

# Mni Siča: How does land use increase coliform bacteria concentrations in drinking water sources for the Santee Sioux Nation?



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The overall aim of my project is to study the effects of land use, elevation, and floodwaters on drinking water quality in Santee, Nebraska.

- Livestock pastures and septic lagoons are two primary point sources of total coliform bacteria in groundwater wells used for the reservation.
- Floodwaters, channeled runoff, and high levels of coliform bacteria will subsequently further degrade water quality within Santee.

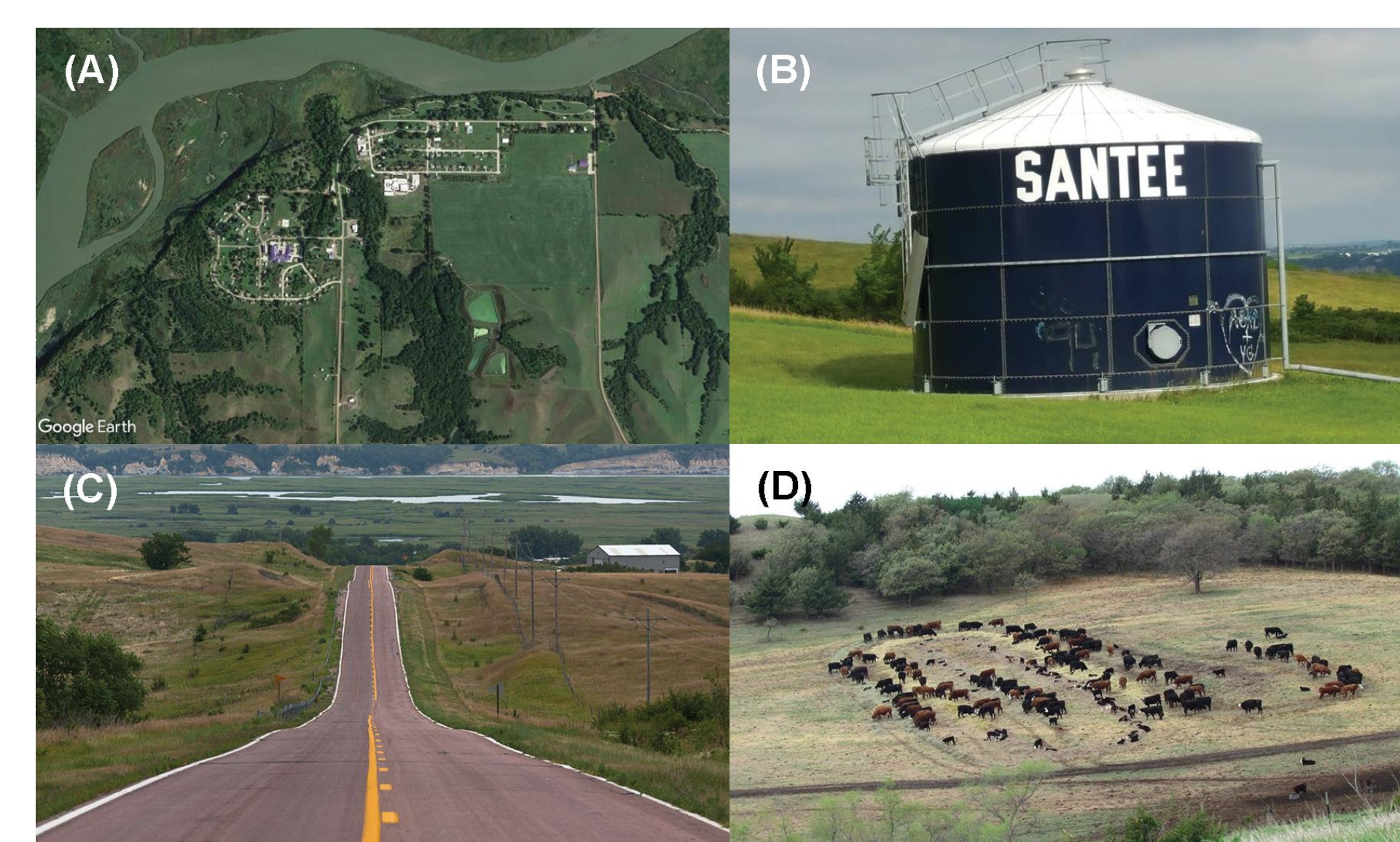


Figure 1: A. Image courtesy of Google Earth, B, C, D, courtesy of Santee Sioux Office of Environmental Protection

## Tribal Land

Established in 1866, Santee is located in northeastern Nebraska along the Missouri River. Current size is approximately 184 square miles with a population 1,460 people. The northern portion of reservation land consists of forests, bottom lands, and the village of Santee. Pasture, rangeland, and cropland cover dissected plains throughout the remainder of the reservation.

## Drinking Water

- Water delivered to the Santee Sioux Nation is of poor quality due to high concentrations of total coliform bacteria (TC) specifically fecal coliform
- TC are organisms present in the environment as well as the intestinal tract of mammals, known as fecal coliform
- TC do not cause illness, their presence in water indicate disease-causing pathogens could be in the water system as well
- 44% of ground water samples taken within reservation boundaries exceed EPA primary drinking water standards for TC
- 100% of streams sampled contained TC, Bureau of Reclamation (2006)

## Seasonal Flooding

- In 1999 flooded well fields resulted in contamination of coliform bacteria requiring months of clean up and emergency trucks of water. In response wells were elevated, although in recent years floods are more frequent, pushing water over wells
- In 2019 heavy rainfall, and rapid snowmelt, associated with the collapse of dams caused catastrophic flooding across Nebraska, including Santee. Flood waters and ice caused a power outage and infrastructural damage to the water supply system, both of which took three days to restore.

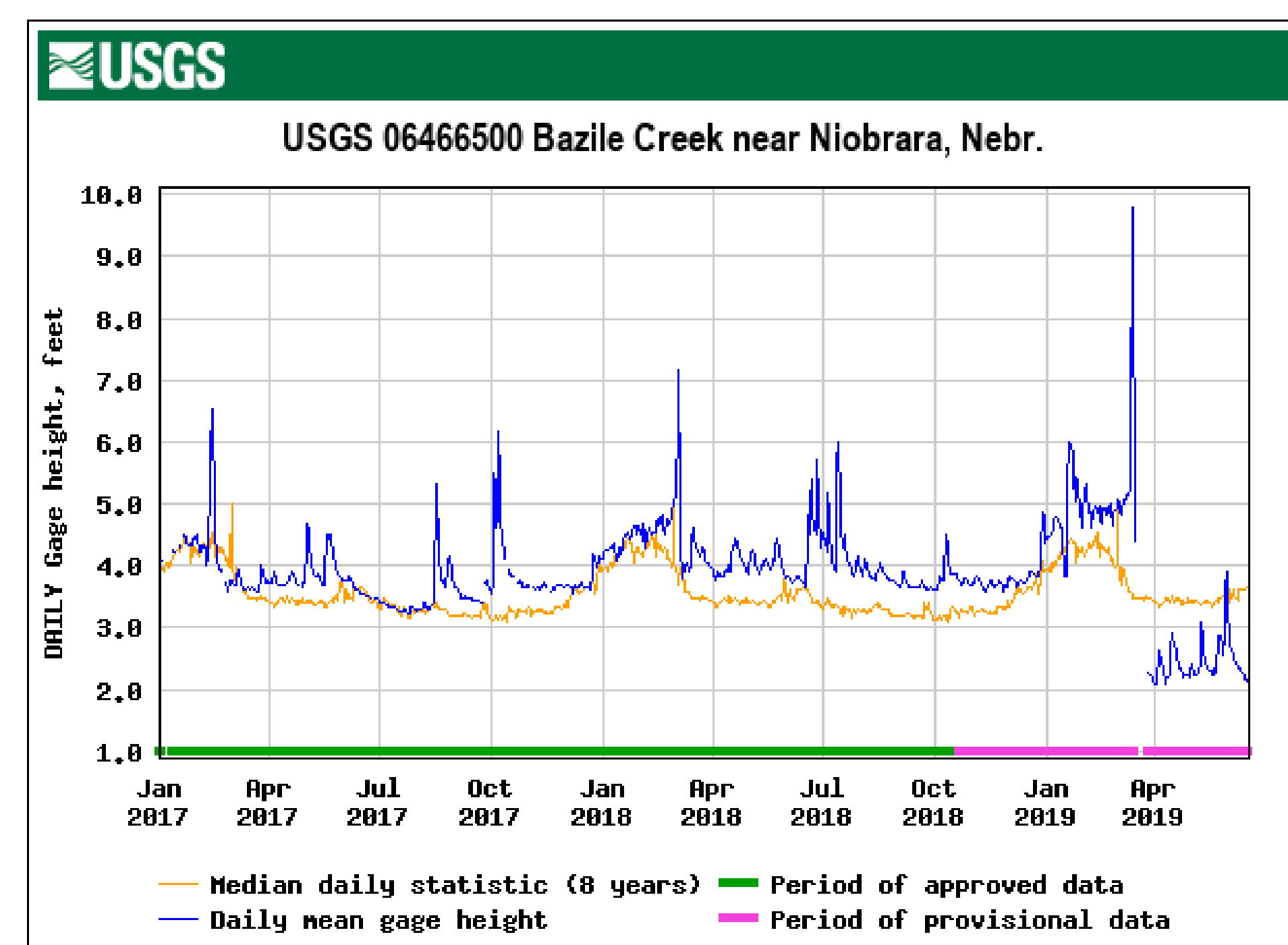


Figure 2: USGS National Water Information System: January 2017 - June 2019

## Santee Sioux Nation Reservation, Nebraska

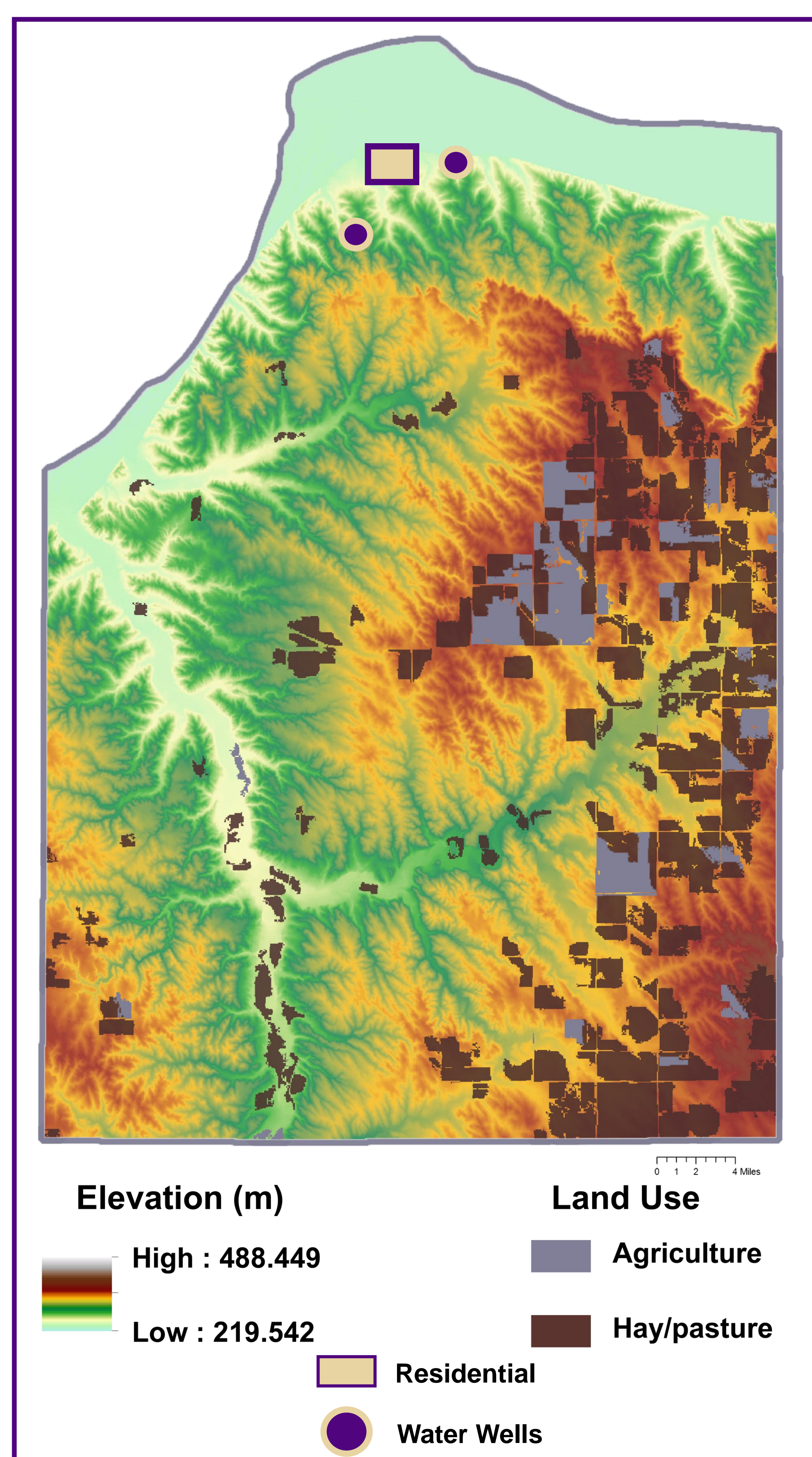


Figure 3: Map by Amanda Rouillard and Josh Meisel. Data Sources: National Elevation Dataset (NED), National Land Cover Database (NLCD), Nebraska Department of Natural Resources, Ground Water Well Data (NDNR)

## Pollution

Four septic lagoons utilized by the reservation are the primary source of pollution, constructed in 1978 and last reconfigured in 1993 due to excess seepage. Another source of TC are livestock pastures, the tribe owns a 3,500-acre ranch with 850 head of cattle and 100 head of buffalo. Non-tribal members also operate livestock pastures within reservation boundaries.

## Runoff

- Heavy rain events and flooding impact water quality through runoff, which acts as a transport mechanism for substances such as TC
- Variation in elevation result in channelized runoff from pastures and lagoons into streams such as Bazile Creek, where the tribe accesses ground water sources
- Unfit ground water supplies are a leading cause of waterborne disease outbreaks due to the common misconception that ground water is a universally safe resource in the United States
- At least 36 waterborne outbreaks following flood events were reported to the Center for Disease Control and Prevention between 1971 and 2008

## Implications

Research has shown drinking water in Santee is unfit for consumption. My research revealed land use and elevation within the study area are the cause of high concentrations of coliform bacteria in groundwater sources. This illustrates seasonal flooding and channelized runoff will further degrade water quality for the Santee Sioux Nation.

Reservations are historically underserved when it comes to potable water, typically a result of government structures and lack of economic resources which makes it difficult for many Indigenous people to contest the right for safe drinking water.

## References

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