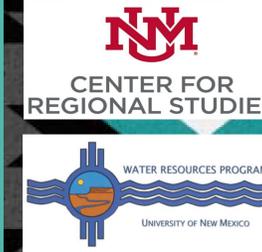


Climate Change Vulnerability Assessment of Navajo Nation Water Resources in the San Juan River Basin, NM: Utilizing Traditional Navajo Ecological Knowledge

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Rio Grande, Albuquerque, NM, 2019



Rio Grande, Albuquerque, NM, 2020.



Rio Grande, Albuquerque, NM, 2020



Rio Grande, Albuquerque, NM, 2018

Dawn and white Shell symbolize positivity, intelligence, and thoughts.

Introduction

- This project summarizes water resources in the San Juan River Basin (SJRB) in New Mexico and identifies the potential risks from climate change and how increasing development of the oil and gas industries will exacerbate the issues.
- The Navajo Nation is targeted in energy resource exploration and extraction, with the negative impacts of this industrial development heavily affecting the safety and health of the surrounding Navajo communities.
- Centering research around preserving traditional knowledge means making Navajo community members the experts in their own space and place and achieves Navajo futurity based on Navajo values (Harjo, 2019).
- Extractive industries take advantage of tribal natural resources through systematic manipulation that sets them in positions of power over Indigenous communities (McBride, 2017).
- Using traditional Navajo Nation chapter names in the Navajo language, Traditional Navajo Ecological Knowledge (TNEK) can assist in identifying vulnerable water resources in the Navajo Nation. In this way Navajo culture can be preserved and Navajo water sources protected.

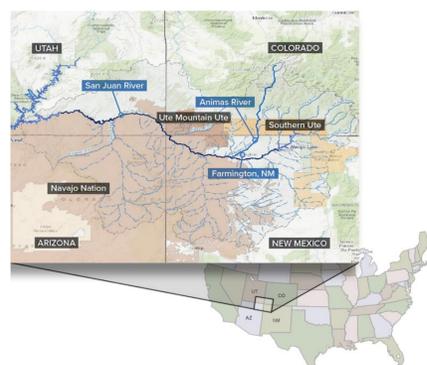


Figure 1: The San Juan River Basin highlighting the San Juan River and Indigenous reservations, including the Navajo Nation, located in the Four Corners area of the U.S. Southwest (EPA, 2020).

Day and turquoise symbolize health, learning, and plans.

Navajo Nation Chapters in the San Juan River Basin

- The SJRB of northwest New Mexico is home of Chaco Culture National Historical Park.
- The SJRB occupies the eastern third of the Navajo Nation with the San Juan River, one of the largest tributaries of the Colorado River, bisecting the Nation.
- The Navajo Nation consists of 110 chapters, local government subdivisions, organized into five regional agencies, which is a portion of the original homeland.
- The Eastern agency and portions of the Northern agency and Fort Defiance agency are in New Mexico.
- Navajo elders maintain majority of the TNEK and have observed for decades significant declines in water quantity and quality (Redsteer et. al., 2013b).
- Oil and gas fracking wells are disproportionately located in poor rural communities and are exposed to significantly higher airborne pollution from such wells.
- The Greater Chaco region has more than 91% of the available land being leased for oil and gas drilling by the Bureau of Land Management (BLM), with the remaining 9% located near Chaco Canyon (Brown, 2019).
- In 2019, the U.S. Court of Appeals for the Tenth Circuit held that the BLM illegally approved oil and gas drilling including fracking in the Greater Chaco region of the SJRB (Diné CARE v. BLM, 2019).

Water is essential for Navajo communities and is intimately interwoven in Navajo worldview through mythology, epistemology, and philosophy.



Figure 2: Holistic Navajo Water Cycle by Kirena Tsosie; depiction of the hydrologic cycle according to Navajo epistemology.

References
 • Brown, E. (2019). Greater Chaco Region Wins Reprieve from Fracking: Federal Appeals Court Holds BLM Illegally Approved Oil and Gas Drilling in Sacred Landscape. *San Juan Citizens Alliance*.
 • Dine Citizens Against Ruining Our Environment; San Juan Citizens Alliance; WildEarth Guardians; Natural Resources Defense Council (Diné CARE) v. David Bernhardt, as Acting Secretary, and Neil Kornze, Director, of the U.S. Bureau of Land Management (BLM). (2019). 10th Cir. No. 18-2089.
 • Redsteer M. H., et al. (2013). *Unique Challenges Facing Southwestern Tribes, Chapter 17 in the Assessment of Climate Change in the Southwestern United States: A Report Prepared for the National Climate Assessment*. A report by the Southwest Climate Alliance, Washington, DC; Island Press, pp. 385-404.

Dusk and abalone Shell symbolize physical strength, resilience, and life.

Methodology

TNEK was obtained from traditional place names in the Navajo language of Navajo Nation chapters (Yurth, 2017). All 110 chapters had their traditional Navajo names evaluated for their affinity to water sources, trees and vegetation, rock formations or non-environmental relations with careful consideration to the story of the name origin.

	Water Related Name	Tree Related Name	Rock Related Name	Non-Environmental Related Name	Total
Eastern Agency	15	5	7	4	31
Fort Defiance Agency	15	3	4	5	27
Western Agency	10	2	2	4	18
Northern Agency	9	3	6	2	20
Central Agency	9	0	4	1	14
TOTAL	58	13	23	16	110

Table 1: Assessment of Traditional Navajo Place Names; kinship to water sources, tree formations, rock formations, or non-environmental elements for all 110 Navajo Nation chapters

28 out of 52 Navajo Nation chapters in the SJRB have water-related names. To ensure the sacredness of the water resources, chapter house locations were mapped instead of water resource locations.

$$\text{Vulnerability} = \text{Exposure} + \text{Sensitivity} - \text{Adaptive Capacity}$$

	Low	Medium	High
Exposure (Distance)	>20 miles	10-19.9 miles	0-9.9 miles
Sensitivity (Drought)	Unaffected	Drying Up	Dried Up

Table 2: Exposure is measured in relation to oil and gas extraction based on distance. Sensitivity is measured by the condition of water resources as observed by Cindy Yurth in the Navajo Times Chapter Series. Combining the exposure and sensitivity analysis can determine the potential impact on water resources.

Table 3: A Holistic Perspective of Adaptation from the SJRB. Adaptive capacity indicators stem from the three dimensions of a sustainable state -- social, economic, and environmental (Pandey et al, 2009). Socioeconomic data obtained from US Census 2000 (Choudhary, 2000). Environmental information obtained from BLM land-use map.

	High	Medium	Low
Adaptive Capacity Social	61%-80% High School Diploma or >	41%-60% High School Diploma or >	21%-40% High School Diploma or >
Adaptive Capacity Economical	21%-40% Individuals < Poverty Level	41%-60% Individuals < Poverty Level	61%-80% Individuals < Poverty Level
Adaptive Capacity Environmental	No Checkerboard Land	<50% Checkerboard Land	>50% Checkerboard Land

References
 • Choudhary, T. (2000). Navajo Nation Data from US Census 2000. Division of Economic Development.
 • Pandey, V. P., Babel, M. S., Shrestha, S., and Kazama, F. (2009). A framework to assess adaptive capacity of the water resources system in Nepalese river basins. *Ecological Indicators*, 11(2011), 480-488.
 • Yurth, C. (2017). Exploring the Navajo Nation Chapter by Chapter. (Alamo-Naschitti, Nazlini-Wide Ruins). *Navajo Times*.

Night and jet symbolize self-awareness, protection, and hope.

Development of Climate Adaptation Strategies

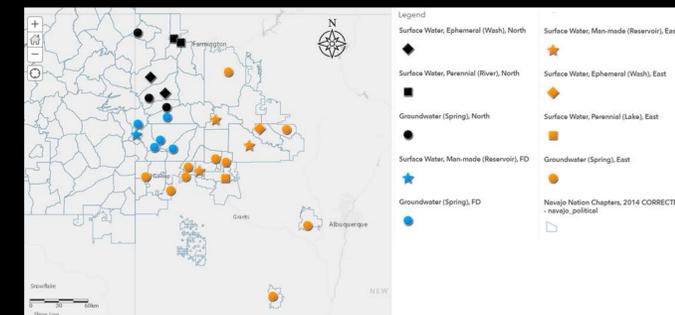


Figure 3: Water Related Names. Navajo Nation chapters in the SJRB correlating to groundwater, surface water (perennial), surface water (ephemeral), and surface water (man-made) mapped through ArcGIS using Navajo Nation chapter boundaries.

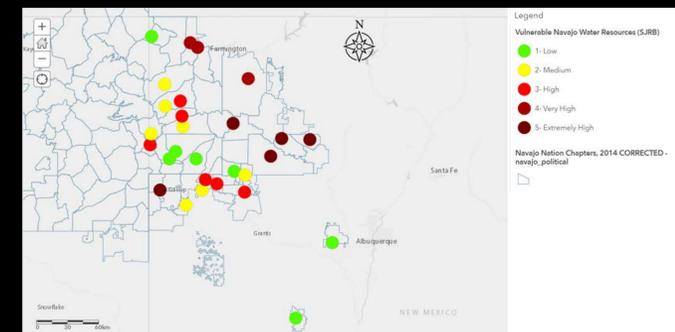


Figure 4: Futurity Risk Map; Vulnerable Navajo water resources in the SJRB based on the climate change vulnerability assessment through ArcGIS using Navajo Nation chapter boundaries

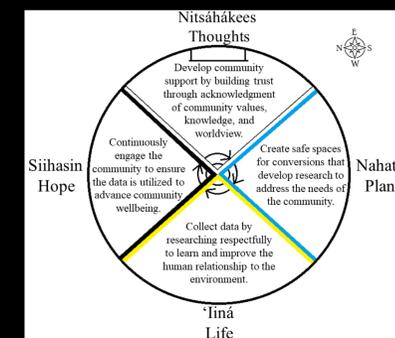


Figure 5: Community-Based Research Learning Model; c.

Redefining policies with Navajo values will aid in future sustainable community development. It is a way for families to heal from past traumas, improve their lifestyles, and reconnect with the sacredness of nature.