

Land Cover Indicators for U.S. National Climate Assessments

William R. Emanuel
Joint Global Change Research Institute

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Pacific Northwest
NATIONAL LABORATORY

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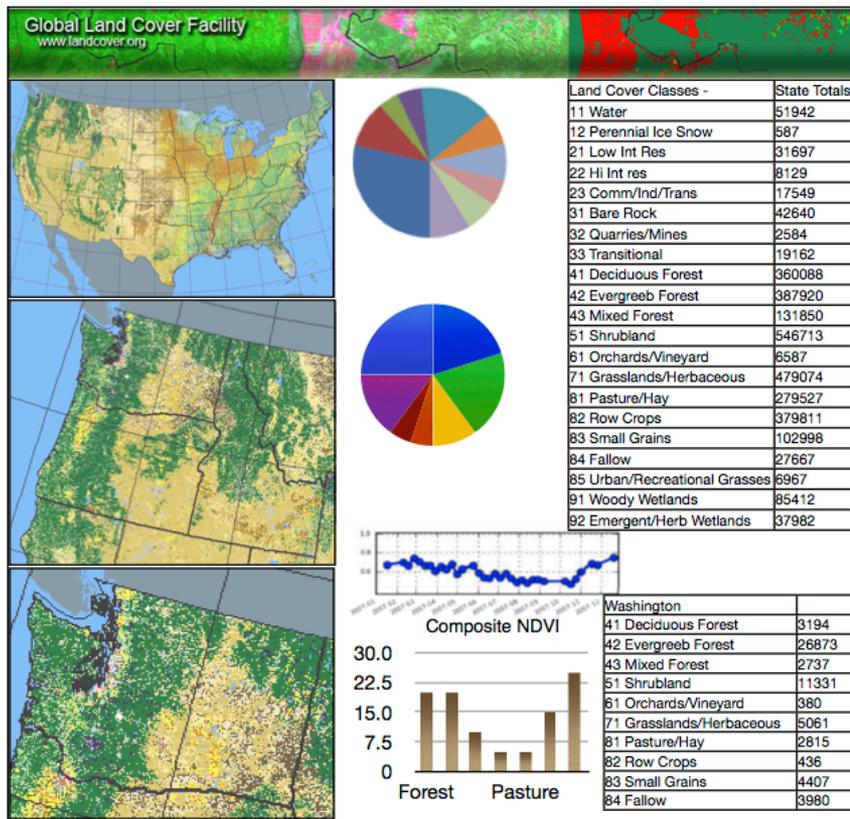
**Joint project of the Joint Global Change Research Institute
and the University of Maryland Global Land Cover Facility**

**William Emanuel and Tristram West
Pacific Northwest National Laboratory**

**Saurabh Channan, Kathrine Collins, John Townshend
Joseph Sexton, and Paul Torrens
University of Maryland, College Park**



A Pilot Land Cover Indicator of National Climate Assessments



- Portray U.S. land cover attributes observed by NASA satellite remote sensing platforms.
 - Geospatial data at multiple spatial scales.
 - Graphical summaries of land cover distributions and temporal variations.
 - Statistical summaries and indices.

- Current focus is on MODIS and Landsat data products.

- ▶ **Take advantage of MODIS land cover data products being produced by an ACCESS project:**
 - **Enabling Centralized Access to Land Cover Data for Climate Change Integrated Assessment Modeling**
 - **Global mosaics of the standard MODIS land cover data products.**
 - **Reprojected into geographic coordinates.**
 - **Aggregated to coarser resolutions.**

- ▶ **Take advantage of Landsat data collections maintained by the Global Land Cover Facility**
 - **High resolution imagery for selected areas where land cover is spatially diverse or where change is evident.**

Phase I (1st Nine Months)

- **Data processing to extract land cover data for the U.S. and for NCA regions.**
- **Development of automated processes to characterize land cover attributes.**

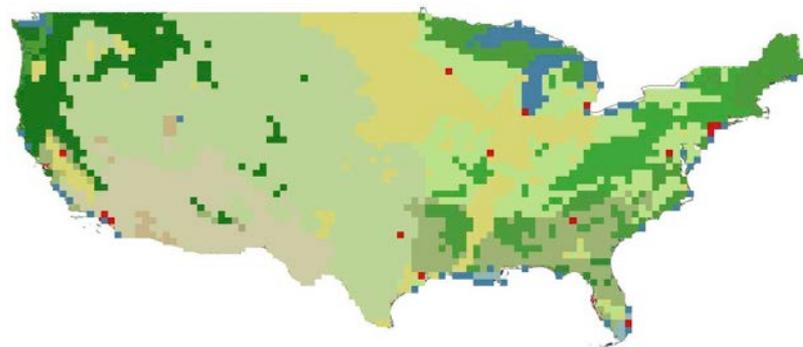
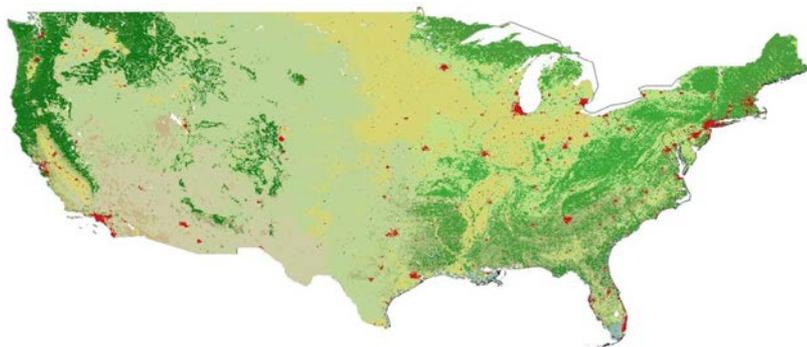
Phase 2 (2nd Nine Months)

- **Development of visualizations and statistical summaries to characterize land cover as a NCA Indicator.**
- **Implementation of a Web interface.**



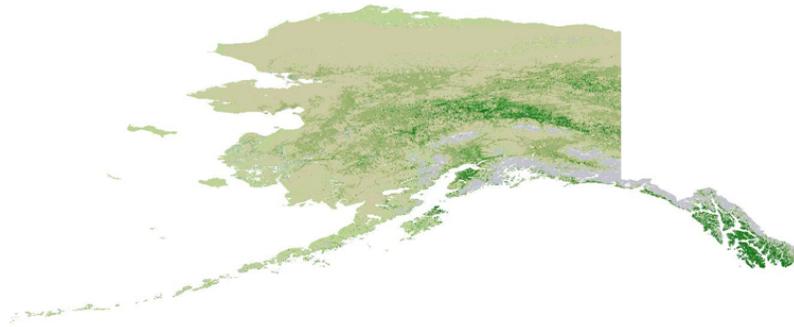
MODIS Land Cover Data Products

- In terms of consistent spatial coverage and temporal stability, the standard land cover data products derived from MODIS observations comprise the highest quality NASA satellite remote sensing data for a NCA land cover indicator.
- The 12 year record (2001 – 2012) is sufficiently stable through time to investigate land cover change and trends.
- Land cover data for NCA regions extracted from global mosaics.
 - Reprojected into geographic coordinates.
 - Native 500 m spatial resolution
 - Aggregated to $5' \times 5'$ and at $0.5^\circ \times 0.5^\circ$ resolutions.

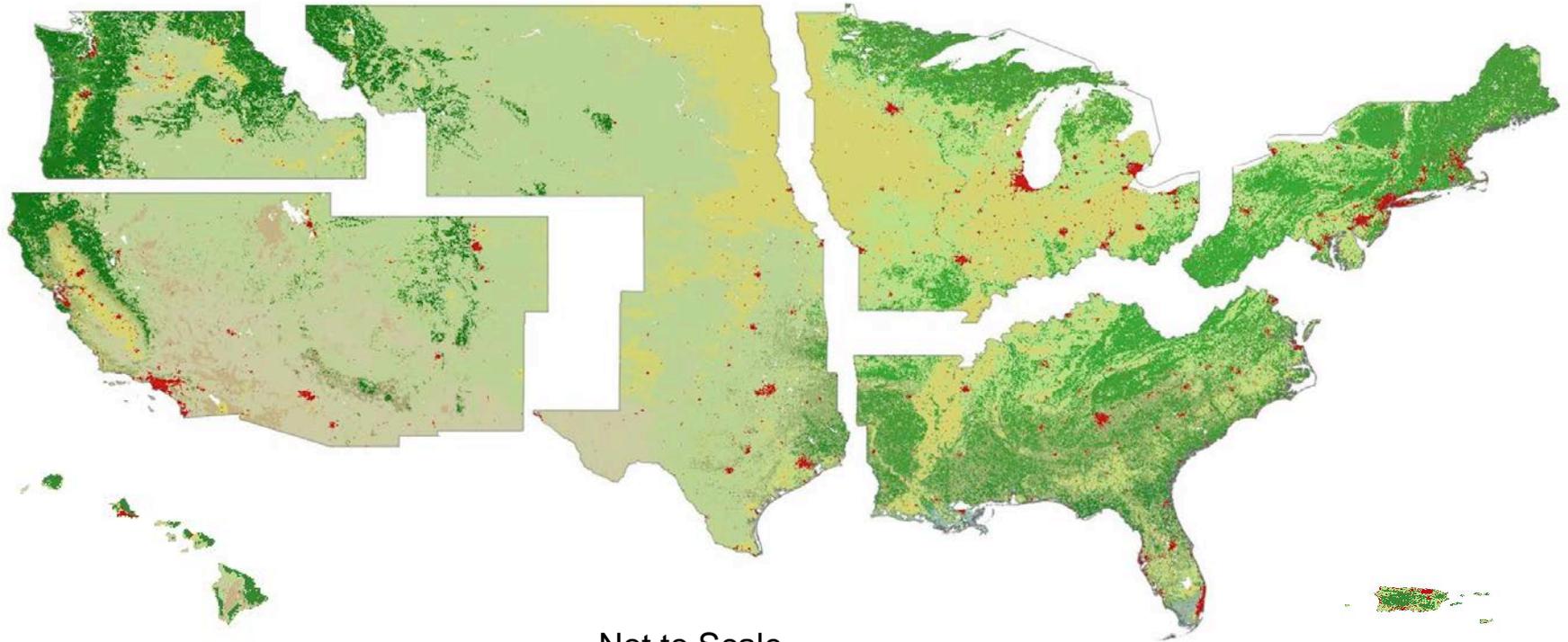


2010 MODIS land cover data product in the IGBP classification at native 500 m and at $0.5^\circ \times 0.5^\circ$ spatial resolutions.

MODIS Land Cover on NCA Regions

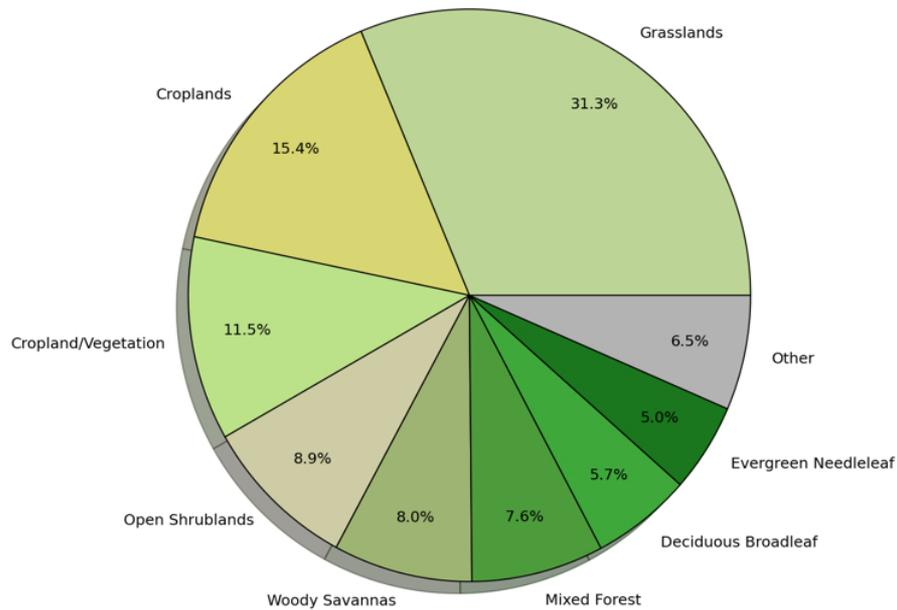


- 2010 MODIS Land Cover
- Native 500 m resolution
 - 9 NCA regions
 - Guam not included

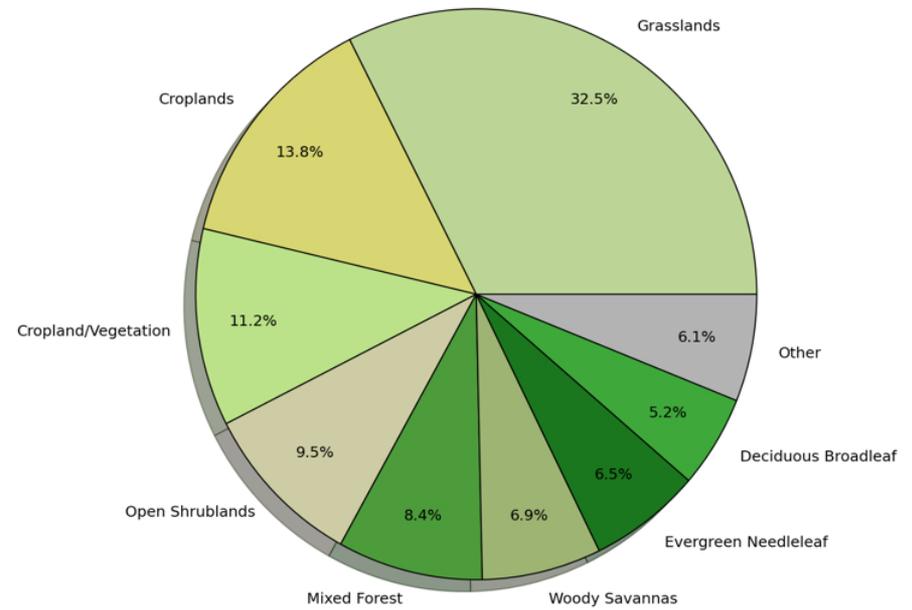


Not to Scale

U.S. 48 States Land Cover Distributions



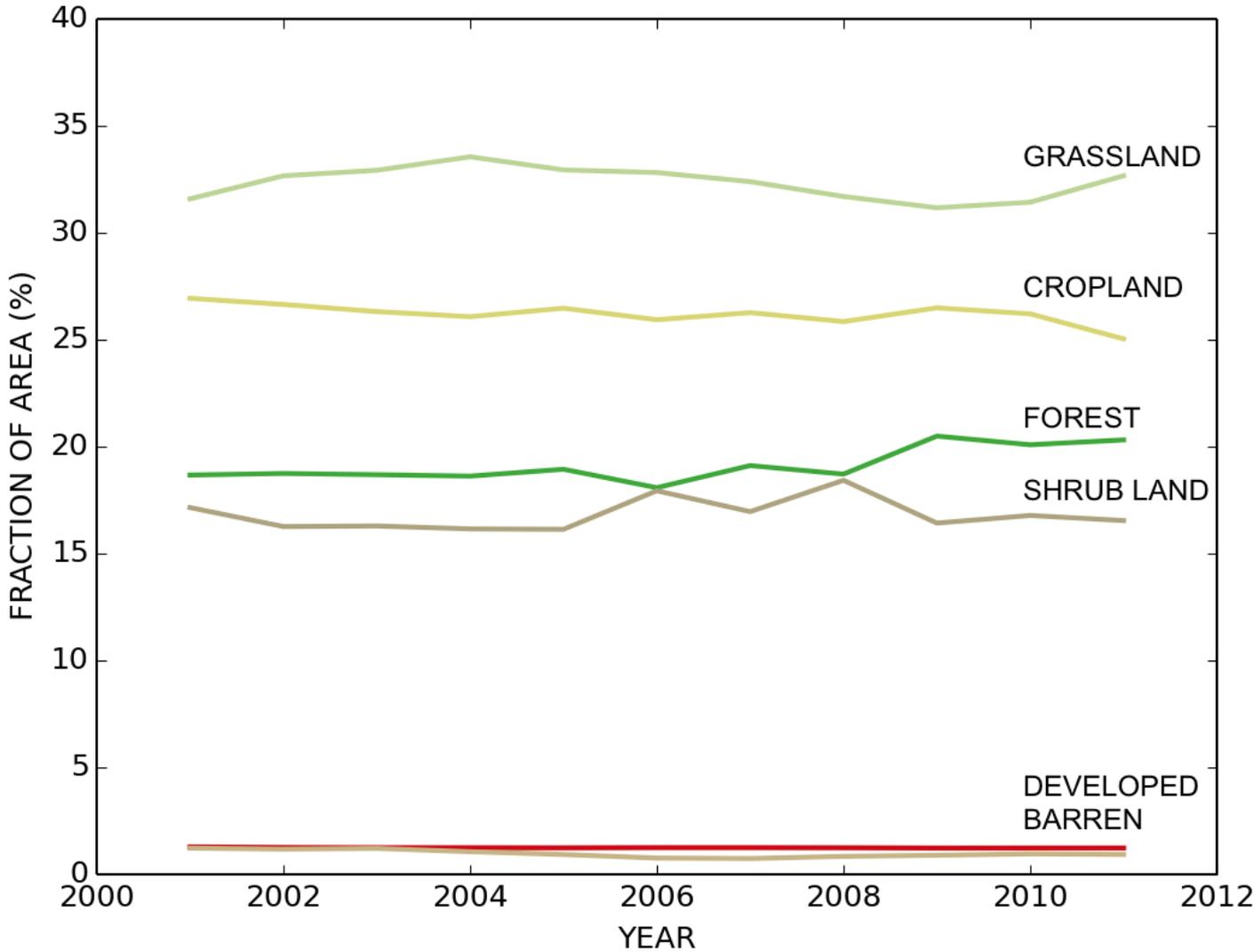
2001



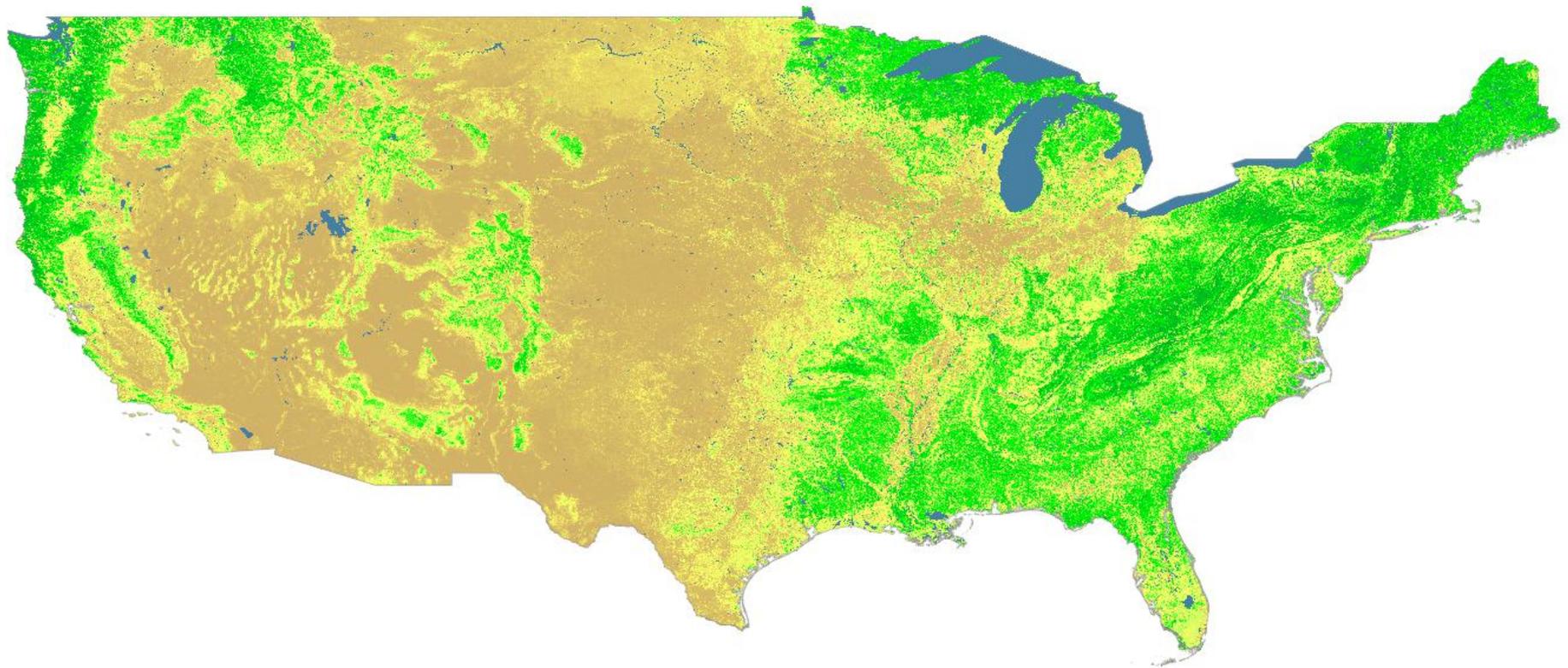
2011

Python scripts automate production of charts from national or regional data for any specified list of years.

Distribution of Land Cover Groups – USA 48 States



Fraction of Tree Cover – Vegetation Continuous Fields



2003 Fraction of Tree Cover (%)
Native 250 m resolution

High-Resolution Satellite Observations - Landsat

- ▶ **Although spatial coverage and temporal stability of MODIS observations are excellent, moderate resolution data do not capture important land cover attributes.**
 - **Proposed to assemble Landsat imagery for selected areas of interest.**

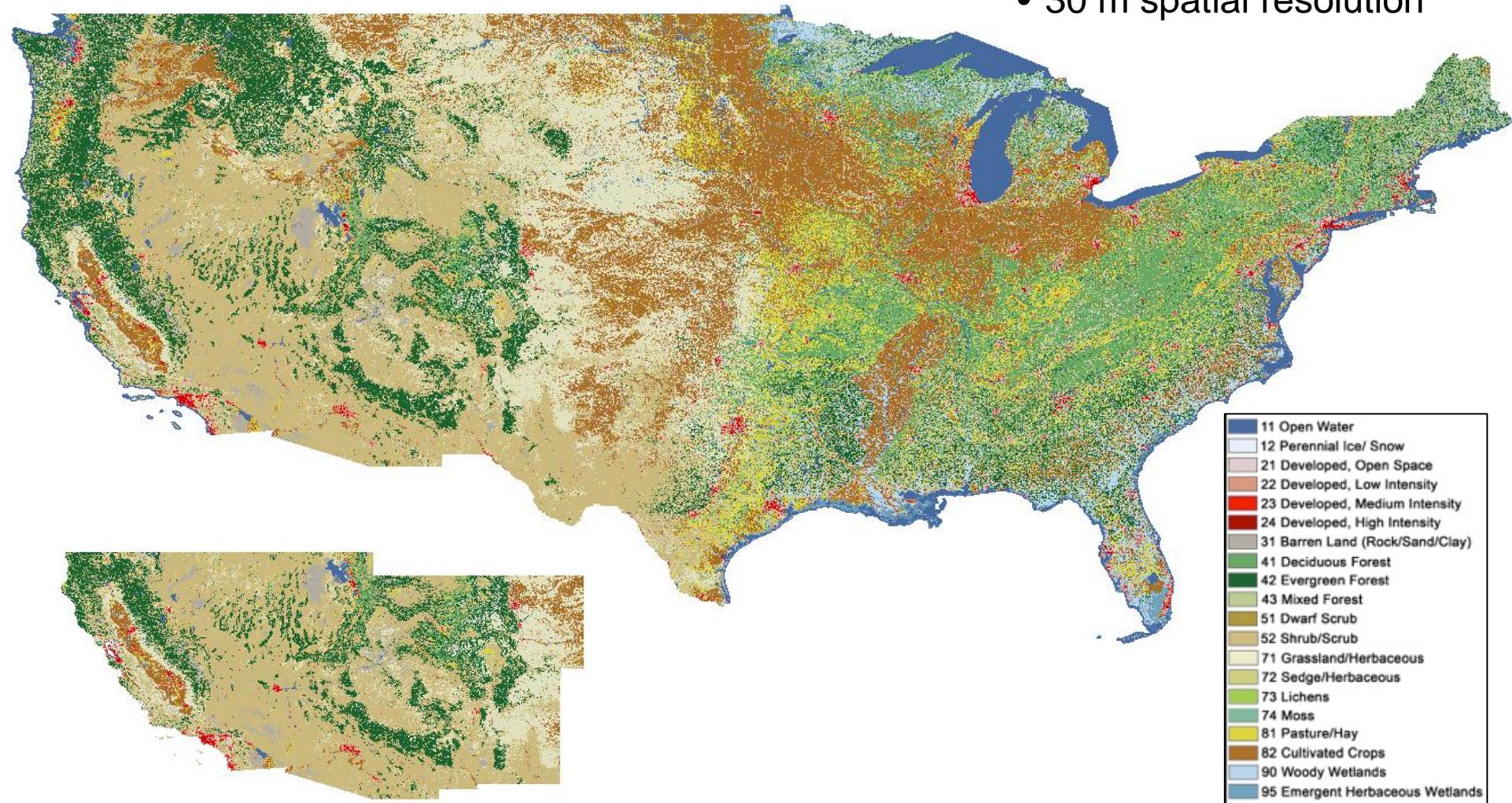
- ▶ **Since we proposed the project, USGS with the Multi-Resolution Land Characteristics Consortium and the USDA National Agricultural Statistics Service (NASS) improved two U.S. national data sets that are based on Landsat observations:**
 - **National Land Cover Database – 1992, 2001, 2006, and 2011**
 - **USDA NASS Cropland Data Layer – (2008 – 2013)**



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National Land Cover Database – 2011

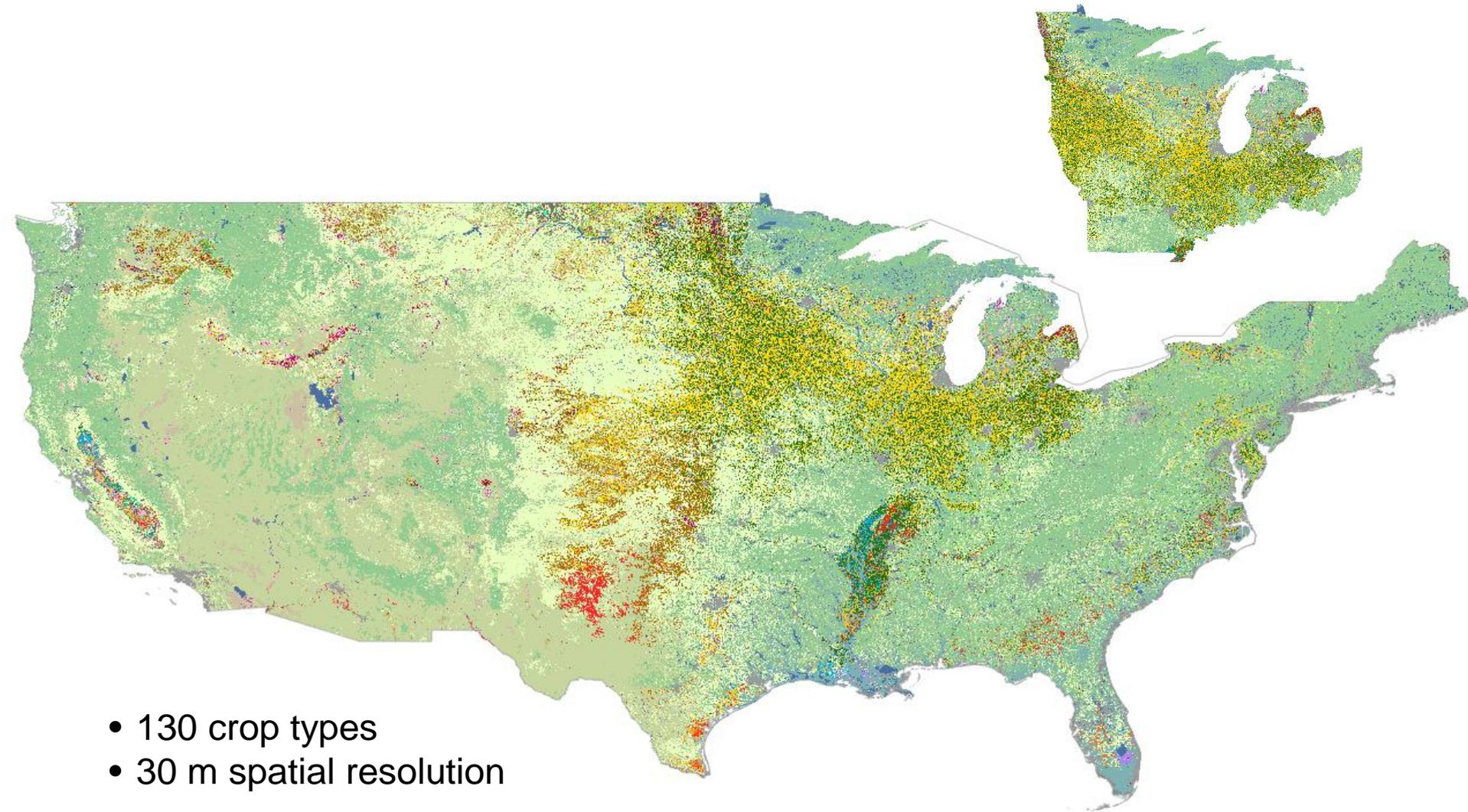
- 16 land cover classes
- 30 m spatial resolution



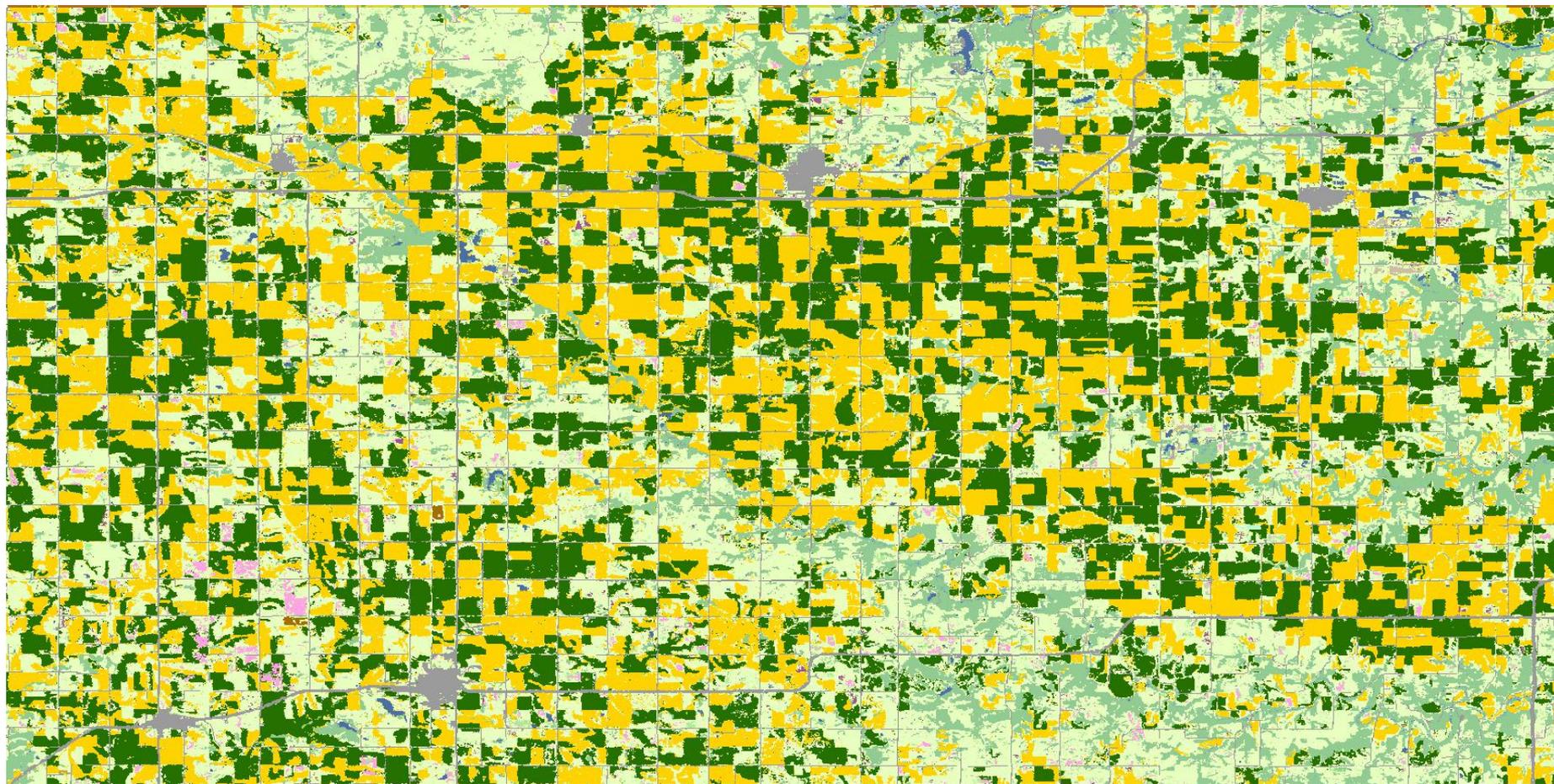
11	Open Water
12	Perennial Ice/ Snow
21	Developed, Open Space
22	Developed, Low Intensity
23	Developed, Medium Intensity
24	Developed, High Intensity
31	Barren Land (Rock/Sand/Clay)
41	Deciduous Forest
42	Evergreen Forest
43	Mixed Forest
51	Dwarf Scrub
52	Shrub/Scrub
71	Grassland/Herbaceous
72	Sedge/Herbaceous
73	Lichens
74	Moss
81	Pasture/Hay
82	Cultivated Crops
90	Woody Wetlands
95	Emergent Herbaceous Wetlands



USDA-NASS Cropland Data Layer – 2010



Land Cover – 30 m Resolution



Comments

- **Maps at different scales are an important means of portraying land cover attributes.**
- **Statistical summaries or other indices may be just as important for a land cover indicator to inform climate change assessments and policy development.**
- **Many assessment and policy questions focus on land cover change.**
 - **It is difficult to attribute land cover change apparent within currently available satellite data records to climate change.**
 - **The largest land cover changes may well be due to human actions in response to climate change rather than direct effects on vegetation or ecosystems.**
- **Land cover indicator research may need to explore simulated effects of climate change in order to identify statistical approaches and indices that best show land cover responses to climate change as these become increasingly significant.**
- **The transition to VIIRS observations will require significant work to derive a consistent long-term record at moderate resolutions.**

Data Availability and Expected Indicator Web Site

- ▶ **Global mosaics of MODIS land cover data products:**
 - <http://glcf.umd.edu/research/portal/nasaaccess2011/index.shtml>
- ▶ **NCA Indicators Data:**
 - <http://glcf.umd.edu/research/portal/nasaindicators/index.shtml>
 - Available ~ May 1, 2014



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