

Working with and Analyzing Vector Data in R

The goal of this exercise is to work with and analyze vector data in R. A wide variety of vector querying, analysis, and overlay tasks will be explored. The following data layers have been provided and were obtained from the West Virginia GIS Technical Center (<http://wvgis.wvu.edu/>). Your results should be delivered as an HTML webpage generated using R Markdown. Create code to obtain the results and answer the following questions. You do not need to provide text description of the method; you only need to include the code, results, and answers. Make sure to include your answers as comments.

spring.shp: point features representing springs

towns.shp: points representing towns in West Virginia

Interstates.shp: line features representing interstate highways

major_rivers.shp: line features representing major rivers in the state

counties.shp: county boundaries for West Virginia as polygons

geology.shp: polygons representing geologic layers in the state

T1: Read in all of the required layers using `st_read()`. (2 Points)

T2: Make a map using `tmap` that includes the county boundaries, town points, interstates, and rivers to visualize the data. (2 Points)

T3: What percentage of towns have a population ("POPULATION") greater than 1,500? (2 Points)

T4: How many towns are categorized as a village (use "TYPE" field)? (2 Points)

T5: Randomly select 25 towns from the dataset. (2 Points)

T6: Randomly selection three towns from each type (use "TYPE" field). (2 Points)

T7: What percentage of springs have an average flow ("AVEFLOW") greater than 700? (2 Points)

T8: What percentage of springs occur on terraces (use "TOPO_POS" field)? (2 Points)

T9: Extract out Interstate 79 from the interstate line features (use the "SIGN1" field). (2 Points)

T10: Dissolve the I-79 features to a single line feature and obtain the total length in kilometers (use the "KM" length field, which provides the length in kilometers). What is the total length? (2 Points)

T11: Extract all towns within 10 km of I-79. How many towns are within 10 km of I-79? (2 Points)

T12: Create a map using `tmap` to visualize the results of T11 that includes the county boundaries, I-79, the I-79 buffer, and the extracted town points. (2 Points)

T13: Extract all springs in limestone geology (use the "TYPE" field in the geology layer). What percent of all springs occur in limestone? (2 Points)

T14: Create a table of counts of springs by rock type. Which rock type has the largest number of springs? (2 Points)

T15: Create 5 random points per county in the state. (2 Points)

T16: Create a map using tmap to visualize the randomly sampled points that includes the county boundaries and sampled points. (2 Points)

T17: Calculate length of major rivers by county. Which county has the longest length of major rivers? (2 Points)

T18: Create a map using tmap to visualize the length of rivers by county using color. (2 Points)

T19: Calculate density of springs by county. Which county has the largest density of towns? (Note that both layers have a "NAME" field, so you will need to rename one of these fields to eliminate the overlap and confusion.) (2 Points)

T20: Create a map using tmap to visualize density of towns by county using color. (2 Points)