Evaluating the equity of greenspace access for infrastructure planning

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Project Impetus

- Large demand for natural infrastructure (NI) BUT lack of methods to account for NI co-benefits thwarts efforts to scale up
- Federal directives like the MOU on Promoting Equitable Access to Nature in Nature-Deprived Communities
- Justice40 Initiative (EO 14096) requires agencies to, "identify, analyze, and address barriers related to Federal activities that impair the ability of communities with environmental justice concerns to receive equitable access to human health or environmental benefits…"

Objectives

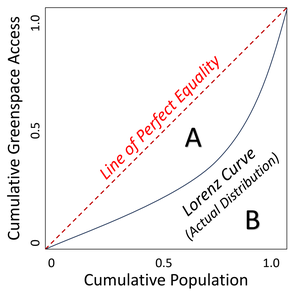
- **Provide a methodology for assessing greenspace access effects of proposed natural infrastructure (NI)**

  How much does a project increase access?
  How much does a project increase access equality?

- **Distribute census population statistics for fine-scale access calculations**
- **Allow user to select:**

  Definition of greenspace – Parks, NLCD vegetation, etc.
  Project impact scale – CBSA, ZCTA, County, Tract, or SHP
  Dasymetric population distribution metric – Microsoft building footprints, NLCD impervious area, etc.
  Definition of access – Euclidean distance, distance along path, acceptable distance of "accessible"

The Gini Coefficient



$$Gini = {A}/{(A+B)}$$

$$A + B = 0.5 \; ; \; B = \sum {P_i}/{P_{city}} * \frac{1}{2}(G_{i-1} + G_i)$$

$$Gini = 1 - \sum {P_i}/{P_{city}} (G_{i-1} + G_i)$$

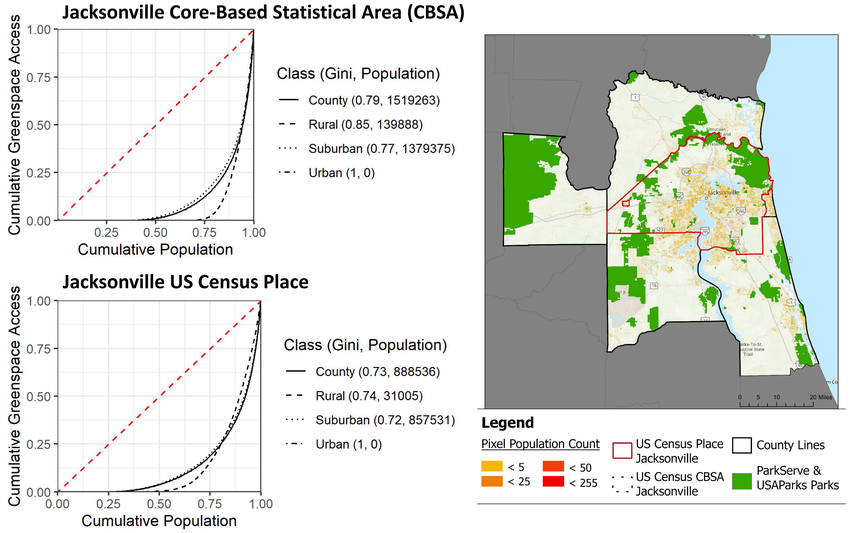
- ***LOWER GINI = MORE EQUAL***
- Based on ratio of difference between idealized Line of Perfect Equality (equal park access across entire population) and the Lorenz Curve (actual curve of cumulative access plotted along cumulative population)
- P is the population count
- G is the cumulative greenspace access
- Everything is summed across i individuals or population cells

Approach

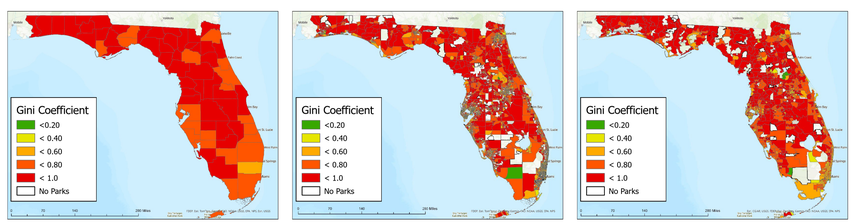
1. **Distribute census population statistics for fine-scale access calculations**
   1. Swanwick et al. 2021 (NLCD impervious area) and Huang et al. 2021 (Microsoft building footprints)

$$Cell\ Pop = Block\ Group\ Pop * \frac{Cell\ Building\ Centroid\ Count}{Block\ Group\ Building\ Centroid\ Count}$$

2. **Combine publicly available park datasets USAParks & ParkServe**
3. **Calculate park area within 1000m (Euclidean distance) of each 30m dasymetric population cell**
4. **Calculate Gini coefficient; assess effects of scale**



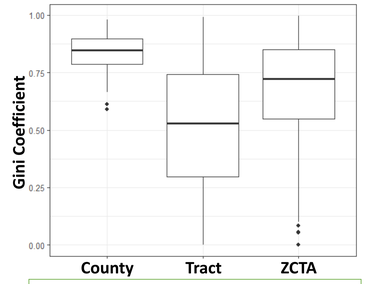
Gini curves and coefficients alongside population counts for two different US Census definitions of Jacksonville, FL. Around 50% of the population in the Core-Based Statistical Area (CBSA, outlined in black on the map) has no park access, as shown by the x-intercept of the County Lorenz Curve on the top graph. Around 30% of the population in the US Census Place (outlined in red) has no park access. No census blocks fell into the "Urban" category at either scale.



Florida Counties | ***Florida US Census Tracts*** | ***Florida ZCTAs (Zip Code Tabulation Areas)***

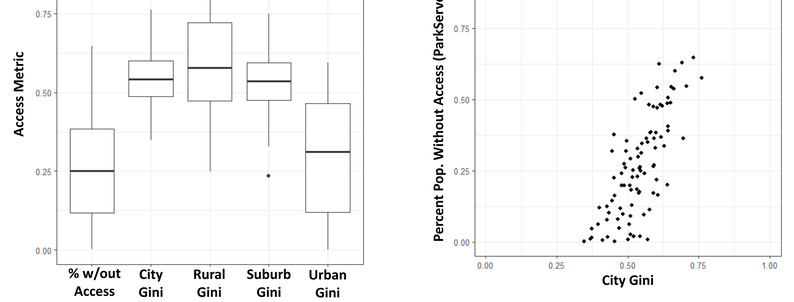
Approach

- Gini greenspace access coefficient is typically higher (less equal) with larger study areas
- Parks are more numerous in urban areas, even if total park area is lower – combining this with dense populations leads to greater access equity



Gini coefficients calculated for all of Florida's counties, tracts, and ZCTAs. Maps at bottom center of poster.

4. **Compare with ParkServe's walkable accessibility**



Gini access coefficients for multiple population densities calculated for ParkServe's 100 largest US cities, excluding Hawaii and Alaska, compared against ParkServe's calculated percentage of people without 10min walking access to parks in those same cities. Lower values indicate better access or access equity.

Future Goals

- **Create function to compare Gini coefficient with and without proposed projects**
  - Definition of access and scale of study area will be important factors – removal of Parque de Menendez in St. Augustine had no impact on Gini
- **Add more definitions of "greenspace" and "access"**
  - Distance along roads, distance decay function, etc.
- **Publish as a package**
  - Allow users to assess Gini impacts of different proposed projects at their chosen scale

Acknowledgements

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