Lab Report

-If you write your name (you don't have to), please remember to write it at the end, not the beginning.
-Please make your graphics as large as possible on the page so I can read them. Feel free to make them landscape if that helps (i.e., rotate them 90 degrees).

Question 1: Is the processing extent a bounding box (rectangle) or a shape outline (irregular polygon)? Is the mask a bounding box or shape outline?
Answer 1: The processing extent is a bounding box, while the mask is a shape outline and follows the shape of the bounding box

Question 2: What is the cell size for frostfree and what is the cell size for elev10k? Why are we using 10k (no points will be given for the answer "because it's smaller").
Answer 2: The cell size for frostfree is 25,000 while the cell size for the raster elev10k is 10,000. Using a higher-resolution elevation raster helps improve accuracy in analysis that depends on terrain, such as temperature variation, precipitation which influences frost free days.

Question 3:

What is the min and max elevation in California?
Answer: Min: 0 ft, Max: 13,424 ft

Georgia?
Answer: Min: 0 ft, Max: 3517 ft

Texas?
Answer: Min: 0 ft, Max: 7383 ft

Question 4: Look up elevation for the highest peak in Georgia and the highest peak in California. Are these values different than the max you returned on your raster? Why or why not? (3 pts)

Georgia: The highest point of elevation in Georgia is Brasstown Bald which has an elevation of 4,784 ft
California: The highest point of elevation in California is Mount Whitney which has an elevation of 14,505 ft
These values are different than the maximum values obtained from the raster file. This may be as when a raster file calculates the maximum point it averages all the highest points in the cell which may result in a lower elevation point.

Question 5: In this particular resulting grid, what does it mean when a grid cell has a 1? What does it mean when it has a 0?
Answer 5: In this case a grid cell having the value equal to 1 indicates that it receives greater than 4000 mm of precipitation annually, while a cell having the value equal to 0 means that it receives less than 4000 mm of precipitation annually. This reminds me of a pass-fail model which has binary inputs and outcomes.

Question 6: How many of each grid code (i.e., value) do you have?

VALUE	CELL COUNT
0	53,776
1	23,772

Question 7: How many of each grid code (i.e., value) do you have?

VALUE	CELL COUNT
0	26,893
1	23,606
2	25,844

Question 8: Write down the possible combinations results if we add.

If we add : 0,1,2,3
If we multiply : 0,1,2
If we concatenate : 0_0,0_1,0_2,1_0,1_1,1_2

Which of the above methods gives the most information about the input values?
Answer: The concatenation method gives the most information about the input values as it clearly differentiates between different possible scenarios regarding precipitation and frost-free days.

Question 9: Fill out the matrix to show how much AREA were in each category. For full points, make sure your values are in square kilometers. 😊 *Remember that area = cells size x cell size.*

Hint: *Are you on the right track? Check to make sure that your grid cells add to the number of total grid cells.*

AREA*	Heat: Thrive (meters square)	Heat: Survive (meters square)	Heat: Insufficient (meters square)
Enough Precipitation	1,421,600	708,200	187,800
Not Enough Precipitation	1,162,800	1,652,400	2,501,500

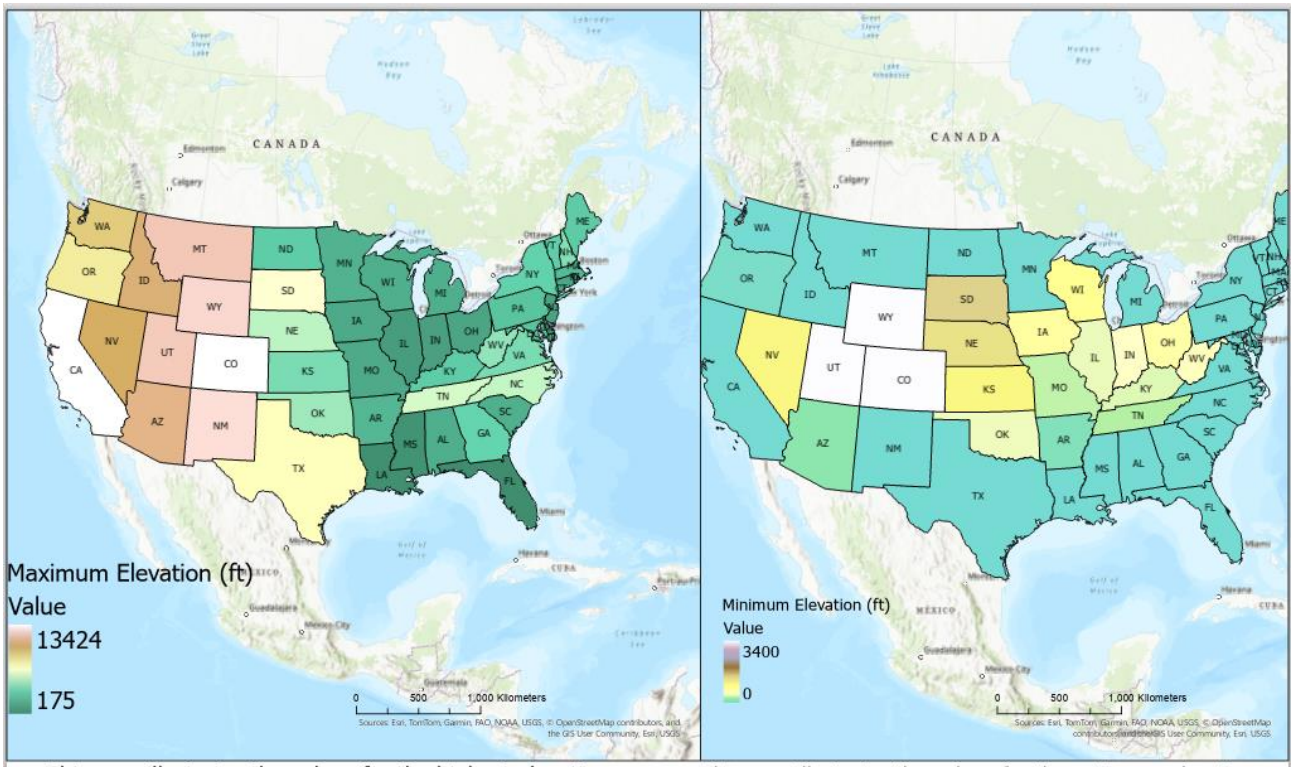
(remember: not cells, area!)

Question 10: What was your more **limiting** criteria: heat or precipitation and why?
Answer 10: Precipitation is the more limiting factor because the largest restricted area (2,501,500 km²) falls under "Not Enough Precipitation & Heat: Insufficient." This indicates that a lack of precipitation excludes more land from being suitable, whereas areas with sufficient precipitation can still support some level of heat survival.
Question 11: What single variable best predicts frost free days? What is the R squared value?
Answer 11: Temperature is the single variable that best predicts frost free days, the R squared value is 0.821

Question 12: Is a single (one) variable the best model for predicting frost free days? Or is it improved when we add more input variables? Give your reasoning.
Answer 12: While including all the four variables for prediction (frostfree, tempc10k, elev10k and precip) the R squared value is 0.848 which is a slight increase in the value compared to when we used a single variable for prediction. Although the increase isn't a lot it still has the possibility of improving the linear regression model.

Bonus 2 pts: Based on what we have learned in this course, what could we do to fill (hint: smooth out) the missing values in our precip or frost free raster? Use terms from class.

GRAPHICS
Graphic 1: (Two maps) Make a map of the elevation Mean and Max for each state. Note these are two maps, place them side by side. Remember your caption, and legend. Label the states with the state name or the state abbreviation

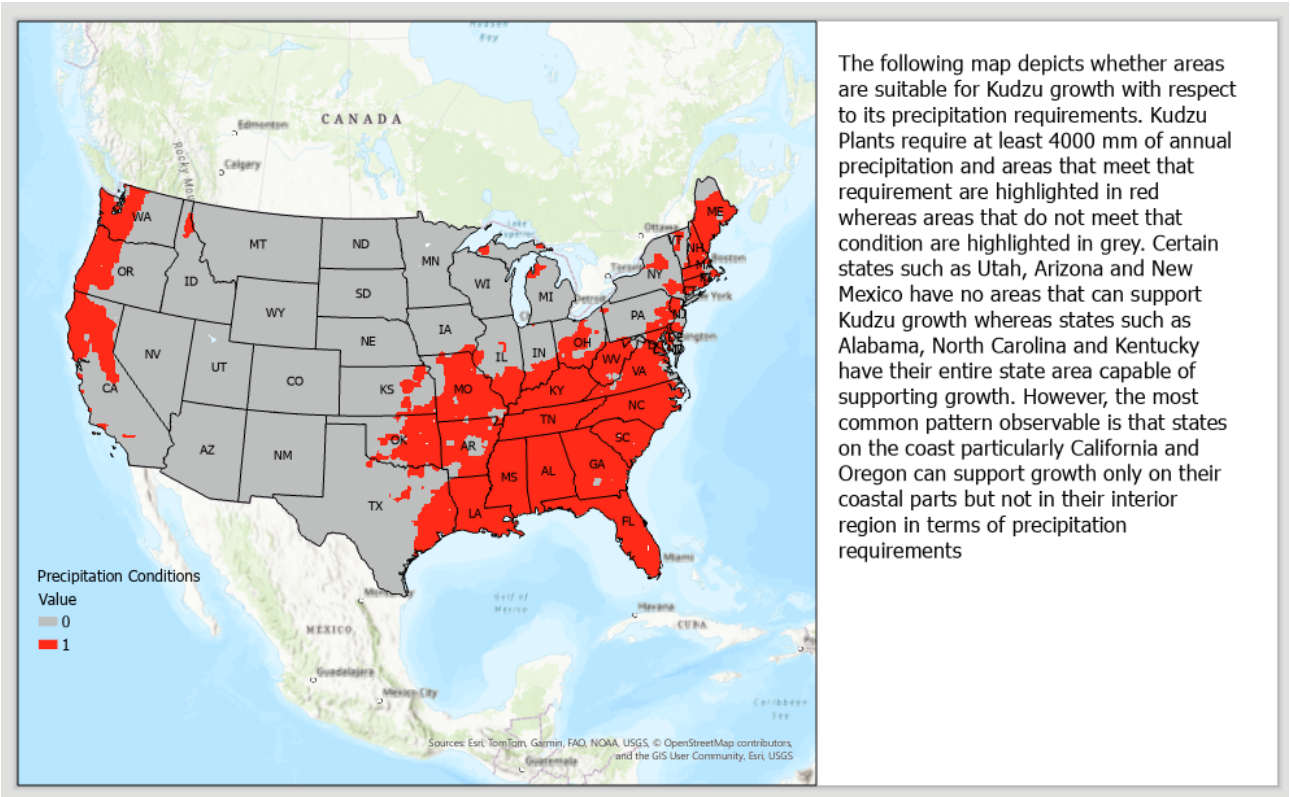


This map illustrates the values for the highest elevation points across the United States with values ranging from 175 to 13,424 ft

This map illustrates the values for the minimum elevation points across the United States with values ranging from 0 ft to 3400 ft

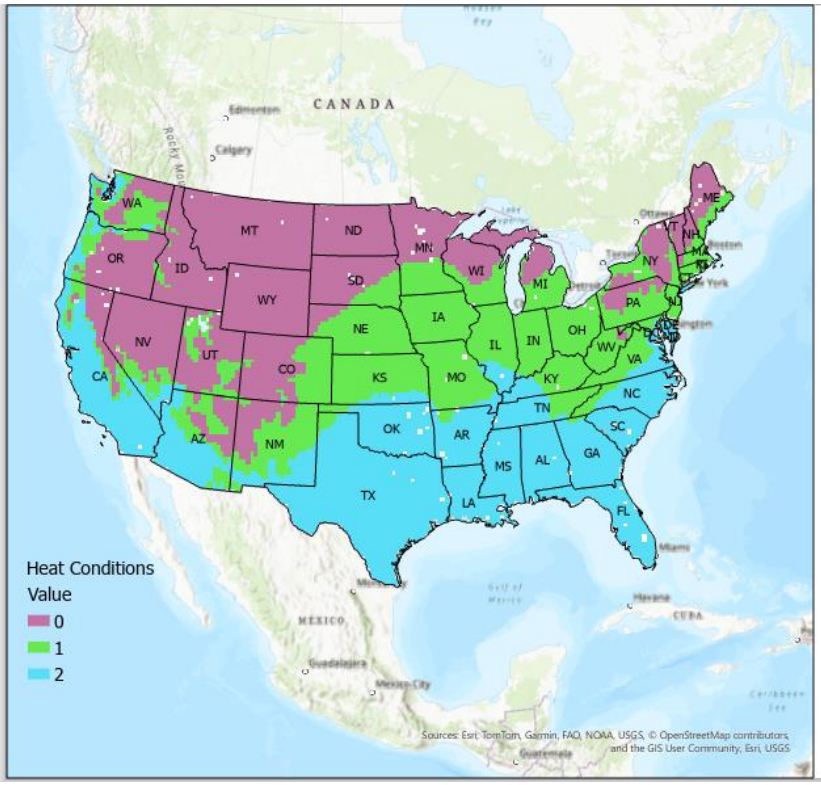
Graphics 2, 3, 4: Turn in three maps: Your input features (two separate maps) and the result of your combination. DO this in layout view with multiple data frames. Scale bar and compass not needed. **Legend needed. State outline needed**. Your map NEEDS to be in a conic projection. Make sure to have a figure caption describing what you see. Name some states in your caption.

Graphic 2: Map illustrating the Precipitation Requirements



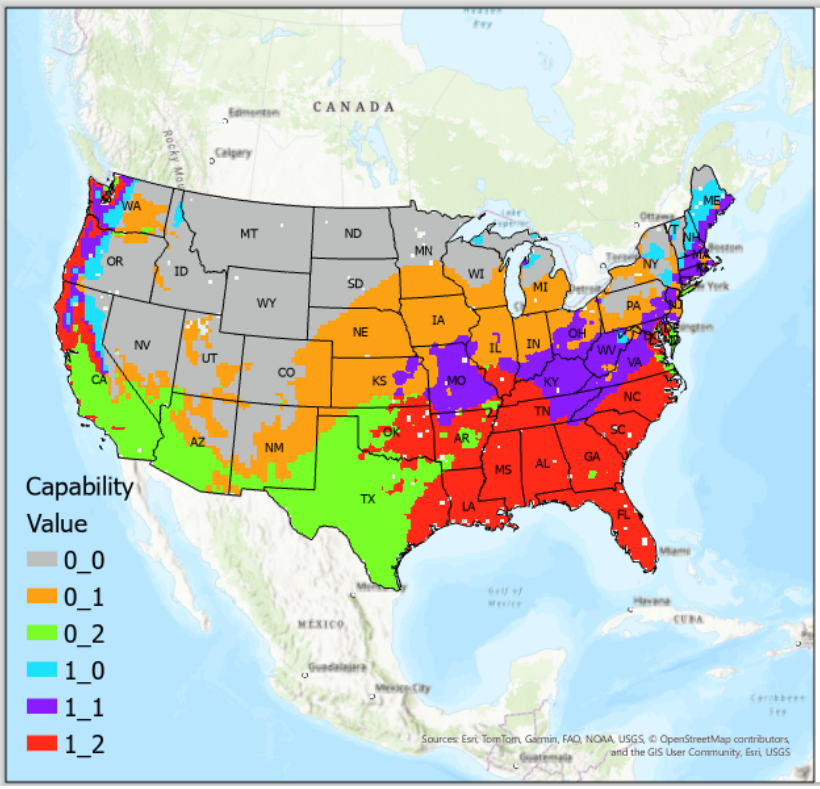
The following map depicts whether areas are suitable for Kudzu growth with respect to its precipitation requirements. Kudzu Plants require at least 4000 mm of annual precipitation and areas that meet that requirement are highlighted in red whereas areas that do not meet that condition are highlighted in grey. Certain states such as Utah, Arizona and New Mexico have no areas that can support Kudzu growth whereas states such as Alabama, North Carolina and Kentucky have their entire state area capable of supporting growth. However, the most common pattern observable is that states on the coast particularly California and Oregon can support growth only on their coastal parts but not in their interior region in terms of precipitation requirements

Graphic 3: Map illustrating the Frost-Free Days requirement



The following map depicts whether areas are suitable for Kudzu growth with respect to its frost free days parameter. Kudzu plants require 150 days to be able to survive and 200 frost free days to thrive. Areas highlighted in purple do not pass this requirement i.e. Have less than 150 frost free days, and this is most commonly observed in the Northern States of Montana, North Dakota and Wisconsin, however certain parts of states such as Arizona and New Mexico also are highlighted which is a bit surprising. Areas highlighted in green have conditions that allow the Kudzu plant to grow i.e. Have between 150 and 200 frost free days and these areas are most commonly observed in the Midwest USA such as Iowa and Indiana. The areas highlighted in blue depict areas where the plant would be able to thrive i.e. Have greater than 200 frost free days, most commonly Southern States such as Georgia and Alabama support these conditions along with the West Coast as these areas are known to have warm temperatures.

Graphic 4: Capability Model



The following map depicts whether areas are suitable for Kudzu growth with respect to both its frost free days and precipitation parameters. The precipitation parameters are 0,1 with 0 being areas receiving less than 4000 mm of annual precipitation and 1 being vice versa. The heat parameters are 0,1,2 with 0 being receiving less than 150 days of frost free days, 1 being areas receiving between 150 and 200 frost free days and 2 being areas receiving greater than 200 frost free days. For Kudzu plant to grow the precipitation parameter must be 1 while the heat parameter must be either 1,2. The areas having 1_1 are the present in states Missouri, Kentucky and Virginia, while areas having 1_2 are Southern States such Georgia, Alabama and Florida which makes sense as these areas receive high precipitation and have warmer temperatures. In conclusion areas having classified as either 1_1 or 1_2 on the map are capable of supporting Kudzu growth