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Data driven approaches to quantifying relationships between urban form & livability

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Research Directions

Understanding the relationships between urbanisation patterns, energy systems, environmental impacts and economic opportunity through an institutional and equity lens
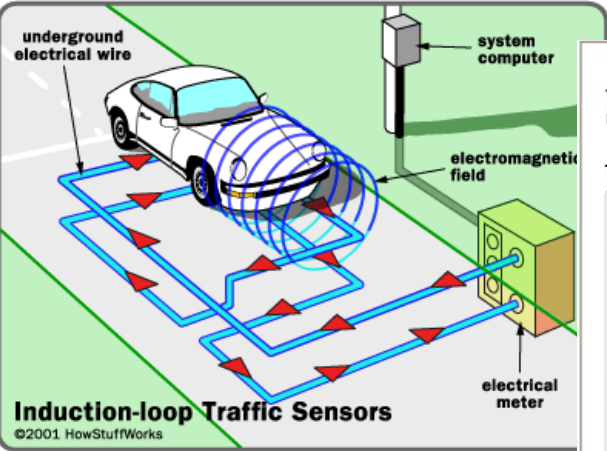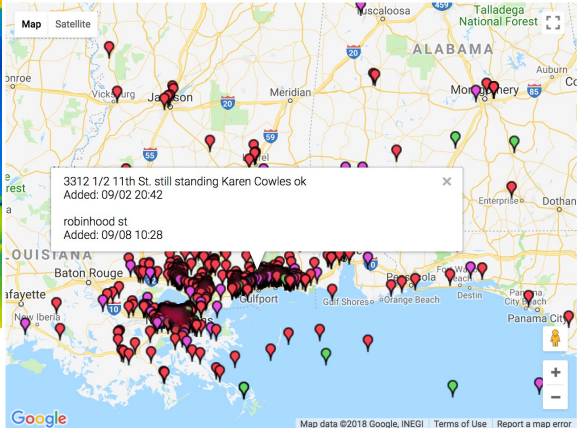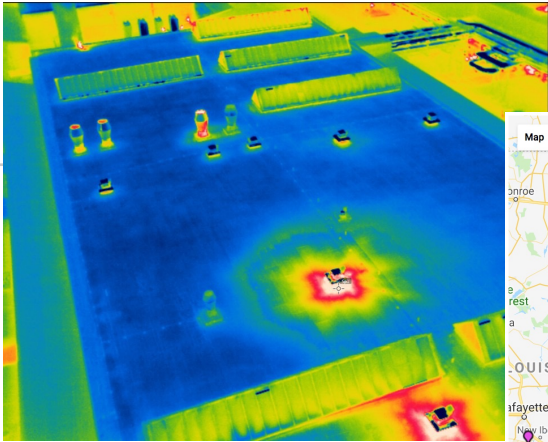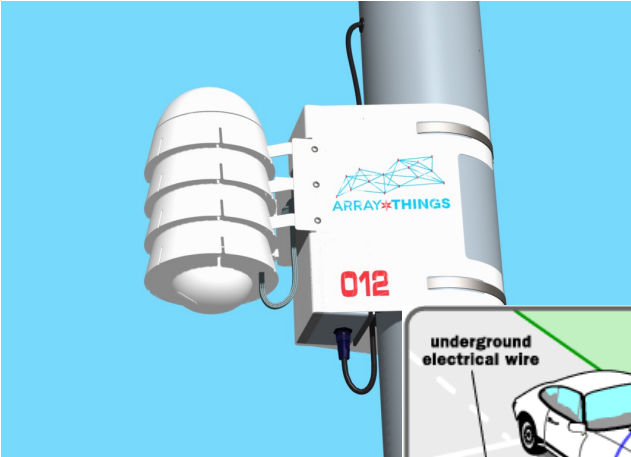
- New forms of technology are increasingly embedded into city systems (both physical and institutional)

- Analysing messy datasets that are generated by sensors and other data collection efforts.

- Fusing administrative and volunteered information to frame and tackle urban problems

- Institutional take on data generation and use

Data Generation Mechanisms

Research Projects

- What counts as urban? MAGPIE project

- Multiple 100m resolution datasets (e.g. landcover, slope, climate, nightlights) for India (~1.2 billion per dataset).

- ~140 million people are misclassified as rural in official statistics. India is more urban than it wants to acknowledge.

- How can we better identify irregular settlements in urban areas?

- 0.5-2m resolution satellite data for 2000 km^2 (~4 billion pixels) for one year.
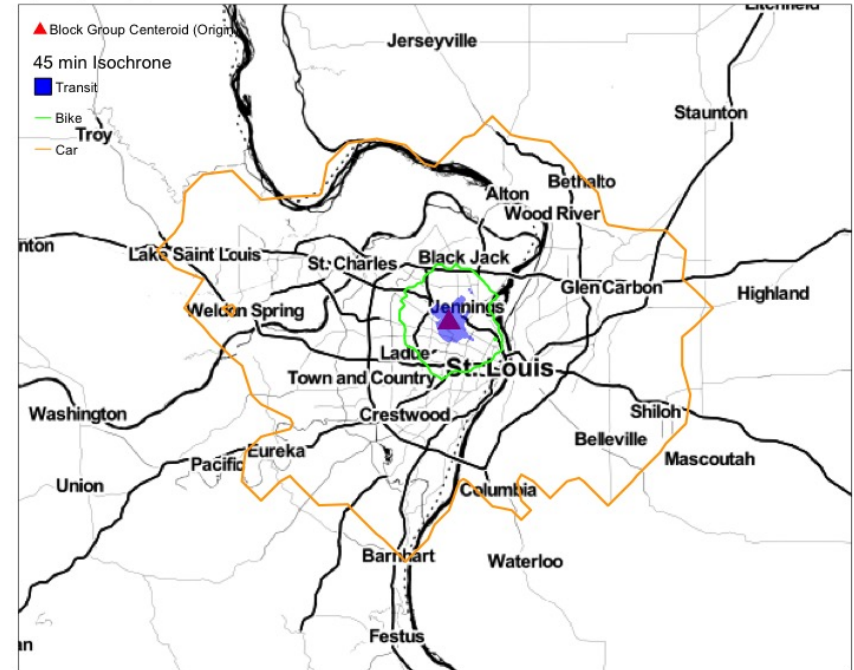
- Official estimates miss 75% of the settlements.

- How to track economic, social impacts of COVID-19 in near real time for North Carolina

- 36 indicators in 6 different categories were harmonized and a visualization platform was built.

- www.carolinatracker.unc.edu

- How is air quality, energy use impacted by land use patterns and configuration?

- 30m resolution land cover data for CONUS(~9 billion pixels) and air quality sensor data from 1300 sensors (~2 million records for 4 years).

- Economic Census from US Census.

- Urban form and configuration of urban and forest uses are associated with air quality.

- Compact urban form is associated with lower transportation energy consumption.
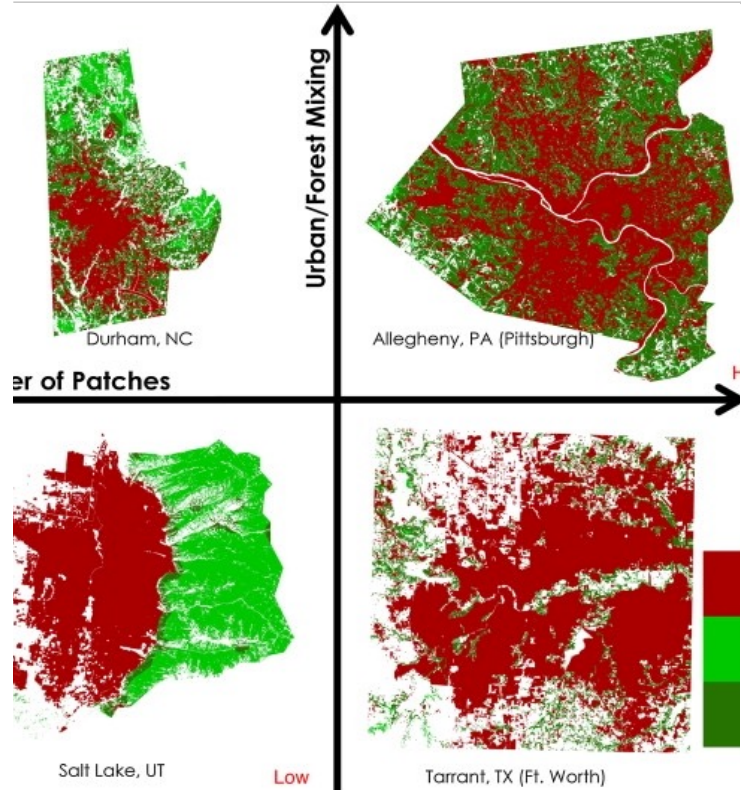
Urban Form Metrics

Total urban area $\sum_{P_i \in C} a_i$, where a_i is the area of the patch P_i and C is the county

Number of patches $N \equiv \sum_{P_i \in C} i$

Mean patch area $\bar{a} \equiv \frac{\sum_{P_i \in C} a_i}{N}$

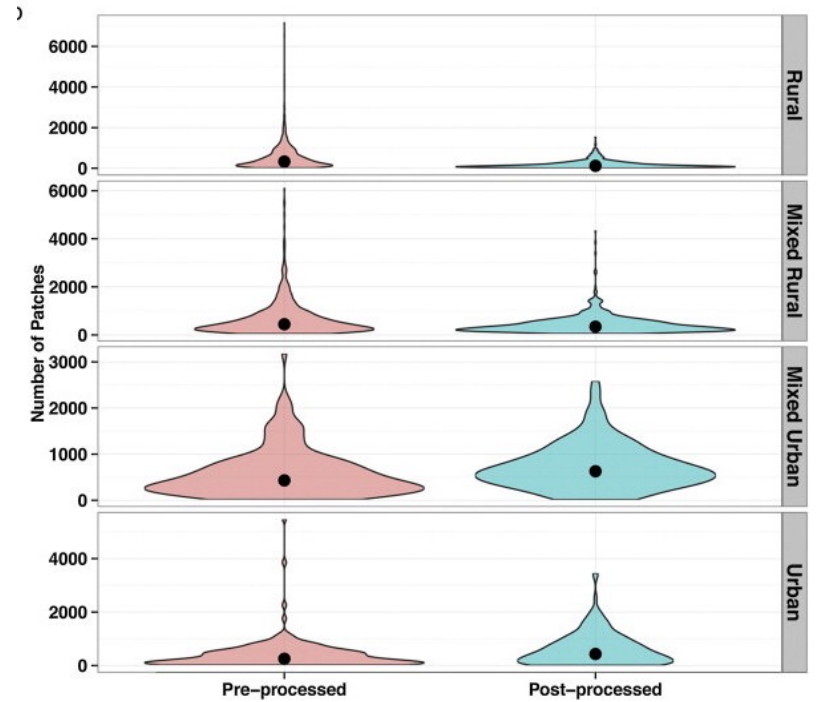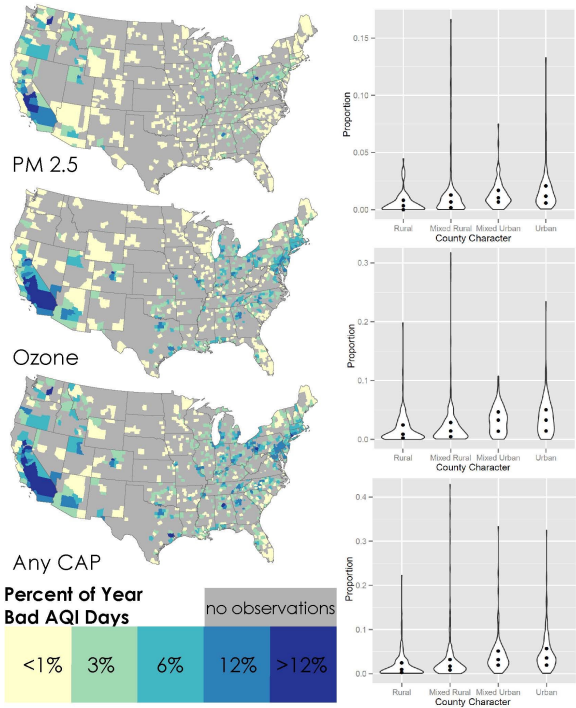Std. dev of patch area $\sqrt{\frac{\sum_{P_i \in C}(a_i - \bar{a})^2}{N-1}}$

Durham, NC

Allegheny, PA (Pittsburgh)

Salt Lake, UT

Tarrant, TX (Ft. Worth)

Urban/Forest Mixing

...er of Patches

Low

Cleaning/Harmonisation

Issues

PM 2.5

Ozone

Any CAP

Percent of Year Bad AQI Days
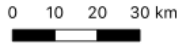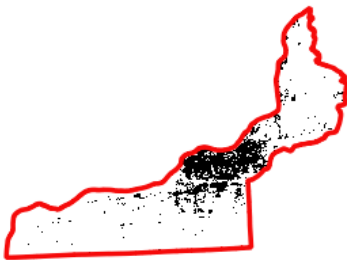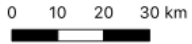
no observations

| <1% | 3% | 6% | 12% | >12% |

New York, NY
IMI: 0.27

Multanomah, OR
IMI: 0.53

Rock Island, IL
IMI: 0.20

Results

- Urban form and configuration of urban and forest uses are associated with air quality.

- Compact urban form is associated with lower transportation energy consumption.

Thank you!

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