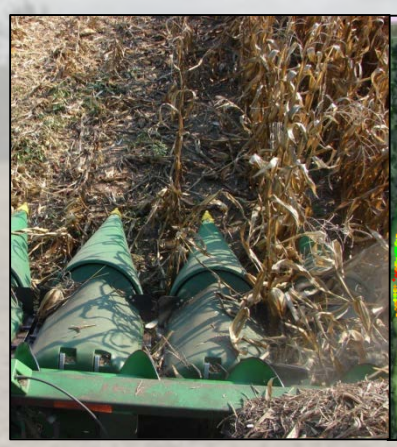
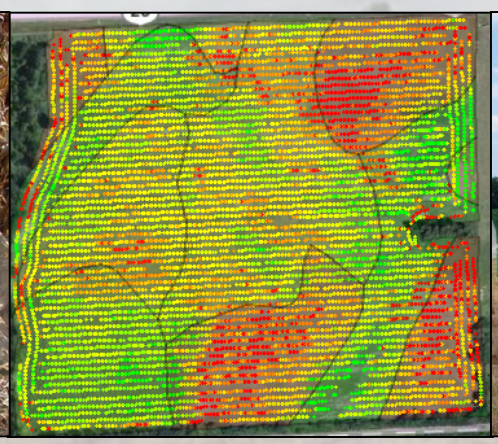
Utilizing the Precision Ag Tools you Already Have

2015 Fremont Corn Expo
January 8th, 2015

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Using Precision Ag Technologies

- Technology allows for variable rate control of crop inputs
- It also provides georeferenced data records when implemented properly
- This gives us the opportunity to compare field productivity with several other data layers
- Technology must be setup and maintained properly to ensure best-possible data
- Some data layers are questionable for analysis

Why do your own field tests?

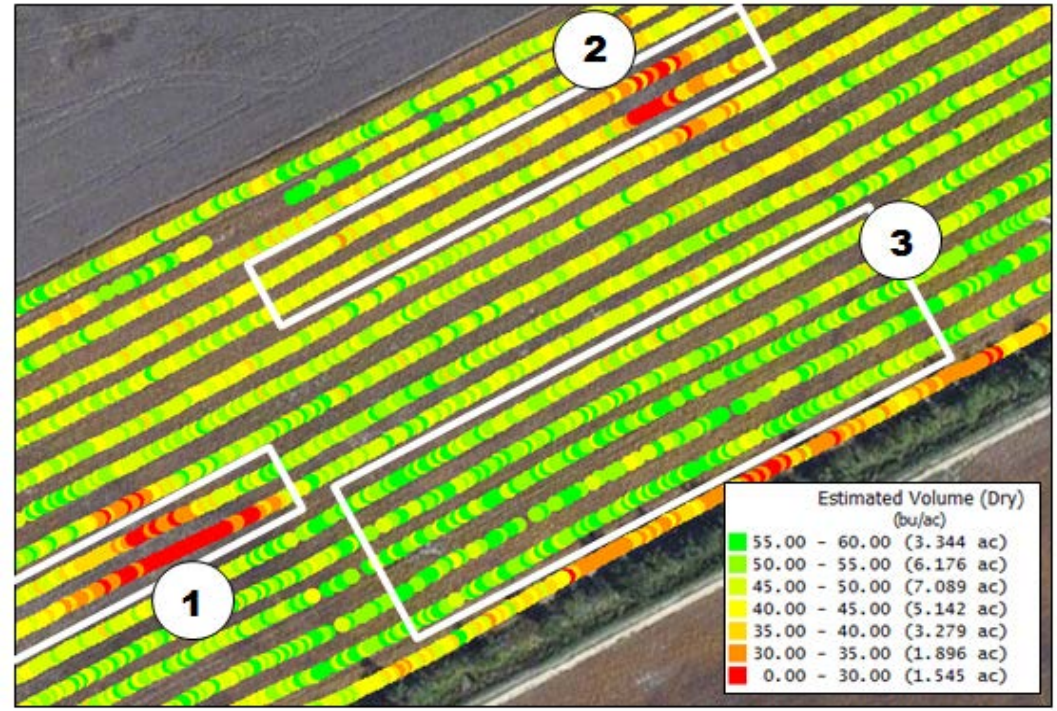
- You may have practices unique to your operation that make a study particularly informative
- You can see how a new product or practice would directly affect your operation
- Some costs may be associated with On-Farm Research (OFR):
  - Time to collect and analyze data
  - Wasted products or inputs
- It's a great way to partner with researchers to supplement University studies

Site Selection

- The site is where you conduct the study, by testing different treatments (products or practices)
- Choose a uniform area of the field to test differences (unless you're using soil type or slope for a treatment, for instance)
- You want to limit the effects of external factors on your treatments, if possible
- Try to focus on simpler studies with two or three treatments to minimize unknown interactions

Site Selection

- Use historical yield data to help identify field locations where studies would be best conducted
- You can use other data layers as well (aerial, soil maps, etc.)



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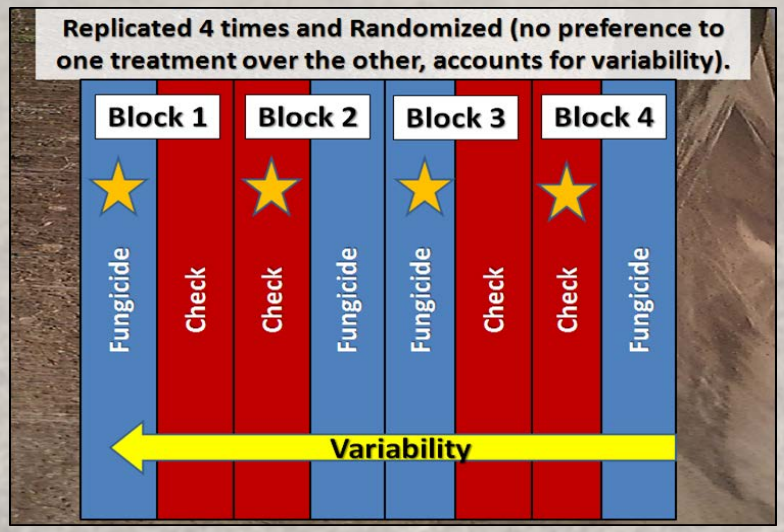
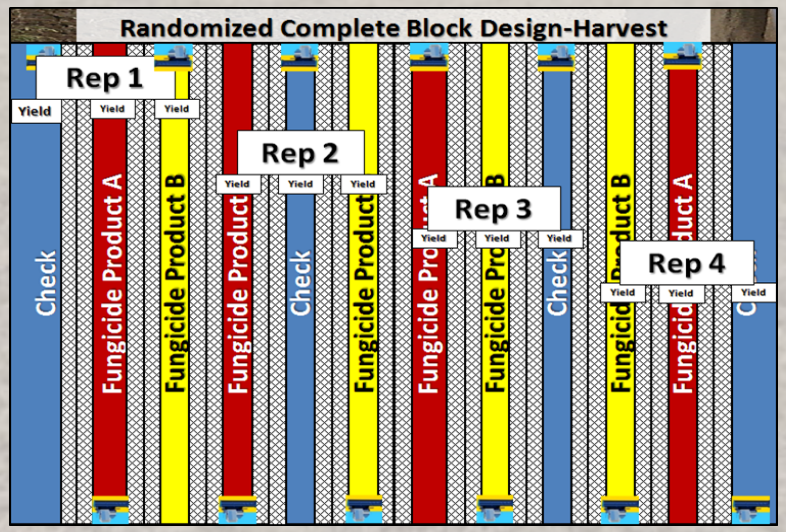
Layout of In-Field Experiments

- Try to always leave a check strip (no treatment) if possible
- Plan to have replications (>> 3) of each treatment (multiple strips of each treatment, for instance)
- Randomize the treatments across the field (not treatment A on the east half and B on the west half)
- Equipment widths become very important!





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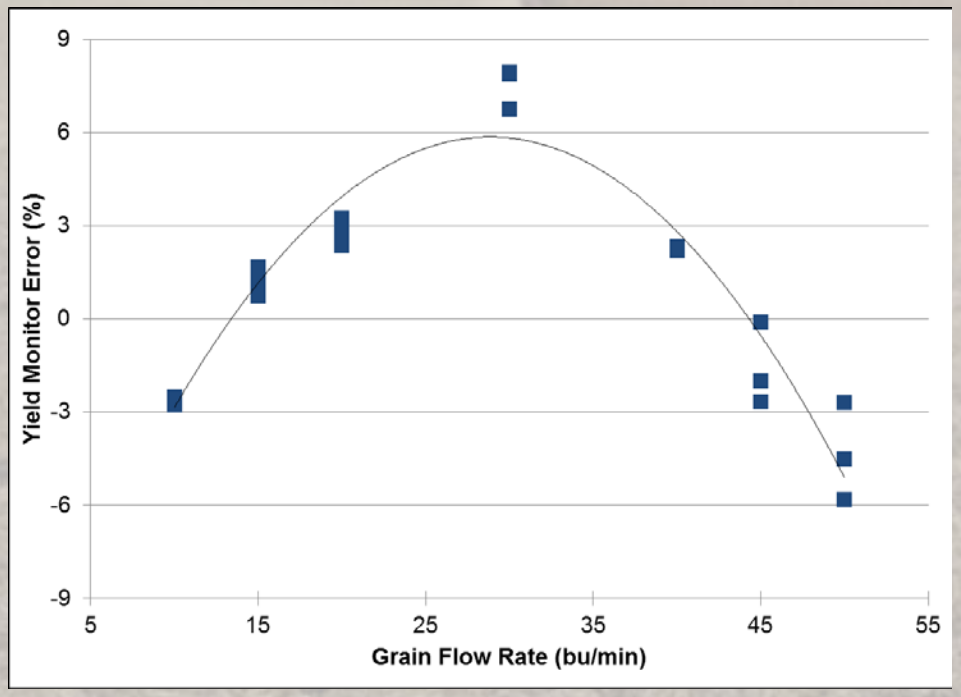
Data Collection

- Some field studies may not lend themselves to using precision ag technology, notes become even more important!
- Examples of data:
  - Dates of planting, harvest, treatments, rainfall
  - Plant populations during the season
  - Any in-field applications
  - GPS points of in-plot issues
  - Photographs of test area

Ensuring Quality Data Collection

- This can be a considerable time investment, but is an important part of the management process
- The basis of these systems rely on sensors which all have error associated with them
- We need to be consistent!



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Precision Ag Tools for Data Collection

- Precision Ag equipment can automate much of this data collection for us
- As-applied planting, chemical application, fertilizers, harvest data are some examples
- GPS gives us the ability to record location and time
- GIS systems (ArcMap, SMS, SST, Apex, etc.) give us the ability to analyze the data
- We will look at some examples of pros and cons with these systems

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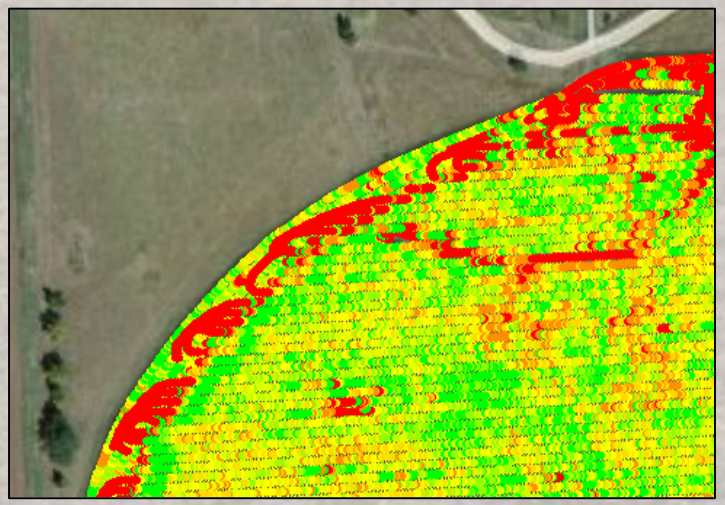
Precision Ag Tools for Data Collection

- Some tips can help with using yield monitor data:
  - Calibration is critical for each crop
  - Plot strips need to be greater than 200 feet in length to ensure data smoothing is minimized
  - Separating data into Loads may help (for instance in headlands)
  - Data should be “cleaned” using post-processing tools like Yield Editor (USDA)



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Precision Ag Tools for Data Collection

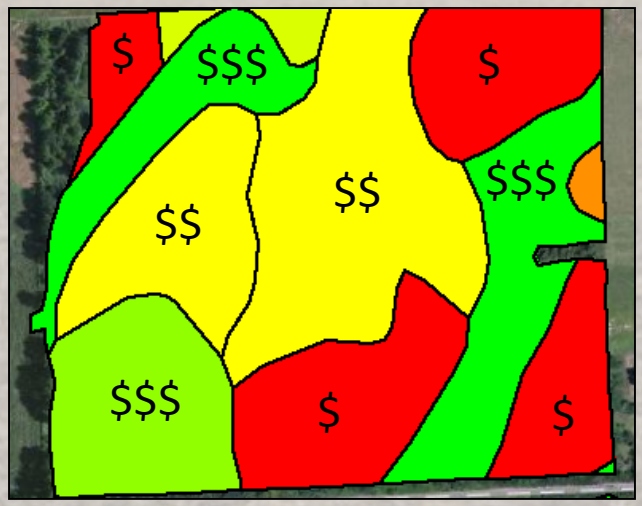
- Other data sets (planters, applicators) also need to be scrutinized to ensure good info is collected:
  - Treatment application locations (hybrids on a planter, paths made by sprayers, etc.) are generally okay, depending on GPS
  - Using a seeding rate or application rate with these implements should be verified somehow (calibration or field verification)
  - Many of these systems are not changing rates instantly, this can affect our results

Analyzing Results

- We’ve focused on collecting good data, remember, bad data in = bad information out
- Data should be analyzed using statistical methods to determine if differences among treatments does exist and how confident we can be in those results
- Work with someone with experience to do this analysis, which often requires special software
- In the end, tying an economic analysis is really worth the time, the change must make sense in dollars, not necessarily bushels!

Drawing Conclusions

- The goal of OFR is to help you decide what products or practices have been beneficial to <u>your</u> operation
- This could be economic or environmental change!
- Hopefully, the information you gain can be used in the next year to improve your operation



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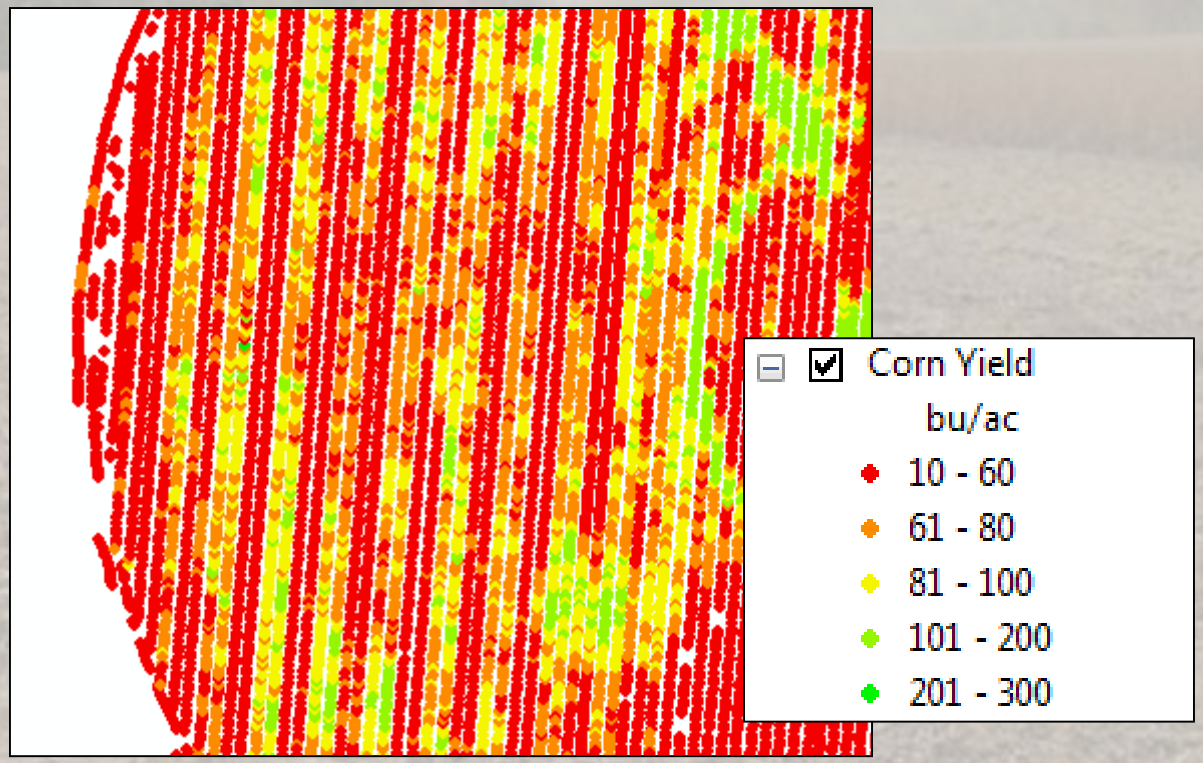
Examples

- Opportunities include using yield monitor data to conduct our OFRN trials
- Data attributes including yield and crop moisture content may be interesting



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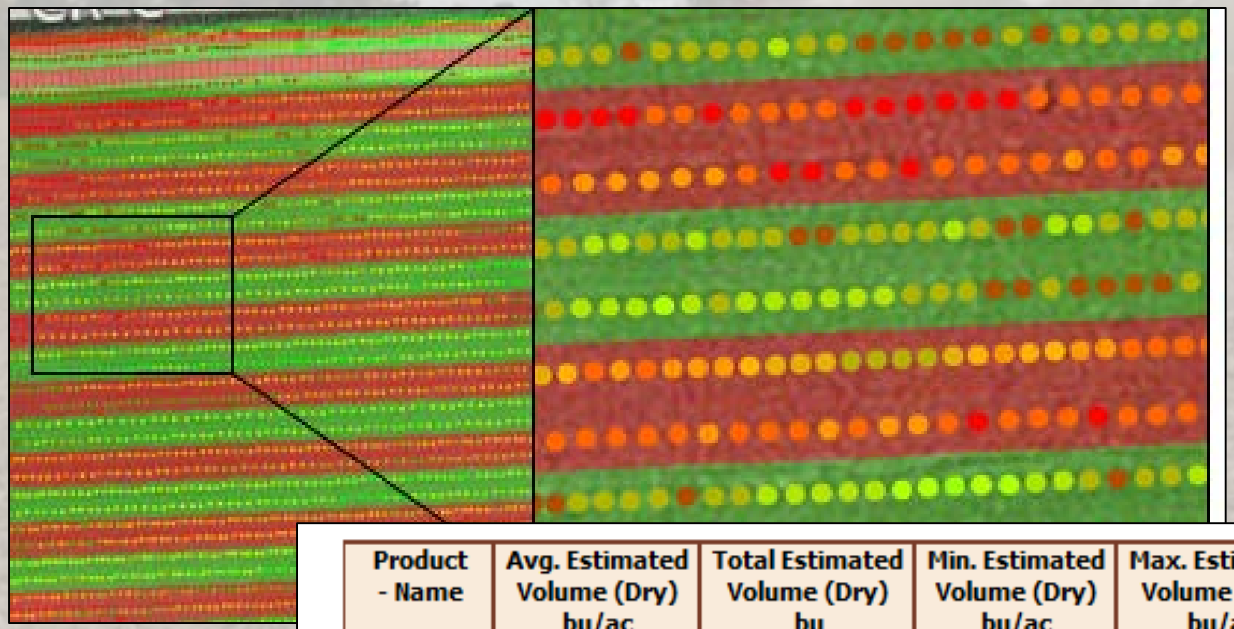
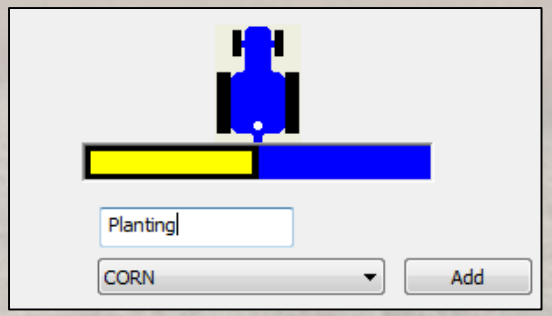
Examples

- GIS analysis of as-applied split-planter data versus yield monitor data across a field
- Analysis can be automated to generate results within minutes





Product - Name	Avg. Estimated Volume (Dry) bu/ac	Total Estimated Volume (Dry) bu	Min. Estimated Volume (Dry) bu/ac	Max. Estimated Volume (Dry) bu/ac	Area ac
Hybrid A	122.48	1,927.4	5.497	529.55	15.74
Hybrid B	129.41	2,026.4	6.966	1,716.1	15.66
(All)	**125.94**	**3,953.8**	**5.497**	**1,716.1**	**31.40**

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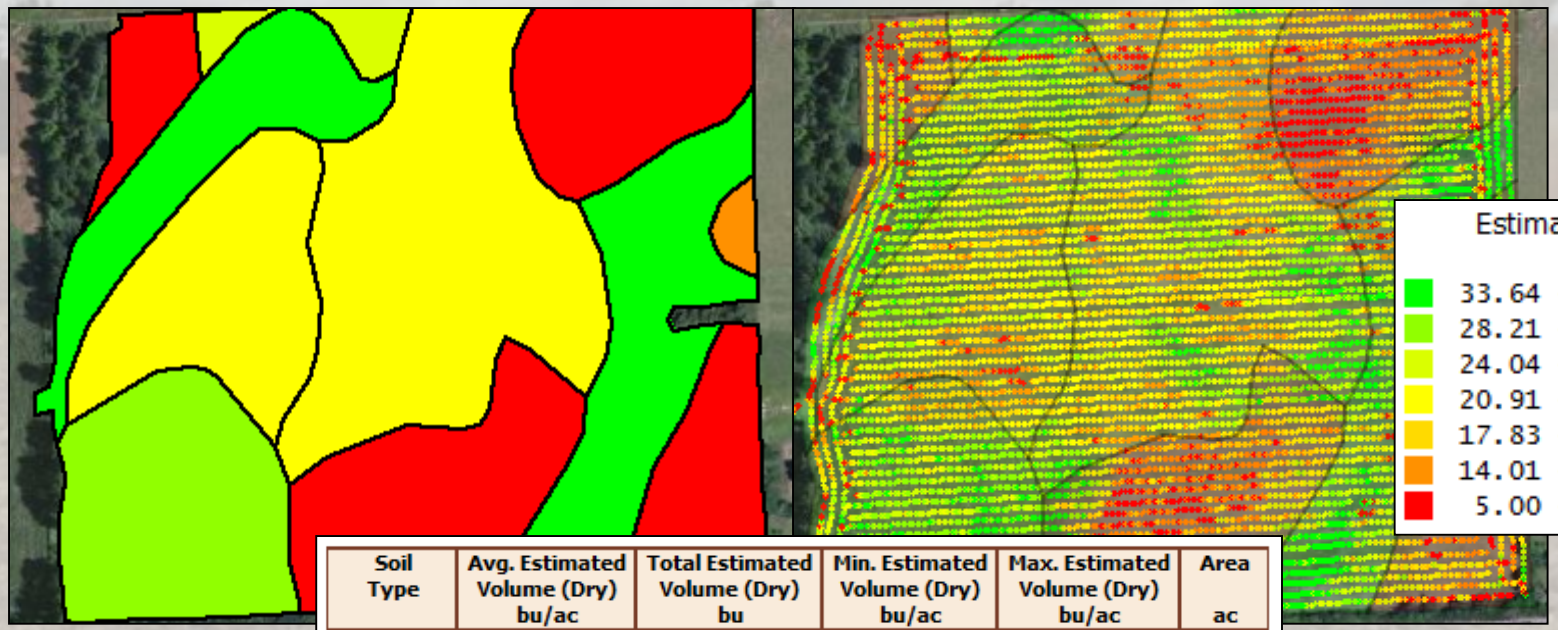
Examples

- GIS can be used to analyze multiple field data layers to separate out unknowns within field
- Did soil type, texture, or slope affect our production



Soil Type	Avg. Estimated Volume (Dry) bu/ac	Total Estimated Volume (Dry) bu	Min. Estimated Volume (Dry) bu/ac	Max. Estimated Volume (Dry) bu/ac	Area ac
Boelus	24.13	1,092.7	7.119	89.82	45.29
Crofton	28.17	330.58	16.62	49.63	11.74
Doger	23.83	38.59	15.54	38.87	1.619
Longford	22.72	545.19	11.32	34.07	24.00
Loretto	29.12	112.74	14.41	39.95	3.872
Paka	46.45	3.031	45.47	49.69	0.065
Thurman	16.88	429.95	5.563	35.76	25.48
(All)	**22.78**	**2,552.8**	**5.563**	**89.82**	**112.06**

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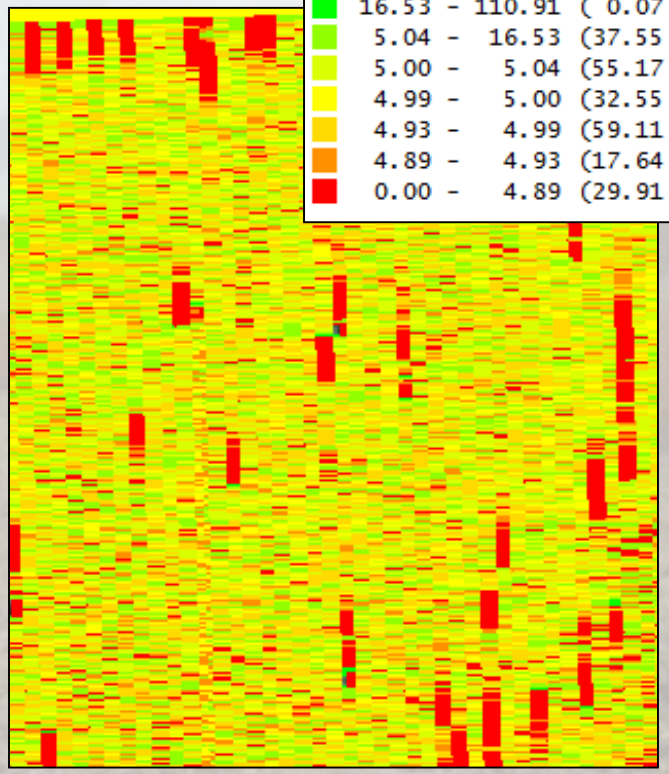
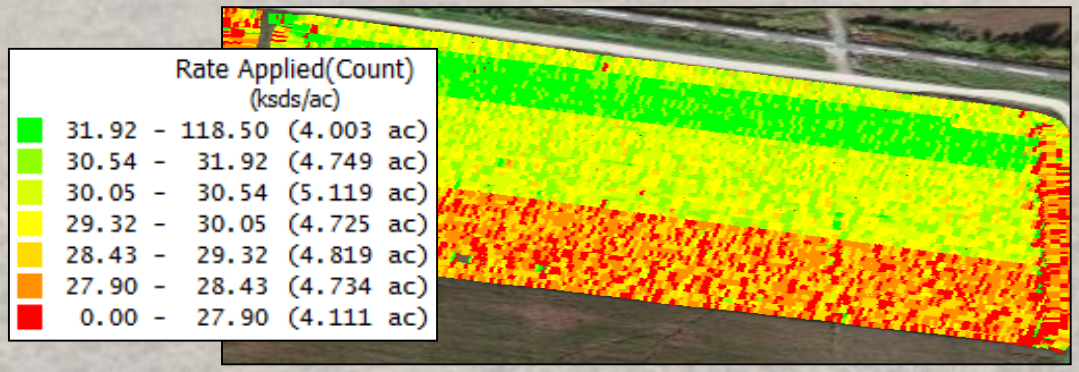
Examples

- Tracking as-applied data can be used to help evaluate field research and record keeping
- GIS analysis can help to separate out unintended “treatments” in the data
- Were natural factors involved?
- Did we unintentionally affect the plots in any other ways?





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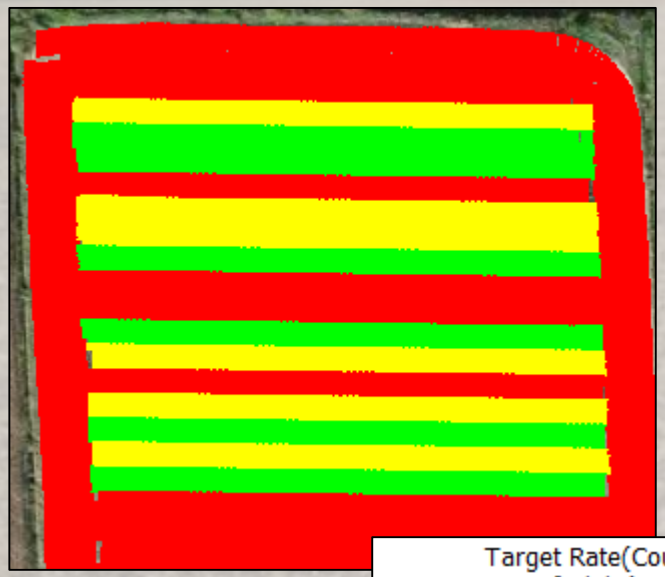
Examples

- Precision Ag technologies to help with study setup and to ensure that our data provides useful and correct information
- Study design is critical in every case



Target Rate(Count)
(ksds/ac)
40.00 (2.619 ac)
36.00 (2.621 ac)
32.00 (25.972 ac)

Target Rate(Count)
(ksds/ac)
32.00 (4.95 ac)
30.00 (13.73 ac)
28.00 (13.58 ac)

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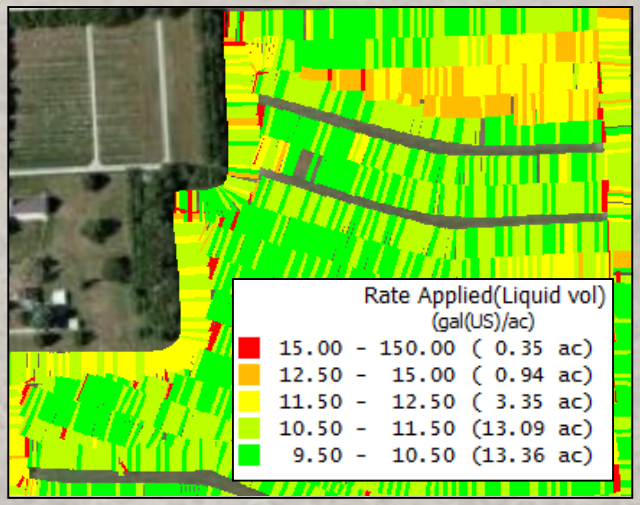
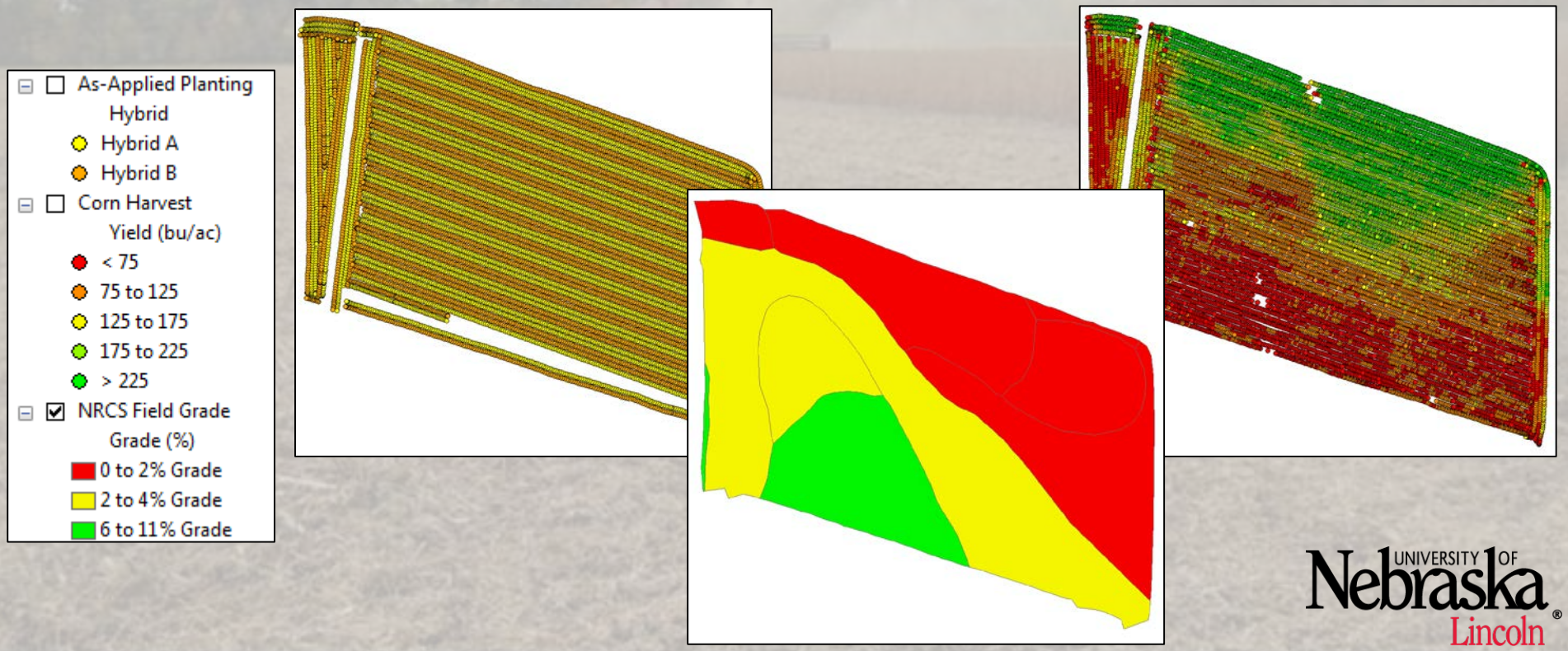
Examples

- We can now track our prescriptions for different products (seed, fertilizer, pesticides)
- Comparisons with as-applied data will allow us to determine where improvements can be made in our operations
- Operator training/technology development will benefit from this information



Furthering GIS Analysis

- GIS analysis provides the opportunity to get more from the data
- In this example, we have as-applied split-planter hybrid, NRCS soil grades, and yield monitor data



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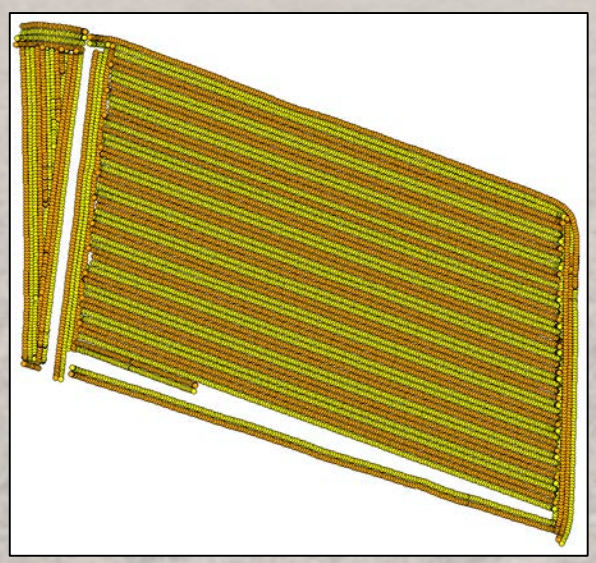
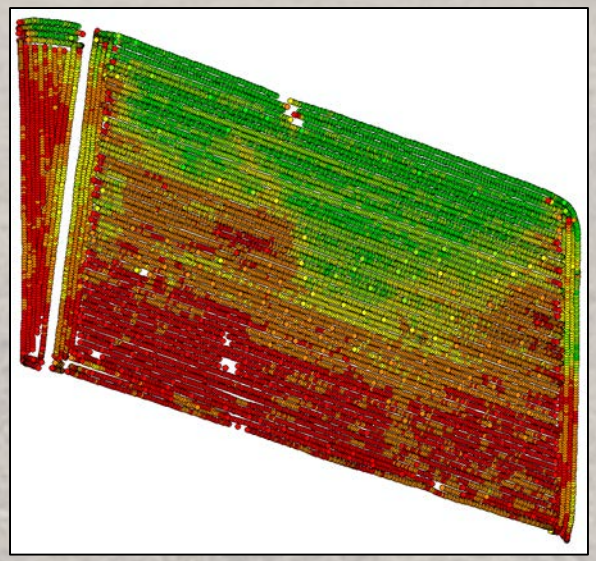
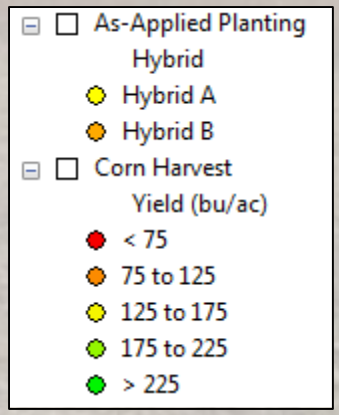
Furthering GIS Analysis

- A preliminary analysis would tell us that yield versus hybrid was:
  - Hybrid A = 137 bu/ac
  - Hybrid B = 135 bu/ac
- Is there more information we can get from these data?







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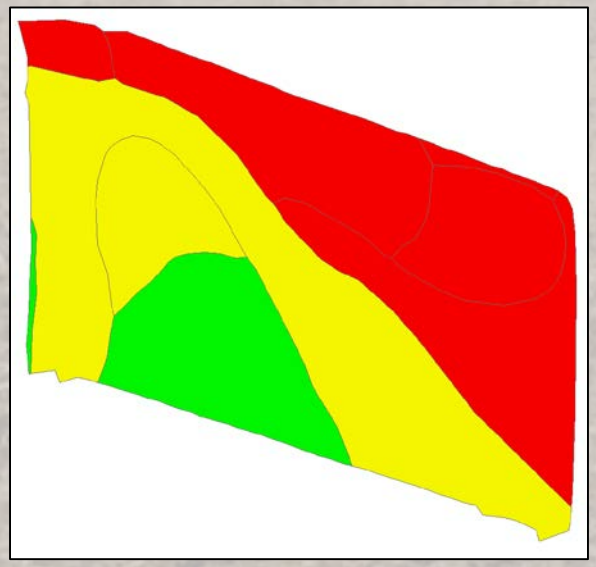
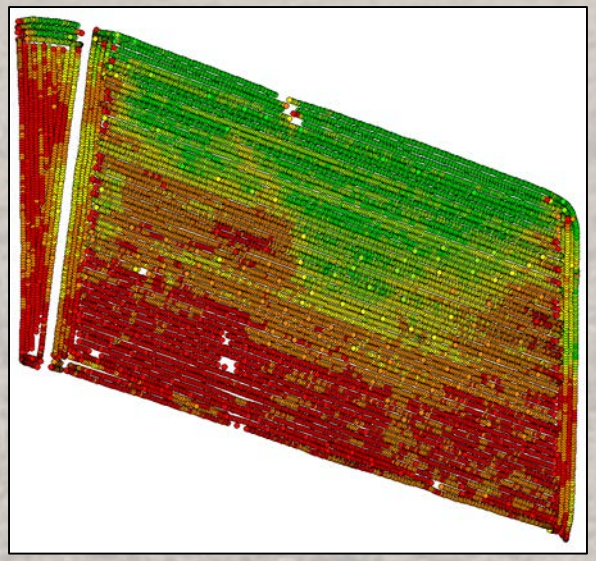
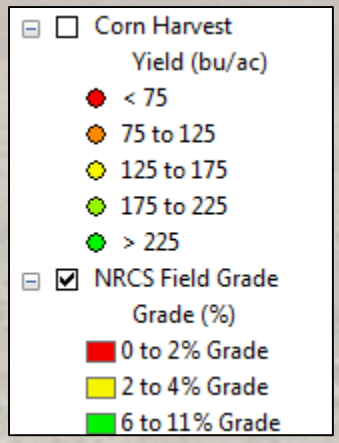
Furthering GIS Analysis

- Overall yield versus NRCS soil grade estimates would lead us to conclude that:
  - 0 to 2% Grade = 188 bu/ac
  - 2 to 6 % Grade = 89 bu/ac
  - 6 to 11% Grade = 58 bu/ac
- Surely there's more we can find???







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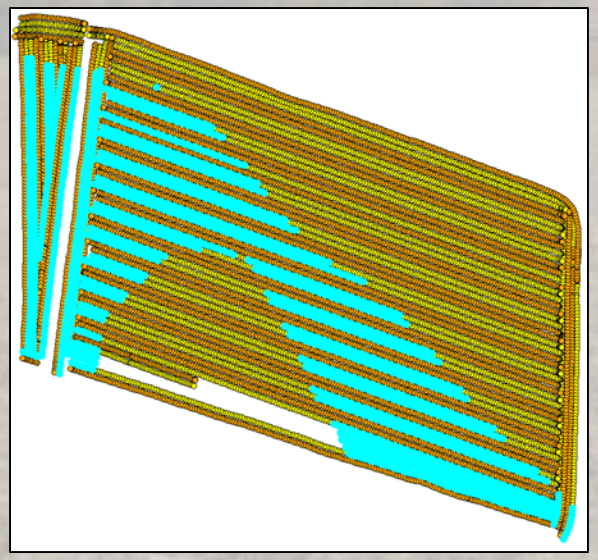
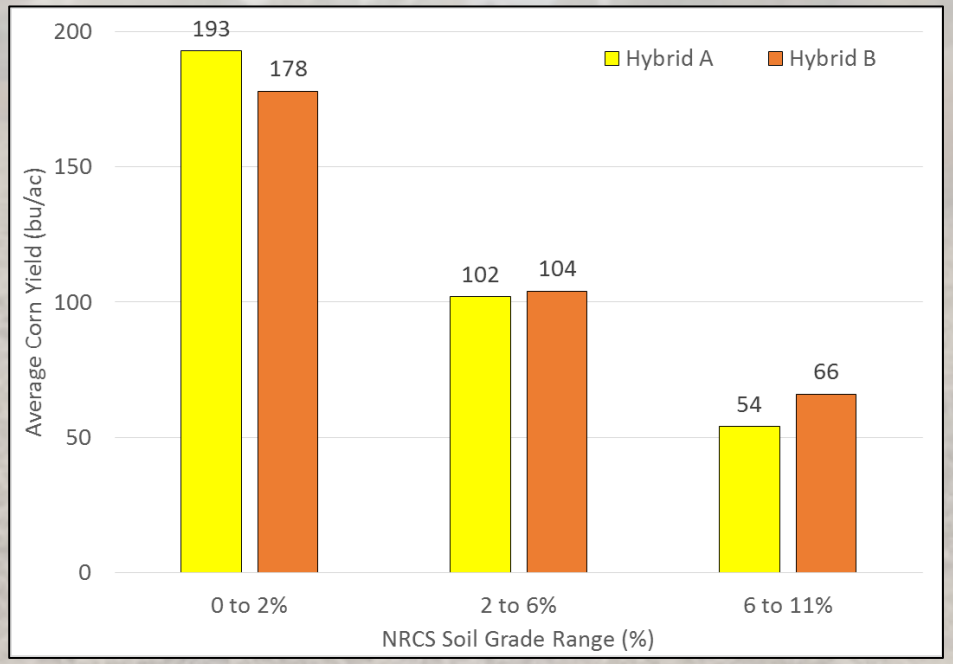
Furthering GIS Analysis

- Furthering the analysis, we can separate Hybrid versus NRCS soil grade to look at yield, which would show:
- Separating these variables with GIS provide more information…what other layers could we use?



Hybrid A planted within NRCS Soil Grade 2 to 6%



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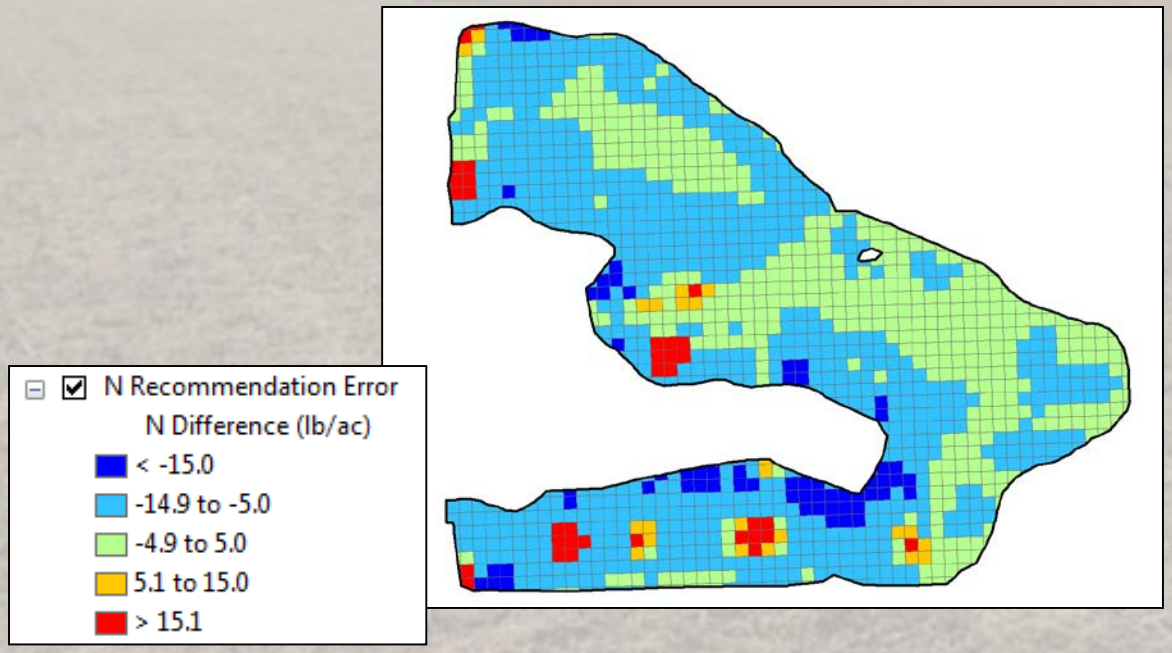
Data Quality

- Poor data into any analysis leads to poor information gained
- This can include future evaluations or prescription development
- Example of yield data errors on N rate predictions:



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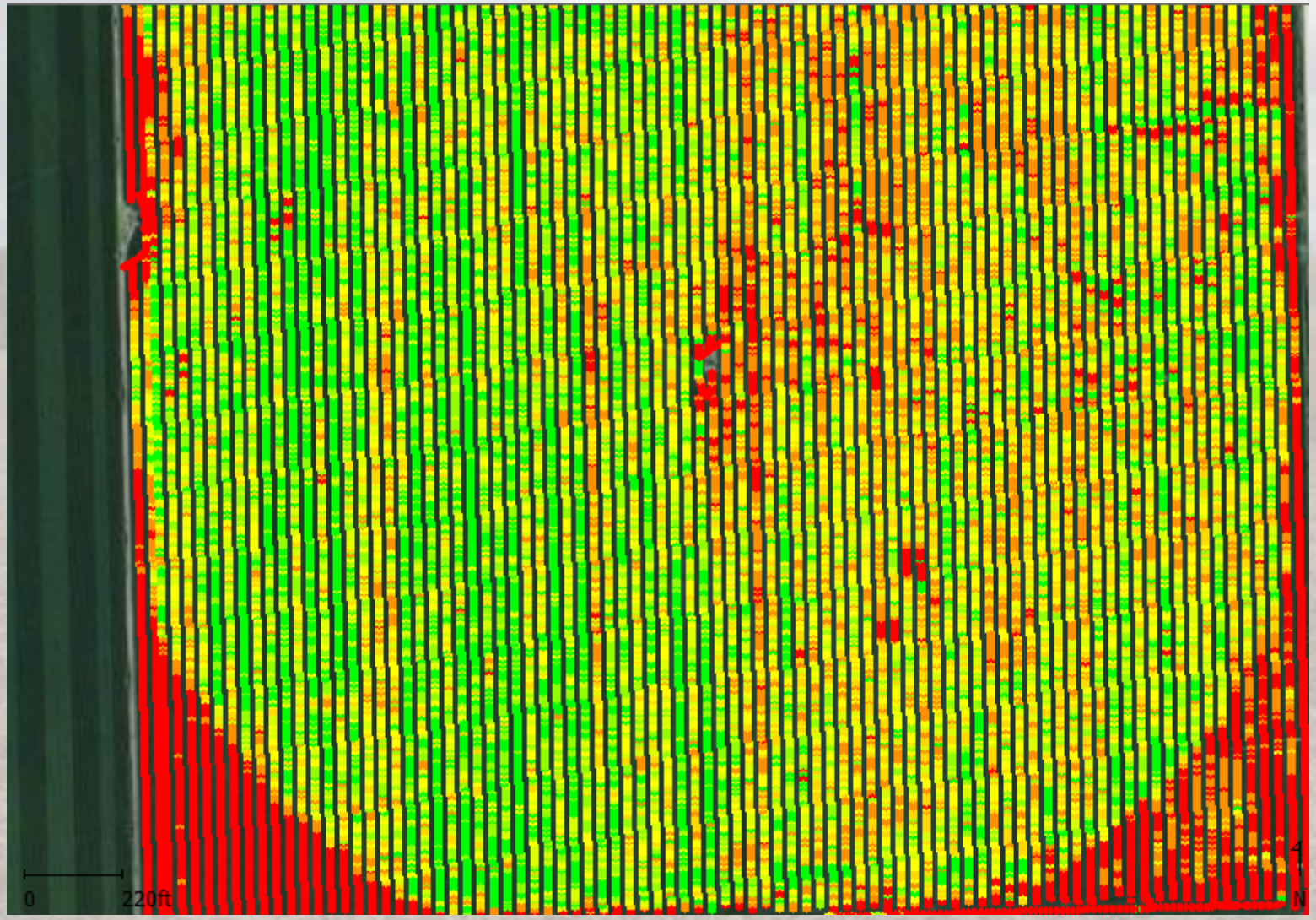
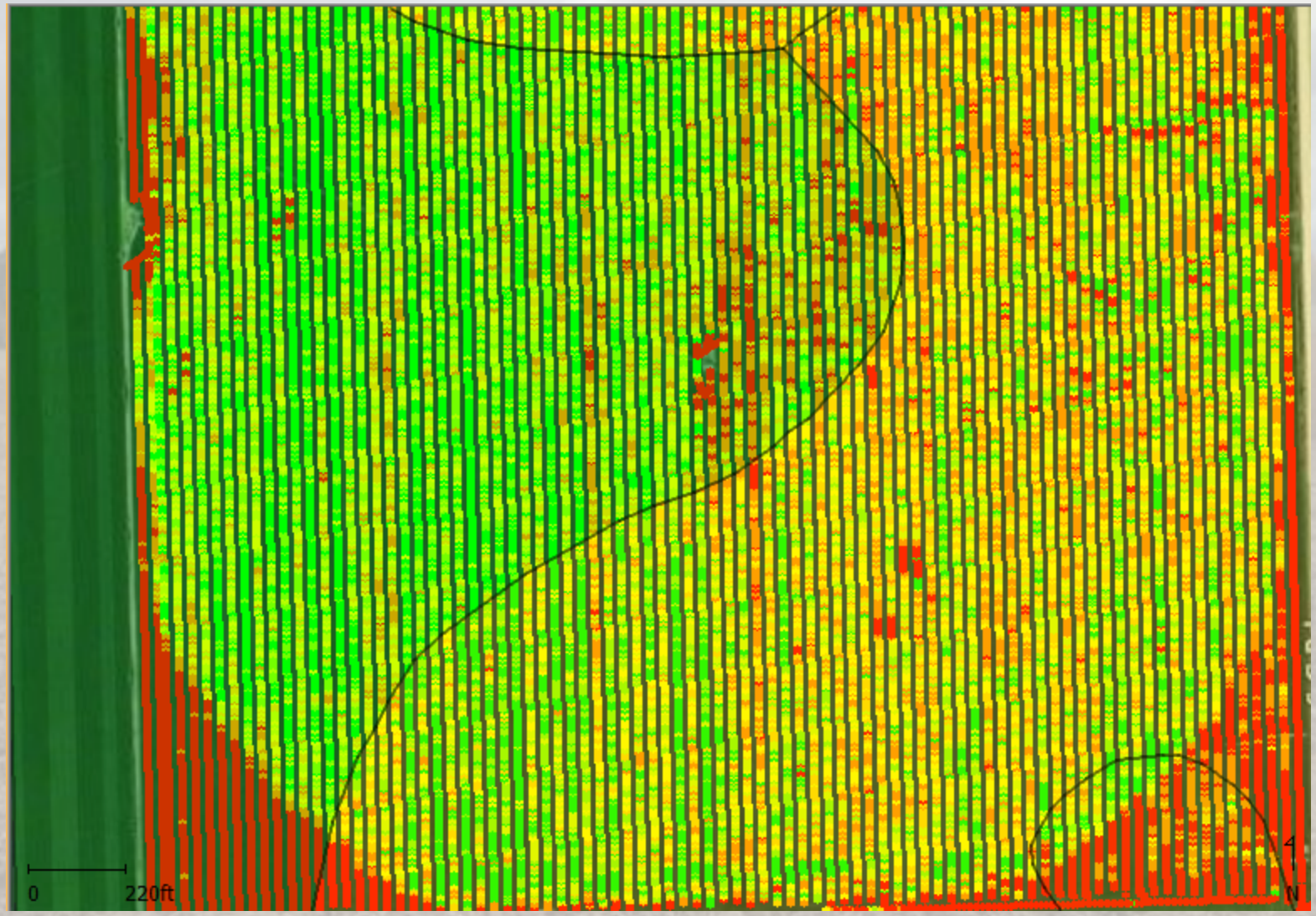
Future Data Analytics:



Dataset Overlay for Spatial Analysis



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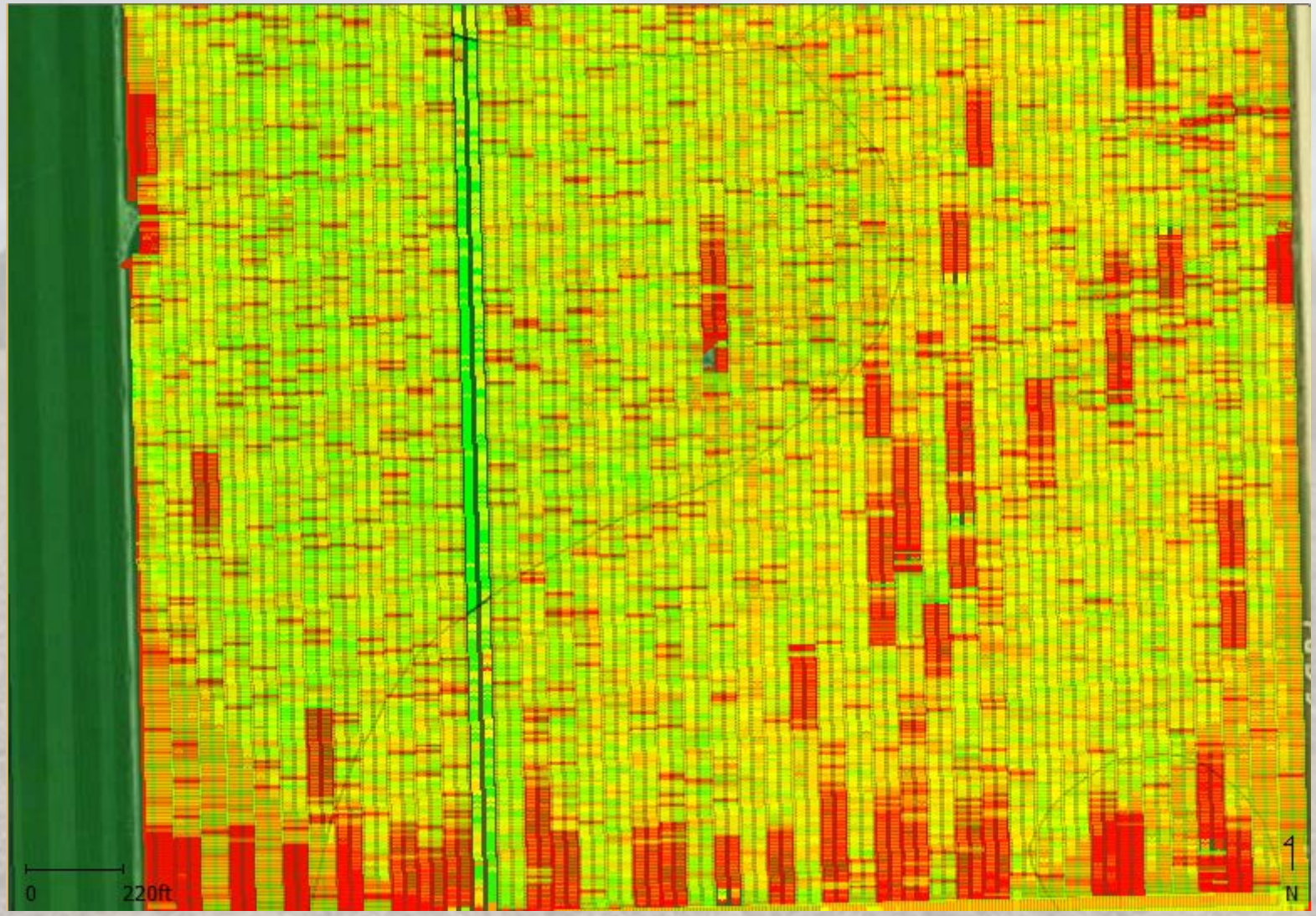

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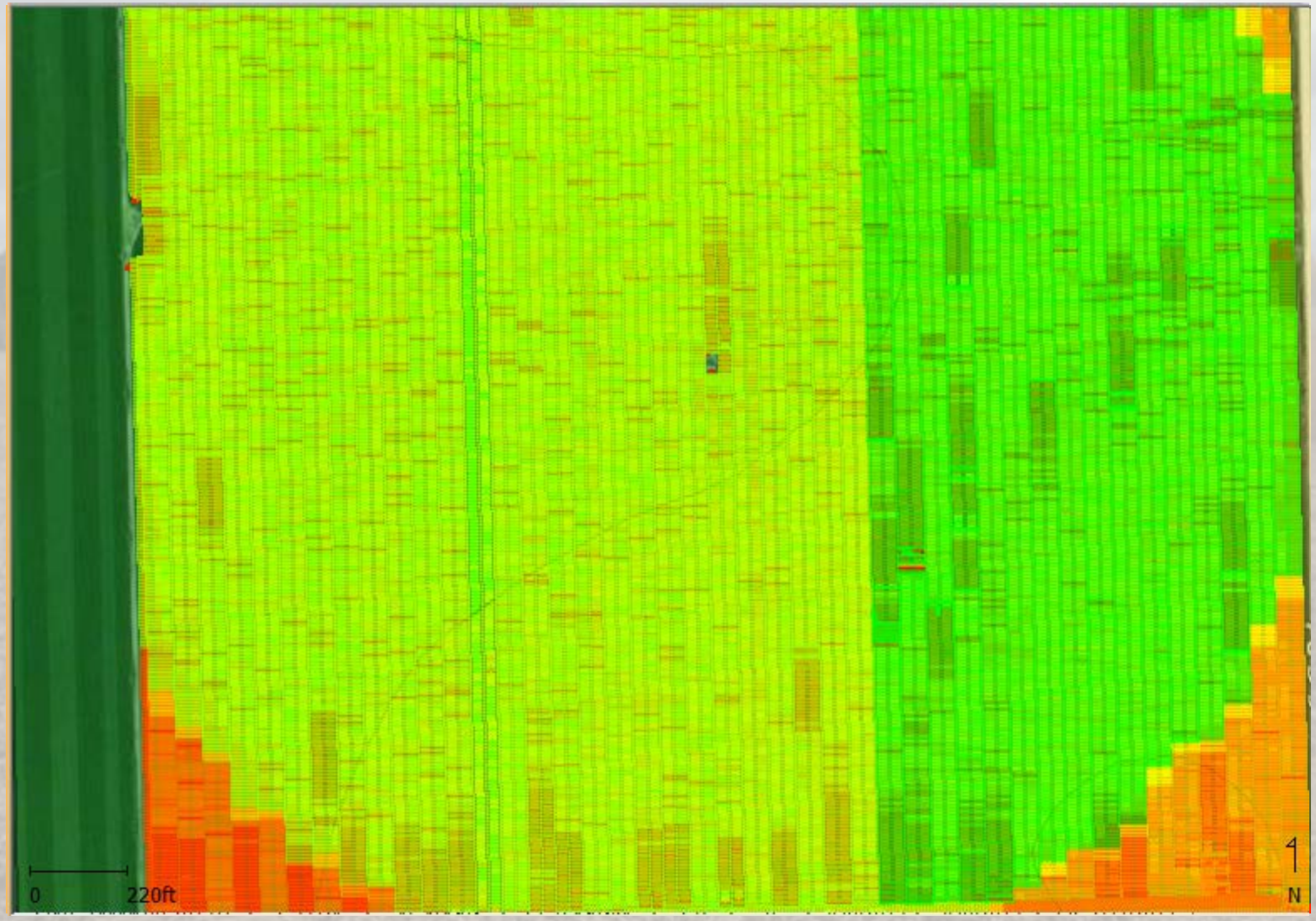
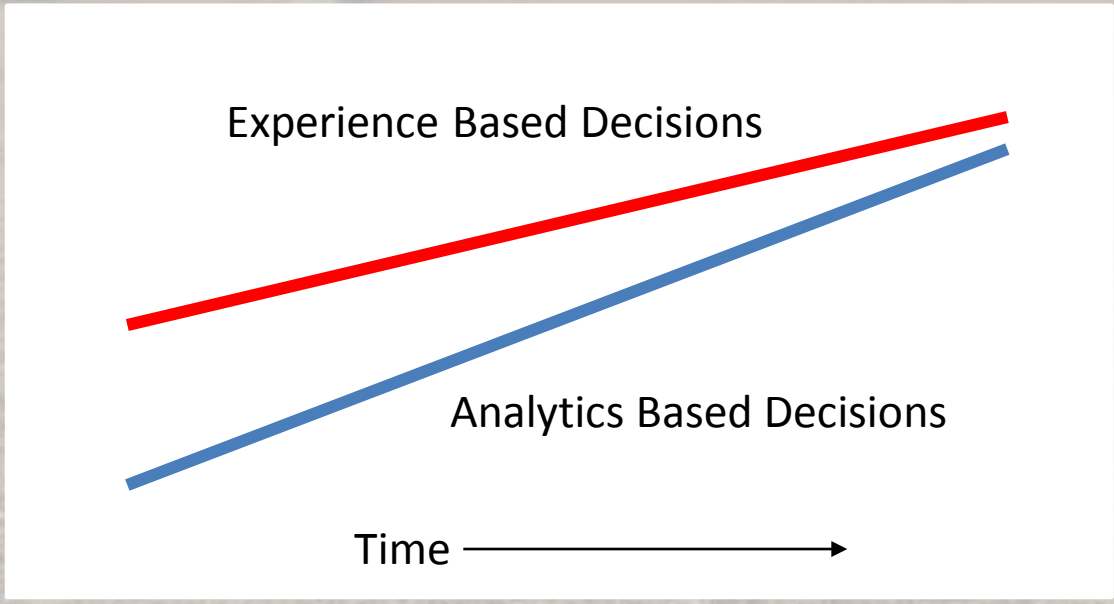


Precision Technology: Coming up

- Harnessing all of these data sources will be difficult for individuals
  - Weather forecasting
  - Remote sensing data (satellite, UAVs)
  - Crop growth modeling
  - In-season sensing from field equipment
- Enrolling in cloud-based data management programs may be necessary for sufficient data analytics tools
- This has been a one reason for the recent discussions on data ownership and usage

Precision Technology: Coming Up

- This may or may not provide good information…depends on what you're looking to change in certain operations and what your management capabilities are
- Decision support tools are lacking, but decisions will likely be increasingly based on ag data analyses



Summary

- Using Precision Ag technologies and GIS software, we can perform analyses based on our own operations
- Equipment setup, calibration, and monitoring is critical for good data
- Proper analysis methods and research trial setup is important: http://cropwatch.unl.edu/farmresearch
- Learning how to conduct proper analyses is also important: http://cropwatch.unl.edu/ssm

Thank you very much!

Please let us know if you have questions!

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