

Lab: Environmental Justice of Park Access in Chicago

In most cases of segregated cities, there will also be unequal and unjust spatial distributions of risks, harms, and amenities. In this lab, we examine patterns of residential segregation in Chicago *vis a vis* environmental justice with regards to access to open space, e.g. parks, playgrounds, and nature preserves. This is an important question because access to open space has strong correlations with positive mental, physical, and social health outcomes.

We have already examined Chicago to determine the areas of the city in which different socio-economic groups form a majority.

Let's further examine these "majority regions" of Chicago as of 2020, asking:

1. Do proportionally fewer people live within 0.25 miles of open space in minority-majority areas of the city?
2. Does open space make up proportionally less of the total area of minority-majority areas of the city?

Note: many urban researchers focus on "open green space" or "urban green space" in their research. Our definition here is more broadly "open space" as it *may* include park or playground space that is not very natural or green, e.g. basketball or handball courts, hardscaped playgrounds or plazas, etc.

PURPOSE

- Analyze an urban (environmental) justice issue by combining socio-economic data with data on the built or natural environment.
- Develop and practice GIS workflows with buffer and overlay operations.

OUTCOMES

The analysis should result in a single multi-polygon layer in which there is one feature for each "majority area" of the city. The attribute table should contain these statistics:

- Percentage of total population in the "majority region" that live within 0.25 miles of a park or green space
- Percentage of "majority region" area that is open park or green space.

The final table should look something like this (but with abbreviated column names).

Majority Category	Number of Tracts	Percentage of People within 0.25 miles of open space	Percentage of Area that is open space
Asian			
Black			
Latino			
Mixed			
White			

DATA

The first data set was a result from the previous lab. **Fill in the blanks with the details of *your* dataset.**

_____ geopackage layer of Census tracts and demographic data:

- **Title:** Cook County Tracts with 2020 Urban Structure Data
- **Responsible Party:** _____
- **Spatial Coverage:** Cook County, Illinois
- **Coordinate Reference System:** EPSG:6454 Illinois State Plane East Projected Coordinate System
- **Spatial Representation Type:** Polygons or multi-polygons
- **Spatial Resolution:** Census tracts
- **Temporal Coverage:** 2020 (Census data) and 1930s (Redlining Data)
- **Lineage:** Downloaded from the U.S. Census API using `tidycensus` in R. In QGIS, data on redlining and rent were joined, the data was filtered to tracts with at least 20 people and nonzero rent, tracts were classified according to which racial or ethnic group is a majority, and distance and direction were calculated from the CBD.
- **Distribution:** Not for redistribution.
- **Constraints:** Not for redistribution.
- **Variables:**
 - **GEOID:** code to uniquely identify tracts
 - **DP1_0095C:** **integer:** Hispanic or Latino by Race: Total Population
 - _____: **decimal:** Redlining score
 - _____: **integer:** Median rent
 - _____: **text:** Majority racial or ethnic group
 - _____: **decimal:** Direction from the CBD (degrees)
 - _____: **decimal:** Distance from the CBD (kilometers)

leisure geopackage layer

- **Title:** Cook County leisure features from OpenStreetMap
- **Responsible Party:** OpenStreetMap
- **Spatial Coverage:** Cook County, Illinois
- **Coordinate Reference System:** EPSG:4326 WGS 1984 geographic coordinate system
- **Spatial Representation Type:** Polygons
- **Spatial Resolution:** unknown
- **Temporal Coverage:** data is from the OSM database as of April 2026

• **Lineage:** Downloaded from OpenStreetMap using the `QuickOSM` plugin in QGIS. An image of the QuickOSM query is shown to the right:

- **Distribution:** OpenStreetMap Overpass API

- **Constraints:**

OpenStreetMap® is open data, licensed under the Open Data Commons Open Database License (ODbL) by the OpenStreetMap Foundation (OSMF). Data can be published and redistributed under the same license with the copyright notice displayed.

- **Variables:**

- **osm_id:** **text:** numerical code to uniquely identify OpenStreetMap features
- **leisure:** **text:** contains the type of leisure feature, including three values relevant to open space: 'park', 'playground', and 'nature_reserve'

	Key	Value	Add	Delete
1	leisure	Query on all values		

METHODS

- First, learn how to implement buffer and overlay tools by following the Central Falls tutorial.
- Next, develop and check a workflow solution for the labs. Take into account these suggestions and parameters for the workflow:
 - Parks and park-like green spaces are all coded with the `leisure` key in OpenStreetMap, including three values of interest: `park`, `playground`, and `nature_reserve`. Please query *all* leisure features first, and then select the categories of interest later.
 - Note that some of the open space features may overlap one another, but should not be counted as additional "area". E.g. if a playground is found inside of a park and the playground polygon overlaps the park polygon, the playground area should not count twice.
 - The concept of “people with access to open space” can be estimated based on the proportion of area of each census tract that is **within 0.25 miles** of the space. For example, if 30% of the area of a census tract is within 0.25 miles of a green space, then we can assume that 30% of the population of the census tract has access to a green space.

CHECK RESULTS

OpenStreetMap changes over time! As of April 2026, you should find:

- 5,378 open space features, of which there are
 - 299 nature reserves,
 - 2,637 parks
 - 2,442 playgrounds

If your numbers vary slightly, it suggests OSM data changed in the meantime and your final results may also vary slightly.

The total population considered in the study is 5,129,820

The sum of population near parks is 3.98672e+06 3,986,724 +/- 20

Final results

Majority Group	Tracts (n)	Population (Total)	Population with Access (Total)*	Population with Access (%)	Region Area (m ²)	Open Space Area (m ²)	Park Area (%)
Asian	6	20,888	20,132	96.4	3,183,000	197,000	6.2
Black	339	1,036,987	762,370	73.5	500,784,000	48,916,000	9.8
Latinx	237	1,008,223	680,896	67.5	268,523,000	17,666,000	6.6
Mixed	194	853,531	697,356	81.7	342,443,000	46,502,000	13.6
White	515	2,210,191	1,825,970	82.6	1,183,081,000	214,146,000	18.1

* Population with access estimates are very sensitive to feature generalization and different area measurements. Your estimates may vary by +/- 10. Our area measurements are planar. Final percentages should be consistent.

If your feature count or total population for each majority group is too low, consider whether your workflow has missed tracts that do not have access to a park at all.

If your park area or population with access is too high, consider whether your workflow has double-counted any areas where green space or park buffers overlap.

AM I DONE?

- Check your results for the percentage of people with access and the percentage of area that is open space
- Back up work to W:\ drive