Planning Proposal

“Establishment of the Duquesne University Tropical Field Station at Lower Dover, Unitedville, Belize”

Developed By

Philip Reeder, Ph.D.
Dean, Bayer School of Natural and Environmental Sciences
Duquesne University

A. Project Overview:

Duquesne University (DU) is in the process of establishing a tropical field station at the site of the current Lower Dover Field Station (LDFS) in Unitedville, Cayo District, Belize, Central America. This proposal provides a detailed overview of the site; its current infrastructure; additional infrastructure that is needed as the project proceeds; the broader impacts and intellectual merit of the project; research, teaching, educational and outreach opportunities; and the specifics of building a relationship between Duquesne University, the Lower Dover Field Station, and any participating partners.

Students from DU and potential partner universities will be intimately involved in projects facilitated through the partnership, and occurring at the LDFS. These include, but are not limited to, (1) summer field experiences organized in concert with the university partners and the LDFS, (2) research projects organized by faculty and/or students from the partner institutions, (3) undergraduate and graduate student independent study, thesis or dissertation research, (4) joint student projects completed by students from the partner institutions and supervised by partner institution faculty and LDFS staff, and (5) Educational outreach projects that involve partner institution students, faculty and LDFS staff, and primary and secondary students and their teachers from the local and regional community.

B. Background:

Duquesne University is the lead institution for this project, and in concert with other potential partner institutions this partnership will emphasize service-learning; community engagement and education; professional development; and commitment to social justice in all forms and expressions. Duquesne University follows the teacher-scholar model, wherein scholarship and research are incorporated with instruction. Faculty from Duquesne and from potential partner institutions will be committed to providing experiential learning opportunities for students, and to guiding them to excellence in the classroom, careers, and life. Experience-based learning can take on a variety of forms, including community-engaged scholarship and service-learning. In the context of this project, service-learning is defined as a teaching method that combines meaningful service, critical reflective thinking, and academic instruction to enhance student
learning and social responsibility. Community-engaged scholarship is not a teaching method, but an orientation that generally describes community-based inquiry. Service learning and Community-Engaged scholarship facilitates linkages with “communities” on a variety of scales, and fosters reciprocity as a means and end of collaborative work. Collaborative, responsible action better aligns university-grounded efforts and students participating in these efforts, with the agenda and vision of non-university partners. Rather than inserting a single-minded agenda, a multidisciplinary approach can facilitate discussion and be a catalyst for learning outside the classroom, systemic assessment, and change.

The establishment of the Duquesne University Tropical Field Station at Lower Dover, fits perfectly with the mission of the university and our potential partners in this project. It provides (1) a safe and secure location where partner university students can gain invaluable real-world/field experience, (2) a location where faculty and students can conduct on site research on a variety of topics, and (3) a base of operations where local-area and regional studies can be completed, and/or (4) a “headquarters” where collaborative community engagement, service learning and educational outreach projects can be housed

**Intellectual Merit**

This project builds on the university partner’s inherent strengths in applied research and problem-solving; interdisciplinary research; hands-on learning; community engaged learning; and educational outreach. The project will serve as a conduit for interdisciplinary collaborations between Duquesne and potential partner faculty, students, and the LDFS with the innovative integration of natural and social sciences being stressed. Synergies developed as part of the cross-disciplinary teaching, research, professional development and outreach that will occur at or be facilitated through the LDFS, will lead to the development of transformative knowledge and curricula, with applications relevant to many social, human, scientific and environmental issues. At the same time, implementation of this project will assist in raising awareness regarding the scope and magnitude of these issues, and some of the differences and challenges pertaining to these issues in the developed and developing world. Belize, and the LDFS, provides a perfect natural laboratory where service learning, community engagement, the intrinsic value of research-based inquiry, professional development and educational outreach are stressed. Teaching about and studying the intersections of social, human, scientific and environmental issues as part of this project will provide a new understanding, especially for the students involved, of what it means to work as part of an integrated team of diverse students/researchers.

**Broader Impacts**

This project will add to the existing base of knowledge about the linkages that exist between experience-based learning, and its applications to Community-Engaged scholarship, service-learning, and research in a developing country like Belize. The project and any associated
research will take on a variety of forms, to include (1) exploratory research to assist in facilitating research and applied project development, (2) constructive research where hypotheses and theories are tested and solutions/conclusions proposed, and (3) empirical research, where knowledge is gained via direct and indirect observation. Projects completed at the LDFS will involve aspects of both qualitative (where human behavior and the reasons that govern such behavior are examined) and quantitative research (where numeric data is collected and analyzed and conclusions are drawn). It will have a substantial educational outreach component wherein partner institution faculty and students will have the opportunity to work with primary and secondary students from the local area schools and local teachers.

This project will facilitate the integration of research, teaching, community engagement, service learning, professional development and educational outreach on a number of levels, to include, but not limited to: 1) cross-disciplinary research projects that will bring together stakeholders from the partner institutions. 2) Learning opportunities that will allow the acquisition and dissemination of knowledge important to all participants. 3) Student participation in all aspects of the project. 4) Educational outreach wherein participants work with local schools both onsite at Lower Dover and offsite at the various participating schools. Students participating in the projects will gain first-hand knowledge of the scientific method, research and analytical techniques, skills related to scientific writing, and they will sharpen their research, critical thinking and leadership skills. Participation in this project will aid in establishing a legacy of educational, personal and professional development. The students learn the importance of completing the task at hand, how to work side by side with a diverse cross-section of their peers and the community, how to enhance their scientific skills through field and laboratory practice, and how to develop personal and leadership qualities.

C. The Site

Lower Dover Field Station (LDFS) is situated south of the Belize River between Little Barton Creek to the east and Big Barton Creek to the west. It is just under 100-acres in size, with approximately 80% of the property forested. The vegetation is mostly secondary growth, and the land use history of the property indicates that it was at least partially cleared about 50-years ago to use for cattle ranching. Other property amenities include an extensive trail system, direct access to the Belize River, Big Barton Creek and Little Barton Creek, the Lower Dover Archaeological Site, and two cleared areas where a banana planation, and buildings affiliated with the field station, and various fruit and hardwood trees, are located (Figures 1 to 5). The site is an outstanding natural laboratory where educational outreach, community engagement and student focused research can take place. What follows is a detailed description of the site.
Figure 1 – The Location of Lower Dover Field Station.
Figure 2 – The Lower Dover Field Station, Unitedville, Cayo District, Belize.
Figure 3 – The Lower Dover Archaeological Site circa 2013.
Figure 4 – Approximate boundary of the Lower Dover Field Station and surrounding area.

Figure 5 – The facilities at the Lower Dover Field Station.
Specific Features and Attributes of the Lower Dover Field Station

Trails

Over two kilometers of trails exist on the property. These trails in some cases parallel the river and creeks. Others transect the property cutting through heavily forested areas. Still others cut through the forest to connect the larger and more open trails, with smaller trails that connect to the Lower Dover Archaeological Site, and other parts of the property. Not all of the trails that exist on the property are depicted in Figure 2. Figures 6 and 7 illustrate sections of the trail network. The trails provide access to unique environments for research and teaching.

![Figure 6 – Trail, north of Plaza H.](image1)

![Figure 7 – Plantation Trail through property.](image2)

Rivers and Creeks

The property is bordered on the east by Little Barton Creek. This stream’s headwaters are located in the hills to the east of the village of Unitedville. The stream’s waters, rich in dissolved calcium carbonate, have formed a spectacular series of tufa dams, which are formed where degassing of carbon dioxide takes place at riffles in the stream (Figure 8). The Belize River forms the north border of the property, and separates Lower Dover from the Mennonite settlement of Spanish Lookout, located on the north side of the river. The Belize River forms about 20 river kilometers upstream from Lower Dover where the Macal and Mopan Rivers join at Branch Mouth. The Belize River drains more than one-quarter of Belize as it winds through the center of the country for 270-kilometers past Lower Dover to enter the sea just north of Belize City (Figure 9). Big Barton Creek enters the Belize River in the northwest part of the property. Big Barton Creek emerges from Barton Creek Cave in the foothills of the Maya Mountains approximately 15-kilometers due south of Lower Dover. The streams are unique environments for research and teaching related to hydrology, water resources, aquatic ecology and stream biology.
The Lower Dover Archaeological Site

Archaeological research at the Lower Dover Archaeological Site (see Figure 3) has been conducted by the Belize Valley Archaeological Reconnaissance (BVAR) Project, directed by Dr. Jamie Awe, previously the director of the Belize Institute of Archaeology. Any agreement between LDFS, and project partners will mandate that BVAR excavations can continue at the site. The site is a classic era Maya site that may have been one of the most socio-politically important sites in the Belize River Valley. Research related to the socio-political development of the site and its role in Belize River Valley archaeology has been ongoing by BVAR since 2010. Thus far twelve “plazas” have been discovered and mapped. Early results indicate that Lower Dover was more “long-lived” than its classic era counterparts in the Belize River Valley, and that it was still occupied just prior to the Terminal Classic Period. The 2015 excavations will complement the 2013 and 2014 research, which exposed small portions of the interior courtyard and structures of the acropolis (Figures 10 and 11). Excavations will focus on the southern-most plaza of the acropolis complex and will feature systematic large-scale horizontal exposures of the courtyard and acropolis structures. In addition, vertical trenches will be placed into the structures in order to identify the chronological history of construction episodes, and to begin to develop a model regarding the use of space through time in the acropolis complex. The presence of this archaeological site at the LDFS provides a location where research and teaching can focus on the linkages between culture and the physical environment.
Buildings and Infrastructure at the Lower Dover Field Station

The following buildings are part of the current “compound” area at the Lower Dover Field Station (see Figure 2).

1. **The main house** (see Figure 15) – a large structure where the owners of the Lower Dover Field Station, Bill and Madeline Reynolds reside.

2. **The old kitchen/library** (see Figures 16 and 17) – An original (circa 1995) wood, thatched roof structure which was the original kitchen for the station in the early years, and has now been converted into a library.

3. **Caretaker’s house/dorm** (see Figure 12) – The original wood frame house on the property was used as the caretaker’s residence and was converted into a dorm that can sleep six and has an indoor bathroom with external/adjacent hot water shower.

4. **The new kitchen** (see Figure 21) – Contains modern appliances, as does the main house, as well as a traditional wood fired hearth where traditional Belizean meals are cooked over an open fire.

5. **Rec room** (see Figure 19) – A meeting place and recreation facility that contains a billiards table, sitting areas, and a television where dvd’s can be viewed.

6. **Chicken coop** – Where the resident population of chickens and turkeys reside. It is a structure that is moved often so that the droppings-rich soils can be used as a garden plot.

7. **Old Dining hall** (see Figure 19) – Where meals were formerly served, and the structure also doubled as a classroom where lectures took place, and during non-meal times quite study or meetings occurred. These activities have now shifted to the Classroom/Dining Hall. The old dining hall is now used for storage.

8. **Shed** – A very sturdy structure where equipment is stored. Field supplies can be stored in this building as well. It has a very solid door that is always locked with a padlock.

9. **Cabana #1** (see Figure 14) – An elevated cottage with a zinc roof, and covered porch. This cabana contains one single bed and one double bed, as well as a desk with chair, and dresser. There is an adjacent external bathroom and hot water shower.

10. **Cabana #2** – Similar to Cabana #1, #2 is slightly larger, and contains similar features, including an adjacent external bathroom, this time with a cold-water shower.

11. **Cabana #3** (see Figure 20) – Is an elevated, zinc roofed cottage that is similar in structure to cabanas 1 and 2, but contains one double bed and an indoor bathroom. Behind cabana #3 is a structure that contains a cold-water shower.

12. **Outhouse** – A still functional traditional two-hole outhouse.

13. **Dorm** – Also called the “high rise” is a two story structure that has been repurposed to serve as the caretaker’s quarters (the lower floor), and a single-room on the upper floor that contains two double beds.

14. **Outdoor Kitchen** – Is a very rough-hewn wood structure, with a zinc roof that is a traditional Belizean-style cookhouse. It is used occasionally to cook traditional Belizean meals.
15. **Cabana #4** – Is also called the Rasta cabana. It is an elevated zinc-roofed cottage that is larger than cabanas 1, 2 and 3, contains a queen-size bed, has an in-cottage bathroom and shower, and is air conditioned. The area under the cabana is enclosed and serves as a dorm that contains eight beds, and it has an attached bathroom with a shower (see Figure 13).

16. **Outdoor Classroom** – All four sides of this structure are open to catch the breeze and it will be equipped with tables and chairs. It also contains electricity (see Figure 18).

17. **Research Lab** – A fully equipped field research lab which is stocked with a variety of both field and laboratory equipment for environmental studies. This lab is probably the most sophisticated lab of its type in this region of Belize.*

18. **Classroom/Dining Hall** – A spacious, air-conditioned classroom, with ample audio-visual equipment and seating for 25 students. The building also doubles as the dining hall where breakfast, lunch and dinner are served.*

Currently, the various cottages at Lower Dover can sleep 22 people or more if beds are shared. Additional construction has recently taken place.*

*1. The research lab was completed in spring 2019.

*2. The classroom/dining hall was completed in fall 2018.

Figures 12 to 22 depict photographs of some of the buildings at the Lower Dover Field Station.

![Figure 12 – The caretaker’s house/dorm.](image12)

![Figure 13 – Cabana #4.](image13)
The Lower Dover Field Station has electricity in every structure on the property, with the current being 110/220 V, similar to the United States. It also has internet (wifi) that comes to the property via cellular signal. All sleeping areas have ceiling and floor fans. Cabana #4 (the Rasta cabana) is air conditioned, as are the classroom/dining hall and the research laboratory. Drinking water is collected off the zinc roofs, and is stored in large vats and
passes through a filter before consumption. These vats also provide water to the showers, but the water in the sinks and used to flush toilets is usually water that is pumped from nearby Little Barton Creek. This water is not potable. Laundry facilities are available on site.

The Lower Dover Field Station is located about ½ mile (0.8 km) off of the Western Highway (a 15-minute walk). The access road to Lower Dover is near mile marker 59 on the Western Highway, meaning that it is 59 miles (~95 km) west of Belize City. The twin cities of San Ignacio and Santa Elena (collectively referred to locally as Cayo) are located 12 miles (19 km) west of Lower Dover. Cayo has all types of retail and eating establishments. Bus service in Belize is privatized and is generally good and for the most part reliable. There is one retail store in the village of Unitedville, which is a 15-minute walk from Lower Dover. This store, called the Mile 59 Superstore, has a fairly wide selection of food and beverages.

D. Research Opportunities at the Lower Dover Field Station and Other Areas

The Lower Dover Field Station is an outstanding natural laboratory for teaching and research. Possible areas of research and related teaching include, but are not limited to, ecology, forestry, soils, agrobiology, geology, geomorphology, micro-climatolgy, microbiology, bacteriology, dendrology, dendrochronology, botany, orchidology, micro-phytology, palynology, zoology, mammalogy, ichthyology, piscatology, micro-paleontology, anthropology, archaeology, avian biology, ornithology, environmental chemistry, biochemistry, zoochemistry, biogeography, conservation biology, biometrics, bionomics, cytology, parasitology, plant and animal physiology, pharmacology, pharmacognosy, ethology, entomology, herpetology, arachnology, hydrology, hydrobiology, limnobiology, limnology, and water resources. Research on these topics can be initiated by students or faculty from partner institutions involved in the project. Students will be involved in these projects on a number of levels, including, but not limited to, (1) summer field camps organized through the partnership. (2) Research projects organized by partnership faculty or directly by students. (3) Undergraduate and graduate student independent study, thesis or dissertation research. (4) Joint student projects completed by groups of partnership students supervised by partnership faculty and LDFS staff. (5) Educational outreach projects that involve partnership faculty and students, and students and teachers from the local and regional community. The proposed teacher education on the environment falls into this area.

The Lower Dover site is rich in both flora and fauna, and the bird populations are especially large and varied (Figures 23 to 25). Hence, it is an outstanding natural laboratory and learning environment.
Mammals and reptiles are also abundant on the property. Perhaps the most prevalent mammal is the Coati (Nasua narica) which is locally called the “quash.” They are diurnal, living both on the ground and in the trees. As a member of the raccoon family they are omnivorous, feeding on fruits, invertebrates, and other small animals. They often are seen at Lower Dover living in large groups of 30 or more individuals (Figure 26). The Common Agouti (Dasyprocta agouti) is also commonly found on the property (Figure 27), as are many other types of mammals. Agouti’s are related to guinea pigs and looks quite similar, but is larger and have longer legs. The species vary considerably in color, being brown, reddish, dull orange, greyish or blackish, but typically with lighter underparts. Their bodies are covered with coarse hair which is raised when alarmed. Baird’s Tapir (Tapirus bairdii) is usually found in the mountainous areas of Belize, but occasionally find their way down into the Belize River Valley (Figure 28). Additionally, many different species of snakes are found on the property, as are iguanas and various types of lizards. The forest is also very diverse and exhibits species adapted to riverine and upland environments (Figure 29). There are also locations where experimental plots can be sited to study flora, fauna, and processes.
justice, political science, ethnology, criminology, law, gerontology, demography and demographics, development theory, environmental education, biotechnology, economics, economic development, social policy, theology, sociology of development, policy studies, mass communication and media, urban/suburban/rural studies, and women's studies. The Lower Dover Field Station already has a stellar reputation in the local community, as well as with universities and colleges in Belize, government agencies and non-government organizations. Hence, the field station can serve as a “headquarters” where collaborative projects between project partners can flourish.

Lower Dover can also serve a similar function for educational outreach. The previously discussed educational outreach project related to the teacher education program that focuses on establishing increased levels of environmental understanding among local populations falls into this category. The details of this program are presented in a separate document titled “Community Engagement, Outreach and the Environment.” The long-term goal of the project is implementation of this teacher education program throughout Belize first and then the Caribbean-Basin over the next ten years. The facilities at the LDFS, and the local community, can be used as a site where project materials are created, tested and refined before broader implementation. Specifically, the program will train teachers to teach about the environment related to the local and regional communities. Students from academic institutions in Western Pennsylvania and Belize will be part of the process of developing and testing teaching materials. These concepts, methods and materials are transferable to other locations beyond Belize, which is one of the long term goals of the partnership and the proposed project.

The physical environment in Belize is the “number one” natural resource. Tourism and Eco-tourism are the largest industries in Belize, and hence, drive the economic engine of the country. It is essential that Belize be conservation and preservation minded and to protect their important and essential resources.

E. Conclusions

The establishment of the Duquesne University Tropical Field Station at Lower Dover will provide tangible benefits to faculty and students, as well as primary and secondary students and their teachers from the local and regional community. Regarding teaching and experiential learning, benefits for the partnership university students, Belizean primary and secondary students and their teachers include, but are not limited to:

1. Engaging students and teachers in inquiry based science activities that integrate scientific disciplines and provide field experiences that enrich student and teacher experiences as related to local and global environmental concerns.
2. Providing opportunities for teaching and reflection on teaching practices, and to provide opportunities for students and teachers to identify the process and products of current scientific research and their value / implications for classroom teaching and learning.

3. Providing students and teachers with skills and knowledge necessary to effectively use technology in research, experiential learning opportunities, and in science education.

4. Providing students and teachers with information regarding initiatives in science education for review and critical analysis, and enabling college and university students and primary and secondary teachers to critically analyze, revise and develop appropriate curriculum and teaching methods in environmental education.

5. Strengthening and broadening student and teacher understanding in content areas of science – including, but not limited to, biology, chemistry, physics and the earth sciences, and providing opportunities for students to learn about and link scientific, economic, and political principles as they pertain to environmental education.

6. Encouraging students to progress from a level of awareness, to knowledge, and finally to action as related to science, the humanities, and technology.

Learning Outcomes Can Include:

1. Active participation in hands-on investigations and inquiry-based activities.
2. Conduct hands-on investigations in environmental science and related disciplines in which students gather and analyze data and produce reports in written and oral formats.
3. Review and critical analysis of science education reform initiatives, assessment strategies, and curriculum and instruction.
4. Identify a variety of methodologies and program designs for investigating a range of environmentally-based issues and concerns, for the Belizean perspective.
5. Integration of information and concepts from a variety of disciplines including the sciences, economics, politics, and behavioral studies as they relate to current environmental issues.
6. Develop appropriate science inquiry-based classroom and non-classroom (field) activities that are an outcome of scientist/teacher/student interactions.
7. Critically analyze curriculum and develop instructional tools (lessons) suitable for teaching and learning in a variety of formal and non-formal educational venues.
8. Effective use of technology (media and laboratory) to enhance learning.

Regarding research, the Duquesne University Tropical Field Station at Lower Dover can be a location where faculty and students, can conduct on site research on a myriad of topics, as previously outlined in this document. The field station can also serve as a base of operations where local-area and regional multi and cross-disciplinary studies can be completed by both students and faculty from partnership institutions.

Forging this collaboration between the partnership academic institutions and the Lower Dover Field Station is a natural extension of the partner’s institutional visions and missions.
This project will espouse the virtues of the teacher-scholar model, wherein scholarship and research are incorporated with instruction, and will enhance experiential learning opportunities for all participating faculty, students, and teachers. It will also enhance the partner’s pedigree in Community-Engaged scholarship and service-learning by providing meaningful service, critical reflective thinking, and instruction that enhances student learning and social responsibility. These endeavors will facilitate linkages with “communities” on a variety of scales, and will foster reciprocity between university-grounded efforts and the agenda and vision of non-university partners. Rather than inserting a single-minded agenda, a multidisciplinary approach can facilitate discussion and be a catalyst for learning, systemic assessment and change.