
Sprayer calibration and chemical application
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www.ento.vt.edu/ Fruitfiles/calib.html

Before You Spray

- Know your target
- Know your equipment
- Do the math

Know Your Target

- Pest
  - Tobacco hornworm
  - Heavy infestation
- Crop
  - Tomato
- Pesticide
  - SpinTor®
    - Label rate: 6 fl oz / acre
- Area
  - 10 rows
    - 50 ft long
    - 2 ft wide
  - 100 ft^2 per row
  - 1000 ft^2
  - 0.023 acres

Know Your Equipment

- Sprayer output
  - 150 mL in 15 sec = 10 mL / sec
- Spray tank capacity
  - 4 L
- Velocity
  - 60 ft in 30 sec = 2 ft / sec
- Spray width
  - 1 ft
- Check your equipment before every application

specialtyhe.net/car_18818.htm

www.northerntool.com/webapp/wcs/stores/servlet/product_6970_200312599_200312599

www.pestcontrolsupplies.com/ Tempo.htm

Do the Math

- How much pesticide
  - Area = 0.023 acres
  - Label rate of SpinTor® for heavy infestation of Tobacco Hornworm = 6 fl oz / acre
  - SpinTor® needed = (0.023 acres)(6 fl oz / 1 acre) = 0.138 fl oz = 4.085 mL

Do the Math

- How much carrier (usually water)
  - Area = 1000 ft^2
  - Velocity = (2 ft / sec)(1 ft spray width) = 2 ft^2 / sec
  - Sprayer output = 10 mL / sec
  - Water needed = (1000 ft^2)(1 sec / 2 ft^2)(10 mL / 1 sec) = 5000 mL = 5 L

Do the Math

- 4.085 mL SpinTor® in 5 L water
- Our sprayer holds 4 L of water at a time
- Must apply 3.268 mL SpinTor® in 4 L of water, note where you stop, then apply the remaining 0.817 mL SpinTor® in 1 L of water
- Or…
  - Adjust velocity (increase to 2.5 ft / sec)
  - Adjust sprayer output (decrease to 8 mL / sec)
  - Adjust sprayer capacity (CO_2 sprayers)

Why is this important?

- Improper application can lead to…
  - Inadequate control of the pest
  - Environmental contamination
  - Negative impacts on humans
  - Negative impacts on non-target organisms
  - **Increased cost!**

and

Its illegal!

"It is a violation of Federal Law to use this product in a manner inconsistent with its labeling"

Precision Agriculture Technologies

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Definition

- Precision agriculture is
  - Managing each crop production input on a site-specific basis to reduce waste, increase profit, and maintain the quality of the environment
  - Carefully tailoring soil and crop management to fit the different conditions found in each field

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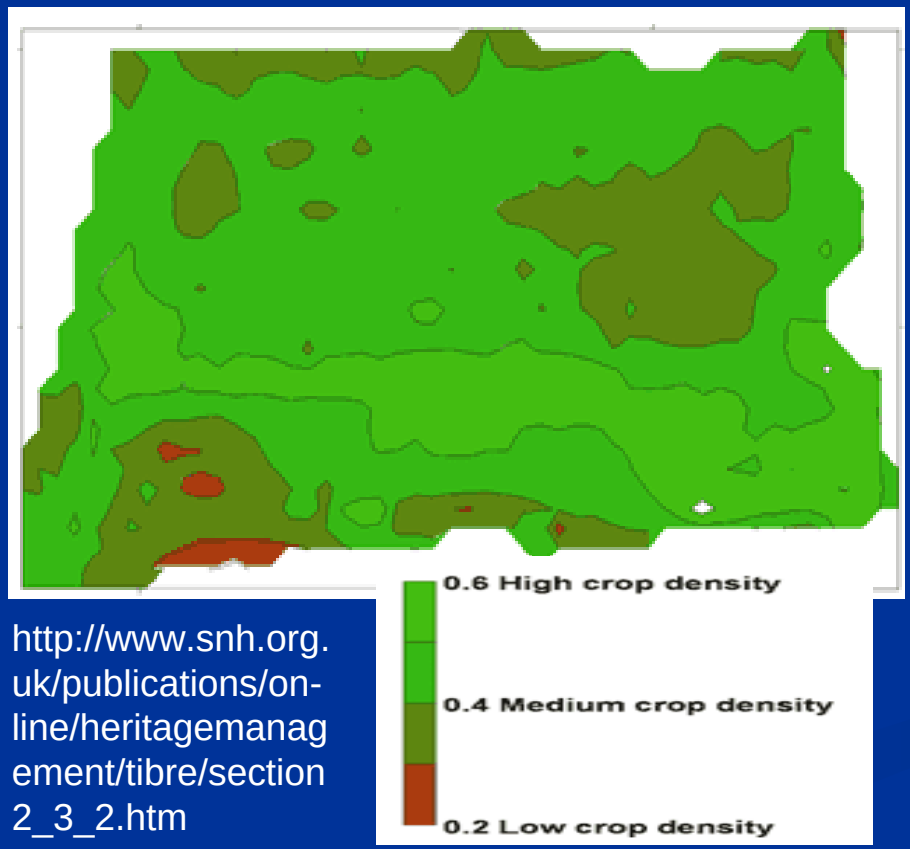
Variability

- Temporal (in time)
- Spatial (in space)



http://www.snh.org.uk/publications/on-line/heritagemanagement/tibre/section2_3_2.htm

- Soil type
- Soil texture
- Soil moisture content
- Soil fertility
- Topography
- Diseases
- Insect and mite pests
- Weeds

Precision Agriculture Technologies

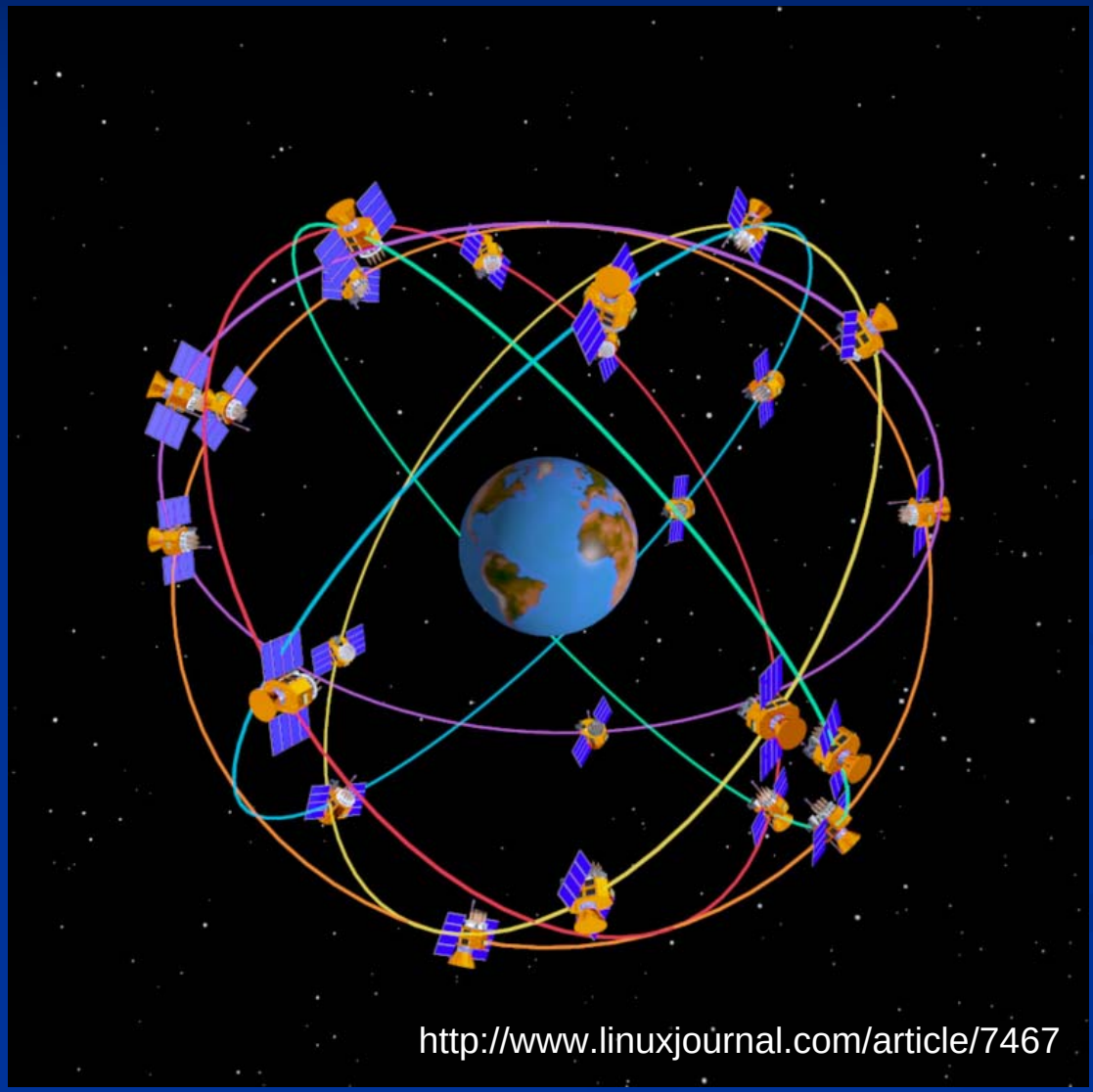
- Positioning systems (GPS)
- Yield mapping
  - Soil sampling
- Remote sensing
- Geographic Information System (GIS)

Global Positioning System (GPS)

- Satellite-based navigation and radio-positioning system
  - Space segment
  - Control segment
  - User segment

http://audioconexus.wordpress.com/2008/06/11/gps-pois/

Space Segment



- 24 satellites in 6 orbital planes
- At least 4 can be seen at any time at any place on the earth

Control Segment

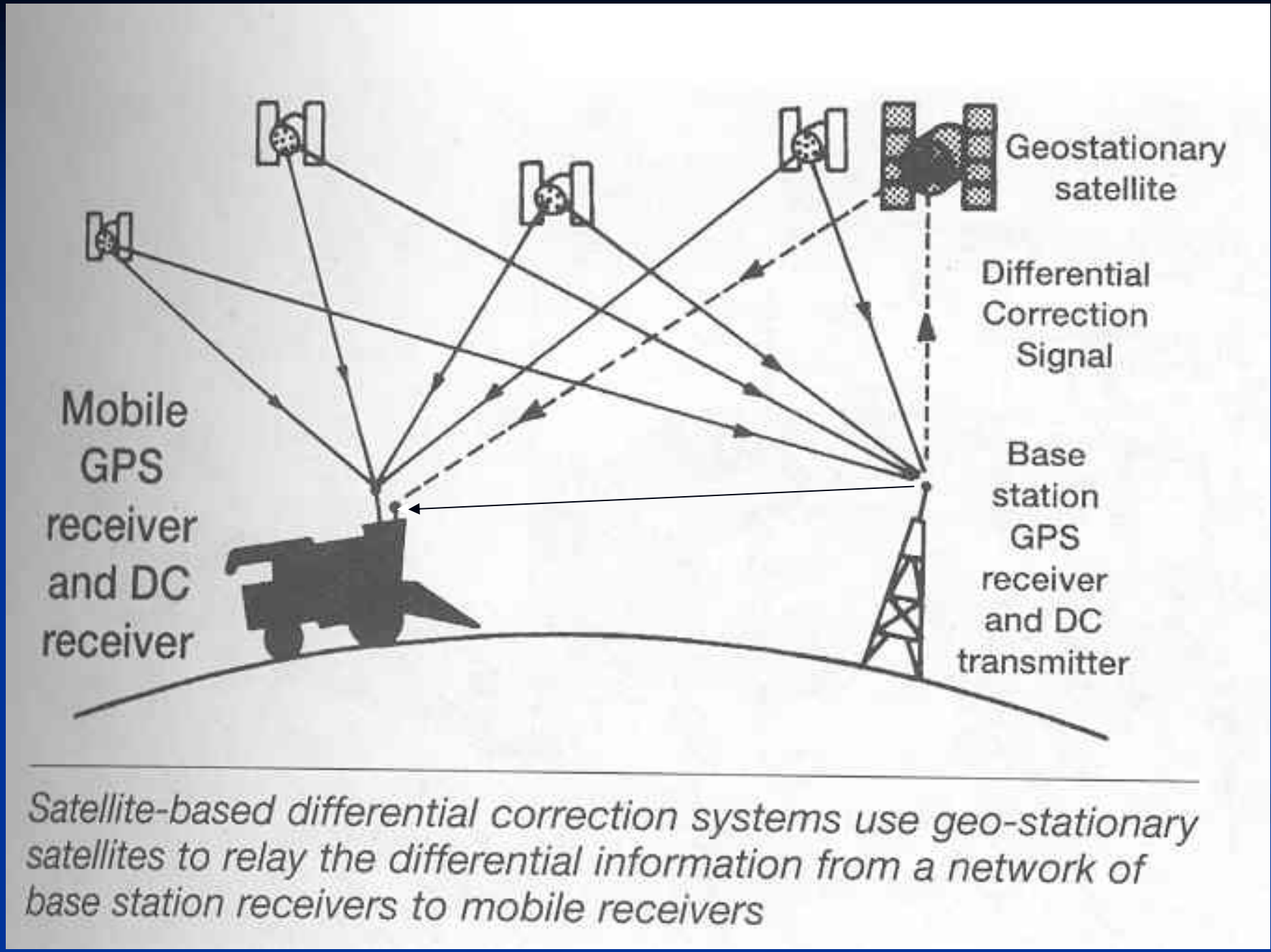
- Network of monitoring stations
  - Department of Defense (DoD)
  - Master control at Schriever Air Force Base in Colorado Springs, Colorado
  - Minimize errors

User Segment

- GPS receivers

http://www.sti.nasa.gov/tto/Spinoff2006/er_5.html

http://gpsinformation.us/main/18-GPS-Receivers.jpg



Satellite-based differential correction systems use geo-stationary satellites to relay the differential information from a network of base station receivers to mobile receivers

Ess and Morgan, 2003

Uses of GPS

- Mapping
- Parallel swathing
- Vehicle guidance system
- Chemical application
- Record locations
  - Soil sampling
  - Crop Scouting
  - Yield mapping

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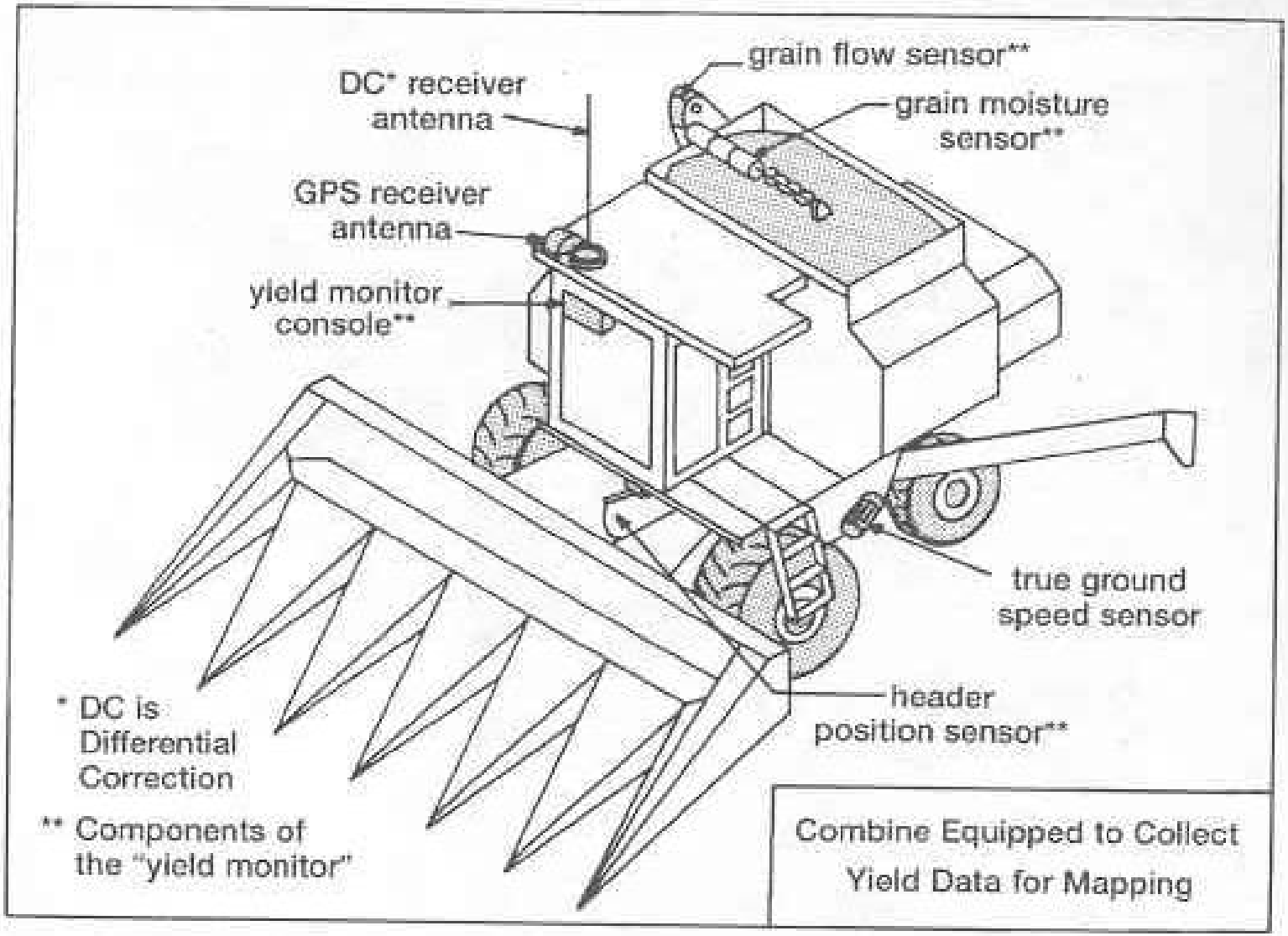
Yield Mapping

- Collect yield data from points within a field
- Use a DGPS to get the coordinates of these points
- Create a map showing the yield variations across the field



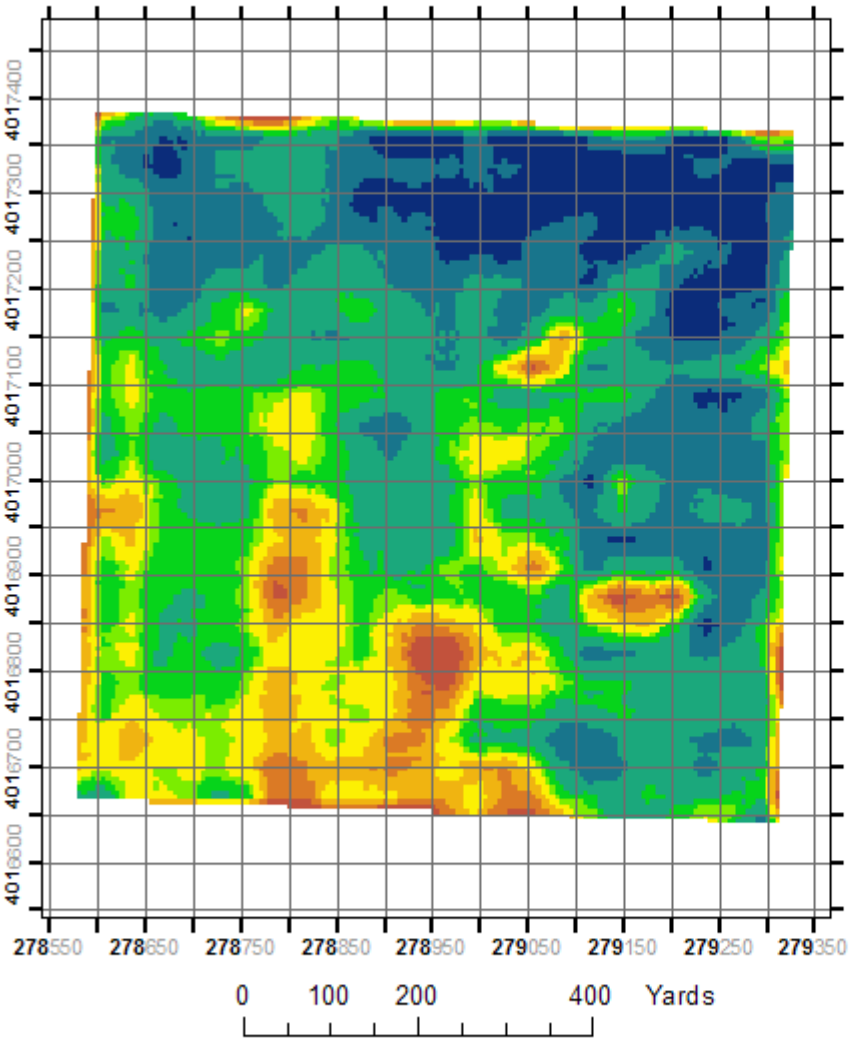
A combine equipped to collect yield data for mapping

Ess and Morgan, 2003

http://www.cropmaps.com/?p=3b

Relative Yield Map

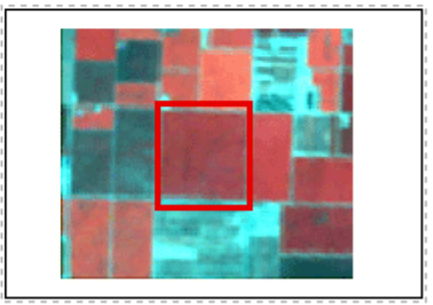
Example of calibrated yield scale after harvest. Average yield was 200 bu / acre.



Relative Yield (bu / acre)	
< -40	< 160
-30 to - 40	160 -170
-20 to -30	170 to 180
-10 to -20	180 to 190
Average	Average
10 to 20	210 to 220
20 to 30	220 to 230
30 to 40	230 to 240
> 40	> 240

The relative yield map shows the spatial variability of yield relative to the average yield of the field. Zones in the colors red-brown to yellow yielded below average. Zones in the colors green to dark blue yielded above average.

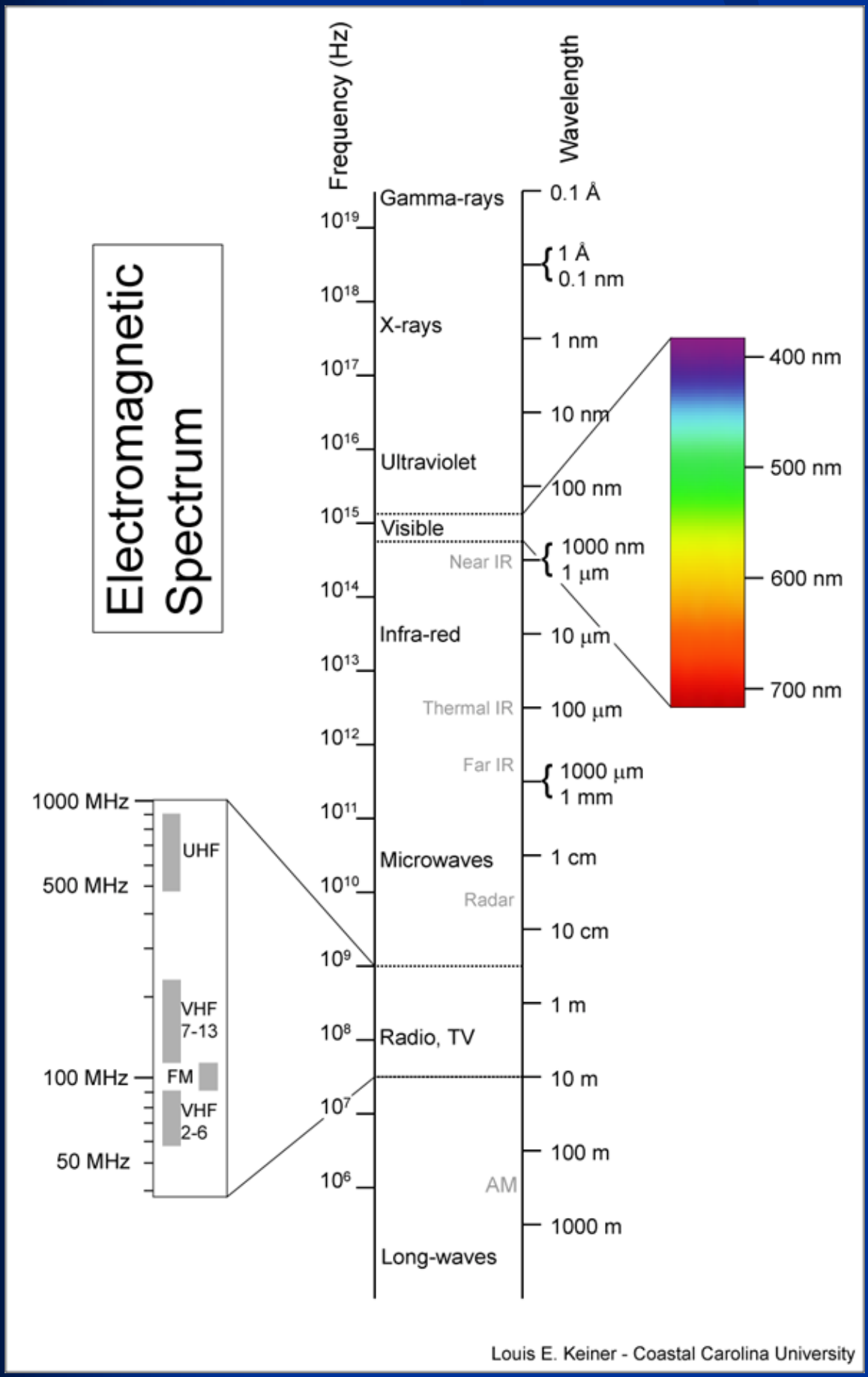
Overview



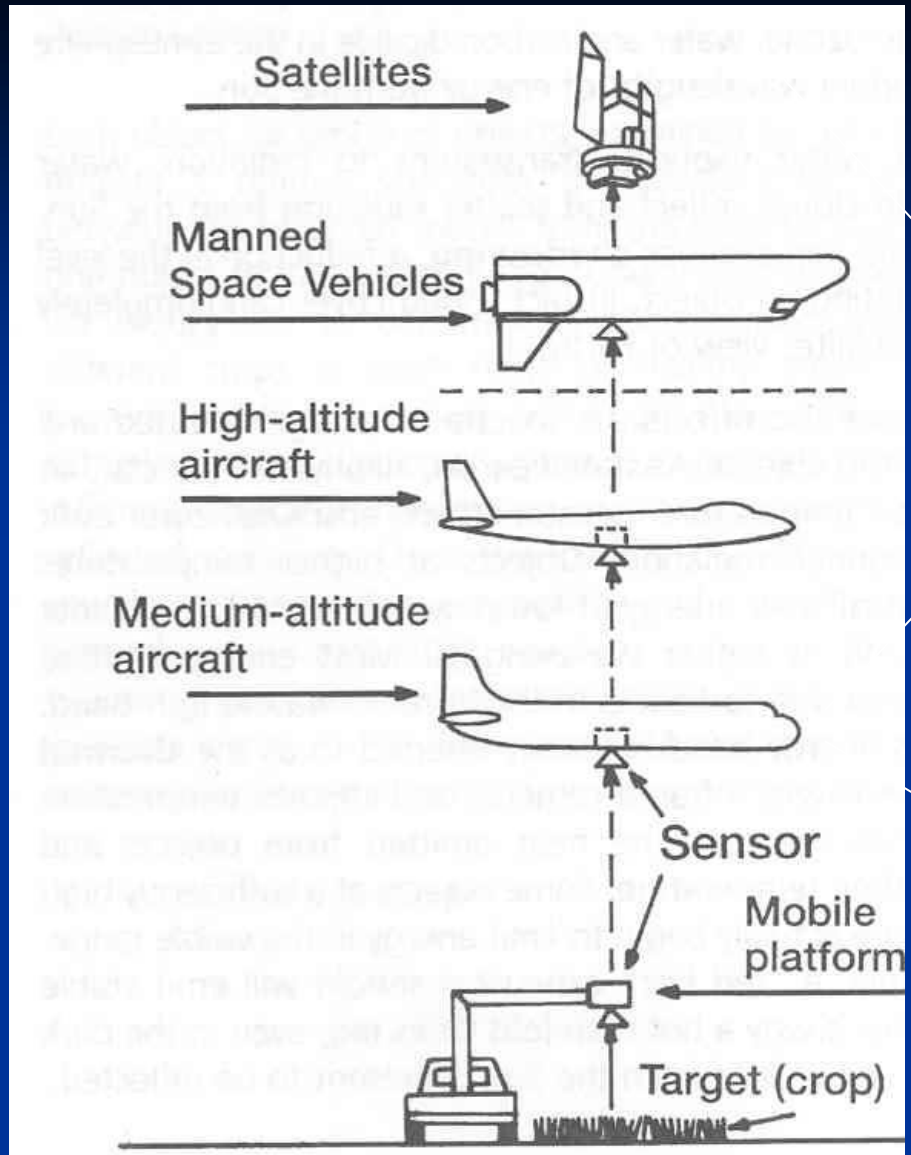
CropMaps, LLC - 1251 S. Huron St., Unit C - Denver, CO 80223
Ph: 303 777-7082 - www.cropmaps.com - e-mail: info@cropmaps.com

Remote Sensing

- Techniques for collecting information about an object that you are not physically touching
  - Passive
    - Sensors detect electromagnetic energy from the sun that is reflected towards them by the object
  - Active
    - A device sends electromagnetic energy towards and object
    - The object reflects part of the electromagnetic energy back towards the device
    - Sensors on the device detect this energy



http://www.stevesportfolio.co.uk/work/easy_gcse/electromagnetic_notes1.html



Remote sensing platforms

Images of fields

-bare soil

Level of pest infestation in a crop

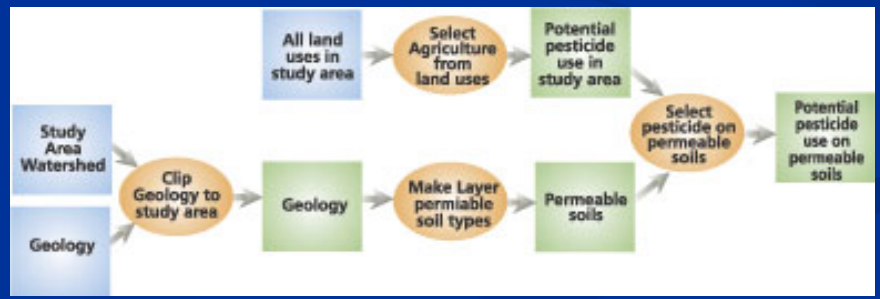
A Geographic Information System (GIS) is…

- A collection of data containing spatial and sometimes temporal information
- The software that contains and manipulates the data
- The hardware that runs the software

http://www.gis.com/

Viewing Data

- Databases
- Maps
- Models



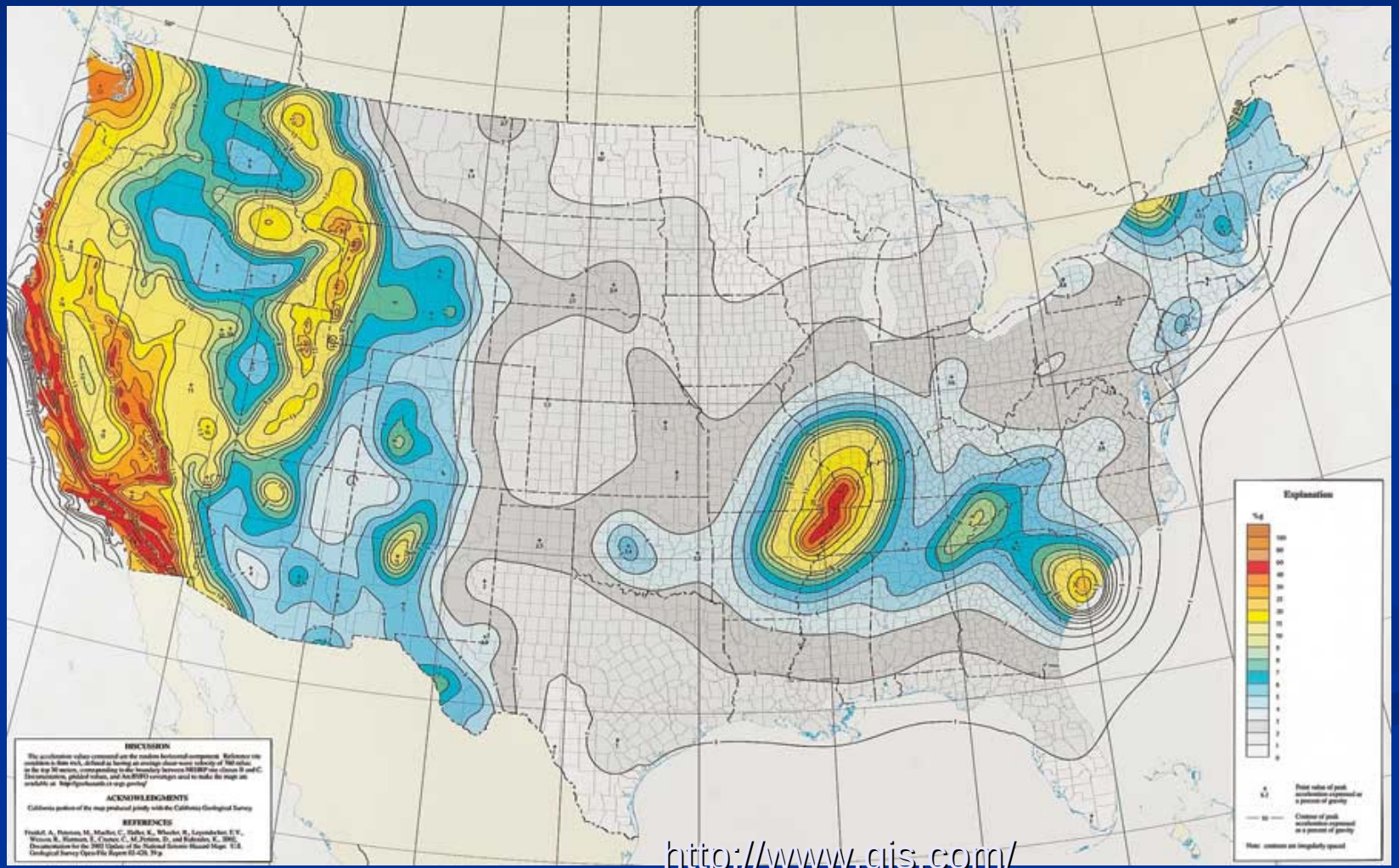
http://www.gis.com/

Applications

- Integrate and manipulate complex data
  - Locate something
  - Find patterns
  - Map quantities
  - Look at the inside of an area
  - Look at what is around an area
  - Map and analyze changes in an area

http://www.gis.com/

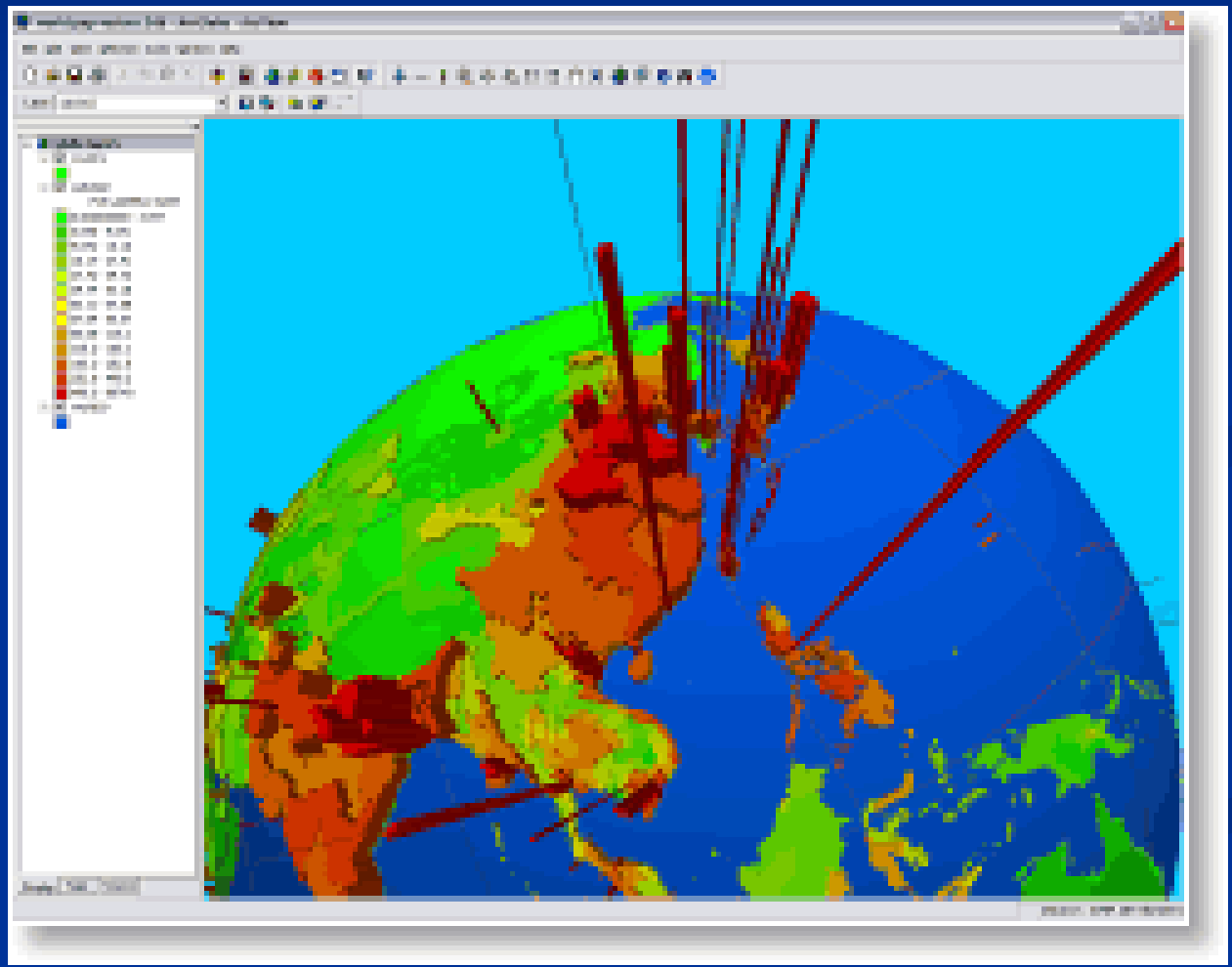
Earthquake Shaking Hazards



http://www.gis.com/

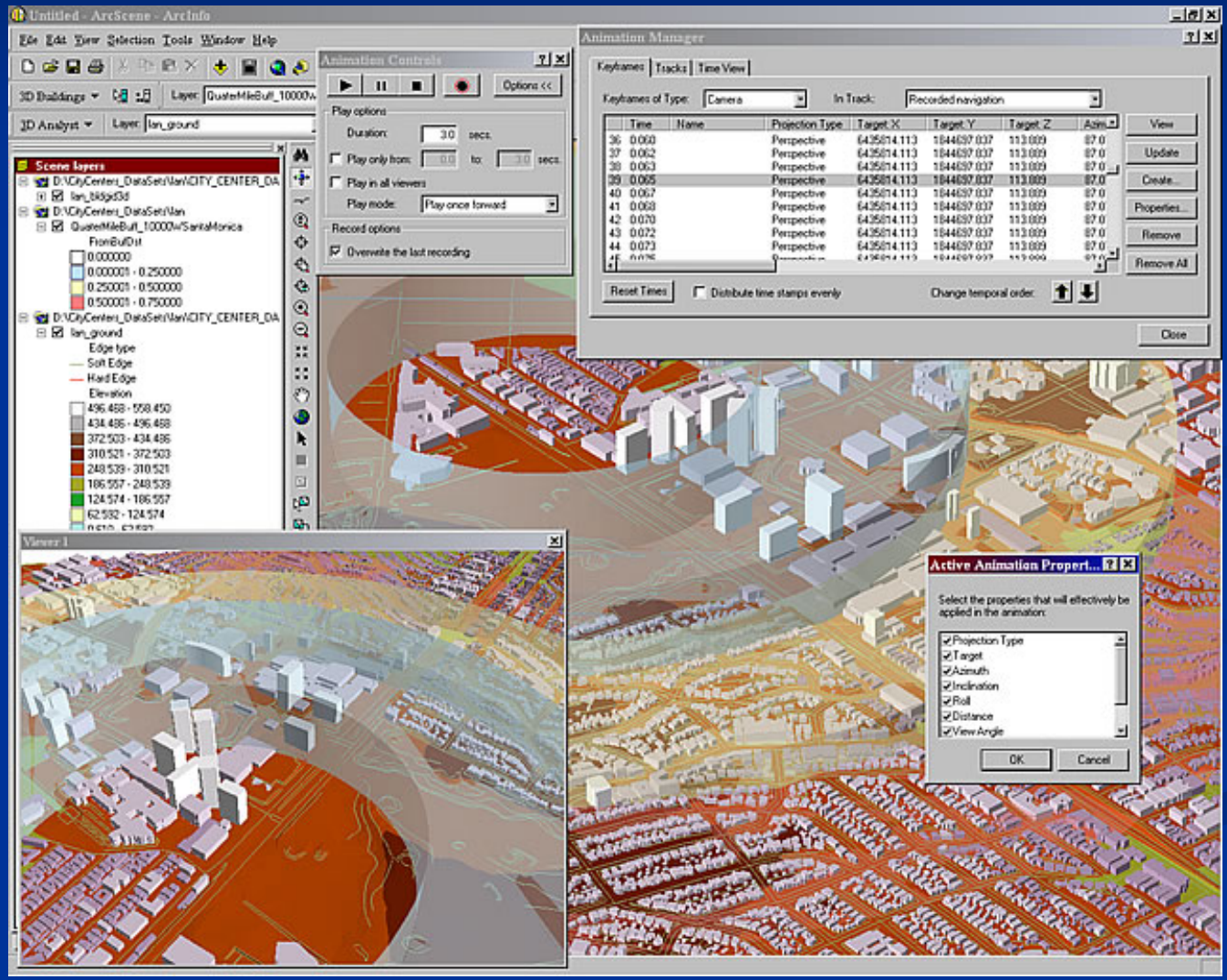
Population Density

http://www.gis.com/



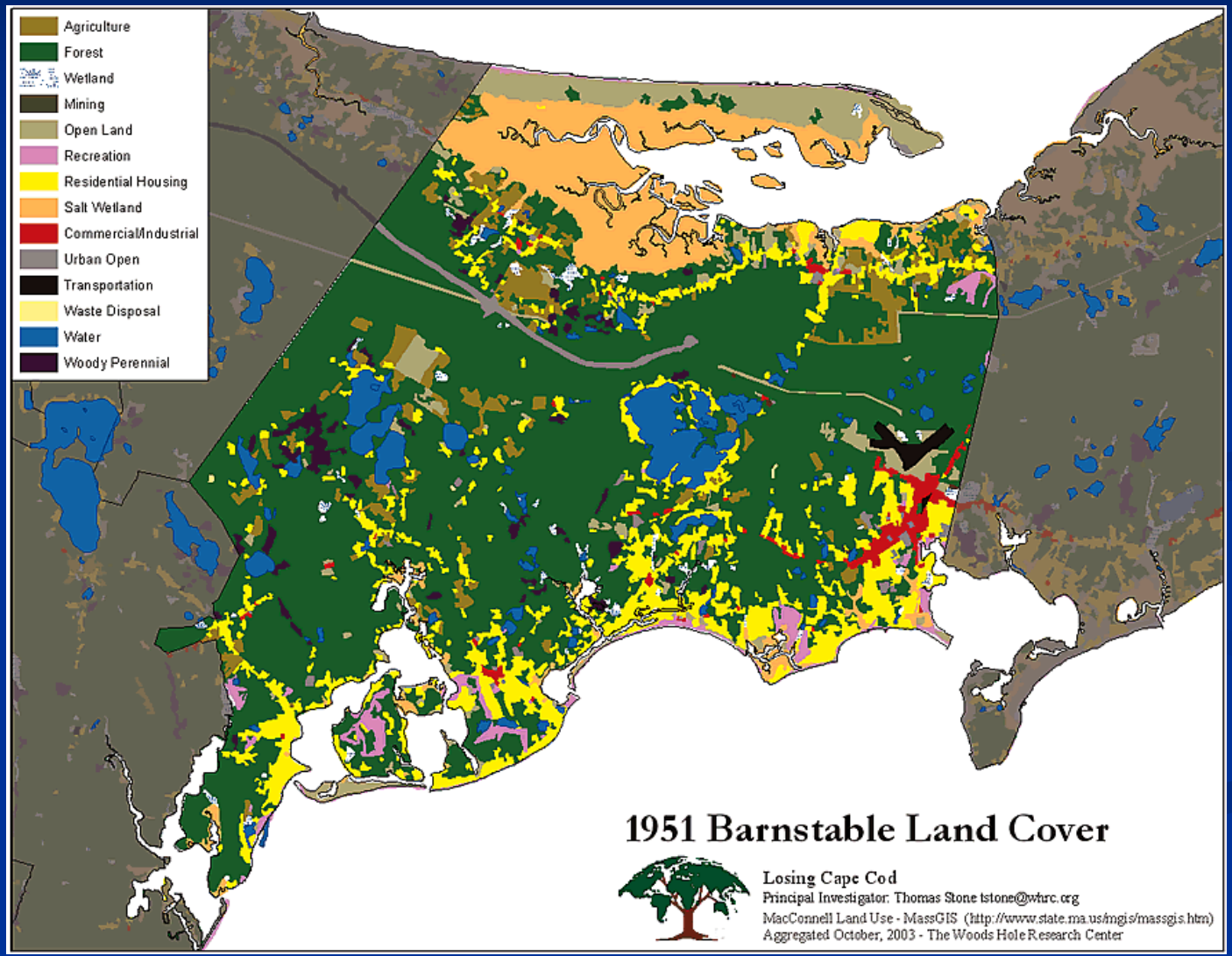
Explosion Radius

http://www.gis.com/



Land Use Change

http://www.gis.com/



Land Use Change

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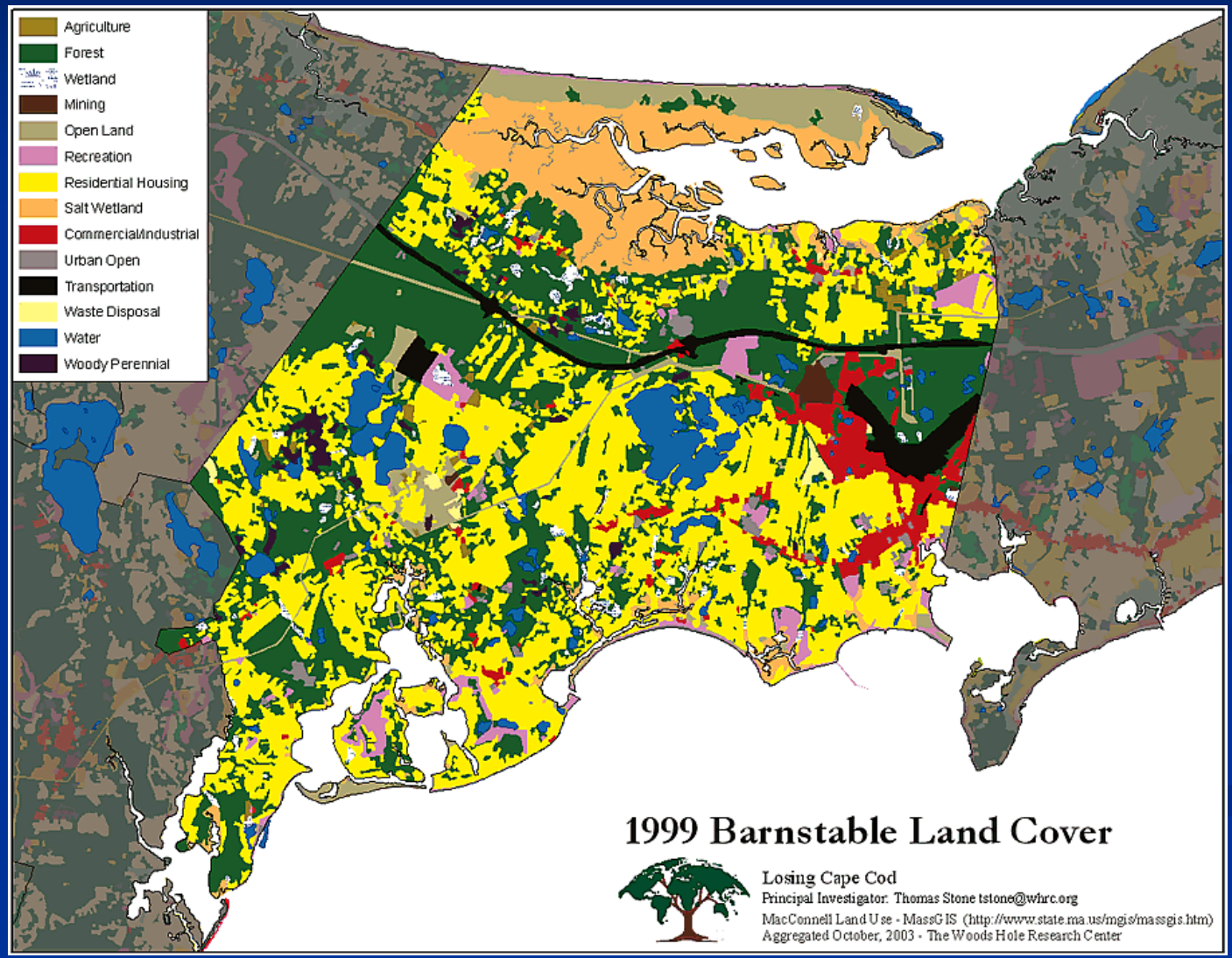


GIS in Precision Agriculture

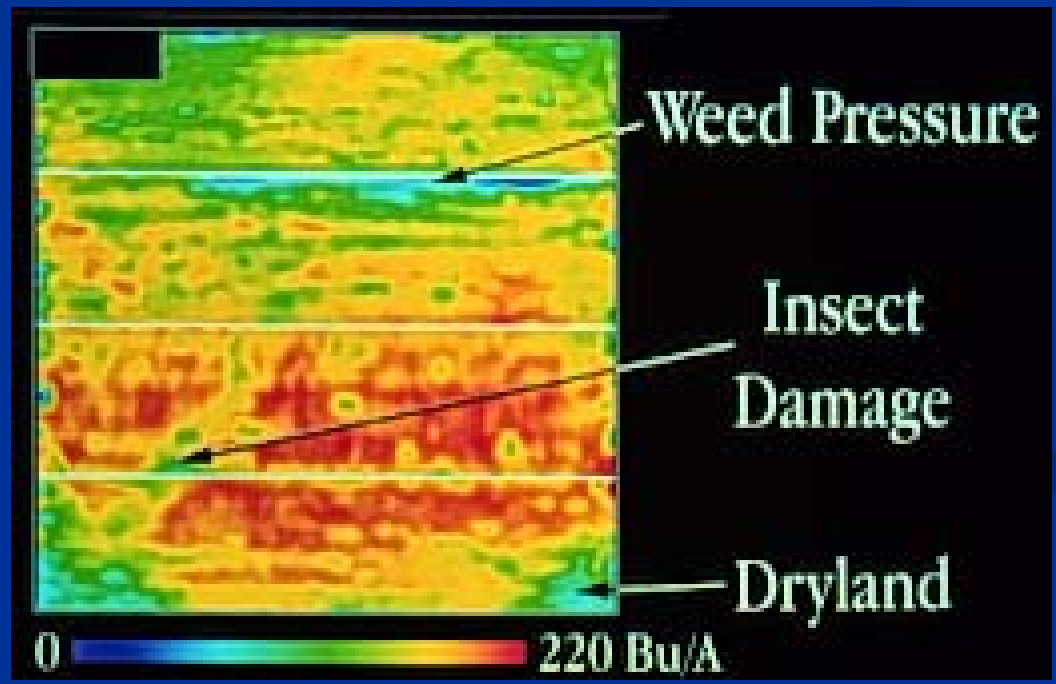
- Input
  - Yield data
  - Soil data
    - Type
    - Texture
    - N, K, P
    - pH
    - Moisture
  - Pest data
    - Weeds
    - Diseases
    - Arthropods

- Output
  - Yield was high / low in this area of the field because…
    - Not enough N
    - Less weeds
    - Hot spot of mites
    - Poor drainage

A Practical Example

Franzen, D. 1999. Yield Mapping. Site-Specific Farming No. 3, SF-1176(3), North Dakota State University. http://www.ag.ndsu.edu/pubs/plantsci/soilfert/sf1176-3.htm.

- Corn in Oakes, North Dakota
- Yield monitor combine



For more information

- Ess, D. and M. Morgan. 2003. The Precision-Farming Guide for Agriculturists. Deere & Company, Moline, IL.
  - ISBN 0-86691-287-8
- http://www.deere.com/publications