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Geography 93
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ADVANCED GIS FINAL REPORT

PROJECT SUMMARY

For my project, I created a series of maps and a web application that look at demographic changes from 2000-2010 in northeastern California, in relation to the impacts environmental policy has on timber harvest. Specifically, I am looking at the area outside of, or adjacent to, the Northwest Forest Plan area. The demographic change I am looking at are changes in population, poverty, and language spoken other than English at the county level. Through creation of the maps two important analytical factor became apparent: percent of usable land and access. Because the Northwest Forest Plan is specifically United States Forest Service (USFS) and Bureau of Land Management (BLM) Land, I created layers that show the percent of non-federal land and private land within a county.

The Census data I used is at the county level. This is because I inherited the data sets from a group at Humboldt State University who are working on demographic analysis of California and Oregon counties outside of the Northwest Forest Plan. I used both TIGER files and excel sheets from the US Census and American Community Survey.

To analyze changes to timber harvest, I included layers showing mill locations. I was prepared to include layers showing timber harvest areas, but including this information soon became too complex for the scope of this project. I instead refocused my attention on demographics.

Purpose

With this project I was hoping to see if there are evident patterns of demographic change in northeastern California as a result of environmental policy impacts to timber harvest. These changes in timber harvest impact timber dependent communities. One possible way of identifying impacts is in population decline or changes in poverty level. To accurately assess the impacts, I need census data sets that show demographics to see trends before the Northwest Forest Plan and after the Plan. I was not able to make these full assessments because I was using data only from 2000-2010.

My second purpose in this project was to learn as much as possible about ArcPro and to create a Web Application.

## GIS DATA MANAGEMENT, CREATION, CARTOGRAPHY TASKS AND METHODS

During this project I used ArcPro to make maps and graphs. I then uploaded the map from ArcPro to a web map to create a Web Application. I have separated this section in to two parts: ArcPro and Web Application

ArcPro

I used ArcPro to create a series of maps using different Tools and Symbology. All data from the demographic layers came from the Excel sheets I created from the Census and ACS data. Including a layer from Caltrans showing major highways and a layer from the USFS showing timber mill locations, and the Northwest Forest Plan boundary added context to my maps.

FEDERAL AND NONFEDERAL LANDS

An important piece of the analysis was the representation of federal land and nonfederal land within each county. Often I see federal (public) land highlighted on a map. While Federal lands are "public" there are limitations on how these lands can be used by citizens as investment and development opportunities. I wanted to get a picture of is how much nonfederal, or private, land is available for the communities to use as they choose.
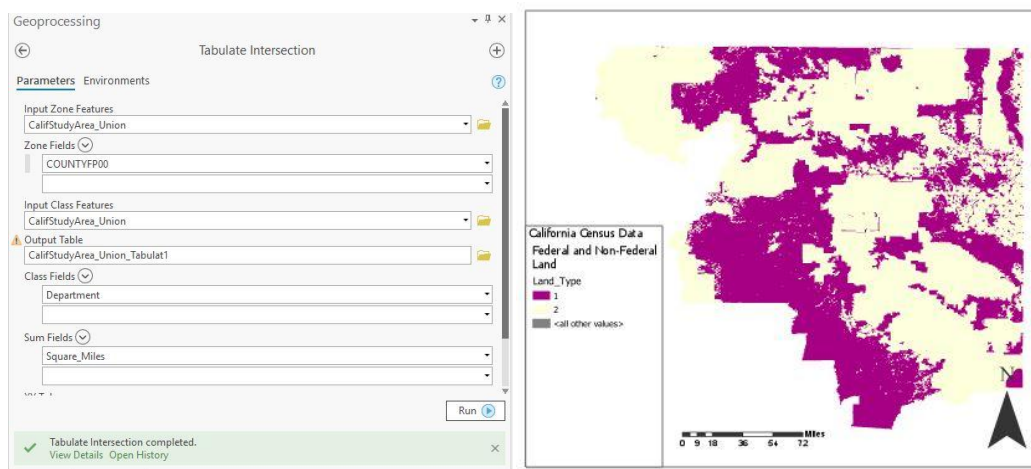
To represent the amount of nonfederal land, found a layer from USFS showing National Park and National Forest layers. I used the **Union** tool to merge these layers. I then found a layer from BLM showing BLM land. Again, I used the **Union** tool to merge these layers. In the attributes, I added a "1" to represent federal land. I added two more fields for square acres and square miles, then calculated the field to represent these values. I then used the **Tabulate Intersect** tool to show the percent of land type "1" (Federal) and the percent of land type "2" (Nonfederal). This gave me the percent, square miles, and square acres of federal and nonfederal lands. I then used a **Symbology** option to represent counties by percent of nonfederal land and **formatted the labels** to show only one decimal point.
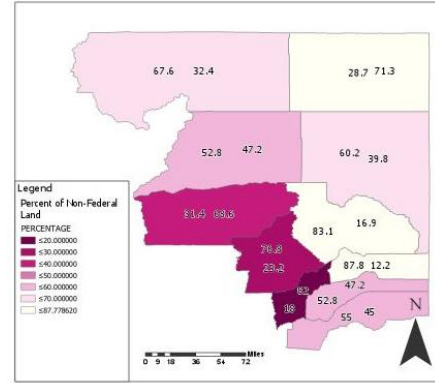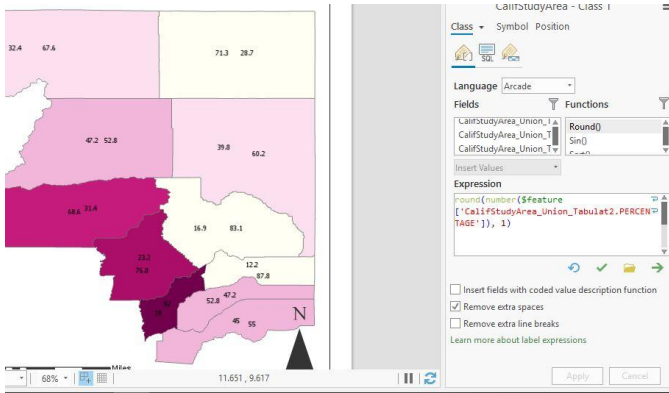
CENSUS DATA

I used nine different Excel sheets of Census and American Community Survey data: Population, Language, and Poverty for the years 2000, 2010, and 2016. Because I am more familiar with Excel, I chose to calculate fields within Excel rather than ArcPro. I then pulled from the nine sheets and combine the information and made calculations that I wanted one sheet that could be joined to the Census TIGER data. To accomplish this, I had to create a **Double** field in the attributes table, then **Calculate Field** to equal the existing FIPS ID. My understanding is that this is needed because the FIPS ID in the TIGER files was a number value and ArcPro was reading the FIPS ID in the Excel table as a text value. I then **Joined** the table to the shapefiles.


**Unformatted Census data in Excel**

CARTOGRAPHY & SYMBOLOGY

I spent a substantial amount of time experimenting with symbology. I wanted to learn how to use different symbology options as well as create several layers that could be turned on all together while providing information in a visually satisfying map. The symbology I used includes:

Graduated Changes with a Manual Setting
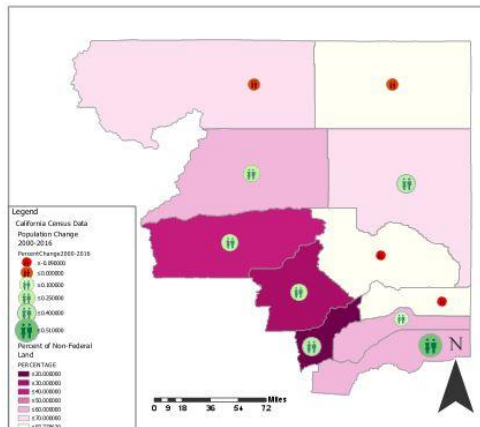
Graduated change showing percent of nonfederal land and percent of population change from 2000 - 2016
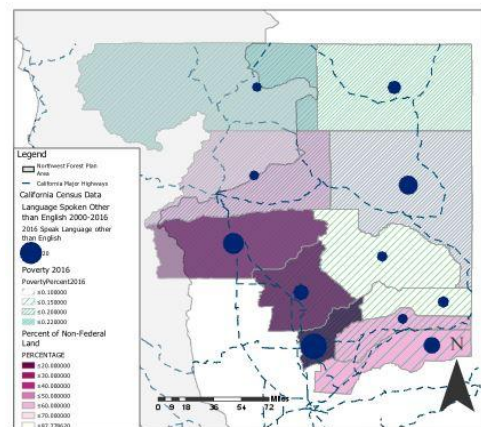

Graduated change using a hashed fill showing 2016 poverty rates

Graduated changes was used to show changes based on certain percentage ranges. I used the manual setting to set the ranges I wanted to represent, rather than using the automated feature which will set a range for the user. I then change the way the symbols looked, such as size, space, and color, to emphasize differences. This Used to show percent of land type and changes in population growth.

Dot Density

I used dot density as a method to represent the 2016 population for the counties in the study area.
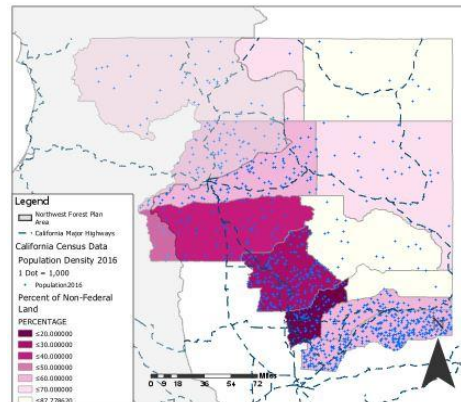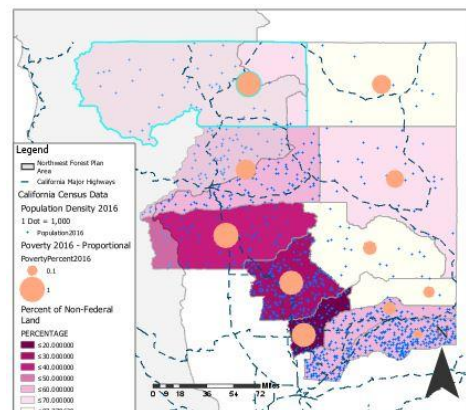

Proportional Change

Proportional change was uses to represent changes in a given year, rather than changes between years.
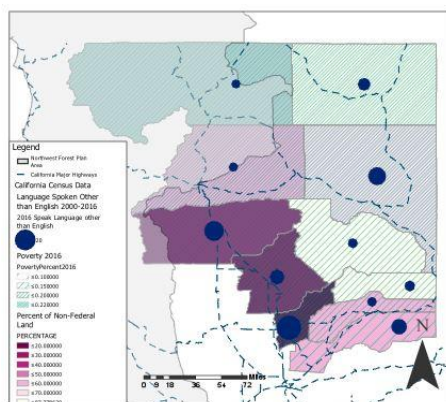
Left: Proportional symbol showing percent of population under poverty in 2016;

Right: Proportional symbol showing percent of population that primarily speak a language other than English in 2016

GRAPHS

The tables and graphs feature was one that I was particularly excited about. I was intrigued to learn how the layers can interact to create graphs. All graphs were created in ArcPro.

2000 - 2016 Total and Poverty Population

Relationship between Percent of Private Land and Poverty 2016

2000 - 2016 Percent of Population Below Poverty Level

Percent Change 2000 - 2016
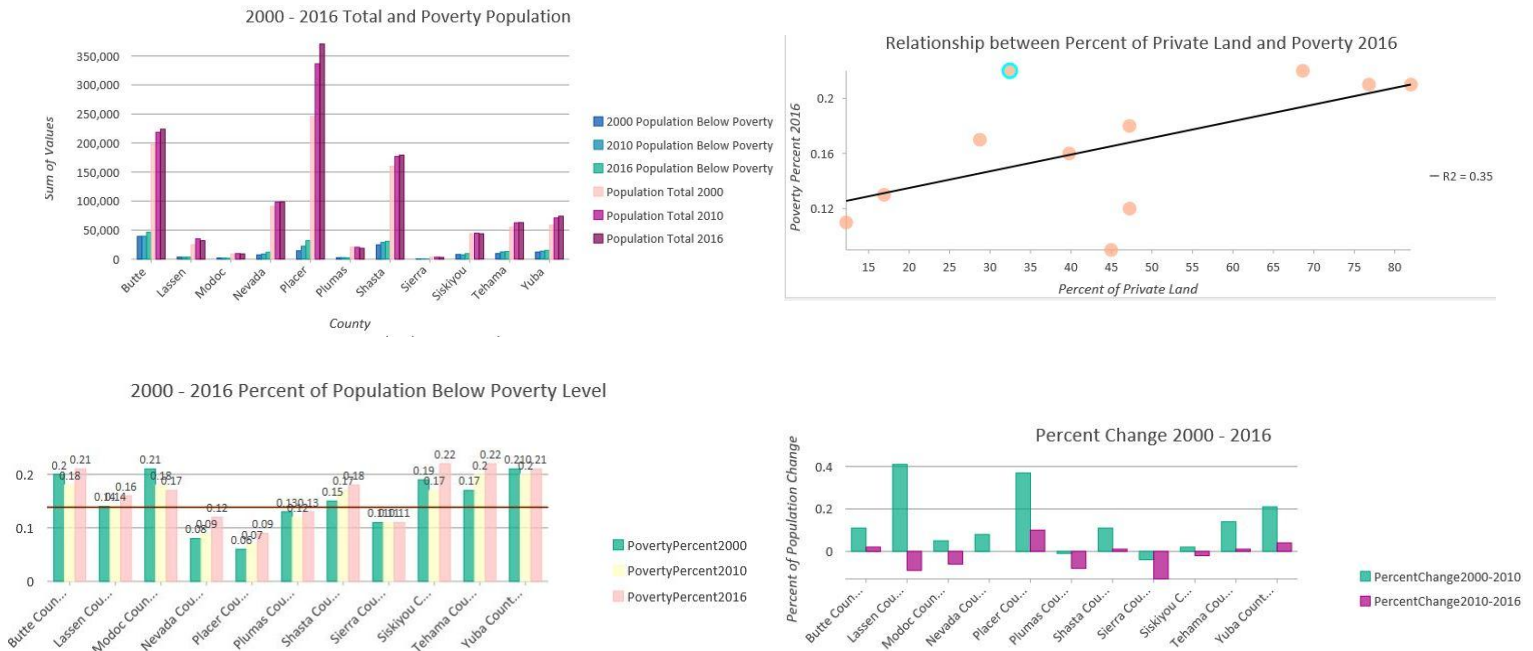
WEB MAP & APPLICATION

Loading the data from ArcPro to the web map was a new experience for me. I formatted my layers in the web map and then used the web map to create a web application. I selected the interactive Web Application because I wanted viewers to be able to compare different layers based on their interests and questions.

SYMBOLOGY

"Relationship" and **"Compare A to B"** are the primary symbols used to create the layers.

Relationship

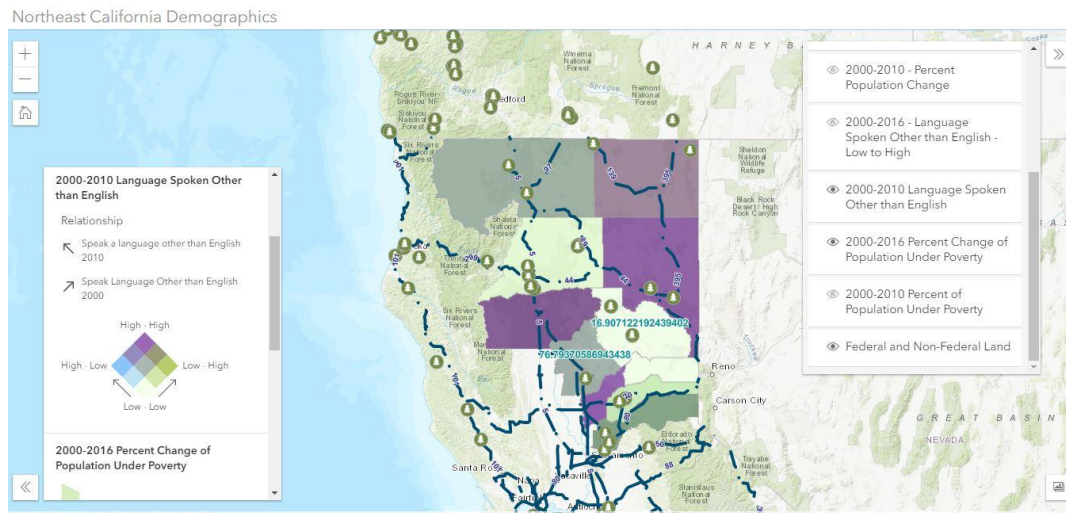The **Relationship** (above) shows the ratio of changes in two or more attributes as they relate to each other. The image above shows the relationship between a language spoke other than English in 2000 and 2010.

Compare A to B
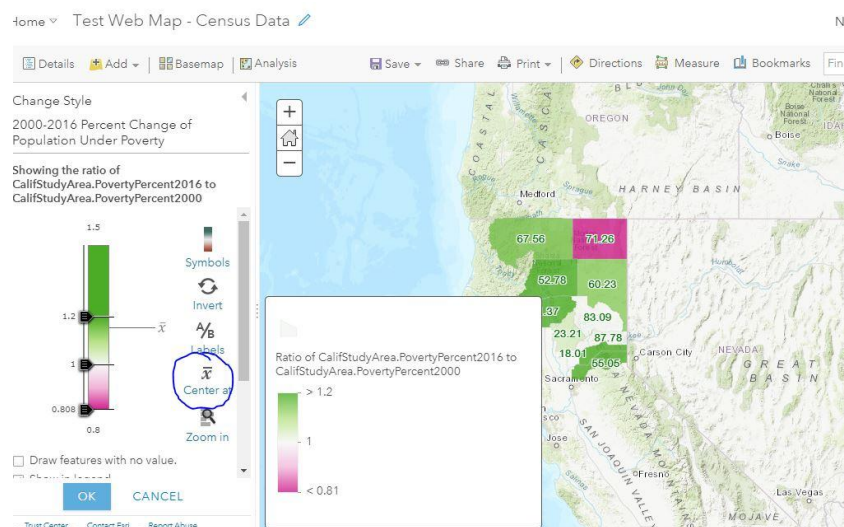
Compare A to B shows the relationship between two attribute fields. The image above shows the changes in poverty between 2000 and 2016. The circled part highlighting the *"center at x"* represents a difficulty I had in choosing the right statistical setting for the representation.

CONFIGURE POPUP

To provide clear and concise information, I configured the popup in the webmap to show only information that is valuable to the viewer.

DIFFICULTIES AND ISSUES

The difficulties and issues I had came at various levels of the project. Some I was able to resolve and others I was not. The table below shows the difficulty or issue and the resolution.

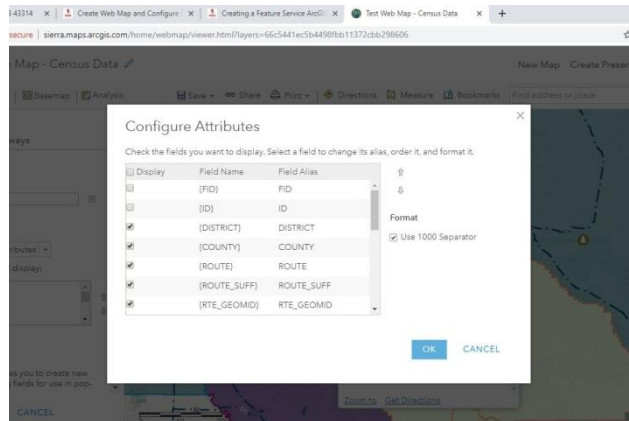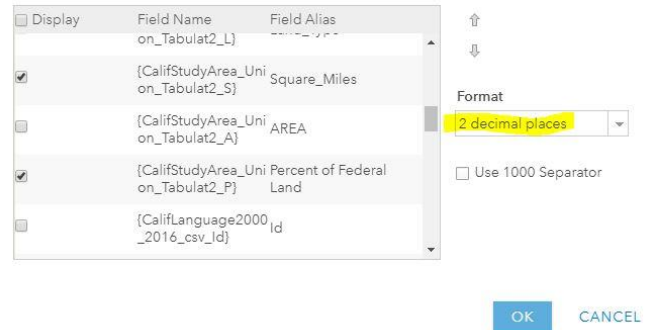| Difficulty or Issue	Resolution
Union of original USFS and BLM files was over a large area. The union created too many attributes to test ways to calculate the percent of federal land coverage.	Clipped layer to a smaller portion to test with fewer attributes and less data. I used Lassen County to experiment with.
Calculate percent of land type.	Created a field that coded federal land to 1. In the union, I then calculated "Null" to equal 2 for non-federal land. Used the Tabulate Intersection feature to calculate the land type. This took some Google-ing and using the ESRI help page to figure out the best tool and how to use it.
Label in webmap showing percent of land type had too many decimal points.	Configured label to represent only two decimal points.
Web App showing percent of land type has too many decimal points.	Unresolved. I cannot figure out how to fix this issue.
"Compare A to B" symbology not accurately	Partially resolved. Changing the center point

representing data in fields. I had particular trouble accurately representing the percent change in language.	for the statistical representation helped more accurately represent the changes I was wanting to show. However, I could not determine how to have the representation all changes with an equal change in percentage the same way. For example, if Yolo county had a 5% change, the color representing that county was not the same shade as another county representing a 4.8% change.
Selecting the right data.	I started with way too much data and project ideas bigger than the scope of this project. Narrowing down the ideas to still provide relevant information was a challenge.
Legend on second map is not showing one of the layers selected, Non-English language spoken.	Unresolved. I tried everything I can think of and could not get this to show up. Other layers appear when I select tem, but this layer does not.

LEARNING OUTCOMES

I took away a lot from this project. This was not the first time I had used ArcPro, but was the first time I had created a web map and a web application.

ARCPRO

Use of additional features, such as Tabulate Intersect, experience joining tables, creating attribute fields, calculating fields, configuring labels, and using different symbology. I now feel much more comfortable using ArcPro and more familiar with the layout of the program. I can use basic tools such as Buffer, Join, and Union.

Creating graphs in ArcPro was also a new outcome. I had no idea how many types of graphs and what kind of information ArcPro could use to create graphs. I especially like how the tools can be combine. This allows for deeper analysis. Another setting I value is the selection to use the same colors in the graphs as used in the layers. This allows for aesthetically pleasing maps and graphics.

WEB MAP

Bringing layers from ArcPro to the web maps is something I had never done before. I did have challenges with a few layers, and learned that in order to export a layer to the web map, it cannot be joined to external data. Instead, a new feature class must be created so that the attributes are embedded in the files, not joined. Only then can the whole package be uploaded to the web map.

The web map allows for different symbology that enabled me to view and analyze the data in different ways. I was excited to find "Compare A to B" and "Relationship" because these tools allowed me to represent the outcomes I was actually interested in: comparing demographic changes in the region. These may be tools in ArcPro, but they were (or are) as clearly available as they are in the web map.

Popup is another feature of the web map that isn't available in ArcPro. I enjoy this feature because it is user friendly and conveys the details that viewers are looking for. Configuring the popup was a learning experience in itself. Not just in making the data I wanted visible, but assessing what data should be visible in which layers and n what order to represent the data. I opted to include the same information in all layer's popup so that viewers can see the numerical changes in demographics at a glance, rather than requiring viewers to switch between layers to relay the numerical changes in data.

WEB APPLICATION

Creating the web application was something I was really looking forward to learning. This was more simple than I was anticipating. I experimented with a couple of different web application types and settled on the interactive application because it enabled viewers to interact with the data and receive information that they may be interested in. I did consider a story map, but decided that I would rather have viewers interact and interpret the map and data as they wanted to than have the data narrated to them.

OUTCOMES

Images of my maps and graphs created in Arc Pro are on the following pages.

[Link to Web Map](#)

[Link to Web Application](#)

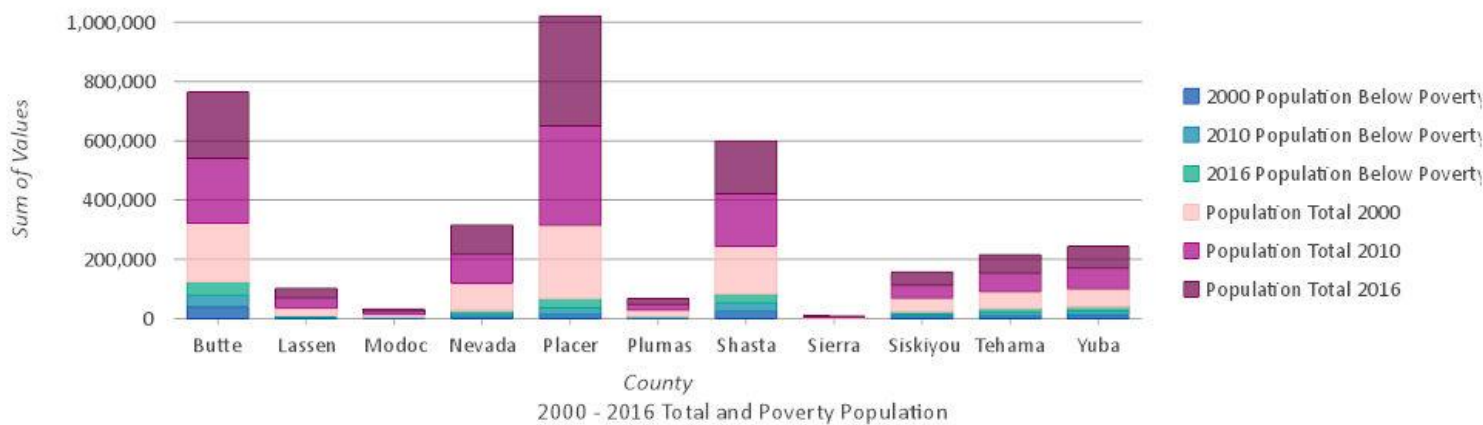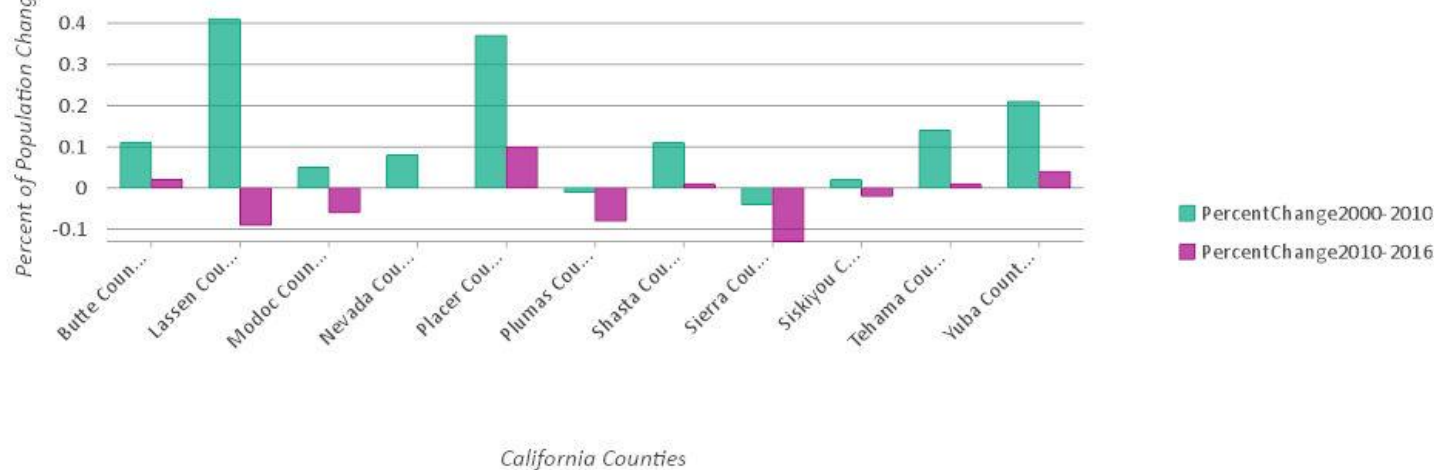# Population Change 2000 - 2016 and 2016 Poverty

N

Miles
0   9   18   36   54   72

2000 - 2016 Total and Poverty Population

Sum of Values

1,000,000

800,000

600,000

400,000

200,000

0

Butte   Lassen   Modoc   Nevada   Placer   Plumas   Shasta   Sierra   Siskiyou   Tehama   Yuba

County

- 2000 Population Below Poverty
- 2010 Population Below Poverty
- 2016 Population Below Poverty
- Population Total 2000
- Population Total 2010
- Population Total 2016

2000 - 2016 Total and Poverty Population

Percent of Population Change 2000 - 2016

Percent of Population Change

0.4

0.3

0.2

0.1

0

-0.1

Butte Coun...   Lassen Cou...   Modoc Coun...   Nevada Cou...   Placer Cou...   Plumas Cou...   Shasta Cou...   Sierra Cou...   Siskiyou C...   Tehama Cou...   Yuba Count...

- PercentChange2000-2010
- PercentChange2010-2016

California Counties

2016 Percent Under Poverty and Percent of Language Spoken Other Than English

Legend

Northwest Forest Plan Area

California Major Highways

California Census Data

PovertyPercent2016

○ ≤0.090000
○ ≤0.150000
○ ≤0.200000
○ ≤0.220000

Land_Type

■ 1
□ 2

0 9 18 36 54 72 Miles
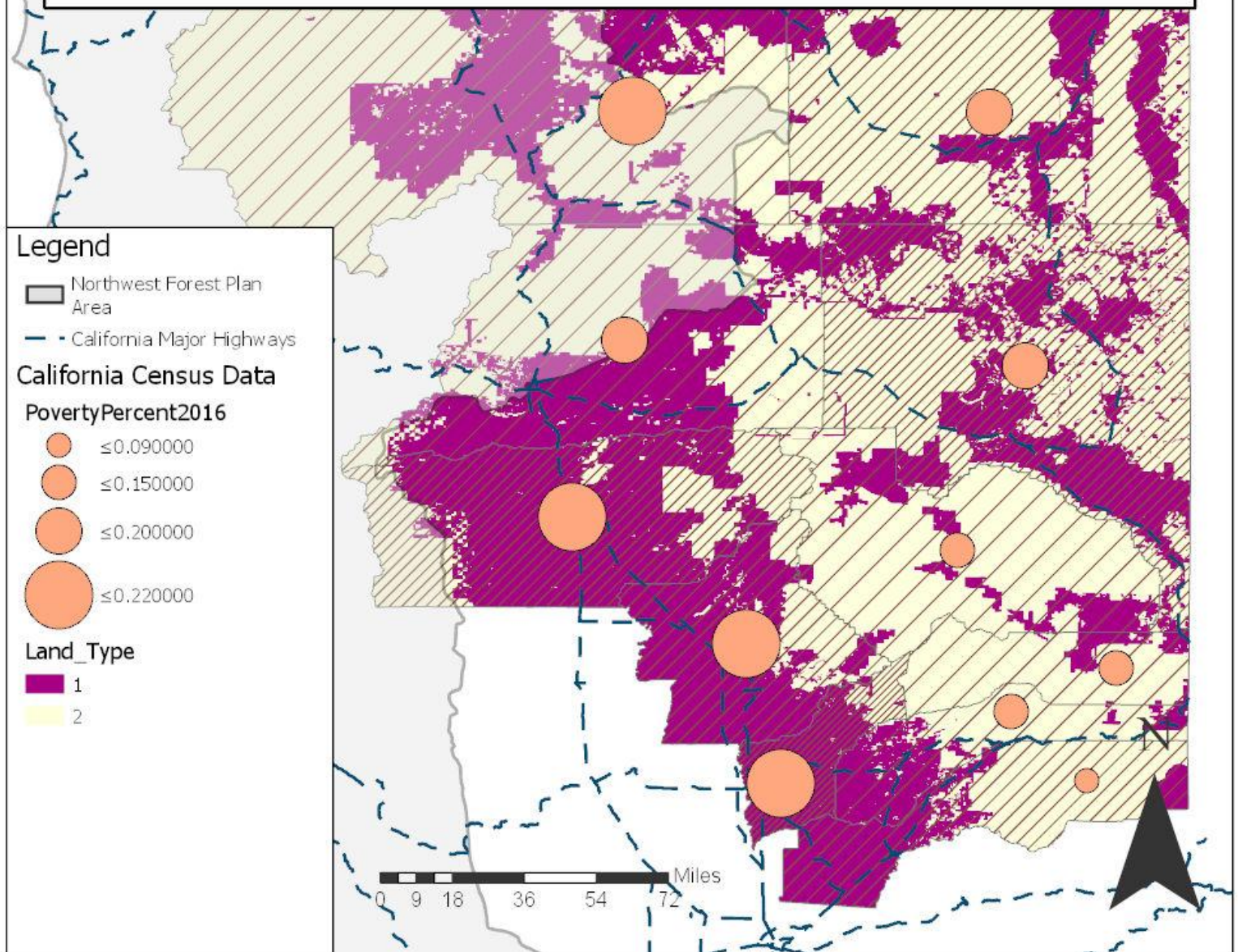
Percent of Federal Land and Language other than English Spoken

Non-English Language Spoken (%)

Percent of Federal Land

◆ Speak Language other than English 2000
◆ Speak Language other than English 2010
◆ 2016 Speak Language other than English

Relationship between Percent of Private Land and Poverty 2016

Poverty Percent 2016

Percent of Private Land

— R2 = 0.35