

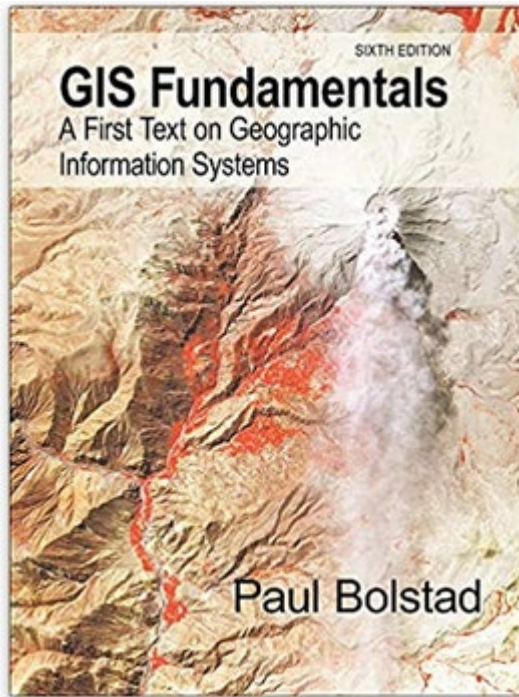
AGR 1540 – Introduction to
Geographic Information Systems
Lecture 1

Learning objectives:

- By the end of the lesson you will be able to:
 - Discuss historical aspects of geographic information systems (GIS)
 - Identify applications of GIS in real life work days
 - Explain components of GIS: Hardware, Software, etc.

Text and E Resources

- GIS Fundamentals – Bolstad

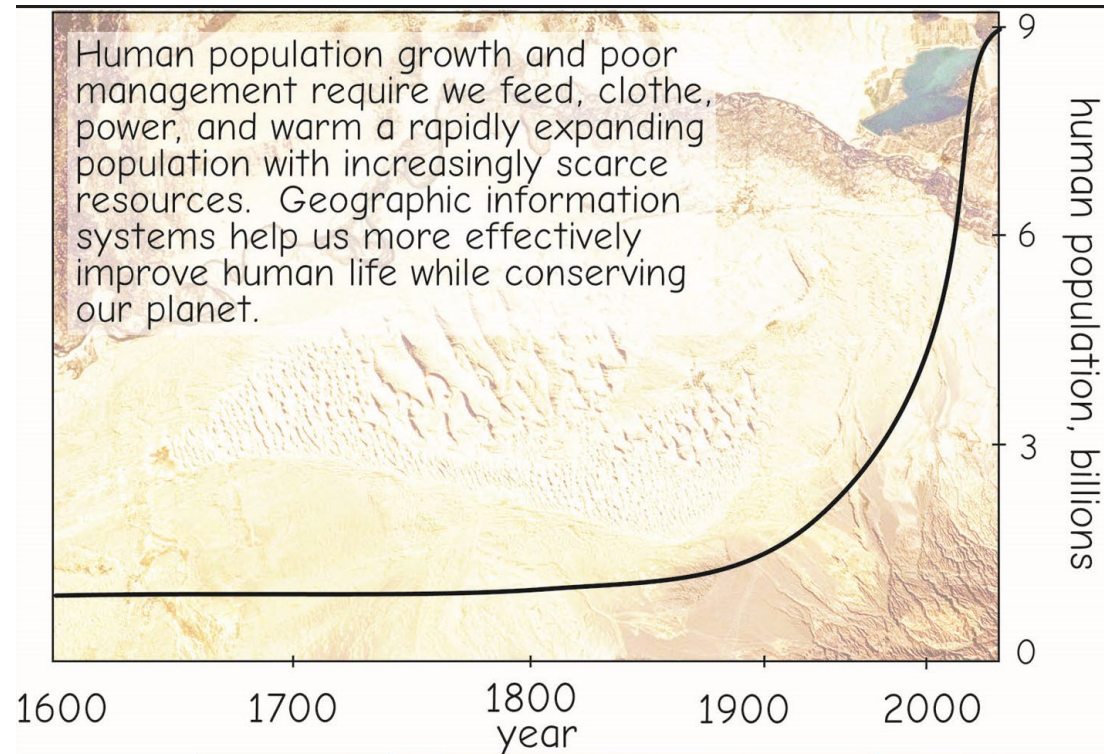


- <https://vector.geospatial.science/>

Search	Textbook	Troubleshoot	File Icons	Toolbars	ArcMap	Cartography	ArcCatalog	Windows Ops.
	TEXTBOOK Table of Contents Glossary Appendix A - Common File Types and Icons in ArcGIS							
	I: HISTORY AND SCOPE OF GIS 1.1: Introduction 1.2: What is GIS? 1.3: Why Do We Need A GIS? 1.4: Putting it all Together: An Example 1.5: Uses of GIS 1.6: History of GIS							
		II: NAVIGATING OUR WORLD 2.1: Introduction 2.2: Geodesy 2.3: Mathematically Measuring the Earth 2.4: Latitude and Longitude 2.5: Geodetic Datums 2.6: Geographic Coordinate Systems 2.7: Projection Methods 2.8: Projected Coordinate Systems 2.9: Just a Few Extras						
						III - SPATIAL DATA 3.1: Introduction 3.2: Vector Data 3.3: Raster Data 3.4: Discrete and Continuous Data 3.6: Introduction to Attribute Tables 3.5: Data Tables		
								IV - DATA ORGANIZATION AND MEET YOUR GIS 4.1: Introduction 4.2: Data Models 4.3: Meet ArcCatalog 4.3B: Meet ArcCatalog Video 4.4: Meet ArcMap 4.4-B: Meet ArcMap Video Tour 4.5: What Are Relational Databases 4.6: ArcGIS File Naming Rules 4.7: The ArcGIS Help Menu
	V: ATTRIBUTE TABLES AND EXTERNAL DATA 5.1: Introduction 5.2: Overview 5.3: Attribute Tables - Intro to the Menus and Buttons 5.4: Selecting Data in ArcMap 5.5: Using Selected Data 5.7: Select by Attribute Part Two 5.6: Select by Attribute Part One							
		VI: DIGITIZING, CREATING, AND EDITING DATA 6.1: Introduction 6.2: Scanning and Digitizing Data 6.3: Other Sources of Primary Data 6.4: Editing Existing Data						
						VII: GEOPROCESSING TOOLS 7.1: Introduction		
								VIII: DATA QUALITY 8.1: Introduction

Geographic Information Systems GIS

- Have greatly evolved in the last 50 years
 - Computer and satellite evolution have aided GIS
- Position and signal
 - Noise, distortion
- With increased population, rapidly generating positional information, systems need to manage data



GIS History Cholera

- 1854 Cholera Soho district of London
- Plumbing was poor and people used public water pumps
- Dr. John Snow mapped cases and identified a public pump associate with high [cases]
- Pump location (spatial) and number of cases (non-spatial data)



<https://www.wired.com/2009/09/0908london-cholera-pump/>

GIS History

- 1855-59 British ordinance survey
 - Glass slides of map layers
- 1943-47 Programmable computers: Vacuum tube
 - Computational statistical analysis
- 1955 Transistor – smaller, faster, more reliable than vacuum tube
 - Better analysis and paper printing of maps
- 1959 Harvard Lab for Computer Graphics and Spatial Analysis
 - Urban planning, GIS etc.
- 1959 Waldo Tobler – Map in Map out
 - Early data capture and manipulation
- 1963-95 Canada Geographic Information System – guide and understand rural resources

GIS History

- 1969 Ian McHarg thin paper layers with polygons to lessen impact of design on land
- 1969 ESRI Environmental Systems Research Institute founded
- 1972 Landsat Launched
- 1982 ESRI ARC/INFO, ArcView, ArcGIS released
- 1990 US Census Bureau release Topologically Integrated Geographic Encoding and Referencing (TIGER) database
- 1996 Mapquest goes online
- 2000 Selective Availability ends
 - Intentional degradation of public GPS signals implemented for national security reasons

Major Goal of the Course

- Apply GIS as part of a model to solve a multi-layered problem or question
- Align your signal (data) with a geospatial point on the earth and understand the relationship of the response, treatment, environment etc.

<https://www.real-statistics.com/design-of-experiments/completely-randomized-design/randomized-complete-block-design/>

- Randomized Complete Block Design

Farm 1	Farm 2	Farm 3	Farm 4
A	C	B	C
C	B	A	A
B	A	C	B

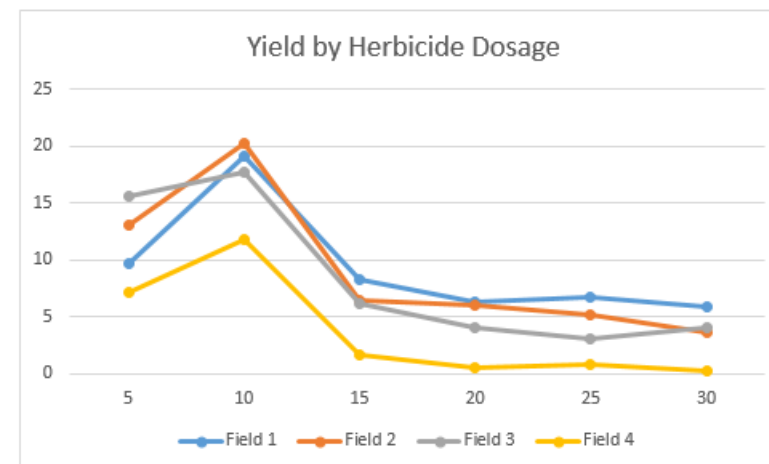
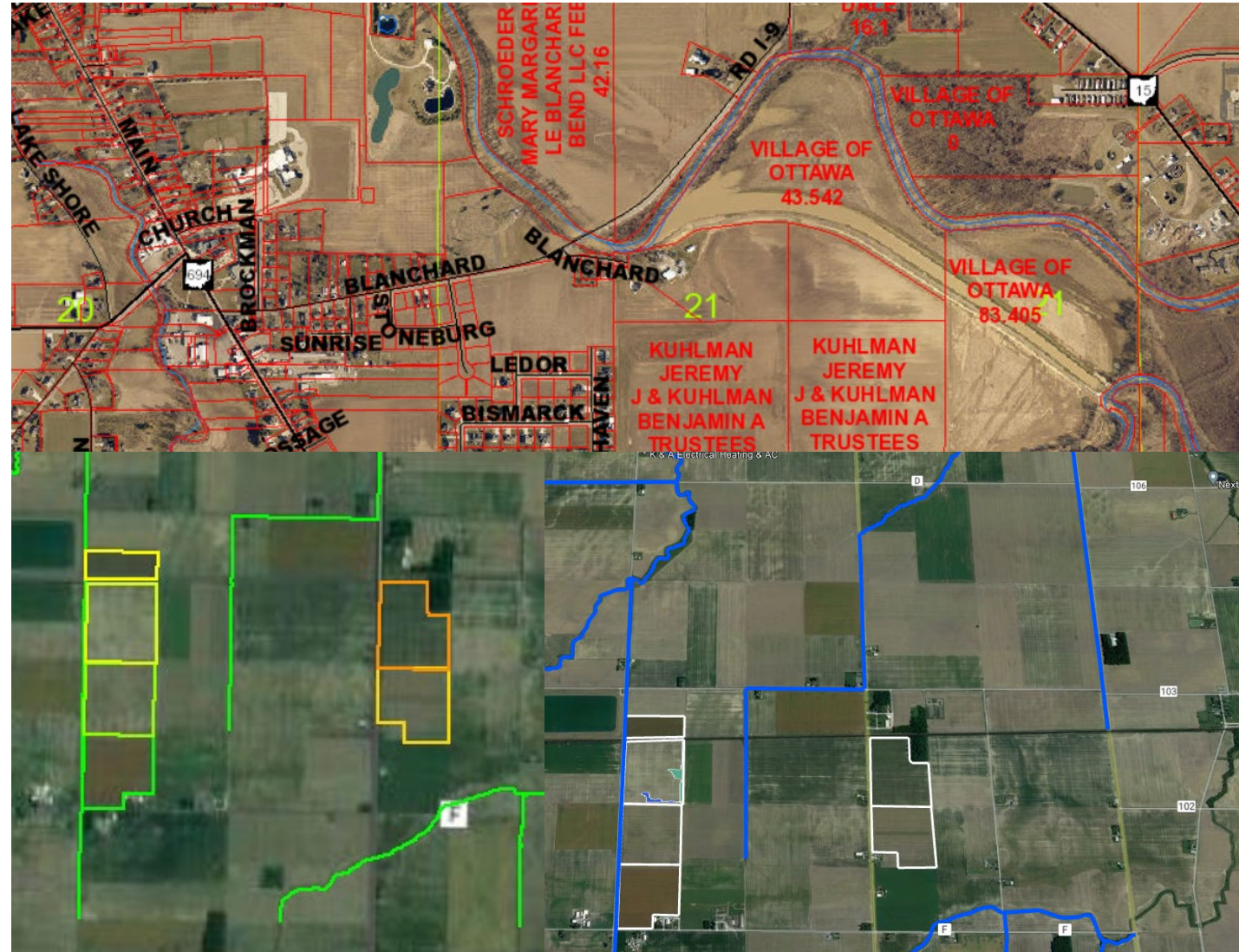


Figure 2 – Chart of the yield

GIS Data and Daily Applications

- Voter information and districts
- Mapping health emergencies
- Mapping natural disasters
- Insurance reporting
- Property and tax records
- Water ways and drainage patterns

<http://www.putnamcountygis.com/>



GIS – Where our Signal Occurs

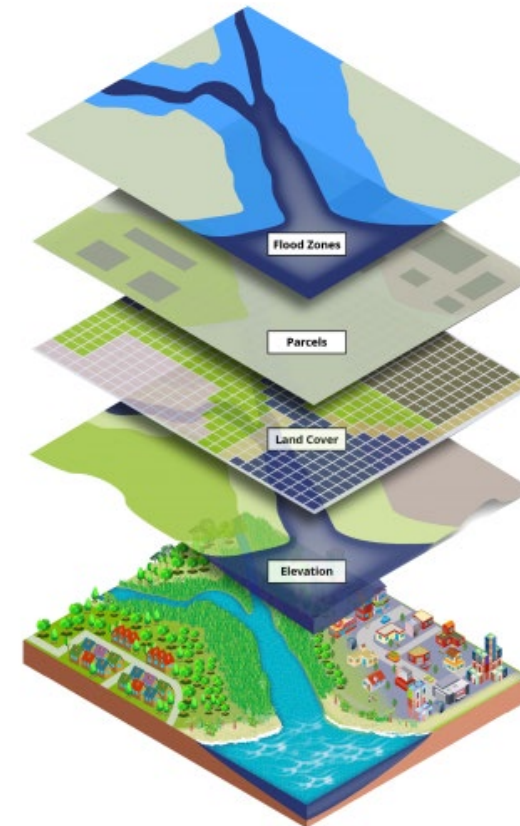
- Cartography – Map making
- Remote Sensing – data collection while not in the landscape
- GPS – Satellite based detection and positioning
- Web map applications – real time information
- Database design and management



<https://gisgeography.com/what-gis-geographic-information-systems/>

Components of a GIS System

- 1. Data – Stored in layers
- 2. Hardware – Field data collection devices
- 3. Software – storage and computation – rapid and repeatable



<https://gisgeography.com/what-gis-geographic-information-systems/>

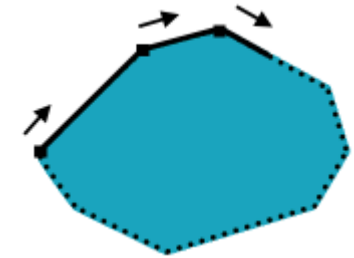
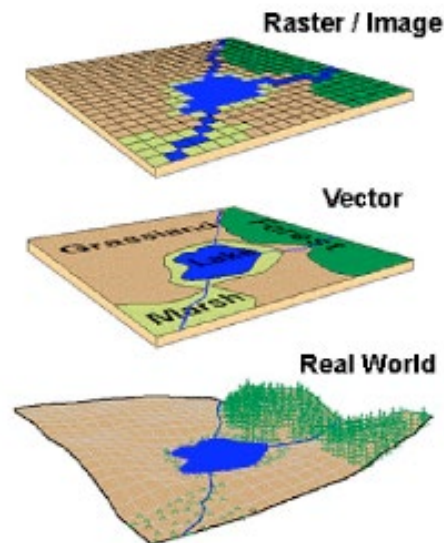
Data – Two Main Types

- Raster – grid appearance
- Stored in rows and columns
- Discrete or continuous
- Ex. - Land cover, temperature, imagery



<https://gisgeography.com/what-gis-geographic-information-systems/>

- Vector – points, lines, polygons with vertices
- Ex. – fire hydrants, contours, boundaries



TY - THES

AU - Saab, David

PY - 2003/05/01

SP -

T1 - Conceptualizing Space: Mapping Schemas as Meaningful Representations

DO - 10.13140/2.1.3030.1767

ER -

Spatial and Non-Spatial Data

- Spatial Data – information relative to the location
 - Addresses, road intersections, building locations, location in a field of variation
- Non-spatial data – information attributed to the location
 - Income at an address, number of accidents at an intersection, yield difference in a location of variation in a field, elevation

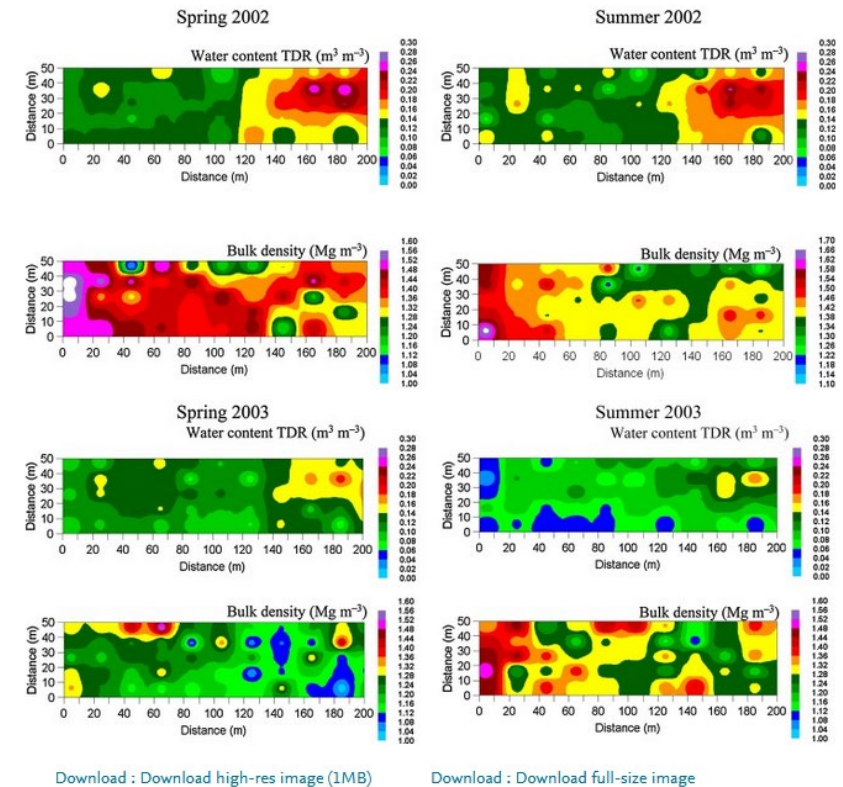
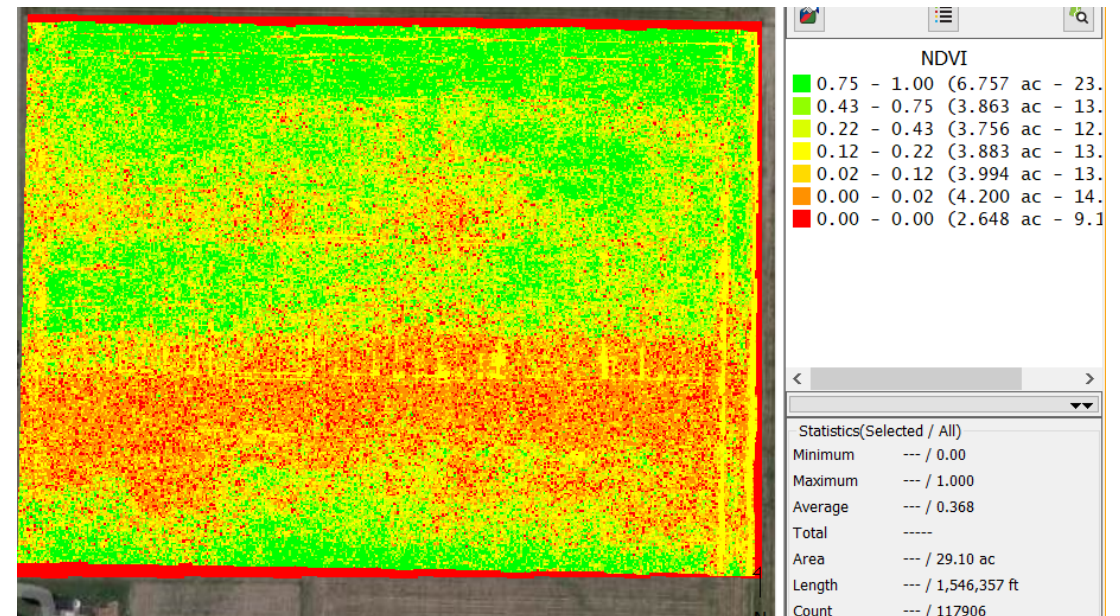
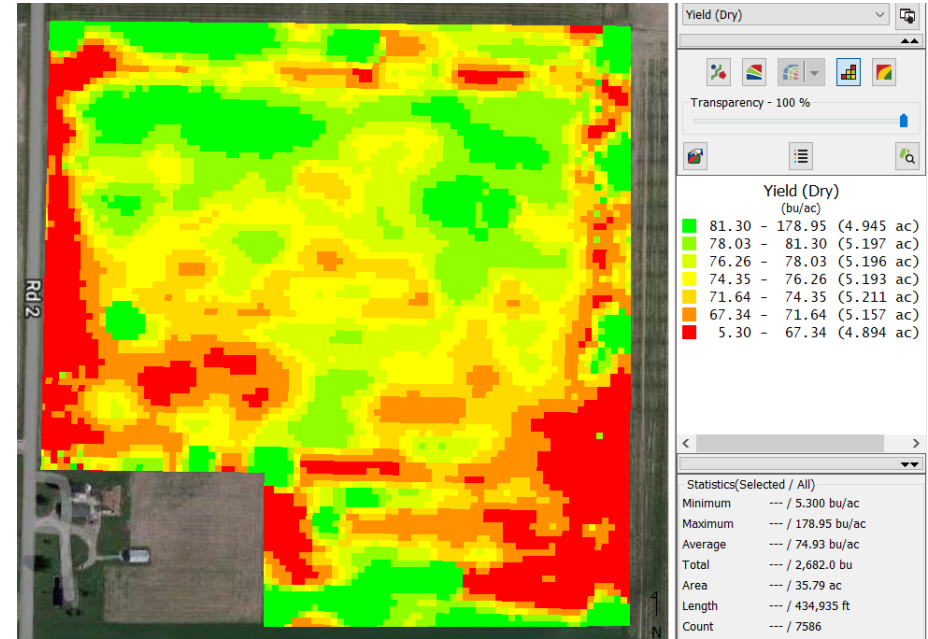


Fig. 4. Spatial distribution of the water content (TDR) and bulk density in the cultivated field for spring and summer measurements.

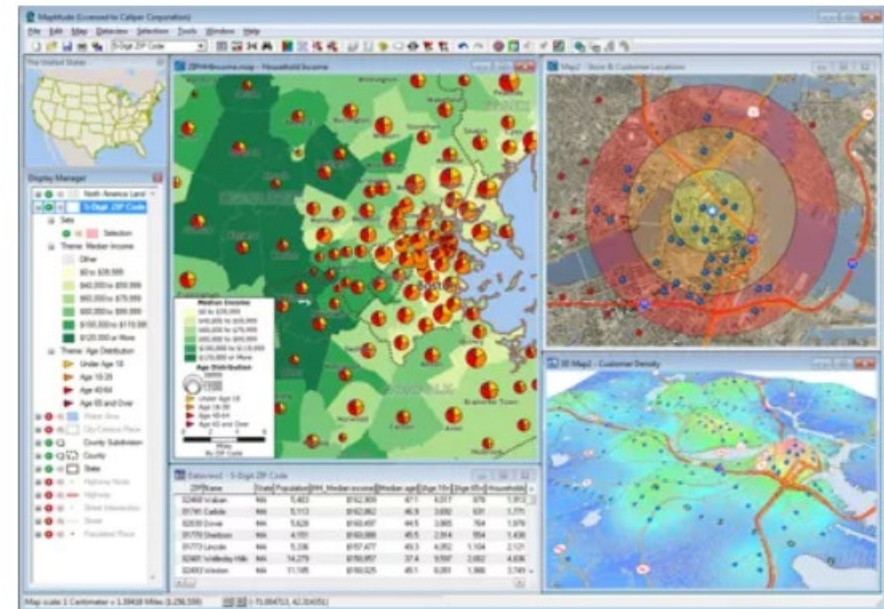
GIS - Hardware

- Computer workstations
- Smart phone
- Satellite
- UAV – NDVI image of 29 acre = 117,906 data lines x 5 measures = 589,530 data points
- Corn planter, combine – 7,586 data lines x 7 measures = 53,102 data points



Software and Analytics

- ArcGIS
- QGIS
- SMS
- Global mapper
- Google Earth
- Open Source – R, Python
- Alphabet soup of software



Mapitude

Lesson Summary

- Spatial and non-spatial data are important aspects of GIS
- Correlation of non-spatial and spatial data can help solve problems
- Intensive computer horsepower is needed for complex computing problems of today.
- It is easier to collect than it is to analyze GIS data

- Discussion: What problems are we trying to solve in Agriculture with a GIS?
- Assignment: list 3 examples of GIS use in Agriculture and 2 uses that are coming in the near future. Answer Exercises 1.1, 1.5, and 1.6 in chapter 1 Bolstad text