Characterizing Annual Land Use Conditions Using Multi-Resolution Imagery

September 7, 2016
CBP Land Use Workgroup

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U.S. Department of the Interior
U.S. Geological Survey

Data used Previously to Backcast Land Use for Calibrating the Chesapeake Watershed Model

1980   **1990**   **2000**   **2010**
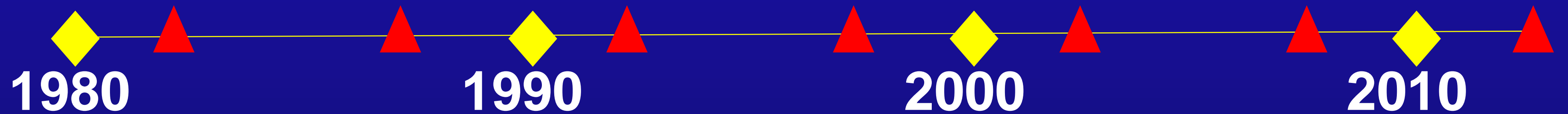
◆ Census of Population and Housing (block level)

▲ Census of Agriculture (county level)

Irani, F. M., & Claggett, P. (2010). Chesapeake Bay Watershed Land Cover Data Series. *US Geological Survey Data Series, 505*.

Backcasting Land Uses Annually from 2013 to 1984 New Methodology:

1. Use the 2013-ish Phase 6 Land Use Dataset to establish anchor for current land use conditions.

2. Use USGS' LCMAP-Continuous Change Detection and Classification (CCDC) data to identify every year of significant spectral change from 1984 through 2013 (for every 30m pixel).

3. Use CCDC to interpolate land cover/use change annually between years represented in the Chesapeake Bay Land Cover Data Series (1984, 1992, 2001, 2006) and 2013 Phase 6 Land Use Dataset.

Three decadal observations:
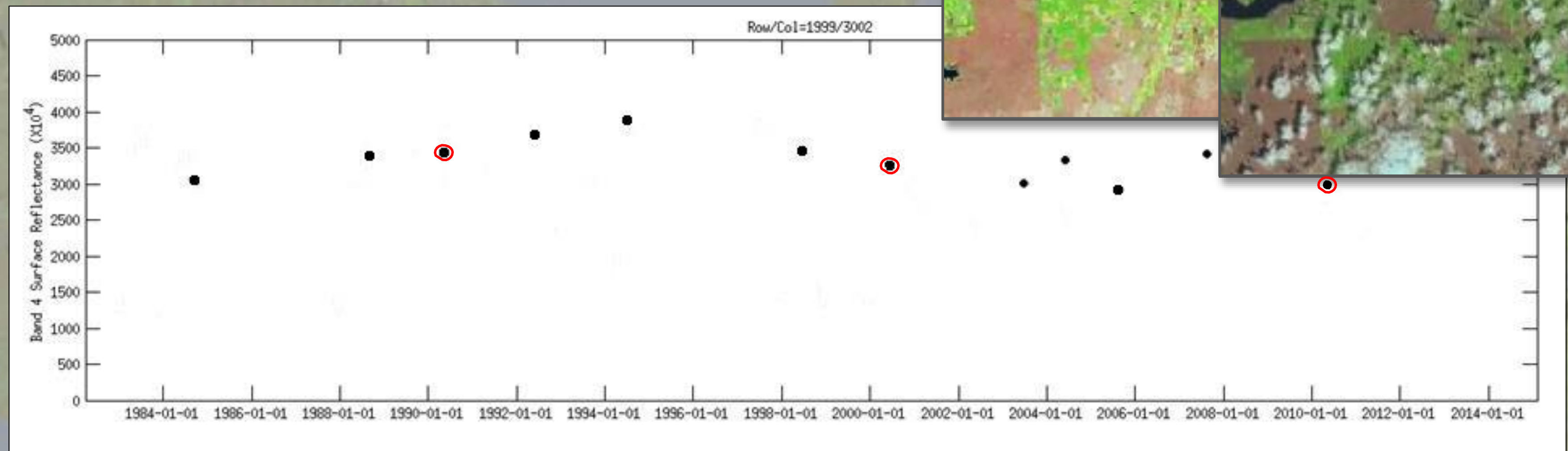growing seasons 1990, 2000, and 2010
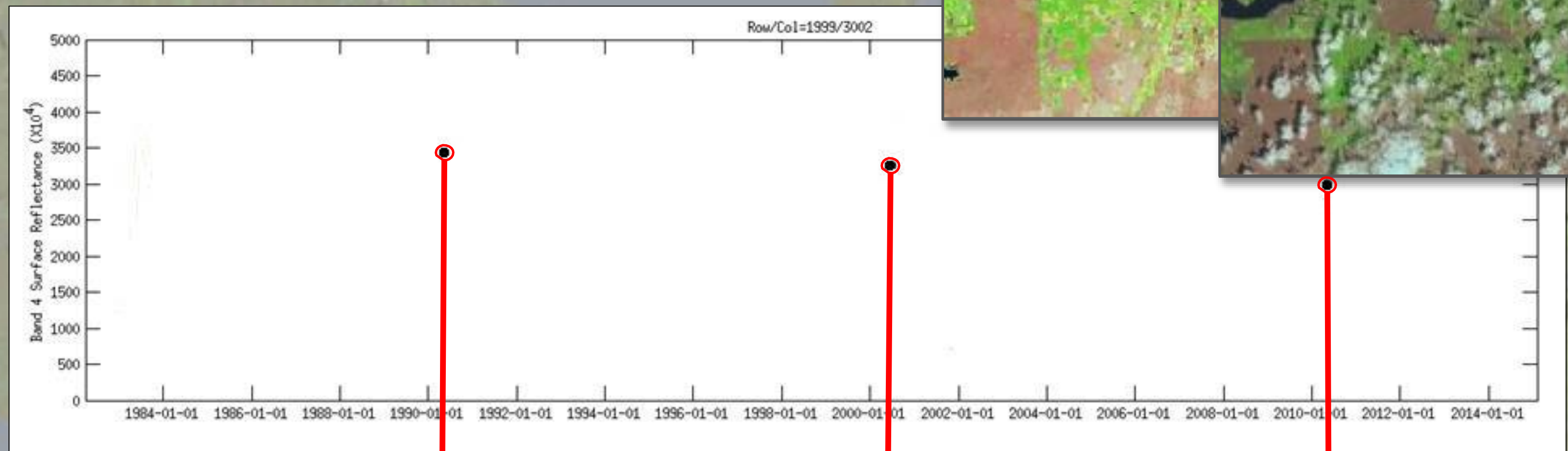
Row/Col=1999/3002

Landsat near-infrared, cloud-screened observations converted to surface reflectance using LEDAPS. Pixel row 1999, column 3002; WRS-2 path 12, row 31
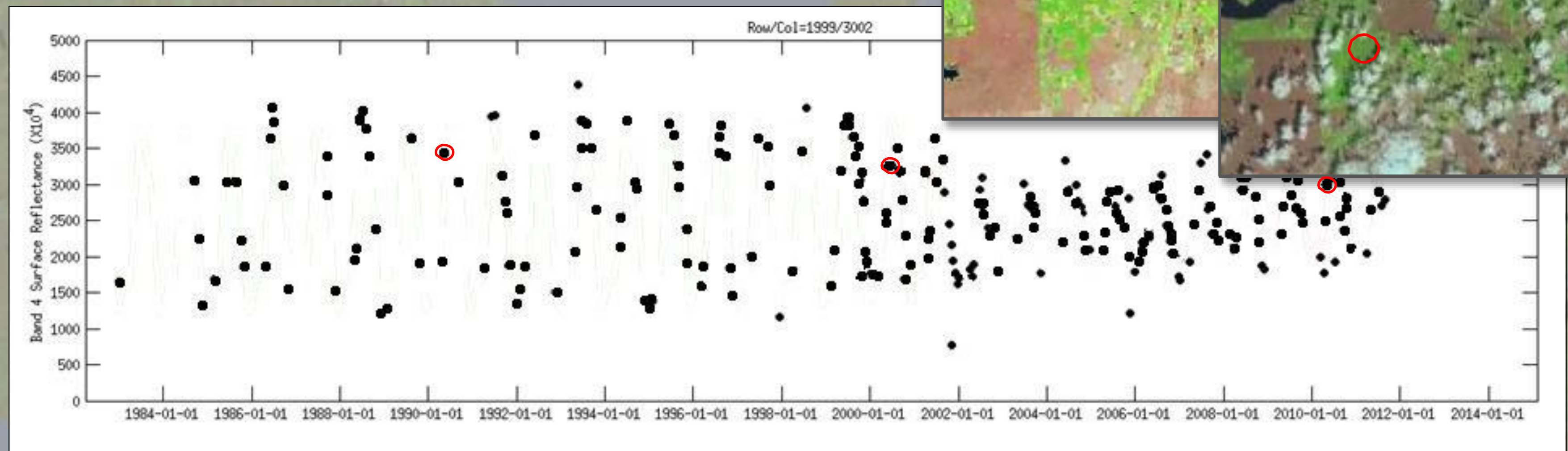
USGS
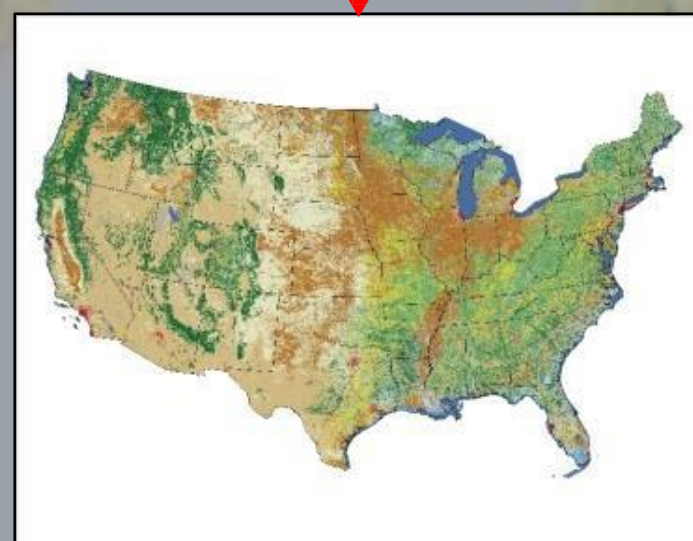
Multiple clear observations,
growing seasons 1984–2010

Landsat near-infrared, cloud-screened observations converted to surface reflectance using LEDAPS. Pixel row 1999, column 3002; WRS-2 path 12, row 31

Graph adapted from C. Holden, Boston University

All clear observations ever acquired
for this location: 1984–2010

Landsat near-infrared, cloud-screened observations converted to surface reflectance using LEDAPS. Pixel row 1999, column 3002; WRS-2 path 12, row 31

A new paradigm for monitoring for change !

Mathematical prediction models fit to clear observations
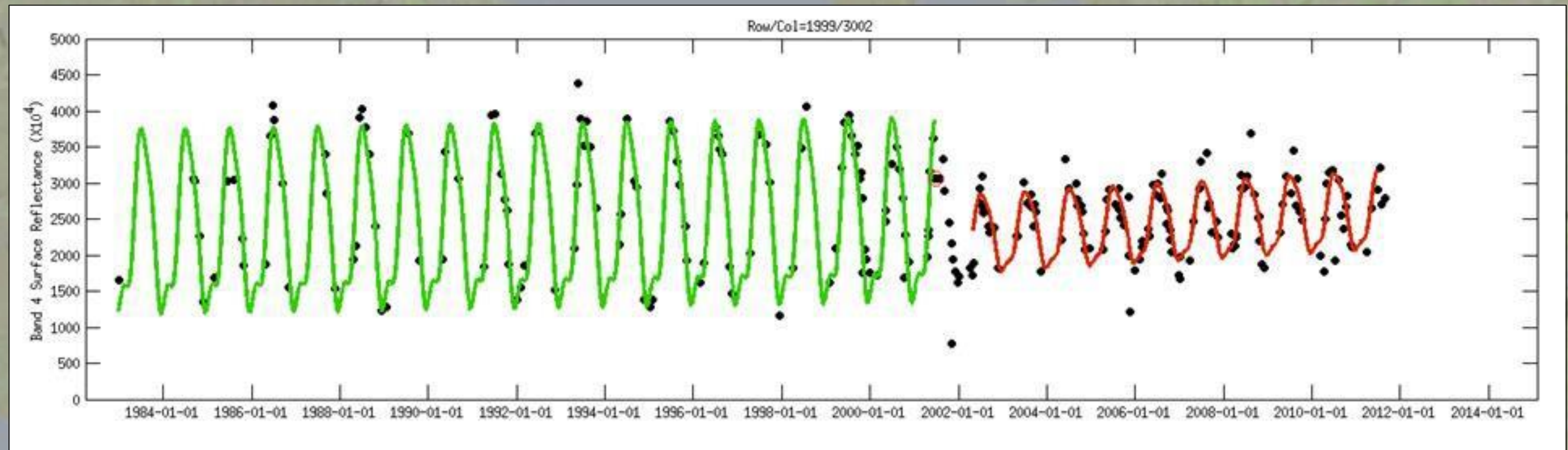
Reference: Zhu, Z. and C.E. Woodcock. 2014. Continuous change detection and classification of land cover using all available Landsat data. Remote Sensing of Environment 144:152–171.

Graph adapted from C. Holden, Boston University

Spectral history of a location in Fort Collins, Colorado, USA

Crop field

Hay field

In conversion

Developed

Ft. Collins USGS

Landsat Band 5

Reflectance (scale factor 0.0001)

4000
3500
3000
2500
2000
1500
1000

1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012

Date
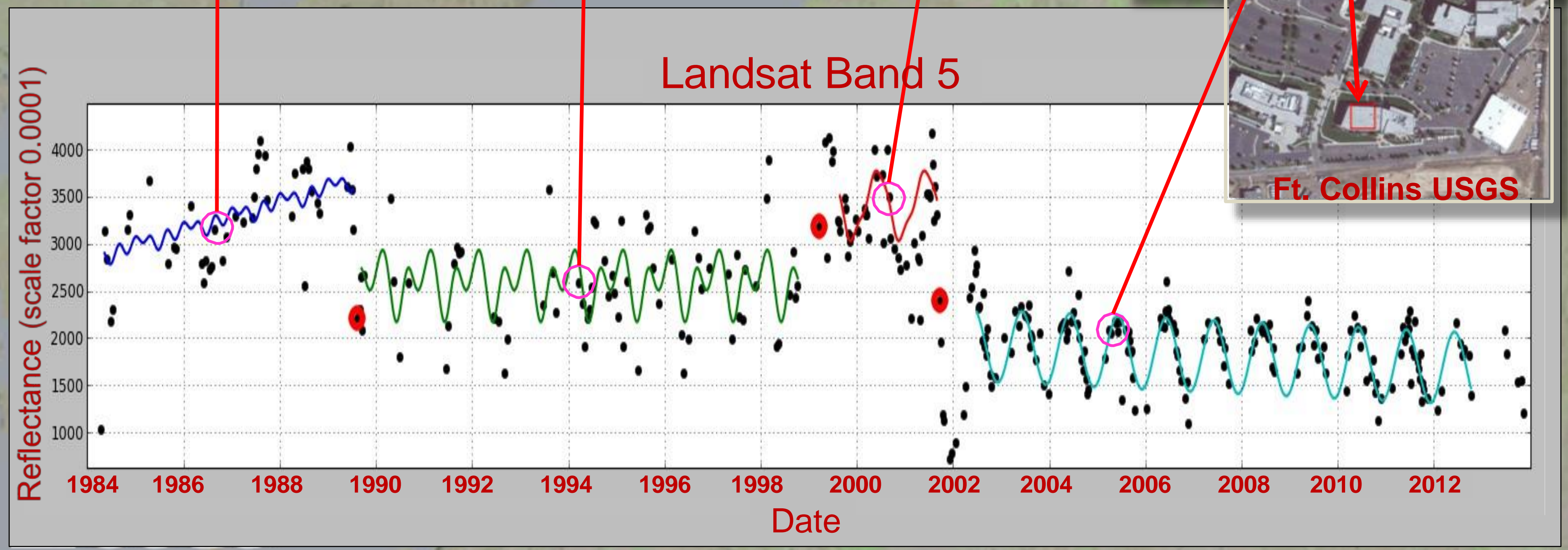
This is happening in all bands simultaneously
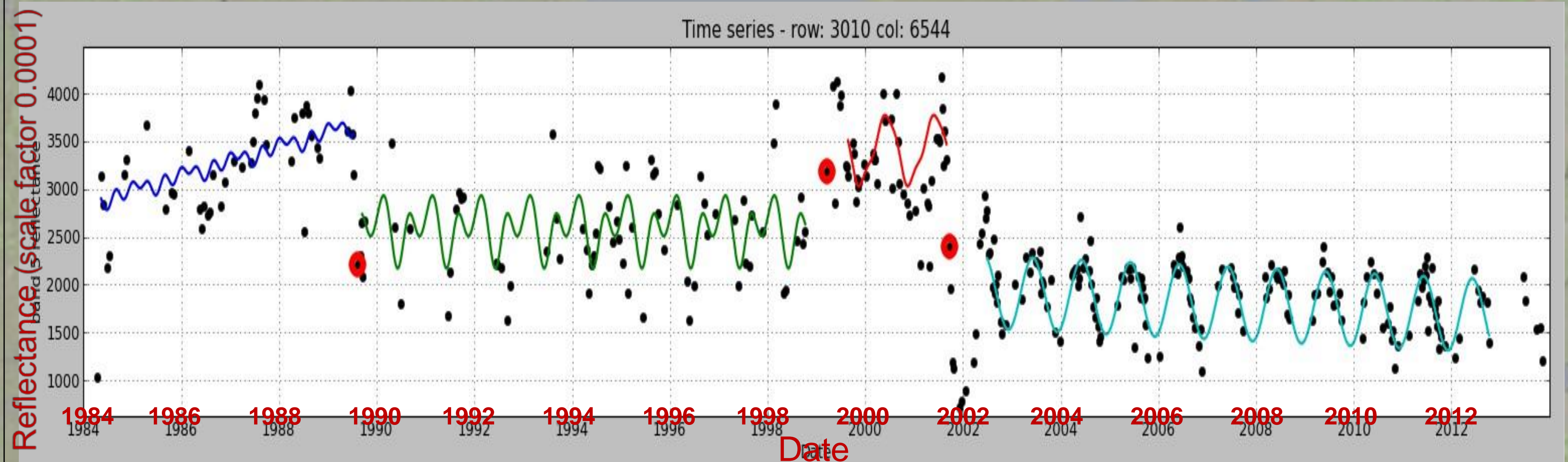
- CCDC first works through the entire history of the pixel to define annual cyclical trajectories and flag changes.

- The coefficients that describe the mathematical trajectories in between change flags are fed to the Random Forest classifier to determine cover-class labels.

Prince George's County
2009 & 2013
1m Land Cover

Andrews Air Force Base, Prince George's County, MD
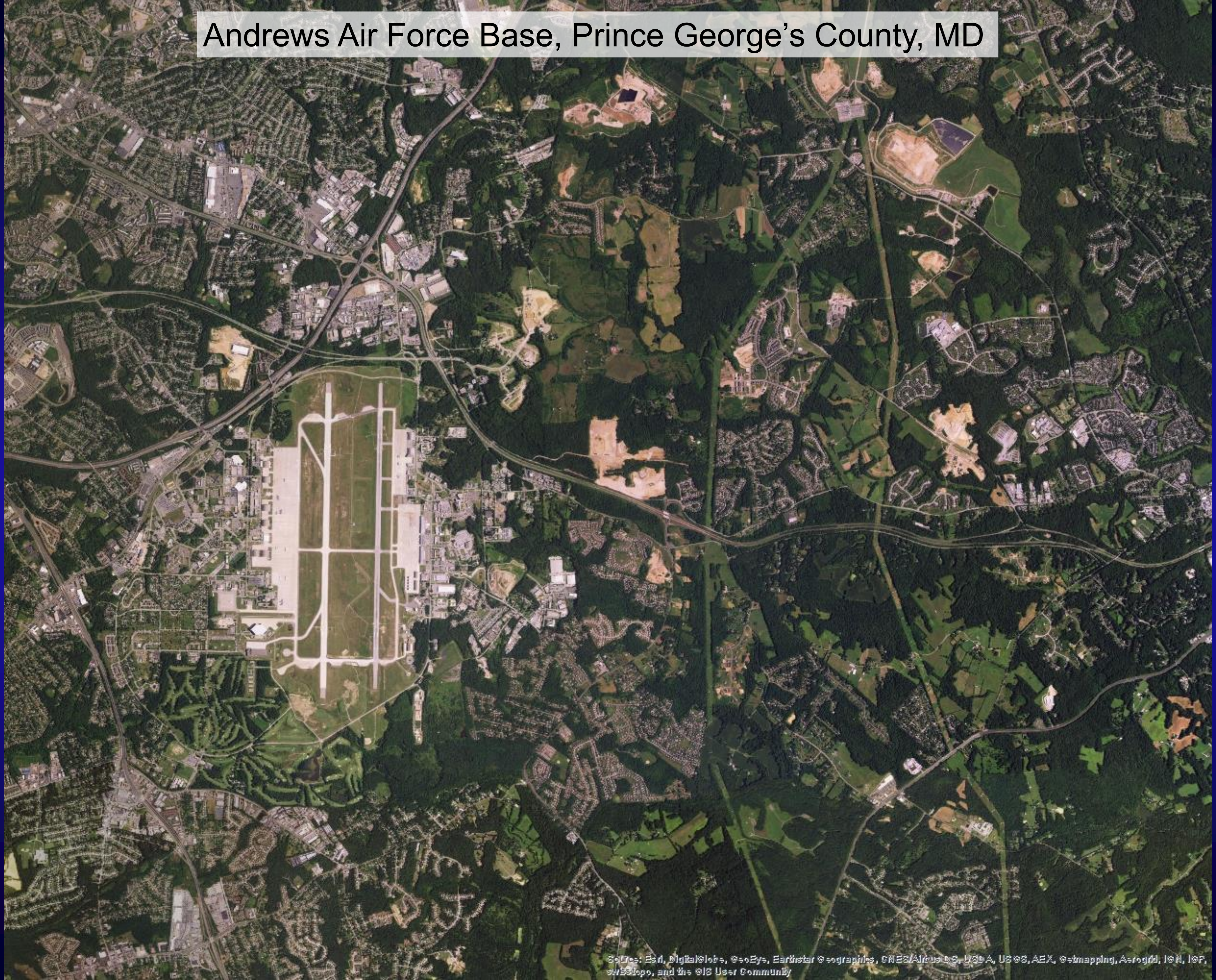
2009 1-meter Land Cover
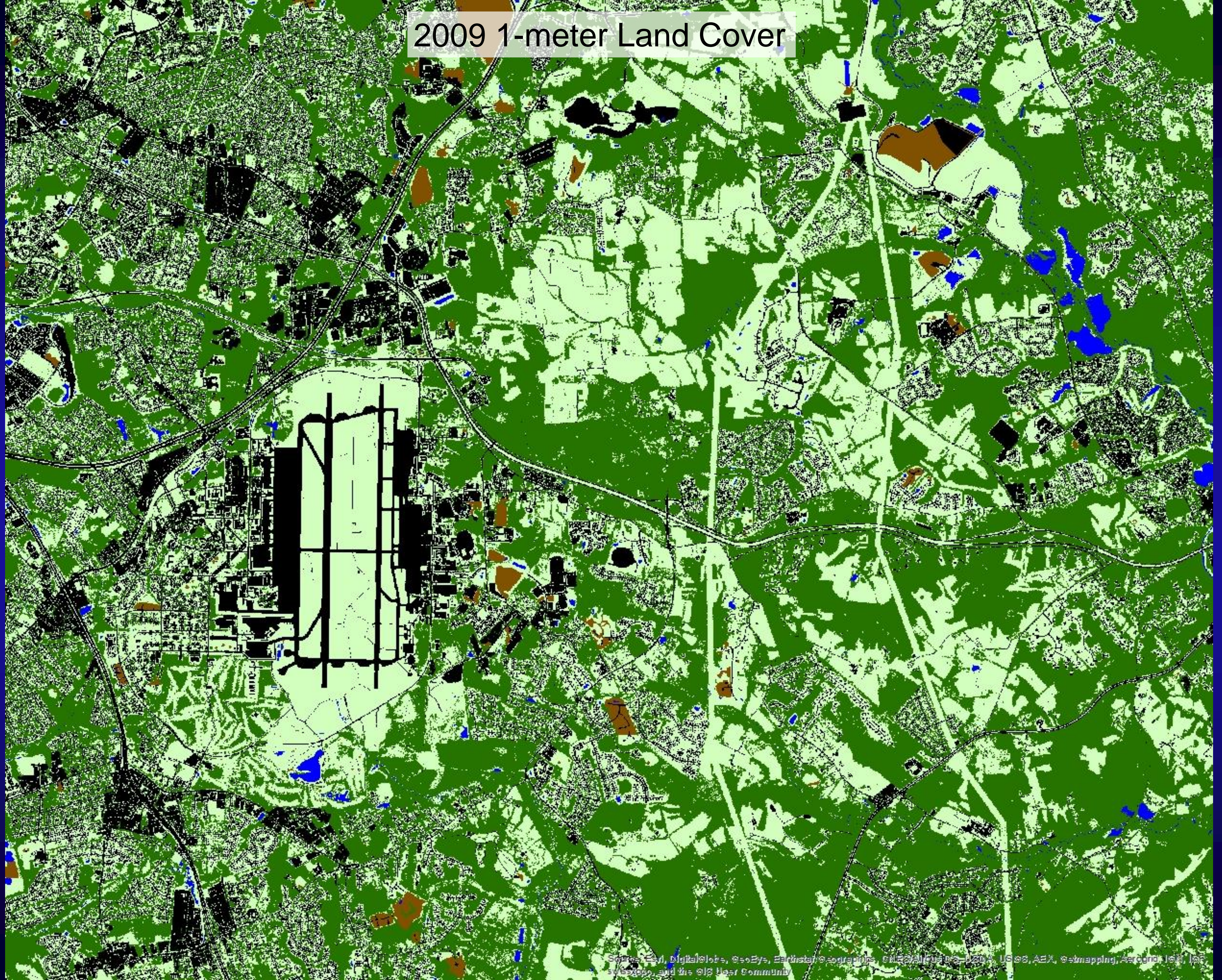
2013 1-meter Land Cover
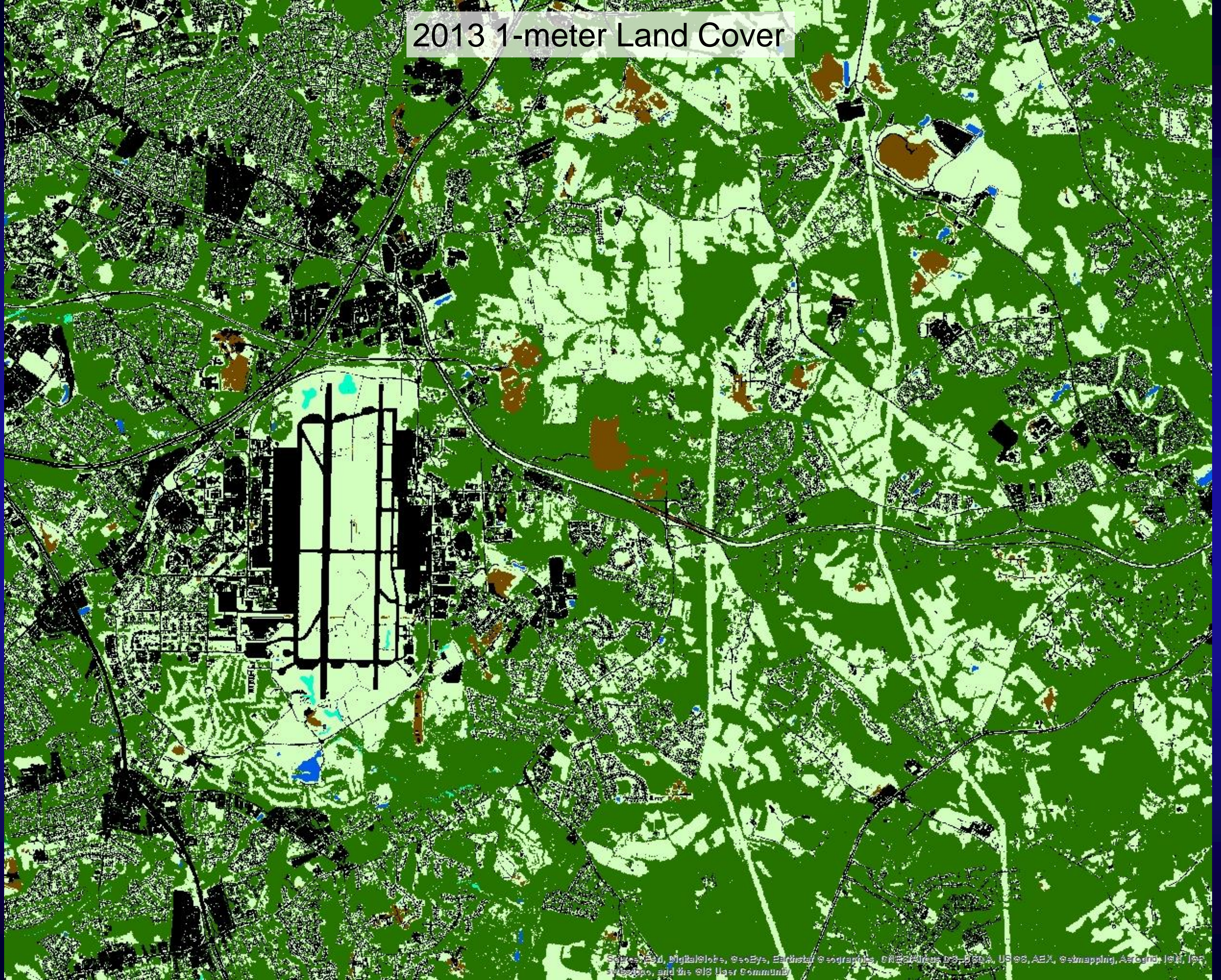
2009 – 2013 Land Cover Change
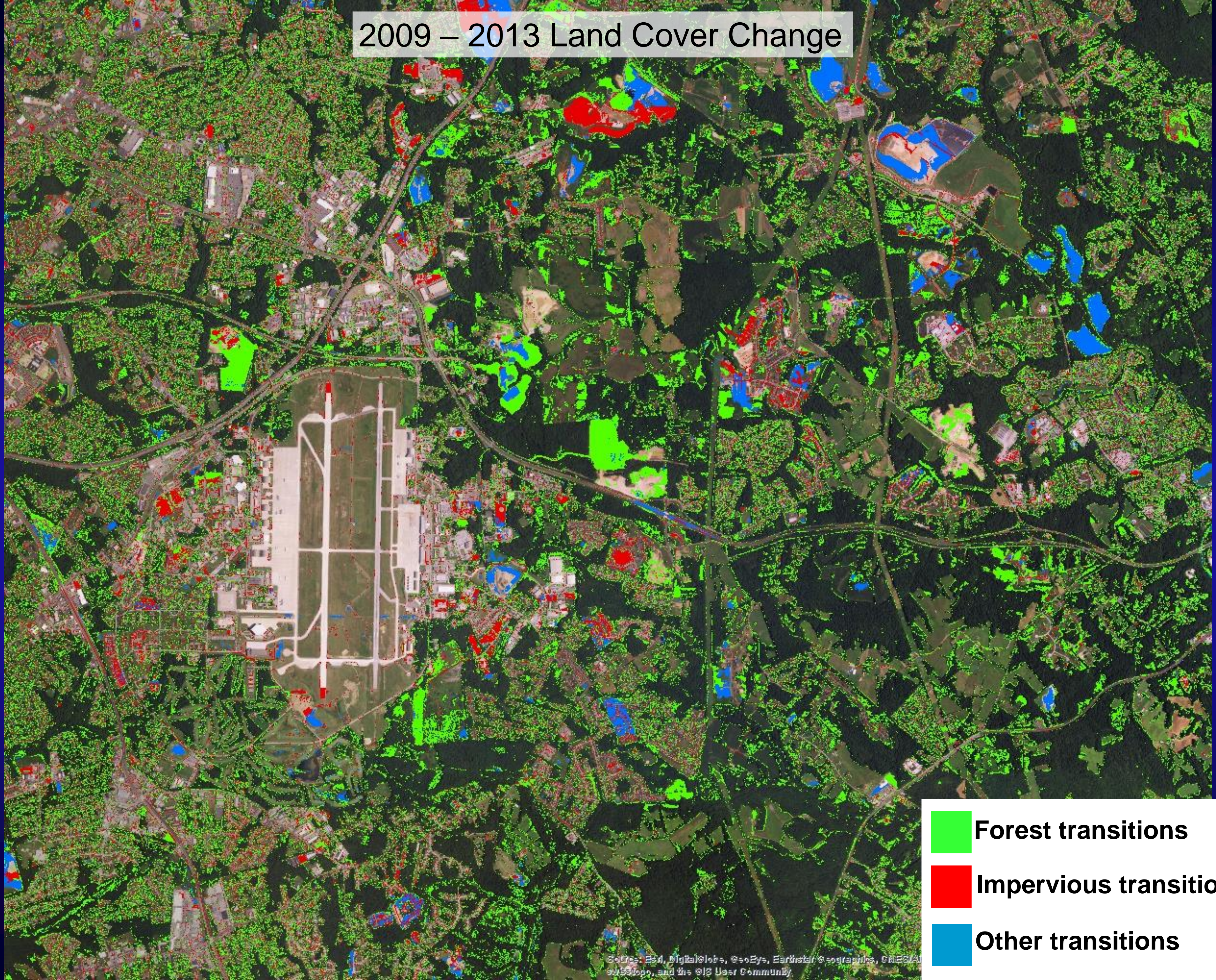
Forest transitions

Impervious transitions

Other transitions

2009 – 2013 Filtered Land Cover Change
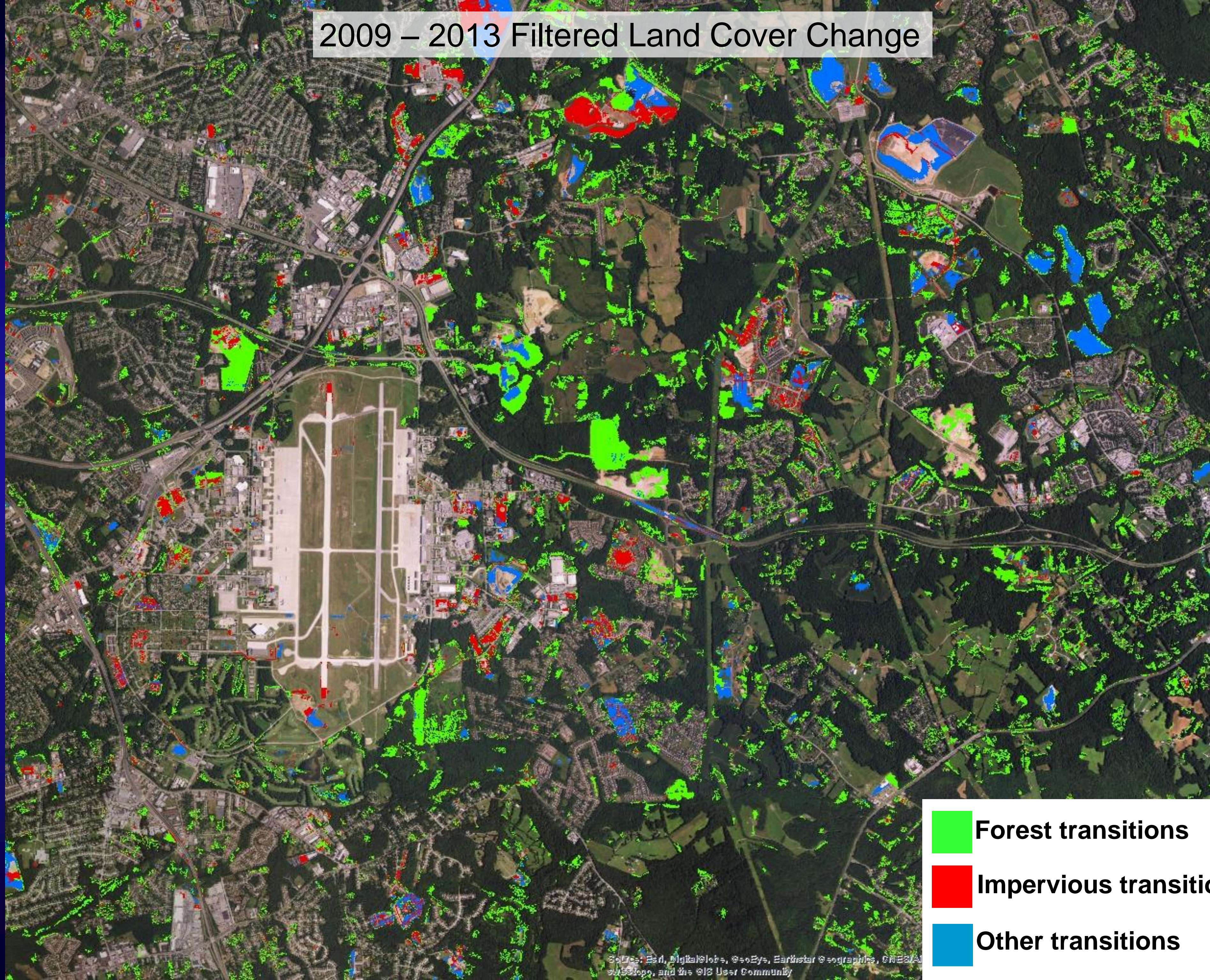
Forest transitions

Impervious transitions

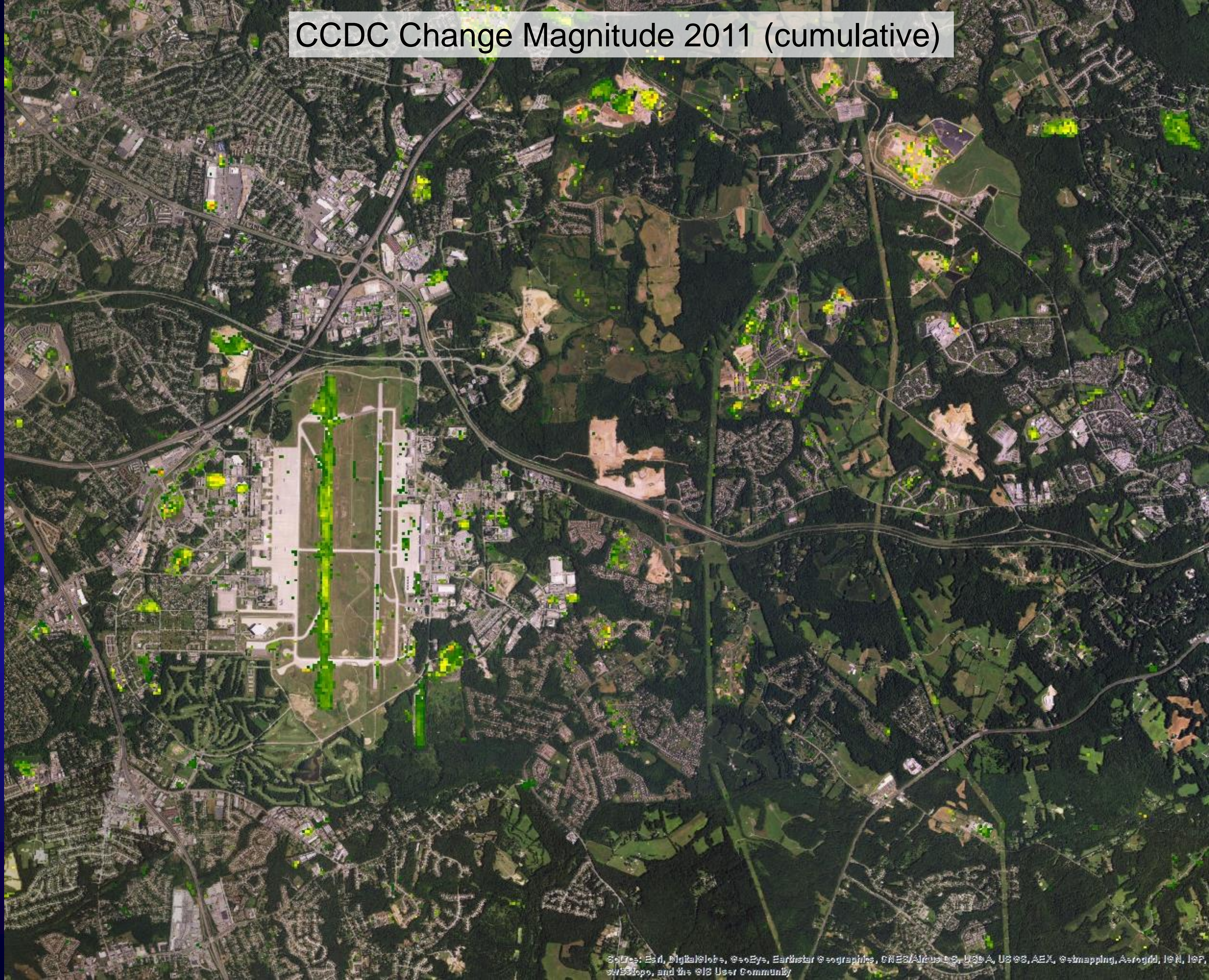**Other transitions**

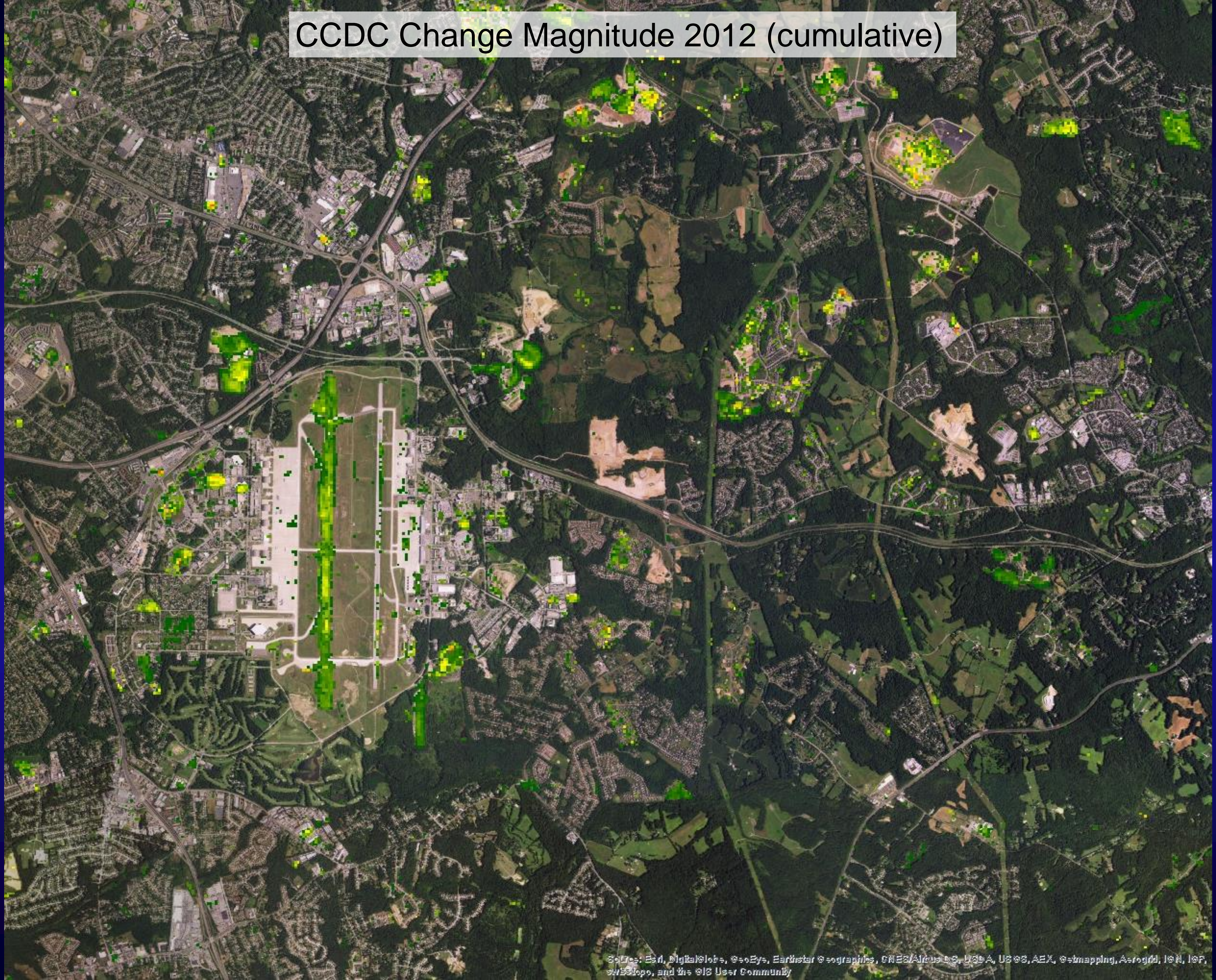Filtered Land Cover Change, Aggregated to 30m
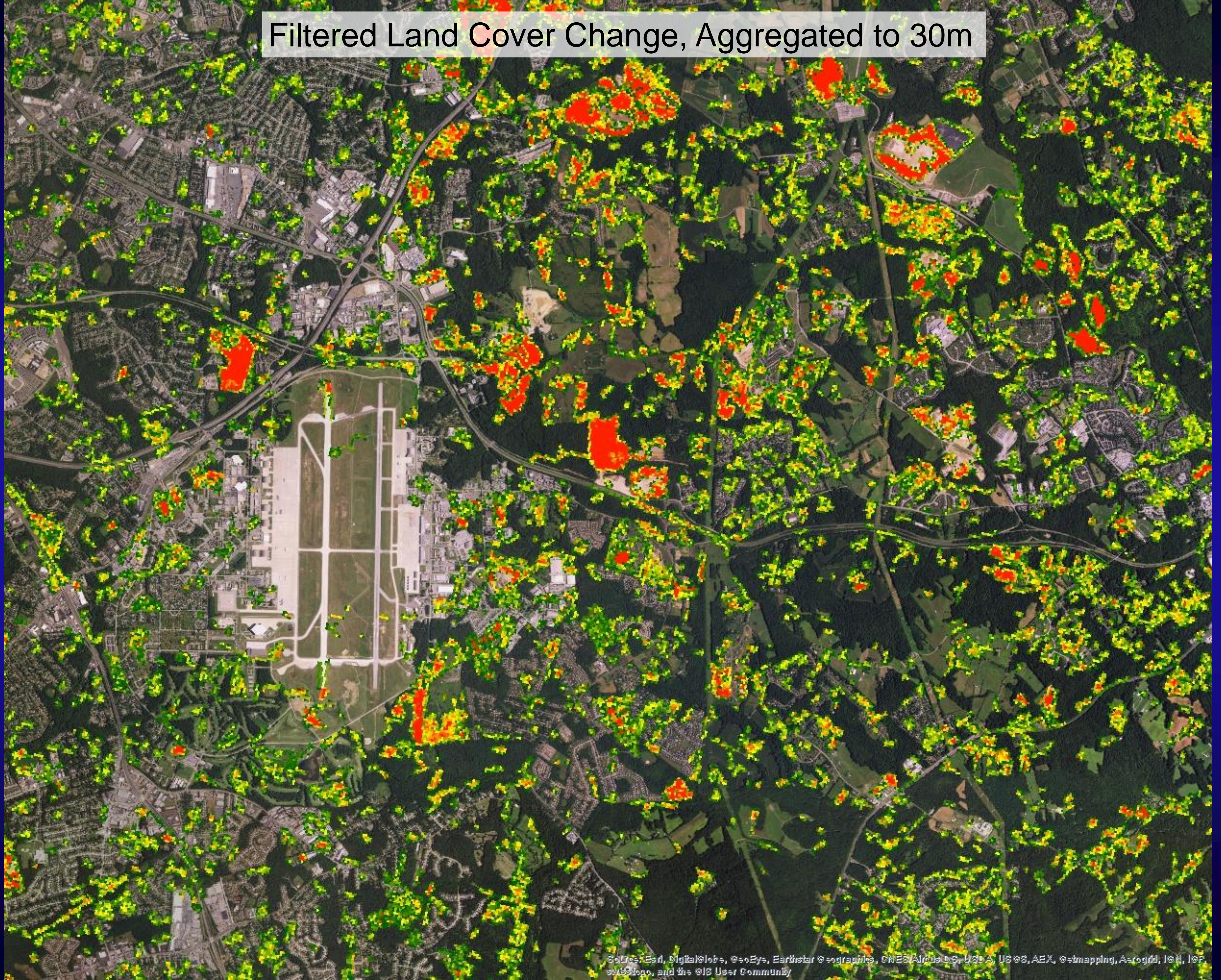
CCDC Change Magnitude 2010

CCDC Change Magnitude 2011 (cumulative)
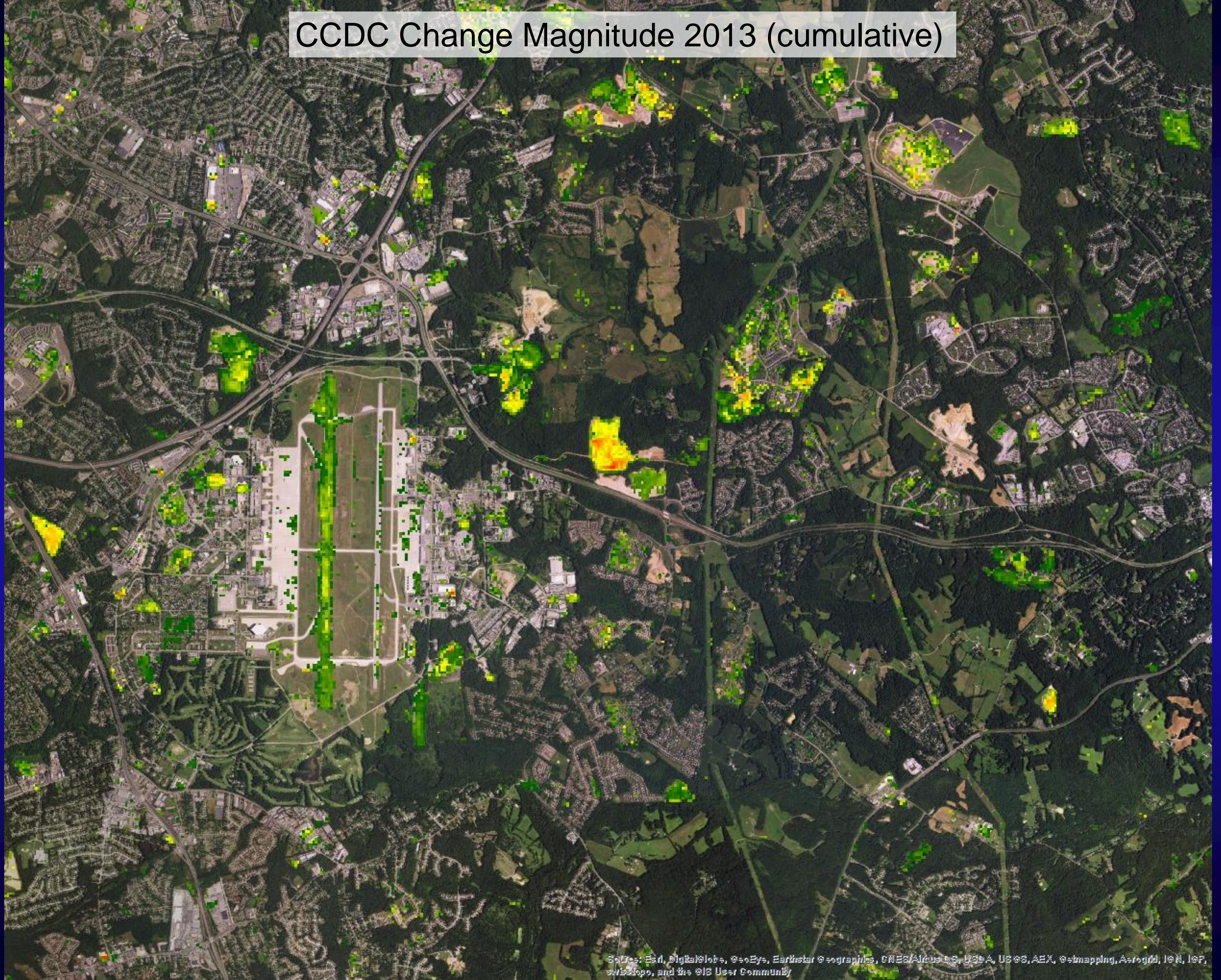
CCDC Change Magnitude 2012 (cumulative)
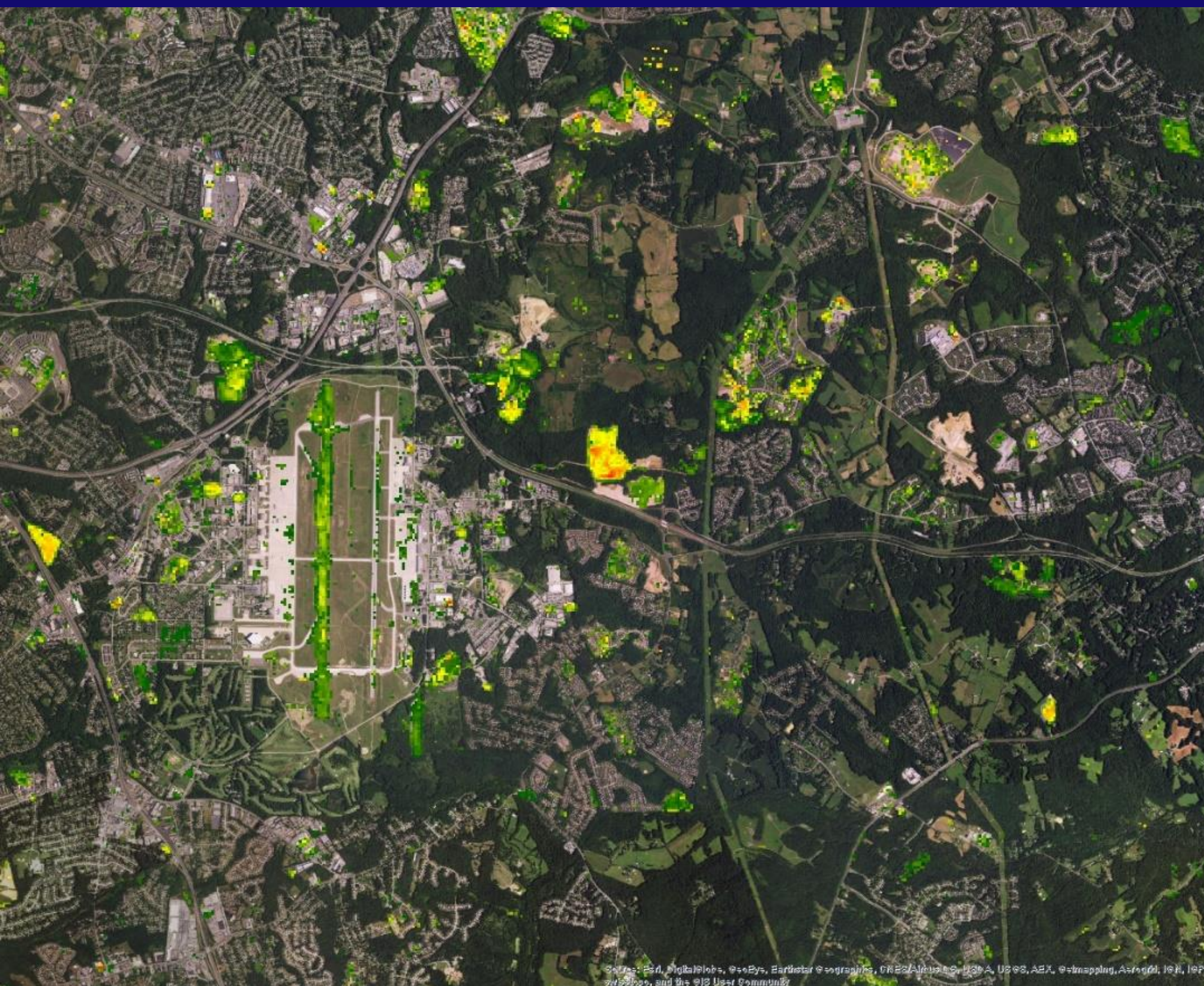
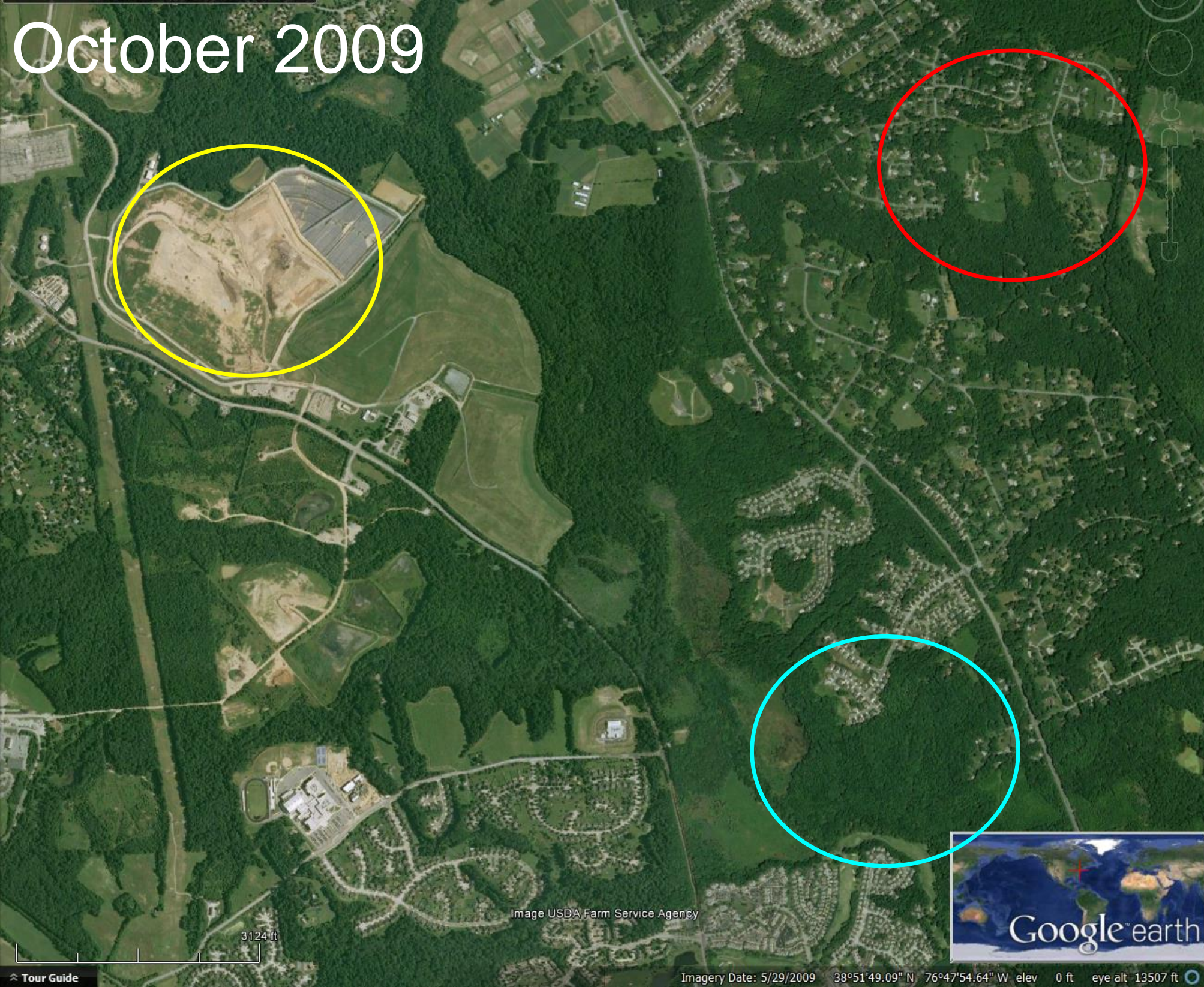CCDC Change Magnitude 2013 (cumulative)

CCDC Change Magnitude
2009 - 2013

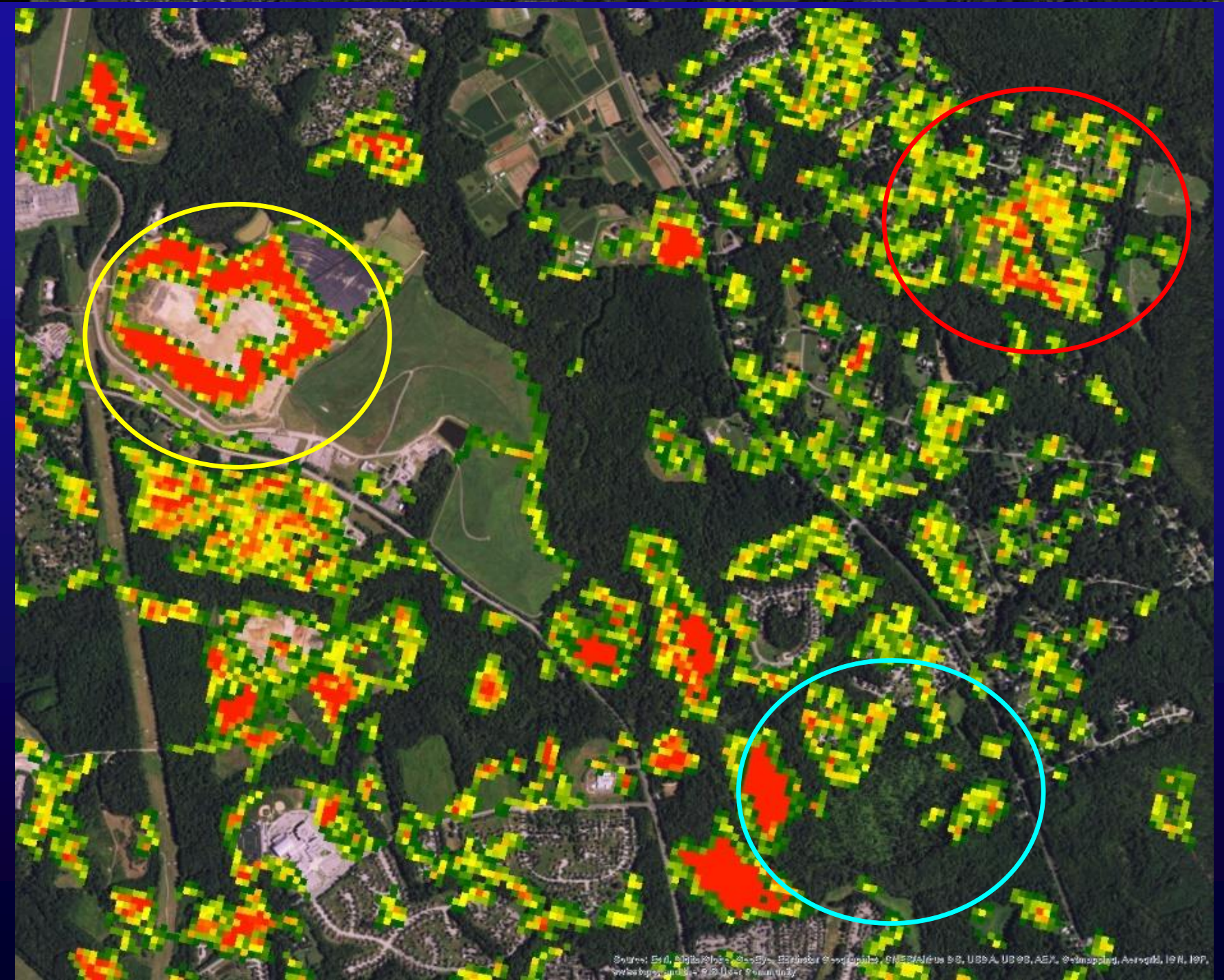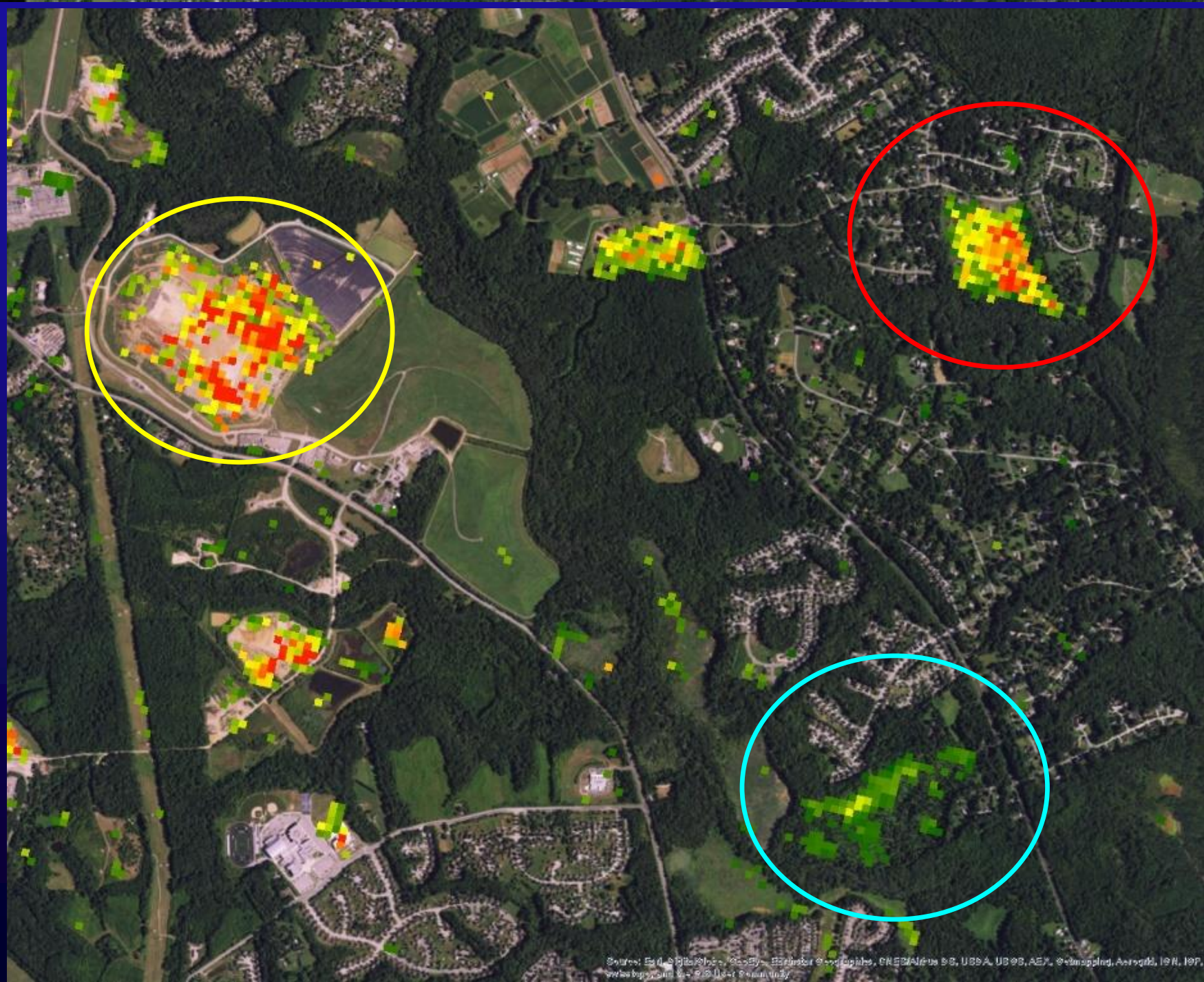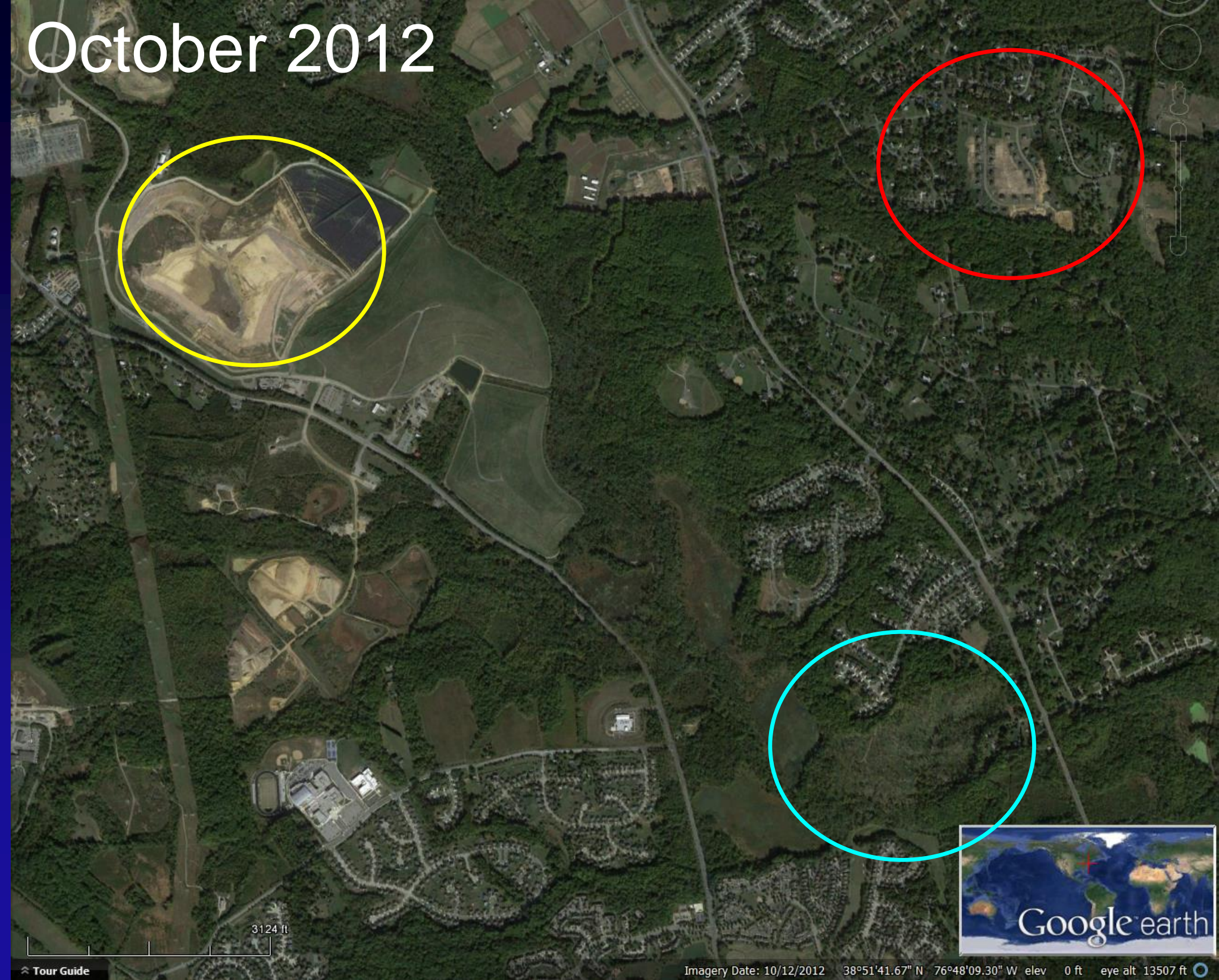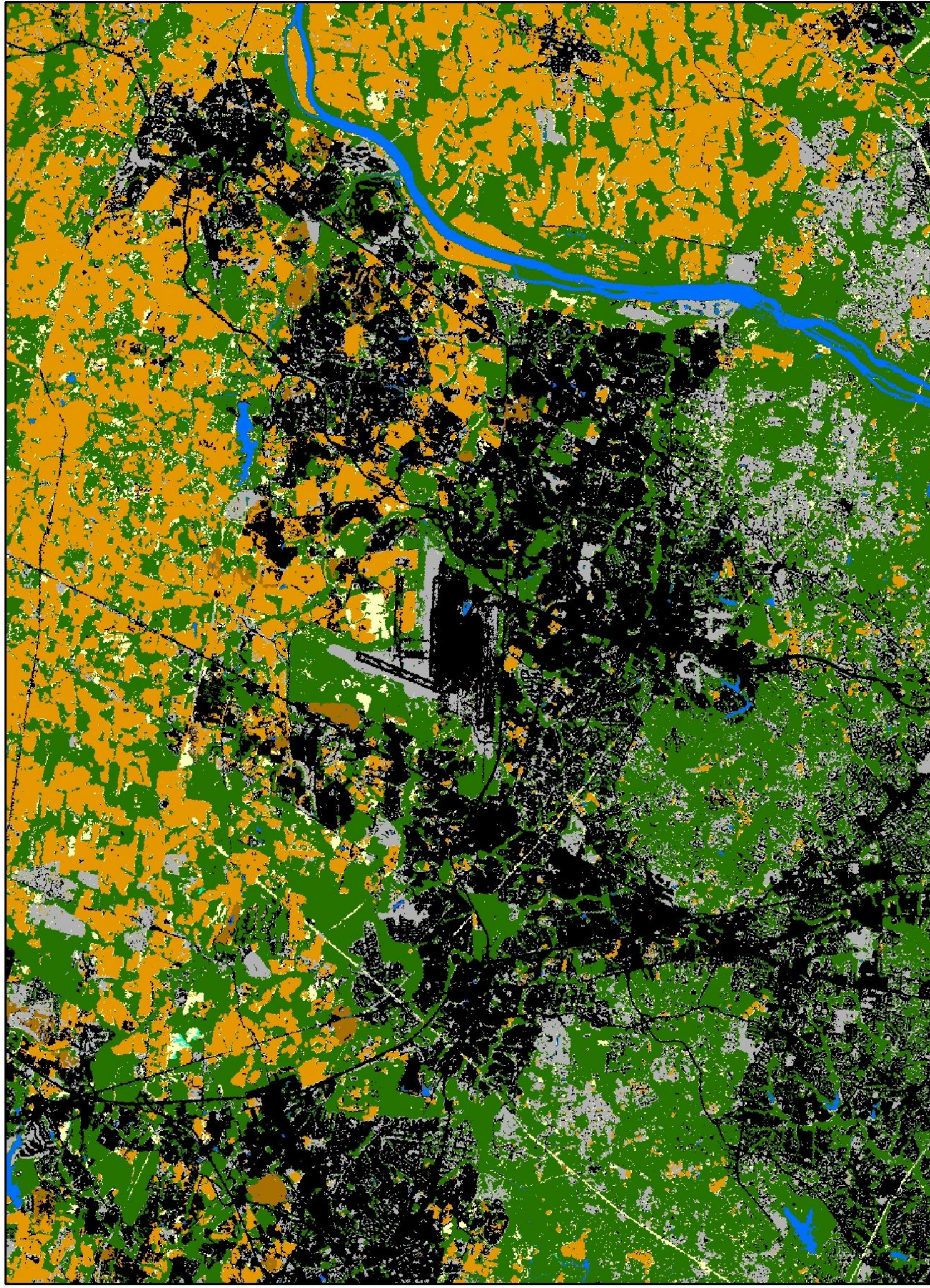Hi-Res Land Cover Change
2009 - 2013

October 2009

October 2012

1984

2011

STAC Review of P6 Land Use

1. Please comment on the data, methods, and stakeholder review process used to create the fine-scale 2013 land cover data set.

2. Please comment on the data and methods used to backcast the 2013 land use annually through the period 1984-2012.

3. Please comment on the method of incorporating Census of Agriculture data into the annual land use database.

4. For longer term CBP considerations, how can the overall approaches and procedures used in the production of the land use data set be improved and what alternative approaches and data gathering might you recommend?

5. Please comment on the documentation for the land use data set. Is it clear, well organized, concise, and complete?