Advanced Topics in GIS
GEOG 270

Lab 3a – Displaying Data

Southwestern Oregon Community College

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SOUTHWESTERN
AN OREGON COMMUNITY COLLEGE

Introduction

Key terms
interval
nominal
normaiization
ordinal
ratio

Map layers support the display of data in many different ways, including both qualitative and quantitative attributes. In this first part of the lab (3a), you will analyze how you can use attributes to visualize your data. Before you create a new map, you should ask yourself the following questions:

- ✓ **Do I have the attributes I need to create a map?**
- ✓ **What types of attributes are in my data?**
- ✓ **Will my map show data categories or quantities?**

Topics covered

1. Evaluating attributes for symbology
2. Levels of measurement
3. Classifying data

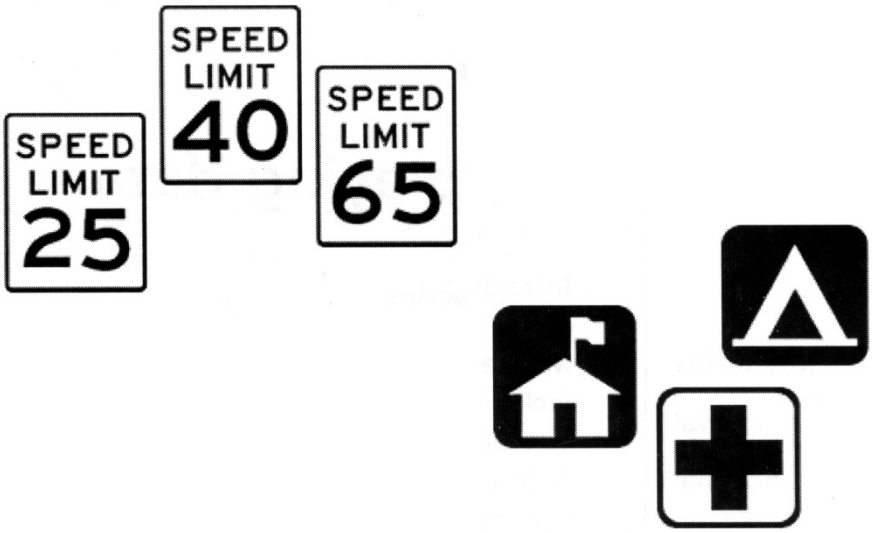
Learning objectives

After completing this lab, you will be able to:

- ✓ Determine when to symbolize features by categories or quantities.
- ✓ Determine levels of measurement when symbolizing data.
- ✓ Apply different methods for classifying quantitative data.

Why symbolize your data?

Geographic and other related data may be symbolized in many ways.



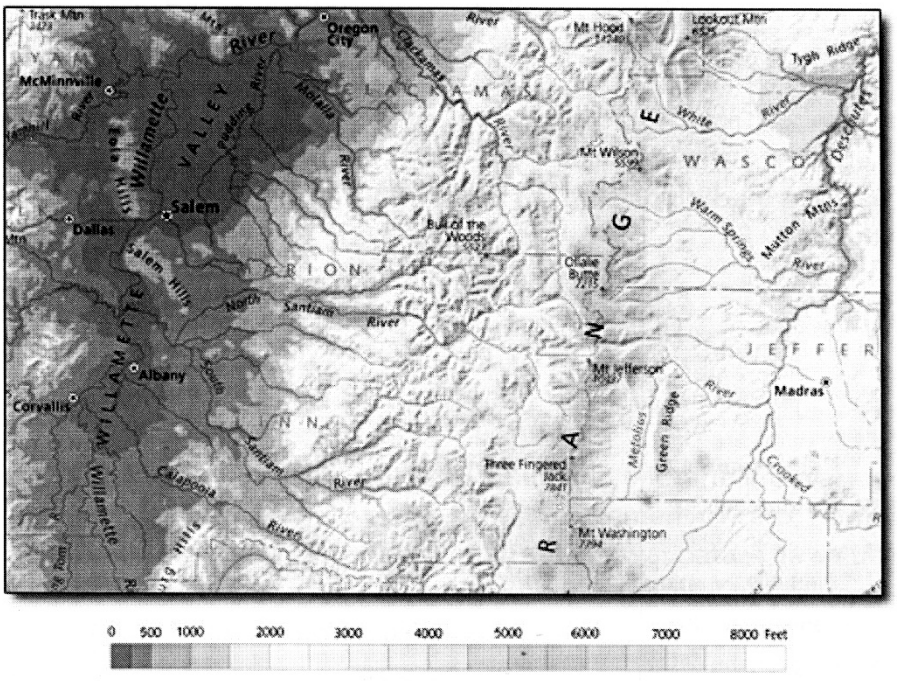
Displaying data categories

Data can be classified into different categories. On a map, features in the same category use the same symbol to differentiate them from other categories of features.

Displaying data quantities

Data can be displayed based on quantities. Most often, a smooth progression of colors or graduated-sized symbols will be used to show quantitative differences. Features with the same quantity or same range of quantities are shown with the same symbol.

Data displayed based on quantities.



Types of attributes

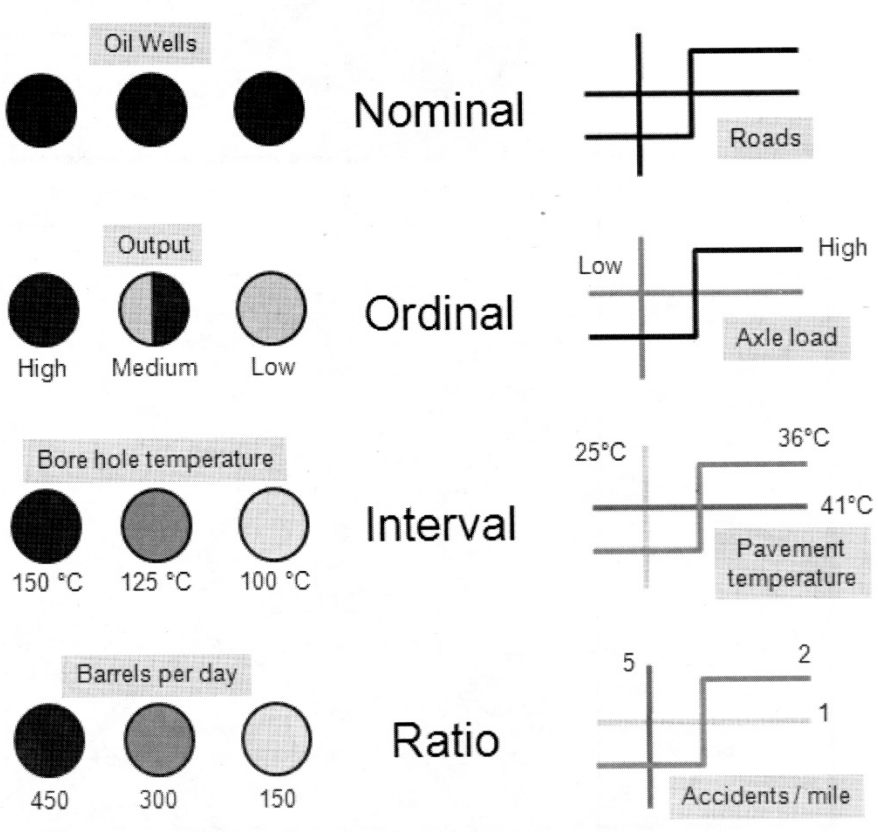
GIS data uses attributes to describe features and distinguish between different feature types. Levels of measurement provide a framework for thinking about and presenting your data.

This concept is important because you need to know whether data is qualitative or quantitative, and which symbology methods will present the data in the most meaningful way. In addition, knowing the level of measurement allows you to use the data appropriately when solving spatial problems using analytical and statistical tools.

The four levels of measurement are:

1. **Nominal**
2. **Ordinal**
3. **Interval**
4. **Ratio**

GiS data attributes can have nominal, ordinal, interval, or ratio measurements. These four levels distinguish the data as categorical or quantitative.



Nominal

Nominal attributes are the simplest type of data and serve to identify one feature from another. Nominal attributes include names of features, such as a city or lake (e.g., Miami or Crater Lake).

Nominal attributes are typically text values but may also be numeric; for example, postal ZIP Codes or other numeric code values.

The numbers in nominal data are only for identification of features. Do not use or interpret them as quantities on which to perform mathematical operations.

Ordinal

Ordinal attributes imply an order or ranking of the data. For example, cities can be ranked by population into small, medium, and large categories. Additional rankings of ordinal data could be presented as:

- ✓ good, fair, poor
- ✓ low, medium, high
- ✓ class1, class2, class3

Interval

As this name implies, interval data is numeric, with the interval between values remaining constant. The placement of zero, however, is arbitrary. This is important in identifying interval data. The value of zero does not mean an absence of a value, but rather an arbitrary placement on the interval scale.

The most common type of interval data is temperature in degrees Celsius or Fahrenheit. The interval between each degree remains constant. For example, the interval from 20° to 30° is the same as 40° to 50°. However, at zero degrees, there is still temperature, in fact, you can have values below zero.

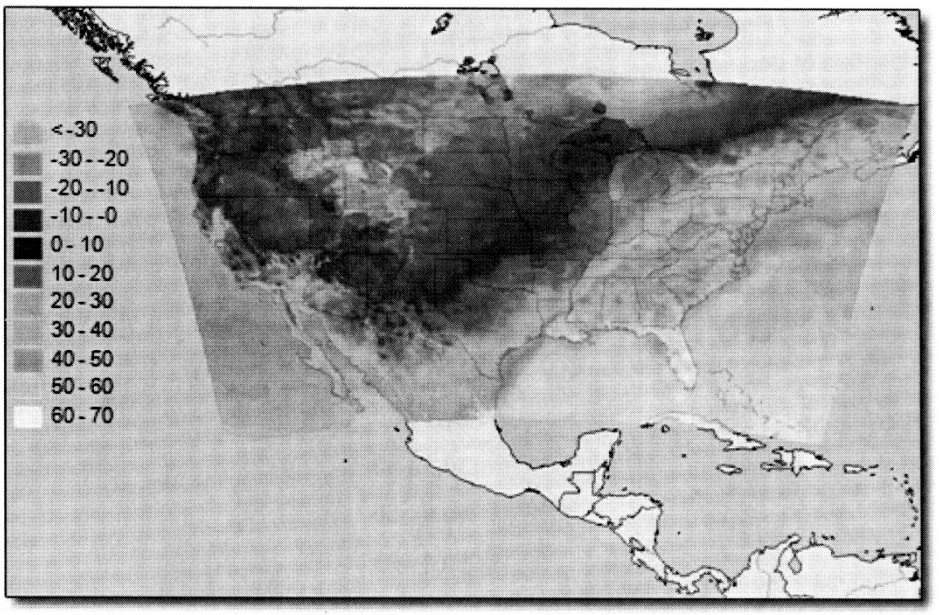
Ratio

Data is classified as ratio if the ratios of two values make sense. Speed limits would be a ratio because a speed of 60 miles per hour is twice as fast (or a ratio of 2:1) as 30 miles per hour. Temperature in degrees Celsius is not ratio, because 80° is not twice as warm as 40°. Mathematical operations make sense with ratio data, such as adding or subtracting values, averaging, etc.

With ratio data, the value of zero means an absence. For example, percentages are ratio data. Consider population growth as a percentage. These values can be made into ratios that make sense. Also, a value of zero-percent growth means an absence of, or zero, growth.

Surface temperature in degrees Fahrenheit

Surface temperature in degrees Fahrenheit



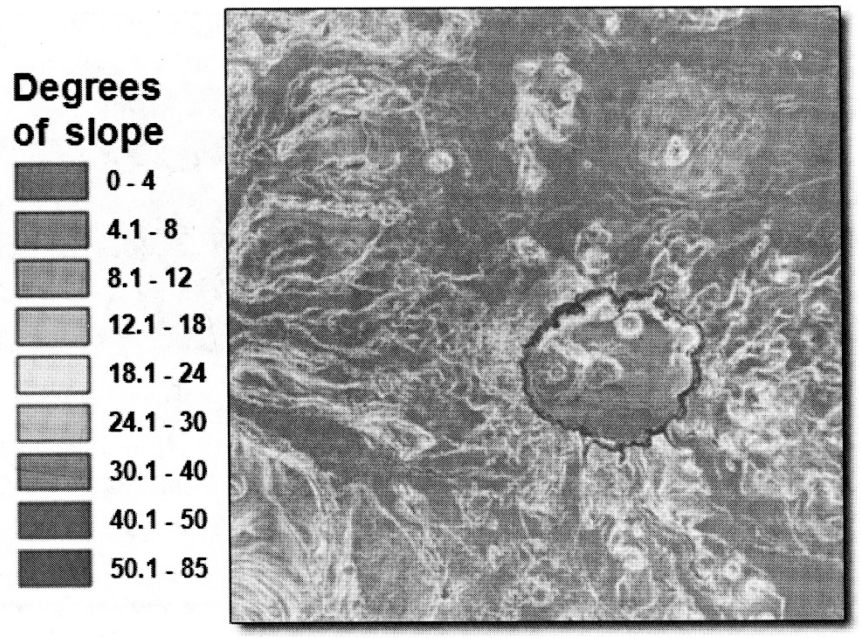
1. Is the main message of the map showing categories or quantities?

2. What is the measurement level of the data?

- o Nominal
- o Ordinal
- o Interval
- o Ratio

Crater Lake area slope

Degrees of slope within Crater Lake National Park



1. Is the main message of the map showing categories or quantities?

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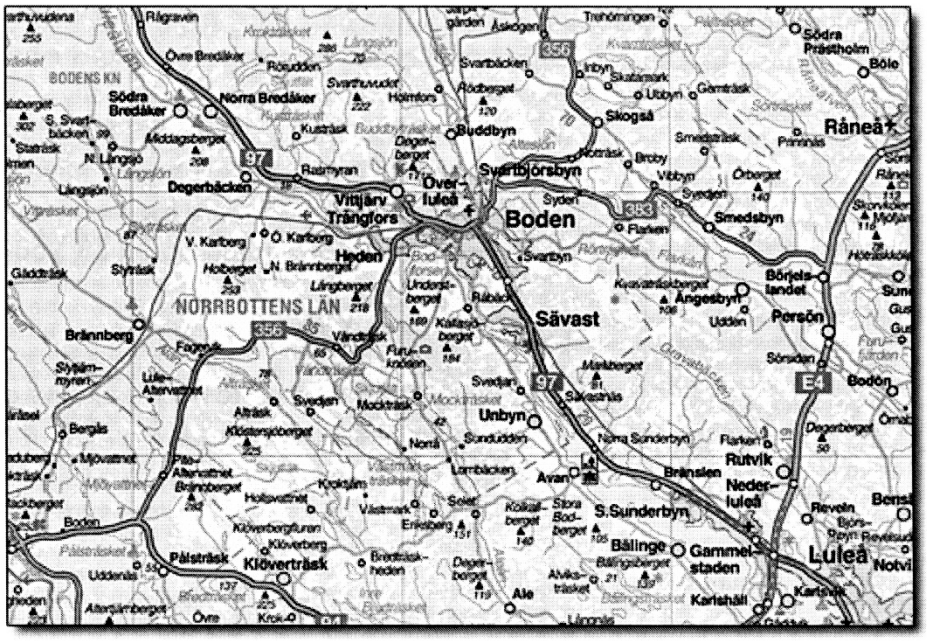
Road atlas



1. In this map, do the route labels represent categories or quantities?

2. What is the measurement level of the data?

- o Nominal
- o Ordinal
- o Interval
- o Ratio

Classifying data

You can display your data in ArcMap in a variety of ways to highlight differences between categories and quantities. The method you choose to symbolize your data is really a decision you should base on the purpose and design of your map. Your most important decision is whether to use qualitative or quantitative symbols. Knowing the level of measurement of your data can help you make these symbology decisions if you are unsure about how your data should be displayed.

Default symbology

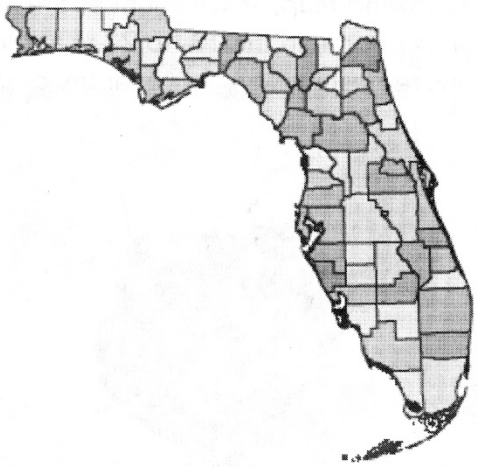
When you first add data to ArcMap, your data will appear with all features symbolized the same way. This map of Florida counties shows all county polygons displayed with the same symbol. The data is shown as a nominal level of measurement.

Florida counties shown with default symbology

Display data based on category

You may symbolize your data on differences of category. This map shows Florida counties displayed with a unique color for each county. In this example, the data is shown as nominal categories.

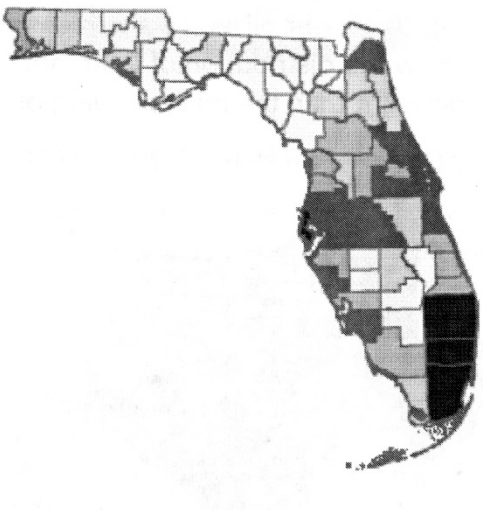
Florida counties displayed by category



Display data based on quantity

Numeric data may be displayed by grouping numeric values together and assigning a symbol to each group. This map shows Florida counties symbolized based on the total population, with the darker shaded counties having a larger population. The population quantiles shown are a ratio level of measurement.

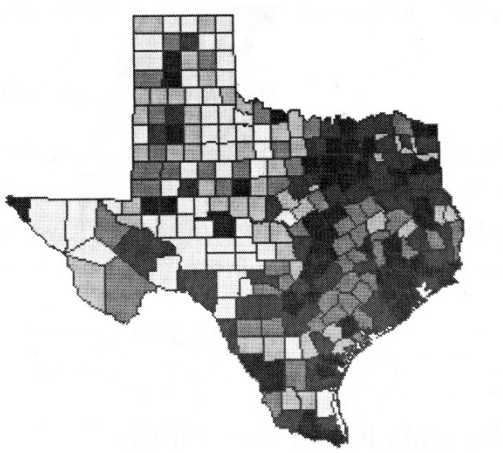
Florida counties grouped into numeric ranges showing total population



Normalizing data

Displaying the values from an attribute often tells only part of the story of your data. In the following map, Texas counties are symbolized based on the number of people in the 18- to 21-year- old age group. The darker polygons represent a greater quantity of people in this age group.

Raw data values shown for number of 18- to 21-year-olds in Texas counties.

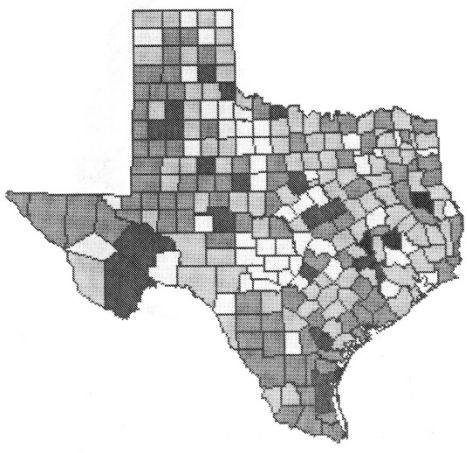


Display your data as a ratio if you want to minimize differences based on the size of areas or number of features in each area.

Through a technique known as **normalization**, you can create a ratio, which often portrays your data differently from the raw values. To create a ratio, divide one value by another.

In this map, the number of 18- to 21-year-olds within each county is divided by the total population. Now the number of 18- to 21-year-olds is symbolized as a percentage of the total population. Notice how the distribution of light- and dark-colored polygons is much different than the map showing only raw data values.

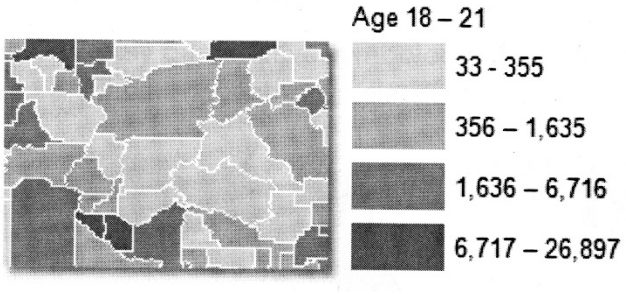
Number of 18- to 21-year-olds in Texas counties normalized by total population.



Mapping raw data values

In this map, the 18- to 21-year-old population is shown for each county. This map looks similar to a map of total population because the counties with a higher population also have higher counts of people in this age group.

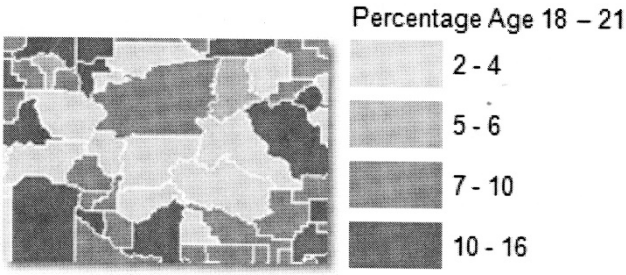
Population values of 18- to 21-year-olds



Normalizing to create a percentage

Dividing the 18- to 21-year-old population by the total population yields the percentage of 18- to 21-year-olds in each county. Notice how this normalized map looks different than the raw values map.

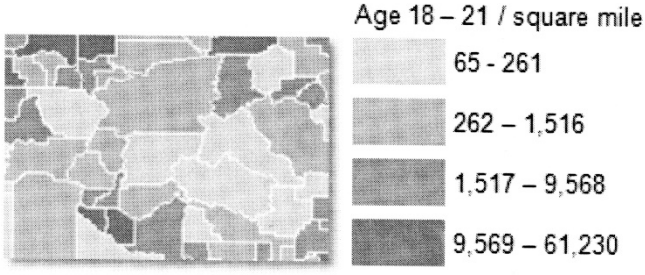
The 18- to 21-year-old population normalized by total population



Normalizing to create a density

Similarly, dividing the 18- to 21-year-old population by the area of each county, such as square miles, yields a value per unit area, or density.

The 18- to 21-year-old population normalized by area



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