**Albuquerque Urban to Wild GIS Analysis Methods**
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# Data Sources

## Parks & Open Space

Parks and Open Space data were obtained from multiple sources, including the City of Albuquerque Open Space Division, received from Tricia Keffer on January 9, 2020. These data included open space by name. Parks data for the City of Albuquerque were downloaded  from ABQ Open Data (http://data.cabq.gov/community/parksandrec/parks/). Additional parks and open space areas were incorporated from the TPL Greenprint dataset produced for Bernalillo County (https://www.bernco.gov/community-services/greenprint.aspx).

Parks were categorized into 6 groups, determined primarily by size:
- Pocket Park:  up to 1 acre
- Neighborhood Park:  1-5 acres
- Community Park:  5-10 acres
- Regional Park:  more than 10 acres
- Aquatics Facility
- Fully-inclusive playground

Open Spaces were categorized into 6 groups, using categories determined by the City of Albuquerque Open Space Division:
- Open Space (closed)
- Open Space (facility)
- Open Space (hiking)
- Open Space (multi-use)
- Open Space (special use)
- Open Space (undeveloped)

## Transit

Bike, Pedestrian and Multi-Use paths data was downloaded from the ABQ Open Data Portal, as were ABQ Ride bus stops and routes.

The ABQ Ride General Transit Feed Specification (GTFS) data was downloaded from https://transitfeeds.com/p/abq-ride/52.

## Informal Trails/Paths

Data for acequias, canals, ditches and drains was obtained from the Middle Rio Grande Conservancy District (https://www.mrgcd.com/mapping-gis.aspx)

## Demographics

We used US Census Bureau American Community Survey (ACS) 2017 5-year summary data at the Block Group and Tract level, depending on the characteristics being mapped. Data were accessed at https://www.census.gov/data/developers/data-sets/acs-5year.2017.html

There are 436 block groups within the study area.

## Health

Data for six of the health vulnerabilities were drawn from the New Mexico CDC AGOL map gallery (Health Insurance, Adult Obesity, Childhood Obesity, Life Expectancy at Birth, Asthma Hospitalizations, Deaths Due to Chronic Disease, Ambulatory Difficulty) (https://nmcdc.maps.arcgis.com/home/gallery.html?view=grid&sortOrder=desc&sortField=modified)

Health statistics are reported at the following geographies:
**Health Insurance:**  NM Small Areas
**Adult Obesity:**  Census tract
**Childhood Obesity:**  Census tract
**Life Expectancy at Birth:**  NM Small Areas
**Asthma Hospitalizations:**  NM Small Areas
**Deaths Due to Chronic Disease:**  NM Small Areas
**Ambulatory Difficulty:**  Census Block Group

We used the ACS data for the seventh health vulnerability, Ambulatory Difficulty, which is defined as "Having serious difficulty walking or climbing stairs (DPHY)"
https://www.census.gov/topics/health/disability/guidance/data-collection-acs.html

## Environmental

Of the seven environmental vulnerabilities we mapped, four came from the US EPA EJ Screen dataset (**respiratory hazard index, proximity to traffic, particulate matter concentration, and ozone concentration**):  https://ejscreen.epa.gov/mapper/
**Percent Tree Canopy** was measured using the tree canopy assessment conducted by The Nature Conservancy

(https://www.nmconservation.org/field-notes/2018/11/8/seeing-the-city-for-the-trees-albuquerques-urban-forest)

**Floodplain Areas** were mapped using data from the US FEMA National Flood Hazard Layer (https://www.fema.gov/national-flood-hazard-layer-nfhl)

**No Walking Access to Any Park** areas were derived from an analysis we conducted, described elsewhere in this document

# Methods

## Walking Access

We used the Network Analyst extension in ArcGIS to create ¼ mile and ½ mile network distance service areas from every block group centroid to the closest entry of every park and open space in the study area. The City of Albuquerque does not maintain spatial data on the entrances to parks, so to more accurately reflect the multiple formal and informal entrances to every park, we buffered parks by 100 ft and created a point at every location where the buffer is intersected by a street. We did not take into account fencing, embankments, or other barriers to entry. This creates multiple potential entrances for every park, which is what we used for the walking access to parks analysis. The three figures below illustrate the process for two neighborhood parks.
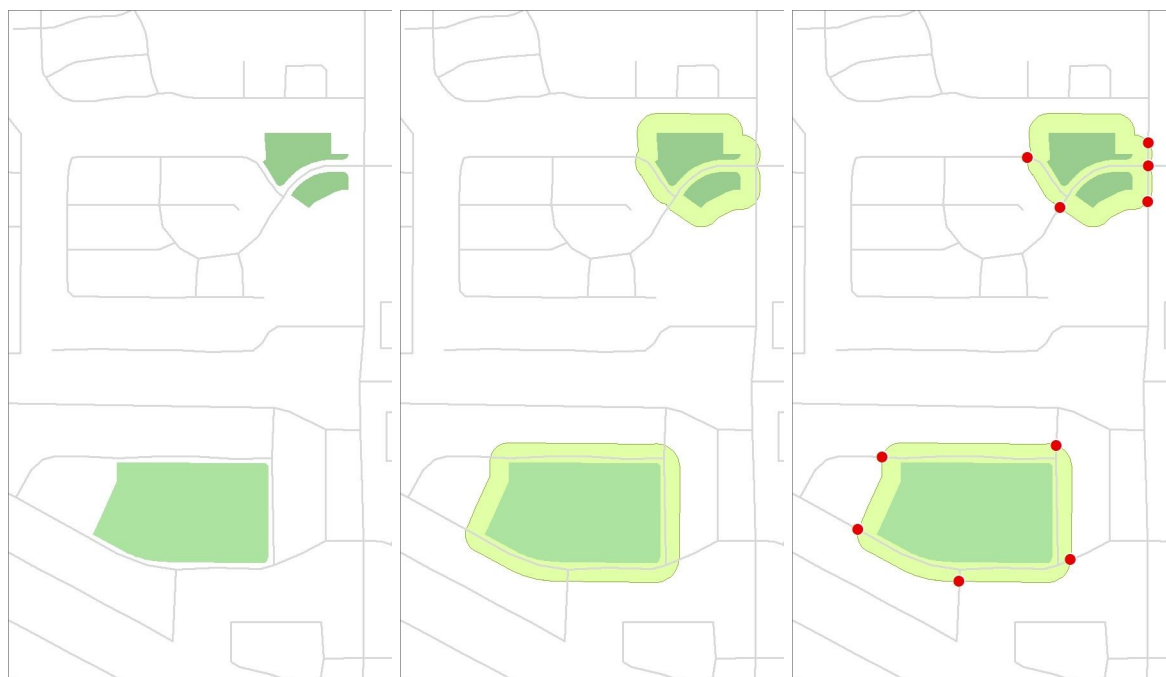


Two neighborhood parks          Parks buffered by 100'          Intersection of streets with 100' buffer

To determine which block groups have limited walking access to parks, we measured the percentage of the inhabited area of each block group that is a 1/2 mile or more walk from the nearest park, and took the top quartile.

Pct_no_walk >= 79%

# Transit

## Transit Access

We used the Better Bus Buffers toolset developed by Esri (https://esri.github.io/public-transit-tools/BetterBusBuffers.html) to measure the level of service or transit access for every bus stop within the ABQ Ride service area. We used the tool to snap bus stops to the street network, build ¼ mile walking network distance service areas, and count the number of trips per hour for each stop for a generalized Wednesday between 4 pm - 8 pm and Saturday 8 am - 12 pm. Level of service was categorized into four groups based on trips per hour.

## Access to Parks/Open Space

We used the GTFS data publicly available from ABQ Ride to generate an Origin-Destination table, where every block group centroid is an origin, and every park entrance is a destination. We calculated the travel time via walking-bus-walking from every block group to every park/open space area for Saturday between 8 am - 12 pm and Wednesday between 4 - 6 pm.

To provide more granularity in the destinations and to more closely reflect how people might access larger open spaces, we manually split the larger open space areas and regional parks into sections based on streets, concentrations of trailheads, or informal parking areas identified using aerial photography and local knowledge. The three figures below illustrate the source data we received from the Open Space Division and how we subdivided larger areas into sections that were considered to be separate destinations for the purposes of the GTFS analysis.

Even after subdividing the larger parks/open spaces, it was not always obvious where the entrance should be located. For modeling purposes, the majority of entrances were located by using a combination of NEAR calculation in ArcGIS:  the first to snap the block group centroid to the closest street, then a second to snap the relocated centroid to the edge of the park closest to the nearest bus stop.

Travel times are the sum of 1) walking from block group centroid to nearest bus stop; 2) waiting for and riding bus to closest bus stop; 3) walking from closest bus stop to modeled park entrance.

Source data from City of ABQ | Major roads | Subdivided Open Space

## Normalizing data by inhabited/uninhabited areas

Significant portions of the study area are covered by block groups that contained large uninhabited areas. To address this issue, we used publicly available building footprints produced by Microsoft (https://github.com/Microsoft/USBuildingFootprints) as a proxy for inhabited areas. However, not all buildings are used for dwellings, so we incorporated zoning data from the City of Albuquerque and Bernalillo County to mask out areas that do not permit residential land use (such as industrial zones). Buildings in these areas were removed, and we used the remaining buildings to select the parcels within which they are located. These parcels are used to represent the inhabited land area of each block group, which serves to normalize the block group by population, rather than overrepresenting large land areas with low density.

The figure below illustrates the three categories used to group building footprints.
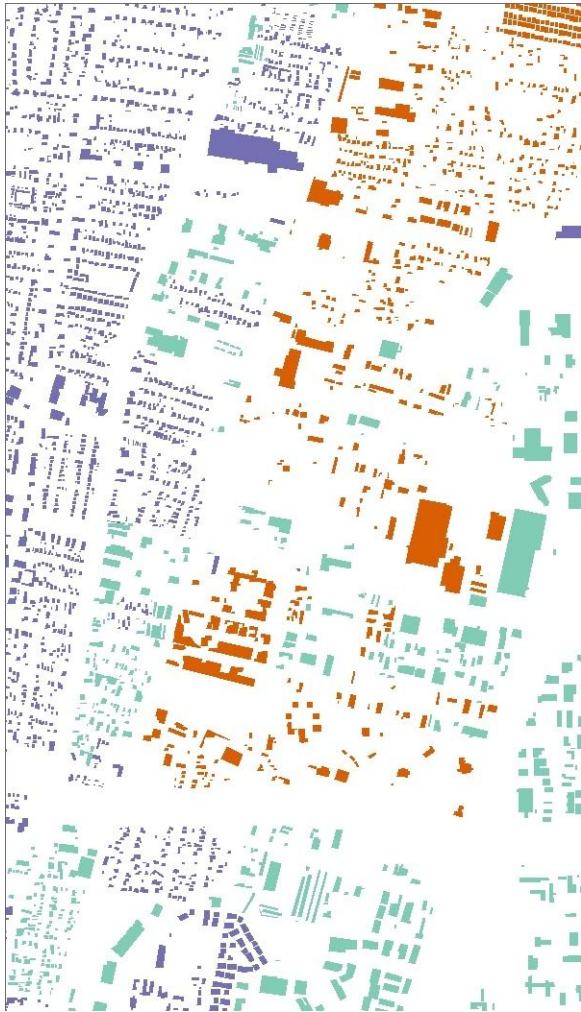


In this map, buildings within residential zones in the City of Albuquerque are blue; buildings outside the incorporated city limits are orange, and buildings in non-residential zones are teal.

# Identifying vulnerabilities

We measured 9 Sociodemographic Vulnerabilities, 7 Health Vulnerabilities, and 7 Environmental Vulnerabilities using the data described above.

## Sociodemographic Vulnerabilities

**People of Color:** For PoC, took total for White Alone, not Hispanic or Latino population B03002e2, and subtracted from total pop:

[ACS_2017_5YR_BG_35_NEW_MEXICO.total_pop] - [X03_HISPANIC_OR_LATINO_ORIGIN.B03002e2]

*Threshold for rollup: greater than 70% PoC*

**Household Income:**  Used field B19013e1

> *Threshold for rollup:  ABQ AMI 2018 = $51,128;  80% AMI = $40,902*

**Seniors:**  Male 65 and older
[male_65and66] + [male_67to69] + [male_70to74] + [male_75to79] + [male_80to84] + [male_85plus]

Female 65 and older
[female_65and66] + [female_67to69] + [female_70to74] + [female_75to79] + [female_80to84] + [female_85plus]

> *Threshold for rollup:  top quartile, Pct_65plus > 0.212*

**Youth:**  Male Children
[male_under5]+ [male_5to9] + [male_10to14] + [male_15to17]

Female children
[female_under5]+ [female_5to9] + [female_10to14] + [female_15to17]

> *Threshold for rollup:  top quartile, Pct_18under > 0.258*

**Unemployment:**  From table 23, calculated into Pct_Unemployed Unemployed pop 16+ divided by total pop 16+
[X23_EMPLOYMENT_STATUS.B23025e5] /[X23_EMPLOYMENT_STATUS.B23025e1]

> *Threshold for rollup:  Mean pct unemployed = 0.041164; + 1 STD = 0.077306 or 7.7%*

**Educational Attainment:**  Pct of pop 25+ with HS diploma or higher; from table 15, took fields B15003e1 and B15003e17 through B15003e25

> *Threshold for rollup:  used mean minus one STD:*
>
> *Mean:  0.882*
> *Standard Deviation:    0.117622*
> *PCT_HS_diploma_25plus <0.764378*

**Household Size** (owner/renter occupied):  Calculated this for both Owner and Renter occupied.
Renter Occ avg HH size mean:  2.59 ; STD = 0.8854; mean + 1 STD = 3.4754
RenterOcc_AvgHH_Size >=3.4754

*Threshold for rollup:  Owner Occ avg HH size mean: 2.698485; STD = 0.558812; mean + 1 STD = 3.25729*

**Zero Vehicle Households:**  separated by tenure, this field is a combination of B25044e3 (no vehicle available, owner occupied) and B25044e10 (no vehicle available, renter occupied)

*Threshold for rollup:  top quartile of zero vehicle households, zero_veh_hh >= 55*

**Limited English Households:**  Combination of multiple fields to encompass language groups (C16002e4, C16002e7, C16002e10, C16002e13)

*Threshold for rollup:  top quintile of households, hh_limited_english >= 53*

## Environmental Vulnerabilities

**Respiratory Hazard Index:**  top quintile within Bernalillo County, Resp_Haz_Pctile >= 84th percentile

**Proximity to Traffic:**  top quintile within Bernalillo County Traffic_Prox_Pctile >= 90th percentile

**Particulate Matter Concentration:**  top quintile within Bernalillo County, PM 2.5 >= 80th percentile

**Ozone Concentration:**  top quintile within Bernalillo County, Ozone_Air_Pctile >= 89th percentile

**Percent Tree Canopy:**  Took the bottom percentile for all block groups, pct_trees < 0.072 (7.2%)

**Floodplain Areas:**  Measured the percentage of the inhabited area of each block group that is 1/2 mile or more walk from the nearest park. Took the top quartile. Pct_no_walk >= 79%

**No Walking Access to Any Park:**  Measured the percentage of the inhabited area of each block group that is 1/2 mile or more walk from the nearest park. Took the top quartile, Pct_no_walk >= 79%

## Health Vulnerabilities

**Health Insurance:**  Using data from NM-IBIS (2017)
https://ibis.health.state.nm.us/indicator/complete_profile/HlthInsurCensus.html
*Threshold for rollup:  Top quintile for cut-point, pct_uninsured >0.16600*

**Adult Obesity:**  Using data from NMCDC
(http://nmcdc.maps.arcgis.com/home/item.html?id=bd74a088596e48358b22ae76a32a2631)

*Threshold for rollup: Taking top quintile cut point 28.7%, and assigning all underlying block groups to this category in the Rollup*

**Childhood Obesity:** Using data from NMCDC
(http://nmcdc.maps.arcgis.com/home/item.html?id=8c1b655ed7aa4415b7e20f66acc97808)
Using MOBESE: Proportion of Students Obese (>95th BMIC)
*Threshold for rollup: Top quintile cut point >=21.76%*

**Life Expectancy at Birth:** Mean in Bernalillo County: 78.315665; STD: 2.841193; Mean minus STD = 75.474472;
*Threshold for rollup: lowest quintile = 75.76*

**Asthma Hospitalizations:** Using top Quintile for cumulative rate of Asthma Hospitalizations per 10,000 residents 2012-2015
*Threshold for rollup: R1215 >10.5*

**Deaths Due to Chronic Disease:** Using data from NMCDC
(http://nmcdc.maps.arcgis.com/home/item.html?id=4e55e8aa57fb43daa9046f8d2c2b5f5c)
Field is CDRAllA, this is Rate per 100,000 of Chronic Disease Deaths, ALL AGES, 2005-2009
*Threshold for rollup: Using top Quintile, this is greater than 587*

**Ambulatory Difficulty:** We received partner feedback that Ambulatory Difficulty numbers looked too high, so we recalculated as:

[X18_DISABILITY.B18105e4] + [X18_DISABILITY.B18105e7] + [X18_DISABILITY.B18105e10] + [X18_DISABILITY.B18105e13] + [X18_DISABILITY.B18105e16] + [X18_DISABILITY.B18105e20] + [X18_DISABILITY.B18105e23] + [X18_DISABILITY.B18105e26] [X18_DISABILITY.B18105e29] + [X18_DISABILITY.B18105e32]

These numbers are correct; the totals turn out to be about 6% of the population
*Threshold for rollup:*

## Summarizing Vulnerabilities by Category

Every block group that met the threshold for the above vulnerabilities was assigned a 1, all other block groups falling below (or above, depending on the specific vulnerability) were assigned a zero. The total number of vulnerabilities within each category was added for each individual block group to create a category rollup, and the category rollup totals were combined to create a value for the total number of vulnerabilities present within each block group.

# Mapping Vulnerabilities by Transit Access

We created a 3x3 matrix of level of transit access by number of vulnerabilities for Wednesday afternoon and Saturday morning. The 9 categories are:

high vulnerabilities, good transit access
high vulnerabilities, moderate transit access
high vulnerabilities, poor transit access
low vulnerabilities, good transit access
low vulnerabilities, moderate transit access
low vulnerabilities, poor transit access
moderate vulnerabilities, good transit access
moderate vulnerabilities, moderate transit access
moderate vulnerabilities, poor transit access

## Definitions for transit access

**Good:** can reach at least 2 Community or Regional parks within 30 minutes AND at least 1 Hiking or Multi-use Open Space within 30 minutes

**Moderate:** can reach either at least 2 Community or Regional parks within 30 minutes OR at least 1 Hiking or Multi-use Open Space within 30 minutes

**Poor:** can reach neither 2 Community or Regional parks within 30 minutes nor at least 1 Hiking or Multi-use Open Space within 30 minutes

## Definitions for vulnerabilities

**High:** the block group has 11 or more of the vulnerabilities described above

**Moderate:** more than 1 and fewer than 11 vulnerabilities

**Low:** 1 or fewer vulnerabilities

The number of people per category for each day as well as the change per category between Wednesday and Saturday can be found here.

# Police Calls for Service

[We used data on police calls for service from the Albuquerque Police Department and Bernalillo County Sheriff's department. We cross-walked the Sheriff's codes into the same categories we used for the Albuquerque data, and summarized calls for service by type within

parks and open space plus a 75 foot buffer. We excluded Traffic related calls for service split the remaining calls into two subsets:  Violent Crime, Theft, and Property Crime (Tot_ViolentPropTheft), and all other calls for service except Traffic (TotNonViolent_NoTraffic). Total calls for service are displayed by park/open space and displayed using the centroid, or center point, of each park/open space.