PNAS PERSPECTIVE OPEN ACCESS

A set of principles and practical suggestions for equitable fieldwork in biology

Valeria Ramírez-Castañeda[a,b,1,2], Erin P. Westeen[a,c,1], Jeffrey Frederick[a,b], Sina Amini[a,b], Daniel R. Wait[a,b], Anang S. Achmadi[d], Noviar Andayani[e,f], Evy Arida[d], Umilaela Arifin[a,g], Moisés A. Bernal[h], Elisa Bonaccorso[i], Marites Bonachita Sanguila[j], Rafe M. Brown[k,l], Jing Che (车静)[m,n], F. Peter Condori[o,p], Diny Hartiningtias[q], Anna E. Hiller[r], Djoko T. Iskandar[s,t], Rosa Alicia Jiménez[a,u], Rassim Khelifa[v,w], Roberto Márquez[x,y], José G. Martínez-Fonseca[z,aa], Juan L. Parra[bb], Joshua V. Peñalba[cc], Lina Pinto-García[dd,ee], Onja H. Razafindratsima[b,ff], Santiago R. Ron[gg], Sara Souza[hh], Jatna Supriatna[e,f], Rauri C. K. Bowie[a,b], Carla Cicero[a], Jimmy A. McGuire[a,b], and Rebecca D. Tarvin[a,b,2]

Edited by Alexandre Antonelli, University of Gothenburg, Gothenburg, Sweden; received February 8, 2022; accepted July 12, 2022 by Editorial Board Member Scott V. Edwards

Field biology is an area of research that involves working directly with living organisms in situ through a practice known as "fieldwork." Conducting fieldwork often requires complex logistical planning within multiregional or multinational teams, interacting with local communities at field sites, and collaborative research led by one or a few of the core team members. However, existing power imbalances stemming from geopolitical history, discrimination, and professional position, among other factors, perpetuate inequities when conducting these research endeavors. After reflecting on our own research programs, we propose four general principles to guide equitable, inclusive, ethical, and safe practices in field biology: be collaborative, be respectful, be legal, and be safe. Although many biologists already structure their field programs around these principles or similar values, executing equitable research practices can prove challenging and requires careful consideration, especially by those in positions with relatively greater privilege. Based on experiences and input from a diverse group of global collaborators, we provide suggestions for action-oriented approaches to make field biology more equitable, with particular attention to how those with greater privilege can contribute. While we acknowledge that not all suggestions will be applicable to every institution or program, we hope that they will generate discussions and provide a baseline for training in proactive, equitable fieldwork practices.

inclusion | diversity | natural history | safety | collections

Field biology, the practice by which investigators seek out organisms in their natural habitats to collect samples and abiotic parameters, perform experiments, and/or record natural history observations, is essential for the description, analysis, and conservation of biodiversity (1). Fieldwork not only provides foundational materials in the form of vouchered and unvouchered biological samples (e.g., blood, feathers, and skin clips), but it also produces vast amounts of scientifically valuable data on species' natural history including distributions and abundances, habitat characteristics, environmental measurements, ecological interactions, and behaviors (2, 3). Moreover, voucher specimens obtained through fieldwork are invaluable for scientists aiming to quantify the effects of historical changes in climate, pollutants, diseases, and other features of the environment on biodiversity (4–6). The value of

Author affiliations: [a]Museum of Vertebrate Zoology, University of California, Berkeley, CA, 94720; [b]Department of Integrative Biology, University of California, Berkeley, CA, 94720; [c]Department of Environmental, Science, Policy, and Management, University of California, Berkeley, CA, 94720; [d]Research Center for Applied Zoology, National Research and Innovation Agency, Jawa Barat 16911, Indonesia; [e]Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Indonesia, Kampus UI Depok, Depok 16424, Indonesia; [f]Research Center for Climate Change, Gedung Laboratorium Multidisiplin, Faculty of Mathematics and Natural Sciences, Universitas Indonesia, Depok 16424, Indonesia; [g]Centre for Taxonomy and Morphology, Leibniz Institute for the Analysis of Biodiversity Change, Hamburg 20146 Germany; [h]Department of Biological Sciences, Auburn University, Auburn, AL 36849; [i]Laboratorio de Biología Evolutiva, Colegio de Ciencias Biológicas y Ambientales e Instituto Biósfera, Universidad San Francisco de Quito, Quito 170901, Ecuador; [j]Biodiversity Informatics and Research Center, Father Saturnino Urios University, Butuan City 8600, Philippines; [k]Biodiversity Institute, University of Kansas, Lawrence, KS 66044; [l]Department of Ecology and Evolutionary Biology, University of Kansas, Lawrence, KS 66044; [m]State Key Laboratory of Genetic Resource and Evolution and Yunnan Key Laboratory of Biodiversity and Ecological Security of Gaoligong Mountain, Kunming Institute of Zoology, Chinese Academy of Sciences, 650223 Kunming, China; [n]Center for Excellence in Animal Evolution and Genetics, Chinese Academy of Sciences, 650223 Kunming, China; [o]Museo de Biodiversidad del Perú, Cusco 08003, Perú; [p]Museo de Historia Natural de la Universidad Nacional de San Antonio Abad del Cusco, Cusco 08002, Perú; [q]Belantara Foundation, Jakarta 10350, Indonesia; [r]Museum of Natural Science, Department of Biological Sciences, Louisiana State University, Baton Rouge, LA 70803; [s]Basic Sciences Commision, Indonesian Academy of Sciences, Jakarta 10110, Indonesia; [t]School of Life Sciences and Technology, Institut Teknologi Bandung, Bandung 40132, Indonesia; [u]Escuela de Biología, Facultad de Ciencias Químicas y Farmacia, Universidad de San Carlos de Guatemala, Ciudad de Guatemala 01012, Guatemala; [v]Institute for Resources, Environment and Sustainability, University of British Columbia, Vancouver, BC V6T 1Z4, Canada; [w]Biology Department, Condordia University, Montreal, Quebec H4B 1R6, Canada; [x]Department of Ecology and Evolutionary Biology, University of Michigan, Ann Arbor, MI 48109; [y]Michigan Society of Fellows, University of Michigan, Ann Arbor, MI 48109; [z]School of Forestry, Northern Arizona University, Flagstaff, AZ 86011; [aa]Nicaraguan Bat Conservation Program, Carazo, Nicaragua; [bb]Grupo de Ecología y Evolución de Vertebrados, Instituto de Biología, Universidad de Antioquia, Medellín 050010, Colombia; [cc]Center for Integrative Biodiversity Discovery, Museum für Naturkunde, Leibniz Institute for Evolution and Biodiversity Science, Berlin 10115, Germany; [dd]Centro Interdisciplinario de Estudios sobre el Desarrollo, Universidad de los Andes, Bogotá 111711, Colombia; [ee]Institute for Science, Innovation and Society, University of Oxford, Oxford OX2 6PN, United Kingdom; [ff]Mention Zoologie et Biodiversité Animale, Université d'Antananarivo, Antananarivo 101, Madagascar; [gg]Museo de Zoología, Escuela de Biología, Pontificia Universidad Católica del Ecuador, Quito 170525, Ecuador; and [hh]Environment, Health & Safety, University of California, Berkeley, CA 94720

Author contributions: V.R.C., E.P.W., J.F., S.A., D.R.W., A.S.A., N.A., E.A., U.A., M.A.B., E.B., M.B.S., R.M.B., J.C., F.P.C., D.H., A.E.H., D.T.I., R.A.J., R.K., R.M., J.G.M.-F., J.L.P., J.V.P., L.P.G., O.H.R., S.R.R., S.S., J.S., R.C.K.B., C.C., J.A.M., and R.D.T. wrote the paper.

The authors declare no competing interest.

This article is a PNAS Direct Submission. A.A. is a guest editor invited by the Editorial Board.

[1]V.R.C. and E.P.W. contributed equally to this work.

[2]To whom correspondence may be addressed. Email: vramirezc@berkeley.edu or rdtarvin@berkeley.edu.

This article contains supporting information online at http://www.pnas.org/lookup/suppl/doi:10.1073/pnas.2122667119/-/DCSupplemental.

Published August 16, 2022.

natural history collections to the broader research community is only increasing over time, as recent collection digitization initiatives have made remote inspection and analysis of the world's biodiversity possible for anyone with internet access (7–10). Given ongoing biodiversity declines (11, 12), research that incorporates natural history collections and field data have garnered sustained interest (13). Thus, field studies continue to be essential for the advancement of biology, while also serving as an impactful educational tool.

Despite the value of fieldwork and field-collected data, we recognize that this activity has been shaped by power asymmetries tied to the foundations of the modern world (14, 15). For example, the early history of biodiversity sampling was intimately associated with colonialism. Colonial nations and later industrialized countries sent scientists around the world with the aim of furthering scientific progress but also often with capitalist goals and resource extraction in mind (16–19). Although many field biologists today are aware of this inequitable history and are working to make field biology more ethical, parachute science—a nonreciprocal practice wherein scientists conduct research with local help and then publish those data without further involvement of local communities—remains common (20). Moreover, research programs are often highly asymmetrical in terms of how the scientific benefits (e.g., authorship, funding, etc.) are distributed among team members (21–23). Dozens of scientific articles describing these issues exist (*SI Appendix*, Table S1). Additional quantitative surveys could help shape relevant solutions.

The conscious need to confront power asymmetries gained traction in the United States after the murder of George Floyd in 2020, with a focus on addressing inequities for people of color, people with disabilities, women, Indigenous people, the LGBTQ+ (lesbian, gay, bisexual, transgender, queer) community, and others (e.g., refs. 24 and 25). These conversations opened space to reevaluate aspects of current scientific practices that perpetuate inequalities, including fieldwork. We are optimistic that self-reflective and action-oriented discussions, combined with proactive planning of research, will help address existing inequalities.

Core Principles for Equitable Fieldwork

In the last decade, many scientific institutions, societies, and conferences have adopted codes of conduct to clarify community norms and provide guidelines for reporting harassment or misconduct (e.g., refs. 26–28). Likewise, most scientific disciplines that work directly with human participants, such as public health and anthropology, have established guidelines for ethical fieldwork (29–32). Furthermore, international agreements and regulations have helped to promote more equitable and conservation-oriented practices (e.g., Convention on Biological Diversity [CBD], Convention on the International Trade in Endangered Species [CITES], and Nagoya Protocol for Access and Benefit Sharing [ABS]). In this spirit, and through assessment and reflection of our own field programs, we created a set of four general principles for biological fieldwork that are intended to help researchers from any country or career level engage proactively in equitable and inclusive practices (Box 1 and Fig. 1). Although some guidelines exist for field courses and stations (e.g., ref. 33), here we focus our discussion specifically on field research programs that are not directly oriented toward commercialization.

For institutions and research groups, we envision that these principles can foster discussions of field practices and act as a basis for generating or revising codes of conduct and designing prefieldwork training programs. For researchers starting a field program, we hope that the four principles provide a useful baseline for creating fieldwork plans that are intentionally ethical. By discussing how to apply these principles, research teams can increase

Box 1. A set of principles to promote equitable fieldwork

Be collaborative: We embrace collaborative science and fieldwork practices with our partners, field teams, and the communities with whom we work. Inequitable involvement of local collaborators can perpetuate historical power imbalances, erode trust in the scientific enterprise, and limit the sense of co-ownership of the knowledge being produced. In planning fieldwork, we encourage colleagues to consider historical power imbalances and strive for equity in collaborations and inclusivity in field teams by communicating clearly, compensating appropriately, and sharing samples, data, and research products equitably.

Be respectful: We prioritize local sovereignty and long-term benefits for the community, and we invest time and effort in learning about and respecting local history and cultures. Long-lasting and reciprocal relationships founded on mutual respect are often crucial for fieldwork. By learning about local history and culture, we seek to understand norms and acknowledge diverse experiences and understandings of the world. We also strive to prioritize local community decisions, to promote modification of our research plans accordingly, and to plan research in a way that has lasting positive impacts, as judged by local communities.

Be legal: We commit to obtaining all necessary permits, authorizations, and land permissions, and to following all legal guidelines and requirements. Legislation helps circumvent some aspects of biopiracy and exploitation and functions to systematically track and regulate biological material. We aim to be vigilant against expropriating knowledge and materials, both by following local regulations and by respecting local authorities and cultural customs.

Be safe: We work proactively to promote a safe physical and emotional working environment for all members of research teams and local communities with clear guidance and communication. Field safety takes many forms and risk is not evenly distributed across team members. We support creating field safety plans that include general guidelines for safety (e.g., working in pairs), emergency protocols, and protocols addressing sexual violence and harassment. We ask our team leaders to solicit feedback and communicate clearly with all team and community members. We further urge team members to be cognizant of unintentionally spreading potentially detrimental pathogens or invasive organisms.

Fig. 1. Four principles to promote equitable fieldwork. Illustrations by Camila Pacheco Bejarano.

awareness about how field activities affect other people(s) and communities, especially in contexts where preexisting power imbalances and implicit biases exist. We note that the principles and suggestions described herein are derived from experiences mostly in the context of academic and natural history museum settings, and mostly involving researchers from the United States (*SI Appendix, Positionality Statement*). Fieldwork is diverse and involves many different types of communities and cultures, and not all of our suggestions are appropriate or feasible in every circumstance. However, we envision that the content of this perspective can apply to an array of scientists who conduct field research within their home country or internationally, especially when working in locations where local communities and/or scientists are less privileged than the organizing institution. To facilitate following the proposed principles, we provide a set of potential actions and considerations, an overview of permitting processes, a field safety plan template, and a set of open questions that arose during the creation of this document (*SI Appendix*). Intentional planning that emphasizes inclusivity and equity in field biology is fundamental to the set of principles proposed herein.

Be Collaborative: We Embrace Collaborative Science and Fieldwork Practices with Our Partners, Field Teams, and the Communities with Whom We Work. Equitable collaboration is necessary to conduct field operations safely, legally, and respectfully (34). The involvement of local collaborators in logistical but not intellectual aspects of research can perpetuate historical power imbalances and exclude those with more marginalized identities from a sense of co-ownership of the science being produced (21, 35). Such asymmetries may erode trust in the scientific enterprise and deter local interest in future scientific collaborations (20). Disrupting these structural imbalances requires a constant effort by everyone—but especially by those who have historically held positions of privilege globally and/or locally—toward decentralizing one's own perspective and creating spaces for new perspectives in science. Furthermore, collaborations that equitably include people and scientists from host regions can help foster inclusivity and a diversity of ideas in field biology (36). Below are some suggestions to foster intentionally reciprocal and collaborative research among scientists from different regions.

Communication among colleagues. We encourage team leaders to discuss the research goals, responsibilities, and expected products before, during, and after fieldwork, allowing all collaborators to shape the fieldwork and research. It is also important to establish regular communication among collaborators throughout the research process, not only during fieldwork. Flexibility, fairness, and honesty about goals and limitations is key during these conversations, yet perceptions of fairness can be biased by one's historical viewpoint and institutional norms, and desired outcomes may differ among collaborators. For example, institutions (e.g., academic vs. governmental) differ in whether they reward researchers for being first or last author, for having many publications rather than a few high-impact ones, or for bringing in infrastructure and funding. General research program goals also may differ depending on institutional interest and limitations (37). Understanding each parties' desired outcomes at the outset, and discussing any changes as the project progresses, can help promote equality among all team members.

Forming inclusive research teams. We encourage researchers to reflect on the diversity of their field teams and to provide opportunities for individuals of identities historically excluded from fieldwork (e.g., women, LGBTQ+, Black, Indigenous, people of color, disabled individuals, and low-income communities). Examples include training, invitations to join expeditions, inclusive hiring practices, and inclusion in decision-making. Students, including from local communities, can also benefit from financial support, especially if they are undertaking thesis work that might otherwise be financed with personal funds (38). Involving social scientists in the research process can help identify power imbalances and promote inclusion and equity at all stages of field research. Equitably structured and reciprocally designed collaborations (e.g., inviting local researchers to serve on student committees) can diversify and enhance the research programs of each group by providing new ideas that draw on different forms of expertise.

Compensation. Planning ahead for fair compensation of field assistants and other team members is necessary to conduct equitable fieldwork (38). We suggest working in advance with collaborators to set salary rates or organize other types of compensation (e.g., providing training, equipment, or resources) that reflect local norms and are fair for the work being undertaken (see also *Be Respectful*). When recruiting assistants to find specific organisms, we recommend paying by the hour or day as it is important to pay for effort even if it is unsuccessful. Overall, communication with local collaborators about how their research programs can be supported shows reciprocity and helps reinforce the value of host-region research (see also Fig. 2). Finally, we note that inequitable access to funding is likely a major source of power imbalance in

Fig. 2. Collaborate with local communities using Prior Informed Consent and/or other methods to maximize the immediate and long-term benefits of fieldwork for the region. Illustration by Camila Pacheco Bejarano. See *SI Appendix*, Box S2 for more information.

multinational or multiregional teams. In our Open Questions section (*SI Appendix*, Box S1), we encourage the global research community to consider how to increase the resources that are directly available to less-privileged researchers.

Sample and data management. An agreement among parties on how to equitably share and store research products such as specimens, tissues, photographs, recordings, etc., is recommended prior to conducting fieldwork. We strongly recommend that all products of fieldwork and their associated metadata be deposited in a collection where they will be taken care of and made accessible to others. Research materials that are held in private or noncurated collections (e.g., personal laboratory freezers) risk getting lost or discarded. When permits require information about where materials will be deposited, researchers should communicate with personnel during the application process to confirm that the intended repository is able to house the materials. Given ongoing financial challenges faced by museums (39, 40), funding could be provided to help with curation and student training (41).

Material sharing or repository agreements often require that specimens and samples be deposited or subdivided among participating institutions. These agreements should be equitable and reciprocal and have the added benefit of insuring against the risk of catastrophic loss. Pertinent examples include the destruction of the California Academy of Sciences in the 1906 San Francisco Earthquake, the loss of museums in Dresden, Hamburg, and Manila during World War II, the destruction of the collection at Museo La Salle in Bogotá during the 1948 riots, and the more recent losses by fire of priceless specimens and documents in Portugal, Brazil, South Africa, and India. Special consideration should be given to the disposition of type specimens. As recommended by the International Code of Zoological Nomenclature (ICZN) and the International Code of Nomenclature for algae, fungi, and plants (ICN), type specimens are best deposited in collections publicly accessible to researchers. The disposition of holotypes in their country of origin recognizes that country's natural heritage, while depositing paratypes or topotypes across multiple collections facilitates access to comparative material and protects against complete loss of reference material for a species. We recommend working on a case-by-case basis with local collaborators to decide where to deposit type specimens and to follow any legal obligations outlined by permits. To increase access to materials stored outside of their countries of origin, museums could adopt a policy of prioritizing loans of collection materials (or returns in cases of unethical possession) to institutions from those respective countries. In countries or regions without a collection, collaborators affiliated with a museum can agree to hold specimens in trust until local institutions reclaim them, although we recognize that such an arrangement may face logistical and legal challenges. Further, collaborators can help set up local teaching collections as a way of educating students and the community about local biodiversity and potentially generating institutional interest in starting a research collection.

Researchers also can take steps to ensure that field data are documented in an accessible and reproducible manner (42, 43) and shared with team members. Digitization and/or duplication of field notes and data provides a timely resource documenting recent work. In addition, collaborators can help implement collection management systems that follow Darwin Core data standards (44), establish portals that provide access to regional biodiversity resources (e.g., ref. 45), and register museums with the national CITES authority to facilitate exchange of CITES-listed species (*SI Appendix, Scientific Permit Checklist*). Collection management systems can track the current location of specimens (important if materials are divided among institutions), manage sample loans or exchanges, link to publications, and protect sensitive data (e.g., locality data for endangered species), among other features.

Rethink authorship criteria. Recent proposals have been made to expand the CRediT authorship criteria system to recognize that collaborators who, for instance, secure permits, foster important relationships, and act as the responsible authority in the field are often integral to project success and thus deserve to be involved in the writing process and offered coauthorship (21, 46). Additionally, local experts who participate in data collection can be included as authors (47). It is important to have a conversation with collaborators and community members to ask what attribution or credit they would value most and to recognize that authorship may not always be meaningful or may not be requested due to norms surrounding workplace hierarchy (21). The process of obtaining Prior Informed Consent (PIC; see *Be Respectful*) can inform these decisions. If community members are not interested in being coauthors, they can still be included in the acknowledgments section along with the proper name of their communities. In general, we recommend discussing and working collaboratively with local team members to decide on authorship.

Publishing and sharing research results. Language can present a substantial barrier to sharing and obtaining scientific knowledge (48–50). To help lower this barrier, investigators can translate their research results into national and local language(s) and include it in the supplementary material of open-access publications or on other forums such as ResearchGate, preprint servers, trip reports, etc., when publishing via open-access journals is not affordable (51, 52). Resources such as DeepL or Google Translate can facilitate translations for some languages. Making translation more common could be valuable to local scientists and policymakers while also showing academic goodwill that is locally impactful and strengthens international collaboration (49, 53, 54).

Be Respectful: We Prioritize Local Sovereignty and Long-Term Benefits for the Community, and We Invest Time and Effort in Learning about and Respecting Local History and Cultures. Many researchers are drawn to different countries or regions to collect data and study the flora and fauna. Interacting respectfully with local communities is fundamental to ensuring reciprocally beneficial long-term relationships. Moreover, aligning research goals with in-region rules, expectations, and needs is fundamental for ethical fieldwork.

Honoring local sovereignty. Conducting fieldwork often means that local communities open their territory (and sometimes their homes) to researchers. It is important to be respectful and to prioritize the perspectives of the local community in these situations (32). Moreover, working with communities to collaboratively assess whether project goals are relevant and realistic helps researchers generate positive and long-lasting impacts for local communities (Fig. 2). Community peer-review methodologies, including Prior Informed Consent (PIC) and Free PIC (FPIC)—specific rights that give indigenous peoples and other ethnic communities the ability to give or withhold access to work that affects their territory, as well as negotiate the terms of work and/or withdraw consent at a later time—offer models of how to incorporate community feedback (55, 56). PIC and FPIC are often legally required to conduct commercial or high-impact activities; however, PIC/FPIC may not be legally required for noncommercial scientific research. Thus, we recommend asking for consent in any circumstance and to approach this process with humility and from an equity perspective, as one's expectations, knowledge, and experiences are not universal or more important than those of another. Furthermore, there is no single conception of "nature" or of what it means to "use nature"; how we interact with a territory and its inhabitants (organisms and otherwise) is a cultural construction (57). Thus, we suggest that researchers respectfully engage in discussions about views that do not necessarily align with their own and to pay particular attention to respecting spiritual or ceremonial areas and species. Fluency in at least one of the local language(s) is critical for discussions to take place on a level playing field. Thus, team leaders in particular should make a concerted effort to gain a working fluency in the local language (if different from their own), and groups can invest in paid translators or guides when that is not possible. Questions about the impact of the research, source of funding, methods, accessibility of generated data, and beneficiaries of the project should be discussed.

Indigenous nations (e.g., Guna Yala in Panama, highland communities in Perú, and Cherokee Nation in the United States) and African-descendant communities (e.g., San Basilio de Palenque in Colombia) may have explicit rules, laws, or constitutions that pertain to scientific sampling in their territories, including PIC/FPIC. This can be especially complex in countries such as Indonesia, where 1,300 ethnic groups are recognized (58). In general, it is important for researchers to follow national and local regulations and to work with regional collaborators to ensure proper communication with communities living in or near research sites. We suggest that territorial and local regulations hold precedence even if they are more restrictive than research permits allow.

Cross-cultural relationships. Diverse customs and communication styles, including within our own teams, are often encountered during both domestic and international field research (59, 60). Learning from cross-cultural interactions allows us to be more empathetic with our teams and local communities, to have a broader view of our research, and to avoid misunderstandings or conflict. Special considerations can be given to interpersonal distance, attire, host and guest behavior, monetary compensation ("tips"), preferred styles of communication, local culture surrounding work and holidays, and addressing community leaders/elders. An action that may be commonplace in one culture can have an unexpected meaning in another, so it is helpful to familiarize oneself with local norms while also reflecting on one's own customs.

Incorporating local knowledge when publishing. When describing new species, it is worth acknowledging that local people are often familiar with their biology, behavior, meaning, value, uses, and other aspects long before they are described for science (61–64). Including local names, terms, and knowledge (65–67), and/or working directly with local communities to select new species names (68), are simple ways to honor and integrate communities with scientific pursuits and to generate local pride and awareness that can dovetail with conservation efforts (69). Reviewers and editors of manuscripts describing new species can suggest incorporating local knowledge if such data are not already included. PIC/FPIC should be discussed by having open conversations with community members about the work being done to gain consent, if any local knowledge or input may become part of a research product (56). Additional processes not addressed here are required when working with human-related data (70).

Designing locally impactful fieldwork. Researchers can intentionally plan activities that not only maximize immediate and long-term benefits for local communities (Fig. 2 and *SI Appendix*, Box S2; refs. 71–73) but also strengthen relationships with regional collaborators and create a better understanding of scientific practices in general. Communicating logistical details can also make a difference, such as teams formally introducing themselves and explaining research to local communities when a project begins and discussing results, future collaborations, and outreach and preferred method of acknowledgment when the project ends.

Conflict resolution. Despite our best intentions, conflicts may arise within research teams and local communities. Because fieldwork often involves groups of researchers spending long periods of time together in stressful conditions, training in conflict resolution can be important in smoothing team dynamics. In addition, conflicts with the local community may arise. It is important to be aware of one's position in existing power structures and to try to reach an agreement that respects local sovereignty.

Be Legal: We Commit to Obtaining All Necessary Permits, Authorizations, and Land Permissions and to Following All Legal Guidelines and Requirements. A key to successful fieldwork entails following the laws of the host country or region. While legality does not always translate to justice, many legal frameworks are geared toward creating symmetrical and ethical relationships. For centuries, researchers and collectors from high-income countries traveled around the world to collect and export specimens to their home institutions for study or profit without local authorizations or credit to local contributions (17, 18) (*SI Appendix*, Table S1). The establishment of international laws and regulations partially leveled the playing field by requiring that scientists obtain the necessary permits and honor expectations for collaborative science. Unfortunately, the practices of conducting research without appropriate permits, working with specimens of questionable origins, and bribing officials to circumvent regulations continue today (20, 74, 75). These approaches are not only illegal and unethical but they also threaten biodiversity, deepen existing power imbalances, and create wariness among researchers and between science and society. To facilitate tracking of legally sourced data and material, we encourage researchers to associate permit numbers with samples in published works and online data repositories. Moreover, some data aggregators require evidence of legality (e.g., ref. 76). We encourage journals to adopt and enforce policies requiring authors to provide information on permits as they do for animal care protocols.

Permit requirements. Identifying and obtaining all the necessary documents to collect samples or data can be a daunting challenge, often involving substantial time and effort, visits to multiple government offices, and working closely with local institutions. We encourage institutions to provide clear, accessible guidelines about permit requirements for researchers, especially because the permit landscape is constantly changing. Many countries require research visas, material transfer agreements (MTAs), and memoranda of understanding (MOUs) or agreements (MOAs), in addition to research, collecting, and/or export permits, to conduct legal research (*SI Appendix, Scientific Permit Checklist*). In China, for example, permits for aquatic animals are managed by the Ministry of Agriculture, while those for terrestrial animals are managed by the National Forestry and Grassland Administration. In the United States, permit requirements depend on national and state regulations, land ownership, and species. As mentioned, commercializable research such as bioprospecting has additional requirements not discussed here and may require its own set of guidelines. Field teams should always carry copies of permits, letters of invitation from local institutions, and/or other legal documents while conducting fieldwork. These proactive measures can help foster positive interactions with local community members and law enforcement officials.

International transfer of field-collected samples. International agreements governing the movement of genetic resources or endangered organisms add another layer of complexity to the permitting process (77–79). For instance, the Nagoya Protocol on Access and Benefit Sharing outlines the equitable use of genetic resources for biodiversity conservation and has important implications for how research is conducted, collections are managed, and information is shared among collaborators (80). Likewise, CITES regulates import/export of endangered organisms and species that are subject to international trade (81), and may require additional permits.

Be Safe: We Work Proactively to Promote a Safe Physical and Emotional Working Environment for All Members of Research Teams and Local Communities with Clear Guidance and Communication. Working in the field comes with inherent risks, but field teams can reduce risks to themselves, to the communities in which they work, and to wildlife with proper preparation. Here we provide some examples of proactive safety practices that can be modified as needed. For more ideas and information, see the Field Safety Plan template (*SI Appendix*).

Field safety plans. Fieldwork is often fast-paced and presents novel situations (82), but having a safety plan for responding to dangerous, medical, or interpersonal scenarios can help mitigate or avoid risk (83). At their core, safety plans include information about nearby medical facilities, law enforcement authorities, and local contacts, as well as plans for specific emergencies such as medical evacuations and political instability. We also recommend developing a specific communication and check-in plan with an emergency contact, identifying multiple safety officers, and investing in the resources needed to facilitate check-ins (e.g., a satellite phone or spot tracker). Field plans should consider mental and emotional safety in addition to physical safety, especially for coping with sexual violence and sexual harassment (SVSH) or discrimination, which is not uncommon in field teams. In general, people with different identities (racial, ethnic, cultural, gender, sexual orientation, ability status, religion, or caste), as well as job title (e.g., principle investigator vs. field assistant), may be more or less at risk for SVSH or health issues within the context of a research environment (24, 84–88). Ideally, field safety plans address SVSH by including procedures for dealing with inappropriate interactions within field teams and between field teams and local communities. Other considerations include having more than one SVSH contact, having team members work in pairs or groups, and including a set of responses team members can use in events of discrimination.

Biosafety. Teams should be careful to avoid contaminating local ecosystems (e.g., with soap, chemicals, or foreign biological material) and to protect themselves from potential biological dangers, including animals and pathogens. Any potentially dangerous chemicals or animals being used for research should be labeled clearly in all languages used by team members and locals. To mitigate the risk of spreading potentially detrimental pathogens and invasive species, teams can disinfect field equipment when moving between sites, before returning home, and/or between sampling individual organisms (89). The spread of white-nose syndrome, chytridiomycosis, and the possible transmission of viruses between wildlife and humans underscore the importance of these steps (90–93). In addition, scientists can consider undergoing wellness checks and quarantining before moving between sites where infecting local populations with diseases is possible (for example, in times of global pandemics like COVID-19). We recommend that team leaders (and other participants) take a wilderness first aid or responder course, provide personal protective equipment to all field members, and lead by example, always handling potentially dangerous wildlife, equipment, and materials in a safe manner.

Health care. Team leaders are responsible for emergencies that occur during fieldwork. Thus, being informed and prepared about local health-care options, such as obtaining short-term travel insurance for all team members—including local collaborators—can facilitate response to emergencies. Additionally, team members may need to receive vaccinations and medications prior to fieldwork depending on the country and possible diseases present, the species that may be handled, and available health-care infrastructure (e.g., getting an influenza vaccine could help prevent an outbreak in a region without regular access to flu vaccines).

Safety meetings. Field safety plans can be improved if teams meet prior to trips to provide input on procedures and scenarios (see examples in *SI Appendix*, Box S3), discuss codes of conduct, and distribute hard copies. Although medical history is personal by nature and team leaders may be limited in what they can ask, knowledge about basic health including prescriptions (e.g., blood pressure), preexisting conditions (e.g., asthma or extreme allergies), and blood group can make a critical difference in an emergency. Consider volunteering health information to team leaders when developing the safety plan, and/or sealing medical documents where they can remain confidential unless an emergency occurs.

Team leaders should be upfront (in a way that does not reveal sensitive identities) about specific challenges and dangers that team members may face because of health issues or personal identity (e.g., LGBTQ+ and women). Further, team leaders can make a good-faith attempt to defer to the group's comfort levels and to create space for private or subgroup conversations regarding safety (see ref. 24). If a given area or field site is too dangerous for some members of the group, team leaders can reconsider whether it is appropriate to conduct field research there. In the field and afterward, we suggest that team leaders proactively check-in with team members and to ensure that everyone feels positive about the experience, as well as debrief afterward to improve future trips.

Concluding Remarks

Here, we present a set of principles based on our self-assessment of how to ingrain equity, reciprocity, access, benefit sharing, and safety into field biology practices. While many of our suggestions are not new (94, 95) and could be applied more generally to other fields, we believe that compiling these ideas into a single document can help researchers plan intentionally inclusive fieldwork. We recognize that our suggested actions may not be applicable to all institutions, teams, or regions and that each group of collaborators will need to make decisions about how to carry out their own fieldwork as equitably and inclusively as possible. Conducting fieldwork can have a positive, transformative effect on an individual's and a community's relationship with science and nature; conversely, bad field experiences can discourage students from pursuing careers in science, technology, engineering, and mathematics and can dissuade communities from collaborating with scientific researchers (20, 38, 96). We believe that following the proposed principles can help ensure positive outcomes.

In reflecting on our own research programs, we recognize that power imbalances are prevalent within field teams and that they can impact collaborative dynamics. Power imbalances can be a product of economic asymmetries (e.g., high- and low-income regions or countries), geopolitical history (e.g., former colonies and colonialist countries, indigenous communities, Black communities in the Americas), job title (e.g., field assistant), and discrimination of specific groups of people (e.g., women, LGBTQ+, racialized people, and people with disabilities). In field biology, power imbalances can result in the formation of collaborative agreements and structural norms that consistently favor those with greater power [e.g., parachute science (20)]. Recognizing and taking power dynamics into consideration can promote equity and safety in field biology, ultimately leading to a more inclusive scientific community and practice.

As power imbalances favor those in privileged positions by default, deliberate planning and proactive efforts, especially by privileged individuals and institutions, can allow for more equitable benefits in science. This could mean discussing each collaborator's goals at the start of a project and asking rather than assuming what collaborators and communities expect and need out of the research program. We ask field researchers to be respectful by prioritizing the safety, comfort, and decisions of local communities in all stages of their field research. In being legal, we promote adherence to all relevant laws and hope that researchers will follow precedents by allowing local authorities to have the final decision on whether and how research is conducted. Finally, in thinking about field safety, we encourage team leaders to emphasize concerns and feedback from team members with less experience or power.

This document represents a collective agreement resulting from months of discussion among the authors. As such it does not entirely reflect each individual's precise point of view but instead captures ideas created by consensus that represent our shared goal of making field biology a more ethical, inclusive, and fair domain of knowledge production. During the process of writing this paper, numerous unresolved questions arose that we could not fully address, but we hope that reporting some of them here will initiate further discussion (*SI Appendix*, Box S1). We encourage other programs, institutions, and individuals to engage in such discussion and to join us by taking action to foster more inclusive and equitable fieldwork.

Data, Materials, and Software Availability. There are no data underlying this work.

ACKNOWLEDGMENTS. We thank many friends and collaborators who provided useful feedback during this project or on related topics over the years, including Dario Alarcón Naforo, Tatsuya Amano, Mileidy Betancourth-Cundar, John Bates, Omar Torres Carvajal, Chris Conroy, Ben Evans, Paul Fine, Pavel García, Shannon Hackett, Steve Hampton, tyrone hayes, Michelle Koo, Karem López, Michael Nachman, Maritza Naforo, James Patton, Lori Schlenker, Carol Spencer, Emma Steigerwald, Bryan Stuart, Carrie Tribble, Elizabeth Wommack, and the many other people involved in our field studies and beyond (many of whom inspired this paper) including field assistants, cooks, drivers, other scientists, community members, hosts and their families (including pets), protected area superintendents, Indigenous peoples' chieftains, and local government representatives, among others. We also thank Camila Pacheco Bejarano, who designed the beautiful illustrations in this paper. In addition, we thank the previous and ongoing work of many that strive to make scientific practices and communities diverse and equitable. Finally, we are extremely thankful for the opportunity to experience all the places that we have visited or lived in and the organisms that they hold.

1. M. W. Holmes *et al.*, Natural history collections as windows on evolutionary processes. *Mol. Ecol.* **25**, 864–881 (2016).
2. A. M. Lister; Climate Change Research Group, Natural history collections as sources of long-term datasets. *Trends Ecol. Evol.* **26**, 153–154 (2011).
3. L. A. Rocha *et al.*, Specimen collection: An essential tool. *Science* **344**, 814–815 (2014).
4. S. G. DuBay, C. C. Fuldner, Bird specimens track 135 years of atmospheric black carbon and environmental policy. *Proc. Natl. Acad. Sci. U.S.A.* **114**, 11321–11326 (2017).
5. M. Soga, K. J. Gaston, Shifting baseline syndrome: Causes, consequences, and implications. *Front. Ecol. Environ.* **16**, 222–230 (2018).
6. C. Weldon, L. H. du Preez, A. D. Hyatt, R. Muller, R. Spears, Origin of the amphibian chytrid fungus. *Emerg. Infect. Dis.* **10**, 2100–2105 (2004).
7. National Academies of Sciences, Engineering, and Medicine, *Biological Collections: Ensuring Critical Research and Education for the 21st Century* (National Academies Press, 2020).
8. G. Nelson, S. Ellis, The history and impact of digitization and digital data mobilization on biodiversity research. *Philos. Trans. R. Soc. Lond. B Biol. Sci.* **374**, 20170391 (2018).
9. G. Nelson, M. Phillips, A. Monfils, B. MacFadden, G. Hogue, *Completing the Data Pipeline: Collections Data Use in Research, Education and Outreach in Biodiversity Information Science and Standards* (Pensoft Publishers, 2018), pp. e26522.
10. J. A. Drew, C. S. Moreau, M. L. J. Stiassny, Digitization of museum collections holds the potential to enhance researcher diversity. *Nat. Ecol. Evol.* **1**, 1789–1790 (2017).
11. C. Moritz *et al.*, Impact of a century of climate change on small-mammal communities in Yosemite National Park, USA. *Science* **322**, 261–264 (2008).
12. E. A. Riddell *et al.*, Exposure to climate change drives stability or collapse of desert mammal and bird communities. *Science* **371**, 633–636 (2021).
13. P. M. Benham, R. C. K. Bowie, The influence of spatially heterogeneous anthropogenic change on bill size evolution in a coastal songbird. *Evol. Appl.* **14**, 607–624 (2020).
14. Y. N. Harari, *Sapiens: A Brief History of Humankind* (Harper, ed. 1, 2015).
15. D. Haraway, Situated knowledges: The science question in feminism and the privilege of partial perspective. *Fem. Stud.* **14**, 575–599 (1988).
16. L. Schiebinger, *Plants and Empire: Colonial Bioprospecting in the Atlantic World* (Harvard University Press, 2009).
17. S. Das, M. Lowe, Nature read in Black and White: Decolonial approaches to interpreting natural history. *Journal of Natural Science Collections* **6**, 4–14 (2018).
18. C. Quintero Toro, *Birds of Empire, Birds of Nation* (Universidad de los Andes, Colombia, 2012).
19. J. Camerini, "17. Remains of the day: Early Victorians in the field" in *Victorian Science in Context*, B. Lightman, Ed. (University of Chicago Press, 2008), pp. 354–377.
20. P. V. Stefanoudis *et al.*, Turning the tide of parachute science. *Curr. Biol.* **31**, R184–R185 (2021).
21. Y. Rayadin, Z. Buřivalová, What does it take to have a mutually beneficial research collaboration across countries? *Conserv. Sci. Pract.* **4**, 528 (2021).
22. C. W. Fox, J. P. Ritchey, C. E. T. Paine, Patterns of authorship in ecology and evolution: First, last, and corresponding authorship vary with gender and geography. *Ecol. Evol.* **8**, 11492–11507 (2018).
23. R. Mbaye *et al.*, Who is telling the story? A systematic review of authorship for infectious disease research conducted in Africa, 1980-2016. *BMJ Glob. Health* **4**, e001855 (2019).
24. A. C. Demery, M. A. Pipkin, Safe fieldwork strategies for at-risk individuals, their supervisors and institutions. *Nat. Ecol. Evol.* **5**, 5–9 (2021).
25. C. J. Schell *et al.*, Recreating Wakanda by promoting Black excellence in ecology and evolution. *Nat. Ecol. Evol.* **4**, 1285–1287 (2020).
26. California Academy of Sciences, Vision & values. https://www.calacademy.org/vision-values. Accessed 17 April 2021.
27. Department of Molecular & Cell Biology, University of California Berkeley, Code of conduct. https://bds-web.berkeley.edu/about/code-of-conduct. Accessed 17 April 2021.
28. Society for the Study of Evolution, Safe evolution. https://www.evolutionmeetings.org/safe-evolution.html. Accessed 17 April 2021.
29. American Anthropological Association, Principles of professional responsibility. https://archaeologicalethics.org/code-of-ethics/american-anthropological-association-aaa-ethics-blog-principles-of-professional-responsibility/. Accessed 17 April 2021.
30. Association of Social Anthropologists of the UK, Ethical guidelines for good research practice. https://www.theasa.org/downloads/ethics/Ethical_guidelines.pdf. Accessed 17 April 2021.
31. J. Lunn, "Ethics in geography fieldwork" in *International Encyclopedia of Geography: People, the Earth, Environment and Technology*, D. Richardson *et al.*, Eds. (Wiley, 2017), pp. 1–9.
32. L. Robles-Silva, Dilemas éticos en el trabajo de campo: temas olvidados en la investigación cualitativa en salud en Iberoamérica. *Ciênc. Amp Saúde Coletiva* **17**, 603–612 (2012).
33. Cocha Cashu Biological Station, Policies and guidelines. https://cochacashu.sandiegozooglobal.org/policies-and-guidelines/. Accessed 15 May 2022.
34. C. H. Trisos, J. Auerbach, M. Katti, Decoloniality and anti-oppressive practices for a more ethical ecology. *Nat. Ecol. Evol.* **5**, 1205–1212 (2021).
35. D. Armenteras, Guidelines for healthy global scientific collaborations. *Nat. Ecol. Evol.* **5**, 1193–1194 (2021).
36. D. Haelewaters, T. A. Hofmann, A. L. Romero-Olivares, Ten simple rules for Global North researchers to stop perpetuating helicopter research in the Global South. *PLOS Comput. Biol.* **17**, e1009277 (2021).
37. L. Soares *et al.*, Neotropical ornithology: Reckoning with historical assumptions, removing systemic barriers, and reimagining the future. EcoEvoRxiv [Preprint] (2022). https://ecoevorxiv.org/yu2fx/ (Accessed 1 May 2022).
38. A. J. Jensen, *et al.*, Attracting diverse students to field experiences requires adequate pay, flexibility, and inclusion. *BioScience* **71**, 757–770 (2021).
39. C. Kemp, Museums: The endangered dead. *Nature* **518**, 292–294 (2015).
40. S. E. Miller *et al.*, Building natural history collections for the twenty-first century and beyond. *Bioscience* **70**, 674–687 (2020).
41. A. E. Hiller *et al.*, Mutualism in museums: A model for engaging undergraduates in biodiversity science. *PLoS Biol.* **15**, e2003318 (2017).
42. M. D. Wilkinson *et al.*, The FAIR Guiding Principles for scientific data management and stewardship. *Sci. Data* **3**, 160018 (2016).
43. J. C. Buckner, R. C. Sanders, B. C. Faircloth, P. Chakrabarty, The critical importance of vouchers in genomics. *eLife* **10**, e68264 (2021).
44. J. Wieczorek *et al.*, Darwin Core: An evolving community-developed biodiversity data standard. *PLoS One* **7**, e29715 (2012).
45. C. Gries, E. E. Gilbert, N. M. Franz, Symbiota–A virtual platform for creating voucher-based biodiversity information communities. *Biodivers. Data J.* **2**, e1114 (2014).
46. S. J. Cooke *et al.*, Contemporary authorship guidelines fail to recognize diverse contributions in conservation science research. *Ecol. Solut. Evid.* **2**, e12060 (2021).
47. G. Ward-Fear, G. B. Pauly, J. E. Vendetti, R. Shine, Authorship protocols must change to credit citizen scientists. *Trends Ecol. Evol.* **35**, 187–190 (2020).
48. V. Ramírez-Castañeda, Disadvantages in preparing and publishing scientific papers caused by the dominance of the English language in science: The case of Colombian researchers in biological sciences. *PLoS One* **15**, e0238372 (2020).
49. T. Amano, C. Rios Rojas, Y. Boum II, M. Calvo, B. B. Misra, Ten tips for overcoming language barriers in science. *Nat. Hum. Behav.* **5**, 1119–1122 (2021).
50. T. Pérez-Bustos, "No es sólo una cuestión de lenguaje": lo inaudible de los estudios feministas latino-americanos en el mundo académico anglosajón. *Sci. Stud.* **15**, 59–72 (2017).
51. E. Bonaccorso *et al.*, Bottlenecks in the open-access system: Voices from around the globe. *J. Librariansh. Sch. Commun.* **2**, p.eP1126 (2014).
52. A. Mekonnen *et al.*, Can I afford to publish? A dilemma for African scholars. *Ecol. Lett.* **25**, 711–715 (2022).
53. R. Khelifa, T. Amano, M. A. Nuñez, A solution for breaking the language barrier. *Trends Ecol. Evol.* **37**, 109–112 (2022).
54. E. Steigerwald *et al.*, Overcoming language barriers in academia: Machine translation tools and a vision for a multilingual future. BioScience (in press). https://doi.org/10.1093/biosci/biac062.
55. M. Liboiron, CLEAR's guidelines for research with Indigenous groups. https://civiclaboratory.nl/2016/09/28/guidelines-for-research-with-indigenous-peoples/. Accessed 22 October 2021.
56. A. Perrault, Facilitating prior informed consent context of genetic resources and traditional knowledge. *Sust. Develop. Law Policy* **4**, 7 (2004).
57. D. J. Haraway, *When Species Meet* (University of Minnesota Press, 2007).
58. A. Ananta, E. N. Arifin, M. S. Hasbullah, N. Budi Handayani, A. Pramono, *Demography of Indonesia's Ethnicity* (Institute of Southeast Asian Studies, 2015).
59. R. E. Nisbett, *The Geography of Thought: How Asians and Westerners Think Differently– and Why* (Free Press, 2003).
60. E. Meyer, *The Culture Map: Breaking Through the Invisible Boundaries of Global Business* (PublicAffairs, ed. 1, 2014).
61. M. Bonta *et al.*, Intentional fire-spreading by "Firehawk" raptors in Northern Australia. *J. Ethnobiol.* **37**, 700 (2017).
62. Q. Wu *et al.*, Outburst flood at 1920 BCE supports historicity of China's Great Flood and the Xia dynasty. *Science* **353**, 579–582 (2016).
63. P. D. Nunn, N. J. Reid, Aboriginal memories of inundation of the Australian coast dating from more than 7000 years ago. *Aust. Geogr.* **47**, 11–47 (2016).
64. R. S. Ludwin *et al.*, Serpent spirit-power stories along the seattle fault. *Seismol. Res. Lett.* **76**, 426–431 (2005).

65. U. Arifin, G. Cahyadi, U. Smart, A. Jankowski, A. Haas, A new species of the genus *Pulchrana* Dubois, 1992 (Amphibia: Ranidae) from Sumatra, Indonesia. *Raffles Bull. Zool.* **66**, 23 (2018).
66. L. N. Gillman, S. D. Wright, Restoring indigenous names in taxonomy. *Commun. Biol.* **3**, 609 (2020).
67. H. Whaanga, W. Papa, P. Wehi, T. Roa, The use of the Māori language in species nomenclature. *J. Mar. Isl. Cult.* **2**, 78–84 (2013).
68. A. R. Acosta-Galvis, A. M. Saldarriaga-Gómez, B. Ramírez, M. Vargas-Ramírez, A new Terrarana frog of genus *Pristimantis* from an unexplored cloud forest from the eastern Andes, Colombia. *ZooKeys* **961**, 129–156 (2020).
69. M. H. Yánez-Muñoz *et al.*, A new Andean treefrog (Amphibia: *Hyloscirtus bogotensis* group) from Ecuador: An example of community involvement for conservation. *PeerJ* **9**, e11914 (2021).
70. V. Y. Hiratsuka *et al.*, Fostering ethical, legal, and social implications research in tribal communities – The Center for the Ethics of Indigenous Genomic Research. *J. Empir. Res. Hum. Res. Ethics* **15**, 271–278 (2020).
71. Nagoya Protocol Learning Portal, The Nagoya Protocol on Access and Benefit-Sharing. https://learnnagoya.com/. Accessed 14 May 2022.
72. O. Fals-Borda, C. R. Brandão, R. Cetrulo, *Investigación participativa* (Instituto del Hombre, 1986).
73. A. Ulloa, J. Godfrid, G. Damonte, C. Quiroga, A. P. López, Monitoreos hídricos comunitarios: Conocimientos locales como defensa territorial y ambiental en Argentina, Perú y Colombia. *Íconos* **69**, 77–97 (2021).
74. Y.-H. Law, New tarantula highlights illegal trade in spiders. *Science* **363**, 914–915 (2019).
75. J. C. Cisneros, A. M. Ghilardi, N. B. Raja, P. P. Stewens, The moral and legal imperative to return illegally exported fossils. *Nat. Ecol. Evol.* **6**, 1–2 (2021).
76. G. Droege *et al.*, The global genome biodiversity network (GGBN) data portal. *Nucleic Acids Res.* **42**, D607–D612 (2014).
77. M. Kozlov, Science with borders: Researchers navigate red tape. TheScientist (2021). https://www.the-scientist.com/careers/science-with-borders-researchers-navigate-red-tape-68443. Accessed 28 April 2021.
78. R. J. V. Alves *et al.*, Brazilian legislation on genetic heritage harms Biodiversity Convention goals and threatens basic biology research and education. *An. Acad. Bras. Cienc.* **90**, 1279–1284 (2018).
79. G. J. Alexander *et al.*, Excessive red tape is strangling biodiversity research in South Africa. *S. Afr. J. Sci.* **117**, 1–4 (2021).
80. Secretariat of the Convention on Biodiversity, Nagoya protocol on access to genetic resources and the fair and equitable sharing of benefits arising from their utilization to the convention on biological diversity. https://www.cbd.int/abs/doc/protocol/nagoya-protocol-en.pdf. Accessed 17 April 2021.
81. The World Conservation Union, Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973).
82. R. G. Nelson, J. N. Rutherford, K. Hinde, K. B. H. Clancy, Signaling safety: Characterizing fieldwork experiences and their implications for career trajectories. *Am. Anthropol.* **119**, 710–722 (2017).
83. L. D. Daniels, S. Lavallee, Better safe than sorry: Planning for safe and successful fieldwork. *Bull. Ecol. Soc. Am.* **95**, 264–273 (2014).
84. J. Anadu, H. Ali, C. Jackson, Ten steps to protect BIPOC scholars in the field. *Eos (Wash. D.C.)* **101**, ●●● (2020).
85. K. B. H. Clancy, R. G. Nelson, J. N. Rutherford, K. Hinde, Survey of academic field experiences (SAFE): Trainees report harassment and assault. *PLoS One* **9**, e102172 (2014).
86. National Academies of Sciences, Engineering, and Medicine, *Sexual Harassment of Women: Climate, Culture, and Consequences in Academic Sciences, Engineering, and Medicine* (National Academies Press, 2018).
87. D. Chiarella, G. Vurro, Fieldwork and disability: An overview for an inclusive experience. *Geol. Mag.* **157**, 1933–1938 (2020).
88. M. A. Rinkus, J. R. Kelly, W. Wright, L. Medina, T. Dobson, Gendered considerations for safety in conservation fieldwork. *Soc. Nat. Resour.* **31**, 1419–1426 (2018).
89. D. H. Olson *et al.*, Enhanced between-site biosecurity to minimize herpetofaunal disease-causing pathogen transmission. *Herpetol. Rev.* **52**, 29–39 (2021).
90. G. B. Nuñez *et al.*, Recommended strategy for researchers to reduce the risk of transmission of SARS-CoV-2 from humans to bats. https://www.iucnbsg.org/uploads/6/5/0/9/6509077/iucn_map_recommendations_for_researchers_v._1.0_final.pdf. Accessed 12 May 2021.
91. C. R. Wells *et al.*, Impact of international travel and border control measures on the global spread of the novel 2019 coronavirus outbreak. *Proc. Natl. Acad. Sci. U.S.A.* **117**, 7504–7509 (2020).
92. H. T. Reynolds, H. A. Barton, White-nose syndrome: Human activity in the emergence of an extirpating mycosis. *Microbiol. Spectr.* **1**, 10.1128/microbiolspec.OH-0008-2012 (2013).
93. S. J. O'Hanlon *et al.*, Recent Asian origin of chytrid fungi causing global amphibian declines. *Science* **360**, 621–627 (2018).
94. M. Buchinger, Improvement of ethical behaviour of outdoor research workers and traveleres. *Bull. Assoc. Trop. Biol.* **8**, 6–6 (1967).
95. B. Bandurski, Ethics for traveling outdoorsmen (researchers). *Bull. Assoc. Trop. Biol.* **8**, 8–9 (1967).
96. L. U. Taylor, L. E. Michael, Methods for young fieldworkers. *Bull. Ecol. Soc. Am.* **99**, 169–172 (2018).