Week 07 Lab: Urban Environmental Justice of Green Space Access in Chicago

Purpose

Our purpose is to assess people's access to green space (parks and forests) in segregated neighborhoods of Chicago. To do so, we will estimate indicators of access to green space according to regions where `Asian, Black, Latinx, or White` ethnic/racial groups are the majority (60% of the population or more), and `Mixed` neighborhoods where no single group makes up 60% or more of the population. The indicators of green space access are:

- Percentage of people living within 0.25 miles of a green space
- Green space area per person (in square meters)

Deliverables

Please combine the following three items into one document and *embed* to Canvas by the due date.

- Workflow diagram created with your group
- Table with five rows (one for each majority group and one for mixed) and at least three columns (majority group, percentage of people within 0.25 miles of a green space, square meter of green space per person). See Table 1 for an illustration. Table 1 also contains correct answers that you can use to check the accuracy of your work.
- A map with two layers: racial/ethnic group majorities in Chicago and locations of green spaces. Include legend, title, scale bar, your name, north arrow, and abbreviated data sources

Background

In this lab, we will conduct a GIS study similar to Wolch, Wilson and Fehrenbach's (2005) research on access to green spaces in Los Angeles, California. Wolch et al's purpose was to assess the environmental justice implications of municipal green spaces and recreation funding policies (Proposition K), asking whether minority groups, and especially minority children, were disproportionately excluded from access to green spaces. They operationalized the concept of "access" in terms of both the proximity and the total area of green spaces, and found significant disparities between racial/ethnic groups, rooted in histories of bias and segregation.

Green space provide numerous public health, social, and environmental benefits to cities and their residents. These include mitigation of urban heat, improved storm water management and water quality, improved air quality, expanded access to exercise, and the social-psychological benefits of enjoying nature.

Data Sources

The data for the lab can be found here:

https://geography.middlebury.edu/GEOG120/data/f_chicagoGreenSpace_1.zip

- `Blocks2010:` census blocks from the 2010 Census for Chicago containing with demographic data joined from the `P2` census data table. Descriptions of variables are available in `DEC_10_PL_P2_metadata.xlsx`
  - `TRACTCE field identifies which tract the block belongs to`
- `Tracts2010dirdist:` Please use the classified census tracts data from 2010 from the previous lab, provided also here for convenience.
  - `TRACTCE field uniquely identifies which tract the block belongs to`
- `Parks`: Chicago city parks. Parks may cross census block and census tract boundaries.
- `Forests`: Forests also count as green space for the purposes of this analysis, but are provided separately because they are maintained by a different government agency.

Census blocks and census tracts data are by

> Steven Manson, Jonathan Schroeder, David Van Riper, and Steven Ruggles. IPUMS National Historical Geographic Information System: Version 13.0 [Database]. Minneapolis: University of Minnesota. 2018. http://doi.org/10.18128/D050.V13.0.

METHODS

In Chicago, both parks and municipal forests are used as green space. Both types of features should be considered as a green space amenity, so they must be combined.

It's a bit of a mystery how Wolch et al (2005) estimated the number of people *within* a census tract that were also within 0.25 miles of green space. Here is how we will do it:

We will use geographic information lower in the hierarchy of census enumeration units to minimize MAUP issues. The smallest unit of census data available is the `block`. We can estimate which `blocks` have access to green space by finding the blocks whose centroids are within `0.25` miles of a green space. We can estimate the population with access in a census `tract` by summing the population of the `blocks` that have access in that `tract`.

We will save ourselves extra work by using the `tract` majority racial/ethnic categorization from Week 04 lab, provided for you in `Tracts2010dirdist.shp`. The major racial/ethnic groups in Chicago are `Asian, Black, Latinx,` and `White`. They are a majority of any given census `tract` if they make up over `60%` of the total population of the `tract`. Tracts with no clear majority are `Mixed`. Tracts with `less than 20 people` are excluded from the analysis.

Report the final results and greenspace access rates in regions defined by majority groups. When a question asks for a rate or percentage, it's helpful to plan out calculations of the numerator and denominator. Think about the last two columns of Table 1:

- Percent of Population with Access: (i.e., what percentage of people live within 0.25 miles of a green space?)
  - Numerator:
  - Denominator:
- Green space per person (in square meters) (i.e., how much greenspace is available per person in that majority area?)
  - Numerator:
  - Denominator:

ADVICE

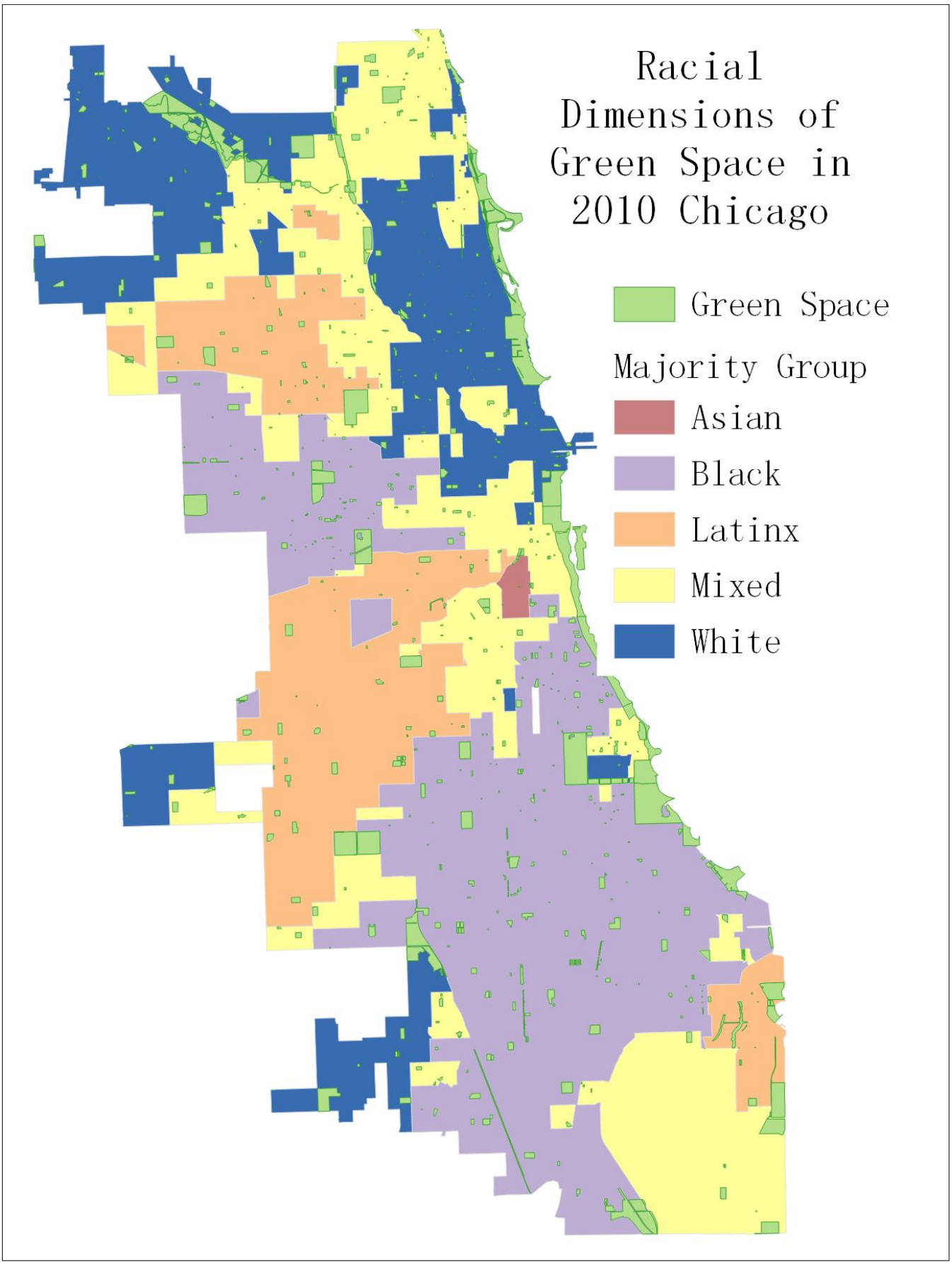
- Break the problem down into smaller intermediary goals, perhaps on notecards. This means that you should draw small diagrams of what the intermediate goal's solution should look like, then stitch those mini-workflows together.
- An instructor must okay your group's workflow diagram before you start implementing it.
- Complete the analysis in GIS and verify your answers with the results shown below.

RESULTS

- 29,544 census blocks have their centroid within 0.25 miles of a park, *or*
- 23,606 census blocks with population > 0 have their centroid within 0.25 miles of a park
- Census block centroids within 0.25 miles of parks contain 1.82173e+06 or 1,821,730 total people

TABLE 1: ACCESS TO PARKS AND DISTRIBUTION OF TREE CANOPY BY MAJORITY GROUPS IN CHICAGO

Majority Group	Tracts	Population	Population with Access	Area (sqm)	Green Space Area (sqm)	Percent Population with Access	Green Space Per Person (sqm)
Black	269	755,569	482,153	196,481,794	13,498,778	63.8	17.9
Mixed	178	669,499	510,794	145,342,623	8,965,317	76.3	13.4
White	190	660,728	485,254	118,606,374	11,511,111	73.4	17.4
Latinx	146	579,637	332,655	96,215,420	2,667,939	57.4	4.6
Asian	4	13,875	10,876	1,983,068	27,683	78.4	2.0


Racial Dimensions of Green Space in 2010 Chicago
Green Space
Majority Group
Asian
Black
Latinx
Mixed
White