Web GIS in Agriculture
Land Use, Crop Management and Planning

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Two Case Studies

Two Custom Developed Web Applications
Both Integrate different technologies
Primary Requirement >>> 100% Web Based

1) Real-time Harvester Tracking and Yield Monitoring

2) Field Data Management & Fertility
Technology Platforms

- ArcGIS Server
  - map services, geoprocessing services, image services
- Esri JavaScript API
- MS SQL Server and SQL Spatial
- Esri base maps and imagery
- Spatial Analysis
- Can be integrated with ArcGIS Online/Portal
Case Study 1: Real Time Harvest Tracking

Custom GIS solution for tracking harvesters and aggravating harvested acres and yield across multiple growers and farms
Case Study 1: Real Time Harvest Tracking

Coop tracks growers harvesters in real time to predict yield and monitor harvest progress

- Aggregates multiple growers and farms
- Completely web-based, no software install.
- Map services and data services with ArcGIS Server
- Web based reports available on desktop or mobile device
- All data securely stored in relational databases

Harvester + GPS Tracking Device & Sensors + Data Processing + Data Visualizatio n(Web GIS)
Case Study 1: Real Time Harvest Tracking

- 50+ harvesters with GPS tracking devices
- Machine independent. Solar powered units work on any harvester
- Require cell connectivity
Case Study 1: Real Time Harvest Tracking

- Database algorithms calculate harvested acres
- Eliminate turns, high speed, etc.
Case Study 1: Real Time Harvest Tracking

- Web maps display real-time progress
- Harvester progress merged with yield rates and tare for QC
Case Study 1: Real Time Harvest Tracking

- Reporting Dashboard >> acres and yield aggregated at field, region, and corporate levels.
Harvest Tracking > Summary and Challenges

End of season accuracy +- 3.5%

- **Margin of error in acres caused by:**
  - Slight GPS precision loss from diminishing solar power
  - Incorrect tracking unit installation
  - Non-linear harvesting around complex field boundaries

- **Old and new database technology challenge:**
  - mainframe vs. GIS and RDMS
- **Time and manpower to police tracking devices**
Case Study 2: Field Data & Fertility Management

Custom GIS solution mapping field, fertility analysis, and prescriptions.
Case Study 2: Field Data & Fertility Management

Solution: Field Analyst

- Simple to use web GIS driven solution for field mapping
- Use Esri platform
- Scalable GIS solution for managing and analyzing field data so growers can optimize soil treatments and yields
- Map more acreage per year
- Unlimited data analysis
Case Study 2: Field Data & Fertility Management

Primary Project Driver >> **Data**
Growers want ownership and control of their data

My Farm
My Data
Case Study 2: Field Data & Fertility Management

• Store and manage field data
  - Client > Farms > Fields meta-data
  - Boundaries
  - Sample points
  - Management Zones
  - Yield
  - EC
  - Imagery

• Generate Soil Fertility Maps
• Surface interpolations and managements zones
• Create Lime and Fertilizer Prescriptions
• Create Crop Zones and boundary splits online
• Manage Crop Plans and fertilizer rules
Case Study 2: Field Data & Fertility Management

- Greatly enhances ability to report and analyze data
- Online maps and tools for sharing and processing data from anywhere
- Electrical conductivity (EC) maps
- Create yield maps and analyze yield data
- Create management zones from soil surveys, NDVI, yield data
- Register maps and layers with your AGOL or Portal
- Spatial analysis - correlation between yields, soil nutrients, soil types, varieties, populations, lime and fertilizer year by year.
Case Study 2: Field Data & Fertility Management

Drawbacks to rigid COTS products for field management:

- Independent providers don’t own their data.
- GIS data stored proprietarily, difficult to use with ArcGIS.
- Difficult to customize
- Prescriptions & treatments often require significant manual editing
- Too many features
- Some systems antiquated – run on a 32-bit computer
- Limited spatial analysis and ad-hoc mapping features
Case Study 2: Field Data & Fertility Management

Fertility Reports

**DamascusBigField: 16 (115.6 ac.) - 2016 Soil Samples - pHw**

- **Client:** John Doe
- **Farm:** damascustarn
- **Field:** DamascusBigField
- **Total Acres:** 115.6
- **Date:** 7/15/2016

**Soil Test pH**

- **Observations:** 41
- **Minimum:** 5.9
- **Maximum:** 7.2
- **Average:** 6.3

**DamascusBigField: 16 (115.6 ac.) Lime Recommendation**

- **Client:** John Doe
- **Farm:** damascustarn
- **Field:** DamascusBigField
- **Total Acres:** 115.6
- **Date:** 7/15/2016

**Product:** Lime
- **Min Rate:** 700
- **Max Rate:** 2295
- **Avg Rate:** 12/29
- **Total Lime (tons):** 36.1
- **Acres to be Applied:** 78.1
Case Study 2: Field Data & Fertility Management

Drag and Drop GIS data and lab data for upload

Upload Spatial Data
Upload field boundaries, sample points, and lab data.

1. Select Client, Farm and Field
Select client or Add new Client.
Oak Hill

Select Farm or Add new Farm.
Oak Hill Farms

Select Field or Add new Field.
Electric System West
Electric System East
KB Cow Pen North
Ray Rayburn

Upload Lab Data
1. Upload Lab CSV File
NOTE: Spatial data (shapefile for sample points or management zones) must already be uploaded for the samples. If necessary, please go to Spatial Data Upload to upload your shapefile.

Lab CSV File Upload
Drag & drop a CSV file within the dashed box, or click Select CSV File.
File extension must be .csv
Maximum file size: 4 MB.

Select CSV File

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Case Study 2: Field Data & Fertility Management

Soil samples and nutrient data management
Create, view, edit lime and fertilizer prescriptions
Case Study 2: Field Data & Fertility Management

Edit Boundaries and Crop Zones online
Field Analyst Project > Summary and Challenges

- Data is the biggest commodity
- Data = high value to apply analytics
- Storing data optimally is critical (database design)
- Technologists & agronomists must work closely together
  - GIS & programming experts are not agronomists… and vice versa
- Fundamentally a workflow exercise
- Surface interpolation method debates
Thank You!

Contact us with any questions!

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