Dasymetric Mapping and Public Transit in Portland, OR Metro Area

Connor Cohn Geog. 492
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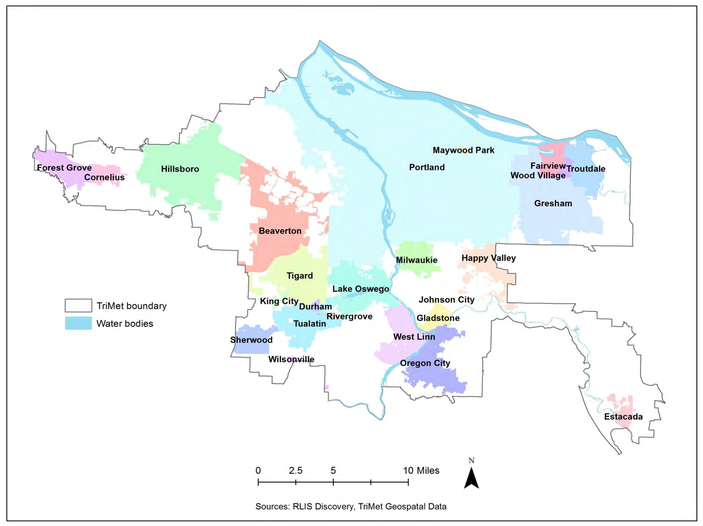
Study Area



Research question

Where are the most underserved areas for mass transit in Portland, OR?

Introduction

The Portland area is one of the best places to live in the country, and it's also one of the fastest growing. According to Metro growth projections, we're on track to add the equivalent of four more Hillsboro's to our population in the next 20 years. That's about 400,000 people and 260,000 jobs (TriMet)**.**

To manage congestion and keep our economy moving, there needs to be an investment in more transit services. For every $1 spent on roads and transit, there's a $2.40 return for our economy. Transit riders in the Portland area can save up to $9,800/year on their transportation costs. MAX has spurred $13.2 billion in development near stations (TriMet). Freight and cars move more freely on our roads, thanks to transit. Transit delivers workers to jobs and brings shoppers to stores.

The Portland region is growing, and we need to make smart investments now to stay ahead of growth and help curb traffic congestion. Expanding transit will connect more people with their community, while boosting our economy and preserving our quality of life.

Data

Spatial Reference	NAD_1983_Lambert_Conformal_Conic
Linear Unit	Foot (0.304800)
Angular Unit	Degree (0.0174532925199433)
False_Easting	1312335.958
False_Northing	0
Central_Meridian	-120.5
Standard_Parallel_1	43
Standard_Parallel_2	45.5
Latitude_Of_Origin	41.75
Datum	D_North_American_1983

Raster Information	Value
Cell Size (X, Y)	98.425, 98.425 feet

Variable	**Original Data Format**
Transit lines	line
Transit stops	point
Censusblock 2010	polygon
Nlcd_Land cover 2011	raster
TriMet service area	polygon

Preprocessing & Methods

Descriptions	**Relative Density (RA)**
Open Water	0
Perennial Snow/Ice	0
Developed, Open Space	5
Developed, Low Intensity	15
Developed, Medium Intensity	20
Developed, High Intensity	44
Barren Land	1
Deciduous Forest	1
Evergreen Forest	1
Mixed Forest	1
Shrub/Scrub	1
Herbaceuous	1
Hay/Pasture	5
Cultivated Crops	5
Woody Wetlands	0
Emergent Herbaceuous Wetlands	0

I created a dasymetric map of my study area in order to determine how much of the population is covered by public transit. I used the method explained by Holloway.

$\mathbf{P = ((R_A*(P_A/ P_A))*N/E)/A_T}$
Where, **P** is the population of a cell,
$\mathbf{R_A}$ is the relative density of a cell with land-cover type A,
$\mathbf{P_A}$ is the proportion of cells of land-cover type A in the enumeration unit,
N is the actual population of enumeration unit (i.e., census block group)
E is the expected population of enumeration unit calculated using the relative densities. E equals the sum of the products of relative density and the proportion of each land-cover type in each enumeration unit.
$\mathbf{A_T}$ is the total number of cells in the enumeration unit.

This landcover data was chosen because it seemed to be the most accurate, especially regarding "Open Water" which there is a lot in the Portland area. Since the land cover data I used was more detailed, I had to determine some of my own values because mine didn't correlate to Holloway's article. All my values have to add up to 100 and I divided that over 12 different land cover types. I gave "Developed" land a combined score of 84, farmland 10, and natural areas 6. This closely resembles Holloway but isn't exact.

Blockgroup2010 data was converted to a Raster from a Polygon and set POP10 as the field.
Output: Pop10

Landcover2011 was Reclassified with my R_A Values shown in the column above.
Output: DensityValue

Using the Tabulate Area tool, set BlockGroups2010 as the input feature. FIPS as the zone field. Set Landcover2011 as the input raster.
Output table: lctab

Added new fields to lctab table as a double: Total, P1, P2, P3, P4, P5, P6, P7, P8, P9, P10, P11, P12. New values were calculated for Total using the Field Calculator. I entered all my Landcover values, except for ones with a "0" value.
P1-P12 was calculated using the formula: (landcover type) / Total. Each P value correlates to a different landcover type.
E was calculated using the following equation:
P1*5+P2*15+P3*20+P4*44+P5*1+P6*1+P7*1+P8*1+P9*1+P10*1+P11*5+P12*5

A table join was made to the BlockGroup using the lctab table.
FIPS: field in BlockGroup that join was based on.
lctab: table to join to
FIPS: field join based on in lctab.

A Raster was created from BlockGroup using lctab.Total and lctab.E

Finally, using the Raster Calculator the following equation was typed in:
"DensityValue" * "Pop10" * 98.425 * 98.425 / ("E" * "Total")
Output: CellValue

Cell Value was clipped to the study area

The Zonal Statistics tool was used to determine the total population within the study area.
Input raster or feature zone data: "TriMet_Boundary"
Zone field: "FID"
Input value raster: "CellValue_Clip"
Statistics type: "SUM"
Examined the output by clicking on properties, source. The value was listed under Statistics.

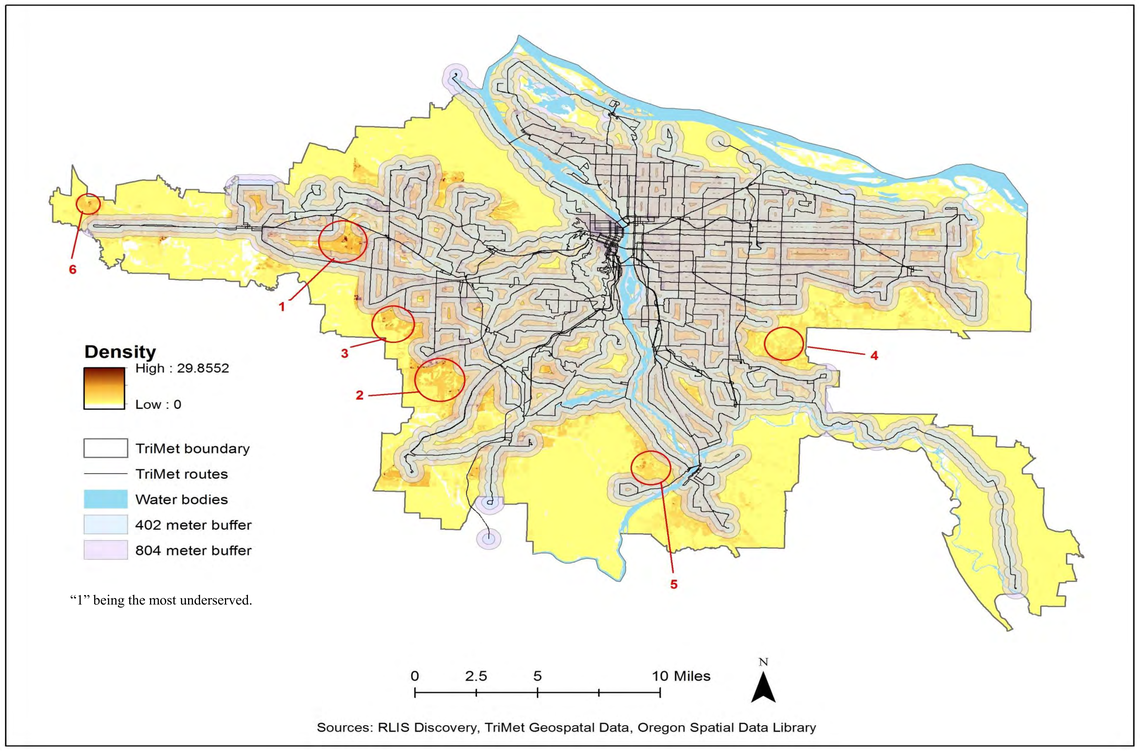
The same process was used to determine the total population the lives within a 402 meter (5 minutes walking) and 804 meter (10 minutes walking) buffer from transit stops. The buffers were put into: Input raster or feature zone data.

The area within the transit buffers was deleted. Created circles around areas that indicated high density. Used the Zonal Statistics tool to calculate the population within the circle area.

Results

Total pop	1,466,392
402 meter buffer	1,040,506 (71%)
804 meter buffer	1,290,780 (88%)

The most densely populated areas with transit deserts are located in central Hillsboro (1), and east Beaverton (2). Both these areas are experiencing fast population growth. I was actually surprised that TriMet covers 88% of the Metro population with transit (804 meter buffer), considering that the Portland Metro area is so spread out and isn't very densely populated.



Conclusion

Problems facing TriMet in the future will be expanding existing networks. Many bus lines are at capacity. The Streetcar network has been expanding in recent years and a new MAX line was just opened, the southwest corridor, which runs along I-5 maybe the next area to receive a MAX line. TriMet is very efficient with its transit coverage, and they are getting ahead of the population growth. There are currently 652 busses in its fleet (TriMet). That is how TriMet is able to cover so many outlying areas. TriMet is looking at bus rapid transit (BRT) as an option to improve the connection between inner Portland and Gresham. Transit coverage in the Portland metro area is very good based on my result. TriMet will need to be creative to expand the capacity of its current network.

Some limitations of my analysis relates to the data I used. Current TriMet data was used with old (2010) census data. It is very possible that the area I indicated as most underserved isn't the most underserved anymore. It is probably still one of them, but it is very likely growth in another area has surpassed that area. I'm not concerned with the land cover data I used because it will relatively be the same. Wetlands and rivers are going to remain where they are. The only changes will be expanded urban area. Due to the urban growth boundary, it is centralized growth in the cities.

Sources

Holloway, Steven et, al.1997."PEOPLE & PLACE: Dasymetric Mapping Using Arc/Info." The University of Montana.
https://d2l.pdx.edu/d2l/le/content/614687/viewContent/2691990/View

TriMet. 2017. *Staying Ahead of the Curve*. https://trimet.org/invest/

GIS Data:
RLIS Discovery
TriMet Geospatal Data
Oregon Spatial Data Library