Using GIS to Enhance Historical Maps

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“The Library of Congress is the world’s largest library, with nearly 170 million items in our collections, and extensive expert services and programs. What does this mean for you?”
LC Strategic Plan 2018-2023

• Vision and Mission
  – All Americans are connected to the Library of Congress.
  – Engage, inspire, and inform Congress/the American people with a universal and enduring source of knowledge/creativity.

• Expand Access and Enhance Services
• Make our unique collections, experts, and services available when, where, and how users need them.
• Create valuable experiences for every user to foster lifelong connections to the Library.
Agenda

- Geographic Information System (GIS)
  - Historic Maps, Data, Events
  - Using Tools and Technology
- External/Internal Customers
- How to adopt current tech
- Items for Consideration
- Challenges
- The Way Forward

https://www.myleszhang.org/here-grows-new-york-city/
Historical Maps and Digitization

Chicago Sanborn Map 1949

Sanborn Fire Insurance Map

Most Heavily Accessed Resource on G&M Online

1 Million Publically Available by 2020
Historical Maps and GIS Index
Historical Data and GIS Mapping

Tornadoes in the United States: 1950 - 2016
This map shows all tornadoes recorded in the United States between 1950 and 2016. Compiled by the Storm Prediction Center of the National Weather Service, this historical record allows researchers to study tornadoes across time and geographic space. At a zoomed-in level, explore the map by panning with the mouse and clicking on individual tornado paths to reveal the date, magnitude, number of fatalities, number of injuries, and path length of each tornado. Magnitude is measured by the Enhanced Fujita (EF) scale, which runs from EF-0 to EF-5. At a zoomed-out level, the map shows tornado counts, aggregated into hexbins. DOWNLOAD MAP DATA HERE.

April 29, 2011, EF-4
Fatalities: 3
Injuries: 122
Path Length: 36.89 miles
Zoom to:
Historical Metadata and GIS Mapping

- Develop geospatial projects using our historical metadata.
- Cataloging Map visualizes country by the LC Classification numbers.
- Includes: General, Subject, Regions, Natural features, Provinces, Cities and towns.
Congressional Cartography and GIS Mapping

• Specialized Cartographic & GIS program for Congress
• Advances the legislative decision-making process using geographic theory & spatial data analysis
• Engages Congressional staff with mapping and data analysis
Congressional Cartography and GIS Mapping

• Custom Maps & Analysis:
  • “What is in my District?”
  • Report maps to communicate issues
  • Global scope of research
  • Authoritative, confidential

• Sources (Federal, Academic, OS)
  • Historic materials from LC/G&M
  • Incorporating federal standards
    • GNIS: http://geonames.usgs.gov/domestic/
    • GNS: http://geonames.nga.mil/gns/html/
Historical Research and GIS Mapping

Dr. Christopher Koontz, USAF Historian
Experiences of an End User: Applying GIS to Historical Research and Writing

• Enables relevant scholarship for military and academic communities
• Ease of use for researchers with varying levels of technological skill
• Test case: “Valley of Fire,” 2019 study of the role of air power during a major engagement in Afghanistan
The Battle for Combat Outpost Keating: October 3, 2009

- Complex assault by Taliban that turned into a daylong firefight
- Close Air Support by USAF “critical” to saving the outpost from being overrun
- Little reporting or research on employment of air power
Source Materials: Discoveries and Challenges

- Evidence collected by official investigators (redacted material available via CENTCOM FOIA @ www3.centcom.mil)
- Documents collected by deployed USAF historians
- Personal research (emails, interviews, Intellink data mining)
- Published material (Tapper’s *The Outpost*, Romesha’s *Red Platoon*)
GIS and Online Resources Used

• Classified: National Geospatial-Intelligence Agency (NGA), Map of the World

• Unclassified:
  – GIS
    • ArcGIS: https://www.arcgis.com/home/webmap/viewer.html
    • Google Maps: https://www.google.com/maps
  – Reference and Data Conversion
    • Legal Land Converter: http://legallandconverter.com/p50.html
    • Earth Point: http://www.earthpoint.us/Convert.aspx

• Reachback expertise @ NGA and Library of Congress
The Kamdesh Valley, Nurestan, Afghanistan

https://www.arcgis.com/home/webmap/viewer.html
COP Keating and Ormol Village

https://www.arcgis.com/home/webmap/viewer.html
Using GIS to Overcome Challenges

\[ d = r \times t \]

• Solved question of initial aerial response
  – Over 20 minutes between dispatch of first aircraft (2 x F-15E) and arrival – why?
• Confirmed urgent dispatch of subsequent flights
  – Supersonic transit of B-1 bomber
  – Near-maximum transit of A-10 attack planes (450 nm/hr)
Using GIS to Overcome Challenges: So, what happened?

- Employed GIS to chart weapons expenditures using NGA Map of the World
  - Confirmed 100% strikes consistent with rules of engagement and JTAC instructions
  - Demonstrated when potentially catastrophic errors were detected and corrected
  - Demonstrated intensity and urgency of strikes as engagement progressed

n.b. – Image is notional.
Summing Up

• GIS data is embedded in our source materials now – take advantage of it!
• Provides hard data for interpretation of events and context for extrapolation and second-order inference
• Basic resources are easy to use and largely budget-neutral
Concluding Thoughts

Dr. Paulette Hasier, Library of Congress
Adoption and Items for Consideration

- Leverage existing technology
- Engage Stakeholders
- Solicit Participation
- Build a Buzz
- Answer Questions
- Address Policy Concerns

https://www.loc.gov/resource/ppmsca.04613/
Challenges and the Way Forward

- Strategic Alignment
- Expand the Model
- Plan but have Patience
- Testimonials---Kudos
- What’s next?
- Questions???