Project 3 Flow Chart

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Project Goals

Develop site suitability index for the development of affordable housing in Chicago by creating a raster layer combining a number of factors informed by a literture review:

- **socioeconomic characteristics:** ratio of median rent to median income (block group level) to measure the need for affordable housing in an area
- **spatial characteristics:** distance from CPS elementary schools, grocery stores, train stops, health clinics, and parks to measure the quality of access to necessities
- **jusisdictional characteristics:** buildable land, zoning, vacant land to measure jursdictional feasibility of construction
- **economic characteristics:** median assessed property value, TIF zones, and enterprise zones to measure economic feasibility from a developer's perspective

1. Sourcing Data

- **socioeconomic characteristics**
  - median after tax income
    - source: ACS 5 Year Estimates, table B19013
  - ratio of median rent to median income
    - source: ACS 5 Year Estimates, table B25071
- **spatial characteristics**
  - CPS elementary schools
    - source: Chicago Data Portal
  - grocery stores
    - source: Chicago Data Portal
  - train stops
    - source: Chicago Data Portal
  - health clinics
    - source: Chicago Data Portal
  - parks
    - source: Chicago Data Portal
- **jusisdictional characteristics**
  - buildable land
    - source: CMAP Land Use Inventory
  - zoning
    - source: Chicago Data Portal
  - vacant land
    - source: CMAP Land Use Inventory
- **economic characteristics**
  - TIF boundaries
    - source: Chicago Data Portal
  - Enterprise Zones
    - source: Chicago Data Portal
  - assessed property value
    - source: Cook County Assessor's Office

2. Preparing Data

- Project all data to NAD 1983 StatePlane Illinois East FIPS 1201 Feet
- For all Census data:
  - prepare tables in Excel (clean up GEOID for joining, remove secondary headers, rename columns as needed)
- Cook County Assessor's dataset may be too large to tidy in Excel and ***will be prepared for use in GIS in R***
- For datasets that expand beyond Chicago:
  - SBL features with centers in the City of Chicago boundary
  - Data > export > save new features in geodatabase

3. ModelBuilder

- Amenities (elementary schools, grocery stores, train stops, health clinics, and parks) will need to be buffered because we want to prioritize building in places with a high level of amenities.
- ***Create model in ModelBuilder to output rasters where values within 0.5 miles of an amenity = 1 and values beyond = 0***
  - Euclidean Distance, cell size = 90 x 90 ft
  - Reclassify
    - 0 to 2640 ft = 1
    - 2640 ft and beyond = 0
  - output will be 5 rasters for each amenity type
    - school_dist
    - grocery_dist
    - train_dist
    - clinic_dist
    - parks_dist

4. Census Data

- we want to look at both median income and the ratio of median rent to median income to avoid focusing too much on high-income areas that may also have high rates of being rent-burdened
- join median after tax income (med_income) and ratio of median rent to median income (medrent_medincome) to shapefile of block groups in Chicago
- create 2 new fields to get approximate values for 90 x 90 cell (see Areal Interpolation exercise. We are using the ***spatial statistics*** modules for guiding the creation of our rasters.)
  - medincome90x90
    - ((90 * 90) * !med_income!) / !Shape_area!
  - ratio90x90
    - ((90 * 90) * !medrent_medincome!) / !Shape_area!
- Feature to Raster
  - Input Features: Chicago_block_groups
  - Field: medincome90x90
  - Output raster: income_raster
  - Output cell size: 90 ft
- Feature to Raster
  - Input Features: Chicago_block_groups
  - Field: ratio90x90
  - Output raster: ratio_raster
  - Output cell size: 90 ft
- Reclassify both rasters
  - ratio_raster
    - sort into severely rent-burdened (50% or more of income goes to rent), rent-burdened (30% - 50% of income goes toward rent), or not rent burdened (30% or less of income goes to rent). Severely rent-burdened will be given highest weight, and not rent-burdened will be given lower weight.
  - income_raster
    - sort into percentages of Chicago's overall median income (30% or less of AMI, 30 % - 50% of AMI, 50% - 80% of AMI, 80% - 100% of AMI, 100% - 150% AMI, 150% or greater AMI). 30% or less of AMI will be given highest weight, and 150% or greater AMI will be given lower weight.

5. Jurisdictional Characteristics & Funding Sources

- buildable land, zoning, vacant land, TIF boundaries, and Enterprise zones will all use a binary weighting schema, e.g. if a place is zoned to allow housing, it will receive a 1, but if not, it will receive a 0. processing extent will be set to the City of Chicago boundary.
- buildable land
  - Feature to Raster
    - Input Features: cmap_land_use
    - Field: land use code
    - Output raster: land_use
    - Output cell size: 90 ft
  - Reclassify
    - water, roads, etc will be given a 0
    - other land use types will be given a 1
- vacant land
  - Reclassify land_use raster from above again
    - non-vacant land will be given a 0
    - vacant land will be given a 1
- TIF boundaries
  - Feature to Raster
    - Input Features: tif_boundaries
    - Field: name of tif zone
    - Output raster: tif_raster
    - Output cell size: 90 ft
  - Reclassify
    - outside of a TIF will be given a 0
    - within a TIF will be given a 1
- Enterprise Zones
  - Feature to Raster
    - Input Features: enterprise_zones
    - Field: name of zone
    - Output raster: enterprise_raster
    - Output cell size: 90 ft
  - Reclassify
    - outside of an enterprise zone will be given a 0
    - within an enterprise zone will be given a 1

6. Property value

- ***Clip Cook County parcel shapefile to City of Chicago in Python window before bringing into ArcGIS Pro***
- Create new field, price_per_sqft = board_tot / Shape_Area
- right-click on new field, find median price per square foot
- New field, price_ratio = median price per sq foot / price_per_sq_ft
- Feature to Raster
  - input feature: parcels
  - field: price_ratio
- May Reclassify, or may just use ratio as weight since price of land is such a considerable factor in construction

7. Combining Rasters

Use Raster Calculator to add all rasters together into final raster of suitability index for the construction of affordable housing

GIS techniques learned in class this semester have been highlighted in bold italics

Literature Reviewed

- Poholka, Holli. 2011. Locating Optimal Affordable Housing Sites : A Determination of Potential Site Locations for New Affordable Housing Units Using Multi-Criteria Analysis: A Case Study of Kelowna, British Columbia. https://urn.kb.se/resolve?urn=urn:nbn:se:hig:diva-9774.
- Thomson, Curtis N, and Perry Hardin. 2000. "Remote Sensing/GIS Integration to Identify Potential Low-Income Housing Sites." Cities 17 (2): 97–109. https://doi.org/10.1016/S0264-2751(00)00005-6.
- Zhang, Zuo, Yanzhong Liu, Jiangfeng Li, and Biao Chen. 2009. "Application of GIS and Spatial Decision Support System for Affordable Housing." In 2009 4th International Conference on Computer Science & Education, 1110–15. https://doi.org/10.1109/ICCSE.2009.5228554.