CHALLENGES AND OPPORTUNITIES ACCOMPANYING GEOSPATIAL BIG DATA

John P. Wilson, Ph.D.

Professor of Spatial Sciences, Sociology, Architecture,
Civil & Environmental Engineering, and Computer Science

Founding Director, Spatial Sciences Institute

Visiting Professor, Chinese Academy of Sciences

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Geospatial Workflows

- Gather and/or acquire data
- Prepare, reconcile, and integrate data
- Conduct analysis, modeling, etc.
- Interpret the results
- Turn results into "actionable" information

Spatial sciences

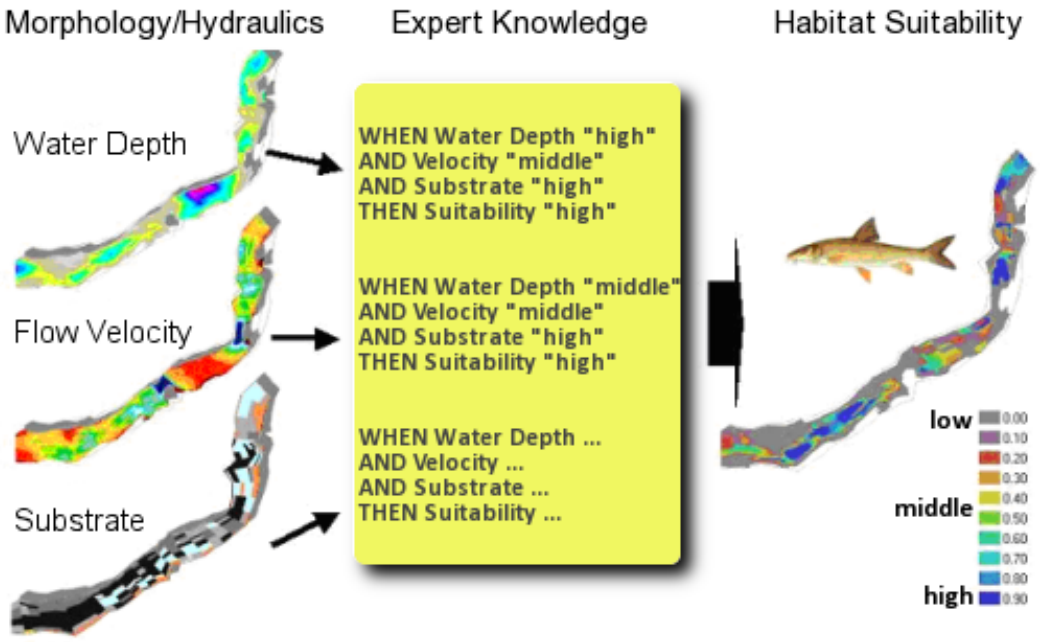
Wicked problems
Academic disciplines

Use of Big Data in Science

- Big data
  - Volume
  - Variety
  - Velocity
  - Veracity
- New opportunities & new challenges (Miller & Goodchild, 2015)
  - Work with populations in place of samples
  - Work with messy as opposed to clean data
  - Work with correlations as opposed to causality
- New opportunities for geographic knowledge discovery & modeling so long as we can solve these problems
- Need to fuse these new methods and data with the theory & empirical knowledge of existing domains

Habitat Modeling

- Spatial modeling often used to delineate Critical Habitat Areas for threatened & endangered species
- Difficult to verify results
- Can use VGI to gather ground-truth data
- Current examples
  - Audubon Christmas Bird Count
  - eBird Program



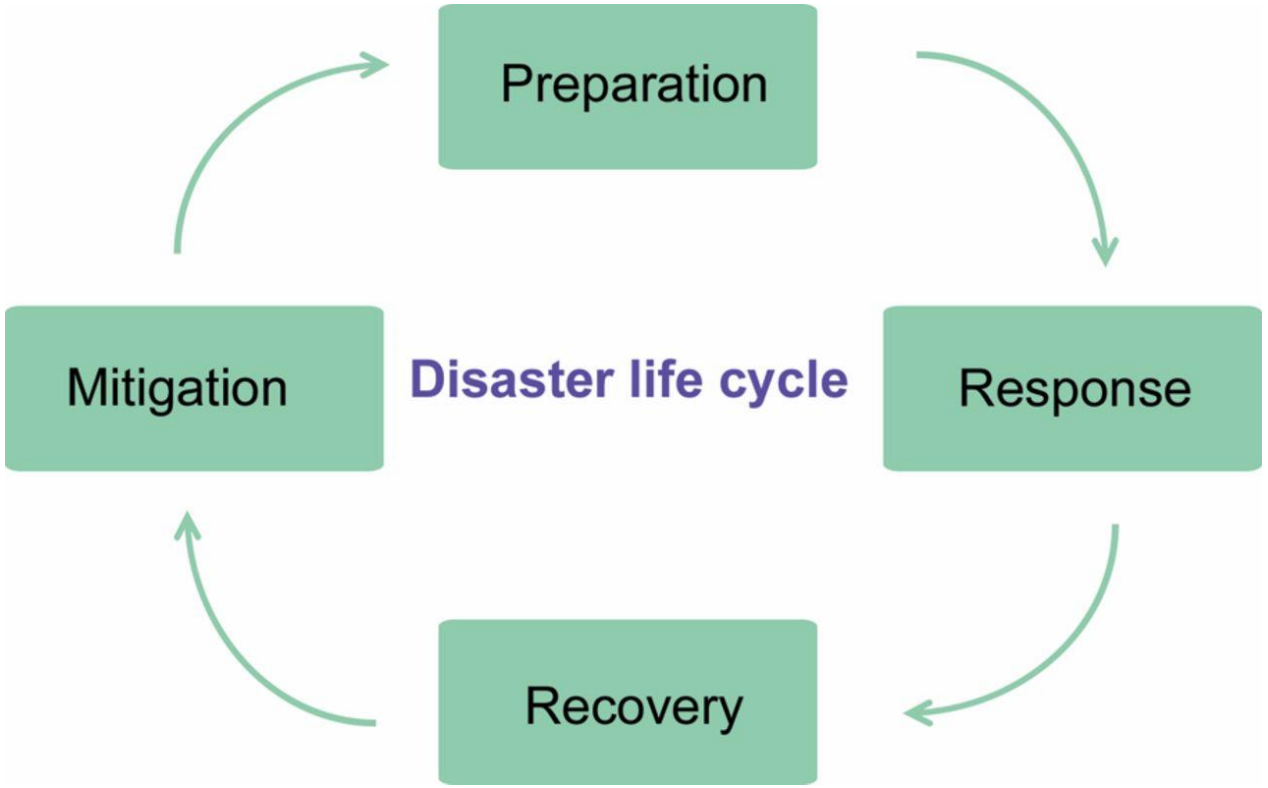
Operation Smile

- Volunteer organization that provides free medical services for children around the world with facial deformities
- Initial Vietnam application
  - Identified number of children by geographic unit
  - Provided series of travel itineraries to maximize opportunities to locate and identify children in need
- Could add additional variables to refine search in future campaigns

Operation Smile

Changing Lives One Smile at a Time

Disaster Life Cycle



Earthquake Preparedness

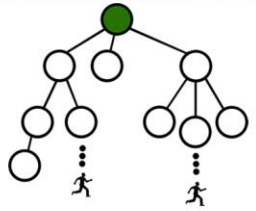
- Anders Carlson and colleagues in the USC School of Architecture have built an interactive seismicity & building response map of Los Angeles
- Looks at the past, present, & future
- Includes specific building characteristics, instrumentally recorded and interpolated past ground motions, & earthquake scenarios

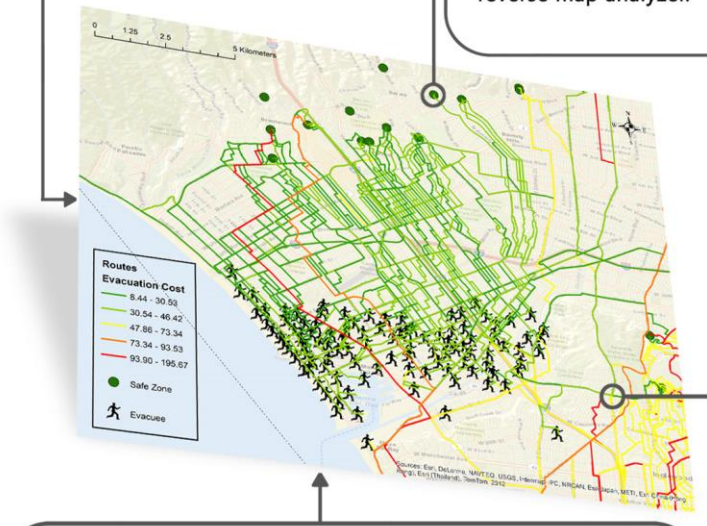
Tsunami Evacuation

- New method to perform urban routing efficiently under capacity constraints
- Part of Kaveh Shahabi's PhD work
- Tools available on GitHub

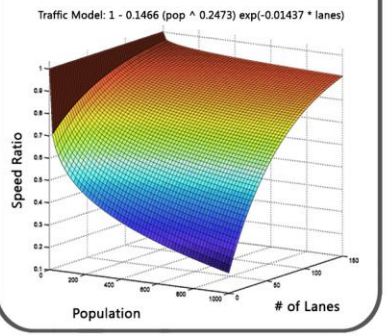
Imagine a tsunami is coming toward southern California. How do you efficiently **evacuate** a large city in time?

We **index** all graph vertices into a tree. We use the tree as heuristic for routing. This step is called **CARMA**: capacity-aware reverse map analyzer.





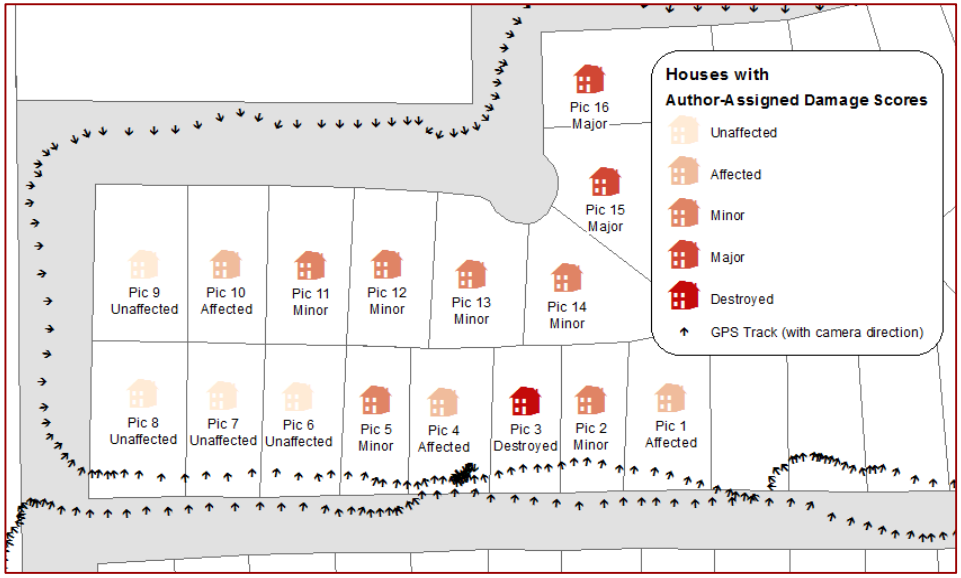
The system runs an A*-like routing algorithm on every evacuee. We use traffic modeling to predict road **congestion**.



The map shows Santa Monica city in California. Each route is colored based on its evacuation cost in minutes. Our **experiments** shows that CASPER consistently generates shorter evacuation routes independent of which traffic model is selected.

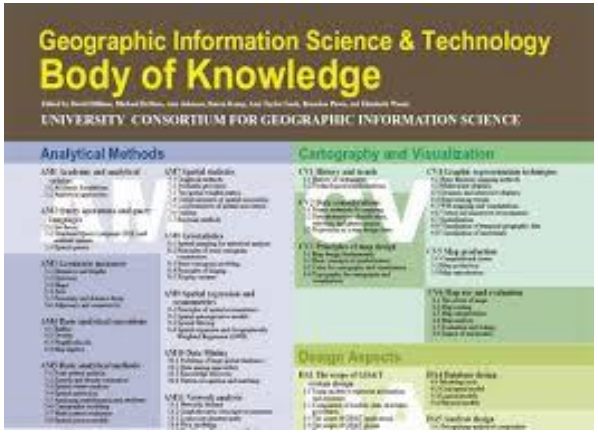
Tornado Damage Assessment

- Collected spatial video following a tornado
- Used FEMA's damage assessment protocols to assess damage to individual residences
- Major goal was to look at the accuracy and reliability of the damage estimates
- Part of Evan Lue's PhD work



GIS&T Body of Knowledge Project

University Consortium for Geographic Information Science



Geographic Information Science and Technology Body of Knowledge (GISTBoK)

The most comprehensive outline of the concepts and **skills unique to the geospatial realm**, including geographic information systems, geographic information science, remote sensing, satellite navigation systems, and cartography.

BoK1 Knowledge Areas

- AM - Analytical Methods
- CF - Conceptual Foundations
- CV - Cartography and Visualization
- DA - Design Aspects
- DM - Data Modeling
- DN - Data Manipulation
- GC - Geocomputation
- GD - Geospatial Data
- GS - GIS and T and Society
- OI - Organizational and Institutional Aspects

- Knowledge Area (10 total)
- Unit (73 total)
- Topic (329 total)
- Learning Objective (1,658 total)

http://ucgis.org/sites/default/files/document-sharing-form-files/72/UCGIS2013_SkupinEtAl_Distribution.pdf