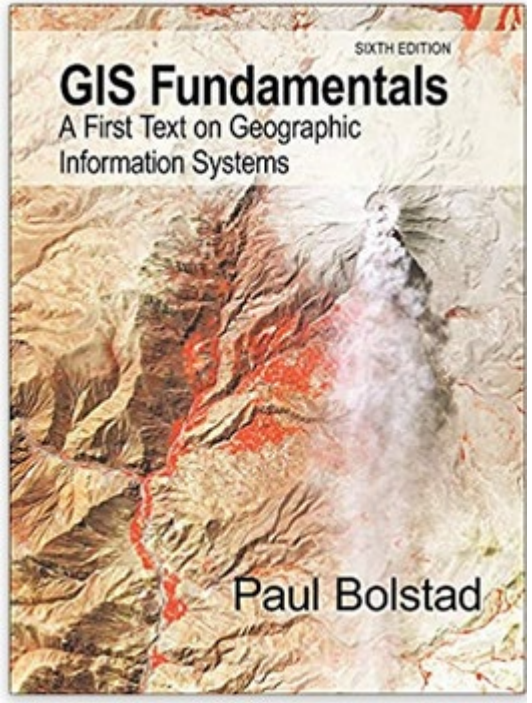
AGR 1540 – Introduction to Geographic Information Systems Lecture 1

Learning objectives:

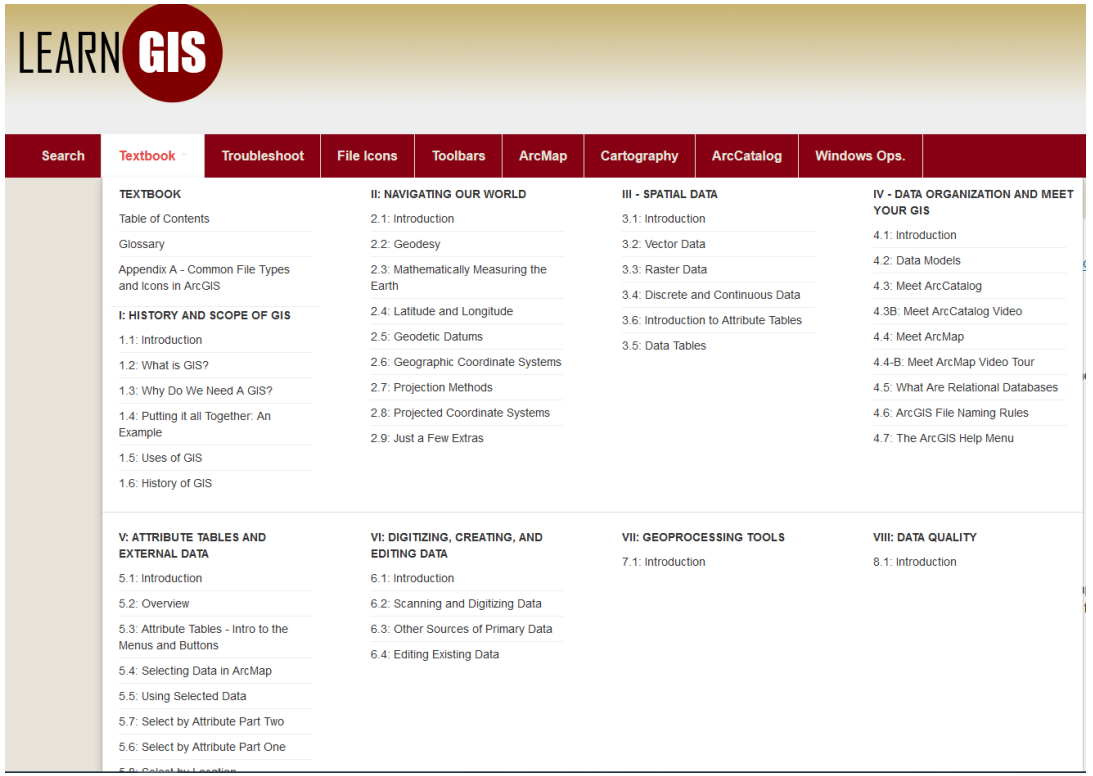
- By the end of the lesson you will be able to:
  - Discuss historical aspects of geographic information systems (GIS)
  - Identify applications of GIS in real life work days
  - Explain components of GIS: Hardware, Software, etc.

Text and E Resources

- GIS Fundamentals – Bolstad

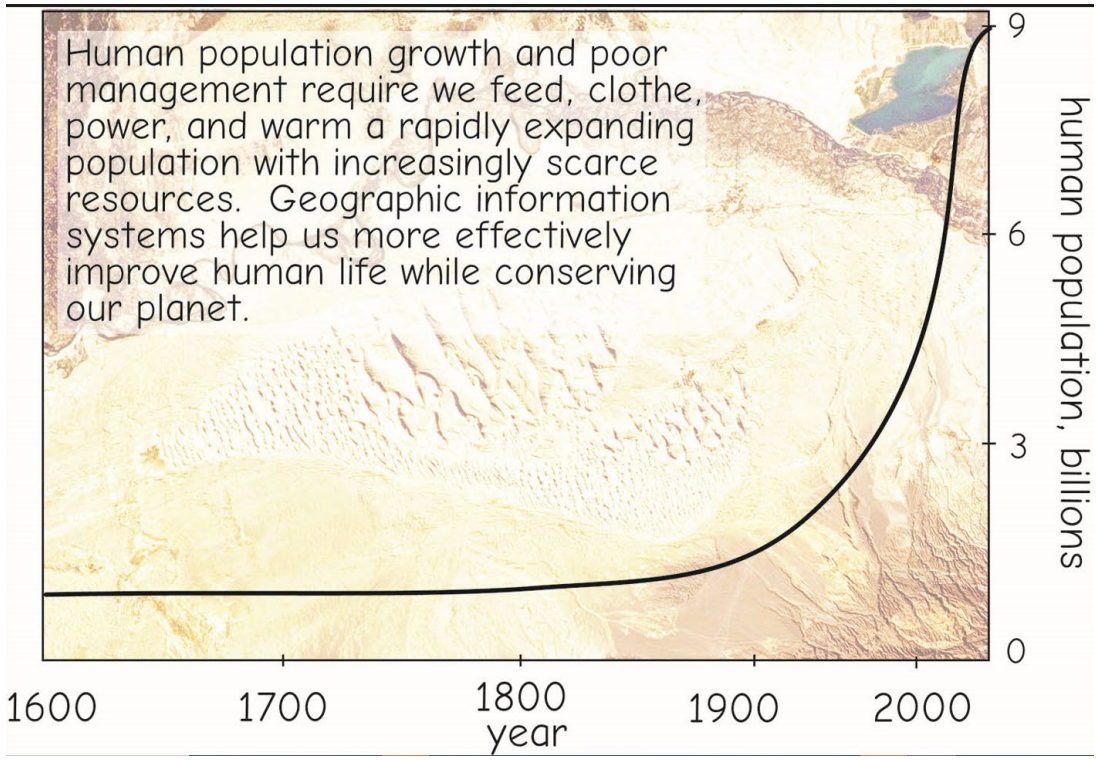


- https://vector.geospatial.science/



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

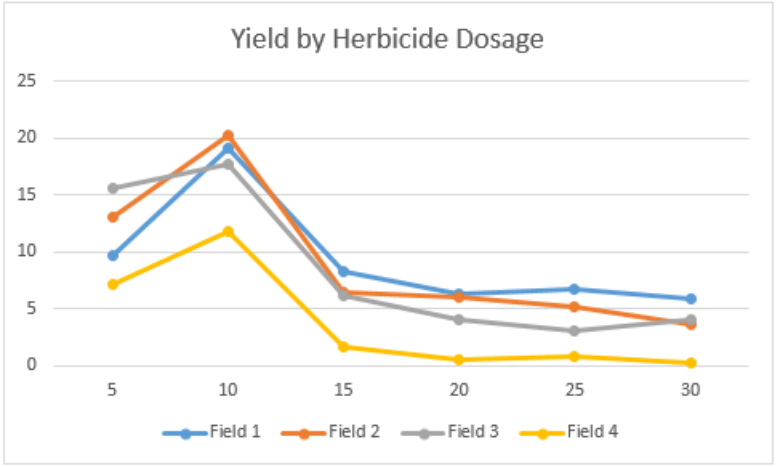
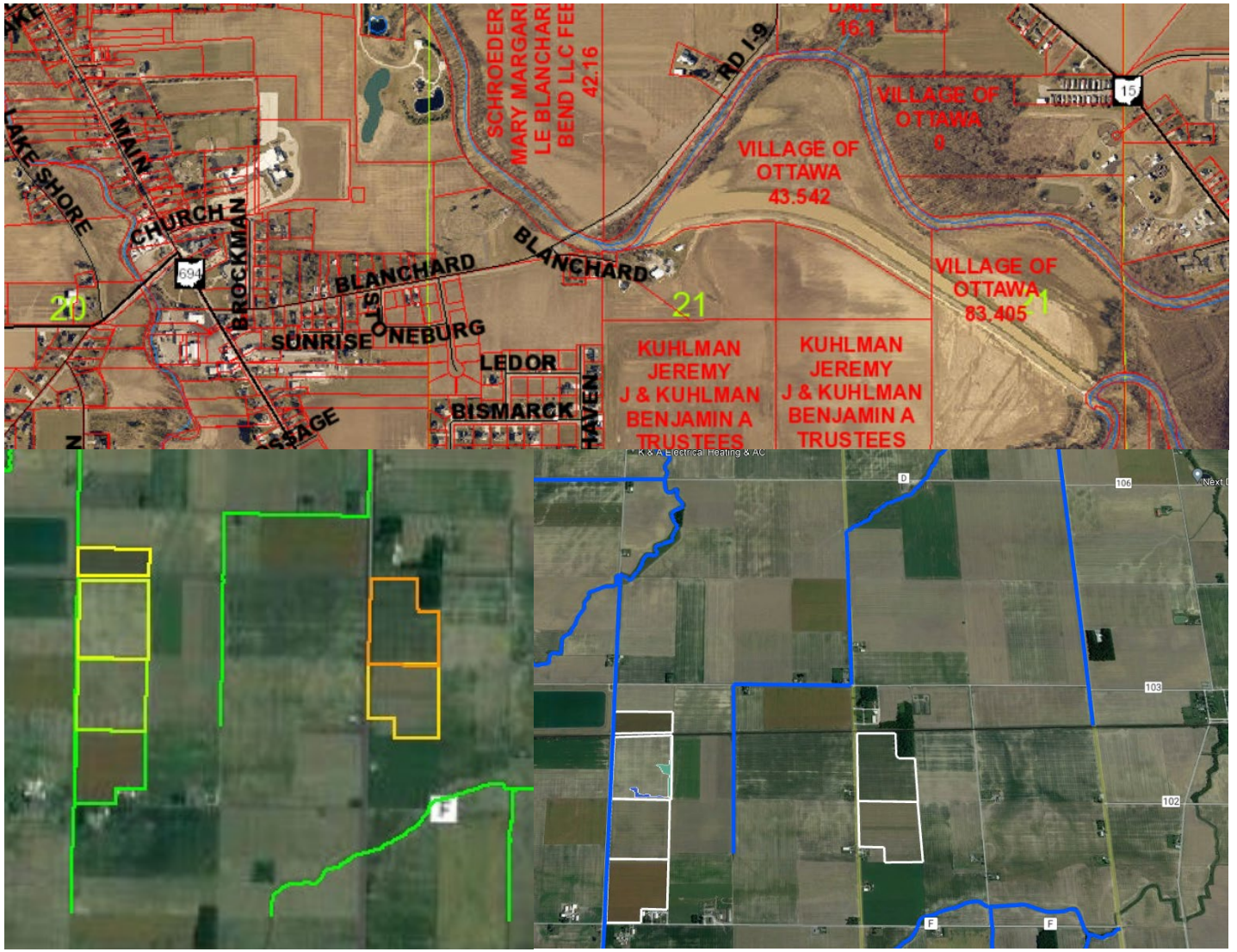


Figure 2 – Chart of the yield

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/

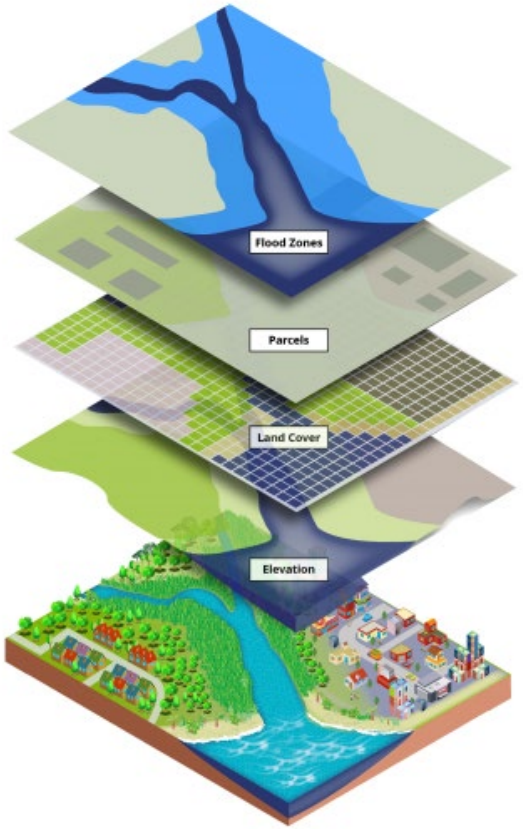
GIS – Where our Signal Occurs

- 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

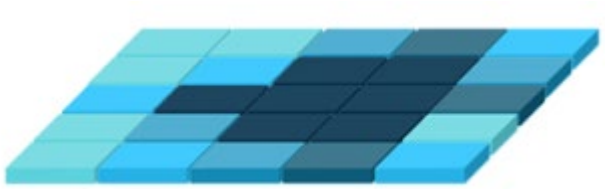
- 1. Data – Stored in layers
- 2. Hardware – Field data collection devices
- 3. Software – storage and computation – rapid and repeatable



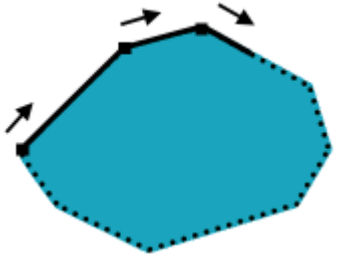
https://gisgeography.com/what-gis-geographic-information-systems/

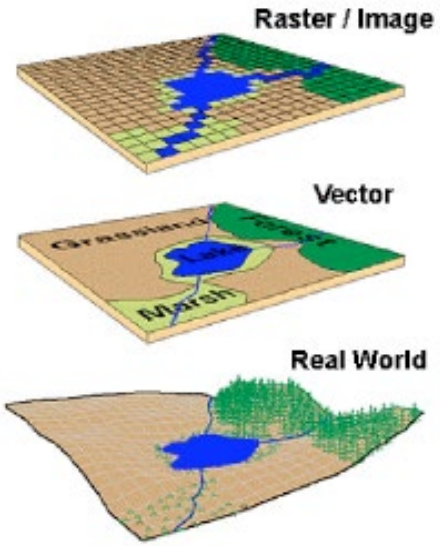
Data – Two Main Types

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



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





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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

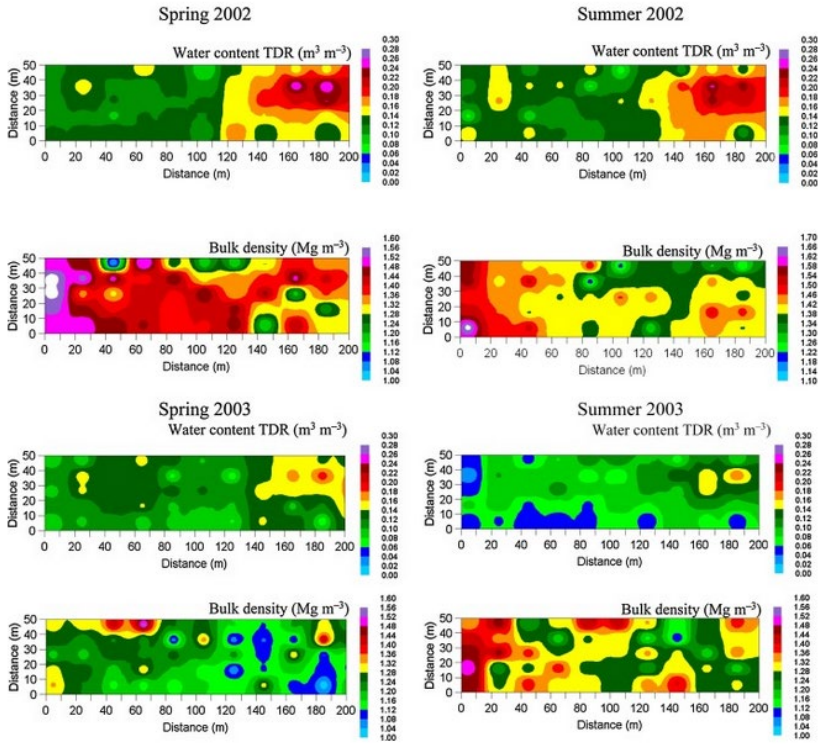
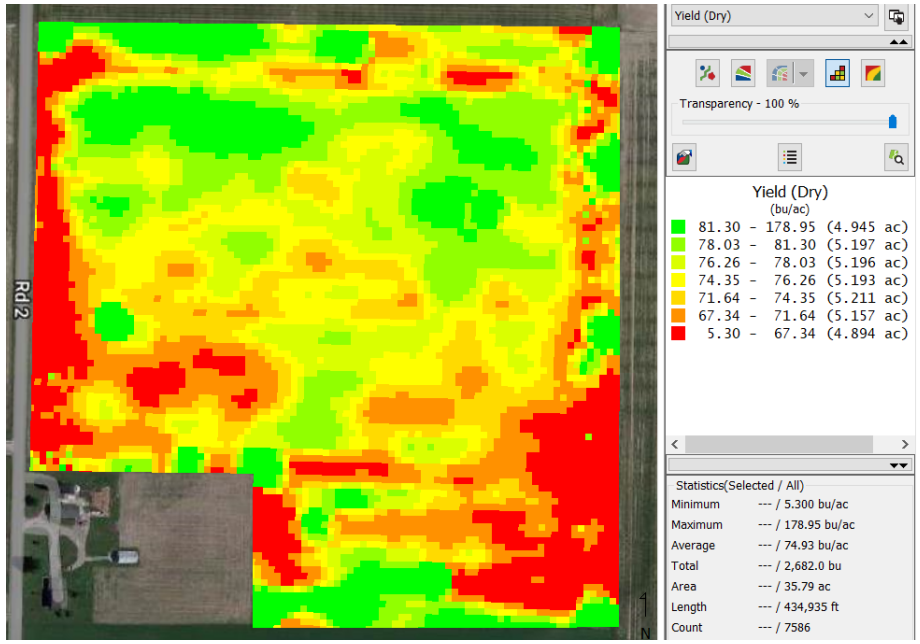


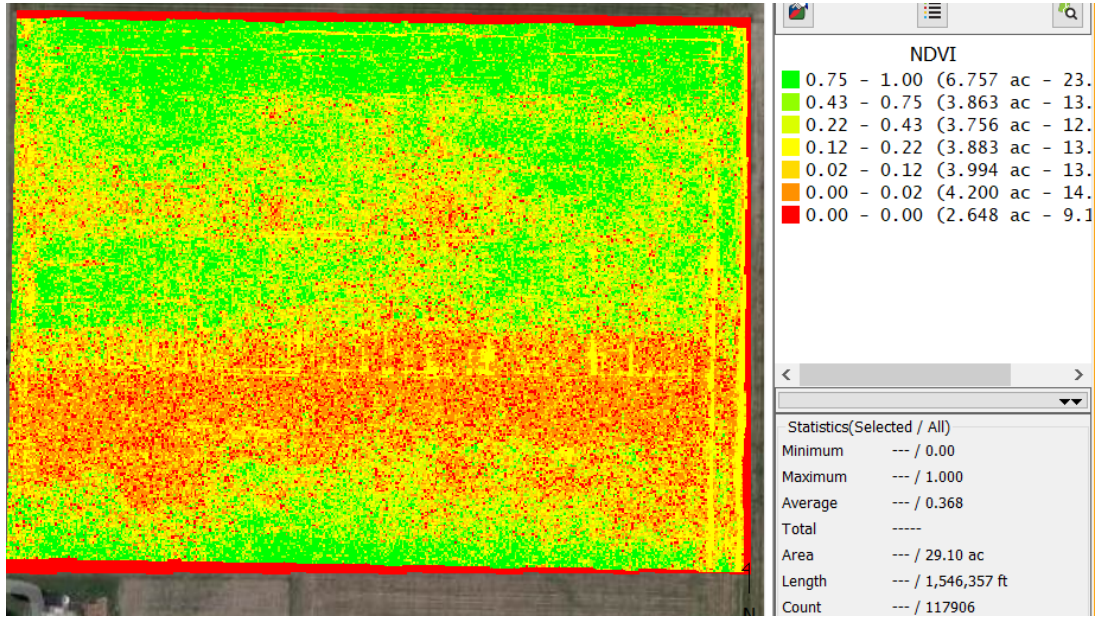
Fig. 4. Spatial distribution of the water content (TDR) and bulk density in the cultivated field for spring and summer measurements.

https://www.sciencedirect.com/science/article/pii/S0167198717301423

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

Maptitude

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