Dasymetric Estimation of Population Within Walking Distance of Portland Transit Stops

GEOG 592 – Term Project

Portland State University

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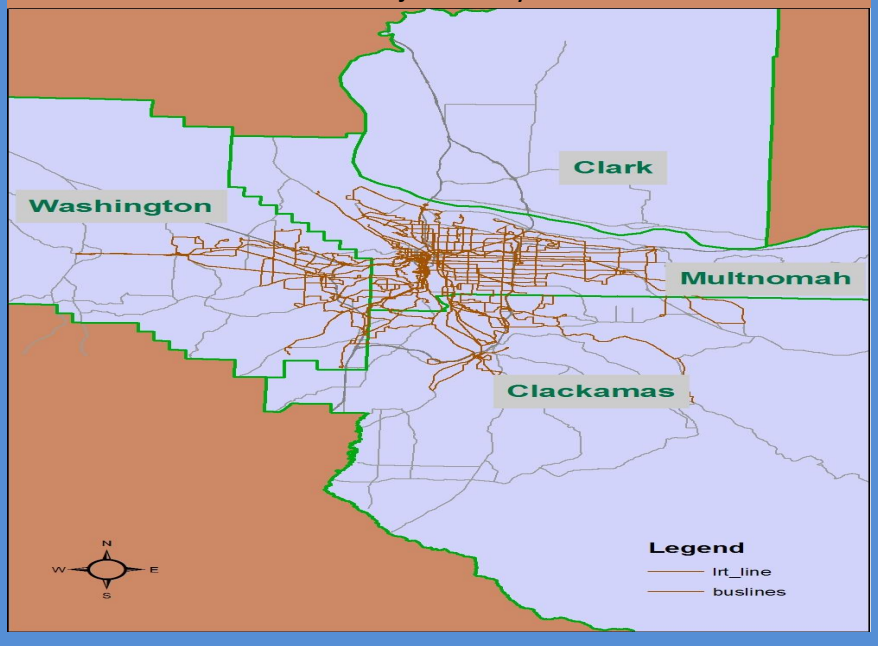
Term Project Study Area



Dasymetric Mapping

Using the Intersection of Two Datasets to Obtain More Precise Estimates of a Spatial Distribution[1]

➔Spatial Distribution of Population

[1]Geographic Information Systems and Science; page 302; Longley, et. al.

Dasymetric Mapping

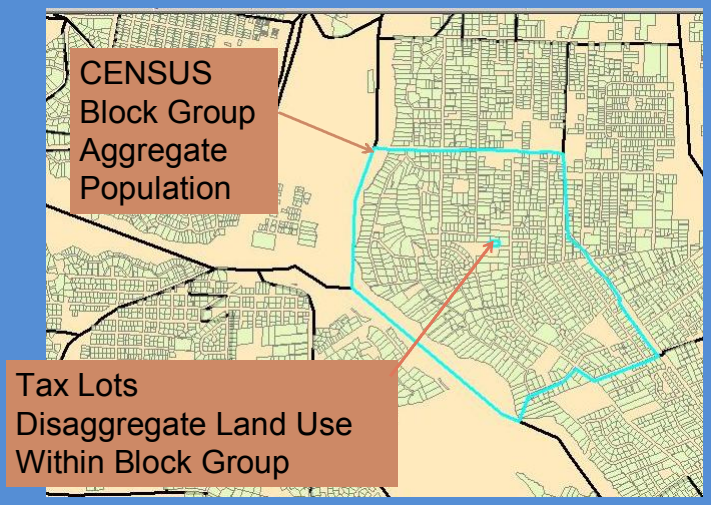
Datasets

METRO Regional Land Information System (RLIS)

CENSUS Block Group (1990)
- •Population
- •Aggregate

Tax Lots
- •Land Use Type, Building Square Footage
- •Disaggregate

Dasymetric Mapping



Study Methodology

Assumption: Population Allocated to Two Land Use Types

- Single-Family Residential (SFR)
- Multi-Family (MF)

Study Methodology

Step 1

Within CENSUS Block Group:

Allocate Population to SFR and MF Land Use

Based on Total SFR and Total MF Building Square Footage

- POP_SFR = Total SFR Population in Block Group
- POP_MF = Total MF Population in Block Group

Study Methodology

Step 2

Distribute Total SFR and MF Population Within Each Block Group to Individual Tax Lots

- Distribution Based on Building SQ FT Proportion:

$$\left(\frac{\text{Individual Tax Lot Building SQ FT (SFR or MF)}}{\text{Summation of Tax Lot Building SQ FT (SFR or MF) Within Block Group}} \right)$$

Study Methodology

Step 3

- •Create Transit Stop 0.25-mile Buffer (Walking Distance)
- •Select By Location Tax Lot Points that are Within Transit Stop 0.25-mile Buffer
- •Sum Population Inside That Buffer

Study Methodology

Step 1

Within CENSUS Block Group:

Allocate Population to SFR and MF Land Use

Based on Total SFR and Total MF Building Square Footage

Equation

$$N = [R_{SFR} * K * A_{SFR}] + [R_{MF} * K * A_{MF}]$$

$$K = N / [\Sigma(R_i * A_i)]$$

- •Estimate R_{SFR} and R_{MF}
- •Sum Building sq ft for A_{SFR} and A_{MF} via Spatial Join
- •N is known (CENSUS Block Group Pop)
- •Calculate K

Study Methodology

Step 1

Within CENSUS Block Group:

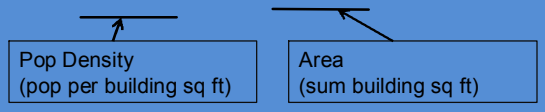
Allocate Population to SFR and MF Land Use

Based on Total SFR and Total MF Building Square Footage

Calculate

Total SFR Population in Block Group

$POP\_SFR = [R_{SFR} * K * A_{SFR}]$



Total MF Population in Block Group

$POP\_MF = [R_{MF} * K * A_{MF}]$

Study Methodology

Step 1

Within CENSUS Block Group:

Allocate Population to SFR and MF Land Use

Based on Total SFR and Total MF Building Square Footage

Estimating R (Relative Population Density of Land Use)

•Search for CENSUS Block Groups with Homogeneous MF or SFR Households (SFRHH and MFHH are attributes in CENSUS Block Group)

•Block Group: Add Field and Calculate Percent Households SFR

•Select SFR HH Percent >= 99% (MFHH >= 95%)

•Tax Lots: Select SFR (MF)

•Spatial JOIN Tax Lots SFR (MF) to BLKGRP_SFR99% ----- SUM Attributes

•SFR (MF) Density Estimate = POP90 divided SUM Bldg Sq Ft

Study Methodology

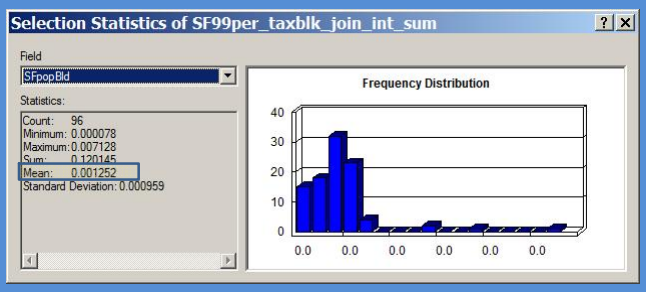
Step 1

Within CENSUS Block Group:

Allocate Population to SFR and MF Land Use

Based on Total SFR and Total MF Building Square Footage

Estimating R_{SFR}



Study Methodology

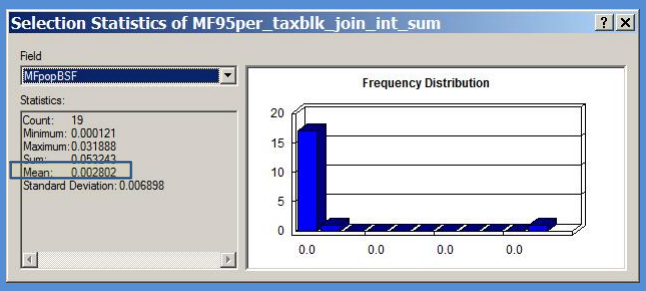
Step 1

Within CENSUS Block Group:

Allocate Population to SFR and MF Land Use

Based on Total SFR and Total MF Building Square Footage

Estimating R_{MF}



Study Methodology

Step 1
Within CENSUS Block Group:

Allocate Population to SFR and MF Land Use

Based on Total SFR and Total MF Building Square Footage

Estimating R

- Large Standard Deviation in Sample
- Population Density Ratio MF-to-SFR is Approximately 2:1
- Based on Building SQ FT
  - $R_{MF} = 2$
  - $R_{SFR} = 1$

Study Methodology

Step 1
Within CENSUS Block Group:

Allocate Population to SFR and MF Land Use

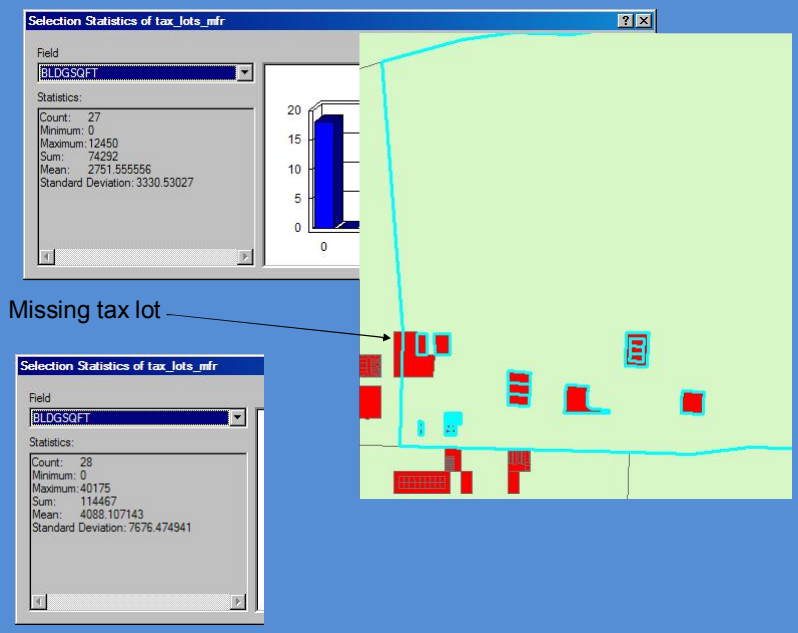
Based on Total SFR and Total MF Building Square Footage

Issue: Spatially Joining Polygons
CONTAINS and INTERSECT

CONTAINS
- Disregards polygon that intersects boundary of polygon that you are joining to

INTERSECT
- Includes polygon that intersects boundary twice

Issue: Spatially Joining Polygons



Study Methodology

Step 1
Within CENSUS Block Group:

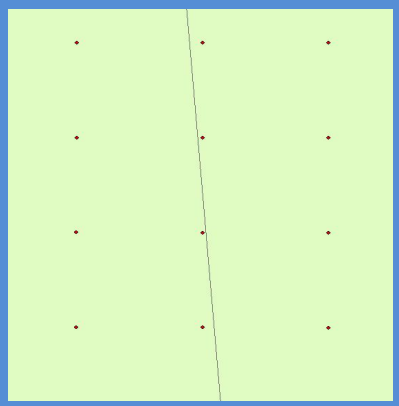
Allocate Population to SFR and MF Land Use

Based on Total SFR and Total MF Building Square Footage

Issue: Spatially Joining Polygons
CONTAINS and INTERSECT

Solution

•Convert Tax Lot Polygons to Points



Study Methodology

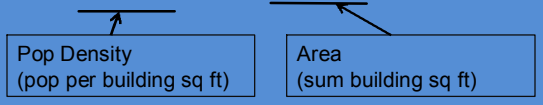
Step 1
Within CENSUS Block Group:

Allocate Population to SFR and MF Land Use

Based on Total SFR and Total MF Building Square Footage

Total SFR Population in Block Group

$POP\_SFR = [R_{SFR} * K * A_{SFR}]$



Total MF Population in Block Group

$POP\_MF = [R_{MF} * K * A_{MF}]$

We Have Estimate of R =➔ Calculate K

Study Methodology

Step 1
Within CENSUS Block Group:

Allocate Population to SFR and MF Land Use

Based on Total SFR and Total MF Building Square Footage

Calculate K

- $K = N / [\Sigma(R_i * A_i)]$; N = Block Group Pop
- Spatially Join Tax Lot Points (SFR, MF Separately)To Block Groups
- Points CONTAINED in Block Group; SUM Attributes of Tax Lots
- Attribute Join These Two Datasets on CENSUS FIPS

Study Methodology

Step 1
Within CENSUS Block Group:

Allocate Population to SFR and MF Land Use

Based on Total SFR and Total MF Building Square Footage

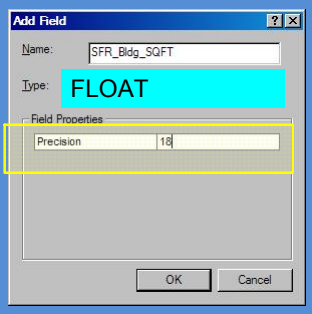
Calculate K

•Add Fields

- •RelDenSFR
- •RelDenMF
- •R*BAreaSFR
- •R*BAreaMF
- •SUM_R*A

K = POP90 / SUM_R*A

Issue: Adding Fields and Calculations



Study Methodology

Step 1
Within CENSUS Block Group:

Allocate Population to SFR and MF Land Use

Based on Total SFR and Total MF Building Square Footage

Calculate POP_SFR (Total SFR Population in Block Group)

$POP\_SFR = [R_{SFR} * K * A_{SFR}]$

Calculate POP_MF (Total MF Population in Block Group)

$POP\_MF = [R_{MF} * K * A_{MF}]$

End Step 1

Study Methodology

Step 2
Distribute Total SFR and MF Population Within Each Block Group
to Individual Tax Lots

Spatially Join the Result From Step 1(Polygon)
to Tax Lots SFR (MF) Points (It Falls Inside or Is Within Option)

Result
Each Tax Lot Has Total SFR (MF) Population for the Block Group
And Total SFR (MF) Building SQ FT for the Block Group it Falls Inside

Proportion This Total to Individual Tax Lots:

LOT_SFR_POP = POP_SFR * [BldGSQFT / SFR_B_SQF_1]

Total POP SFR for BLKGRP

Individual SFR Lot SQ FT

Total SFR SQ FT for BLKGRP

Study Methodology

Step 2

Distribute Total SFR and MF Population Within Each Block Group to Individual Tax Lots

Checks:

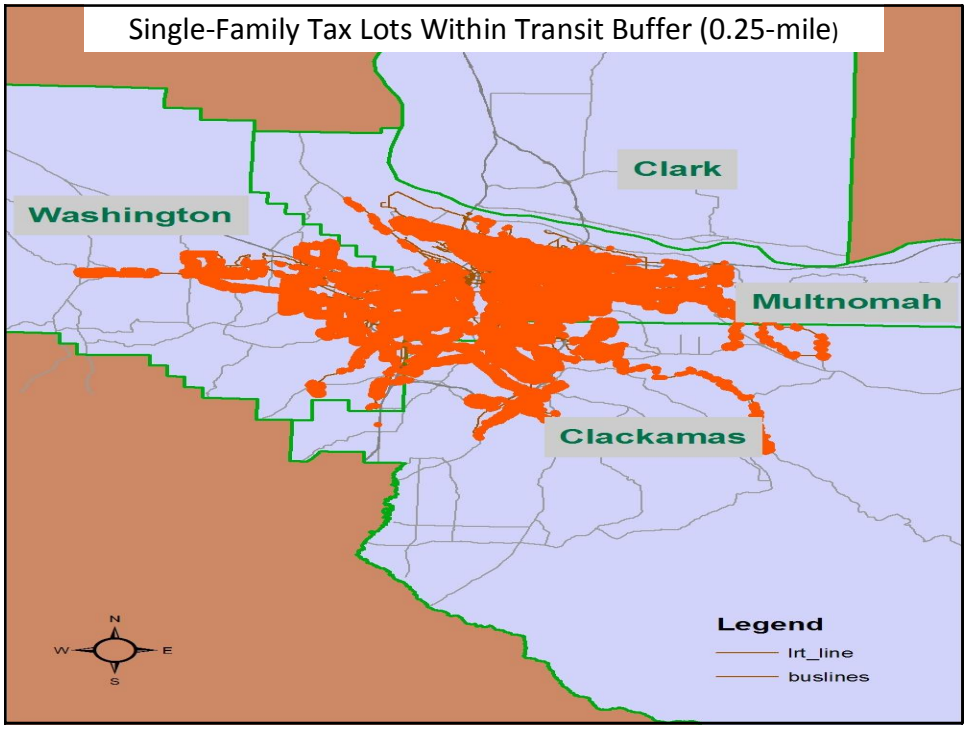
- Selected Four Block Groups
- Summation of Individual Tax Lot Populations Equal to Total Block Group POP

Study Methodology

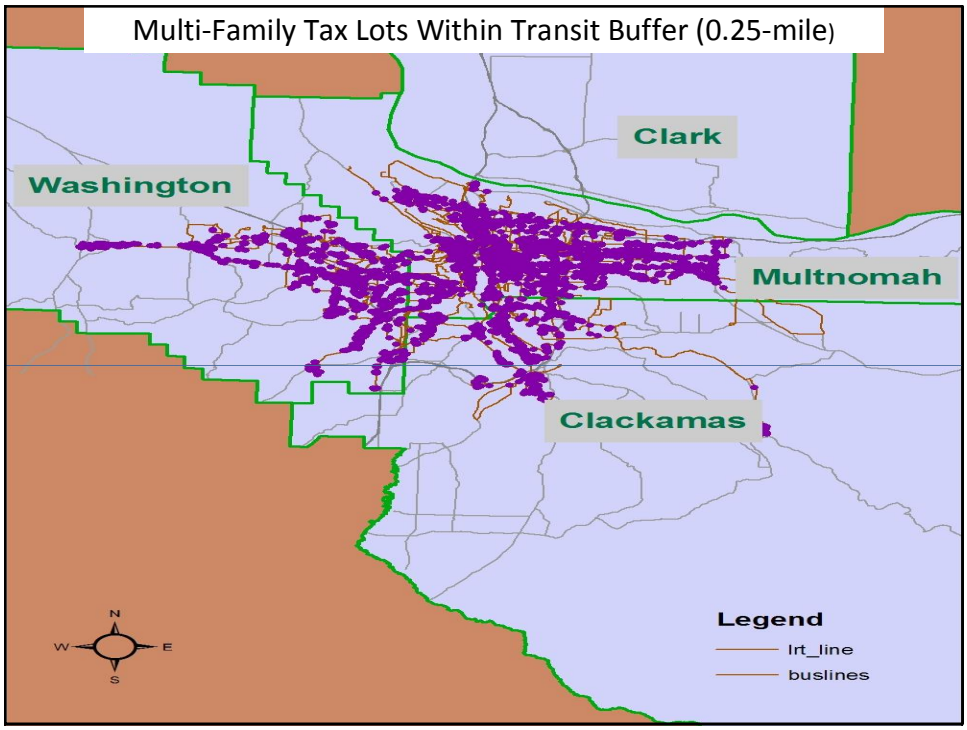
Step 3

- Create Transit Stop 0.25-mile Buffer (Walking Distance)
- Select By Location Tax Lot Points that are Within Transit Stop Buffer
- Sum Population Inside That Buffer

Single-Family Tax Lots Within Transit Buffer (0.25-mile)

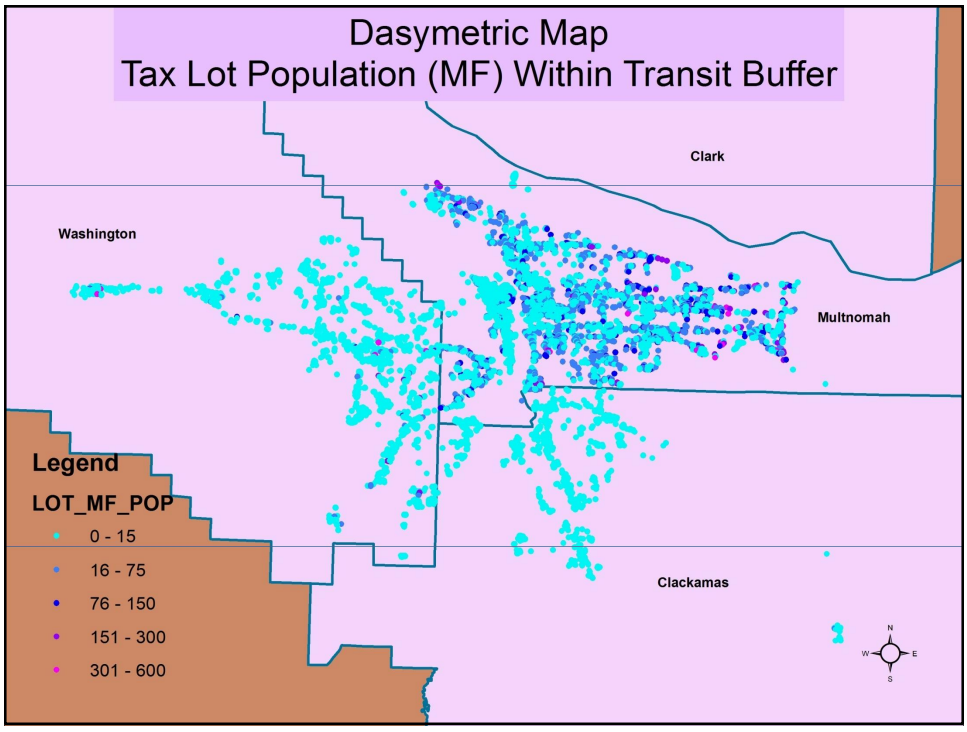


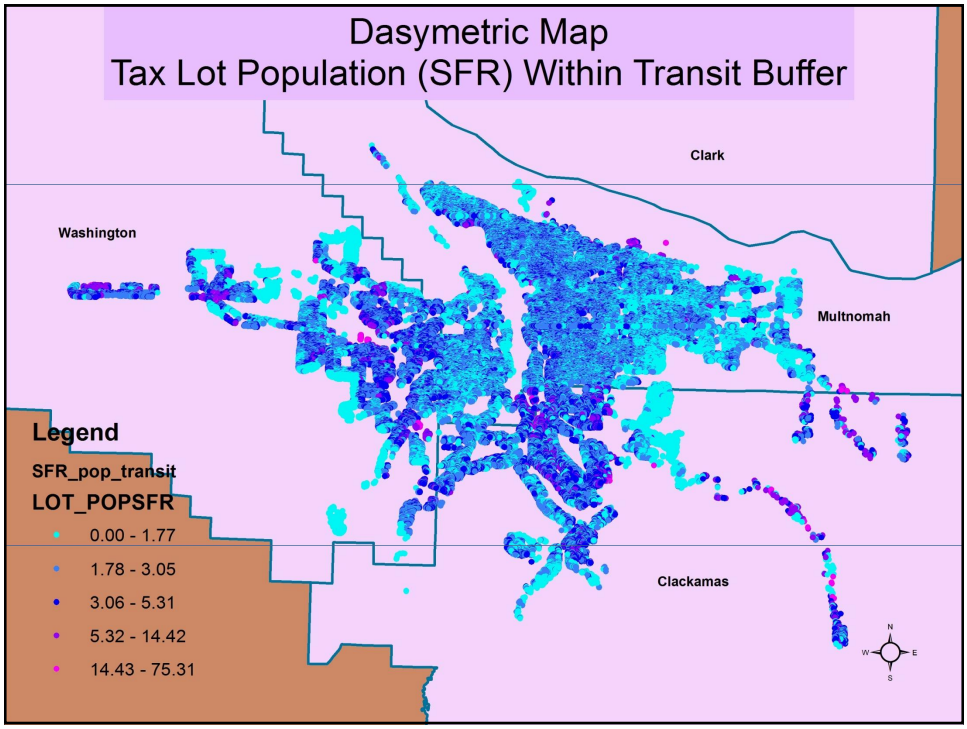
Multi-Family Tax Lots Within Transit Buffer (0.25-mile)



Population Within Transit Buffer

	Tax Lots		**1990 CENSUS Population**	
Single-Family Residential	259,371		600,464	
Multi-Family	49,179		194,061	
SUM	308,550	55.7%	794,525	67.6%
Total (Extent Rectangle Encompass Transit Lines)	554,191		1,175,784	




Dasymetric Map
Tax Lot Population (SFR) Within Transit Buffer
Clark
Washington
Multnomah
Clackamas
Legend
SFR_pop_transit
LOT_POPSFR
0.00 - 1.77
1.78 - 3.05
3.06 - 5.31
5.32 - 14.42
14.43 - 75.31
N
W
E
S