

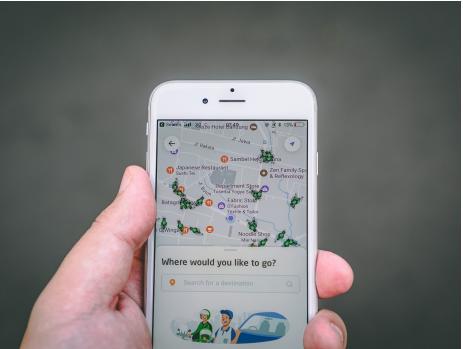
# Utility-Based Accessibility to Community Resources: An Application of Location-Based Services Data

NARSC Annual Conference

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# Outline

- Access to community resources
- Methodology
- Results
  - Choice Models
  - Accessibility
- Future Work

# Access to Community Resources

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# Access to Community Resources

- Lack of consistency in spatial impact findings
  - Parks access and physical / mental health
  - Nutrition access and physical health
  - Libraries and community membership / educational attainment
- Frustrating inconsistency in spatial definitions
  - Percent of green space within 5 miles / any park within 10 minute walk, etc.
  - A “high-quality” grocery store within 1 mile

# Utility-based Access

A destination choice model logsum gives a measure of access

$$A_i = \ln \sum_{j \in J} \exp(u_{ij})$$

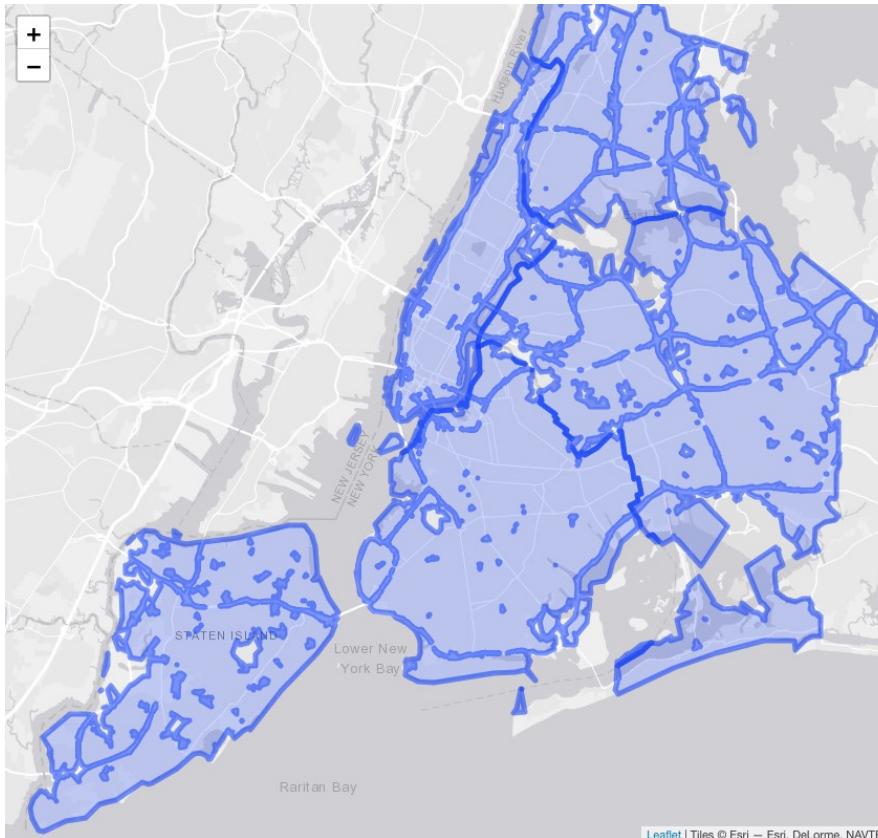
Where  $u_{ij}$  is the *utility* of destination  $j$ ,

$$u_{ij} = f(t_{ijk}, X_j, \beta)$$

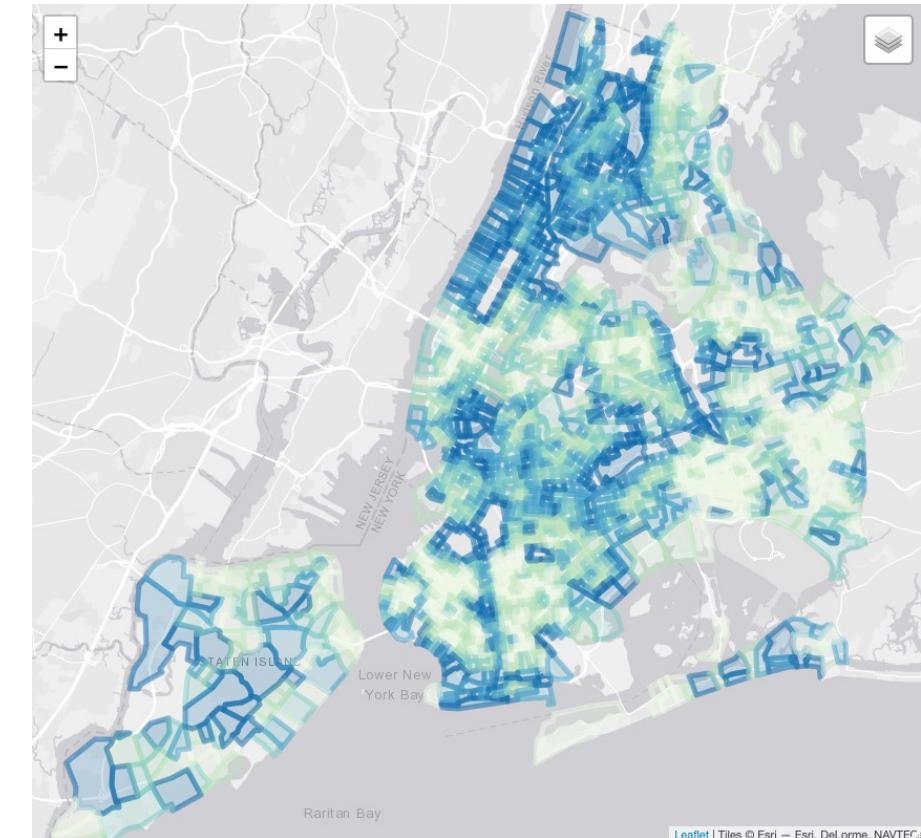
Problem: how to get plausible estimates of  $\beta$ ?

# Buffers vs Utility-based Access

**ParkScore**  
**10-minute network walk to any park**



**Kinnel et al (2006)**  
**Park choice utility logsums**



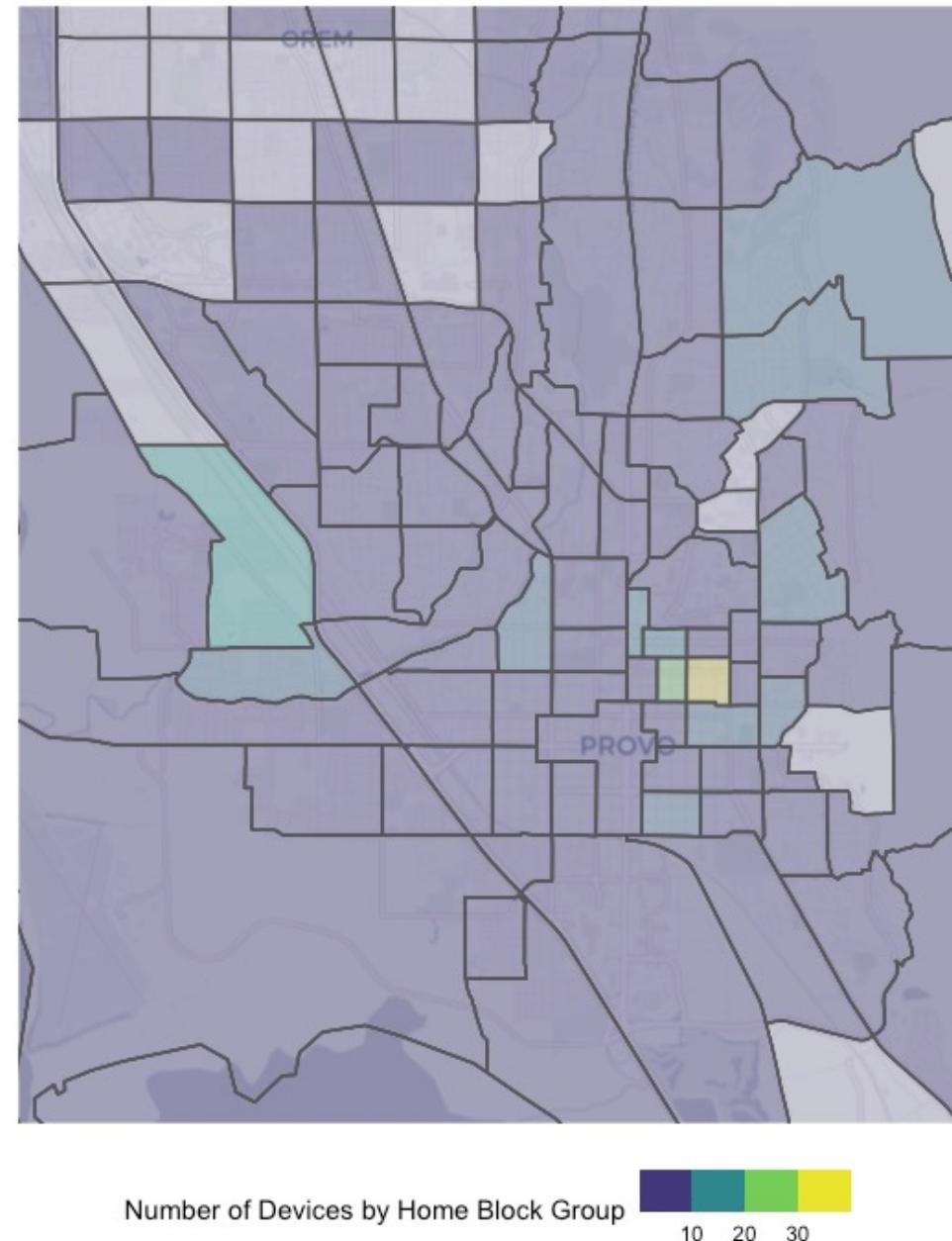
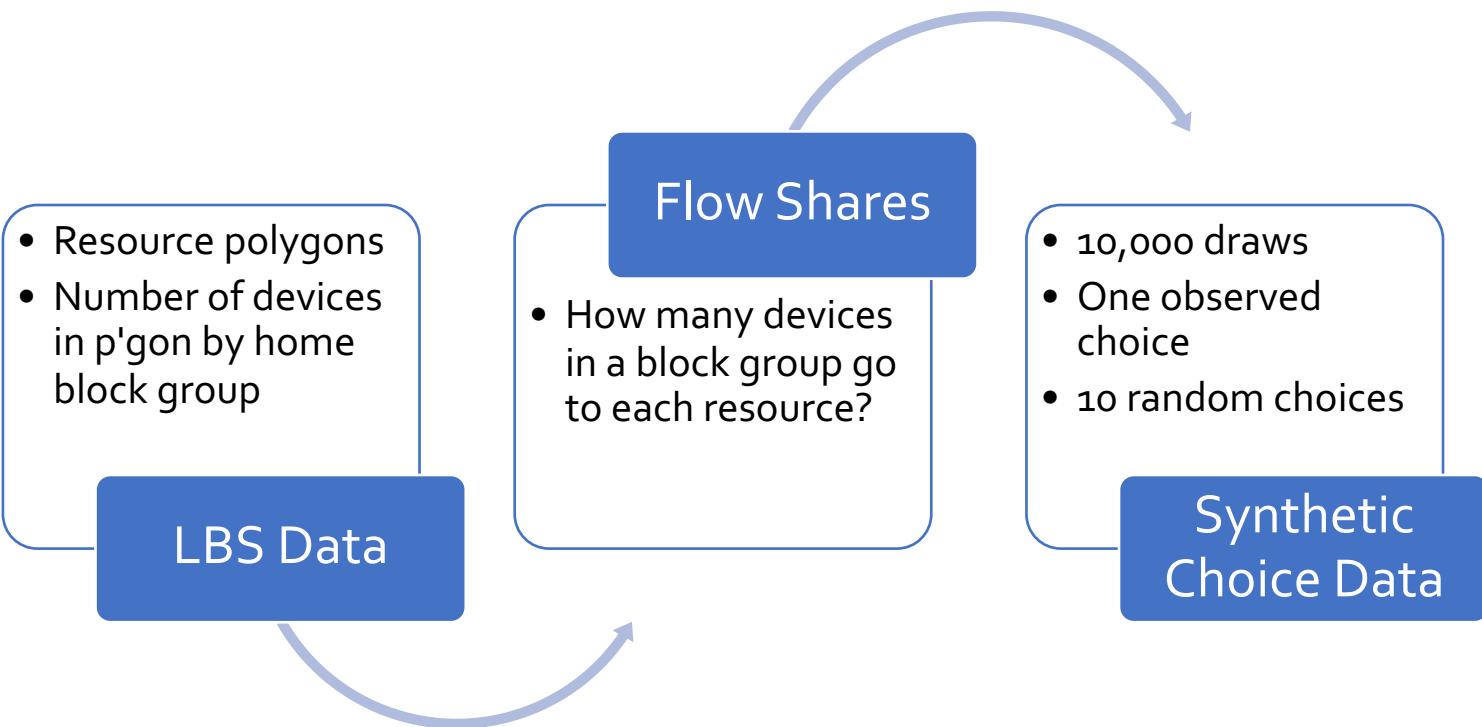
# Methodology

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# Objective

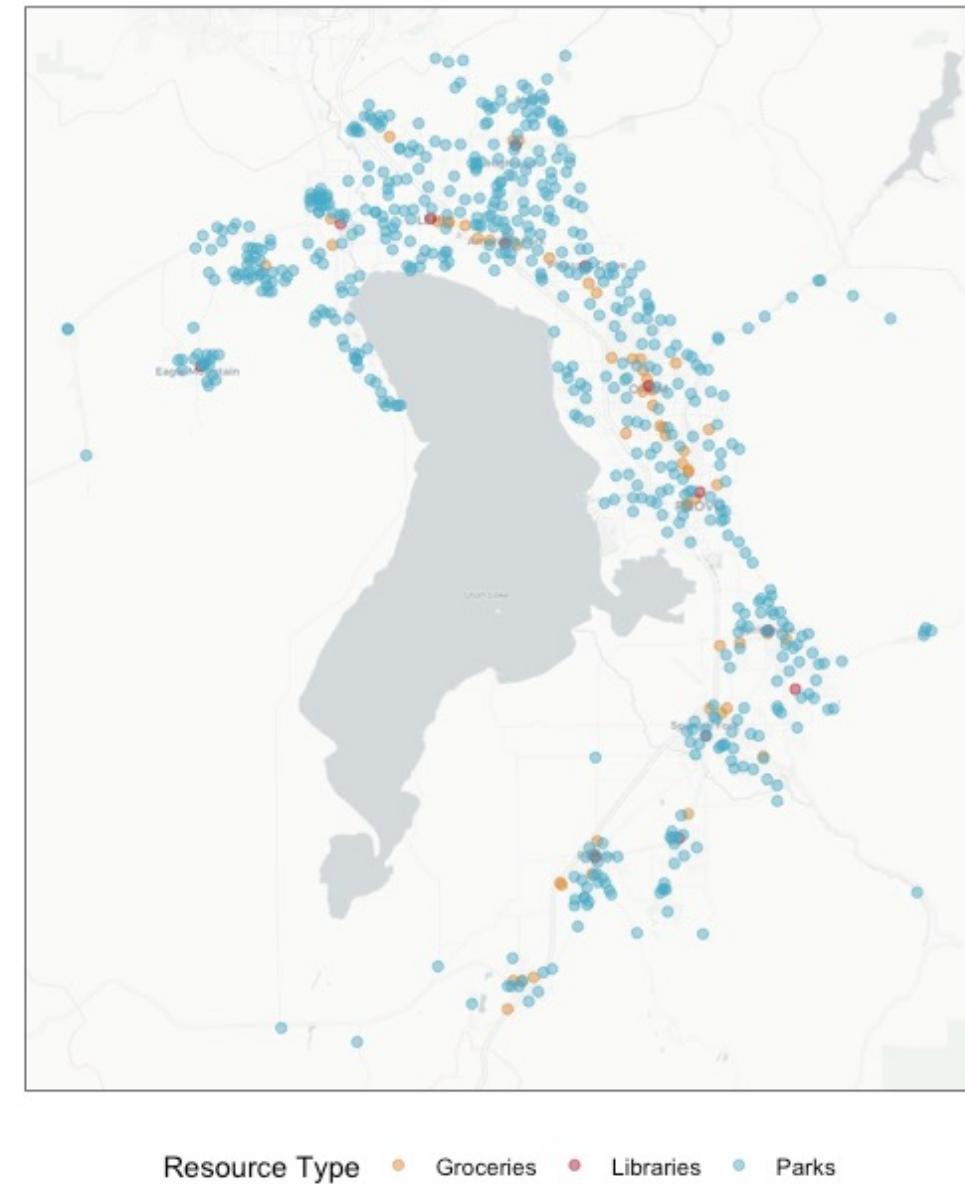
- Estimate initial destination choice models for multiple community resources
- Construct a composite utility-base accessibility measure
- Consider discrepancies between this and a travel-time buffer

# Location-based Services Data



# Resources in Utah County

- Attributes from OpenStreetMap
  - Parks: manual satellite imagery and in-person validation
  - Grocery stores: in-person NEMS-S data collection
  - Libraries: websites and in-person



# Travel Times

From population-weighted block group centroid to resource

- Auto
- Transit (including wait and transfer)
- Walk
- Mode choice logsum (multimodal impedance)

$$V_{ij\text{auto}} = -0.028 * (t_{ij\text{auto}})$$

$$V_{ij\text{transit}} = -4 - 0.028 * (t_{ij\text{transit}}) - 0.056 * (wt_{ij}) - 0.372 * (at_{ij})$$

$$V_{ij\text{walk}} = -5 - 0.028 * (t_{ij\text{walk}}) - 1.12 * (d_{ij} | d_{ij} < 1.5) - 5.58 * (d_{ij} | d_{ij} \geq 1.5)$$

# Results

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## Park Destination Choice Utilities

	<b>Car</b>	<b>MCLS</b>	<b>Attributes</b>	<b>All - Car</b>	<b>All - Logsum</b>
Drive time	-0.215(-95.949)**			-0.209(-69.212)**	
Mode Choice		7.678(95.958)**			7.450(69.216)**
Logsum					
log(Acres)			1.308(77.120)**	1.300(46.869)**	1.301(46.858)**
Playground			4.567(33.939)**	4.476(30.127)**	4.477(30.118)**
Volleyball			-0.369(-9.580)**	-0.663(-11.065)**	-0.664(-11.067)**
Basketball			-0.669(-15.625)**	-0.534(-7.632)**	-0.535(-7.642)**
Tennis			-0.549(-13.065)**	-0.884(-14.678)**	-0.886(-14.693)**
Num.Obs.	8,984	8,984	8,984	8,984	8,984
Log Likelihood	-9,288.8	-9,284.7	-11,822.1	-4,774.9	-4,772.2
McFadden Rho-Sq	0.569	0.569	0.451	0.778	0.778

t-statistics in parentheses. \* p < 0.5, \*\* p < 0.1

### Grocery Destination Choice Utilities

	<b>Attributes</b>	<b>Size</b>	<b>All - Logsum</b>
Mode Choice Logsum			7.733(78.399)**
Convenience Store	-2.339(-11.310)**	-1.600(-7.684)**	-1.488(-6.773)**
Other non-standard	-1.894(-14.604)**	-1.255(-9.554)**	-1.056(-7.490)**
Has pharmacy	0.616(19.421)**	0.329(8.901)**	0.249(5.502)**
Ethnic market	-1.680(-16.846)**	-0.997(-9.750)**	-0.884(-8.078)**
Has other merchandise	1.523(48.309)**	0.769(19.144)**	0.882(17.660)**
Number of registers		0.073(42.117)**	0.083(36.294)**
Number of self-checkout		0.031(15.255)**	0.027(10.041)**
Num.Obs.	8,404	8,404	8,404
Log Likelihood	-16,898.4	-15,806.6	-8,802.2
McFadden Rho-Sq	0.161	0.216	0.563

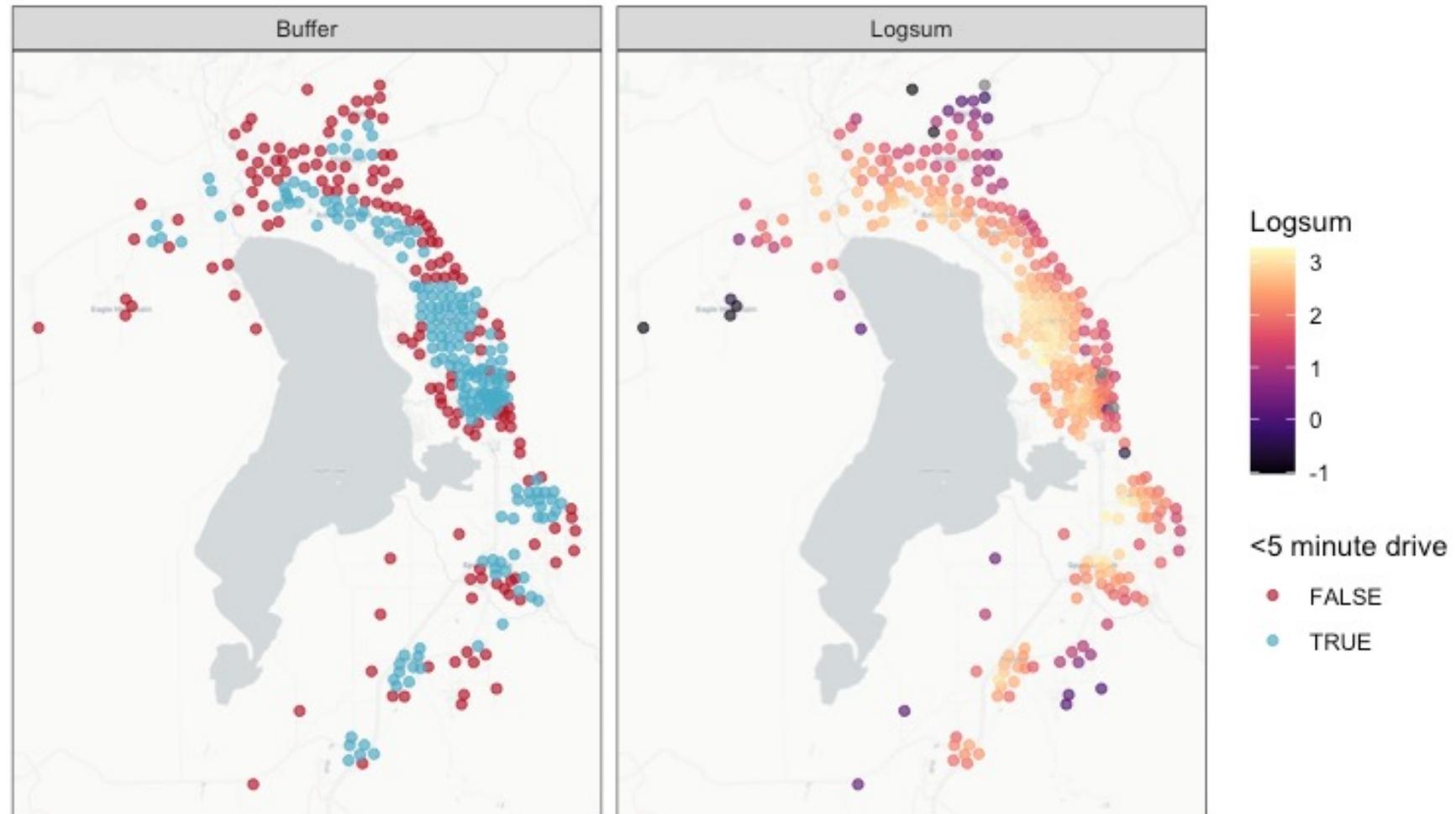
t-statistics in parentheses. \* p < 0.5, \*\* p < 0.1

### Library Destination Choice Utilities

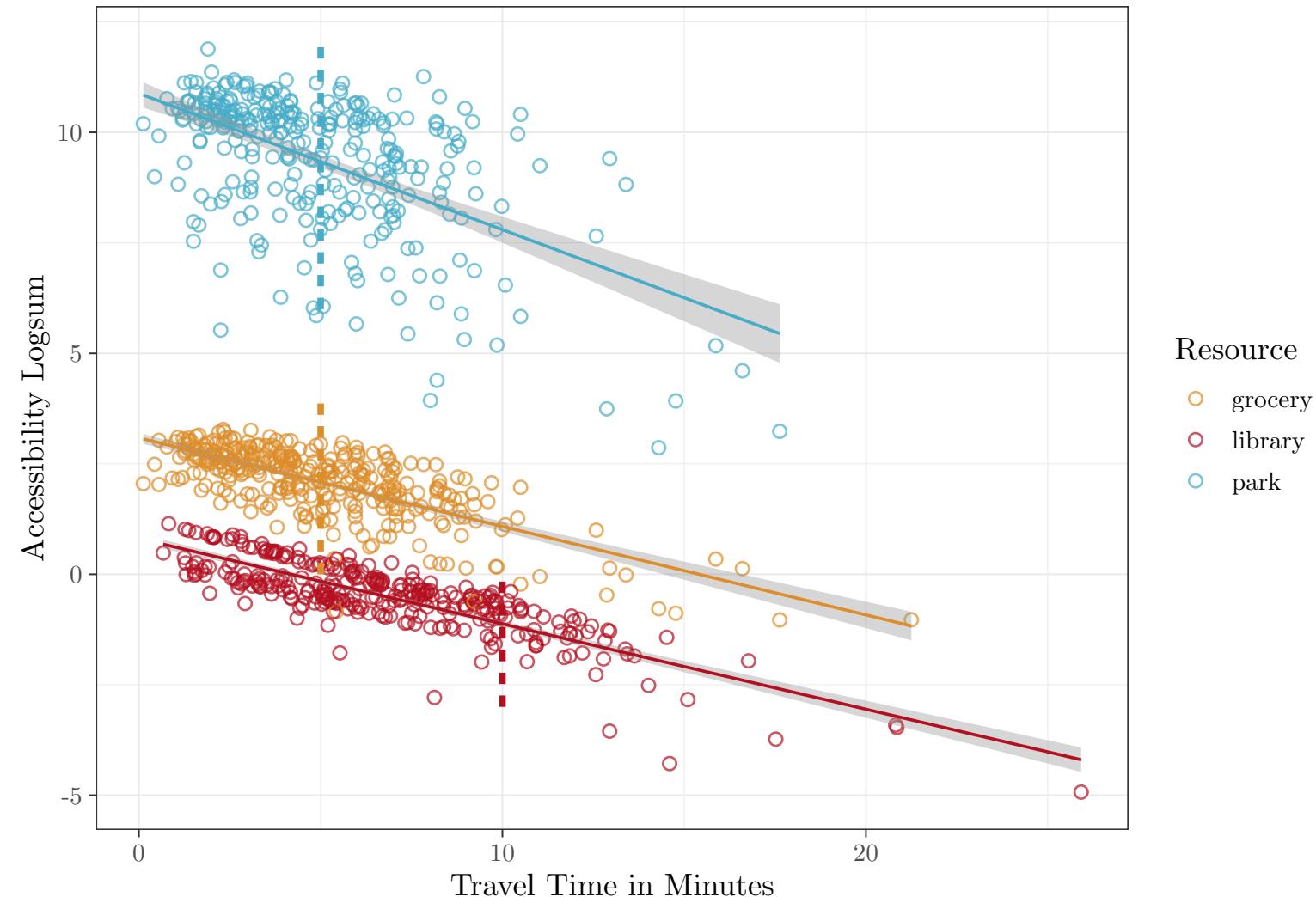
	<b>Attributes</b>	<b>All - Logsum</b>
Mode Choice Logsum		8.270(89.266)**
Offers Classes	1.318(44.405)**	1.257(23.033)**
Genealogy Resources	-1.127(-44.021)**	-1.024(-25.601)**
Num.Obs.	9,816	9,816
Log Likelihood	-21,944.4	-10,321.7
McFadden Rho-Sq	0.068	0.561

t-statistics in parentheses. \* p < 0.5, \*\* p < 0.1

# Grocery 5-minute Buffer vs Logsum

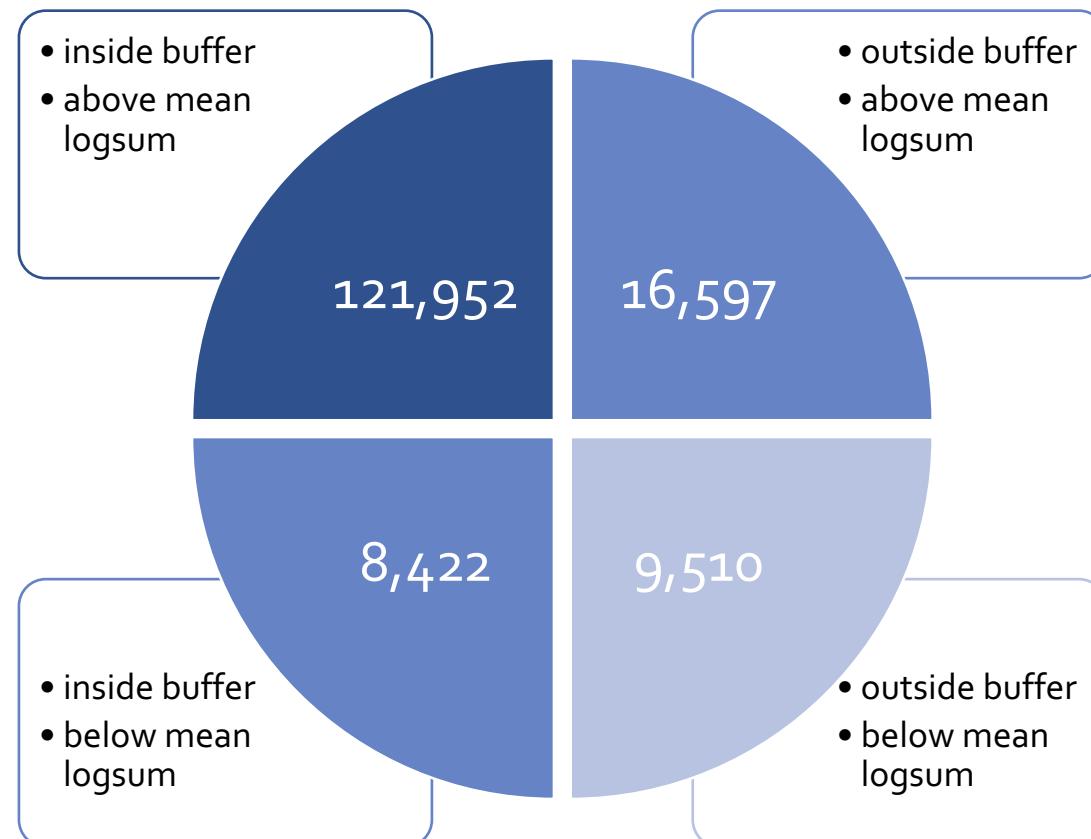


# Travel Time vs Logsum

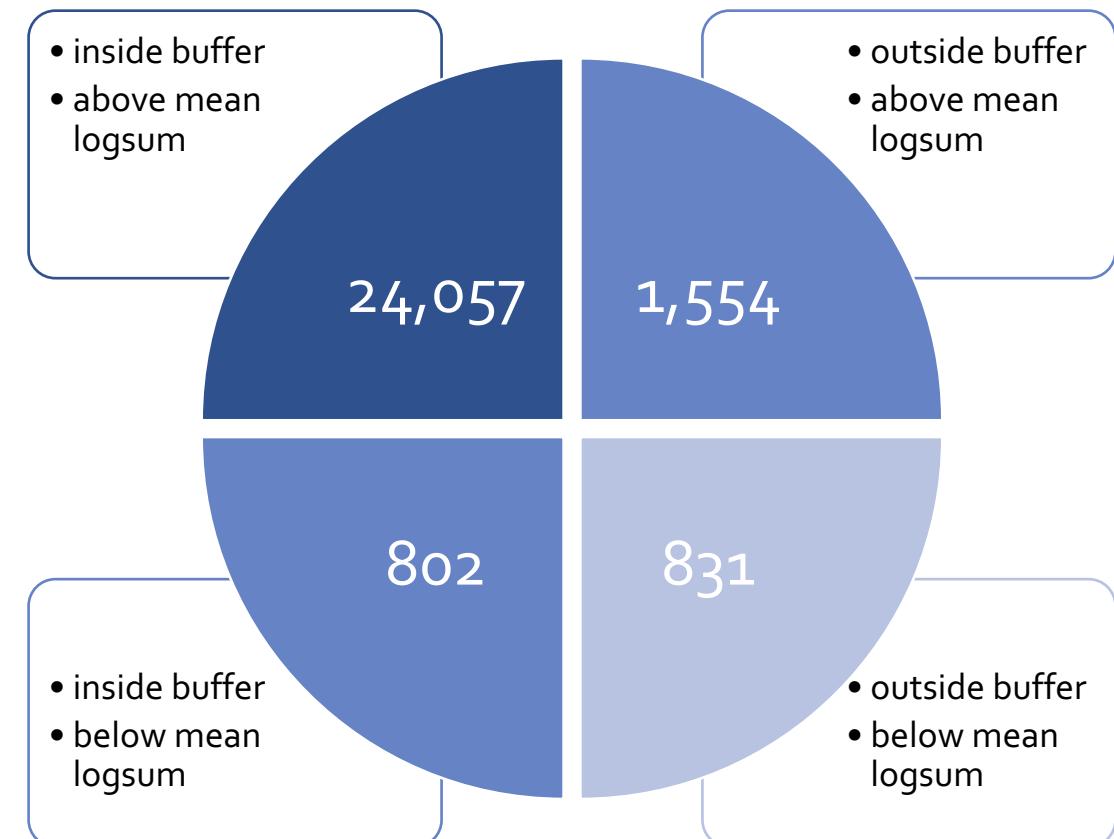


# Equity implications of Access Definition

## All Households



## Low-income (<\$35k) Households



# Limitations / Future Work

- Ongoing discussion about accuracy / fidelity of LBS data
- Refine choice models
  - Segment MCLS by income / ethnicity?
  - Synthetic population?
  - LOTS of stuff in NEMS-S
- More detailed equity analysis
  - What happens in rural / more diverse areas?

