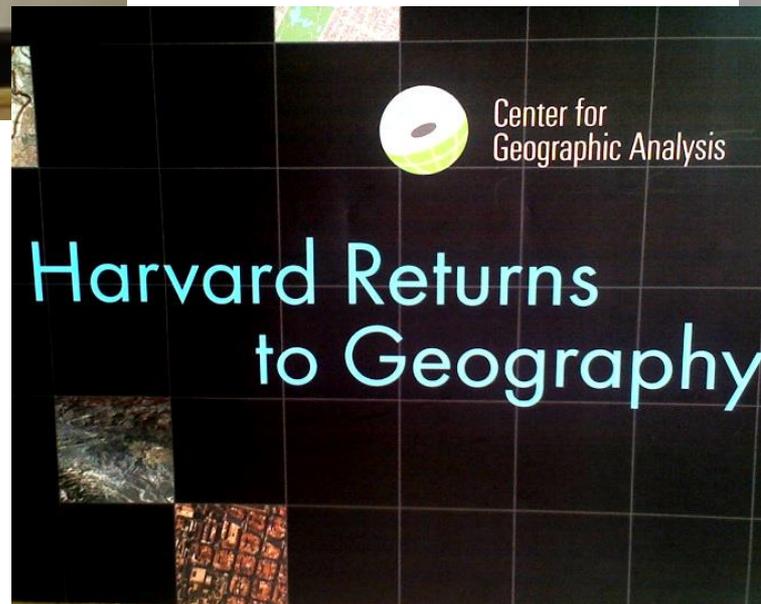


A Data Community in Practice -- WorldMap at Harvard

Wendy Guan

2013 UCGIS Symposium

Harvard established the Center for Geographic Analysis (CGA) in May 2006





Roger Tomlinson, Tomlinson Associates, "Father of GIS"

Laura Dangermond, ESRI Co-founder

Jack Dangermond, ESRI President

Richard Marston, American Association of Geographers President

Douglas Richardson, Executive Director, American Association of Geographers

At the CGA inauguration
event, May 2006

Seven years into its operation,
the CGA has been recognized as
a center of excellence, for...

SERVICE

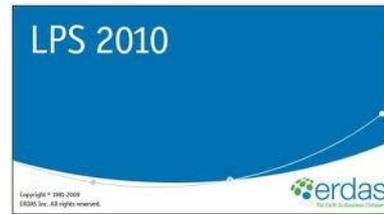
CGA **Enables...**

research and education
that use, improve or study
geospatial technologies
at all levels and all fields
across the university

It is a big job for a small center...

We can't do everything for everybody,
so we started building simple tools
to help users help themselves,
that was the beginning of the story...

GIS Site Licenses



Online Mapping Platforms

- ***Light weight*** – Google Map API, Chart API, Fusion Table, CartoDB, Leaflet, ArcGIS Online...
 - For example: Surgical Safety Web Map
http://maps.cga.harvard.edu/surgical_safety
- ***Heavy weight*** – ArcGIS Server
 - For example: DARMC <http://darmc.harvard.edu>
- ***Middle ground*** – WorldMap
 - Many examples on: <http://worldmap.harvard.edu>

What is WorldMap

a web-based, cloud hosted, open source mapping platform available to the world designed to lower barriers for researchers who wish to use geospatial technology

WorldMap Allows Users to

- **Organize** one's own (large) mapping datasets online
- **Discover** other people's (public) data
- **Mashup / Overlay** one's data with data of others
- **Create** maps with complex symbology
- **Collaborate** by letting several people edit the same map, comment on maps and rank data
- **Publish** maps and data to the world or to just a few collaborators

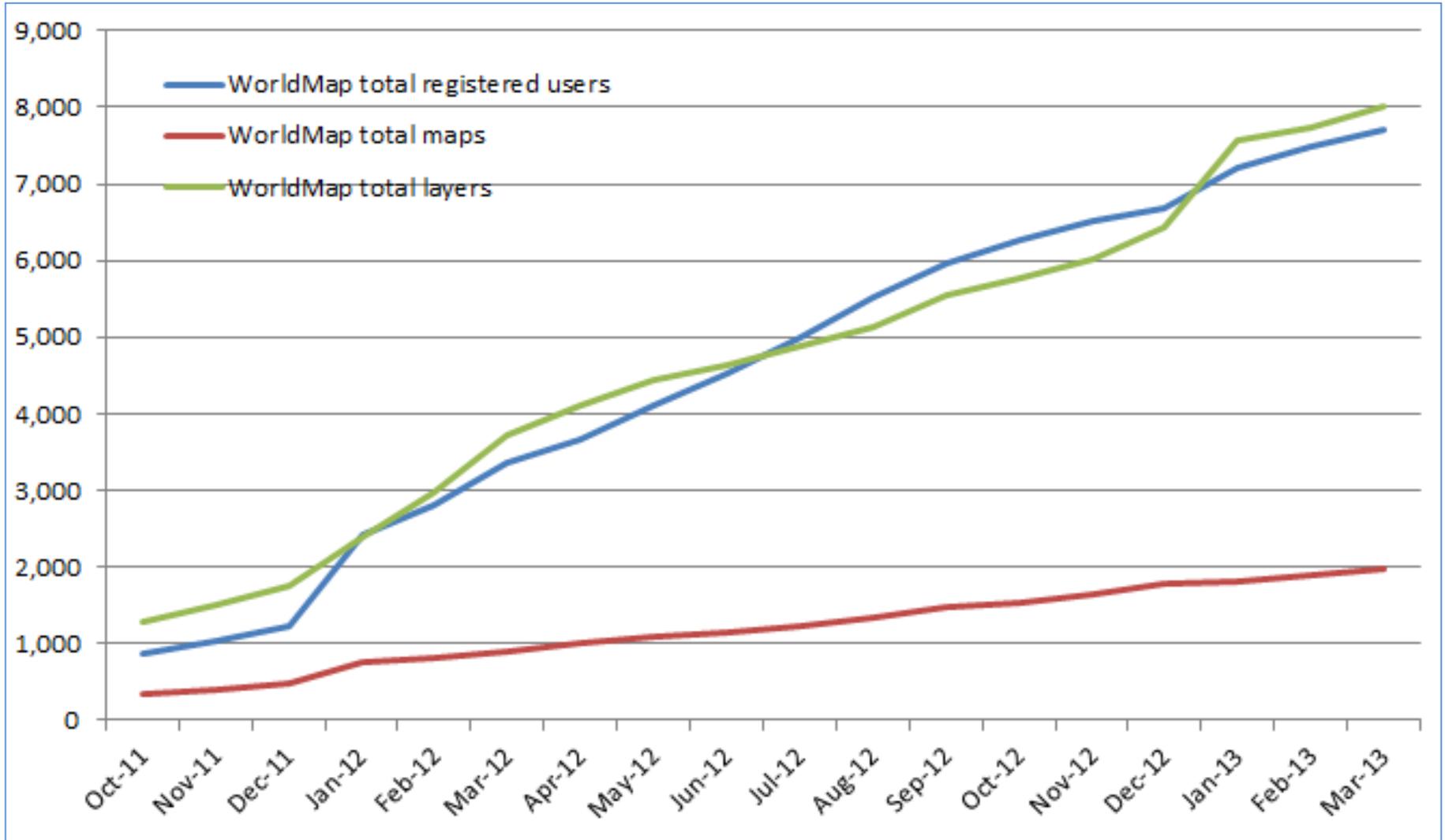
Brief History of WorldMap

- Evolved from our experience with the AfricaMap project (Beta release in Nov. 2008)
- Requests for custom versions lead to complete redesign and re-architecture in late 2010
- WorldMap versions:
 - Alpha released July of 2011
 - Beta released January of 2012
 - Version 1.0 released July of 2012
 - Version 1.1 released January of 2013

From January 2012 to May 2013

- 7844 registered users
- 8199 layers added or created
- 2054 map collections created
- ~350,000 visitors from 200+ countries
- Hundreds of system improvements from us and the global developer community

Usage Records

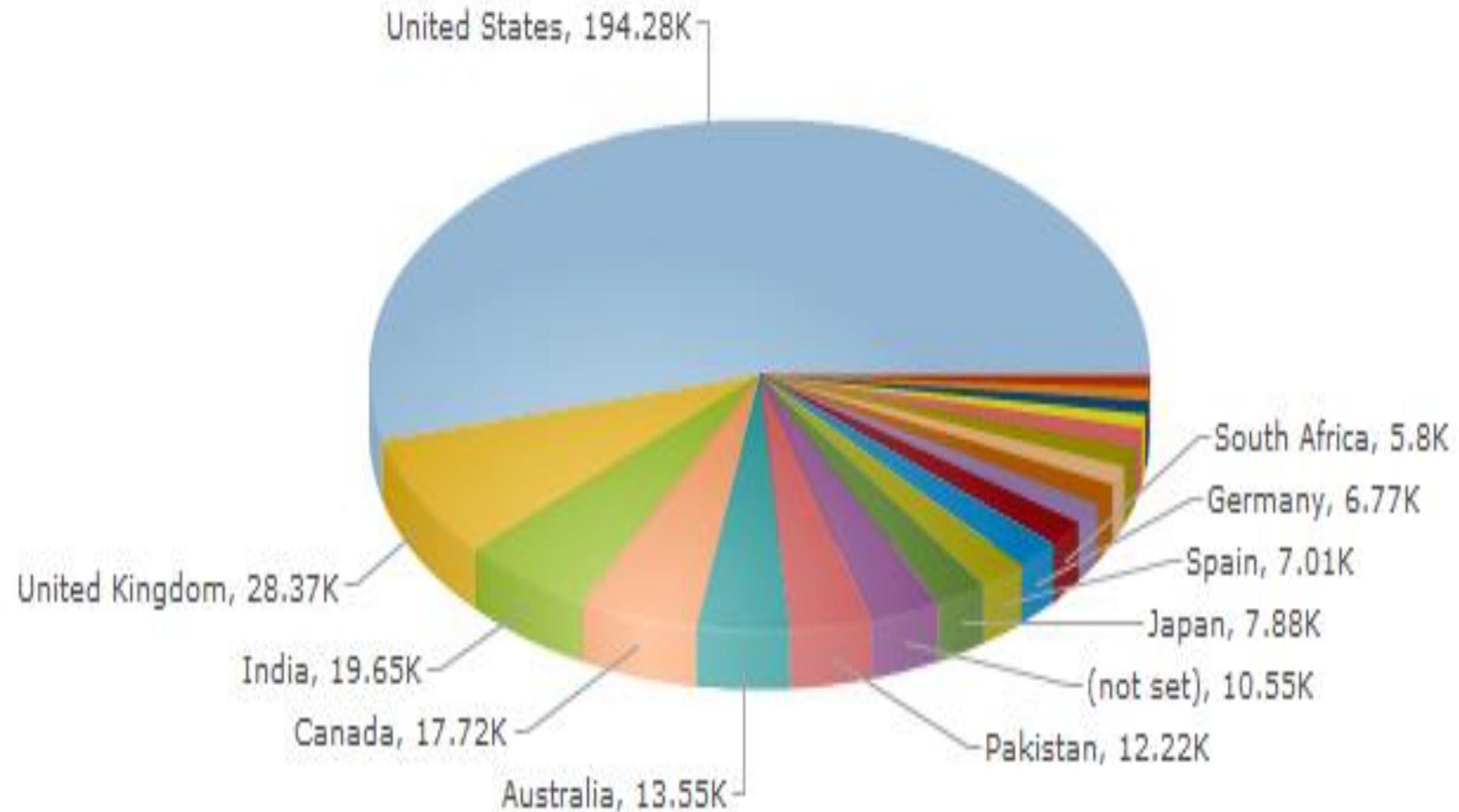


WorldMap in Harvard Classrooms

- “World Religions and Multicultural America”
 - taught by Diana Eck
- “Reinventing Boston: The Changing American City”
 - taught by Rob Sampson and David Luberoff
- “Societies of the World 28”
 - taught by Kelly O’Neill
- “Environmental Management of Tourism Development”
 - taught by Megan Epler Wood
- “The African City”, “The African Past: Art and History to 1800”
 - taught by Suzanne Blier
- “Chinese History 200R”, “Societies of the World 12”, “Culture and Belief 26”
 - taught by Peter Bol

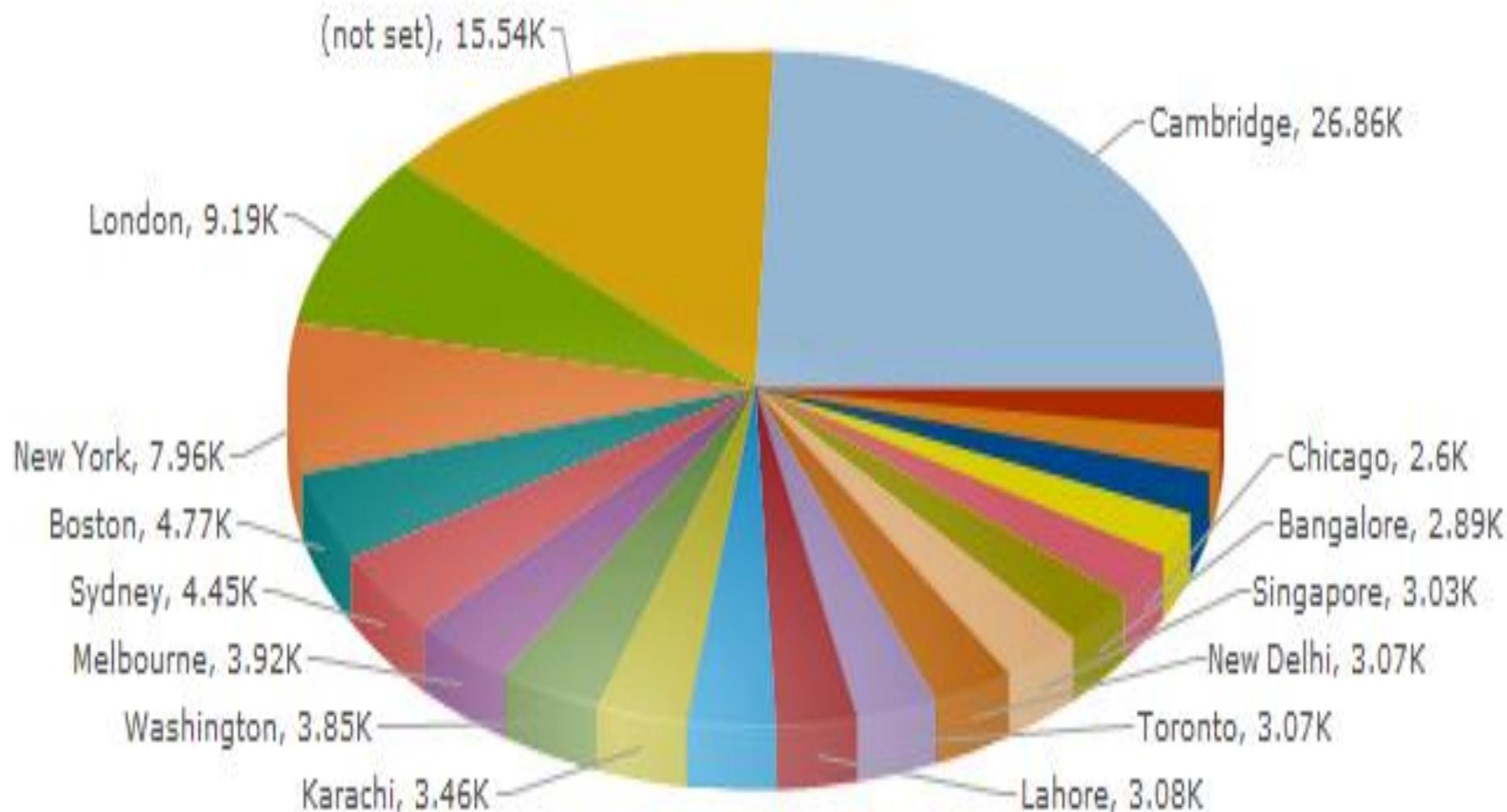
worldmap.harvard.edu

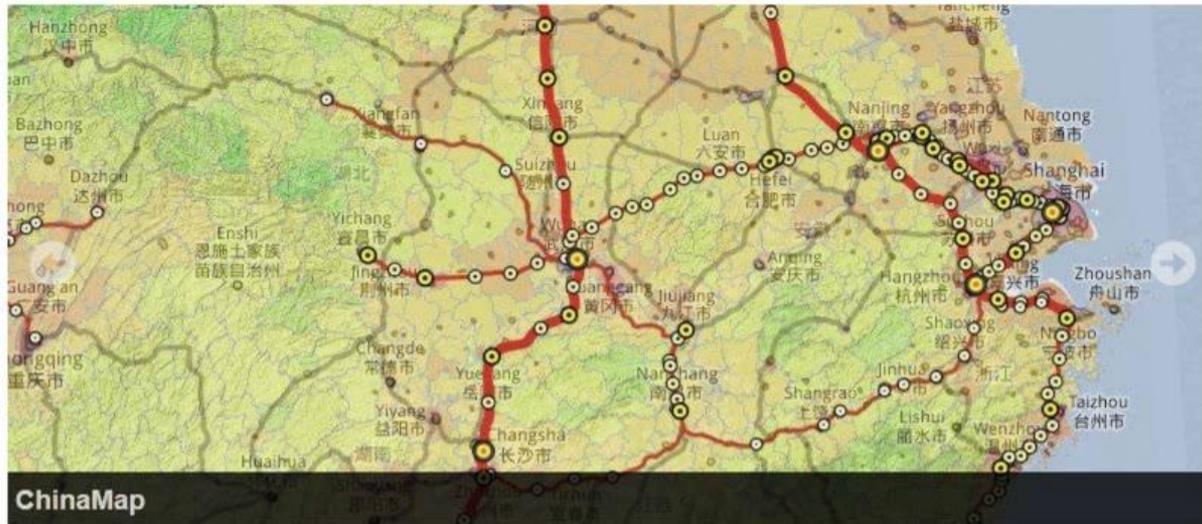
Visits by country



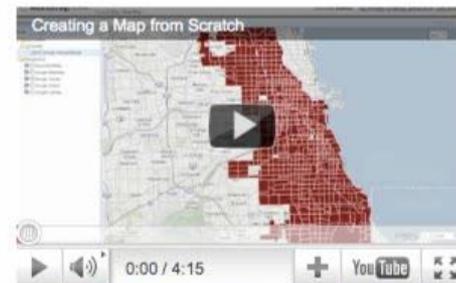
worldmap.harvard.edu

Visits by city



[Create a Map](#)[View a Map](#)[About](#)

Build your own mapping portal and publish it to the world or to just a few collaborators. WorldMap is open source software.



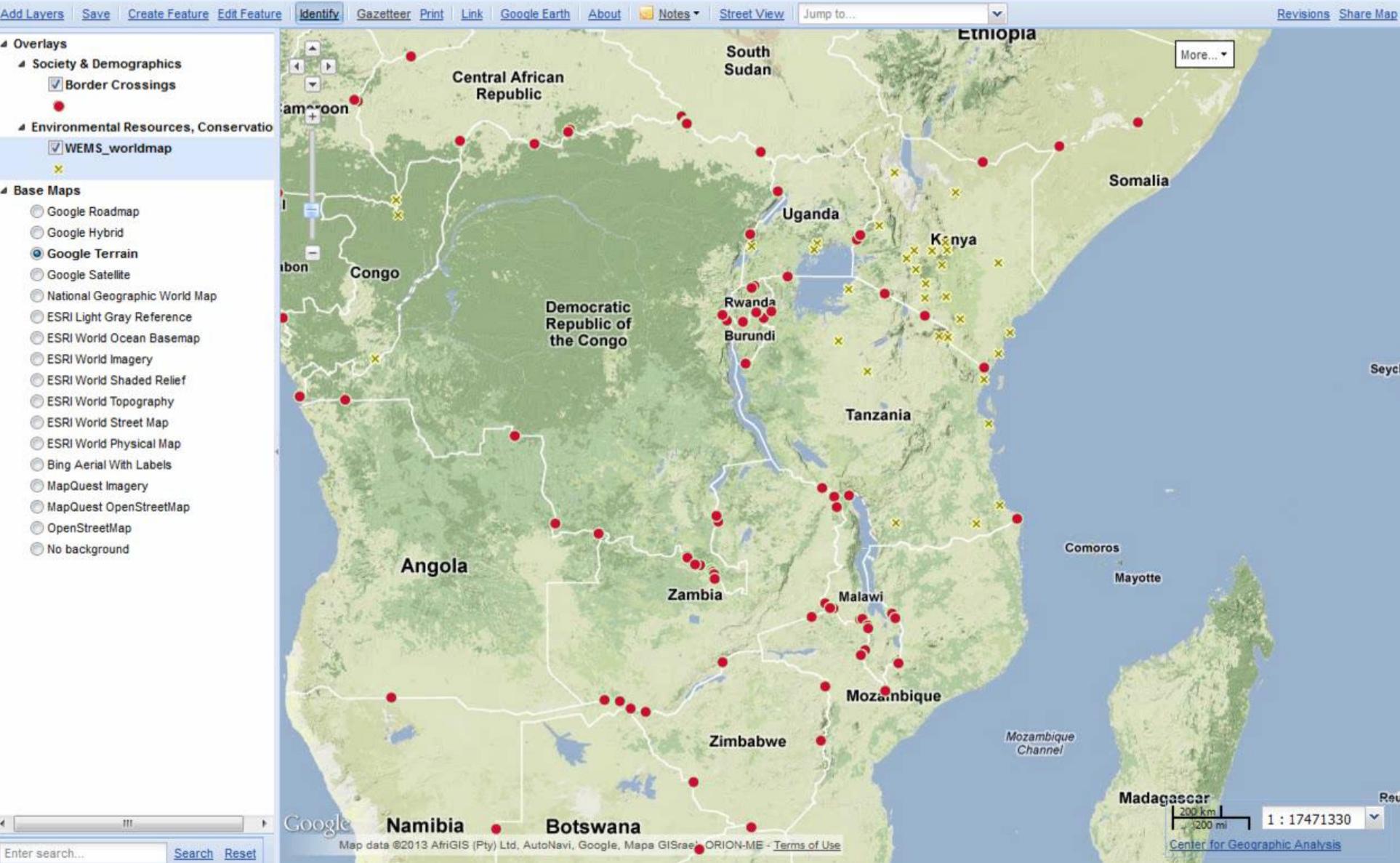
[Watch the WorldMap Quick Start video](#)

WorldMap is being developed by the [Center for Geographic Analysis](#) at [Harvard University](#).

WorldMap Basics (1 minute video)

Connection to Many Data Sources

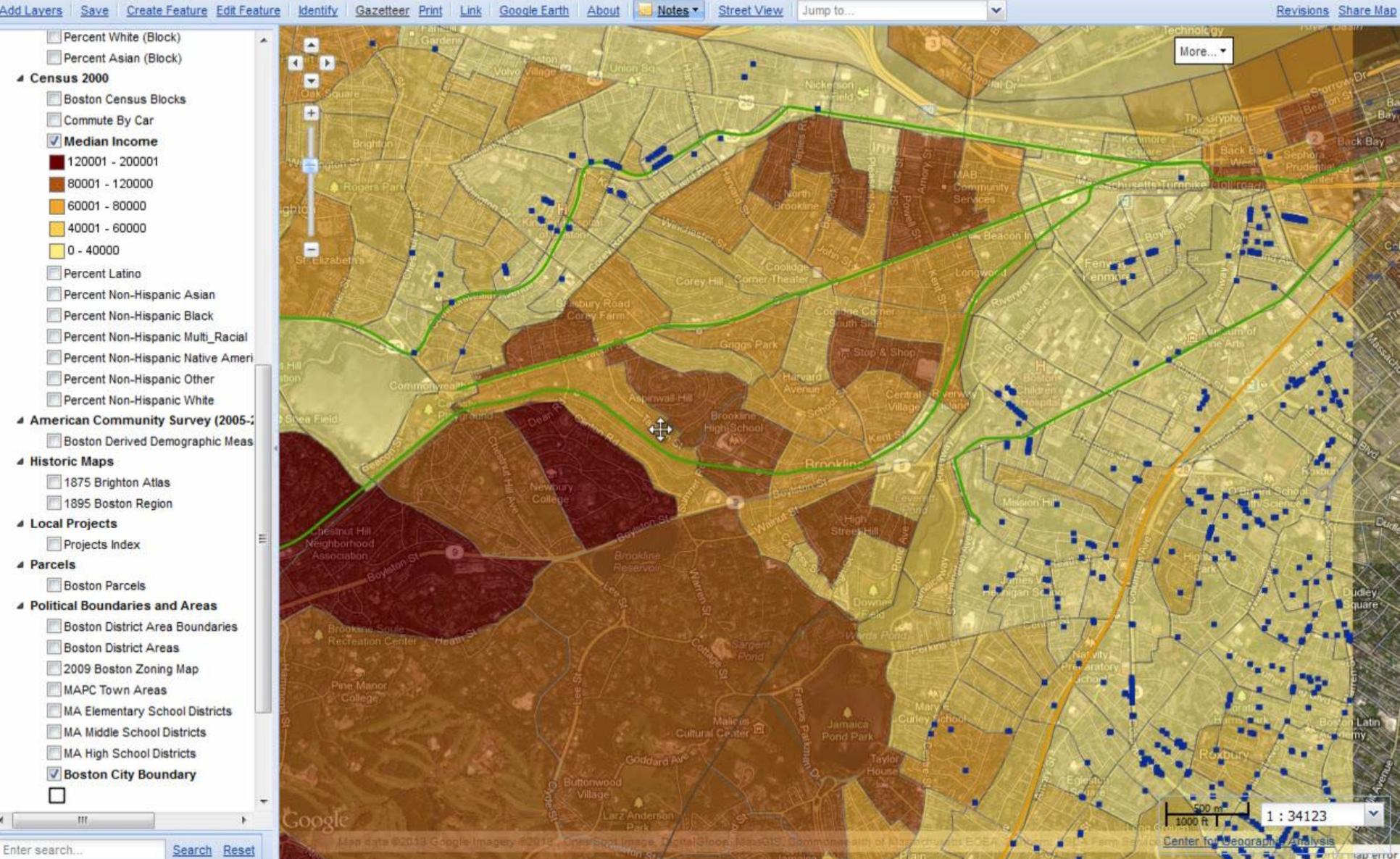
- Google maps, Open Street Maps, Bing, MapQuest, ESRI
- Google Street View
- Google Earth
- Picasa, YouTube, GeoRSS
- Geonames, Google Places, Yahoo Places
- Social Explorer, Yelp
- WMS, WFS, ESRI REST, MapD



How to Bring in Live Feeds (27 second video)

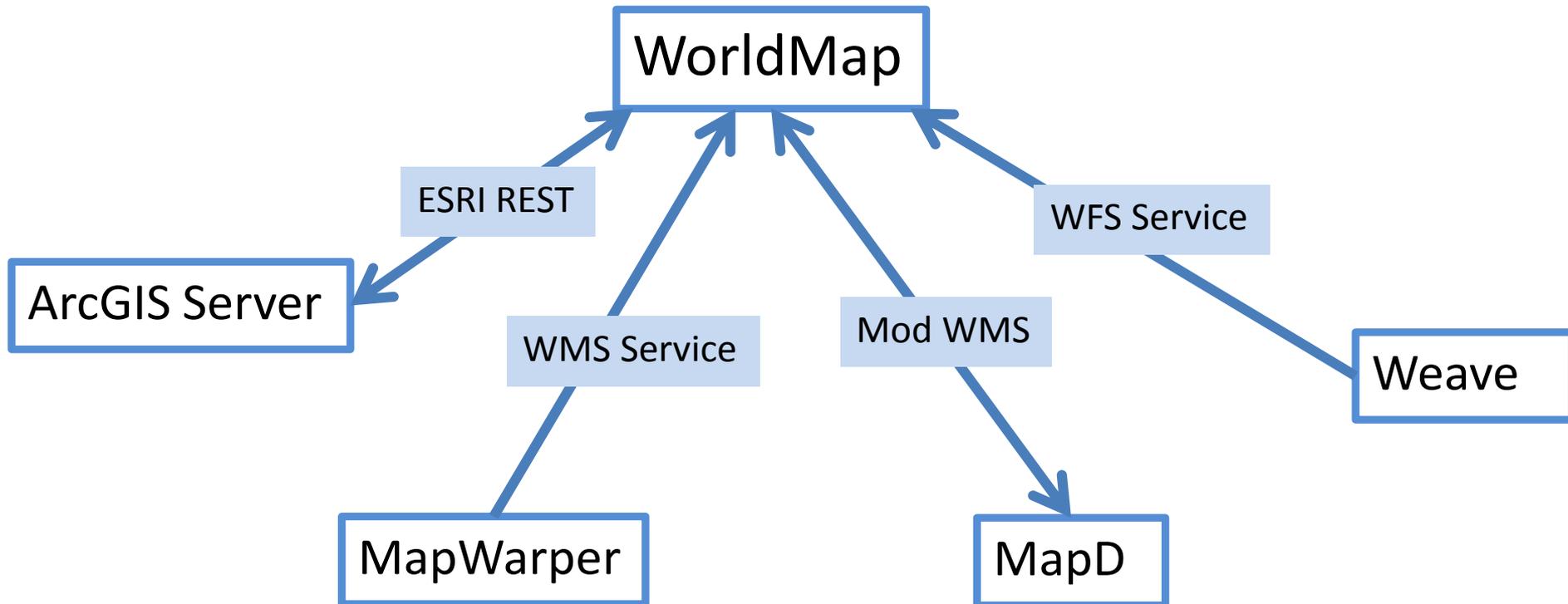
Facilitate Collaboration

- User profiles
- Upload local data and share it
- Download data in many formats
- Permission controls
- Linking and embedding maps
- Commenting and ranking
- Map annotation
- Mobile



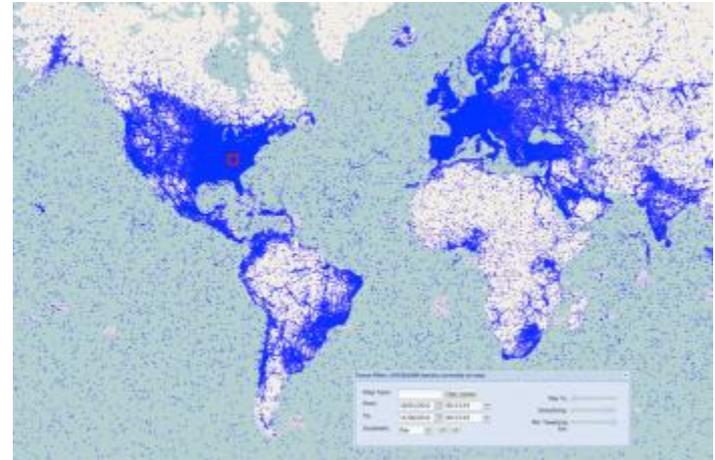
Linking and Embedding (33 second video)

Loosely Coupled Approach for Adding Functionality



What is MapD?

- A GPU (Graphics Processing Unit)-accelerated SQL column store database
 - Scales to any number of Nvidia GPUs
- A real-time map generator
 - Uses GPUs to render point and heatmaps of query results in milliseconds
- A WMS web-server
 - Can serve out of the box as the backend for a web mapping client, allowing for querying and visualization of billions of features
 - Fast and cost-effective
 - 4 Nvidia commodity GPUs provide provide over 12 Teraflops of compute power and nearly 1 TB/sec of memory bandwidth

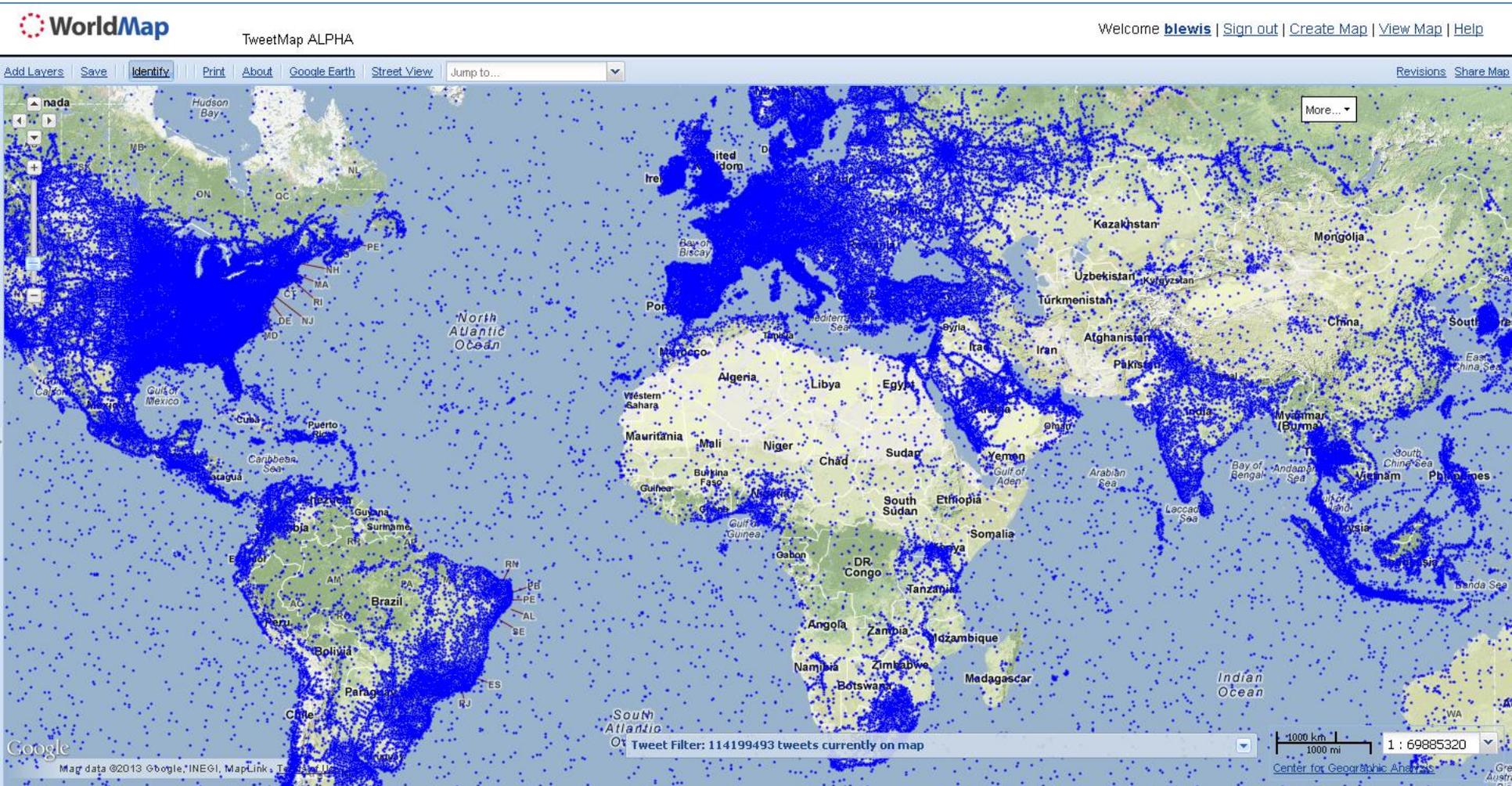


147,201,658 tweets from Oct 1, 2012 to Nov 6, 2012



Relative intensity of "tornado" on Twitter (with point overlay) from February 29, 2012 to March 1, 2012

125 million geocoded tweets
by 5 million people
~2% of all tweets in ~3 weeks





“snow” (10 second video)

Tweet Filter:

Filter Term: [Filter Tweets](#)

From:

To:

Increment:

[Download Tweets](#)

Auto Max %

Max %:

Smoothing:

Min Tweets/sq km:

Online Georeferencing

<http://warp.worldmap.harvard.edu>

Makkah Plan - 1946
Uploaded by Ben. Last modified 3 months ago. 4 control points.

Remove from My Maps | Links: Source / Biblio Ref | Publish | Download KML | Is a map

Share | Facebook | Twitter | Export

Show Edit Rectify Crop Align Preview Map Export Metadata Activity Comments (0)

Fig. 44. Plan of Mecca
Heights in feet shown the central valley are approximate.

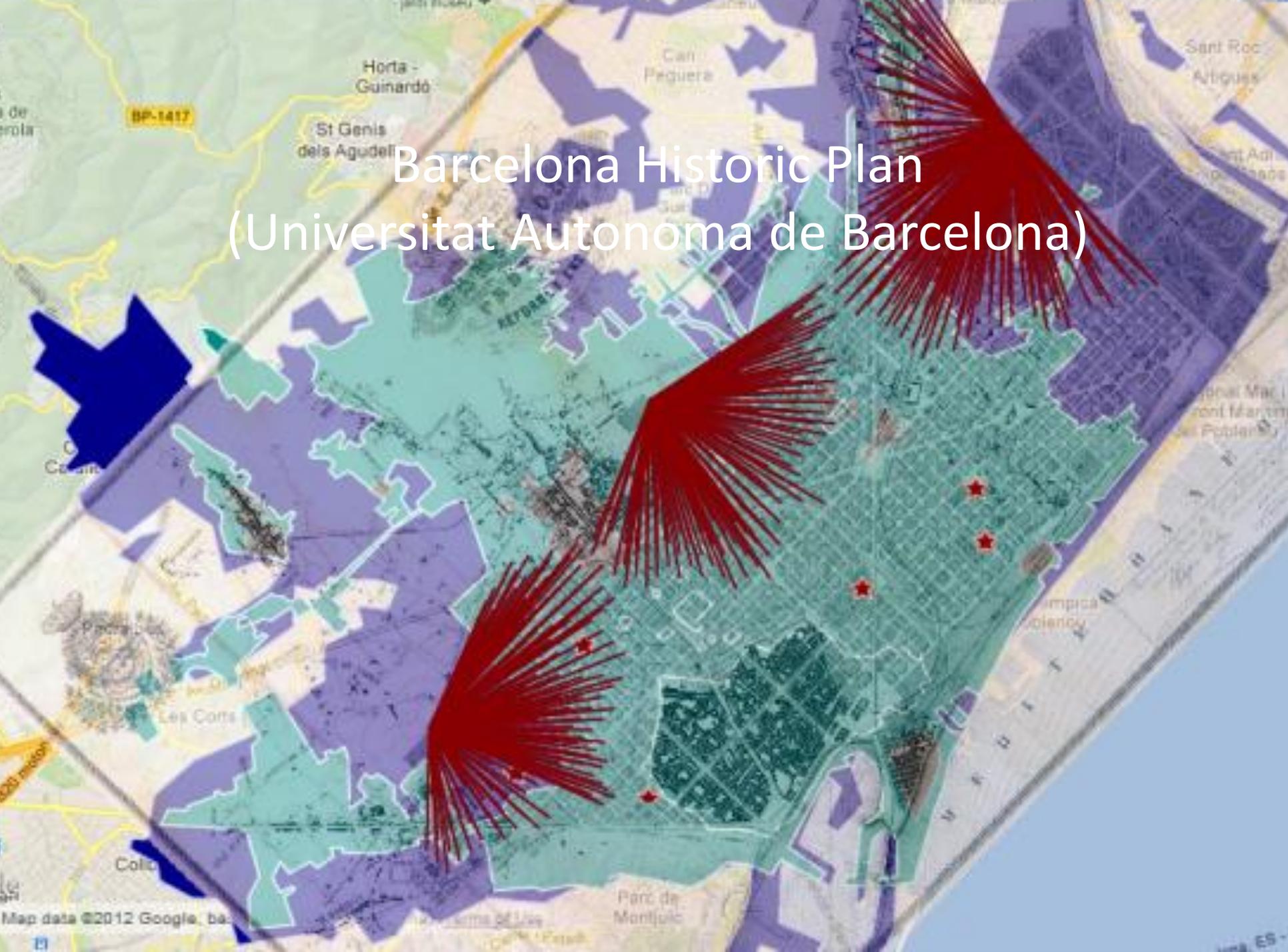
1. 1000	11. 1000	21. 1000
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6. 1000	16. 1000	26. 1000
7. 1000	17. 1000	27. 1000
8. 1000	18. 1000	28. 1000
9. 1000	19. 1000	29. 1000
10. 1000	20. 1000	30. 1000

OpenStreetMap

New Data through Collaboration (examples)

- University of Barcelona - Barcelona
- Kelly O'Neil – Russian Empire – historical atlas
- Du Bois – AfricaMap – JOGS, Murdock, Slave trade
- Virtue/Newsweek – Women in the World – Women-run NGOs
- University of Iowa – Mapping Decline of St. Louis
- Um Al-Quera U – MakkahMap – Historical Makkah data

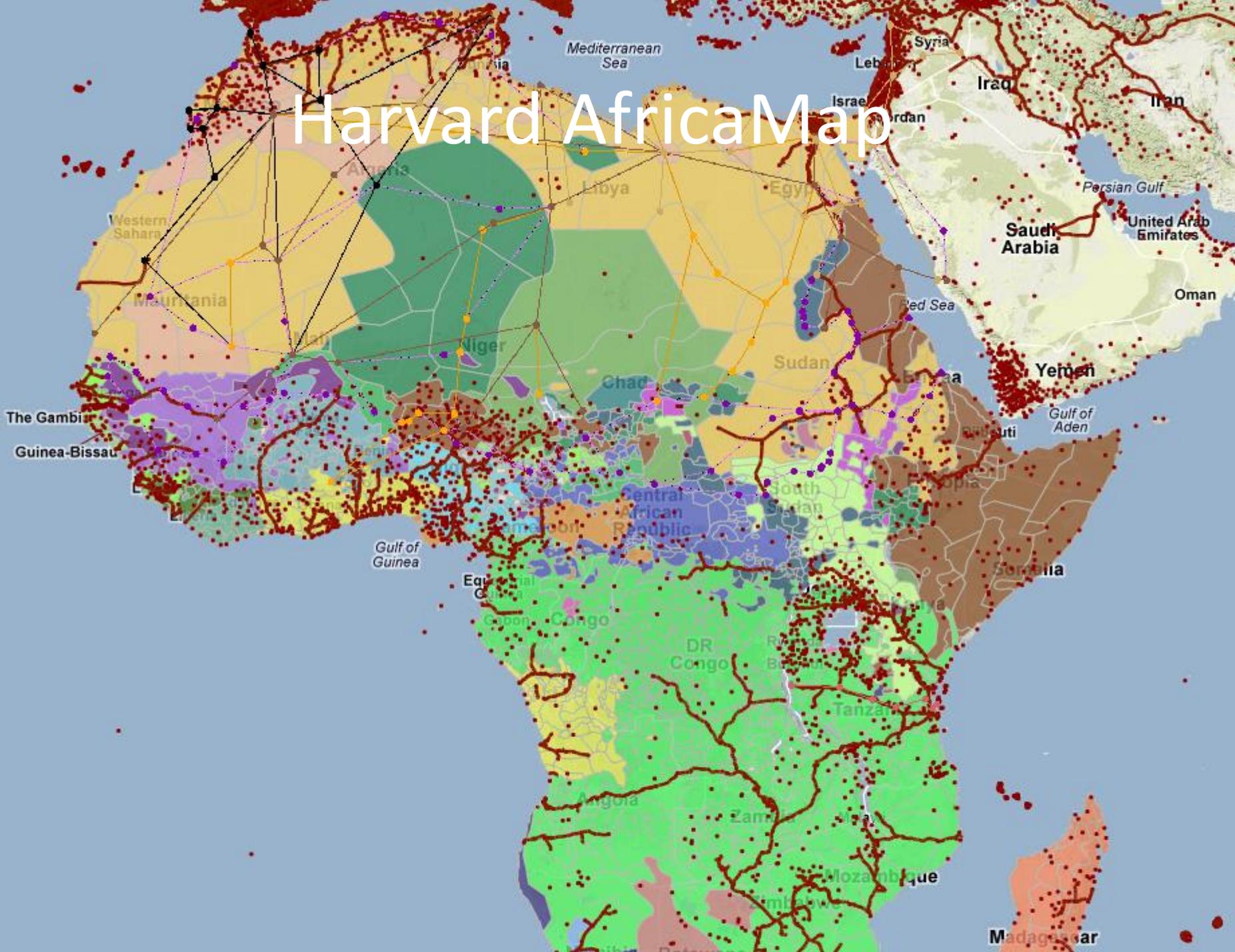
Barcelona Historic Plan (Universitat Autònoma de Barcelona)



Mapping the Russian Empire (History Dept Harvard)



Harvard AfricaMap



[Identify](#) [Gazetteer](#) [Print](#) [Link](#) [Google Earth](#) [About](#) [Notes](#)



Women-run NGOs
 (Virtue Foundation)

Identify Results

[Reset](#)

Name

- Environment
 - International Society of Doctors for...
- Health and Well-Being
 - CARE
 - Al-Imdaad Foundation
 - Africare
 - African Women in America
 - Adventist Development and Relief
 - International Islamic Relief Organiza...
 - Islamic Countries' Women Sports S...
 - UN Women
 - UN Women
- Law and Justice
 - International Trade Union Confeder...
 - ACT Alliance - Action by Churches...
 - UN Women
 - UN Women
- Number of Organizations
 - 20
- Politics and Leadership
 - All Africa Students Union
 - African Youth Panel
 - African American Thinktank
 - Islamic Countries' Women Sports S...
 - Youth Environment Democracy Dev...

Feature Details

Orgname Africare

Description

Africare

Specializes in: Health & Well-Being

Founded in 1971, this organization works to fight poverty and improve quality of life in Africa with a particular focus on agriculture & food security, health & HIV/AIDS, and Water & Sanitation

Africare's work to Empower Women

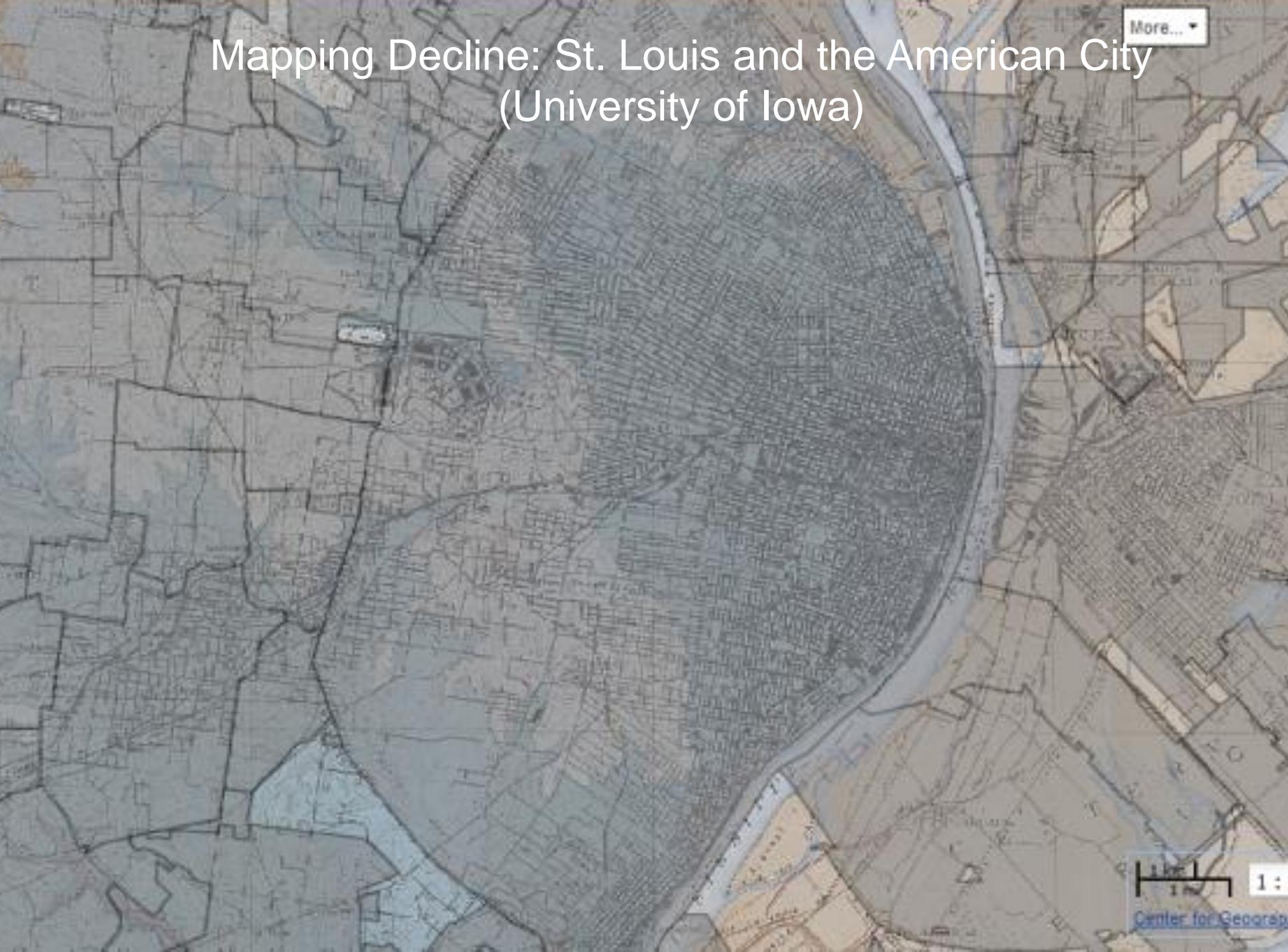
0:00 / 4:33

[Link to website](#) | [Link to photos](#) | [Link to YouTube](#)

Niamey, Niger -

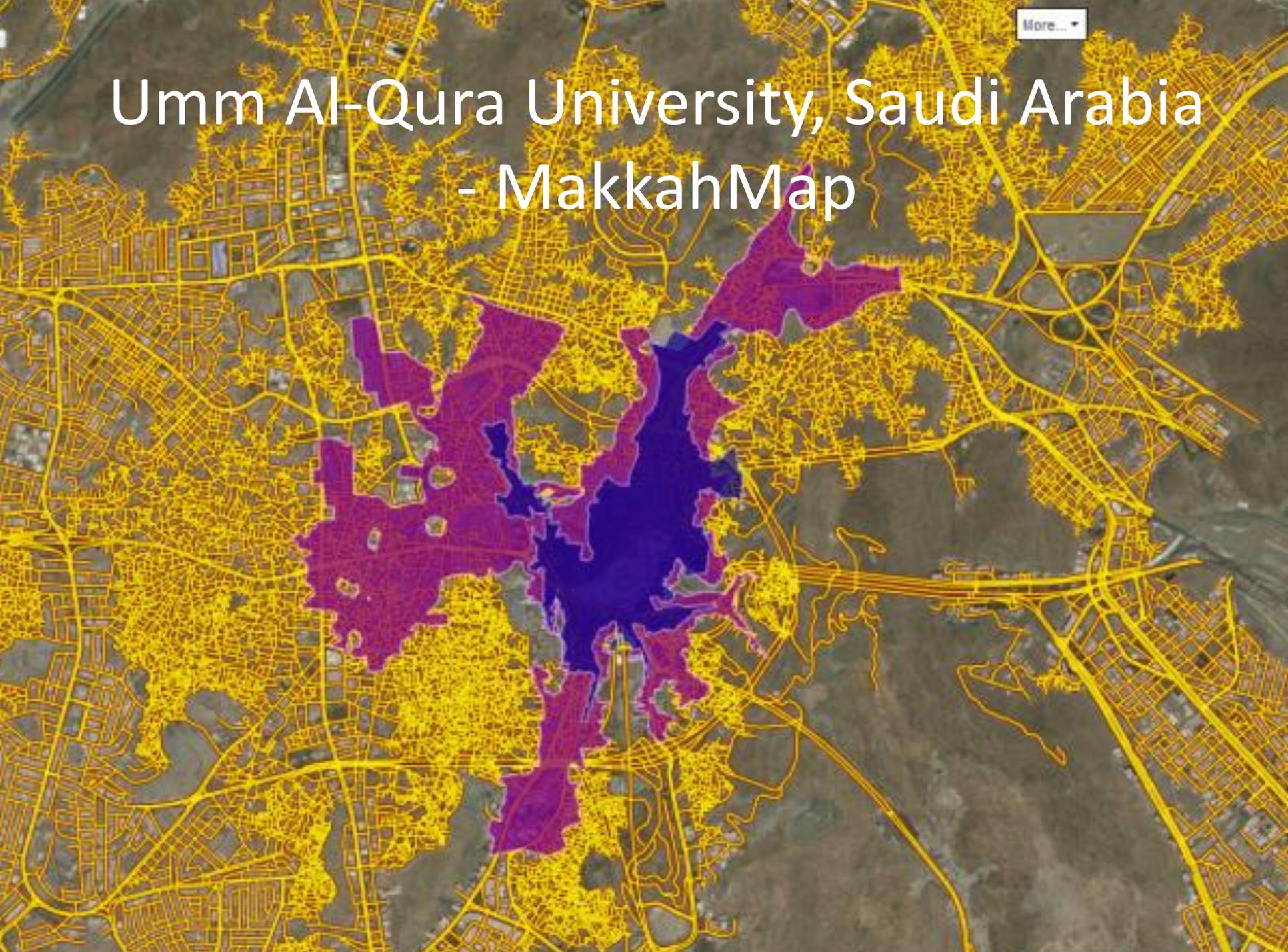
Mapping Decline: St. Louis and the American City (University of Iowa)

More... ▾

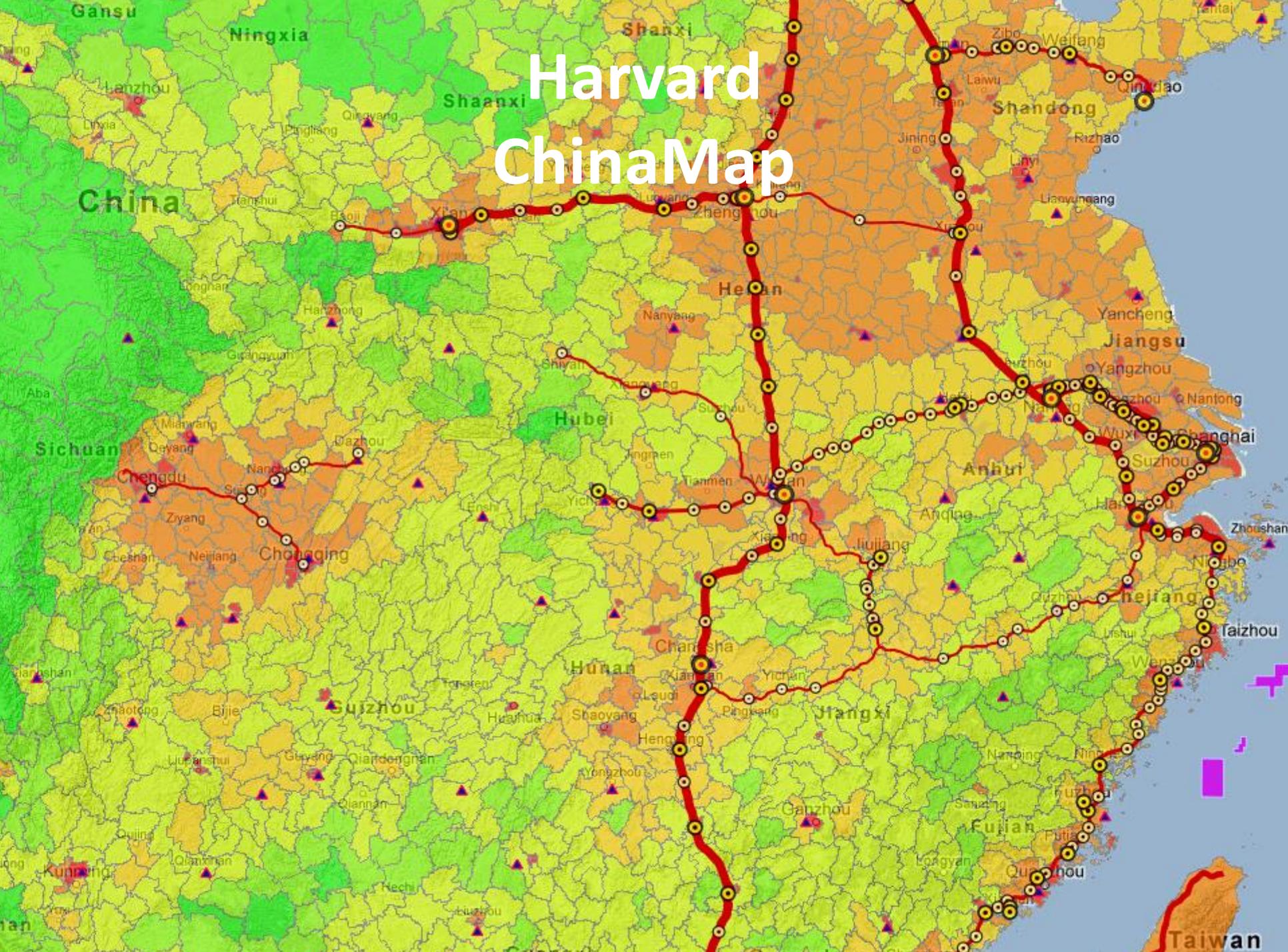


More...

Umm Al-Qura University, Saudi Arabia - MakkahMap



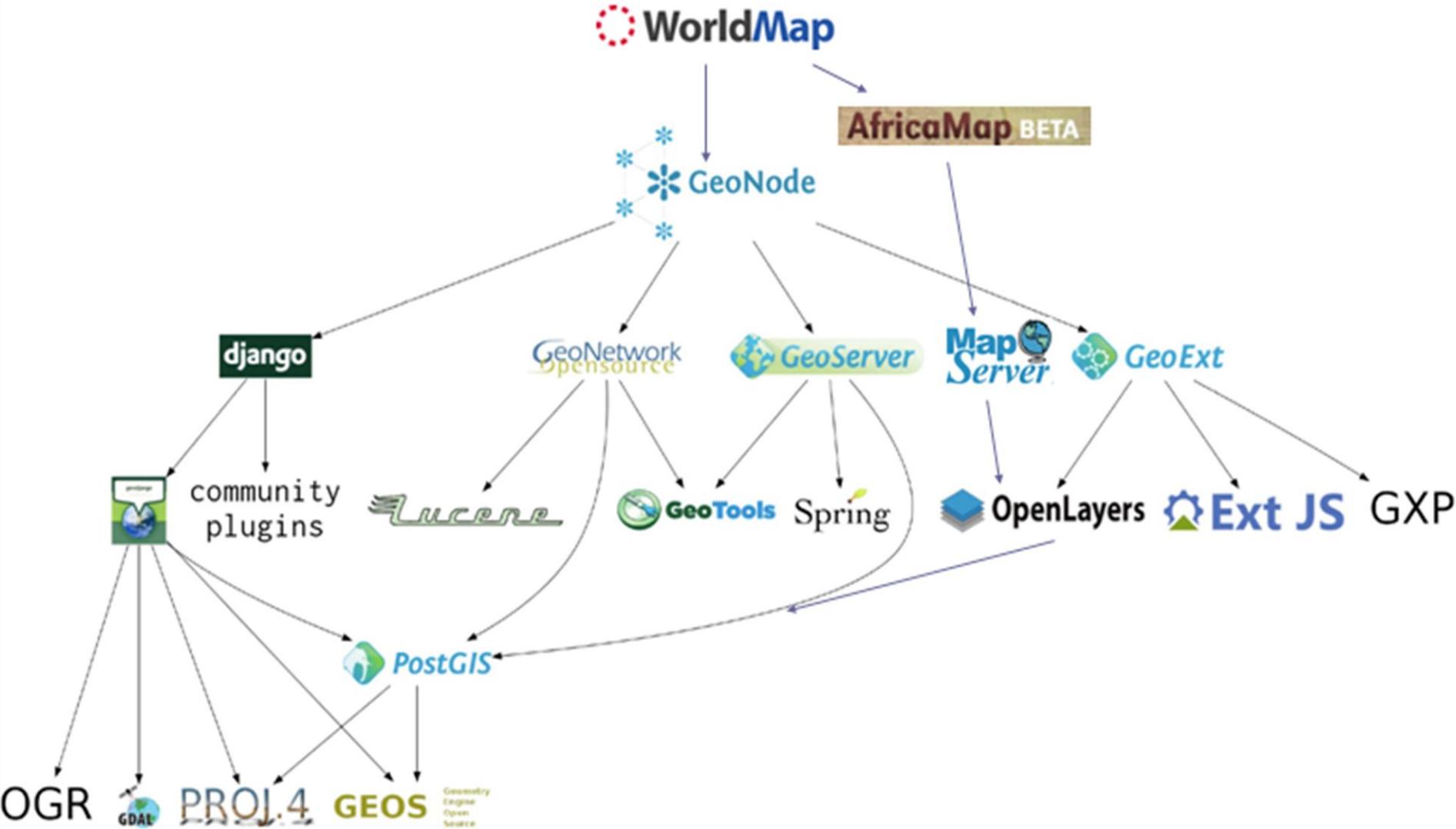
Harvard ChinaMap



Open Stack for Collaboration

- Open registration
- Open access to data
- Open service protocols (WMS, WFS, ESRI Rest)
- Open data formats (Shape, GeoTIFF, GeoRSS, KML, Json, CSV)
- Built on Open Source Components
- Open source code (GPL on github)
- Runs on open source operating systems (Linux, can port to Windows)

Built on Open Source Components



Development Philosophy

- **Best tool for the job** – we support a very broad range of user so maximum flexibility is key.
- **Loosely coupled architecture** – we want to be able to easily interoperate with any system out there using existing open standards or if necessary, creating one.
- **Interoperability** – need to be able to dependably get data in and out in a variety of formats.
- **Global developer community** – having an active, global development community is a good guarantee of enhancements and continually improving performance.
- **Licensing** – it is important that we can give entire platform to any organization that wants to collaborate.
- **Code access** – having access to the source code helps make the platform vendor neutral, easier for researchers to extend and modify, easier for other organizations to build on.

Future Development

- Much work remains to be done:
 - Content
 - Function
 - Infrastructure
 - Collaboration
 - User support
 -
- Some asked by users, others required to keep the system running.

Improve User Experience

- Better search (by time, multi-faceted search, deep content search, etc.)
- Content quality control (by crowd ranking, usage stats, etc.)
- Federation (multiple instances sharing authentication and search).
- User community (create groups, set group permissions)
- Internationalization (user interface in other languages).
- Usability (testing, interface re-design, show/hide tools)

Add Capabilities

- More uploading formats (spreadsheets, GPS data, KML, etc.)
- Measurement tool (distance, area, etc.)
- Analytics (temporal animation, polygon overlay, spatial regression, heatmaps, buffering, viewshed, etc.)
- Big data handling (twitter, weather, sensors, large archives, etc.)
- Mobile beyond Alpha released (support disconnected editing and synchronization)

Strengthen the Foundation

- Tighter integration (between WorldMap and MapWarper, MapStory, MapD, etc.)
- More scalability (cluster servers, GPU-CPU hybrid, Google Maps Engine, etc.)
- Interoperability (with Dataverse Network, Harvard Geospatial Library, ArcGIS Online, etc.)
- Long-term content archiving
- User support (online help, training, forum, outreach, etc.)

Funding Model: First Ask, First Pay

- New functionality and system improvements are developed as requested or needed
- Requests which include funding generally receive priority
- Often there has been cost sharing when multiple groups with funding have common needs

List of Contributors

- Lee and Juliet Folger Fund (ChinaMap)
- W.E.B. Du Bois Institute (AfricaMap)
- Harvard Department of African and African American Studies (AfricaMap)
- Harvard Committee on African Studies (AfricaMap)
- Radcliffe Institute for Advanced Study (BostonMap)
- Reischauer Institute (JapanMap)
- Harvard Fairbanks Center (ChinaMap)
- Harvard Rappaport Institute (BostonMap)
- Harvard Weatherhead Center (ChinaMap)
- Harvard Business School
- Harvard Dean of Arts and Humanities (AfricaMap)
- Harvard Academic Technology Group (ParisMap)
- Harvard Forest (Harvard Forest Map)
- Harvard Institute for Quantitative Social Science
- Harvard Department of Earth and Planetary Sciences
- Harvard Provost Fund
- Milton Fund (AfricaMap)
- Harvard Faculty of Arts and Sciences
- Amazon Web Services Research Grants
- TelaScience
- Azavea (AfricaMap)

Key Players in WorldMap Development



Prof. Suzanne Blier



Prof. Peter Bol



Ben Lewis



Matt Bertrand



Todd Mostak



A Data Community in Practice

<http://worldmap.harvard.edu>

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2013 UCGIS Symposium