

**Mapping Valencia County:
A Comparison of CropScape Data vs. Census of Agriculture Data**

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Author Note

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Mapping Valencia County: CropScape Data vs. the Census of Agriculture Data

Motivation & Background

Valencia County, New Mexico is located approximately 45 km to the south of Albuquerque. *Figure 1* (below) shows the location of Valencia County in New Mexico. Valencia County has a very long history of farming. Native Americans began farming, complete with irrigation, long before European and other settlers came to what would later become the state of New Mexico. Farming and agriculture are part of the cultural heritage of Valencia County. *Figure 2* (below) is a graph of the land usage in Valencia County in 1997. In 1997, 56% of all land in Valencia County was in farms. *Figure 3* (below) provides a contrast to 1997, showing land use by 2017 in Valencia County. By 2017, nearly 76% of all land in Valencia County was in farms (*Census of Agriculture, 1997-2017; CropScape 2008, 2012, 2015, 2017*)..

Crops that once thrived in Valencia County may no longer grow well as the climate changes. This GIS project is part of a larger project looking at crop changes in the Middle Rio Grande valley over the last two to three decades, given changing flows to the river and temperature variations (Griego, Fleck, & Gutlzer, 2020). Of interest are pecans and other orchard crops because pecans in particular have relatively high water requirements.

Figure 4 is a photograph taken in 1935 in Bosque Farms, Valencia County, New Mexico; the workers are leveling the field in preparation for irrigating the field (Lange, 1935). *Figure 5* is a photograph taken in Valencia County, New Mexico by John Fleck (2020). In this photograph, a farmer has found a unique way to power his or her pump in order to irrigate the fields. Farming is a way of life in Valencia County, regardless of whether farming is the operator's primary profession or the size of the farm.

Figure 1: Vicinity Map of Valencia County, New Mexico

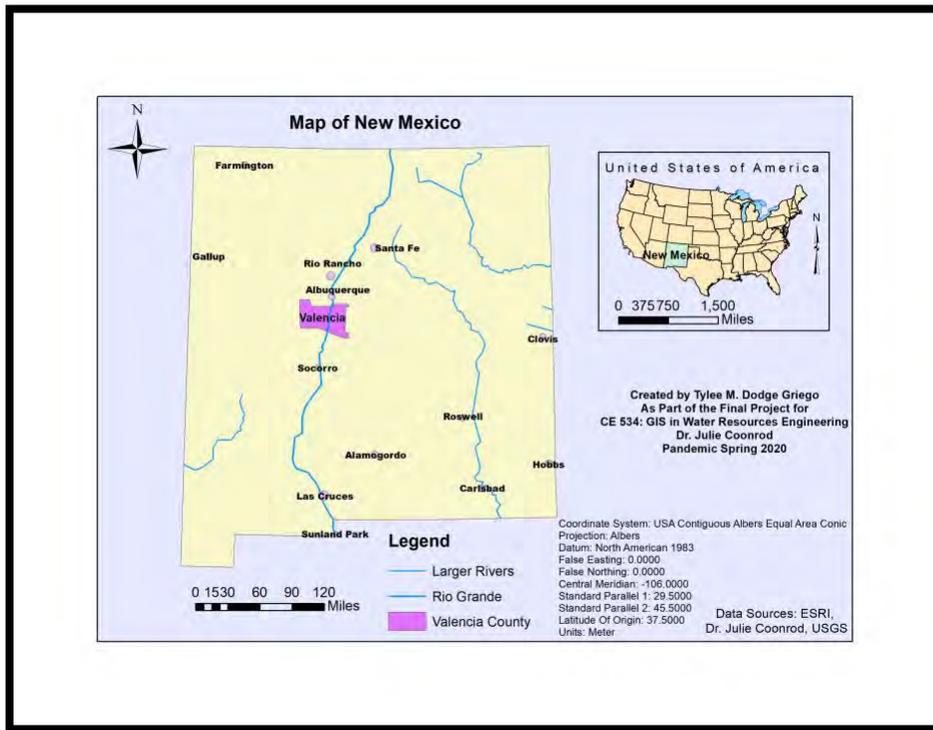


Figure 2: Valencia County Land Use Map for 1997 (based on Census of Agriculture Statistics, 1997; Griego et al., 2020)

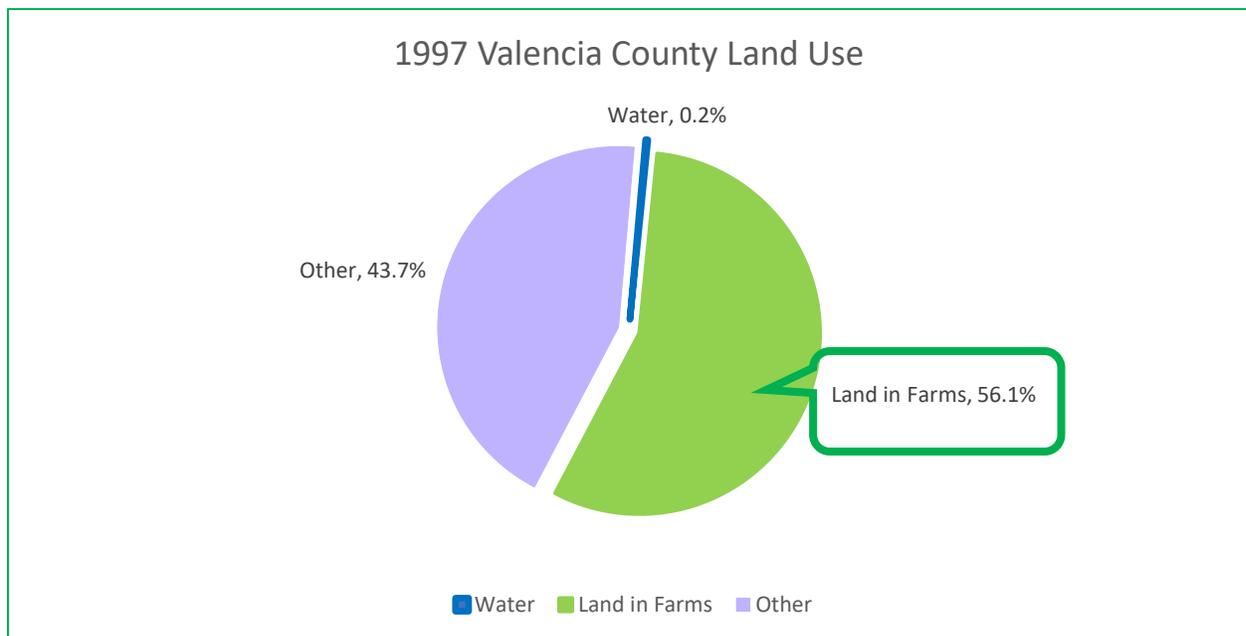


Figure 3: Valencia County Land Use Map for 2017 (based on Census of Agriculture Statistics, 2017; Griego et al., 2020)

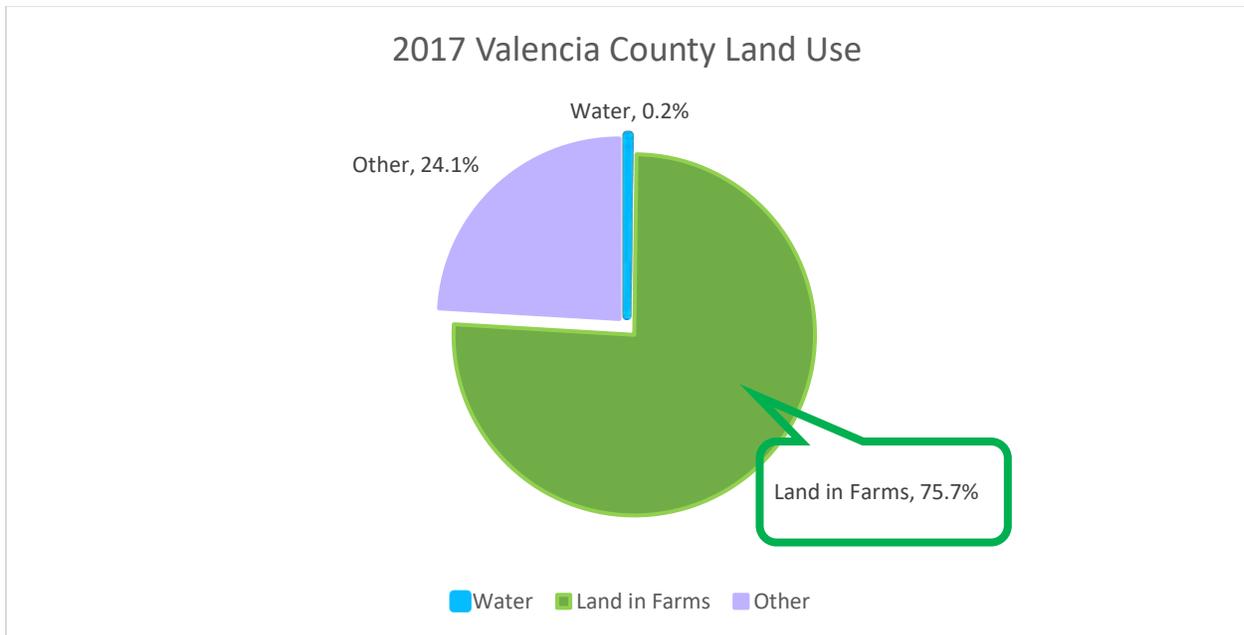


Figure 4: Bosque Farms, 1935, the leveling of a field in preparation for irrigation (Lange, 1935)



Figure 5: Valencia County, 2020, a unique way to pump irrigation water to the fields (Fleck, 2020).



Objective

The objective of this project is to evaluate the reliability of CropScape data as compared to the Census of Agriculture data for Valencia County, especially noting changes to pecan and other orchard crops. The objective is also to get a better understanding of where water is flowing in relation to the crops grown. The goal is also to observe/identify any agricultural trends.

Methods

Data Sources

RGIS was used to find base maps including a map of the U.S.A. with cities, maps of rivers and roads. New Mexico counties file was obtained from data provided by Julie Coonrod for use in CE 547: GIS in Water Resources Engineering homework assignments. Crop data for

maps was also provided by RGIS using CropScape data. Water data was obtained both through RGIS and the USGS. Historical farm and crop data were transcribed into Excel for comparison. RGIS' sources for data included CropScape, ESRI, and the USGS.

Projection Used

The map of the U.S.A that I used was originally in *GCS_North_American_1983*. I felt it looked odd, and so I changed the projection to *USA Contiguous Albers Equal Area Conic*. This reduced the squatty appearance of my map of the U.S.A.

Belen's water data (representing the locations of rivers, ditches, arroyos, etc.) was originally in *GCS_North_American_1927*. I did not want New Mexico to be tilted so I changed the projection to *Transverse Mercator: NAD_1983_UTM_Zone_13N* with the central meridian changed to -106 degrees.

The rest of the maps are in *Transverse Mercator: NAD_1983_UTM_Zone_13N*. I chose this projection because it was suitable for the smaller state-sized and the smaller still county-size levels of data that I was looking at. Most of these have the central meridian at -105 degrees.

Software Environment

The software environment that I used for this was ArcMap mainly. I did use ArcCatalog to try to see my data and to try to import it. I also used Excel, particularly for creating graphs as I found ArcMap's interface for graphs to be rather limited. I had many types of files that I imported including raster data, as well as vector data, shapefiles (when I could find them), Excel files, and some TIFF files.

Analysis

See appendices for further information. Analysis of data in ArcMap became very difficult with the program crashing any time I tried to use tools like the Spatial Analyst or when I tried to

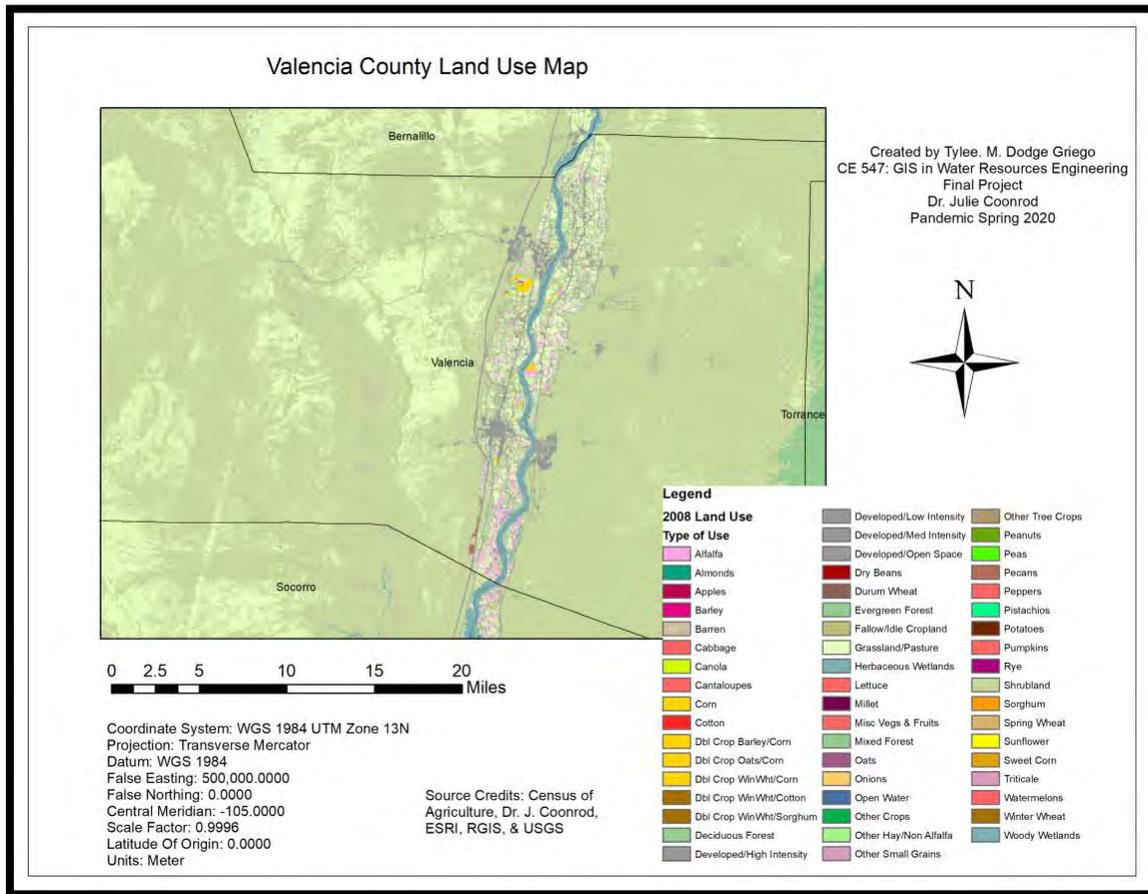
open attribute tables that once functioned and opened. I also encountered an error when trying to import .csv files. I ultimately was able to cut and paste the data I wanted into an Excel spreadsheet, after cleaning up the data. I used the *Query* function to restrict my USA map(s) to display restricted a) to New Mexico, and then, b) to Valencia County. When I selected the state of New Mexico, I created a new layer to add to my map, and for use in other maps. When I selected Valencia County, I created a new layer for this as well, for use both in that map and in other maps. Thus, many of my Queries led to the creation of new layer(s). I also was able to use the Clip function to restrict data for the area I wanted to look at. I clipped streams/rivers to a) New Mexico, and then to b) the two HUC's that are contained at least partly by Valencia County. Symbology was altered to reflect that data as ideally as possible for each map.

More procedures and error messages received are provided in the appendix.

Results

Figure 10: Valencia County Land Use in 2008 was the first map I made after the vicinity map. The coloring is lovely, but there are too many types of crops listed in the legend and too many colors for me to easily see when is happening with the pecans and other orchards and/or vineyards. We can see very clearly though that the Rio Grande runs through Valencia County, and that the county has very little developed areas compared to the size of the county.

Figure 6: Valencia County Land Use in 2008



I was hoping to show changes over time in Valencia County, snapshots in time. However, I tried to combine four maps into one map with four time-snapshots. *Figure 11* attempts to accomplish this. Unfortunately, on my laptop, this map is not visible at great enough detail to be able to look at easily. Thus, I decided to create four separate maps: *Figures 12, 13, 14, and 15*. This allowed me to see more detail on my laptop. The maps are on the following pages.

Figure 7: Valencia County Select Crops: 2008, 2012, 2015, 2017 (Data sources: CropScape, and as listed on map document).

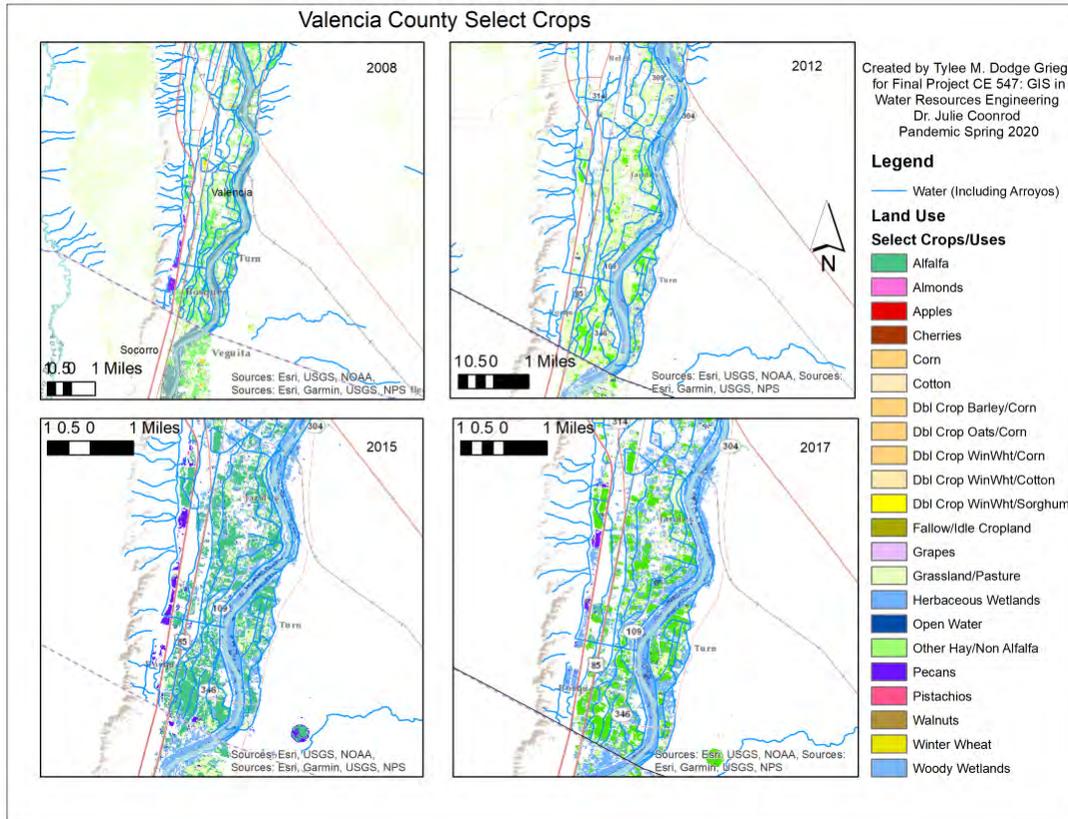


Figure 8: Valencia County 2008 Land Use Map (note pecans shown in purple)

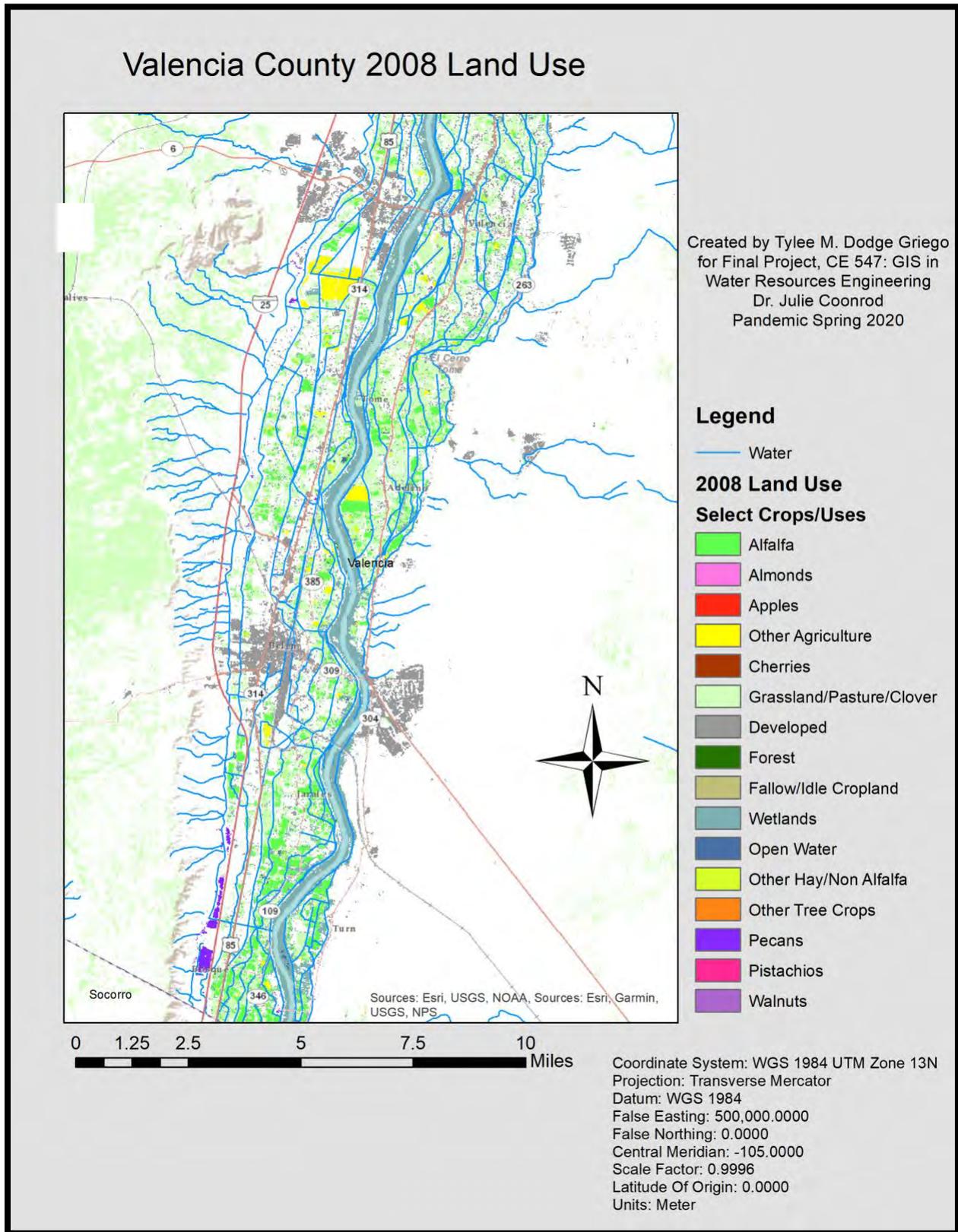


Figure 9: Valencia County Land Use (note pecans shown in purple – are missing)

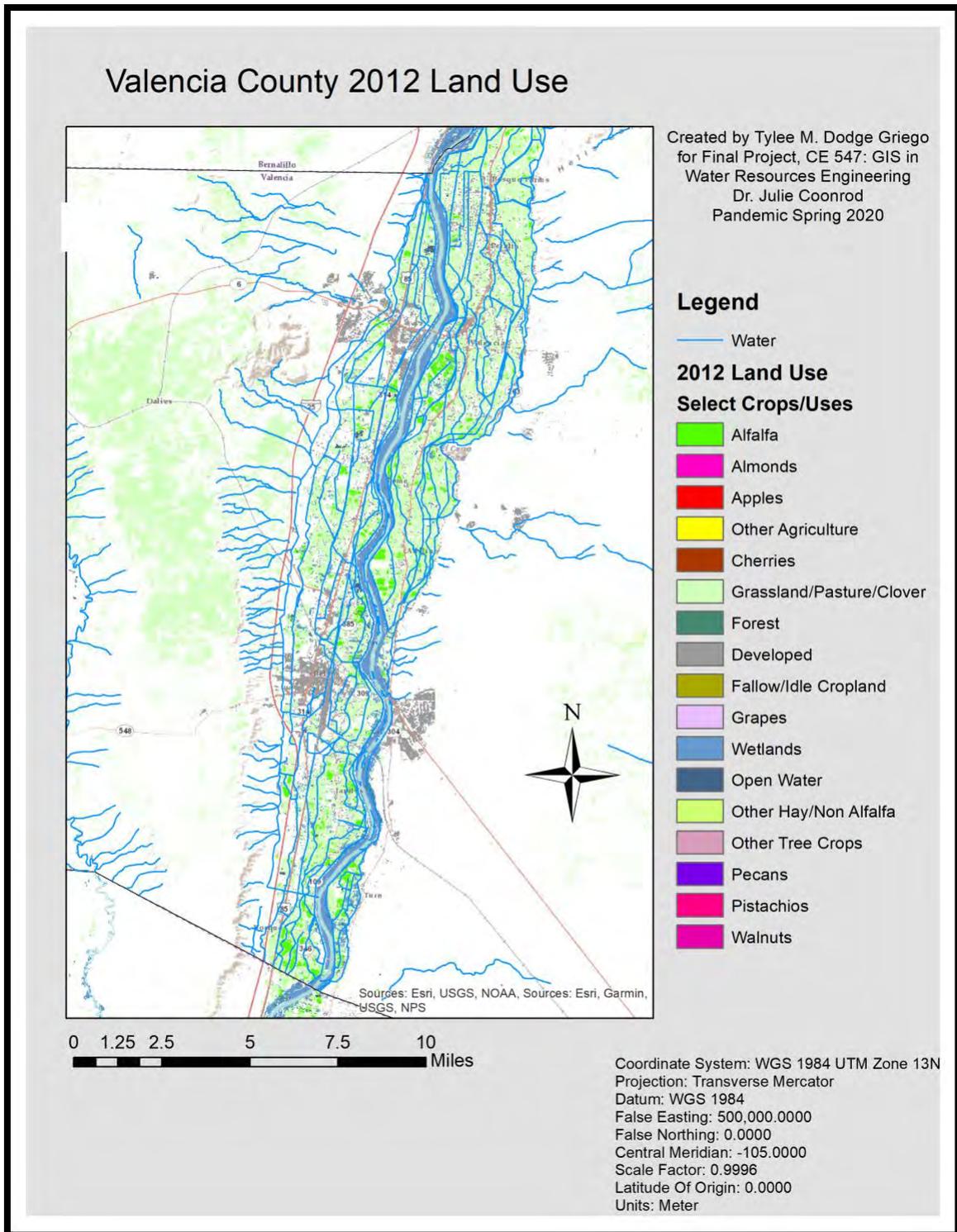


Figure 10: Valencia County 2015 Land Use Map (note pecans shown in purple – pecans reappear)

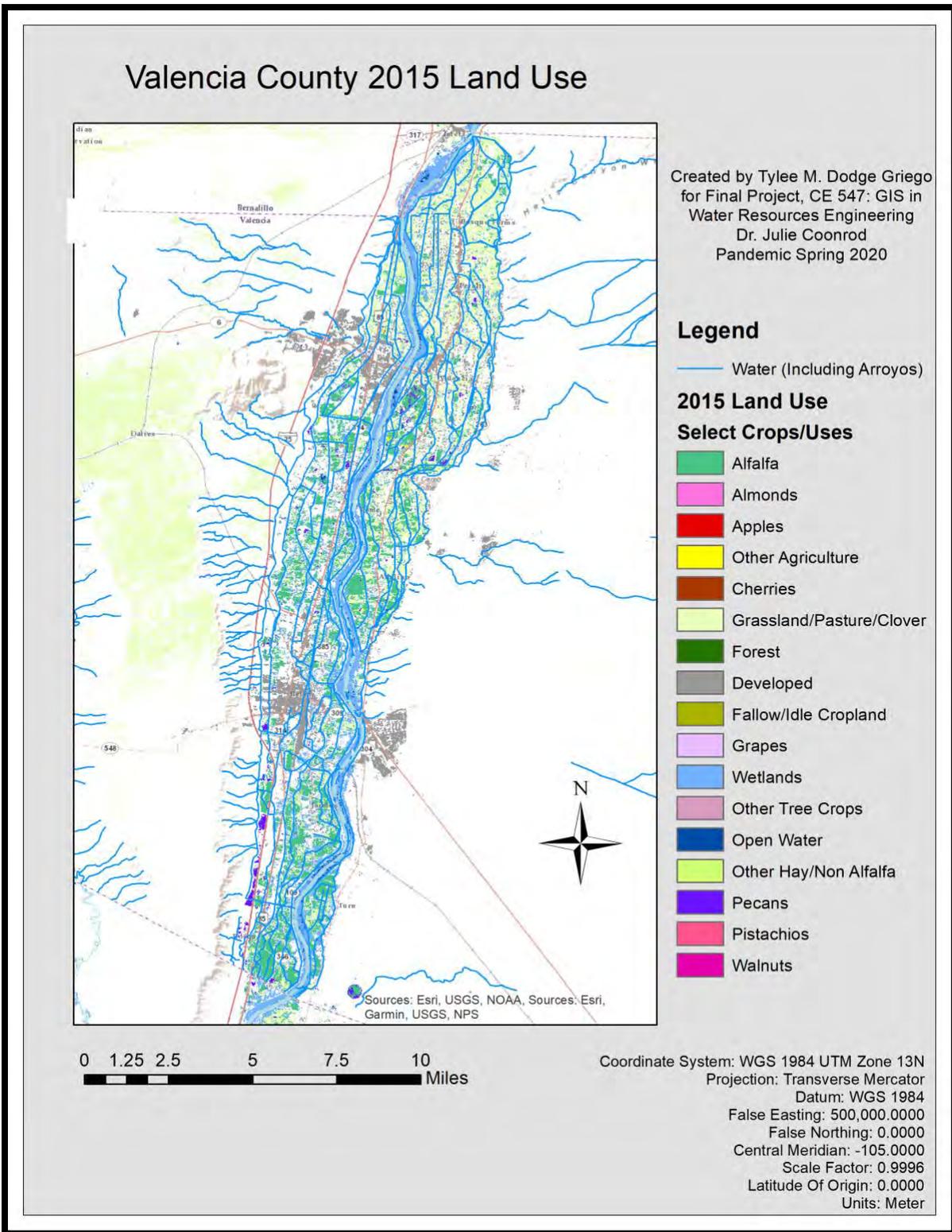
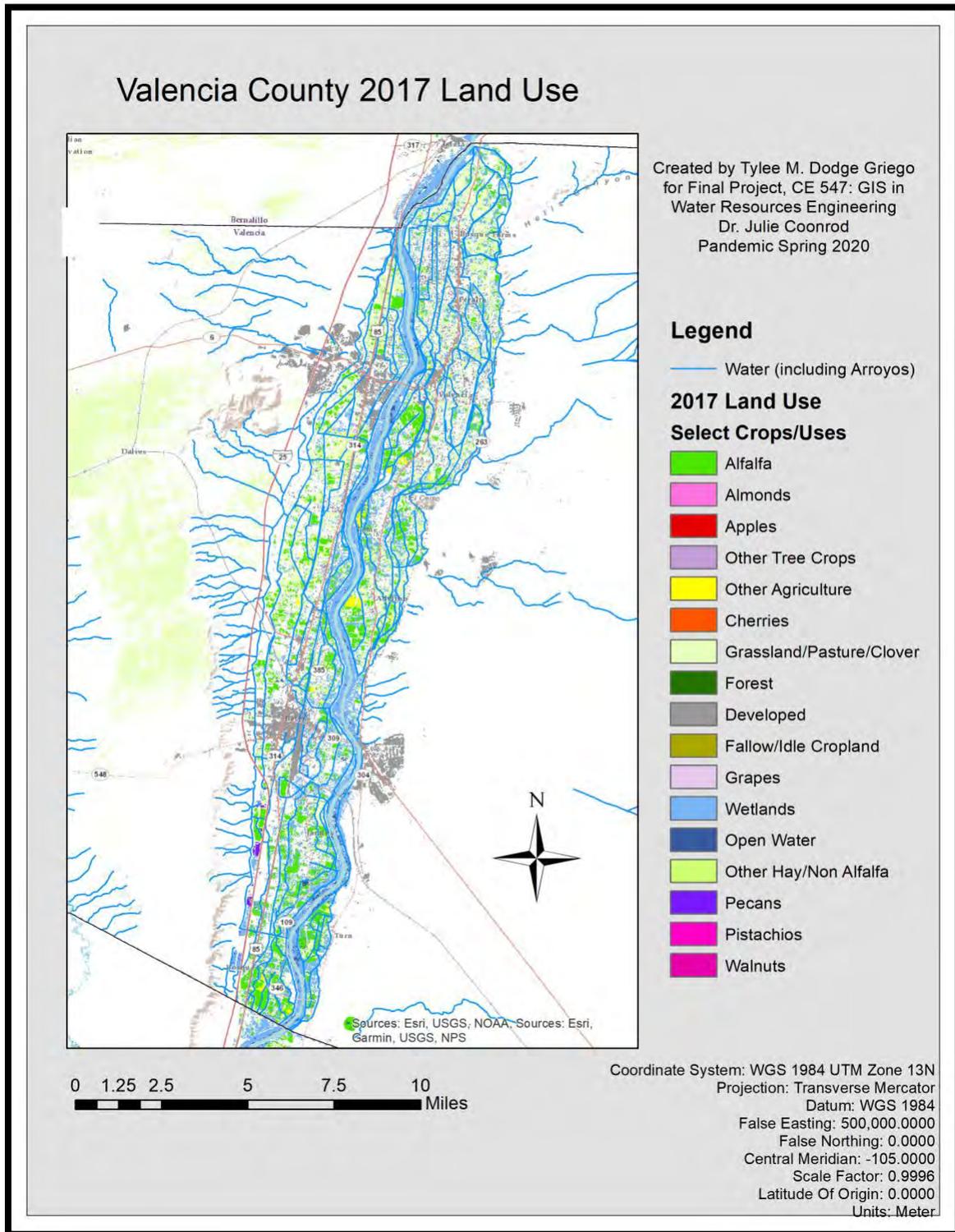


Figure 11: Valencia County 2017 Land Use Map (note pecans shown in purple – some areas of pecan trees are visible again, while others appear to have become wetlands, according to CropScape)



Figures 12, 13, 14, and 15 show a lot of variation between the years in crops, more than can be explained by typical cropping patterns. Thus, I created a graph Figure 16 to see what the agricultural trends are. As we can see in Figure 16, alfalfa, shown here in green, is by far the predominate crop found in Valencia County. The other categories appear so tiny by comparison that I decided to make a graph where alfalfa is excluded (*CropScape*, 2008, 2012, 2015, 2017).

Figure 12: CropScape Agricultural Land Use Data: Snapshots in Time: 2008, 2012, 2015, 2017 (graph constructed with data from *CropScape*, 2008, 2012, 2015, 2017).

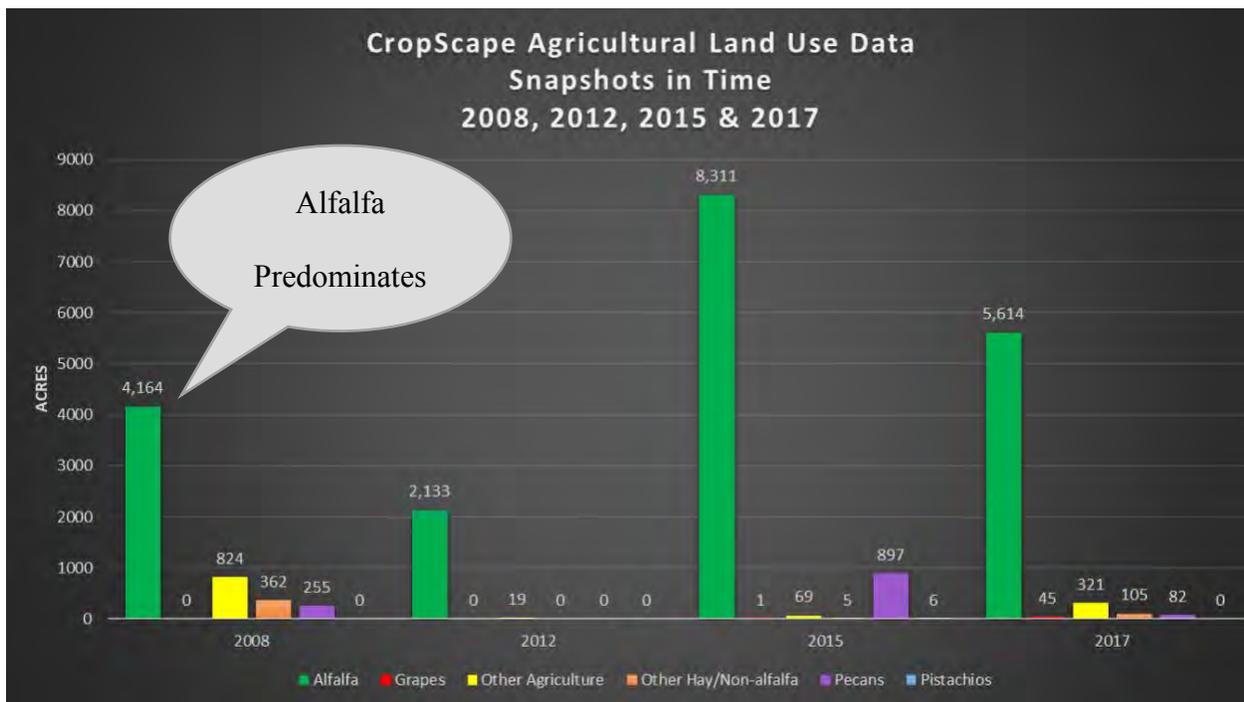
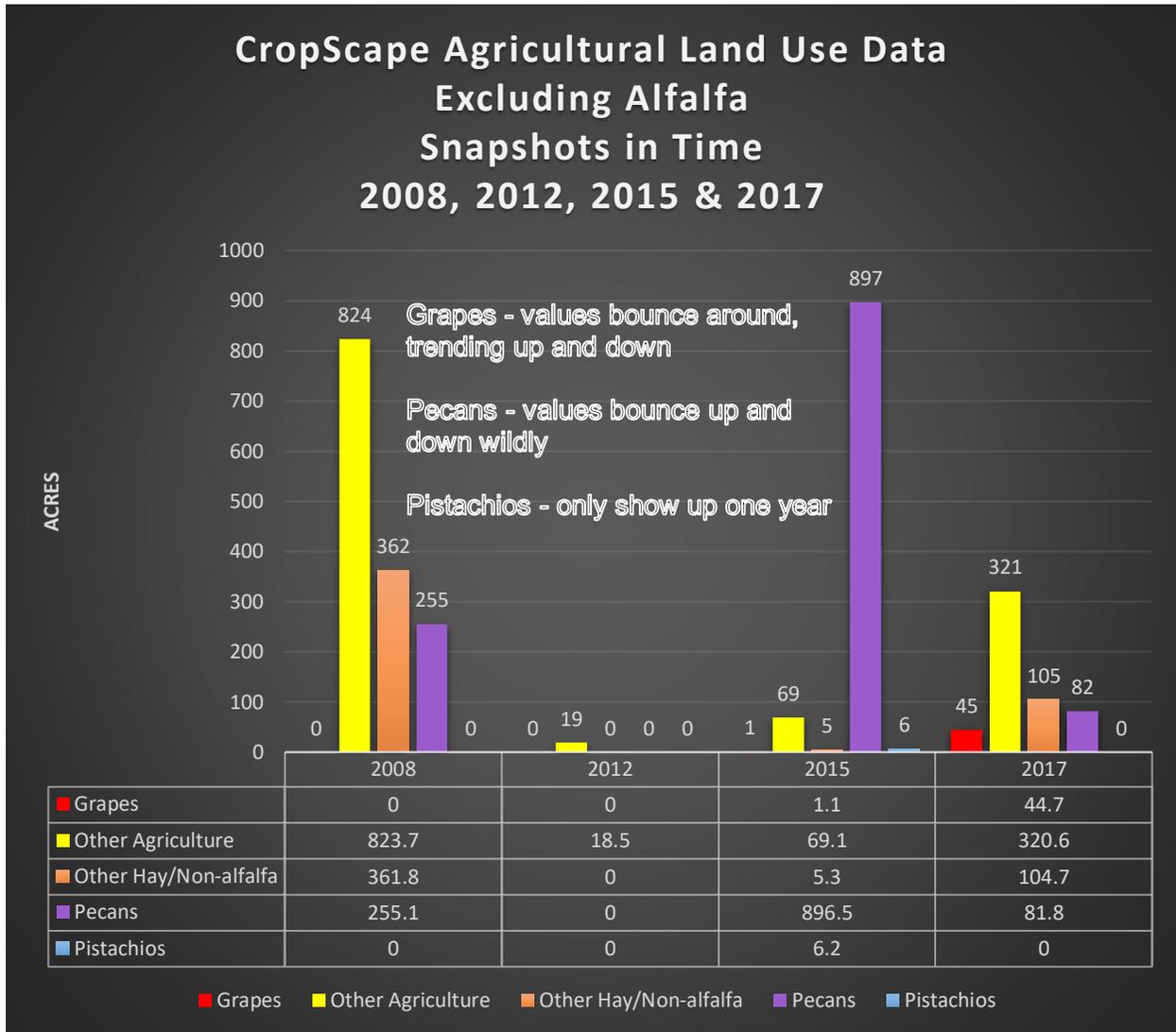


Figure 17 (on the following page) shows us a graph of CropScape’s interpretation of agricultural land uses, excluding alfalfa. The data seems capricious. The acres devoted to agriculture vary more significantly between years looked at than can be reasonable. Grapes appear to be increasing overall; however, CropScape shows years where numbers were nearly zero or zero for agricultural land acreage. Pecans, shown in purple, are almost 900 acres in 2015, but by 2017

there are just over 80 acres in the county (*CropScape*, 2008, 2012, 2015, 2017). We look next at the Census of Agriculture Data.

Figure 13: CropScape Agricultural Land Use Data (Excluding Alfalfa): *Snapshots in Time: 2008, 2012, 2015, 2017* (graph constructed with data from *CropScape*, 2008, 2012, 2015, 2017).



Census of Agriculture Data

Unfortunately, due to the size of the county and the number of farms, sometimes the Census of Agriculture does not list acreages, to protect privacy, but rather list the number of farms. The number of pecan farms is shown in *Figure 18* in purple. The number of pecan farms

has been increasing from two farms in 2002 to 28 farms in 2017. The number of nut farms is increasing overall, as well as orchards increasing (*Census of Agriculture, 1997-2017*).

Figure 14: Number of Farms with Orchards or Nut-Bearing Trees, 1997-2017 (Data source: *Census of Agriculture, 1997, 2002, 2007, 2012, 2017*).

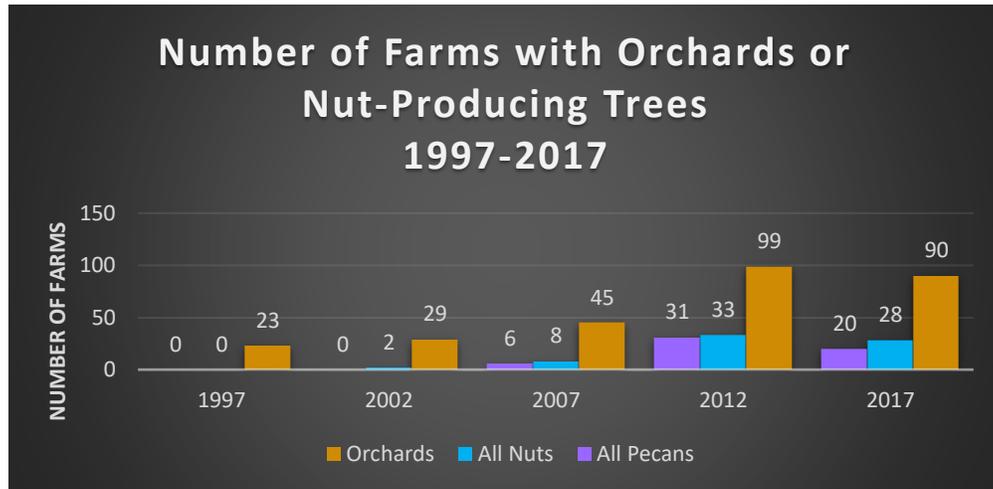


Figure 19 (below) shows the acreages of grapes falling from 1997 to 2017. Acres of apples orchards fall during that same time period. Cherries increase slightly from 2 acres to 4 acres between 1997-2017. The graph shows the Census of Agriculture reports fruit trees that are absent in CropScape’s data.

Figure 15: Acreage in Non-Citrus Fruits (Excluding Berries), 1997 vs. 2017 (Data source: *Census of Agriculture, 1997, 2017*)

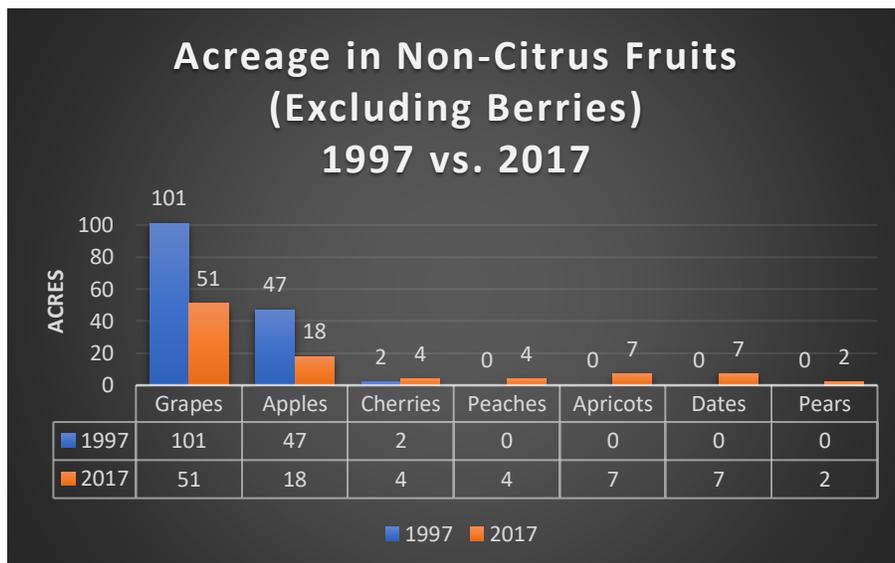


Table 1, below, shows in 2012 the Census of Agriculture classified over 16,000 acres of alfalfa being grown in Valencia County; however, the data from CropScape for that same year shows just above 2,000 acres of alfalfa. In 2017, the Census of Agriculture reported just under 10,000 acres of alfalfa; yet, CropScape only lists just over 5,600 acres of alfalfa (*Census of Agriculture, 1997-2017; CropScape, 2008, 2012, 2015, 2017*).

Table 1: Census of Agriculture vs. CropScape: Comparison of Acreage Quantified for Select Crops (Data source: *Census of Agriculture, 1997-2017; CropScape, 2008-2017*)

Crops Land Use (acres)	1997 Census of Ag	2007 Census of Ag	2008 Crop-Scape	2012 Census of Ag	2012 Crop-Scape	2015 Crop-Scape	2017 Census of Ag	2017 Crop-Scape
Alfalfa	8306	12201	4164.3	16195	2133.2	8311.3	9809	5613.5
Other Hay/Non-alfalfa	1689	2900	361.8	1000	-	5.3	2461	104.7
Apples	47	26	-	39	-	-	18	-
Cherries	2	1 + #D	-	3 + #D	-	-	4	-
Grapes	101	50	-	20	-	1.1	51	44.7
Orchards, All	156	93	-	580	-	-	559	-
Pecans	0	<9	255.1	472	-	896.5	<462	81.8
Pistachios	0	#D	-	#D, 1 farm	-	6.2	#D, 6 farms	-
Other Tree Crops	<6	≥13 + #D*3	-	≥43 + #D	-	-	≥20 + #D*2 + z	-

#D = Unlisted amount of acreage/privacy concerns

z = Unknown amount of acreage

Conclusions

CropScape does fairly well at correctly identifying crops occupying a larger amount of acreage in other areas. However, when dealing with crops occupying a smaller amount of acreage, as is often found in Valencia County, CropScape is not accurately capturing the crops grown. CropScape is not accurately identifying alfalfa or other hay/non-alfalfa acreages. Additionally, during certain years, CropScape identifies peppers as growing in the center of the Rio Grande – which is suspicious. Farmers do not often farm in the middle of the river.

CropScape is completely failing to capture the smaller acreage crops accurately. Apple orchards and cherry orchards are completely absent from CropScape, while, as seen in *Table 1*, and *Figure 19*, apple orchards have been decreasing, while cherry orchards have increased slightly in acreage. Peaches, Apricots, Pears, and Dates are completely absent from the CropScape data, while in the Census of Agriculture data, each of these categories has been increasing in acreage. The results for the grapes are quite off when you compare the results from *Figure 19 and Table 1* along with the maps created. CropScape has very different values for grapes than the Census of Agriculture's data, and it is not until 2017 that CropScape even gets close to the Census of Agriculture's data.

Figure 18 was compared with the maps produced to identify patterns in pecan orchards. The Census of Agriculture data shows us the amount of acreage in pecan orchards is gradually increasing. However, CropScape captures the pecan orchards very poorly, making it appear that pecan orchards appear and disappear from year to year, even becoming wetlands during 2017. Visual inspection of that area of Valencia County shows that the area is not a wetland, but rather

a tree orchard; from the distance visual inspection was done, the type of tree orchard could not be confirmed. However, it was certainly not wetlands, but rather an orchard.

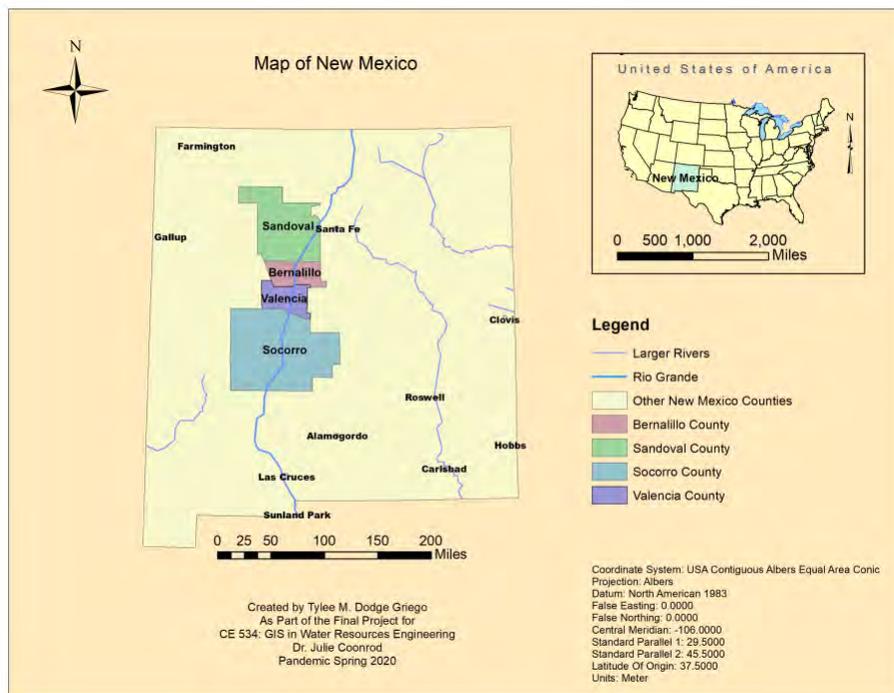
At this time, CropScape is an unreliable indicator of agricultural land uses occupying smaller amounts of acreage. CropScape may not be effective for use in Valencia County since most farms represent small amounts of acreage as compared to other agricultural areas.

Future Work

Near Future Plans

I plan to add in USGS historic streamflow data and any depth to water information for Valencia County. I'd like to make a 3-D image for the area. I also would like to access a PC (vs. BootCamp on a MacBook Pro laptop) to see if ArcMap continues to crash when I try to view attribute tables (which I was previously able to view). The second reason I would like to access a PC is to see if the Query tab, which has disappeared from my map documents, reappears.

Figure 16: Middle Rio Grande Vicinity Map



Long-Term Plan

I would like to extend the scope of this project to include the four counties in the Middle Rio Grande: Bernalillo, Sandoval, Socorro, and Valencia counties, as shown in Figure 20 (shown at the left).

Secondarily, I plan to create layer(s) out of the Census of Agriculture county-level data with the goal of seeing how trends vary between the four counties. Lastly, an investigation could be undertaken to see if peppers really grow in the middle of the Rio Grande some years, although this hardly seems necessary. The use of drones would be interesting in this context to see if they are better able to delineate and classify the crop types, especially farms that represent smaller amounts of acreage. This could prove to be very interesting since CropScape does not seem to consistently identify these smaller acreage crops correctly.

References

- Fleck, J. (2020). Photograph: *Pickup Truck Pump for Irrigation*. Valencia County, New Mexico.
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Please see other map data sources in the *Data Dictionary* including RGIS and the USGS, as well as materials provided by Dr. Julie Coonrod and Smriti Chaulagain for use in homework assignments.

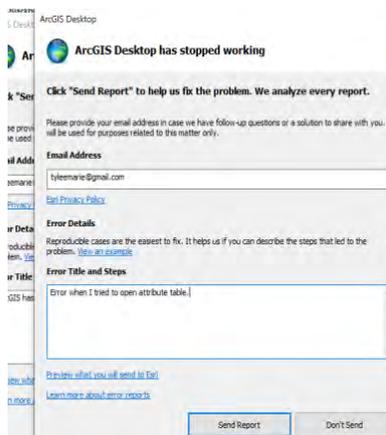
Appendices

Procedures

Further Issues Encountered

Eventually, my query tab disappeared. No amount of recreating the map or downloading the files again fixed this query-tab-disappearing problem. Restarting the program did not help. Attribute tables that previously had opened became inaccessible; every time I tried to open an attribute table, ArcGIS crashed, and *Figure 6* is the screenshot of the error message I received.

Figure 17: Screenshot of error message when trying to open attribute tables.



Unable to use Query to select the crops I wanted to look at or open the attribute tablet, I began to investigate. I used the *Symbology* tab in *Layer Properties* to group things together. Thus, instead of having 4 different types of forest listed, I was able to highlight

them and group them together as seen below in *Figure 7*.

Then, I changed the legend label to 'Forests'. I went through this very painstaking process of grouping all 'other' agriculture, grouping together all developed areas, grouping together the different types of wetlands, grouping the different types of trees, aside from the main orchard crops I wanted to feature, etc., and then giving them an appropriate label. I altered the colors in *Symbology* applying very bright colors to the trees, such as pecan trees and other nut trees. I represented developed areas with a dark grey, and water and the different types of wetlands were changed to the color blue. Other colors were chosen to help make pecans, grapes, and other orchards/vineyards more visible. The land cover marked Barren Land was left out of

the map(s) because there is so much barren land in the county that allowing the Barren Land to be even a light terrain color, caused the key features I was looking for to become extremely hard to see.

Figure 18: Screenshot of missing Query tab; how to group items together in the Symbology tab.

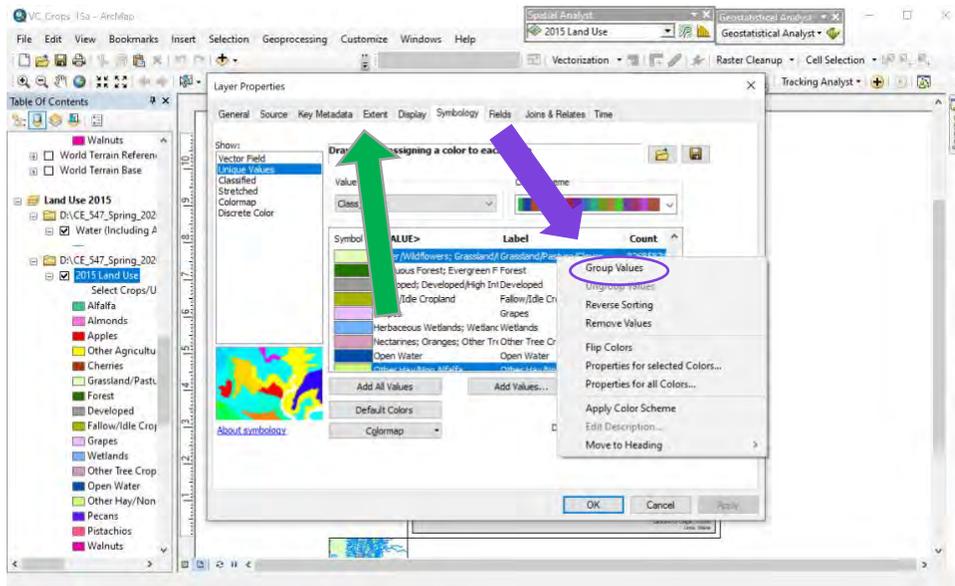
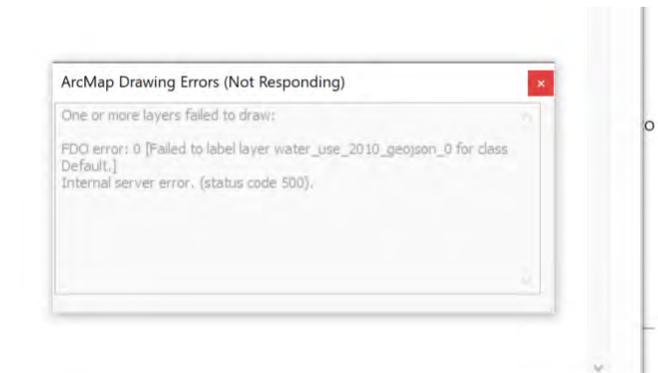
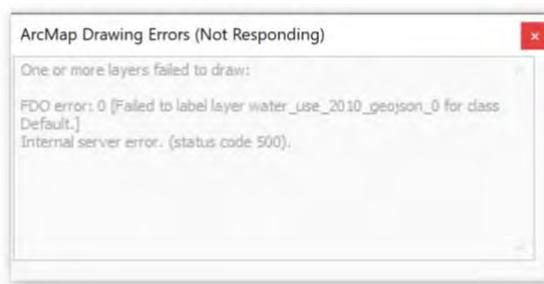


Figure 19: ArcMap error message - failing to draw layer, even when all other layers were turned off.



I further encounter issues with layers refusing to draw. I tried several times and received the error message seen in Figure 8.

Figure 20: Another ArcMap error message - failing to draw layer, even when all other layers were deselected.



I tried turning every other layer off, and still received the error message in *Figure 9*.

Ultimately, after restarting ArcMap and importing my data again, this

issue seemed to resolve. I did see the error message once more, but then the layer began to display, and the error message disappeared.

Map Procedures

Four County Vicinity Map

(Found under Future Work)

Data Frame 1 – I imported the map of the U.S.A., as well as roads and rivers. I thought it looked odd in NAD_83 so I changed the projection to USA Contiguous Albers Equal Area Conic because I preferred the way this made the U.S.A. looked. I used a query for select only New Mexico. I created/exported this as shapefile from that for use in Data Frame 2. I used queries to get the main rivers flowing in New Mexico. Then I used the Clip tool to clip the rivers to show them only in New Mexico. I exported this as a shapefile for use in Data Frame 2.

Data Frame 2 (Valencia County)– I imported the shapefile I had created of New Mexico and the shapefile I had created of the main rivers. I added a shapefile of the counties of the U.S.A. as it turned out. I clipped counties to my New Mexico layer to display only New Mexico counties. I queried counties of interest, originally Boolean phrasing for Bernalillo, Sandoval, Socorro, and Valencia Counties.

I looked at my layout and ended up removing anything that seemed too cluttered. I added labels, then queried to show only desired labels. I ended taking out most of the rivers because after watching the maps and graphs displayed by the New Mexican government during this pandemic, I have concluded that while a really colorful map looks pretty, it may not be the best way to tell the story you are trying to tell or elucidate the important data.

Valencia County Vicinity Map

Data Frame 1 - I imported the map of the U.S.A. again, along with cities, rivers, and roads. It looked odd so I changed the data frame properties to USA Contiguous Albers Equal Area Conic. Queried → State Name = 'New Mexico'. I exported the data of the selected feature to a shapefile. I queried rivers in New Mexico, and exported a shapefile, added as a layer of the rivers in NM. I selected NM and labeled.

Data Frame 2 – Brought in shapefile of New Mexico. I used ArcToolbox to project the New Mexico shapefile into Albers with a Central Meridian of -106. I selected the Rio Grande River System via query and clipped it to New Mexico Projection. I added US Counties, queried Name = 'Valencia'. I added cities only in New Mexico by querying State Name = New Mexico. That was just too many cities, but I wanted more than the capital city only. I queried Population2012 >=15,000. I changed the symbol sizes to graduated symbols to range from 4-10 points. I then did a nested set of queries so that the name of the city could equal Socorro or Belen, but not the South Valley because the South Valley label was causing issues. The South Valley just refused to stop being labeled. So, finally, I settled on a query of pop2012 > 15,600 OR Name = Socorro AND NOT Name = South Valley. I played with adding a buffer to labels and making them better font sizes and colors.

I then clipped with my input as US Rivers being clipped to my New Mexico Proj. I went back up to the states' layer Queried New Mexico. I inserted all appropriate elements. Decided that I wanted to show only the counties I chose so I queried Name = Valencia OR Name = Bernalillo OR Name = Socorro OR Name = Sandoval. I changed the colors to each county having a different color in Symbology.

Ultimately, since I wanted the counties labeled the city names were getting in the way so I queries Pop2012 > 15,600 AND NOT 'Name' = "Albuquerque" AND NOT 'Name' = 'Rio Rancho' AND NOT 'Name' = 'South Valley'.

New Mexico: 2010 Surface Irrigation in K acres

New Mexico: 2010 Surface Water Withdrawals for Irrigation in Mgal/day

(Found other Additional Maps in Appendices)

Irrigation for crops in thousand acres found on ArcGIS online. Changed projection to NAD_1983_UTM_Zone_13N with a central meridian at -105 so that New Mexico would stand up straight. This is Transverse Mercator. I imported the 2010 Valencia County crop cover, building pyramids using nearest neighbors' value. This was in raster format. I added a shapefile for roads which was in WGS_1984 and transformed to match data frame. However, there were just too many roads so I changed symbology and went into query builder → "Type" = 'U.S.' OR "Type" = 'Interstate'. I added New Mexico Federal lands and BLM wilderness lands, as well as a water shapefile; however, I found most of these cluttered the map too much. I changed the field I was pulling data from so that I could represent New Mexico surface water withdrawals for irrigation in Mgal/day.

Land Use Data for 2008

I added crop data for New Mexico, and chose the Transverse Mercator with UTM Zone 13 N again (originally WGS_1984) with a central meridian of -105 degrees so New Mexico would stand upright. I queried crops with “Count” > ‘0’. I inserted the main rivers that are flowing through my study area. To focus on only the crops or uses I wanted, I did a query “Full Name” = ‘Rio Puerco’ OR “Full Name” = ‘San Jose’ OR “Full Name” = ‘Rio Grande’. I used the query builder again trying to show tribal lands, but it just looked too distracting.

Valencia County Crops

I made a copy of the map above and downloaded data for crops in 2012. I used the query builder to select only the crop types I wanted to look at. I added waterways, arroyos, ditches, etc. I inserted different data frames for the years: 2008, 2012, 2015, and 2017, and downloaded the data for the other years performing queries for the crops I was interested in. I was not happy with the results of the four panel map I made as I had trouble getting the panels to have the same scale and the panels were just too small.

Thus, I made a map document for each of the years on its own, going through the laborious process of grouping types of land uses together into the appropriate categories and applying appropriate colors for consistency.

Basin Map

I went to CGIS and added the HUC layer to a new map. I used query builder selecting “REG” = ‘13’. I changed symbology on the Rio Grande Basin map to make the colors very bright for sub-basins included in Valencia County. I chose to use Transverse Mercator NAD_1983_UTM_Zone_13N because of its suitability for the New Mexico region.

I inserted a new data frame and inserted my HUC layer into it in the same projection as above. I queried “Cat” = ‘13020203’ OR “Cat” = ‘13020204’. I then added in streams and queried “HUC” = ‘13020203’ OR “HUC” = ‘13020204’. That did not work.

I decided to use the clipping tool again with the input of Streams and clipping it to my HUC of interest. I then added reservoirs, made sure the projection was correct, and exported my New Mexico reservoirs to a shapefile.

A Few Technology Issues

Attribute tables are no longer available for any of my land use data. I opened a new map document and inserted 2015 crop/land use data. I selected by attribute “Count” > 0. That didn’t help me. I tried to make a column and did, but then couldn’t figure out how to type in that column. I also realized that procedure was likely not going to get me to the information I wanted.

Symbology → I found through trial and error that if you highlight crops/land uses in the symbology table when you have chosen unique values, you can group those objects together. In this way, you can group all the various types of forests together under one heading name and one color displayed. This is a very slow process when you are doing it for multiple crops and multiple years. The benefit is that you are not leaving out information about certain crop types. If you are not interested in that crop type for analysis purposes, you are easily able to group all of that agriculture into an “other” category.

Additional Maps

At the very end, once I did not have time to work on it, I found more data on 2010 surface water irrigation. I downloaded the data, looked at the attribute table, and made color selections, symbology changes, and changed classification breaks, as I had for the other maps as well. I applied labels and other pertinent information.

Data Dictionary**New Mexico Cropland Data Layer 2008**

Originator: USDA, National Agricultural Statistics Service

Publication Date: 12-20-2019

Title: NM Cropland Data Layer – 2008

Geospatial Data Presentation Form: Raster digital data

Published: USDA, National Agricultural Statistics Service, Washington, D.C.

Online Linkage: https://gstore.unm.edu/apps/rgis/datasets/b090a6b4-d96d-48da-9c88-2c9cd2ffebe8/cdl_30m_r_nm_2008_utm13.original.tif or

<https://nassgeodata.gmu.edu/CropScape/>

Date Accessed: 04-05-2020

New Mexico Cropland Data Layer 2012

Originator: USDA, National Agricultural Statistics Service

Publication Date: 12-20-2019

Title: NM Cropland Data Layer – 2012

Geospatial Data Presentation Form: Digital raster data

Published: USDA, National Agricultural Service, Washington, D.C.

Online Linkage: https://gstore.unm.edu/apps/rgis/datasets/0e2b5021-0761-420a-b837-a0bfdcd711cc/cdl_30m_r_nm_2012_utm13.original.tif or

<https://nassgeodata.gmu.edu/CropScape/>

Date Accessed: 04-05-2020

New Mexico Cropland Data Layer 2015

Originator: USDA, National Agricultural Statistics Service

Publication Date: 12-20-2019

Title: NM Cropland Data Layer – 2015

Geospatial Data Presentation Form: Raster digital data

Published: USDA, National Agricultural Statistics Service, Washington, D.C.

Online Linkage: https://gstore.unm.edu/apps/rgis/datasets/0e2159a2-ebed-4ce6-8c1f-ce9307594bcc/cdl_30m_r_nm_2015_utm13.original.tif or

<https://nassgeodata.gmu.edu/CropScape/>

Date Accessed: 04-05-2020

New Mexico Cropland Data Layer 2017

Originator: USDA, National Agricultural Service

Publication Date: 12-20-2019

Title: NM Cropland Data Layer – 2017

Geospatial Data Presentation Form: Raster digital data

Published: USDA, National Agricultural Statistics Service, Washington, D.C.

Online Linkage: https://gstore.unm.edu/apps/rgis/datasets/4e0b5922-be57-4771-80ea-d7667e12ec55/cdl_30m_r_nm_2017_utm13.original.tif or

<https://nassgeodata.gmu.edu/CropScape/>

Date Accessed: 04-05-2020

Belen 1:100000 Quad Hydrography DLGs

Originator: US Geologic Survey or another agency in cooperation with the USGS

Publication Date: 04-15-2019

Title: Belen 1:100000 Quad Hydrography DLGs

Geospatial Data Presentation Form: Vector digital data

Coordinate System: GCS_North_American_1927

Published: US Geological Survey, Reston, Virginia

Online Linkage: https://gstore.unm.edu/apps/rgis/datasets/d5ff81f3-869e-4017-b694-df29d482e490/hbelen_2.derived.shp or <https://nassgeodata.gmu.edu/CropScape/>

Date Accessed: 04-22-2020

HUC 250K Layer

Originator: Steeves, Peter and Douglas Nebert

Publication Date: 1994

Title: 1:250,000-scale Hydrologic Units of the United States

Geospatial Data Presentation Form: Vector digital data

Series Information: Series Name: Open-File Report; Issue Identification: 94-0236

Published: U.S. Geological Survey, Reston, Virginia

Online Linkage: <https://water.usgs.gov/lookup/getspatial?huc250k>

Date Accessed: 04-20-2020

Base-map – World Topographic Map

Originator: ESRI

Sources: ESRI, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO,

NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, ESRI Japan, METI,

ESRI China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User

Community

Publication Date: Not Given

Title: World Topographic Map

Geospatial Data Presentation Form: ESRI geometry polygon

Online Linkage: http://goto.arcgisonline.com/maps/World_Topo_Map

Date Accessed: 04-20-2020

Base-Map U.S. Counties

Originator: ESRI, TomTom, U.S. Department of Commerce, U.S. Census Bureau

Publication Date: 12-21-2017

Title: U.S. Counties (Generalized)

Series Name: Data and Maps for ArcGIS; Issue: 2017 – World, Europe, & United States

Geospatial Data Presentation Form: Vector

Coordinate System: GCS_NAD_1983

Online Linkage:

https://services.arcgis.com/P3ePLMYs2RVChkIj/arcgis/rest/services/USA_Counties_Generalized/FeatureServer

Date Accessed: 04-02-2020

Base-Map U.S.A

Originator: ESRI, TomTom, U.S. Department of Commerce, U.S. Census Bureau

Publication Date: 12-21-2017

Title: U.S. States (Generalized)

Series Name: Data and Maps for ArcGIS; Issue: 2017 – World, Europe & United States

Geospatial Data Presentation Form: Vector

Coordinate System: GCS_North_American_1983

Online Linkage:

https://services.arcgis.com/P3ePLMYs2RVChkIj/arcgis/rest/services/USA_States_Generalized/FeatureServer

Date Accessed: 04-20-2020

Roads Layer

Originator: ESRI, TomTom North America, Inc.

Publication Date: 06-18-2019

Title: USA Major Roads

Geospatial Data Presentation Form: Vector, shapefile

Coordinate System: GCS_WGS_1984

Published: ESRI, created 11-03-2010

Online Linkage:

https://landscape1.arcgis.com/arcgis/rest/services/USA_Roads/MapServer

Date Accessed: 04-20-2020

New Mexico Reservoir Layer

Originator: Ruddy, B. C. and Hitt, K. J.

Publication Date: 09-10-2019

Title: New Mexico Reservoirs

Geospatial Data Presentation Form: Shapefile

Coordinate System: GCS_Clark_1866

Published: U.S. Geological Survey, Reston, Virginia

Online Linkage: <http://water.usgs.gov/lookup/getspatial?reservoir> or

[https://gstore.unm.edu/apps/rgis/datasets/bf4ddcc7-db1c-4599-8426-](https://gstore.unm.edu/apps/rgis/datasets/bf4ddcc7-db1c-4599-8426-945f0e60aa24/reservoirs_NM_derived.shp)

[945f0e60aa24/reservoirs_NM_derived.shp](https://gstore.unm.edu/apps/rgis/datasets/bf4ddcc7-db1c-4599-8426-945f0e60aa24/reservoirs_NM_derived.shp)

Date Accessed: 04-20-2020

New Mexico Irrigation – 2010

Originator: Available through ArcGIS Online, Jones.

Publication Date: Date not given

Title: New Mexico Agriculture and Irrigation

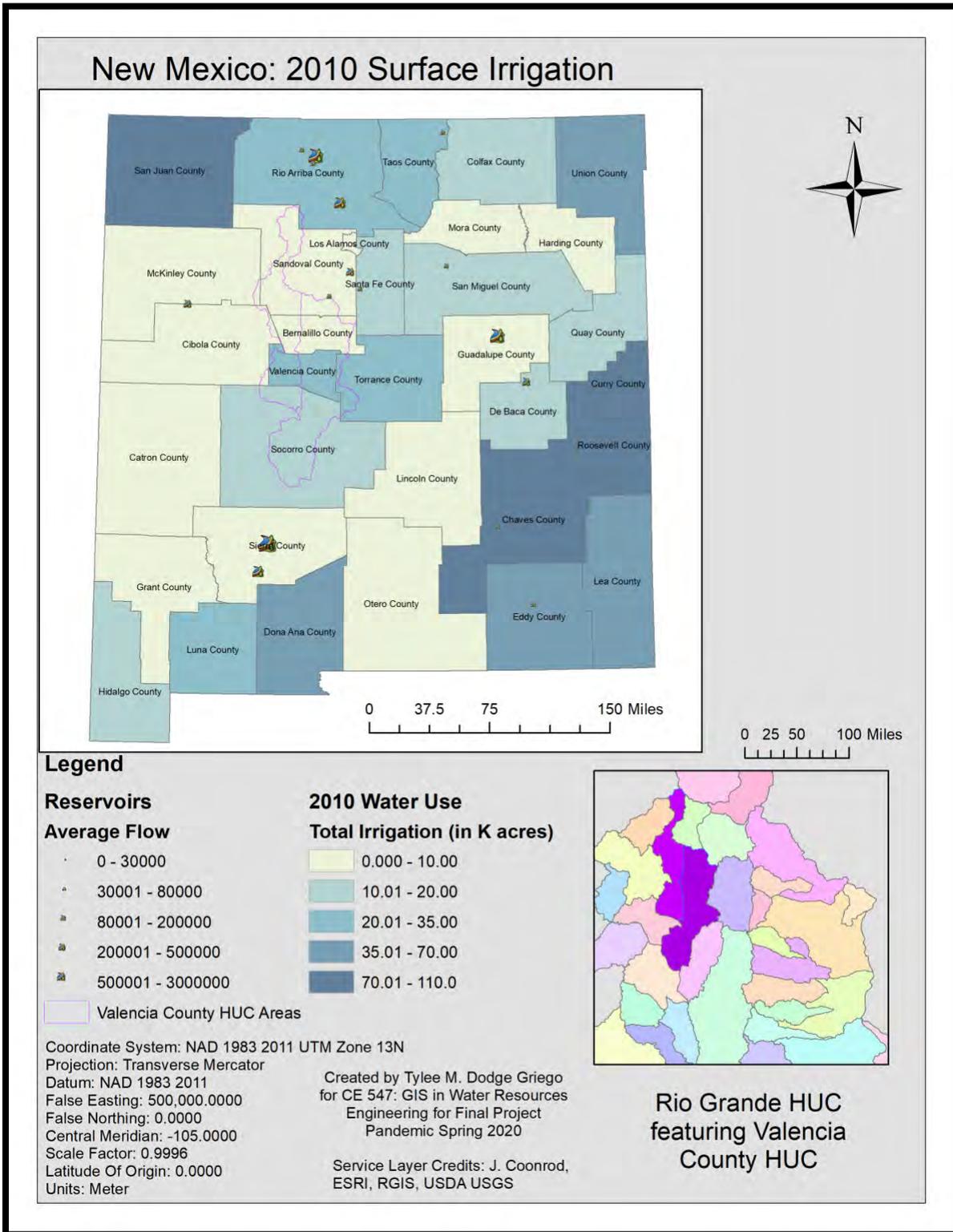
Geospatial Data Presentation Form: Raster

Coordinate System: NAD_1983_2011_UTM_Zone_13_N

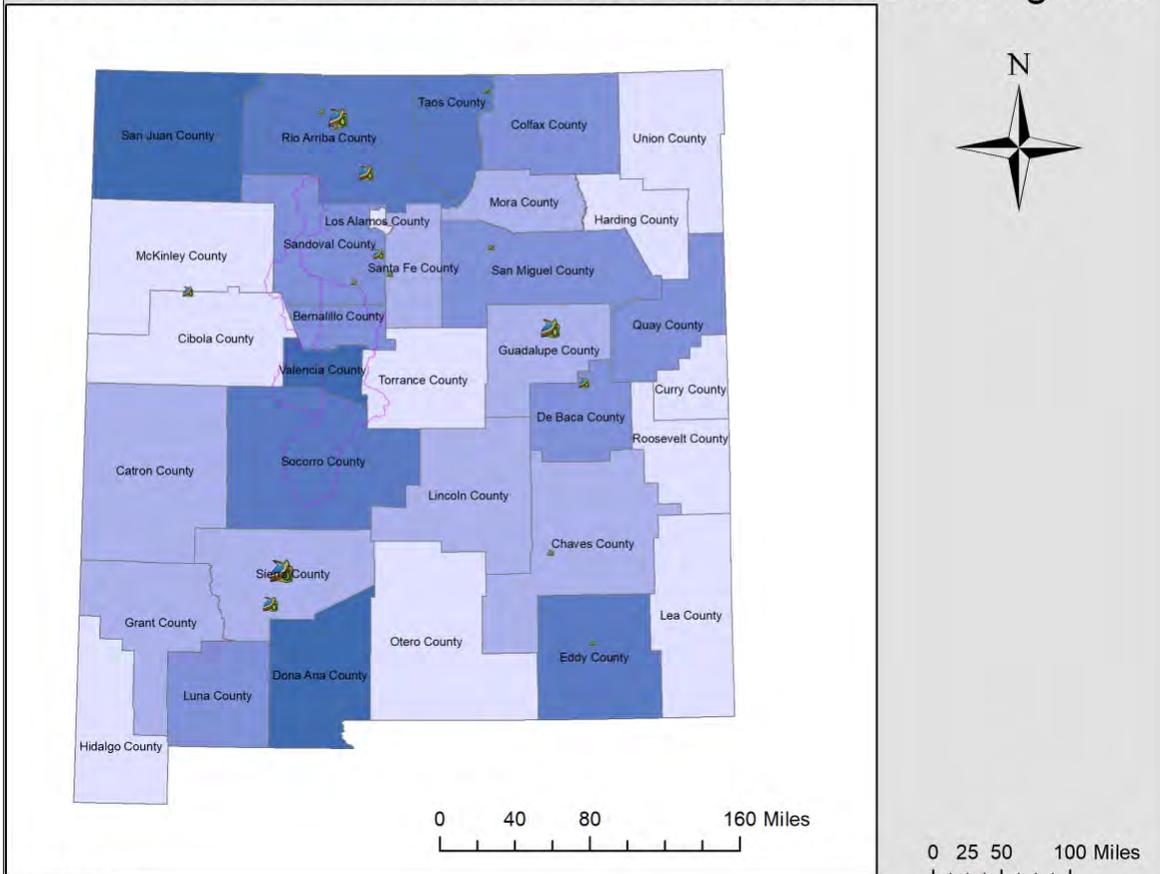
Published: Date not given

Date Accessed: 05-01-2020

Additional Maps & Figures



New Mexico: 2010 Surface Water Withdrawals for Irrigation



Legend

Reservoirs

Average Flow

- 0 - 30000
- ▲ 30001 - 80000
- 80001 - 200000
- 200001 - 500000
- 500001 - 3000000

Valencia County HUC Areas

2010 Water Use

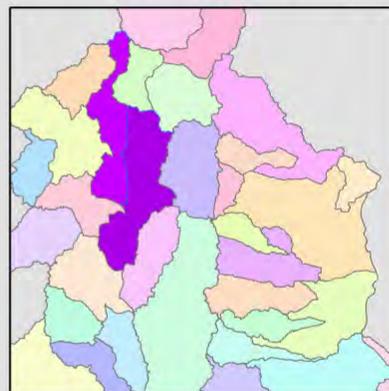
Mgal/day

- 0-10
- 10-30
- 30-70
- 70-140
- 140-300

Coordinate System: NAD 1983 2011 UTM Zone 13N
 Projection: Transverse Mercator
 Datum: NAD 1983 2011
 False Easting: 500,000.0000
 False Northing: 0.0000
 Central Meridian: -105.0000
 Scale Factor: 0.9996
 Latitude Of Origin: 0.0000
 Units: Meter

Created by Tylee M. Dodge Griego
 for CE 547: GIS in Water Resources
 Engineering for Final Project
 Pandemic Spring 2020

Service Layer Credits: J. Coonrod,
 ESRI, RGIS, USDA USGS



Rio Grande HUC
 featuring Valencia
 County HUC

