Florida Citrus Inventory Modernization Project

Building a GIS of Florida's Commercial Citrus Groves

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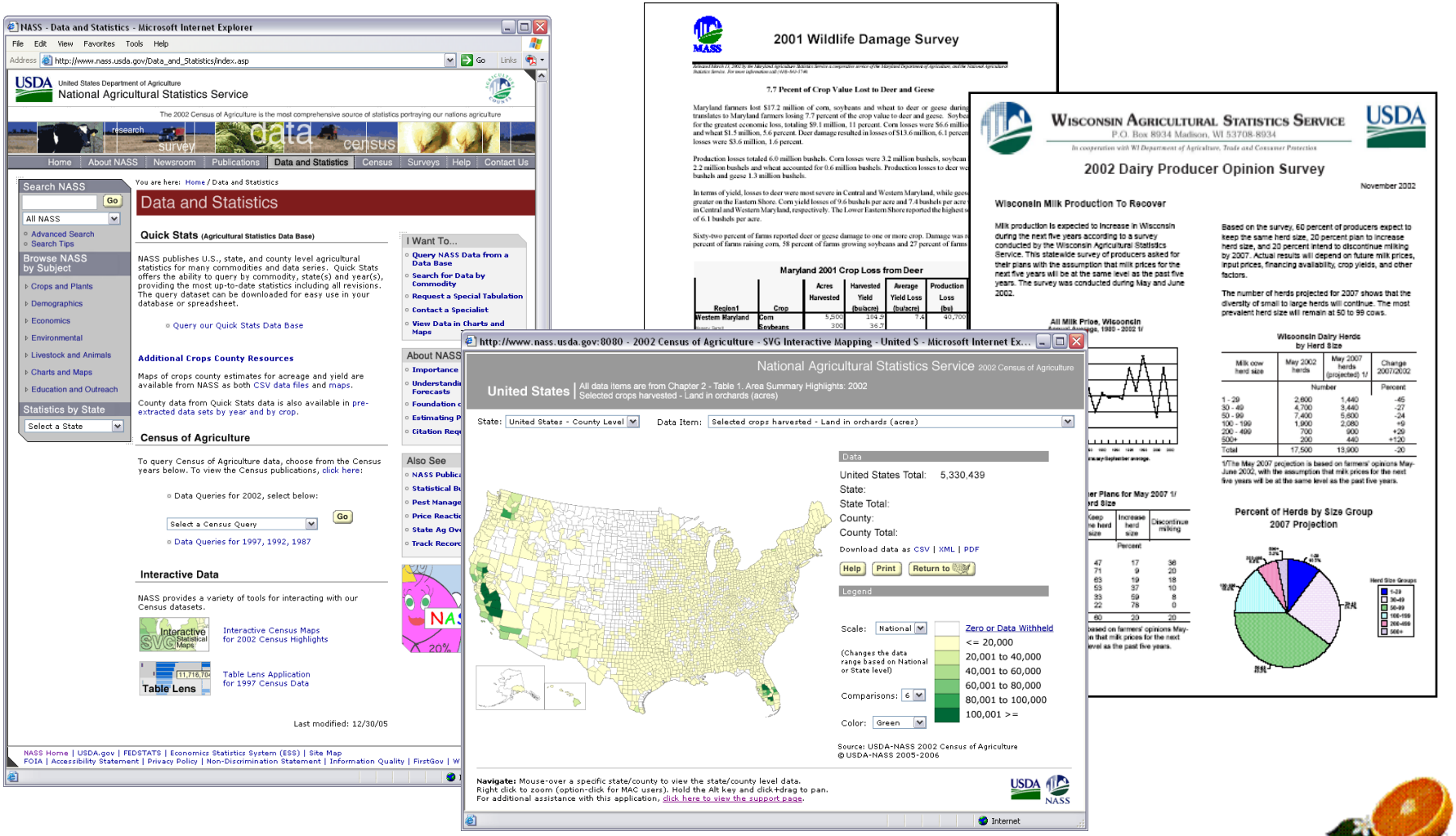
NASS
FACT FINDERS FOR AGRICULTURE
UNITED STATES DEPARTMENT OF AGRICULTURE

Presentation Overview

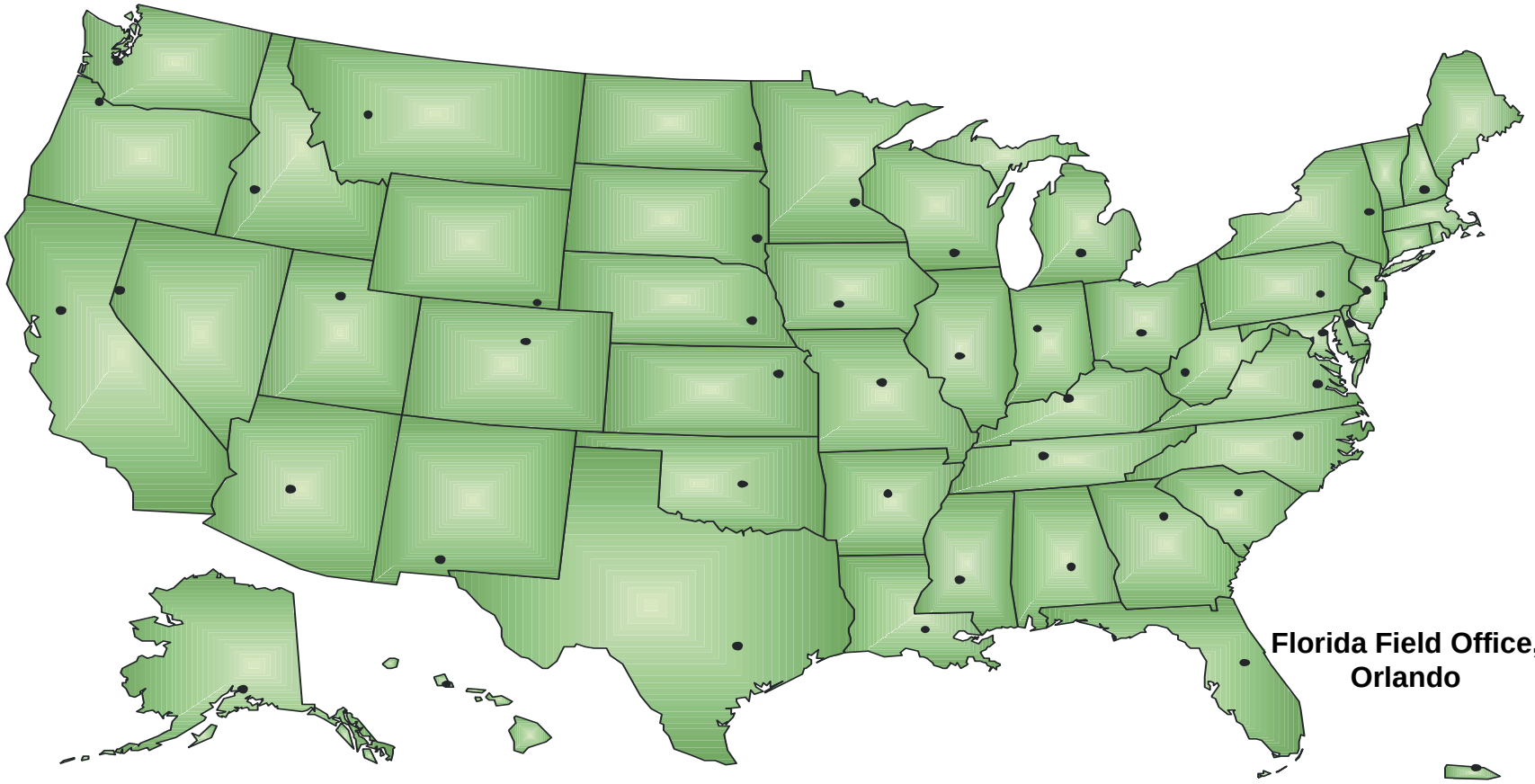
- NASS background
- Florida citrus industry facts
- Citrus inventory program
- Pre-GIS methodology
- Reasons to adopt a GIS
- Digitizing methodology
- Progress to date
- Future and related work

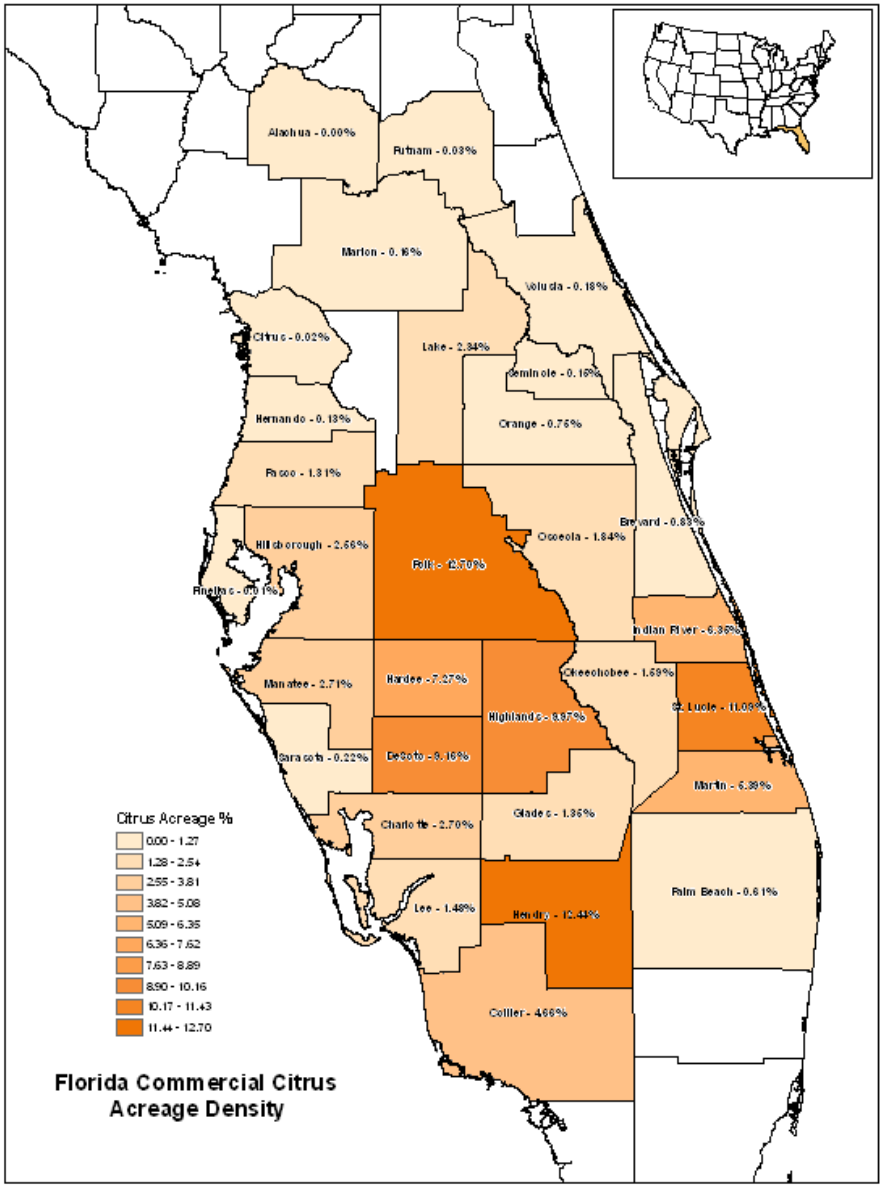
The National Agricultural Statistics Service

Provider of timely, accurate, and useful statistics in service to U.S. agriculture



NASS Field Office Locations



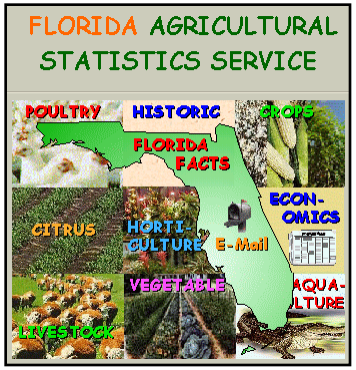


Distribution of Commercial Citrus in Florida, 2004

Florida citrus industry facts

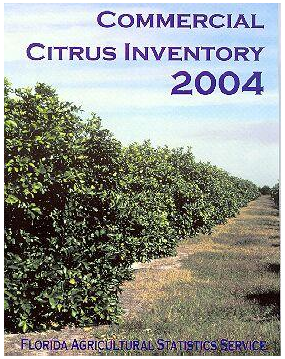
- 750,000 acres (1170 sq. miles, 304,000 hectares)*
- 80% oranges, 10% grapefruits, 10% specialty*
- Leading producer in world of grapefruits**
- Second, to Brazil, in orange production**
- 90% canned, chilled, or concentrated**
- 80% of U.S. supply**
- $9.13 Billion industry**
- 89,700 jobs**

*NASS/FFO 2004 **UF/IFAS 2000

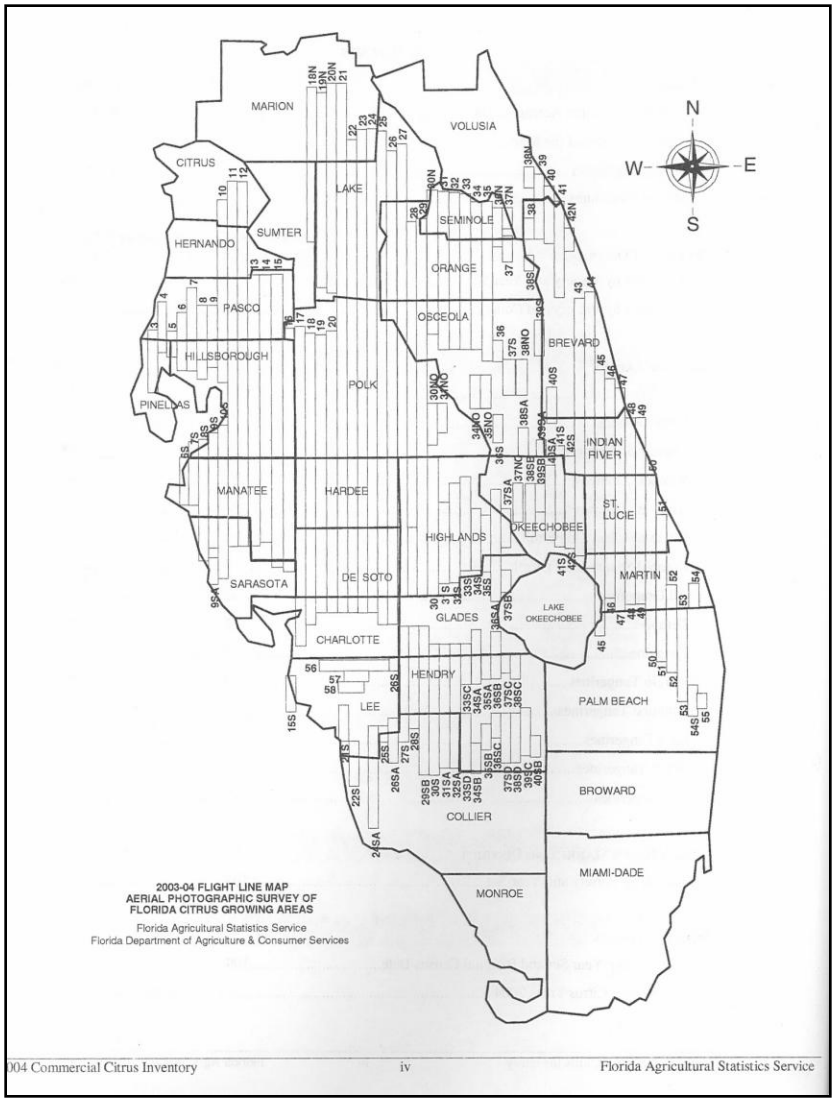


Florida Agriculture Statistics Service Citrus Program

- Census of commercial citrus tree inventory published every 2 years
  - Information provided at county level of acreage and tree counts
  - Includes tabulated statistics of citrus tree planting dates and variety
  - Special interim surveys for 7 counties undertaken in 2005 in response to hurricane damage
  - Tree information stored in a tabular database that is updated each survey cycle
  - Cooperative undertaking with the Florida Department of Agriculture and Consumer Services and sponsored by the Florida citrus industry

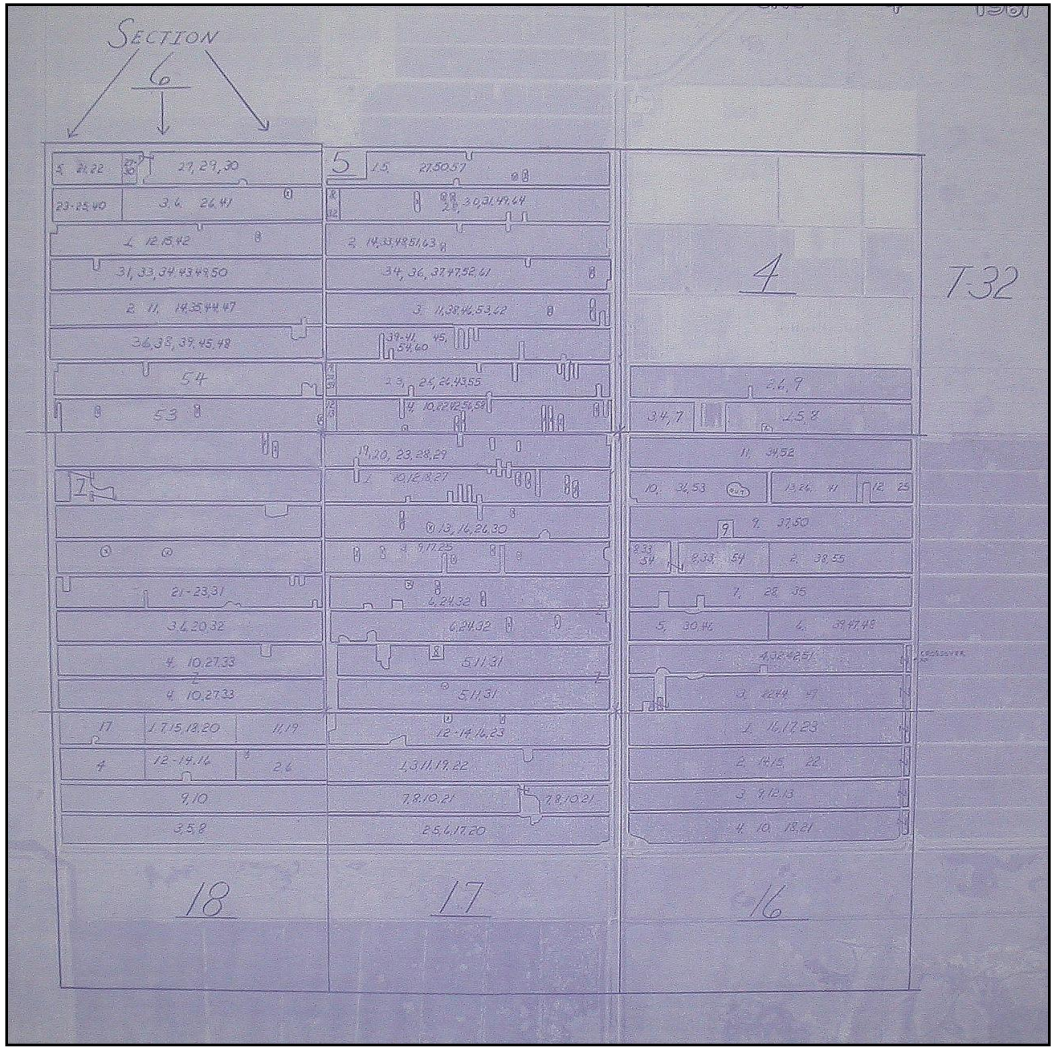


Past census methodology



- Aerial film-based imagery flown biennially
- Imagery is photo interpreted manually to determine groves that have likely undergone change since last census

- Field survey crews dispatched to the areas to assess and record any changes
  - Tree counts
  - Variety, Year, Spacing
    - if new planting
- Tabular data updated with observations of field crew



Example survey “ozalid” style map showing hand drawn grove and section boundaries and labeled with basic record information

Drawbacks of past system

- Over 1000 hand-drawn maps must be reworked each survey cycle
  - Labor intensive
  - Time consuming
- Limited spatial analysis capabilities
- Difficult to use ancillary GIS information that is already available
  - Digital aerial photography
  - GPS data
  - Related GIS sources
    - Roads
    - Land-cover
    - Tax parcels
    - Etc.…

Benefits of the GIS-based citrus census

- More efficient
- Lower cost
  - …in the long run
- Sharing of data
- GPS tools can be incorporated
  - PDA/Tablet PCs
- Increased analytical ability
  - Spatial-based queries/summaries
  - Other GIS capabilities
    - Tracking disease (canker, greening)
    - Hurricane analysis (overlay tracks)
    - Land cover conversion (urbanization)
- Cartographic capabilities
  - Eliminates manual polygon and label redrawing
  - Customizable and consistent map layouts

GIS data capture methodology

- Using ESRI ArcGIS as software platform
  - Industry standard
  - Large user community
  - USDA has site-wide license
- Gathered existing digital data
  - Georeferenced 2004 aerial 1 meter resolution imagery (DOQQs) from Florida Department of Environmental Protection
  - Ancillary information sets including the PLSS grid, county boundaries, roads, infrastructure etc.
  - FASS tabular tree census database
    - SAS based
- Gathered existing analog data:
  - FASS map sheets

Grove boundary creation

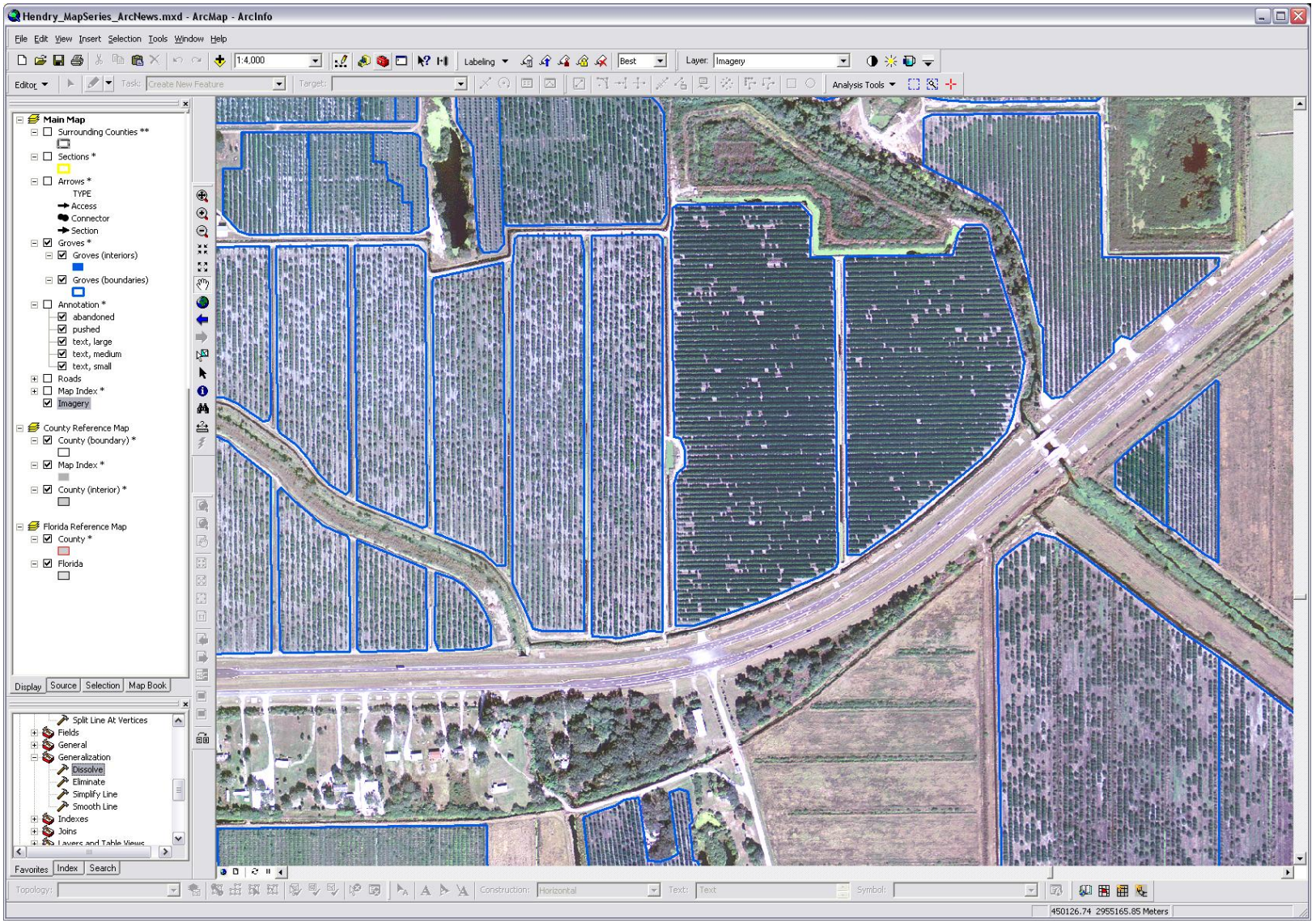
- Digitizing of 2004 grove layer within ArcGIS
  - Used 2004 DOQQ imagery for spatial reference
  - Used 2004 hand drawn maps as grove boundary ground truth
- Utilizing ESRI's Shapefile GIS data format for initial digitizing of polygons
  - Process involved heads-up digitizing technique
  - Included editing of block numbers within feature attribute table
  - Drawing precision was specified at 3 meters, or 1:4000 scale

Digitizing comments

- Digitizing was relatively slow
- Started in early 2005, nearly 100% was complete a year later
- Many people with a range of computing skill levels helped with the digitizing effort.
  - A challenge to train
  - A challenge to manage
  - Most were not familiar with concepts of a GIS
  - Most had never used ArcGIS before

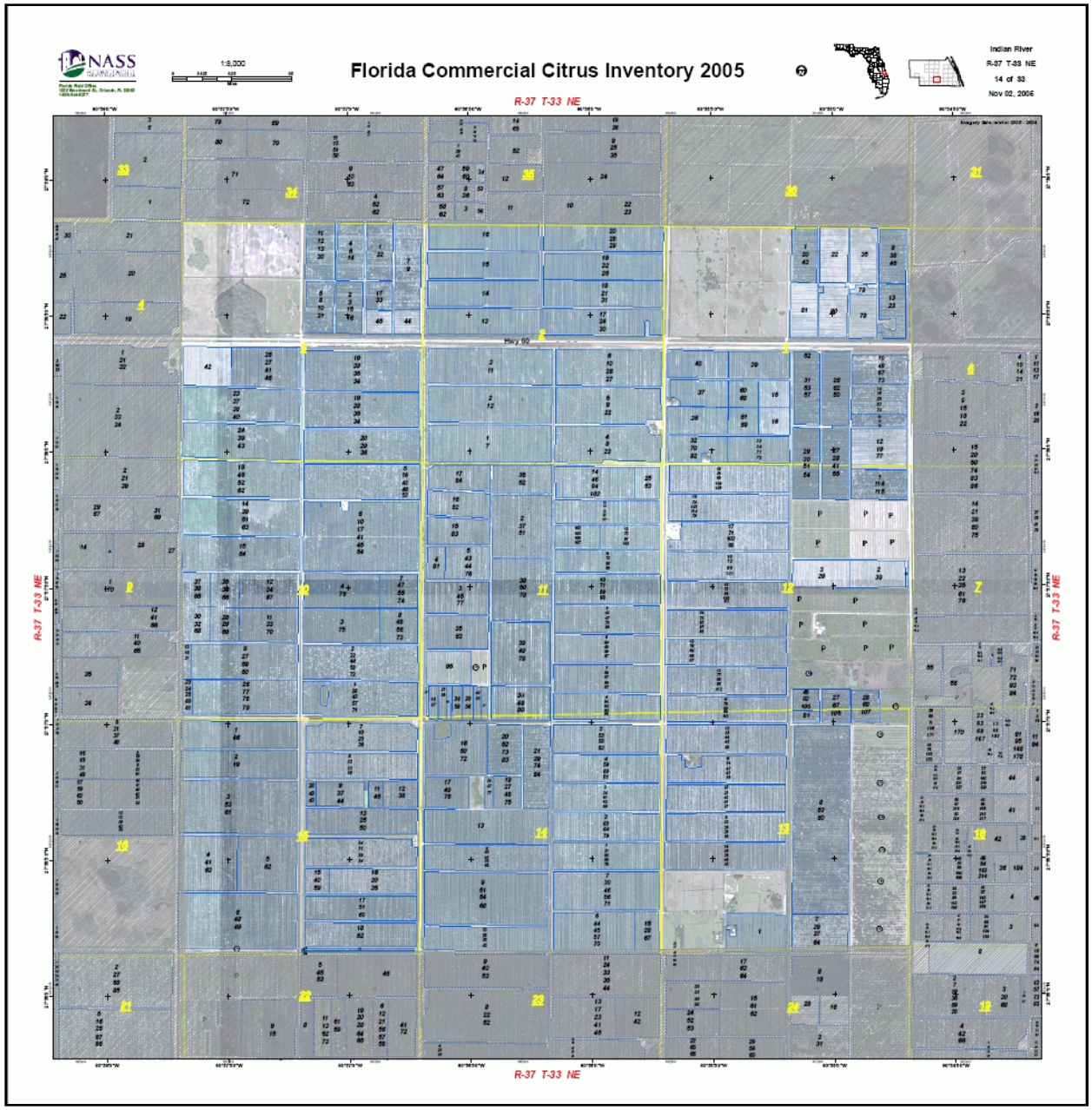
Beyond just digitizing

- Other steps and information were added to the citrus GIS including:
  - Migration of boundary polygons from Shapefile to personal geodatabase format
  - Topology validation assuring no polygons overlapped
  - Creation of an “inactive” grove layer in addition to the active one
    - Parcels of land that have a high potential to become productive again
  - Digitizing of annotation
    - Special labels unique to the enumerators, could contain grower contact information, field notes, grove access routing, landmarks etc.
  - Linking the polygons to the tabular files via relational database
  - Revising of the Public Land Survey System grid
    - township, range, sections boundaries
  - Building of map series
  - Plotting output
  - Checking for errors!

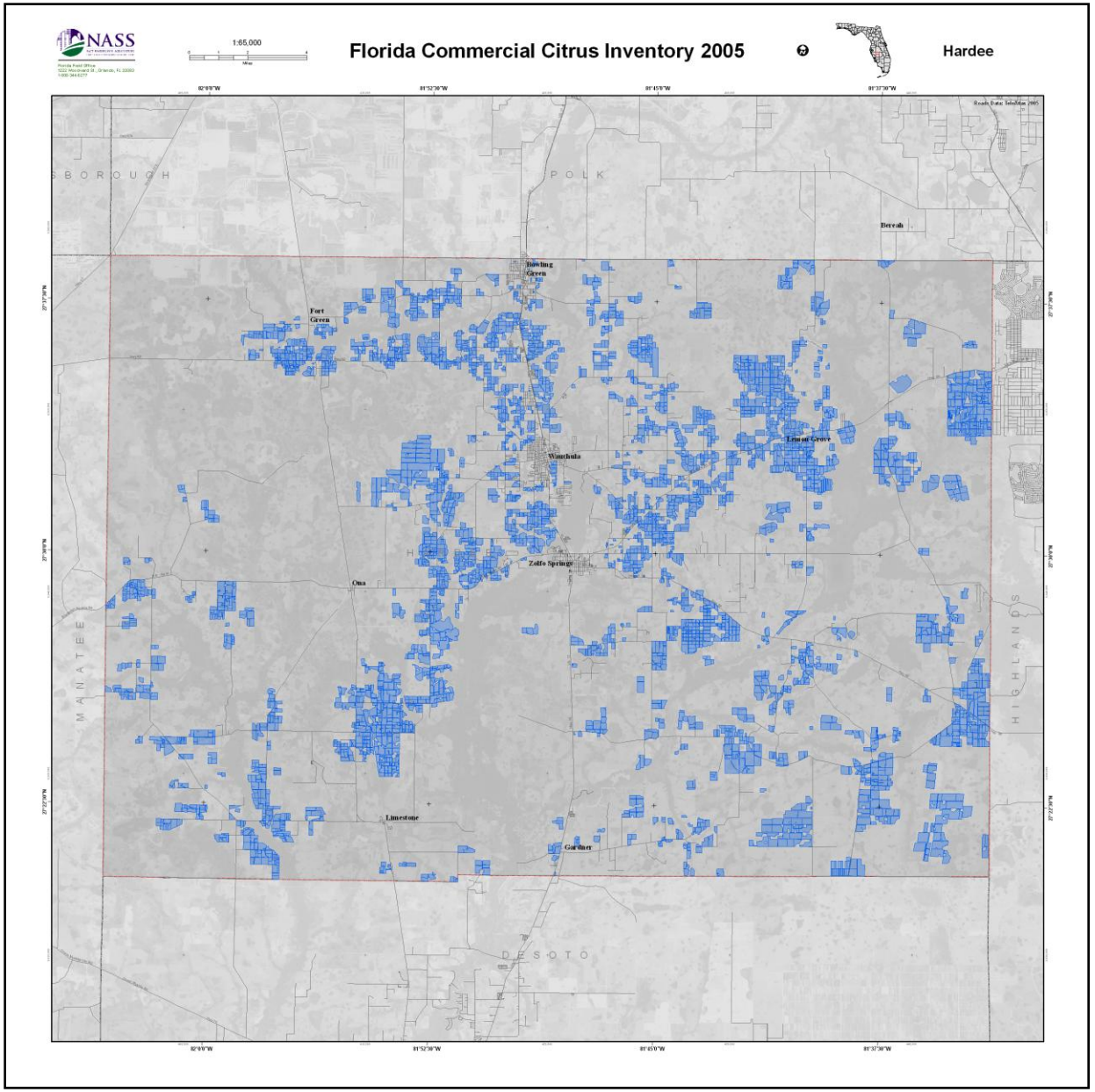


Screen capture of ArcMap in action

Map sheet example



County reference map example



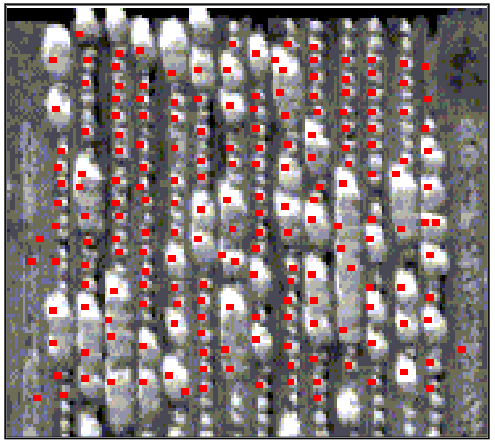
Some statistics

- Approximately 40,000 commercial groves were digitized
- The groves contain records for nearly 130,000 plantings
- Over 1000 unique map sheets created
  - Based on quadrants of the Public Land Survey System Townships
  - 1:8000 scale
  - Each contain 9 square mile sections
- 1 year was needed to digitize and compile everything
  - With several staff members working full or part-time on the project

The future

- The NASS Florida Field Office now has a dedicated GIS infrastructure
  - A pioneering group within NASS!
  - Beginning to incorporate objective yield point sample data
  - Likely to become a model for other NASS state offices
    - Perhaps for inventorying other Fruits, Nuts, Berries….
- Imagery Issues
  - The citrus program relies heavily on timely high resolution imagery and currently NASS is benefiting from the freely distributable data of other groups
    - Florida Water Management districts (1 meter)
    - Florida Department of Revenue (sub 1 meter)
    - USDA National Aerial Imagery Program (NAIP) (2 meter)
  - How to manage it all
    - Computing and storage requirements are relatively large

Related research work



- Imagery exploitation
  - Satellite versus aerial
    - Availability
    - Cost/benefit
  - Information extraction
    - Tree counting
    - Change detection
- Mobile/field GIS applications
  - GPS receivers
  - PDA/Tablet PCs
- Citrus land-cover classification (within Cropland Data Layer program)

Thanks

- NASS
  - www.nass.usda.gov
- NASS / Research and Development Division
  - www.nass.usda.gov/research
- NASS / Florida Field Office
  - www.nass.usda.gov/fl

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