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## WORK PLAN

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Project Name: Pine Ridge Affordable Housing Project

Client: First Families Now

State: South Dakota

Chapter(s) or Section(s) Involved: Cornell University Chapter, Domestic Sub-team

Project Lead(s): Evelyn Chiu and Isabel Câmara

Responsible Engineer in Charge (REIC): Adam King, PE

## 1 Project Description

With housing insecurity and overcrowding as major problems in the Pine Ridge Reservation in South Dakota (“Pine Ridge” or the “Reservation”), the goal of the Sustainable Housing Unit (SHU) project is to create a safe and comfortable housing unit for three members of the Reservation and their families. The goal of this project is to design a sustainable solution for the families by planning for a four-person home with all basic utilities and comfortable living space, including a kitchen and a full bathroom. The final deliverable for this project is a housing design for a standardized, replicable SHU.

### 1.1 Client Description

The client is First Families Now, which is an organization within Pine Ridge that organizes donations and other services for geographically isolated communities with various needs. Alice Phelps, the Director of First Families Now, assists the Cornell University chapter of Engineers Without Borders (the “Domestic Sub-team” or “project team”) in multiple ways: she connects them to individuals in Pine Ridge who would benefit from the SHU project and provides valuable input regarding design choices, local suppliers, and funding.

The relationship between the Domestic Sub-team and First Families Now began in the Fall of 2019, when the Domestic Sub-team was directed to Alice Phelps through a related organization while doing new project outreach. The Domestic Sub-team and First Families Now decided to pursue a housing project in February of 2020. Communication has occurred frequently since then. The First Families Now and the Domestic Sub-team connect via email, phone, and Zoom meetings at least once a month in order to review design ideas, answer questions, and find suppliers.

### 1.2 Community Background and Beneficiary Description

Pine Ridge, which is home to the Oglala Sioux Tribe, is located in the southwest region of South Dakota and is among the largest reservations in the United States. The Reservation’s population is approximately 20,000.

According to a proposal prepared by First Families Now, the following statistics describe housing in the Pine Ridge community:

- An estimated 17 people live in each family home, and these family homes often have two to three rooms, some with dirt floors.
- More than a third of homes have no electricity or water/sewer systems, forcing many to carry (often contaminated) water from local rivers daily.

- At least 60% of homes on the Reservation need to be demolished due to potentially fatal black mold infestations. However, there is no insurance or government programs to assist families in replacing their homes.

With the need for safe housing so urgent within the community, community members experiencing homelessness or housing insecurity would benefit from the implementation of the SHU project. In Spring 2022, First Families Now identified three elders who serve as the top priority for these housing units. They are located within Pine Ridge, specifically in Porcupine, SD and Kyle, SD.

### 1.3 Location

There have been multiple locations where the client has considered building the SHUs. The client has identified three elders within Pine Ridge as the highest priority homeowners. These elders live in three different locations within Pine Ridge, in deteriorating mobile homes on their own property.

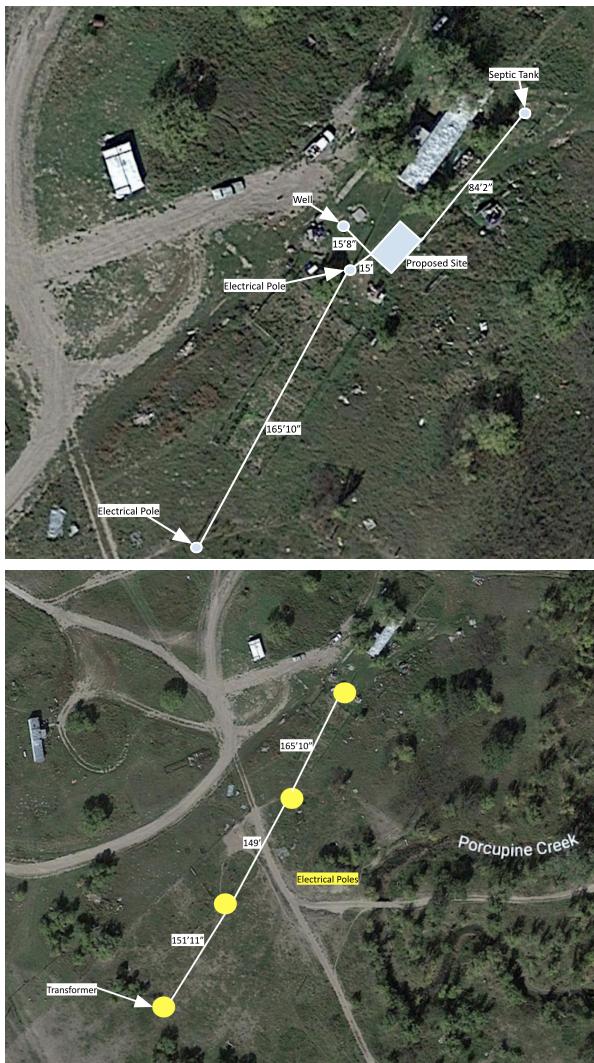
Because the elders are already living in mobile homes within their own property, many of the required site connections already exist for a foundational home. Many of the homes have existing water meters, drain fields, and septic tanks for plumbing purposes. Additionally, electricity is accessible for the proposed site through transformers and electrical lines on the property. The locations of these have been mapped out on the following site maps generated from the project team's first site assessment trip.

*David Pourier*

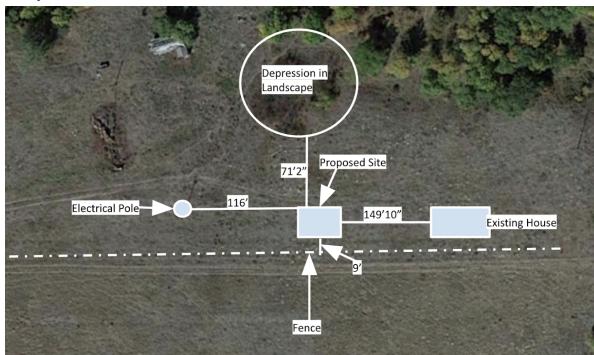


One of the elders that has been identified as a top priority homeowner is David Pourier. The coordinates of his property are:  
 43.413806°, -102.407518°.

*David Swallow*



*Stephanie Two Crow*



The second elder that has been identified as a top priority homeowner is David Swallow. The coordinates of his property are  $43.265656^\circ, -102.349320^\circ$

The last elder that has been identified as a top priority homeowner is Stephanie Two Crow. The coordinates of her property are  $43.339257^\circ, -102.206367^\circ$ .

Unlike the other elders, however, she does not have running water or a septic tank.

## 1.4 Environmental Resources Present

There are no known environmentally sensitive habitats that would impact the design of the Project. The housing units are being constructed on land chosen and owned by the members of the community where there are no nearby habitats or bodies of water to impact local biodiversity.

Soil samples were obtained in a spring assessment trip to collect soil types and elevation data. Soil boring tests were conducted on each site. The project team will be looking into hiring a surveyor to confirm that no contaminants are present in the soil in the sites of the three elders.

## 1.5 Population & Growth Capacity

According to the U.S. Census Bureau's American Community 5-Year Survey in 2017-2021, the population of Pine Ridge is estimated to be 19,157.

Previous U.S. Census data shows that the Pine Ridge community experienced an increase in the population of 21% between the years of 2000 and 2010. The population of Pine Ridge is expanding, and the community's housing capacity does not match this increasing rate. With the SHU project, the project team hopes to mitigate Pine Ridge's housing shortage by designing a home that is easily replicable and cost-effective, providing design-related support throughout the process.

Because SHUs will be developed by the Pine Ridge community for individual community members on a member-by-member basis, the project team does not attempt to project the numbers necessary to meet a certain housing capacity by the end of the SHU project. The project team is only providing the community a housing design and is not directly involved in the construction process nor the number of SHUs constructed. The project team shall not be responsible for any replication of the design for use other than the SHUs for the three identified elders.

## 2 Need for Project

The Oglala Sioux Tribal Housing Authority has only constructed housing for 43% of the 2,300 families that live on Pine Ridge, and as a result, housing insecurity and overcrowding have become major problems in Pine Ridge. Extended families squeeze into small trailers that are often old and run-down. Many families lack insulation, heating, electricity, running water, or sewage systems. This is especially a problem for the tough weather conditions that Pine Ridge often faces. Pine Ridge faces wet seasons, frozen soil, blizzards, large hail, heavy winds and rains. This is no match for the deteriorating mobile homes of the Pine Ridge residents. Most homes are patched with plywood, tape, and plastic where the weather has destroyed the home.

The lack of sufficient housing conditions results in poor health conditions over time. The Oglala Sioux Tribal Housing Authority council has estimated that at least 4,000 homes would need to be constructed in order to assist the housing insecurity issues and meet the demands of the growing population. Thus, the Domestic Sub-team's goal is to produce a sustainable and affordable housing solution for families by designing a four-person home with basic utilities and comfortable living space. The client has three identified elders in need of housing.

The project team aims to create a design for a home that will be standard and easily replicable. The design will aim to consider housing longevity by including a foundation, proper insulation, heating, electricity, and plumbing. To minimize cost and allow for efficient implementation, the design will be a small 20' x 24' structure.



Nord, James. "Oglala Sioux Seek Solutions on Chronic Housing Shortage." Argus Leader, Argus Leader, 20 Dec. 2015, <https://www.argusleader.com/story/news/2015/12/20/oglala-sioux-seek-solutions-chronic-housing-shortage/77668294/>.

"Our Work: Lakota Kidz: Hull, MA." Lakota Kidz, <http://www.lakotakidz.com/our-work.html>.

## 2.1 Health, Sanitation, and Security

Because each of the target homeowners currently lives in houses that are in poor condition, the project team must remain aware of the safety concerns associated with the failing infrastructure. Additionally, loose parts and large pieces of scrap sit on the property of the elders because of the monetary expense required to remove trash from homes. Furthermore, many community members do not live with running water and rely on outhouses and water spigots, introducing sanitation concerns that may be relevant at the sites to be examined. These both present a safety concern as well. The project team members entered the elders' properties for site assessments in April 2022, but further site risks will be mitigated through virtual methods of contact with the elders for project updates and questions.

There are no county planning or zoning requirements in Pine Ridge that would prevent this project from being constructed on the aforementioned properties. Because the subject properties are not on non-fee land, no federal planning or zoning regulations apply. The Domestic Sub-team contacted the Fall River/Oglala Lakota Counties Director of Equalization via email (attached below) and the local Bureau of Indian Affairs office via phone call to confirm each of the above statements, respectively.

### *Photos from Assessment Trip*



*BIA Superintendent Correspondence about Zoning*

# Cornell

Evelyn Chiu &lt;ewc55@cornell.edu&gt;

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**Pine Ridge Reservation Planning and Zoning Requirements**

2 messages

 Evelyn Chiu <ewc55@cornell.edu>  
 To: doe@frcounty.org

Wed, Feb 23, 2022 at 10:37 AM

Good morning,  
 I am a part of Engineers Without Borders at Cornell University, and we are working on a small housing unit that will be located on the Pine Ridge Reservation. We were able to find this attached letter, which says there are no planning and zoning restrictions.  
 Does this letter reflect the county's most recent regulations for planning and zoning for tribal lands? Are there additional requirements that we should be made aware of as we progress with our plumbing, electrical, and structural designs?  
 Thank you so much.

Best,  
 Evelyn

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 Oglala Lakota County Planning \_ Zoning Letter.pdf  
 64K

 Cody Johnson <doe.johnson@frcounty.org>  
 To: Evelyn Chiu <ewc55@cornell.edu>

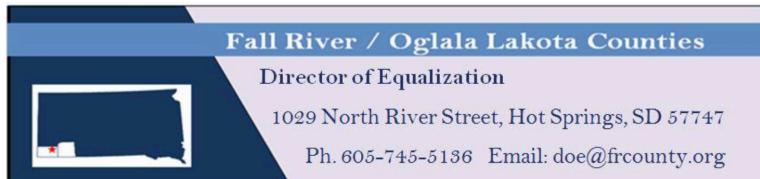
Fri, Feb 25, 2022 at 10:24 AM

Hi Evelyn,

We do not have planning and zoning but the tribe may have regulations or information that you may want to explore.  
 Please give Troy Ferguson a call 605-867-5141 and he may be able to help you sort out your concerns in Oglala Lakota County.

[Quoted text hidden]  
 --

**Cody Johnson**  
 Administrative Assistant  
 Director of Equalization  
 Fall River & Lakota Oglala Counties  
 1029 North River Street  
 Hot Springs, SD 57747  
 605-745-5136

*Zoning Requirements Letter:*


August, 3 2020

To Whom It May Concern:

Oglala County does not currently have any planning or zoning regulations in place for any of the fee land. Oglala County does not currently require a building permit for new construction that is outside of the corporate limits of the municipalities. For questions regarding building planning and zoning on Tribal Lands, please contact the local BIA office.

If you have any questions regarding this matter, contact me at the above telephone number.

Susie Hayes  
 Director of Equalization

## 2.2 Infrastructure

According to the Pine Ridge Reservation Humanitarian Rescue, 60% of the homes within Pine Ridge do not meet basic standards—lacking water, electricity, insulation, and sewage. The current homes of many of the Pine Ridge residents include deteriorating mobile homes that lack a foundation. This makes the homes in Pine Ridge highly vulnerable to the harsh weather conditions that Pine Ridge often faces.

The current housing of the three elders in Pine Ridge shows this lack of proper infrastructure. Windows are covered with wood and plastic wrap because tough weather conditions have broken original window panes. Ceilings leak and floors are broken down from water damage. Residents are unable to afford more durable housing and instead rely on attempting to rebuild their old, damaged homes with temporary and insufficient solutions. Their homes are dilapidated and are inadequate for living standards regarding safety and sanitation requirements. Thus, the SHU project aims to provide a small, efficient, and cost-effective solution to help meet the basic needs for housing in Pine Ridge.

### *Current Housing of the Elders in Pine Ridge*

*David Pourier*



David Pourier's housing is a turquoise trailer that is more than forty years old. His windows have been broken from hail and he relies on plexiglass sheets to cover any damage.

*David Swallow*



David Swallow has been living in a cabin that is over twenty years old. It is without a foundation. The doors of his home are drapes, the wooden floors are chipped, and there is a leak in his ceiling. He lacks a proper kitchen, relying on a microwave and his wood stove to boil water. He lacks running water and uses an outdoor well and outhouse.

*Stephanie Two Crow*



Stephanie Two Crow's house is more than sixty years old. The kitchen and living room floors burst because of plumbing issues that require her to turn the water off. Water is instead hauled from a water spigot on her property and drinking water comes in the form of jugs that she buys from the nearest town. Her windows have been broken by the hail and are covered with plexiglass sheets.

### 3 Stakeholder Analysis

The client for the SHU project is First Families Now. The project team works with the Director of First Families Now, Alice Phelps, to make design choices based on the community, identify local suppliers, and find grants to assist with funding. First Families Now has also identified three elders who serve as the priority homeowners for this SHU project. Alice Phelps has connected the project team with these elders, who are David Pourier, David Swallow, and Stephanie Two Crow.

The project team has connected with these three elders. Although the housing designs are uniform for all individuals, the project team wants to ensure that the sustainable housing design would be able to support their needs, as well as receive valuable community input for their designs. The project team has also visited their land and mobile homes, in order to better understand their needs.

| Name               | Position/Title, and Affiliated Organization or Employer                                      | Describe relation to project or role                  | Email and Phone Contact Information  |
|--------------------|--|---|--|
| Alice Phelps       | Director of First Families Now<br><a href="http://1stfamiliesnow.org">1stfamiliesnow.org</a> | Client Representative                                 | <a href="mailto:alicephelps2018@gmail.com">alicephelps2018@gmail.com</a><br>(605) 407-8561 |
| David Pourier      | Elder and Resident in Porcupine, SD  | Community Representative, Potential Resident for Home | <a href="mailto:pourierdavid@yahoo.com">pourierdavid@yahoo.com</a><br>(605) 407-2172       |
| David Swallow      | Elder and Resident in Porcupine, SD  | Community Representative, Potential Resident for Home | <a href="mailto:daveswallow56@gmail.com">daveswallow56@gmail.com</a><br>(605) 407-0922     |
| Stephanie Two Crow | Elder and Resident in Kyle, SD   | Community Representative, Potential Resident for Home | <a href="mailto:stwocrow@olc.edu">stwocrow@olc.edu</a><br>(605) 381-7462                   |

## 4 Scope of Services

### 4.1 Deliverable(s)

| <b>Deliverable Type</b>                        | <b>Purpose</b>  | <b>Detailed Description:</b>  |
|--|---|---|
| Design Documents                               | Stand-alone documents that can be used for the construction of the SHU project. | <p>Detailed design documents presenting dimensions, materials, calculations, and procedures will be created using AutoCAD software and compliance with the most recent International Building Code.</p> <p>Within these design documents, the project team will compile a floor plan, elevation drawings, structural drawings, building frame drawings, mechanical drawings, plumbing drawings, electrical drawings. Calculations will be provided separately in a schedule detailing the results of those calculations and construction details.</p> |
| Specifications and Quality Assurance Documents | Written documents detailing how the SHU should be maintained.                   | Detailed written documents that will include specifications to guide homeowners to make decisions related to the long-term maintenance of the SHU.  |
| Bill of Quantities                             | Preliminary cost estimation based on selected materials                         | Description of materials recommended by the project team for the SHU, complete with estimates of cost and quantity of materials.  |

After discussion with First Families Now, the Domestic Sub-team has decided to not include a site connection plan within the deliverables. This is because the client has plans to use the construction drawings in multiple locations and has ensured the project team that the community, construction team, and contractors can ensure that the home is connected to utilities.

### 4.2 Client's Plan for Deliverable(s)

The project team's deliverables will be for a 20' by 24' housing unit. CECorps will not be involved in any future implementations of the SHU outside of the scope of the three identified homeowners.



First Families Now has identified local suppliers, utility companies, and construction workers that will be utilized for the implementation of this SHU project. First Families Now's construction crew will be in charge of the construction of the home, using the project team's designs, material suggestions, and manual as support throughout the SHU project. The SHUs will be built on land owned by community members in need.

## 5 Project Schedule

| Event  | Date                            | Description  |
|--|---------------------------------|--|
| Project Kickoff                                | February 7, 2022                | CECorps staff officially starts the project team. The Project Lead, REIC, and QAM were present at the meeting.   |
| Initial Site Visit                             | April 22, 2022 - April 23, 2022 | Work-planning with community representatives on the scope of work and deliverables requested. Interview conducted with community representatives to ensure that individual needs are accounted for and met within the standard design of the home. |
| Submit Work Plan & ESA to CECorps for Review   | November 2022                   | Submitted to CECorps for review by Technical Review Committee and Legal Review Committee and approval. <i>Please allow 2-3 weeks for CECorps review.</i>   |
| Work Plan Finalized                            | February 2023                   | Finalized Work Plan will be sent to the REIC and client representative. ESA to be signed by REIC and client representatives shortly afterward.   |
| Submit Draft Deliverable to CECorps for Review | End of 2023                     | Present draft deliverable to CECorps for review by Technical Review Committee.   |
| Final Submittal of All Deliverables to Client  | Beginning of 2024               | Present all listed deliverables.   |

## 6 Quality Control

The Project Lead often connects with CECorps professionals throughout the year. Any time the project team has a CECorps-related question or requires additional advice or input about the direction of the Project, the Project Lead reaches out to the CECorps representative. Additionally, the Project Lead reaches out to the CECorps representative when the project has an important update. Once the Project has been moved to the Execution Phase, the Project Lead will update the CECorps representative about important project design iterations.

At a minimum, at the beginning and conclusion of each semester, the Domestic Sub-team contacts the REIC and QAM with plans for the semester and design progress that was completed during the duration of the semester. However, the Domestic Sub-team connects with the REIC and QAM under several other conditions:

- Project has an important update (e.g. site visit, completion of Work Plan, etc.)
- A new project iteration has been completed
- Project team has a question or requires advice that pertains to the expertise of the REIC or QAM

Additionally, because of the multifaceted nature of this SHU project, the project team has a team of professionals that assist with multiple aspects of the SHU project. The project team has divided itself into trades – a Structural & Architectural trade, an Electrical & Heating trade, and a Plumbing trade. Each trade has at least one expert who works professionally in that trade that provides feedback and advice for the current design. Each trade connects with these professionals via Zoom meetings or email at least once a semester, and during these meetings, the trade reviews all key decisions with the professional and asks questions about future decisions. However, as the Domestic Sub-team works to integrate and coordinate trades in the final design, these meetings will increase in frequency as necessary to complete the design of the SHU.

*Professionals Assisting with the SHU Project*

| Name                 | Position/Title, and Affiliated Organization or Employer   | Describe relation to project or role | Email and Phone Contact Information                                |
|----------------------|---|--------------------------------------|--|
| Adam King, P.E.      | Professional Structural Engineer<br><a href="http://www.kingengineer.com/">http://www.kingengineer.com/</a>       | REIC                                 | <a href="mailto:adam@kingengineer.com">adam@kingengineer.com</a>   |
| Rain Araneda         | Engineer, STEAM Educator<br><a href="https://mutualaiddisasterrelief.org">https://mutualaiddisasterrelief.org</a> | QAM                                  | <a href="mailto:rain.araneda@gmail.com">rain.araneda@gmail.com</a> |
| Matthew Reiter, P.E. | Cornell University Civil Engineering Professor  | Assists Structural Trade             | <a href="mailto:mtr68@cornell.edu">mtr68@cornell.edu</a>           |

|                         |  |                                      |  |
|-------------------------|--|--------------------------------------|--|
| Michael Chen,<br>P.E.   | Principal at Socotec US<br><a href="https://www.socotec.us/">https://www.socotec.us/</a>                         | Assists Structural Trade             | <a href="mailto:michael.chen@socotec.us">michael.chen@socotec.us</a>                                   |
| Ken Hover               | Cornell Civil Engineering Professor<br>(Concrete Expert)   | Assists Structural Trade             | <a href="mailto:kch7@cornell.edu">kch7@cornell.edu</a>   |
| Joe Adamson,<br>P.E.    | Principal at Adamson Riva & Lepley Architects<br><a href="https://adamsonriva.com/">https://adamsonriva.com/</a> | Assists Architectural Trade          | <a href="mailto:jadamson@adamsonriva.com">jadamson@adamsonriva.com</a>                                 |
| Nadine Hachmann         | Architect with Cornell University Facilities   | Assists Architectural Trade          | <a href="mailto:nh372@cornell.edu">nh372@cornell.edu</a>   |
| Hon Chang,<br>P.E.      | Plumbing Engineer at IAQ Systems<br><a href="http://www.iaqsys.com/">http://www.iaqsys.com/</a>                  | Assists Plumbing Trade               | <a href="mailto:hchang@iaqsys.com">hchang@iaqsys.com</a>   |
| Dr. James Yarmus        | President at Yarmus Consulting Services Group, Past REIC for Cornell EWB's Bolivia Project                       | Assists Electrical and Heating Trade | <a href="mailto:yarmus@yahoo.com">yarmus@yahoo.com</a>   |
| Patrick Engels,<br>P.E. | Geotechnical Engineer Licensed in South Dakota<br><a href="https://www.coresd.com">https://www.coresd.com</a>    | Former REIC                          | <a href="mailto:patrick@coresd.com">patrick@coresd.com</a><br>Ph: (605) 234-2673<br>Cl: (605) 280-8596 |

## 7 Site Specific Safety Hazards

The project team has reviewed the CECorps Health and Safety Guidelines and understands the conditions and expectations set forth by CECorps.

To expand upon site-specific safety hazards that the project team may face, the project team does not have any direct safety hazards in regard to the Project, as the project team will not be participating in the construction of the individual SHUs.

However, there are extra safety precautions that the team will be taking in terms of travel because of the ongoing COVID-19 pandemic. They have been outlined in the CECorps COVID-19 Safety Plan that the project team submitted before their initial site visit. To reiterate the most important points:

- Before any site visit, the project team will ensure that permission has been obtained to visit the community and/or community partners
- Each traveler will follow the proper health precautions
  - Negative viral test prior to any trip
  - All travelers will be fully vaccinated, at least two weeks prior to travel
  - Sufficient PPE (masks and hand sanitizer) for the project team and close contacts
  - Maintain social distancing when possible
  - Confirm knowledge and understanding of common signs and symptoms of COVID-19
- The project team will plan for contingencies in the event of a positive COVID-19 test

## References

David Norris, Christy Rogers, Matt Martin, and Jason Reece. "Strengthening the Pine Ridge Economy" (2015). The Kirwan Institute for the Study of Race and Ethnicity at The Ohio State University, 6. [https://www.policylink.org/sites/default/files/PineRidge\\_FINAL.pdf](https://www.policylink.org/sites/default/files/PineRidge_FINAL.pdf)

NoiseCat, Julian Brave. "'We Gotta Carry on': The Struggle to Rebuild in One of the Poorest Places in America." HuffPost, HuffPost, 10 June 2019, [https://www.huffpost.com/entry/pine-ridge-thunder-valley-housing-community-development\\_n\\_5cd47574e4b0796a95d8824f](https://www.huffpost.com/entry/pine-ridge-thunder-valley-housing-community-development_n_5cd47574e4b0796a95d8824f).

Tell, Dana and Betz, Axton, "Housing Issues and Solutions for the Residents on the Pine Ridge Reservation, South Dakota" (2012). *Faculty Research & Creative Activity*. 15. [http://thekeep.eiu.edu/fcs\\_fac/15](http://thekeep.eiu.edu/fcs_fac/15)

U.S. Census Bureau (2017-2021). American Community Survey 5-Year Estimates. Pine Ridge Reservation, SD--NE

<https://data.census.gov/cedsci/table?q=Pine%20Ridge%20Reservation,%20SD--NE%20%28part%29%3B%20South%20Dakota&tid=DECENNIALPL2020.P1>