Lab 5: Color and Projection

In this laboratory session, our focus is on color and map projections in cartography. For color, we are going to be on identifying the different approaches to identifying and creating color palettes for our maps. We will also look at how to apply different projections to datasets.

Your tasks involve executing and comprehending the provided R code, followed by addressing the questions listed below.

Deliverables:

1. An R script of the code that you wrote, which showcases your findings from the ‘Your turn to code’ section below.
2. The answer to the below questions need to be submitted in a Word Document or some other word-based program.
3. A jpeg of the updated choropleth map as described in #1 in ‘Your turn to code’.
4. A jpeg of a side-by-side projection of Lithuania as described in #4 in ‘Your turn to code’

Questions

1. Describe the difference between hue, saturation, and lightness (HSL) and the use cases for when to change the values of HSL for different cartography maps.

Hue, Saturation, and Lightness (HSL) are three components used to define colors in digital graphics and cartography. Each component has a distinct role in determining the final appearance of a color.

**Hue**: Hue refers to the pure color of a pixel, representing its position in the color spectrum. It is essentially what we colloquially refer to as the "color" of an object. For example, the hue of a red pixel would be red, while the hue of a blue pixel would be blue. In HSL notation, hue is measured in degrees (ranging from 0 to 360), with 0 degrees corresponding to red, 120 degrees to green, and 240 degrees to blue.

**Saturation**: Saturation refers to the intensity or purity of a color. A fully saturated color is pure and vivid, while a desaturated color is dull and closer to grayscale. In HSL notation, saturation is represented as a percentage (ranging from 0% to 100%), with 0% being fully desaturated (i.e., grayscale) and 100% being fully saturated (i.e., pure color).

**Lightness**: Lightness refers to the brightness or darkness of a color. A light color has a high lightness value, while a dark color has a low lightness value. In HSL notation, lightness is represented as a percentage (ranging from 0% to 100%), with 0% being black and 100% being white.

The use of HSL values can be adjusted for different cartography maps to achieve specific visual effects or to convey different types of information. For example:

1. **Topographic Maps**: In a topographic map, where elevation changes are important, one might use lightness to represent elevation. Higher elevations could be represented by lighter colors (closer to white), while lower elevations could be represented by darker colors (closer to black). This allows for a clear visual representation of elevation changes.
2. **Climate Maps**: In a climate map, where temperature differences are significant, one might use saturation to represent temperature. Warmer regions could be represented by more saturated colors (e.g., reds and oranges), while cooler regions could be represented by less saturated colors (e.g., blues and greens). This allows for a clear visual representation of temperature differences.
3. **Land Use Maps**: In a land use map, where land use patterns are important, one might use hue to represent different types of land use. For example, agricultural land could be represented by green hues, urban areas could be represented by gray or brown hues, and water bodies could be represented by blue hues. This allows for a clear visual representation of land use patterns.
4. **Population Density Maps**: In a population density map, where population density is important, one might use a combination of hue, saturation, and lightness to represent population density. For example, high population density areas could be represented by bright and saturated colors, while low population density areas could be represented by dull and desaturated colors. This allows for a clear visual representation of population density differences.
5. What are the RGB values of Red, Blue, and Green?

The RGB values for red, green, and blue are (255, 0, 0), (0, 255, 0), and (0, 0, 255), respectively

1. What are some pros and cons of EPSG and ESRI based approaches to projections?

The European Petroleum Survey Group (EPSG) and Environmental Systems Research Institute (ESRI) both offer approaches to projections, each with its set of advantages and disadvantages. EPSG provides a standardized database of coordinate reference systems (CRS) and transformations, facilitating interoperability between different software and systems. This comprehensive approach, however, can be complex to navigate, especially for novice users, and requires regular updates and maintenance.

On the other hand, ESRI's approach offers seamless integration with ArcGIS software, user-friendly interfaces, and the ability to create custom projections. Yet, it might lead to vendor lock-in, limiting the user's flexibility, and might involve proprietary algorithms that are hard to replicate. Overall, the choice between EPSG and ESRI-based approaches depends on the user's expertise, project requirements, and software environment.

1. What is an EPSG value appropriate for the state of Michigan?

Michigan is located within the continental United States, and its appropriate EPSG (European Petroleum Survey Group) code for a commonly used projected coordinate system would be EPSG:102121 or EPSG:102120. These EPSG codes correspond to the NAD 1983 State Plane Michigan North and NAD 1983 State Plane Michigan South, respectively. These projections use the Lambert Conformal Conic projection method and are widely used for state and local government mapping, planning, and surveying applications in Michigan.

Your turn to code

1. I made a pretty bad choropleth map using a rose colored palette. Correct the coloring of my map using any of the approaches identified in the lab but keep the color as close as possible to the misty rose. Hint - enhance the coloring so that there is more or less. (Your code should include code for this export)saturation. Export your map as a jpeg.
2. I created a 5-class ordinal map based on the total of marriages by county. Please create an ordinal map that uses 4 classes and a different set of colors. Make sure you use the appropriate color scheme.
3. Reproject the Michigan Shapefile data to be a more appropriate projection for Michigan.
4. Filter to Lithuania. Compare a WGS 1984 projection to an equal area projection that is appropriate for that area. Have a side-by-side comparison image in a jpeg and submit the jpeg. (Your code should include code for this export).
5. Take the Michigan Shapefile and reproject it to be suited for Michigan (your choice which type equal area, equal distance, etc.). Create a choropleth map for relative risk.

Once complete with the ‘Your turn to code’ please push your code to your Git Repository and provide the link to your lab instructor.

Mount Kenya's afro-alpine ecosystems provide vital services but face escalating threats from climate change and human activities. Monitoring vegetation dynamics is critical for conservation efforts yet underlying drivers remain poorly quantified. This study aims to map vegetation changes in Mount Kenya's alpine zone from 1990-2020 using unsupervised classification of Landsat satellite data. Multispectral imagery will be clustered into spectral classes representing dominant vegetation types using k-means and principal components analysis. Time series vegetation maps will elucidate change trajectories and relationships with climate and land use variables. This machine learning approach offers an objective means to decipher complex socio-ecological changes threatening biodiversity. Findings will strengthen scientific understanding of alpine vegetation shifts to guide evidence-based conservation strategies. The methodological framework is readily transferable to other East African mountain ecosystems. Overall this research demonstrates the power of open-access satellite data analytics using Google Earth Engine and cloud computing to advance ecological monitoring globally.

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