



# Discovering Inclusivity in Remote Sensing: Leaving No One Behind

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## OPEN ACCESS

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### Specialty section:

This article was submitted to  
Remote Sensing Time Series Analysis,  
a section of the journal  
Frontiers in Remote Sensing

**Received:** 04 February 2022

**Accepted:** 30 May 2022

**Published:** 01 July 2022

### Citation:

Joyce KE, Nakalembe CL, Gómez C,  
Suresh G, Fickas K, Halabisky M,  
Kalamandeen M and Crowley MA  
(2022) Discovering Inclusivity in  
Remote Sensing: Leaving No  
One Behind.  
Front. Remote Sens. 3:869291.  
doi: 10.3389/frsen.2022.869291

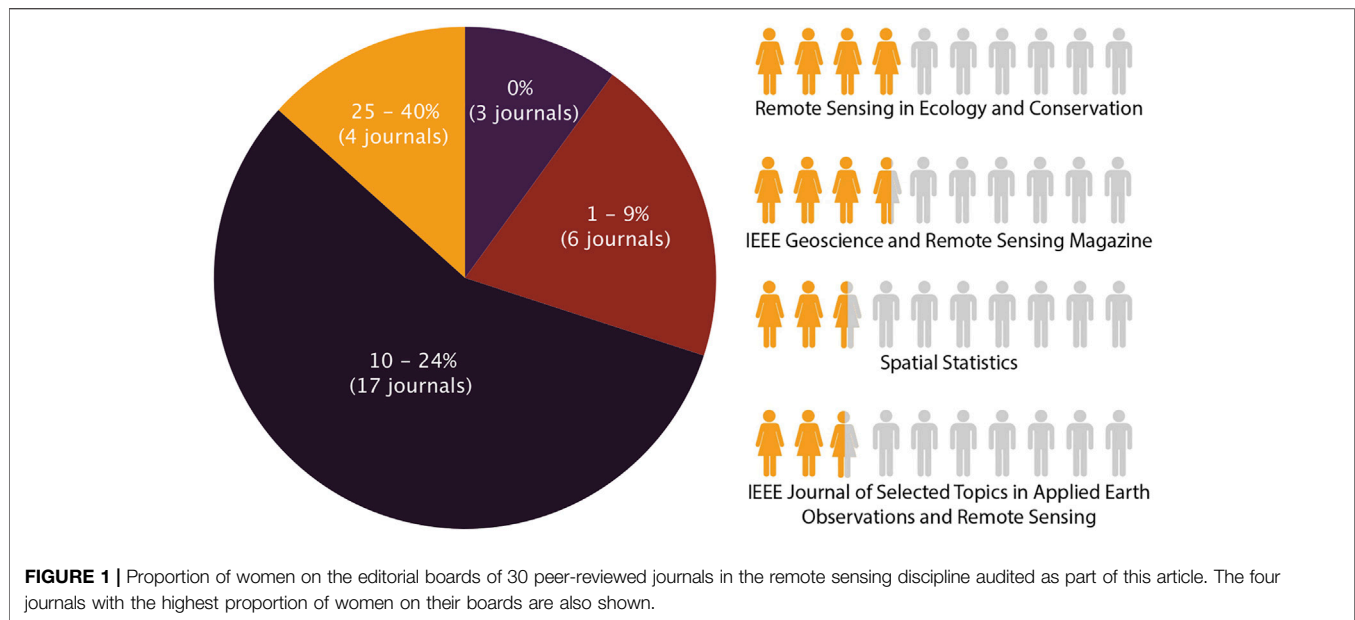
Innovative and beneficial science stems from diverse teams and authorships that are inclusive of many perspectives. In this paper, we explore the status of inclusivity in remote sensing academic publishing, using an audit of peer-reviewed journal editorial board composition. Our findings demonstrate diversity deficiency in gender and country of residence, limiting the majority of editors to men residing in four countries. We also examine the many challenges underrepresented communities within our field face, such as implicit bias, harsher reviews, and fewer citations. We assert that in the field of remote sensing, the gatekeepers are not representative of the global society and this lack of representation restricts what research is valued and published, and ultimately who becomes successful. We present an action plan to help make the field of remote sensing more diverse and inclusive and urge every individual to consider their role as editor, author, reviewer, or reader. We believe that each of us have a choice to continue to align with a journal/institution/society that is representative of the dynamic state of our field and its people, ensuring that no one is left behind while discovering all the fascinating possibilities in remote sensing.

**Keywords:** equity, diversity, inclusion, gatekeepers, editorial boards, bias, women in STEM, remote sensing

## 1 SETTING THE SCENE

The rules of any game determine the winners and losers, whether it is in sports or academia. In academia, the definition of success includes who is talented, who is competent, who is brilliant, what research has potential, and what methods are innovative. However, this very definition of success has been and continues to be determined by a group incongruous with the demographic depth of the field. Yet rules defining success do not have to be static. Science, just like nature, is dynamic and must evolve, to provide the greatest opportunity for advancement. It is, therefore, time to examine the various stages in academic publishing to make them more inclusive and representative of the present state of our dynamic planet.

Perhaps the ultimate determinant of a journal's success is its financial bottom line, and its ability to stay 'in business' and sustain a high impact factor. Contributions from editors, authors, reviewers, and the readership drives any journal as a business. These stakeholder groups are not mutually



exclusive, and many people act in two or more of these roles at any given time. If large numbers of individuals within any of these groups disengage, the journal's 'success' may be in jeopardy. It is therefore beholden on a journal to keep its mission, publications, and management in line with stakeholders' desires, demands, or values. The stakeholders therefore have the power to shape the success of the journal. Including a diverse set of voices from a variety of communities and geographical locations into these stakeholder groups compels the journal to be representative of the current state of global research.

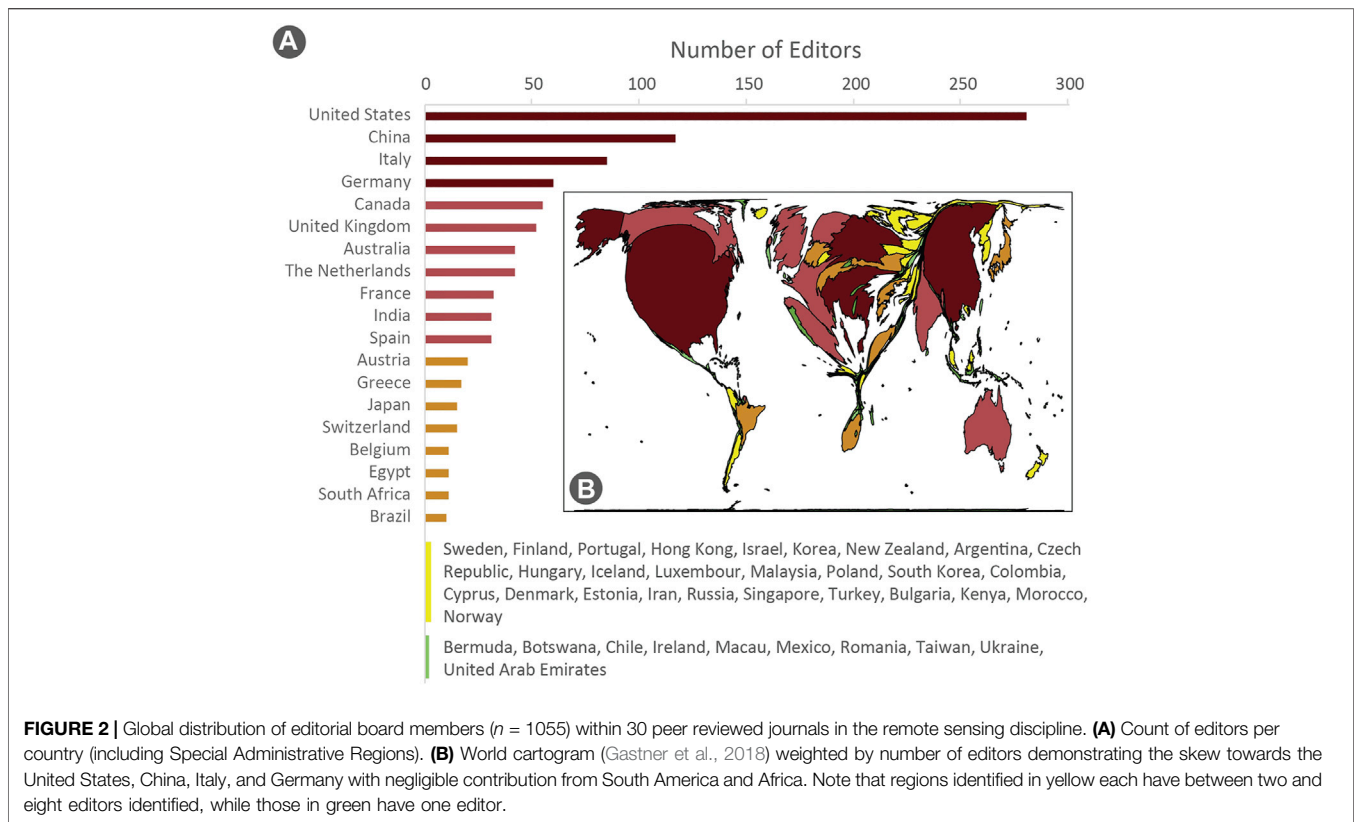
However, not all stakeholders hold equal power and weight in shaping the vision and trajectory of a journal. The editors - and to a lesser extent reviewers - act as gatekeepers, deciding which research is worthy of publication (Demeter, 2020; Schurr et al., 2020). Previous studies have shown marginalisation in research gatekeeping positions work against promoting research by women, especially women of colour (Davies S. et al., 2021; Davies S. W. et al., 2021) and a phenomenon known as the "Matilda Effect" where women's achievements are attributed to men. This Effect acknowledges and contributes to the gender gap in recognition, award winning, tenure, and citations for women, that clearly exists in scientific publishing (Lerchenmueller and Sorenson, 2018; Lincoln et al., 2012; Weisshaar, 2017). While these articles only studied the marginalisation of women, implicit bias and discrimination exist for all underrepresented genders, communities, and groups in science, technology, engineering, and mathematics (STEM) at every career stage (Larivière et al., 2013; Jones et al., 2014; Silbiger and Stubler, 2019; Chaudhary and Berhe, 2020; Huang et al., 2020; Berhe et al., 2022).

As scientists in the field of remote sensing, we must ask ourselves—Are the present publishing gatekeepers representative of the entire scientific community? We assert that in the field of remote sensing, the gatekeepers are not representative of the global society and that this lack of representation restricts what research is valued and published, and ultimately who becomes successful.

## 2 STATUS OF DIVERSITY IN REMOTE SENSING ACADEMIC PUBLISHING

To demonstrate the diversity deficiency in our discipline, we conducted a baseline audit of the editorial boards of 30 well-established peer reviewed journals within the remote sensing discipline based on Schurr et al. (2020), over the period September–November 2020. It was necessary to create our own editorial board audit for baseline demographics characteristics because this information was not easily accessible for a majority of the top remote sensing journals. Our findings indicate eight out of the top ten remote sensing journals (by impact factor) have editorial boards with more than 80% men (Figure 1). Three (10%) of the audited journals do not have any women on their editorial boards, and the largest percentage of women on any editorial board was just 40%. In fact, 84% of the journals had fewer than 20% women on their board. Our findings reinforce previous analyses in other scientific fields that there are fewer women in scientific journal editorial roles (Chawla 2018; Feeney et al., 2019). We also note that in a recent study of leading geoscience journals, women were identified as first author in 13–30% of publications (Pico et al., 2020), which is consistent with broader analyses of scientific authorship (Larivière et al., 2013; West et al., 2013). First author publications and editorial board roles seem to reflect each other in other fields (Dhanani and Jones, 2017; Helmer et al., 2017). As we advocate for diversifying editorial boards, we believe this will also result in more diverse authorship and more inclusive publication processes (Cho et al., 2014; Lerbäck and Hanson, 2017; Cheng et al., 2021), leaving no one behind.

Further documenting the gatekeeping countries, based on the affiliation of the editorial board members, we report that the majority of editors reside within just four countries. The United States (27%), China (11%), Italy (8%), and Germany (6%) represent 52% of the residence countries of editorial



board members (Figure 2). While we bring to light gender and country of residence, these are not the only aspects of gatekeeping needing attention. In particular, there is a lack of survey data of other self-identification characteristics, like race, in the field of remote sensing. We suggest that future analyses could conduct direct surveys of editorial board members to gather stakeholder information and work towards reducing other disparities in the field of remote sensing. While we treat gender and country of residence as separate metrics, we acknowledge the complexity of privilege, exclusion, and intersectionality associated with these identities (e.g., Schurr et al., 2020), which could be examined in future survey analyses.

The lack of representation and diversity at this evolved stage of scientific publishing in fields like remote sensing restricts science from reaching its full potential (Murray et al., 2019; Schurr et al., 2020). Conversely, developing more gender and geographically diverse editorial boards will provide the opportunity to connect with research from around the globe, thereby aiding in considering global opinions and voices (Cheng et al., 2021). This will better represent different global, regional, or local communities and interests, and ultimately lead to superior science-based solutions to the world's most pressing problems like climate change or loss of diversity. By acknowledging and tackling implicit biases, we will benefit from more fair and balanced conversations and debates about what we as a remote sensing community value in our field.

The history of bias in remote sensing science is a two-fold problem. Like many other disciplines, remote sensing has

historically been driven and shaped by the most dominant voices who hold positions of power, many of whom have acted as gatekeepers when they have consciously or unconsciously chosen to not recognise or act to rectify the implicit bias and lack of representation in the field. These dominant voices include the most frequently published authors, the members of technical science teams, and the most-funded principal investigators. Further, the remote sensing field has fewer marginalised voices in positions of power, and many describe feeling invisible or feel like their voices go unnoticed (Crowley, 2019; Adams et al., 2020; Crowley, 2020; Crowley et al., 2021a; Crowley et al., 2021b; Stéphenne et al., 2021; Vizireanu et al., 2021). It is the responsibility of every individual in our remote sensing community to proactively make our field's editorial boards more diverse and inclusive, but it is the duty of gatekeepers to act responsibly and promote underrepresented and diverse voices (Ryan 2022).

Gatekeeping occurs at every stage of science, and not just on editorial boards. Our remote sensing community consists of all of our combined excellence, with many gears that fit together and depend on one another. The success of a scientist depends on their host institution, faculties, co-investigators, affiliations, citations, number of publications, and other factors (van den Besselaar and Sandström, 2017; Davies S. et al., 2021; Davies S. W. et al., 2021). Our field is not exempt from implicit and explicit bias. Some of the authors on this article have suffered implicit bias, especially when submitting manuscripts to technical and

methods-oriented journals that have a larger gender gap, not only in the editorial or review boards, but also in the number of manuscripts submitted by first authors that are men. Our experience is that as authors who identify as women, we gain lesser visibility and increased risk due to biases from editors, reviewers, and readers throughout the publication process in many remote sensing journals, similar to what has been found in the field of ecology (Fox et al., 2016; Fox and Paine, 2019). Further, authors with non-western presenting names from underrepresented communities receive harsher reviews and fewer citations (Fejes and Nylander, 2017; Silbiger and Stubler, 2019). In addition to men self-citing their papers more than women (King et al., 2017), women's research is less likely to be cited by others, their ideas are more likely to be attributed to men, and women's solo-authored research takes twice as long to move through the review process (Dion et al., 2018). In a world where metrics and h-indices define the success of a scientist (Davies S. et al., 2021; Davies S. W. et al., 2021; Maas et al., 2021), this implicit bias against women and other minorities hinders their career forcing many to leave science (Bostwick and Weinberg, 2022; Huang et al., 2020; Larivière et al., 2013). The loss of scientists and their ideas has detrimental impacts on potential scientific innovations.

### 3 IT'S TIME TO DO BETTER

To reduce negative impacts incurred from bias, it is not enough for any organisation to claim to be 'champions of diversity and inclusion', without demonstrating actions towards achieving a goal. It takes active allies to put the work in turning the ship towards more diversity and inclusivity. To increase representation, institutions must actively increase visibility of their scientists, researchers, and authors from underrepresented and marginalised groups and communities. These could be by using social media platforms and professional networks such as the Ladies of Landsat, Sisters of SAR, Women in Copernicus, IEEE GRSS IDEA, Women+ in Geospatial, and other networks (Crowley et al., 2021a; Crowley et al., 2021b; Riedler et al., 2021; Stéphenne et al., 2021; Vizireanu et al., 2021) that aim to promote and support women in remote sensing. Actively nominating women for grants/awards, or by creating 'special issues' within a journal to amplify their work can also help to promote and support their research (Amon 2017; Van Oosten et al., 2017; Joyce et al., 2021).

Within the remote sensing community, we must assign roles with decision-making powers to researchers and scientists from previously underrepresented groups, actively and consciously. This must not be tokenistic, instead including them on editorial boards, in senior management and positions with power to make change. Focusing solely on empowerment programs does not change the system, because underrepresented groups do not need 'fixing' and rarely lead such programmes. They have the skills and knowledge but may lack the resources that enable visibility. They need to be heard, and we need to listen.

We suggest an action plan to change this, specifically within our remote sensing discipline.

- 1) Collect diversity data to learn and change: Publishers, professional societies, institutions, and individuals need to actively collect baseline demographic data over time and assess the extent of gender, racial, regional, and institutional bias and their impacts on remote sensing scientists (e.g. van Veelen et al., 2019) to enable change.
- 2) Journals and gatekeepers must act responsibly: Gatekeepers and journals should actively make their editorial and review boards more representative and inclusive, and with modesty enable regional experts to evaluate what is relevant work in specific areas. These efforts can be achieved through policies that support more diverse editorial and review boards (Cho et al., 2014; Cheng et al., 2021; Maas et al., 2021).
- 3) Editorial boards must strive for internal diversity: This will drive change from the top, create visible pathways for junior academics, and encourage diverse perspectives and expertise in areas sought for special issue publications (Cheng et al., 2021; Cho et al., 2014; Emerald Publishing, n.d.; Lerback and Hanson, 2017; Squazzoni et al., 2021).
- 4) Double blind reviews or fully open reviewing to tackle bias and harsh reviews: Given the bias observed towards accepting papers from authors considered 'similar' to the editors and reviewers (Helmer et al., 2017; Murray et al., 2019), we should investigate more widespread double blind reviews (Darling 2015), or alternatively fully open reviews where all are accountable for their words and decisions. We must also continue to provide clear guidelines for reviewers to produce constructive and fair reviews to avoid negative impacts on authors from underrepresented groups (Silbiger and Stubler, 2019).
- 5) Actively promote work undertaken by underrepresented or marginalised remote sensing scientists: This might include promoting the work and authors once published, but also in actively seeking out/inviting work from these authors in the first place (Maas et al., 2021) and offering language or financial support where required. We also recognise that there are further accessibility challenges regarding publishing fees and gaining access to the articles once published. Open access publications help to remove the barrier of access to publications, and initiatives supporting fee waivers for minoritised groups help to provide financial support by reducing or removing article-processing charges (Valenzuela-Toro and Viglino, 2021; Ross-Hellauer, 2022).
- 6) Accept and encourage ideas and manuscripts that are multidisciplinary, transdisciplinary, and different from the established norm: By promoting and inviting these types of articles in remote sensing and special collections, especially from minoritised scientists, we can contribute as a field towards reaching global targets such as the Sustainable Development Goals and the Sendai Framework.
- 7) Ensure that local communities/institutions are credited appropriately and benefit from "successful publications" conducted in their geographic regions: This includes collaborating with local representatives and organizations and recognizing their contributions to the remote sensing



research to avoid “helicopter” science and increase the impact of remote sensing articles (Abbasi and Jaafari, 2013).

Systemic change will not happen overnight. However, our audit shows that the remote sensing literature is driven by and largely contains the voice of primarily men from a minority of countries. Can we afford to let only a narrow scientific community make a majority of the editorial decisions in the field of remote sensing? As a result, is the field of remote sensing limiting the inclusion of remote sensing scientists from the rest of the world (Maas et al., 2021)? It is the responsibility of the privileged, including established institutions, journals, and scientists to help create the platform and spaces for underrepresented and marginalized groups and communities to be in line with the motto of Agenda 2030 of “leaving no one behind”. Therefore, more journals must update their editorial boards and policies. Creating diverse and inclusive organisations includes more than doing what is right for individuals and underrepresented groups: it is vital that we make large-scale structural changes to the system. The data clearly demonstrate that we see more innovative and beneficial science that stems from diverse teams and authorships that are inclusive of many perspectives (Abbasi and Jaafari, 2013; Freeman and Huang, 2014; AlShebli et al., 2018). This is a change we must embrace to excel our discipline.

## 4 OUR CALL TO ACTION

It is difficult to translate individual desire or demand into systemic change, particularly at a discipline level. That is where the power of the collective is increasingly important. We can choose to continue to ‘hold our stake’ in journals whose mission aligns with our own values, and advocate for others to do so with us. As a community, we can strive to create

## REFERENCES

- Abbasi, A., and Jaafari, A. (2013). Research Impact and Scholars’ Geographical Diversity. *J. Inf.* 7, 683–692. doi:10.1016/j.joi.2013.04.004
- Adams, E. C., Crowley, M. A., Casey, K., and Halabisky, M. (2020). *Gender and Social Inclusion in Climate Data Services and Analyses I Posters*. Washington, DC: American Geophysical Union. Available at: <https://agu.confex.com/agu/fm20/meetingapp.cgi/Session/104606> (Accessed May 3, 2022).
- AlShebli, B. K., Rahwan, T., and Woon, W. L. (2018). The Preeminence of Ethnic Diversity in Scientific Collaboration. *Nat. Commun.* 9, 5163. doi:10.1038/s41467-018-07634-8
- Amon, M. J. (2017). Looking through the Glass Ceiling: A Qualitative Study of STEM Women’s Career Narratives. *Front. Psychol.* 8, 236. doi:10.3389/fpsyg.2017.00236
- Berhe, A. A., Barnes, R. T., Hastings, M. G., Mattheis, A., Schneider, B., Williams, B. M., et al. (2022). Scientists from Historically Excluded Groups Face a Hostile Obstacle Course. *Nat. Geosci.* 15, 2–4. doi:10.1038/s41561-021-00868-0
- Bostwick, V. K., and Weinberg, B. A. (2022). Nevertheless She Persisted? Gender Peer Effects in Doctoral STEM Programs. *J. Labor. Econ.* 40 (2), 397–436.
- Chaudhary, V. B., and Berhe, A. A. (2020). Ten Simple Rules for Building an Antiracist Lab. *PLoS Comput. Biol.* 16, e1008210. doi:10.1371/journal.pcbi.1008210
- Cheng, S. J., Zaringhalam, M., Carvalho, A. P. S., Barnes, R. T., Goldman, G., Simonis, J. L., et al. (2021). *Moving Scientific Publishing toward Social Justice*. Washington, DC: Times Higher Education. Available at: <https://www.insidehighered.com/advice/2021/09/09/call-action-more-socially-just-publishing-opinion> (Accessed May 3, 2022).
- Cho, A. H., Johnson, S. A., Schuman, C. E., Adler, J. M., Gonzalez, O., Graves, S. J., et al. (2014). Women Are Underrepresented on the Editorial Boards of Journals in Environmental Biology and Natural Resource Management. *PeerJ* 2, e542. doi:10.7717/peerj.542
- Crowley, M. A., de Souza Mendes, F., Fickas, K. C., and Halabisky, M. (2021a). *Celebrating International Day of the Girl with Ladies of Landsat*. Washington, DC: USAID. Available at: <http://www.agrilinks.org/post/celebrating-international-day-girl-ladies-landsat> (Accessed May 3, 2022).
- Crowley, M. A. (2020). *How Small Acts Became Big Movements towards Inclusivity*. Mountain View: Google Earth and Earth Engine. Available at: <https://medium.com/google-earth/how-small-acts-became-big-movements-towards-inclusivity-9ba5cedc8db5> (Accessed May 3, 2022).
- Crowley, M. A. (2019). *Ladies of Landsat Builds Inclusivity in the Geosciences*. Google. Available at: <https://blog.google/products/earth/ladies-of-landsat/> (Accessed May 3, 2022).
- Crowley, M. A., Fickas, K., and Halabisky, M. (2021b). *Ladies of Landsat*. Ottawa, Canada: Women in Wood. Available at: <https://www.womeninwood.ca/single-post/ladies-of-landsat> (Accessed May 3, 2022).
- Darling, E. S. (2015). Use of Double-Blind Peer Review to Increase Author Diversity. *Conserv. Biol.* 29, 297–299. doi:10.1111/cobi.12333
- Davies, S., Putnam, H., Ainsworth, T., Baum, J., Bove, C., Crosby, S., et al. (2021). *Shifting Our Value System beyond Citations for a More Equitable Future*.

enough noise in hope that it will 1 day resonate loud enough to be heard.

As an individual, consider your role as an editor, author, reviewer, or reader. Is the journal you select or represent demonstrating their worth as an active ally in creating a diverse and inclusive remote sensing discipline? You have the choice to continue aligning with that journal, or you can seek alternatives and be the change you wish to see, leaving no one behind.

As the all-women team of co-authors on this paper, we invite all active allies to join us for a more inclusive future in our discipline.

## DATA AVAILABILITY STATEMENT

The raw data supporting the conclusion of this article will be made available by the authors, without undue reservation.

## AUTHOR CONTRIBUTIONS

All authors have contributed substantially to every aspect of conceptualization, data curation, writing, reviewing, and editing. All authors have read and agreed to the published version of the manuscript.

## ACKNOWLEDGMENTS

As co-authors of this article, we each pay our respects to the traditional custodians of the land, sea, and sky country from the diverse parts of the world from where we live, breathe, work, and play.

- Available at: <https://www.preprints.org/manuscript/202102.0493/v1> [Accessed May 3, 2022].
- Davies, S. W., Putnam, H. M., Ainsworth, T., Baum, J. K., Bove, C. B., Crosby, S. C., et al. (2021). Promoting Inclusive Metrics of Success and Impact to Dismantle a Discriminatory Reward System in Science. *PLoS Biol.* 19, e3001282. doi:10.1371/journal.pbio.3001282
- Demeter, M. (2020). "Gatekeepers of Knowledge Dissemination: Inequality in Journal Editorial Boards," in *Academic Knowledge Production and the Global South: Questioning Inequality and Under-representation* (Cham: Springer International Publishing), 137–151. doi:10.1007/978-3-030-52701-3\_6
- Dhanani, A., and Jones, M. J. (2017). Editorial Boards of Accounting Journals: Gender Diversity and Internationalisation. *AAAJ* 30, 1008–1040. doi:10.1108/AAAJ-08-2014-1785
- Dion, M. L., Sumner, J. L., and Mitchell, S. M. (2018). "Replication Data for: Gendered Citation Patterns across Political Science and Social Science Methodology Fields," in *Harvard Dataverse V1*.
- Emerald Publishing. (n.d.). What Is Preventing Diversity on Editorial Boards? Available at: <https://www.emeraldgroupublishing.com/opinion-and-blog/what-preventing-diversity-editorial-boards> [Accessed May 3, 2022].
- Feeney, M. K., Carson, L., and Dickinson, H. (2019). Power in Editorial Positions: A Feminist Critique of Public Administration. *Public Admin Rev.* 79, 46–55. doi:10.1111/puar.12950
- Fejes, A., and Nylander, E. (2017). The Economy of Publications and Citations in Educational Research: What about the 'Anglophone Bias'? *Res. Educ.* 99, 19–30. doi:10.1177/0034523717740146
- Fox, C. W., Burns, C. S., and Meyer, J. A. (2016). Editor and Reviewer Gender Influence the Peer Review Process but Not Peer Review Outcomes at an Ecology Journal. *Funct. Ecol.* 30, 140–153. doi:10.1111/1365-2435.12529
- Fox, C. W., and Paine, C. E. T. (2019). Gender Differences in Peer Review Outcomes and Manuscript Impact at Six Journals of Ecology and Evolution. *Ecol. Evol.* 9, 3599–3619. doi:10.1002/ece3.4993
- Freeman, R. B., and Huang, W. (2014). Collaboration: Strength in Diversity. *Nature* 513, 305. doi:10.1038/513305a
- Gastner, M. T., Seguy, V., and More, P. (2018). Fast Flow-Based Algorithm for Creating Density-Equalizing Map Projections. *Proc. Natl. Acad. Sci. U. S. A.* 115, E2156–E2164. doi:10.1073/pnas.1712674115
- Helmer, M., Schottdorf, M., Neef, A., and Battaglia, D. (2017). Gender Bias in Scholarly Peer Review. *eLife* 6, e21718. doi:10.7554/eLife.21718
- Huang, J., Gates, A. J., Sinatra, R., and Barabási, A.-L. (2020). Historical Comparison of Gender Inequality in Scientific Careers across Countries and Disciplines. *Proc. Natl. Acad. Sci. U.S.A.* 117, 4609–4616. doi:10.1073/pnas.1914221117
- Jones, T. M., Fanson, K. V., Lanfear, R., Symonds, M. R. E., and Higgie, M. (2014). Gender Differences in Conference Presentations: A Consequence of Self-Selection? *PeerJ* 2, e627. doi:10.7717/peerj.627
- Joyce, K. E., Anderson, K., and Bartolo, R. E. (2021). Of Course We Fly Unmanned—We're Women!. *Drones* 5, 21. doi:10.3390/drones5010021
- King, M. M., Bergstrom, C. T., Correll, S. J., Jacquet, J., and West, J. D. (2017). Men Set Their Own Cites High: Gender and Self-Citation across Fields and over Time. *Socius* 3, 2378023117738903. doi:10.1177/2378023117738903
- Larivière, V., Ni, C., Gingras, Y., Cronin, B., and Sugimoto, C. R. (2013). Bibliometrics: Global Gender Disparities in Science. *Nature* 504, 211–213. doi:10.1038/504211a
- Lerback, J., and Hanson, B. (2017). Journals Invite Too Few Women to Referee. *Nature* 541, 455–457. doi:10.1038/541455a
- Lerchenmueller, M. J., and Sorenson, O. (2018). The Gender Gap in Early Career Transitions in the Life Sciences. *Res. Policy* 47, 1007–1017. doi:10.1016/j.respol.2018.02.009
- Lincoln, A. E., Pincus, S., Koster, J. B., and Leboy, P. S. (2012). The Matilda Effect in Science: Awards and Prizes in the US, 1950s and 2000s. *Soc. Stud. Sci.* 42, 307–320. doi:10.1177/0306312711435830
- Maas, B., Pakeman, R. J., Godet, L., Smith, L., Devictor, V., and Primack, R. (2021). Women and Global South Strikingly Underrepresented Among Top-publishing Ecologists. *Conserv. Lett.* 14, e12797. doi:10.1111/conl.12797
- Murray, D., Siler, K., Larivière, V., Chan, W. M., Collings, A. M., Raymond, J., et al. (2019). Author-Reviewer Homophily in Peer Review. *bioRxiv*. 400515.
- Pico, T., Bierman, P., Doyle, K., and Richardson, S. (2020). First Authorship Gender Gap in the Geosciences. *Earth Space Sci.* 7, e2020EA001203. doi:10.1029/2020ea001203
- Riedler, B., Stéphenne, N., Aguilar-Moreno, E., Jagaille, M., Monfort-Muriach, A., Fiore, G., et al. (2021). "Towards Gender Equality in Education and Career in the Earth Observation and GI Sector," in *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences* (Nice, France: ISPRS), 21–27. doi:10.5194/isprs-archives-XLIII-B5-2021-21-2021
- Ross-Hellauer, T. (2022). Open Science, Done Wrong, Will Compound Inequities. *Nature* 603, 363. doi:10.1038/d41586-022-00724-0
- Ryan, M. (2022). To Advance Equality for Women, Use the Evidence. *Nature* 604, 403. doi:10.1038/d41586-022-01045-y
- Schurr, C., Müller, M., and Imhof, N. (2020). Who Makes Geographical Knowledge? the Gender of Geography's Gatekeepers. *Prof. Geogr.* 72, 317–331. doi:10.1080/00330124.2020.1744169
- Silbiger, N. J., and Stubler, A. D. (2019). Unprofessional Peer Reviews Disproportionately Harm Underrepresented Groups in STEM. *PeerJ* 7, e8247. doi:10.7717/peerj.8247
- Singh Chawla, D. (2018). Huge Peer-Review Study Reveals Lack of Women and Non-westerners. *Nature* 561, 295–296. doi:10.1038/d41586-018-06678-6
- Squazzoni, F., Bravo, G., Farjam, M., Marusic, A., Mehmani, B., Willis, M., et al. (2021). Peer Review and Gender Bias: A Study on 145 Scholarly Journals. *Sci. Adv.* 7, eabd0299. doi:10.1126/sciadv.abd0299
- Stéphenne, N., Riedler, B., a Aguilar-Moreno, E., Jagaille, M., Monfort-Muriach, A., Fiore, G., et al. (2021). "Women in Copernicus: Recommendations from Women Testimonials," in 2021 IEEE International Geoscience and Remote Sensing Symposium IGARSS, Brussels, Belgium, 11-16 July 2021 (IEEE), 33–36. doi:10.1109/IGARSS47720.2021.9554567
- Valenzuela-Toro, A. M., and Viglino, M. (2021). How Latin American Researchers Suffer in Science. *Nature* 598, 374–375. doi:10.1038/d41586-021-02601-8
- van den Besselaar, P., and Sandström, U. (2017). Vicious Circles of Gender Bias, Lower Positions, and Lower Performance: Gender Differences in Scholarly Productivity and Impact. *PLOS ONE* 12, e0183301. doi:10.1371/journal.pone.0183301
- Van Oosten, E. B., Buse, K., and Bilimoria, D. (2017). The Leadership Lab for Women: Advancing and Retaining Women in STEM through Professional Development. *Front. Psychol.* 8, 2138. doi:10.3389/fpsyg.2017.02138
- van Veelen, R., Derks, B., and Endedijk, M. D. (2019). Double Trouble: How Being Outnumbered and Negatively Stereotyped Threatens Career Outcomes of Women in STEM. *Front. Psychol.* 10, 150. doi:10.3389/fpsyg.2019.00150
- Vizireanu, A.-M., Wagemann, J., Szeto, S. H., and Vranceanu, C.-A. (2021). "Women in Geospatial+ - Changing the Status Quo by Creating a Strong Network of Women+ Leaders and Changemakers," in 2021 IEEE International Geoscience and Remote Sensing Symposium IGARSS, Brussels, Belgium, 11-16 July 2021, 46–48. doi:10.1109/IGARSS47720.2021.9554033
- Weisshaar, K. (2017). Publish and Perish? an Assessment of Gender Gaps in Promotion to Tenure in Academia. *Soc. Forces* 96, 529–560. doi:10.1093/sf/sox052
- West, J. D., Jacquet, J., King, M. M., Correll, S. J., and Bergstrom, C. T. (2013). The Role of Gender in Scholarly Authorship. *PLOS ONE* 8, e66212. doi:10.1371/journal.pone.0066212

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