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EPICS Lakota: Promoting Food Sovereignty on Pine Ridge Indian Reservation

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Cover Page Footnote

To Professors Bill Oakes and Brandon Fulk, two of our team's advisors over the years, for the guidance you gave and continue to give us. To our project partner Jim Sanovia, for our partnership. To Seyedali Ghahari, our writing advisor, mentor, and most importantly our friend, for always pushing us to strive for greatness. Most importantly, to the entirety of the EPICS Lakota team, members past and present. Thank you for everything you all have helped us to accomplish over the years and for the continued support as we look to the future.



EPICS LAKOTA:

Promoting Food Sovereignty on Pine Ridge Indian Reservation

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Samantha Bijonowski is a fifth-year student in the Civil Engineering program at Purdue University. She will be graduating in May 2021 with the intent to find a job in the transportation field. She was a member of EPICS Team Lakota from August 2018 until December 2019 and was Design Lead for her team during her third semester.

Kathleen Johnson is a fourth-year student majoring in Aeronautics and Astronautics Engineering at Purdue University and will be graduating in May 2022. After graduation she hopes to get a job working with spacecraft in astronautics. She was a member of EPICS Team Lakota from August 2018 until May 2020 and was a Design Lead for the team her second year.

Jonathan Damon is a senior in Civil Engineering, specializing in structures, at Purdue University. He will be graduating in December 2021 and hopes to be able to work in the construction field in New York City. He was a member of EPICS Team Lakota from its conception in August 2017 until May 2020 and was the Project Manager of the team for five semesters.

INTRODUCTION

Pine Ridge Indian Reservation, located near Rapid City, South Dakota, is classified by the United States Department of Agriculture as a low-income and low-access area. More specifically, it is a “low-income census tract where more than 100 housing units do not have a vehicle and are more than ½ mile from the nearest supermarket, or a significant number or share of residents are more than 20 miles from the nearest supermarket” (Food Access Research Atlas, 2020). In simpler terms, the reservation is what many people refer to as a “food desert.” Home to the Oglala Lakota people, it has an area of 3,469 square miles and is one of the poorest counties in the United States, with residents needing to drive over an hour just to have access to a store with fresh food.

Purdue Engineering Projects in Community Service (EPICS) Team Lakota was started in partnership with students and faculty at Oglala Lakota College (OLC) and South Dakota School of Mines (SDSM) to help address the issue of the food desert by promoting food sovereignty and combating the loss of cultural knowledge. The Declaration of Nyélení from the 2007 Forum for Food Sovereignty explains the concept of food sovereignty best: “Food sovereignty is the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems. It puts the aspirations and needs of those who produce, distribute and consume food at the heart of food systems and policies rather than the demands of markets and corporations” (Nyélení International Steering Committee, 2007). Becoming producers

of their own fruits and vegetables will aid in the reduction of the food desert, and the methods of food sovereignty being ecologically sound and sustainable methods of food production goes hand in hand with the Lakota ideal of respecting Mother Earth.

EPICS is a project-based service-learning engineering course that is open to all majors across all of the colleges at Purdue and that partners students with a community organization with the goal of solving a community problem. One of Team Lakota's projects that has withstood the test of time is the Greenhouse Project. Over the years, the team has planned, obtained grants for, and purchased a greenhouse that was constructed on OLC's Rapid City campus in May 2020. The establishment of the greenhouse on the college campus is a step in the right direction as it can be used as a teaching tool and incorporated into classes to educate students on culturally significant plants as well as agricultural methods they can bring back and use with their community.

Although the initial greenhouse was delivered, the project still flourishes and the team has continued the vision by working on updates for our original structure and creating a partnership with the OLC campus located in Kyle, South Dakota, on the reservation, to achieve our goal of using our first greenhouse as a model to establish more educational agriculture structures on the reservation and increase our overall impact.

DESCRIPTION

Our community partners are the Oglala Lakota College and the residents of the Pine Ridge Native American Reservation. According to the U.S. Census, this reservation is home to about 20,000 people (Center for New Media & Promotion (CNMP), United States Census Bureau, 2017). The poverty rate is 53.75% and the average per capita income for Native Americans living on the reservation is \$7,773 according to Re-Member, a nonprofit organization on the Pine Ridge Reservation (Re-Member, 2021). This is low compared to the overall U.S. average of \$27,599 as well as the average for all reservations of \$10,543. Life expectancy on the reservation is only 47 years for men and 55 years for women. Furthermore, Oglala Lakota County, which is located within the Pine Ridge Reservation, is recognized as the poorest county in the country with an unemployment rate of 89% (Re-Member, 2021), compared to the national average of 6.3% (Employment Situation Summary, 2021). These statistics are as accurate as possible, but it is important to note that because of how spread-out parts of the community are, the poor condition of many

roads on the reservation, and residents' general mistrust of outsiders, these numbers have been extrapolated and are feared to be underestimated. Many of these problems have led to a loss of culture within the community, which the Lakota tribe has been trying to fix and teach to the youth on the reservation. The Lakota people have a variety of prayers relating to growing, nurturing, and harvesting plants. By trying to both maintain and bring these traditions back to life, the Lakota people have been able to stay connected with their ancestors and their history.

When we started our partnership with Oglala Lakota College, the intention was to produce plans for both small greenhouses and bee boxes that would be placed on the reservation. The initial idea for these two projects was to allow for self-sufficiency among individual Pine Ridge residents and for possible revenue-generating sustainable projects. If at some point in the future Pine Ridge residents had their own personal greenhouses, that would help them with the problems they faced with food sovereignty. If bee boxes could be set up on the reservation, locals would be able to sell the honey for a profit and fund more sustainable projects in their communities. During the first year, much time was spent initially learning about our project partners and what their vision looked like. After a few weeks spent learning and researching, designs were created for bee boxes using the computer design software AutoCAD and delivered to the partners for construction. The students from OLC took over the project from that point on. The team has continued to have multiple projects during the partnership with the greenhouse becoming the largest project. Faculty from OLC had secured funding for a high tunnel greenhouse and operation through a federal grant, which allowed the scope of the project to be expanded to a larger greenhouse structure, with a complementary learning/community center on the Oglala Lakota College campus in Rapid City.

Although some EPICS students can meet with their local community partners in person, due to our distance Team Lakota had limited opportunities to meet directly with the partners. Over the course of the project, there were two trips that involved students traveling to Pine Ridge. Weekly conference calls with our project partners during which we each gave updates as to the progress made on the project were the main mode of communication. Over the course of the project, these conference calls have not only been important in making progress with our project but have also given our team valuable cultural insight that we would not have had otherwise. During these weekly meetings we would sometimes discuss current

events with our project partners, such as the severe flooding that Pine Ridge Reservation faced in March 2019, and we would get firsthand accounts of the issues facing the residents that we would not have gotten simply by watching the news. We also spent time learning from our project partners about historical events, the versions that they would not have taught us in school, and issues with racism that Native residents still face today. Our meetings with our project partners throughout the last couple of years have been beneficial to the project and beneficial to our development into understanding and compassionate people.

The project gained a lot of traction going into its second year with funding. Two grants were submitted in collaboration with the student team and the advisors. One was for \$25,000 from the Ford Community Foundation and the second was from the South Dakota Foundation for \$10,000. These funds were added to the OLC federal grant and allowed an expansion of the design and equipping of the greenhouse. The EPICS team was also paired with a Purdue Senior Design team from Construction Engineering and Management to help with designing the cultural center and greenhouse. Our team spent the year focusing on the interior of the greenhouse, including

tables, lighting, and irrigation. We also spent time researching and designing a rocket mass heater that we had planned on being a centerpiece in the cultural center. During this time, the senior design team was able to work with our project partners and develop a design for a greenhouse to purchase and construct, as well as hiring contractors to do the necessary construction and utilities hookups. They also delivered a design for the cultural center, which was beyond the scope of available funding and as of now has been put on hold. At the end of the school year in May 2019, part of our team was able to take a trip to Rapid City, meet our project partners, and prep the land for the greenhouse that was set to be delivered and constructed weeks later (Figures 1 and 2).

Unfortunately, due to issues with local codes, the design of the greenhouse needed to be changed to accommodate the snow loads, which involved the engineers at the greenhouse company. This delayed the delivery and construction of the greenhouse, and when we came back in the fall semester for our third year on the project, the team had to spend some time evaluating what we could do in the meantime. Much of the work we did focused on finalizing what would be ordered for the interior of the greenhouse, budgeting and rebudgeting as we gained



Figure 1. EPICS Team Lakota members with two of our project partners (far right) during our 2019 trip to Rapid City.



Figure 2. Team members moving a shed to prepare the area for greenhouse construction.

funds, managing our contracts, and maintaining contact with the contractors we had hired in the spring. We designed a drip irrigation system, created a table layout to both optimize grow space and ensure the interior would be ADA accessible, and did extensive research into lighting options. The overall budget for the project

was finalized at \$79,500, which went toward the greenhouse, the construction, the utilities hookup, and items for the interior of the greenhouse such as lighting, irrigation, and grow areas, which were ordered. In the spring semester of 2020 COVID-19 added to the complexities of finishing the designs. Our team, like all Purdue students, was sent home and we moved to all virtual meetings. Similarly, OLC moved to all online. Fortunately, the work we were doing with the partner more than 1,000 miles away could be done remotely. The devastation of the pandemic added many issues with government permitting offices closing at times and travel restrictions. The delivery and installation of the greenhouse meant navigating restrictions within Purdue, Illinois where the greenhouse was manufactured, and South Dakota where it would be installed. This delayed the delivery and construction of the basic structure until after the spring semester.

The greenhouse was finally delivered and constructed in May 2020 (Figure 3). Because of COVID-19 restrictions and the need for OLC to focus on their students and the shift to remote learning, the greenhouse was not brought



Figure 3. The fully constructed greenhouse in May 2020.

into operation in 2020. Since we have left, the EPICS team has continued to work with the OLC partners to finish the approvals for operation including securing all of the permits and bringing it online in the spring of 2021. The EPICS team has also started two new projects, one focusing on the next-generation greenhouse that would be located on the Kyle campus and a new project helping the tribe establish their own software dashboards to monitor the impact of COVID-19 on the reservation. The greenhouse follow-up team has been working on multiple aspects of the greenhouse operation including fully automating the interior of the greenhouse to allow operation to continue in the summer when the He Sapa campus is not staffed each day. The team has also been working toward making the greenhouse fully ADA accessible.

EPICS Lakota is one of 44 EPICS teams available for students to join. Like any EPICS team, Lakota is open to students from any year and any major. Whether it is engineering, education, economics, or other fields interested in food sovereignty and Native American issues, all are welcome and all are encouraged. It is an experience you will not get from any other class.

COMMUNITY IMPACT

One easy way to see how successful our project has been is to see how community involvement has grown over the years. What originally started as a partnership with only a handful of students and faculty at OLC Rapid City and South Dakota School of Mines has become a web of communication between a consistently full Purdue EPICS team and faculty and students at multiple OLC campuses, including occasional communication with other schools and professionals in the Rapid City area. We hope that our project continues to take root and grow into other communities across the reservation.

Looking toward the future, we are hoping future teams build on our success and can expand the impact to other areas including the new design in Kyle, a community on the reservation. We have been working on identifying what we can scale down from our original greenhouse in an effort to make it more affordable, with the intention to make it able to be mass produced.

While the EPICS staff have traveled to the community multiple times to create and nurture the relationship, we were able to take two trips to meet our project partners, once in November 2017 and once in May 2019. It was an incredible experience to go see the communities we were helping firsthand and meet with our project partners after

having spent so many hours communicating with them over the phone and through video calls. While we had always known that the work we were doing was important for these communities, it was reinforced when we got to meet residents in person and hear their stories about what life was like on the reservation and what this project and partnership meant to them. We spent a day with them on campus at Oglala Lakota College where they shared with us stories about what they hoped for the greenhouse, as well as brought in food like fry bread and homemade blueberry compote for us to try. One of the teachers at the school brought in buffalo hair from a ceremony they had recently completed and gifted us with a small amount after explaining its significance.

The intention for our greenhouse was not only to help the Lakota people create their vision for a better community, but to be a benchmark and provide a guide to help make agriculture more accessible across Pine Ridge. It is our hope that the relationship that we helped start with Purdue students can continue for many years and the impact of the work will be felt well beyond that. The main purpose of our project was to build our relationships as we worked and walked with the Lakota people as they worked to implement their vision. We left behind a tangible structure that we worked together to make a reality, and our instructions and suggestions for use. Our project partners also have had access to our project documentation, so they would be able to replicate our work if need be. We have also left an EPICS team that has continued to work with the partners. In the future, we will know our project was successful if we are able to see the impact we made as students still echoing years after we have left.

One of the biggest challenges we faced throughout the project was communication. Since our project partners were over 1,000 miles and two time zones away, we often ran into issues with scheduling time to discuss project updates, which sometimes caused us to run into timeline issues. It was sometimes difficult to get feedback from our project partners, so we would analyze their previous thoughts and use those to move forward, occasionally having to make some changes as feedback came through. Overall, none of our barriers were insurmountable, and we were able to make the first of hopefully many team deliveries with the construction of the greenhouse in 2020 in the middle of a global pandemic.

STUDENT-AUTHOR IMPACT

EPICS provides a unique experience with regard to team and project work. There are not many places where

undergraduates can work on projects that have real-world effects and involve deadlines and approval by project partners. Going into this project we did not know what to expect. Given that most people on the team were first-years at the beginning of the new team, they had not experienced teamwork like this. Most of the time, especially in a high school setting, when students are involved in projects, the stakes are not that high. While they have grades to consider, many times school projects involve mundane work that does not have much real-world impact. With EPICS, and even more so with Team Lakota, the projects that our team were engaging in were directly benefiting the lives of dozens or hundreds of people halfway across the country. To make things even more interesting, students are mostly left to complete project work and lead communication with project partners with feedback and guidance from their teaching assistants and faculty advisors. The faculty and graduate assistants were present for all of the communications and they also communicated with the partners, including visits to the partners, so we really felt that we had ownership of the project and the relationship. This helps show students what their careers may look like in a couple years when they have deadlines and managers to report to.

Besides gaining valuable insight into how real-world projects function, we also gained a tremendous amount of understanding with regard to working as a team. Having to communicate with our partners through a video call every week, coordinate group work, and

report progress proved to be quite challenging in the early stages of our project. There were many instances when miscommunication led to potential problems with group work. Thankfully, we were able to overcome these challenges and work ourselves into a productive groove that helped carry our project through the next few semesters. Compiling all of our progress into bi-semester presentations to show to our team advisors, project partners, and external reviewers allowed for further individual learning. We were introduced to new ways of articulating information in a formal setting. We often structured the design review presentations to include our partners from South Dakota to co-present our work and ideas together. It always felt amazing to show what we had accomplished and explain what was to come.

Projects like this that have a lot of moving parts and involve many different groups of people can be very daunting. One way that team members can be better prepared for what is to come is to have them on call with the project partners and have the partners explain to the students what the project means to them, and what their vision is for the future. We did this several times throughout the multiple semesters we were working on our project and it always gave us a greater understanding and appreciation for what we were doing.

Another opportunity for cultural exposure is the Native American Cultural Center on Purdue's campus (Figure 4). There we learned about the history of various



Figure 4. Team members visiting Purdue's Native American Educational and Cultural Center.

Native American tribes and some of the traditions and stories they have passed down through the generations. We also got to learn about what it is like for Native Americans in the country today and the resources centers like theirs have to help out students and families.

CONCLUSION

Purdue EPICS gives students an incredible opportunity to see how their efforts can make a real difference in people's lives. While our project was large-scale and far from home, there are many other teams that have larger and smaller scale projects that involve West Lafayette and the surrounding communities as well as global partners. Getting involved with EPICS is one of the best decisions a student can make here at Purdue because you learn a lot while doing very rewarding work. It is very rare that students are able to make a real difference by doing their schoolwork, but EPICS students do exactly that.

For this project in particular, we felt it was important to write this article to show that projects can evolve as the scope focuses and the amount of information increases, but the intent of the project remains unchanged. Our team has spent four years working with local students and community leaders to figure how to best meet the needs of the community and the work of the team continues with new students. It took time for the project to take on direction, and that time was entirely necessary to build up a working relationship. Because of this relationship, our team has been able to adapt as the project changed, our partners were not hesitant to bring up any issues with us, and we were able to clarify anything vague. This experience has taught us a lot about working with a community, which is something every member of our team will be able to use as they set out into the workforce.

Every person who has worked on this project has been able to see the commitment our team has. The relationship between the students at each school has had four years to develop into its current strength. We have all had to learn how to properly communicate our ideas, and our team especially has had to learn how to share technical information so that it can be understood by everyone. We have also learned from the misunderstandings that have occurred when information is not

accurately communicated. By having weekly meetings with our project partners, we have all been able to benefit from the different levels of expertise and experience brought to the table by each school and have had access to resources we would not have been able to have at just our school.

And this project is far from over. The overarching goal of increasing food sovereignty on the reservation is a lofty goal that will not be solved overnight or even with our four-year project. Our approach has thus far been indirect, but with the hope of spreading knowledge that residents of the reservation could implement on their own. Many good ideas have developed over the course of this project, and many were abandoned along the way to focus on more timely things. But what this project could use more than anything is more involvement from more students. More students willing to put their time and effort toward a project that aims to make a difference on a larger scale. The experience that can be gained from working on this team is invaluable. EPICS courses are a great way to learn about what a degree in engineering could look like as a career, and Team Lakota more than most. Any student looking to be a part of something important that will teach them things beyond the academic world could do no better than EPICS Team Lakota.

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