Development of LandScan HD: A High Resolution Population Distribution Database for the World

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University of Pennsylvania

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OAK RIDGE NATIONAL LABORATORY
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Disparate data integration improving knowledge of population distribution and dynamics

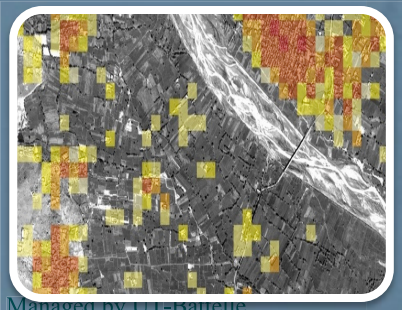
Geographic Information Science and Technology

LandScan Global

- Spatial resolution of 30 arc seconds (~1km)
- Ambient population (average of 24 hours)
- Remote sensing based global data modeling and mapping

LandScan USA

- Spatial resolution of 3 arc seconds (~90m) coverage for the United States
- Nighttime and daytime population
- Integration of infrastructure and activity databases



LandScan HD (ongoing development)

- Spatial resolution of 3 arc seconds (~90m) global coverage
- Ambient population (average of 24 hours); Nighttime and daytime population where adequate land use data is available
- Settlement mapping from very high resolution imagery (1m or less)
- Integration of population density and activity databases

Spatial refinement of LandScan Global

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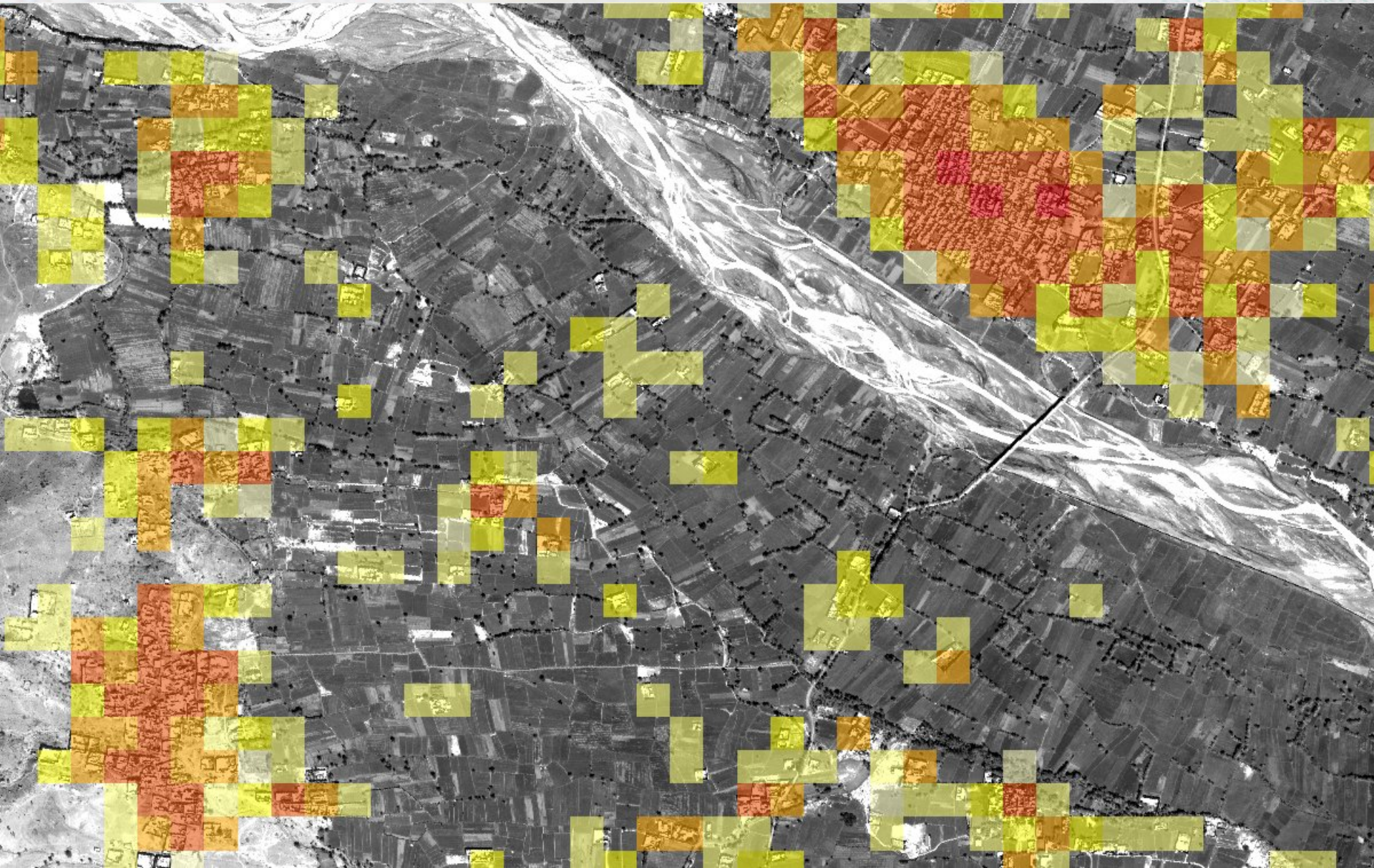
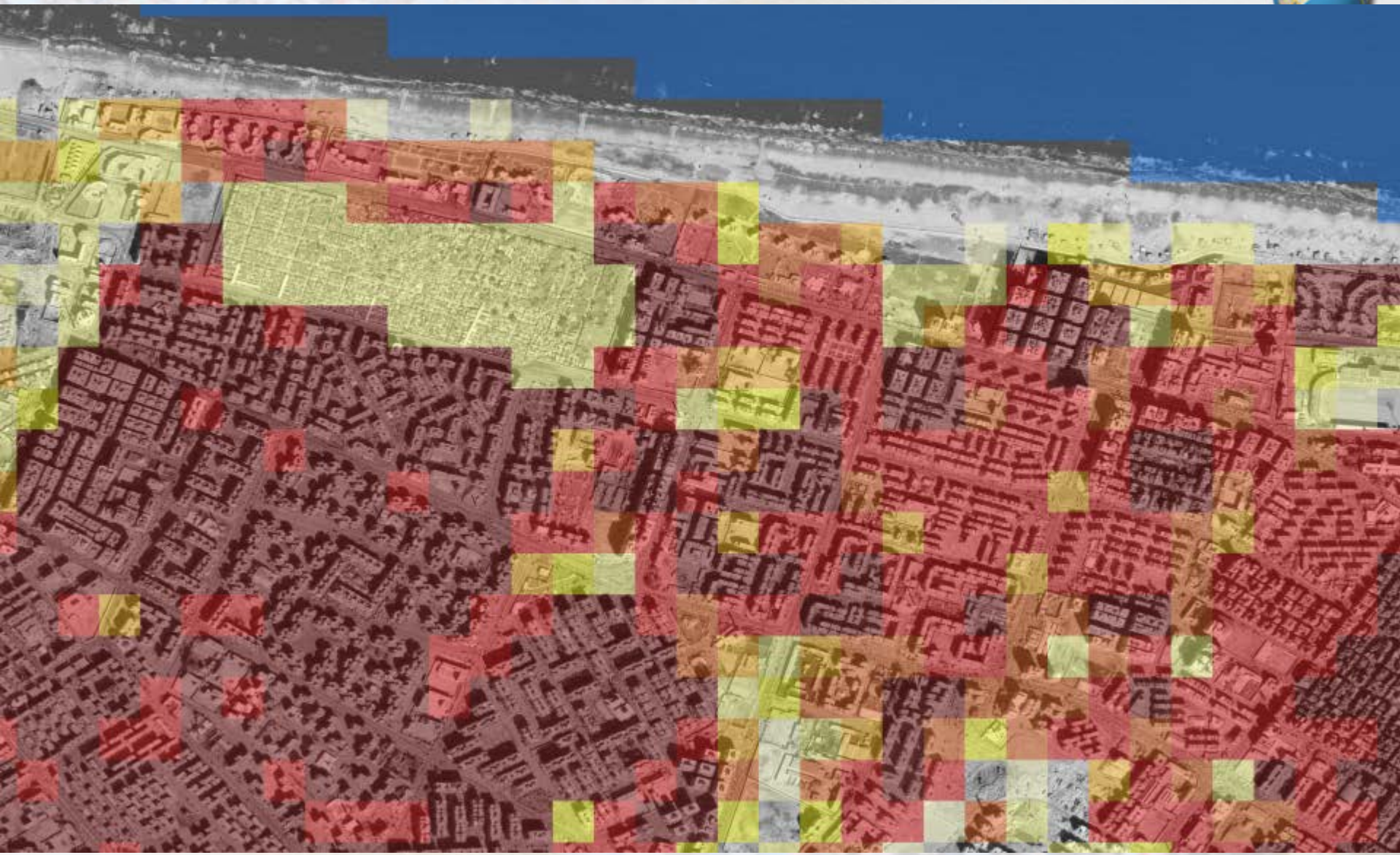
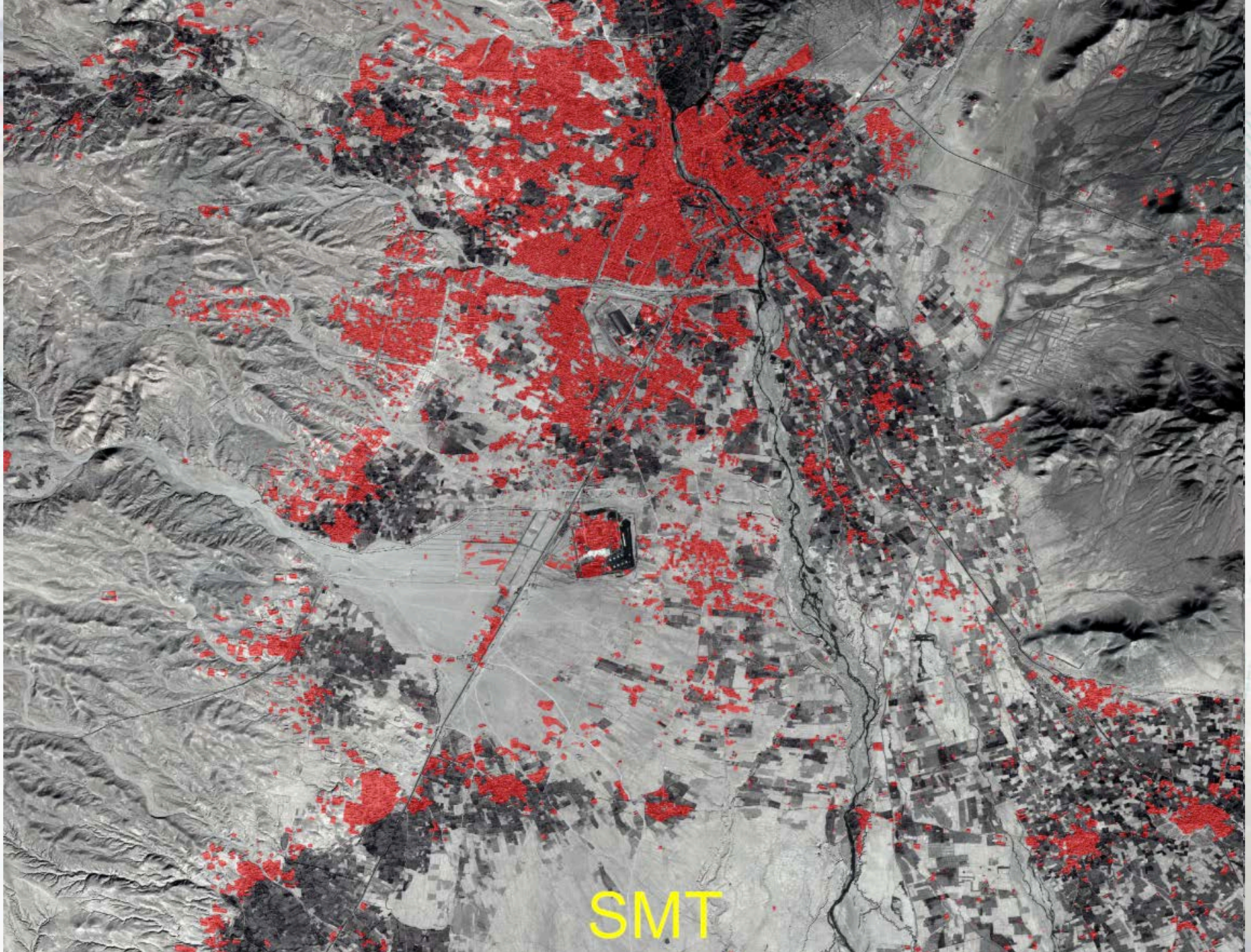
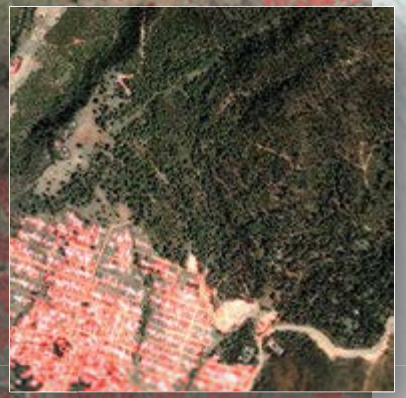


Port Said




SMT

Addis Ababa, Ethiopia



- Image analyzed (0.6m)
  - 40,000x40,000 pixels (800 sq. km)
  - RGB bands
- Overall accuracy 93%
  - Settlement class 89%
  - Non-settlement class 94%
- Total processing time
  - 15 seconds

Settlements are economic indicators

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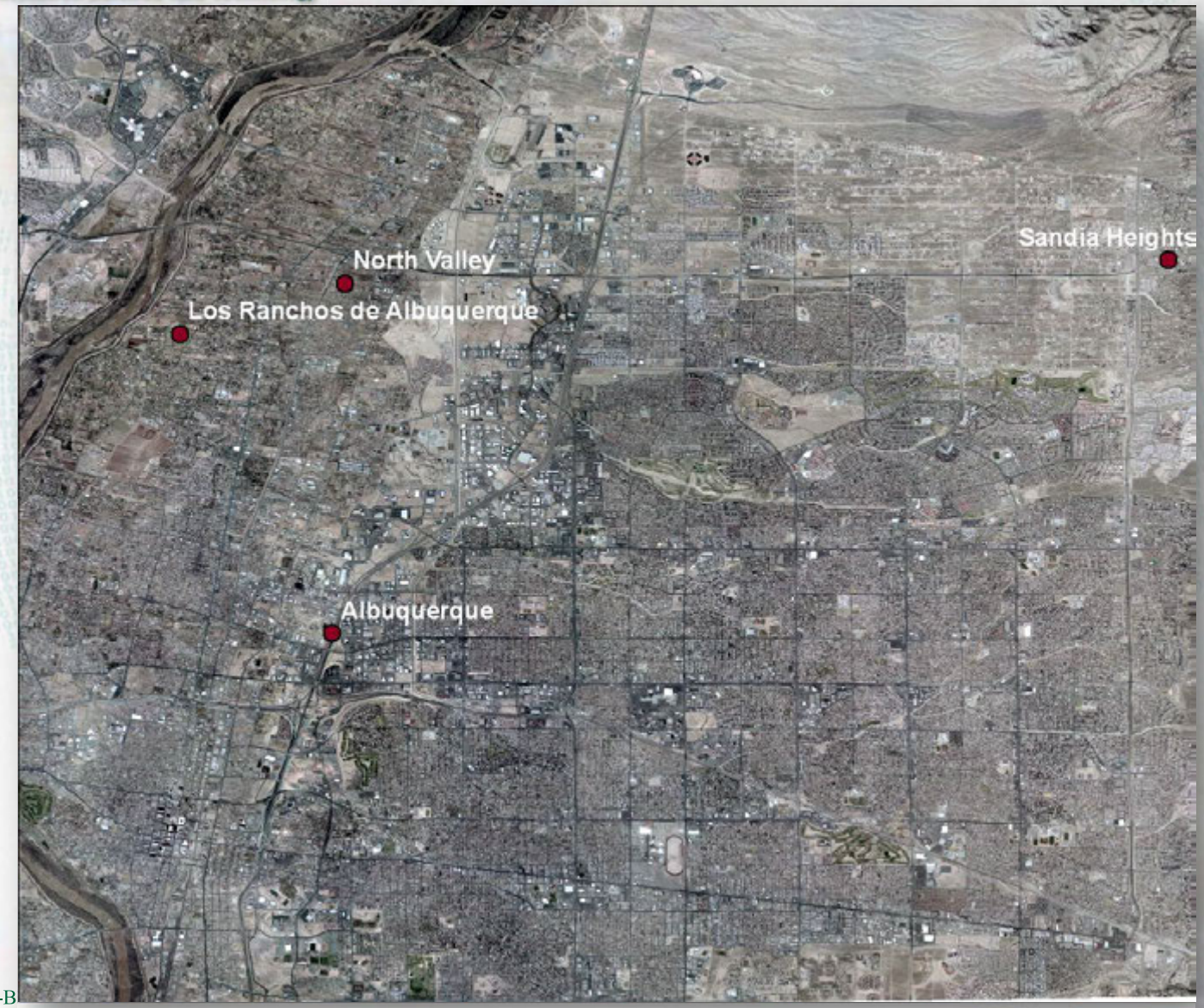

Patterns in overhead imagery

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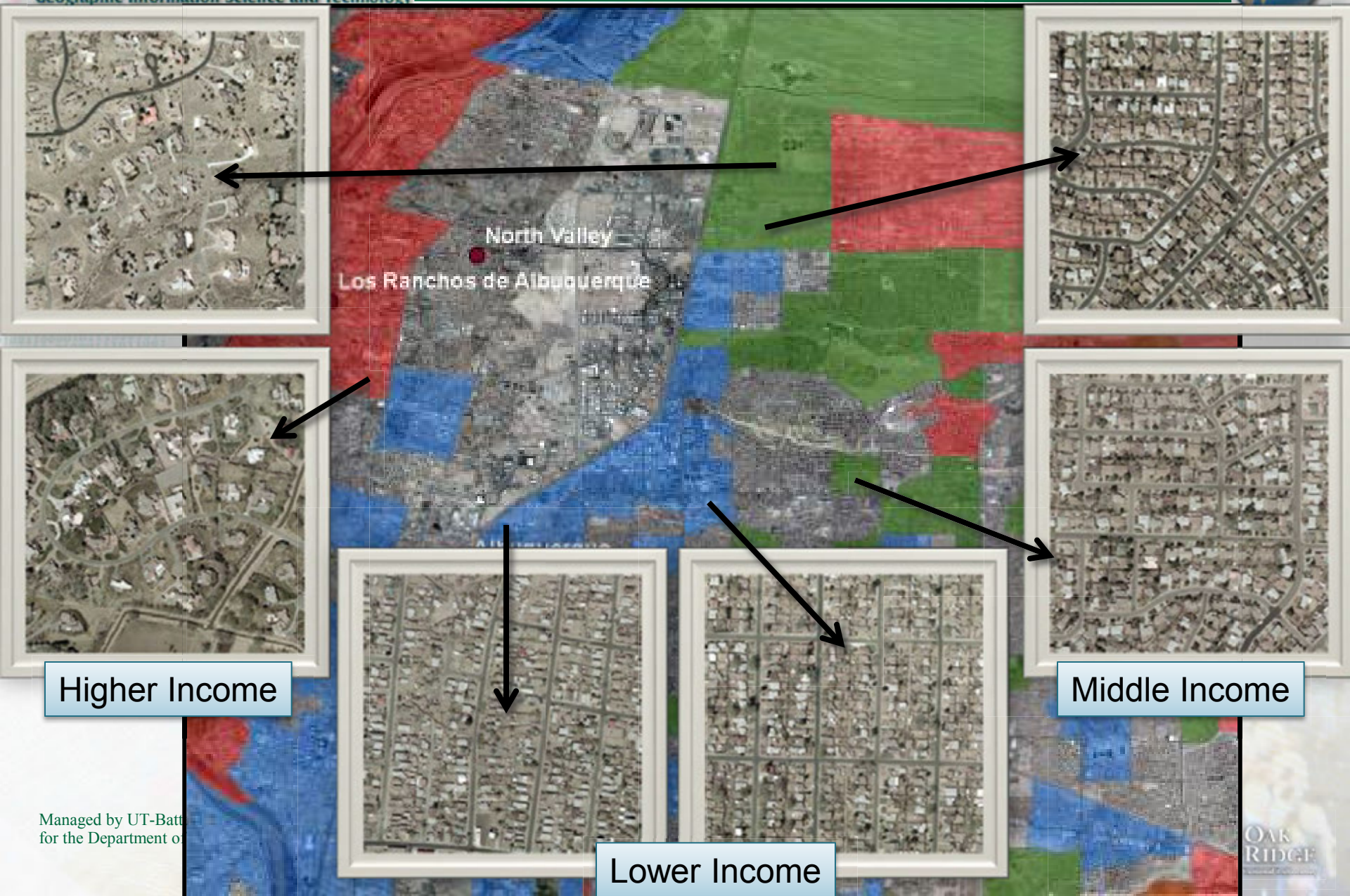
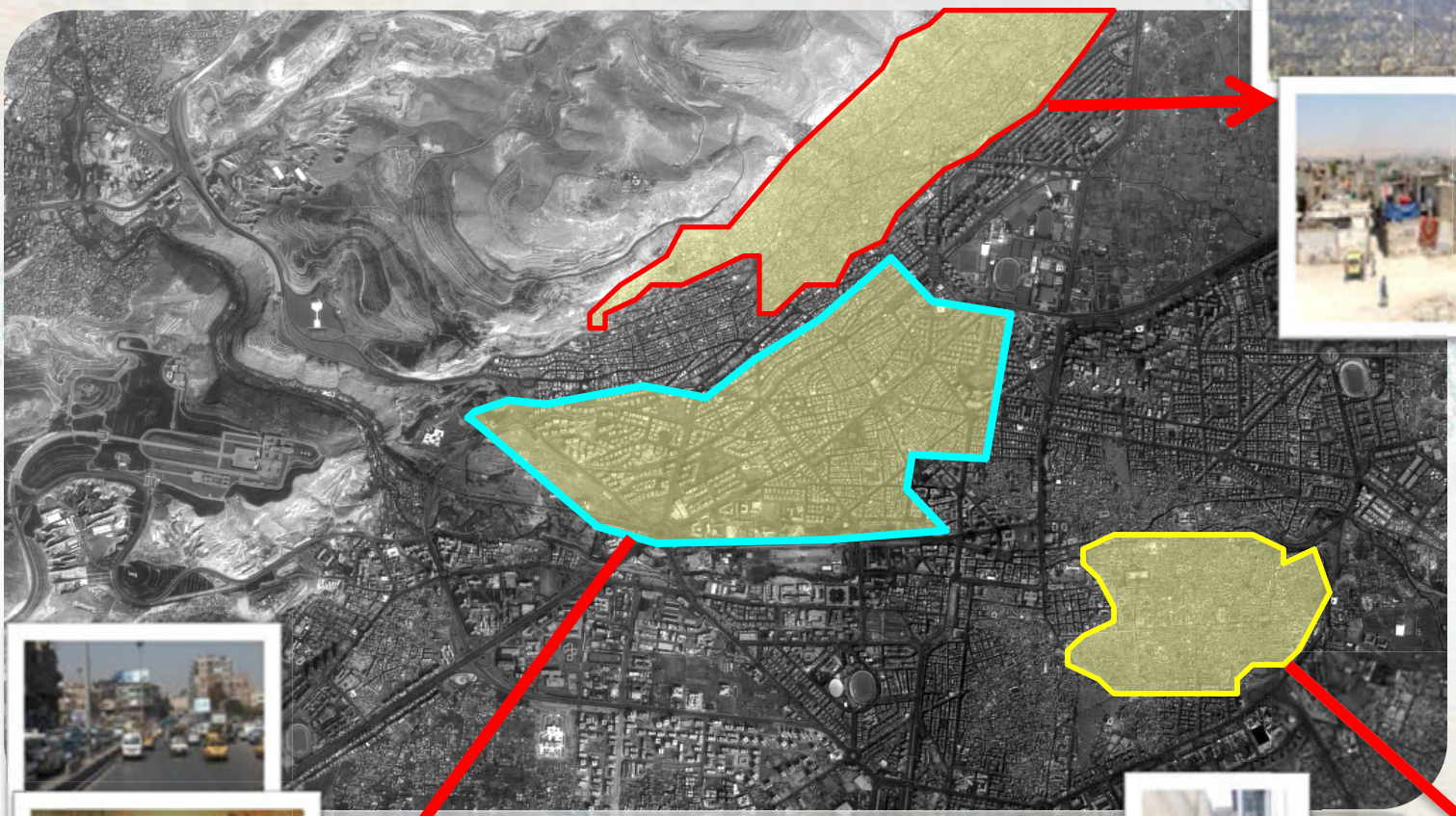
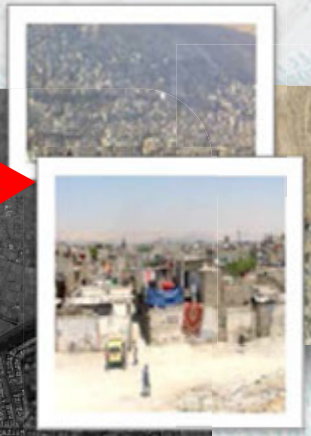


Neighborhood mapping: From local interactions to global realizations

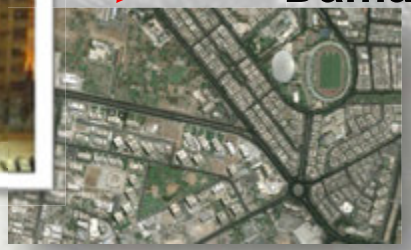
Geographic Information Science and Technology





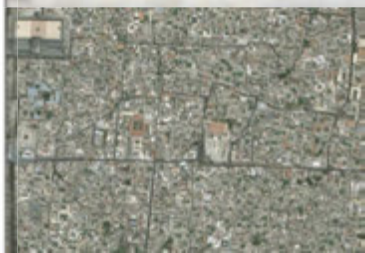
- Unstructured Settlements
- Lowest to lower middle income
- Rural migrants

- Very loosely structured
- Historical ethnic quarters/neighborhoods
- Poor residents currently being displaced in some areas with urban development/tourism



- Formal Urban Planning
- Typical Urban Services
- Middle to Upper Income

Damascus, Syria



Edge Orientation Distribution

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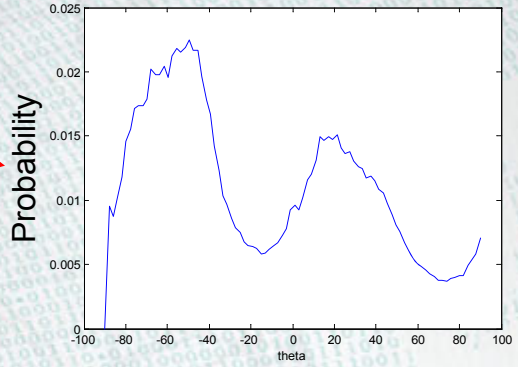
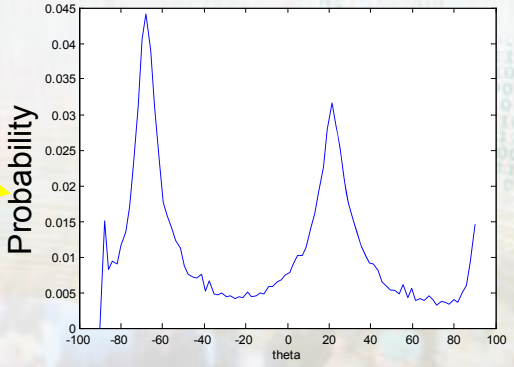
Unplanned Settlement



Edge Orientations

Planned Settlement



Edge Orientations

Peakness in the distribution around edge orientations separated by 90 degrees is a good indicator for planned settlements.

Formal & informal settlement mapping

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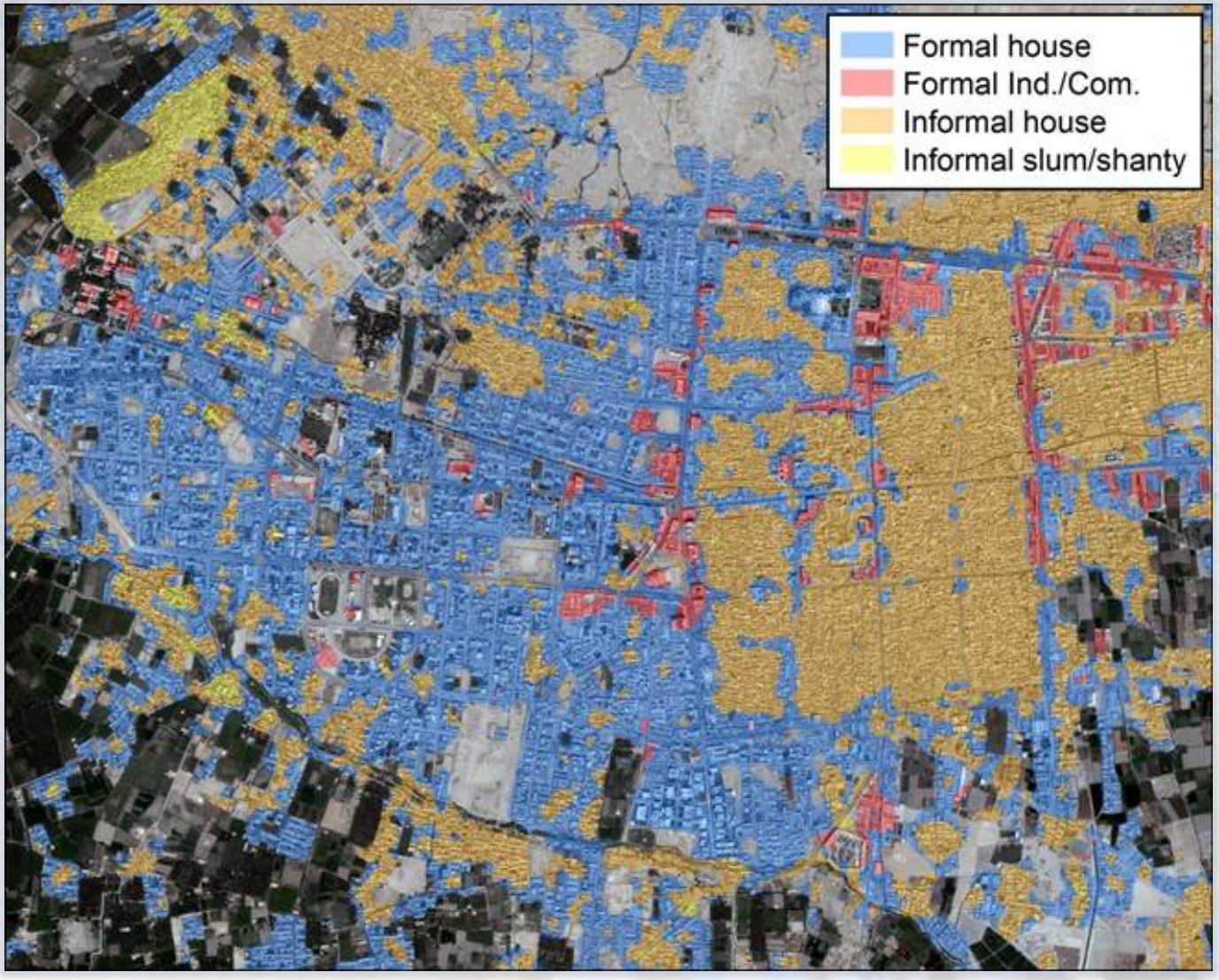

J. Graesser, A. Cheriyadat, R. R. Vatsavai, V. Chandola, J. Long and E. Bright, "Image Based Characterization of Formal and Informal Neighborhoods in an Urban Landscape ," *EEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 5(4):1164-1176, 2012

Population density data from open source

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- Population/1000 ft^2
- 55 facility categories in 8 land use classes
- Documented data sources and methodology with traceable provenance
- Open source collection from reputed sources
  - Academic journals, official government statistics, corporate and university webpages, tourism brochures.
  - Utilizing other sources such as GeoCommunity, Wikipedia, Panoramia, and Wikimapia.
- http://extranet.ornl.gov/pdt

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Retaining data provenance is critical

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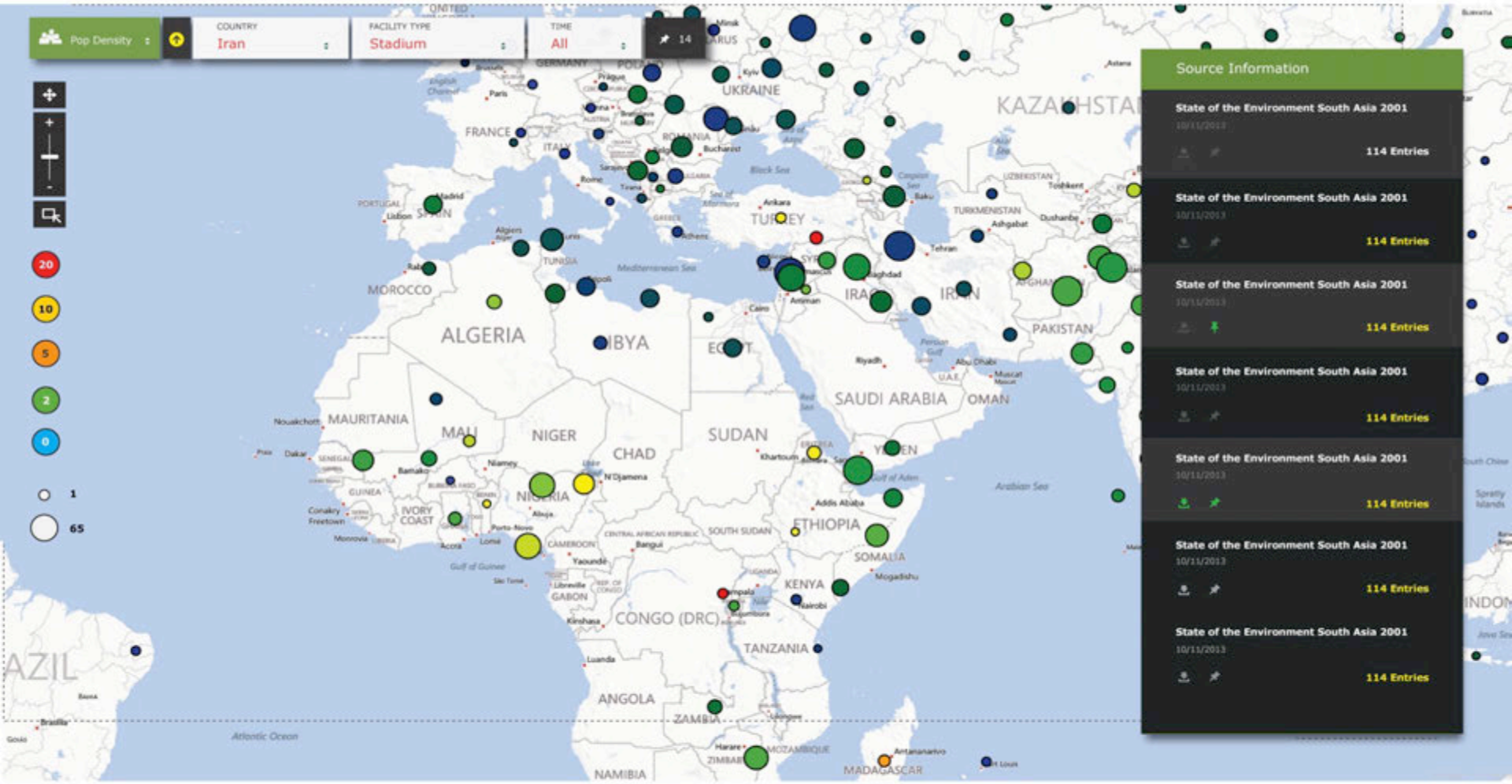

PDT includes modeled and other data

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Bayesian approach provides modeled data for areas where observation based data is unavailable

Example: LandScan HD data for Bahrain

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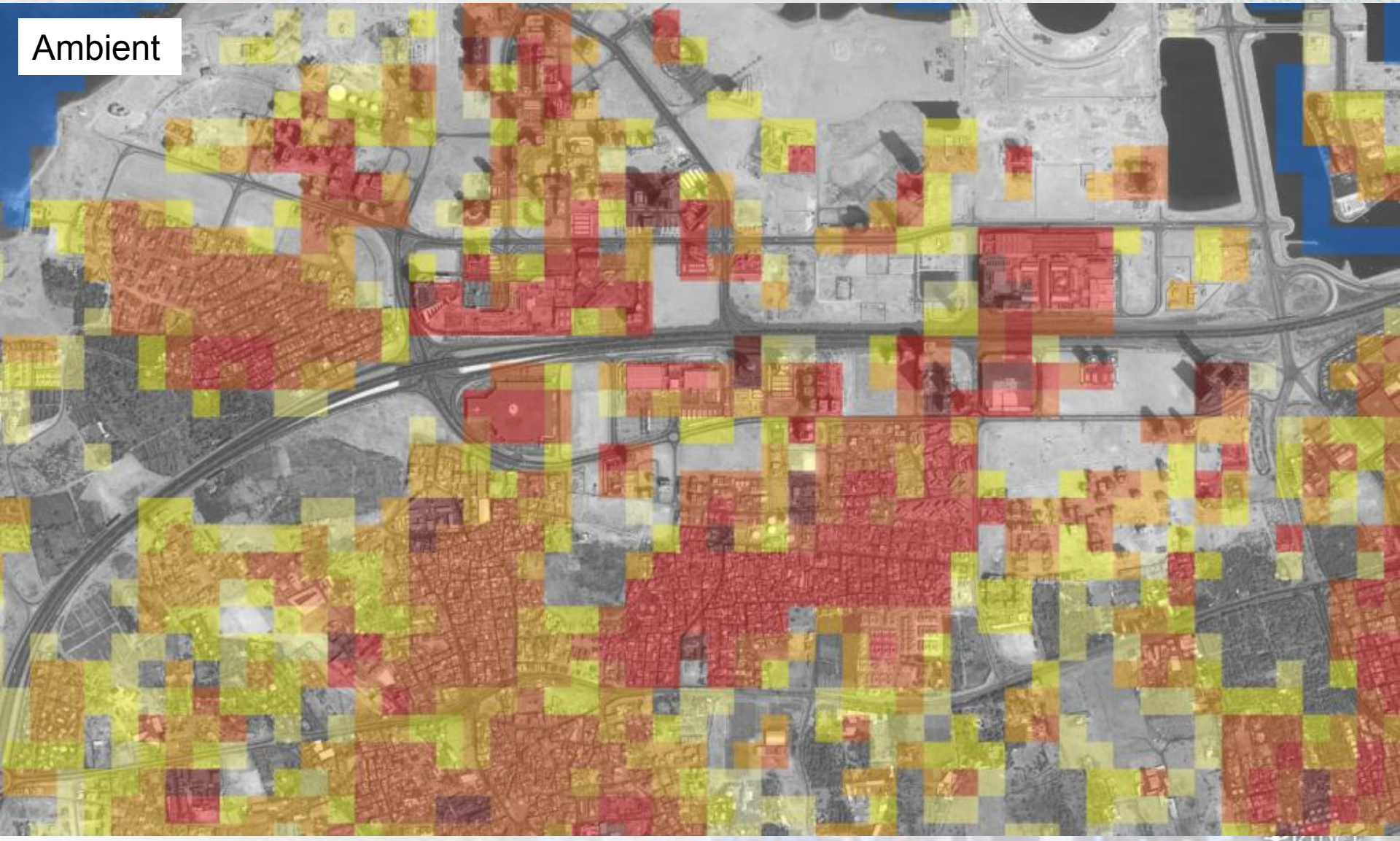
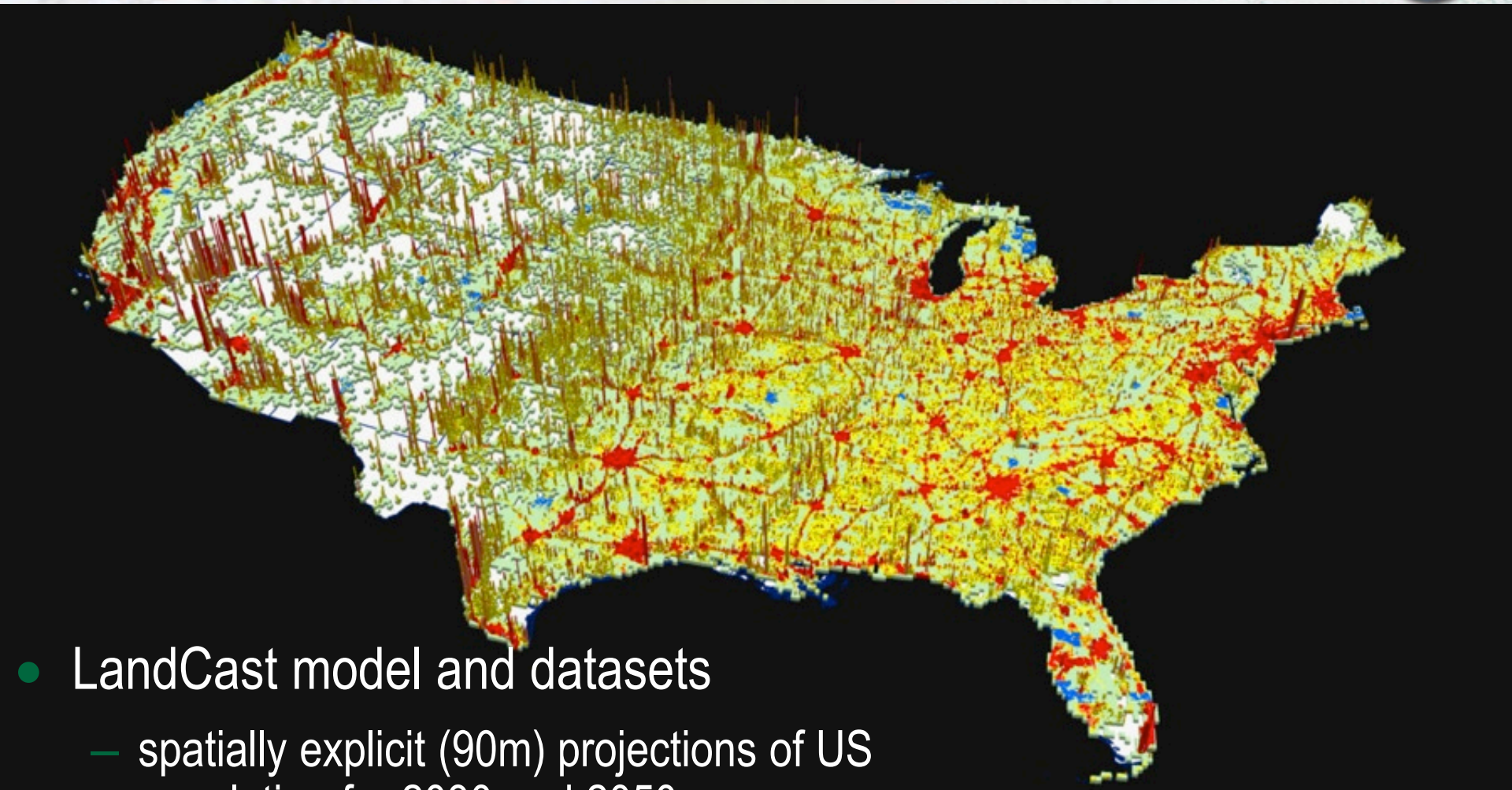


Population Dynamics Models and Data



- LandCast model and datasets
  - spatially explicit (90m) projections of US population for 2030 and 2050
  - McKee et al. 2015 (www.pnas.org/cgi/doi/10.1073/pnas.1405713112)