

Understanding the Power Dynamics and Spatial Patterns of Water Insecurity in the Navajo Nation

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Purpose

Understanding the limitations of resource accessibility is crucial to understanding the power dynamics behind environmental injustice. According to reports from the Navajo Water Project, one-third of the Navajo Nation does not have indoor plumbing. Other reports indicate unregulated water sources are a principal concern.

Active Freshwater Infrastructure in the Navajo Nation

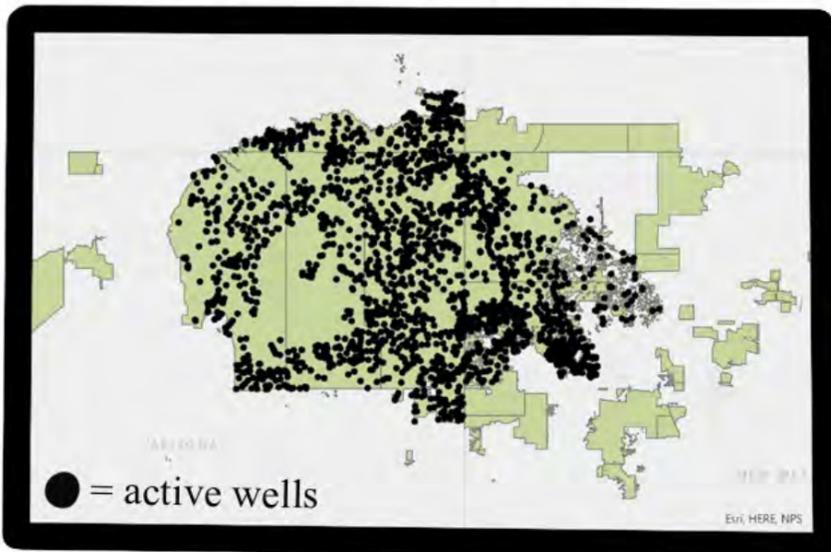


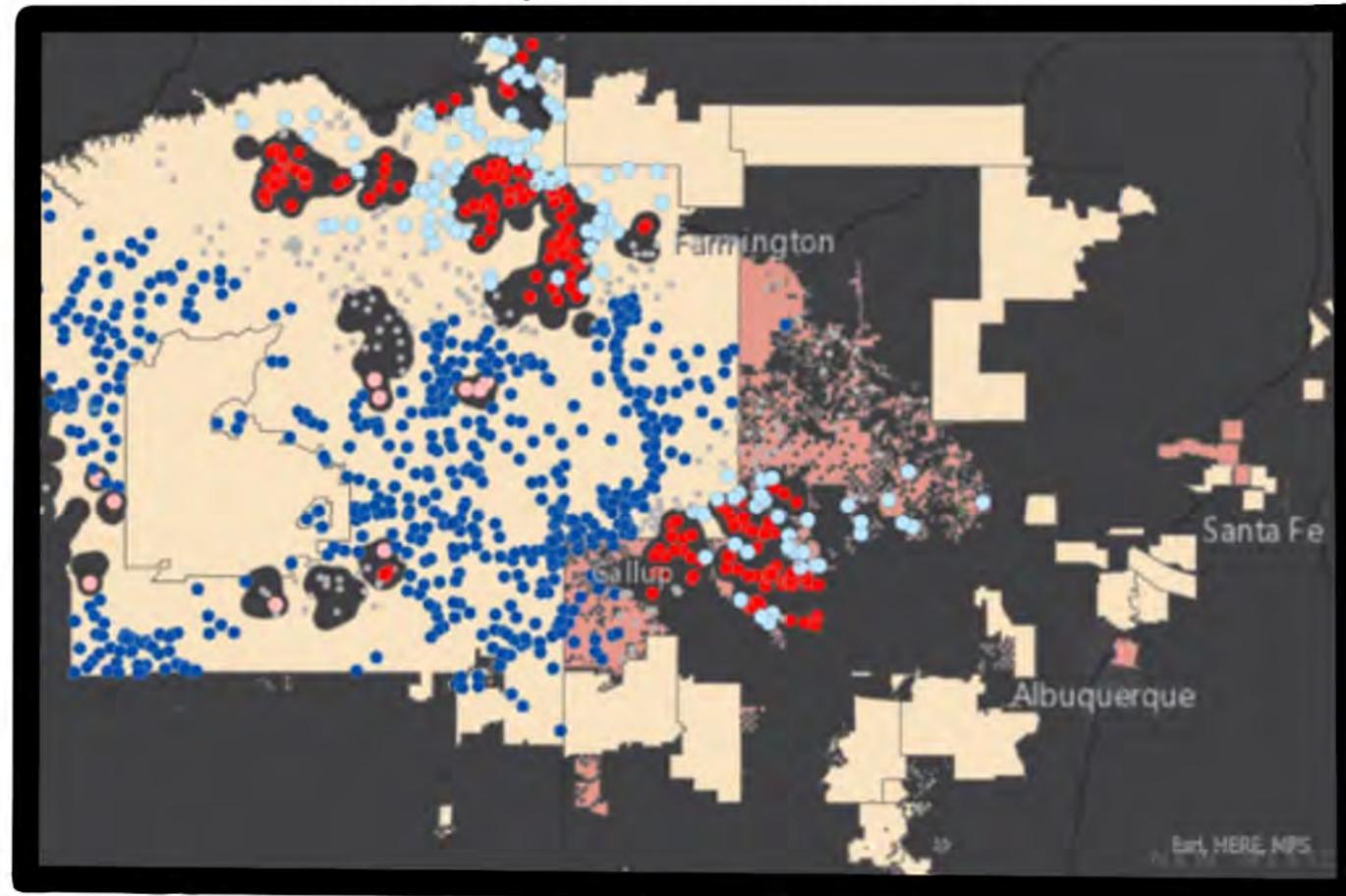
Figure One

My research on the spatial patterns of well presence confirms accounts that one third of the Navajo Nation lacks service from the public water supply. While water access has received attention in media, my research indicates that 36% of mines are located within four miles of an abandoned uranium mine (Figure 3). Furthermore, I found that the 10 largest water service companies in the Navajo Nation have committed 262 major health based violations in relation to arsenic contamination (Figure 4). Arsenic groundwater contamination poses a serious threat to human health. Exposure to this carcinogen is associated with fatal diseases such as skin and internal cancers (lung, liver, kidney) (Shankar 2014). More research is needed to examine the role of water service providers, water contamination from the mines and the potential health impacts.

According to county health rankings, physical environment is ranked by the water quality violations and air quality in a region

Clustering of Active Freshwater Infrastructure in Relation to Proximity to Abandoned Mines

Figure Two



Density VS Proximity to Mines

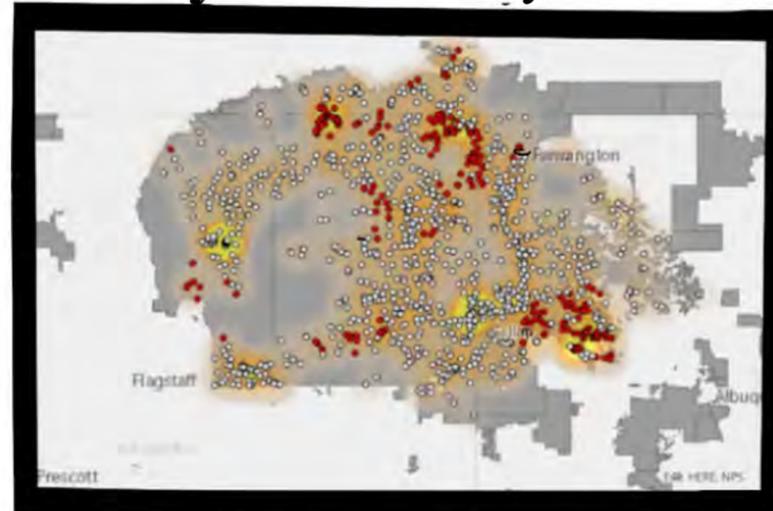
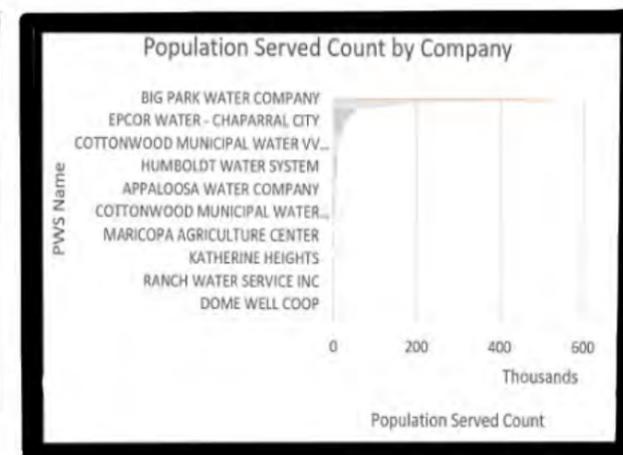


Figure Three

0 30 60 120 Miles

Figure Four

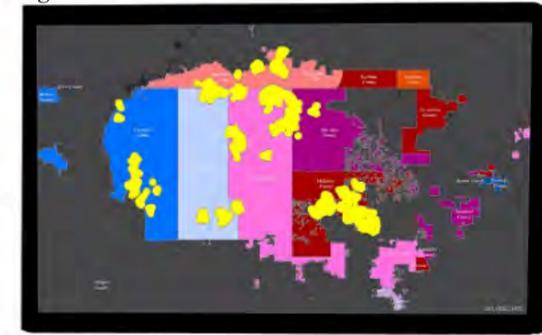


Active Wells
 Within 4 miles of Abandoned Uranium Mine
 • No
 • Yes
 • <all other values>
 Sparse
 Dense
 Navajo Nation



Physical Environment Rank vs Location of Contaminated Zones

Figure Five



Physical Environment Rank
 2016 Population
 High
 Low
 LowHigh
 LowLow
 Contaminated Zones
 1 Cluster
 0 Cluster - 1 Outlier
 1 Cluster - 0 Outlier
 0 Cluster
 Not Significant
 POP_TOT / SQ_MILES
 ≤100
 ≤275
 ≤800
 ≤2765

Binary

0 = Not Within 4 Miles
 1 = Within 4 Miles

Conclusions

Understanding the physical distribution of contaminated freshwater infrastructure in the Navajo Nation is crucial when protecting the health and safety of Indigenous communities. This environmental injustice is unfortunately not unique to the Navajo Nation. As shown in figure two, there are incredibly dense clusters of infrastructure built within four miles of an abandoned uranium mine. It is also important to note the high presence of "non contaminated" outliers around "contaminated" clusters.

Figure five is a bivariate choropleth map that compares the overall environmental rank in a county to the 2016 population per county. The contaminated zones is a polygon feature aggregated from the four mile buffer layer around the contaminated wells points. They are meant to represent the presence of mines in each region. As shown in the figure, significant portion of the counties in the region were given poor environmental ranking. According to county health rankings website, physical environments are quantified by the number of water violations and the air quality of a county. Based on my research, I can conclude that a large driver of water insecurity, as well as the poor environmental conditions in the Navajo Nation are largely due to the creation and implementation of infrastructure within these contaminated zones.

Citations

How healthy is Your County?: County health rankings. (n.d.). Retrieved March 31, 2021, from <https://www.countyhealthrankings.org/>
 Navajo water Project. (n.d.). Retrieved March 31, 2021, from <https://www.navajowaterproject.org/>
 Shiv Shankar, Uma Shanker, Shikha, "Arsenic Contamination of Groundwater: A Review of Sources, Prevalence, Health Risks, and Strategies for Mitigation", *The Scientific World Journal*, vol. 2014, Article ID 304524, 18 pages, 2014. <https://doi.org/10.1155/2014/304524>