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Who is publishing in ecology and evolution? the underrepresentation of women and the Global South

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Introduction: Most global biodiversity is in developing economies. Decades of capacity building should have built sufficient in-country capacity to develop biodiversity baselines; yet has effort provided the expertise to build these baselines?

Methods: Grants and access to research opportunities are often linked to success in publishing, with the H-index providing the main metric of academic success. Recent compilations of "Top Researchers in Ecology and Evolution" included 5,419 researchers, but where these researchers are and how representative they are has not been well studied. We explored the global distribution of "Top Researchers in Ecology and Evolution" and explored the representation of Women, non-Caucasians, and non-Caucasian women, as well as the representation of "local" top researchers in different regions.

Results: Over half Top Researchers in Ecology and Evolution are from just three countries (United States, United Kingdom, and Australia), and 83% come from 12 higher-income countries. Even in lower-income economies the majority of the few "high impact" researchers are originally from higher-income economies. Only China had a high proportion of their high-impact non-Caucasian researchers, with the majority of researchers coming from that region. Women were also underrepresented across the globe, only three countries had more than 20% of top-performing ecologists being female.

Discussion: Ultimately, despite decades of capacity building, we are still failing to build in-country capacity for research or to provide sufficient support for female ecologists to publish and lead the field. Here we discuss why these issues persist, and how we might improve representation and access to opportunity and support for all groups, and provide the analysis needed to provide solutions to global challenges in biodiversity conservation, which require diverse representation to develop effective, and nuanced solutions.

KEYWORDS

representation, diversity and inclusion, minorities, access and benefit sharing, conservation

The dimensions of publication and how well "capacity building" works

Publishing has become increasingly important in academia, with citation rates and the H-index becoming the indices to measure the "ability" of researchers and as such to access grants and other funds, or provide other benefits and opportunities such as promotion. Researchers regarded as high-impact researchers can have better access to such resources, starting with greater facilitation but also access to funds and equipment, or may even be regarded as 'more competent' and have an easier process of review (Murrar et al., 2021). However, whilst decades of capacity building (providing resources and training to increase capacity in developing regions) may be expected to have increased the number of highly cited researchers across the world, no overarching analysis has actively explored if we have seen this growth of capacity. Such analysis is long overdue, as not only has capacity building and transfer of technology been part of almost every UN declaration for decades but developing regions still host the majority of global biodiversity and have the most to lose in terms of biodiversity loss. For example, one of the stated goals of the Fulbright initiative (which started in 1946) is "*intercultural competence between the people of the United States and other countries through the exchange of persons, knowledge, and skill*". Clearly establishing, if these over 70 years of capacity building have been effective, it should be evaluated, especially as the monitoring framework (a core element of the post-2020 global biodiversity framework), that should be co-developed by countries which host diversity, and core capacity is essential for developing the National Biodiversity Strategy and Action Plan within many diverse countries. Understanding if these decades of capacity building have been effective in terms of highly published researchers should determine if these decades of capacity building have enabled countries to build within-country capacity, or conversely, if the top researchers based in low- and middle-income countries are from higher income countries (and thus likely to facilitate access to high diversity regions, but also possibly transient as many of such researchers may move between countries based on opportunity).

In addition to assessing the ability to build capacity across countries and the representation of "top ecologists" globally, understanding the representation of diverse researchers within higher income economies, as well as assessing if the decades of work to provide equal opportunities for women in science have been effective is important. Many studies have highlighted the under-representation of women in academia, with increasing numbers of female PhDs generally not being associated with significant increases in female faculty positions (Casad et al., 2021). Yet whilst the underrepresentation is acknowledged, and in some regions acted on, how these patterns vary globally has been relatively neglected. Furthermore, intersectional issues (e.g., women of minorities) is still less known, and given that diverse groups develop better science (Bang and Frith, 2017), (especially when the research may influence policy and practice) understanding on intersectional issues needs further attention (Guy and Boards, 2020; Liévano-Latorre et al., 2020; Giakoumi et al., 2021). Consequentially, understanding patterns of representation, and discussing why and where disparities exist is also crucial if we are to generate the best science, and science-based solutions for ecology and conservation (James et al., 2022).

Here, we explore the distribution of "high impact researchers" in ecology and evolution across the planet, how this can be broken down based on gender and ethinicity, and how equal are these opportunities. Categories aim to determine the level of representation of non-Caucasians in research overall and if capacity is being built in lower-income regions. Given that some regions (such as North Asia) have accelerated in research outputs in recent years, we aimed to explore how diverse high publishing researchers are when this group is also excluded. We also assess how well-represented women are, as many endeavours have been made to facilitate women in science, but the success of this has also not been well explored.

Methods

We used the list of Top ecologists in Ecology and Evolution (https://research.com/scientists-rankings/ecology-and-evolution) published in spring 2022, which collated all researchers with an H-index of over 30 as of December 2021. We separately analysed each country and counted the number of researchers, the number of women, the number of non-Caucasians, the number of North Asians (Cantonese and Mandarin, Japanese, Korean) and the number of women from minorities. These categories were established via name and photographs, where photographs were not present or were unclear, we searched for the researcher's personal webpage to check gender or ethnicity, which given the high profile of these researchers was always accessible, and their own personal webpage would note "he" or "she" if it was unclear from the name and photograph (which were always used in combination). Counts of each country were based on recounting the number for each category three times (by the first author) to ensure that the number was the same, and in case of differences, they were recounted. For countries with long lists each "page" of results was recounted seperately three times and recorded in excel to compute the total number. Whilst algorithms exist to assay sex based on name, these can perform poorly on non-Western names, hence a combination of name (already assigned within the list) and photograph was used, and personal website was used to verify characteristics where necessary. For Latin American countries, we checked the profiles (and websites where needed) of how many researchers were "local" (from Latin America) based on the individual profiles to assess how representative ecologists

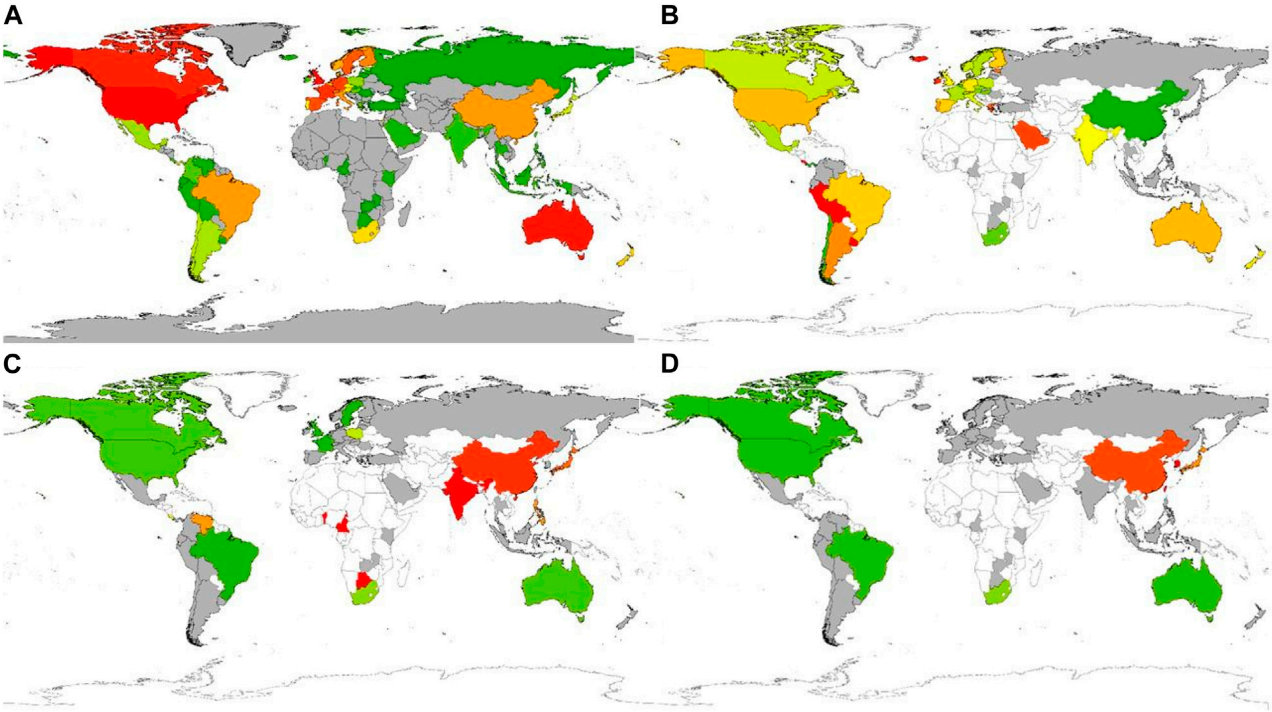

FIGURE 1
(A). Number of top ecologists, (Green-Yellow-Red, max 1889 United States), grey; no "top" ecologists. **(B)**. Percentage female top ecologists (Green-Yellow-Red, max 50%, Peru, Bolivia, Uruguay, n.b each of these only has a total of 2 "top" ecologists), grey; no "top" female ecologists, white: no top ecologists. **(C)**. Percentage non-Caucasian top ecologists (Green-Yellow-Red, max 100%, Benin, Botswana, Cameroon, India, n.b each of these have only 1 researcher, except India which has 7), grey; no "top" non-Caucasian ecologists, white: no top ecologists. **(D)**. Percentage North Asian top ecologists (Green-Yellow-Red, max 100%, Taiwan, South Korea, n.b S Korea has only 1 top ecologist, Taiwan has 5, Mainland China is almost as high at 95% –82 people), grey; no "top" North Asian ecologists, white: no top ecologists (North Asia includes Chinese (Cantonese and Mandarin names), Japanese, Korean).

were in these countries. For this we checked where they had attended for undergraduate degree if we were unclear on where they came from as this is a good indication of if they were from that, or adjacent countries.

Analysis was conducted based on the number of top scientists rather than the entire population to understand the distribution of "top researchers" overall and within that the composition of the researchers.

Comparison of GDPc and percentage of women as faculty in tertiary education

Whilst getting a breakdown per discipline is impossible, data are available from the World Bank on the percentage of women as academic faculty in tertiary education (The World Bank, 2022a). Understanding the relationship between GDPc (Gross Domestic Product per Capita) and female representation is important, as gaps and trends can be identified. Based on World Bank data (The World Bank, 2022b) we noted the region (South America, North America, Europe, Africa, Middle East, Asia, and Oceania) and then calculated the relationship between GDPc and the percentage of women as academic faculty using linear regression. Statistical analysis was run in Spatial Analysis for Macroecology (Rangel et al., 2010).

Results

Based on the summary of researchers who had an H-index of over 30 at the end of 2021 and working in ecology and evolution, we broke down who is working, and if capacity building for research is effective. Whilst globally there were 5,419 "top researchers" almost 35% of them were from the United States alone, and this increases to 54% when the United Kingdom and Australia are also included, thus three countries host more than half of the world's 'top ecologists'. The top 'middle-income' country was Brazil (14th globally) with 1.5% of researchers. However, 83% of all Top researchers are based in the top 12 countries, which are all European, North American or Australian. Following Brazil is mainland China which is equal to Brazil in terms of top researchers. The only country with a GDPc of under $7000 to have more than 5 top researchers was India. Publishing patterns can clearly be seen to closely mirror GDPc (outside Persian Gulf states) with relatively few exceptions (Figure 1A).

However, the percentages of the top female ecologists were radically different from those of all ecologists (Figure 1B), and only 14% of the top ecologists were female. The percentage of top scientists being female was far higher in Latin American countries. However, much of this was because most countries have a low total number of ecologists with an H-index of more than 30, the first country with at least 10 top ecologists was Estonia,

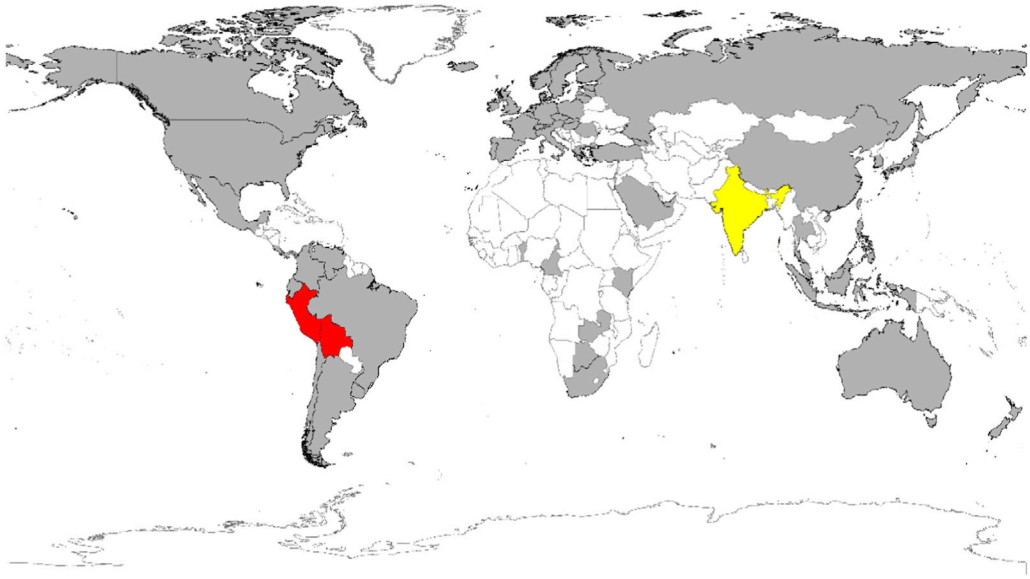

FIGURE 2
Percentage of female non-Caucasians top ecologists (Green-Yellow-Red, max 50%, Bolivia and Peru, N.b each of these only has two individuals).

where 21.4% were women; this was followed by Argentina with 20%, then Australia at 17%, the United States at 16.5%, and Brazil, Finland, Spain, and Singapore with between 15% and 16%, 15 additional countries had between 10% and 15%, and a further nine countries had more than 1%.

For countries with at least 10 top ecologists, the number of non-Caucasian top ecologists was highest in mainland China at 94% (Figure 1C), though it should be noted that all of those are from North Asia. Singapore has the second highest with 39%, of which most are North Asian (4 out of 5) (Figure 1D). The next highest was Poland with 6% (but this is still only one person). South Africa was next with 5%, of which 3.3% were North Asian. Only six other countries with over 10 top ecologists had over 1%. Globally, only 2.97% of ecologists are not Caucasian, and of these only 0.33% were not North Asian.

However, it should be noted that some trends are actually worse than they seem, for example, in countries like Panama where there are 24 top ecologists, not one is from Latin America, all are from the United States or Europe (likely due to the presence of the Smithsonian Tropical Research Institute). African countries, as noted above are similar in lacking local representation. However South America does have a better representation of regional scientists than many other regions, with the best representation of local scientists in Chile, Argentina, Colombia, and Brazil.

Non-Caucasian women are the least represented (Figure 2), only 0.24% of top ecologists are female non-Caucasians, and not a single country with more than 10 ecologists has more than 1% of their ecologists who are female non-Caucasians, although five have between 0 and 0.4 (France, United Kingdom, Canada, United States, Australia). If all countries are considered, then some countries with less representation overall are higher, India has 7 top ecologists overall and 14.3% are women who are not Caucasian, (Bolivia and Peru both have one each, but only a total of 2 top ecologists).

Characteristics (i.e., ethnicity, nationality) of who is publishing have been noted. In developing countries, people publishing are normally Caucasians from the West; in all other regions it is generally people from that country (highlighting a lack of researcher mobility), the only real exception to this is Australia, which has a real mix of nationalities. Based on the names, Greek researchers seem fairly mobile (outside Greece), likewise more "Russian" research names appear outside Russia than in countries with those languages. Within Europe, most names are from the country and few from outside. Also, there are almost no Asian names apart from Chinese, some Japanese, and very few South Koreans, and almost no African names outside a couple of countries in Africa. Latinos were considered with Caucasians but were the main researchers in South, but not Central America. Only 33 countries have at least 10"top" ecologists, of which the best place for women in Estonia (21%), for non-Caucasians was mainland China and Japan (94%-but all are from North Asia in both cases), Singapore (38% but 31% is from North Asia) and then Poland at 6%. The number of women from minorities is consistently low.

Correlates of women as academic staff in tertiary education and GDPc

Trends varied significantly between regions, but overall there was a significant positive relationship between GDPc and the percentage of female academic staff (p = 0.0081, r^2 = 0.03582, F = 7.17, Y = 0.0001*X + 36.50, N = 195) global average 38.36% ± 15.41%. In Africa, there was a positive relationship between GDPc and the percentage of female academic staff (p =

0.0002, r^2:0.2668, F = 16.74, Y = 0.0031*X + 15.77, N = 48) 23.15% ± 14.1%. In Asia, there was not significant trend ($p = 0.282$, $r^2 = 0.055$, F = 1.217, Y = −0.0002*X + 44.62, N = 23). Asia actually had an average of 41% ± 16.66% of female academic staff, but regions with more researchers noted as "Top researchers" often had the least representation (i.e., Japan: 18%, Hong Kong: 25%).

If we look at the average GDPc of countries with under 40% academic staff as female the figure is $23,246, *versus* just $6,266 for over 50%. Europe had a significant negative regression ($p = 0.008$, $r^2 = 0.1482$, F = 7.830, Y = −7.485e-005*X + 49.17, N = 47) but the average was higher than some other regions at 46% ± 7.8%. For the Middle East, there was no significant relationship (and since Central Asia was included there was high variation in the region), ($p = 0.769$, $r^2 = 0.004$, F = 0.09, Y = 5.368e-005*X + 37.01, N: 22), mean = 37.71 ± 13.84. In Oceania, there was no significant relationship ($p = 0.453$, $r^2 = 0.01621$, F = 0.58, Y = 6.515e-005*X + 44.65, N = 37) 45.95% ± 12.16%. In Latin America, there was not a significant relationship ($p = 0.701$, r2 = 0.011, F = 0.154, Y = −0.0002*X + 41.74, N = 16), mean = 39.65 ± 11.16%.

Discussion

For decades considerable resources have been devoted to building capacity, with programs such as the Fulbright initiative and many programs aiming to build partnerships between higher and lower-income economies. However, here we clearly show that despite this, ecology and evolution research is dominated by Caucasian men, and even in most developing economies, the majority of "high impact" researchers are Caucasian men. However, in an era where publishing has become unaffordable to many due to unaffordable APCs (Article Processing Charge) when some middle-income countries have no legitimate way to pay, this disparity is likely to increase further (Acharya and Pathak, 2019). Ultimately, new approaches are clearly needed to ensure science becomes more representative in the future and that local expertise is cultivated across the most diverse parts of the world.

Where are the women?

Compared globally, women represented less than a third (29.3%) of those employed in science (Ugwuegbula, 2020), although this does not account for the ratios in different career phases and stages. This is lower than the global average of women employed in academia (38%) showing that sciences have lower female representation than other academic disciplines. Furthermore, all the national level statistics for inclusion are much higher than the "top performing" researchers that are female, reiterating the lack of facilitation for women to publish well [and a higher chance that they will have greater management, "service" and lecturer roles (Bird et al., 2004; Link et al., 2008; Bird, 2011)]. Our results are similar to those focused solely on women publishing in conservation, which showed that 11% of the top publishers were women (Maas et al., 2021). Furthermore, it should be noted that in recent years this has shown little, if any improvement, for example, within the United States women increased in only 1% representation over a decade (2010–2020) and still only represent 35.5% of ecologists, which is considerably higher than the proportion of "Top ecologists" at only 16.5% (Zippia, 2021). Furthermore these women are less likely to have children than male academics, or other women, meaning many women may leave academia because of the life choices it influences (Metcalfe and Gonzalez, 2013). This is echoed by the fact that even in the United States men still hold 65% of science and engineering jobs, and the vast majority of these are caucasian (Docter-Loeb, 2023). Conversely, an even smaller proportion of top publishers (with their first papers since 2000) were female (Maas et al., 2021) suggesting that a lack of mentorship and support may exacerbate equalities in the future. Many suggestions have been made for the lack of women at higher academic levels across disciplines, with many dropping out in early career stages and having disproportionate under-representation as senior authors, editors or invited speakers at meetings (Salerno et al., 2020; See et al., 2021). Whilst the lack of support and "leaky pipeline" may contribute (Ysseldyk et al., 2019; Huang et al., 2020), especially to advancement at early and mid-career stages; these alone are not solely responsible for additional barriers faced by women in academia. Furthermore "maternal profiling" and differing expectations based on gender (Staniscuaski et al., 2021; 2023), as well as shorter and less positive reference letters, and negative self-perceptions can hinder hiring and progression (Sassler et al., 2017; Herbst, 2020; Marín-Spiotta et al., 2020). Consistent and even growing pay gaps, even in first positions after graduating with a PhD have been recorded almost universally in studies across the globe, with, for example, an almost 25% gap in the United States (Fleming, 2018; O'Neill, 2019; Science and Technology Australia, 2019; Woolston, 2019). These gaps also persist across careers of women, even for those performing at the highest levels (i.e., men vs. women in the same field and same H-index over 40 (Nietzel, 2022), and highlights the danger of not making salaries public knowledge (Baserga, 2022). Furthermore, women are more likely to be on temporary "precarious" contracts at each level (De Angelis and Grüning, 2020; Rennane et al., 2022), again highlighting the additional barriers in place for women. Simultaneously, at the other end of the spectrum women often have to retire 5–10 years earlier (ChartsBin, 2011; Trading Economics, 2022), thus whilst men may enjoy more awards and building on earlier investment and may show an increase in citations during this part of their career (Jones and Weinberg, 2011; Flaherty, 2017).

In addition to issues in advancement, women also often receive less credit than men for comparable work, in addition to less funding, prestige and respect for their research, especially co-authored research (Sarsons, 2017; Ma et al., 2019). Furthermore women may receive higher rejection rates in publications, which can be improved through the use of doubleblind review (Budden et al., 2008; Hagan et al., 2020; Zandona, 2022). Women are more prone to being "left off" authorship lists [up to 30% less likely to be included in authorship (Koffi, 2021)] and not credited for contributions, especially for potentially "high impact" research (Lissoni et al., 2013; Ross-Hellauer, 2022). Female scientists at the top levels show different patterns of collaboration (closer knit networks with more female collaborators) and citation than "elite" men (Lerman et al., 2022). Furthermore, papers are disseminated less and receive less interactions online based on altmetric scores (Vásárhelyi et al., 2021). Women are stated to be more likely to be asked to provide "honorary citations" to reviewers, who are likely to be male (because of the underrepresentation of women) (Fong and Wilhite, 2017; Stockemer et al., 2020; Mahrous, 2021). In addition, women are less likely to be able to access mentors (due to a lack of women in more senior positions), which does translate into long-term academic success (Sarsons, 2017). Additionally, women are often provided with less laboratory space, making it harder to build groups and conduct research (Wadman, 2023). This lack of support and credit is coupled with harassment, and an inability to access support when needed (Mattheis et al., 2022). These issues are known, and yet we still fail to see the equitable representation of women almost anywhere and approaches to recruiting women are unlikely to see long-term success without mechanisms to maintain them, support them and respect their work.

Representativity

Whilst reasons behind the continued lack of women in science are largely known, the lack of inclusivity of women who do succeed is often overlooked (Dutt, 2020). There is also a marked disparity of Caucasians within Academia relative to the population at large, for example, in United States, where Caucasians make up 90% of doctoral degrees in STEM (Science, Technology, Engineering and Mathematics), and 96.2% of faculty positions (Dutt, 2020). Patterns are similar in other areas with high numbers of researchers such as the United Kingdom (Dowey et al., 2021), highlighting that areas with the greatest numbers of high-performing researchers do not provide representation across different groups. These statistics are echoed by the numbers of Ecologists in the United States overall, where 77% were Caucasian and 12% Asian, leaving all other groups under-represented (Zippia, 2021). Furthermore, the ability to publish is also linked to how well countries are represented as editors in International journals, which still shows huge levels of bias (Rubin et al., 2023). This also translates into direct influence in conservation decision making and advancement for women, and this is exacerbated for minorities (James et al., 2023).

Interestingly, China recently added clearer guidelines to prevent the harassment of women, and Xi Jinping highlighted a need for equality in the workplace; but reversing the negative trends of female inclusion within China will be challenging (notably the first absence of women in the polit bureau in 25 years), and support (Ministry of Foreign Affairs of the People's Republic of China, 2020; The Economist, 2022), mentorship and other provisions for female scientists will be needed to provide equal opportunities following from PhD in particular, and such measures have not been implemented following previous similar statements. This is especially true when systematic biases (higher score requirements, capped numbers, male-only positions) prevail (Steinfeld, 2014). This is echoed by the defence of quotas drastically limiting women's access to degrees by statements such as "*women need to be caregivers and expect men to fill the leadership roles*" (Dong, 2021).

These issues are exacerbated when we consider intersectionality between issues, with non-Caucasian women consistently the least represented and the less well paid in almost all instances (Marín-Spiotta et al., 2020). This lack of inclusion and progression in changing patterns of inclusion is unsurprisingly multifaceted (Fry et al., 2021). Devaluation of work, exclusion, lack of support and representation are commonly cited as major factors contributing to the lack of retrospectivity of women of colour in high-level academic positions (Rollock, 2021; Settles et al., 2022). The lack of mentorship and guidance also plays a considerable role in preventing the advancement of women (Buchanan, 2020), and needs to be addressed to stem the leaky pipeline (Greider et al., 2019).

Building capacity?

The results are striking in the lack of effective capacity building across the planet, and yet the need for this inclusion is evident, such as the lack of progress towards NBSAPs (National Biodiversity Strategic Action Plans) and global biodiversity targets (Prip et al., 2010; Hughes, 2017; Hu et al., 2022), and the slow development and release of National Biodiversity Strategic Action Plans (Bhatt et al., 2020). At least 23 countries never submitted an NBSAP following the setting of the Aichi targets, and support to develop effective plans is essential (Erdelen, 2020). Building in-country capacity for conservation is not merely a function of global equitability, it is also a cornerstone to sensible and effective negotiation and action plans for global conservation, for management at national and international scales and the effective mobilisation and targeting of resources (United Nations Environment Programme, 2015). Lack of scientific capacity in developing countries has been attributed to one of the greatest challenges behind setting effective conservation targets, developing baseline biodiversity inventories, or monitoring progress towards goals, as needed for any conservation target (Chandra and Idrisova, 2011; Koh et al., 2022). Furthermore, it is low and middle-income countries which host the vast majority of biodiversity, thus without the capacity (including resource capacity) to develop appropriate targets and the mechanisms to implement them, reaching global conservation targets is simply not possible.

Our results demonstrate a phenomenal lack of progress in increasing academic achievements in ecology and conservation worldwide, with vanishingly few "high impact" researchers outside developed countries, and even countries with "high impact" researchers, often only host non-local researchers. The only real exceptions to this are in regions like Latin America where in countries like Brazil 90% of top researchers were local, and to a degree Argentina where 75% were local. Furthermore, Latin America had a higher representation of female top-researchers, though structural barriers persist (Hipólito et al., 2022). Conservation relies on a more nuanced societal understanding, as well as the recognition and inclusion of indigenous knowledge; for longer-term solutions, genuine capacity building will be crucial, and lessons may be learnt from middle-income countries which have cultivated local capacity.

Making progress

Solutions for better representation and inclusion in higher-income economies have been discussed at length, though progress is slow, and much more work is needed. Research shows that double-blind reviews can ameliorate at least some discrimination against marginalised groups and regions (Tomkins et al., 2017; Kern-Goldburger et al., 2022; Fox et al., 2023; Smith et al., 2023) in addition to "home editor bias" (Rubin et al., 2023). Thus further steps such as triple-blind review, initialising non-family names on publications, and setting clear rank-related transparent salaries, as well as "family leave" rather than targeted maternity leave may help (Etzkowitz et al., 2020; Brodie et al., 2021). Reference letters can be written through forms that request targeted information relating to key skills, rather than an open-form unstructured recommendation letter. In conferences, involving women as keynote speakers can increase women's visibility and achieve gender balance during such scientific events. Within workplaces training for subconscious biases, inclusive mentorship, and greater efforts for representation on committees and speakers at events will reduce the alienation of women and minorities within the sciences (Schell et al., 2020; Dowey et al., 2021).

Moreover, our research highlights the lack of progress across low and middle-income economies in the lack of high-impact researchers [or indeed editors of ecology journals (Espin et al., 2017)]; despite decades of capacity-building efforts highlighting the need for new strategies. It is known that setting or achieving future environmental goals may be impossible without building capacity and making access to science, and the ability to publish accessible (Mutiso, 2022). In addition, many high-impact journals in ecology and conservation are now transitioning to fully open access, yet this creates an additional publication barrier for many academics and researchers from developing countries. Whilst this scheme gives more advantage to institutions from more developed western economies who could afford open-access publication through their institutional agreements with the publishers (e.g., Projekt DEAL in Germany) (Kieselbach, 2020). This allows authors from these institutions to have more opportunities for their work to be published open access, which exacerbates inequality by providing higher accessibility to their papers, increasing their citation rates, and consequently exacerbating the difference between developed and developing economies (Tang et al., 2017). Thus the removal of harmful and unaffordable APCs, regulation to ensure any charges are accessible and subject to fair competition standards, or waivers are genuinely available is crucial (Ellers et al., 2017). Open Access journals and papers have lower diversity than subscription papers, even in the same journals (Smith et al., 2021; Ross-Hellauer, 2022), thus moves of European countries to prop-up and support an Open Access system rather than capping and regulating costs creates barriers much of the world cannot overcome (Else, 2021). The denial of waivers to middle-income countries (i.e., see Retractionwatch, 2023), such as the few waiver deals available in Latin America relative to the numbers of "high impact researchers" from the region may actively reverse progress in publishing in these regions, and reducing the ability to publish may reduce the competitiveness of these researchers at accessing international grants (Huber et al., 2022; Kowaltowski et al., 2022). The branding of these increasing processing charges is not only regressive (replacing diamond access -free to publish journals in regions like Latin America) and under the branding of 'transformative agreements' not only instituting APCs but increasing the price by several orders of magnitude over just a few years (Alperin, 2022). Genuine diamond open access funded at a national or even international level (such as through the Global Environment facility for ecological journals) would facilitate publishing, and remove barriers to both publishing and accessing science. Furthermore, given that much research is funded by taxes, paying to access or publish the results that the government has already paid for is circular and disadvantageous for both research and researchers.

Furthermore, more efforts to build collaborations and exchanges within emerging economies will be crucial. Bringing the best and brightest students to the west risks depriving developing economies of some of their best potential scientists; thus new modes of collaborative development and exchange are needed. These should be paired with funding structures, and provide longer-term support and mentorship. Middle and low-income countries should enhance their "reverse brain drain" policies to bring back talents and facilitate the transfer of skills and knowledge.

In addition, flexibility around split positions may also enable both retention of talent in developing economies (to both provide the highest quality of science and to train the next-generation) and to enable scientists from regions already publishing well to put more effort into building capacity across the globe. Lastly, open-access science should have paved the way for access and inclusion, just as the digitisation of scientific collections is starting to allow for better access to specimens taken from diverse developing economies decades ago for reference and collaboration. We live in a world where whilst telecommunications enable collaboration across the world, and we can now access science, new barriers risk (such as exaggerated APCs) make publishing even less equitable.

Conclusion

The authors of this paper are all from the Landscape Ecology Group of Xishuangbanna Tropical Botanical Garden during 2020 and 2021. Learning from each other, and from our diverse group in contrast to the patterns here we hope to highlight the issues and inspire the urgent need for change to develop better solutions for tomorrow. As a team that was based in China and has learned from each other, and from our diverse group in contrast to the patterns we observed and described in this paper, we attempted to highlight the issues and pointed to new inclusive approaches. In our opinion, significant efforts will have to be made to change current inequitable patterns of research and publishing in ecology and evolution in order to be better prepared for the future in science.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary Material, further inquiries can be directed to the corresponding author.

Author contributions

AH led writing, All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fenvs.2023.1211211/full#supplementary-material

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