CENTER for DIGITAL SCHOLARSHIP

ArcGIS Online

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Navari Family Center for Digital Scholarship
Hesburgh Library, University of Notre Dame

library.nd.edu/cds/

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Outline

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- What is GIS?
  - Data types
- Online software and analysis
- Campus resources

What is GIS ?

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In short: "computerized mapping software"

Formal definition

A Geographic Information System (GIS) is a computerized database management system for capture, storage, retrieval, manipulation, analysis and display of spatial (i.e. locationally defined) data

Layers

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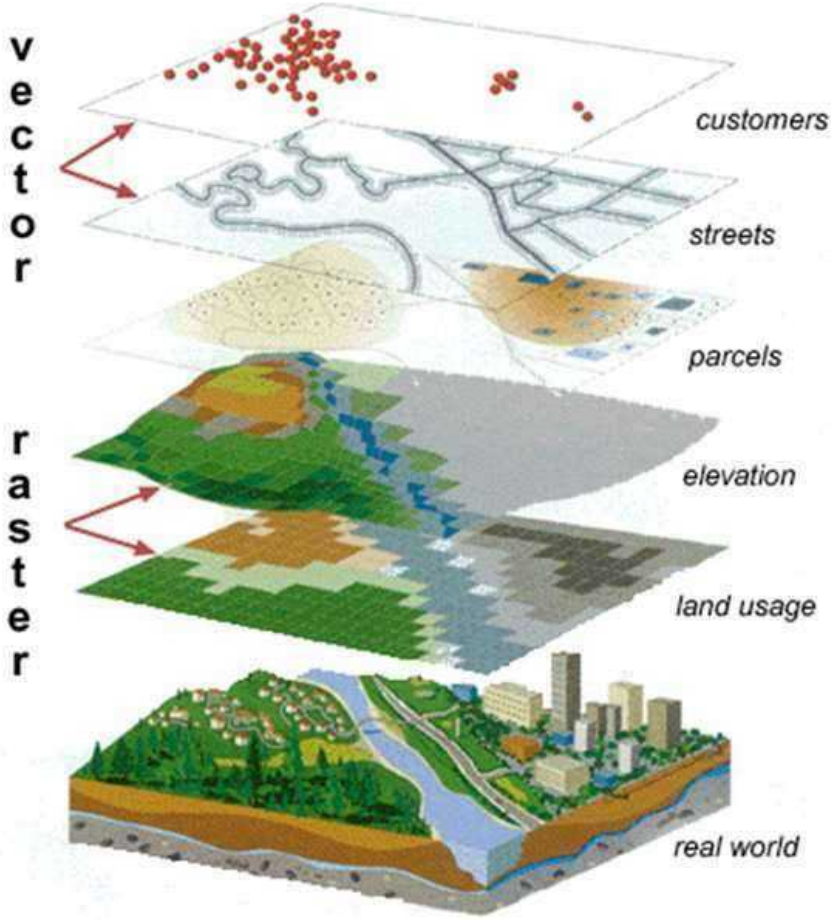
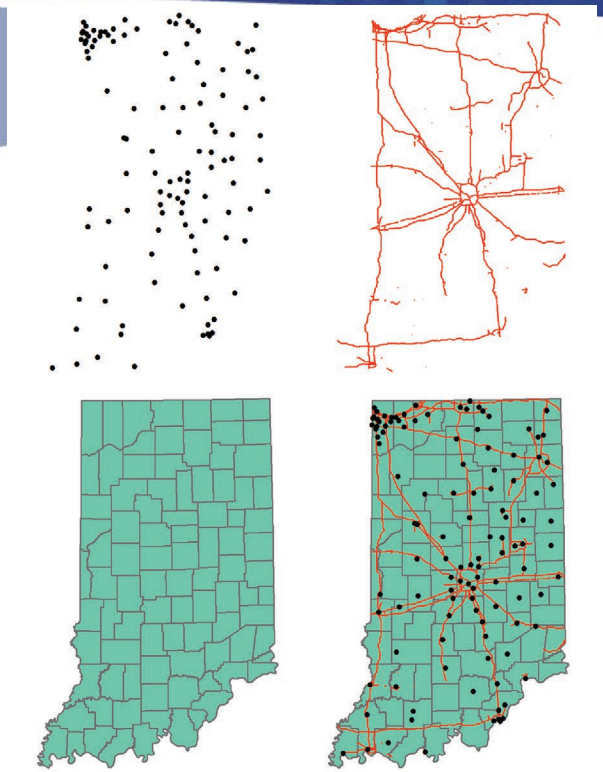
- A GIS is composed of layers of spatial information
- Can be different types of data
- Everything is referenced to a coordinate system
  - e.g. latitude / longitude

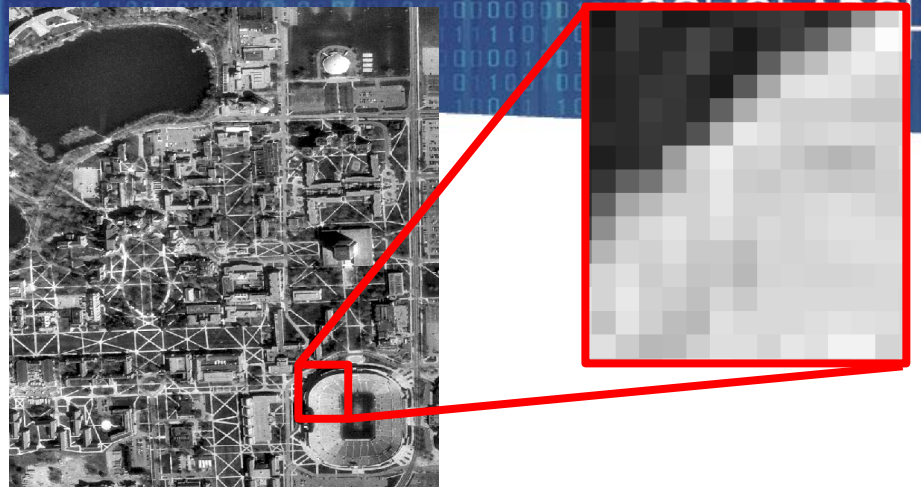


GIS digitally models the real world using:



Three types of geometry

- -Points
- -Lines
- -Areas



Cells in an image

Table

Indiana Counties

FID	Shape *	NAME_L	POP2000	MALES	FEMALES	AGE_UNDER5	AGE_5_17	AGE_18_21	AGE_22_29
0	Polygon	Steuben	33214	16771	16443	2199	6322	2241	3307
1	Polygon	Lagrange	34909	17681	17228	3432	8381	2199	3674
2	Polygon	Elkhart	182791	90848	91943	14800	37999	9881	20712
3	Polygon	St Joseph	265559	128133	137426	18673	49616	20658	28143
4	Polygon	Lake	484564	233367	251197	34639	95158	26621	48719
5	Polygon	Porter	146798	72046	74752	9488	28314	9093	14112
6	Polygon	La Porte	110106	56539	53567	7116	19886	5454	11258
7	Polygon	De Kalb	40285	20059	20226	3061	8238	1977	4210
8	Polygon	Noble	46275	23310	22965	3695	9729	2441	5074
9	Polygon	Marshall	45128	22415	22713	3290	9369	2335	4256
10	Polygon	Kosciusko	74057	36982	37075	5519	15043	3728	7655
11	Polygon	Starke	23556	11660	11896	1520	4792	1142	2169
12	Polygon	Whitley	30707	15238	15469	2101	6112	1469	2853
13	Polygon	Allen	331849	162425	169424	25440	66511	18022	36702
14	Polygon	Jasper	30043	14888	15155	2077	6157	1985	2856
15	Polygon	Newton	14566	7239	7327	902	2945	728	1265
16	Polygon	Fulton	20511	10139	10372	1348	3986	961	1835
17	Polygon	Pulaski	13755	6938	6817	845	2858	610	1171
18	Polygon	Wabash	34960	16957	18003	2073	6504	2377	3234
19	Polygon	Huntington	38075	18537	19538	2536	7412	2395	3600

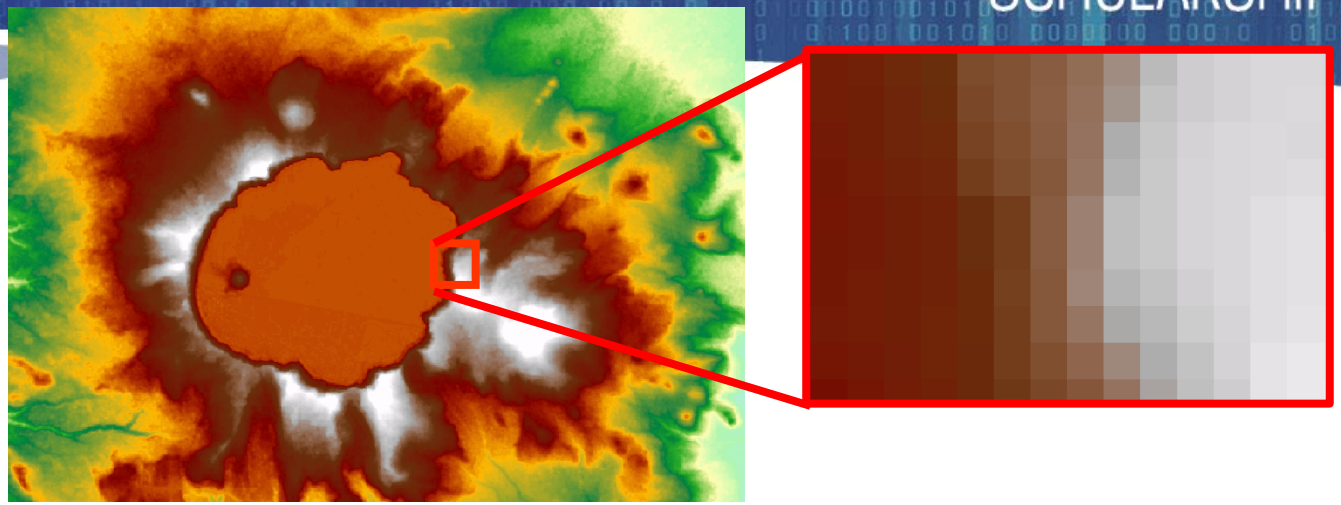
0 (0 out of 92 Selected)

Indiana Counties

Data tables

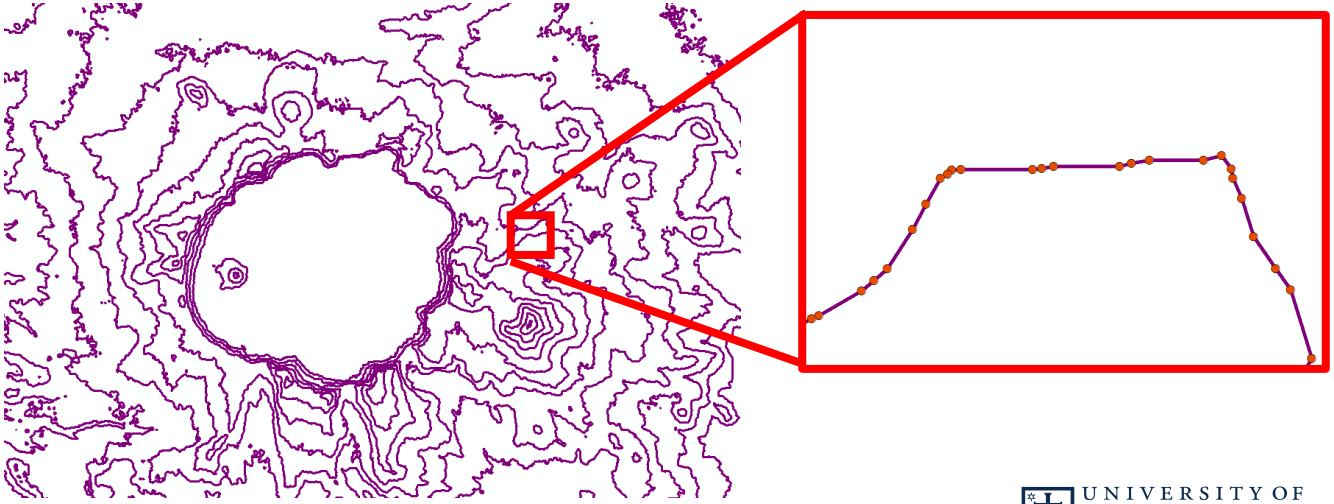
Raster Data

Based on pixel



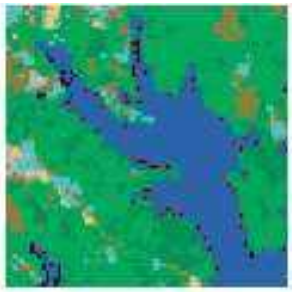
Vector Data

Based on discrete points

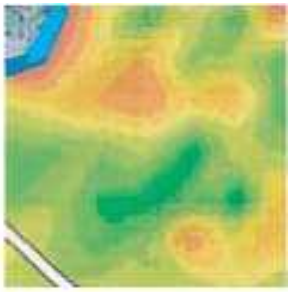


Rasters

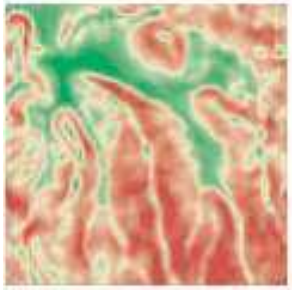
Orthophoto



Land Use

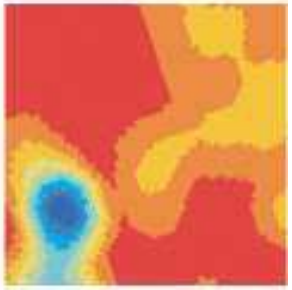


Concentration



Slope

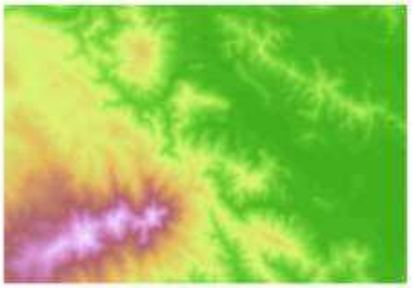
Elevation



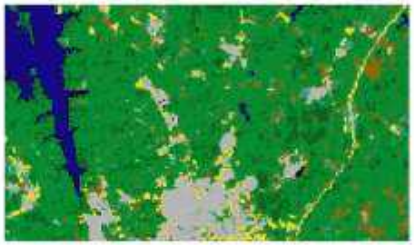
Population

Aerial Imagery

Surface Elevation

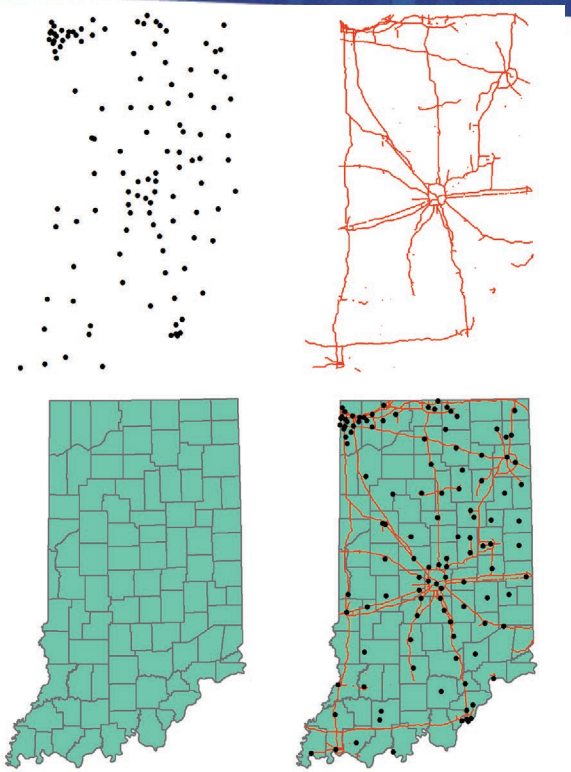


Land Use Classes



- Agriculture
- Bare ground
- Water
- Deciduous Trees
- Deciduous / Pine Mixed
- Grassland
- Pine
- Shadow
- Urban / Developed

Vectors:



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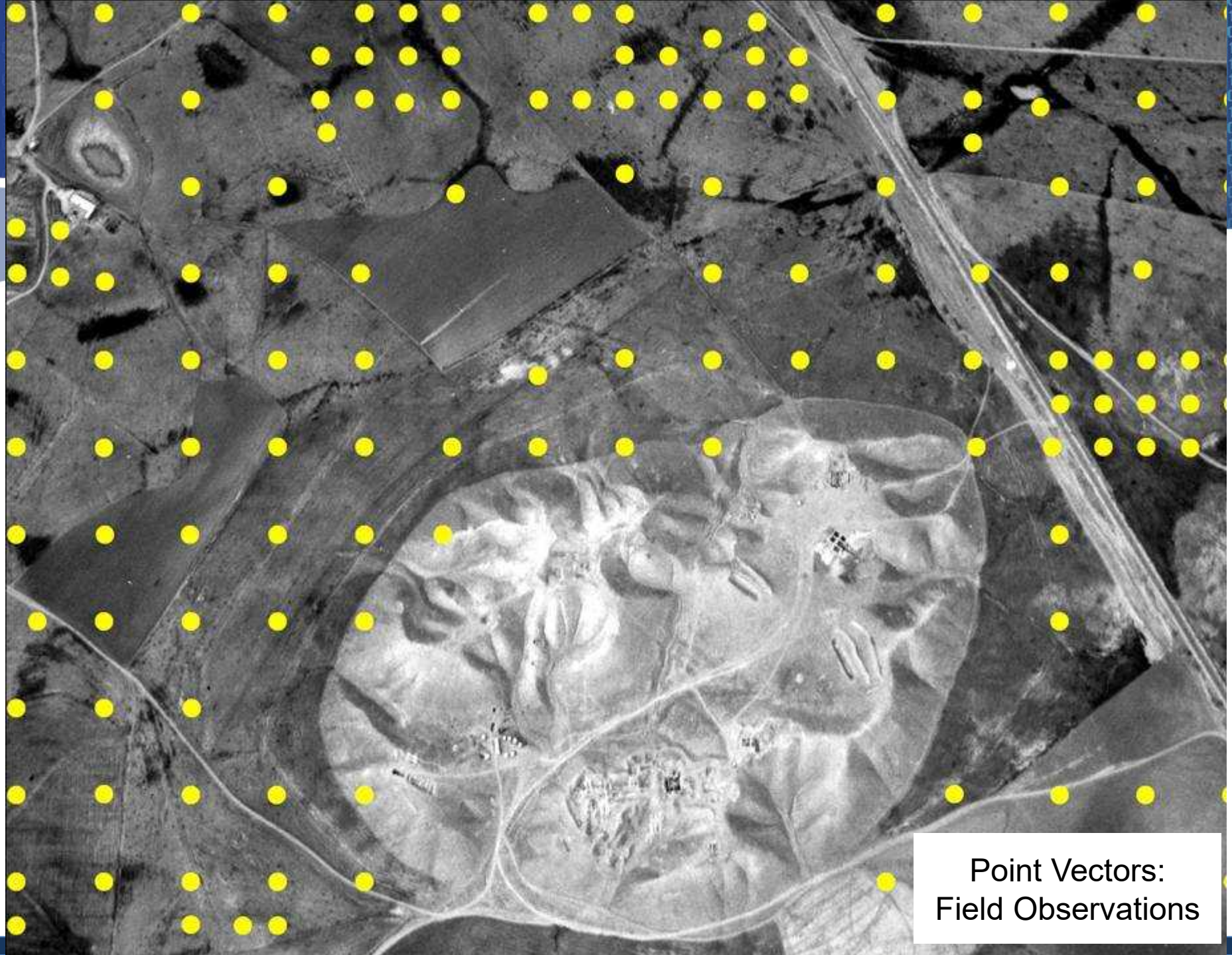
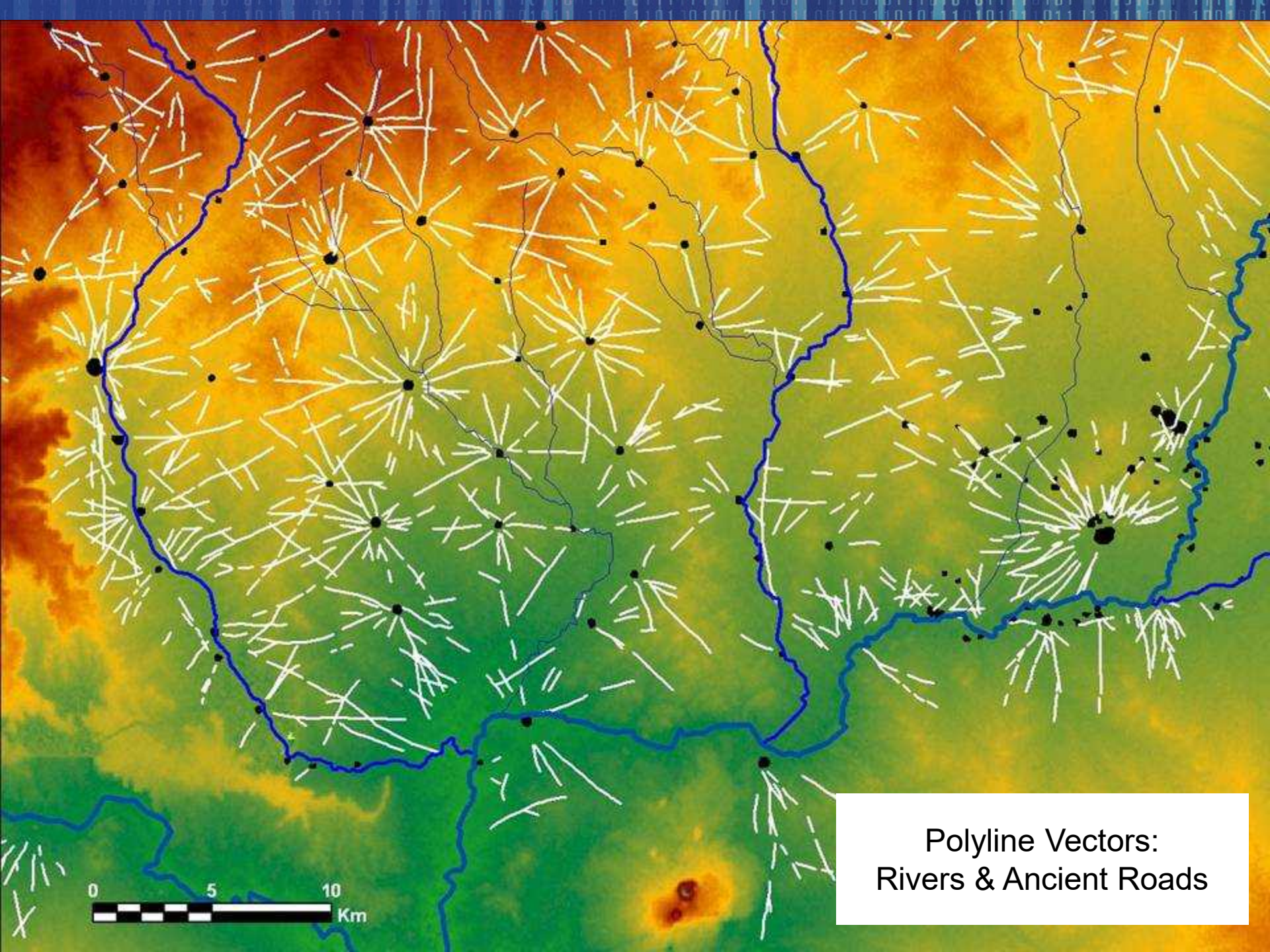
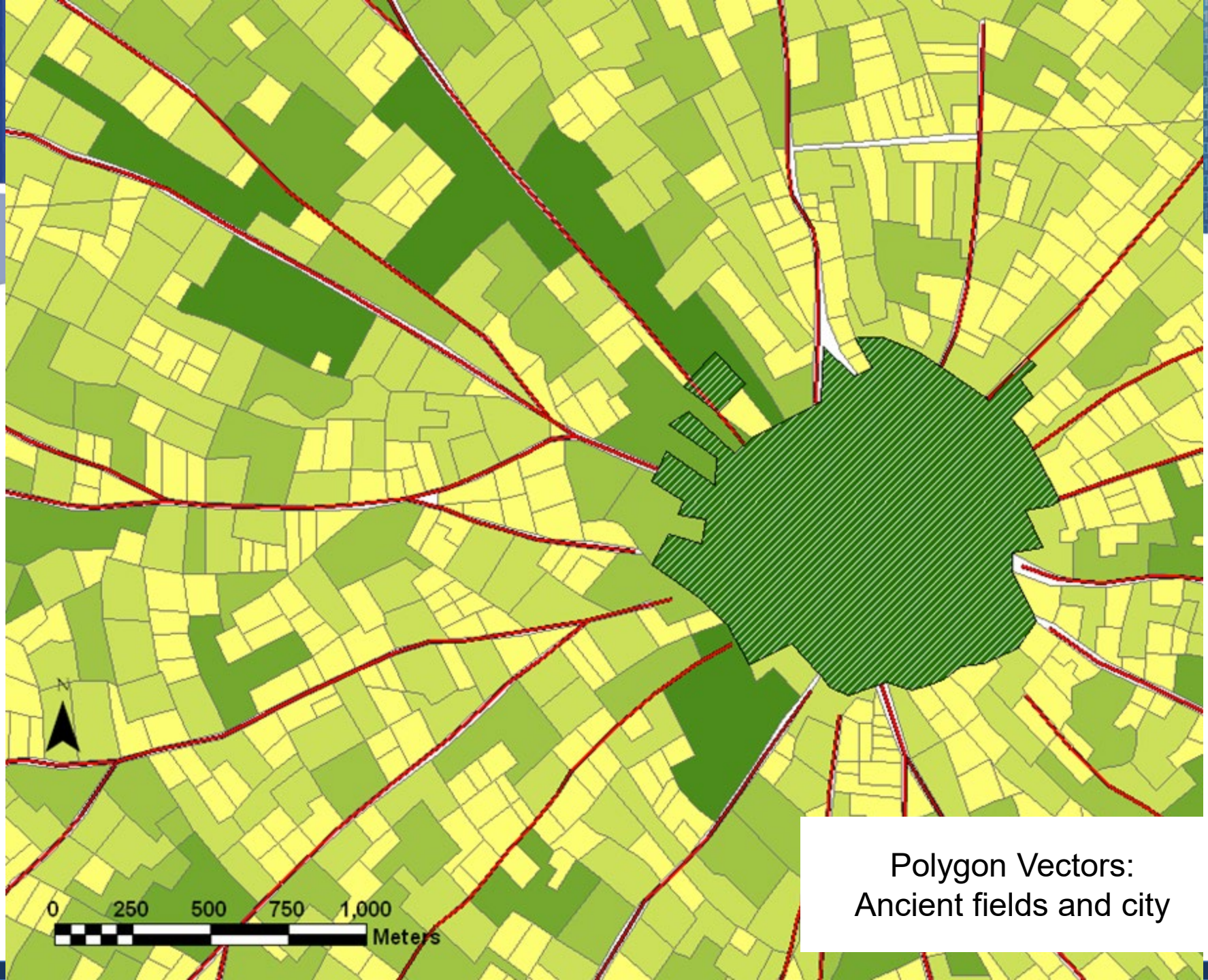

Point Vectors:
Field Observations

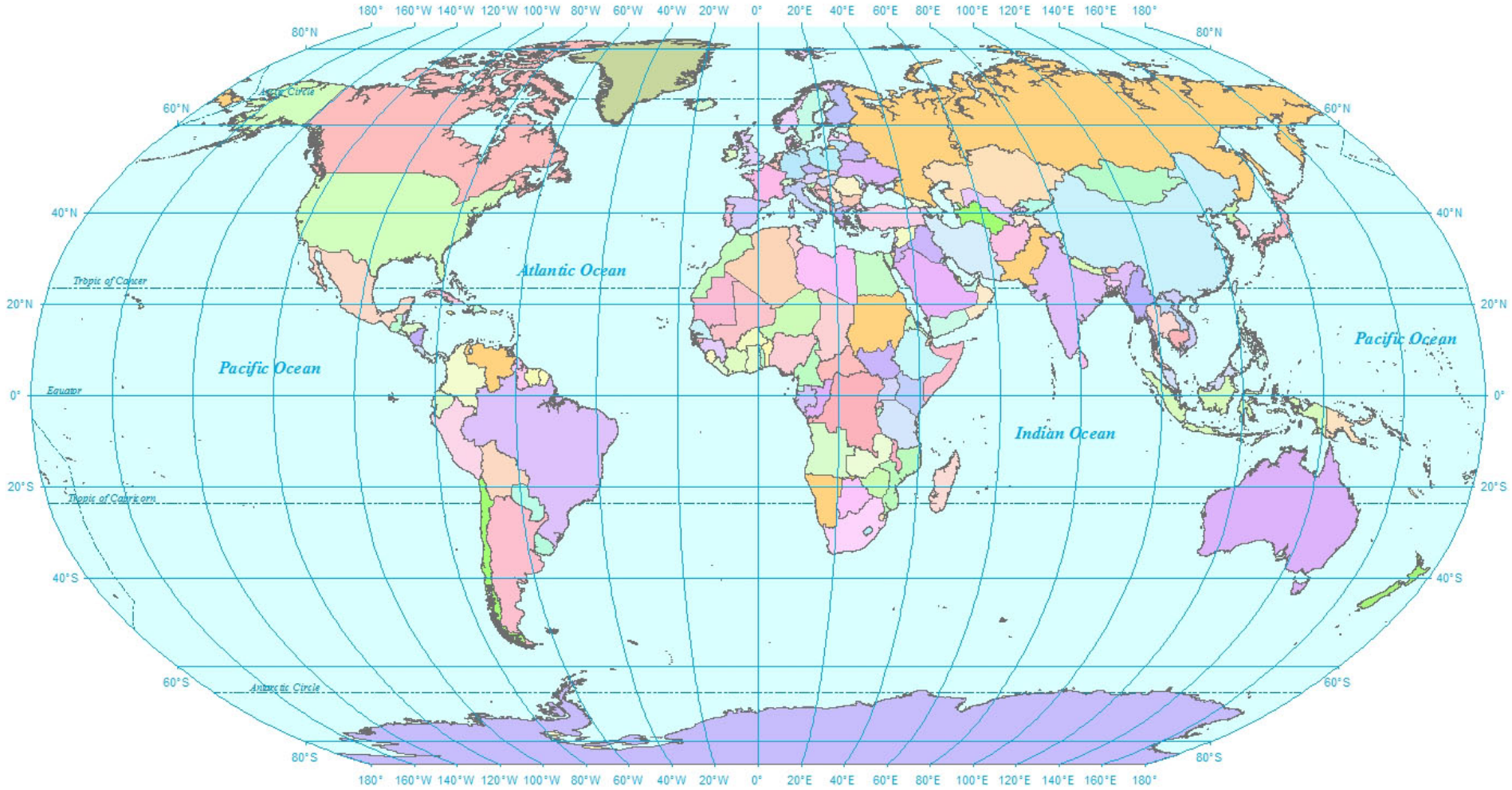


Polyline Vectors:
Rivers & Ancient Roads



Polygon Vectors:
Ancient fields and city

Attribute Data



Attribute Data

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Attributes of Country Areas

ObjectID	FIPS_CNT	GMI_CNT	CNTRY_NAME	POP_CNTRY	CURR_TYPE	CURR_C	LANDLO	SQKM	SQMI	Shape
393218	BF	BHS	The Bahamas	272209	Dollar	BSD	N	12163.91	4696.49	Polygon
458752	CS	CRI	Costa Rica	3319438	Colon	CRC	N	51286.8	19801.83	Polygon
458753	PM	PAN	Panama	2562045	Balboa	PAB	N	74445.89	28743.56	Polygon
524288	BH	BLZ	Belize	207586	Dollar	BZD	N	22166.04	8558.31	Polygon
524289	CJ	CYM	Cayman Is.	31777	Dollar	KYD	N	209.25	80.79	Polygon
524290	CU	CUB	Cuba	11102280	Peso	CUP	N	109495.2	42276.1	Polygon
524291	ES	SLV	El Salvador	5752470	Colon	SVC	N	20646.47	7971.6	Polygon
524292	HO	HND	Honduras	5367067	Lempira	HNL	N	112618.31	43481.93	Polygon
524293	NU	NIC	Nicaragua	4275103	Cordoba Oro	NIO	N	128594.63	49650.38	Polygon
589824	AA	ABW	Aruba	67074	Euro	EUR	N	200.35	77.35	Polygon
589825	DR	DOM	Dominican Republic	7759957	Peso Oro	DOP	N	48516.99	18732.41	Polygon
589826	HA	HTI	Haiti	7044890	Gourde	HTG	N	27254.61	10523	Polygon
589827	JM	JAM	Jamaica	2407607	Dollar	JMD	N	11072.63	4275.14	Polygon
589828	NT	ANT	Netherlands Antilles	191572	Euro	EUR	N	791.72	305.68	Polygon
589829	TK	TCA	Turks & Caicos Is.	14512	US Dollar	USD	N	299.61	115.68	Polygon
655360	GY	GUY	Guyana	754931	Dollar	GYD	N	211507.8	81663.16	Polygon
655361	TD	TTO	Trinidad & Tobago	1292000	Dollar	TTD	N	5030.55	1942.29	Polygon
655362	VE	VEN	Venezuela	19857850	Bolivar	VEB	N	914737.19	353180.03	Polygon
720896	AC	ATG	Antigua & Barbuda	65212	EC Dollar	XCD	N	538.66	207.98	Polygon
720897	MH	MSR	Montserrat	12771	EC Dollar	XCD	N	112.95	43.61	Polygon
786432	AV	AIA	Anguilla	9208	EC Dollar	XCD	N	91.57	35.36	Polygon
786433	VI	VGB	British Virgin Is.	18194	US Dollar	USD	N	115.74	44.69	Polygon
786434	RQ	PRI	Puerto Rico	3647931	US Dollar	USD	N	9176.41	3543.01	Polygon
786435	SC	KNA	St. Kitts & Nevis	42908	EC Dollar	XCD	N	196.24	75.77	Polygon

Record: 0 Show: All Selected Records (0 out of 250 Selected.) Options

Tabular data associated with each feature

Not just pretty maps

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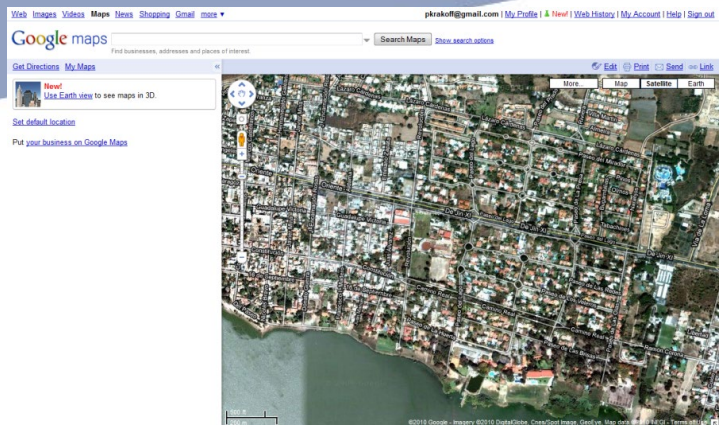
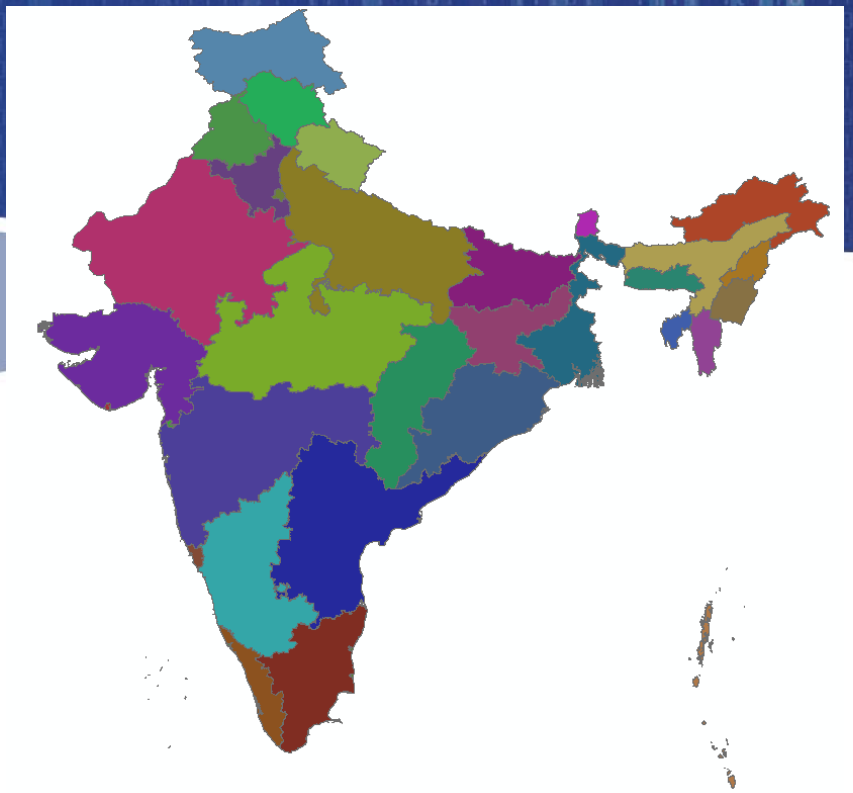
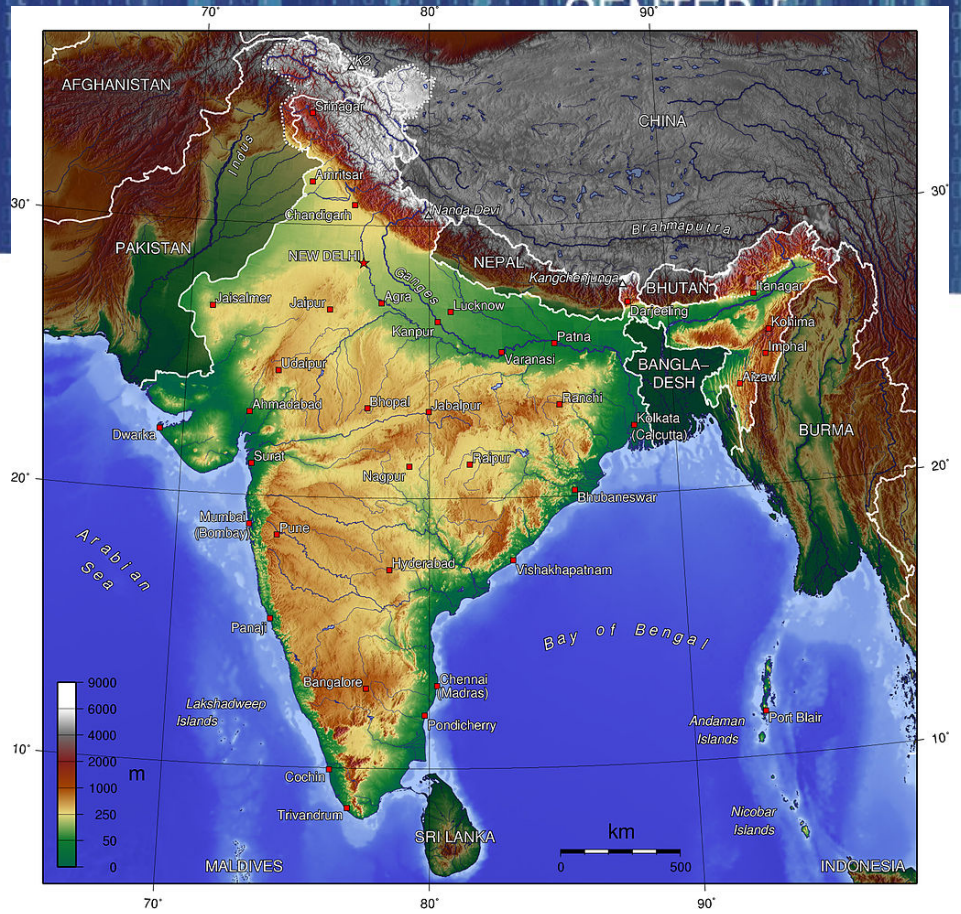


- Google Maps and similar software are a type of simple GIS
- Full GIS packages usually have additional editing and analytical tools





There is very little in the GIS toolkit that cannot be done by traditional means, but it might be computationally difficult or very time consuming

What can GIS be used for?

GIS adds "space" to research dimensions

- Geographical significance & patterning
  - Does location make any difference?
    - Real estate, new business locations
  - Are there any patterns?
    - Migration patterns? How did the disease spread?
- Geographical correlations and relationships
  - Are A and B in this location related?
    - Crime rate and average income
- Prediction and predictive modeling
  - How many people will be affected by something?
  - Where are we likely to find something?

Why is GIS important?

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Government

- 80% of **local government** activities estimated to be geographically based
  - plots, zoning, public works (streets, water supply, sewers), garbage collection, land ownership and valuation, public safety (fire and police)
  - natural resource management
  - highways and transportation

Businesses

- retail site selection & customer analysis
- logistics: vehicle tracking & routing
- natural resource exploration
- civil engineering and construction

Military and defense

- Battlefield management
- Satellite imagery interpretation

Research:

- Hard Sciences: Geography, geology, botany, epidemiology
- Social Sciences: Anthropology, sociology, economics, political science
- Humanities: History, criminology

Examples

Location

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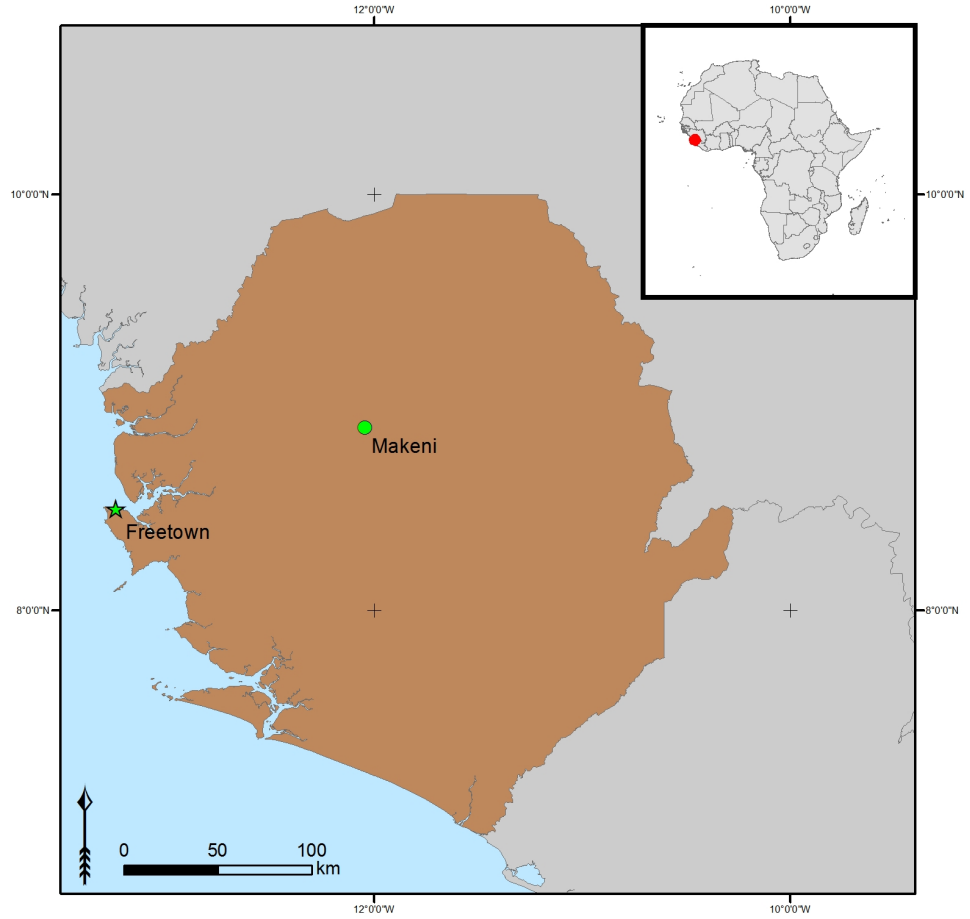

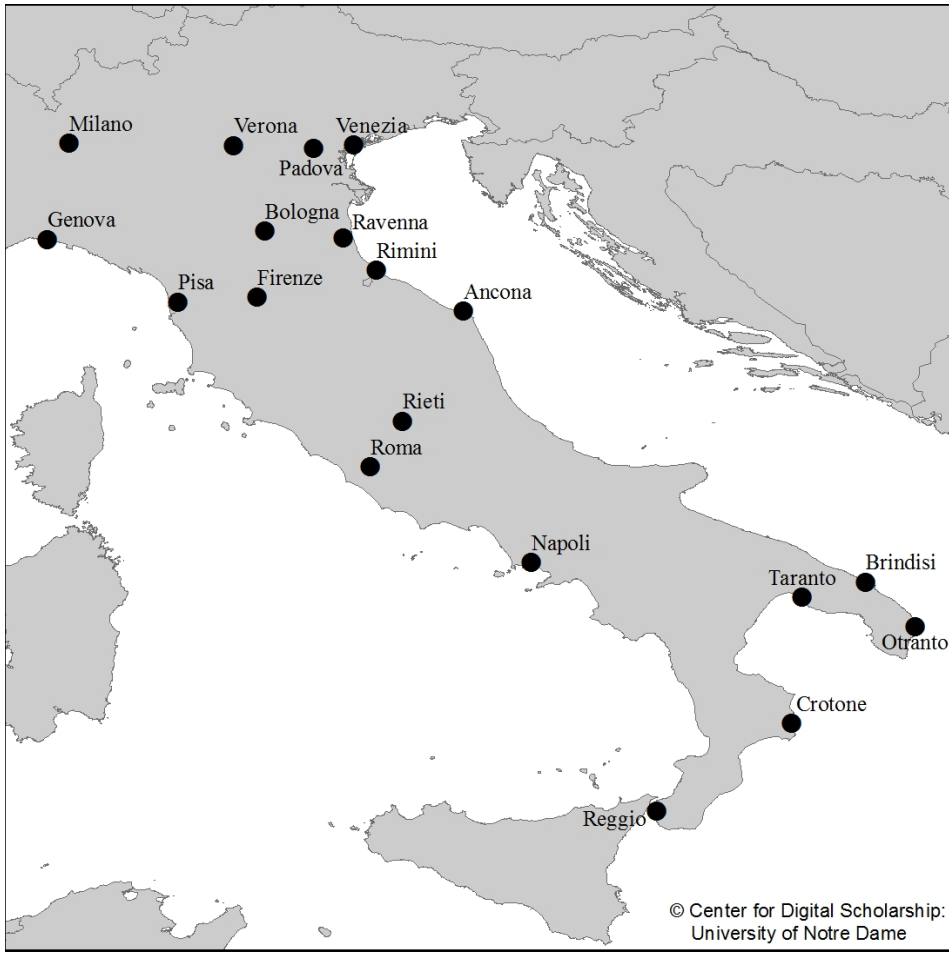

Illustration 3: La mappa dell'Italia di Petrarca, Epistola metrica, 2.11

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Classification

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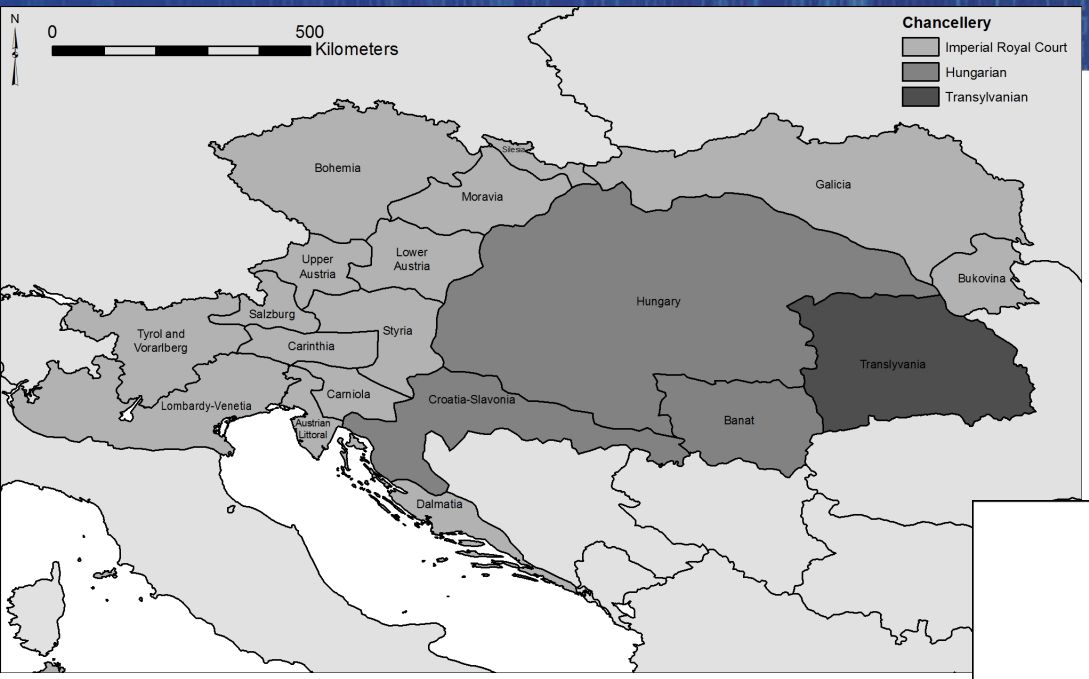

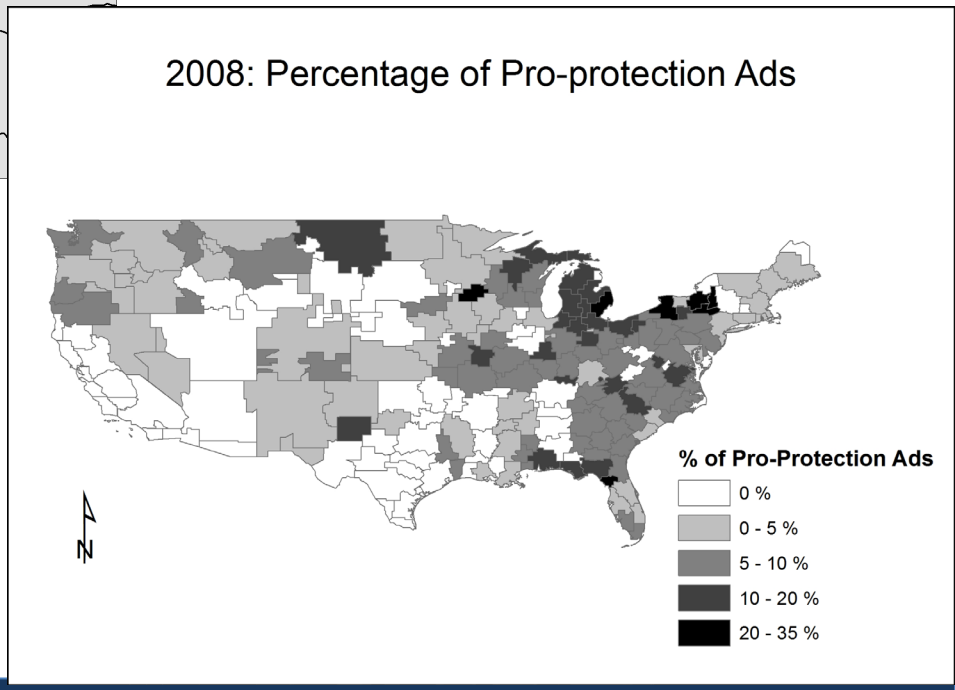

Values: Patterns

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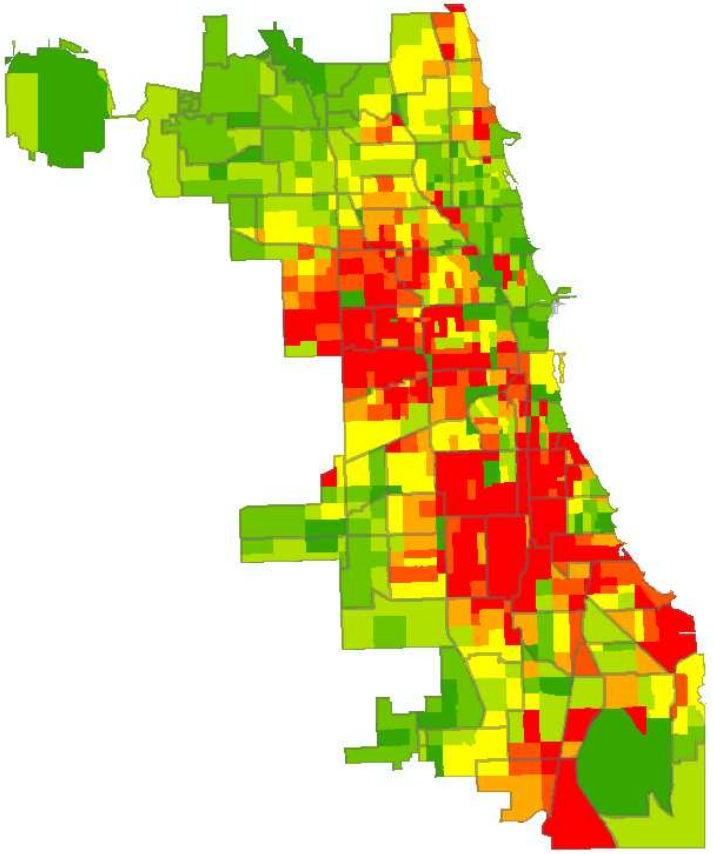
Socio-economic

2000 Census data
Unit – Census Tract
Over the community area boundaries

% families below poverty level



Values : Trends

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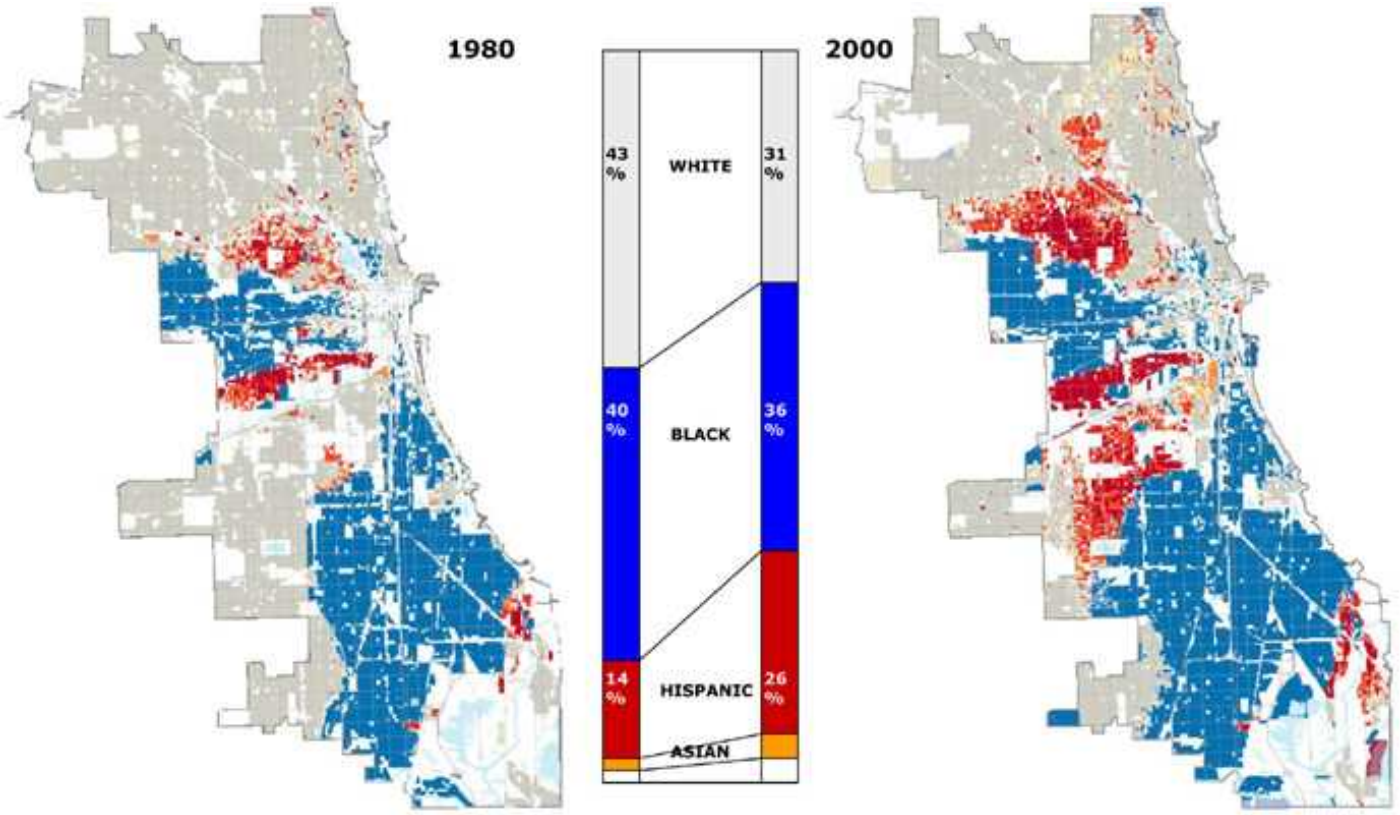
Trends

Changes over time using historical (time-series) data



Source: US Census 1980 & 2000, CensusWatch, CIESIN

Univ. of Illinois – Chicago, Documents & Maps, 2005

Values : Relationship

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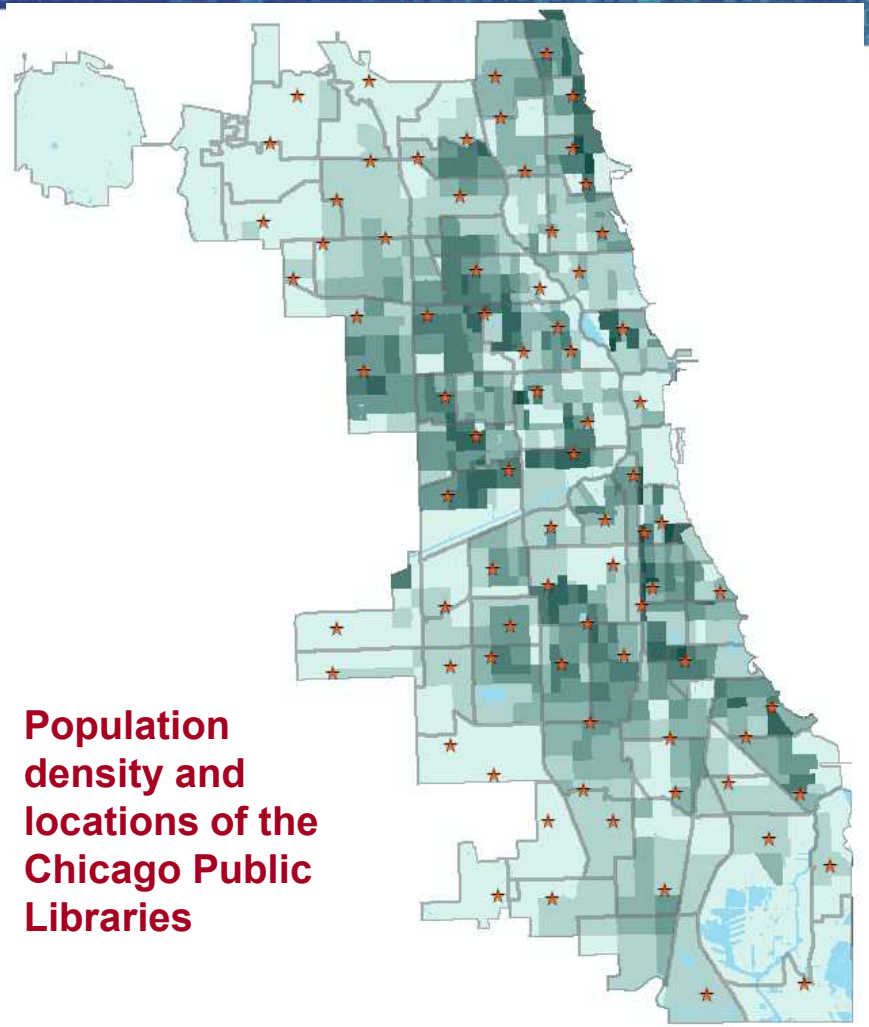
- Association
  - Demography and Libraries
  - Are there enough libraries to serve local residents?



Population density and locations of the Chicago Public Libraries

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Values : Associations

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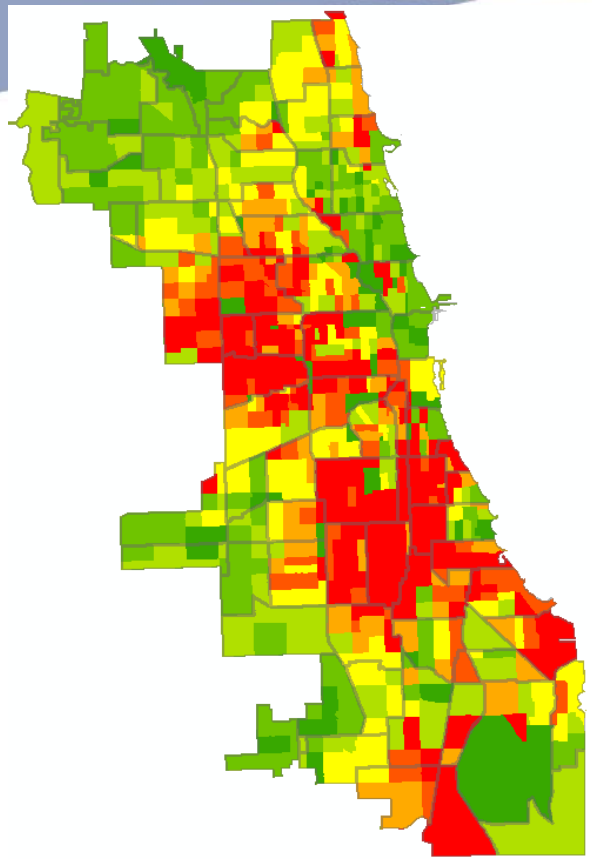
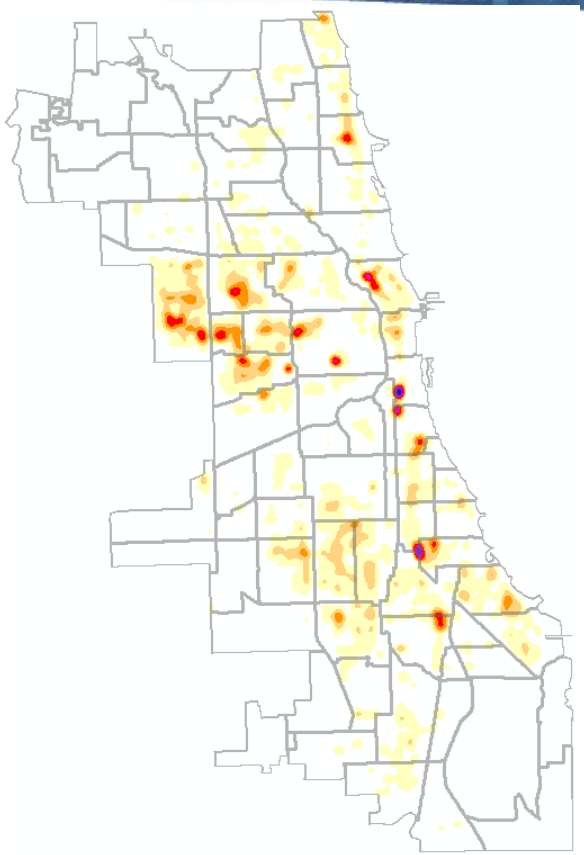


% families below poverty level



Crime hotspots

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GIS software and analytical tools

GIS Software

GRASS:
Open source GIS

Quantum GIS:
Open source GIS

ArcInfo GIS:
Proprietary, industry standard, GIS package

ArcGIS Online

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- Interface between desktop environment and online data
- Quick and easy ways of making web-based maps and data collection apps
  - http://arcg.is/2eXCr6g
  - http://arcg.is/2eyFx6w

ArcGIS Online

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- Create an account with ESRI
  - https://www.arcgis.com/home/signin.html
  - The free account should be sufficient
- Log in to ArcGIS Online and click the Map button at the top

Story Maps

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- Create the data you want to work with
  - Use Microsoft Excel, OpenOffice or Google Sheets
  - Create a record for each thing you want to show
  - Include some locational information
    - Address, city name or latitude / longitude coordinates
  - Save your file as a CSV (comma separated values)

- If you need coordinates for a few locations, just googling it is sufficient,
- If you need more, email me and I can do them

Story Maps

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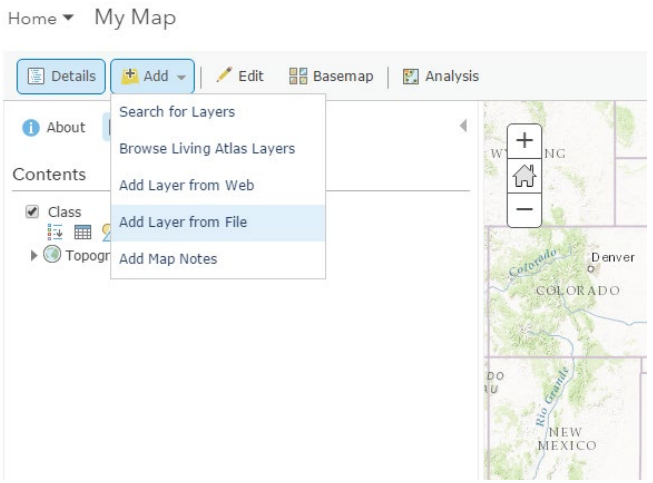
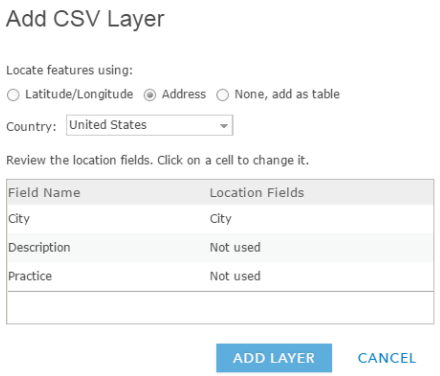
- Add your data to the map in ArcGIS Online
- Choose Add -> Add Layer from File
- If you have addresses, make sure the field names have been correctly mapped to the what part of the address they are





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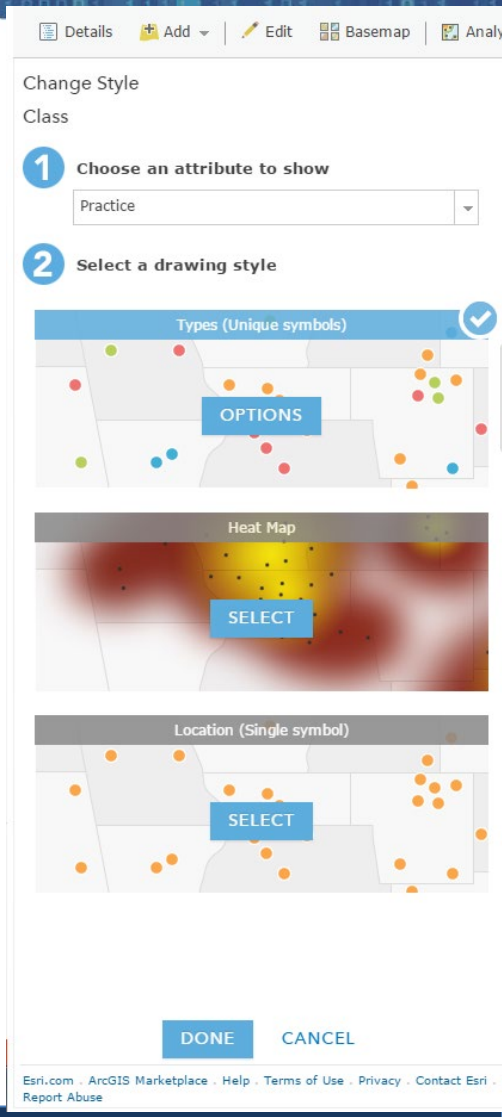
ArcGIS Online

CENTER for DIGITAL SCHOLARSHIP

- Choose how to display your information
  - **Types** will let you display different categories as different symbols
  - **Location** will display all of the points as the same symbol
- You can change the symbology later



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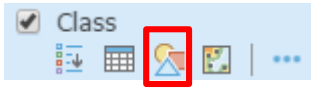
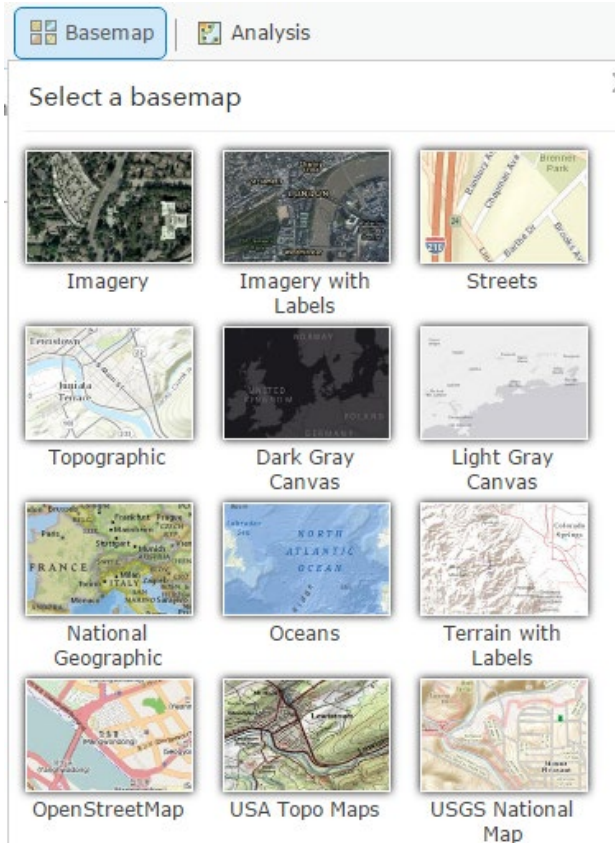
- You can change the background by clicking on the basemap button
- If you want to change the symbols, use the Change Style Button under the name of the layer

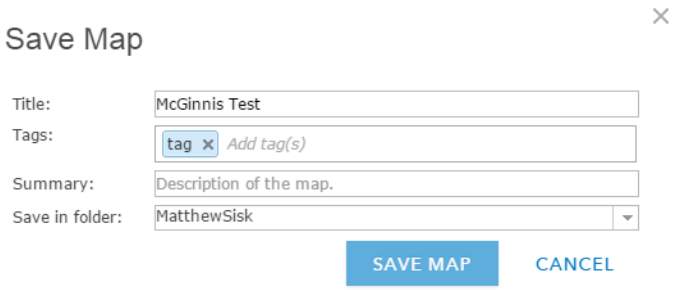




ArcGIS Online

CENTER for DIGITAL SCHOLARSHIP

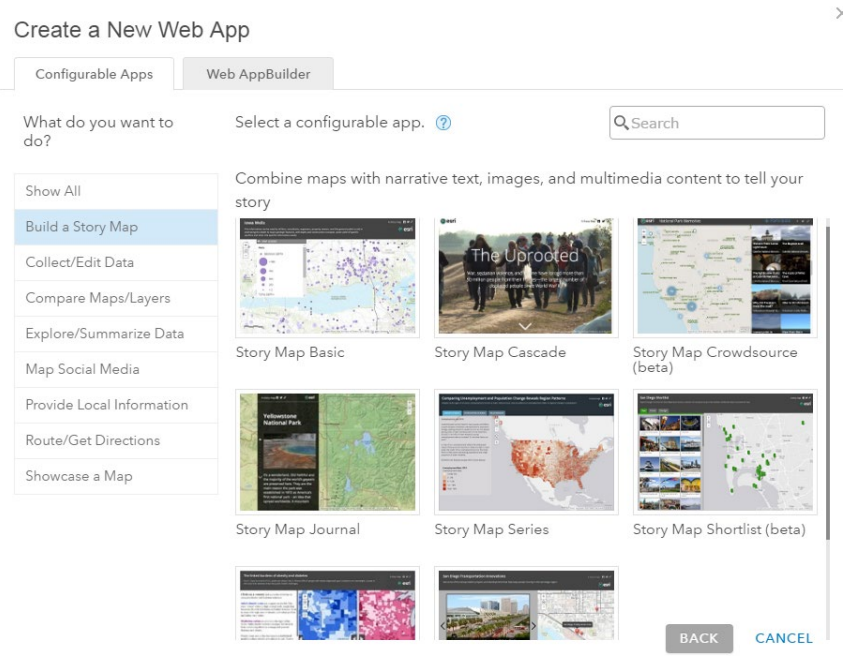
- Now, save the map using the save button
  - You will have to give it a name and a tag
- We now have the map to incorporate into our story



Story Maps

CENTER for DIGITAL SCHOLARSHIP

- Click the Share Button
  - Check Everyone (this shares your map with anyone who has the link)
  - Then click Create a Web App
  - Choose Build a Story Map
  - Choose a type to work with
    - Look at the gallery for some inspiration on which type might work best for you.



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Story Maps

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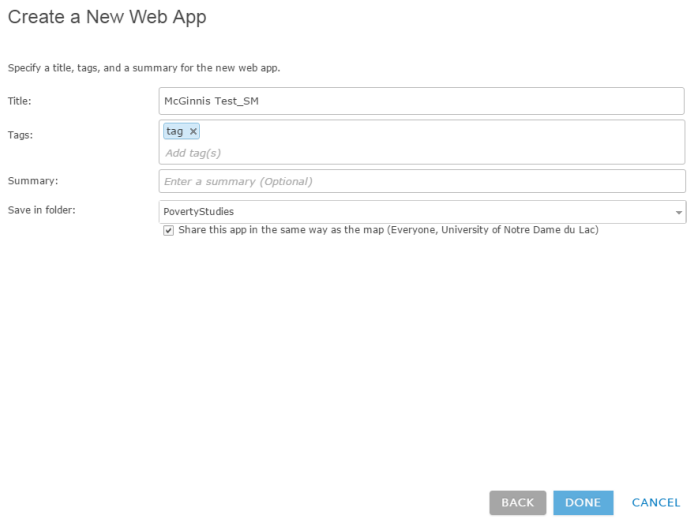
- Give it a new name and choose done
- This will bring you into the Story Map builder.



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Story Maps

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- http://uark.libguides.com/storymaps
- http://storymaps.arcgis.com/en/how-to/
- http://storymaps.arcgis.com/en/gallery/

GIS resources in the library

CENTER for DIGITAL SCHOLARSHIP

- Center for Digital Scholarship
  - Bank of 8 computers with extensive GIS software
    - ESRI ArcGIS
    - DIVA-GIS
    - GRASS
    - Quantum GIS
    - Google Earth Professional
  - 42” sheet-feed map scanner
  - 8 baseline GPS units and 2 high-end data collectors

GIS resources in the library

CENTER for DIGITAL SCHOLARSHIP

- Staff
  - **Matthew Sisk (CDS)**: General GIS questions, Data acquisition and management, Satellite imagery analysis
  - **Milan Budhathoki (CRC)**: Industry GIS, Vector analysis, GIS Analysis

GIS Classes

CENTER for DIGITAL SCHOLARSHIP

- **AL 33201 / 53201: Geographic Information Systems:**
  - 3 credit Introduction to GIS class

- **CSC 33300: Home and Dome**:
  - 1 credit Community Based Research Class focusing on mobile GIS data collection in the Near Northwest Neighborhood of South Bend

Online Modules

CENTER for DIGITAL SCHOLARSHIP

- Beta version of modular sections from credit bearing class
  - http://library.nd.edu/cds/workshops.shtml
  - https://edge.edx.org/courses/course-v1:NotreDame+GIS000+0000/about
- Currently ArcGIS only. qGIS coming next semester