mexico, Tlanepantla, Estad de México, Mexico | [12]Instituto de Investigaciones Oceanologicas, Universidad Autonoma de Baja California, Ensenada, Baja California, Mexico | [13]Instituto de Ecología, Unidad Mérida, Universidad Nacional Autónoma de México, Mérida, Yucatán, Mexico | [14]Laboratorio de Ecología Evolutiva y Conservacion de Anfibios y Reptiles, Facultad de Estudios Superiores Iztacala, Universidad Nacional Autónoma de México, Tlanepantla, Estado de México, Mexico | [15]Departamento de Ecología Tropical, Campus de Ciencias Biologicas y Agropecuarias, Universidad Autonoma de Yucatan, Merida, Yucatan, Mexico | [16]Unidad de Recursos Naturales, Centro de Investigación Cientifica de Yucatán (CICY), Mérida, Yucatán, Mexico | [17]Instituto de Ecologia, Universidad Nacional Autonoma de Mexico, Ciudad de Mexico, Mexico | [18]Museo de Zoología "Alfonso L. Herrera", Departamento de Biología Evolutiva, Facultad de Ciencias, Universidad Nacional Autónoma de México, Ciudad de México, Mexico | [19]Biodiversity and Reef Conservation Laboratory, Unidad Academica de Sistemas Arrecifales, Instituto de Ciencias del Mar y Limnologia, Universidad Nacional Autonoma de Mexico, Puerto Morelos, Quintana Roo, Mexico | [20]Instituto Tecnológico de Sonora, Cd. Obregón, Sonora, Mexico | [21]Escuela Nacional de Estudios Superiores, Unidad Merida, Universidad Nacional Autonoma de Mexico, Merida, Mexico | [22]Departamento de Botanica, Instituto de Biología, Universidad Nacional Autonoma de Mexico, Ciudad de México, Mexico | [23]Laboratorio de Genomica de la Biodiversidad (LAGEBI), Facultad de Estudios Superiores Iztacala, Universidad Nacional Autonoma de Mexico, Tlanepantla, Estad de México, Mexico | [24]Red de Ecología Funcional, Instituto de Ecología AC, Xalapa, Veracruz, Mexico

Correspondence: Wesley Dáttilo (wesley.dattilo@inecol.mx)

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ABSTRACT

Over the last decades, climate change biology has become a central field in global science, yet knowledge production and its inclusion in global strategies remain profoundly unequal. Our bibliometric analysis of over 580,000 records shows that ~80% of

author affiliations come from Global North institutions, meaning that research agendas, theoretical frameworks, and priorities are still largely shaped outside the regions with the highest biodiversity and greatest vulnerability to climate change. This imbalance reflects structural and historical inequalities that limit the ability of Global South countries to conduct autonomous research and sustain long-term monitoring. When research and funding originate abroad, local scientists are often excluded, leading to the loss of traditional knowledge, regional perspectives, and long-term capacity building. These dynamics leave tropical and subtropical bioregions (generally in the Global South) underrepresented in global climate knowledge. To address this imbalance, we propose six actions: invest in infrastructure and monitoring, strengthen local research networks, link funding to capacity building, promote open and equitable data access, connect science with regional policies, and foster intersectoral collaboration. We argue that truly effective climate change biology must be global, equitable, and diverse.

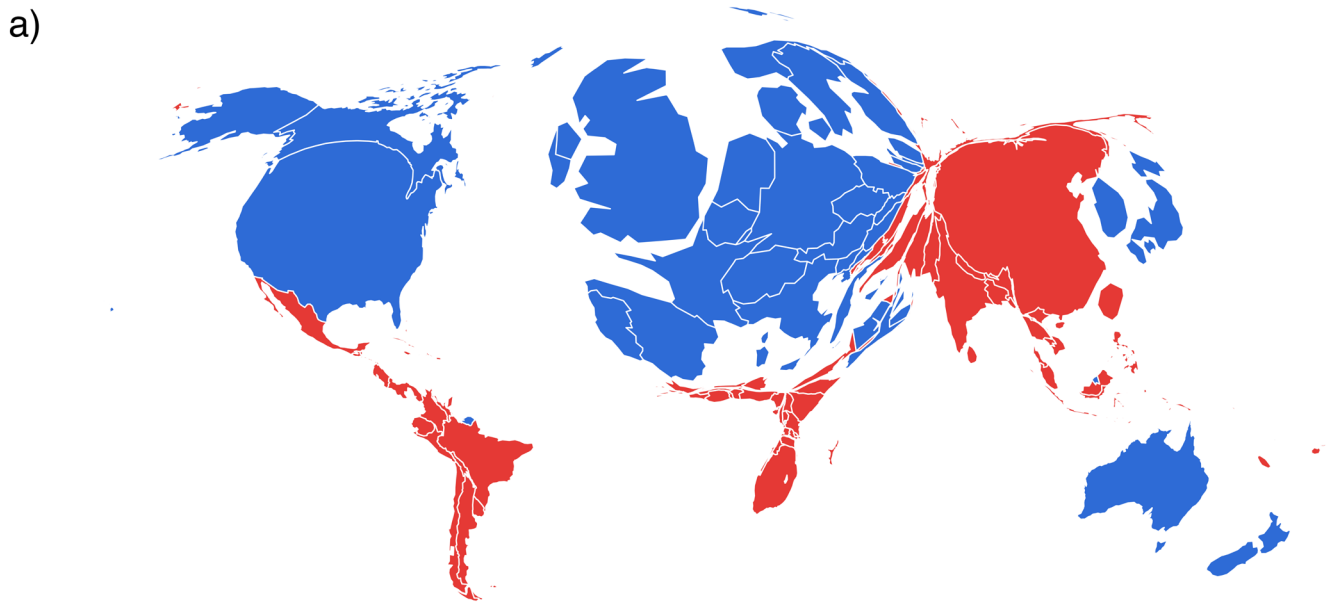
Inequalities in academic knowledge production are critical in the climate and biodiversity crises, affecting whose voices are heard and which solutions are prioritized (Lawlor et al. 2024). This asymmetry manifests as an imbalance in research funding, project implementation, scientific infrastructure, local capacity building, and the influence on global strategies and policies aimed at mitigating climate impacts. As a result, major intellectual gaps persist across large regions of the planet regarding biological responses to climate change. These gaps threaten the ability to respond effectively and fairly to climate challenges. The effects on social-ecological systems are especially severe in the Global South (i.e., regions historically subjected to extractive relations, limited investment in research, and marginal participation in global decision-making) (Ngcamu 2023). Meanwhile, about 92% of excess emissions have been produced by the Global North (i.e., countries that historically concentrated wealth, scientific capacity, and political influence in the global system) (Hickel 2020). Over the last decades, climate change biology has become a central field in global research, providing key knowledge for understanding, mitigating, and adapting to a rapidly changing planet (Callaghan et al. 2021). However, as the field expands, it becomes increasingly important to examine where this knowledge is produced and which contexts and realities it reflects.

To explore the geographic development of the scientific discourse in climate change biology, we performed a bibliometric review using the Web of Science database (access date: September 2025). Our search targeted publications containing the terms "climate change" AND "biology" (for the top 30 countries see https://doi.org/10.6084/m9.figshare.30735533). From the resulting 581,072 records, we extracted affiliation data and focused our analysis on the top 30 countries, which collectively accounted for over 85% of the total publications. To classify geographic affiliations into the Global North versus Global South, we followed the structural categorization from the Scholarly Community Encyclopedia (https://encyclopedia.pub/entry/37558). We found that 80% of all authors were affiliated with Global North institutions ($n = 24$; Figure 1), with the strongest concentration in the USA and many European countries. Importantly, these affiliations reflect institutional headquarters rather than study locations. In other words, even when research could be conducted in the tropics, its decisions regarding study design, interpretation, and authorship are disproportionately shaped by Global North institutions.

The reasons behind this disparity are multiple and structural, with historical imbalances persisting to the present. The Global North continues to extract highly skilled labor and resources from the Global South, generating economic and scientific losses for the latter (Hickel et al. 2022). Moreover, international climate change funding is heavily concentrated in institutions and agencies based in the Global North (Bergsvik et al. 2024), and projects involving the Global South are often designed and led mainly from Europe or North America (excluding Mexico), while local researchers are frequently limited to data collection or technical roles. This dependency is reinforced by the lack of sufficient scientific infrastructure and trained personnel, including precarious or outdated laboratories, monitoring equipment, and databases, as well as research groups. Local realities (e.g., political instability, insecurity, economy, and fragile institutions) further complicate research continuity.

International agendas also tend to prioritize topics set by global forums such as the Intergovernmental Panel on Climate Change (IPCC) and the Convention on Biological Diversity (CBD), often without grounding in local socio-environmental contexts in the Global South (Trisos et al. 2021). Consequently, tropical and subtropical regions (home to the Earth's richest biodiversity and most vulnerable to climate change) remain strikingly underrepresented in the scientific literature (Titley et al. 2017). The loss of opportunities to generate contextualized knowledge that addresses local social-ecological needs, including diverse forms of understanding (e.g., local cosmovisions and human–nature relationships), not only limits adaptive capacity in the Global South but also prevents the discovery of evidence and solutions relevant to the Global North. These disparities weaken Southern countries' ability to design evidence-based policies, as predictive models and management recommendations built on foreign data often lack local relevance, perpetuating a cycle of dependency (Zhunusova et al. 2022). Systematic discrimination in high-impact journals further compounds the problem, beginning with publication fees that are prohibitively expensive for many scientists based in the Global South (le Roux 2015; Willis et al. 2021).

Underrepresentation of the Global South risks building global frameworks on incomplete evidence, undermining legitimacy and effectiveness. Recognizing this, initiatives such as the Kunming–Montreal Global Biodiversity Framework and boundary organizations such as the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) call for reducing knowledge gaps through co-design, local leadership, equitable funding, and capacity building in the Global South (Báldi and Palotás 2021). Ineffective conservation measures often arise from poorly informed decisions, reinforcing the perception that local science is insufficient. In fact, major databases used



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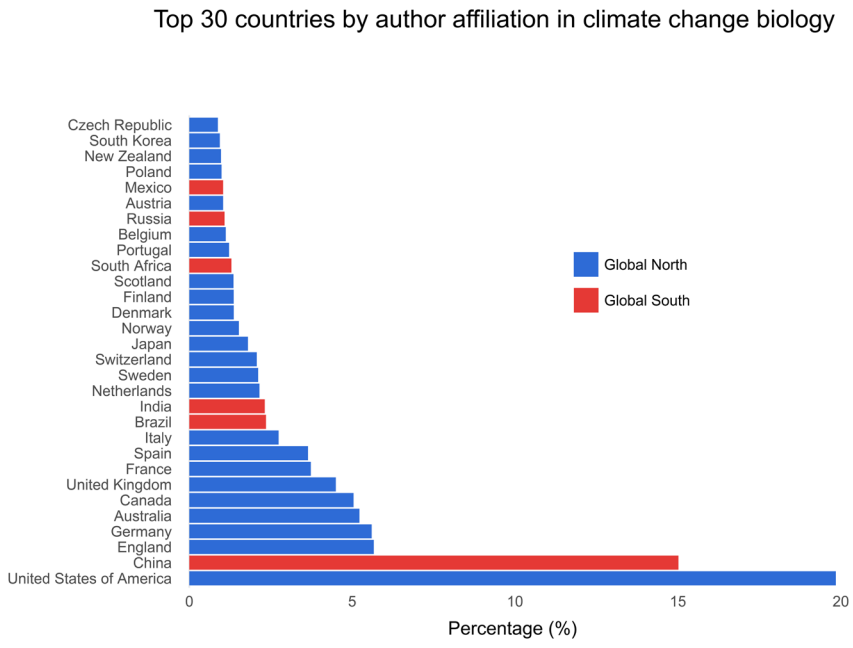

Position	Country	Number of affiliation records
1	United States of America	98143
2	China	74242
3	England	28002
4	Germany	27682
5	Australia	25828
6	Canada	24941
7	United Kingdom	22232
8	France	18447
9	Spain	18022
10	Italy	13572
11	Brazil	11634
12	India	11448
13	Netherlands	10642
14	Sweden	10452
15	Switzerland	10242
16	Japan	8903
17	Norway	7530
18	Denmark	6757
19	Finland	6748
20	Scotland	6718
21	South Africa	6401
22	Portugal	6048
23	Belgium	5546
24	Russia	5365
25	Austria	5142
26	Mexico	5141
27	Poland	4909
28	New Zealand	4823
29	South Korea	4622
30	Czech Republic	4326

FIGURE 1 | Author affiliations in climate change biology publications (Web of Science, September 2025). (a) The cartogram displays countries resized in proportion to their total number of author-affiliation records, highlighting geographic disparities in research representation between the global North and global South, and (b) the bar chart and table show the 30 countries with the highest number of author-affiliation records, which together account for more than 85% of all publications in the dataset.

to model biological responses, such as the Global Biodiversity Information Facility (GBIF), the TRY Plant Trait Database, and the International Union for Conservation of Nature (IUCN) Red List, also show severe data gaps across tropical and subtropical regions (Titley et al. 2017; Hughes et al. 2021), reducing the accuracy of models and the effectiveness of conservation strategies in the Global South.

Given this context, it is urgent to transform how climate change biology is designed, funded, and practiced worldwide.

Addressing these disparities can help drive a necessary paradigm shift in climate change research, which requires sustained action. For these, we propose at least six lines of action:

- *Sustained investment in infrastructure and monitoring between the Global South and North*: Ensuring equipped labs, training programs, long-term monitoring, and local databases enables autonomous, sustainable research while reducing reliance on external resources, with shared responsibilities from the local and foreign beneficiaries.
- *Strengthening locally-led research networks*: Countries in the Global South should lead essential scientific research in their regions, set priorities, and collaborate internationally on an equal footing. This includes fostering local leadership and building regional research networks, increasing the training of specialized researchers, and promoting diversity in terms of gender and ethnicity to strengthen outcomes and increase the probability of success, given the local contexts.
- *Link international financing to local capacity building*: Projects funded from the Global North should include a clear commitment to capacity building in the countries they operate, including strengthening researchers, technology transfer, data analysis infrastructure, training, and institutional sustainability, ensuring that the developed capacities remain in the countries of the Global South.
- *Promote open science and equitable access to information*: Accessible and open repositories and journals based in the Global South can reduce data gaps, democratize access to knowledge, and ensure that scientific results are available to the entire scientific community, civil society, and local decision-makers. Science and its benefits are a human right, and the academic community has the responsibility to ensure they are accessible to all. Language should not be another barrier limiting the dissemination of information, so more weight should be given to publications in the local languages of the Global South.
- *Integrate science into local and regional policies*: Linking climate change research with adaptation, mitigation, and restoration programs allows the data generated to be translated into concrete actions, strengthening government decision-making and environmental planning. To develop effective actions, they must be designed according to the context of each region (i.e., Global South), rather than relying on extrapolations from other locations and ecosystems (i.e., Global North).
- *Foster intersectoral and multi-stakeholder interaction and collaboration*: The alternative of the imposition of agendas and research topics defined at international forums is the partnership between governments, universities, non-governmental organizations, the private sector, and local communities. This strategy ensures that research has practical relevance, promotes effective solutions, and strengthens institutional capacity to address the impacts of climate change at different levels.

Our goal is not only to diagnose inequality, but to chart a path toward a more equitable and effective global climate change biology. Achieving this transformation requires shared responsibility, commitment, and accountability between Global South and North partners. Scientific publishers, funding agencies, institutions, governments, and researchers must break with extractive and colonizing dynamics. If disparities in funding, infrastructure, capacity, and access to information persist, our responses will remain incomplete and unfair.

Highlighting these disparities is not about victimizing the Global South but about acknowledging a systemic imbalance that requires investment and collective solutions. By embedding research within diverse, context-specific realities and connecting these efforts to inclusive global networks, climate change biology can fully reflect its inherently multi-scalar nature, from genes and species to ecosystems and social-ecological systems (Scheffers et al. 2016). True global science requires decentralized, inclusive collaborations and leadership that values both scientific, cultural, and gender diversity. Only through these perspectives, with strong and context-sensitive foundations but also integrated into global frameworks, can we fairly and effectively address the complex challenges that climate change poses to humanity and to the planet's biodiversity.

Author Contributions

Wesley Dáttilo: conceptualization investigation writing - original draft writing - review and editing methodology formal analysis data curation. **Rodrigo Beas-Luna:** conceptualization investigation writing - original draft writing - review and editing. **Alma Mendoza-Ponce:** investigation, validation, writing - review and editing. **Angela Nava-Bolaños:** investigation, validation, writing - review and editing. **Angela P. Cuervo-Robayo:** investigation, validation, writing - review and editing. **Carolina Ureta:** investigation, validation, writing - review and editing. **Constantino González-Salazar:** investigation, validation, writing - review and editing. **Cuauhtémoc Sáenz-Romero:** investigation, validation, writing - review and editing. **Daniel Jiménez-García:** investigation, validation, writing - review and editing. **David A. Prieto-Torres:** investigation, validation, writing - review and editing. **Eduardo Cuevas:** investigation, validation, writing - review and editing. **Gabriela Castaño-Meneses:** investigation, validation, writing - review and editing. **Gabriela Mendoza-González:** investigation, validation, writing - review and editing. **Hibraim A. Pérez-Mendoza:** investigation, validation, writing - review and editing. **Jonas A. Aguirre-Liguori:** investigation, validation, writing - review and editing. **José Alberto Zepeda-Domínguez:** investigation, validation, writing - review and editing. **Jose Miguel Sandoval-Gil:** investigation, validation, writing - review and editing. **Juan Manuel Dupuy-Rada:** investigation, validation, writing - review and editing. **Julio Campo:** investigation, validation, writing - review and editing. **Lázaro Guevara:** investigation, validation, writing - review and editing. **Leticia M. Ochoa-Ochoa:** investigation, validation, writing - review and editing. **Lorenzo Alvarez-Filip:** investigation, validation, writing - review and editing. **Luis Osorio-Olvera:** investigation, validation, writing - review and editing. **Ornela De Gasperin:** investigation, validation, writing - review and editing. **Pilar Angélica Gómez-Ruiz:** investigation, validation, writing - review and editing. **Pilar Rodriguez:** investigation, validation, writing - review and editing. **Rafael A. Lara-Reséndiz:** investigation, validation, writing - review and editing. **Rusby G. Contreras-Díaz:** investigation, validation, writing - review and editing. **Santiago Ramírez-Barahona:** investigation, validation, writing - review and editing. **Tania Garrido-Garduño:** investigation, validation, writing - review and editing. **Tarin Toledo-Aceves:** investigation, validation, writing - review and editing. **Enrique Martínez-Meyer:** investigation, validation, writing - review and editing.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are openly available in Figshare at https://doi.org/10.6084/m9.figshare.30735533, reference number 30735533.

References

Báldi, A., and B. Palotás. 2021. "How to Diminish the Geographical Bias in IPBES and Related Science?" *Conservation Letters* 14, no. 1: e12786.

Bergsvik, R., A. Gupta, R. Weikmans, and I. Möller. 2024. "Is Transparency Furthering Clarity in Multilateral Climate Governance? The Case of Climate Finance." *International Environmental Agreements: Politics, Law and Economics* 24, no. 4: 565–588.

Callaghan, M., C. F. Schleussner, S. Nath, et al. 2021. "Machine-Learning-Based Evidence and Attribution Mapping of 100,000 Climate Impact Studies." *Nature Climate Change* 11, no. 11: 966–972.

Hickel, J. 2020. "National Responsibility for Ecological Breakdown: A Fair-Shares Assessment of Resource Use." *Lancet Planetary Health* 4, no. 9: e399–e404.

Hickel, J., C. Dorninger, H. Wieland, and I. Suwandi. 2022. "Imperialist Appropriation in the World Economy: Drain From the Global South Through Unequal Exchange, 1990–2015." *Global Environmental Change* 73: e102467.

Hughes, A. C., M. C. Orr, K. Ma, et al. 2021. "Sampling Biases Shape Our View of the Natural World." *Ecography* 44, no. 9: 1259–1269.

Lawlor, J. A., L. Comte, G. Grenouillet, et al. 2024. "Mechanisms, Detection and Impacts of Species Redistributions Under Climate Change." *Nature Reviews Earth & Environment* 5, no. 5: 351–368.

le Roux, E. 2015. "Discrimination in Scholarly Publishing." *Critical Arts* 29, no. 6: 703–704.

Ngcamu, B. S. 2023. "Climate Change Effects on Vulnerable Populations in the Global South: A Systematic Review." *Natural Hazards* 118, no. 2: 977–991.

Scheffers, B. R., L. De Meester, T. C. L. Bridge, et al. 2016. "The Broad Footprint of Climate Change From Genes to Biomes to People." *Science* 354: aaf7671.

Titley, M. A., J. L. Snaddon, and E. C. Turner. 2017. "Scientific Research on Animal Biodiversity Is Systematically Biased Towards Vertebrates and Temperate Regions." *PLoS One* 12, no. 12: e0189577.

Trisos, C. H., J. Auerbach, and M. Katti. 2021. "Decoloniality and Anti-Oppressive Practices for a More Ethical Ecology." *Nature Ecology & Evolution* 5, no. 9: 1205–1212.

Willis, M., A. J. Bridges, and K. N. Jozkowski. 2021. "Gender and Racial/Ethnic Disparities in Rates of Publishing and Inclusion in Scientific-Review Processes." *Translational Issues in Psychological Science* 7, no. 4: 451–460.

Zhunusova, E., V. Ahimbisibwe, A. Sadeghi, T. Toledo-Aceves, G. Kabwe, and S. Günter. 2022. "Potential Impacts of the Proposed EU Regulation on Deforestation-Free Supply Chains on Smallholders, Indigenous Peoples, and Local Communities in Producer Countries Outside the EU." *Forest Policy and Economics* 143: 102817.