Fixed Wireless Broadband

Analyzing FCC's CAF II Census Blocks

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DATS 6501 – Data Science Capstone Final Report, April 2020



Outline

- 1. Introduction
- 2. Methodology
- 3. Data Sources
- 4. Workflow
- 5. Results
- 6. Limitations & Future Research
- 7. Questions

The FCC's Connect America Fund (CAF) is a reverse auction that aims to expand broadband connectivity to underserved regions of the US through grants to internet service providers. Connecting households via coax, fiber, and similar physical technology is prohibitively expensive. Wireless technologies make connectivity more economical but are limited to areas with minimal natural or man-made structures impeding signal propagation.

The goal for this project is to analyze all CAF-eligible census blocks to identify those most suitable for fixed wireless broadband deployment. Each block will be scored based upon housing density, tree coverage, and the area's topology using publicly available geospatial datasets.

Literature Review

ESRI Telecom Team (2019, October 30). Broadband Mapping: A Geospatial Approach to Broadband Mapping & 477 Reporting

https://storymaps.arcgis.com/stories/28c86dcfd4e54f009e0b9259dd8f25d8

Mike Dano (2018, February 15). Editor's Corner – Fixed wireless is a big deal. Here's why. https://www.fiercewireless.com/wireless/editor-s-corner-fixed-wireless-a-big-deal-here-s-why

Steven J. Steinberg, Ph.Da,b,*, Rebecca Degagnea, M.S., Michael Gough. **Broadband Demand Aggregation: Planning Broadband in Rural Northern California.** <u>https://proceedings.esri.com/library/userconf/proc08/papers/papers/pap_1708.pdf</u>

Patrick Huls (2020, February 1). Why the G in 5G should stand for Geospatial – Part 1 http://www.telcoprofessionals.com/telecomblogs/166/why-the-g-in-5g-should-stand-for-geospatial-part-1

Patrick Huls (2020, February 8). Why the G in 5G should stand for Geospatial – Part 2 http://www.telcoprofessionals.com/telecomblogs/167/why-the-g-in-5g-should-stand-for-geospatial-part-2



FCC's Connect America Phase II

reverse auction for grants to ISPs to accelerate buildout of broadband networks to underserved areas in US

103 bidders won

\$1.98 billion over 10 years to provide fixed broadband and voice

to provide fixed broadband and voice services

Winning bids cover 700k locations across 45 states

with minimum speeds of 25 Mbps downstream and 3 Mbps upstream

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¹⁹⁰ M É X L C Source: <u>https://www.fcc.gov/reports-research/maps/caf-2-auction-preliminary-area</u>



Wired Broadband Challenges

Housing Density

CAF II Eligible Census Blocks are largely rural areas with low housing density

Infrastructure Costs

Buried fiber/coax requires extensive engineering, permitting, and labor-intensive buildout

Aerial (poles) requires permission to use the poles and pay a recurring pole attachment fee to the owners.

Infrastructure costs range between \$18,000 and \$22,000 per mile *

https://www.fiercewireless.com/wireless/editor-s-corner-fixed-wireless-a-big-deal-here-s-why

Wireless Broadband

Economics

About one tenth the cost of building out wired broadband infrastructure

Coverage

Can provide broadband speeds to businesses and residences with direct line-of-sight to tower

Signal Propagation

Radio signal propagation blocked or degraded by natural and man-made structures



Data Sources



Geospatial Geometry



Housing Density

US Census Bureau: TIGER/Line Shapefiles -ALAND10 -HOUSING10

Houses Per 100k Square Meter



Tree Coverage

NASA / UMD: Global 30m Landsat Tree Canopy Version 4 -Tree_Canopy_Cover

Average Tree Coverage



Terrain

NASA JPL: Shuttle Radar Topography Mission Digital Elevation Data 30M -Elevation

> Average Slope

Workflow



Results – Eligible Census Blocks

Eligible Census Blocks 210,647

Results – Incomplete Data



Results – Scored Census Blocks

Eligible Census Blocks	210,647
Incomplete Data	24,014
Scored Census Blocks	186,633



Results – Class 5 Census Blocks

Eligible Census Blocks 210,647 Incomplete Data 24,014 Scored Census Blocks 186,622
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arad Capsus Placks 196.622
SCOLEG CELISUS DIOCKS 190,035
Class 5 Census Blocks 14,643

Results – Class 4 Census Blocks

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Eligible Census Blocks	210,647		
Incomplete Data	24,014		
Scored Census Blocks	186,633		
Class 5 Census Blocks	14,643		
Class 4 Census Blocks	41,110		
		16	

Results – Class 3 Census Blocks



Results – Class 2 Census Blocks

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ncomplete Data	24,014					Ż
Scored Census Blocks	186,633					
Class 5 Census Blocks	14,643	A STATE OF THE REAL		Acres !		
Class 4 Census Blocks	41,110					
Class 3 Census Blocks	45,100					
Class 2 Census Blocks	55,310					

Results – Class 1 Census Blocks

Eligible Census Blocks	210,647	
Incomplete Data	24,014	
Scored Census Blocks	186,633	
Class 5 Census Blocks	14,643	
Class 4 Census Blocks	41,110	
Class 3 Census Blocks	45,100	
Class 2 Census Blocks	55,310	
Class 1 Census Blocks	30 470	



Limitations & Future Research

- Out-Dated Statistics 2020 Census
- Higher Resolution Data Sources
- Household Clustering Identification
- Viewshed Analysis Signal Propagation



Questions