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LETTER

Parachute conservation: Investigating trends in international research

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Abstract

Parachute science (inequity in research relationships between Global North and South scientists) has known detrimental impacts on Global South researchers in conservation. Using two international datasets of English and non-English-language studies testing conservation interventions, we compared the continents in which studies were conducted to those in which authors were affiliated. We found that a substantial proportion of English-language studies conducted in Global South continents were led by researchers affiliated to Global North institutions. Studies in the Global South had relatively few locally affiliated lead authors and a higher percentage of studies with no locally affiliated authors. There were similar but typically less pronounced patterns for non-English-language studies. We discuss the potential drivers of these problematic findings and future directions that could help avoid and eliminate unethical parachute conservation science.

KEYWORDS

biodiversity conservation, capacity building, colonialism, conservation action, conservation evidence, helicopter science, inequity, neo-colonial science, parachute science, research relationships

1 | INTRODUCTION

Parachute science is a term to describe the inequity in research relationships between Global North and South scientists. This is typically characterized by a lack of meaningful, long-term involvement of local researchers in research and of investment in building local research capacity (Asase et al., 2021; de Vos, 2022; Stefanoudis et al., 2021). Similar, often synonymous, terms include helicopter or neo-colonial science (Ahmadia et al., 2021). Such inequitable relationships are sometimes conducted with the best of intentions but may persist due to poor awareness and institutional barriers (Mwampamba et al., 2022).

Parachute science can substantially impact Global South partners. Their research needs can be neglected when visiting scientists fail to meaningfully involve local researchers in formulating research questions and projects (Asha de Vos, 2020; Burivalova & Rayadin, 2022). Local researchers may be uncredited for their contributions, forgotten in the publication process, or given inadequate recognition as an author (Burivalova & Rayadin, 2022; Dahdouh-Guebas et al., 2003), which can undermine career progression and prevent local institutions strengthening their

representation (Ahmadia et al., 2021). Sometimes, local dissemination of research findings can be limited if it is published in a foreign language, access is restricted behind paywalls, or if local researchers' involvement ends after data collection (Minasny et al., 2020). Parachute science can also exclude valuable local knowledge in the design and interpretation of the study, and perpetuate dependence on external expertise, hindering the development of scientific capacity in the research country (Ahmadia et al., 2021). Many of these effects, in addition to being socially damaging, are counterproductive to the advancement of conservation science.

The nature and detrimental impact of colonial legacies in conservation science and ecology has become a high-profile topic (Nat. Ecol. Evol., 2021), as has parachute science specifically. Researchers have quantified the prevalence of parachute science in geoscience, climate change, and coral reef research (Ahmadia et al., 2021; Minasny et al., 2020; Overland et al., 2021; Stefanoudis et al., 2021), often focusing on a particular region, but this has yet to be explored more widely in the conservation literature testing conservation actions.

This is the first international analysis, to our knowledge, of parachute science across the scientific evidence base testing biodiversity conservation actions in both English and non-English languages (see Section 2 for details). Focusing on quantifying parachute science in studies testing conservation actions in different languages is particularly important for several reasons. First, evidence is accumulating that the success of conservation action in projects often hinges on meaningful engagement with local partners, scientists, and institutions (Barrow & Murphree, 1998; Waylen et al., 2010; Sterling et al., 2017). Second, scientific evidence on conservation action from the Global South is severely lacking, placing great emphasis on improving future research collaborations in these underrepresented regions and their native languages (Amano et al., 2021; Christie et al., 2020, 2021). Third, the conservation community is increasingly recognizing the importance of Indigenous and Local Knowledge and other worldviews in informing conservation action alongside scientific evidence, placing renewed emphasis on appropriate research relationships that enable this (Christie et al., 2022; Hauser et al., 2021 ; Kutz & Tomaselli, 2019; Trisos et al., 2021). Research is therefore needed to quantify parachute science in the testing of conservation actions (which may reflect wider patterns within conservation as a whole) to ensure more ethical and ultimately better conservation science.

In this study, we aim to answer the following questions:

- Are researchers affiliated with institutions in the Global North overrepresented in author teams on studies conducted in the Global South?
- Are there differences between English and non-English-language studies in the local representation in author teams?
- Has the local representation of author teams changed over the last decade?

Due to inequities in capacity, economic, and scientific power, we hypothesize that researchers from Global North institutions will be overrepresented in studies conducted in the Global South and that this trend may be weaker in the non-English-language literature. However, with increasing awareness of parachute science over the last decade (Watson, 2021), we expect to see a corresponding increase in the representation of researchers with local affiliations.

Given the topic of this study, we would like to draw the attention of readers to our Positionality Statement (Supporting Information) where we reflect upon how our experiences, perspectives, knowledge, and biases may have influenced our interpretation of our study's results and discussion.

2 | METHODS

2.1 | Data sources

English-language studies were extracted from the Conservation Evidence database (www.conservationevidence.com), a collection of 8337 studies examining the effectiveness of 3510 conservation interventions (as of April 2022) for a wide variety of species and habitats in different fields of conservation (see Sutherland et al., 2019 for the methods used to collate these studies). The database is primarily composed of peer-reviewed scientific literature, but also contains grey literature (e.g., report series). We used the corresponding non-English-language database associated with the Conservation Evidence database, which contains 1234 studies published across 16 languages (Arabic, French, German, Hungarian, Italian, Japanese, Korean, Persian, Polish, Portuguese, Russian, Simplified Chinese, Spanish, Traditional Chinese, Turkish, and Ukrainian) with most searches conducted to 2020 (see Amano et al., 2021 for full details). We used these two databases as they represent the most comprehensive collection of English and non-English-language studies that have quantitatively tested conservation interventions—which would

otherwise be time-consuming and difficult to obtain using bibliometric analyses.

We used a random-stratified sampling method (without replacement) to extract author affiliations from 50 English-language and 25 non-English-language studies conducted in each continent. Antarctica was excluded from both datasets, while no studies from North America or Oceania were present in the non-English-language dataset. We sampled fewer non-English-language studies because we were limited by the continent with the smallest number of studies in the database. In total, our sample therefore contained 300 English-language studies from the Conservation Evidence English-language database (six continents; Sutherland et al., 2019) and 100 non-English-language studies from the Conservation Evidence non-English-language database (four continents; Amano et al., 2021). We restricted our sampling to studies published since 2009 because we wanted to assess the contemporary extent of parachute science over the last decade.

We excluded reviews and studies conducted in multiple countries from our sampling because we were interested in primary research conducted in a single country or continent. We also excluded studies conducted in overseas territories of nations to simplify analyses. If we could not extract author affiliations (e.g., if accessing the study was difficult), another study from the same continent was randomly selected.

2.2 | Data extraction protocol

We applied a consistent protocol to extract author affiliations (Supplementary Information). First, studies were found through Google Scholar, Google, or Web of Science using bibliographic information from the Conservation Evidence databases. Second, all authors' metadata were extracted, including author rank (e.g., first and second), full institutional affiliations, and affiliation continents and countries. The continent and country each study was conducted in (herein termed *study continent* or *study country*) and the publication year were extracted from the databases.

2.3 | Assigning authorship type

Once authorship data were extracted, we categorized studies based on the following variables: whether the study had (i) *no authors* affiliated to the study continent (yes/no), (ii) *any authors* (i.e., middle or lead authors) affiliated to the study continent (yes/no), (iii) *at least one lead author* affiliated to the study continent (yes/no), and (iv) *all authors* affiliated to the study continent (yes/no). Note that a single study could be assigned to all the latter three categories, but the first is mutually exclusive to the others. We identified lead author affiliations as those of the first or last author in the study by common convention. For authors with multiple affiliations, we selected the first listed affiliation based in the study continent, if present; otherwise, we selected the first affiliation. This would provide a conservative estimate of parachute science. We repeated this process separately with the criterion that an author was from the study country (instead of the study continent).

2.4 | Analysis

Using chord diagrams, we visualized the continent containing each authors' institutional affiliation and the study continent for the English and non-English-language literature separately. We used a binomial logistic regression model (a generalized linear model [GLM]) to test whether the proportion of studies featuring a *lead author* affiliated to the study continent varied by study continent. We chose a binomial logistic regression as we were modeling the binary response variable of a lead author being affiliated to the study continent (0 = no "local" lead author, 1 = at least one "local" lead author). We repeated this modeling by changing the binary response variable to reflect whether *any author* was affiliated to the study continent (0 = no "local" authors, 1 = at least one "local" author). We used model diagnostic plots for our GLMs to confirm linear relationships between response and predictor variables, along with a lack of large or extreme outliers using Cook's distance, and the predictor variables were not highly correlated. All analyses were repeated using the criterion for *study country* (instead of continent—see Section 2.3) and for the non-English-language dataset.

In addition, we examined the percentage of studies assigned to the authorship types detailed in Section 2.3 for each continent and set of literature. We also used binomial logistic regression models, on the English and non-English datasets separately, to assess how the percentage of studies for each authorship type (Section 2.3) changed over different publication years in the last decade (see Supporting Information for full methods and results).

3 | RESULTS

3.1 | Comparing institutional affiliations to study locations

There was a statistically significant difference between continents in the proportion of English-language studies featuring a lead author affiliated to the study continent (GLM, $\chi^2 = 45.8$, $p < 0.001$; Table S1). Substantial propor-

tions of studies conducted in Africa and Latin America and Caribbean were lead authored by researchers from North American and European institutions (and to a lesser extent from Oceania; Figure 1). Few or zero studies that were conducted in North America, Europe, and Oceania were led by researchers from African, Asian, or Latin American institutions. Highly similar, albeit exaggerated, patterns were observed for studies conducted in the Global South by researchers from North American and European institutions when considering all authors including lead and middle authors (GLM, $\chi^2 = 85.1$, $p < 0.001$; Table S3; Figure S1).

We found no statistically significant difference between continents in the proportion of non-English-language studies featuring a lead author affiliated to the study continent (GLM, $\chi^2 = 4.6$, $p = 0.203$; Table S2), but there was a statistically significant difference when considering all authors (GLM, $\chi^2 = 29.2$, $p < 0.001$; Table S4; Figure S1). A substantial proportion of non-English-language studies conducted in Africa were led by researchers from European institutions and a small proportion of studies in Asia were led by researchers from North American or European institutions. No non-English-language studies were conducted in North America or Oceania, while no researchers from Oceanian institutions were lead authors in our sample (Figure 1; Figure S1).

3.2 | Local author representation by continent

For English-language studies, we found a clear difference in the representation of authors affiliated to the study continent between two groups of continents: (1) Africa, Asia, and Latin America and the Caribbean (generally Global South) and (2) Europe, North America, and Oceania (generally Global North). The Global South continents had higher proportions of studies (2%–14% vs. 0%–2% for the latter group) featuring no authors affiliated to the study continent, as well as substantially lower proportions of studies featuring lead authors (64%–88% vs. 98%–100% for the latter group) or all authors (40%–66% vs. 92%–98% for the latter group) with study continent affiliations (Figure 2). Similar but more exaggerated differences in proportions were found when considering whether authors were affiliated to the *study country* (Figure S2; Table S5).

The differences in these proportions between the two continental groups were less pronounced for the non-English-language literature than the English-language literature (Figure 2; Tables S5 and S6). For example, a greater proportion of non-English-language studies (than

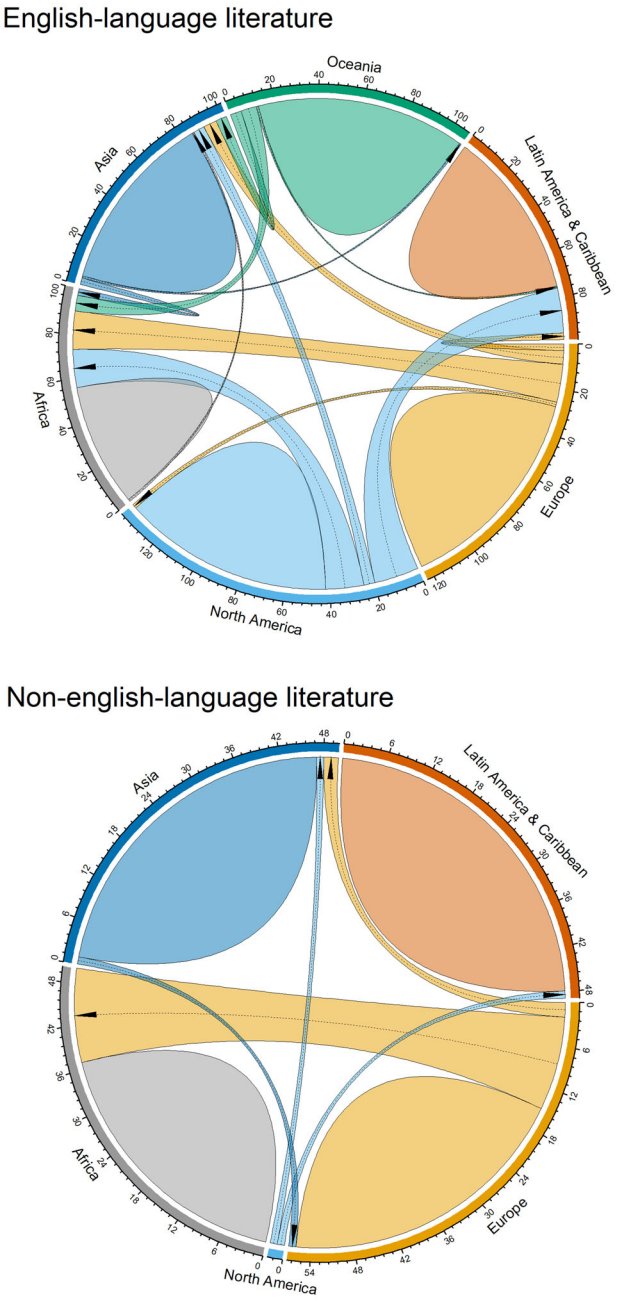

FIGURE 1 Comparison of the affiliation and study continents of lead authors in the English and non-English-language literature. Numbers on the perimeter show the numbers of lead authors (first or last authors) whose studies were conducted in that continent and/or with an affiliation to that continent. Arrows start from the affiliation continent of the lead author and point to the continent in which the study was conducted. Chord thickness is proportional to the number of lead authors. Humps without arrows represent where the affiliation continent and study continent are the same for a lead author (i.e., they may be considered "local" lead authors to that continent). There were 581 lead authors in 300 English-language studies and 190 lead authors in 100 non-English-language studies (N.B. there are often, but not always two lead authors per study—i.e., first and last authors).

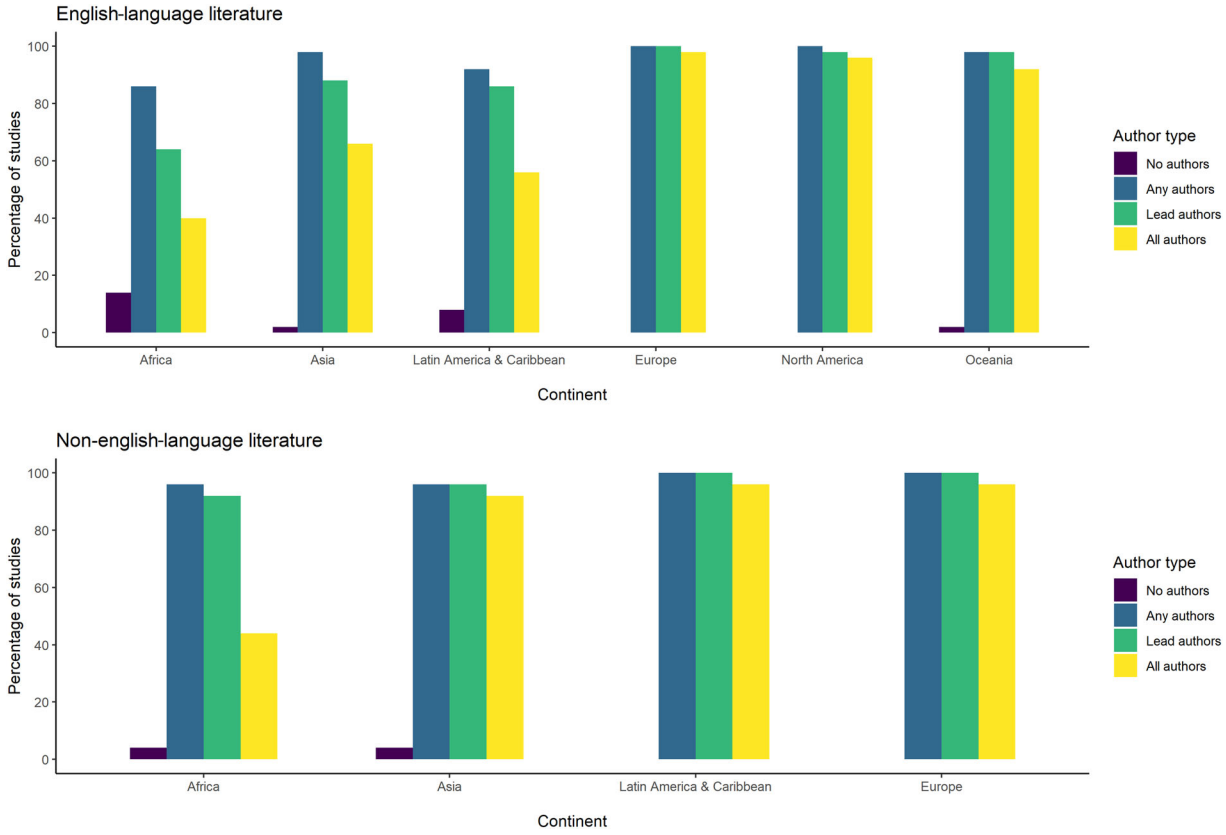

FIGURE 2 Comparison of the composition of author teams by continent between English and non-English literature studies. Each continent shows the percentage of studies (N = 50 and N = 25 per continent for English-language and non-English-language studies, respectively) which had *no authors* affiliated to the *study continent* (purple bars), *any authors* affiliated to the study continent (blue bars), *lead authors* affiliated to the study continent (green bars), and *all authors* affiliated to the study continent (yellow bars). Note that while the authorship types represented by the purple and blue bars are mutually exclusive (no authors and any authors add up to 100%), the authorship types represented by the green and yellow bars (lead authors and all authors) are subsets of the blue bars for each continent. Figure S2 presents similar data for authors affiliated to the *study country*.

English-language studies) conducted in Africa and Latin America and the Caribbean featured an entire author team that was affiliated to the study continent (Figure 2). The proportions of non-English-language studies for which lead authors were affiliated to the study continent were also higher for most continents than for English-language studies (Figure 2; Tables S5 and S6).

3.3 | Local author representation over time

We found no statistically significant changes from 2009 to 2018 for the sampled English-language literature, or from 2009 to 2020 for the sampled non-English-language literature, in the percentage of studies where no authors, lead authors, or all authors were affiliated to the study continent (Tables S7–S12; Figure S3).

4 | DISCUSSION

4.1 | Findings

We showed that a substantial number of English-language studies conducted in the Global South were led by researchers affiliated to the Global North and extremely few studies showed the reverse. Parachute science also manifested in poor local author representation; for example, 16% of studies conducted in Africa featured no host continent authors, while this figure ranged from 0% to 2% in studies conducted in the Global North. These results concur with trends observed in the environmental sciences (Asase et al., 2021; Dahdouh-Guebas et al., 2003; Stefanoudis et al., 2021). For the first time, we revealed weaker signs of parachute science in the non-English-language literature, although there was still evidence of research being led by European-affiliated researchers in Africa with negligible local author representation.

Our findings point to a general underrepresentation of Global South scientists as lead authors on English-language studies conducted in the Global South and vice versa for Global North scientists, as noted in the literature (Jeffery, 2014; North et al., 2020; Stefanoudis et al., 2021). We suggest there are several potential contributing factors to this disparity. First, low levels of Global South scientists as lead authors may be driven by relatively poor access to the training, experience, and status needed to lead publications. Second, studies conducted in the Global South may also be disproportionately funded, conceived, and/or directed by Global North scientists, who may only involve local scientists to facilitate fieldwork. Third, Global South scientists face reduced access to funding for travel, equipment, and publishing in journals, and more restricted access to literature and biological collections (Agosti, 2006; Trisos et al., 2021). Fourth, lower salaries may also force them to diversify their income and focus less on research (Harris, 2004). Fifth, researchers whose primary language is not English and those living in countries with socio-political issues such as corruption and conflict face additional barriers to publishing research (Asase et al., 2021). Ultimately, many of these access-related disparities are relics of colonial relationships (Sandell et al., 2012) and although many nations have since become independent, the imbalances in economic and scientific resources have lingered (Acemoglu & Robinson, 2017; Asase et al., 2021).

These possible drivers of parachute science relationships may also explain some of the patterns we highlighted in the non-English-language literature. For example, European-affiliated researchers leading studies conducted in Africa were typically affiliated to French institutions and linked to Francophone countries in West Africa, where colonial legacies persist in the large imbalances in scientific resources. We also found fewer researchers affiliated to Europe and North America conducted non-English-language studies in Asia and Latin America than for the English language studies. This may be because of limited linguistic abilities or limited incentives to publish research in non-English languages, such as institutional and funder-related policies (Amano et al., 2021).

Although we have revealed some clear signs of parachute science, we must acknowledge some limitations. By using institutional affiliations, we may not have recognized (i) authors who lack local affiliations but contribute to local capacity building in other meaningful ways or (ii) researchers from the Global South affiliated solely with Global North institutions. Grey literature studies (e.g., MSc/PhD theses, project reports, or other publications) might also have exhibited different levels of parachute science—although this is unlikely to have substantially changed the broad patterns we identified given the databases we sampled included a small, but not insignificant amount of grey literature.

Despite the disparities in research observed, most studies in the Global South had at least some local author representation (84%–94%). This was higher than found in previous studies in conservation-related disciplines (e.g., Ahmadia et al., 2021). For example, only 59.5% of coral reef studies in Indonesia, 77.8% in Australia, and 56.86% in the Philippines included local authors (Stefanoudis et al., 2021), and only 30% of high-impact geoscience articles on African research topics contained an African author (North et al., 2020). This may reflect a greater awareness in conservation intervention research, or potentially general improvements over time as we considered studies since 2009 (see Stefanoudis et al., 2021). However, our analyses did not find a reduction in the proportion of English or non-English-language studies lacking local authors over time—although our inability to detect this reduction, if it exists, could be because we had to pool data between continents, thus potentially masking differing temporal trends, or because we examined a relatively recent timescale.

4.2 | Future directions

While we found significant levels of international collaboration, parachute science is still prevalent in the testing of conservation actions. Reducing this prevalence is important from the perspective of decolonization and reducing global inequities (Nat. Ecol. Evol., 2021; Trisos et al., 2021), as well as raising research standards. However, recommending a better configuration of international research relationships is challenging. Knowledge exchange, capacity building, and science generally would all be severely hampered if only local scientists conducted local research. We suggest that local scientists should lead far more research than they currently appear to, with strong international, inclusive, collaborative teams in which appropriate contributions are made and properly recognized (e.g., expertise, funding, and equipment). Studies conducted and published without any local author representation, especially those involving inequitable relationships or limited outreach and capacity building, will almost always be inappropriate.

On reflection, we believe others are better suited and qualified to develop recommendations (see Positionality Statement; Supporting Information), and we encourage readers to consult recent papers that provide excellent recommendations and explore good practice (Asase et al., 2021; Ahmadia et al., 2021; de Vos, 2022; Haelewaters et al., 2021; Minasny et al., 2020; Stefanoudis et al., 2021; Trisos et al., 2021). For example, readers may find de Vos (2022) useful, which sets out recommendations

for project planning and when sharing and disseminating knowledge in conservation. We also suggest readers learn from, reflect upon, and share experiences of good (and bad) practice (e.g., Crowder, 2022; Vargas et al., 2022)—for example, Vargas et al. (2022) describe an innovative mutualistic researcher–practitioner relationship in Bolivia where local NGOs led on developing research priorities and local practitioners were trained in scientific thinking, while delivering impactful, high-quality science.

Future research could investigate the impact of recent changes such as legislation to empower local scientific institutions, funding/journal criteria to reduce parachute science (e.g., mandating the inclusion of local scientists), and increasing awareness (Sandy & Shen, 2019). We hope our study inspires others to quantify patterns of parachute science and reduce unethical practices in their own research.

AUTHOR CONTRIBUTIONS

Conceptualization: Alec P. Christie, Thomas B. White, and James Miller. *Data acquisition*: Alec P. Christie and James Miller. *Methodology*: Alec P. Christie, Thomas B. White, and James Miller. *Formal analysis*: Alec P. Christie, Thomas B. White, and James Miller. *Investigation*: James Miller. *Writing original draft*: James Miller. *Writing review and edition*: Alec P. Christie, Thomas B. White, and James Miller. *Visualization*: Alec P. Christie and James Miller. Supervision: Alec P. Christie and Thomas B. White.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interests.

DATA AVAILABILITY STATEMENT

All data and code used in this study are freely available from Zenodo https://doi.org/10.5281/zenodo.6504248.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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