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Using GIS to Enhance Historical Maps

Dr. Paulette Hasier, Chief of Geography and Map (G&M) (phasier@loc.gov)

"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 <u>you</u>?"

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/

Geography and Map
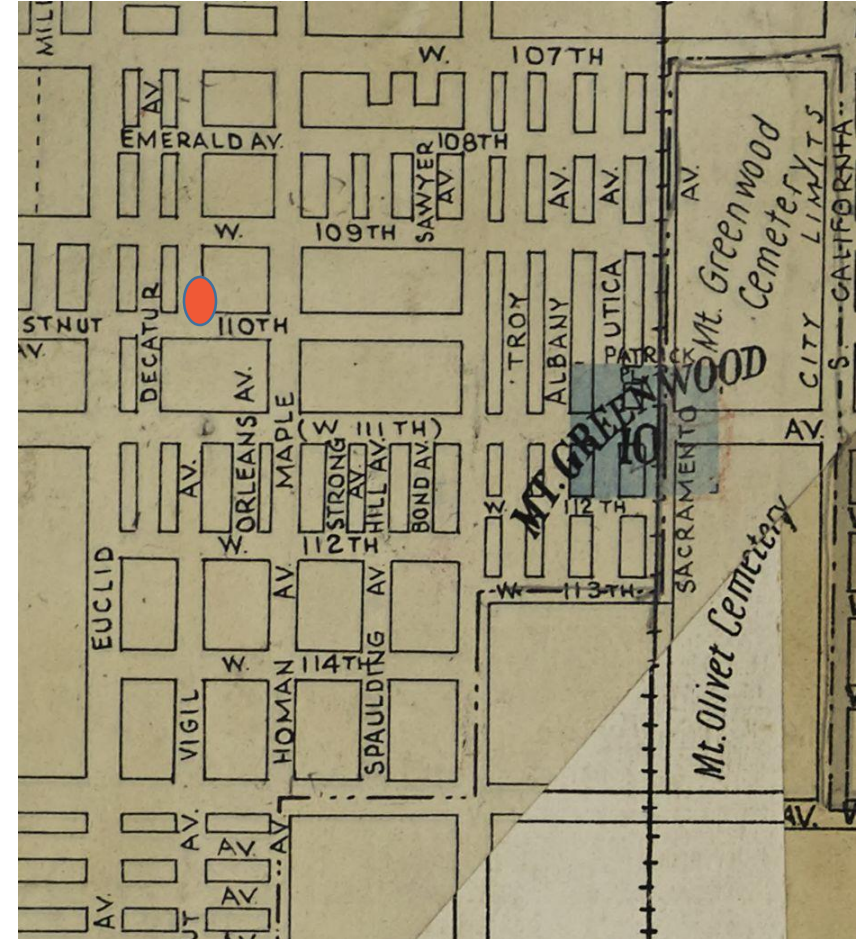
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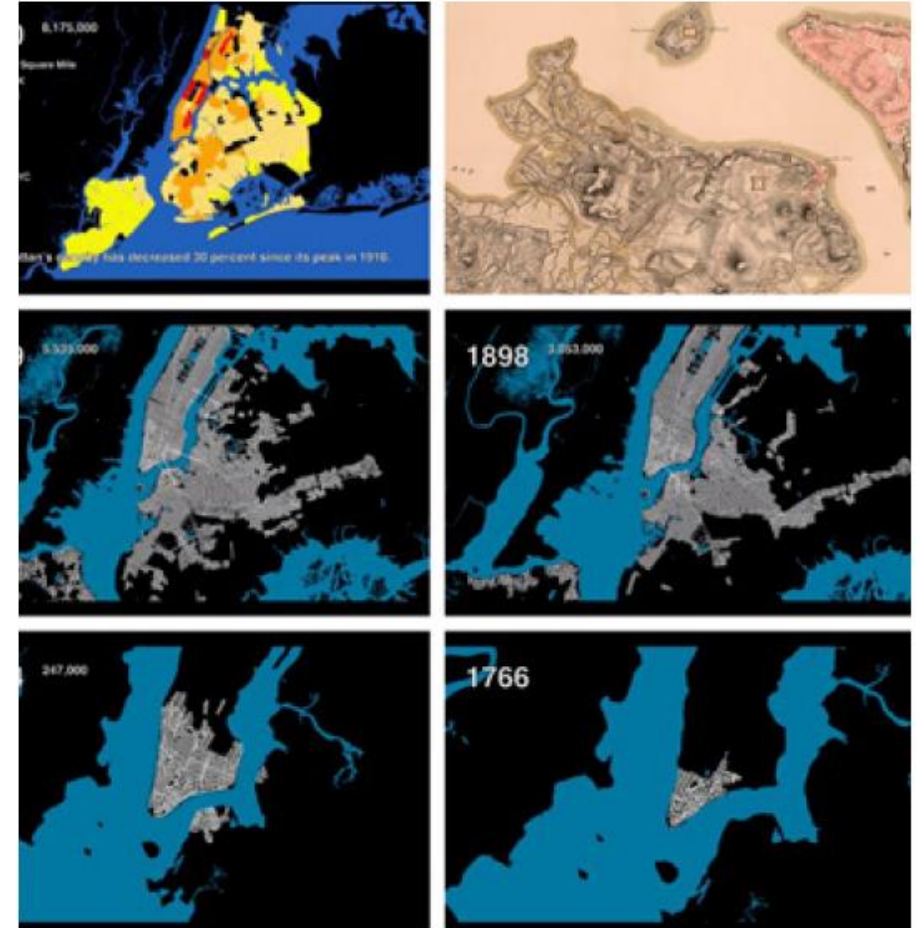
Historical Maps and Digitization

Chicago Sanborn Map 1949

Sanborn Fire Insurance Map

Most Heavily Accessed
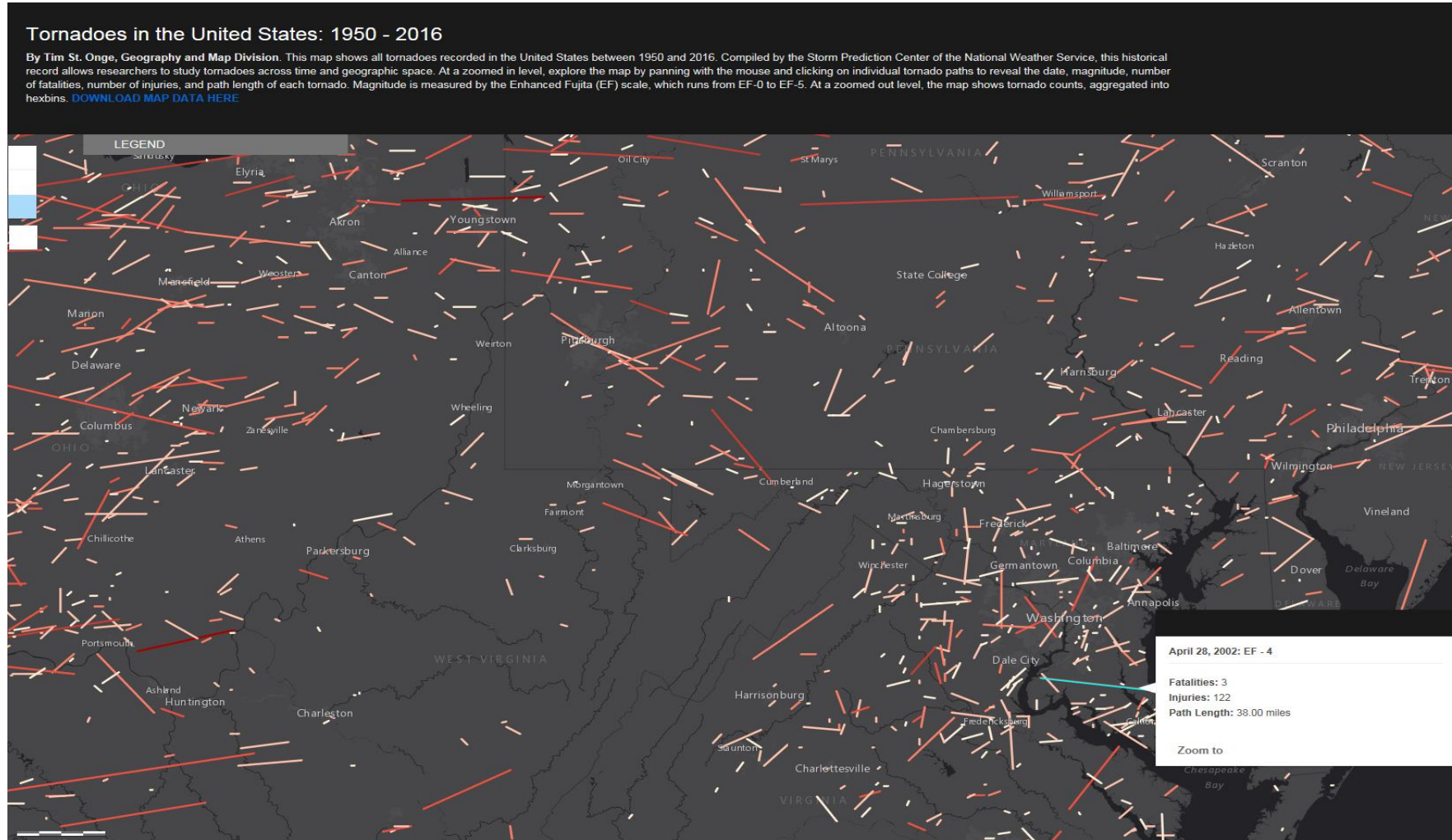Resource on G&M Online

1 Million Publically Available
by 2020

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Historical Maps and GIS Index
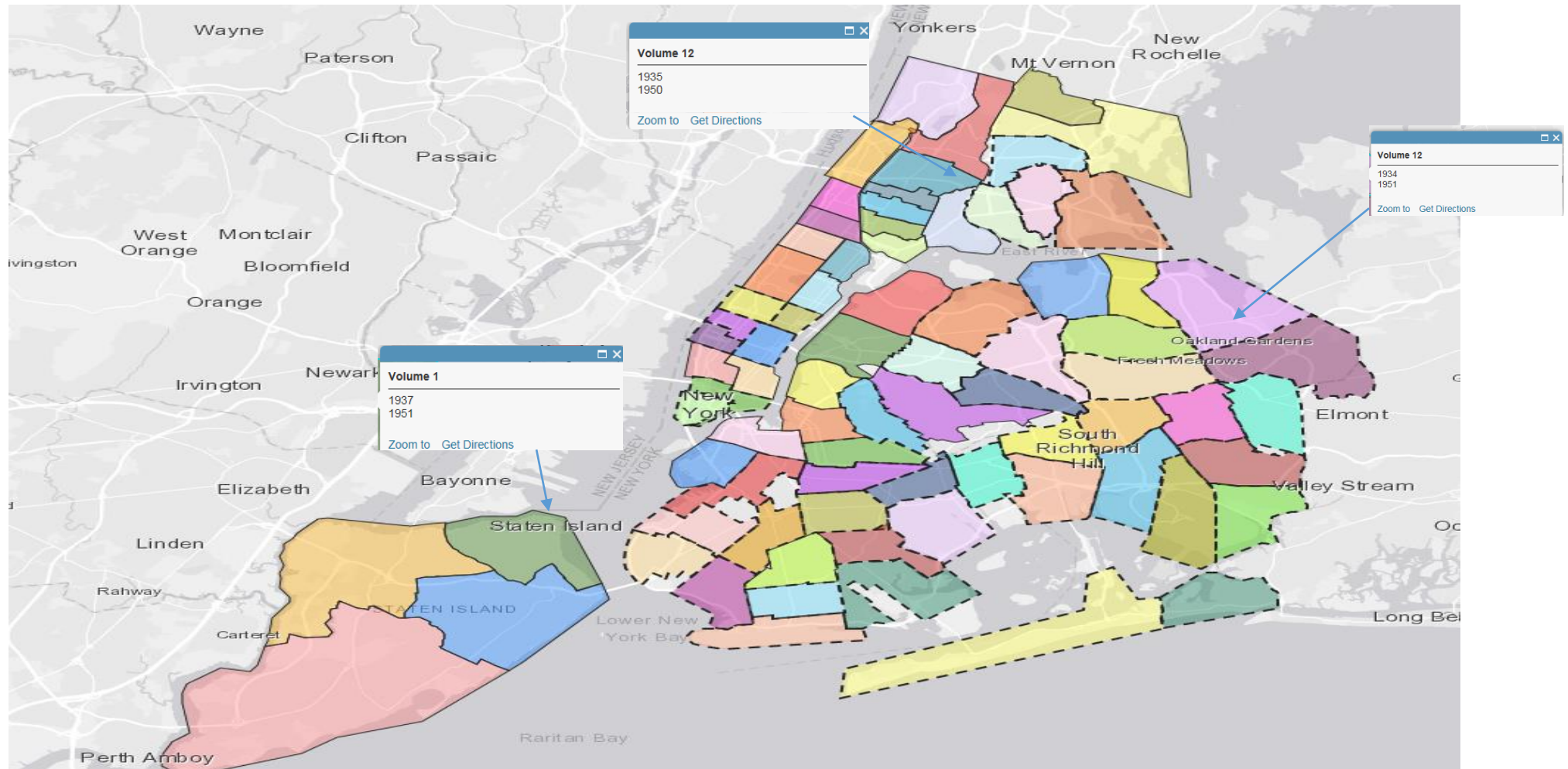
Historical Data and GIS Mapping

Tornadoes in the United States: 1950 - 2016

By Tim St. Onge, Geography and Map Division. 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 28, 2002: EF - 4

Fatalities: 3
Injuries: 122
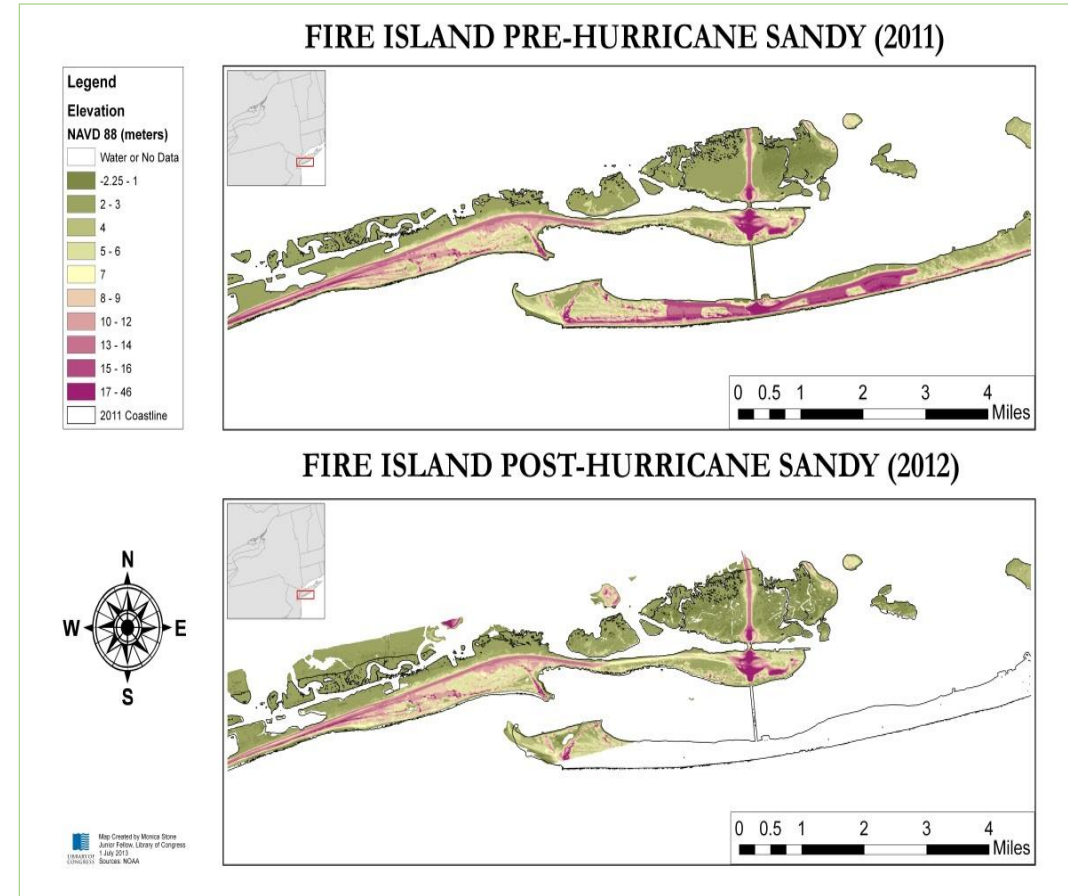Path Length: 38.00 miles

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.

Cartographic Resources in G&M

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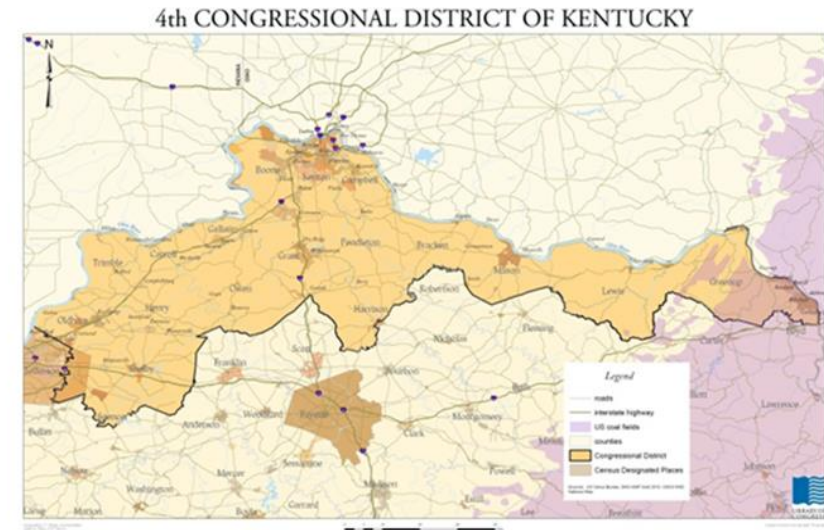# Congressional Cartography and GIS Mapping

- 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

FIRE ISLAND PRE-HURRICANE SANDY (2011)

Legend
Elevation
NAVD 88 (meters)
- Water or No Data
- -2.25 - 1
- 2 - 3
- 4
- 5 - 6
- 7
- 8 - 9
- 10 - 12
- 13 - 14
- 15 - 16
- 17 - 46
- 2011 Coastline

0 0.5 1 2 3 4 Miles

FIRE ISLAND POST-HURRICANE SANDY (2012)

0 0.5 1 2 3 4 Miles

Map Created by Monica Stone
Junior Fellow, Library of Congress
1 July 2013
Sources: NOAA

Geography and Map

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/

4th CONGRESSIONAL DISTRICT OF KENTUCKY

Geography and Map

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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
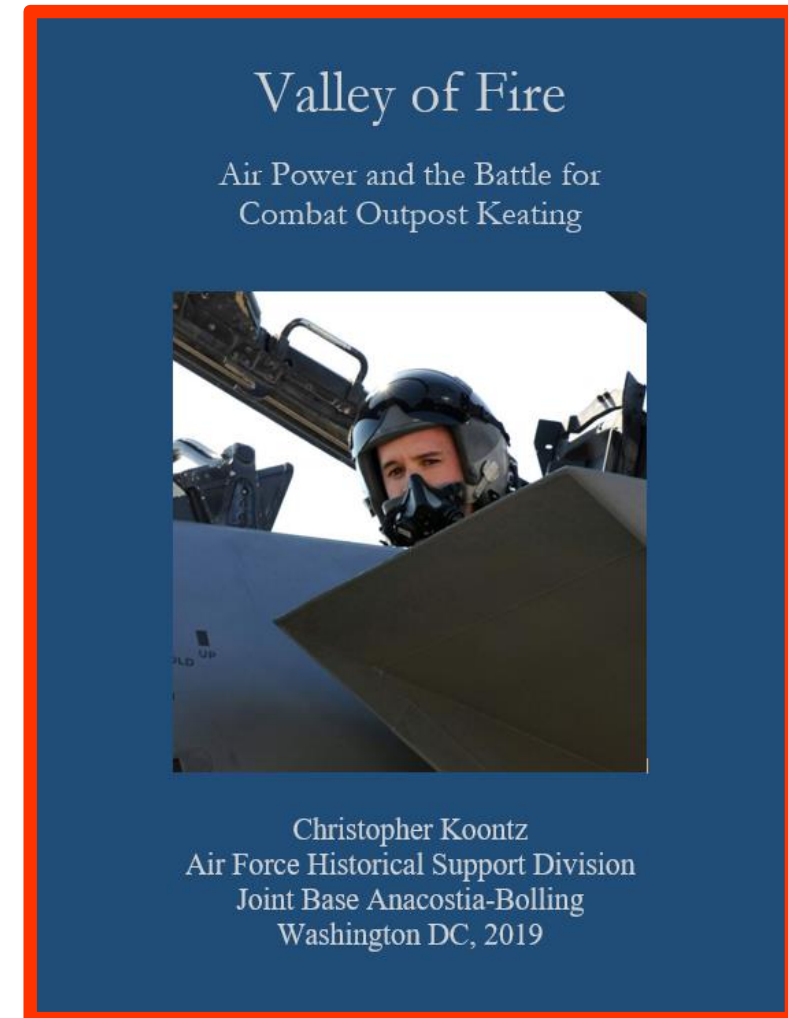
The Battle for Combat Outpost Keating: October 3, 2009

- 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

BATCAVE_AIR – mIRC log

Session Start: Sat Oct 03 00:00:01 2009

Session Ident: #batcave_air

[01:03] <afcent_msg> * CHAT CLASSIFIED UP TO SECRET//REL USA,CAN,AUS,GBR *

[01:13] * Darkknight_OPS is now known as Darkknight_OPSAFK

[01:33] <Darknight_35> TIC/DARKNIGHT 34/GN33/92CU3/42S YE 115 224 /IDF/ HAVE AIRCRAFT CHECK IN OVER FOB BOSTICK

[01:36] <Darknight_34> Update: COP Keating/Op Fritsche are taking heavy contact mortars and heavy machine gun fire.

[01:37] <Darknight_OPSAFK> c

[01:37] <Darknight_OPSAFK> stdby for a/c and eta

[01:43] <Darknight_OPSAFK> c

[01:43] <Darknight_34> ROZ BATTLEKING GUNS HOT ATT/ FOB BOSTICK 155MM_ YE 116 198/ GTL:315/ MAX ORD 66K

[01:43] <Darknight_OPSAFK> c

[01:46] <Darknight_34> Need eta for(b)(2)Higwe have take 2 x casualties.

[01:47] <Darknight_OPSAFK> c working

[01:47] <Darknight_34> c

[01:51] <Darknight_OPSAFK> 9mins eta DE25

[01:51] <Darknight_OPSAFK> TIC IO ISAF# 0212

- 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)
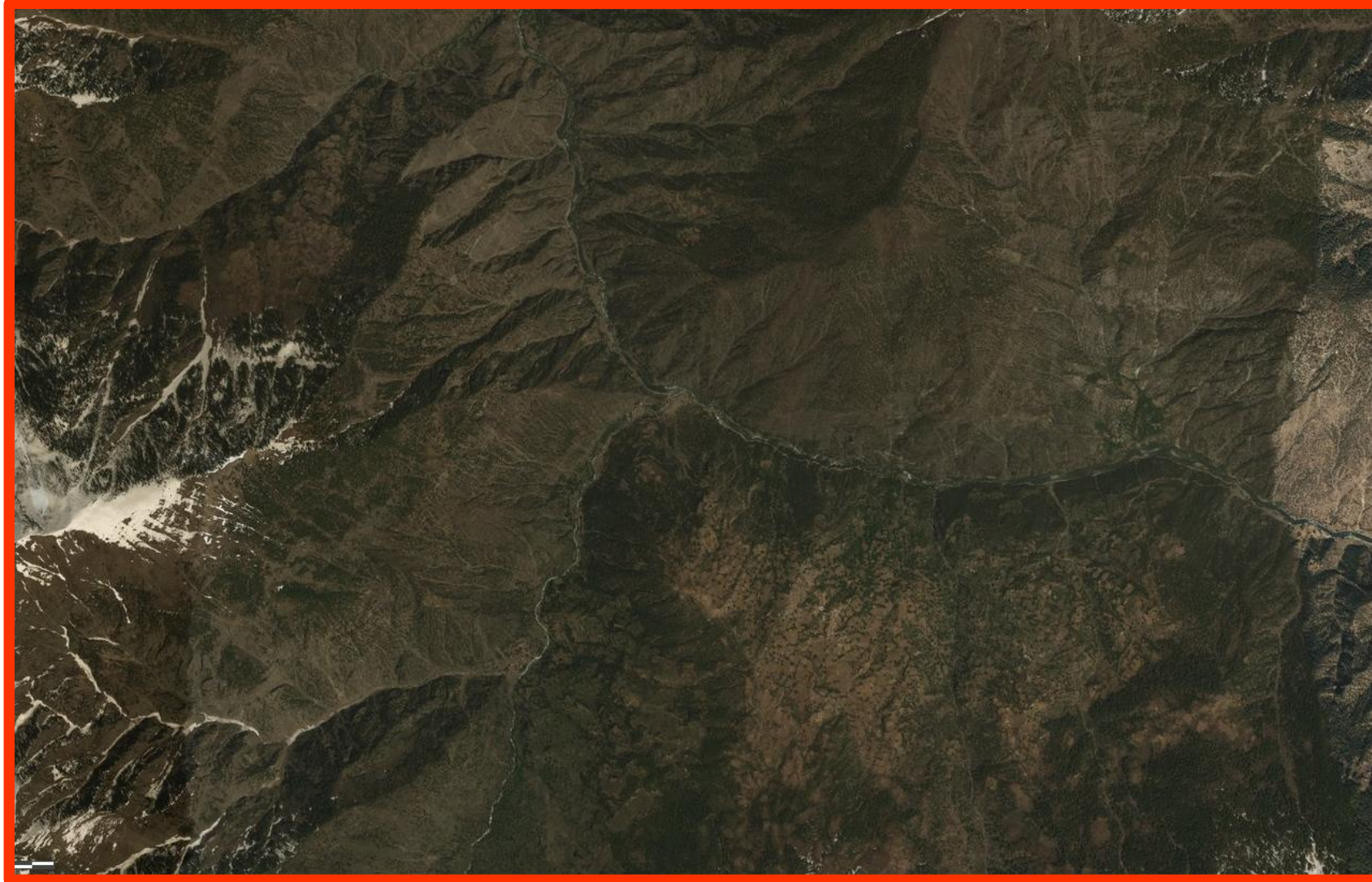- Published material (Tapper's *The Outpost*, Romesha's *Red Platoon*)

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

Using GIS to Overcome Challenges
$d = r \times t$

Air and Land Distances From COP Keating to Major Bases in Afghanistan

COP Keating/ OP Fritsche

196 km/122 mi/106 nm

To Kandahar AF: 684 km/425 mi/369 nm

137 km/85 mi/74 nm

FOB Bostick

Bagram AB

FOB Fenty
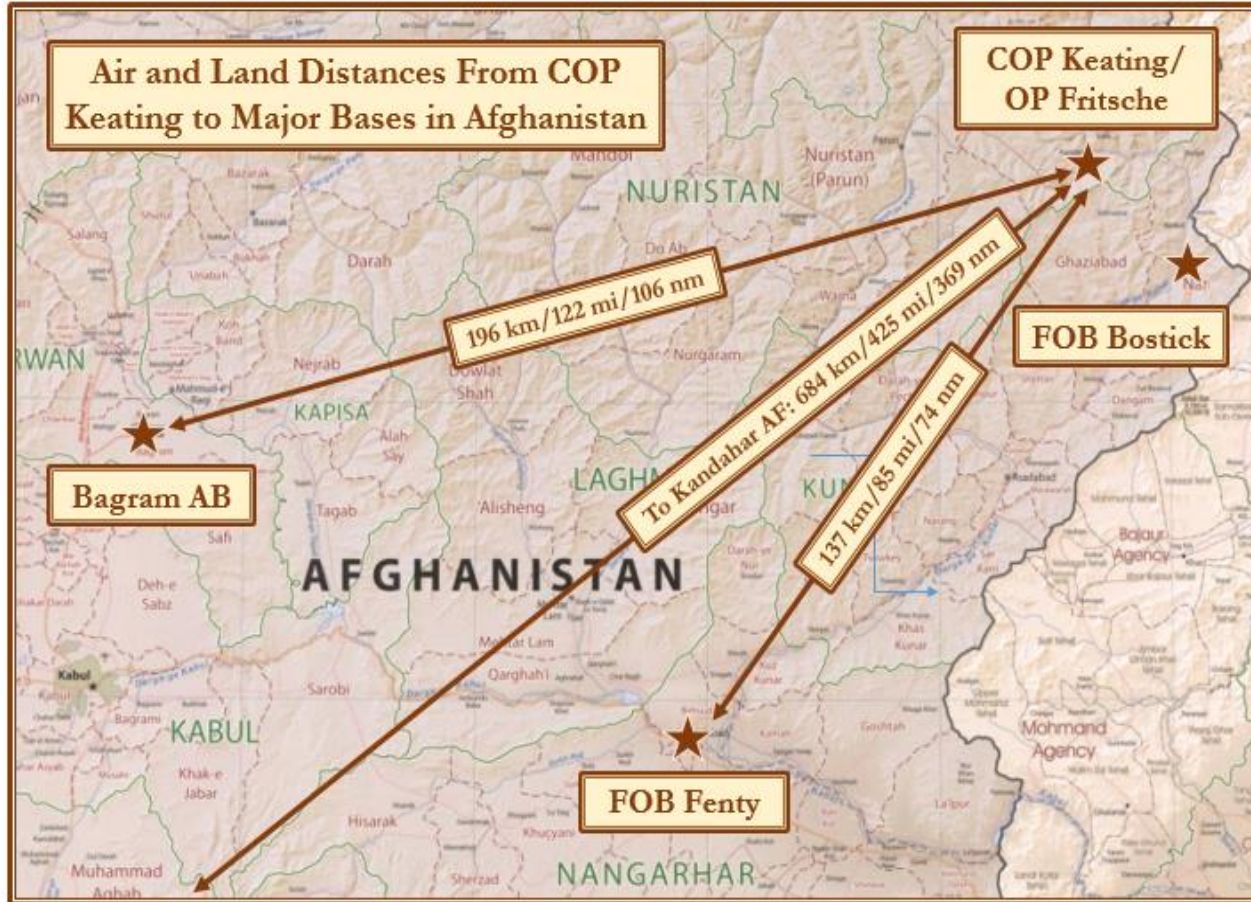
- Solved question of initial aerial response
  – Over 20 minutes between dispatch of first aircraft (2 x F-15E) and arrival – why?
- Confirmed urgent dispatch of subsequent flights
  – Supersonic transit of B-1 bomber
  – Near-maximum transit of A-10 attack planes (450 nm/hr)

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
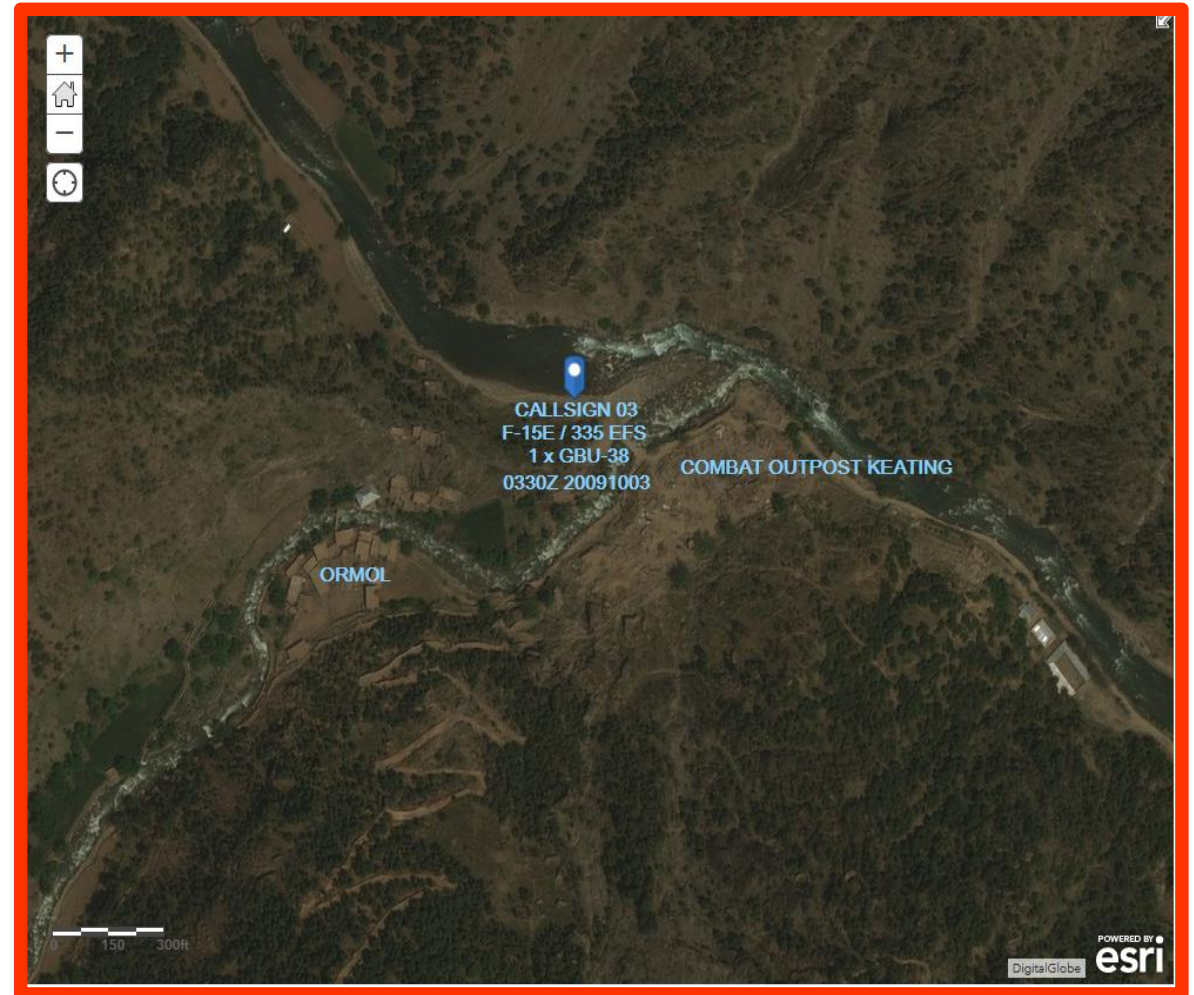
n.b. – Image is notional.

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
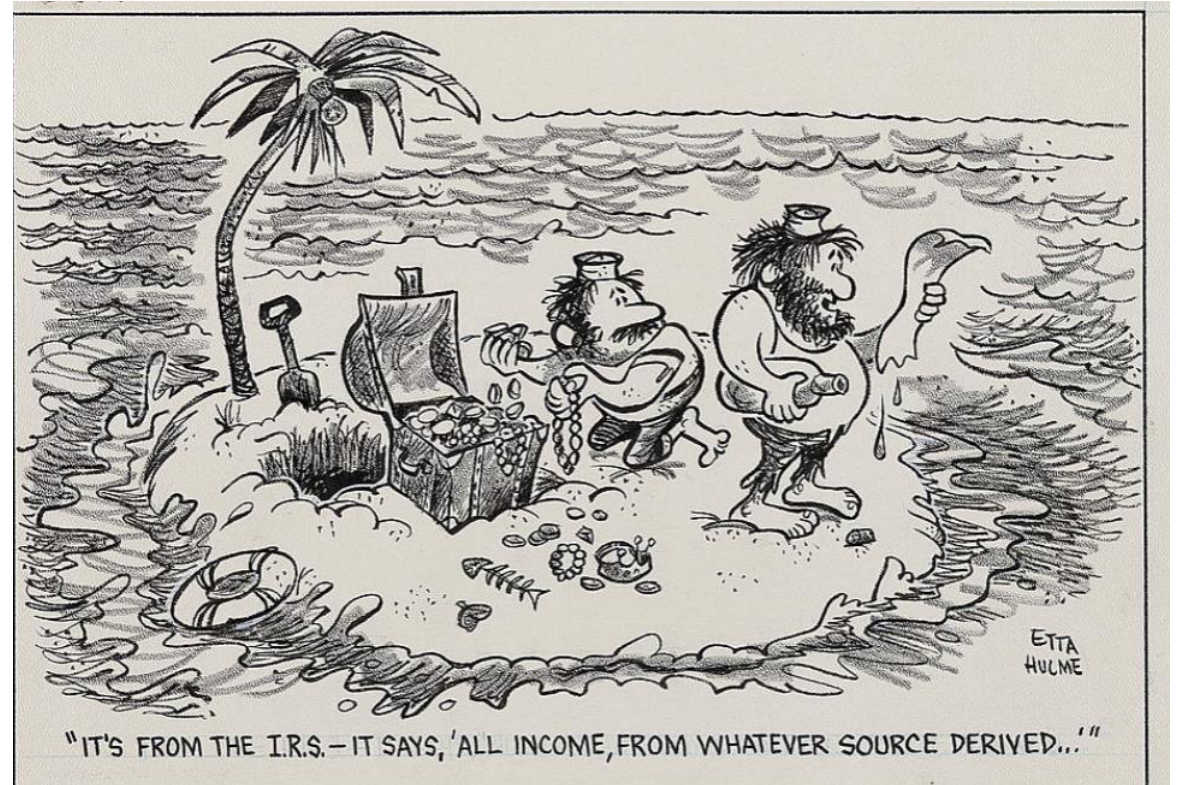
Concluding Thoughts

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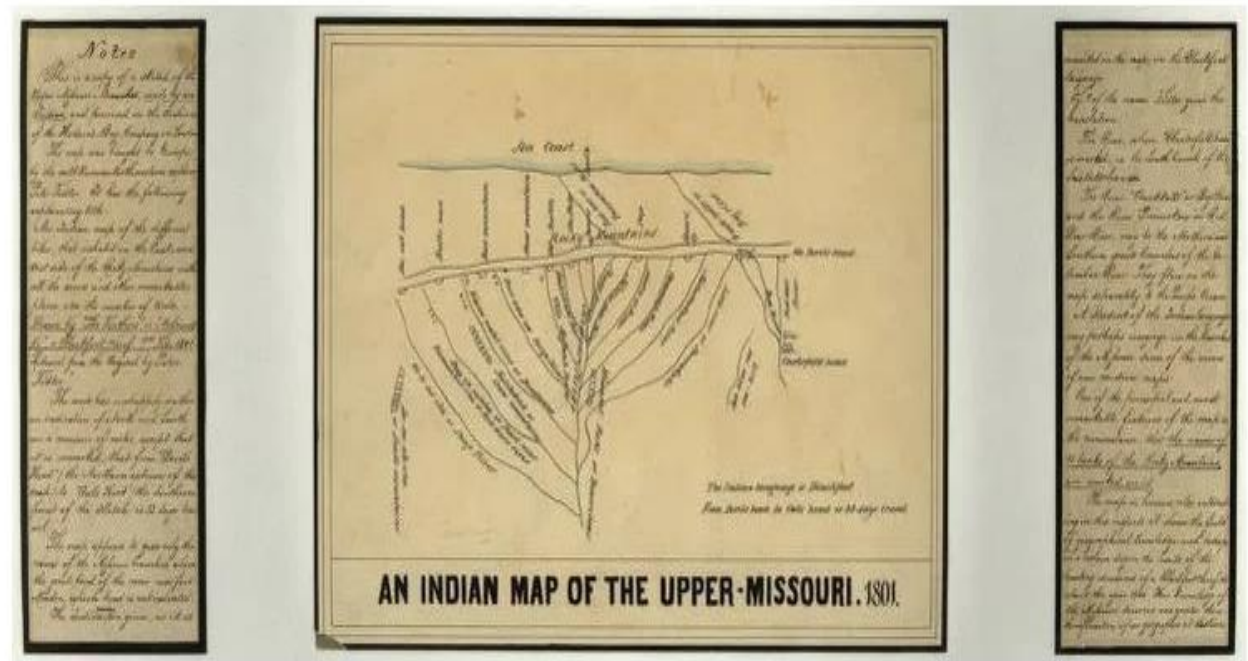
Adoption and Items for Consideration

- Leverage existing technology

- Engage Stakeholders

- Solicit Participation

- Build a Buzz

- Answer Questions

- Address Policy Concerns

"IT'S FROM THE I.R.S. — IT SAYS, 'ALL INCOME, FROM WHATEVER SOURCE DERIVED..'"

https://www.loc.gov/resource/ppmsca.04613/

Geography and Map

Challenges and the Way Forward

- Strategic Alignment

- Expand the Model

- Plan but have Patience

- Testimonials---Kudos

- What's next?

- Questions???

http://chi.anthropology.msu.edu/2019/11/the-geospatial-west-georectifying-historical-native-american-space/

Geography and Map