Introduction

Fieldwork is an exciting, challenging, and often important component of hydrologic research and graduate student training. Fieldwork provides first-hand experience in diverse natural and human-modified landscapes, contributing to a more holistic understanding of hydrologic processes. However, field-based research settings include unique barriers for inclusivity and safety which require special attention to ensure the well-being and success of all participants.

A key component to building inclusive and safe field settings is dedicating time to build trust, identify participants needs, and develop codes of conduct. This guide is intended to serve as a starting point for early-career researchers to explore the complexities of field-based research. To achieve this goal, we have defined six elements of field research, provided discussion questions, and consolidated resources to support each element. Importantly, we acknowledge that this is far from a comprehensive summary of all of the unique and complex components of field research. Drawing from fieldwork experiences in the hillslopes of California’s oak woodlands, intermittently dry stream beds in Alabama, and the terrestrial-aquatic interface in the Arctic, we hope this guide can help research groups discuss personal needs, concerns, and excitement for field-based research.

1. Physical, mental and social well-being

Conducting fieldwork comes with the inherent risks of working outside in often remote locations. Accidents, falls, wildlife, and physical exhaustion can all pose risks while in the field. Fieldwork is not only physically demanding but can also be emotionally taxing. Fieldwork often necessitates long hours under harsh conditions working closely with the same people day in and day out. Particularly if you’re staying at a field station for long periods, many people can feel isolated and out of their routines, which can compound mental health challenges (e.g., anxiety, depression, etc.). In addition, to physical and mental health challenges, it is important to consider how the team can ensure the overall well-being for all participants. For minoritized groups, threats to safety and well-being historically have ranged from microaggressions to personal violence from people within or outside the working group. To help prevent and prepare for some of these challenges, we recommend discussing with your research group:

Discussion questions

• What are the field safety considerations for our site? What are our field safety plans? How often should we revisit them?

• How comfortable are research group members with being alone in the field? What are the limits? How do we accommodate this with fieldwork schedules?
Discussion questions (cont.)

• What is the accessibility of the field site and individual field tasks? How can we improve accessibility to ensure that all participants are engaging meaningfully?

• How can we build an equitable sampling schedule? Are we accounting time for breaks and time off in this schedule?

• How do your personal and social identities influence your safety needs in the field?

• What do you need to be supported (e.g., personal time in the evenings, a way to contact your support structure, daily check-ins, special snacks, etc.)?

Further resources related to this topic

• Field safety plan template: https://scholars.unh.edu/ersc/218/


• FieldFutures: https://www.fieldfutures.org/workshop

2. Power and positionality

Power dynamics and positionality exist within the structure and function of science. Therefore, understanding how power and positionalities operate is essential to ensuring a safe and equitable working environment. Power dynamics relate to how authority is distributed across a team, and positionality refers to how the components of one’s personal identity (e.g., gender, race, class, geographical location, etc.) interact to influence how they experience the world. Together, these internal and external factors determine how members of a team interact with one another, and can influence how decisions get made (and who is accounted for in those decisions). Given the especially inherent power hierarchy in academia, it is incredibly important to assess your boundaries and be ready to advocate for yourself. Friction often occurs within field teams when researchers’ boundaries and comfort levels are not accommodated and can lead to negative field experiences. This is where – as with all team efforts – communication is key. Understanding what you are and are not comfortable with is the first step. Additionally, establishing team norms for how decisions will be made with all team members in mind, and communicating these decisions in an effective and timely manner is important. To start establishing these group norms, we recommend open and iterative discussions of the following with your group:
3. Collaboration

Science is a team sport and field work often necessitates collaboration within your lab group and research teams. This can be one of the most exciting parts of field work when you can work with science friends, but it can also be challenging to manage group dynamics and expectations. Ensuring everyone’s ideas are heard, individual roles are clear and the project schedule is outlined effectively, is essential for effective collaboration across lab members and research teams. We encourage you to discuss the following with your collaborators:

Discussion questions

• What are the values of good collaboration?

• What are everyone’s roles and expectations of each other on the project?

• What is our timeline for completing this project’s short and long term goals?

• What are the goals that must be accomplished by the end of the project? (i.e., non-negotiable deliverables), and who will be responsible for them?

• What constitutes authorship (e.g., order)?

Further resources related to this topic

• [https://elephantinthelab.org/manifestations-of-power-abuse-in-academia-and-how-to-prevent-them](https://elephantinthelab.org/manifestations-of-power-abuse-in-academia-and-how-to-prevent-them)

• Field Inclusive general resources: [https://www.fieldinclusive.org/resources/](https://www.fieldinclusive.org/resources/)

• AdvanceGEO resources for equitable fieldwork: [https://serc.carleton.edu/advancegeo/resources/field_work.html](https://serc.carleton.edu/advancegeo/resources/field_work.html)
4. Expect the unexpected

While every field visit will have defined objectives, be prepared for and learn to be comfortable with the unexpected. In your field experiences, many things may not go according to plan, which is okay! The act of making a plan, getting organized, and communicating your plan to others is only the first part. The next part of “doing science” is overcoming your feelings of failure when plan A (or B or C) don’t go as expected. It requires allowing yourself and others to make and learn from mistakes. Trust the process – your plan may fall apart but your story will come together. We encourage you to consider with your research group:

Discussion questions

• What supplies or protocols would improve our ability to overcome unexpected situations? (e.g., toolbox with defined miscellaneous items)

• Mentor-mapping for field settings: Who in the field is there to support when things don’t go according to plan? How can you contact them if something goes awry (e.g., mode, frequency)?

• Normalizing: Members of the lab share a time when they needed to be flexible in a field or lab setting. What did you learn from this experience and how does it apply to our fieldsite?

Further resources related to this topic

• Kamini Singha’s “No-nonsense advice” for early career hydrologists

5. The importance of place and ethics in field-based research

Field sites are special places that scientists investigate to understand how the world works. However, the place that you use as your “natural experiment” is part of a larger ecosystem and is the home of or connected to local stakeholders/rightsholders. While you may develop a sense of ownership or responsibility toward your fieldsite, remember that you are often a visitor. The data collected and shared from the field must follow the FAIR (Findable, Accessible, Interoperable, Reusable) and CARE (Collective benefit, Authority to control, Responsibility, Ethics) principles. To consider how you can conduct your field-based research with the importance of place and ethics in mind, we encourage you to discuss these questions:

Discussion questions

• Do we have the right permits, permissions, and collaborations to effectively start field work at this site?

• How can we incorporate both the FAIR and CARE principles into our research protocols and lab culture?

• How do our field-based research questions fit into the context of the surrounding ecosystems and communities needs?

• Once the fieldwork is complete, how will we ensure the instrumentation is either maintained or cleaned-up to minimize scientific waste?

• How does the local community know we are researchers (i.e., labeled lab truck)?

• How do we communicate our field work findings to stakeholders across different stages (i.e. collecting data and disseminating findings).

Further resources related to this topic


• FAIR principles: https://www.go-fair.org/fair-principles/

• CARE principles: https://www.gida-global.org/care

• Decolonizing methodologies. Dr. Linda Tuhiwai Smith
6. Overcoming the feelings of “drowning in data”

Field data is often time sensitive (e.g. event-scale) and difficult to interpret with a single dataset alone, creating pressure to collect as much data as possible. Many field scientists describe feelings of not having “enough” data, then having “too much” data, with the added challenge of constantly interrogating the data quality. Finding the balance between ensuring that you are collecting the appropriate datasets for your research questions, maintaining proper data management practices, and preventing burn-out takes time! We encourage you to consider with your research groups:

**Discussion questions**

- Define and consistently revisit the “why” and “how”: Why are you collecting this dataset? How are we going to collect the data to meet our goals? (e.g. frequency, locations)

- Acknowledging the time and effort it takes to collect field data: Does collecting this dataset reduce your capacity to collect another? Are there solutions? (e.g., increase support, decrease frequency)

- Can we utilize other tools (e.g. models) to inform further field data measurements? Conversely, if this field data can be useful for a model what is needed?

- Once the data is collected, what are the next steps and time expectations to ensure proper data management and care for the lab equipment (e.g., cleaning protocols)?

- Normalizing: Have your PI and lab members share datasets that were collected but not used. Why was it collected? Why wasn’t it used?

**Further resources related to this topic**


**Conclusion and personal notes from the authors**

Field work is a central component of the hydrologic sciences that is essential to advance our process-based understanding. In addition, fieldwork experiences are often the most rewarding and memorable times of research and education. While every field site, team, and experience is unique, there are many commonalities in the struggles and successes early career researchers can experience. This guide is just a starting place for discussions, but early career researchers should remember that they are not alone and have resources (outlined here) and a support network they can lean on (reach out to H3S!).
Conclusion and personal notes from the authors (cont.)

My name is Amanda Donaldson, and I am a 6th year PhD candidate from the University of California, Santa Cruz. I established and managed “Arbor Creek Experimental Catchment” in a California oak woodland. During my PhD, I “storm-chased” to ensure we were collecting water samples and accurate discharge data. However, this also included a fair bit of getting trucks stuck in mud and “missing” rain events because I felt unsafe to traverse down to the stream. Here, I am showing a picture of me shoveling out a laughable amount of debris that collected in Arbor Creek after a BIG rain event. My advice to any early-career field-scientist is to celebrate the small successes. After each field day when we fixed an issue we would go get milkshakes. Over the last 6 years, I’ve had a lot of milkshakes…

My name is Cheristy Jones, and I am a 3rd year PhD candidate from the University of New Hampshire. My PhD research takes place in Arctic Sweden and Greenland. Over the past two summers, I have explored the spatial variability of aquatic CO2 and CH4 fluxes which has meant carrying equipment up steep mountains, across tundra, and paddling through wind storms. This picture was taken at our last sampling site after a long day hiking through the Swedish mountains collecting water samples. I am standing in water up to my knees because every path down seemingly ended in a wetland but I was so excited to have had such a successful first sampling day. My advice to new field-scientists is to take time to explore the place where you work. Whether that means hiking nearby or visiting a local cafe or shop, experiencing a new location with my collaborators turned good friends is a special experience that has made me appreciate my research and field work even more.

My name is Delaney Peterson, and I am a 4th year PhD candidate from the University of Alabama. My research is focused on the patterns of stream intermittency in the Southeast. As a part of my PhD, I have installed and managed the hydrologic instrumentation across four research watersheds for a large interdisciplinary project. This meant babysitting a LOT of sensors that lived in a LOT of different places, but it also meant that I got to spend a lot of time working in the field and experiencing these watersheds across a variety of conditions, which has been incredibly valuable. This picture is of me after I installed the first stilling well and piezometer at the outlet of one of the research watersheds (little did I know, I would have to reinstall both of these a number of times across the project…), and I was excited to see what the rest of these sites and sensors would look like. My advice to early-career field scientists is to take your time (and try to enjoy your time) doing fieldwork. It always feels like there’s so much to do, so much data to collect, and such little time to do it, so try to slow down and take advantage of the time you’re spending with your collaborators in a place that is special to so many people.