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Designing a collective prototype of future (sub)tropical science

Gracielle T. Higino^{a,b,c}, Krishna Anujan^{d,e,f}, Mickey Boakye^g, M. Eugenia Degano^{h,i}, Norma-Rocio Forero-Muñoz^{j,k}, and Tanya Strydom^{l,k,l}

^aDepartment of Zoology and Biodiversity Research Centre, University of British Columbia, Vancouver, BC, Canada; ^bThe Living Data Project, Canadian Institute of Ecology and Evolution, Canada; ^cBIOS² Training Program Université de Sherbrooke Faculté des Sciences, Local D5-204 2500 Boul. de l'Université Sherbrooke, Québec, J1K 2R1, Canada; ^dDepartment of Ecology, Evolution and Environmental Biology, Columbia University in the City of New York, USA; ^eSmithsonian's National Zoo and Conservation Biology Institute, 1500 Remount Road, Front Royal, VA 22630, USA; ^fSmithsonian Environmental Research Center, 647 Contees Wharf Road, Edgewater, MD 21037, USA; ^gDepartment of Environmental Science Policy and Management, University of California, Berkeley, CA, USA; ^hSenckenberg Biodiversity and Climate Research Centre (BiK-F), Frankfurt am Main, Germany; ⁱDepartment of Biological Sciences, Goethe University, Frankfurt am Main, Germany; ^jDépartement de Sciences Biologiques, Université de Montréal, Montréal, QC, Canada; ^kQuébec Centre for Biodiversity Sciences, Montréal, Canada; ^lEcology and Evolutionary Biology, School of Biosciences, University of Sheffield, Western Bank, Sheffield, S10 2TN, United Kingdom

Corresponding author: Gracielle T. Higino (email: graciellehigino@gmail.com)

Abstract

Ecologists coming from certain countries are currently disfavoured on the peer review process, the recognition of their research products and academic labour, and the lack of leadership opportunities in global settings. Additionally, we often witness deliberate obfuscation of (sub)tropical ecologists on matters pertaining to our own communities, and we believe that putting these researchers at the centre of the discussion on the practice of tropical science is urgent. Breaking barriers for early career researchers with lived, living, and working experience in the tropical and subtropical regions to lead and contribute meaningfully to their own communities will be decisive to revamp academic culture, as well as to bring the necessary change to public policies affecting local ecosystems. In this perspective, we acknowledge the multiscale efforts needed to shape the future of ecology as a profession, delineating the effects of social spheres outside academia, academic and adjacent institutions, and the scientific community on the opportunities available for (sub)tropical researchers.

Key words: early career researchers, science practice, science policy

1. Introduction

What does the future hold for (sub)tropical ecologists when present circumstances seem to rapidly dismantle their opportunities? Research on tropical biology and conservation requires a deep understanding of local ecosystems, socio-cultural elements, and their histories, making it uniquely important that researchers from the region participate and lead research and conservation efforts. Yet, as early career researchers (ECRs) from this region, we experience barriers that hinder our contributions to research and conservation in our home landscapes. The current academic culture seems to disfavour ecologists coming from certain countries, where researchers are often overlooked in the peer review process, the recognition of their research products and academic labour, and appointment to leadership opportunities in global settings (Maas et al. 2021; Amano et al. 2023a; Fox et al. 2023; Ocampo-Ariza et al. 2023; Smith et al. 2023).

Coming from a (sub)tropical region (broadly defined as countries in and around the Tropics of Cancer and Capricorn)

and being at an early career stage is a very particular experience, with unique challenges and opportunities. These researchers are often obfuscated on matters pertaining to their own communities (Ocampo-Ariza et al. 2023), but they are also living and studying in some of the most important ecological regions on the planet, surrounded by incredible biodiversity and being impacted by human-induced environmental changes. We believe that putting these researchers at the centre of the discussion on the practice of tropical science is urgent. Breaking barriers for ECRs with experience living and working in the (sub)tropics to lead and contribute meaningfully to their own communities will be decisive to revamping academic culture by expanding the range of academic contributions, interchange of knowledge and methods, and increasing innovation (Tilley and Kalina 2021; Kent et al. 2022; Turba et al. 2025), as well as to bring the necessary change to public policies affecting local ecosystems.

This paper is based on an interactive session held at a conference in 2021 (Higino et al. 2021). By that time, we were

Box 1. Story from the future.

At the end of the session, we asked participants to write a speculative story about a scientist from the future who lives in a (sub)tropical region, based on what we've discussed and on what we've explored of other peoples' stories. The following text was adapted (for means of clarity) from the original product (available as Supplementary material):

"We are in a conference. Participants are presenting their most recent research using the language they are most comfortable with, and translation services are provided widely. They were encouraged to use multiple languages in their supporting visuals if they wanted to. As we walk through posters, we see a fun mismatch between spoken language and visuals, and posters are now multidimensional—you can smell one, touch another, and build another one. Sign language interpreters are spread out in the room.

Many of these scientists will have their posters turned into scientific papers that will be published in the open. Some of these posters are already preprints, and the discussion around them is actually a peer-review, which will also be published and used in the publication process. By the time these scientists submit their manuscripts to an open-access journal, published by a scientific society, they will not have to pay unreasonable processing fees, and the intellectual property will remain with the research group that produced it.

Back home—and they are back *home* because they are valued there—they do not suffer any kind of harassment. They find a welcoming and safe place to work because there are systemic mechanisms and policies that are effective against misbehaviour in the community. These scientists feel safe reporting any misconduct of their superiors to their institutions and the scientific societies to which they are related. Their efforts on science communication in their mother language are encouraged and rewarding, and they are more and more enthusiastic about building science *with*—not *to* or *about*—their local communities".

about 18 months into the COVID-19 pandemic, which highly impacted the scientific careers of ECRs (Corlett et al. 2020; Lokhtina et al. 2022; Schadeberg et al. 2022). In this context, we used speculative story-making to outline our wishes for the future of (sub)tropical ecological research (Box 1; Supplementary material). Here, we expand on the story that we wrote together and frame our wishes for inclusion of, and collaboration with, ECRs from (sub)tropical regions as three different facets based on who has the power to effect change (Fig. 1). We outline a few aspects that affect opportunities for (sub)tropical researchers, starting with social spheres outside academia (focusing on governments and policies), followed by academic and adjacent institutions, and finally, the personal attitudes of researchers and the research community. With that, we acknowledge that shaping the future of (sub)tropical ecology is dependent on (and should be addressed at) multiscale efforts.

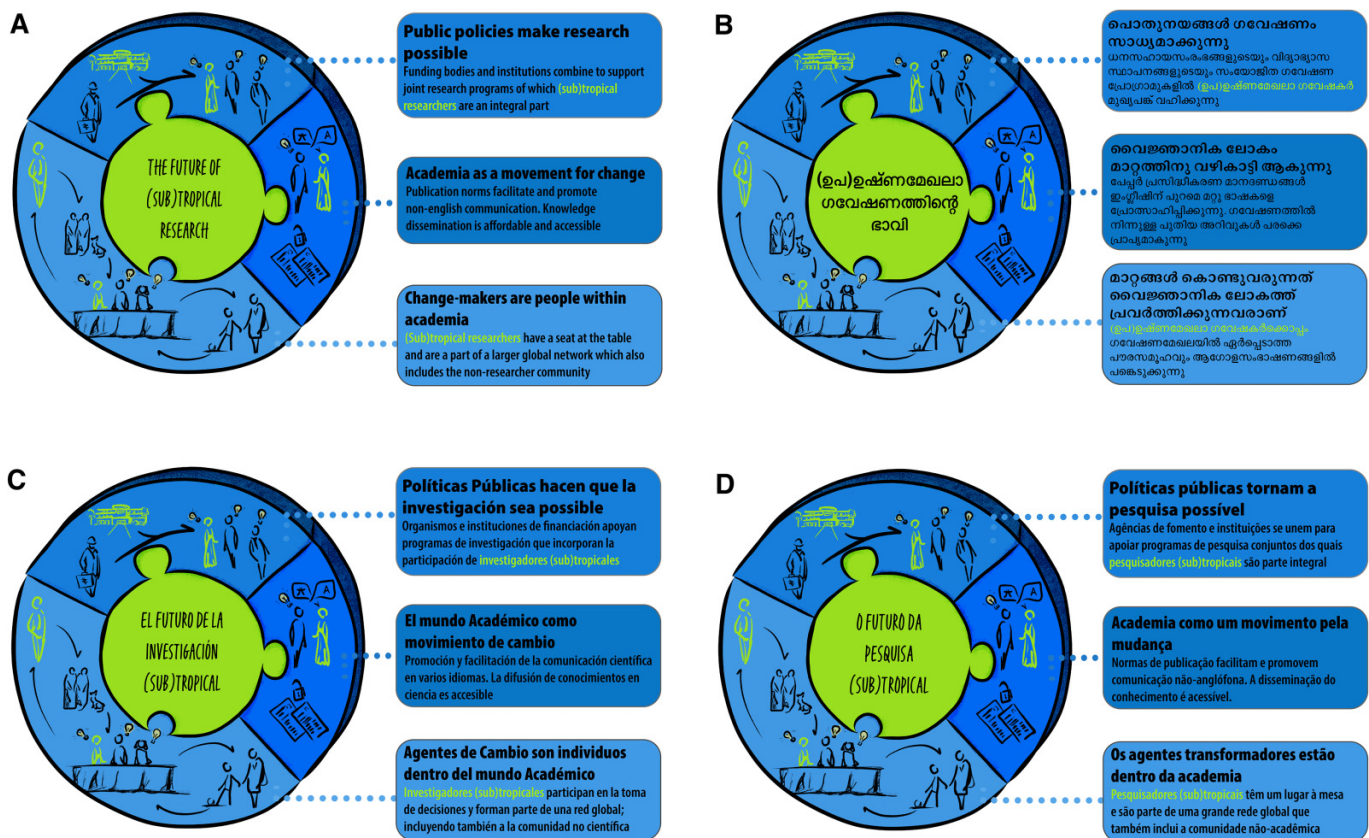
We choose to not define the term "ECR" so as not to exclude people that fall outside the limits of a definition, and because we understand that different life histories shape our work as scientists in a way that is not always reflected in the amount of time we have in this profession. Also, we consider (sub)tropical ecologists as those professionals who were born, raised, and/or professionally trained in a (sub)tropical region. For us, the ecosystems in which we live play a fundamental role in this discussion, as they are frequently targeted in parachute research—a research practice that extracts knowledge from a region, but does not develop meaningful relationships with local researchers (Mwampamba et al. 2022; Odeny and Bosurgi 2022; Bhaumik 2023; Miller et al. 2023). These areas and communities will also be the most affected by climate change (Beaumont et al. 2011; Lenton et al. 2023), but they are also the ones that rarely benefit from the outcomes of the research produced there (Asase et al. 2022; Odeny and Bosurgi 2022). Additionally, we recognize that it is difficult to draw a line that separates "(sub)tropical

regions" from "non-European and non-North American countries", and we do not see this as a problem. Most countries considered in this paper are not from Europe and North America, but we choose this terminology because it reflects better the blurred lines between ecology and politics. For example, by choosing the term "(sub)tropical regions", we can include regions of Australia and the United States that might face the same barriers as non-European and non-North American countries in different levels, such as language barriers given their colonial and migration history (when non-English speakers are disfavoured) and parachute conservation research (Amano et al. 2023b; Smit et al. 2025).

We also recognize that the social, historical, political, and economic contexts of these regions contribute largely to the problems and solutions described here, and that there are numerous publications extensively discussing this theme (Ramírez-Castañeda 2020; Armenteras 2021; Kowaltowski et al. 2021; Maas et al. 2021; Rodrigues 2021; Taubert et al. 2021; Tilley and Kalina 2021; Trisos et al. 2021; Valenzuela-Toro and Viglino 2021; Asase et al. 2022; Cisneros et al. 2022; Kwon 2022; Mwampamba et al. 2022; Odeny and Bosurgi 2022; Bhaumik 2023; Miller et al. 2023; Ocampo-Ariza et al. 2023; Smith et al. 2023; Turba et al. 2025), and here, we combine this body of knowledge to highlight the points that we consider the most important in affecting the development of the research agenda of Tropical Biology and Conservation. Finally, we are also aware that most of the topics in this commentary are also valid for senior academics, but our discussion is focused on ECRs because we draw our comments from personal experiences, and discuss the future of research in Tropical Biology and Conservation, something which should be designed right now to benefit future generations.

This team of authors is composed of ECRs pursuing or having recently earned a Ph.D. degree, who are citizens of six different countries in South America, Africa, and Asia, but

Fig. 1. (A) English—Points of entry for change: how we can act now to re-design the future of tropical ecology for early career researchers (ECRs). Public policies should ease international collaborations (including funding), while cultural changes in academia will value non-English communication. Individual attitudes towards inclusion of (sub)tropical ECRs in a global context would then become the norm. (B) Malayalam—മാറ്റത്തിനായുള്ള പ്രവേശന പോയിന്റുകൾ: കരിയറിലെ ആദ്യകാല ഗവേഷകർക്കായി ഉഷ്ണമേഖലാ പരിസ്ഥിതിയുടെ ഭാവി പുനർരൂപകൽപ്പന ചെയ്യാൻ നമുക്ക് ഇപ്പോൾ എങ്ങനെ പ്രവർത്തിക്കാം. പൊതു നയങ്ങൾ അന്താരാഷ്ട്ര സഹകരണം (ഫണ്ടിംഗ് ഉൾപ്പെടെ) ലഘൂകരിക്കണം, അതേസമയം അക്കാദമിയയിലെ സാംസ്കാരിക മാറ്റങ്ങൾ ഇംഗ്ലീഷ് ഇതര ആശയവിനിമയത്തെ വിലമതിക്കുന്നു. ആഗോള പശ്ചാത്തലത്തിൽ (ഉപ) ഉഷ്ണമേഖലാ ആദ്യകാല കരിയർ ഗവേഷകരെ ഉൾപ്പെടുത്തുന്നതിനുള്ള വ്യക്തിഗത മനോഭാവം അപ്പോൾ ഒരു മാതൃകയായി മാറും. (C) Spanish—Puntos de entrada para el cambio: cómo podemos actuar ahora para rediseñar el futuro de la ecología tropical para los investigadores que inician su carrera. Las políticas públicas deberían facilitar las colaboraciones internacionales (incluida la financiación), mientras que los cambios culturales en el mundo académico valorarán la comunicación no inglesa. Las actitudes individuales hacia la inclusión de los ECR (sub)tropicales en un contexto global se convertirían entonces en la norma. (D) Portuguese—Pontos de entrada para mudanças: como podemos agir agora para redesenhar o futuro da ecologia tropical para pesquisadores em início de carreira. As políticas públicas devem facilitar as colaborações internacionais (incluindo financiamento), enquanto as mudanças culturais no meio acadêmico valorizarão a comunicação não-inglesa. Atitudes individuais em relação à inclusão de ECRs (sub)tropicais em um contexto global se tornariam então a norma.



currently working in North America and Europe. This discussion stems from our lived experiences of learning and practising science in our home countries and making (and being afforded) the choice to move for education and professional opportunities. Therefore, we are not exempt from biases, and this paper should be read as a collective affirmation, not as scientific evidence supporting a specific way of change. Nevertheless, we do aim to spark a discussion and create awareness about the barriers faced by ECRs from (sub)tropical regions so that all ECRs can work together fairly and equitably. We present here the challenges and opportunities faced by (sub)tropical ECRs at three different scales: public sphere, institutional, and individual.

2. Public policies make research possible

Ecological research in (sub)tropical regions is often funded and executed by foreign institutions, who then retain control over the production and diffusion of new scientific knowledge (Fabbri et al. 2018; Raja et al. 2021; Trisos et al. 2021; Qin et al. 2022; Miller et al. 2023). As local funding is limited and competing for international grants might be difficult (especially in a foreign language), funding then becomes a key barrier in developing innovative research due to its impacts on study design (e.g., equipment, sample size, replicates). This issue influences ECRs decision to pursue a scientific career abroad. Additionally, history has shown that

data collected in the (sub)tropics is held in places far from their origin (e.g., species specimens in European natural history museums from the exploration of territories outside of Europe), and even today this seems to be true (albeit in the form of digital collections) (Asase et al. 2022; Cisneros et al. 2022). Consequently, where data repositories are held, who holds the right to these data, and what is needed to access them are barriers that deter (sub)tropical ECRs from staying “at home” in favour of seeking professional training opportunities abroad (Maas et al. 2021; Asase et al. 2022). Moreover, ownership over funding, data, and research infrastructure determines who asks the research questions, and therefore, ECRs from (sub)tropical regions are often disregarded in conservation debates.

To counteract the imbalance in access to funding and resources across the globe, a partnership among international institutions is key. Foreign aid agencies aiming to invest in research in the (sub)tropics could either partner with their local counterparts to design joint funding packages or make funding contingent on partnerships with local academic institutions. Furthermore, this funding would not require researchers to move abroad, and complete support should be provided for them and their families if moving is an option. International collaborations are key factors in the professional development of scientists, combining mutual assistance in equipment, research permits, and familiarity with the study system. They also ease resource access restrictions and promote opportunities for researchers from under-represented areas to gain exposure. This will ultimately result in higher chances for funding for local researchers. Enhancing the combination of different skills, cross-pollination of ideas, division of labour, and pooling of resources generate economies of scale in research activity by increasing the quantity and improving the quality of publications (Asase et al. 2022; Smit et al. 2025). Collaborations, therefore, create enabling environments for Research and Innovation and foster capacity-building (Asase et al. 2022).

Another societal barrier is local public support for research efforts, which is crucial to pushing conservation issues onto the public agenda. Successful conservation science is achieved when findings can actively foster and lead to science-based decision-making (Winterfeldt 2013; Smit et al. 2025). This success, therefore, depends on the access to scientific outputs to be universal, and intentional efforts to be made to disseminate understanding in the country where the research was conducted, such as multilanguage abstracts and partnerships with local press. Funding systems or national programs could then set conditions or deliver rewards, respectively, for community engagement and public access to publications. We believe that a strong collaborative world and large participatory projects involving both the private and public sectors and other community members are critical to overcoming these barriers and preventing the brain drain we witness in most (sub)tropical countries.

When it comes to public policy and ECRs, a very urgent topic is immigration and temporary visas. The exchange of students and researchers is very much delayed and restricted by global policies and temporary measures, which are very imbalanced against (sub)tropical countries. For ex-

ample, while citizens from countries like Japan, Germany, Italy, Spain, Sweden, France, the United States, and Canada are allowed to enter >185 countries and territories without a visa, the majority of African citizens can only access less than 70 countries without a visa (Henley and Partners 2023). The process of getting a visa usually takes a lot of time and money while also requiring, very often, a high level of fluency in another language, enough to argue in legal terms with an immigration officer.

Notwithstanding, (sub)tropical countries have good policies in place that have the potential to foster two-way collaboration between them and non-(sub)tropical countries. For example, in Brazil, graduate students usually get paid a salary by the government and do not need to pay tuition. This is a potential benefit for international collaboration because these costs would not need to be covered, and instead, the budget could be reallocated to research logistics or professional improvement of the researcher. Another example is how decision-making in many countries does not exclude non-English literature, in opposition to the very low representation of non-English literature in international biodiversity reports (Amano et al. 2023a). A quarter of the report authors said that they struggled with English literature, showing English language barriers to the uptake of evidence in decision-making. However, half of them said that when papers had non-English titles or abstracts, it would help them search and understand English papers. These findings point to the importance of diversifying the scientific literature to make the best available evidence accessible to anyone regardless of the publication language and achieving Target 21 of the Kunming-Montreal Global Biodiversity Framework: to ensure that knowledge is available and accessible to guide biodiversity action (IPBES 2022).

3. Academia as a movement for change

Academia still hinders equal recognition and accessibility to science in the (sub)tropics. From requirements that thwart publishing scientific findings for non-native English speakers or those with limited funding, to not paying cognizance to the identities of scientists and histories of marginalization at the hiring, funding, and evaluation stages, academia is designed to not be inclusive. Publishing, both in numbers and impact, is currently crucial for advancing scientific careers and disproportionately important for career advancement for ECRs. One way that (sub)tropical researchers are excluded in this context is through language barriers: although they are from countries that correspond to the majority of the global population with a wide range of languages and cultures, scientific knowledge continues to be communicated largely in only one language, following one general format, and valuing only a small part of human knowledge. Usually, scientists who are non-native English speakers still face challenges in publishing, communicating, and reviewing academic work due to their origin country or mother language (Corlett et al. 2020; Maas et al. 2021; Amano et al. 2023a; Smith et al. 2023). For instance, Valdez et al. (2023) report that researchers from the Tropical Andes face difficulties in publishing their findings not only due to language barriers, but

also due to the complexity of the publication system (which is aggravated by the language barriers) and lack of institutional and governmental support for publications. Actions such as free language editing services for non-native English speakers and incentives for multilingual text helps to promote multilingual scientists (as many in the (sub)tropics are) globally. Finally, it is imperative that people in power (be them journal editors or department heads) take immediate action to punish unethical comments related to ethnicity and language.

Organizations such as SciELO, Public Knowledge Project, and EcoEvoRxiv support the publication of scientific products in multiple languages (Public Knowledge Project, n.d.; SciELO, n.d.; SORTEE, n.d.). However, open publishing is often costly (in particular, products under a Gold Open Access agreement) and thus, a limited opportunity for researchers from the (sub)tropics (Kowaltowski et al. 2021; Mekonnen et al. 2021; Smith et al. 2022). While the average open access publication fee in Ecology and Evolution (USD \$3000) represents less than 10% of the average unique grant amount for Canadian researchers (Shafer 2021), only 10% of this fee can be paid with grants in Nigeria (Mekonnen et al. 2021). Ideally, open access publishing fees should be set at much lower rates globally, if rated at all. Alternatively, the assessment of accessibility to waivers should be multifaceted and not focused only on a single aspect (e.g., global economic indexes), but instead, on local investment in research and development, and on political dynamics (e.g., considering political, economic, or environmental threats) (Kowaltowski et al. 2021). In a study conducted in 2021, from the 40 top-ranked ecology journals listed in Journal Citation Reports, only 23.7% had waiver policies benefiting African researchers (Mekonnen et al. 2021). According to Taubert et al. (2021), these waivers, when granted to developing countries, are not going to cause much revenue loss to the publishers, and therefore, can be economically feasible. A possible approach, therefore, is for academic institutions, journals, and societies to incentivize mentorship and inclusion of local counterparts in publishing, through mandates (e.g., by requiring funded research to be published openly) and rewards (e.g., highlighting or waiving processing fees for articles with local authors), synergistically working with funding policy mandates (mentioned above) to increase representation.

While academic prestige, promotion, and tenure processes pose a significant weight on the number of publications and citations, especially in high-impact journals, new generations of scientists are challenging the old system, moving from high-impact publishing goals to high social impact endeavours. Beyond the h-index, ECRs are calling for new frameworks for assessment that recognize and reward outputs that contribute to diversity, equity, and inclusion and other “service” efforts, such as supporting the advancement of (and access to) scientific knowledge, serving science and society, educational outcomes, dataset creation, and outreach products (Goring et al. 2014; Esposito et al. 2022). For instance, Choi et al. (2024) found a mismatch between the incentives for academic researchers and the scientific needs of conservation implementation—with low-impact-factor journals underpinning actionable conservation laws. In this context, the Open Science culture has been a welcoming environment for

change led by ECRs. They are often the ones engaging in open access initiatives, developing open source software and sharing their data. In Latin America, Argentina pioneered the mandates encouraging the open publication of research outputs, but still, there is a lack of infrastructure to support this behaviour (Arza and Fressoli 2019).

It urges, then, that academic institutions and scientific societies expand existing merit and reward systems to recognize contributions that build knowledge collectively (e.g., by co-leading authorship as in Dryflor et al. (2016)) and ensure that scientists are creating ethical outputs (e.g., Cooke et al. 2021). Moreover, it is key that mandates related to Open Science do not follow a single format, as the concept of Open Science is context-dependent (as are the different requirements and actors, even in different stages of research (Chan et al. 2019)) and should not serve to the purpose of imposing a model of science from one country upon another.

Our career path might differ greatly depending on which country we live in (paid internships might not be the norm, access to highly functional computational infrastructure might be impossible, social demands might impose a different pace on our scientific production, etc.), and having that in mind in selection processes and career recognition of all sorts has a great potential to diminish the barriers impeding a global exchange of scientists. By making science better connected, open, and equitable, academic institutions will create a mechanism that welcomes everyone to the big table, and these systemic changes within academia will enhance the collaboration and perceived benefits of science, and ultimately feed into national and global policies.

4. Change-makers are people within academia

The breaking down of barriers faced by ECRs in (sub)tropical countries can also come from creating and fostering connections at a more personal level. ECRs from the (sub)tropics might perceive themselves as being outside of the larger research community, which turns into a limitation to speaking out and engaging with others about our research and fostering collaboration, something which is further exacerbated by the high costs associated with attending network activities such as larger conferences.

Avoiding hosting conferences in restrictive countries (while also considering people’s safety regarding their identities) and allowing or encouraging remote presentations are examples of attitudes that can particularly help the participation of ECRs. While travel support and fee waivers are available, these are often limited and highly competitive, requiring additional time and effort, especially from ECRs (Valenzuela-Toro and Viglino 2021). Such conferences and meetings are key for ECRs based in (sub)tropical regions to be visible outside their networks and may be the only “big” platforms to share research findings. The global scientific community could contribute to bridging this gap by interacting and engaging with research groups from (sub)tropical regions regularly while including them in the global conversation both through “low-cost” measures (e.g., inviting ECRs to

give virtual guest presentations during lab meetings) to more “high-cost” initiatives (e.g., hiring ECRs as guest researchers), as well as being critical of authorship team composition when reviewing papers and grants (Tilley and Kalina 2021). Providing extensive support to students and researchers navigating immigration processes should be a regular practice in Academia to nurture a better future, as immigration paperwork and fees are currently important burdens for international researchers (Chugh and Joseph 2024). These ally attitudes can help to foster long-lasting, collaborative relationships that would transcend larger geographic barriers, something that is particularly meaningful for ECRs (Pannell et al. 2019). With these suggestions, we strongly emphasize that non-(sub)tropical scientists play a significant role in the change we envision for (sub)tropical science by helping centre scientists from (sub)tropics in global discussions.

Science communication is fundamental to encouraging scientific support, informing and gardening a sense of stewardship to the public. The need for stakeholder engagement and meaningful exchange with local knowledge systems is a global topic of conversation (Sterling et al. 2017), but it is perhaps of greater importance when doing research outside of one’s immediate country/area of expertise (e.g., Sacande and Berrahmouni (2016) showcase the value in cross-border community engagement when developing restoration projects). Taking part in sci-comm activities aimed at (sub)tropical regions might help to highlight the value of research and local scientists to their communities and even encourage the youth to pursue a career in science. Even though science communication efforts demand institutional support, meaningful conversations happen one-on-one, and therefore, are ultimately the result of a personal drive.

5. Manifesting the future

It is often normalized that a successful scientific career cannot be pursued in our home countries. Being far from home ourselves, we acknowledge that we were granted the option to work and study abroad, although here we question whether this is a privilege or a contingency (Del Valle 2023). With this disclaimer, we aim to highlight that our commentary is not without biases, and as much as we try to approach problems and solutions from a neutral and realistic perspective, we are still reflecting on things from the perspective of someone who is not working from a (sub)tropical country at the moment. In fact, all six of us are currently working from four of the 10 leading countries in natural sciences research (Nature Index 2025), and we came here because our home countries (Argentina, Brazil, Colombia, Ghana, and South Africa) did not offer us the professional stability or opportunities we needed to achieve our full potential.

Our vision for the future embraces diversity and the exchange of ideas and experiences. We wish that ECRs from the future will be included in all scientific conversations and that their contributions will be valued. Young scientists from the future will have support from their local governments to pursue their careers without having to choose between comfortable levels of funding and diverse professional opportunities, and contributing to their local communities

while staying close to their friends and families. The bottom line of our imagined future is that **communication is key**—engaging with broader communities, listening to the challenges faced by researchers, and opening cross-border discussions between policy-making bodies. Ultimately effective communication is both a mechanism for participating at a larger scale and improving the transparency of shortcomings from within the system. This commentary piece is not an attempt to delineate ultimate solutions to the practice of science but rather invites the scientific community to look at and be aware of the differences among different countries. We invite you to build this future with us so the next generation won’t need to go through the same preventable challenges we needed to.

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Gracielle T. Higino, Krishna Anujan, Mickey Boakye, M. Eugenia Degano, Norma-Rocio Forero-Muñoz, and Tanya Strydom contributed equally to this work and reserve the right to prioritize their names in the publication list on their CV.

Author contributions

Conceptualization: GTH, KA, MB, MED, NF, TS

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The corresponding author confirms on behalf of all authors that there have been no involvements that might raise the question of bias in the work reported or in the conclusions, implications, or opinions stated.

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Supplementary data are available with the article at <https://doi.org/10.1139/facets-2024-0113>.

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