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An initiative of the Computation Institute of the University of Chicago and Argonne National Laboratory

Charlie Catlett, Senior Computer Scientist, Argonne National Laboratory
Senior Fellow, Computation Institute of the University of Chicago and Argonne National Laboratory
Director, UrbanCCD
catlett@anl.gov

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HOME PEOPLE PARTNERS ENGAGE US

Computational Urban Sciences Center Forms in the City of Big Data

MacArthur Foundation Grant Fuels Computational City Research

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The Urban Sciences Research Coordination Network

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The Eric and Wendy Schmidt 'Data Science for Social Good' Summer Fellowship

APR 2013 "Civic hacking" is an increasingly popular way for people skilled in programming and data crunching to give back to their community. Through

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Obama Campaign Chief Data Scientist Joins University of Chicago

APR 2013 Rayid Ghani will work with Computation Institute and the University of Chicago Harris School of Public Policy

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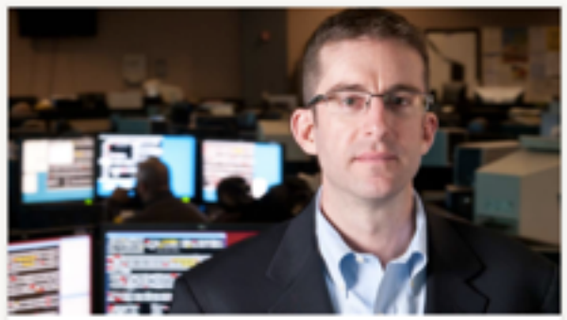

Brett Goldstein, CIO for City of Chicago, joins Chicago Harris, UrbanCCD

MAY 2013 Brett Goldstein, Chief Data and Information Officer for the City of Chicago, has been named the inaugural recipient of the Fellowship in Urban Science at the University of Chicago Harris School of Public Policy. He will begin the two-year fellowship on July 1, 2013.

Chicago Harris, with generous support from the

Obama Campaign Chief Data Scientist Joins University of Chicago

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A New Research Community for Urban Data

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The Eric and Wendy Schmidt 'Data Science for Social Good'

UrbanCCD

about a day ago
RT @CeC Day 1 of Data Science for Social Good summer student fellowship program. #dssg (at 303 E Wacker) [pic] — path.com/p/3j6SmD

about 6 days ago
Super excited to welcome @chicagocdo Brett Goldstein to the team! urbanccd.org/2013_05-001.ph

about 7 days ago
RT @Comp_Inst Brett Goldstein, Chicago's Chief Data and Information Officer, is joining @UrbanCCD and @UChicagoHarris: http://t.co/szl16xgmbs

about 8 days ago
Startling. Sobering. RT @davewiner: Timelapse of 30 Years of Human Impact on Earth. 4ix.r2.ly"

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Urban sciences: Meeting the growing energy needs of cities

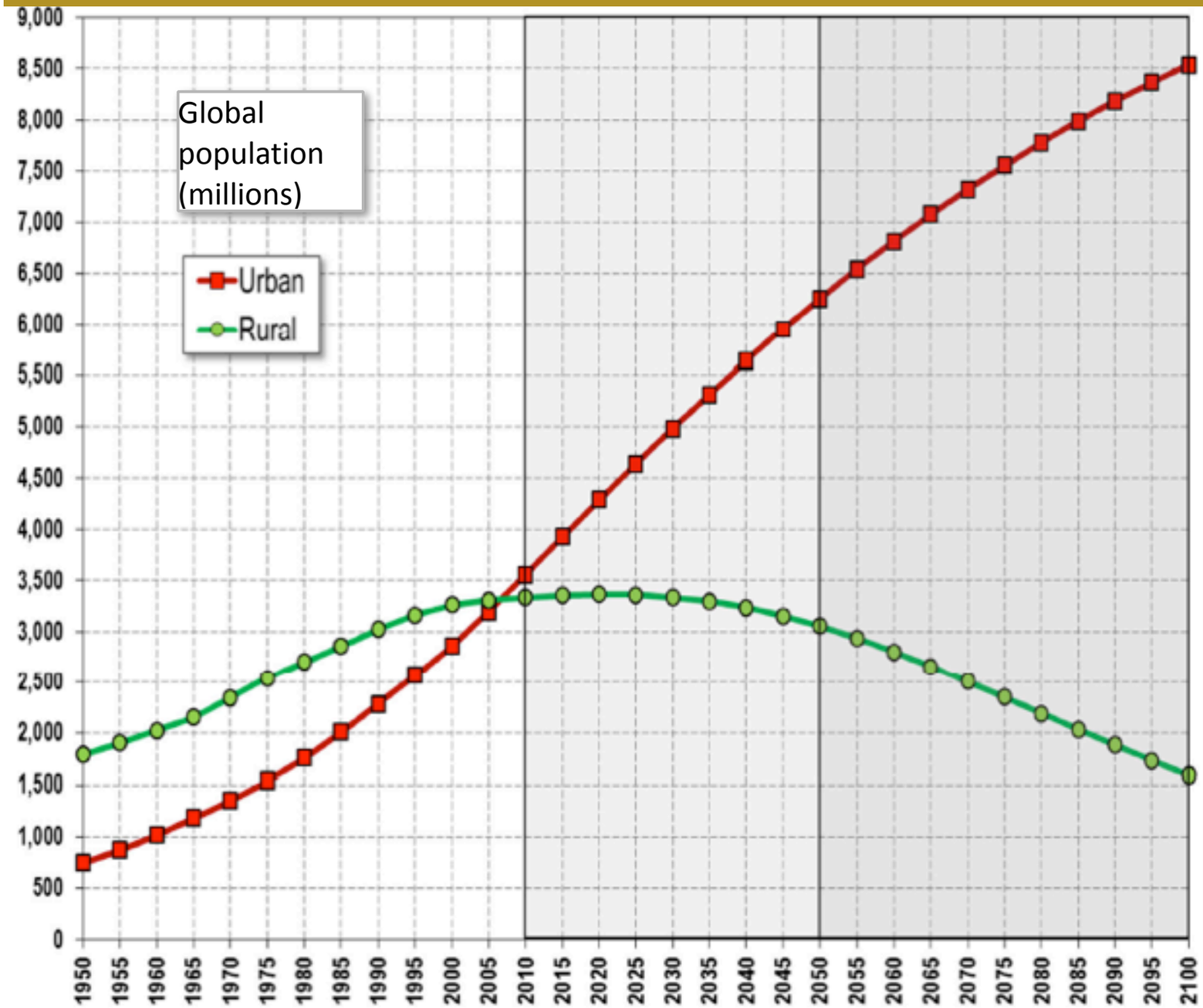
THE CHALLENGE

- By 2030, 87% of U.S. energy will be consumed in cities
- Urban growth is skyrocketing in developing economies

THE VISION

- Cities made livable through ‘intelligent,’ energy-efficient, renewable technologies: sensors & controls, predictive analytics & optimization, multi-scale computational models

WHY NOW?



United Nations, Department of Economic and Social Affairs, Population Division (2012); World Urbanization Prospects, the 2011 Revision, New York;

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Motivation: Rapid Global Urbanization

IN 2025:

70%

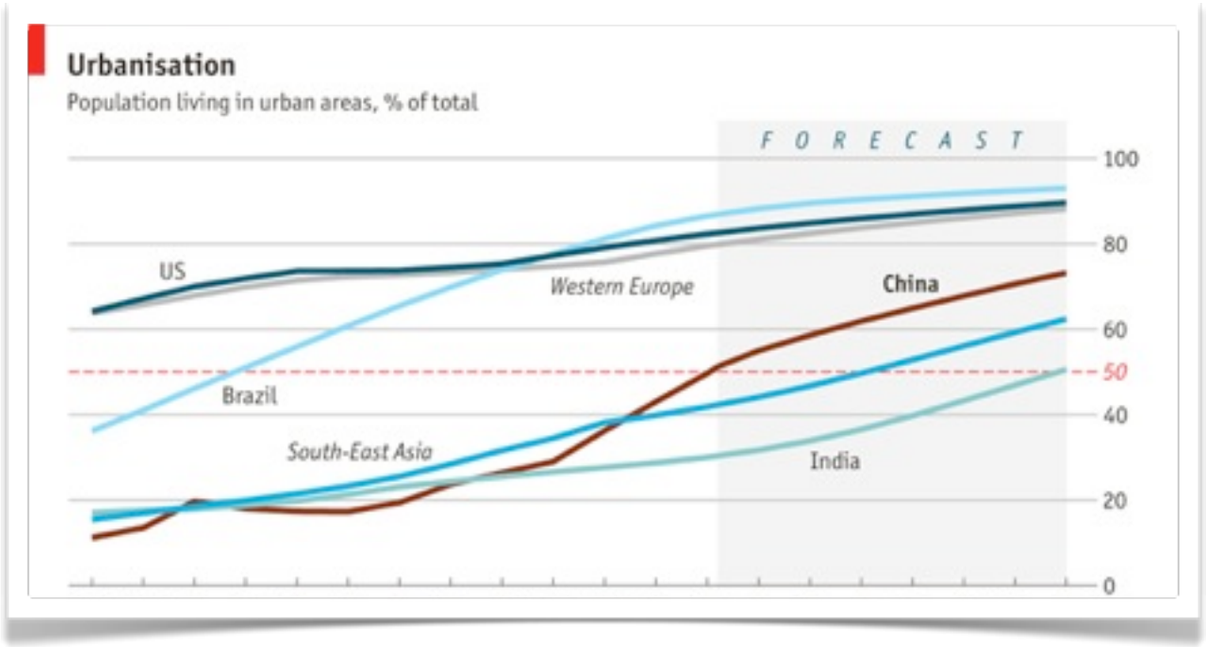
of Chinese will live in cities with 1M or more people.

And by 2030...

221

Chinese cities will have 1M or more people.

Source: Foreign Policy Magazine, Sep/Oct 2010, "Megacities," Richard Dobbs (McKinsey Global Institute)



Sources: CEIC; UN Population Division; The Economist

More than the entire population of the US...

China will *add*

400

million city dwellers

....requiring the construction of one New York City every year for several decades....

...enough floorspace to cover the country of Switzerland.

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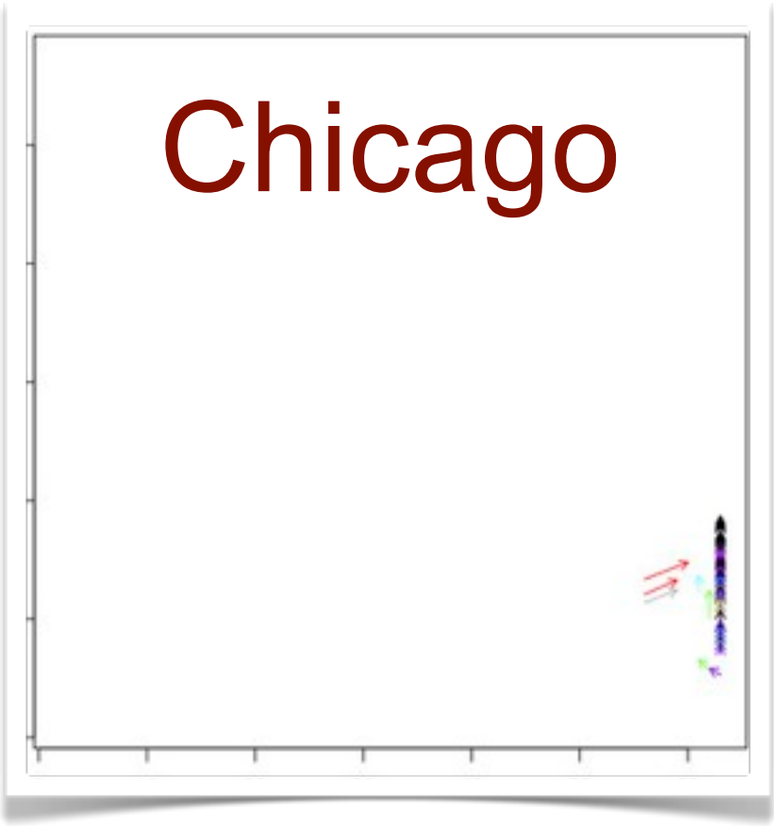

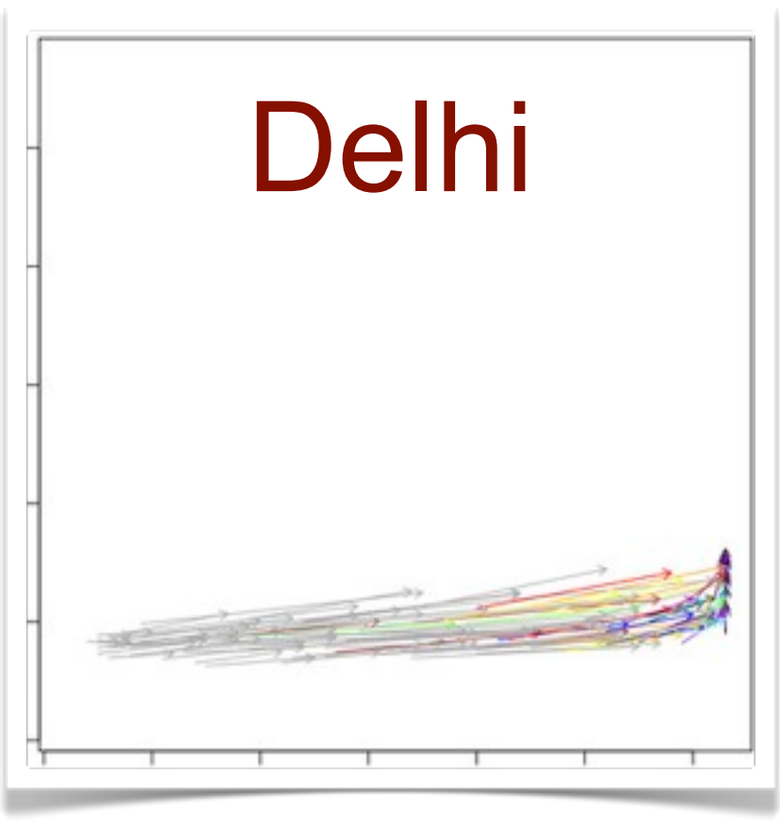

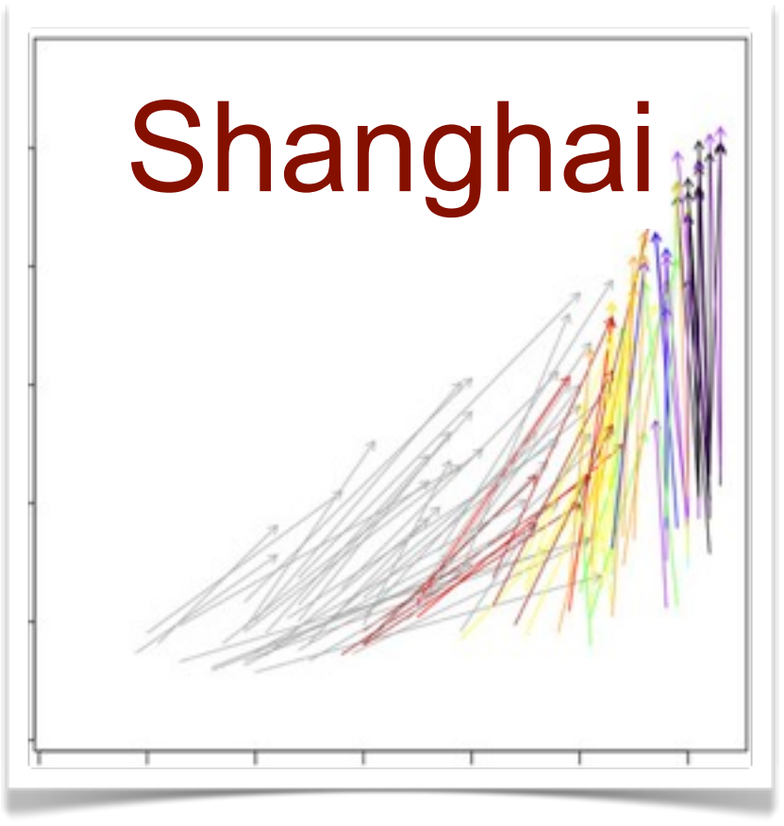

1999-2009 Land Area Increase

1999-2009 Building Height Increase

Cities in India and Southeast Asia are Growing at Unprecedented Rates

Frolking S, T Milliman, KC Seto, MA Friedl. 2013. A global fingerprint of macro-scale change in urban 2-D and 3-D structure from 1999 to 2009, Environ. Res. Lett.

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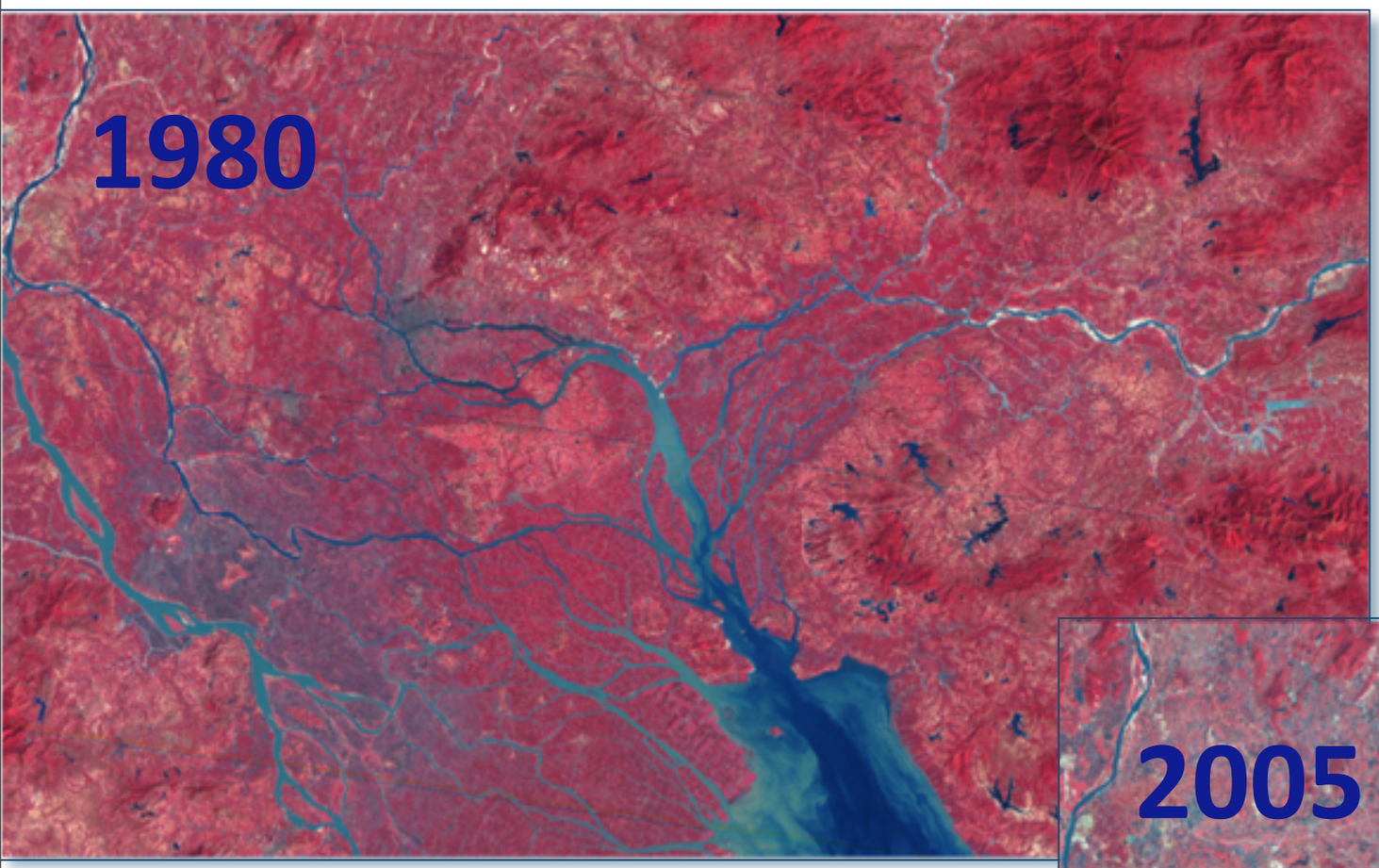
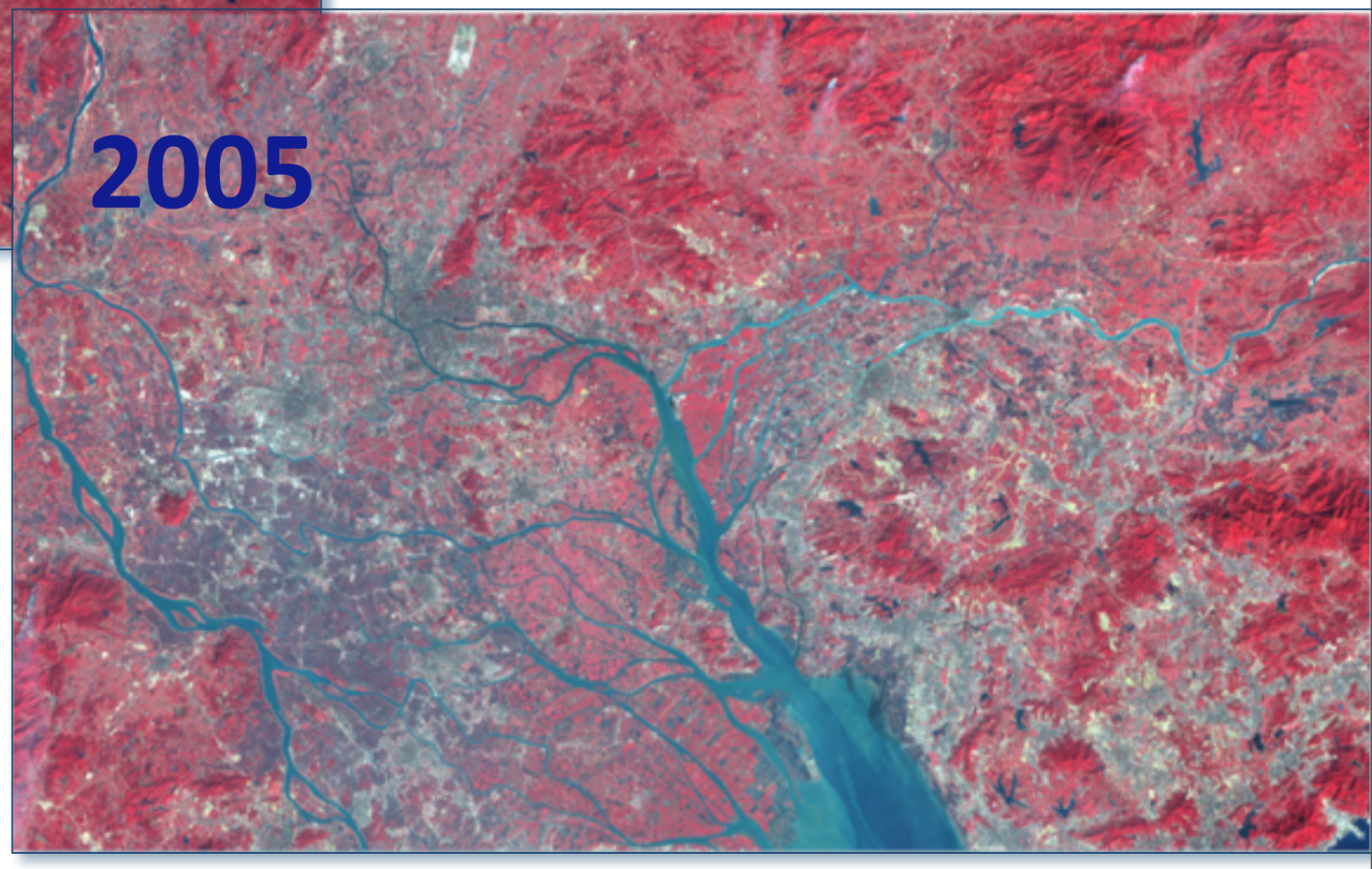
Climate, Energy, and Water



The Pearl River Delta in 1980 and today, illustrating the impact of urbanization on the planet.



By 2020, China will invest $300B in new infrastructure to transform the delta into a single 40M person city.

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Charlie Catlett (cec@uchicago.edu)

UrbanCCD Programs

Environment

Infrastructure

Society

Impact and Challenges of Urban Growth

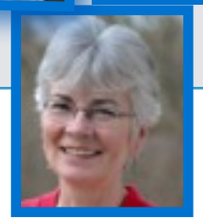
Modeling

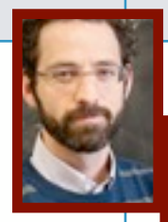
Data Analytics

Sensing

Dissemination and Training

Tools, Methods, and Programs





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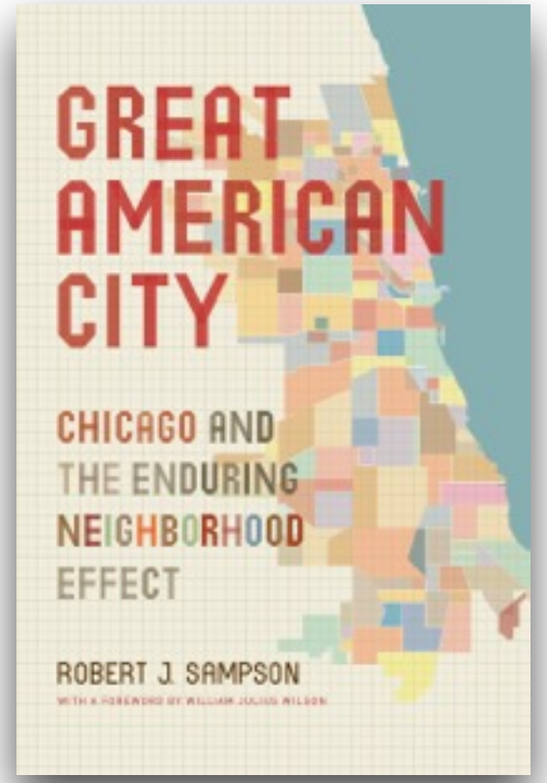
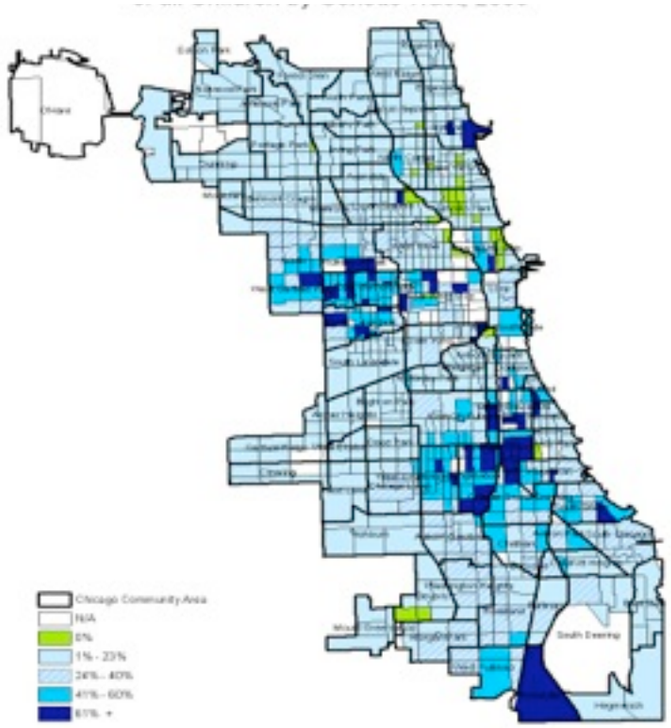
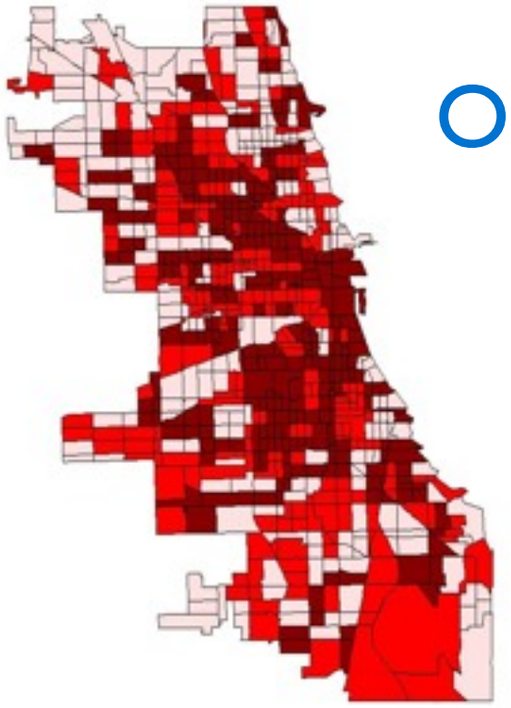
SOM SKIDMORE, OWINGS & MERRILL LLP

SAIC School of the Art Institute of Chicago

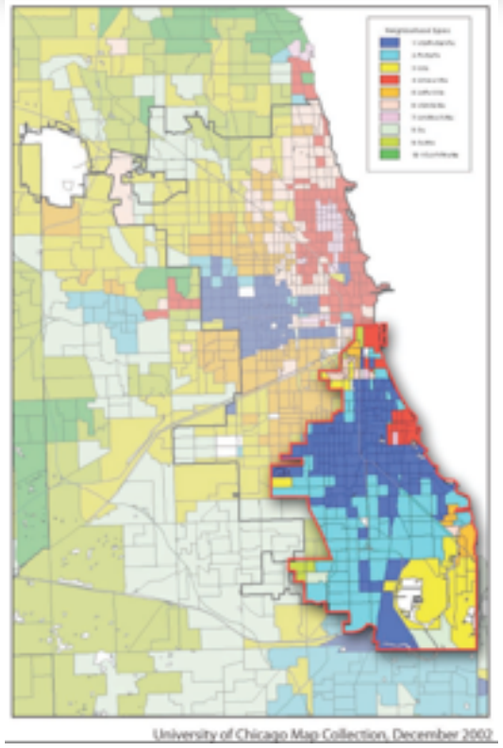
(CI Fellows)



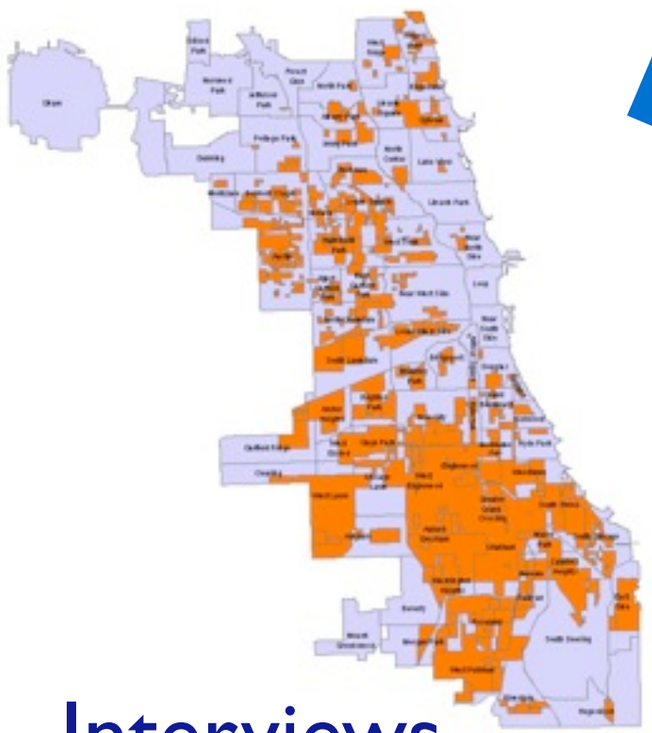




Opportunity: City of Chicago open data and unique City/ University partnerships.



Social Service Data



Census

Interviews

Bob Goerge, Kathleen Cagney

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Opportunity: broad range of urban data at UChicago.

Data Set	Description	Provider
Chicago Open Data Portal	740 data sets (including 311, crime, inspections, code violations, financial, GPS vehicle movement)	City of Chicago
Social Services Data	Data sets from State of Illinois, Cook County, and City of Chicago law enforcement, education, health, employment, and welfare agencies	Chapin Hall (UChicago)
Nielsen Consumer Data	Consumer survey (nationwide), product purchase, advertisement data	Booth School / Kilts Center (UChicago)
ComEd Energy Usage and Building Data	Electrical usage (monthly) and building details for 480,000 Chicago buildings	ComEd and City of Chicago
Oak Park Energy Usage and Building Data	Electrical usage (15m interval) for 40,00 Oak Park accounts	Village of Oak Park
South Side Community Assets	Longitudinal data on assets and services for 13 (35 square miles) South Side of Chicago neighborhoods (expanding to 10 zip codes in 2012)	Pritzker School of Medicine (UChicago)
GIS Built Environment Models	Chicago buildings and transport systems	Skidmore, Owings & Merrill

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- **Research Project Example:** Identifying, measuring, and forecasting conditions of neighborhoods (w.r.t. socio/economic vitality, public safety, etc.)

Examples of City of Chicago Research Questions*

- Predicting high rates of EMS calls and contributing factors
- Populate a unique building ID across datasets
- **Creating 'neighborhood health index'**
- Predicting movements in the neighborhood health index
- Predicting locations of abandoned buildings / vacant lots
- Visual recognition of neighborhood improvement or retrograde
- Route optimization for routine city vehicle routes (snow plows, garbage collection, tree trimming) and for emergency routes as well.
- Estimate increases in crime incidents
- Prediction of restaurants which will fail food inspections
- Estimate economic health ("micro-GNP") of neighborhoods and sub-neighborhoods
- Generate industrial profiles for neighborhoods
- Financial fraud detection (from city transactions)
- Payment error detection (from city transactions)
- Measuring satisfaction with agencies through social media
- Identify delays in fulfilling 311 service requests
- M/WBE (minority/women owned) companies that attempt to skirt procurement regulations

**From City of Chicago, Dept. of Innovation and technology.*

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Example: City of Chicago Proactive Intervention

Create "**Neighborhood Health Index**" - identify early indicators to neighborhood decline and corresponding preventative interventions, e.g.:

Predict locations of abandoned buildings/vacant lots.

Predict restaurant failures based on food service reports, social media, and other data.

Estimate economic health ("micro-GNP") of neighborhoods and sub-neighborhoods.

Articulated need common to multiple city departments and functions

Research Capabilities

Analytics, machine learning, and other algorithms, guided by social, economic, education, health, and related research areas, to examine urban data as a means to define and measure neighborhoods and related functions.

Requires computer scientists, mathematicians, economists, and social scientists.

Impacts on City Challenges

Early detection of at-risk neighborhoods w.r.t. crime, education, economics, employment, leading to preventative vs reactive intervention.

With specific and measurable outcomes for city government and/or city dwellers.

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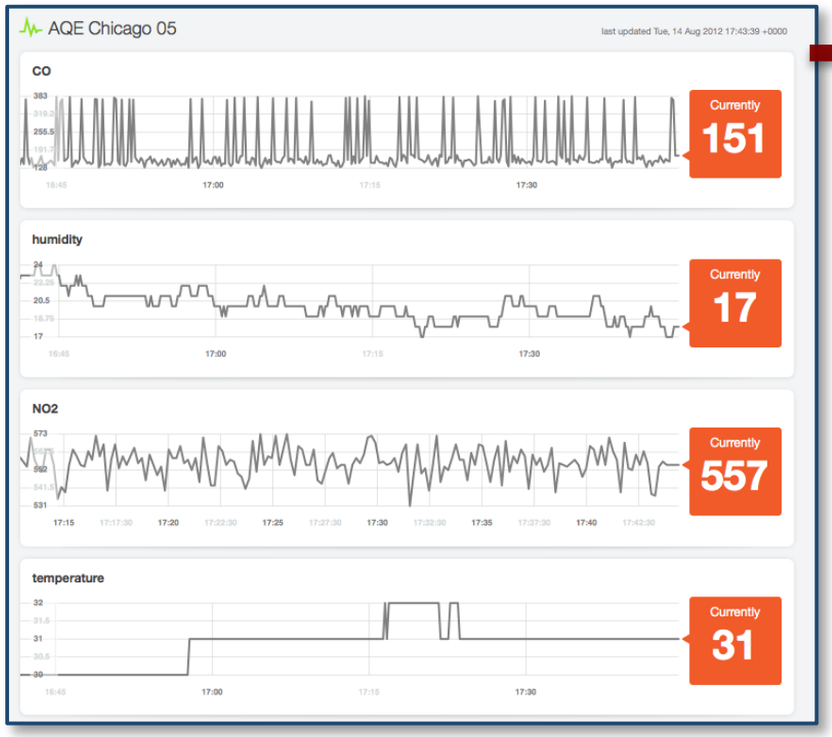
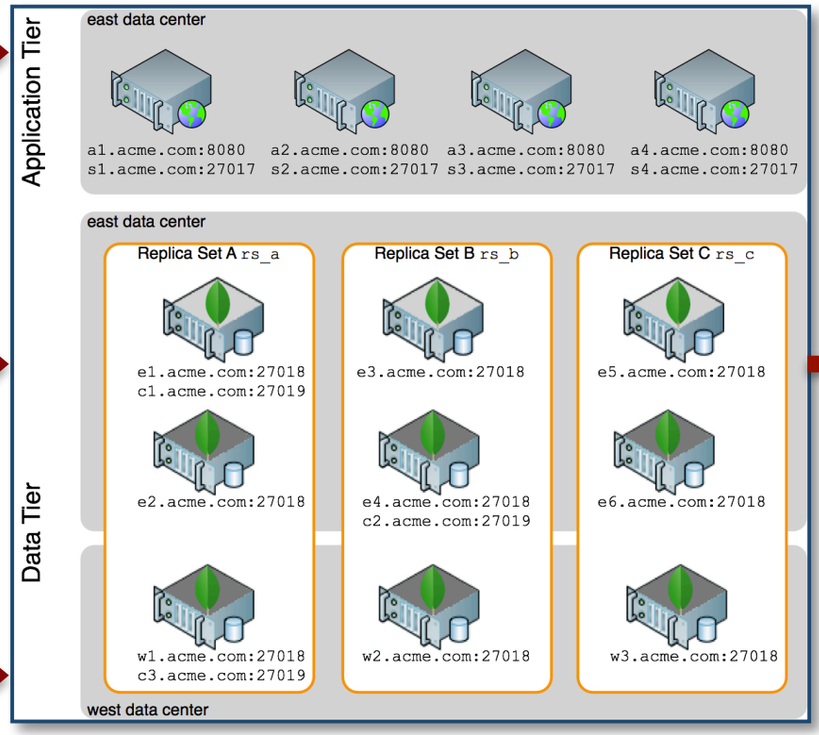
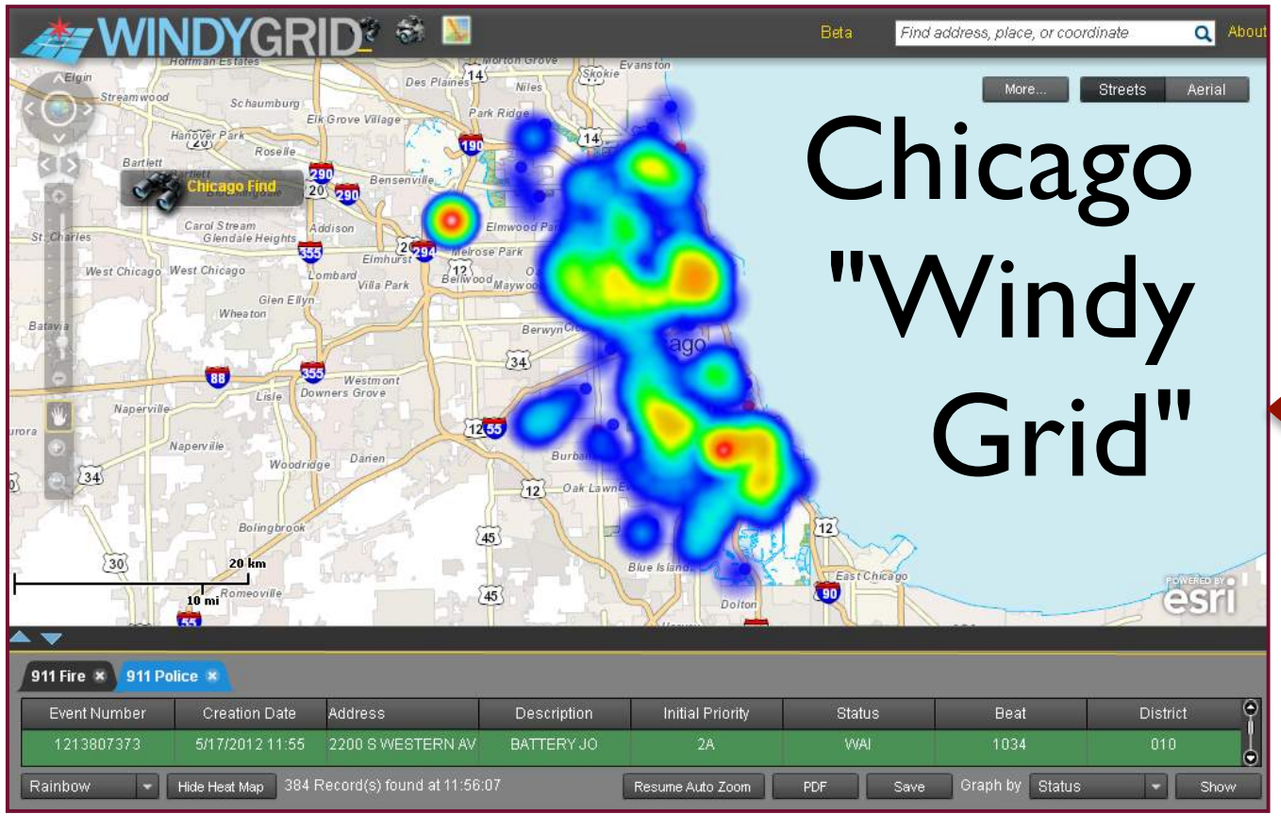




Opportunity: partnership with City of Chicago on new capabilities.

Daily
Crimes
Building Permits
Building Violations
Business Licenses
Facilities
Right-of-Way Permits

Every 30 seconds
311 Service Requests
Tweets
Weather
CTA Buses (GPS)
911 Police Service Calls
911 Fire Service Calls
Other City & Public Safety Mobile Assets (GPS)



Chicago "Windy Grid"

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Ryan Briones, Brett Goldstein - City of Chicago

Opportunity: partnership with developer and architect of 600-acre city expansion.

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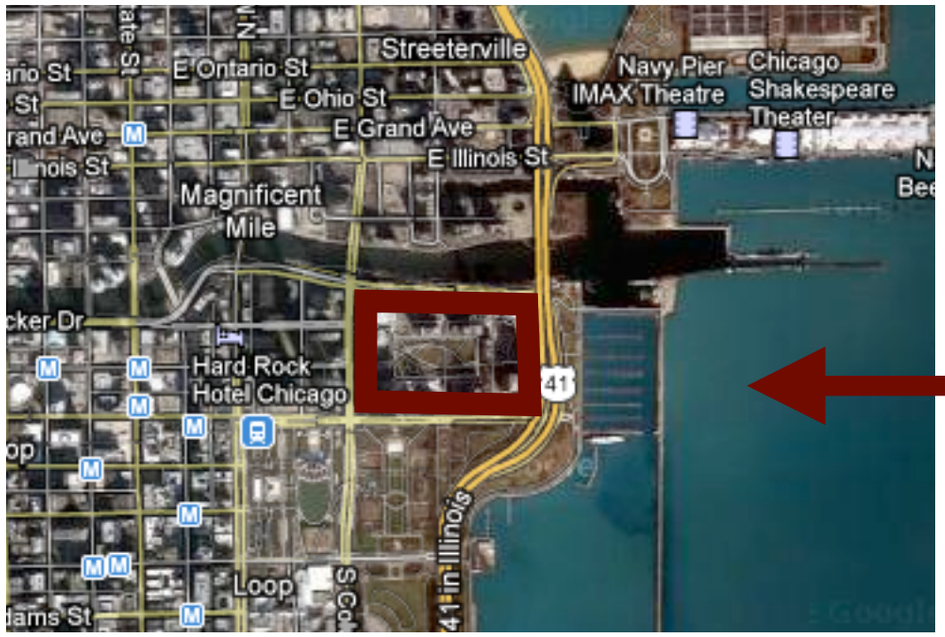
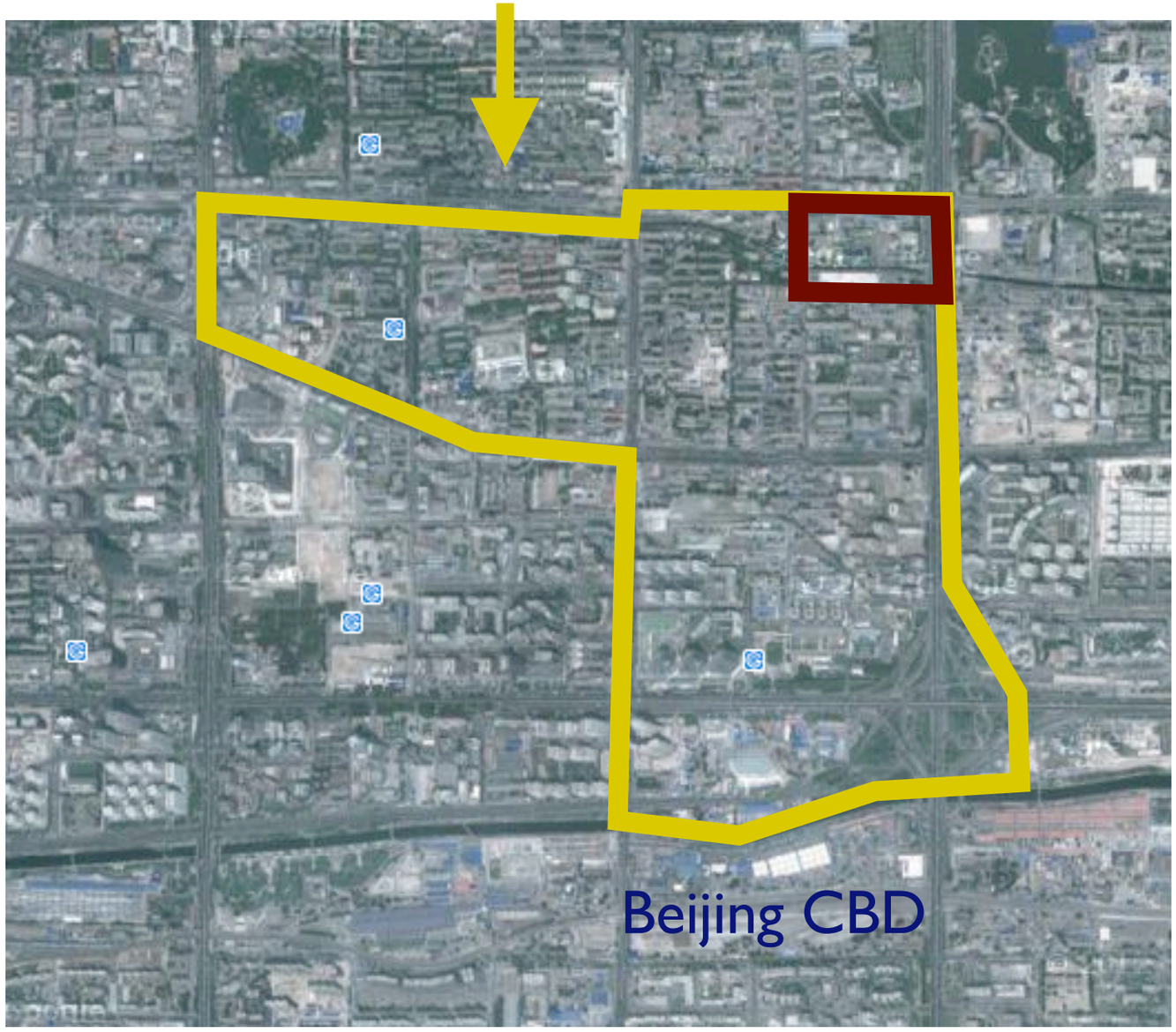
Today's urban growth is driving *city-scale* development projects.



Urban design experience.

Urban design demand today.



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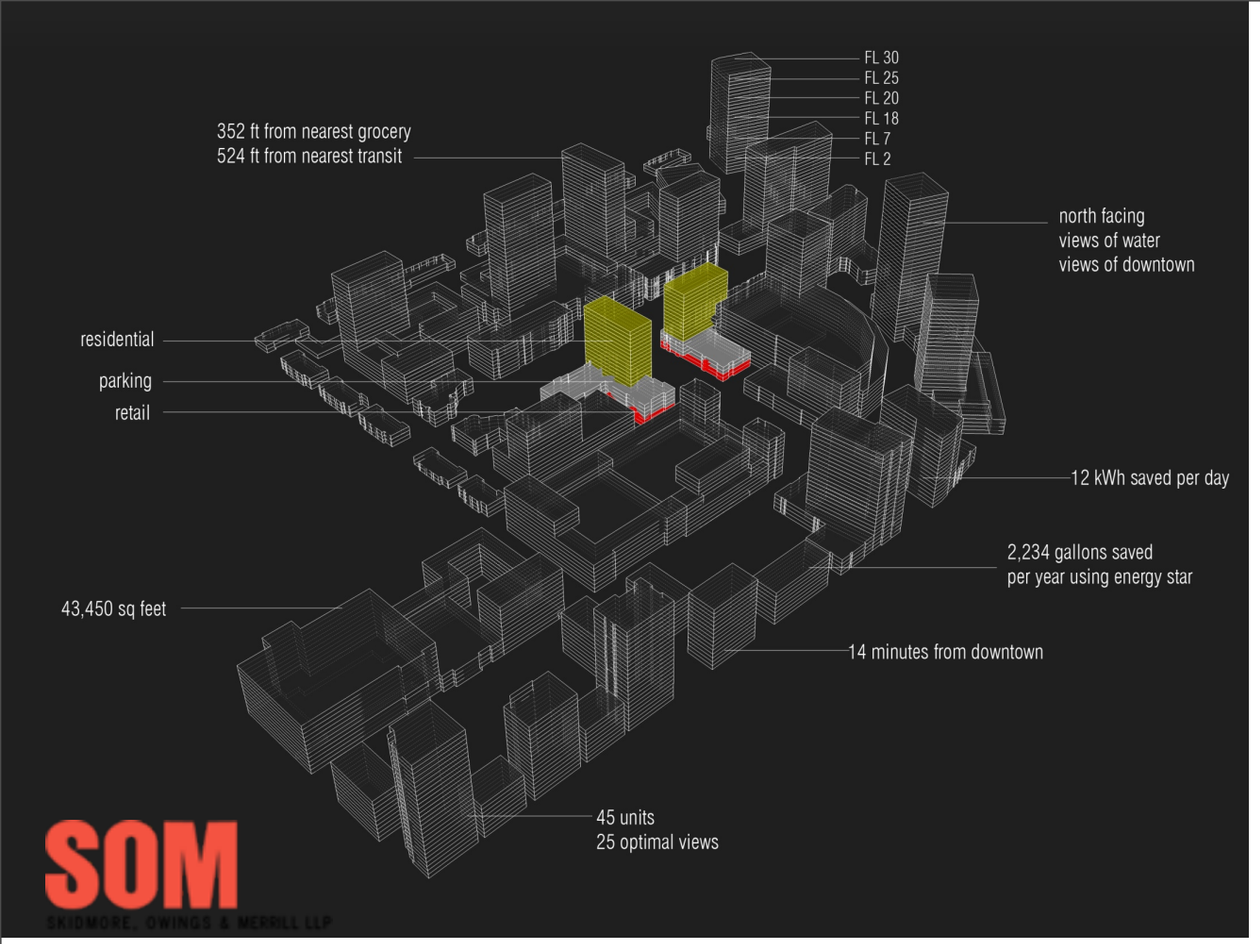

Zoning and Use

Physical Attributes

Decisions: Energy, Water, Civil Engineering, Transportation

Goal to close the gap between design and impact, allowing interactive "what if" exploration.

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The New York Times Technology | Personal Tech | Business Day

Bits

JULY 25, 2013, 7:47 AM | Comment

A Summer of Data Hacking Social Problems

By STEVE LOHR

FACEBOOK
TWITTER
GOOGLE+
SAVE
E-MAIL
SHARE
PRINT

The idea, Rayid Ghani recalled, grew out of his experience speaking to computer science students at elite schools like Carnegie Mellon, Stanford and the University of Chicago. President Obama had just won his re-election bid last fall. And Mr. Ghani, chief scientist for the campaign, was on a kind of explanatory victory tour, describing how cutting-edge data analysis and computing tools gave its side an edge.

Robert Kozloff

Rayid Ghani, chief scientist for President Obama's re-election campaign.

For Mr. Ghani, the Obama campaign demonstrated how those tools could be used to influence people in fields beyond the well-known commercial ones, like search, social networks and online advertising. And beyond politics, he would tell the students, were a host of social challenges in health care, education and urban development where their skills could be put to good use, working with nonprofits, civic groups and local governments.

The Eric & Wendy Schmidt
Data Science for Social Good
Summer Fellowship 2013

We're training data scientists to tackle the problems that really matter.

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Stanford University

University of California-Irvine

Arizona State University

University of Texas-Austin

University of Wisconsin-Madison

University of Texas-Austin

Instituto Technológico Autónomo de México

University of Chicago

University of Illinois-Chicago

University of Michigan

University of Alabama

Georgia Institute of Technology

Carnegie Mellon University

Cornell University

Israel Institute of Technology

University of Maryland

City University of New York

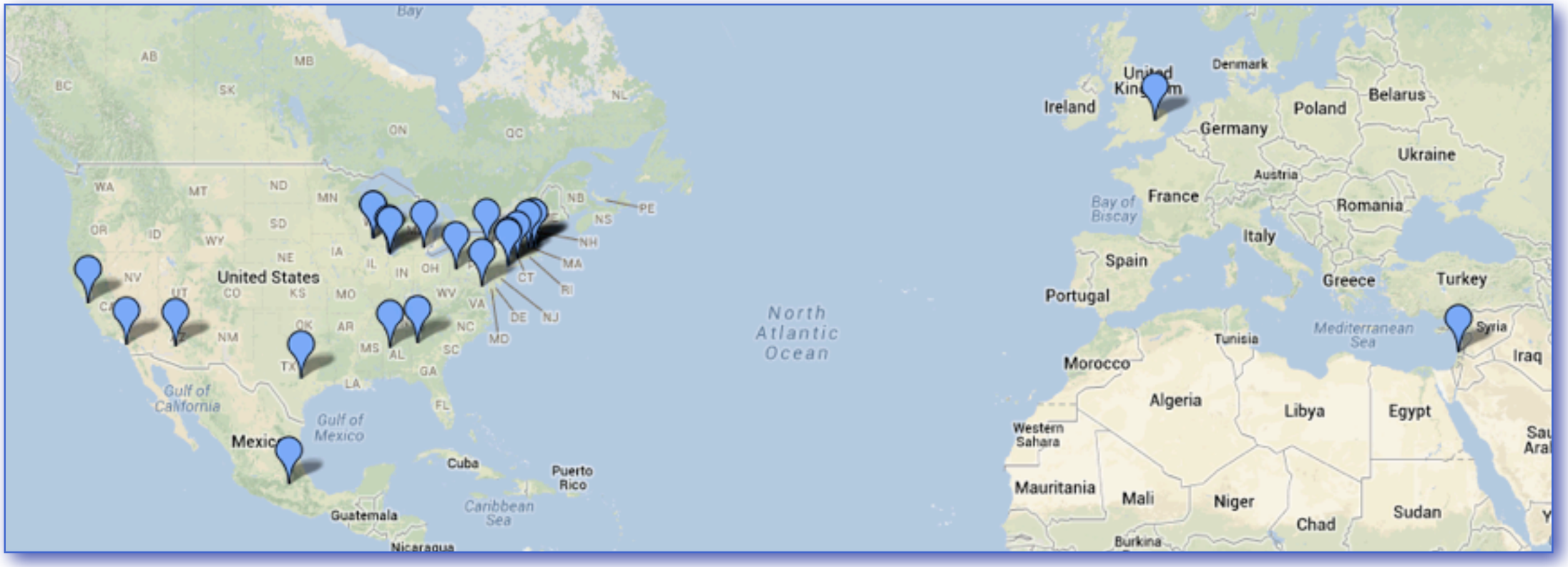
Columbia University

Yale University

Harvard University

Massachusetts Institute of Technology

University of Cambridge



2013 Eric and Wendy Schmidt Data Science for Social Good

36 Summer Fellows from 22 Universities

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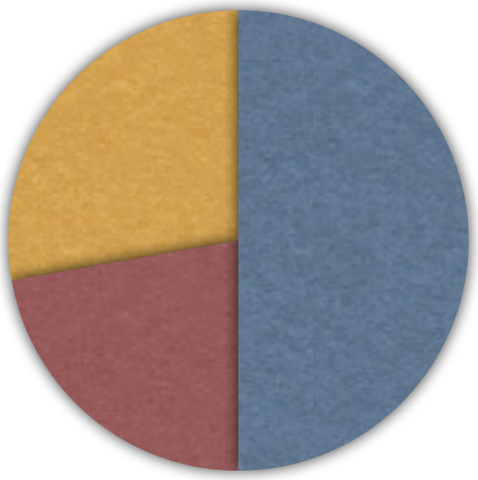
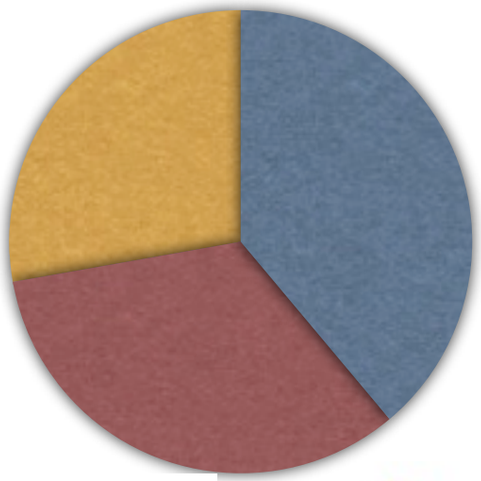
2013 Eric and Wendy Schmidt Data Science for Social Good

A diverse interdisciplinary community.



- PhD/Postdoc/Professional
- Masters
- Undergraduate



- Computer Science
- Social Sciences & Public Policy
- Mathematics, Statistics, Physical Sciences

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Real-world projects with public and private sector partners.

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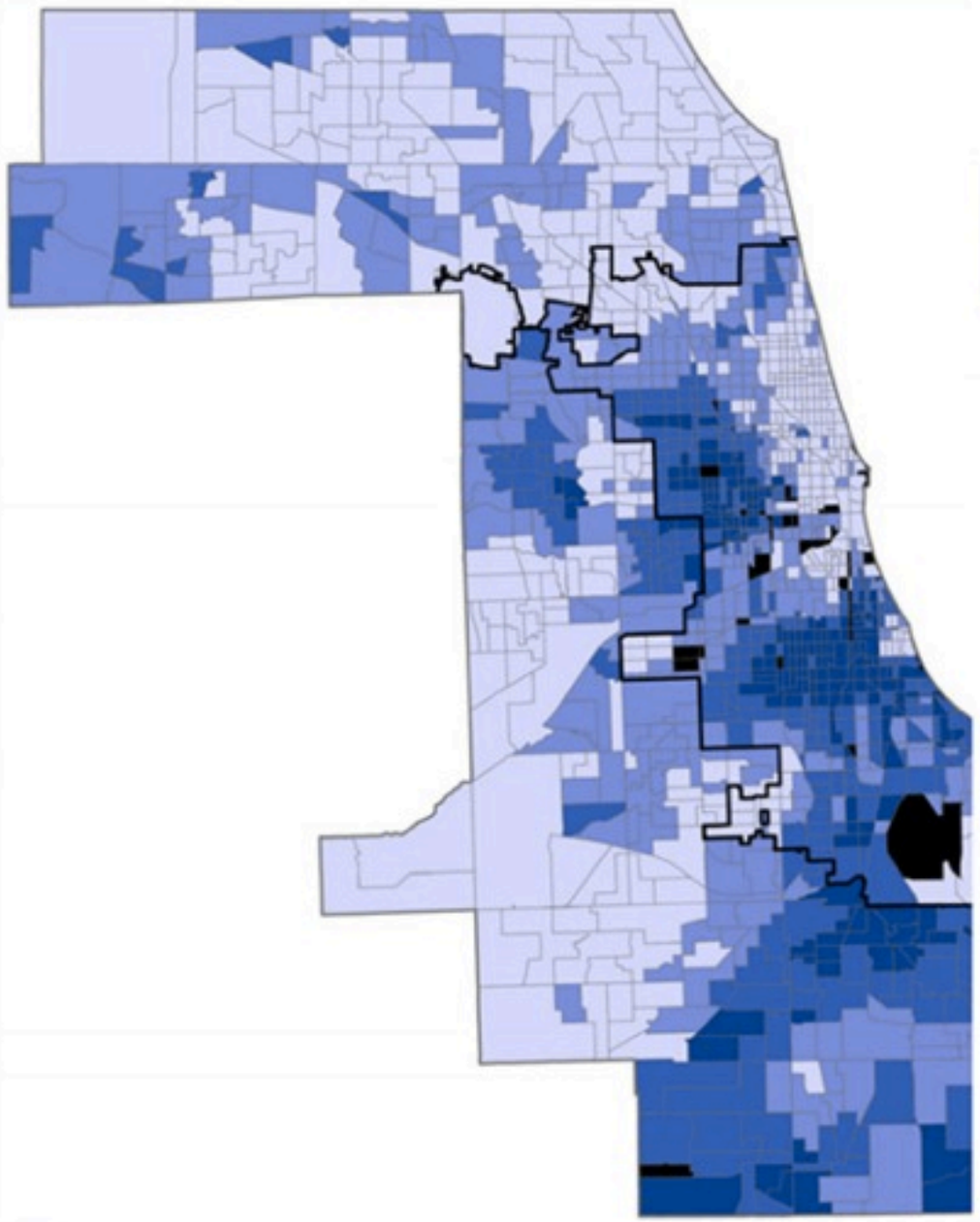
Percent of Residential Properties with a Foreclosure Between 2005 and 2011, by Census Tract



- Less than 10%
- 11 to 20%
- 21 to 30%
- Greater than 30%
- N/A (Tract has fewer than 20 residential parcels)
- City of Chicago

Foreclosure Map Source: Record Information Services, Cook County Assessor. Prepared by Institute for Housing Studies at DePaul University.

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OpenTripPlanner Analyst

Search Type

Single origin/destination

Time lenience: up to 10 min

Lenience at: Initial

Search Setup

Time of day:

Arrive by 2013-07-12T08:00:00

Mode: Transit

Max walk/bike: 4km

Refresh Map

* Times must be expressed in ISO8601 combined date/time format: YYYY-MM-DDTHH:MM:SS

travel time (minutes)

0 30 60 90 120

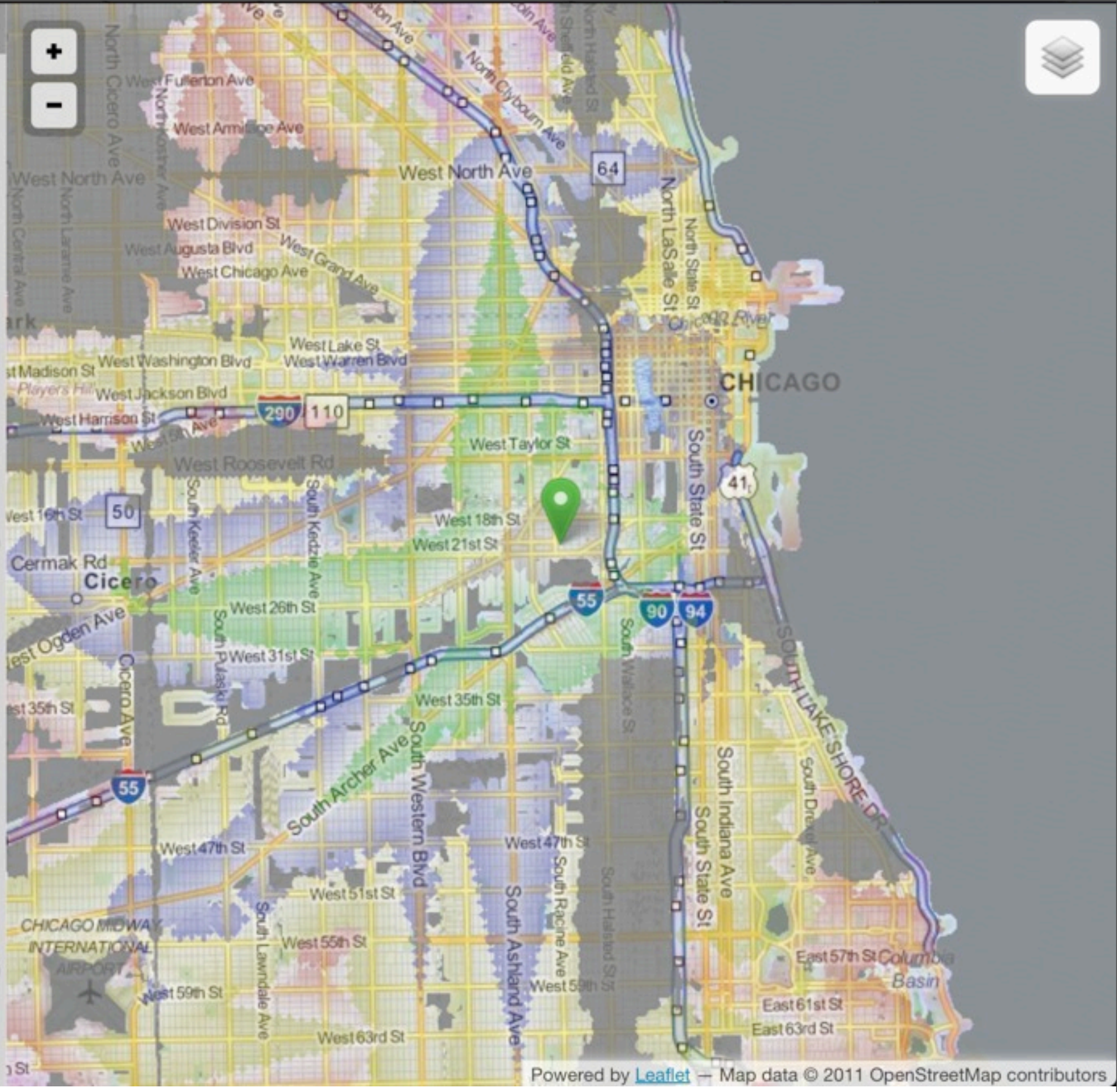
Download Image Tool

Image Format: GeoTIFF

Projection: EPSG:4326

Resolution (SRS units):

Download Image



Source: David Sekora, DSSG Fellow

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Urban Sciences

Impacts on energy systems

- Optimized transportation saving $B's in productivity and fuel.
- Improved efficiency of energy production and delivery
- Reduction in GHG emissions
- Improvement in energy security

Strategic considerations

- Opportunity to integrate urban components (buildings and materials, vehicles, appliances, energy delivery) into multi-scale solutions to guide sustainable urban design, optimizing for energy security, water, and climate
- 'Smart cities' create pull for intelligent products

Path forward

- Potential commercialization path
  - Embedded in city service provider software and technologies
  - City design, assessment, planning tools and services to guide sustainable city growth in the global market
- Partnership requirements
  - City governments (US and foreign), utilities, academia, manufacturers, Labs, architecture and urban design industry

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