

Healthy Communities by Design

November 15–17, 2010 • Redlands and Loma Linda, CA



Mapping Food Deserts

Jim Herries, Esri



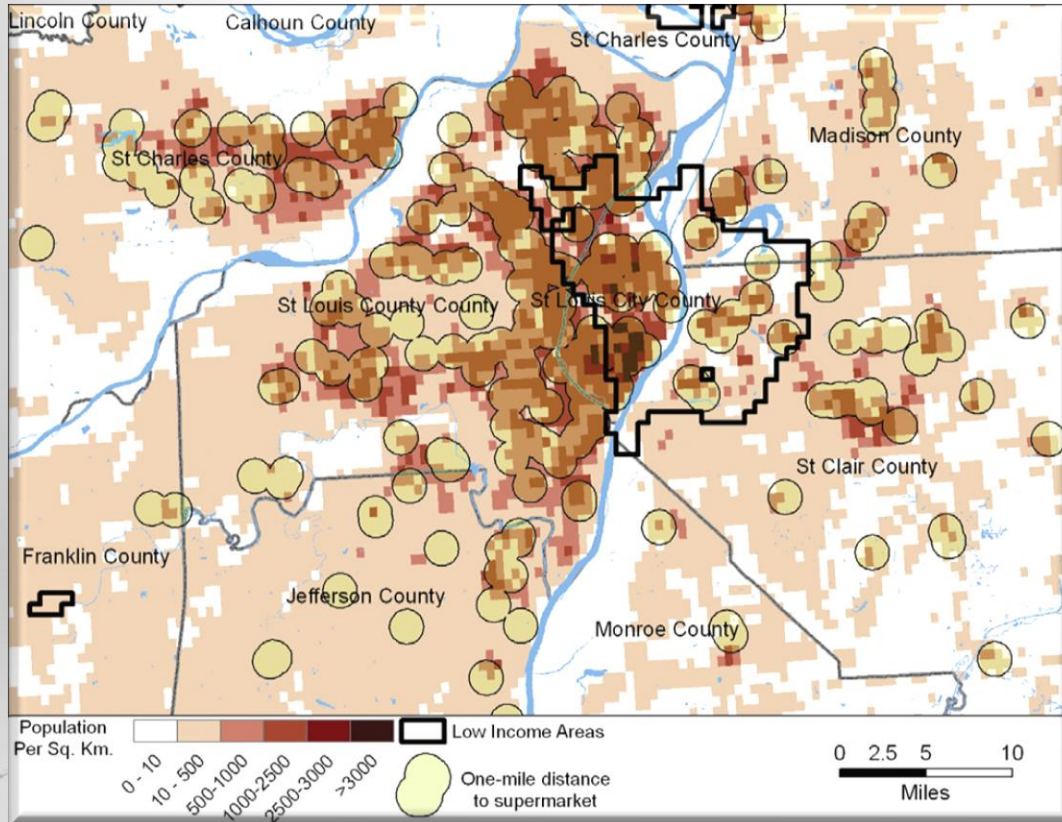
What is a “food desert?”

- **Desert, not dessert**
- **Defined by areas with limited access to affordable and nutritious food**

Context

- **Frequently associated with health issues (obesity)**
- **Often associated with demographic characteristics**
- **Sometimes includes competing destinations in the definition**
 - **Fast food**
 - **Convenience stores**
- **Clear behavioral choice component**
 - **Access does not automatically result in good choices**

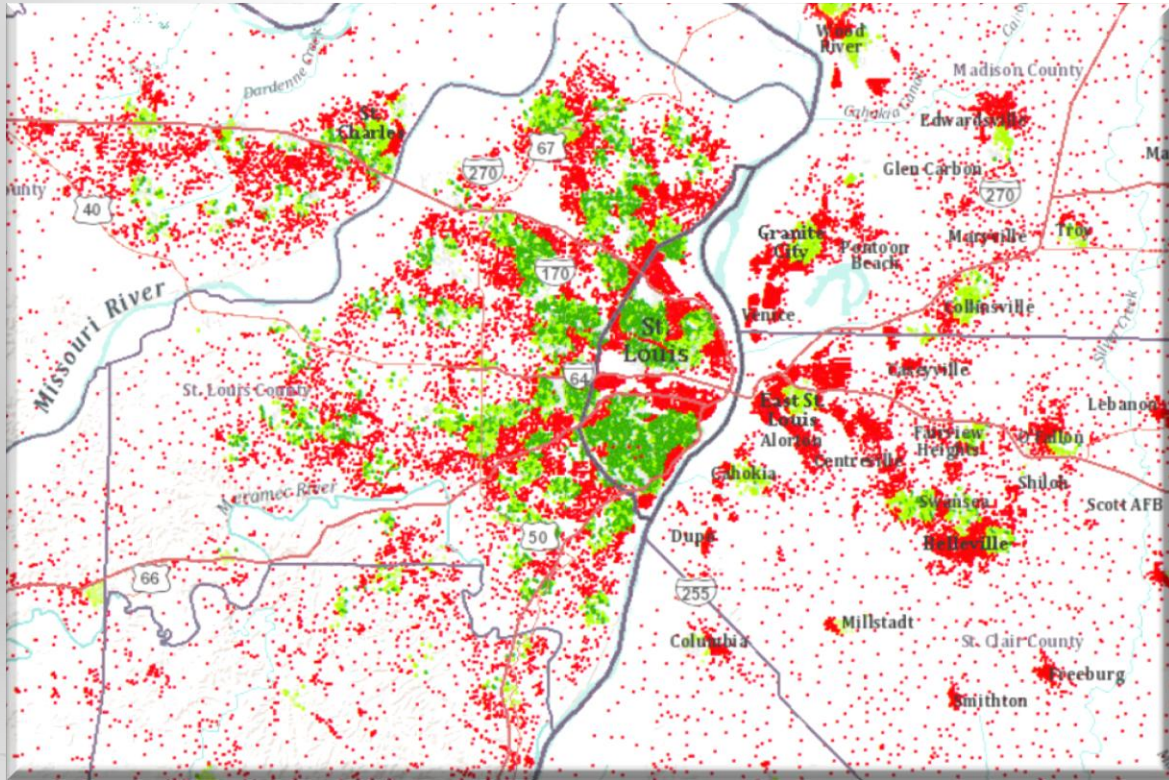
Where is it? USDA Example:



Food: 40,000 grocery stores
Access: 1 mile ring population grids and low income areas
Areas: 1 km

Conclusion: 2 to 7 million households with access issues

Where is it? Esri Example:



Populations within 1 mile of a supermarket

Where is it?

Mari Gallagher Example

- scores each tract
- overlays neighborhoods

Food: nearest grocery store, nearest fast food store

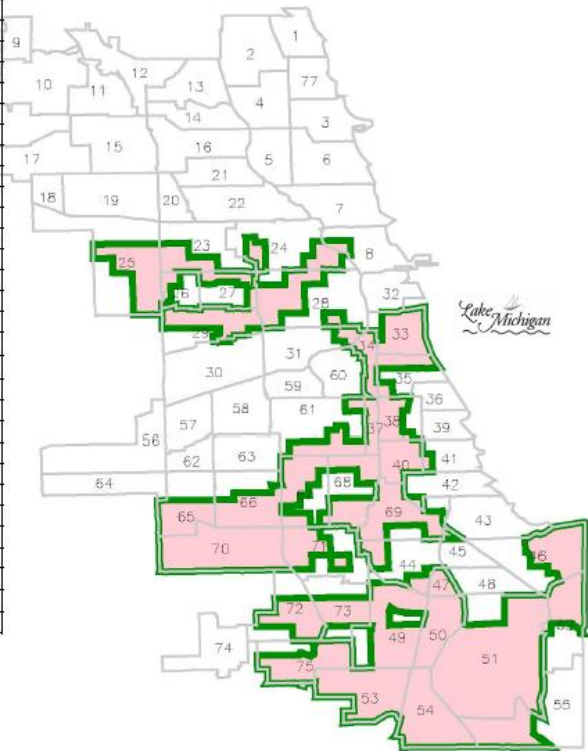
Access: 0.5 mile ring

Areas: tract centroids

#	Community Name	#	Community Name
1	ROGERS PARK	40	WASHINGTON PARK
2	WEST RIDGE	41	HYDE PARK
3	UPTOWN	42	WOODLAWN
4	LINCOLN SQUARE	43	SOUTH SHORE
5	NORTH CENTER	44	CHATHAM
6	LAKE VIEW	45	AVALON PARK
7	LINCOLN PARK	46	SOUTH CHICAGO
8	NEAR NORTH SIDE	47	BURNSIDE
9	EDISON PARK	48	CALDMET HEIGHTS
10	NORWOOD PARK	49	ROSELAND
11	JEFFERSON PARK	50	PULLMAN
12	FOREST GLEN	51	SOUTH DEERING
13	NORTH PARK	52	EAST SIDE
14	ALBANY PARK	53	WEST PULLMAN
15	PORTAGE PARK	54	RIVERDALE
16	IRVING PARK	55	HEGEBWISCH
17	DUNNING	56	GARFIELD RIDGE
18	MONTCLARE	57	ARCHER HEIGHTS
19	BELMONT CRAIGIN	58	BRIGHTON PARK
20	HERMOSA	59	MCKINLEY PARK
21	AVONDALE	60	BREXESPORT
22	LOGAN SQUARE	61	NEW CITY
23	HUMBOLDT PARK	62	WEST ELSDON
24	WEST TOWN	63	GAGE PARK
25	AUSTIN	64	CLEARING
26	WILSON	65	WEST LAWN
27	CHICAGO LAWN	66	CHICAGO LAWN
28	WEST ENGLEWOOD	67	WEST ENGLEWOOD
29	ENGLEWOOD	68	ENGLEWOOD
30	GREATER GRAND CROSSING	69	GREATER GRAND CROSSING
31	ASHBURN	70	ASHBURN
32	AUBURN GRESHAM	71	AUBURN GRESHAM
33	BEVERLY	72	BEVERLY
34	WASHINGTON HEIGHTS	73	WASHINGTON HEIGHTS
35	MOUNT GREENWOOD	74	MOUNT GREENWOOD
36	MORGAN PARK	75	MORGAN PARK
37	O'Hare	76	O'Hare
38	EDGEWATER	77	EDGEWATER
39	KENWOOD		

Map #1
Chicago's 3 Revised 2009 Food Deserts By Tract
With Community Area Boundaries

 Food Desert

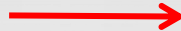


What does “food desert” mean?

- “...As a researcher, if ‘food desert’ is something policymakers hear and want to do something about, I’m in support of it. But as a community member, it’s another negative thing about the place where I live.”
- “It’s not the need that brings in the resources. There’s got to be that ‘and’: There’s a need and there’s an economic opportunity.
- Source: Angela Odoms-Young, an instructor in UIC’s College of Applied Health Sciences



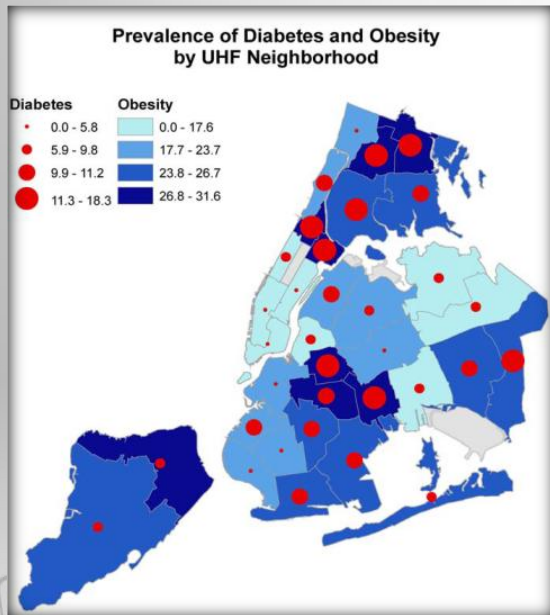
Globalshift.org



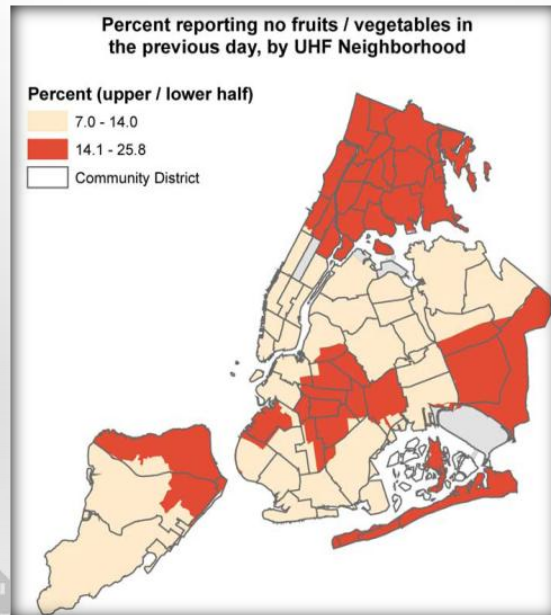
New York

How are health issues related to behaviors?
How are behaviors related to the food environment?

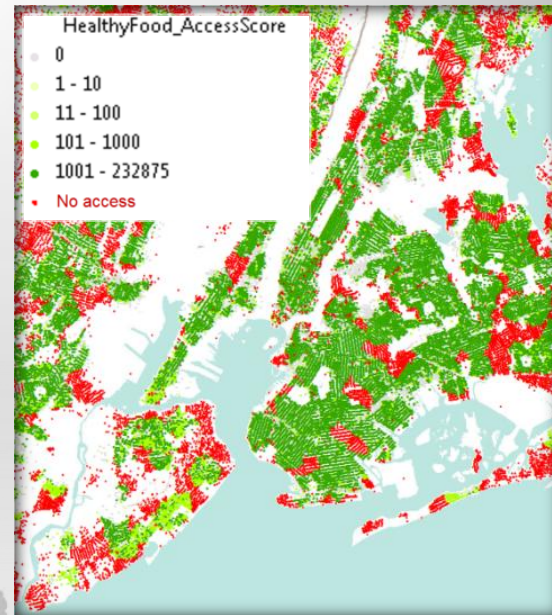
health issues



behaviors



food environment



Source: New York City Department of City Planning, NYC Health, New York City Economic Development Corporation

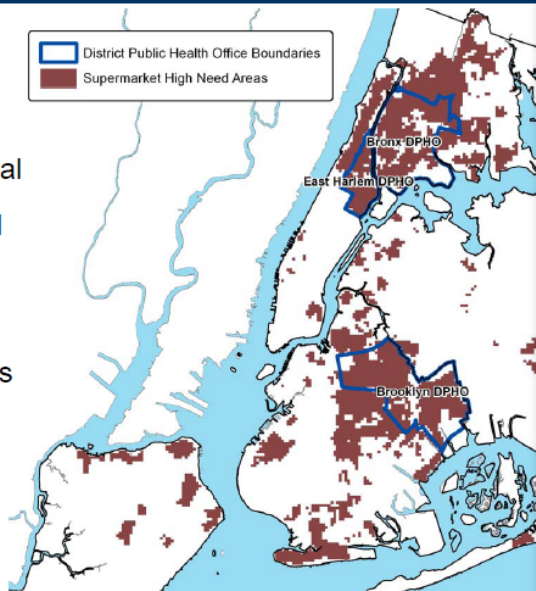
Source: Esri

New York's Need

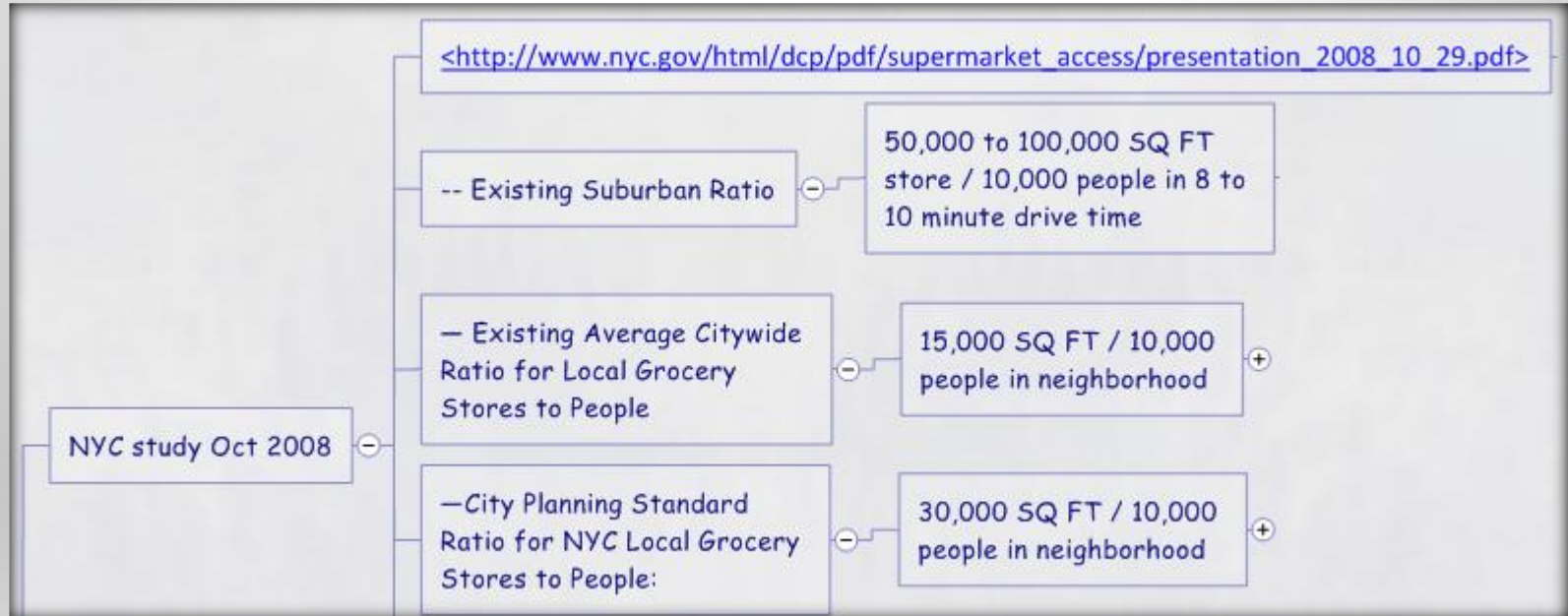
Assessing Need for New Grocery Stores

Findings:

- The Department of Health established District Public Health Offices (DPHO) in Harlem, the Bronx, and central Brooklyn, areas where concentrations of diet-related diseases, such as obesity, diabetes, and heart disease are high
- Over one million New Yorkers live in the three DPHO areas
- Our index also identifies the DPHO areas as having high need for additional neighborhood grocery stores and supermarkets



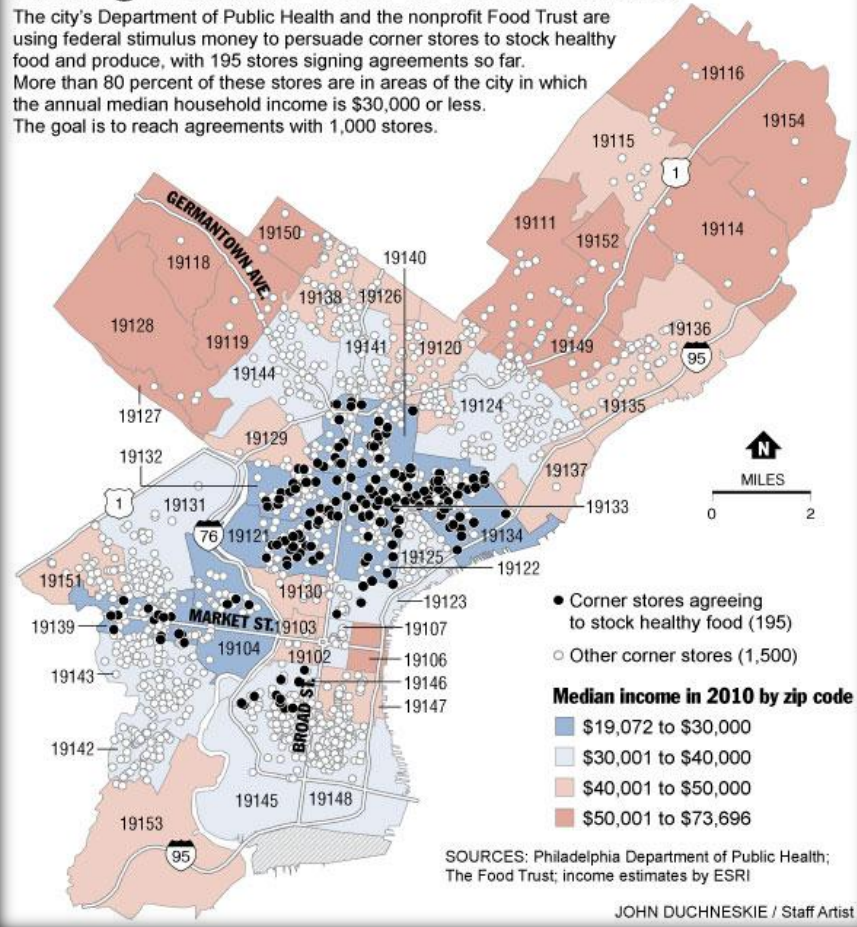
New York's Economic Opportunity:



Philadelphia takes action

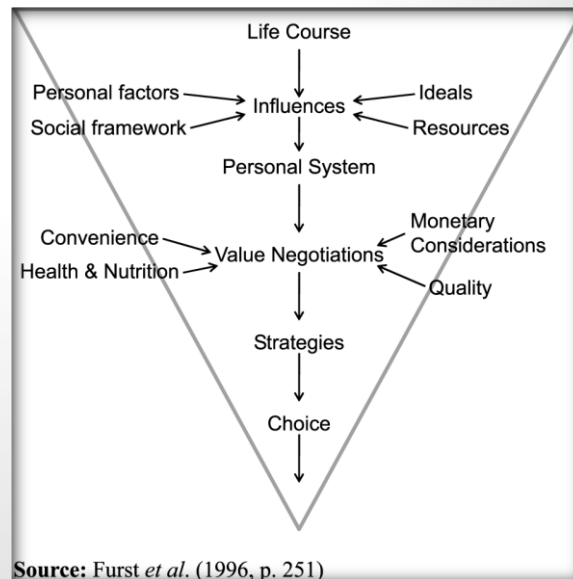
Getting Healthier Food to Corner Stores

The city's Department of Public Health and the nonprofit Food Trust are using federal stimulus money to persuade corner stores to stock healthy food and produce, with 195 stores signing agreements so far. More than 80 percent of these stores are in areas of the city in which the annual median household income is \$30,000 or less. The goal is to reach agreements with 1,000 stores.



Factors in choosing food

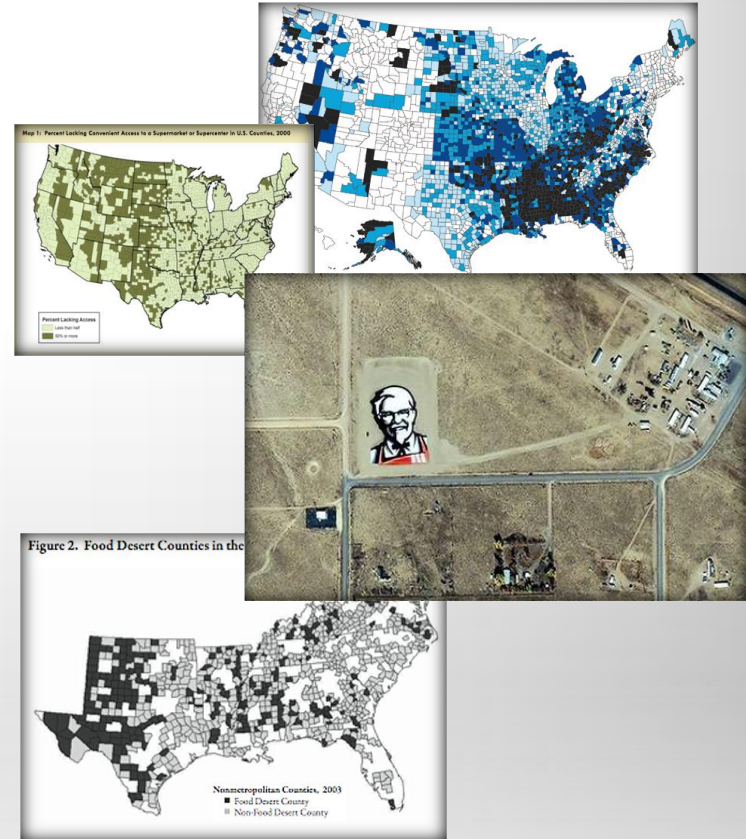
- **Aware of options**
- **Preferences, influenced by lifestyle, taste**
- **Food quality**
- **Cost (food prices plus travel)**
- **Distance (access)**



- **“...access is a more accurate and less misleading concept than food deserts when it comes to highlighting food inequalities.” (Furst *et al.*, 1996)**

How GIS helps

- **Model and map access to food**
- **Map the health issues**
- **Map the behaviors**
- **Map the options available**
- **Map preferences, lifestyle, consumption**
- **Map food quality**
- **Map food prices**
- **Map travel costs**
- **Map the advertising environment**

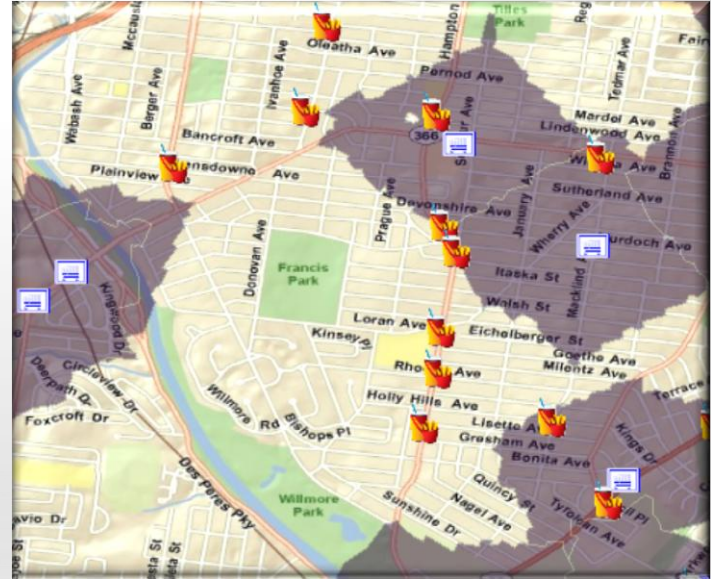


How GIS models food access

- **We know where the people are**
 - demographic data by census geography or household location
- **We know where the food is**
 - Locations of grocery stores, restaurants, etc.
- **We know how people travel**
- **People + Access + Food**

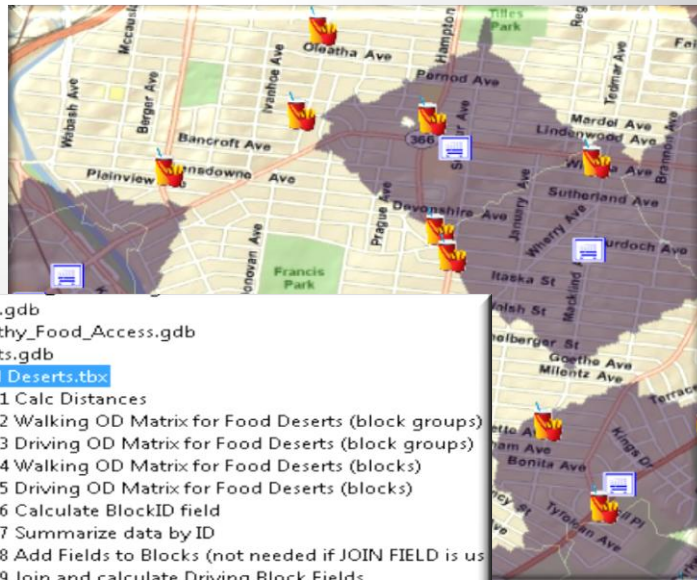
How do people get to the food?

- **Walking**
 - 0.5 mile (10 minutes @ 3 mile per hour)
 - 1 km
 - 1.0 mile
- **Driving**
 - 10 minutes
 - 15 minutes
- **Other**
 - Mass transit / walking
 - Cycling
 - A service where they live (nursing home, college campus)



Project Goals

- Relate to existing studies and literature
- Draw on experience with food retailers
- Improve the measures of distance and access
- Make maps available at a useful scale
- Make local studies easier to do
- Support local efforts looking at the food environment



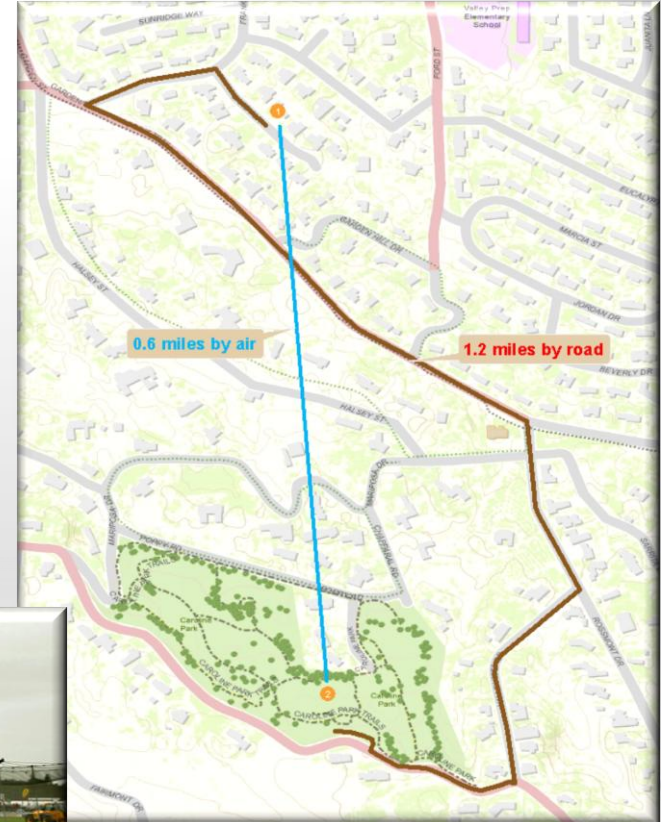
Access Measures Evaluated

- Rings aka straight line or crow flight distance
- Service areas based on a network
- Origin-Destination matrix based on a network

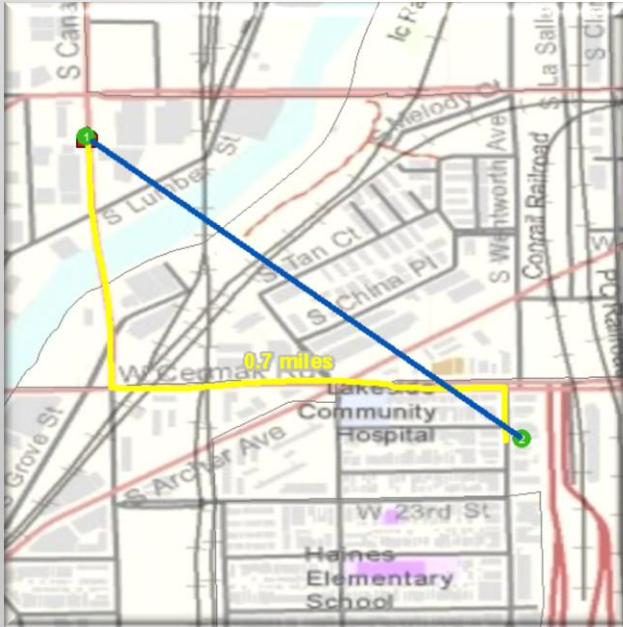


“Crow flight” distance v. Network distance

- Straight line distance ignores the actual landscape in which we move.
- Network distance accounts for it, and allows modeling of real-world factors such as rate of travel, slope, turn restrictions, blocked roads, one-way streets, pedestrian-capable segments, etc.
- 50% and higher error rates are common with crow flight, causing gross overestimation of access



Example: origin-destination matrix

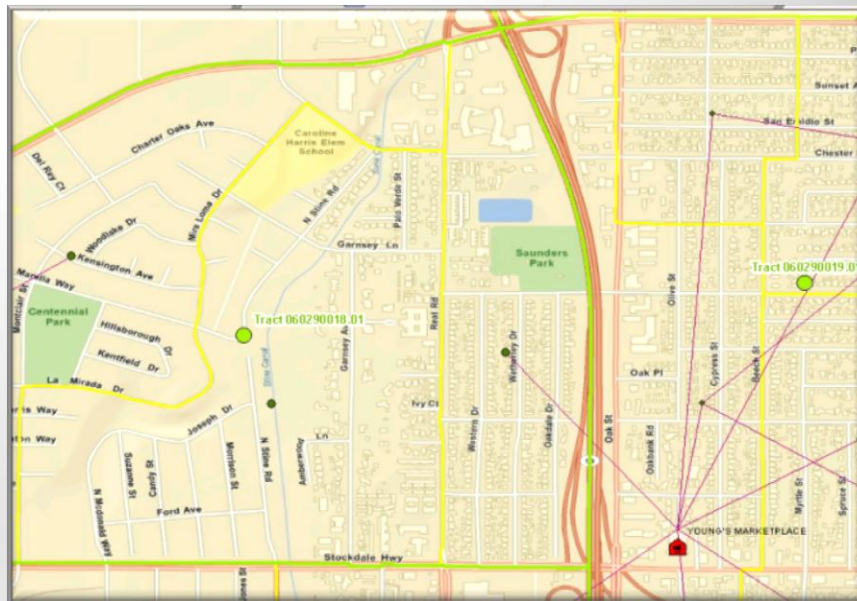


The OD cost matrix analysis calculates the least-cost **network paths (in yellow, above)** from origins to destinations. It outputs line features (in blue, above) that link origins to destinations.

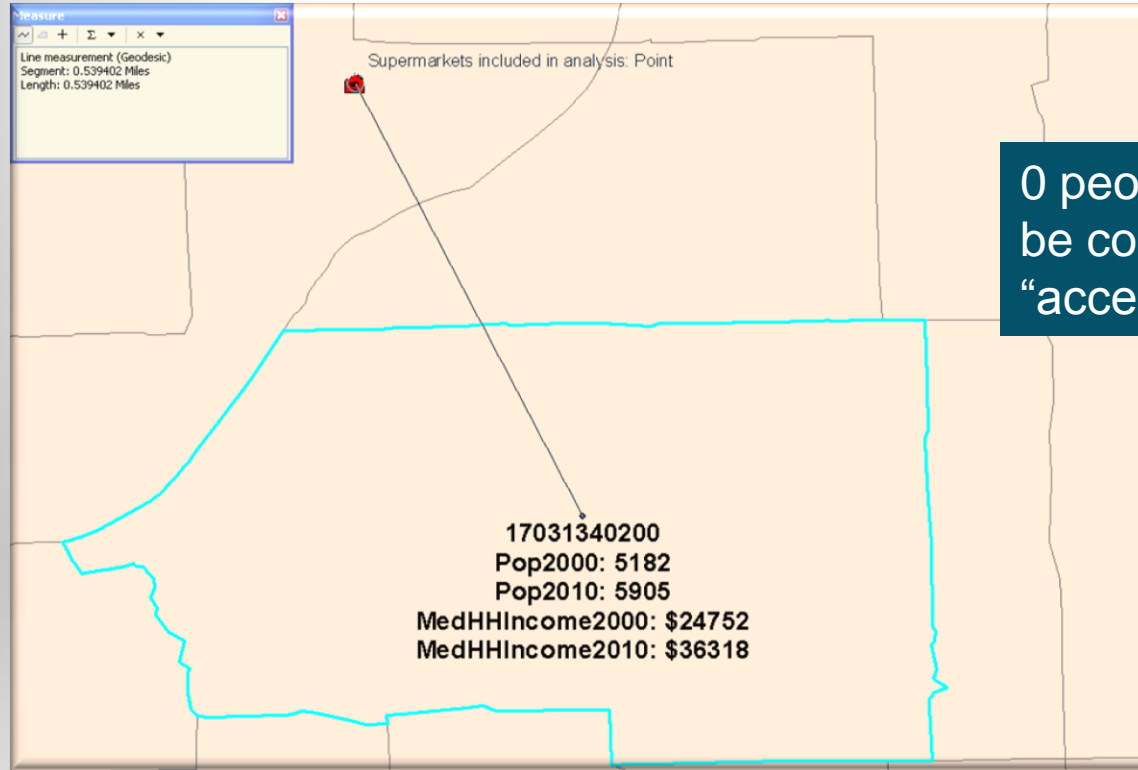
Each line feature stores the total network cost of the trip as an attribute value. Analysts often take the attribute table and use it as input for linear programming applications.

Improve the use of population data

- **Many analyses at tract level**
 - **Convenient**
 - **Resulting maps are good for policy making but do not show neighborhood level details**
 - **Access is experienced at a scale smaller than tracts.**
 - **Most retailers use more detailed data in a GIS**
 - **Household level data is ideal, but can be hard to come by**

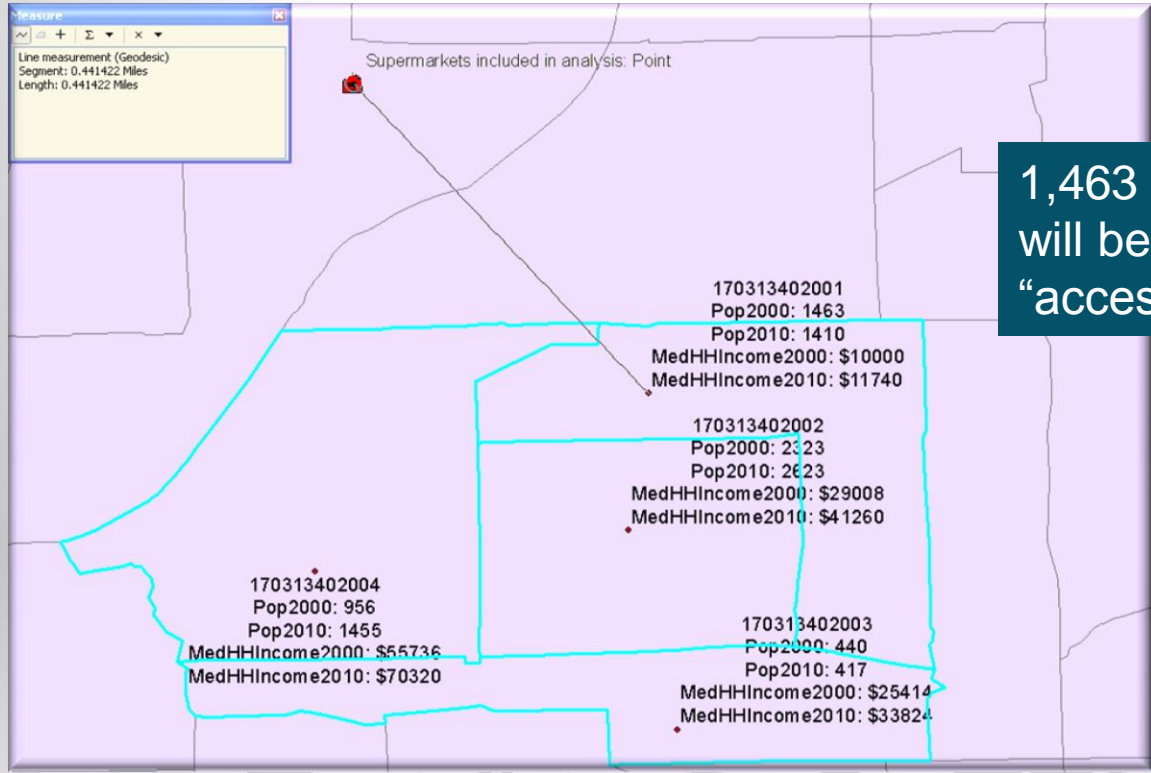


Ring Example: a census tract 0.53 miles from a supermarket



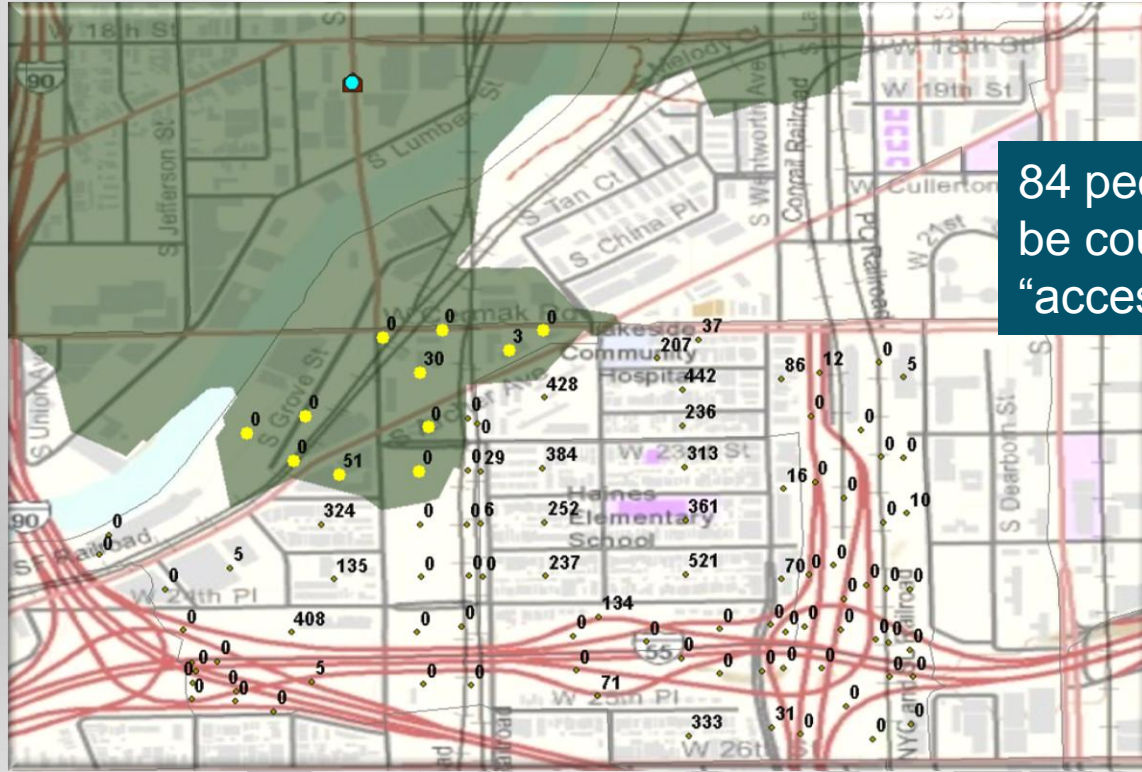
0 people out of 5,182 will be counted as having “access”

Ring Example: 1 block group is within 0.5 mile (1463 people)



1,463 people out of 5,182 will be counted as having "access"

Network Example: 11 blocks are within 0.5 mile (84 people)



84 people out of 5,182 will be counted as having “access”

Supermarket Access Layer = People + Access + Food

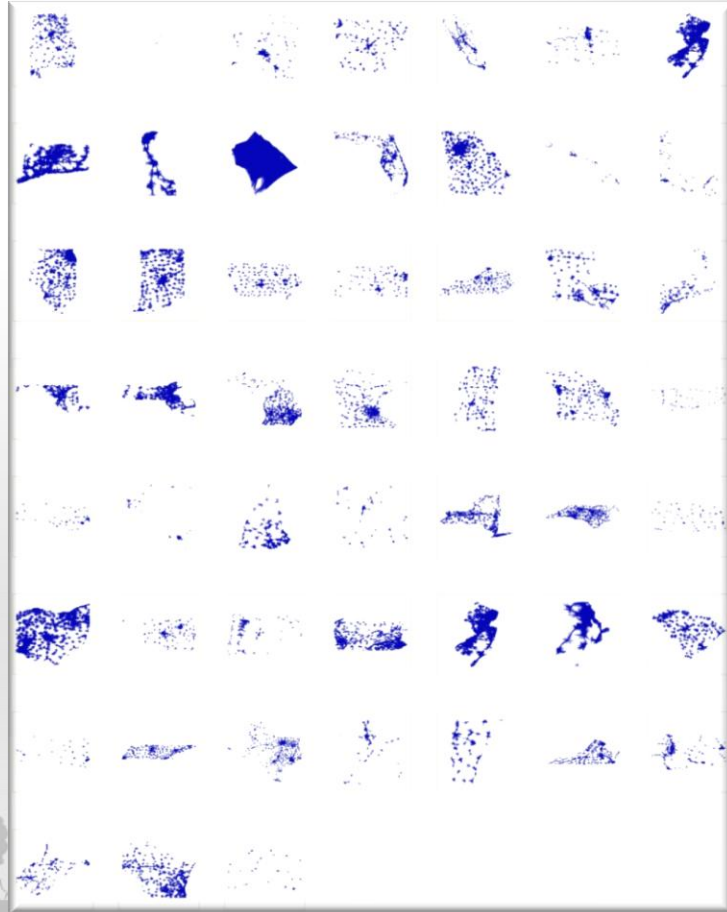
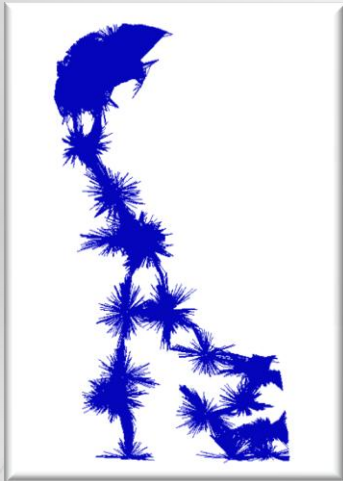
- 8 million Census block centroids placed in an Origin-Destination matrix with 26,627 Supermarkets



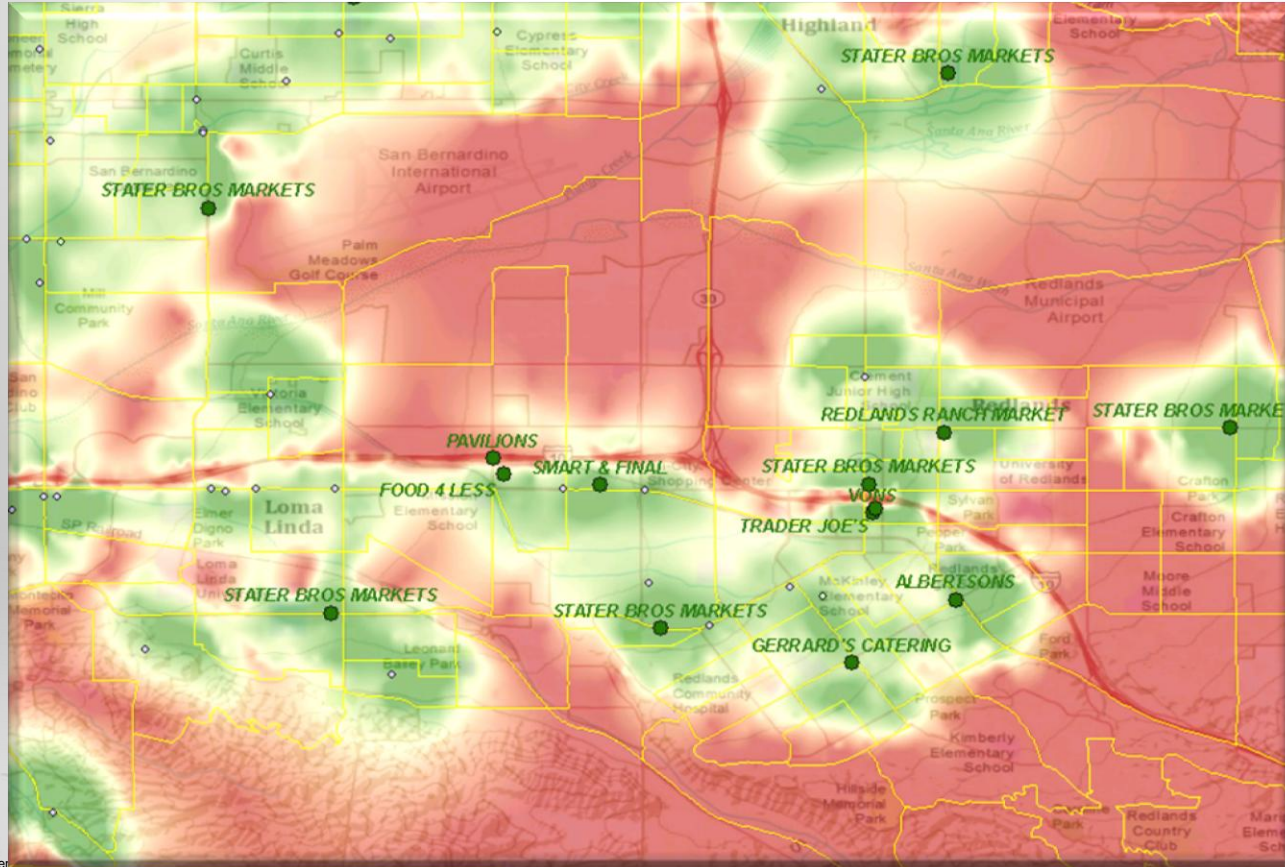
- Walk Score = 10 minute walk along pedestrian-capable streets
- Drive Score = 10 minute drive along the full road network
- Summarized by block
 - Mean distance to nearest store
 - Number of stores within 10 minutes' effort
- Spatial Analyst Interpolation used to create a heat map

Results

- 50 states + DC
 - Used new iterators in ModelBuilder
 - For each block, count how many supermarkets are within threshold

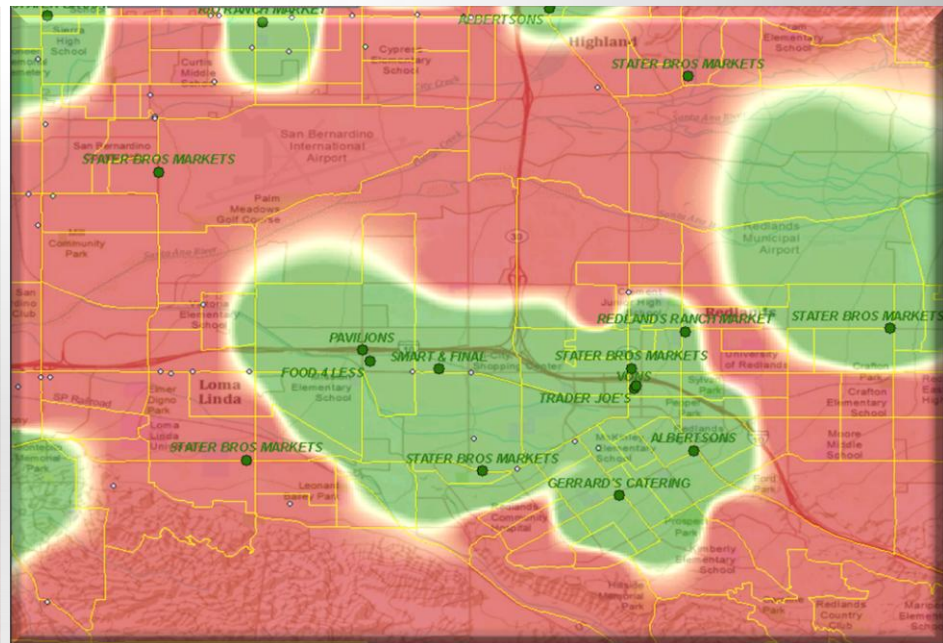
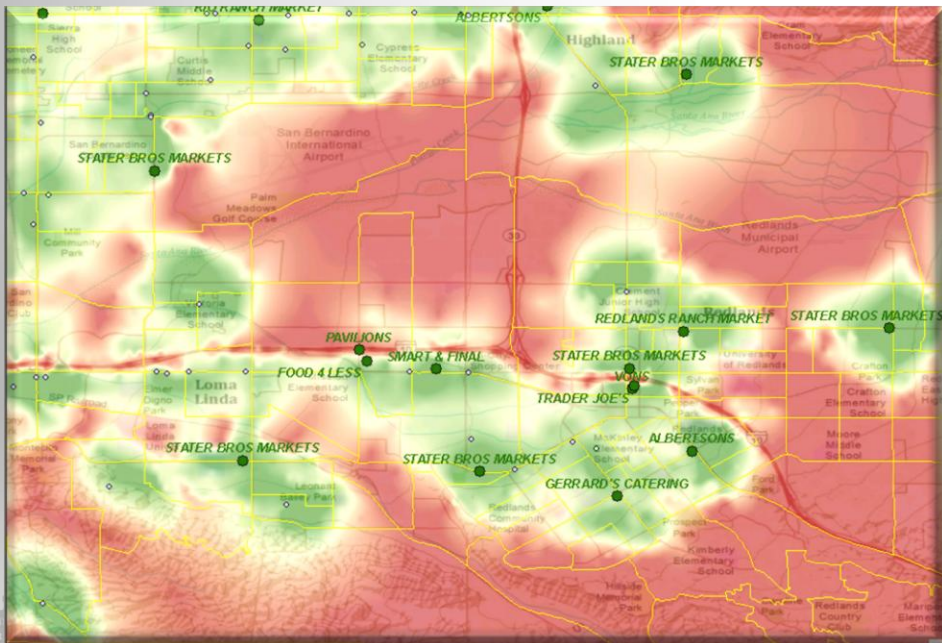


Food Desert – block level, 1 mile walk

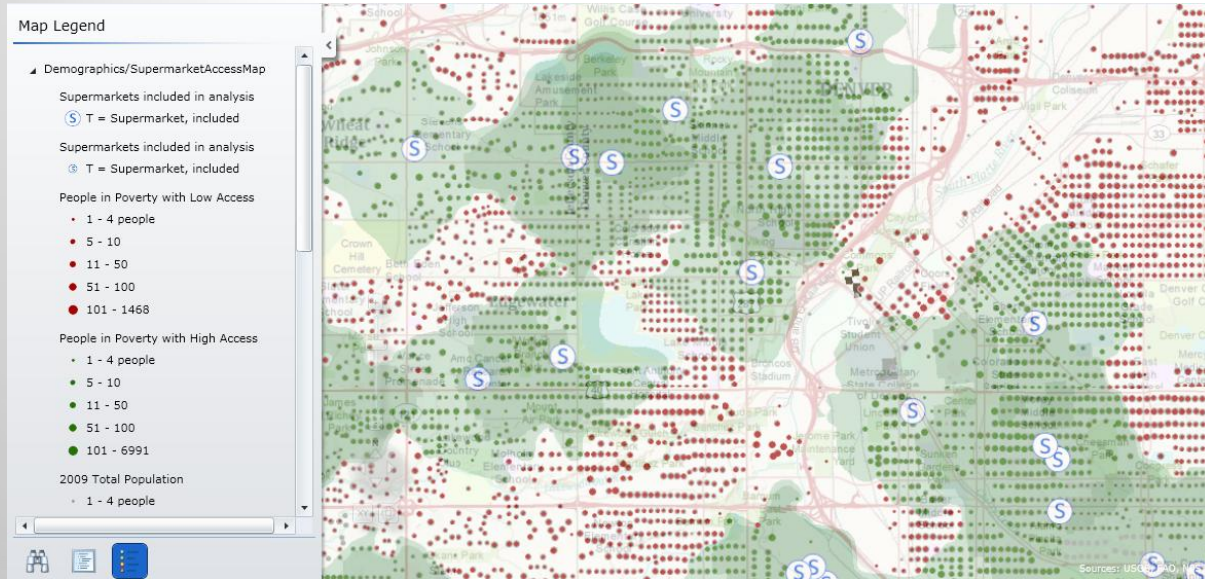


Food Desert – blocks v. block groups

- The combination of distance threshold and scale of analysis can begin to ignore real world features which affect access (interstates, rivers, lakes)



Supermarket Access Score sample map



About 80% of U.S. households have a score > 0

Opportunity: 20% of U.S. households have less equal access to good food at supermarkets.

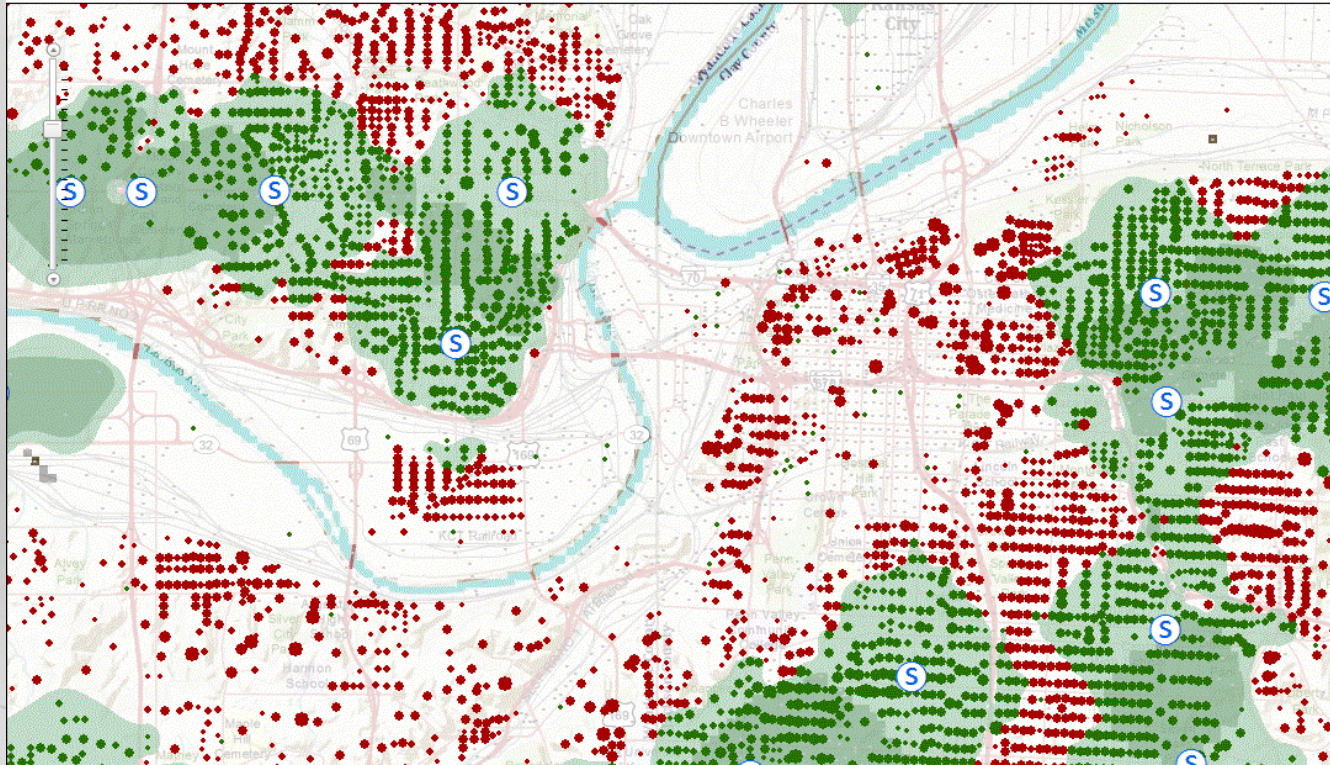
That is 23 million households underserved (vs. USDA estimate of 2-7 million)

That is 62 million people under served, or 6,200 NYC sized stores.

Kansas City, MO

ArcGIS JavaScript API: Demographics/SupermarketAccessMap3

Built using the [ArcGIS JavaScript API](#)



Next Steps

- **“Healthy Food Access” map** (heat map, dot map)
 - For background map, research, apps, iPhone
- **“Am I in a Food Desert?” application**
 - Enter your address to see if you live in a food desert
- **“Healthy Food Access” application**
 - Enter your address, view your HFA score
 - Score the stores to more accurately represent your local situation
 - Runs the model again to show you the effects
 - VGI approach gives us actionable, local information
 - Esri updates the national map periodically to share local knowledge
- **Share ModelBuilder model used to create the HFA map**
- **Other access analyses (parks, freeway exits, mass transit stops)**

More Information ... and Thank You!

- **Jim Herries**

- 909-793-2853 ext 1-2489

- jherries@esri.com

-  **jherries**

Useful reports and articles

- [USDA report to Congress](#)

- [NYC report](#)

- [Chicago](#)

- [California Center for Public Health Advocacy](#)

- [The Effect of Fast Food Restaurants on Obesity](#)

- [SDSU Study](#)

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