

Coverage Mapping and Performance Comparisons of 5G Networks in the North Florida Region

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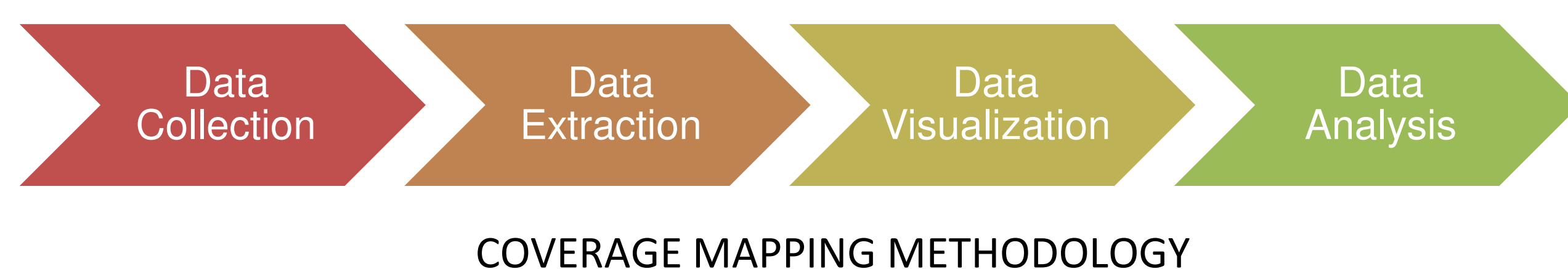
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BACKGROUND

In this study we perform two case studies. One study is on **coverage mapping** of actual network coverage in the North Florida Region for three common carriers AT&T, T-Mobile and Verizon. The figure outlines the process used in this study.



The second study compares various **network performance parameters** of the 3 common carriers including signal strength and connectivity using passive measurements from data collection tools (i.e. SIGCAP – a digital tool that collects various signal and sensor data through an Android API, in conjunction with GPS location).

Further analyses overlay socioeconomic status and median income data and coverage areas to gain insight on network performance in underserved and under-resourced neighborhoods.

RESEARCH QUESTIONS

1. What is the **baseline performance** of the top three cell phone carriers (Verizon, AT&T, and T-Mobile) in terms of connectivity, signal strength, latency, throughput,?
2. What is the **correlation** between the socio-economic status (SES), median income, and network performance of these 3 carriers?

METHODS AND MATERIALS

Case Study 1: COVERAGE MAPPING

Data collection deployment zones were identified, and passive measurements were collected using the following tools. Data visualization results are shown in figure 1.

Measurement Tools:

- Devices: 3 X Samsung S22+
- App Tool: SIGCAP, FCCSpeedTest
- Java for data extraction and
- ArcGIS for data visualization

5 Regions:

- (C)ampus – FAMU and FSU
- (D)owntown – State Capitol, Cascades Park
- (R)ural – Gadsden (Midway) and Wakulla (Crawfordville)
- (A)irport – Tallahassee International Airport
- (U)rban - 10 miles from city center in each direction

RESULTS

Case Study 2: PERFORMANCE COMPARISONS

The data collected from case study 1 was analyzed to determine key performance parameters including:

- GPS Coordinates (Latitude, Longitude)
- NETWORK (5G, 5Ge, LTE “long-term evolution)
- RSRP (Received Signal Reference P-channel)
- RSRQ (Received Signal Reference Q-channel)
- CDF (Cumulative Distribution Function)

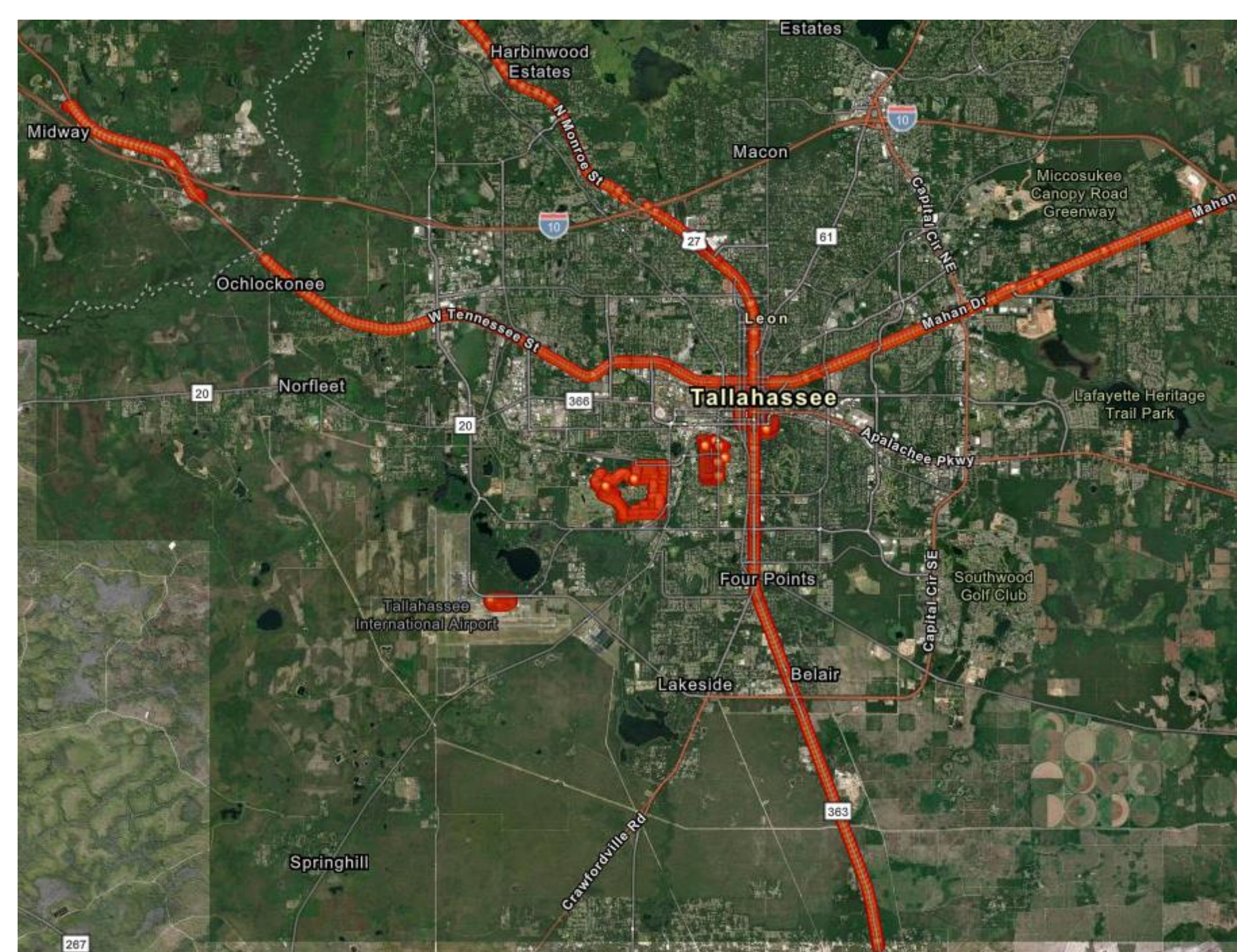


Figure 1: Coverage Mapping – Data Collection Deployment Zones ((C)ampus, (D)owntown, (R)ural, (A)irport, and (U)rban)

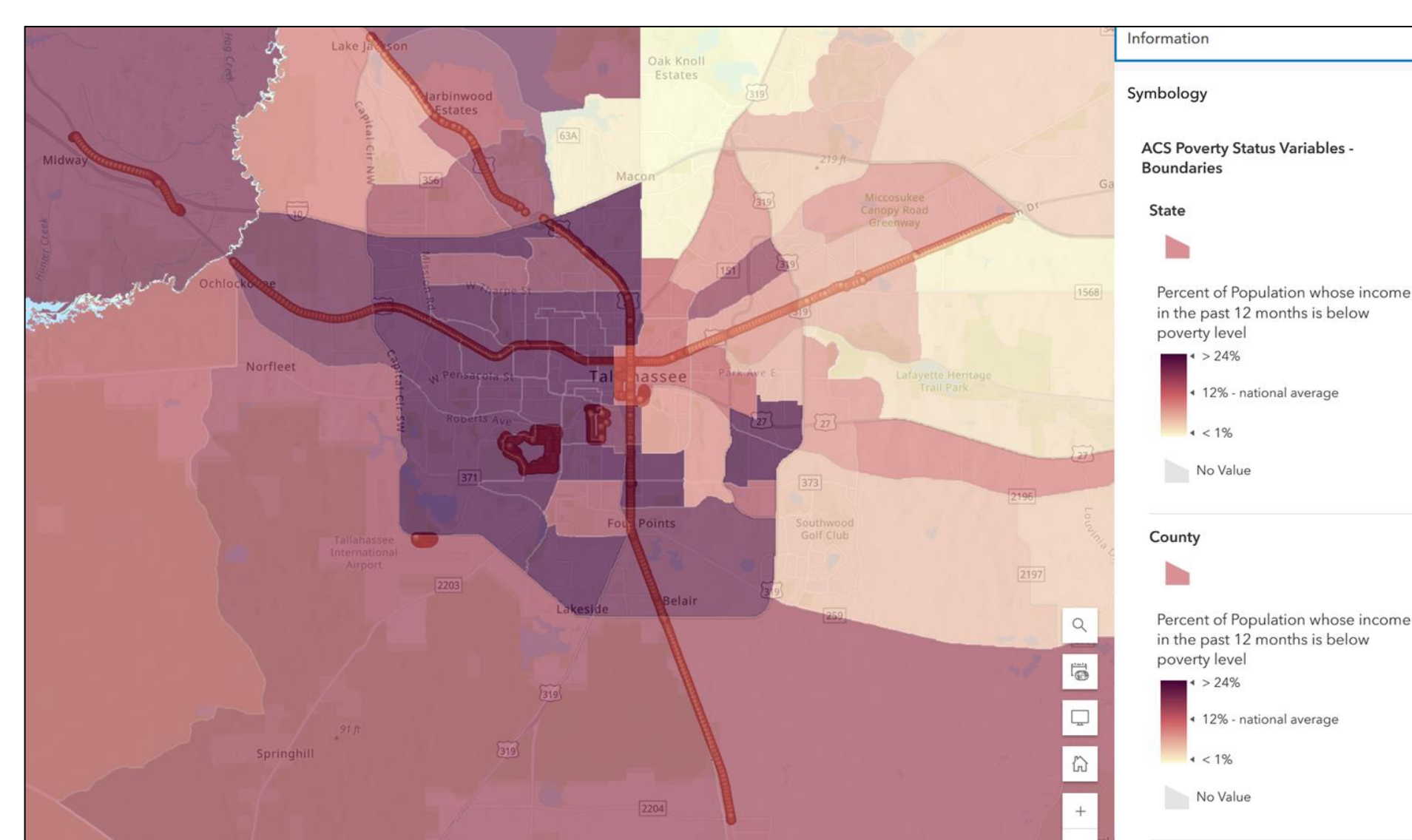


Figure 2: Coverage Map Deployment Zones Overlay – POVERTY STATUS Variable (2020 US Bureau Census Data)

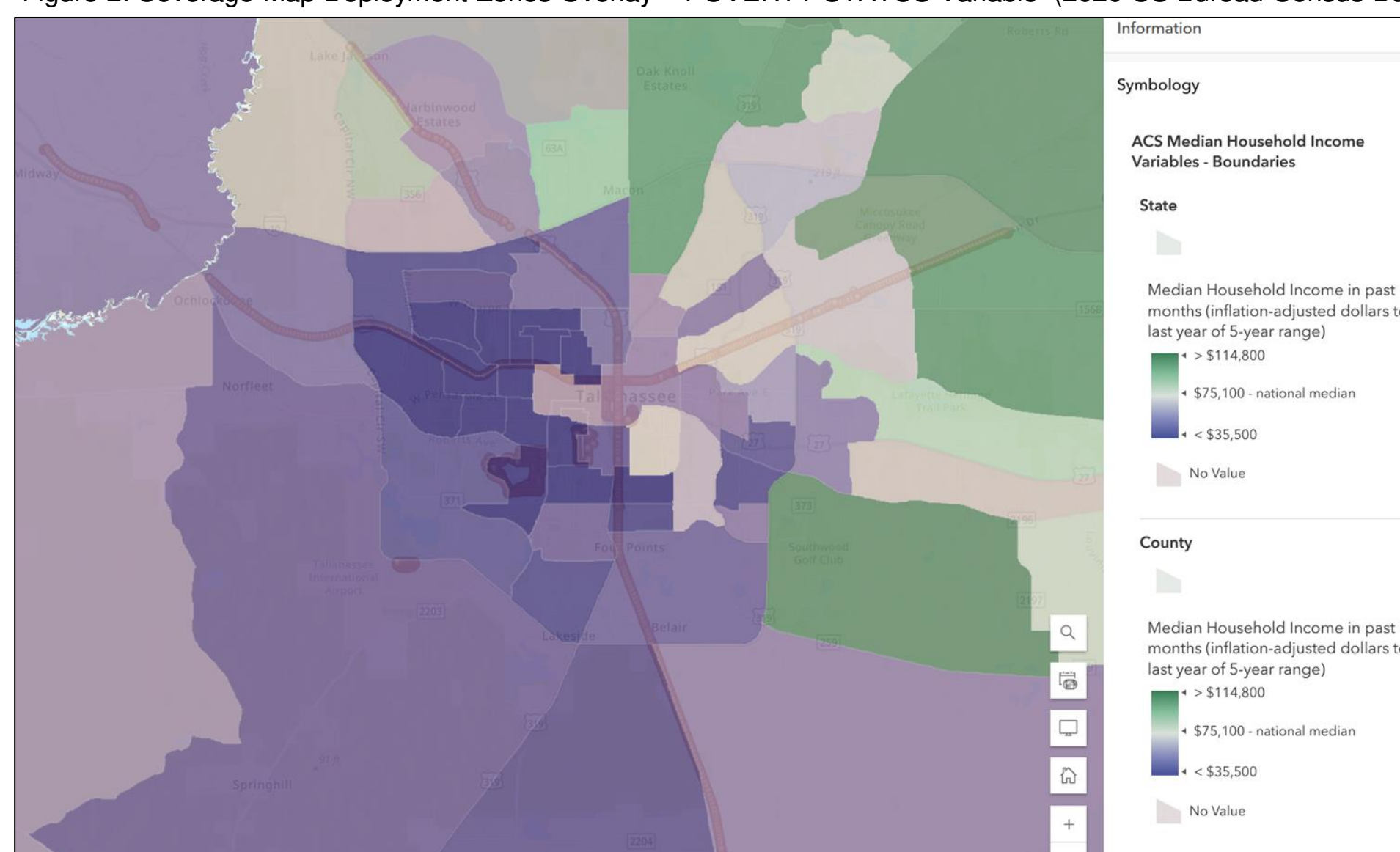


Figure 3: Coverage Map Deployment Zones Overlay – MEDIAN INCOME Variable (2023 US Bureau Census Data)



- Figure 4 shows the CDF plots of the RSRP values from each of the three carriers. From the plot, we can see that AT&T had the best RSRP, received signal strength across all deployment zones.
- The other performance parameters (uplink/downlink, throughput, latency) were unable to be analyzed due to a malfunction of the FCC Speed Test measurement tool. Thus, not enough data could be collected.
- Future studies will perform root cause assessments to determine and correct the source of the malfunction so more data can be collected.

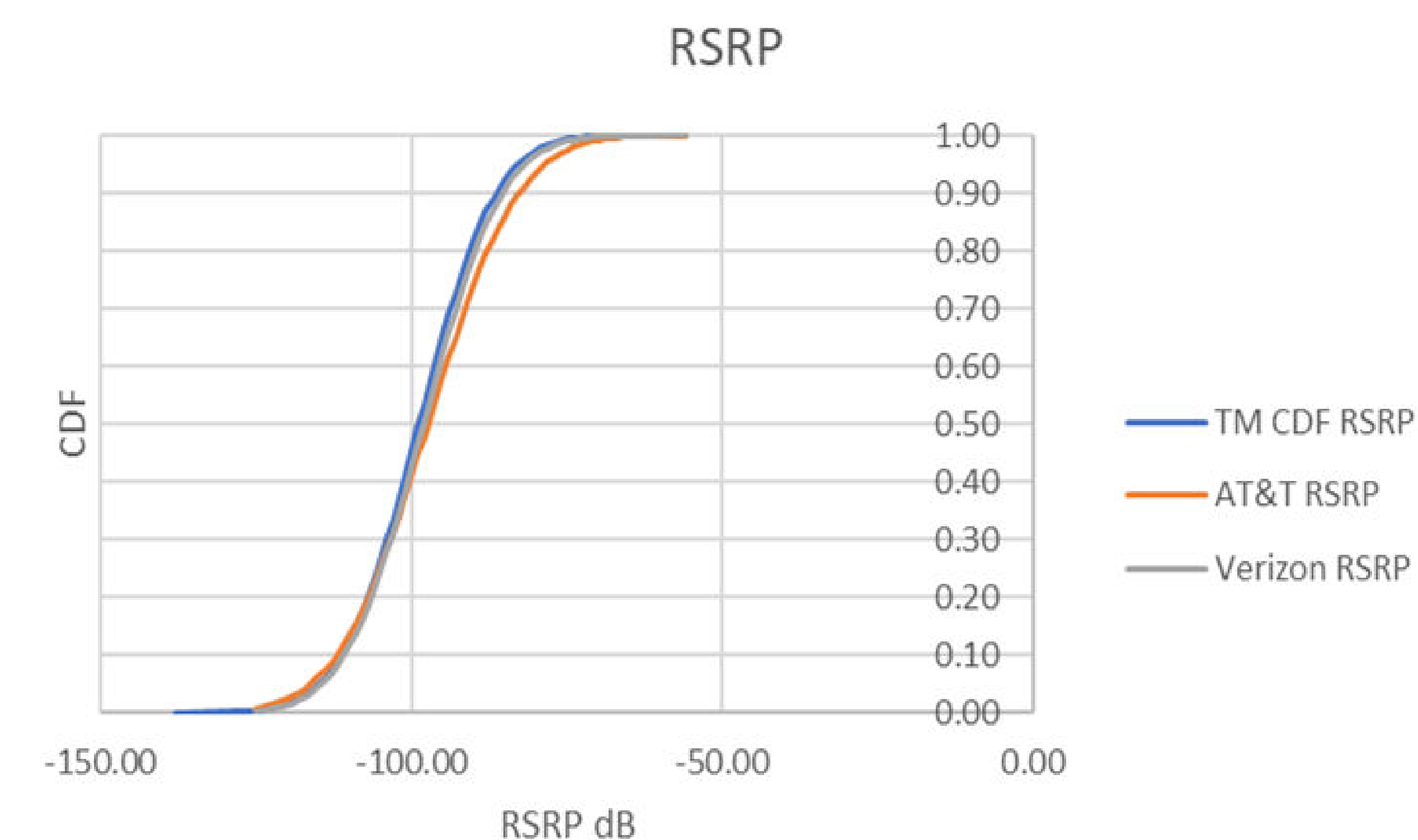


Figure 4: CDF of RSRP measurements for carriers

CONCLUSION

Future works may include whether an outreach strategy can be devised that focuses on minimizing the digital divide in underserved and under-resourced communities in the North Florida region.

ACKNOWLEDGEMENTS

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