Journal of International Agricultural and Extension Education

Volume 29
Issue 2 *29(2)*

Article 3

5-2022

Building Global Leaders through Field Research and Extension Experiences in Belize

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Recommended Citation

Gill, T., & Willcox, A. S. (2022). Building Global Leaders through Field Research and Extension Experiences in Belize. *Journal of International Agricultural and Extension Education, 29*(2), 24-42. https://doi.org/10.4148/2831-5960.1013

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Keywords

workforce development, cultural competency, study abroad, tropical agriculture, biodiversity conservation

Funding Source

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Introduction

Developing undergraduate students of agriculture and natural resources who can synthesize and address complex, transdisciplinary, global challenges is important for these students to become leaders in their field (Clancy, 2017; Easterly III et al., 2017). One of the most complex agricultural and natural resources challenges of our time is reconciling sustainable global food security and biodiversity conservation (Glamann et al., 2017). Effective experiential learning opportunities play an important role in developing technical and cultural competencies in students, so that they are prepared to address this challenge.

Undergraduate research and international experiences are important pathways for developing globally-minded graduates who can be the next generation of globally-competent US agriculture and conservation leaders (Moore et al., 2009). Undergraduate research brings opportunities for students to conduct mentored discovery, and help grow their own scholarly identity and intellectual vibrancy (Banks & Gutierrez, 2017; Howitt et al., 2010; Stebner et al., 2016). Such opportunities foster student originality, creativity, curiosity, independence, confidence, and problem-solving skills (Houser et al., 2013; Wilson et al., 2018). In turn, undergraduate research facilitates career clarification, enhanced interest and preparation for graduate school, and improved scientific research and discovery aptitude (Griswold, 2019; Hayward et al., 2017; Linn et al., 2015). Undergraduate research that involves fieldwork further enhances these personal and professional skills and competencies by placing researchers and the research in the context of local communities, challenging students to relate theoretical concepts and apply their practical skillsets to real-world settings (Fontanier et al., 2019; McLaughlin et al., 2018; Odera et al., 2015).

International experiences are a vital way to globalize the undergraduate experience. Such experiences help students to enhance critical-thinking skills, and broaden their global perspective by experiencing different worldviews (Butcher et al., 2017; Roberts et al., 2018). This also helps to increase students' sensitivity to diversity and sustainability issues (Bruening et al., 2004). As a result, students with international undergraduate experiences and cross-cultural skills in agricultural and natural resources sciences are very competitive as they enter the professional workforce in leadership roles (National Research Council [NRC], 2009; Vetter & Wingenbach, 2019).

There are multiple synergies when the high impact practices of undergraduate research and international experiences are integrated. International undergraduate field research allows students to go beyond the traditional study abroad classroom or study tour experience. International experiences require that students deal with uncertainty, and conducting field research is also inherently about understanding and dealing with uncertainty (McKeown, 2009). International field research experiences allow students to immerse themselves and adapt to unfamiliar sociocultural and geophysical environments, challenging them to apply their emerging skillsets in new ways (Houser et al., 2013). Individual mentorship is essential for encouraging students to integrate knowledge and concepts they have learned and applied (Houser et al., 2013). When mentored effectively, international field research can lead to increased confidence and leadership ability, and students are able to develop metacognition skills as they synergize concepts and relate lessons learned back to their home environment (Banks & Gutierrez, 2017). International field research experiences also open opportunities for graduate school and prepare college students for positions and careers that involve multidisciplinary

scientific research and international agriculture and conservation development (Banks & Gutierrez, 2017; Conner et al., 2013).

Including opportunities for undergraduates to also participate in international extension is critical for developing global leaders who can convey scientific knowledge to a variety of audiences (Conner et al., 2013). Incorporating meaningful outreach can help ensure that international undergraduate research is non-extractive and of benefit to both the research teams and the local communities which they serve. Students who extend their research to the communities in which they have been operating can improve their ability to synthesize important information and communicate findings to diverse stakeholders. Students who take time to extend the findings of their research to relevant audiences are able to develop an appreciation for a diversity of cultures and contexts, and for the complexity of agricultural and natural resource systems that cut across geographical scale and across the physical and social sciences (Acker & Scanes, 1998).

Students need to understand and incorporate systems-level approaches that integrate biological, abiotic, social, and economic processes in order to be effective leaders in the global workforce (NRC, 2009). In terms of economics, global agricultural demand will need to grow to meet the expected more than nine billion projected global population by 2050 (Food and Agriculture Organization of the United Nations [FAO], 2018). Most of this increase in demand is expected to come from low- and middle-income economies (FAO, 2018). This increased demand will create opportunities for the US to expand exports and build international trade partnerships to further grow the US agricultural economy. In addition, US consumer demand for global agricultural commodities (e.g. cacao, coffee, rubber) that have limited production in the US is increasing, furthering the need for a globally-sensitized national agricultural workforce (NRC, 2009).

Furthermore, US national security is dependent upon global food security (Somerville et al., 2014). The rising concerns about US national security are juxtaposed with the ability of the US to be a leader in collaborating with other countries, many of whom remain dependent on agriculture for economic growth. The US will remain at the forefront of alleviating national and global food insecurity by working around the world with both public and private sector entities to trial and implement innovations for agricultural growth. To do this, there is a need for the next generation of US agriculture leaders to understand other cultures and build strategic international partnerships to strengthen global and national security (Ungar, 2016; Smith et al., 2013). This cadre of agriculture leaders will be at the forefront of innovative applications and have the skillset in researching and extending these technological advances in diverse environments, including domestically and globally (NRC, 2009).

Conceptual Framework: Agroecology in the Context of Grand Challenges

Our planet faces several "grand challenges" in the environmental management of our agricultural and natural resource systems, including climate change, water security, and changing patterns of pest and disease pressure (Nair, 2014; Reid, 2010). These challenges know no borders. One of the most complex challenges is the reconciliation of the need to feed a growing global population while conserving natural ecosystems, which cuts across the sometimes disparate United Nations Sustainable Development Goals 2 (end hunger, achieve food security and improved nutrition and promote sustainable agriculture) and 15 (sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss) (Brussaard et al.,

2010; Scherr & McNeely, 2008; Zhang et al., 2021). Two approaches to meet this challenge have been proposed: 1) land sparing—segregating intensive agriculture lands and reserved lands for conservation; and 2) land sharing—combining production and conservation on the same land (Fischer et al., 2014; Green et al., 2005; Phalan et al., 2011a, Phalan et al., 2011b). Scientists continue to debate which approach is preferable, from both crop production and conservation perspectives, without general consensus (Fischer et al., 2014).

However, scientific evidence supporting the two approaches has focused on a relatively simple tradeoff model that compares agricultural yield with biodiversity between the two systems (Green et al., 2005; Phalan et al., 2011a). This tradeoff model, while providing strong foundational evidence for the root of the issue of crop yields versus biodiversity, overlooks the inherent complexity and connectedness of agricultural, social, political, and economic systems. Critical aspects of those systems currently not incorporated include, but are not limited to: the importance of diverse pollinators and pest predators to crops; diversified crop contribution to local food security and disaster resistance; economic and cultural importance of non-food crops and natural or planted forest products; potential added value of sustainable agriculture; the cultural, health, and conservation benefits of connecting nature and people; and the impact and value of the two systems on soil quality and fertility (Fischer et al., 2014; Tscharntke et al., 2012). Fischer et al. (2014) proposed future directions in this research, which include "alternative, more holistic frameworks…to analyze the nexus of food and biodiversity" (p. 155).

One of the primary methods to conceptualize and investigate the nexus of food and biodiversity is by looking at agricultural systems holistically through the lens of agroecology. Agroecology covers several different disciplines, and can be defined as "the integrative study of the ecology of entire food systems, encompassing the ecological, economic, and social dimensions, more simply the ecology of food systems" (Francis et al., 2003, p. 100). Teaching agricultural and natural resources science using agroecology provides students competence in and appreciation for multiple disciplines, an understanding of the interconnectedness of agriculture and the environment, and opportunities to work in teams of varied individual expertise to understand complex agricultural and natural resources challenges (Jordan et al., 2005, Wezel et al., 2011).

Operational Framework: Research and Extension Experiences for Undergraduates Belize program

Using an agroecological approach, we designed and piloted a research and extension experience in Belize for a multi-disciplinary team of US undergraduate students and US faculty mentors to address the challenge of reconciling food security and forest conservation by various stakeholders in the Vaca Forest Reserve. Belize was selected for a variety of reasons. First, several of the faculty involved in mentoring the students had previous experience and connections in Belize. This included leading student learning experiences and conducting field research. Secondly, one of the key stakeholders in the management of the Vaca Forest Reserve, the Friends for Conservation and Development (FCD) had approached our faculty team requesting assistance in data that could be used to inform a sustainable conservation and management plan for the reserve. This was an ideal opportunity to engage a team of multi-disciplinary researchers in providing scientific evidence to support a specific, locally demand-driven need. Thirdly, for engaging undergraduate researchers, Belize provides a perfect backdrop – it has a diverse population; its national language is English; it is a short flight from the

continental US; the tropical rainforest setting is different from what can be found in the continental US; many aspects are relevant to US management of agriculture and natural resources. As a result, this was an excellent opportunity to work with a wide range of stakeholders in a forest management zone, understand competing land-use demands, and collect empirical data to help balance the need for conservation with that of agricultural provision for food and nutrition security. Student and faculty pairings were able to focus on a collective challenge of collecting multi-disciplinary research data to aid the development of a long-term management plan for the Vaca Forest Reserve.

We recruited 14 first- and second-year undergraduate students as Research and Extension Experiences for Undergraduates (REEU) program fellows. Students were recruited from seven institutions. Eleven students were women and three students were men, aged 18 to 25 years old, including two Latina and one African American. We also identified 10 faculty members who were willing to serve as mentors. Undergraduate fellows were grouped in two cohorts of seven students each. During Fall of their first year, students were recruited and paired with one primary faculty mentor in the student's area of interest. In Spring, students worked with mentors individually and in groups, both in person and through electronic communications, including email and videoconferences. All students committed to spending two consecutive summers in Belize. This involved conducting research in the first summer, and then extending the findings of their research in the second summer to local, national and international stakeholders. The first cohort (Cohort A) of seven students was recruited in the 2016-17 academic year and spent the summers of 2017 and 2018 in Belize. The second cohort (Cohort B) was recruited one year later and spent the summers of 2018 and 2019 in Belize. Hence, there were seven students in Belize in the summers of 2017 and 2019, but the two cohorts overlapped in the summer of 2018. This overlap was intentional and helped to propel the research conducted by Cohort B, using the initial findings and experience from Cohort A. Students spent approximately seven weeks conducting research in Belize in their initial summer, and then approximately four weeks conducting extension of their research findings the following summer. In between their fieldwork experiences, and for one semester following their final visit to Belize, students continued working with mentors and local stakeholders to analyze research data and develop materials, including extension materials, scientific reports, and peer-reviewed research manuscripts.

The Vaca Forest Reserve

In western Belize, some smallholders have started to switch from conventional to land-sharing conservation agriculture adjacent to and within the Vaca Forest Reserve (Vaca). The 40,375 acre Vaca is part of the larger 1.25 million acre Chiquibul/Maya Mountain Massif. The Vaca differs from most of the other 13 protected areas in the Massif, as it is specifically managed to incorporate some agricultural use. Farmers in and around the Vaca are switching to land-sharing conservation agriculture in response to extension efforts by a local NGO, FCD. Vaca farmers primarily grow fruit and vegetable crops and raise beef cattle that are sold at local markets. Conservation agriculture extension efforts have focused on apiculture, landscape planning, integrated multi-crop farms, composting, organic farming, reforestation, and agroforestry (Manzanero & Melendez, 2013). These extension efforts have resulted in the majority of farmers each adopting several of these practices. Manzanero and Melendez (2013) also report concurrent benefits of farmers practicing this land-sharing style of conservation

agriculture with participants showing an increasing place attachment (Lewicka, 2011) and connectedness to nature (Mayer & Frantz, 2004), resulting in attitudinal shifts to protect and conserve, rather than exploit, forest resources. By enabling land-sharing conservation agriculture, FCD has also strengthened a land-sparing reserve system, with these local farmers appreciating and taking interest in conserving the reserved forest and additional protected areas (e.g. Chiquibul Forest Reserve and Caracol Archeological Reserve) surrounding and adjacent to their farms. This could be critical to the long-term survival of the Vaca as, currently, the Belize Forest Department does not have the resources to adequately patrol or monitor the Vaca and it is being degraded by illegal logging and poaching, mostly from neighboring Guatemala (Arevalo & Chan, 2012).

Purpose and Objectives

The purpose of this paper was to investigate US undergraduate student learning gains under a research and extension experience offered in an international setting. The objectives of this study were to investigate whether situating the REEU outside of the US would result in: 1) student learning gains in research, 2) positive mentoring relationships, 3) production of research and extension outputs, 4) collaborative learning through individual projects under a broader research approach (agroecology) and theme (contested land at the intersection of natural resource conservation and agricultural production), 5) cross-cultural skill development, and 6) preparation for future careers in scientific research.

Methods

We adopted a common survey tool to assess student learning gains under a research experiences for undergraduates (REU) as used by the National Science Foundation (NSF) (NSF, 2021). The tool has been validated as an online survey instrument of REU student outcomes through the University of Colorado at Boulder's Undergraduate Research Student Self-Assessment (URSSA) team, supported by the National Science Foundation. This tool is currently housed on the salgsite.org website platform that hosts a range of Student Assessment of Learning Gains (SALG) instruments. We amended the URSSA tool to include agroecology concepts and cross-cultural skills items. Electronic notifications were sent to all 14 students four months after completing their second summer of fieldwork in Belize, at the end of the Fall semester during which each student had worked with their faculty mentor to finalize outputs from their research. This was December 2018 for cohort A and December 2019 for cohort B. 13 out of 14 students completed the survey, which was administered via QuestionPro. The survey included 98 questions that covered topics including students' gains in knowledge, mindset, skill and attitudes and behaviors toward research through their REEU experience (54 questions), outputs from the REEU (10 questions), students' gains in agroecology approaches and cross-cultural skills (10 questions), and preparation for next career steps (24 questions). In order to capture student experiences with regards to their overall experiences, including both research and extension, we added five open-ended questions and collected data on extension deliverables, including publications, trainings, workshops and presentations. Results were analyzed using both QuestionPro graphic analytics and Microsoft Excel.

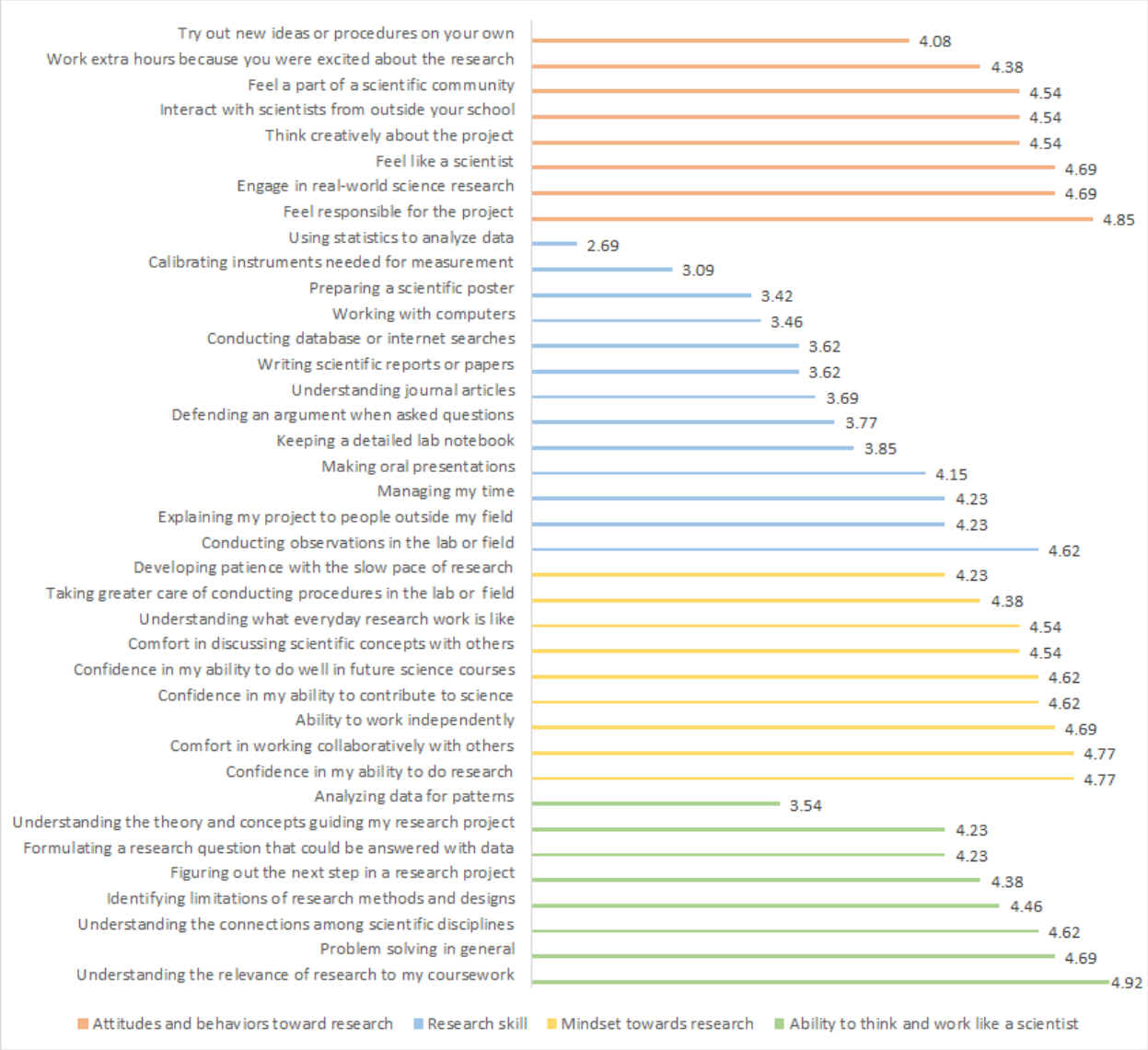
Results

Research experience

Average (mean) scores were calculated for the 13 student respondents for 38 statements that related to attitudes and behaviors toward research (8 statements), research skill (13), mindset towards research (9), and ability to think and work like a scientist (8). Students reported the level of gain they subjectively experienced as a result of their Belize REEU experience. The level of gain was reported on a five-point scale, *1 = no gain, 2 = a little gain, 3 = moderate gain, 4 = good gain, 5 = great gain*. On average, students rated 28 statements at between good and great gain, nine statements at between moderate and good gain, and one statement at between a little gain and moderate gain (Figure 1). Nine of the ten statements to receive the lowest average gain score were aligned with the "research skill" category. However, there were still moderate to good gains across the majority of the "research skill" statements. All statements, except "analyzing data for patterns", in the other three categories (attitudes and behaviors toward research, mindset towards research, and ability to think and work like a scientist) recorded an average gain score between 4 (good gain) and 5 (great gain). In ranked order, the four statements for which students reported their greatest gains were: 1) "understanding the relevance of research to my coursework"; 2) "feel responsible for the project"; 3) "comfort in working collaboratively with others", and 4) "confidence in my ability to do research".

Figure 1

Average (mean) student gains reported through their Belize REEU experience against 38 statements about their attitudes and behaviors toward research, research skill, mindset towards research, and ability to think and work like a scientist (n=13)



Rating scale: (1 = no gain; 2 = a little gain; 3 = moderate gain; 4 = good gain; 5 = great gain)

When asked to rate the impact of their REEU experience on their overall research abilities, mindsets, skills, and attitudes and behaviors, students reported positive improvements for all categories (Table 1). On average, students rated themselves as having little to moderate ability to think and work like a scientist prior to their Belize experience. However, all students rated themselves as having good or great ability to think and work like a scientist following the completion of their REEU.

Table 1
Average (mean) student retrospective ratings of their research aptitudes and attitudes before and after their REEU Belize experience (n=13)

Student response categories	Before REEU	After REEU
Overall ability to think and work like a scientist	2.69	4.46
Overall mindset toward research	3.69	4.85
Overall research skill	3.00	4.46
Attitudes and behaviors toward research	4.08	4.69

Rating scales: Overall ability to think and work like a scientist: (1 = no ability; 2 = a little ability; 3 = moderate ability; 4 = good ability; 5 = great ability); Overall mindset toward research: (1 = not favorable; 2 = a little favorable; 3 = moderately favorable; 4 = favorable; 5 = strongly favorable); Overall research skill: (1 = no skill; 2 = a little skill; 3 = moderate skill; 4 = good skill; 5 = great skill); Attitudes and behaviors toward research: (1 = very negative; 2 = negative; 3 = neutral; 4 = positive; 5 = very positive).

In open-ended survey responses, the majority of students highlighted that the most significant experience in their REEU participation was the ability to follow through on their own projects from research design all the way to extension impacts. Quotes that supported this included:

"Having a project that was entirely my own from design to implementation to manuscript writing."

"The ability to see a whole project from start to finish and work abroad for an extended period of time."

"Before this experience, I have only ever conducted research. I have never been able to see my results be implemented. Being able to explain my results informally, create educational materials, and coordinate with local partners to hold an extension event allowed me to gain real-world experience that I will use in my professional and academic careers."

The most challenging experiences for the fellows were the human interactions (both with other fellows and working across cultures) and the availability of time to work on their research write-up after returning to the U.S. from Belize. Students stated:

"The most challenging experience in this program was adapting to a new culture."

"Working with some fellows who are much different than you."

"Finding time to work further on the project when back in the United States."

"Time management for writing a manuscript."

Students also commented on the value of implementing the REEU field experience in an international setting. Comments included:

"The value of implementing field experience this in a different country exponentially increased its efficacy. Being able to see how conservation works in a subtropical location is an irreplaceable experience"

"It was my first time out of the country, so it was great to get a larger perspective on life."

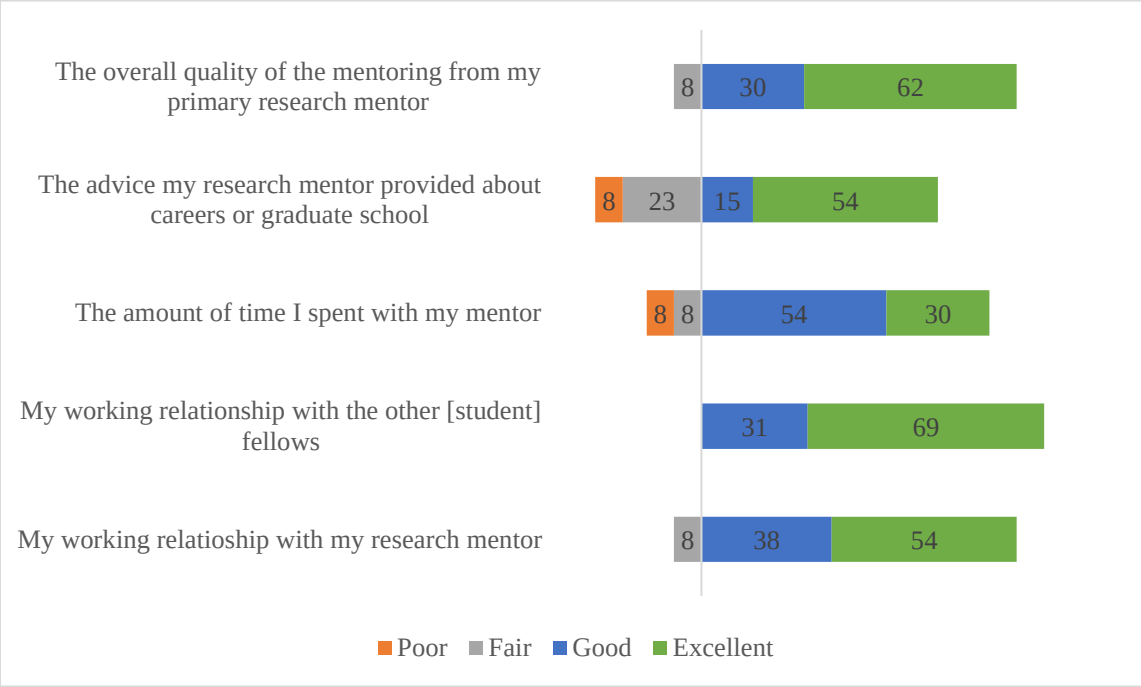
"Understanding other cultures and getting acquainted in a new place gives one a broader perspective. It opened the possibility of working and getting along in other foreign countries to me."

Mentoring

The majority of students reported positive (good or excellent) experiences with their primary research mentors (Figure 2). Overall, 12 of the 13 students reported positive working relationships with their mentors. Where mentors were identified as least useful was in providing advice on careers or graduate school; however, the majority of students still reported that they received excellent advice from their mentors. All students reported good or excellent working relationships with their peers in the program.

Figure 2

Percentage of student responses to statements about their mentoring relationships in the REEU experience (n=13)



Presentations and publications

All fellows presented and/or published research findings and extension materials during their undergraduate careers. All students in cohort A, and many from cohort B, presented research results at 13 local, national, and international conferences. Over both cohorts, two manuscripts have been published in international peer-reviewed journals (Shapiro et al., 2020, Shapiro & Willcox, 2019) with an additional two in development. Cohort B presented six posters and two oral presentations at the Mesoamerican Society for Biology and Conservation Belize Symposium in 2019. Two graduate student mentors presented their research at this symposium and both successfully defended their theses.

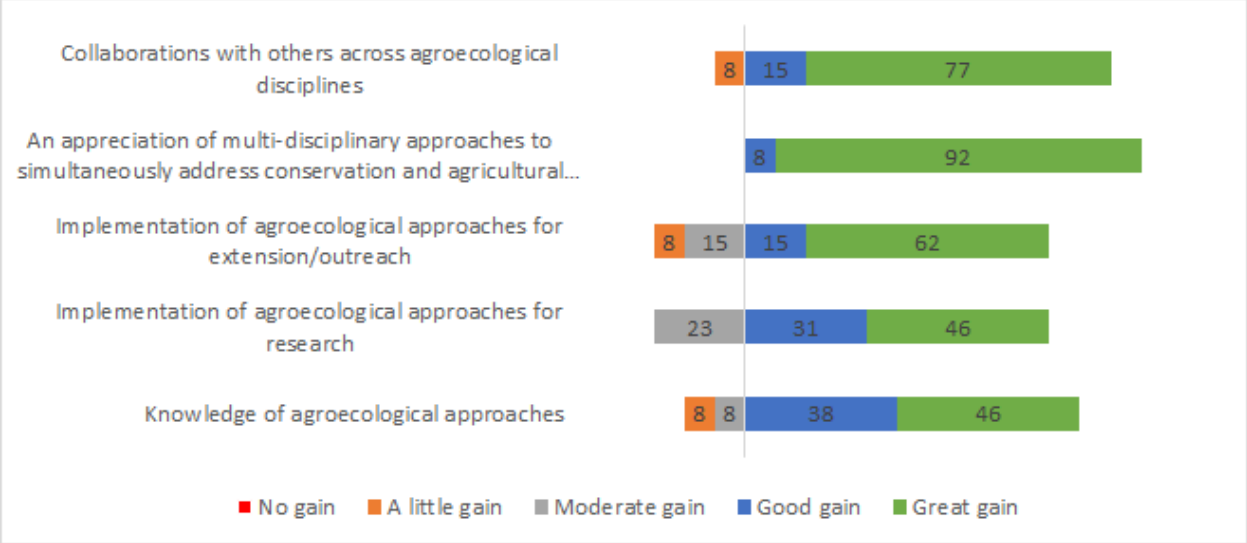
In terms of extension outputs, Cohort A hosted a farmer field day in 2018 on crops and soils was the highest attended event by the farmers in the Vaca Forest Reserve. They published in the Belize Agricultural Report (Becker & Ottinger, 2018), published a comprehensive technical report for our local NGO partners, and produced three pamphlets based on their research results. Cohort B successfully completed five extension events: one farmer field day, one field day for the Vaca farmers to the national fish hatchery, one evening event on bat conservation, and two presentations to agriculture students at Mopan Technical High School. Additionally, Cohort B completed a technical report for our local partners, individualized reports for farmers on water quality and aquaculture, and eight brochures and posters.

Agroecological approaches

Overall, students indicated that they made positive gains in all aspects of taking an agroecological approach through their REEU experience (Figure 3). All students responded positively (good gain or great gain) to "an appreciation of multi-disciplinary approaches to simultaneously address conservation and agricultural development goals". The statement that generated the second highest level of positive responses was that the REEU experience provided "collaborations with others across agroecological disciplines". The majority of students responded positively with regards to the REEU experience providing opportunities for implementation of agroecologcial approaches for research and extension/outreach, and increased knowledge of these approaches.

Figure 3

Percentage of student responses to statements about the impact of their REEU Belize experience on their ability to enhance their skills in agroecological approaches (n=13)

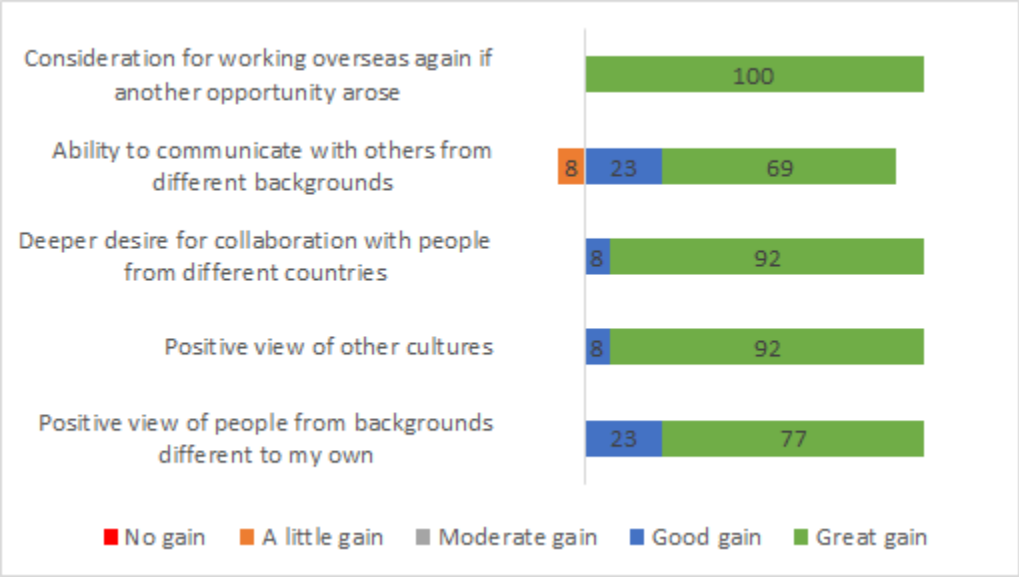


Cross-cultural skills

Students reported significant gains across all five aspects of cross-cultural skill development (Figure 4). All students reported good or great gains for four of the five statements; the statement for which one student reported "a little gain" and three students reported "good gain" was "ability to communicate with others from different backgrounds. All students reported "great gain" for the statement "consideration for working overseas again if another opportunity arose".

Figure 4

Percentage of student responses to statements about the impact of their REEU Belize experience on their ability to enhance their cross-cultural skills (n=13)

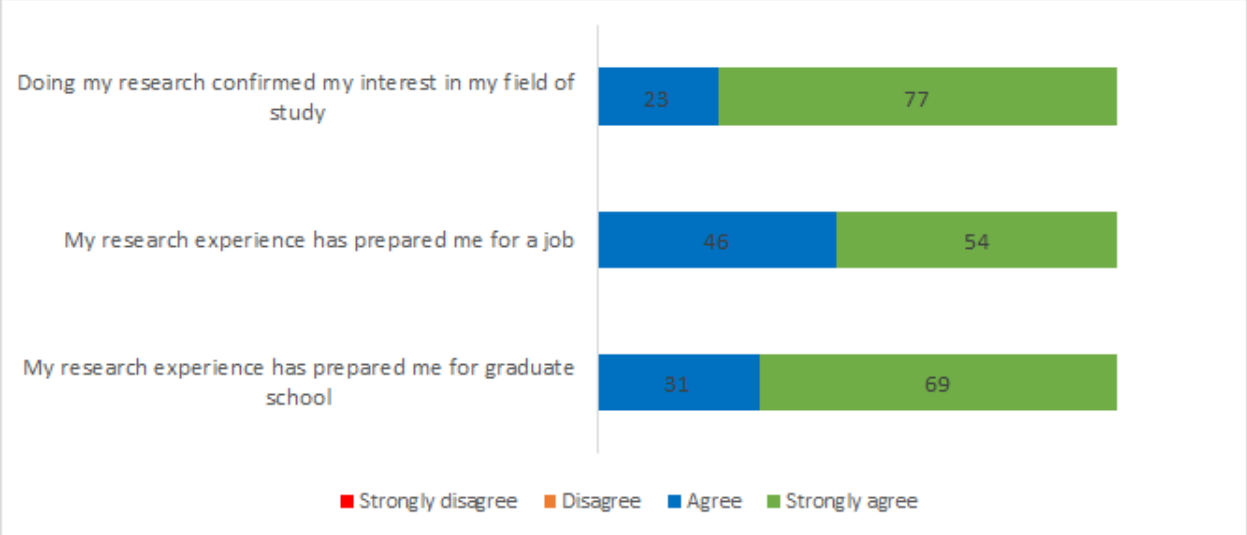


Next steps preparation

All students agreed or strongly agreed with all three statements about the impact of their REEU Belize experience on their next career steps (Figure 5). The statement "doing my research confirmed my interest in my field of study" received the largest number of "strongly agree" responses. All statements received a majority of "strongly agree" responses.

Figure 5

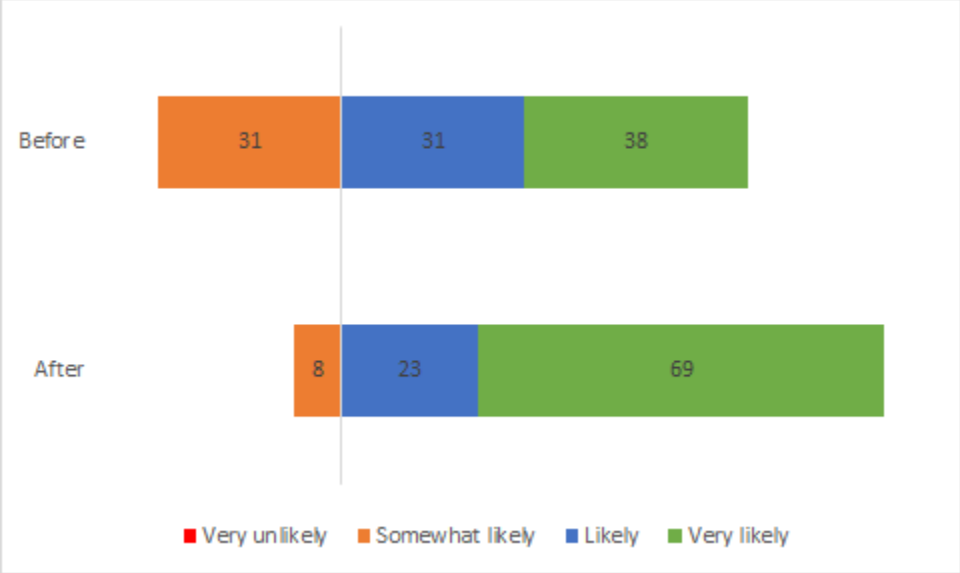
Percentage of student responses to statements about the impact of their REEU Belize experience on their next career steps (n=13)



Students retrospectively reported a positive shift towards being more likely to pursue a career in science that includes research after their REEU Belize experience (Figure 6). Student responses were approximately evenly distributed among "somewhat likely", "likely", and "very likely" when considering their pursuit of a career that includes research before their REEU experience, but following their time in Belize, the majority of responses indicated that students were very likely to pursue a career that includes research.

Figure 6

Percentage of student responses, both before and after their REEU Belize experience, to the question "Will you pursue a career in science that includes research?" (n=13)



The positive views of student REEU participants towards their next steps are supported by our fellow placement data after project completion. Of those that graduated from Cohort A (six of seven), two immediately entered graduate school, one was employed by a National Laboratory and started graduate school, one was awarded a Fulbright Research opportunity in Slovenia, one started work as a research assistant in her mentor's lab intent on graduate school, and one is currently seeking graduate school opportunities or employment. In cohort B, we had one fellow complete her two-year Associates degree and entered a BS program in Fall 2019, one was awarded a Fulbright Research opportunity in the Netherlands, two entered into graduate school, and the remaining have found employment in agriculture or natural resources or are seeking graduate student positions.

Conclusion, Implications and Recommendations

International field research and extension experiences can provide measurable gains in student perceptions and technical skills. Our REEU students reported gains across all four categories of research experience – attitudes and behaviors toward research, mindset towards research, ability to think and work like a scientist, and research skills. This corresponds with Shebitz et al.'s (2017) findings from a conservation of biodiversity undergraduate research experience to Costa Rica, from which students reported significant gains in confidence and scientific skills. However, our students reported larger gains in perceptions towards research than

in acquired skills. This highlights the value of undergraduate field research experiences, which not only provide hands-on skill development, but also deepen understanding of real-world issues and contexts. The inclusion of extension with research experiences also further encouraged students to use research methodologies that could generate applicable findings for local communities. Providing an international research and extension learning experience was effective in building undergraduate students' confidence and career interest in research and extension.

Our findings highlighted the importance of mentoring relationships – both between faculty members and students, and among student peers. Students produced research outputs that were of high quality for publication and presentation, and arguably had broader reach through presentation at global conferences and publication in internationally-focused journals. Our findings also highlighted the importance of empowering students as change agents working together in the context of a larger narrative. Stebner et al. (2016) noted that student motivation and satisfaction are closely linked to the topic of their undergraduate research experience. We provided students with a motivating topic to address by providing a research experience in an international setting, in the context of the global challenge of the intersection of food security and natural resource conservation.

Initiating a new global undergraduate research experience is no small task. From our findings and experience with the Belize REEU, we provide some recommendations which could be useful for higher education institutions wanting to develop meaningful global undergraduate research experiences:

- Seek opportunities to address demand-driven challenges, articulated by local partners. Our REEU was led after several years of faculty involvement in Belize, developing collaborations with local organizations. Students are more likely to prosper in undergraduate research if there is already a well-established connection to the global setting by the university.
- Narrow the focus of the research experience to a single challenge or topic that can serve as an umbrella for a series of individual research projects for students from diverse disciplines. This promotes interdisciplinary learning among students and faculty mentors and provides a model for engaging a real-world challenge from multiple vantage points. Multidisciplinary research is difficult because of its disparate dimensions. At the same time, multidisciplinary research is important as real-time synergies can be discussed and assessed, allowing for in-field adaptations of research design and data collection based on current findings and field conditions. We used the intersection of food security and natural resource conservation as an umbrella challenge and agroecology as an operational approach through which students could realize multi- and interdisciplinary learning gains.
- Carefully consider and spend intentional time cultivating relationships between faculty mentors and students, and among students themselves, both before and during fieldwork. Conducting research in an international setting can be simultaneously daunting and exhilarating for undergraduate students, so it is important to consider the right mix for effective student peer support, and the best matches for faculty-student support. Students that are well prepared for potential setbacks can accept them when they happen and still have a positive experience (Stebner et al., 2016).
- Integrate extension of field research findings into the undergraduate research experience to ensure outreach and impact for a wide range of beneficiaries. Land

> grant institutions that provide an educational model that integrates teaching, research and extension are well placed to develop students who can translate classroom and lab experiences to applied research and outreach. However, this is not exclusive to land grant institutions, as all higher education institutions want to develop students into effective change agents.

Finally, in the midst of a global pandemic and the rising threat to our globe of climate change, now is also an important time to think carefully about how we continue to build the global leaders of the future for agriculture, food, and natural resources. Conducting field research and extension experiences in a setting outside of your home country may be an impractical option, due to cost, access, the time it takes to build global partnerships, or a number of other challenging barriers. Opportunities to conduct globally oriented and relevant undergraduate research do not only exist outside of a country's borders. Further research should include comparing globally focused REEUs based in international locations versus domestic locations to understand whether location has a significant impact on student perceptions, skills, and outcomes.

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