

# Utilizing the Imagery Holdings of the APFO in a GIS

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# Outline

- u About the APFO
- u Data holdings at the APFO
- u Real world imagery applications in a GIS
- u Questions





# Data Holdings at the APFO

- u Current holdings

- u About 65,000 archived rolls of film from 1955-present (over 10 million images)
- u Over 500 terabytes of digital geospatial data





# Film Holdings

## u Pre-1955

### u Film acquisitions

- u 1937: 375,000 square miles flown; by 1941 90% of US agricultural areas had been acquired

- u All housed at the National Archives in Washington, D.C.

## u 1955-1980

### u Film holdings

- u 1:20000 scale

- u ASCS (Agricultural Stabilization & Conservation Service)

- u APFO archive: >23,000 rolls

- u Forest Service

- u APFO archive: >19,000 rolls

- u SCS (Soil Conservation Service; now NRCS) film

- u APFO Archive: >2,000 rolls



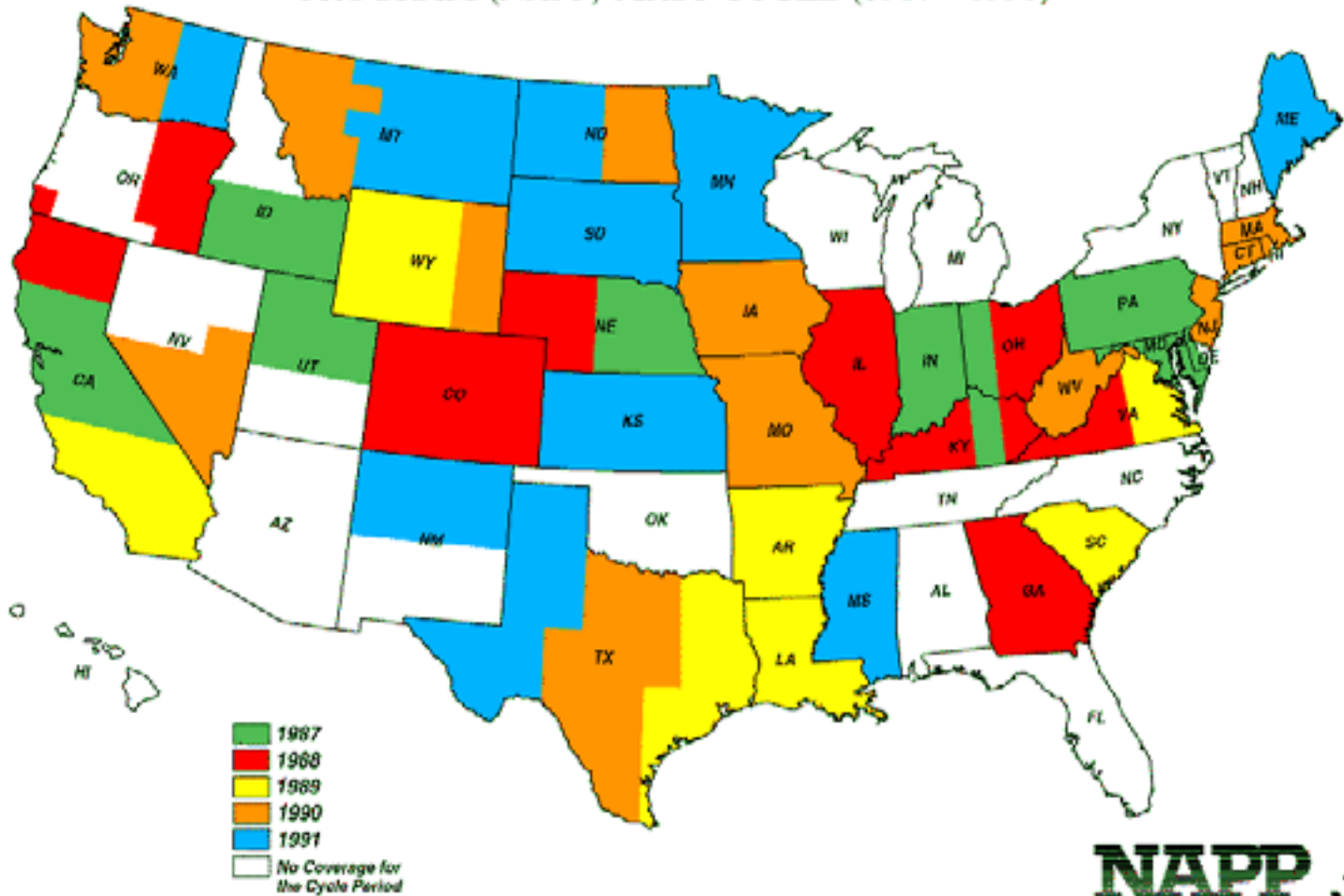


- u NHAP (National High Altitude Photography Program)
  - u Ran from 1980-1989
  - u USGS coordinated interagency program
  - u 48 states, 5 year cycle
    - u Coverage varied due to budget
  - u CIR 1:58,000, BW 1:80,000
    - u 40,000 feet flying altitude
  - u APFO archive: >1500 rolls of film



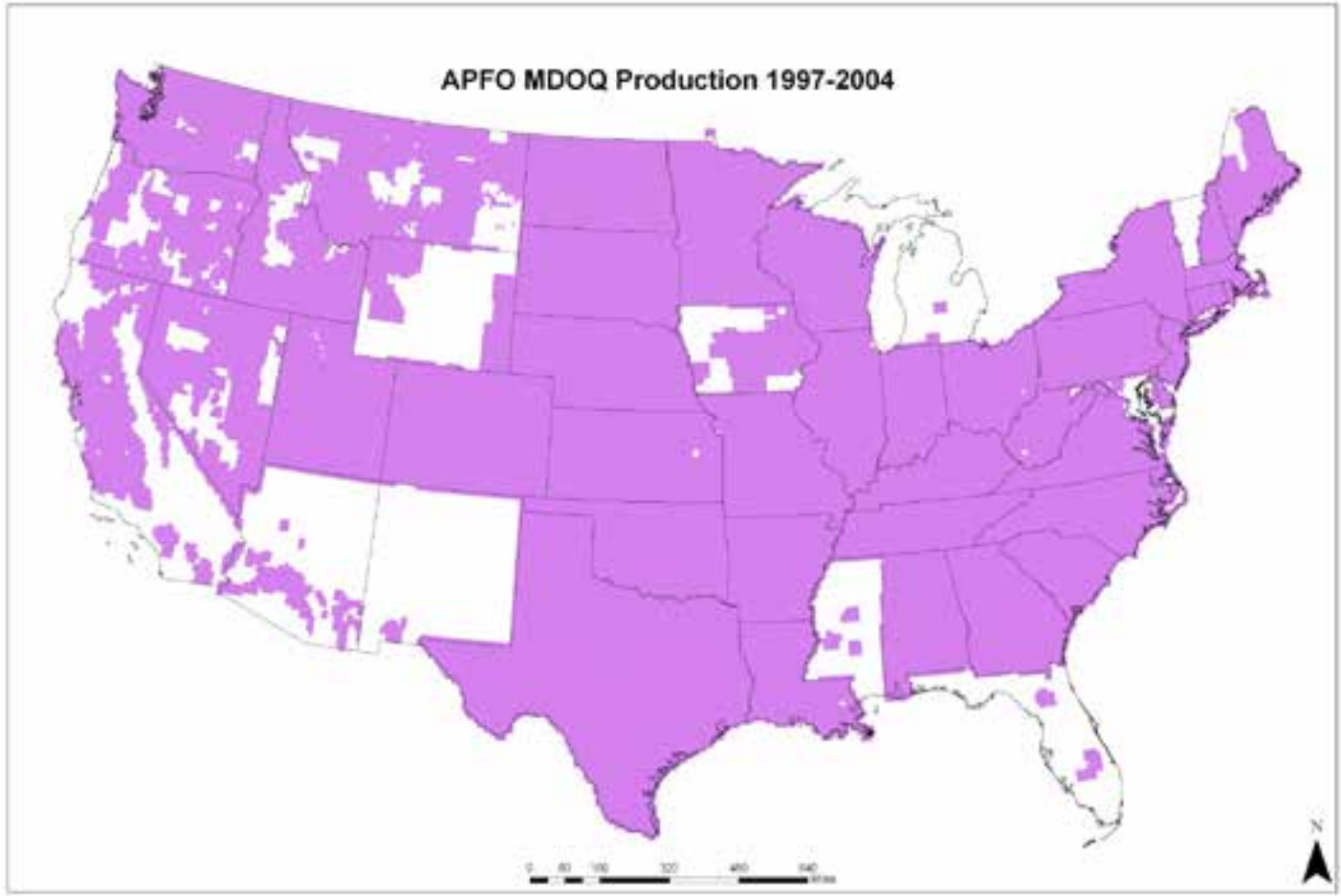
- u NAPP (National Aerial Photography Program)
  - u 1987-2003 (replaced NHAP)
  - u USGS coordinated interagency program
  - u 48 states & Hawaii, 5-7 year cycle
    - u Coverage varied due to budget
  - u 1:40,000 scale
    - u 20,000 feet flying altitude above mean terrain elevation
  - u APFO archive: > 5,000 rolls of film

## CONTRACTED AREAS OF THE NATIONAL AERIAL PHOTOGRAPHY PROGRAM (NAPP) FIRST CYCLE (1987 - 1991)



# Digital Imagery Holdings

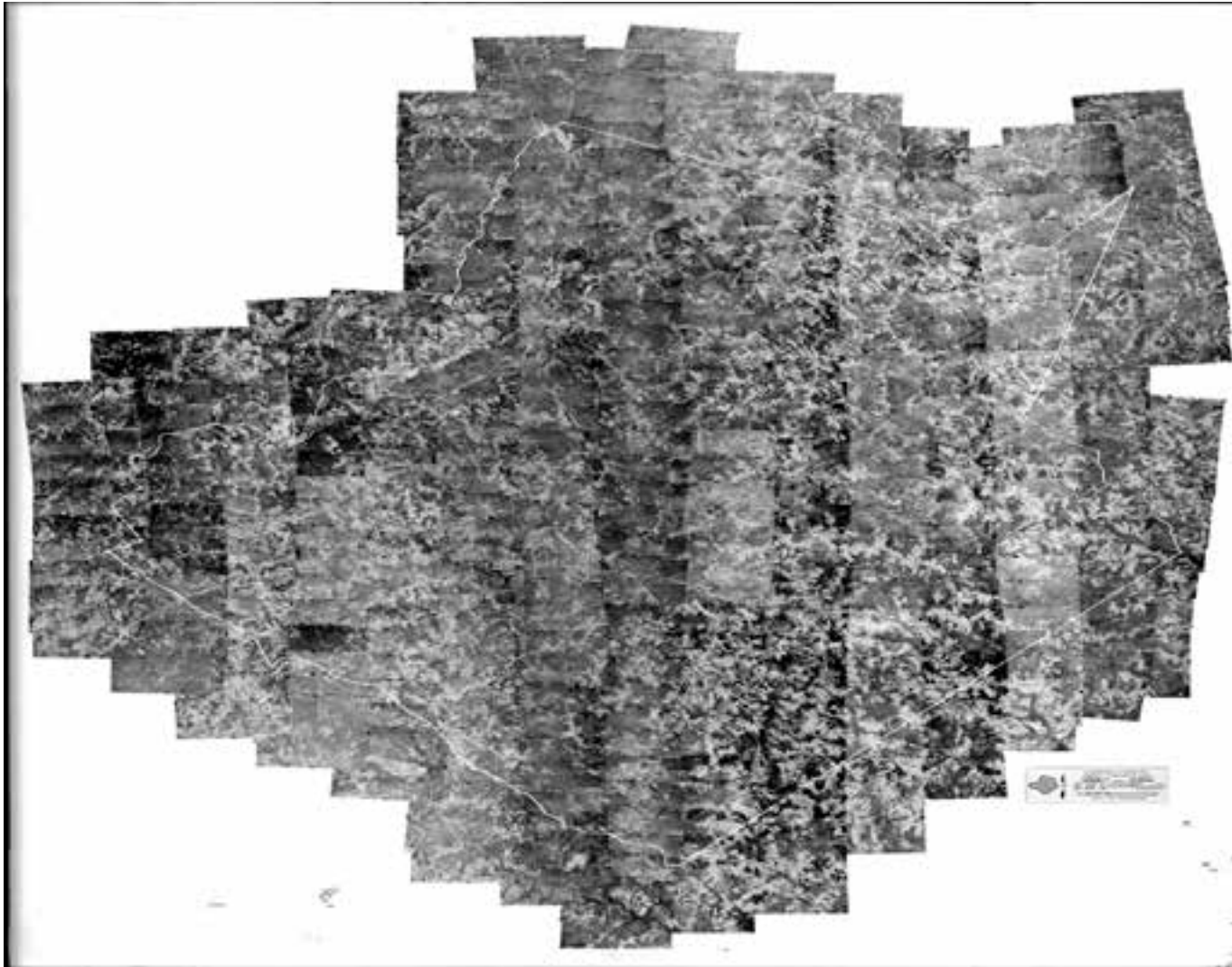
- u MDOQ (mosaicked digital ortho quarter quad) creation
  - u Process ran from 1997-2004
  - u Seamed and color balanced
  - u 16 DOQQs (digital ortho quarter quad) to create 1 MDOQ
    - u 4 primary + 12 surrounding
  - u CCM (compressed county mosaic) created from these MDOQs
  - u Used as base layer in GIS
  - u About 6 terabytes of MDOQ data hosted at APFO





- u NAIP (National Agriculture Imagery Program)
  - u Began as a pilot program
  - u 2002-present
  - u Developed as a response to needs for more current imagery to support USDA programs
  - u Acquisition cycle is about every 3 to 4 years
    - u Continental U.S.
    - u Mostly 1 meter GSD; some 2 meter and Idaho 2013 is .5 meter
  - u Current NAIP archive at APFO is about 1/2 petabyte with an annual ingestion of 25 terabytes.





## u Spot Indexes

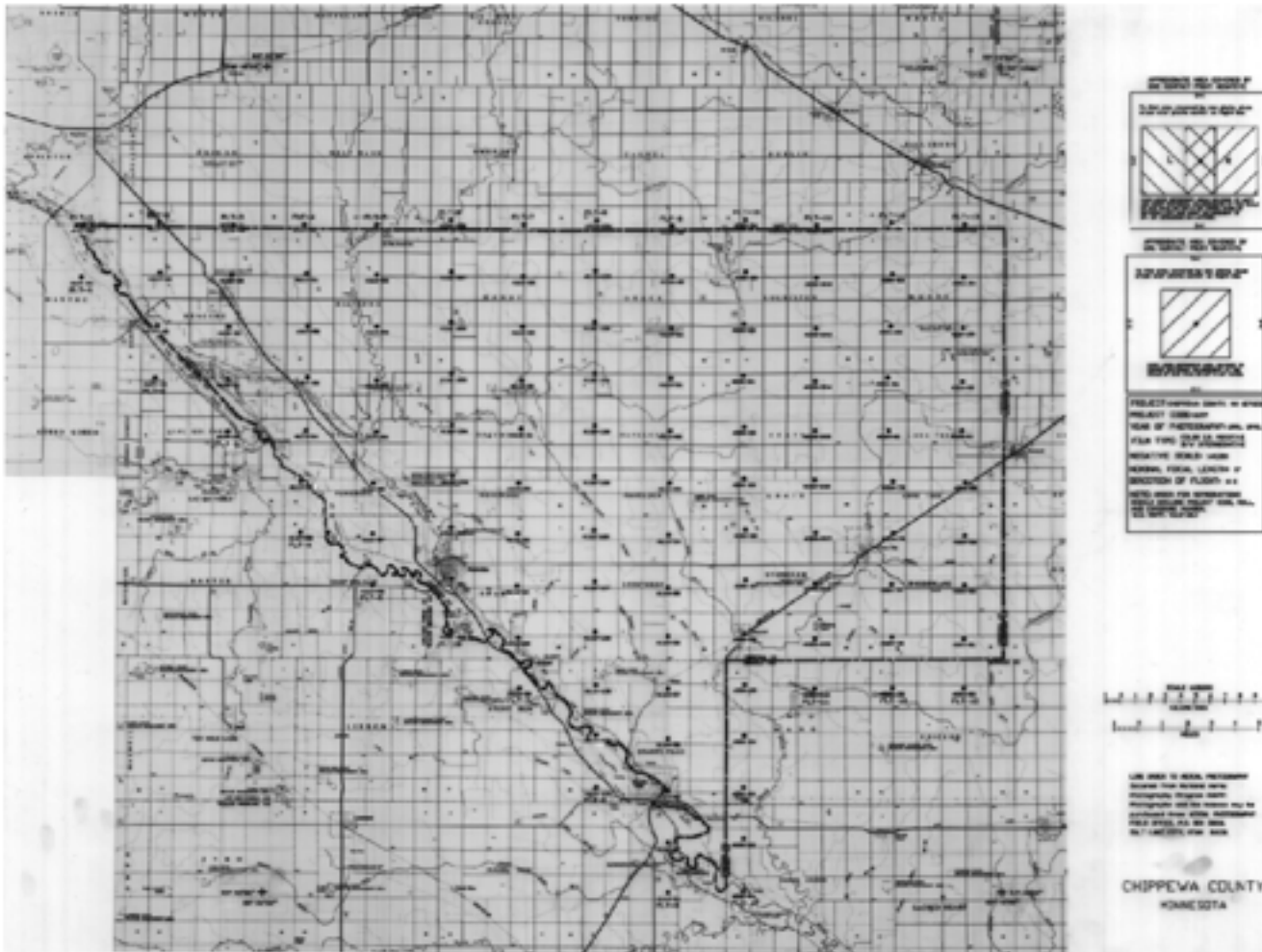
- u Began with NHAP
  - u Created through late 1980s
- u Shows center point of each image
- u APFO archive: >5,000 spot indexes

## u Line Indexes

- u United States Forest Service acquisitions
- u Shows center point of each image
- u APFO archive: >10,000 spot indexes

## u Digital Line Indexes

- u Shows center point of each image
- u Created at APFO using AutoCAD
- u Late 1980's-2003 (coincided with NAPP cycles)
- u APFO archive: > 2,000 indexes



# Real world imagery applications in a GIS

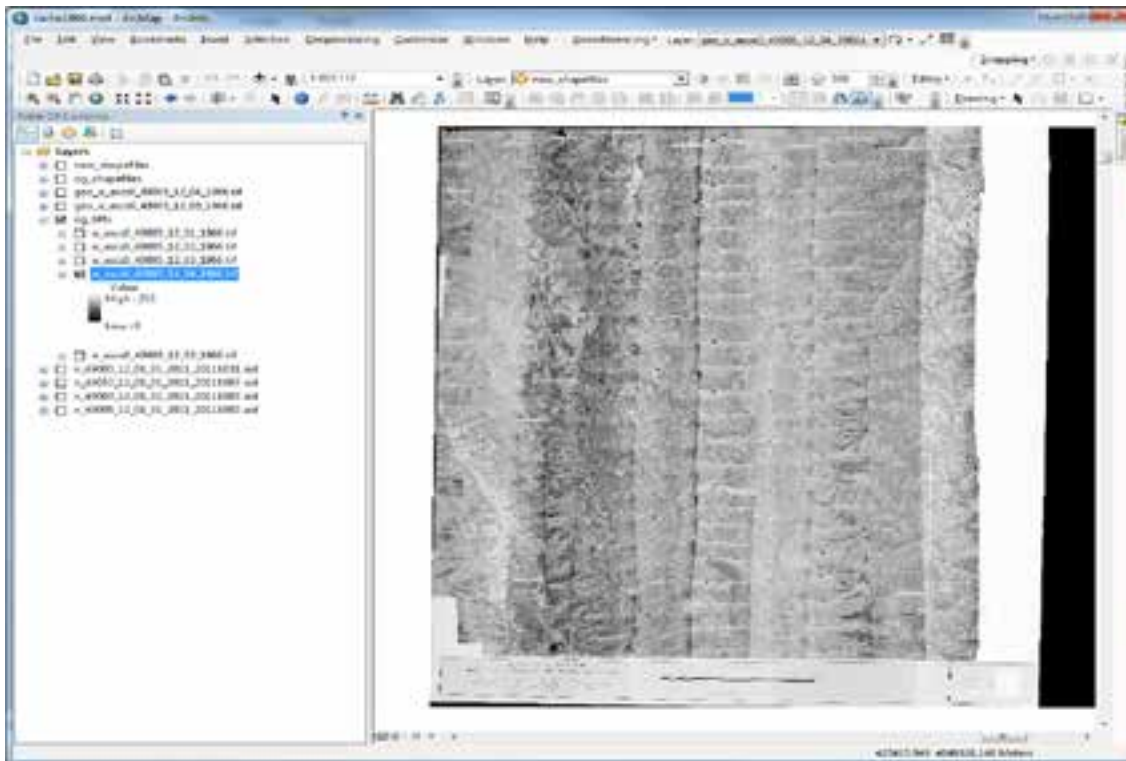
- u Creating digital indexes from the historical APFO imagery archive
- u Identifying land use change using current and historical imagery
- u Historical orthorectified mosaicked imagery for Salt Lake County

# Application 1: Creating Digital Indexes from the APFO Historical Imagery Archive

- u The APFO Historical archive contains images dating all the way back to the 1950s. Over 60 years of historical imagery of the United States is stored within the APFO archives.
- u Currently there is no digital map tool or spatial search tool on the historical imagery archive. The APFO is creating a digital index based on spatial image footprints to make searching imagery easier in the archive.

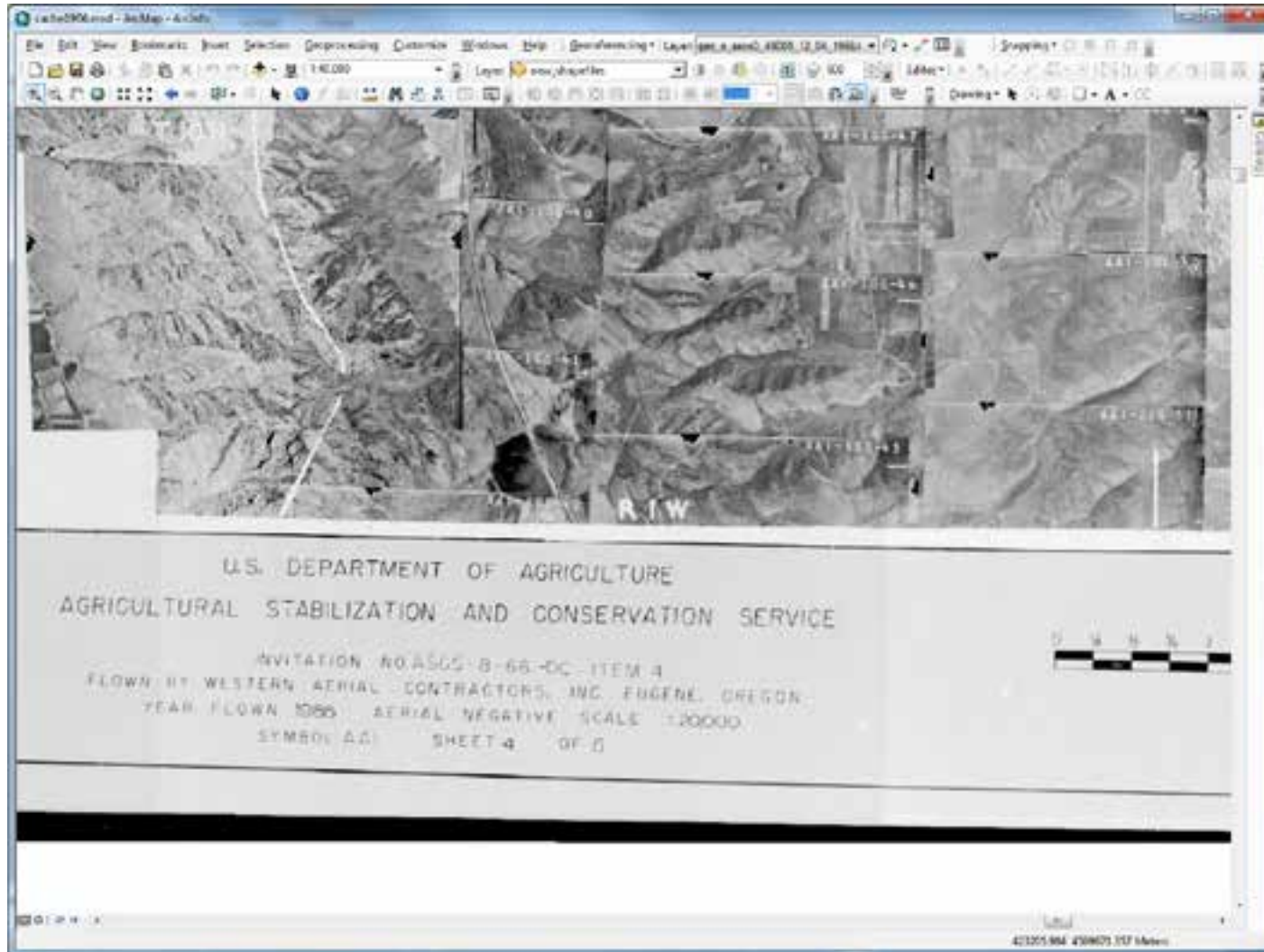


Currently we have paper indexes composed of aerial images that were mosaicked and photographed for each county. These indexes have been scanned into digital format.

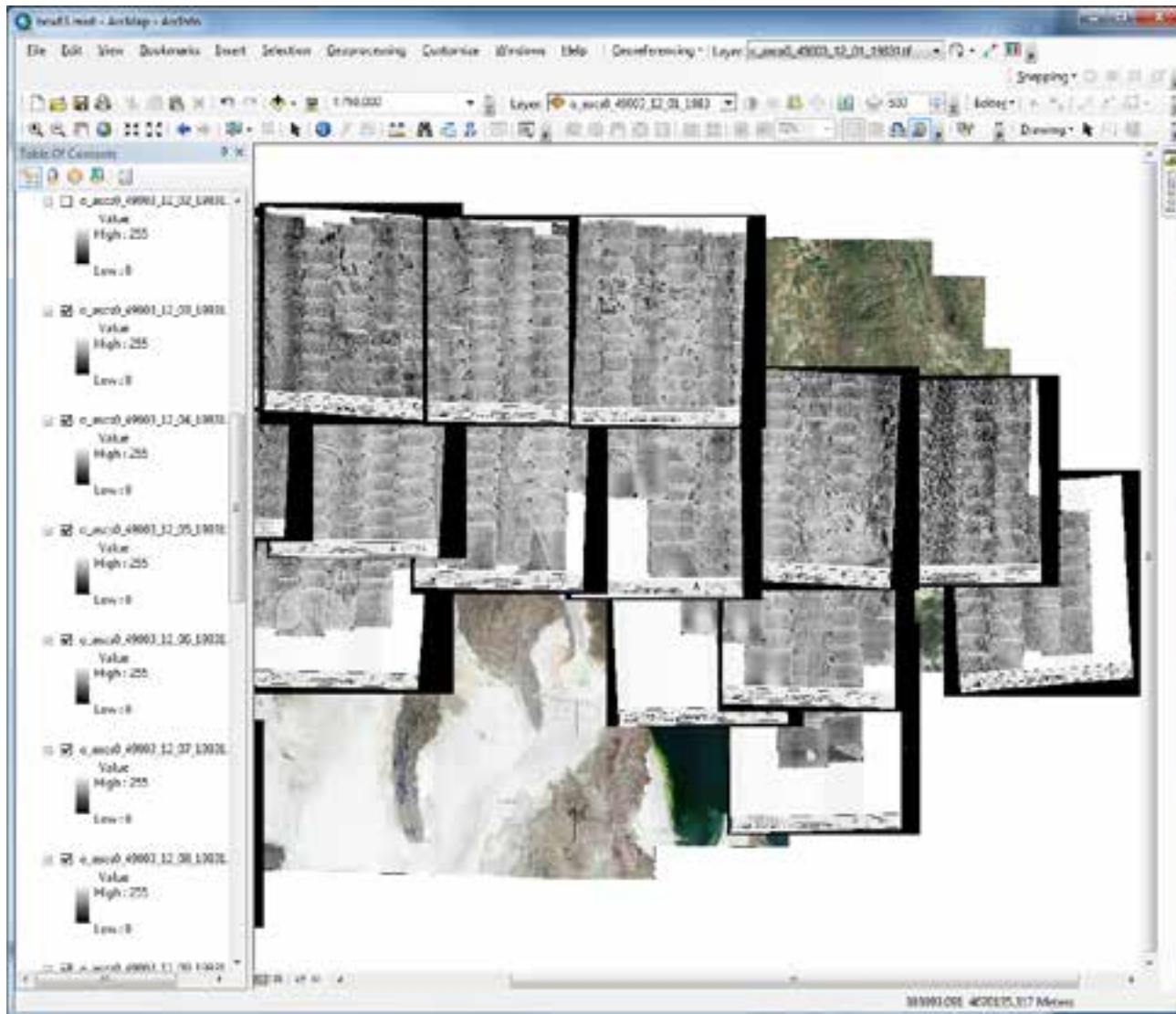


**Many of these indexes  
have no spatial reference**

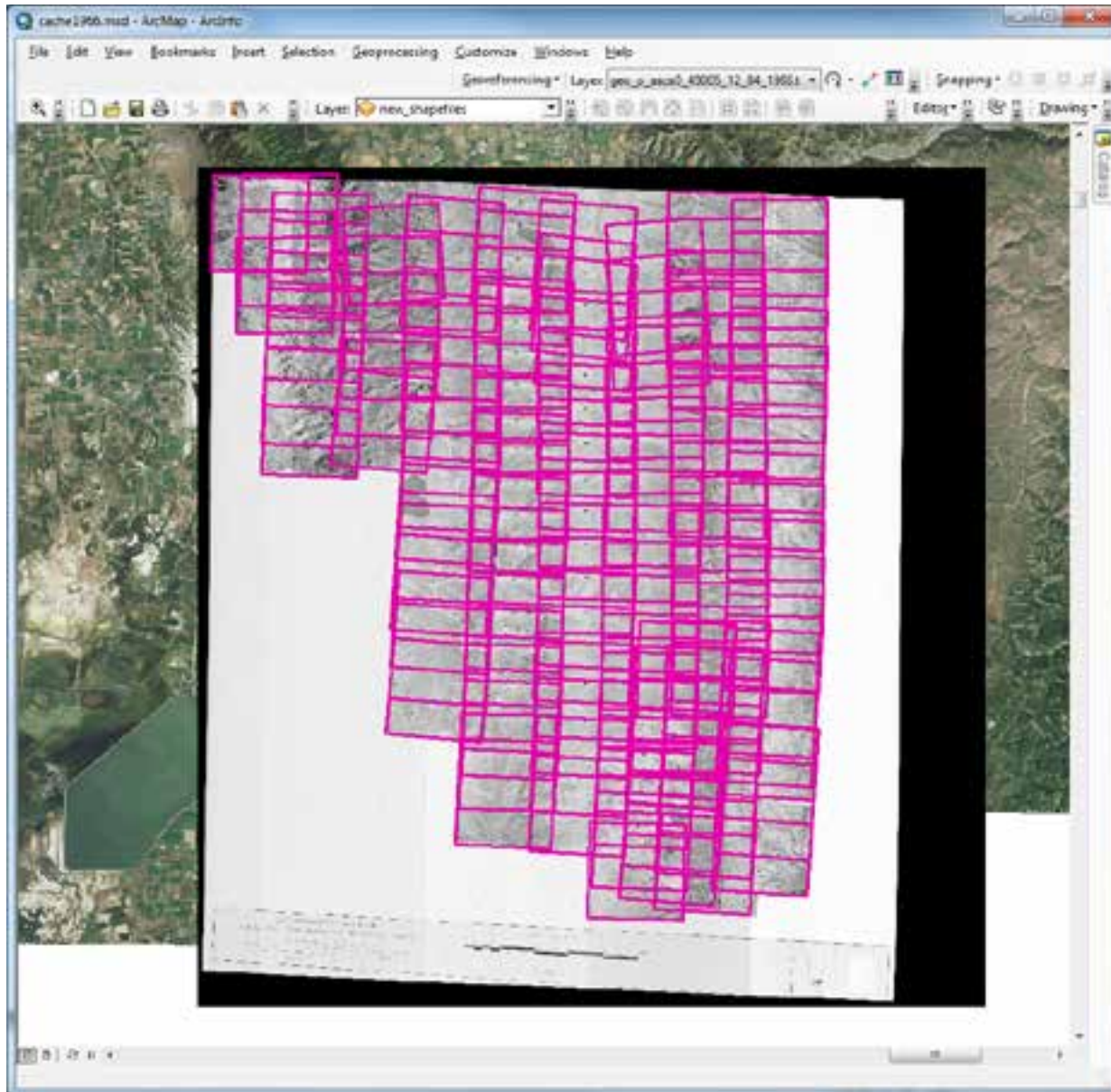
A closer look at one of the paper indexes.



First step is to do a 4 point georeference on the digital index scans. This will give us a rough placement of where the index and corresponding images fit into geographic space.

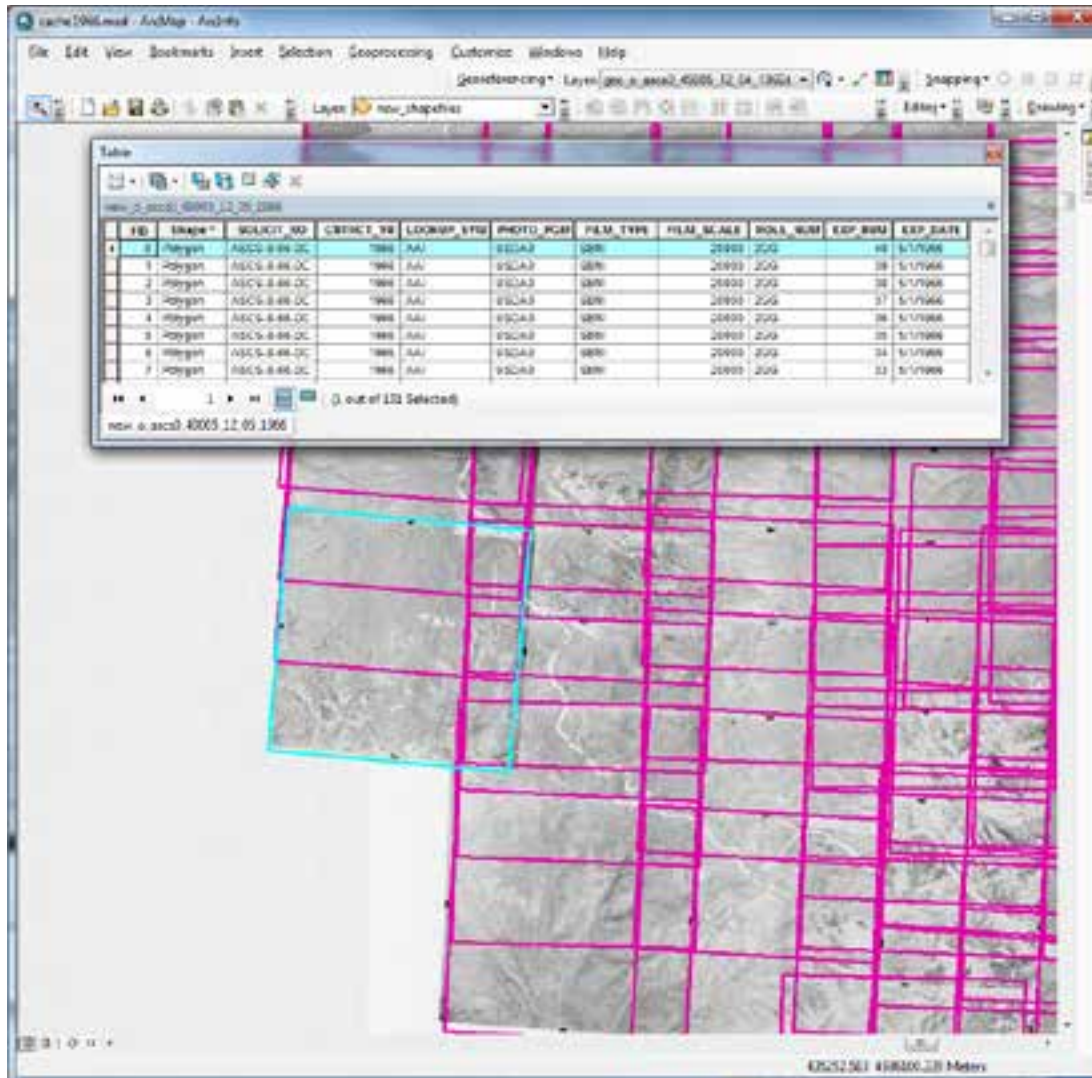


Next step is to digitize the photo footprints.





Each polygon represents a photo in the Index. The image polygon has a corresponding line in an attribute table listing things such as Solicitation Number, Contract Year, Lookup Symbol, Film Type, Film Scale, Roll Number, Exposure Number and Exposure Date.



# Corresponding metadata is also created for the polygon indexes.

```

C:\app\49001_12_01_1SET\app\Mapal
File Edit Format View Help
Identification_Information:
  CITEINFO:
    Citation_Information:
      Originator: USDA-FSA-APFO Aerial Photography Field Office
      Title: C:\app\49001_12_01_1SET
      Publication_Date: 20130118
      Edition: version
      Geospatial_Data_Presentation_Form: vector digital data
      Publication_Information:
        Publication_Place: Salt Lake City, Utah
        Publisher: USDA-FSA-APFO Aerial Photography Field Office
    Description:
      Abstract: This data set contains polygons delineating the approximate boundaries of exposures represented by
      roll and exposure numbers, and exposure dates. Indexes are formatted to the UTM coordinate system using either
      purpose: to preserve in a geospatially ready format unique and irreplaceable data, most historical geospatial
      Time_Period_of_Content:
      time_period_information:
        Single_Date/Time:
          Calendar_Date: 20130118
        Currentness_Reference: GSD: shapefile creation date.
    Status:
      Progress: Complete
      Maintenance_and_Update_Frequency: None Planned
    Spatial_Domain:
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        east_bounding_coordinate: -113.88927
        north_bounding_coordinate: 41.17310
        south_bounding_coordinate: 40.86111
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        Theme_Keyword: Farming
        Theme_Keyword: Title Vault
        Theme_Keyword: Historical
        Theme_Keyword: United States Department of Agriculture (USDA)
        Theme_Keyword: Digital Georeferenced Image
      place:
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        Place_Keyword: ESA
        Place_Keyword: Utah
        Place_Keyword: Aerial Photography Field Office
        Place_Keyword: APFO
        Place_Keyword: USDA
        Place_Keyword: United States Department of Agriculture (USDA)
        Place_Keyword: FIPS 49003
        Place_Keyword: UT
        Place_Keyword: Utah
        Place_Keyword: USDA-FSA-APFO
    Access_Constraints: None
    Use_Constraints:
      None, The Aerial Photography Field Office asks to be credited
      in derived products.
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        Contact_Organization_Primary:
          Contact_Organization: USDA-FSA-APFO Aerial Photography Field Office
        Contact_Address:
          Address_Type: mailing and physical
          Address: 2222 West 2100 South
          City: Salt Lake City
          State_or_Province: Utah
          Postal_Code: 84119-2010
          Contact_Voice_Telephone: 801-844-2990
          Contact_Electronic_Mail_Address: apfo.safes@fc.usda.gov

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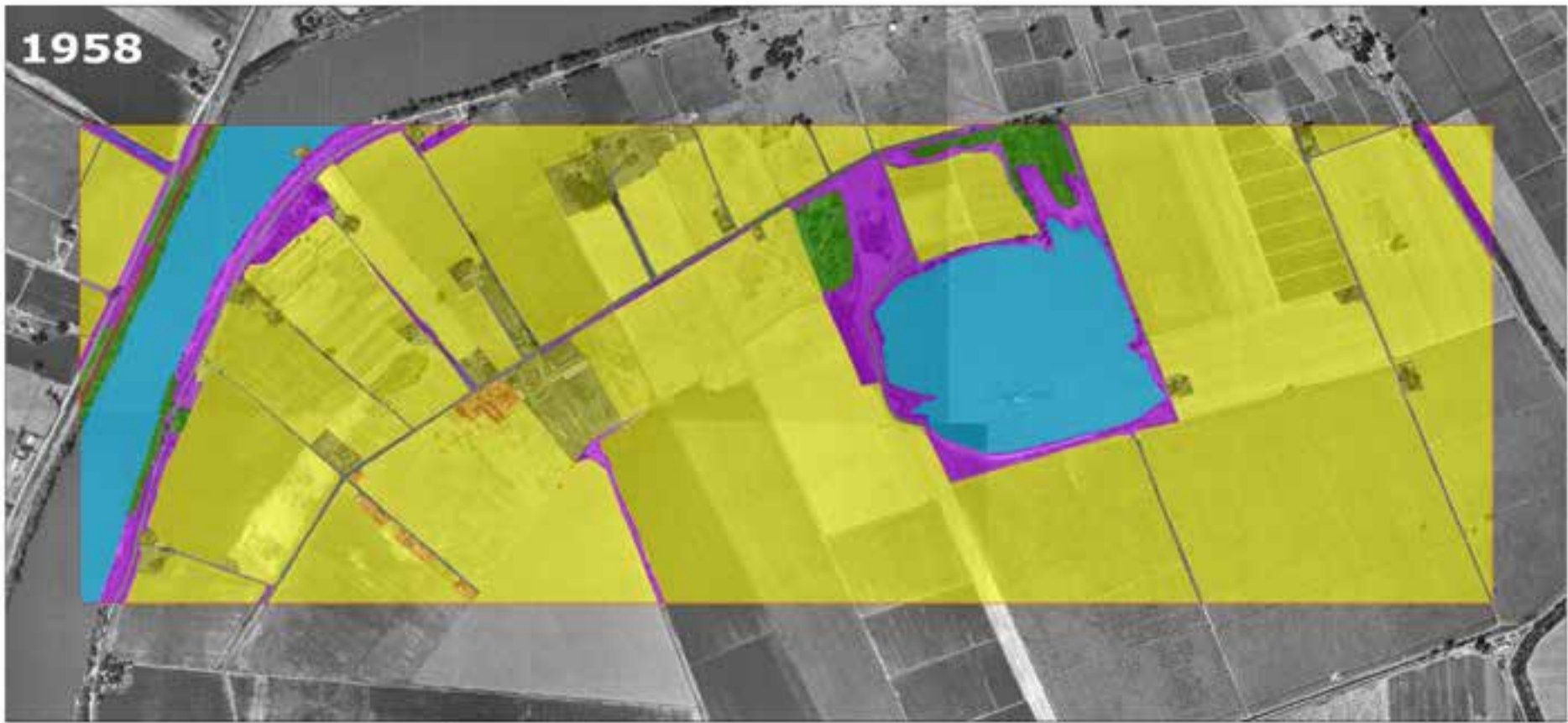


Ideally, a customer will be able to search the archive with the goal that the historical archive will now not just be on paper indexes but within a digital map.








# Application 2: Identifying land use change using current and historical imagery

- u Land use change over time
  - u Focus on rural to urban
  - u Change between 1958 and 2009
  - u Ten land cover class types identified
    - u Farmland, water, road, railroad, residential, commercial/industrial, forest/woodland, recreational, farm, other
  - u Land cover types were manually digitized using ArcGIS

1958











### Land Cover Types

	farmland		commercial/industrial
	water		forest/woodland
	road		recreational
	railroad		farm
	residential		other

2009



### Land Cover Types

	farmland		commercial/industrial
	water		forest/woodland
	road		recreational
	railroad		farm
	residential		other



- u Loss of agricultural land over time
  - u Area of interest near Sacramento, CA
    - u Important rice growing area as well as other crops
  - u Agricultural lands were manually digitized using ArcGIS for 6 different years of historical imagery
  - u Digitized areas were statistically analyzed

# Agricultural Loss Around Sacramento, CA: 1958-2009



1958



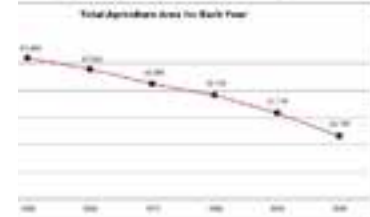
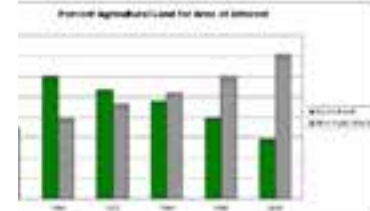
1964



1972

This graphic shows the loss of agriculture land around Sacramento from 1958 to 2009. The area of interest is along the Sacramento River from near the present day airport in the north to the Pocket-Greenhaven area in the south.

Overall, the area has experienced loss in farmland. This is most evident in Greenhaven which was nearly all agricultural in 1958; in 2009 it is entirely devoid of lands.



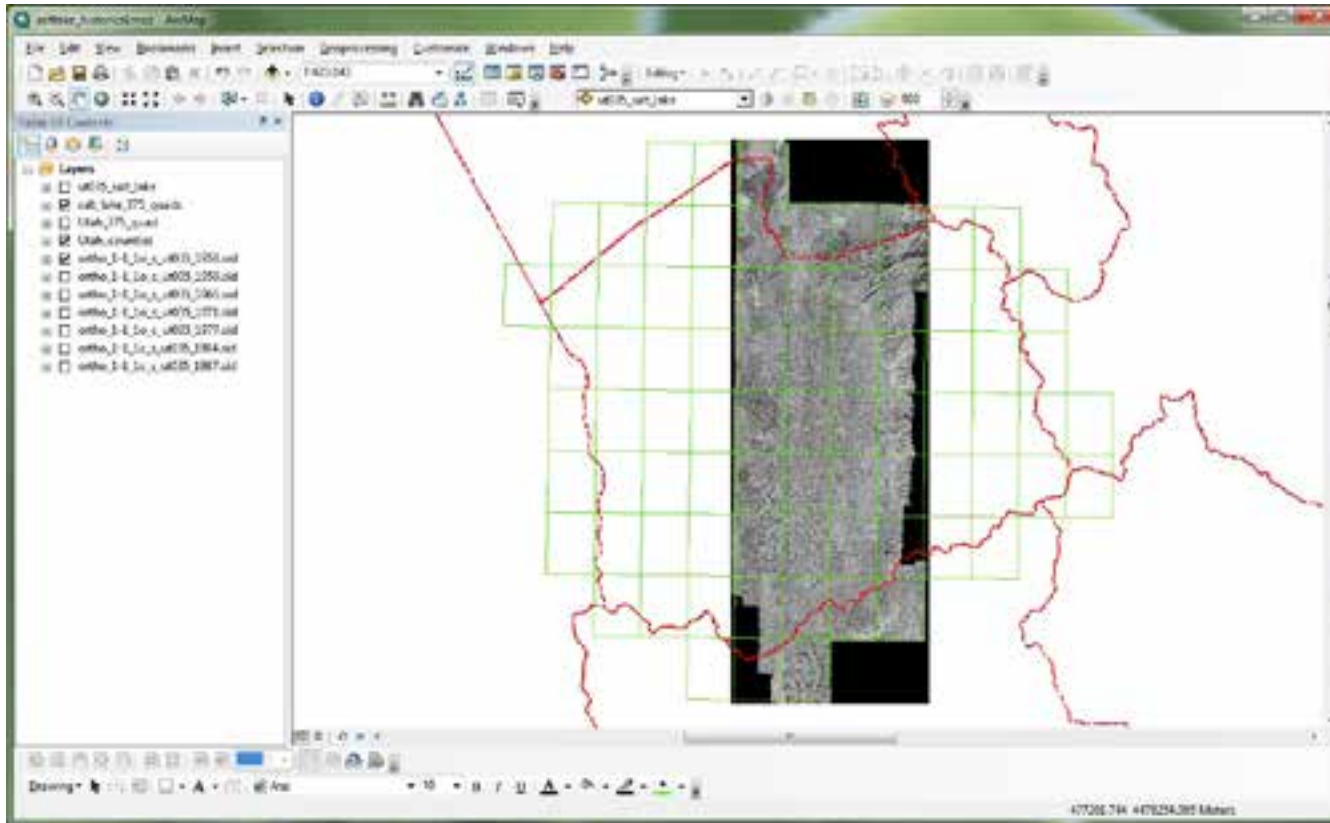
Data Sources: USDA/FSA/APFO, ESRI, FSA-California  
 Note: Areas in transparent yellow represent agriculture.





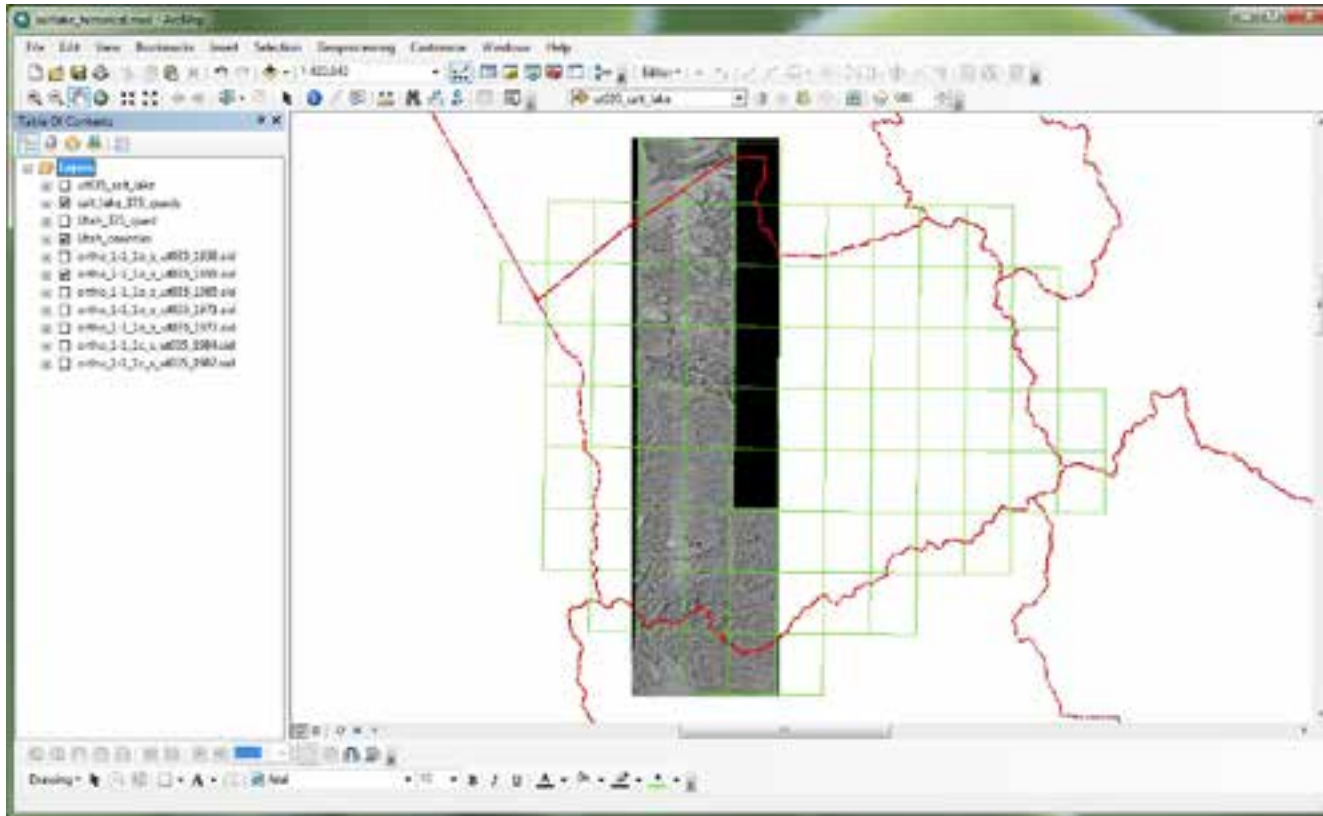
# Application 3: Historical Orthoimagery for Salt Lake County: 1958 through 1987

# 1958



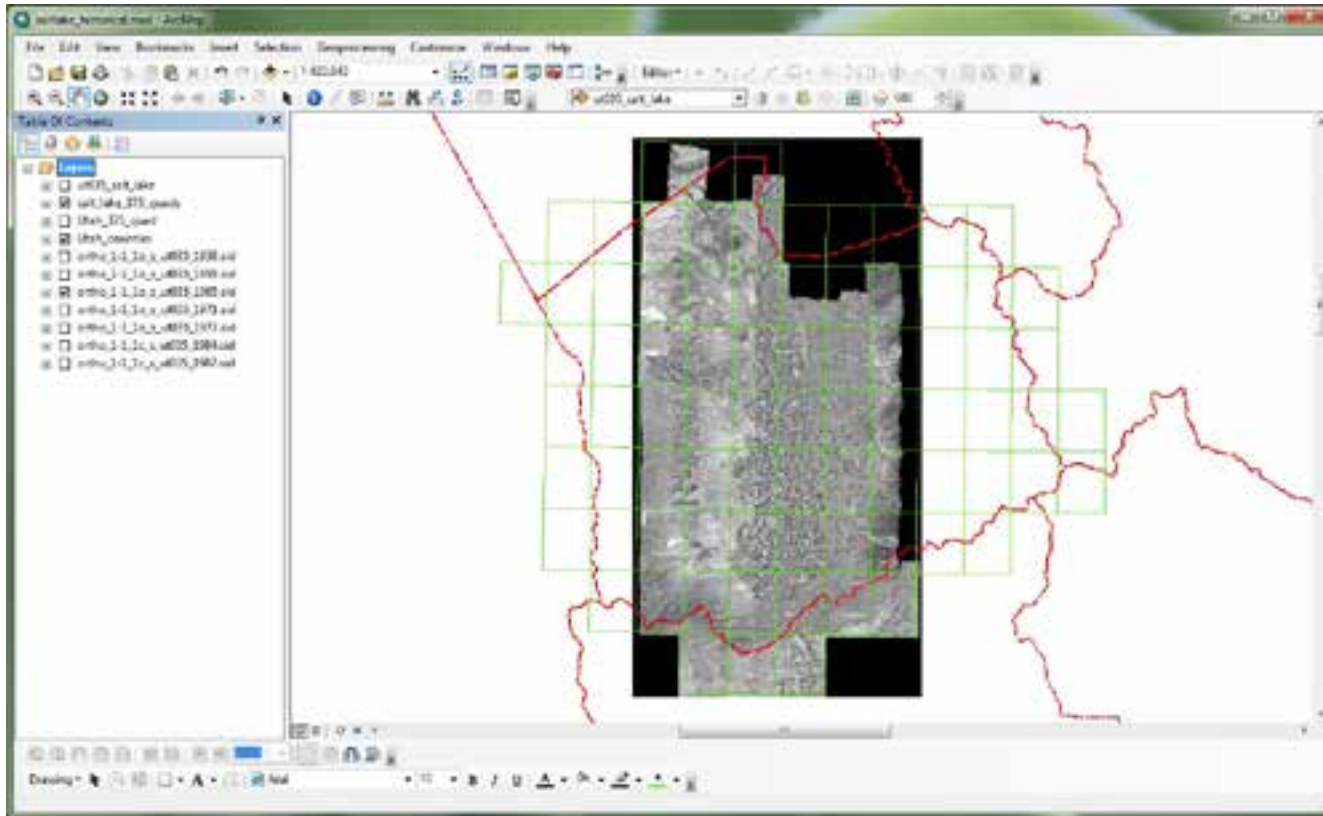
1:10,000 Scale – 1,030 Images

# 1959



1:20,000 Scale – 137 Images

# 1965



1:20,000 Scale – 326 Images



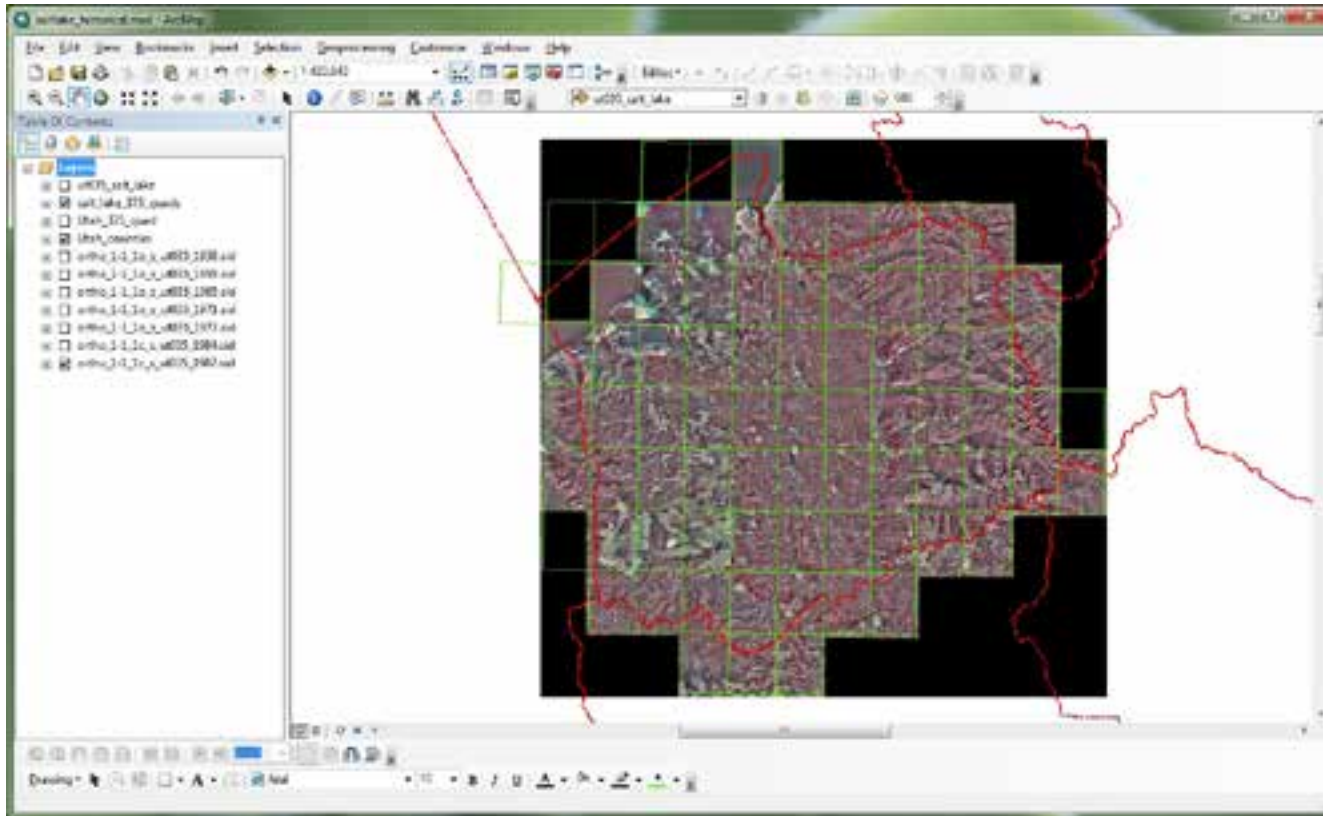








# 1987



1:40,000 Scale – 210 Images

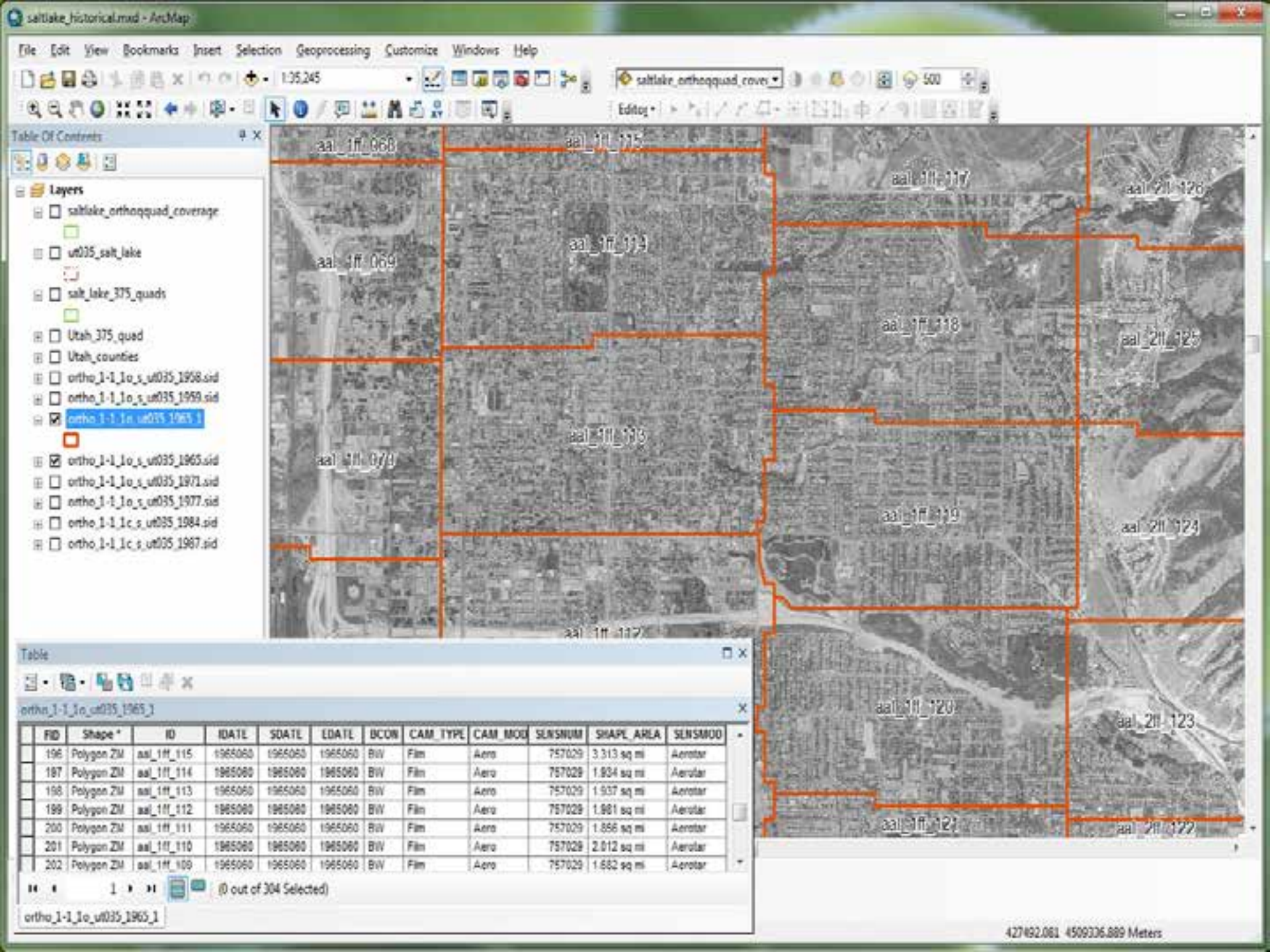


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- Layers
- saltlake\_orthoquad\_coverage
- u035\_salt\_lake
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- Utah\_counties
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- ortho\_1-1\_1e\_u035\_1959.sid
- ortho\_1-1\_1e\_u035\_1965\_1
- ortho\_1-1\_1e\_u035\_1965.sid
- ortho\_1-1\_1e\_u035\_1971.sid
- ortho\_1-1\_1e\_u035\_1977.sid
- ortho\_1-1\_1e\_u035\_1984.sid
- ortho\_1-1\_1e\_u035\_1987.sid

Table

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197	Polygon ZM	aal_1f_114	1965060	1965060	1965060	BW	Film	Aero	757029	1.804 sq mi	Aerotar
198	Polygon ZM	aal_1f_113	1965060	1965060	1965060	BW	Film	Aero	757029	1.937 sq mi	Aerotar
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201	Polygon ZM	aal_1f_110	1965060	1965060	1965060	BW	Film	Aero	757029	2.012 sq mi	Aerotar
202	Polygon ZM	aal_1f_109	1965060	1965060	1965060	BW	Film	Aero	757029	1.682 sq mi	Aerotar

0 out of 304 Selected

ortho\_1-1\_1e\_u035\_1965\_1

# Data Sources

- u USDA/Farm Service Agency/APFO
  - u <http://www.apfo.usda.gov>
- u USDA Geospatial Data Gateway
  - u <http://datagateway.nrcs.usda.gov/>
- u APFO ArcGIS image service
  - u <http://gis.apfo.usda.gov/arcgis/services/>
- u APFO sales section
  - u (801) 844-2922 [apfo.sales@slc.usda.gov](mailto:apfo.sales@slc.usda.gov)