



The Decline of Riparian Habitat in Canyon de Chelly

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Introduction

Canyon de Chelly is found northeast of the Navajo Nation located in Chinle, Arizona. Cottonwood trees (*Populus fremontii*) in Canyon de Chelly are declining due to invasive plants, human activity, and desertification. Cottonwood trees are used in a number of ways like medicinal purposes for stomach cramps, to make a *chaha'oh* (wickiup; summer shelter), control flooding during monsoon seasons, and to make cradleboards. Cottonwoods are prevalent within Canyon de Chelly National Monument which is why it holds cultural significance among the Navajos. The canyon is the location of historic ruins, the start of the Long Walk, a home filled with abundant path of trees and rivers, production of agriculture, and home to legendary Spider Woman. Canyon de Chelly is facing desertification due to climate change that could affect the distribution of cottonwood species.



Figure 1. The *chaha'oh* is made of leafy cottonwood trees to create a cooler summer shelter for cooking, sheep herding, or place for relaxation.

Cultural Aspects

Tseyi in the Navajo language translates to "within the rock." The Ancient Ones, also known as the Anasazis, lived in the canyon for thousands of years cultivating the land; their tribal relatives the Pueblos (750 A.D.-1300) and also Hopi (1300-1600s) lived in the canyon then migrated elsewhere because of drought that began in 1200 along with diseases and conflicts (National Park Service 2016, 1). The Diné (Navajo tribe) reside in Canyon de Chelly along with traditional stories and histories. Elders would tell one particular story of the Holy Ones creating Spider Woman and Spider Man. Spider Woman's purpose is weaving a map of the universe and geometric patterns of the spirit deities in the night sky. Her determination helped her weave the technique the Holy People instructed. Spider Woman taught the Diné to create their own beauties in life with balance in the mind, body, and soul (Adam Teller 2007, 1). Spider Woman resides in the canyon on Spider Rock along with other deities that live in the canyon, making it a sacred place of peace.



Figure 2. Slender tall rock is known as Spider Rock, on the top of is where the legendary Spider Woman resides within Canyon de Chelly.

Desertification

The Navajo Nation faces increasing drought, intense-erosion, and expanding sand dunes connected to desertification. Canyon de Chelly's rivers are evaporating because of the temperature rise that increase two degrees every year. The process of desertification is seen by 1) plant communities disappearing on dunes or other regions leaving the soil uninhabitable 2) invasive plants over the native plant's territory 3) winds intensifying 4) soil particles evaporating and forming sand dunes (Margaret Hiza Redsteer 2017, 2-3). Climate change will negatively affect the home of many tribes if water wells are no longer running, and crops are being planted on corroded soil; families would need to move off the reservation to live a manageable life. The loss of snow and rainfall would hinder Navajo culture because during the

winter seasons the Navajos pass their traditional knowledge by telling the creation stories and the sound of thunder marks the end of winter along with the arrival of spring. This change in precipitation will also affect how and where plants grow ultimately changing how Navajo medicine men harvest and find plants, because they use a traditional ethnobotany method and knowledge passed down through generations. (Redsteer et al. 2015, 12).



Figure 3. 1) The white highlighted part is the location of Canyon de Chelly 2) The blue is the riparian areas filled with cottonwood and willow trees along the river bank trench 3) The yellow indicate the sand sheets/dunes in the Chinle area. The sand dunes are expanding each year in the riparian areas.

Cottonwood Trees

- Cottonwood trees also known as *Populus fremontii*, are found in riparian zones that require surface and ground water in order to survive, meaning a large body of a river or stream.
- Before colonization, most Southwest Tribes used cottonwood trees for ethno-medicinal purposes to treat scurvy, headaches, menstrual cramps, and fevers.
- The tree contains anti-inflammatory properties, salicylic acid (aspirin) in the tree trunk and anodyne (painkillers).
- Cottonwoods provide habitat for fish and wildlife, shady areas provide cooler temperatures to understory environments, the root systems keep soil intact, prevent erosion, and filter pollutants.
- The native cottonwood trees cannot thrive sufficiently due to drought, overgrazing, intense wildfires, human activity. (eowynbdh 2012, 5)



Figure 4. It is illustrated here that the Cottonwood tree provides shade and used to make a Hogan.

Canyon de Chelly, AZ

Canyon de Chelly National Monument has two partnerships with the federal government and the Navajo Nation tribe. The tribe manages the natural resources while the archeological sites are overseen by the federal government. To this day 200 Navajos live at the bottom of the canyon which is their right to live where their ancestors did, and plant crops following both modern and traditional practices (Fonseca 2008,1). It is believed that other deities in their creation stories live in the canyon including Spider Woman, Talking God, and the Holy People. Petroglyphs or paintings on the canyon wall tell the creation stories of Sun God walking along with his Twin Hero sons (Fonseca 2008, 1). In 1864 Kit Carson ordered the removal of the tribe and Navajos resisted the order, Kit Carson and his men chased after the Navajos at Canyon de Chelly. The Navajos escaped into the maze canyon forcing the tribe to walk from Canyon de Chelly to the concentration camp of Bosque Redondo; after four years the Navajos were released by the U.S government to return to home, to the Navajo Nation (Bright 2012, 2).

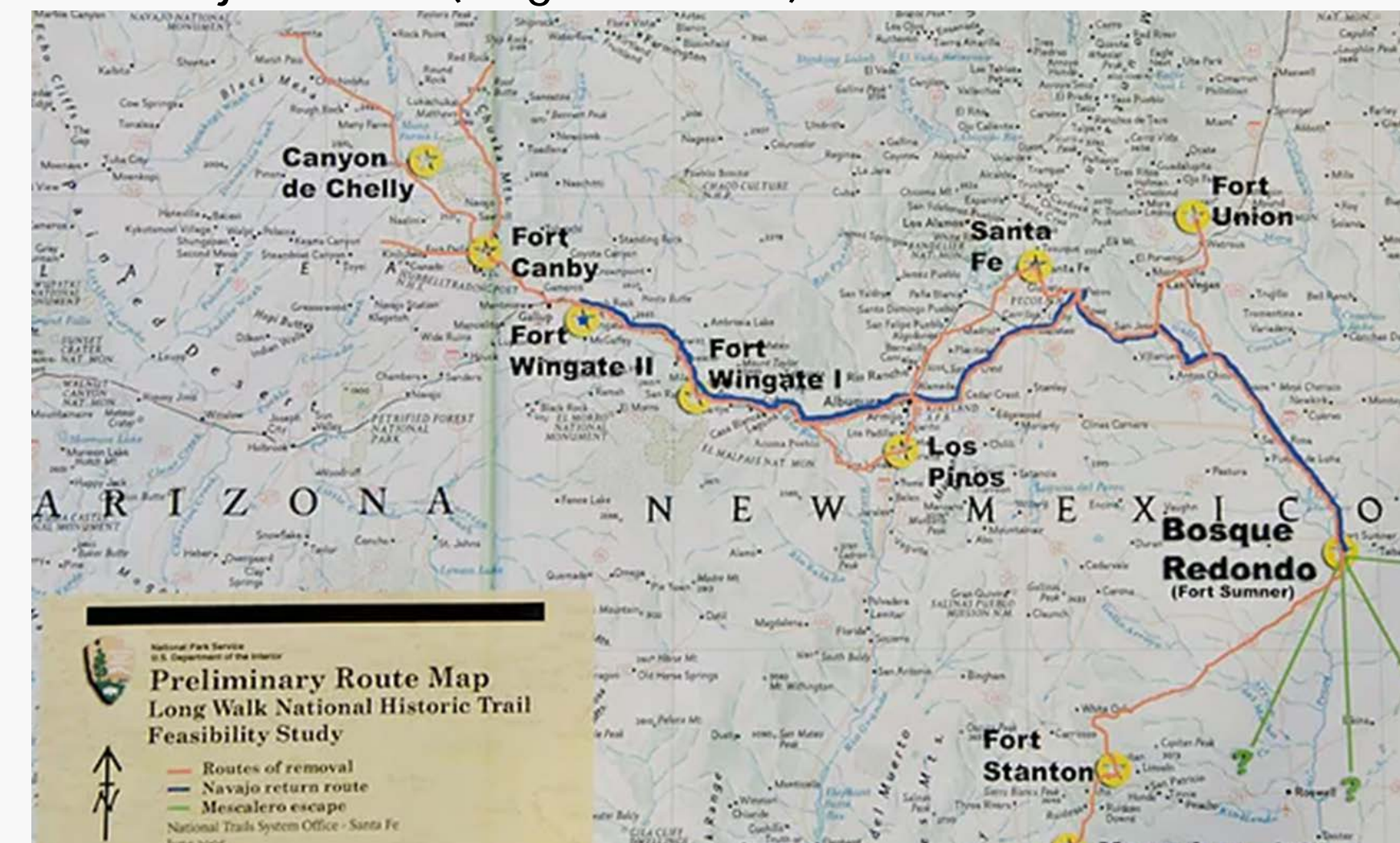


Figure 5. Map indicating the 8,000 captured Navajos and Apaches walking 300 miles from Canyon de Chelly to Bosque Redondo

Solutions

- Current projects have assembled to conduct research to partners with local Navajo Chapters, Tolani Enterprises (a Tribal Non-Profit Group), the Little Colorado Water Conservation Association, the Navajo Nation Council Resources Committee, and the Navajo Youth Conservation Corps
- The Navajo Nation is coming together with the U.S. Geological Survey and the Northern Arizona University Environmental Education Outreach Program (EEOP) to educate to stabilize sand dunes by testing out methods
- One method that Mongolians used to stabilize native plants in sand dunes, are "sand sausages" it's a corn-based fabric material to filled with sand. People structure the sand sausages in a grid pattern and plant small seed cakes containing native seeds.
- The tubes keep the dunes from blowing away and secure the seeds for growth. (Redsteer 2017, 4)



Figure 6. Illustration of the grid pattern of the sand sausages to maintain the sand dunes on the Navajo Nation

Conclusion

Climate change induced drought and exploitation of vegetation, also known as desertification, depletes the topsoil in the desert and semiarid regions in Southwestern, US. Traditionally Navajo medicine men identify specific plants from memory and the use of language. However, the loss of medicinal plants are making it hard to locate and connect the knowledge passed down based on their original location causing traditional knowledge loss. Families are leaving their homes due to soil erosion and because of invasive species like Russian-olives (*Elaeagnus angustifolia*) and tamarisk (*Tamarix ramosissima*) have a rapid evapotranspiration rate, meaning the water loss through evaporation ("Cottonwood Management" June 2015, 2-3). These threats must be addressed because cottonwoods serve an important role in maintaining riparian regions in arid and semiarid climates/biomes, and the trees also balance out the region from becoming an infertile or inhabitable landscape.

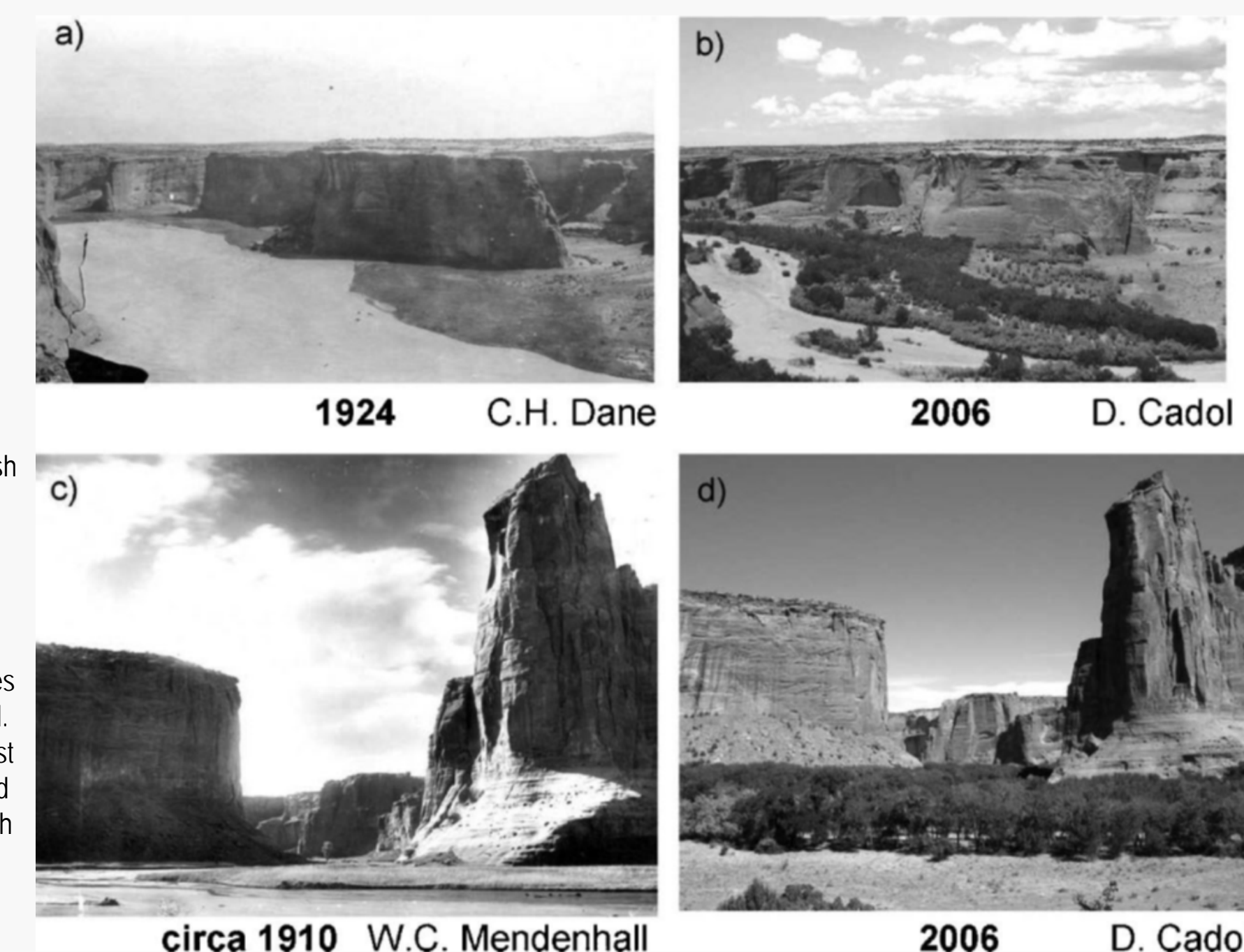


Figure 7. (a) and (b) Mainstream of Canyon de Chelly, vegetation established on the extinct wash bed which includes Tamarisk, cottonwood, Russian-olive, and willow trees on the channel. (c) and (d) Most are cottonwood trees along with Russian olive with the same location.

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Acknowledgements

I would like to personally thank the HERS program for preparing and teaching me the ways to do a research project for my future graduate school. I would like to acknowledge the HERS mentors, staff, behind the scenes staff, Haskell Indian Nations University, Haskell professors, University of Kansas, KU professors, ESCOPOR, and funding provided by NSF grant #0078563.