

PERSPECTIVE

A guide for developing a field research safety manual that explicitly considers risks for marginalized identities in the sciences

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Handling Editor: Aaron Ellison**Abstract**

1. Field research can be an important component of the career trajectories for researchers in numerous academic fields; however, conducting research in field settings poses risks to health and safety, and researchers from marginalized groups often face greater risks than those experienced by other researchers in their fields; If these additional risks are not actively and thoughtfully mitigated, they are likely to hinder the participation of qualified investigators in field research and counteract efforts to improve and promote diversity, equity and inclusion in the field sciences.
2. Here we provide, from our perspectives as co-authors of a field safety manual for the Department of Biological Sciences at the University of Pittsburgh in Pennsylvania, United States, (A) background on risks and barriers that should be considered when planning and conducting field research and (B) suggestions on how to work as a collaborative team for developing an inclusive field safety manual.
3. As an example of a manual this proposed process has yielded, we have included our own field safety manual written with diversity, equity and inclusion as a central focus.
4. We hope this publication serves as a starting point for those interested in developing a similar document for use in their laboratory group, department or institution.

KEYWORDS

accessibility, diversity, equity, field research, intersectionality, marginalized identities, risk mitigation, safety manual

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1 | INTRODUCTION

Personal biases and institutional barriers have long hindered the involvement and support of marginalized researchers in many areas of science. These obstacles should be removed to foster the development of a diverse scientific community that reflects our society. There is also strong evidence that enhancing the gender, racial and ethnic diversity of research teams results in better quality science and higher impact publications (AlShebli et al., 2018; Campbell et al., 2013; Demery & Pipkin, 2021; Milem et al., 2005; Nielsen et al., 2017; Puritty et al., 2017). Recent efforts by many academic institutions and research organizations to promote diversity and inclusion have led to increased recruitment of faculty and graduate trainees from different racial, ethnic, gender, sexual orientations and persons with disabilities (U.S. Department of Education, 2016). However, various metrics, including earned PhDs and student and workforce survey findings, suggest that many scientific disciplines—including ecology, evolutionary biology, conservation biology, entomology, environmental and geosciences, anthropology and palaeontology—remain quite ineffective at recruiting and retaining diverse trainees and postdoctoral or faculty researchers (Bernard & Cooperdock, 2018; Evangelista et al., 2020; Gill, 2018; Gonzales et al., 2020; National Science Foundation, 2017; O'Brien et al., 2020; Pickrell, 2020). This suggests that, for these fields, additional attention and specific policies will be required to foster inclusion and belonging for researchers from marginalized groups.

Understanding and dismantling barriers that prevent individuals from diverse backgrounds from participating in ecology, evolutionary biology, conservation science and allied fields is imperative for supporting efforts to make these fields more inclusive and equitable. One key area where these disciplines differ from other academic fields is that research may involve substantial time in field settings; from short local trips in urban or rural locations to extensive, distant and isolated long-term expeditions to remote locations that can lack basic amenities like electricity and potable water and where interactions with other people can be limited. Field experiences are more likely to be negative, hostile or dangerous for researchers with marginalized identities,

thus exacerbating inequity in these academic disciplines. Field investigators report that marginalized trainees, especially those from racial and ethnic minorities, are at a higher risk of dealing with prejudice and conflict that may affect their productivity or threaten their physical health and life (Demery & Pipkin, 2021; McGill et al., 2021; Viglione, 2020). In addition to dealing with prejudice and discrimination, field research needs to mediate conflict among field investigators. For example, a survey of researchers from the fields of anthropology, archaeology, biology, zoology and geology found that female trainees were the primary victims of unwanted contact originating from their superiors (Clancy et al., 2014). Scientists who identify as lesbian, gay, bisexual, transgender, queer, intersex, asexual or other sexual orientation/gender identity (LGBTQIA+) may need to conduct field research in unwelcoming or dangerous areas, including countries where their identities are criminalized (Olcott & Downen, 2020). Researchers with disabilities face unique challenges when conducting field research and these challenges (and potential solutions to them) are rarely considered, even in the geosciences where field experiences are considered a core element of the curriculum (Chiarella & Vurro, 2020). Finally, individuals who share identities with multiple of these marginalized groups may experience compounded disadvantages due to the intersections of their identities (Figure 1; Clancy et al., 2017).

Increasing safety and reducing risk during field research is critical for welcoming and retaining talented researchers from marginalized groups in academic disciplines where extensive field research is routine. There is a pressing need for better policies, procedures and guidelines to ensure safe and equitable access to field research (Cronin et al., 2021; Demery & Pipkin, 2021; McGill et al., 2021; Nelson et al., 2017; Viglione, 2020). Institutions and researchers should strive to make field research equally safe for all participants for ethical and moral reasons, and work on this front helps to ensure long-term positive impacts on marginalized trainees (Beltran et al., 2020). For example, longitudinal surveys show higher self-efficacy gains, increased graduation rates, higher grade point averages and higher retention rates among marginalized trainees who were previously involved in field research (Beltran et al., 2020;

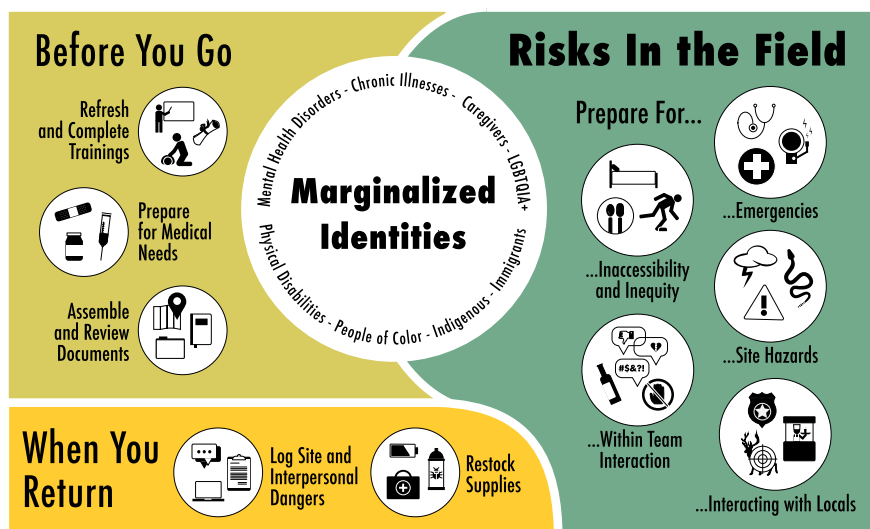


FIGURE 1 Marginalized identities can conduct safe and successful fieldwork by training and preparing for risks before fieldwork, active risk management during fieldwork, and reporting dangers and restocking supplies upon return from fieldwork.

McGill et al., 2021). Furthermore, field courses can be a powerful tool for closing achievement gaps in ecology and evolutionary biology across trainees of different genders and racial identities (Beltran et al., 2020). Therefore, developing written guidelines and best practices for promoting safety and equity in field settings represents a tangible step toward attracting and retaining marginalized individuals in these fields. Recognizing their importance, funding agencies, such as the United States National Science Foundation, will require plans for safe and inclusive field research as part of research proposal applications beginning in January 2023 (NSF, 2022).

Creating field safety manuals to include explicit considerations of how a field researcher's identity intersects with safety concerns, and to outline proactive means of mitigating these specific risks, is just one step supervisors or institutions can take to increase support and safety for at-risk individuals engaging in field research (Figure 1; Demery & Pipkin, 2021). Many colleagues and researchers have shared their personal experiences conducting field work (Box 1A and B) that provide valuable insight into the barriers and risks faced by marginalized scientists. Additionally, many other colleagues have compiled recommendations and best practices for promoting field safety (Box 1C).

BOX 1 VOICES FROM THE FIELD

Writing a field safety manual that explicitly considers the multitude of ways that institutional policies and academic and social norms can exclude and increase risk for researchers is hard. Especially if you are at an institution with low diversity or your own personal privileges protect you from experiencing exceptional barriers or increased risk because of your identity. We found the following essays, surveys, interviews and publications to be extremely helpful resources as we learned about the various risks and barriers faced by researchers with marginalized identities conducting field research.

A. Personal narratives from field researchers

- Mothers in the Field (MacDonald & Sullivan, 2008).
- 'We Thought You Would Be White': Race and Gender in Fieldwork (Henderson, 2009).
- Being queer in the jungle: The unique challenges of LGBTQ scientists working in the field (Ragen, 2017).
- I Am One of You: A Gay wildlife biologist's perspective on our profession (Booms, 2019).
- Challenges of fieldwork for LGBTQ+ scientists (Atchison, 2021).
- What happens when a field biologist becomes disabled? (Mendelson III, 2022).

B. Surveys and Interviews of field researchers:

- Fieldwork and disabled students: discourses of exclusion and inclusion (Hall et al., 2004).
- Survey of academic field experiences (SAFE): Trainees report harassment and assault (Clancy et al., 2014).
- Impact of inclusive field trips (Gilley et al., 2015).
- Signalling safety-characterizing fieldwork experiences and their implications for career trajectories (Nelson et al., 2017).
- Family in the field: expectations of a field based research career affect research family planning decisions (Lynn et al., 2018).
- Racism and harassment are common in field research—scientists are speaking up (Vigione, 2020).
- Scientists push against barriers to diversity in the field sciences (Pickrell, 2020).
- Black birding is about hope. (Hou, 2020).

C. Essays and best practices recommendations

- Volunteer Field Technicians are bad for wildlife ecology (Fournier & Bond, 2015).
- Mental health in the field (John & Khan, 2018).
- Making geoscience fieldwork inclusive and accessible for students with disabilities (Stokes et al., 2019).
- Toilet stops in the field: an educational primer and recommended best practices for field-based teaching (Greene et al., 2020).
- Barriers to fieldwork in undergraduate geosciences degrees (Giles et al., 2020).
- Promoting inclusion in ecological field experiences: examining and overcoming barriers to a professional rite of passage (Morales et al., 2020).
- Fieldwork and disability: an overview for an inclusive experience (Chiarella & Vurro, 2020).
- Elevate, do not assimilate, to revolutionize the experience of scientists who are Black, Indigenous and people of colour (Halsey et al., 2020).
- Ten steps to protect BIPOC scholars in the field (Anadu et al., 2020).
- Safe fieldwork strategies for at-risk individuals, their supervisors and institutions (Demery & Pipkin, 2021).
- Cultivating inclusive instructional and research environments in ecology and evolutionary science (Emery et al., 2021).
- Anti-racist interventions to transform ecology, evolution and conservation biology departments (Cronin et al., 2021).
- You are welcome here: A practical guide to diversity, equity and inclusion for undergraduates embarking on an ecological research experience (McGill et al., 2021).
- Ecology and evolutionary biology must elevate BIPOC scholars (Massey et al., 2021).
- Next steps in dismantling discrimination: Lessons from ecology and conservation science (Chaudhury & Colla, 2021).

Thanks to many researchers' efforts, writing field safety manuals and understanding the dimensions of how personal identities manifest to different safety risks are aided by the wealth of personal experiences and best practices already published and available. Our contribution here is to outline a process, which we developed as an outgrowth of the understanding we gained from these prior efforts and our own shared experiences, for writing a customized field safety manual that explicitly addresses the inequities that exist in field research (Box 2).

1.1 | Goals of this document

Here, we contribute to the growing literature on mitigating risks and increasing safety for field researchers by (1) providing guidelines on how to develop one's own inclusive field safety guide while trying to avoid bias, (2) helping researchers understand the importance of knowing what resources or rules their institutions may have concerning field research safety and aspects of inclusion and finally (3) providing an example field safety guide that can be adapted to other institutions or working groups.

We work to achieve these goals by describing the process we used to create a customized field safety manual for our own department (see our example in the [Supplemental Materials](#)). We describe how we formed our authorship team, synthesized the wealth of knowledge from both published literature and our personal experiences, and navigated writing and editing a manual as a group. We found that writing a comprehensive field safety manual was not a trivial process, and we benefited from including a team of researchers with a variety of

personal identities and field experiences in our effort. This manuscript builds on previous literature (Daniels & Lavallee, 2014) by describing how to write a field research safety plan that acknowledges how and why field safety risk is not equal for all team members, and suggesting targeted actions and policies to mitigate these unequal risks.

We also discuss the benefits and lessons we learned from our writing process, which include building awareness and a deeper appreciation of the range of risks and barriers we and our colleagues face while in the field and a better understanding of our own institution's support networks for promoting safer field research for all researchers. We developed this manuscript to serve as a resource for others wishing to write or update a field safety manual covering specific safety risks and mitigation strategies for their own research groups, departments, programmes or institutions. We believe field researchers from different disciplines, such as geology, environmental sciences and others, could benefit from such efforts. We emphasize that writing a field safety manual is an important, but certainly not the only, step towards making research more accessible, safe and welcoming to all researchers.

2 | GUIDELINES FOR DEVELOPING A SAFETY MANUAL

2.1 | Activating the process

An obvious, but not effortless, first step to developing a field safety manual is either a single person or a group of people activating the process. The activation energy required to move a

BOX 2 POSITIONALITY STATEMENT

We view the generation of a field manual that centres issues of equity, diversity and inclusion as only a single step to make our departments, research institutions and research fields welcoming to marginalized researchers. We emphasize that the generation of such a field safety manual does not condone the status quo of institutional and societal oppression, but rather acts as a method for supporting marginalized scientists until systemic equality is achieved. Initiatives of writing a field safety manual should be accompanied by the actions outlined by others (Box 1) that are required to truly bring about equity and inclusion.

We recognize that the language ascribing personal identities is complex. Here, we use the term 'marginalized' as an encompassing term to describe those individuals that face bias and discrimination during field research, such as racially and ethnically marginalized individuals, women, individuals with disabilities, those that identify as lesbian, gay, bisexual, transgender, queer, intersex and/or asexual (LGBTQIA+), and others. We chose the term 'marginalized' with a hope to focus on the marginalizing action of societal and institutional barriers, avoiding terms like 'historically excluded' because this exclusion is still occurring present-day, or 'underrepresented minority' which can sometimes present negative connotation and ambiguity regarding the cause of this underrepresentation. However, we recognize that the term 'marginalized' may still contain negative connotations and may falsely imply limited power or numbers in these groups. Language is ever changing, and we recognize initiatives to introduce empowering terms such as Powerful Groups Targeted for Oppression as potential replacements (Cooper, 2016).

Importantly, where possible (and especially in our field manual) we highlight and draw on examples for specific marginalized identities to highlight that the needs of, and risks faced by, various marginalized groups are not identical, while also recognizing that those with intersecting identities may face distinct challenges. We acknowledge that we do not cover all possible examples of how a researcher's identity may intersect with field safety risks, and that those examples we include are not more important or pressing than those we exclude. We welcome readers to share additional examples of how barriers and risks manifest for marginalized groups not covered in our manual, which we will include in future versions of our field safety manual.

group from general discussions about field safety for marginalized individuals to formally developing and drafting policies and protocols to mitigate those risks is not minimal and requires a sustained commitment by a core group of people. Our hope, in writing this, is that the examples and shared experiences we provide will help others to overcome this hurdle. In our case, we realized that there were many separate discussions revolving around field safety happening within separate laboratory groups in our department but that there was little 'cross-talk' happening among field researchers in the department, especially among researchers at different career stages [e.g. between principal investigators (PIs), and trainees]. Moreover, there was inconsistent knowledge about institutional rules and resources related to these issues. One of us took the initiative of emailing our departmental listserv, which included faculty, staff, postdocs and graduate students, and organizing an initial meeting to discuss the idea of developing a set of department-wide safety protocols for field researchers. Our intent from the outset was to focus on understanding how researchers' identities affect the landscape of risk during field research and developing strategies to mitigate those risks to promote diversity, equity and inclusion. We aimed to be as inclusive as possible in terms of the voices we brought to the table.

2.2 | Determining the scope and need

Once an initial group of people interested in developing a safety manual has coalesced, the initial authors should consider a few guiding questions: First, what is the need for this document? Second, what scope best serves that need? Answering these questions will guide the rest of the brainstorming and writing process, including identifying who should be invited to join the writing team, what specific information needs to be included in the manual and how the writing team can encourage uptake and use of the manual after it is written.

The recent outpouring of publications, news articles and discussion concerning the widespread prevalence of inequities and safety risks during field research suggests that there is a clear and pressing need for institutions to address how to make field research safe, accessible and welcoming for everyone (Demery & Pipkin, 2021; Jha, 2021; McGill et al., 2021; National Academies of Sciences & Medicine, 2018; Olcott & Downen, 2020; Viglione, 2020). A good place for all teams to start is by listening to and reading the essays, interviews, tweets and published journal articles by field researchers who outline and discuss the inequities they face in field research and where researchers face heightened risks because of their demographic identities (See Box 1 and Table 1). In reading these, keep in mind that these accounts are largely written by

TABLE 1 Suggested core sections, focus areas and literature citations for field safety manual development

Core sections	Suggested areas of focus	Citations
Cultivation	The cultivation of a well-informed team before going into the field is vital in conflict resolution and preventing unsafe environments. Informing your team through training and explanation of institutional policies regarding discrimination and harassment will enhance team strength and plan of action (1–16)	1. (BARCC, 2022) 2. (Clancy et al., 2014) 3. (Demery & Pipkin, 2021) 4. (Glenn, 2020) 5. (JAN, 2018)
Communications	Gathering information about the field site ahead of time will help to ensure the safety of everyone going into the field. Knowing all required permits, regulations, health and safety risks is vital for preventing unnecessary risk (17–18)	6. (John & Khan, 2018) 7. (Kintisch, 2014) 8. (Nelson et al., 2017) 9. (Pickrell, 2020)
Children	Parents, especially women, are easily excluded from field research because of the lack of accommodations and flexibility for people with children. This section should address options for flexibility in timing and (conditions warranting) considerations for parents wishing to bring their children into the field (19–20)	10. (RAINN, 2022) 11. (Schumer, 2019) 12. (Scovanner, 2017) 13. (Shortall, 2015) 14. (Skiba, 2020)
Risks	Because there are a multitude of risks associated with going into the field, making the experience as safe and equitable as possible can be complex. Risks can be different depending on individuals' identities, therefore, extra careful examination of the risks and strategies to minimize them must be detailed (21–22)	15. (Ullman & Peter-Hagene, 2014) 16. (Viglione, 2020) 17. (Desilver et al., 2020) 18. (Edwards et al., 2019) 19. (Lynn et al., 2018) 20. (McGuire et al., 2012)
Medical	Training the entire team about health risks is important for the safety of all those involved in field research. Field leaders should take responsibility for keeping a well-stocked first aid kit. Ensuring that researchers have access to medical insurance coverage will open the field to those that were previously excluded (23)	21. (Bodie-Williams & Knowles, 2016) 22. (O'Kelly & Lambert, 2020) 23. (Zhang et al., 2020) 24. (Greene et al., 2020) 25. (Chaudhury & Colla, 2021)
Returning	Reporting and checking in with supervisors about negative or risky interactions that occur within field teams or with the public will help inform future decisions about field sites and aid in modifying protocols to prevent the same situations from happening again. It is also important to resupply or upgrade safety equipment	26. (Chiarella & Vurro, 2020) 27. (Hall et al., 2002) 28. (Olcott & Downen, 2020) 29. (Ragen, 2017) 30. (Thurston et al., 2017)

individuals who persisted in their chosen fields despite the barriers they faced and that we are much less likely to hear from those who decided to pursue another career path *because* of the barriers they faced. The group may also find it helpful to source and collect the current field safety resources used by researchers at their institution. This exercise may identify field safety topics that have been well described and topics that require more research or updating. When we searched for safety manuals within our department, we found that many faculty PIs did not have field safety manuals, indicating that there was a clear need for a manual in our department. We also found that of the laboratories that had safety manuals, most focused on medical and environmental safety (first aid, dangerous animals and plants, etc.) topics, which we were able to expand and build from in our own manual. During this process, building a library of existing safety resources from other laboratories and groups at your institution can be incredibly helpful. Finally, we found many topics were not discussed in any field safety manual, including how safety risks can vary across researchers based on their demographic identities, how interactions with other people can be unsafe, or how researchers can report harassment or other safety violations during field research.

The initial writing team should develop a process for identifying *specific needs* that are unique to individual institutions or

research teams based on their research or group composition. One process could be the creation and dissemination of anonymous surveys, both within the writing group and across the department, institution or organization to gather information. The writing group should also consider that they may not be able to identify all the specific needs that should be addressed within the manual and thus may need to also talk with people outside the writing group to get a fuller picture of the specific needs for the manual. Writing groups may reach out to Human Resources, Diversity Offices or Title IX Departments (or similar office that handles sexual and gender harassment) at their institution or develop a survey that can be distributed anonymously to field researchers at the institution to understand the social climate and identify current problems that field researchers face.

As important as determining the need for a safety manual is determining the scope of the safety manual. Determining the scope of field research undertaken by individuals will help make a focused and practical guide. A suggested timeline of this process, based on our own experiences in writing a safety manual, can be seen in [Figure 2](#). Questions the initial group may ask might include: Is this document needed for a single lab group, an entire department or an entire institution? Will the manual cover only domestic field

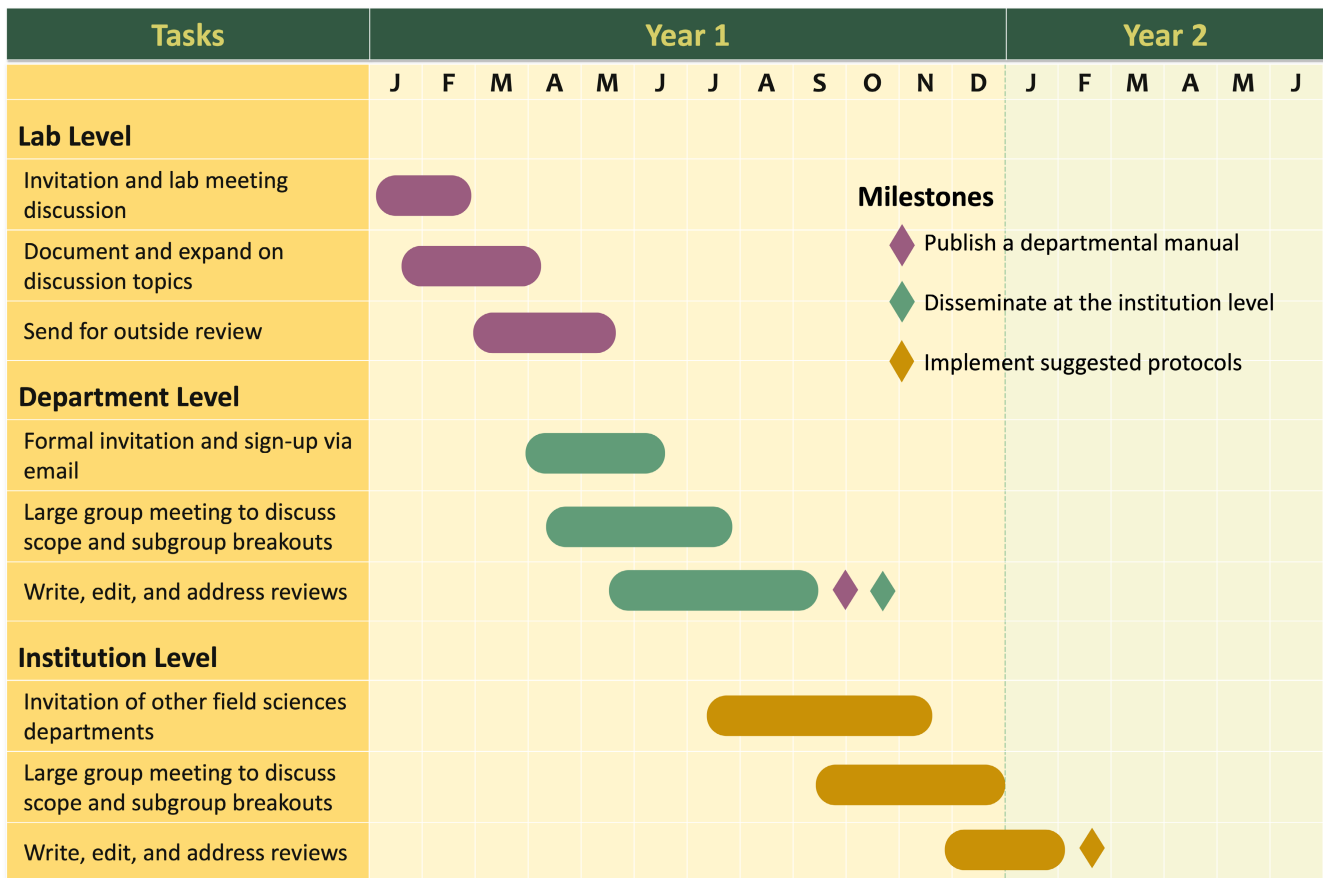


FIGURE 2 Suggested timeline for writing a fieldwork safety manual. When beginning to write a field safety manual, leaders must decide the scope needed to accomplish their needs, then assemble a group, and begin tackling the long process of writing and reviewing.

research or also international? Who will use this manual (i.e. is this for only researchers concerned about field safety, or perhaps instructors who teach field safety courses)? Who will be covered by the manual (would it be limited to just researchers, or would it span to include students in a class, undergraduates, graduate students, and/or postdocs)?

2.3 | Assembling the full writing team

After the initial group determines the scope and need for their manual, they should assess the group itself and expand it to ensure individuals vary in expertise, experience and identity. We found that a writing group that was diverse in as many dimensions as possible enhanced our discussions and helped identify important areas to focus on for mitigating field safety risks. This diversity included individuals that varied in professional identities—such as career stage, job description (lecturer, researcher, administrator and trainee), the methods and tools they used in the field, the types of habitats in which they conducted research, the geographical region where they conducted research, their study organisms—and most importantly aspects of personal identities—such as their gender identity, sexual orientation, disability, ethnicity, race, religion, socioeconomic status, native language, relationship status, and if parenting or childfree—that influenced what barriers they had faced and their personal experiences when conducting field research.

Sending a formal invitation to the group of individuals you would like to receive support and input from when writing the document is a good first step in assembling a writing team. Depending on the document's intended scope, the invitation may be a departmental or institution-wide email or a conversation during a laboratory meeting. Be upfront and honest about the time commitment and the potential emotional work and burden that writing a guide like this could entail for marginalized scientists (Miller, Guida, et al., 2018; Miller, Jones, et al., 2018). When assembling a team, ensure you promote marginalized voices first. Be aware that marginalized individuals are often asked for free professional, mental and emotional labour (Lerma et al., 2020). Thus, be sure to encourage and, when possible, compensate those that have given labour to create a safer and more equitable field environment. Compensation might include, but is certainly not limited to, monetary support, formal recognition of efforts in annual work, promotion or merit raise reviews or authorship of the resulting document. As the group is forming, be sure to hold discussions on the many ways an author can contribute to the manual and establish clear expectations for what would determine authorship.

You may find that despite your best efforts, the team's diversity remains low. In this case, while not an adequate substitution for having diversity within the team, it can be useful to consult the literature to find missing voices and perspectives (Booms, 2019; Chaudhury & Colla, 2021; Demery & Pipkin, 2021; Olcott & Downen, 2020; Pickrell, 2020; Ragen, 2017; Viglione, 2020). Another potential solution would be to reach out to a diversity and inclusion officer and ask them to collaborate with your team and provide different

perspectives. A benefit of this approach is that collaborating in this way may be within the job description of this individual, avoiding the need for volunteer service. Diversity officers, as administrators, may also add unique and helpful perspectives on institutional policies and practices. However, diversity officers may not be familiar with the complexities of field research, so while they are general DEI experts, they might not be able to foresee important field-specific issues. If you need to reach outside your team or diversity office for additional perspectives, be ready and willing to compensate contributors for the labour you request.

2.4 | Developing team writing goals and guidelines

Writing a field safety manual that specifically addresses the inherent dangers and challenges of field research for marginalized identities in the sciences will confront groups with topics that are challenging to discuss. The team will work more effectively and develop a better manual if everyone feels safe sharing their thoughts and ideas. We recommend a series of guidelines to achieve this safe space.

First, develop a code of conduct to help the group navigate discussions on difficult topics. Begin with a discussion of the goals and environments, the group wants to foster and start forming those objectives into a list. The code of conduct published by Schmidt et al. (2017) is a great example that can be applicable to many fields and situations. The group should discuss methods of addressing intentional or unintentional hurtful comments, microaggressions, or implicit biases that surface in the discussion or writing process. It is important that privileged individuals be active participants in identifying, addressing and reporting microaggressions and other hurtful behaviour. Marginalized individuals have a variety of complex reasons and concerns that may make them unable to, or feel that they are unable to, address problematic comments or actions (Sue, 2010). To help relieve some of these concerns and increase the likelihood of reporting, the group should establish a process for addressing violations of the code of conduct or conflict between team members. The process should include a protocol for anonymous reporting behaviour that breaches group goals or the code of conduct (Foxy et al., 2019), a specific procedure for addressing reports, and a list of consequences and actions. A code of conduct without transparent consequences that apply to all team members, regardless of seniority, holds very little power or legitimacy.

Second, the writing group should openly acknowledge power dynamics and discuss ways to mitigate them. Our group was composed of faculty, postdocs and graduate students, but there was little overlap between mentor/mentee pairs, which we think may have made people more comfortable with sharing their ideas and perspectives about personal field research experiences. Given that senior people are more likely to dominate discussions than junior people, due to power dynamics and the level of comfort, the group needs to discuss ways to make the space open for everyone to speak (see Box 3). One way to do this would be to ask each person to respond to questions anonymously by typing into a shared Google Document or asking

BOX 3 POWER DYNAMICS

While we strive to promote voices equally, inherent power dynamics between individuals can make this challenging. Power dynamics arise from societal expectations or norms that give certain individuals more influence or ability to affect change relative to other individuals. For example, faculty members tend to have more 'power' than postdocs or grad students. Power dynamics can affect the discussion and writing of field safety manuals because individuals with less power may feel uncomfortable sharing experiences and ideas with individuals with more power. This hesitancy to share could limit the functionality of the field safety manual if it actively leads to the exclusion of marginalized concerns that need addressing while conducting field research. We compiled advice from dominant and marginalized protectives about navigating the complex power dynamics present while constructing our field manual

Advice for addressing power dynamics:

- Hold a group activity to get to know each other before writing the manual.
- Participate in diversity and allyship workshop/trainings as a team to build trust.
- Set codes of conduct for how the group should navigate difficult topics.
- Develop a protocol for addressing harmful comments, microaggressions or implicit bias.
- Create anonymous surveys to assess the climate of the group at several stages in the manual writing process.
- While brainstorming, discuss ways to make space for everyone to speak (e.g. anonymous responses in google doc, round robin discussion).
- Take sufficient time during discussion to allow everyone to participate.
- Develop a co-leadership team to limit the chance of one person dominating the discussion.
- Discuss as a group the many ways an author can contribute to the manual and expectations for what would determine authorship on the manual.
- In writing groups, have little overlap of mentor/mentee pairs.

Our thoughts on this topic were influenced by Dwyer (2020) and van Scherpenberg et al. (2021), as well as by courses and workshops offered by our institution.

everyone to complete an anonymous survey. Questions could include, 'What were your personal experiences?', 'What do you think is the most important reason for creating this manual?' and 'How can we make sure the manual is effective?'. Developing a way, early in the process, for participants to share past experiences anonymously and without judgement can help ensure everyone has a voice and make the process less emotionally draining.

Third, participating in workshops, courses or training on implicit biases and allyship as a team can be a great way to get everyone on the same page. Privilege awareness is critical for well-informed and balanced discussions on sensitive topics. Diversity training has been shown to be an efficient method in educating individuals on their privileges and improves attitudes towards marginalized communities (Ehrke et al., 2020). Additionally, becoming familiar with microintervention and microaffirmation tactics can both help with addressing and disarming microaggressions, and generally promote an environment where all individuals feel heard (Sue et al., 2019). We recommend checking with the office of diversity, equity and inclusion at your institution for guidance on available training courses.

Finally, consider creating volunteer-based task lists instead of assignments. When discussing the issues of equity and inclusion, especially in the context of safety, there can often be an intersection between these conversations and personal vulnerabilities (Crumpton, 2017). To maintain a safe writing space, our group

operated by creating task lists and asking members to volunteer for the tasks they wanted to help complete. This allowed team members to write for areas they felt knowledgeable or interested in, but also helped ensure that members were not assigned to topics that could cause a resurgence of traumatic memories or negative emotions.

2.5 | Outlining the manual

The essential foundations of the field safety guide should cover cultivating a safe and constructive team of field workers that all understand what safety tasks need to be done before the team goes, while in the field, and upon completion. However, under this structure, the document can become redundant. Therefore, we created seven core sections that could be addressed within this framework. Any number of alternative structures could be used, but we found that the framework we describe was effective in creating an easy-to-understand document with limited redundancy. Consistent formatting and organization throughout each section will allow for a more comprehensive and digestible manual.

We recommend that the first three core sections focus on interpersonal interactions: (1) cultivating productive and inclusive research teams; (2) communication with the public and land managers and (3) bringing field workers' children into the field. The next three

sections deal with mitigating risk and increasing access to the places where we conduct field research: (4) understanding field site risks, (5) transporting field teams safely and (6) planning for medical emergencies. The final section, (7) returning from a field trip, outlines actions to take after the field team is safely home, such as reporting unsafe situations.

Within each section, thoughtful considerations for the health, safety and equity of marginalized scientists should be highlighted and written in a visible manner. These sections will be shaped by the cultures of the locations where the field science will be performed and of the institution (see [Box 1](#)), for example, different regions have different customs and regulations that may need to be addressed to aid in promoting safety for all participants. Additionally, some groups may want their document to go beyond safety concerns to providing guidelines for ensuring equal access to learning and skill development. It is essential to be detailed and inclusive about the procedures to be followed by anyone taking part in the field research your laboratory, department or institution will be performing. Some examples include procedures for use of field vehicles, required or recommended vaccines, health insurance, passports, and governmental organization rules and permit applications.

2.6 | Writing the manual

This section outlines practices we found helpful while collaboratively writing our department's field safety manual. After writing an outline, we divided up into smaller writing groups that tackled each of the individual sections, with individuals choosing (rather than being assigned) which section(s) they would work on ([Figure 2](#)). We used this structure to write and edit the document, with each subgroup reading and editing a section that they did not initially draft. We established many different and valuable roles that authors could play within these sub-groups and the overall group. These roles included generating ideas during meetings, researching policies, reading relevant literature, writing sections, editing, creating figures, maintaining the document once finished, collecting feedback and disseminating the document. We found each of these roles to be necessary and that we could divide them among members of each smaller group based on authors' experiences, strengths and other time commitments (like field research) that changed throughout the writing process. We did not have a single lead person during this process, but instead multiple team members shared the responsibility of managing the document and task list, organizing meetings and setting deadlines for tasks. We found that establishing this sort of co-leadership group allowed us to manage the document better and keep pushing ahead without having anyone dominating the direction or assuming complete responsibility for the manual's final form. These individuals would help organize the sub-groups, set meetings and set deadlines for completing different tasks. We found this overall structure very helpful in alleviating the pressure of incorporating the opinions of many different contributing authors while also allowing the writing process to always be moving forward.

Our group found it useful to meet via video conference and work on an online editable word processor (e.g. Google Docs), which allowed for synchronous collaborative writing and editing. While we were forced by the COVID-19 pandemic to adopt this model, in the end we felt it helped us to write effectively by allowing us to review and discuss the document as a group. After writing and editing a full draft of the safety manual, we circulated the draft among peers and colleagues to solicit feedback ([Figure 2](#)). To find 'friendly reviewers', we emailed our department for volunteer readers and used pre-scheduled meeting times, like laboratory meetings, to get others' thoughts. This was a critical part of the writing process for us because it engaged an even larger group of individuals, many with different field research experiences than our own. Integrating institutional training (i.e. Office of Diversity and Inclusion and Title IX policies/office) for field researchers before assembling teams and beginning writing the document could allow for more thorough conversations and ideas. These trainings should be easily accessible within the guide and organized by the section that they most pertain to.

We found it useful to allow for flexible and longer-than-usual deadlines (e.g. 3- or 4-week time spans) when writing and editing our field safety manual as this facilitated contributions from a larger group of authors. Writing the manual was a long and intensive process. In total, our group took 9 months from initial conversations to a final, but living, document. In our case, speeding up the process would not have been possible or pleasant given that this type of service activity necessarily came second to the authors' research and teaching priorities.

2.7 | Sharing and updating the manual

In addition to writing the safety manual, it is important to consider how it will be accessed, shared and updated. For the manual to be used as intended, it should be easily accessible. Copies should be printed and packed along with field equipment in case of emergencies. In addition, the manual should be easily accessible online. The file, in a format viewable on many devices including mobile phones (e.g. PDF), should be stored on a publicly accessible website (such as a departmental site) that does not require institutional login, a Virtual Private Network, or the need for a user account (e.g. Dropbox). This will not only maximize the number of potential users of the manual but also avoid delays in accessing it during emergencies. We posted a PDF of our safety manual on our Department's Field Research Station's website (<https://www.pitt.edu/research/information-researchers>).

Ideally, the manual will be useful to many different users. When complete, the authors should consider sharing it within and among departments, directly with colleagues, including those teaching field courses, or even to their institution's safety office. Orientation periods are an excellent time to share the document with incoming trainees, researchers and staff. Such documents could be considered as required reading for permission to engage in field research or work at field research stations. We emailed the manual to graduate students,

postdocs, faculty and staff in our department. We also emailed the document to the chairs of other departments that conduct field research within our institution.

It is critical to update, improve and assess the usefulness of the document you create over time. Topics may have been forgotten, procedures change, additional concerns may arise and clarity can always be improved. It is a good idea to seek regular feedback and plan for periodic revisions to the manual. The authors could send out surveys to end-users after each field season requesting comments on readability, usefulness and content. The authors could then meet and decide what feedback to incorporate into updated versions and redistribute them. We suggest adding a small summary box at the start of each updated version highlighting major changes. After we published and shared our field safety manual, we received excellent suggestions from new readers about topics to include and update (i.e. we too missed things). We have been adding these suggestions to our manual in a shared Google Doc in preparation for a meeting to discuss our first formal update. We plan to do this annually from here forward.

2.8 | Reflection on what we learned in the process and conclusion

Throughout this process, we became aware of a multitude of take-aways that benefited many of the team members. We learned of different allyship training opportunities and developed more open communication pathways among the authorship team. Many of the faculty or staff members actively changed the way they conducted field research or trained researchers and trainees. For example, Dr Sara Kuebbing adapted the manual to create a more specific manual for her group's single field site during the 2021 field season. The manual for Dr Kuebbing's laboratory and the resulting preparations, documentations and guidelines has already aided in resolving and avoiding issues with aggressive neighbouring landowners. Dr Richards-Zawacki incorporated the use of the manual into orientation activities for trainees taking field courses at the field station she directs. Multiple laboratory groups also read and discussed the manual during their weekly laboratory meetings, which also allowed a natural progression into discussion of topics that may not otherwise have come up in a typical laboratory meeting. While these individuals were not originally involved in the writing process, ideas and suggestions that arose from those laboratory meetings ended up contributing to future updates of the manual. Finally, the writing of both the manual and this manuscript highlighted gaps in the relevant literature as well as in the data for what practices work to promote equity in field research (i.e. does consistently recording and sharing incidents after coming home from field research positively impact safety and equity going forward?).

We also experienced expected and unexpected benefits of our efforts for the broader community. As expected, our manuscript

called attention to policies, opportunities and limitations that existed (or did not exist) within our institution. It also provided justification and documentation of needs for infrastructure investment to help improve safety and achieve equity. This information can be utilized to seek internal institutional funds or support from external funding agencies. In our case, faculty have utilized our manual and research within it to make requests for departmental expenditures to improve field safety. Additionally, while we originally wrote the manual with the intention to share it with our department (Biological Sciences), we were surprised to find that the final product was shared outside of our department and was met with such enthusiasm from other departments (e.g. Geology and Environmental Science) and schools within our institution, as well as the Office of Health and Safety. Many readers were receptive to incorporating the information we provided both laterally and vertically in our institution. We hope that by sharing our experiences, we may lower the activation energy needed to make similar impacts within your teams and institutions.

AUTHOR CONTRIBUTIONS

All authors provided critical feedback that helped outline and shape the manuscript. Elizabeth N. Rudzki, Corinne L. Richards-Zawacki and Sara E. Kuebbing lead group discussions, facilitated communications and drove project stages and deadlines. Burhan Gharaibeh, Corinne L. Richards-Zawacki, David R. Clark, Elizabeth N. Rudzki, Kevin D. Kohl, Michel E. B. Ohmer, Mary J. Janecka, Martin M. Turcotte, Rachael Kramp and Sara E. Kuebbing contributed to group discussions, research and initial drafting of the manuscript. Talia Mastalski created the infographic figure and art used within it. Burhan Gharaibeh, Elizabeth N. Rudzki and Rachael Kramp created the Gantt chart. Kevin D. Kohl drafted the positionality box with input from all authors. Corinne L. Richards-Zawacki and Elizabeth N. Rudzki edited the manuscript with input from Burhan Gharaibeh, Martin M. Turcotte. and Sara E. Kuebbing. Elizabeth N. Rudzki edited and formatted the final manuscript draft in consultation with Corinne L. Richards-Zawacki.

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CONFLICT OF INTEREST

All authors declare that they have no conflicts of interest.

DATA AVAILABILITY STATEMENT

No data are used in this manuscript.

SUMMARY OF SUPPLEMENTAL FILES

Example field safety manual: We have provided an example field safety manual that was developed for a large biological sciences department. This manual is generic, so it can serve as a starting point for developing a field safety manual at any institution. This generic manual also includes various appendices to compliment the manual, including training scenarios for managing interpersonal conflicts in the field, a field safety incident log, a list of recommended safety equipment to keep in a field vehicle, a 'field safety plan' form that can be filled in before leaving on a field trip, a list of first aid kit essentials, and a document outlining steps to take if a medical emergency occurs in the field.

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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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