DIGITAL MAPPING TECHNIQUES 2015

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Secrets of STATEMAP: Florida's Experience in Standardizing GIS Workflows for Year-to-Year Efficiency in Geologic Mapping

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In August of 2010, the Florida Geological Survey's (FGS) STATEMAP program added its first full-time GIS staff member. After this addition, STATEMAP began a multi-year process of iterative needs and workflow assessments in an effort to streamline map production and to increase the year-to-year efficiency of its staff in geologic mapping. The focus of the workflow assessments concentrated on improving three key areas: the initial project setup, the development of a digital system for field data acquisition, and streamlining the production of the final map. These efforts have been a great success, with the STATEMAP team successfully doubling the area mapped per year and seeing a concomitant rise in receiving competitive USGS STATEMAP federal funding: the FGS STATEMAP team formerly fell in the middle of the pack in terms of the funds awarded each year by the USGS and has since become one of the top 5 most funded STATEMAP programs in the nation.

In order to streamline the initial project setup for each STATEMAP project, the STATEMAP team developed an ArcGIS model called "ProjectCreator" that draws upon a standardized, master database of GIS data needed throughout the project year. The ProjectCreator model – and the standardized database it draws from – produced two efficiency gains in the mapping teams' productivity. First, the time required to complete the tedious, repetitive work of clipping statewide data layers to a particular project area has been reduced from several weeks of staff time to less than an hour. Second, by standardizing the inputs into each project, the ProjectCreator model has resulted in a more standardized data structure within the final STATEMAP product produced at the end of the year.

Another area of focus was the development of a digital field data acquisition system in ArcPad. This system was built almost entirely with parts surplused by other programs within the Florida Department of Environmental Protection and using software licenses already owned by the FGS. A suite of custom tools was built within ESRI's ArcPad software environment, with shortcuts linked to a Logitech G13 gaming keyboard. The combination allows FGS staff to very quickly attribute new field data while conducting fieldwork from a moving vehicle, and removes the need to dedicate a staff member to digitizing hand drawn notes on 1:24,000 USGS field quads. The new field data acquisition system has allowed for a fivefold increase in the data recorded by FGS field teams, including ancillary data such as accessible private properties that,

while not directly related to the geology of an area, provides direct information about the study area that is extremely useful in developing a particular year's geologic map.

Finally, the FGS STATEMAP team conducted several workflow changes to streamline the process of each year's final deliverable. These changes included: swapping out layer files for geodatabase representations in order to maintain a single, easy-to-use source of symbology definitions, streamlining label production as native ArcGIS annotation feature classes rather than text labels within an MXD file, using the Cartographic Refinement toolbox in conjunction with representations to speed up the process of finding and correcting labeling conflicts, and using topologies and topologic rules to ensure the integrity of the data produced by the FGS STATEMAP team.

Most of these advancements and refinements were relatively easy and low-cost to implement, and illustrate the simple fact that GIS staff can increase the efficiency of traditional geologic staff significantly. Added efficiency in the field produces a team that is actively looking to map more area each year. Mapping more area each year can lead to increased USGS funding as productivity gains are steadily implemented and realized by a geologic mapping team.

Florida Department of Environmental Protection

Florida Geological Survey

Secrets of Statemap:

Florida's Experience in Standardizing GIS Workflows For Year-to-Year Efficiency in Geologic Mapping

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Setting the Stage…

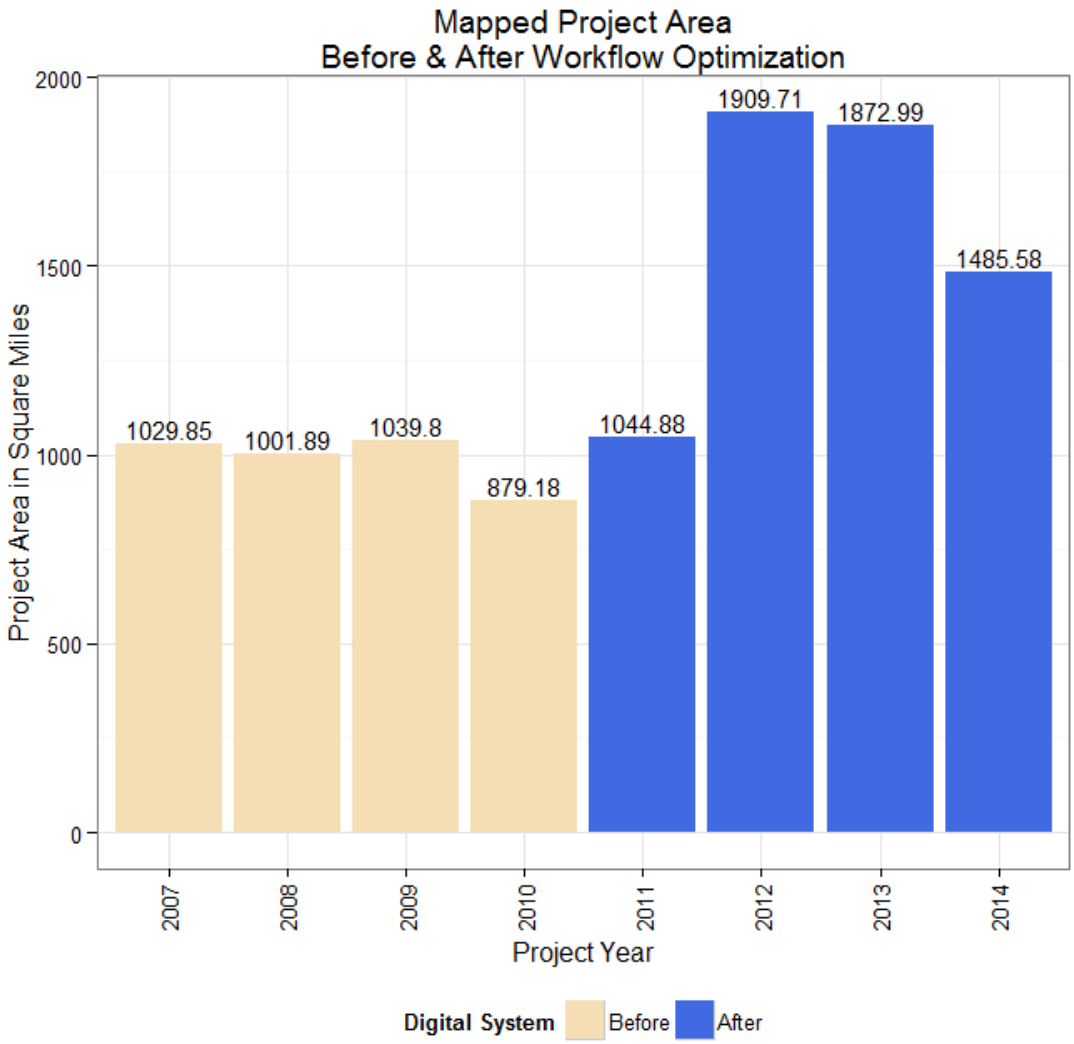
The Characters

- Seth Bassett
- Rick Green
- Levi Hannon

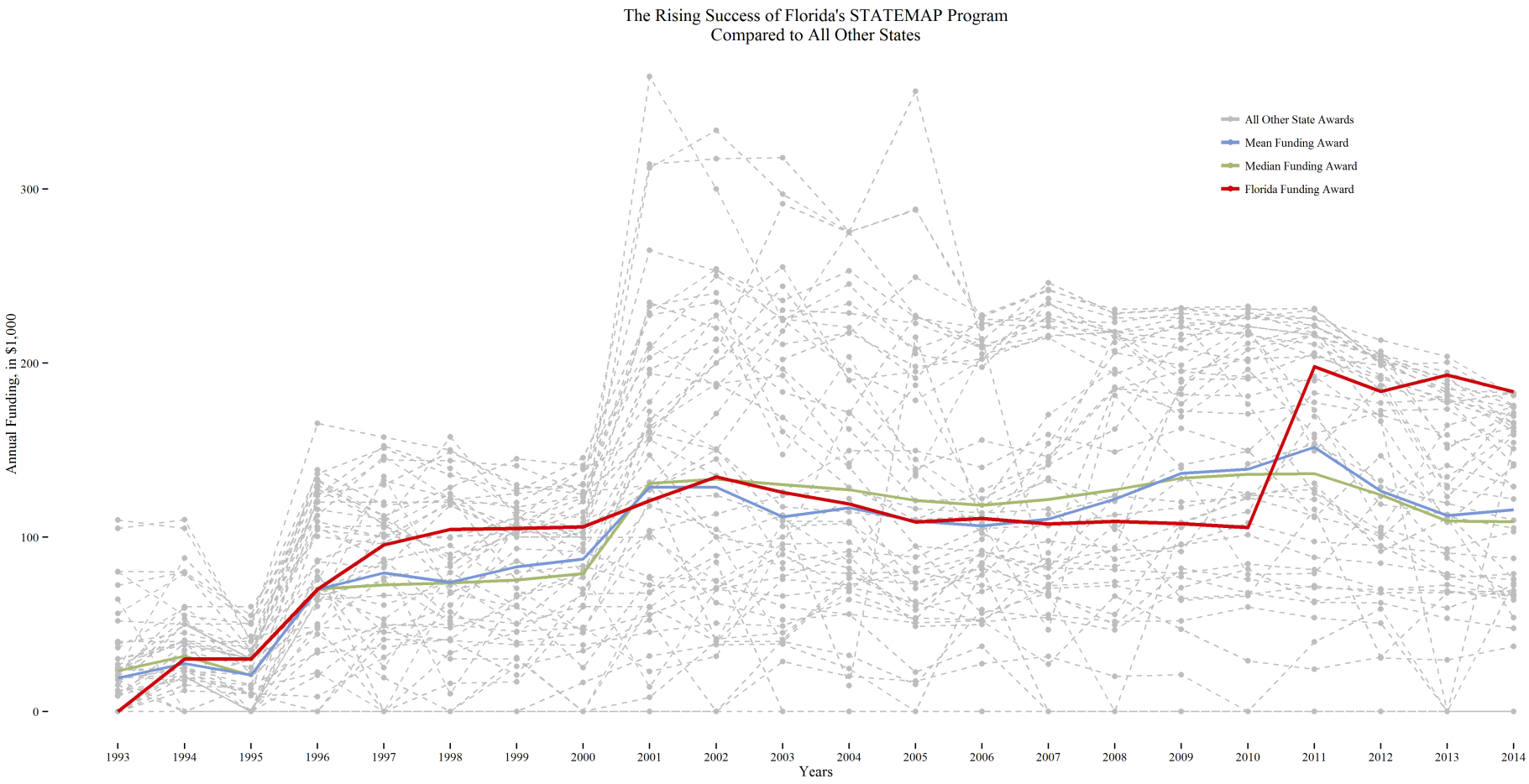
The Story

- STATEMAP Program added first full time GIS staff member in August of 2010
- Standardized map template & styles already developed
- Immediate Needs Assessment revealed three areas in need of improvement
  1. Project Setup
  2. Acquisition of Field Data
  3. Production of the Final Map
- Streamlining workflows produced immediate results in terms of efficiency and increased funding

Increased Efficiency



Increased Funding



The Final Product

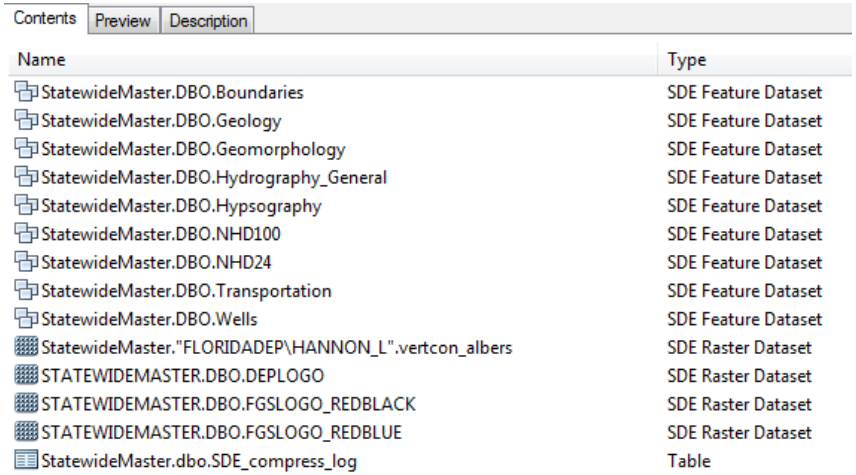
What we are working towards

Initial Needs Assessment:
Project Setup and Preparation

- Weeks invested in manual preparation of project from year to year
- Repetition of workflows
  - Clip
  - Merge
  - Dissolve
  - Development of cartographic shapefiles
  - .lyr management
- Ad hoc project structure

Master Database

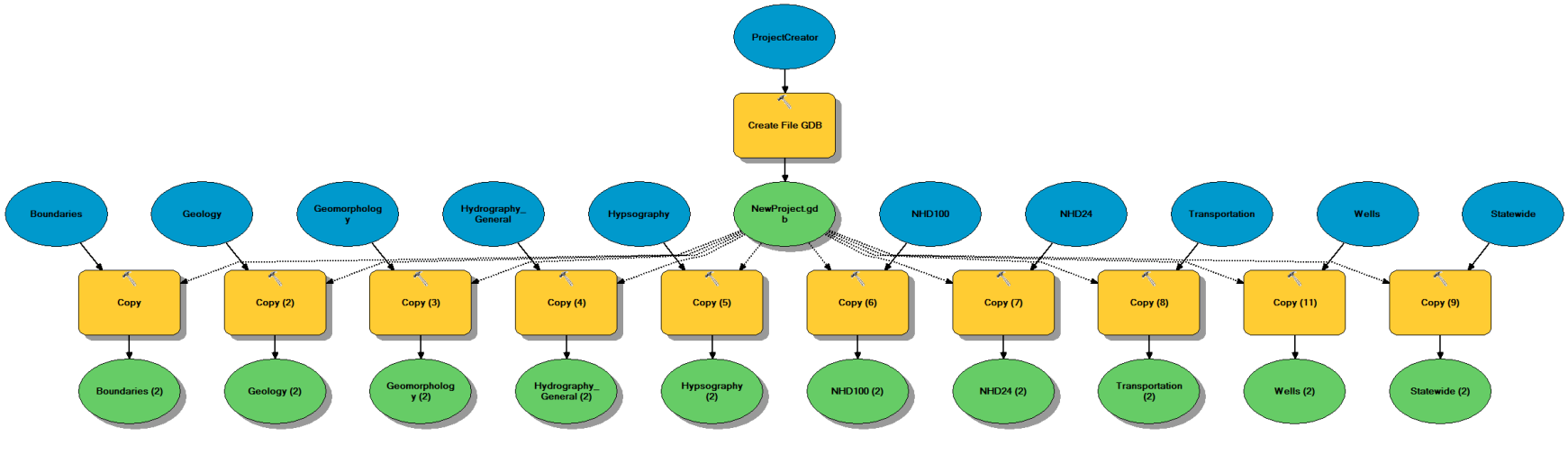
- Holds all relevant statewide feature classes
- Exists on SDE server (but could easily be a file geodatabase)
- Most feature classes have at least 1 representation for their “on the page” symbology
- Serves a standardized project template



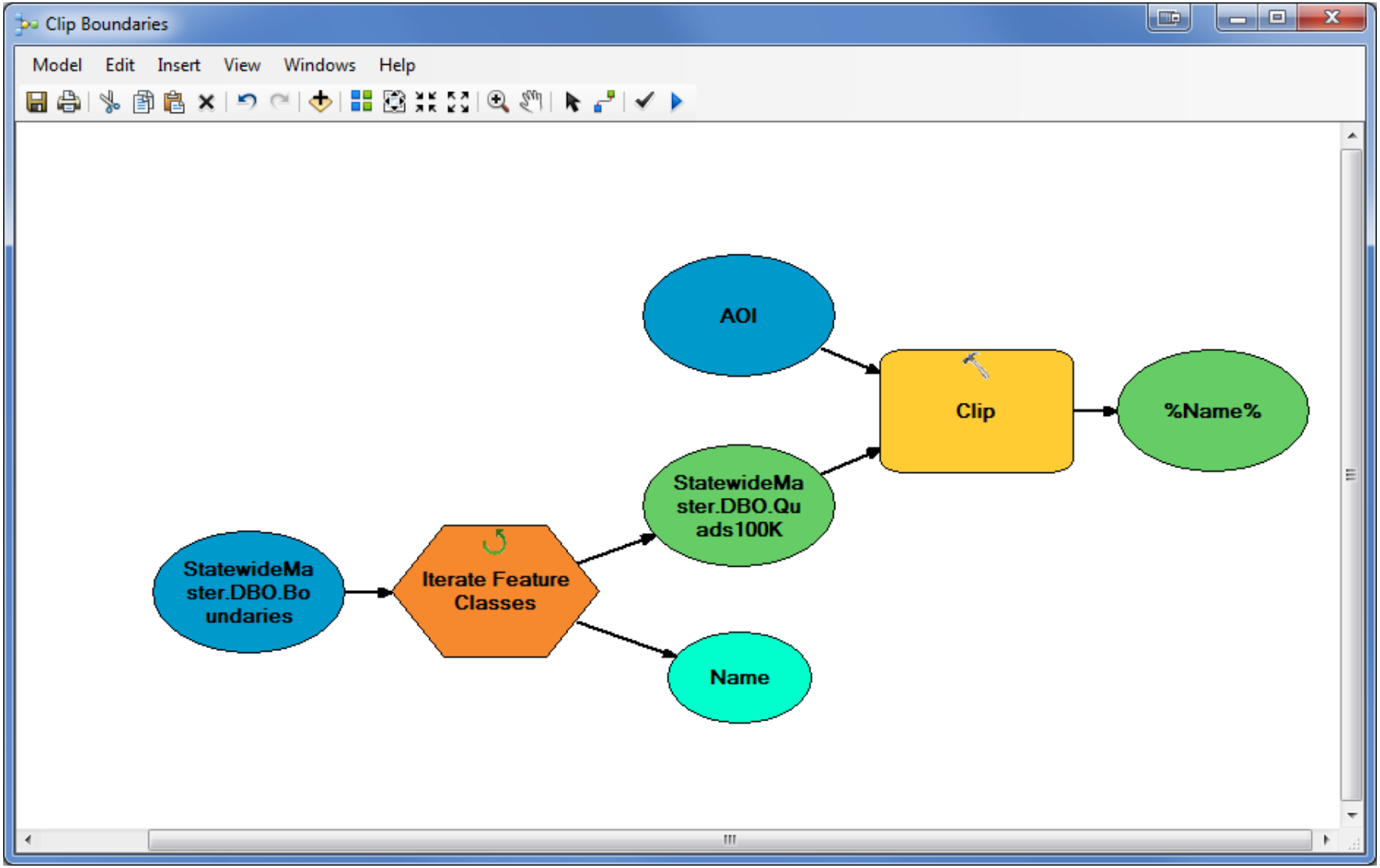
Project Creator Model

- Created in ArcGIS Modeler
- Proceeds in 3 steps:
  1. Copy a blank database template
  2. Set the Area of Interest
  3. Clip the feature datasets and copy individual items as necessary
- Nested and iterative

Project Creator Model

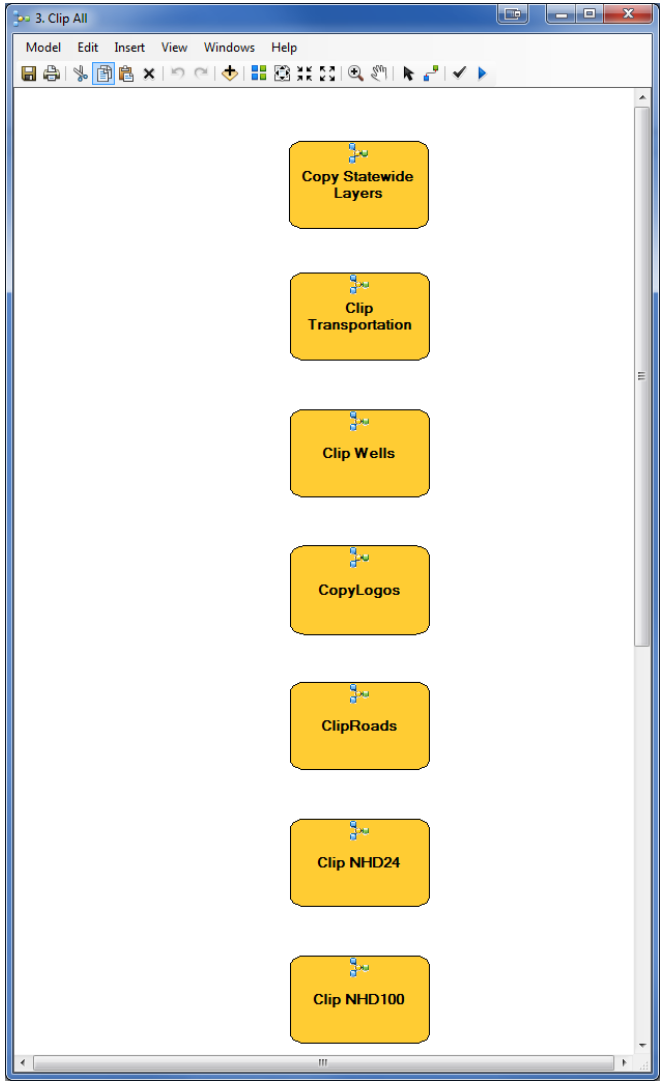


Project Creator Model



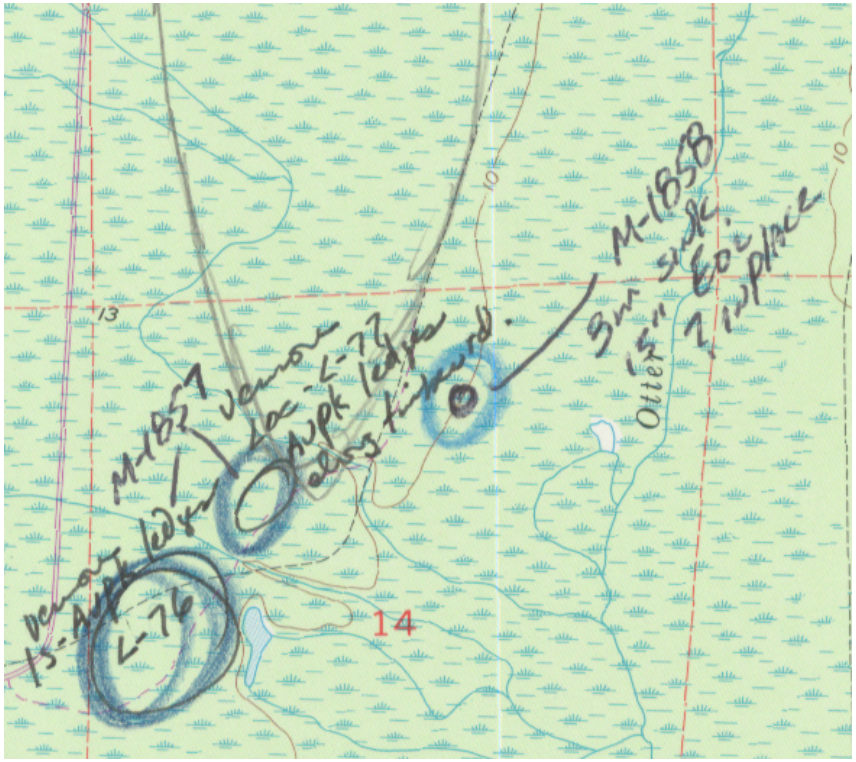
Project Creator Model

- ProjectCreator
  - ProjectCreator.gdb
    - Boundaries
    - Geology
    - Geomorphology
    - Hydrography_General
    - Hypsography
    - NHD100
    - NHD24
    - Statewide
    - Transportation
    - Wells
    - AOI
    - CreateProjectTools
      - 3b. ClipIndividuals
        - Clip Boundaries
        - Clip Geology
        - Clip Geomorphology
        - Clip Hydrography General
        - Clip Hypsography
        - Clip NHD100
        - Clip NHD24
        - Clip Transportation
        - Clip Wells
        - ClipRoads
        - Copy Statewide Layers
        - CopyLogos
      - 1. Create Blank DB
      - 2. Replace AOI with Feature Class
      - 3. Clip All



Initial Needs Assessment: Field Data Acquisition

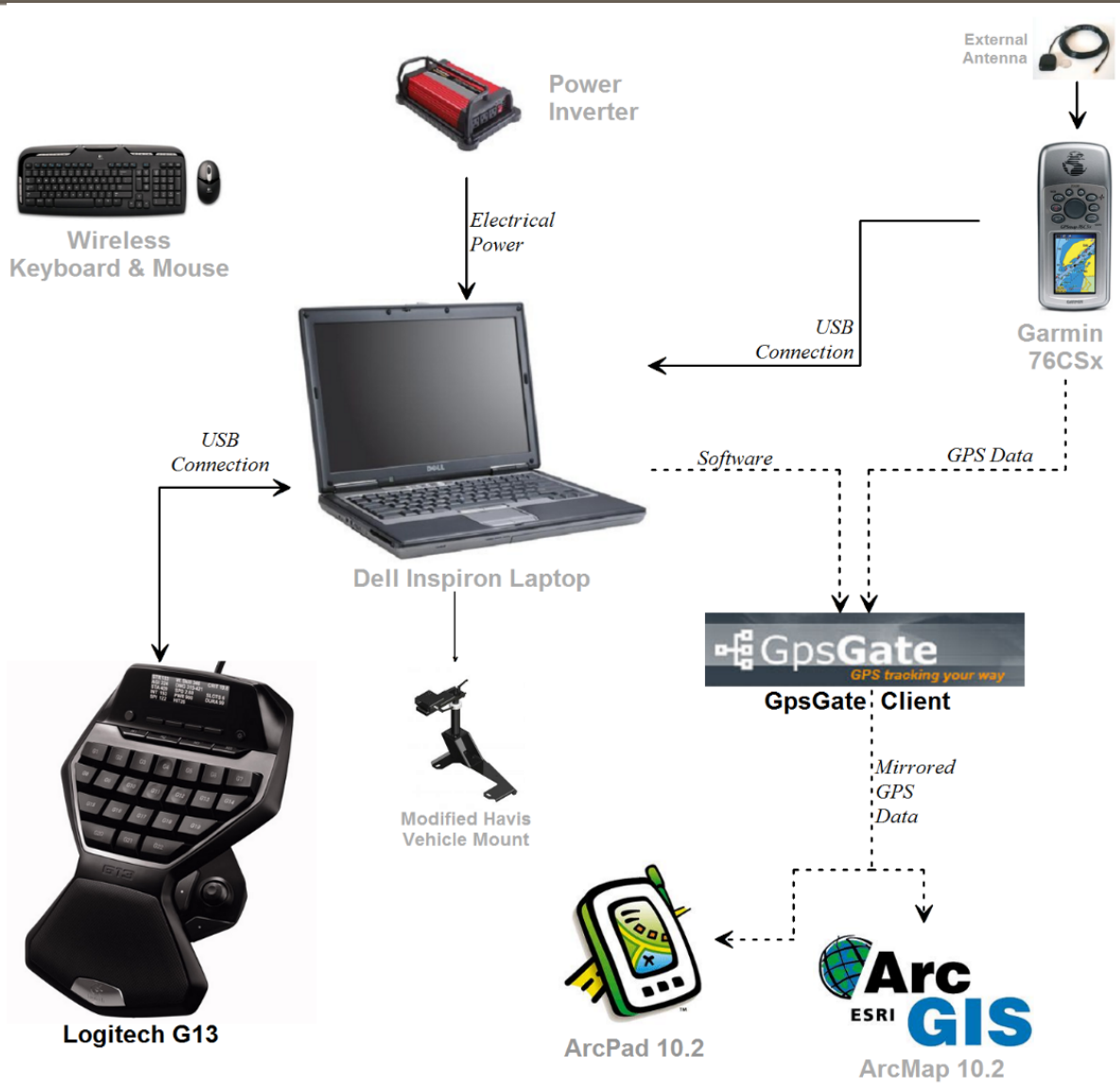
- Prior to streamlining workflow, fieldwork was completed using hand drawn notations on printed USGS 1:24,000 topo maps that were later digitized



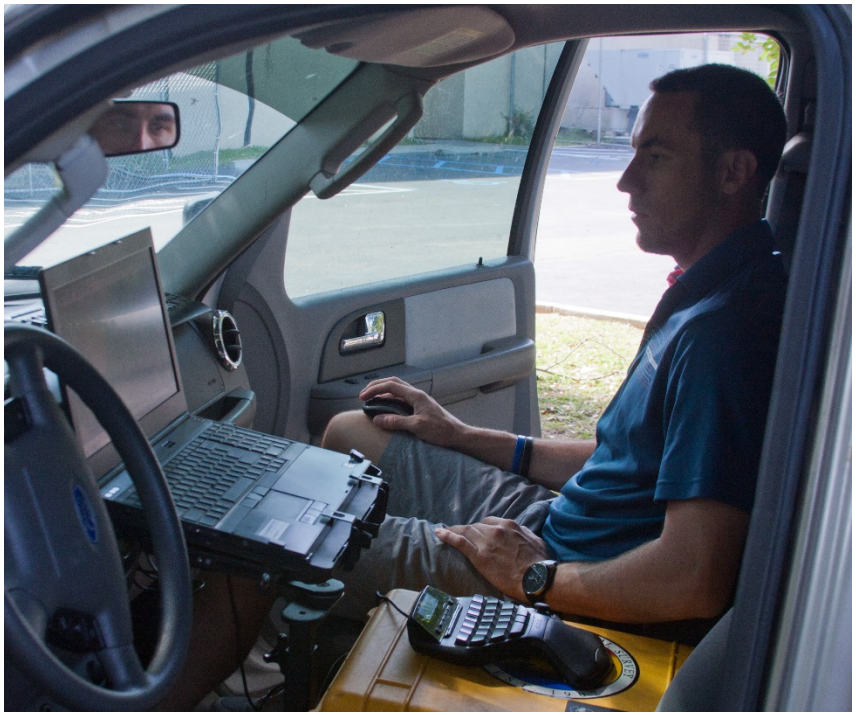
Design Criteria

- ArcMap is unsuited to use in the field
  - Complexity and frustration
  - Edit sessions
  - Lack of robustness
- A new solution was needed:
  - Customizable
  - Robust
  - Optimized for use in a vehicle
  - “Down to earth”
  - So easy a geologist can do it
    - “I want to be able to click a button and put a dot on the map”

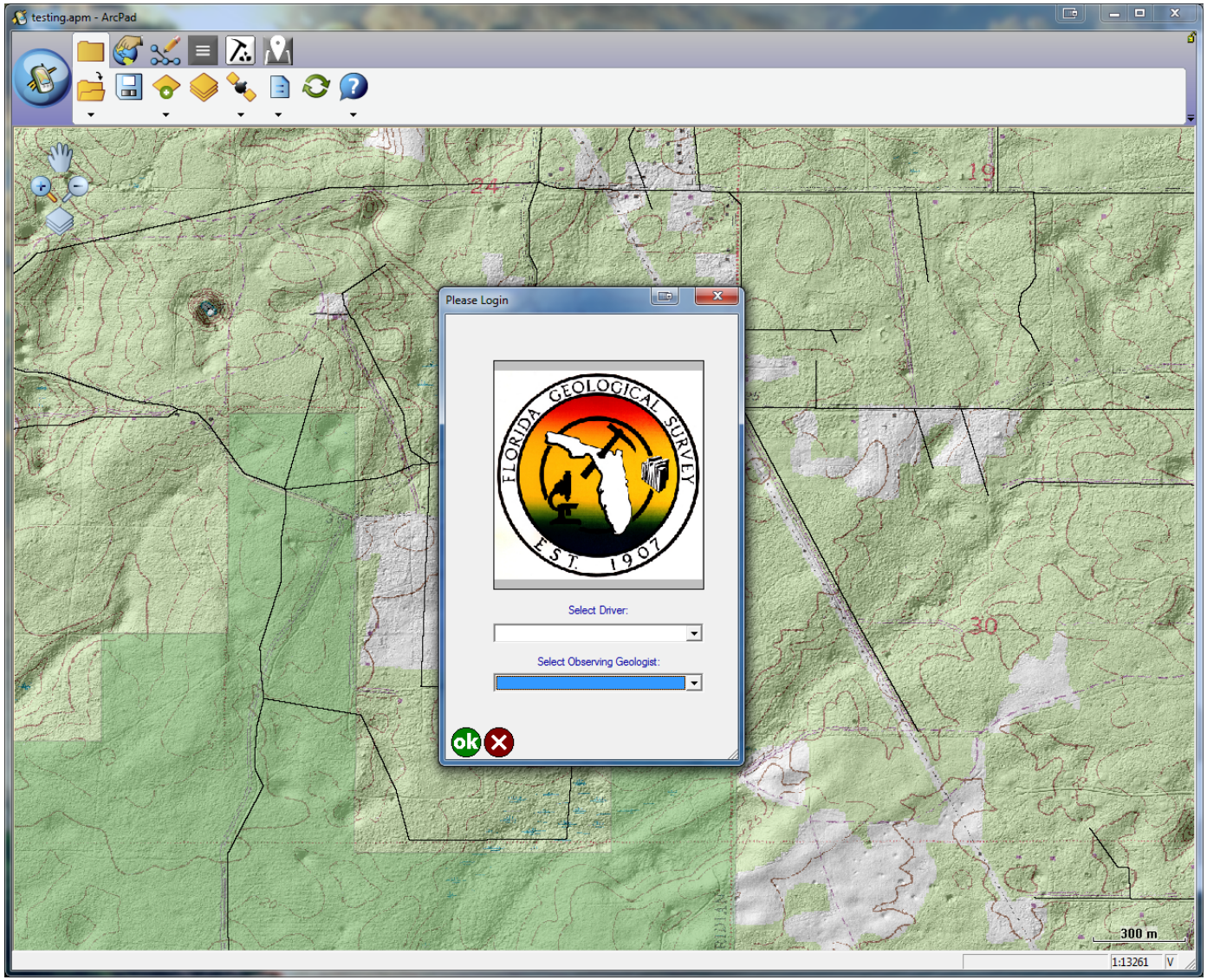
Digital Field Data



Digital Field Data



ArcPad Login



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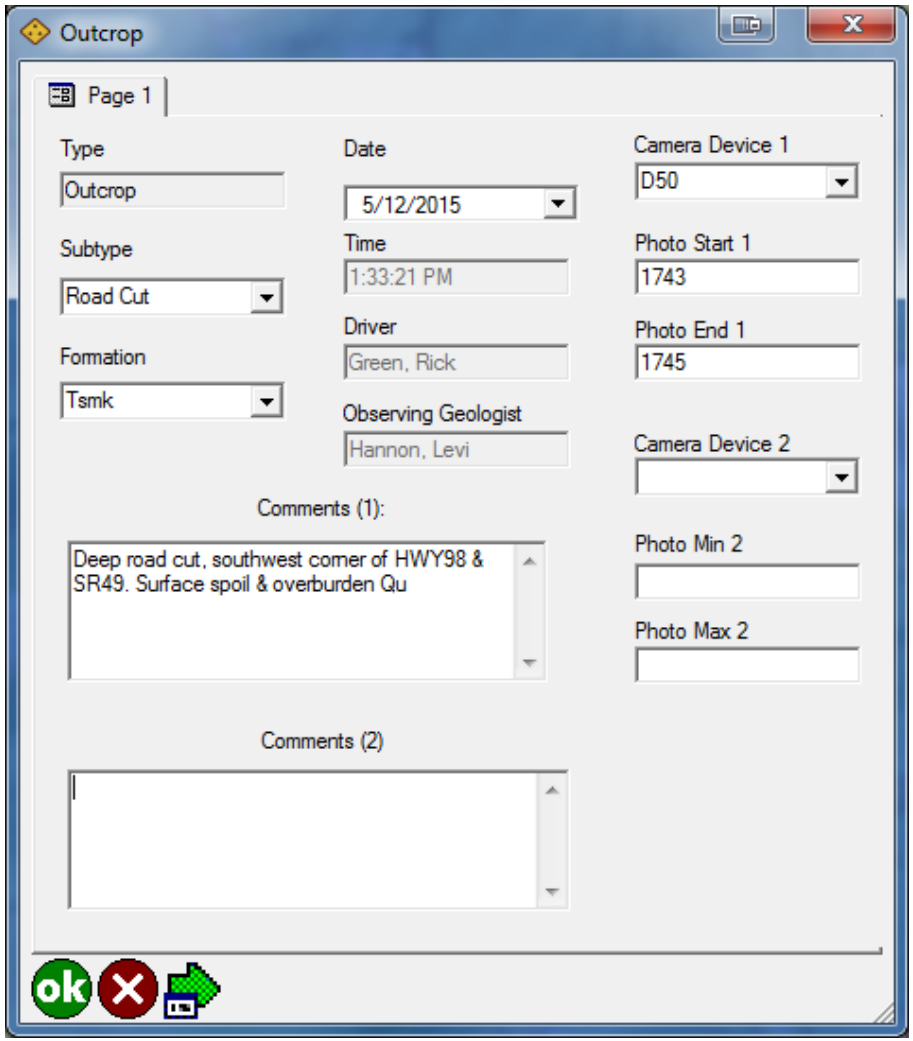

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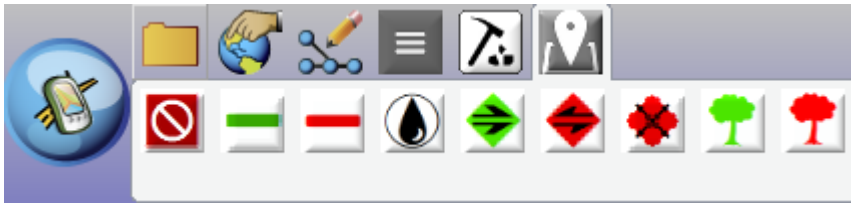

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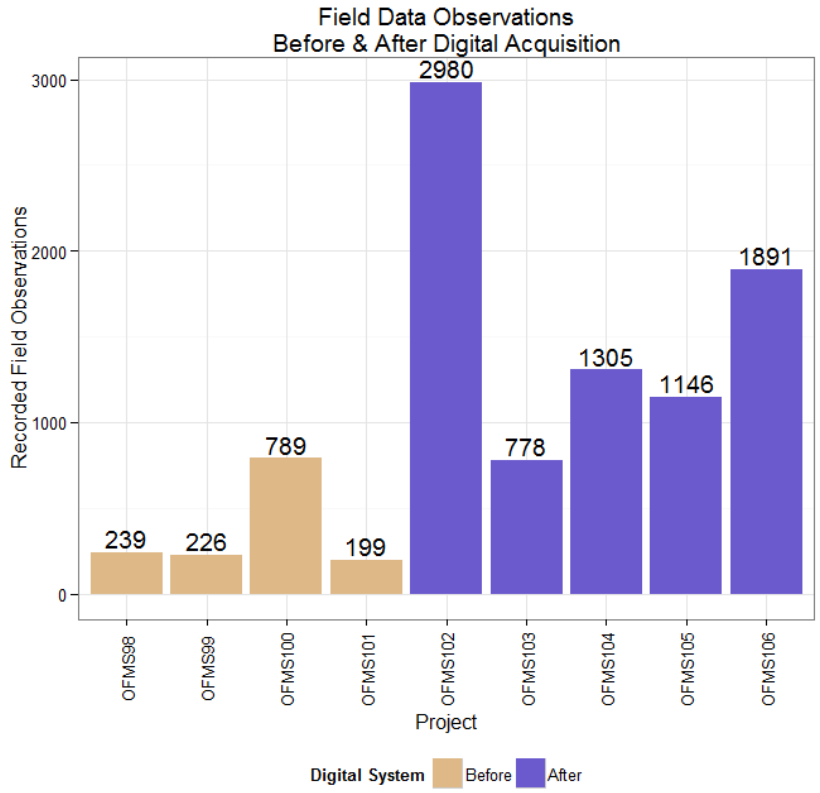

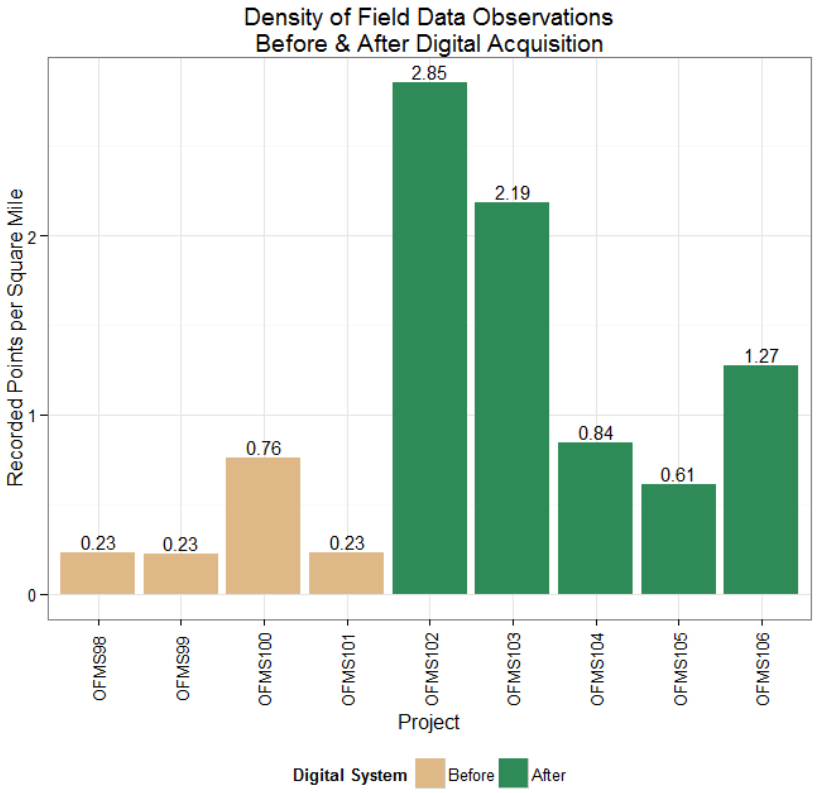

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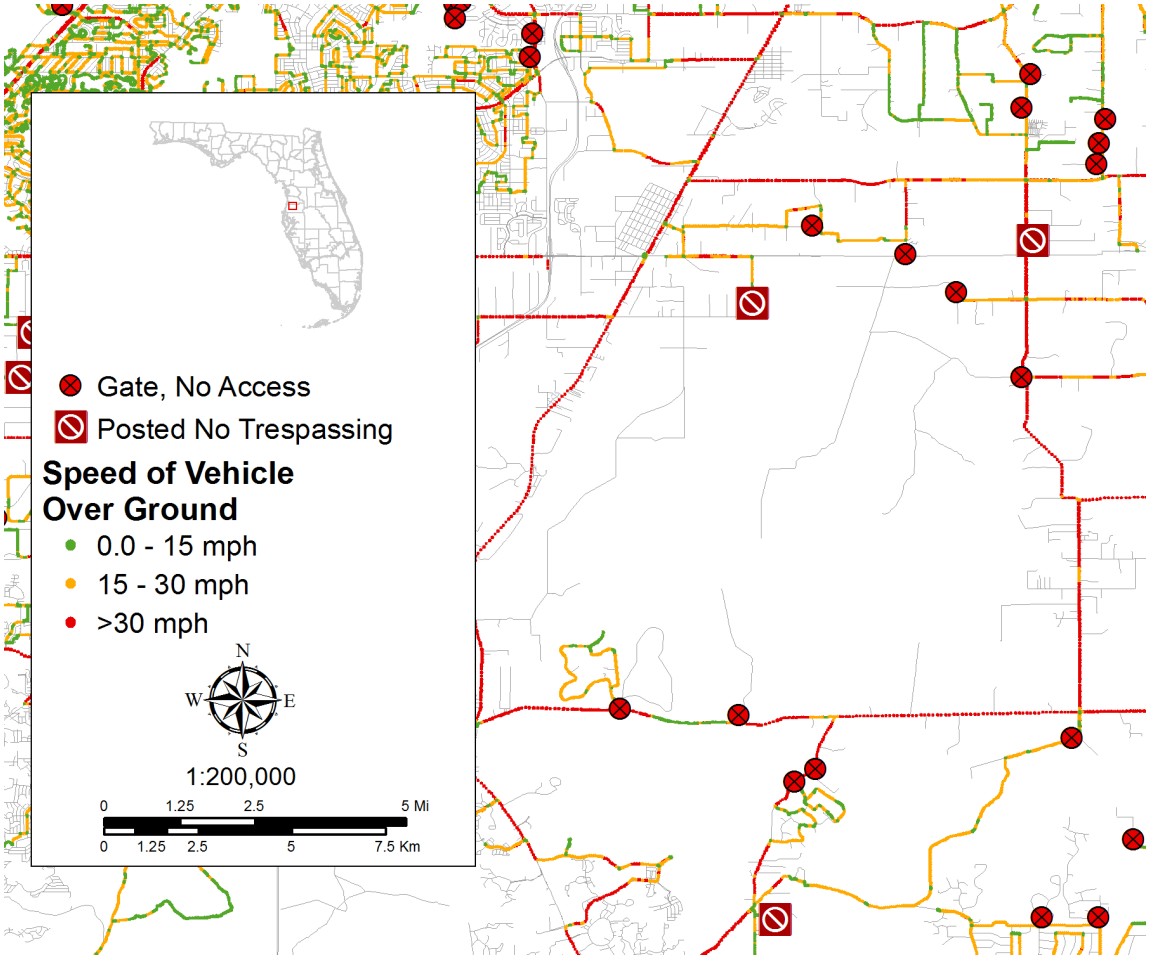
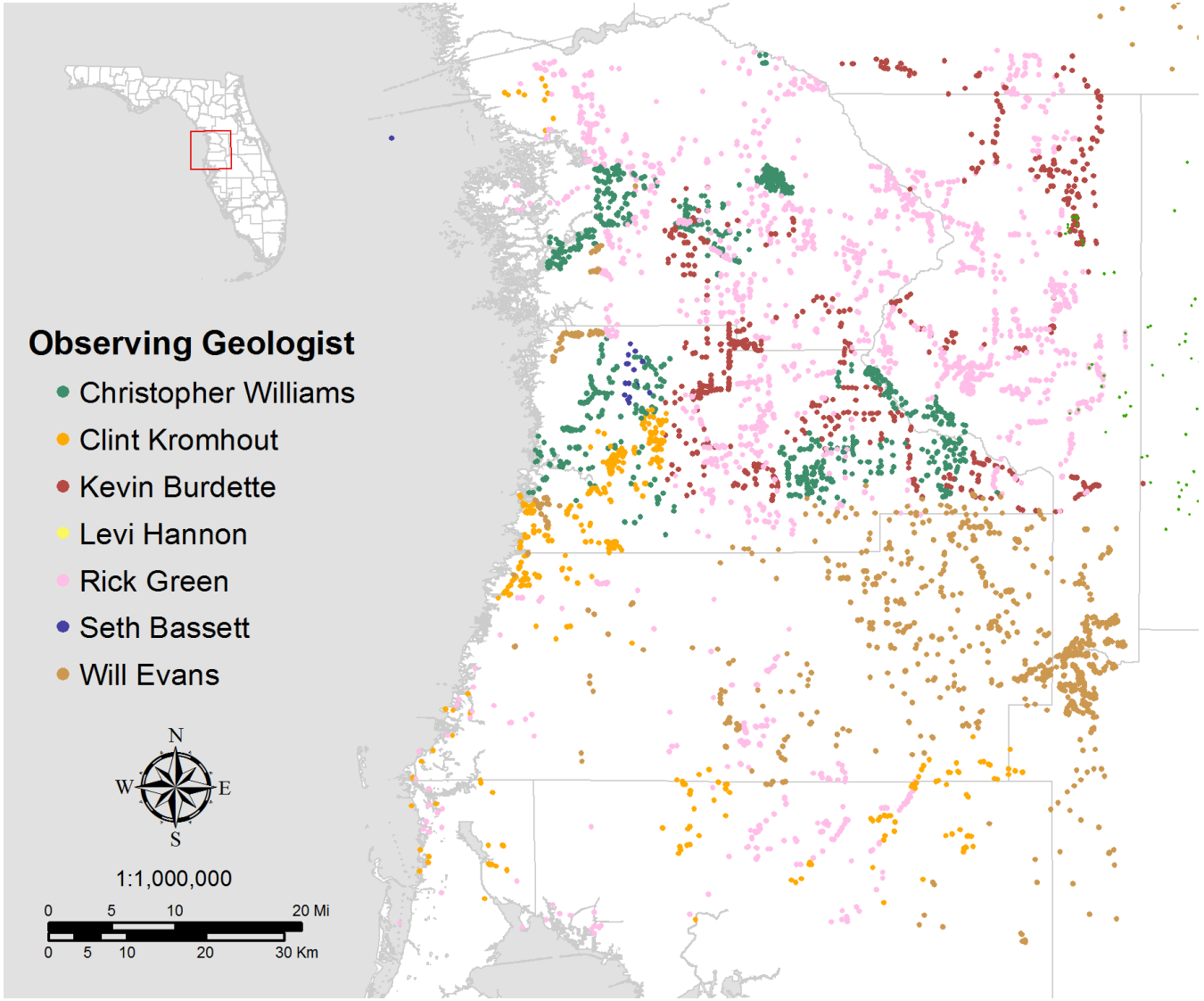


Digital Field Data



ArcPad:
The Experience Thus Far

Positives

- Easy to use in the field
- Customizable
- EXTREMELY robust
- Speedy and efficient
- Increased accountability
- "Figure it out once and then leave it"
- Exactly what is needed, when it is needed, and no more

Negatives

- Support & development nightmare
  - Addition of numerous file types means there are an enormous amount "moving parts" for the GIS analyst to keep track of
    - .APL files
    - .VBS files
    - .APM files
    - .APX files
    - Applets Folder
    - MyArcPad folder
  - Multiple, identical deployments are problematic
- Shoddy and/or abbreviated documentation
- Raster handling is problematic and preparation of raster imagery is very time consuming

Streamlining Map Production

- Streamlining Map Production
  - Layer Files vs. Representations
  - Label production
  - Cartographic Refinement
  - Topologies and Topologic Control

The Power of Representations

Positives

- Representation becomes the default symbology in ArcMap when held in a FileGDB
- “Set once and forget”
- Children layers bring representations with them automatically!
- More cartographic control over how the symbols appear on the page
  - Nicer editor and editing system (buried deep in ArcMap)
  - “Cased Roads”
  - Cartographic Overrides
- Easily to manipulate through field calculations or scripting
- Cartographic Refinement Toolbox

Negatives

- Application of representations across layers is difficult
- ArcInfo License Required

Label Production Graphical Conflicts

Label Production

- Previously labels had been done through drawing layers
- Switch to Annotation feature class increased efficiency of labeling and control over labels
- Provides a more permanent label solution than the drawing toolbar

Cartography Toolbox

- **Generalization Toolbox**
  - Collapse Dual Lines to Centerline
  - Collapse Road Detail
  - Thin Road Network
  - Merge Divided Roads
  - Simplify Line/Polygon
  - Smooth Line/Polygon
- **Graphic Conflicts Toolbox**
  - Detect Graphic Conflict
  - Propagate Displacement
  - Resolve Road Conflicts
- **Masking Toolbox**
  - Feature Outline Mask
  - Intersecting Layers Mask
- **Representation Management Toolbox**
  - Select Feature By Override
  - Update Override

Next Steps

- Master database representations are scheduled to be reworked end of this project year
- Project creator model to be rewritten in pure Python
- ArcPad development is ongoing and now in use across multiple research teams at the FGS, allowing fast, easy sharing of field data in a common format
  - ArcPad Project Creator scripts
  - Internal Documentation of Custom Apps
- MXD Creator Scripting
- Cartographic Scripting
- NCGMP09 Compliance

Conclusions

- Dedicated GIS personnel increase the efficiency of traditional geologic staff by an order of magnitude
- Efficiency in GIS = more “bang for the buck” = more funding = more geology
- Standardization of map and data products from year-to-year and project-to-project is tedious but necessary
- Forethought and preparation on the front end of a project can mean large productivity gains down the stretch
- Increasing automation makes a project more dependent on GIS staff, not less

Sources & Citations

- Bassett, S., Richard C. Green, Christopher P. Williams, Kevin Burdette, 2011. A new GIS-based method for gathering geological field data.
- Green, R.C., Williams, C.P., Burdette, K.E., Bassett, S.W., Flor, A.D., Paul, D.T., 2011. Geologic map of the eastern portion of the U.S.G.S. Inverness 30 x 60 minute quadrangle, central Florida. Open File Map Series.
- Williams, C.P., Green, R.C., Bassett, S.W., Flor, A.D., Paul, D.T., 2011. Text to accompany geologic map of the eastern portion of the U.S.G.S. Inverness 30 x 60 minute quadrangle, central Florida (No. 96), Open File Report. Florida Geological Survey, Tallahassee, FL.