

Equator to Pole: Using Science Diplomacy to Incorporate Best Practices from Latin America and the Caribbean for Sustainable Cruise Tourism in the Polar Regions

[Julian Campisi](#)¹, [Ana Watson](#)², [Julianne Yip](#)³

¹University of Toronto-Scarborough, Department of Political Science, Toronto, Canada

²University of Calgary, Department of Geography, Calgary, Canada

³MITACS Science Policy Fellow, Ottawa, Canada

<https://doi.org/10.38126/JSPG200301>

Corresponding author: julian.campisi@utoronto.ca

Keywords: science diplomacy; polar regions; cruise tourism; tourism; cruises; best-practices; knowledge sharing

Executive Summary: During the last decade, cruise tourism in the Arctic and the Antarctic has grown exponentially as changing environmental conditions have enabled increased access to the polar regions. This industry has the potential to support communities via financial and social benefits; however, it is also a climate- and capital-intensive global economic activity whose negative impacts are difficult to assess, monitor and control. The current state of voluntary, industry-led standards and regulations around polar cruise tourism are likely insufficient to deal with the negative environmental impacts which will escalate in the coming years due to global warming and over-tourism. As such, science diplomacy—a mode of international relationship-building that mobilizes science, technology, and innovation to tackle transnational issues—can be used as a tool to enhance science-based conservation efforts and address cruise tourism’s governance challenges that often escape jurisdictional boundaries. Addressed to the United Nations World Tourism Organization (UNWTO), this policy memo outlines how science diplomacy can help develop collaborative policies to manage the risks and opportunities of cruise tourism expansion in the polar regions. It presents key recommendations based on best practices from regional experiences in Latin America and the Caribbean, including convening an international workshop on climate change and cruise tourism, soliciting a request for proposals for establishing a UNWTO polar observatory, and using outreach tools to develop knowledge-sharing partnerships.

I. Background

Climate change is accelerating the melting of sea ice in the polar regions, opening waters and new transit lanes to increased marine traffic (Hausfather 2019). Currently, both the Arctic and Antarctic are experiencing a considerable increase in visits, though the Arctic receives many more tourists than the Antarctic. Over the 35-year period from 1957-1992, roughly 39,000 tourists visited Antarctica on an organized trip. In the 2018-2019 season alone, that number ballooned to 56,000

visitors (McLanahan 2020) and continued to rise as 74,401 visitors traveled with International Association of Antarctic Tour Operators (IAATO) members between October 2019 and April 2020 (IAATO 2020). In the Arctic, itineraries of cruise ships more than doubled between 2011 and 2017 (Cajaiba-Santana et al. 2020), and in 2016, the first large cruise ship, the *Crystal Serenity*, navigated the once impassable Northwest Passage from Alaska to New York. Cruise tourism will have further opportunities to expand as navigable seas maintain

less ice, but this growth is not without repercussions.

As cruise tourism—a transnational and rapidly expanding economic sector—has grown in popularity, so has its reputation for being environmentally unfriendly (Lloret et al. 2021). Large vessels require enormous amounts of diesel fuel, construction of ports and other infrastructure, and thousands of crew and passengers, who themselves require air or land transportation to commute to the port. In Antarctica, tourism is one of the most energy-intensive activities, producing increased greenhouse gas emissions (Amelung and Lamers 2007). In addition, cruise ships bring increased risk of oil spills, waste runoff into local waters, soil degradation, and contribute to noise pollution and wildlife disruption (Stewart et al. 2005; Cabrerizo et al. 2016). For example, in 2007, the cruise ship *MS Explorer* sank while traveling through Antarctica, even though it was a veteran ship operating in polar waters, leading to a massive rescue operation of hundreds of tourists. Not long after, in 2010, the *MV Clipper Adventurer* was grounded when it ran into a rock shelf in Nunavut, Canada. In 2017, the owners of the *MV Clipper Adventurer* were ordered by a Canadian Federal Court judge to pay \$496K in environmental clean-up costs to the Canadian Government (Hinchey 2017). Beyond the risks of environmental degradation, tourism in polar regions can also represent social, and economic hazards to local communities, such as loss of cultural heritage, degradation of traditional livelihoods, increasing flows of people from tourism, and the importation of health risks and diseases (Lloret et al. 2021).

i. Governance and policy shortcomings

Although cruise tourism¹ is increasing in the polar regions, governance of this sector remains complex, multijurisdictional, and fragmented (Cajaiba-Santana

et al. 2020). There is consensus among Arctic analysts that greater coordination of regulatory and voluntary mechanisms is needed to ensure that the cruise industry meets safety and environmental protection standards (Dawson et al. 2017). Of the few transnational rules or norms that exist, the most followed is the “Polar Code,” adopted by the International Maritime Organization (IMO) in 2017, which sets uniform rules and standards for shipping in polar waters. Specific to the Antarctic, the annual Antarctic Treaty Consultative Meetings regularly discuss codes of conduct and treaties that aim to set limits on tourism. Furthermore, the IAATO, which is composed of more than 100 relevant and influential companies and operators, seeks to promote and practice safe and environmentally responsible private sector tourism to the region. Similarly, the Arctic has an Association of Arctic Expedition Cruise Operators (AECO), which also protects the culture and habitat of indigenous populations. The AECO, however, has no regulatory powers and is confined to the European Arctic.

An important study by Dawson et al. (2017) clarified major policy gaps in polar cruise tourism that have hampered both operators and local communities. Complex permits and permissions required to operate cruise vessels change by country, with, for example, some Canadian rules being described by ship operators as “a treasure hunt,” “a maze,” “a mess,” “laughable,” “ridiculous,” and “a nightmare” (Dawson et al. 2017, 76). The fragmentation of polar cruise regulatory policy among nations and the litany of different rules to follow make it difficult to ensure that environmental standards are upheld and respected in all corners of the delicate polar regions. In fact, a more recent investigative report by West Coast Environmental Law and Stand.Earth (2021) exposed many cruise tourism regulatory shortcomings in the Pacific Northwest and Alaska, pointing out that Canada’s lax cruise ship pollution laws allow the discharge of Arctic-bound cruise sewage in certain open waters off British Columbia, which are more strictly regulated along the US coast and Alaska. Naturally, many large operators take advantage of this and contribute to the pollution problem.

These studies highlight the importance of developing a more streamlined policy environment for the cruise industry in the Arctic. The lack of agreed-upon

¹For the purposes of this memo, we focus on cruise tourism vessels, rather than the much larger commercial shipping industry, whose important environmental concerns are addressed in other ways and fora in the context of global trade, multinational corporations, and the sheer number of commercial container ship emissions. Due to the particular regulatory context and constellation of stakeholders involved, commercial shipping lanes and supply chains should be analyzed separately.

codes of conduct that govern tourism in the polar regions underscores the need to address the fragmented governance arrangements and regulatory structures as polar cruise tourism increases and more operators and communities come onboard. The current policy mechanisms are insufficient, differ by region, as well as depend on the desire to cooperate and the financial resources of the actors involved, which further risks environmental deregulation. These governance shortcomings are not unique to polar tourism, and such a lack of multilateral agreements have often challenged major financial and climate governance initiatives over the past few decades. The expanding interest in polar tourism and concomitant cause for environmental concern suggests that better management and governance of the industry is needed.

II. How can science diplomacy help?

Science diplomacy uses international relationship building to mobilize science, technology, and innovation to tackle transnational issues. It can be leveraged by offering polar and equatorial nations a means for shaping international norms, standards, and regulations for sustainable cruise tourism while developing and strengthening strategic international partnerships. A sustainable cruise tourism industry in the polar regions can present opportunities for raising awareness and showcasing local cultural practices as well as diversifying sources of income for local communities (Stewart et al. 2015; Enzenbacher 2011), but a better understanding of the potential impacts of tourism in this vulnerable ecosystem is still missing (Tejedo et al. 2022). While potential collaborations between Arctic and Antarctic can facilitate the translation of lessons learned and scientific evidence to monitor tourism impacts (Bennett et al. 2015), other possible solutions, such as knowledge sharing and experience on governance of sustainable cruise tourism in other ecosystems and coastal areas, have been less explored.

i. Success in science-based collaboration

Science diplomacy has directly or indirectly informed and/or facilitated the development of standards, norms, rules and regulations to encourage more socially and environmentally sustainable models of tourism in different regions of the world. For example, international scientific

partnerships played a crucial role in the development of “ecotourism” as a concept and industry in Costa Rica (Jones and Spadafora 2016). Specifically, the rise of “ecodevelopment” and “park-based conservation” as a form of non-extractive land use and nature protection can be directly traced to scientific collaboration between Costa Rican and American scientists in the 1950s to build capacity in biology and conservation work (Evans 1999; Jones and Spadafora 2016). This work converged with international scientific efforts in the 1980s to establish a formal definition of “biodiversity,” alongside a growing global environmental awareness and related campaigns to preserve tropical rainforests, which influenced the establishment of Costa Rica’s National Parks system and the adoption of ecotourism more broadly as a model for other countries in Latin America and the Caribbean (LAC). Such scientific partnerships help advance sustainable tourism through national scientific capacity building, consensus building, and policymaking.

Within the polar regions, the International Polar Tourism Research Network (IPTRN) is an interdisciplinary, inter-institutional network that grows out of an interest in polar tourism issues shared by both poles. While science diplomacy is not the explicit basis of the IPTRN, it performs some of the same functions in terms of promoting scientific cooperation among members and supporting research to advance evidence-informed policymaking on tourism (e.g., Dawson et al. 2021; Stewart et al. 2015). Grassroots, international scientific cooperation among researchers can seed more explicit and formalized science diplomacy approaches to connect polar countries to LAC. For instance, “Many Strong Voices” (MSV) is a program led by universities, non-profits, and motivated individuals that connects the Arctic and Small Island Developing States (SIDs) to raise awareness about the global interconnectedness of climate change. It brings together over twenty organizations from these regions to produce scientific research to inform policymaking and advocacy, as well as strengthen the voice of these communities in international fora such as the UN Climate Change Conference. Most importantly, MSV demonstrates how geographically distant communities from the poles to the equator can work collectively on shared issues. Initiatives like MSV may provide a framework

for future science diplomacy efforts between polar countries and LAC to work collectively on cruise tourism.

ii. Science diplomacy and the UNWTO

Researchers working in polar regions and LAC, however, continue to carry out work in their own respective regions. By highlighting potential synergies and issues of shared concern regarding cruise tourism between the two, this policy memo suggests that science diplomacy offers a productive framework to collectively tackle cruise tourism issues by facilitating best-practices sharing, promoting science and technology collaboration for sustainable cruise tourism, and mobilizing scientific collaboration to develop governance frameworks for cruise tourism in LAC and polar regions. The United Nations World Tourism Organization (UNWTO) is well suited to tackle this problem for its dedication to the promotion of responsible, sustainable, and universally accessible tourism, as well as a tourism industry better equipped to adapt to and mitigate climate change. As a multilateral institution, the UNWTO is uniquely positioned to invoke its mandate as a forum for global cooperation, to reach out to relevant institutions and actors, offer international guidance on cruise tourism as a global phenomenon, and convene its member states to work together on tourism-relevant issues. In particular, many UNWTO member nations in the equatorial region offer rich experiences, insights and lessons learned on tourism, providing useful parallels with cruise tourism in the Arctic and Antarctic-adjacent communities.

III. Policy options

i. Option 1: Continue with the status quo (regional/voluntary regulation)

Currently, the status quo is characterized by various efforts to manage cruise tourism in LAC and polar regions that are informed by science but which remain separate and organized along regional lines (e.g., the IPTRN focuses exclusively on the polar regions). As mentioned above, there are also well-established, self-governing associations of cruise lines and tour operators (e.g., IAATO, AECO, the Florida-Caribbean Cruise Association), but these are also organized along regional lines. Continuing with the status quo can take active or passive forms. Passively, no direct intervention is taken. In its active

form, continuing the status quo can be characterized as a *laissez faire* approach that relies on motivated associations, institutions, and individuals to self-organize. This was the case in the Costa Rican example, in which connections between scientific individuals and institutions from different countries organized amongst themselves to develop ecotourism as a model. The advantage of allowing grassroots-driven efforts is the benefit of having a clear motivation, stakes, and vision to shape collective efforts. The disadvantages of such an approach are that there are no guarantees any action will be taken or how long it may take. It is also unclear if the lack of science diplomacy connections between LAC and polar regions on cruise tourism is due to a lack of interest or of resources, the latter of which may facilitate productive connections if they are provided. Finally, the status quo increases the risks of negative environmental outcomes from over-tourism and pollution.

ii. Option 2: Formalize science diplomacy as a UNWTO tool to promote collaborations between polar countries and LAC for sustainable cruise tourism

Drawing on its mandate to develop competitive and sustainable tourism policies and instruments, the UNWTO could formally promote science diplomacy as a framework for collaboration on cruise tourism. For instance, it could develop a new program under its “Sustainable Tourism Focus Area” that is dedicated to encouraging science diplomacy collaboration. Such a program would set standards and guidelines for developing and implementing science diplomacy partnerships to tackle tourism issues like cruises.

The advantages of such an intervention include foregrounding science diplomacy as an effective method for tackling a variety of transboundary tourism issues including, but not limited to, cruise tourism, setting a unified agenda to guide science diplomacy activities for sustainable tourism, building leadership in this area, and promoting environmentally-friendly activities. A focus on science diplomacy as a method rather than cruise tourism as a topic also reduces the risk of duplicating existing efforts to govern the cruise industry by various national and international organizations (e.g., International Maritime Organization, International Labour Organization, port states, etc.). In addition to establishing a new

science diplomacy program, the UNWTO could draw on its capacity as a multilateral agency to develop partnerships and associations like the Caribbean Regional Tourism Organization, but between polar countries and LAC. This could include liaising with organizations such as the Arctic Council or networks like the UK Arctic and Antarctic Partnership to expand inclusion to other nations and stakeholders that play key roles in cruise tourism governance. The disadvantages of formalizing science diplomacy as part of UNWTO's programming include the diversion of resources from other focus areas and programs to an explicit science diplomacy program, which may not fall within UNWTO's core mandate. In addition, the focus of a new science diplomacy program as a topic does not guarantee that cruise tourism will be addressed or that it will lead to greater pole-to-equator collaborations between polar countries and LAC.

iii. Option 3: Facilitate and coordinate science diplomacy collaborations between polar countries and LAC as a way to develop strategies for sustainable cruise tourism in the polar regions

The UNWTO can offer its resources and positioning as a multilateral forum to actively promote and facilitate formalized science diplomacy on sustainable cruise tourism through its existing programs and outreach tools without taking on a central role. Leadership on setting the agenda for science diplomacy efforts can be determined from the bottom up by participants from academic institutions, governmental and non-governmental organizations, the private sector, and local stakeholders. With the assistance of the UNWTO as convener and facilitator, these actors can collectively determine what kind of research and evidence is required to support sustainable cruise tourism in polar countries and LAC, how to provide scientific advice for national and international policymaking on cruise tourism, and what mechanisms or partnerships can best support scientific collaboration between polar countries and LAC on sustainable cruise tourism.

The UNWTO can contribute by connecting relevant actors in the cruise tourism world, offering itself as a platform to support collaboration, and helping coordinate efforts to reduce duplication and to find synergies to mitigate environmental degradation from cruise tourism in the poles. As the Costa Rican

example shows, the UN has been instrumental in providing common understandings of key concepts (e.g., "biodiversity"), a coherent vision, and global priorities for other countries to follow. Existing outreach tools that the UNWTO could use to facilitate science diplomacy activities include, but are not limited to, convening a series of international workshops for researchers and tourism operators to assess the impacts of climate change on cruise tourism in polar countries and LAC or soliciting proposals to major polar destinations and organizations to facilitate the creation of a sustainable tourism observatory (STO) for the polar regions as part of the UNWTO's International Network of Sustainable Tourism Observatories (INSTO)². The international workshops would help develop a network of collaborators from the poles to the equator to identify potential collaborations, share best practices, and mobilize lessons learned from other regions to mitigate climate externalities. In addition, Sustainable Tourism Observatories implemented in other regions support policymakers, tourism managers, and industry with strategies and tools to monitor the performance of tourism, yet the polar regions lack this tool.

IV. Policy recommendation and conclusion

We recommend Option 3 to the UNWTO to actively promote and facilitate science diplomacy for sustainable cruise tourism in the polar regions in order to help mitigate future environmental risks. Option 3 offers a middle road between leaving polar cruise tourism actors to organize amongst themselves to develop governance mechanisms (Option 1) and the UNWTO formalizing science diplomacy as one of its tools to promote collaborations between, for instance, polar countries and LAC for sustainable cruise tourism (Option 2). The UNWTO has the resources and mandate as a multilateral organization to convene governmental and non-governmental actors from the poles to the equator, facilitate international governance mechanisms and standards-setting based on scientific best-practice sharing and the promotion of collaboration amongst interested parties and industries in cruise tourism. This option offers the

²See also: UNWTO INSTO
<https://www.unwto.org/sustainable-development/unwto-international-network-of-sustainable-tourism-observatories>

best path to use outreach tools, to foster cooperation and dialogue among governments, local communities and the tourism industry. It represents an inclusive and scientific approach to developing regional standards and down-stream benefits of science production, which will be needed to protect fragile ecosystems as cruise tourism increases.

i. Conclusion

Science diplomacy is a valuable instrument for the governance of issues that transcend national borders. Through the exchange of skills and knowledge, science diplomacy can facilitate regional and international cooperation, strengthen partnerships, develop mutual understandings, and advance national interests. Drawing on science diplomacy, this policy memo points out the benefits of promoting connections between science, technology and international affairs to mitigate the detrimental aspects of cruise tourism in the Arctic

and the Antarctic while enhancing science-policy collaboration. It also identifies governance and regulatory gaps in polar tourism that currently exist, and points to cases in which international scientific partnerships played a role in identifying and accelerating the adaptation of tourism best practices and policies in environmentally sensitive regions. Finally, it offers a few policy options for the UNWTO to pursue regarding the use of science diplomacy tools for governing cruise tourism specific to the polar regions. Specifically, this memo recommends that the UNWTO adopt a role in facilitating science diplomacy collaborations. In doing so, we suggest that decision makers can turn to areas of the world such as LAC that have already navigated similar challenges in order to support the development of new, coordinated international standards to further protect the delicate environments in which cruise tourism operates.

References

- Amelung, Bas, and Machiel Lamers. 2007. "Estimating the Greenhouse Gas Emissions from Antarctic Tourism." *Tourism in marine environments* 4 (2): 121-133.
<https://doi.org/10.3727/154427307784772020>
- Bennett, Joseph R, Justine D Shaw, Aleks Terauds, John P Smol, Rien Aerts, Dana M Bergstrom, Jules M Blais, et al. 2015. "Polar Lessons Learned: Long-Term Management Based on Shared Threats in Arctic and Antarctic Environments." *Frontiers in ecology and the environment* 13 (6): 316-324.
<https://doi.org/10.1890/140315>
- Cabrerizo, Ana, Pablo Tejado, Jordi Dachs, and Javier Benayas. 2016. "Anthropogenic and Biogenic Hydrocarbons in Soils and Vegetation from the South Shetland Islands (Antarctica)." *The Science of the total environment* 569-570: 1500-1509.
<https://doi.org/10.1016/j.scitotenv.2016.06.240>
- Dawson, J., Carter, N.A., van Luijk, N., Cook, A., Weber, M., Orawiec, A., Stewart, E.J., and Holloway, J.E. 2021. *Tourism vessels and low impact shipping corridors in Arctic Canada: trends, risks, community perspectives, and management strategies*. Ottawa: University of Ottawa.
<https://doi.org.10.20381/d3dd-yk49>
- Dawson, Jackie, Margaret Johnston, and Emma Stewart. 2017. "The unintended consequences of regulatory complexity: The case of cruise tourism in Arctic Canada." *Marine Policy*. 76: 71-78.
- Enzenbacher, Debra. 2011. "Polar tourism development: Who benefits?" In *Polar Tourism: A Tool for Regional Development*, edited by Alain Grenier and Dieter Müller, 1st ed., 23-60. Presses de l'Université du Québec.
<https://doi.org/10.2307/j.ctv18ph1gb.8>
- Evans, Sterling. 1999. *The Green Republic: A Conservation History of Costa Rica*. Austin: University of Texas Press.
- Hausfather, Zeke. 2019. "Explainer: How climate change is accelerating sea level rise." *Carbon Brief*.
<https://www.carbonbrief.org/explainer-how-climate-change-is-accelerating-sea-level-rise>
- Hinchey, Garrett. 2017. "Arctic Cruise Ship Owners Ordered to Pay \$469K in Costs for 2010 Grounding." *CBC News*, February 9, 2017.
<https://www.cbc.ca/news/canada/north/cruise-ship-clipper-adventurer-nunavut-judgement-1.3973937>
- IAATO. 2020. 'IAATO Antarctic visitor figures 2019-2020'.
<https://iaato.org/wp-content/uploads/2020/07/IAATO-on-Antarctic-visitor-figures-2019-20-FINAL.pdf>
- International Network of Sustainable Tourism Observatories. 2021.
<http://insto.unwto.org/>

- James, Laura, Lise Olsen, and Anna Karlsdóttir. 2020. "Sustainability and Cruise Tourism in the Arctic: Stakeholder Perspectives from Ísafjörður, Iceland and Qaqortoq, Greenland." *Journal of Sustainable Tourism* 28(9): 1425–41. <https://doi.org/10.1080/09669582.2020.1745213>
- Jones, Geoffrey, and Andrew Spadafora. 2016. "Creating Ecotourism in Costa Rica, 1970-2000." *Enterprise and Society*. <https://doi.org/doi:10.1017/eso.2016.50>
- Lloret, Josep, Arnau Carreño, Hrvoje Carić, Joan San, and Lora E Fleming. 2021. "Environmental and Human Health Impacts of Cruise Tourism: A Review." *Marine pollution bulletin* 173, Pt A: 112979–112979. <https://doi.org/10.1016/j.marpolbul.2021.112979>
- Mclanahan, Paige. 2020. "Tourism in Antarctica: Edging Toward the (Risky) Mainstream". *New York Times*. <https://www.nytimes.com/2020/02/26/travel/antarctica-tourism-environment-safety.html>
- Stewart, Emma, Jackie Dawson, and Margaret Johnston. 2015. "Risks and Opportunities Associated with Change in the Cruise Tourism Sector: Community Perspectives from Arctic Canada." *The Polar Journal* 5 (2): 403–27.
- Stewart, Emma, D. Draper and Margaret Johnston. 2005. "A Review of Tourism Research in the Polar Regions." *Arctic* 58(4): 383–94. <https://doi.org/10.14430/arctic452>.
- Sustainable Development Goals (2021). United Nations. <https://sdgs.un.org/goals>
- Tejedo, P., J. Benayas, D. Cajiao, Y-F. Leung, D. De Filippo, and D. Liggett. 2022. "What Are the Real Environmental Impacts of Antarctic Tourism? Unveiling Their Importance through a Comprehensive Meta-Analysis." *Journal of environmental management* 308: 114634–114634. <https://doi.org/10.1016/j.jenvman.2022.114634>
- United Nations World Tourism Organization (UNWTO). 2021. <https://www.unwto.org/about-us>
- West Coast Environmental Law and Stand.Earth (2021) 'Regulating the West Coast Cruise Industry: Canada at the Low Water Mark'. <https://www.wcel.org/publication/regulating-west-coast-cruise-industry-canada-low-water-mark>

Julian Campisi is Assistant Professor, Teaching Stream at University of Toronto-Scarborough. He completed his Ph.D. in Political Science at York University in 2019. His research interests are predominantly in the field of international political economy and comparative politics, specifically the methodologies that underpin political risk assessments in the private and public realms, with specific interest in the Italian case. Julian has worked and studied in China, Australia, and Italy over the years in a variety of industries. Currently, he teaches courses on Canadian politics, public policy, international relations, and multiculturalism, in addition to providing consulting advice on geopolitical risks. He recently completed a 2020-21 MITACS Science Policy Fellowship with the Department of National Defense in Canada, a Fellowship at the Inter-American Institute for Global Change Research (IAI), and is a visiting Fellow at JHU SAIS Bologna.

Ana Watson is a Ph.D. candidate in Geography at the University of Calgary. She is originally from Peru and her background includes more than 10 years as a biodiversity specialist. She has been involved in research projects that explore gaps and needs for inclusive and participatory governance for conservation and international development. She was a 2021-2022 Science, Technology, Policy Fellow at the Inter-American Institute for Global Change Research (IAI).

Julianne Yip received her Ph.D. in Sociocultural Anthropology from McGill University (Montreal, Canada) with a focus on the anthropology of scientific knowledge. Following sea ice and climate scientists, her research has focused on understanding the worlds and times that Arctic sea ice gives rise to, and the implications this has for human self-understanding. She was a 2020-21 MITACS Canadian Science Policy Fellow, and a Science, Technology, Policy Fellow at the Inter-American Institute for Global Change Research (IAI).

Acknowledgements: The authors would like to thank the IAI Step program staff and collaborators for all of their help and guidance throughout the fellowship year, and for their assistance in pushing forward this

project and outcome, including comments on the first draft. They would also like to thank Sofia Nanni and Megan Postema for their help and work on the project. Finally, the editorial and reviewer comments and suggestions on part of the JSPG team were much appreciated.