

Summative Evaluation:

RCN-UBE: Building capacity for evidence-based undergraduate field experiences Undergraduate-Field Experiences Research Network (U-FERN)

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Introduction to UFERN

The *RCN-UBE: Building capacity for evidence-based undergraduate field experiences Undergraduate-Field Experiences Research Network (U-FERN)* sought to build a vibrant, supportive, and sustainable collaborative network that fosters effective undergraduate field experiences. This goal was addressed through four objectives:

- Identifying and sharing evidence-based models and practices for engaging a diverse range of undergraduates in effective field and marine learning experiences.
- Identifying, modifying, developing, and sharing assessment tools for understanding the impact of field and marine learning experiences on undergraduate student learning, STEM identity, and career trajectories.
- Investigating how undergraduate field experiences may help broaden the participation and retention of students from different ethnic racial groups and physical disabilities who are currently underrepresented in field-based sciences such as marine ecology, ecology and geosciences.
- Establishing undergraduate learning experiences at field stations and marine labs as “interdisciplinary laboratories” for researching evidence-based practices in undergraduate research, service learning, and place-based education.

The UFERN project consisted of the leadership team (5 members), Steering Committee (7 members), and Network participants (156 members). For the latter group, an individual was considered a Network member if they attended at least one of three Network meetings that occurred before this report was completed. To recruit Network members, the leadership team and Steering Committee recruited professionals through various organizations including the National Association of Marine Laboratories (NAML), Organization of Biological Field Stations (OBFS), Long-Term Ecological Research (LTER) network, the Ecological Society of America, the National Association of Geoscience Teachers, large research institutions, community colleges, and Historically Black Colleges and Universities. Invitations were also sent to individuals with expertise relevant to UFERN. The professionals included researchers, faculty, and staff of geology field camps, extended field courses, and field-based research experiences that targeted undergraduate students.

Through the five-year UFERN grant, the project team led or facilitated multiple Network activities as listed below:

- Four Network meetings
 - April 30 to May 2 2018 at the Kellogg Biological Station (28 attendees)
 - October 15 to 18 at the H.J. Andrews Experimental Forest (28 attendees)
 - March 1 to 5 2021 virtual (144 attendees).
 - January 27 to 28, 2022 (123 attendees)
- Nine recorded webinars (404 attendees with more likely watching later); these included a webinar on developing virtual field trips with 227 attendees hosted during the COVID pandemic.
- Three Community Conversations (with over 100 attendees) and two Ecological Society of America (ESA) Water Cooler Chats (~100 attendees).
- Six working groups focused on development of UFERN resources.

The project resulted in multiple products. Several key products are listed below:

- UFERN Model (previously called a “framework”), which provides a tool for designing and studying student-centered undergraduate field experiences (O’Connell et al., 2022)
- Assessment tool for understanding and evaluating outcomes of undergraduate field experiences (Shortlidge et al., 2021)
- Article in the Ecological Society of America (ESA) that emerged from a session at the 2019 ESA Conference Inspire Session (Morales et al., 2020)
- Eight collaborative, peer-reviewed publications on engaging community college students in field learning (<https://ufern.net/publications/>)
- Various UFE resources including, PowerPoints from UFERN Network meetings, and a listing of relevant publications (produced through UFERN and elsewhere)
- Presentation/workshops at nine practitioner meetings (six workshops or sessions at OBFS conferences between 2018-2021, one poster at the Earth Educator Rendezvous in 2020, and two at the ESA conference including the 2019 ESA Inspire Session with over 100 participants)

Finally, the leadership team and Steering Committee made plans for sustainability of the Network beyond the funding period.

Evaluation, Targeted Outcomes and Data Collection

Dr. Cathlyn Davis served as the evaluation advisor of the UFERN project. She was also the evaluator on UFERN supplemental project, which centered on developing and implementing a professional learning community; that effort is summarized in a separate report.

As described in the proposal, the evaluation objectives of the UFERN Network were to:

- Conduct a landscape analysis to understand and inform the project team and steering committee of the current programming and assessment efforts around extensive undergraduate field experiences;
- Provide ongoing formative data to help project leaders and core members understand the evolving network for informing practice through an integrated and iterative formative evaluation;
- Document the impacts of the project, including activities and products among core membership as well as awareness of the network within the broader undergraduate STEM education field.

The project leaders conducted the landscape analysis, which characterized the nature of extended field programs, collection of evidence by these programs and a sense for their design, and resulted in a peer-review publication (O’Connell et al. 2020). Dr. Davis reviewed and provided recommendations on early drafts of the manuscript. After each network meeting, the project leaders administered a brief online questionnaire to gather feedback. Based on these data and attendance of Network and Steering Committee meetings, Dr. Davis provided suggestions for refinement of future gatherings and associated materials. Finally, Dr. Davis designed an online post-Network questionnaire, which asked respondents to report and reflect UFERN activities and value for UFEs (see Appendix for the questionnaire). It was administered between November 2, 2011 and December 13, 2021 with recruitment and reminder emails sent to 156 Network members who had attended at least one Network meeting. It was administered before the fourth network meeting because COVID forced the team to reschedule this final meeting close to the end of the grant window).

The next section provides a summary of key findings from the post-Network questionnaire, while the following section has a more detailed description of these findings. Note that a second and separate questionnaire was administered at the fourth and final meeting with 54 members completing some portion (35% response rate); a brief summary of this separate questionnaire is provided in Appendix 2.

Summary of Key Findings

Questionnaire respondents tend to work at institutions that were either research focused or primarily undergraduate. Most were STEM education researchers (i.e., social and behavioral scientists who work in place-based education, undergraduate STEM education, learning sciences, education psychology or related fields) or instructors of UFEs (i.e., faculty or other educators leading STEM- and field-based undergraduate research experiences, field courses or other similar programs). For most, the STEM focus was ecology and environmental science. Many identified as female and white/European American. Most attended at least two Network meetings.

As members of the UFERN Network, questionnaire respondents reported that they received two clear benefits that directly supported their work with UFEs. First, almost all made connections with other

members. The number of connections varied from just a few to over 20 but most were formed during their UFERN experience. Most of these connections centered around talking with other members during Network meetings but some also worked with and collaborated with other members on UFERN related activities. Second, respondents used and shared UFERN products to support themselves and others in their work related to UFEs. The most valuable products were the UFERN peer-reviewed articles, UFERN webinars, and the UFERN Framework.

Evidence of the impact of the UFERN experience is readily apparent in respondents' high rating of the value of the Network and tools. Many reported learning something new, thinking they could apply this new information, and actually applying it. This new learning included gains in understanding, skills, resources and ideas along with connections and dialogues to likeminded UFE professionals. For example, the UFERN Model helped respondents consider various elements as they developed/ revised UFEs, such as outdoor constraints, safety, accessibility, and student contextual factors. Although preliminary, a few even reported positive impacts from these applications and dramatic changes in their thinking about UFEs.

Overall, questionnaire respondents praised many aspects of the UFERN Network, including the high quality of the resources and activities. Given these accolades, it is not a surprise that almost all indicated that they would remain involved in the UFERN Network beyond the funding period—particularly through continuing to use and share UFERN products and maintaining informal discussions with other UFERN members.

Detailed Findings

The first section below provides a summary of 54 UFERN Network members who completed some or all portions of the questionnaire. The remaining sections provide other data on connections with other members, using and sharing UFERN products, value of UFERN experience, and ongoing UFERN involvement.

Questionnaire respondents

About 80% of respondents worked at institutions that are research focused and/or primarily undergraduate (Table 1). The less common home institution types were Hispanic-serving (9%); community college, historically black college or university, and tribal college or university (each 3%); and Alaska Native or Native Hawaiian-Serving (2%).

Table 1: Respondents' home institution type

	Percentage	Count
Research focused	52.31%	34
Primarily undergraduate	27.69%	18
Community college	3.08%	2
Historically black college or university	3.08%	2
Hispanic-serving institution	9.23%	6
Tribal college or university	3.08%	2
Alaska Native- or Native Hawaiian-Serving Institutions	1.54%	1
Total	100%	65

As shown in Table 2, most respondents were STEM education researchers (33%) or instructors of undergraduate field courses, research experiences or other field learning program (35%). Some were also directors of undergraduate field programs (17%) and leaders of professional networks, associations or societies (15%). As shown in Table 3, just under half listed their disciplinary area as ecology/environmental science (26%) and biology (20%). Additional disciplinary areas were geology (13%) and oceanography, marine science and marine biology (12%), botany and plant science (5%), and atmospheric/climate science. Under “Other” (9%), they also listed geography, education, evolution, biology education research, and environmental studies.

Table 2: Respondents’ UFE Role

UFE Role	%	Count
An instructor of an undergraduate field course, research experience, or other field learning program	34.57%	28
A director of an undergraduate field learning program	17.28%	14
A STEM education researcher	33.33%	27
A leader in a professional network, association, or society	14.81%	12
Total	100%	81

Table 3: Respondents’ disciplinary areas

	%	Count
Atmospheric or Climate Science	2.60%	2
Geology	12.99%	10
Oceanography/Marine Science/Marine Biology	11.69%	9
Ecology & Environmental Sciences	36.36%	28
Archaeology	1.30%	1
Biology	20.78%	16
Botany & Plant Sciences	5.19%	4
Other (please list)	9.09%	7
Total	100%	77

About two-thirds of respondents stated that they identified as female with about a quarter identifying as male (Table 4). Eight percent selected “Other” or “prefer not to answer”. As listed in Table 5, most respondents were white/European American (72%) with the rest identifying as or also as Latino(a)/Hispanic (9%), Asian American/Asian (2%), and Native American/American Indian/Alaskan Native (2%).

Table 4: Respondents’ gender identity

	%	Count
Female	66.00%	33
Male	26.00%	13
Transgender	0.00%	0
Non-binary	0.00%	0
Other (Please describe)	2.00%	1
Prefer not to answer	6.00%	3
Total	100%	50

Table 5: Respondents' race/ethnicity

	%	Count
African American/Black or African descent	3.77%	2
Asian American/Asian (East, South, Southeast)	1.89%	1
Hawaiian/Pacific Islander	0.00%	0
Latino(a)/Hispanic	9.43%	5
Native American/American Indian/Alaskan Native	1.89%	1
Middle Eastern/Arab American	0.00%	0
White/European American	71.70%	38
Other (please describe)	0.00%	0
Prefer not to answer	11.32%	6
Total	100%	53

Just under a two-third of members attended one of the three UFERN Network meeting (60%) with 18% attending two of these, and 8% attending all three (Table 6). Twelve percent (6 members) reported that they did not attend any Network meetings, which was surprising as the questionnaire was sent to members who attended at least one UFERN Network; we assume that these members made an error in their response or were engaged in the Network in some other ways.

Table 6: Respondents' attendance at UFERN Network meetings

	%	Count
0	12.24%	6
1	61.22%	30
2	18.37%	9
3	8.16%	4
Total	100%	49

Connections among UFERN members

All but one respondent made connections with other members during their UFERN experience (Table 7). Number of connections varied with about a third who had three or fewer connections, about a third who had four to nine connections, and about a third who had 10 or more connections. For about two-thirds of members, most (24%) or all (40%) of these connections with other members were made during their UFERN participation (Table 8). For 13% and 15%, about half or only a few of these connections were made during their participation, respectively. Only about 8% did not make a new connection during the UFERN experience.

Table 7: Number of connections made during UFERN Network involvement

	%	Count
None	1.85%	1
1	7.41%	4
2-3	25.93%	14
4-6	14.81%	8
7-9	18.52%	10
10-14	7.41%	4
15-19	3.70%	2
More than 20	20.37%	11
Total	100%	54

Table 8: Number of connections from Table 7 that were made during the UFERN experience

	%	Count
None	7.41%	4
A few	14.81%	8
About half	12.96%	7
Most	24.07%	13
All	40.74%	22
Total	100%	54

There was also a lot of variation in terms of the type of connections (Table 9). Most common were the least in-depth connections that involved “talking” with other members (55%); specifically, talking with other members during network meetings (24%), outside of network meetings (19%), and to brainstorm on a UFERN product (12%) (Table 9). Somewhat common were moderately in-depth connections that involved “working” with other members (27%); specifically, working with other members to further brainstorm ideas (12%), on a UFERN committee (6%), and on a working group (6%). Least common were the most in-depth connections that involved “collaborating” (17%); specifically collaborating with other members to co-develop and complete a UFERN product (7%), to co-lead a UFERN Community Conversation, webinar, or “water cooler” chat (4%), and to represent UFERN at a conference or workshop (6%).

Table 9: Type of UFERN connections among members

	%	Count
Talked with other members about UFERN topics during UFERN network meetings	24.43%	43
Talked with other members about UFERN topics outside of UFERN network meetings	18.75%	33
Talked with other members to brainstorm ideas for a UFERN product (i.e., teaching resource, presentation, proposal, manuscript) during a UFERN network meeting	11.93%	21
Worked with other members to further brainstorm product ideas (i.e., teaching resource, presentation, proposal, manuscript) outside of UFERN network meetings	11.93%	21
Worked with other members on a UFERN committee (i.e., steering committee, network organizing committee, sustainability committee)	6.25%	11
Worked with other members on a working group (e.g., mentoring, assessment, community college, 'what is the field?' group)	9.09%	16
Collaborated with other members to co-develop and complete a UFERN product (i.e., teaching resource, proposal, manuscript, report)	7.39%	13
Collaborated with other members to co-lead a UFERN Community Conversation, webinar, or “water cooler chat”	3.98%	7
Collaborated with other members to represent UFERN by giving a conference or workshop presentation	6.25%	11
Total	100%	176

Use and sharing of UFERN products

Respondents used the various UFERN products in their UFE efforts (Table 10). The most commonly used products were UFERN peer-reviewed products (23%) and UFERN webinars (20%). They also used the UFERN Model (15%) and non-UFERN articles and weblinks provided at the March 2021 meeting (14%). The least commonly used were the UFERN landscape study report, assessment tools table and PowerPoints from the March 2021 meeting (10% for each one).

Table 10: UFERN products used and shared by members

	Use in your work		Shared with colleagues	
	%	Count	%	Count
UFERN peer-review articles (see this link for a list of papers)	22.56%	30	26.67%	24
UFERN Landscape Study Report (see this link for the Report)	9.77%	13	10.00%	9
UFERN Model (aka UFERN Framework) (See this link for a poster of the Model, which is now included in the O'Connell et al. article)	15.04%	20	21.11%	19
UFERN Table of Assessment Tools (see this link for the Table, which is now included in the Shortlidge et al. article)	9.77%	13	11.11%	10
UFERN webinars (live or recorded) (see this link for recordings)	19.55%	26	15.56%	14
UFERN PowerPoints from March 2021 UFERN meeting (see this link for PowerPoints)	9.77%	13	5.56%	5
Non-UFERN articles and weblinks shared at March 2021 UFERN meeting (see this link for articles/weblinks)	13.53%	18	10.00%	9
Total	100%	133	100	90

They also shared UFERN products, which followed a somewhat similar pattern as use. The most commonly shared products were the UFERN peer-reviewed articles (27%) and the UFERN Model (21%). They also shared the UFERN webinars (16%). They only infrequently shared non-UFERN articles and March 2021 weblinks, landscape study report, assessment tools table and March 2021 PowerPoints.

Value of UFERN experience to members

Almost three-fourths of respondents rated the overall UFERN experience as high value (48%) to very high value (24%) in terms of connecting to likeminded professionals and fostering UFEs (Table 11). Twenty-two gave it medium value. Only eight percent gave it low value, and none gave it very low value. Similarly, a majority rated the UFERN tools as high value (46%) and very high value (22%). Again, 22% gave it medium value. Only 10% gave it low value (8%) and very low value (2%).

Table 11: Respondents’ rating of value in connecting to others and tools within UFERN

	Overall value in connecting with others in UFERN to collaborate on UFEs		Overall value of UFERN tools to improve work with UFEs	
	%	Count	%	Count
Very low value	0.00%	0	2.00%	1
Low value	6.00%	3	8.00%	4
Medium value	22.00%	11	22.00%	11
High value	48.00%	24	46.00%	23
Very high value	24.00%	12	22.00%	11
Total	100%	50	100%	50

We asked respondents to reflect on gains in the context of five types of values (Table 12). The most common were “immediate value” (learning something new about UFEs, 28%), “potential value” (learning something new that may be applied to work, 25%), and “applied value” (learning something new that was applied, 26%). Somewhat common were “realized value” (learning and applying something new and see a positive impact, 12%) and “reframed value” (learning something that dramatically changes thinking, 9%). The next five subsections describe examples of each type of value provided by respondents.

Table 12: Respondents' rating of five types of value with regard to the UFERN Network

	%	Count
I learned something new about UFEs (immediate value)	28.45%	33
I learned something new about UFEs that I think can apply in my work (potential value)	25.00%	29
I learned something new about UFEs that I did apply in my work (applied value)	25.86%	30
I learned something new about UFEs that I applied in my work and saw a positive impact on my students (realized value)	12.07%	14
I learned something new about UFEs that has dramatically changed how I think about and/or do this work (reframed value)	8.62%	10
Total	100%	116

Immediate value

Questionnaire respondents gained immediate value through new understandings, skills, resources and ideas from the UFERN experience. Their examples of this value included learning about effective recruitment, mentoring and inclusivity. As one member noted,

I learned something new about UFEs. I will strive to increase inclusivity in my UFEs and recognize the challenges some students have. I will also encourage more student input to strengthen the experience for all students and the instructor.

Several pointed to benefits of connecting with and hearing from a community of likeminded professionals, such as these three:

Before I attended the UFERN conference I didn't know any other researchers who were studying UFE's. After attending, I learned that many researchers are (like me) interested in rigorously studying affective outcomes of UFE's and that we are all eager to contribute to the body of literature on UFE's so that we can understand and document their importance and value to the broader STEM education community.

I learned about the diverse offerings across institutions that I can refer students to seek out.

I think it is always useful to hear about other experiences which may lead to thinking about our programs differently.

Another respondent echoed this benefit along with the value of understanding the theoretical foundations underlying effective UFE approaches:

I learned a lot of new science being done on undergraduate field experiences. I've been attending the society for the advancement of biology education research (SABER) meetings for around 5 years now and, while I value that community, I felt like there were so many exciting areas for research in biology education surrounding undergraduate field experiences. I was happy to discover a vibrant community in UFERN where I learned a lot about the state of the field (and felt less alone in studying undergraduate field courses).

Another member also highlighted gaining an appreciation for developing community among students in their UFE:

I learned the value of developing a sense of community and a sense of belonging with my undergraduate students during our undergraduate field experiences and saw a positive impact on them.

Four members pointed to the value of tools, highlighting tools associated with engaging students in research experience and assessment. For example, one stated,

In working with the Assessment working group, I became aware of new assessment instruments that I can use in my field based courses.

Potential value

Respondents saw the potential to apply what they learned in UFERN to their UFEs. Some applied what they learned from other attendees, such as this example:

I learned something new that I can apply to my work. I chose this because at the workshops and webinar I learned what others were doing and was able to take pieces of it to apply to my own field courses. [H]aving a variety of information made it easier to apply pieces.

Others pointed to presentations on effective practices that they planned to apply, as described in this example:

I also learned about the value of building in breaks and unstructured time during UFE's (something I intuitively understood and valued as a student, but as an instructor, I sometimes feel pressure to maximize the time spent in the field)-- I took home an important reminder from the conference that students

need breaks, and students value unstructured time in the field as much as structured 'lab' time.

Two mentioned the potential use of UFERN resources in supporting UFEs and related activities, as described here:

I am the assistant director of a small field station and plan to use the UFERN framework when planning future UFEs.

My work is on the fringe of undergraduate research experiences (I mentor an[sic] undergraduate internship and k-12 teacher research experiences) but the UFERN network offers resources that support this work and give me guidance in my overall role with LTER and our biological station.

Applied value

Respondents highlighted applied value in the context of the field components of their experiences (e.g., outdoor constraints, safety, accessibility, student contextual factors) as illustrated in these examples:

I think the UFERN experience helped me focus on the field component of my course, and really how to emphasize that within the constraints of our semester, student demographic, and instructor dynamics. I think it is always useful to hear about other experiences which may lead to thinking about our programs differently

I have been working with our departmental faculty and staff to update our fieldwork health, safety, conduct, and well-being policies using materials and resources shared during the 2021 network meeting, particularly resources about safety and inclusion for students of color in the field

I'm in the process of developing more accessible field activities for a class where mobility is a barrier to participation (for someone in a wheelchair for example).

I learned much more about the student context factors and tried to bring some of that into a few small changes into my UFE this past summer, I can't wait to learn more and keep building on the experience for students

"Apply in my work"--Learned much more about the field context and the distinct aspects of field experience, which informed future iterations of surveys.

Two respondents brought up assessment as an applied value, stating:

The highest impact for me was the discussion of how to best assess changes made. This allowed me to more effectively tweek the different things I tried to the course to achieve the best learning outcomes.

"...that I applied in my work" UFERN showed me assessment tools and strategies that I hadn't used or considered. I found this very valuable. I also found the collaborations from UFERN participants to be very valuable.

Given the pandemic, it is not a surprise that two respondents reflected on applications in the context of virtual offerings:

I was introduced to work on virtual sense of place that I immediately applied in my own work on in-person sense of place.

Because I interacted with a person that taught me how to develop virtual field trips that could be useful during the pandemic and also had a wonderful discussion about how they can help inclusion in field work. I have not investigated the impact yet on my students.

Respondents also reported applications beyond UFEs including other context:

"I learned something new about UFEs and did apply in my work" would reference carrying some of the UFERN framework to other projects in which I am engaged. In other words, I found the UFERN approach useful in a[sic] different context (not a teaching situation, however).

I have shared articles and website links from UFERN members (e.g. Chris Atchinson, Nia Morales, Ajisha Alwin) with our instructional faculty as I ask them to make their classes more accessible for and accommodating of all students and with colleagues as we strive to make our website and promotional materials more welcoming for a diverse group of students.

I learned something new about UFEs that I did apply in my work". Participating in UFERN activities has introduced me to many new ideas about what UFEs look like, research from other disciplines that I was not previously aware of, and new ways to think about designing UFEs. I have directly applied this knowledge to ongoing research projects.

Realized value

A few respondents saw positive impacts on students based on the changes to their UFEs. One remarked on students' reflections on learning, while another mentioned virtual UFEs:

I had two different groups of undergraduate students and one graduate student involved in analyzing and synthesizing their learning into presentation for a UFERN meeting. The experience was invaluable for them to reflect on what they had learned, why it was important and how they could move forward. The graduate student actually changed MS graduate program from Immunology to Ecology as a result of his contacts with UFERN network.

I was able to learn about virtual field trips that I used during the pandemic but then had a discussion with the person that developed the methods about how to use them to be more inclusion. I have assess my students on the positive impact.

A third pointed to impacts associated both with implementing and leveraging tools:

I learned about the UFER[N] model for course design and also their assessment resources. Both were extremely valuable to me and also the RCN-UBE I lead. We have shared these materials with our network members (105 members) and have [had] UFERN leaders do webinars and come in the field with us. They have been tremendously supportive. We are extremely excited to leverage these UFERN tools to help us provide better UFE[s] and create more impact[ful] lessons. Personally, as a field ecologist interested in UFEs, working with Education scholars was extremely rewarding. I certainly hope we continue to collaborate with UFERN members in years to come.

Reframed value

Several respondents indicated that the UFERN experience dramatically changed how they think about UFEs. One person explained this a bit more, stating, "I have expanded how I think about UFEs and who should be part of them."

Ongoing UFERN Involvement

Almost all respondents indicated that they would remain involved in UFERN beyond the funding period (97%). Most thought this involvement would primarily consist of using/sharing UFERN products and continuing informal discussions with other UFERN members (33% and 32%, respectively). Some offered to help organize future meetings (16%), while a few said they would help raise funds (6%), organize a journal club (2%) or being involved in "other" activities (7%). These other activities centered on collaboration---ongoing study of UFER and partnership building between UFERN and the Organization of Biological Field Stations. Additional activities aligned with the provided choices (i.e., using UFERN tools

to efforts within freshwater field studies and promote UFERN). Only three respondents of the 111 who answered this question state they would not remain involved in UFERN (one due to retirement and one due to a lack of available time).

Table 13: Respondents’ interests in remaining involved in UFERN

	%	Count
Help to raise funds	6.31%	7
Help organize meetings	16.22%	18
Continue informal discussions with other UFERN members	32.43%	36
Use and share UFERN products	33.33%	37
Organize a journal club	1.80%	2
Other (please describe)	7.21%	8
I won’t remain involved in UFERN	2.70%	3
Total	100%	111

Final comments

In their final comments, respondents praised many aspects of UFERN and expressed excitement in continuing their collaboration with the Network. They highlighted the value of developing a deeper understanding of how people learn:

UFERN was a wonderful opportunity for students and myself to delve deeper into how people learn and apply ecological and environmental concepts.

They highlighted the helpfulness of the resources as indicated by these two comments:

Loved my experience with the UFERN PLC and found the guided home-works and group discussions invaluable to transforming my UFE!

I feel so fortunate to have "found" this network. It was an amazingly rich resource for my personal growth and knowledge and that of our field program.

Finally, they highlighted the efficient and effective organization and delivery of the UFERN experience, as described by these two comments:

I only attended one UFERN meeting (I didn't know about it prior to that meeting) but it was the most thoughtfully organized and interactive virtual meeting that I've attended. I interacted with more UFE researchers and instructors that I ever have before, and felt welcome and included in the community. I left the meeting feeling like I could possibly continue to study UFE's (and teach them) and felt inspired to continue the work I am currently doing as a postdoc in my career. Seeing other researchers and field

instructors doing what I am doing was inspiring, educational, and made me feel welcome-- I am very grateful for the time that I have been involved.

Having been to numerous virtual meetings and workshops over the past 18 months, the 2021 UFERN meeting was easily one of the best organized, collaborative, and most informative that I attended. I especially appreciated the cross-disciplinary focus and the opportunity to network with field instructors and education researchers from disciplines outside of my own.

References

Morales, N., O'Connell, K. B., McNulty, S., Berkowitz, A., Bowser, G., Giamellaro, M., & Miriti, M. N. (2020). Promoting inclusion in ecological field experiences: Examining and overcoming barriers to a professional rite of passage. *The Bulletin of the Ecological Society of America*, 101(4), e01742. <https://doi.org/10.1002/bes2.1742>

O'Connell, K., Hoke, K., Berkowitz, A., Branchaw, J., & Storksdieck, M. (2020). Undergraduate learning in the field: Designing experiences, assessing outcomes, and exploring future opportunities. *Journal of Geoscience Education*, 69(4), 1-14. <https://doi.org/10.1080/10899995.2020.1779567>

Shortlidge, E. E., Jolley, A., Shaulskiy, S., Geraghty Ward, E., Lorentz, C. N., & O'Connell, K. (2021). A resource for understanding and evaluating outcomes of undergraduate field experiences. *Ecology and Evolution*, 1–22. <https://doi.org/10.1002/ece3.8241>

APPENDIX

Appendix 1

UFERN post questionnaire

Q1 Thank you for participating in UFERN. We are interested in understanding UFERN impacts on its members, which includes you! Thus, we ask you to complete this short questionnaire with your perspective and feedback by November 24.

In this questionnaire we use the following terms:

UFERN: Undergraduate Field Experiences Research Network

UFE: Undergraduate Field Experience

UFERN members: Anyone who has participated in at least one UFERN network meeting prior to Nov 2021.

UFERN connection: Any dialogue or joint activity about UFERN-related topics between members

To protect your identity, I will be the only person who will see your individual responses, and I will only share a summary of responses with the UFERN team.

Thanks for taking the time!

Cat Davis

Q2 About how many other members did you connect with while being involved in the UFERN Network? Recall we define “connection” as any dialogue or joint activity about UFERN-related topics between members.

- None (1)
- 1 (2)
- 2-3 (3)
- 4-6 (4)
- 7-9 (5)
- 10-14 (6)
- 15-19 (7)
- More than 20 (8)

Q3 Of these, about how many were new connections made during your UFERN participation?

- None (1)
- A few (2)
- About half (3)
- Most (4)
- All (5)

Q4 What kinds of UFERN connections did you make with other members? Select all that apply.

- Talked with other members about UFERN topics *during* UFERN network meetings (1)
- Talked with other members about UFERN topics *outside* of UFERN network meetings (2)
- Talked with other members to brainstorm ideas for a UFERN product (i.e., teaching resource, presentation, proposal, manuscript) *during* a UFERN network meeting (3)
- Worked with other members to further brainstorm product ideas (i.e., teaching resource, presentation, proposal, manuscript) *outside* of UFERN network meetings (4)
- Worked with other members on a UFERN committee (i.e., steering committee, network organizing committee, sustainability committee) (5)
- Worked with other members on a working group (e.g., mentoring, assessment, community college, 'what is the field?' group) (6)
- Collaborated with other members to co-develop and complete a UFERN product (i.e., teaching resource, proposal, manuscript, report) (7)
- Collaborated with other members to co-lead a UFERN Community Conversation, webinar, or "water cooler chat" (8)
- Collaborated with other members to represent UFERN by giving a conference or workshop presentation (9)

Q5 Select the UFERN products that you have used in your own work. Select all that apply.

- UFERN peer-review articles (see this link for a list of papers) (1)
- UFERN Landscape Study Report (see this link for the Report) (2)
- UFERN Model (aka UFERN Framework) (See this link for a poster of the Model, which is now included in the O'Connell *et al.* article) (3)
- UFERN Table of Assessment Tools (see this link for the Table, which is now included in the Shortlidge *et al.* article) (4)
- UFERN webinars (live or recorded) (see this link for recordings) (5)
- UFERN powerpoints from March 2021 UFERN meeting (see this link for powerpoints) (6)
- Non-UFERN articles and weblinks shared at March 2021 UFERN meeting (see this link for articles/weblinks) (7)

Q6 Select the UFERN products that you have shared with colleagues. Select all that apply.

- UFERN peer-review articles (see this link for a list of papers) (1)
- UFERN Landscape Study Report (see this link for the Report) (2)
- UFERN Model (aka UFERN Framework) (See this link for a poster of the Model, which is now included in the O'Connell *et al.* article) (3)
- UFERN Table of Assessment Tools (see this link for the Table, which is now included in the Shortlidge *et al.* article) (4)
- UFERN webinars (live or recorded) (see this link for recordings) (5)
- UFERN powerpoints from March 2021 UFERN meeting (see this link for powerpoints) (6)
- Non-UFERN articles and weblinks shared at March 2021 UFERN meeting (see this link for articles/weblinks) (7)

Q7 What was the overall value of UFERN in connecting you with other professionals to collaborate on fostering effective UFEs? Recall we define UFE as undergraduate field experience.

- Very low value (1)
- Low value (2)
- Medium value (3)
- High value (4)
- Very high value (5)

Q8 What was the overall value of UFERN in providing you with tools (i.e., new knowledge, skills and/or resources) to improve your work around UFEs?

- Very low value (1)
- Low value (2)
- Medium value (3)
- High value (4)
- Very high value (5)

Q9 What specific value have you gained from participating in UFERN in terms of UFEs? Select all that apply.

- I learned something new about UFEs (1)
- I learned something new about UFEs that I think can apply in my work (2)
- I learned something new about UFEs that I did apply in my work (3)
- I learned something new about UFEs that I applied in my work and saw a positive impact on my students (4)
- I learned something new about UFEs that has dramatically changed how I think about and/or do this work (5)

Q10 Pick one of the value statements that you selected in the previous question ("I learned something new about UFEs ..."), and briefly explain why you chose this statement.

Q11 UFERN's NSF funding ends by March 31, 2022. How do you see yourself involved with UFERN moving forward? Select all that apply.

- Help to raise funds (1)
- Help organize meetings (2)
- Continue informal discussions with other UFERN members (3)
- Use and share UFERN products (4)
- Organize a journal club (5)
- Other (please describe) (6) _____
- I won't remain involved in UFERN (7)

Q12 How many UFERN Network meetings did you attend? These meetings were on April 30 - May 2nd, 2018 (Kellogg Biological Station), October 15 - 18 (H.J. Andrews Experimental Forest), and March 1 - 5, 2021 (virtual).

- 0 (1)
- 1 (2)
- 2 (3)
- 3 (4)

Q13 What is your role in UFEs? Select all that apply

- An instructor of an undergraduate field course, research experience, or other field learning program (1)
- A director of an undergraduate field learning program (2)
- A STEM education researcher (3)
- A leader in a professional network, association, or society (4)

Q14 What is your disciplinary area(s)? Select all that apply

- Atmospheric or Climate Science (1)
- Geology (2)
- Oceanography/Marine Science/Marine Biology (3)
- Ecology & Environmental Sciences (4)
- Archaeology (5)
- Biology (6)
- Botany & Plant Sciences (7)
- Other (please list) (8) _____

Q15 What type is your home institution? Select all that apply.

- Research focused (1)
- Primarily undergraduate (2)

- Community college (3)
- Historically black college or university (4)
- Hispanic-serving institution (5)
- Tribal college or university (6)
- Alaska Native- or Native Hawaiian-Serving Institutions (7)

Q16 Which of the following best describes your gender identity. Select all that apply.

- Female (1)
- Male (2)
- Transgender (3)
- Non-binary (4)
- Other (Please describe) (5) _____
- Prefer not to answer (6)

Q17 What is your race/ethnicity? Please select all that apply.

- African American/Black or African descent (1)
- Asian American/Asian (East, South, Southeast) (2)
- Hawaiian/Pacific Islander (3)
- Latino(a)/Hispanic (4)
- Native American/American Indian/Alaskan Native (5)
- Middle Eastern/Arab American (6)
- White/European American (7)
- Other (please describe) (8) _____
- Prefer not to answer (9)

Q18 Is there anything else you would like to add?

Appendix 2

Summary of findings from a separate questionnaire of the fourth and final UFERN Meeting

The 2022 UFERN Network meeting, which took place virtually on January 27th and 28th, had 123 registered participants from all over the North American continent and over ten different disciplinary foci including ecology, geology, environmental studies, archeology, and learning sciences. The meeting was organized around highlighted speakers, critical conversations, workshops, a poster session, and networking opportunities. The meeting began with a speed networking session, followed by the kick-off with the keynote Julie Libarkin, who spoke on Transformative Justice in Field Research and encouraged deeper conversations in breakout groups. Workshop topics included: Diversity, Equity, Inclusion, and Access in undergraduate field experiences, mentoring, and ally skills. Special thanks go out to all the UFERN members who helped make the meeting a big success, especially the volunteer organizing committee: Alec Aitken, Amanda Robin, Meghan Cook, Sammy Nyarko, Carol Colaninno, Debbie Lichti, and Mallory Rice, and the panelists for the day two panel session about accessibility in undergraduate field education, Lisa Corwin, Angel Garcia, Amanda Marshall, and Chris Mead.

Meeting Evaluation

We present data below from two sources: 1) meeting registration which included questions about demographics, discipline, and institution type, and 2) meeting evaluation which included questions about affiliations with other professional organizations, meeting attendance and usefulness, interest in aspects of UFERN beyond the current NSF grant, and conduciveness of the meeting environment in supporting inclusivity, collaborations, and learning. The meeting evaluation was emailed twice to all individuals registered for the meeting. Twenty-five participants responded, a response rate of 20%.

Meeting Participants

For almost half of the individuals who registered (N=123), this was the first time they had attended a meeting or participated in a network event. There were almost 100 different institutions represented and the types of institutions varied; among those represented were Hispanic Serving Institutions (HSI), Historically Black Colleges and Universities (HBCU), Alaska Native and Native Hawaiian-Serving Institution (ANNH), community colleges, research intensive universities, and research centers. Most registrants identified as a STEM education researcher and/or an instructor or director of an undergraduate field course, research experience, or other field learning program. Responses from the meeting evaluation indicated that participants were affiliated with over 12 professional organizations, including the Organization of Biological Field Stations, National Association of Geoscience Teachers, Geological Society of America, and Ecological Society of America.

Value of the meeting

Feedback indicated that participants left the meeting with connections, information, or resources that they could apply to their work and that they felt the meeting was inclusive. Respondents indicated value in hearing the research, the workshops, and opportunities for networking. Illustrating aspects of the meeting that were reported most valuable is a word cloud generated in Qualtrics (Figure 1). One survey respondent shared the following about what aspects of the meeting were most valuable for them:

“Hearing from the breadth of participants. I was able to note ideas and practices from a bunch of different perspectives that I can adapt for my program. If it was just one discipline or just one focus for the talks, there'd be less I could take away.”



Figure 1. Aspects of the meeting reported as most valuable by the meeting evaluation respondents.

Moving Forward

While only a sampling of meeting attendees, the survey respondents all indicated some interest in involvement with UFERN moving forward. This involvement included using and sharing products, attending informal meetups, and continued informal discussions on undergraduate field experiences.

At the end of the wrap-up session on Friday, people shared through the Menti platform what they were going to do following the meeting. We have compiled and grouped responses to share with you below:

- Stay connected.
 - Emailing new connections
 - Involvement with an interest group
- Work on ally skills
- Grow professionally.
 - Reflect on practices and field accessibility
 - Read and learn more about undergraduate field experiences
 - Integrate UFERN capabilities and resources into professional associations
- Share resources and information from the meeting
- Submit a proposal
- Get outside!