Outline

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Problem Statement

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

Mike Dano (2018, February 15). Editor’s Corner – Fixed wireless is 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.

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
Introduction

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 services

Winning bids cover **700k locations across 45 states** with minimum speeds of 25 Mbps downstream and 3 Mbps upstream

Source: [https://www.fcc.gov/reports-research/maps/caf-2-auction-preliminary-areas/](https://www.fcc.gov/reports-research/maps/caf-2-auction-preliminary-areas)
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 *

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
Methodology

- CAF Eligible Census Blocks
- Housing Density
- Tree Coverage
- Terrain
Data Sources

- **CAF Eligible Census Blocks**
  - FCC: CAF2 Auction Publish Block Feb 2018 -Block_Id
  - US Census Bureau: TIGER/Line Shapefiles -Geometry

- **Housing Density**
  - US Census Bureau: TIGER/Line Shapefiles
    - ALAND10
    - HOUSING10

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

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

- **Geospatial Geometry**
- **Houses Per 100k Square Meter**
- **Average Tree Coverage**
- **Average Slope**

Data Science Capstone Final Report, April 2020
Data Collection & Warehousing
Built geospatial data warehouse using Azure SQL. Located disparate datasets and ETL'd into data store. Calculated housing density metric.

Geospatial Processing
Used census block geometry to calculate slope and tree coverage from raster data.

Scoring
Scored each census block based upon calculated metrics, weighted in favor of ideal geography and housing density.

Mapping & Analysis
Mapped all scored census blocks, creating 5 equal-width bins. Analyzed results to confirm successful scoring of census blocks.
Results – Eligible Census Blocks

Eligible Census Blocks 210,647
Results – Incomplete Data

Eligible Census Blocks: 210,647
Incomplete Data: 24,014
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: 186,633
- Class 5 Census Blocks: 14,643
Results – Class 4 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
Results – Class 3 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
## Results – Class 2 Census Blocks

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<th>Category</th>
<th>Count</th>
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<tr>
<td>Eligible Census Blocks</td>
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<tr>
<td>Incomplete Data</td>
<td>24,014</td>
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<tr>
<td>Scored Census Blocks</td>
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</tbody>
</table>
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