Assignment 10: Healthy transportation to work kernel density map (50 points)

In an earlier assignment you studied healthy transportation to work variables as separate choropleth maps. Suppose you want to explore locations in a city where multiple variables are concentrated in one map to not only identify where populations are taking healthy means to work but to also inform public works department where focus for maintaining infrastructure such as sidewalks is needed, or where bike lanes or transit stops are needed. You could do so using transportation data by block group combined in a model with one raster map as the result.

In this assignment, you will use block group centroids (with transportation means to work data) to create a raster layer showing areas of the city with combined "healthy" transportation variables. You will create a "contour" layer that could be used to define the high-density healthy transportation to work areas to determine sidewalks maintenance, bike lane assessment, and transit stop priority. Clipping features to the contour polygons will create features of bike lanes, sidewalks, and transit stops that will provide statistics about features in areas of high density of healthy transportation populations.

Get set up:

Rename the Assignment10 folder to **Assignment10YourName**. Open Assignment10.aprx. The needed map layers are already included and classified in the map that opens. The projected coordinate system of the map is NAD_1983_StatePlane_Pennsylvania_South_FIPS_3702_Feet.

- **Pittsburgh**, outline of the city. Obtained from the City of Pittsburgh.
- **Neighborhoods**, neighborhood polygons for the city of Pittsburgh. Obtained from the City of Pittsburgh.
- **Rivers**, water polygons for the city of Pittsburgh. Obtained from the City of Pittsburgh.
- **PortAuthorityStops**, point features of bus stops the city of Pittsburgh. Obtained from the Western PA Regional Data Center and Allegheny County Port Authority (9/1/2019 to 11/23/2019)
- **BikeLanes**, bike lane polylines in the city of Pittsburgh. Obtained from the Western PA Regional Data Center and Bike Pittsburgh (2019 data)

- **Sidewalks**, sidewalk polylines in the city of Pittsburgh. Obtained from the Southwestern Pennsylvania Commission (SPC) 2019
- **BlockGroups**, point layer of census block groups centroids. US Census American Community Survey (2015-2019)
    - **Walk**: Numbers of persons who walk to work.
    - **Bicycle**: Numbers of persons who bicycle to work.
    - **Bus**: Numbers of persons who take public transportation to work.

Requirements:

Save all new rasters and layers to your file geodatabase.

Standardize inputs

- In the BlockGroups attribute table, create and calculate Z score columns for transportation variables ZWalk, ZBicycle, and ZBus (original field – mean)/standard deviation.

Create health transportation index model and raster

Similar to the model you created in tutorial 10-3 you will create a model using kernel density layers that shows the concentration of healthy transportation to work variables as one raster in the City of Pittsburgh. More weight will be given to walk and bicycle variables. You will *not* create parameters for this model.

- In the Catalog Pane, create a toolbox called **TransportationAnalysis.**
- In the TransporationAnalysis toolbox, create a new model with name **TransportationIndex** and label **Transportation Index** that is similar to the Poverty Risk model in chapter 10 but using the Z scores of the three transportation variables from above.
- Set up the global environment with Pittsburgh as Mask.
- For the kernel density rasters, use 100 as the output size, 3000 as the search radius, and SQUARE FEET as the area unit.
- Use BlockGroups as the input features and the Z score fields as the “Population” field when creating separate kernel density maps.

- Use the current map's projected coordinate system (NAD_1983_StatePlane_Pennsylvania_South_FIPS_3702_Feet) as the output coordinate system.
- Name the interim raster outputs WalkKD, BicycleKD, and BusKD.
- Name the final raster **HealthyTransportationKD**.
- Using a raster calculator and the following weights:
    - WalkKD 40%
    - BicycleKD 40%
    - BusKD 20%
- Save and run the model.
- Add the output raster to the map. Note that some areas of the city will have open areas. That is OK and because the block centroids do not extend beyond the city boundary.

Rename and symbolize raster layer

- Rename the output raster layer **Healthy Transportation Density** and move it to the bottom, of contents.
- Symbolize the final raster as a classify symbology and 1/2 standard deviation and Yellow-Green-Blue (continuous) color ramp.
- Make note of the lower value for the highest classification. You will use this number to create a polygon contour of that raster "elevation".
- Rename the transportation index labels like the lecture example of the Greater Pittsburgh Community Food Bank with values of 1, 2, 3 etc. with the first classification the least healthy and last classification the healthiest.

Create contour elevation polygons for the high-density healthy areas

Using analysis tools Contour List and Feature to Polygon, create polygons of the highest raster elevation areas. These polygons could be used to identify areas for high priority transit stops, sidewalks for maintenance, bike lane assessment, etc.

- Contour List tool
    - Use **Healthy Transportation Density** layer as the input raster**.**
    - Name the output features **HighDensityContourLines.**

    - For the contour value, type the *lower value of highest classification* of TransportationDensity raster.
- Feature to Polygon tool
    - Use HighDensityContourLines as the input
    - Name the output polygon features **HighDensityContourAreas**
    - Change the outline color of the polygon to Mango, 2pt, no fill.
- Remove the HighDensityContourLines layer.

Clip features to polygons

- Clip PortAuthorityStops, BikeLanes, and Sidewalks to the HighDensityContourAreas naming the new features as follows:
    - PortAuthorityStopsHighDensityAreas
    - BikeLanesHighDensityAreas
    - SidewalksHighDensityAreas

      HINT: When clipping the sidewalks, in the Envronments/Processing_Extent of Clip tool, select Extent = Sidewalk
- Remove the original PortAuthorityStops, BikeLanes, and Sidewalks features and rename the new layers appropriately.

Create a layout and report with statistics

- Remove the BlockGroups layer.
- Turn the basemap layer off.
- Create a layout include all map layers except Pittsburgh, a legend, and map scale. Export your layout as **Assignment10YourName.jpg**.
- Insert the layout in a Word document called **Assignment10YourName.docx**.
    - Include your name and date.
    - Insert your layout as a figure.
    - Include a title describing the map, the data sources and the following statistics for the features in the high-density contour areas. Include the data source for the transportation variables.
        - number of bike lanes
        - number of Port Authority stops

- sum of the sidewalk (lengthmile)

What to turn in

Compress your Assignment10YourName folder as a .ZIP file and upload it to Canvas under **Assignment10 > Submit Assignment.**