Farming Suitability on the Navajo Nation

Overview

The Navajo Nation (NN), situated in rural and arid Arizona (AZ), New Mexico (NM) and Utah, has about 200,000 members living on 27,000 square miles (1). Some Navajo communities experience living conditions similar to those of developing countries: over half of residents live below the poverty line, 42% are unemployed (2), and an estimated 18,000 households lack electricity (3) and about 20% of the Nation does not have home plumbing.

The remote nature, lack of full-scale grocery stores with affordable healthy food options (4) coupled with widespread poverty contribute to the Navajo facing extraordinarily high levels of overweight, obesity and chronic disease.

The Navajo have a long history of raising livestock, particularly sheep, and growing crops such as corn, squash, melons and some types of beans (5) however farming practices have changed as youth leave the reservation for education and work and collective efforts are no longer the norm (6). Increasing locally grown produce sold on the NN could contribute to addressing multiple social determinant factors impacting well-being of the Navajo: improving access to healthy, perishable food at regular intervals, increasing farmer livelihoods and decreasing need for long-distance travel of either individuals or produce. Despite what is typically reported, the Agricultural Census shows a significant amount of small-scale farming occurring on the NN and although a large portion is in livestock (7), the three counties in AZ and two in NM with the largest Navajo populations reported 2,652 operations of 0.1 to 4.9 acres in vegetable production in the 2007 Agricultural Census (8). Most products grown at small scale are consumed by the family or given to neighbors (6). Given current vegetable production on the NN, there is promise for increasing produce availability through supporting local growers and expanding the agricultural land base.

This project sought to answer the question:

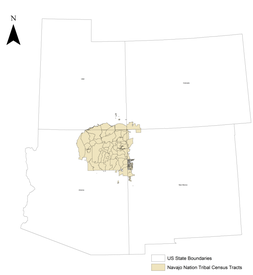
Based on land use, precipitation, elevation and slope, what regions of the Navajo Nation are best suited for agricultural use?

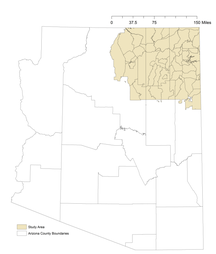
Methodology

The types of data used in this analysis were determined through: a literature review, consulting other similar GIS projects, coherence of the data and through availability of data at the necessary scale. For this study: land cover, elevation, slope and average annual precipitation were used to assess suitability for farming on the Navajo Nation. In order to test the feasibility of using GIS and these chosen layers to determine local level farming potential, this study focused on the Navajo Nation census tracts that fall within Arizona county boundaries. All data sets were clipped to the study area and the geoprocessing environment was set to NAD 1983, the appropriate coordinate system for the region. Data in each layer were reclassified to one of four categories: 1 (most suitable), 2 (moderately suitable), 3 (less suitable) and 4 (least suited) for agriculture. The desire was to identify areas of the Nation that were open space at low elevation, minimal slope with the highest annual precipitation. Since water scarcity is a primary limiting factor to agricultural production, the data were also analyzed increasing the weight of precipitation (to 0.5) while slope was set to 0.20 and land cover and elevation to 0.15.

Farming Suitability

Weighted Farming Suitability: Prioritizing Precipitation





Discussion

This analysis identified pockets of suitable farming regions throughout the Navajo Nation. However, further study is needed incorporating additional data and partnering with local land use planners before recommendations are made. Given that the Navajo Nation is located in the arid southwest, availability of and proximity to water is of primary concern when considering expansion of food production. As such, regions of higher annual precipitation were prioritized in the weighted analysis. However, for the purposes of this project, this strategy was not necessarily the best approach as higher levels of precipitation occur in areas at higher elevation where land cover is primarily forest and unlikely to be converted to agricultural use. Additional constraints and weighting could better inform a future suitability analysis.

Implications for future use

Using GIS to understand the potential for increasing agriculture on the Navajo Nation has strong potential and this initial study illuminated challenges and insight for additional work. Although the Navajo Nation primarily sits within the state of Arizona, a more complete understanding of farming suitability on this sovereign Nation would incorporate the entire land base. Below are considerations for additional studies expanding on the current analysis:

- Partner with Navajo land use planning and Cooperative Extension to identify location of current food production
- Identify land parcels adjacent to current farming in order to minimize disturbance of land in other use
- Research the potential for development of a Navajo acequia system, one strategy for utilizing river water to irrigate farm land
- Explore potential for increasing dry-land farming and use of natural “rain catchment” within gullies and canyon floors

Works cited:

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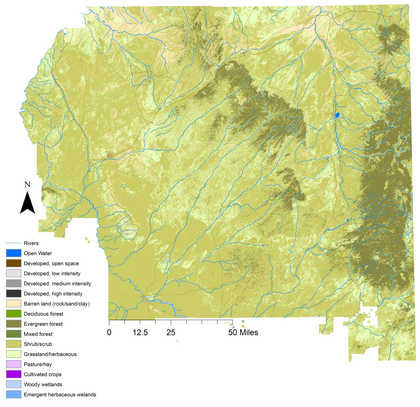
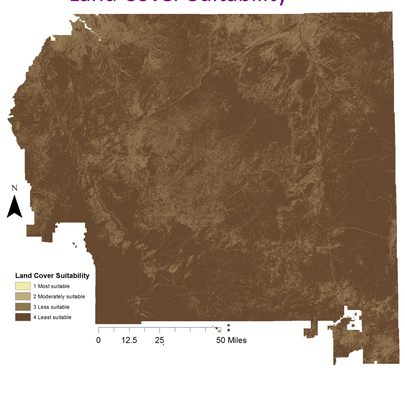
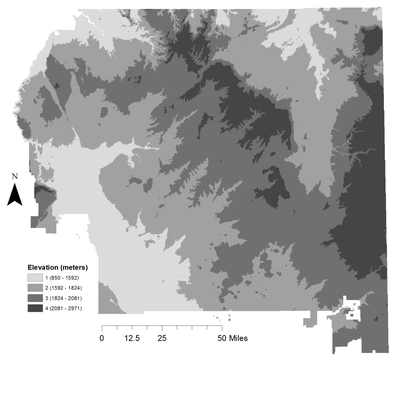
Land Cover



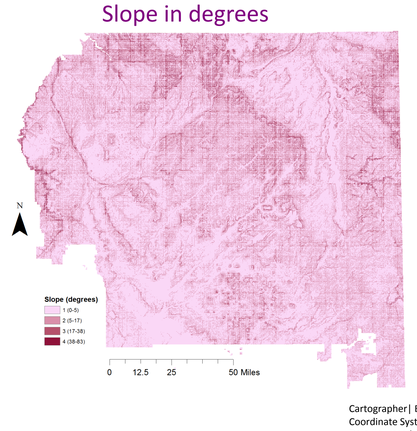
Land Cover Suitability



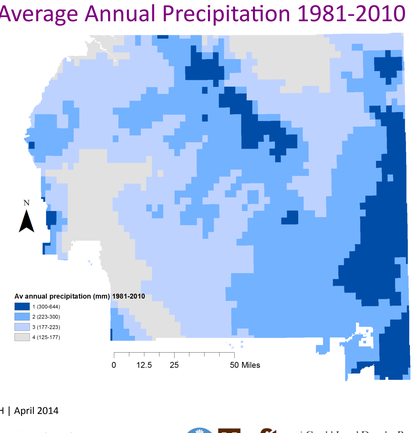
Elevation in meters



Slope in degrees



Average Annual Precipitation 1981-2010



Cartographer| Emily Piltch, MPH | April 2014
Coordinate System| NAD_1983
Data Sources | US Census Bureau, US Geological Survey, Arizona Department of Water Resources, Oregon State University

Tufts University | Gerald J. and Dorothy R. Friedman School of Nutrition Science and Policy