USING *LEED for Neighborhood Development* TO COMPARE RESOURCE EFFICIENCY IN US CITIES

David Quinn, Artessa Saldivar-Sali, John E Fernández
djq@mit.edu, artessa@mit.edu, fernande@mit.edu

Massachusetts Institute of Technology

INTRODUCTION

This poster describes an approach for estimating the resource efficiency of a city. This is calculated using the location of residential areas and services, and the distance to these locations within the city. This analysis also explores three measures from the U.S. Green Building Council's *Leadership in Energy and Environmental Design for Neighborhood Development* (LEED-ND) [1]. This analysis was conducted on 21 US cities.

OBJECTIVE

The objective of this analysis is to estimate how the density of the city influences transportation energy. This was done using the following three steps:

1. Examine population distribution.
2. Calculate straight-line distance to services, and frequency that each service is visited.
3. Examine fraction of city that satisfied LEED-ND criteria.

ANALYSIS

This analysis was conducted using *ArcGIS*, *Python* scripts[a] and statistical analysis using *R*.
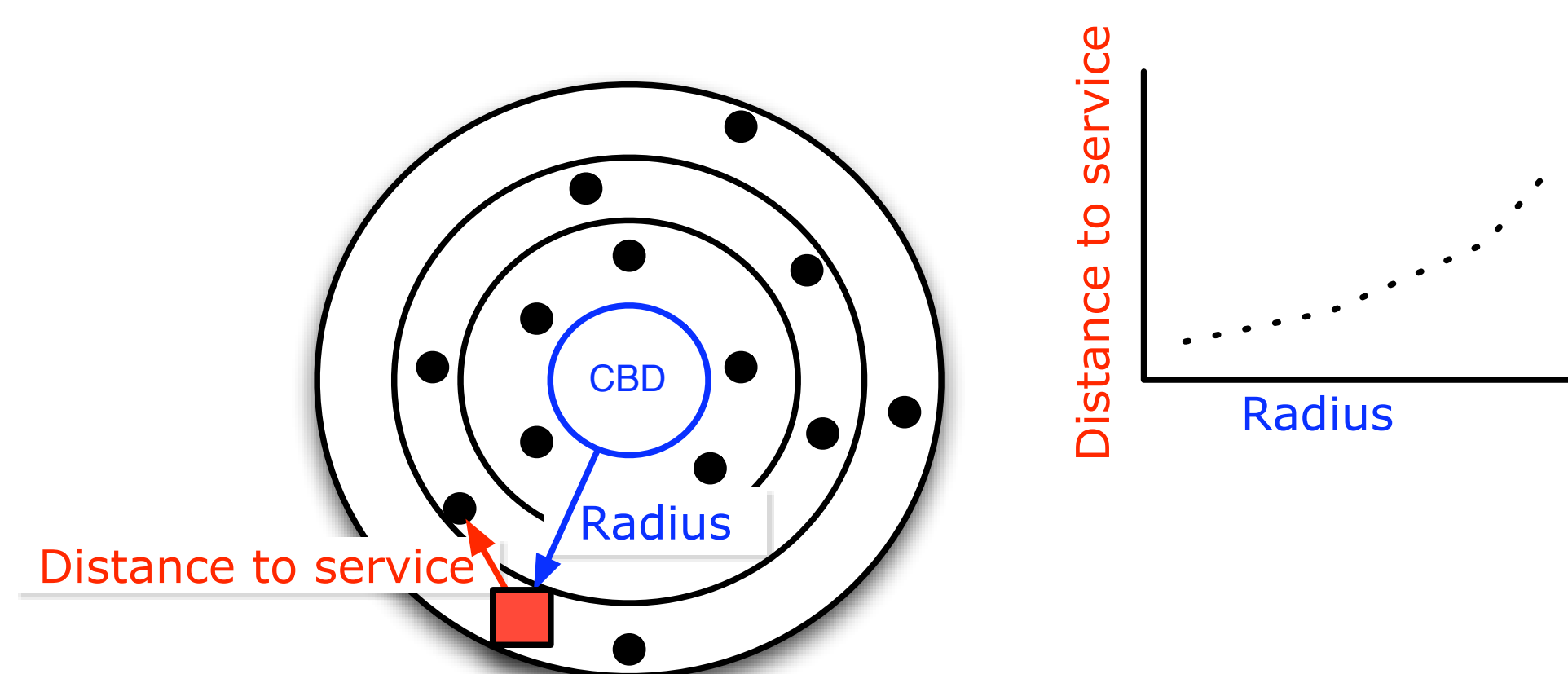

Figure 1: Distance to services
The estimated structure of this relationship is:

$$y = Ae^{br}$$

where y is the distance travelled per week by one household, r is the distance from the urban center, and A and b are parameters for each city. The value of b ranged from 0.031 to 0.048, while A varied from 17.7 to 41.9.

[a]The scripts used in the analysis are available at: http://www.urbmet.org/analysis

REFERENCES

[1] USGBC, LEED for Neighborhood Development http://www.usgbc.org/DisplayPage.aspx?CMSPageID=148

DATA

- Population data: US Census (2000) http://www.census.gov.
- Spatial data: US Census (2009) http://www.census.gov/geo/www.
- Service data: ESRI Business Analyst (2009) http://www.esri.com/software/bao (classified using North American Industrial Classification System)
- Service frequency: US Time Use Survey (2008) http://www.bls.gov/tus/

LEED-ND SERVICES

SERVICE	FREQUENCY [VISITS/WEEK]
Bank	0.370
Child care facility	0.382
Community/Civic center	1.078
Convenience store	2.556
Hair care	0.151
Hardware Store	1.379
Health club/Rec. facility	0.957
Laundry/dry cleaner	0.056
Library	0.254
Medical/Dental office	0.706
Pharmacy	2.044
Place of worship	0.900
Police/Fire station	0.002
Post Office	0.488
Restaurant	7.553
School	1.298
Senior care facility	0.204
Supermarket	1.173
Theater	0.823

CITY PARAMETERS
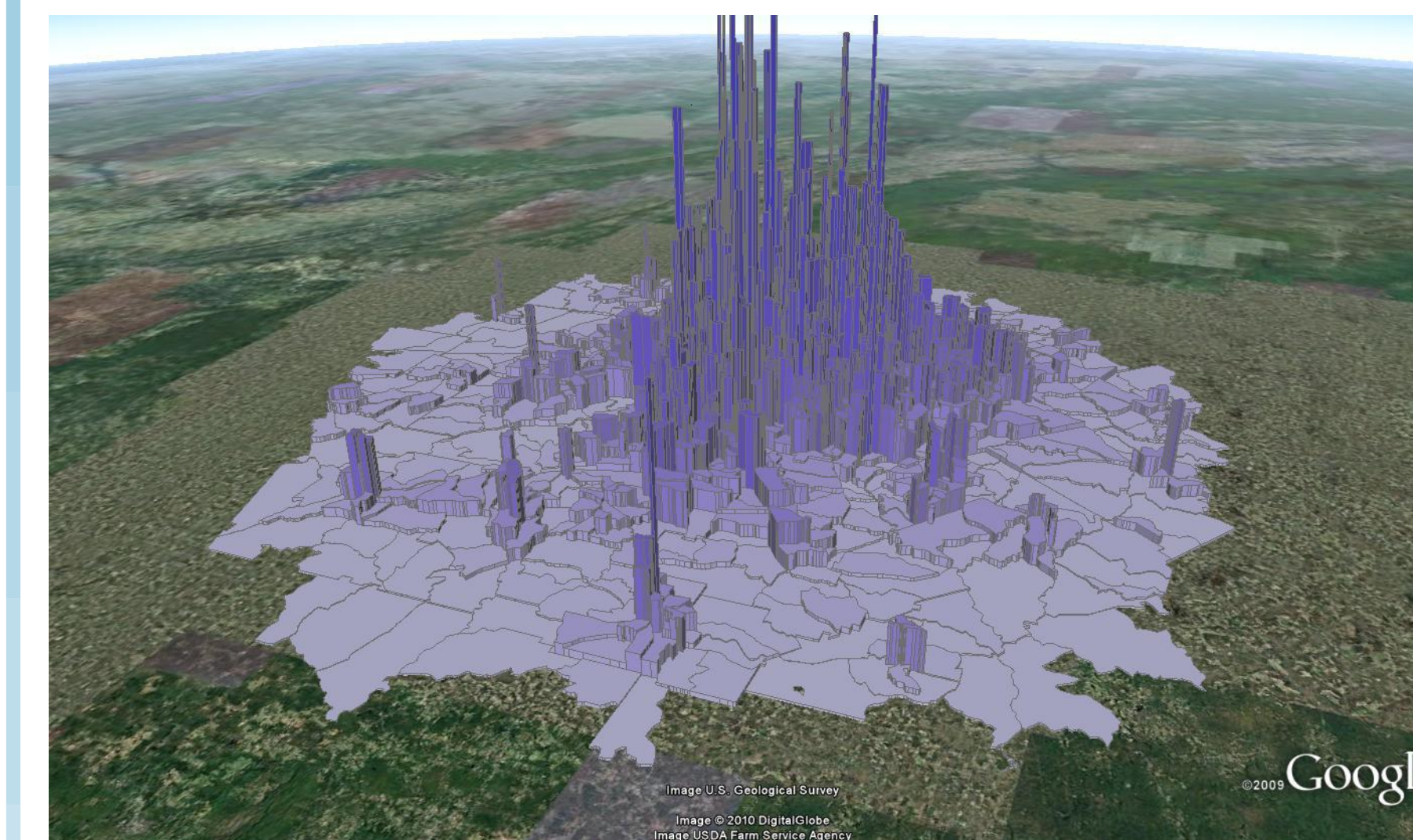
Figure 2: Population Density of Atlanta

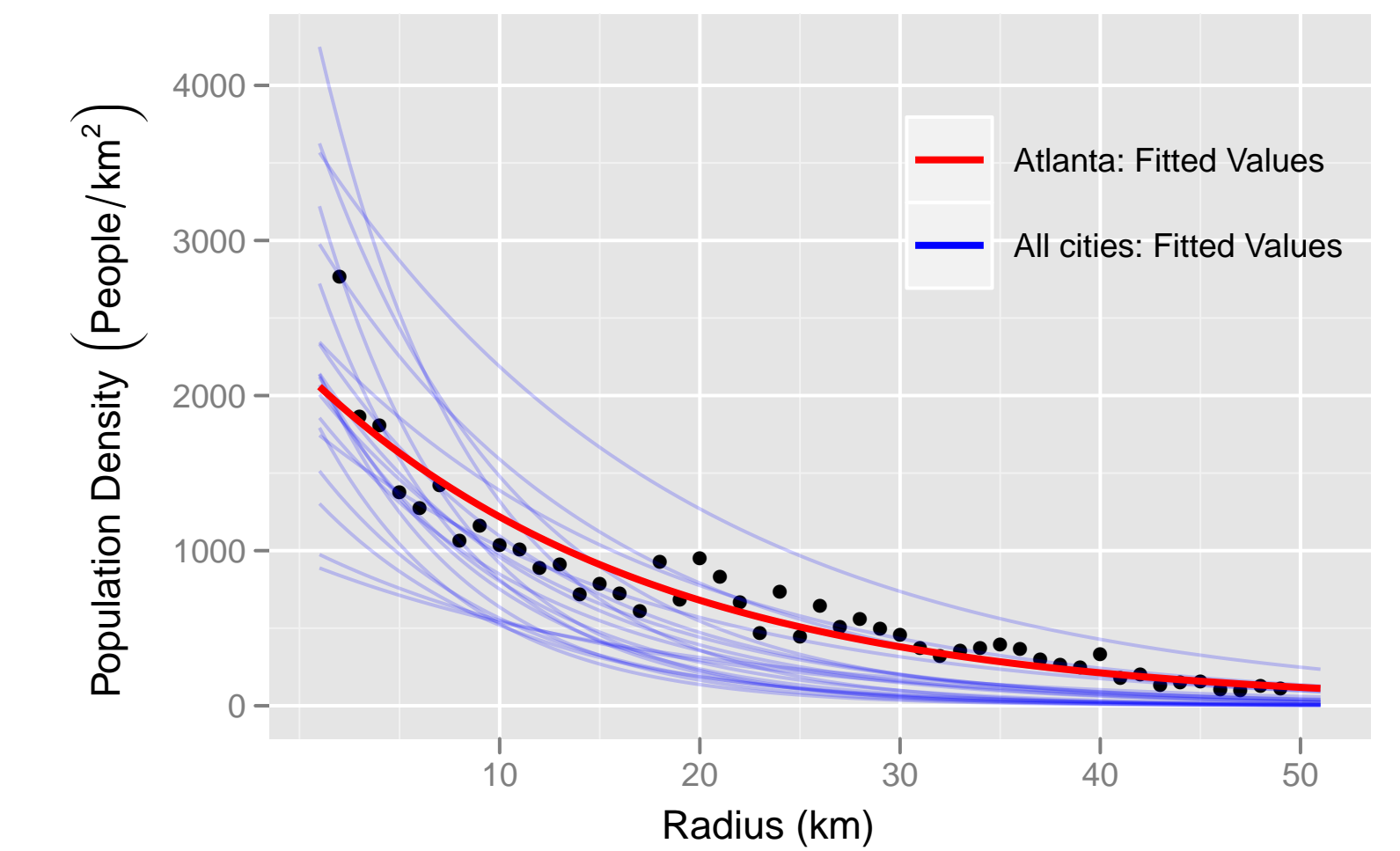**Figure 4: Population Density Gradient**
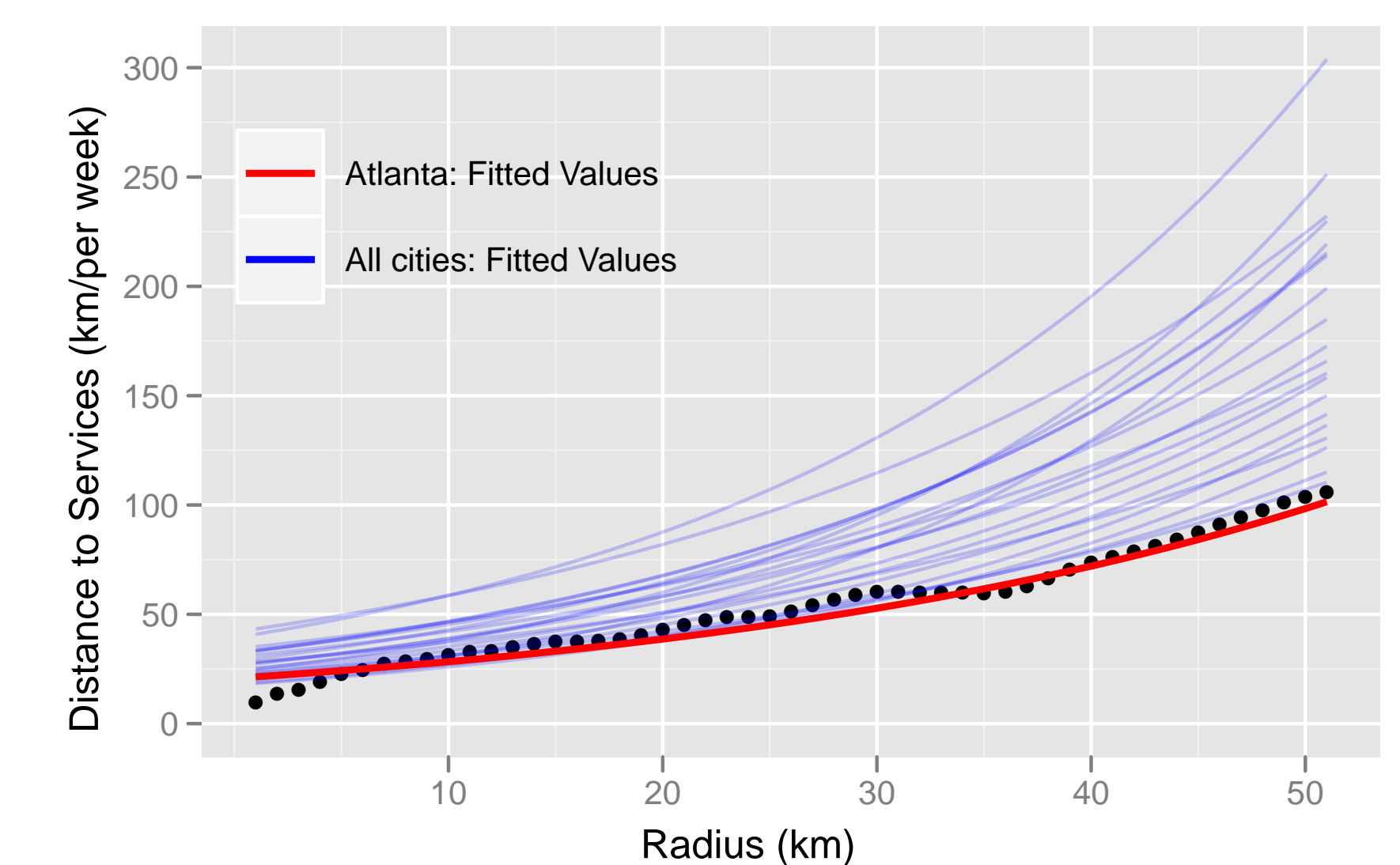

Figure 3: Service Density of Atlanta

Figure 5: Distance to Services

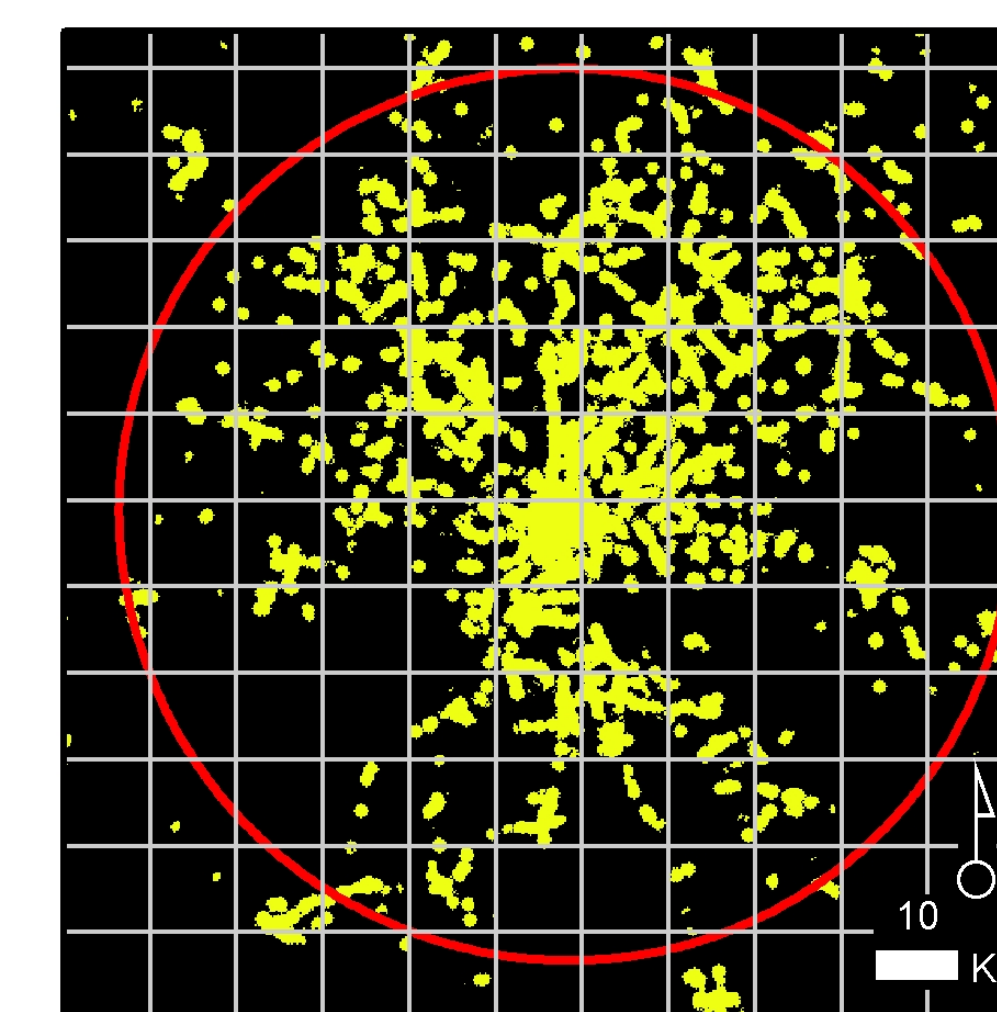## LEED-ND AT CITY SCALE - ATLANTA

Figure 6: Leed Criteria-SLL 1
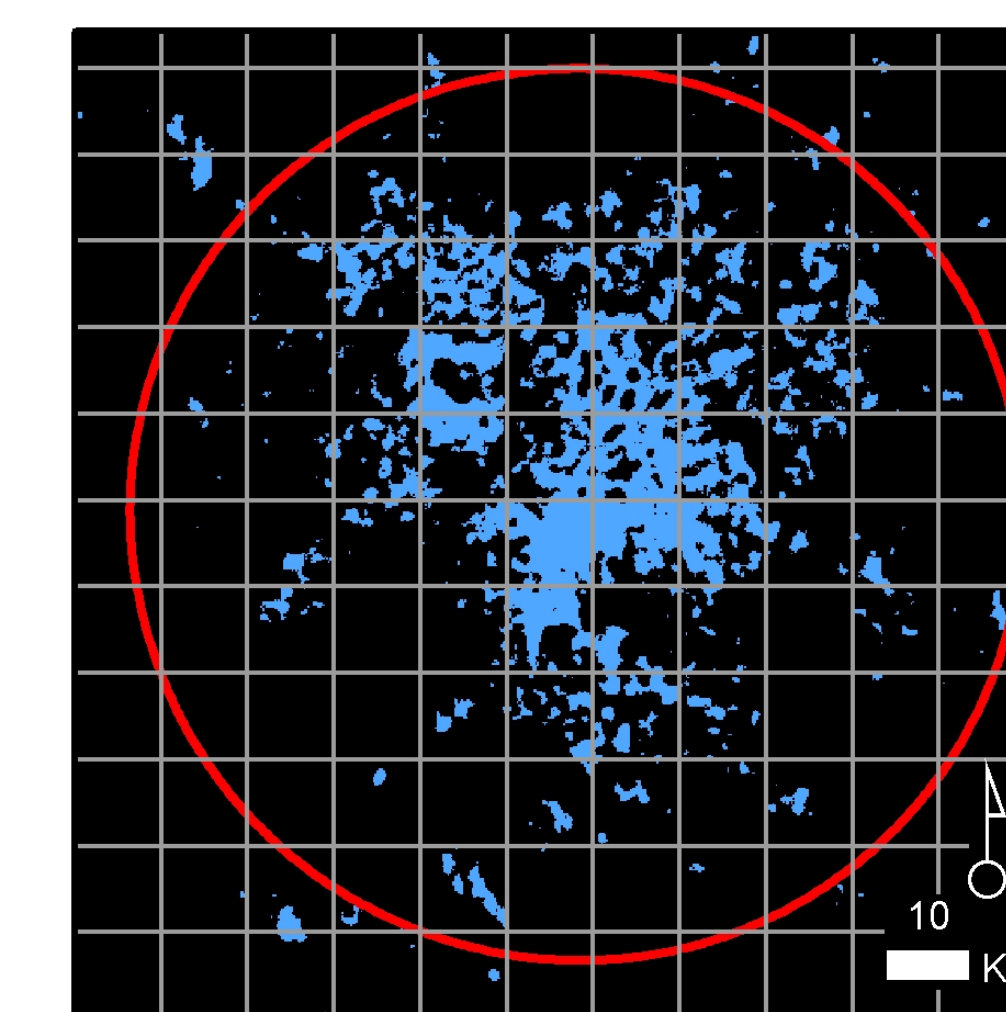Areas in Atlanta that are within 1/2 mile of 6 or more services.

Figure 7: Leed Criteria-SLL 3
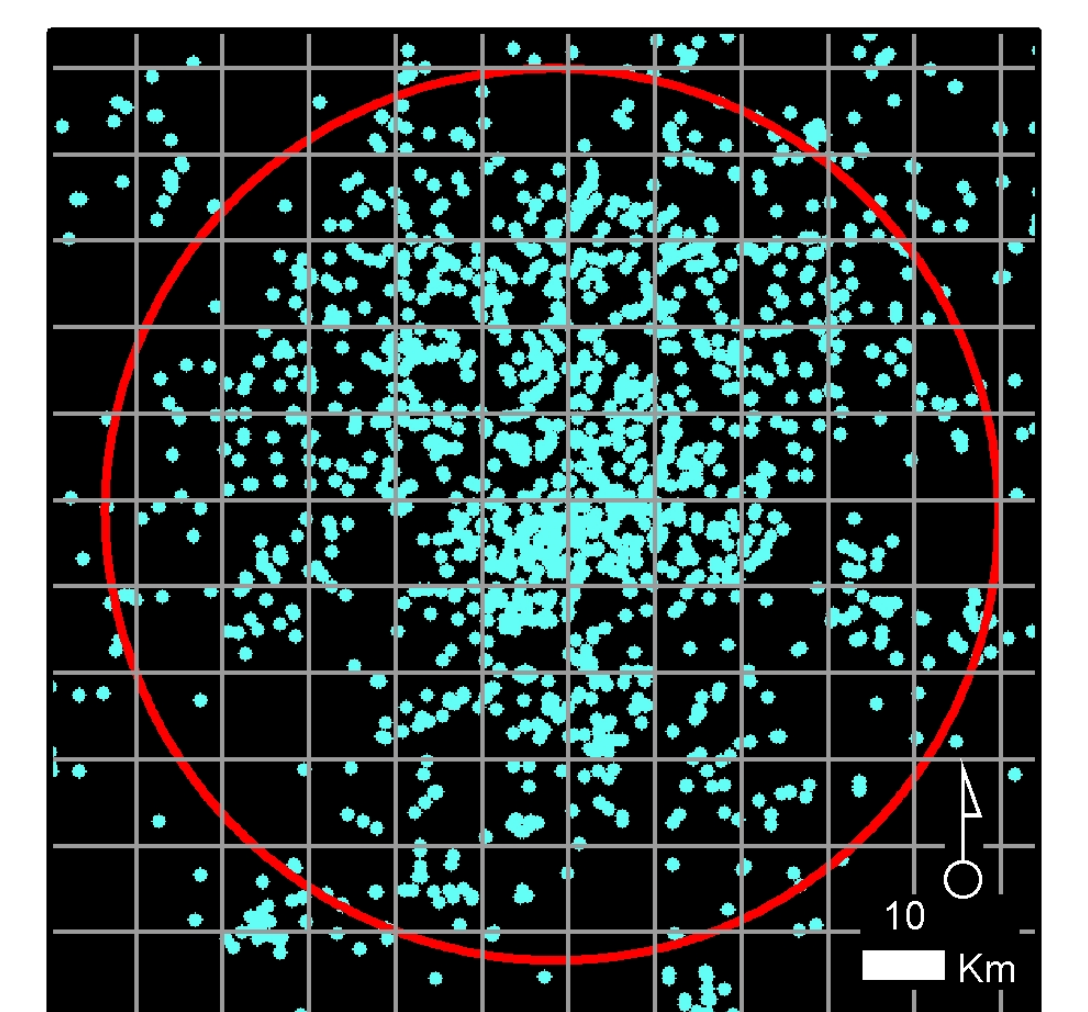Areas in Atlanta that have sufficiently high road density.

Figure 8: Leed Criteria-SLL 7
Areas in Atlanta that are within 1/2 mile of a school.

CONCLUSIONS

The fraction of a city that satisfies LEED-ND criteria, can be used to estimate its performance as it identifies parts of the city that are compact. In the next part of this work, more LEED-ND measures will be examined.