Precision Agriculture in an Energy Intensive World

USDA ARS United States Department Of Agriculture
Agricultural Research Service

Southeast Watershed
Research Laboratory

Energy Impacts Ag

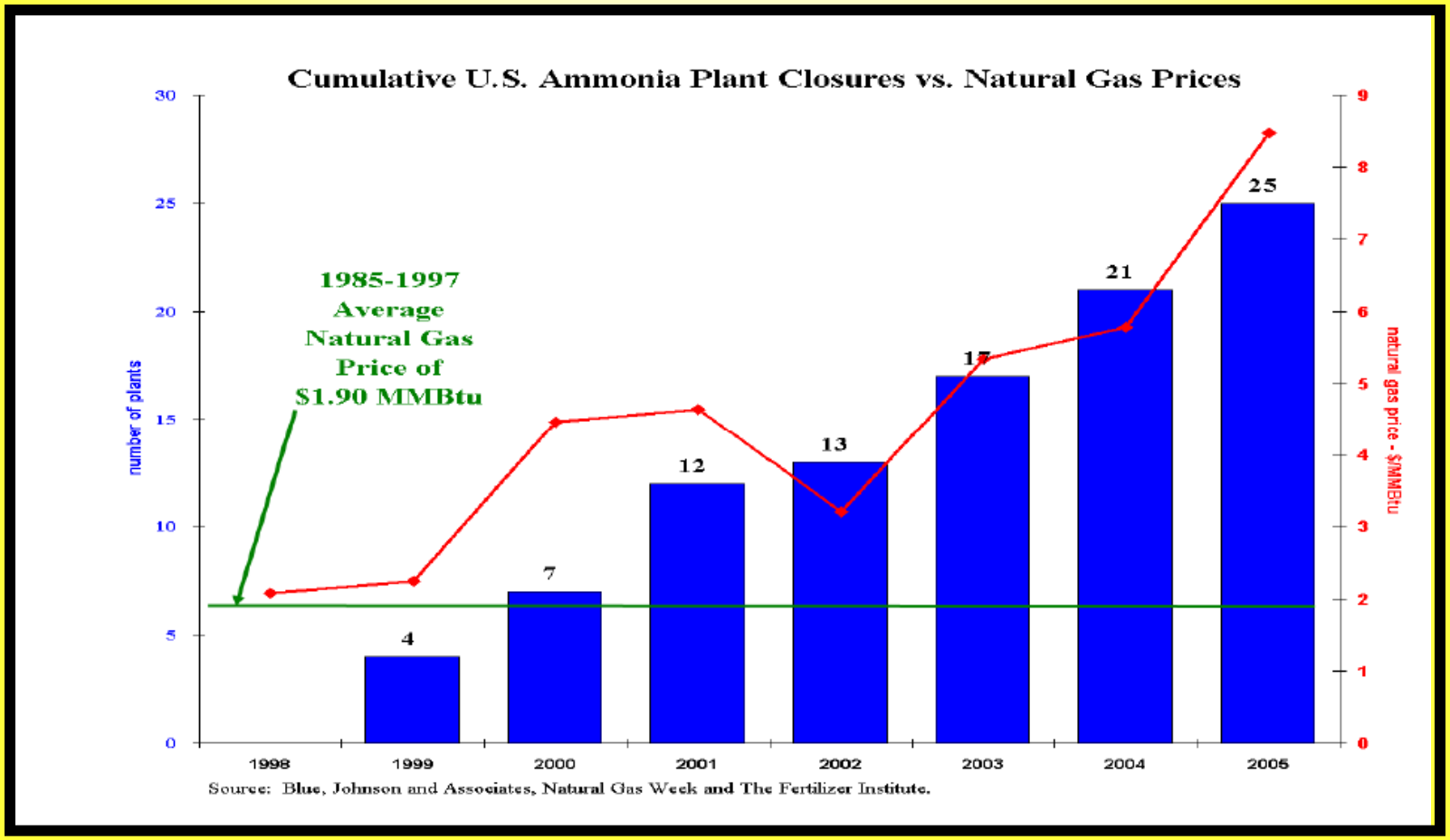
- **Energy = "Bottom-Line"**
  - Transportation
  - Agro-chemicals
  - Irrigation
  - Tillage

Energy Impacts Ag

- **Focus on Fertilizer**
  - Prices have more than doubled since 2000
    - Natural Gas ~ 85-90 % of total cost
    - Import nearly 50% of our N
    - Weak U.S. $ in a global market

Source: NCGA Fertilizer Outlook: Supply and Demand Trends. 14 Feb. 2008 Fertilizer Webinar

Energy Impacts Ag



Vroomen, H. 2008, Domestic supply and demand trends.

Energy Impacts Ag

- **Focus on Fertilizer**
  - Some good news
    - Some commodity prices of increased with Fertilizer cost.
    - EQIP Energy Cost Assistance (2006)
    - Strategies that conserve energy and the bottom-line.

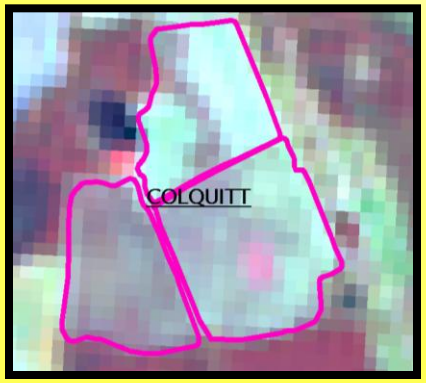
Energy Impacts Ag

- **Conservation Strategies**
  - Nutrient Management ($85 ac^{-1})
  - Irrigation ($9-41 ac^{-1})
  - IPM ($40 ac^{-1})
  - **PRECISION AGRICULTURE ($13 ac^{-1})**

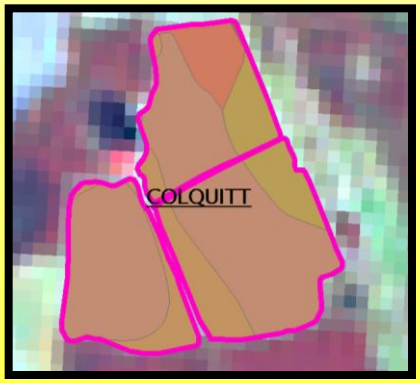
Source: No-Till Farmer, 2008.

Precision Ag

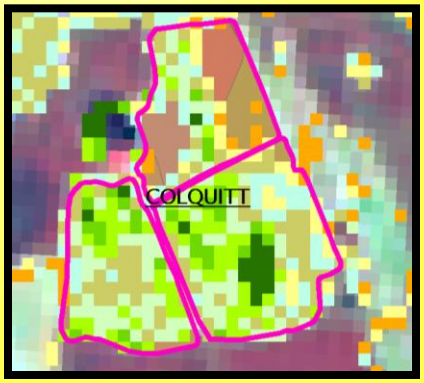
- Tailors Inputs to Expected Outputs
- Core Component = Management Zone



Imagery



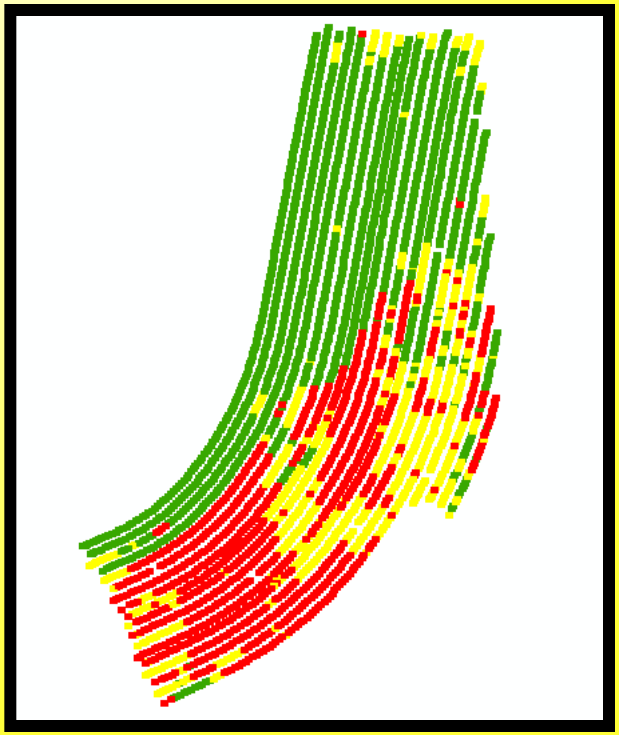
Soils



Yield

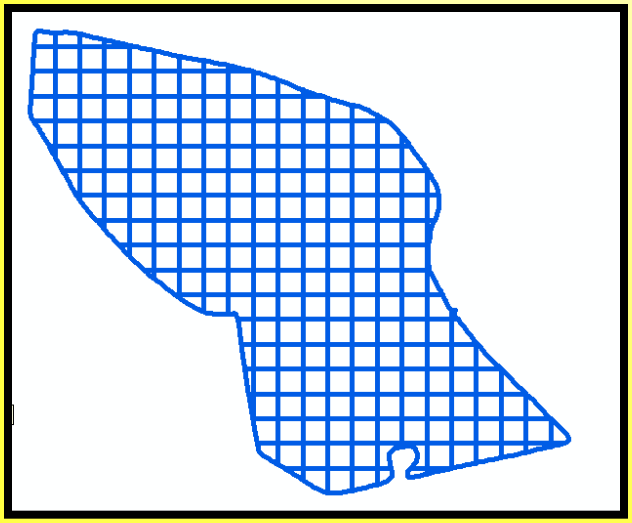
Precision Ag

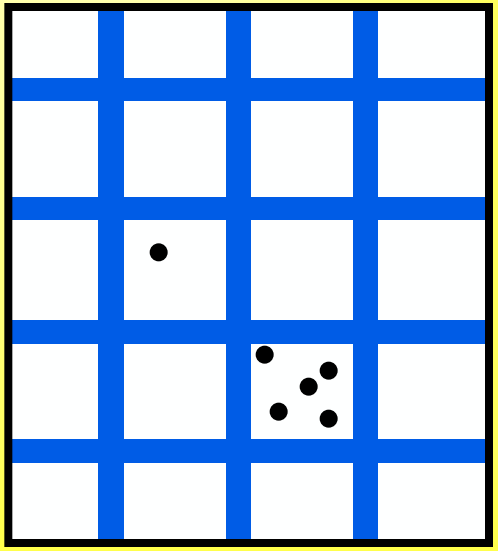
- Targeted Soil Sampling
- Variable Rate:
  - **Irrigation**
  - **Seeding**
  - **Harvest**
  - **Lime**
  - **Pesticides**
  - **Fertilizer**



Delineating Management Zones

- **Grid Sampling**
  - Grid Cell Vs. Grid Center

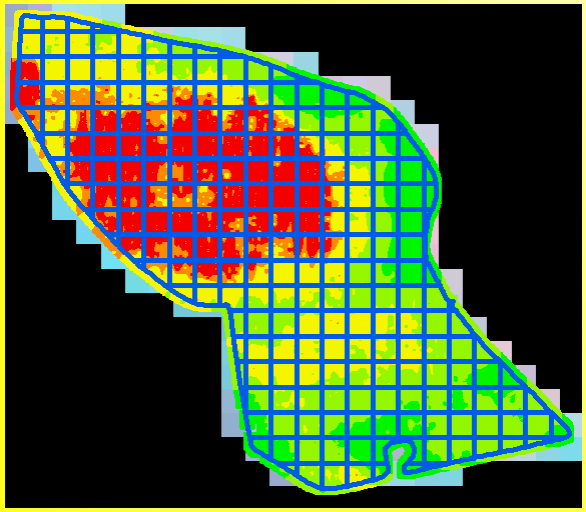




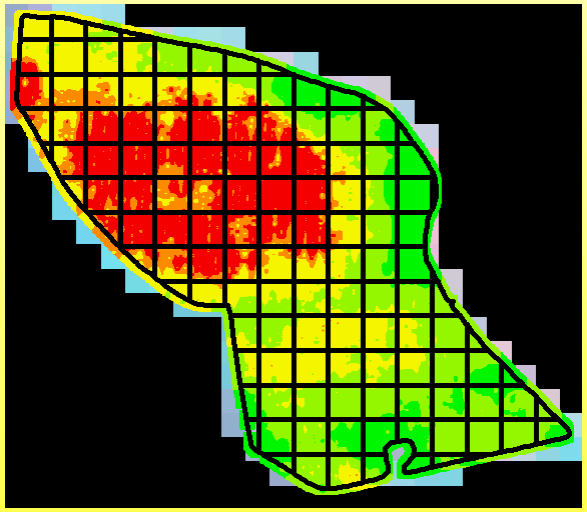
Delineating Management Zones

- **Grid Considerations!**

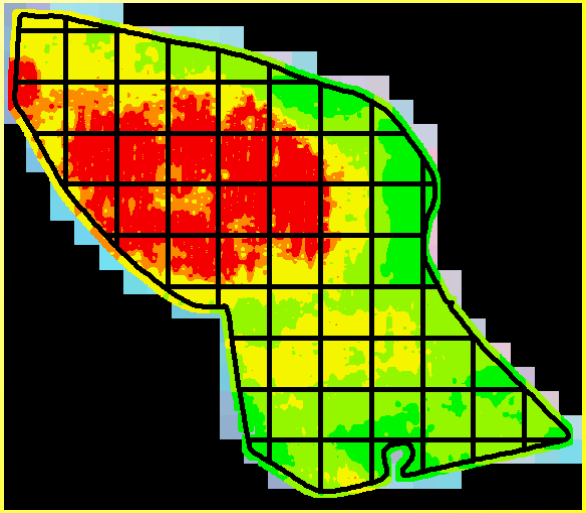
  -Number of Samples – Time and Expense



0.25 ac grid



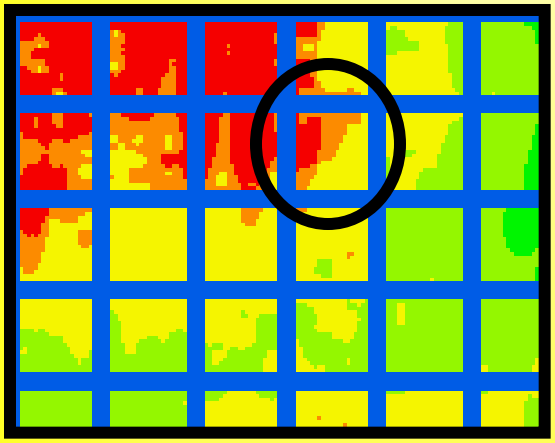
0.50 ac grid



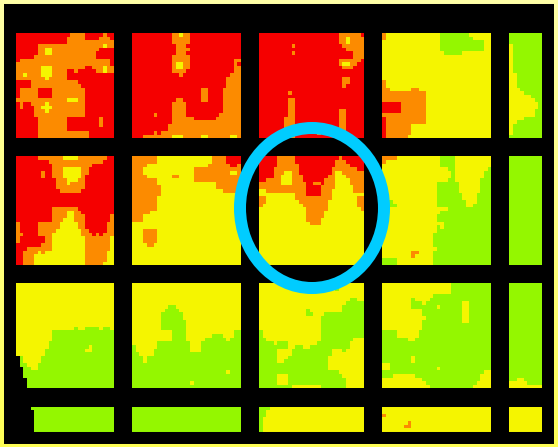
1 ac grid

Delineating Management Zones

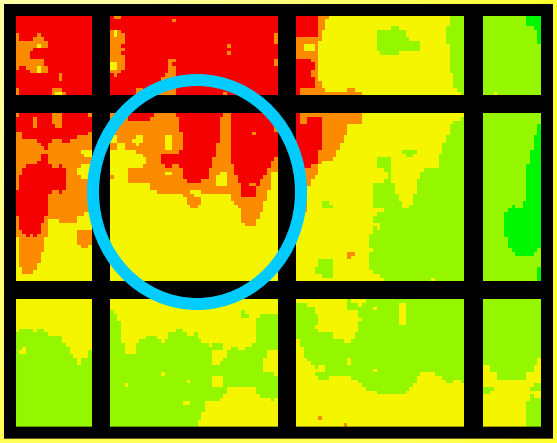
- **Grid Considerations!**
  - Data Quality



0.25 ac grid

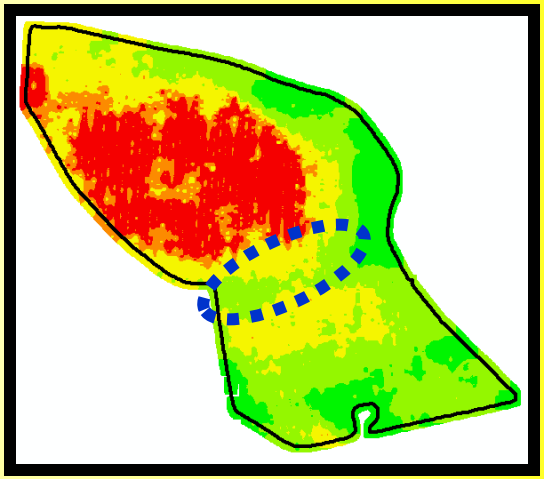


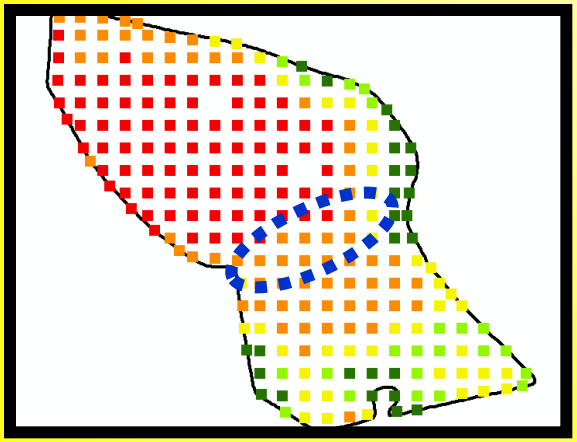
0.50 ac grid



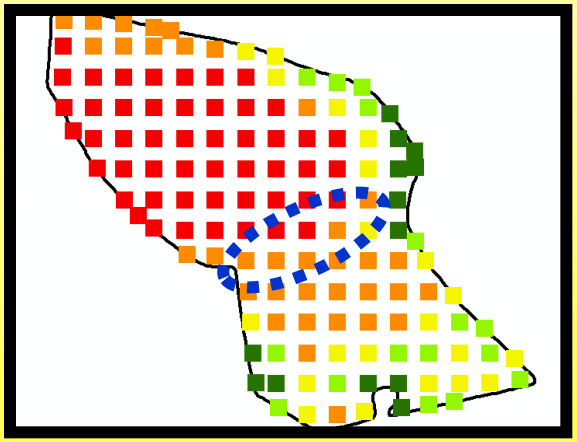
1 ac grid

Delineating Management Zones

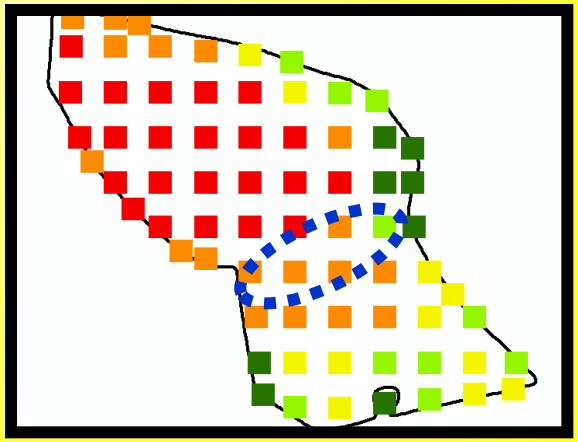




0.25 ac grid



0.50 ac grid



1 ac grid

USDA ARS United States Department Of Agriculture Agricultural Research Service

Southeast Watershed Research Laboratory

Delineating Management Zones

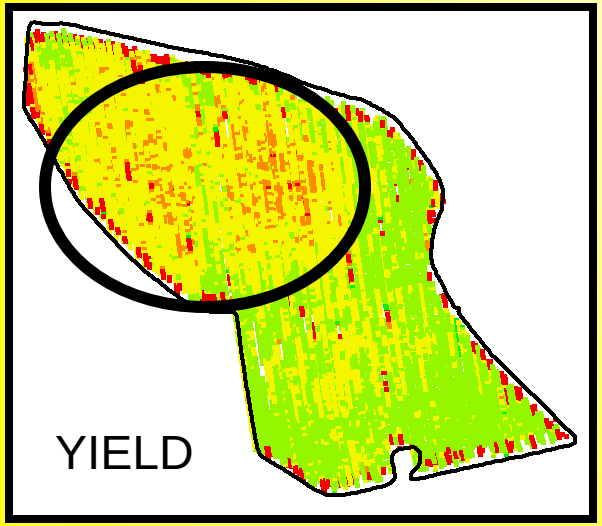
- **Letting Data Drive Zones**
  - Greater upfront investment
    - Gathering Data
    - Analysis
    - Defining Zones
  - Kinds of Data
    - Yield Maps
    - Aerial or Satellite imagery
    - Soil and Topo Maps
    - Site History

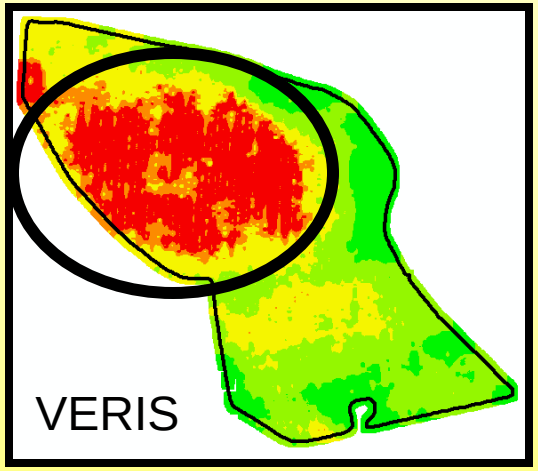
Delineating Management Zones

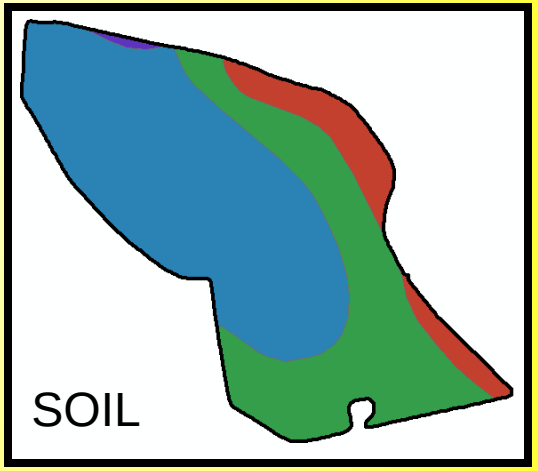
USDA ARS United States Department Of Agriculture Agricultural Research Service

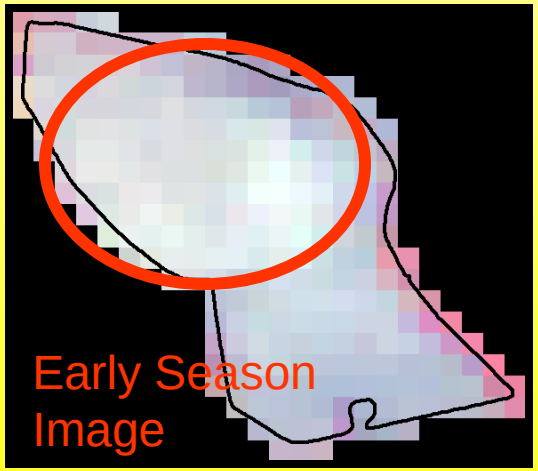
Southeast Watershed Research Laboratory

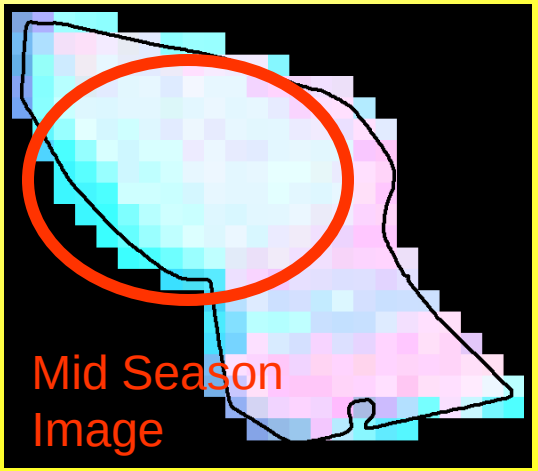
Delineating Management Zones







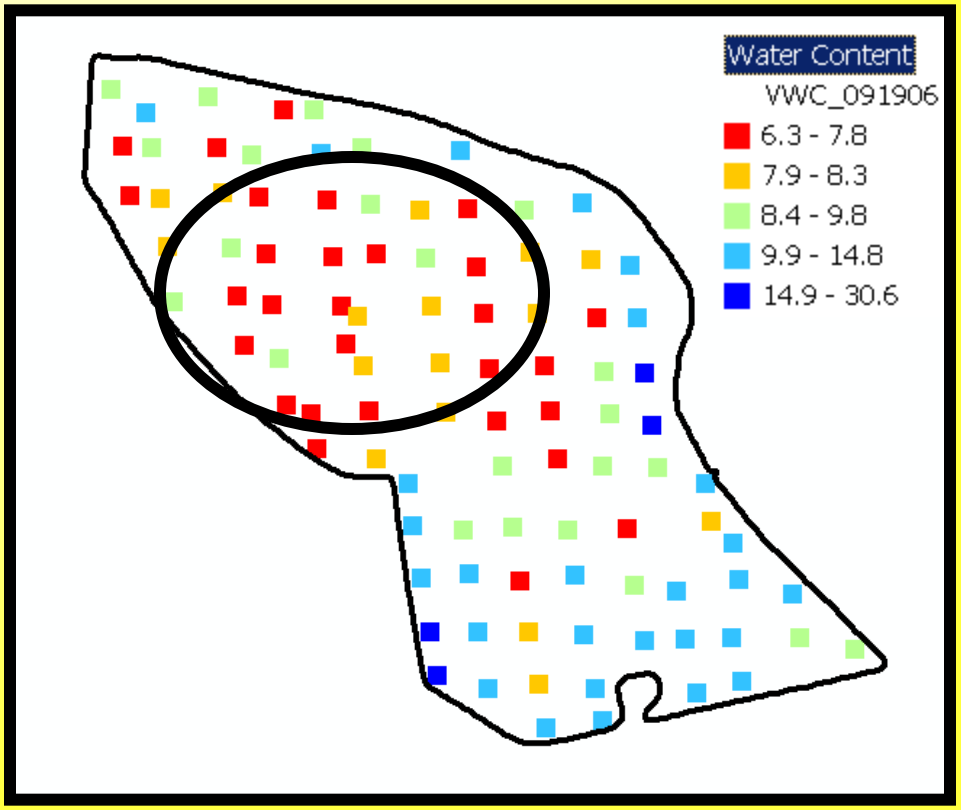




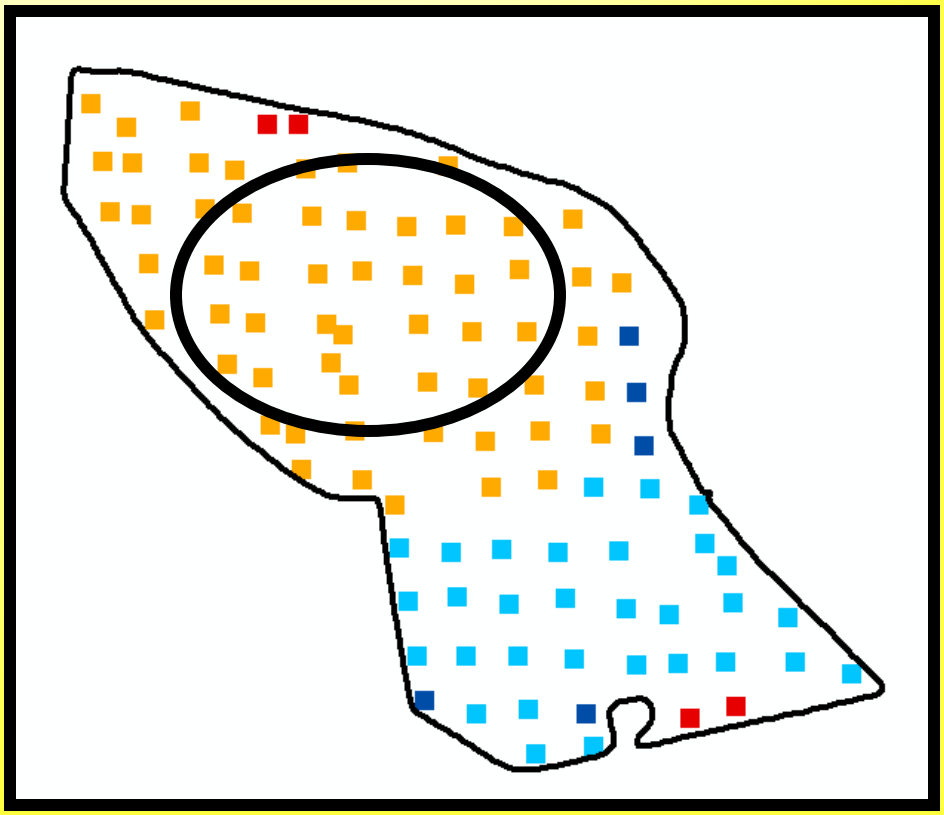
USDA ARS United States Department Of Agriculture
Agricultural Research Service

Southeast Watershed
Research Laboratory

Delineating Management Zones



Delineating Management Zones

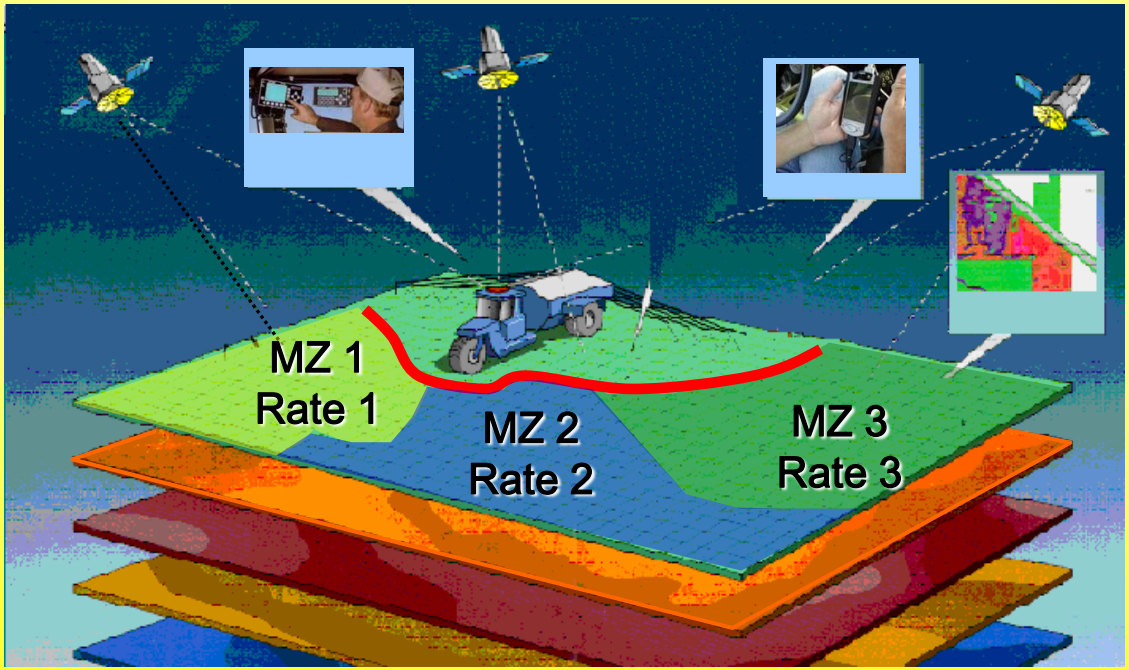


A Precision Ag Example

- Objective
  - What is the integrated effect of pest pressure, fertility, and landscape position on cotton yield???
  - Can we define zones that reflect these differences?
  - Is there an overwhelming "feature" that controls "expected" yield?

A Precision Ag Example

Can we manage cotton inputs site specifically?
Reduce Input
Maximize Returns $$

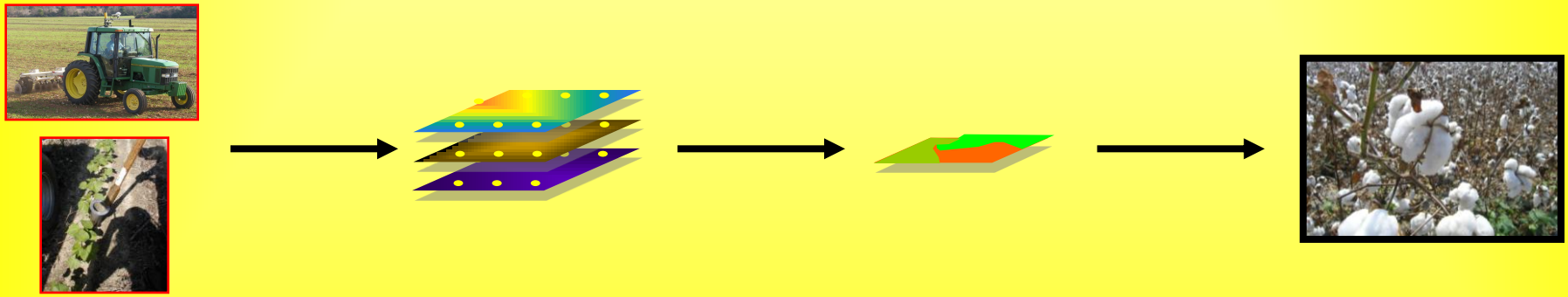


USDA ARS United States Department Of Agriculture
Agricultural Research Service

Southeast Watershed
Research Laboratory

A Precision Ag Example

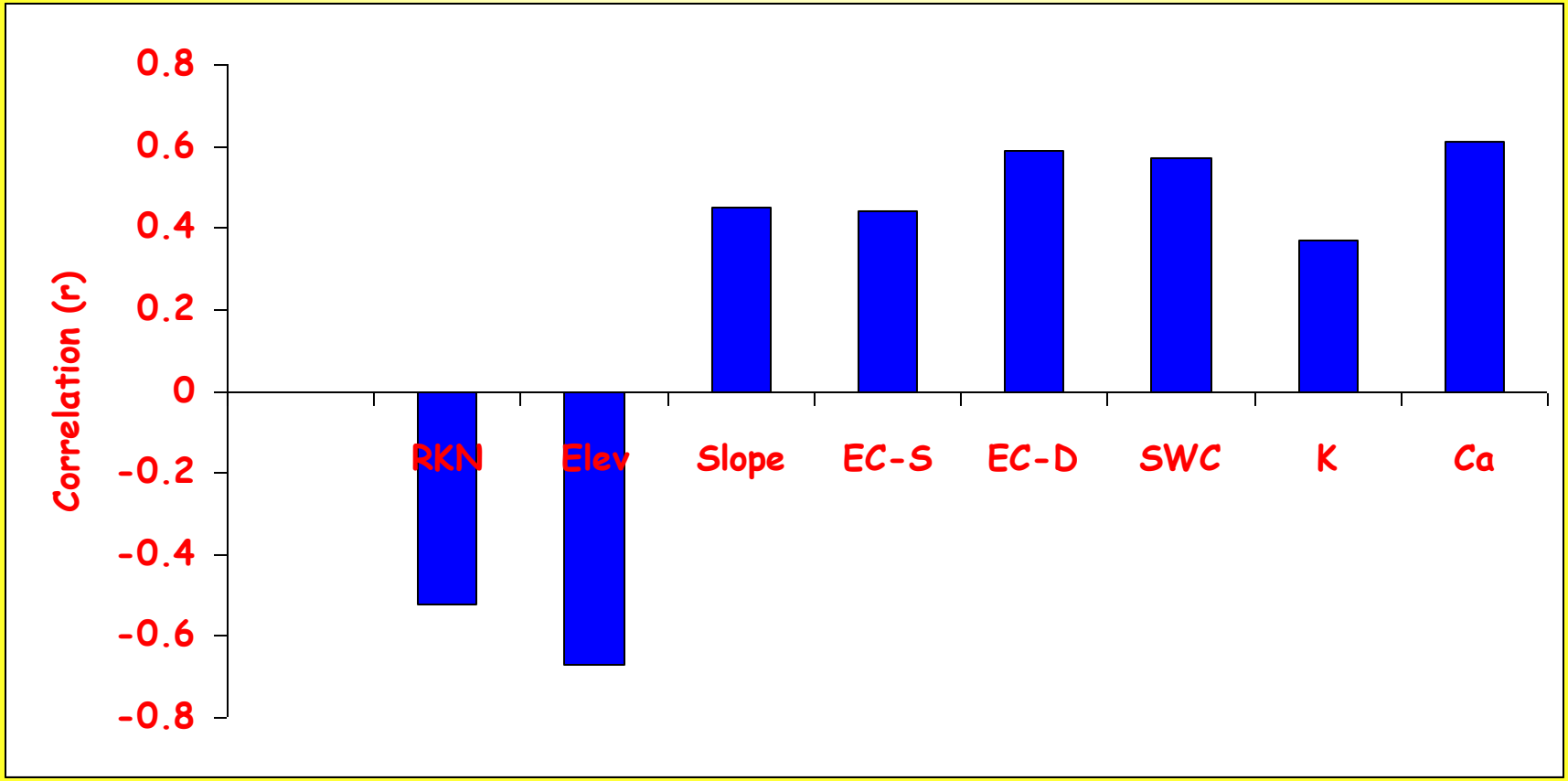
Site: SE Coastal Plain, GA
Soil: Loamy Sand
History: Root-knot Nematode Infested
Data:



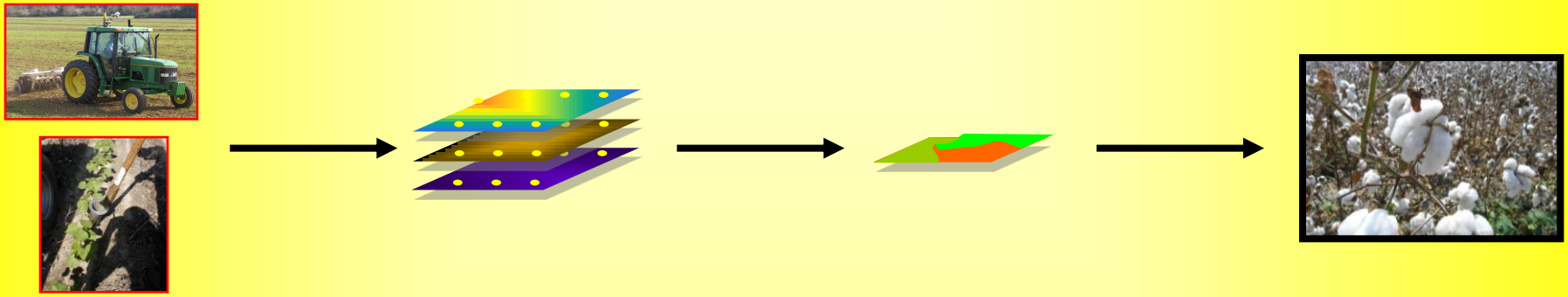
USDA United States Department Of Agriculture
Agricultural Research Service

Southeast Watershed
Research Laboratory

A Precision Ag Example



A Precision Ag Example

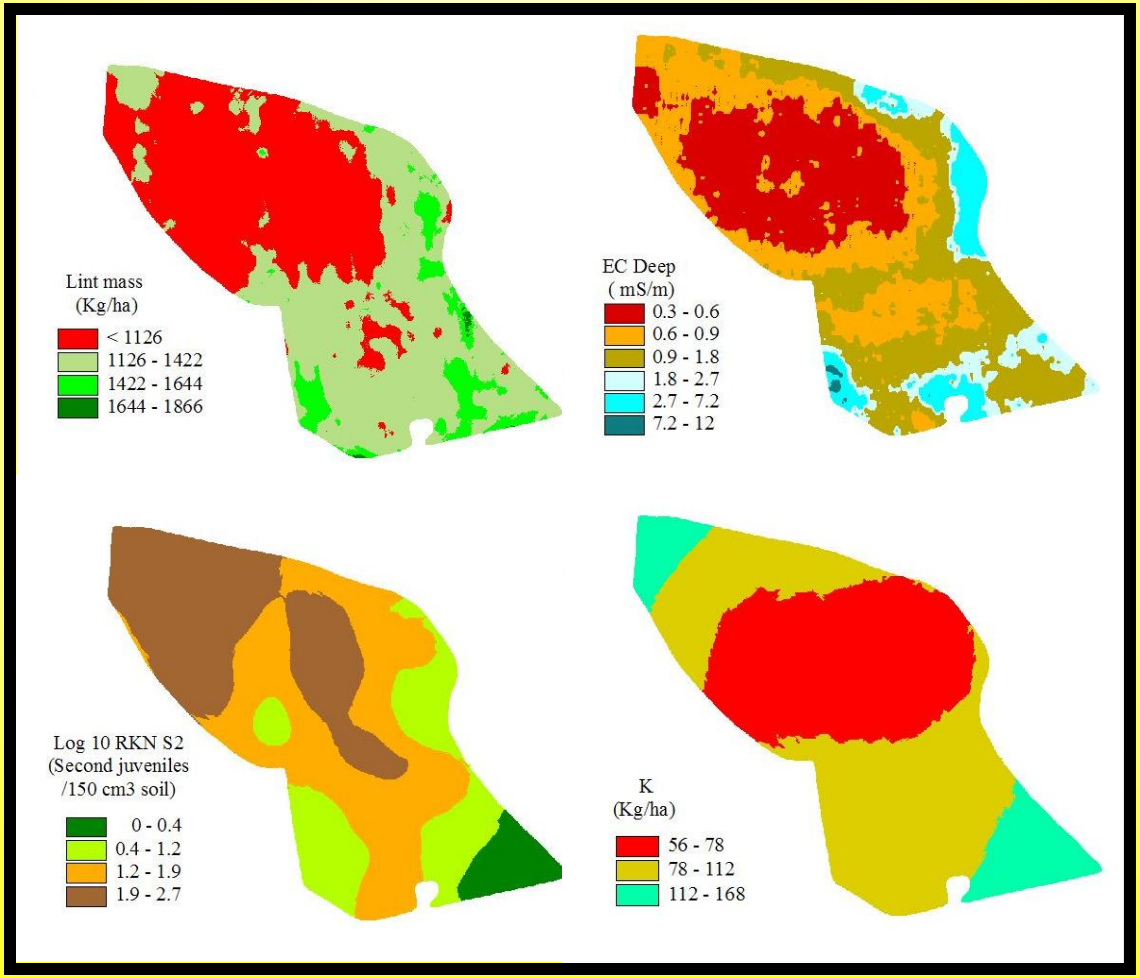


EC-deep, K, RKN = 54% of yield variability

EC-deep = 35% of yield variability

RKN = 12% of yield variability

A Precision Ag Example



In Summary

- **Soil Texture is correlated with:**
  - Water Availability
  - Fertility
  - Some Pests (RKN)
  - Most Importantly YIELD
- **Site specific mgmt of fertilizers shows promise as a tool to minimize inputs and maximize gains.**

In Summary

- Remember, tailoring inputs (fertilizer) works best when matched to EXPECTED yields.