Geospatial Data Tools, ACS, and Service Populations

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Key Question Addressed in Our Talk Today

Issue: American Indians and Alaska Natives service populations are eligible to receive service funded by the Bureau of Indian Affairs.

Question: If one chooses to use the best available public census data, how might one better estimate service populations and also provide information on labor market conditions?

Spatial Science Techniques

- Challenge: How do we use ACS population estimates of AI/AN population outside of Census Tribal Boundaries?
- Solution: Gravity Models and Travel Distance Method
  - As Combes (2017) describes it “Basic gravity models state that economic interactions between two geographically defined entities are **proportional to the size** of these entities and **inversely related to the distance** between them.”
  - In our context, eligible AIAN populations living off reservation boundaries may be more likely to travel greater distances to tribal geographies that have certain characteristics.
  - Geographies with large **populations** and **land area** are more likely to draw people living off-reservations.

Dividing Data into Quintiles

Population	Weight
Largest	5
	4
	3
	2
Smallest	1

Area	Weight
Largest	5
	4
	3
	2
Smallest	1

Combined	Weight	Travel Time
Largest	10	4.5
	9	4.0
	8	3.5
	7	3.0
	6	2.5
	5	2.0
	4	1.5
	3	1.0
Smallest	2	0.5

In addition to population counts, what are some available Labor Indicators from ACS?

- American Community Survey (ACS) variables (ages 16-64) include:
  - Unemployed
  - Civilian Labor Force (employed and unemployed civilians)
  - Unemployment Rate (unemployed ÷ civilian labor force)
  - Armed Forces
  - Labor Force (unemployed and employed civilians + Armed Forces)
  - Not in Labor Force
  - Labor Force Participation Rate (labor force ÷ total population)

Summary of “Gravity” Model

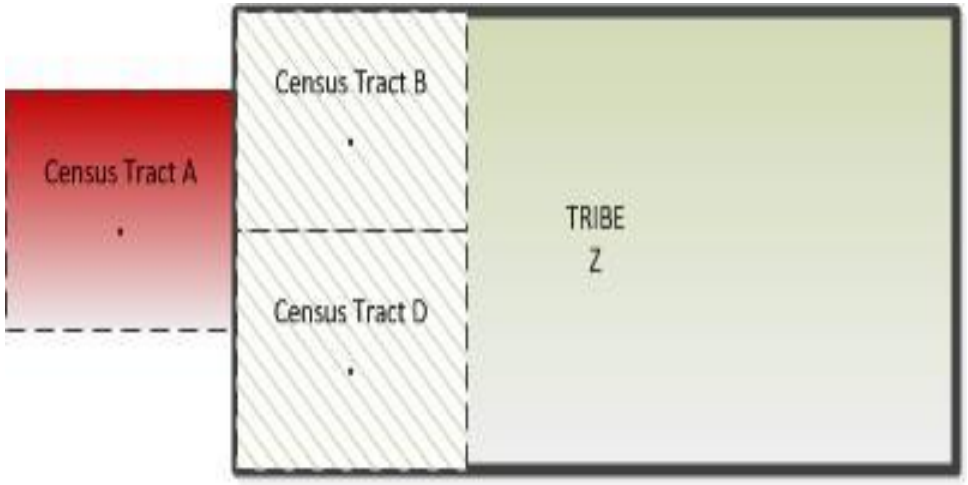
- Maximum driving distance for a reservation determines which off-reservation tracts are eligible to be considered.
  - $f(land\ area\ quintile, population\ quintile)$

- All else equal, the strength of “pull” of off-reservation AIAN populations for an eligible census tract is a function of the actual driving distance and reservation population.
  - $f(actual\ driving\ distance, population\ quintile)$

Stylized Example

How can we assign ***off-reservation*** AI/AN populations to a specific service population?

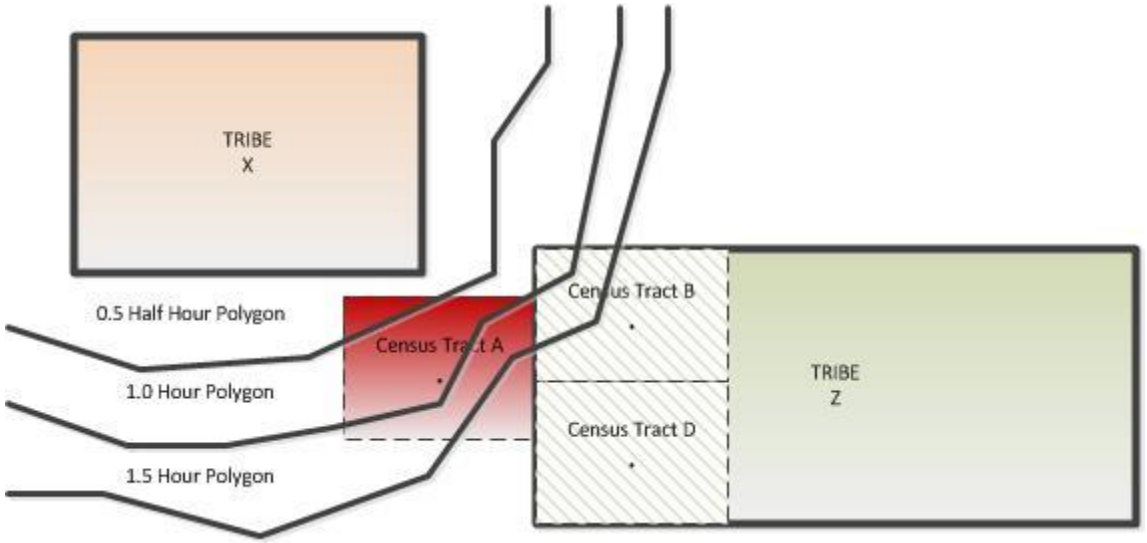
Census tract A (shaded red) does not fall within Tribe Z's reservation boundary. Assume the AIAN population is 1,000.



In contrast, census tract B and D (shaded green with diagonal lines) do fall within Tribe Z's reservation boundary.

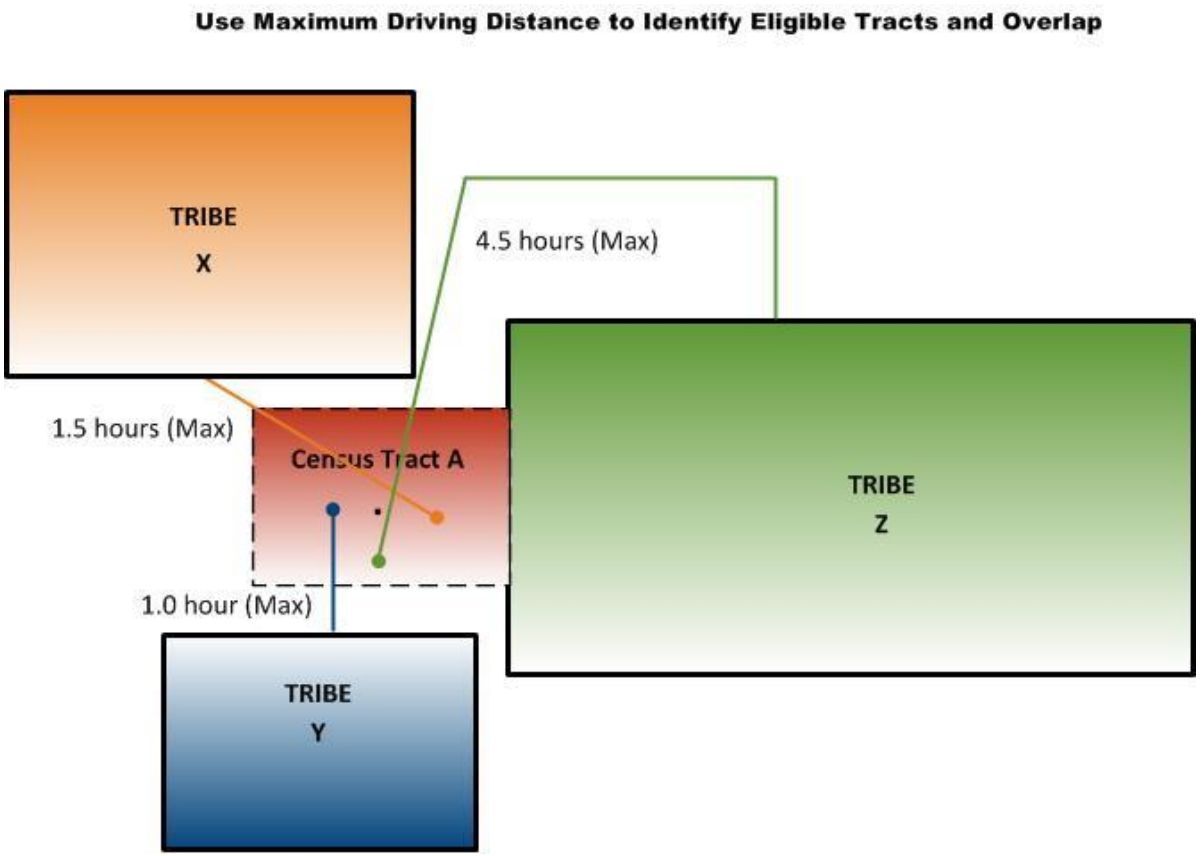
To solve the overlap problem and avoid double counting, use driving distance polygons to calculate numerical weights for each reservation and distribute population

Tribe X's maximum driving distance (determine by population and land area) is 1.5 hours. Census Tract A's centroid is within one hour driving distance of Tribe X.



Avoiding double counting and the overlap problem: given the proximity of reservations, existing road networks and maximum driving distance, how do we "distribute" an off-reservation tract's AIAN population? What rule shall we use?

Census tract A (shaded red) falls within driving distance of ***multiple reservations X, Y, Z.***



Which Service Population Does Census Tract A's AI/AN Population Get Assigned?

Tribe	Maximum Driving Distance for Tribe	Is Census Tract A within the Maximum Driving Distance?	Actual Driving Time Polygon (hours)	Population Quintile	Weight Calculation	Share	**Service Population**
X	1.5	Yes	1.0	5	1/(1.0) × 5 = 5.00	5.00/8.25 = 61%	**610**
Y	1.0	Yes	1.0	2	1/(1.0) × 2 = 2.00	2.00/8.25 = 24%	**240**
Z	4.5	Yes	4.0	5	1/(4.0) × 5 = 1.25	1.25/8.25 = 15%	**150**
				Total:	8.25	100%	**1,000**

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