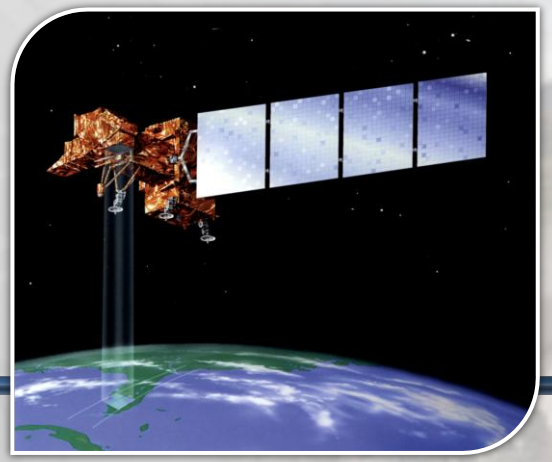
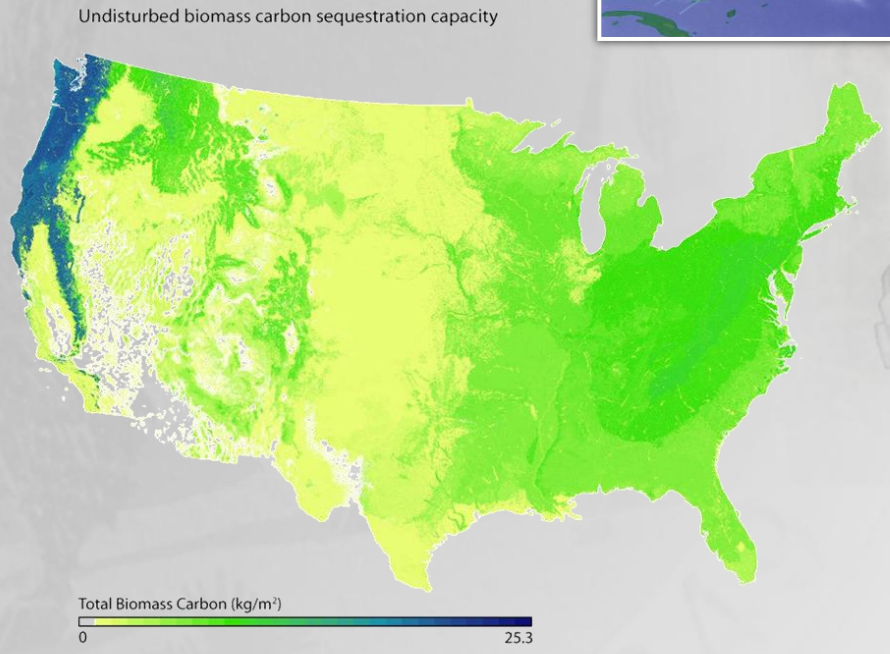
USGS
science for a changing world



Landsat and Carbon Assessments

Presentation for COP-15



Dr. Marcia McNutt

Director, U.S. Geological Survey

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

Landsat and Carbon Assessments

Outline

- **USGS**
  - A Federal science agency in the U.S. Department of the Interior
- **Landsat**
  - Provides globally consistent data
  - A vital tool for carbon assessments
- **Biological Carbon Studies**
  - Terrestrial carbon sequestration to mitigate climate change
- **Conclusion**

Landsat 7: Lena Delta
Image taken 7/27/2000
The Lena River, some 2,800 miles (4,400 km) long, is one of the largest rivers in the world. The Lena Delta Reserve is the most extensive protected wilderness area in Russia. It is an important refuge and breeding grounds for many species of Siberian wildlife.

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Finding Balance: Advancing Sustainability

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USGS Science Strategy: A Systems Approach

When we try to pick out anything by itself, we find it hitched to everything else in the universe.

John Muir

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Landsat: A Global Imagery Archive of Land Features

- Landsat - a multispectral land remote sensing program dating back to 1972.
- Landsat satellites 5 & 7 presently operating well beyond their design lives.
- Landsat Data Continuity Mission (LDCM) is in development.
  Scheduled to launch in December 2012 – it then becomes Landsat 8.
- Landsat data continuity required by U.S. law
  (Land Remote Sensing Policy Act, 1992)
- USGS has over 2.4 million Landsat images that are the world's only global, continual, radiometrically accurate record of land cover over the last 37 years.

Diverse uses of Landsat data include:

- Agriculture
- Mapping
- Fire/Disaster Management
- Carbon Inventory/Credits
- Land Use Planning
- Deforestation
- Global Change
- Flood Management
- National Security
- Ecosystem Management
- Land Use/Land Cover
- Famine Early Warning
- Drought Monitoring
- Insurance Risk Management
- International Treaty Management

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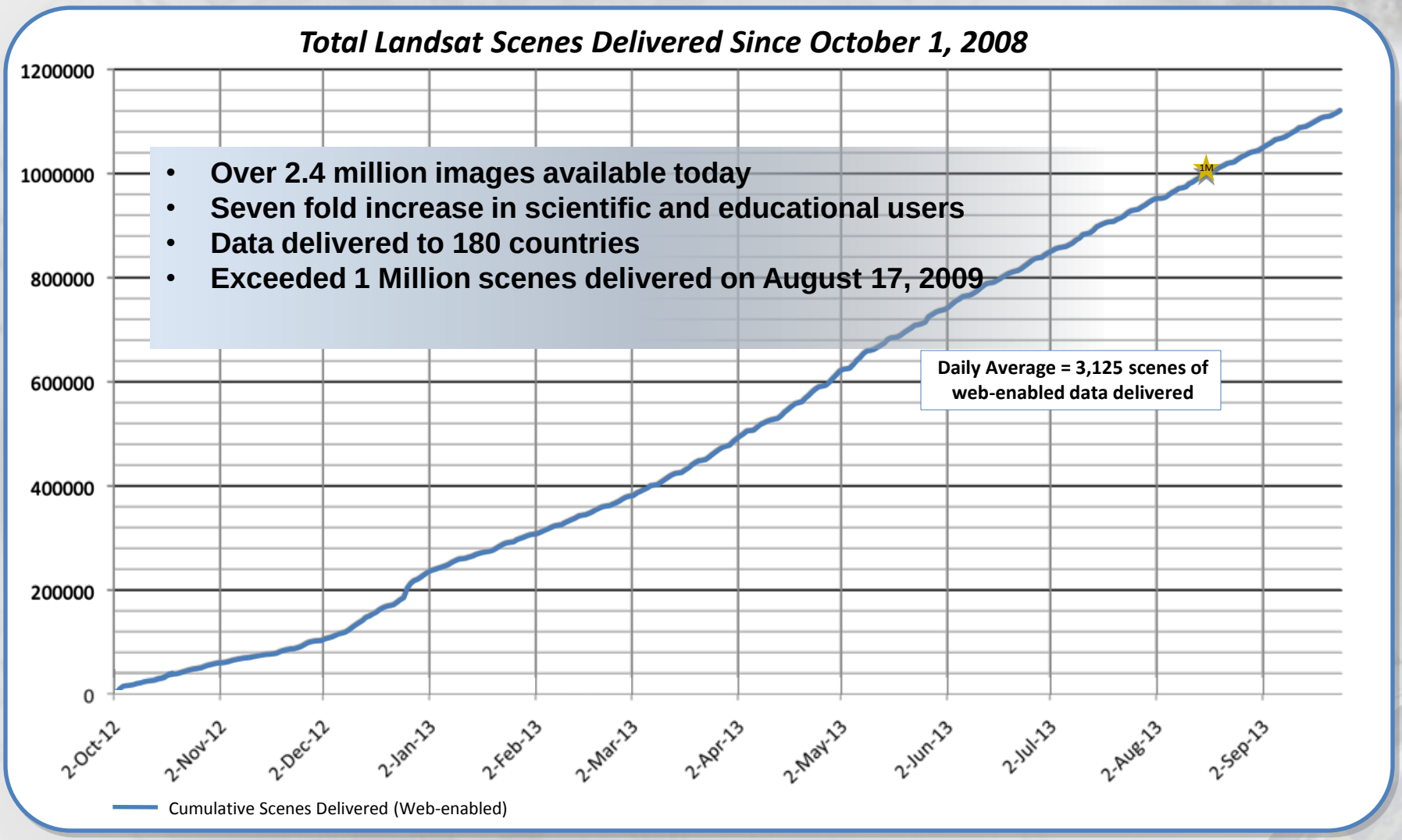
Worldwide Usage of Landsat Imagery



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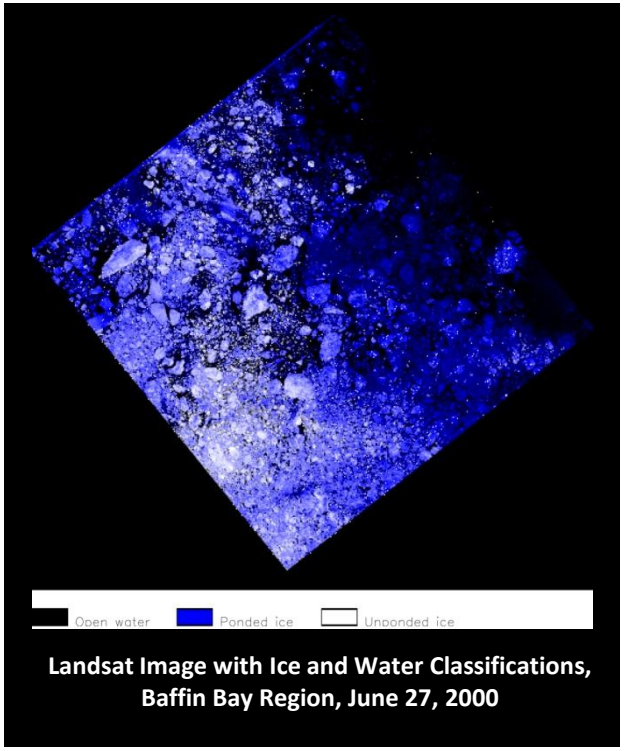
Landsat Remote Sensing of Global Change

Role in Global Change Research

- **Climate studies**
  - Human dimensions of global change
  - Land-atmosphere interactions
  - Land use modifications of weather and climate
- **Monitoring climate-driven land dynamics**
  - Changes in snow and ice extent, e.g., glaciers
  - Changes in fire frequency and severity
  - Drought cycles
- **Impacts of land use and land cover change**
  - Carbon cycle dynamics
  - Changes in ecosystem services, e.g., deforestation
  - Carbon inventory
  - Carbon credit verification



Landsat Image with Ice and Water Classifications, Baffin Bay Region, June 27, 2000

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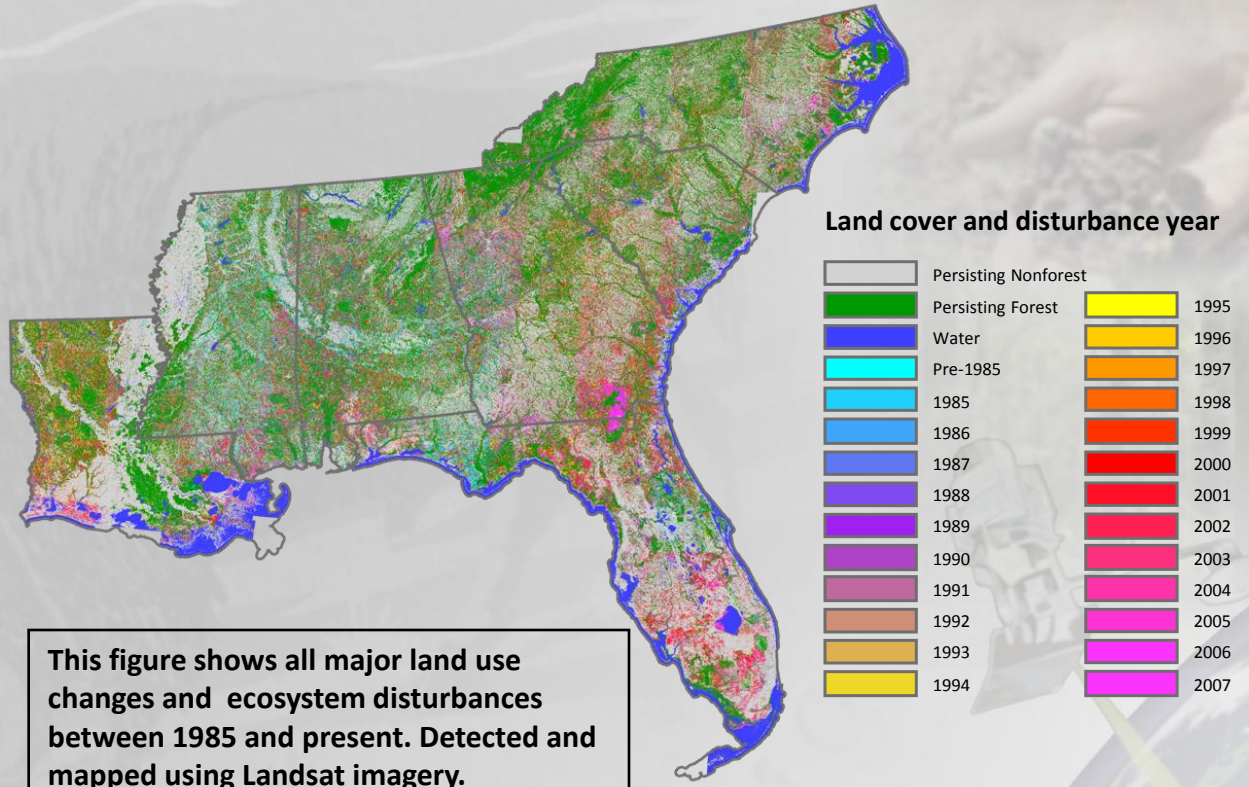
Landsat: Carbon Sequestration

- USGS is mandated by law to assess capacities of ecosystems for carbon sequestration. This is a high priority for the US government.
- Remote sensing systems such as Landsat are a critical component of the assessment methodology
  - Remote sensing offers large geographic coverage that is consistent and accurate
  - Landsat global coverage ensures the assessment can be done for many different global ecosystems
  - Landsat can detect and characterize major carbon flux drivers: land cover and land use changes as well as major ecosystem disturbances such as fires



This figure shows all major land use changes and ecosystem disturbances between 1985 and present. Detected and mapped using Landsat imagery.

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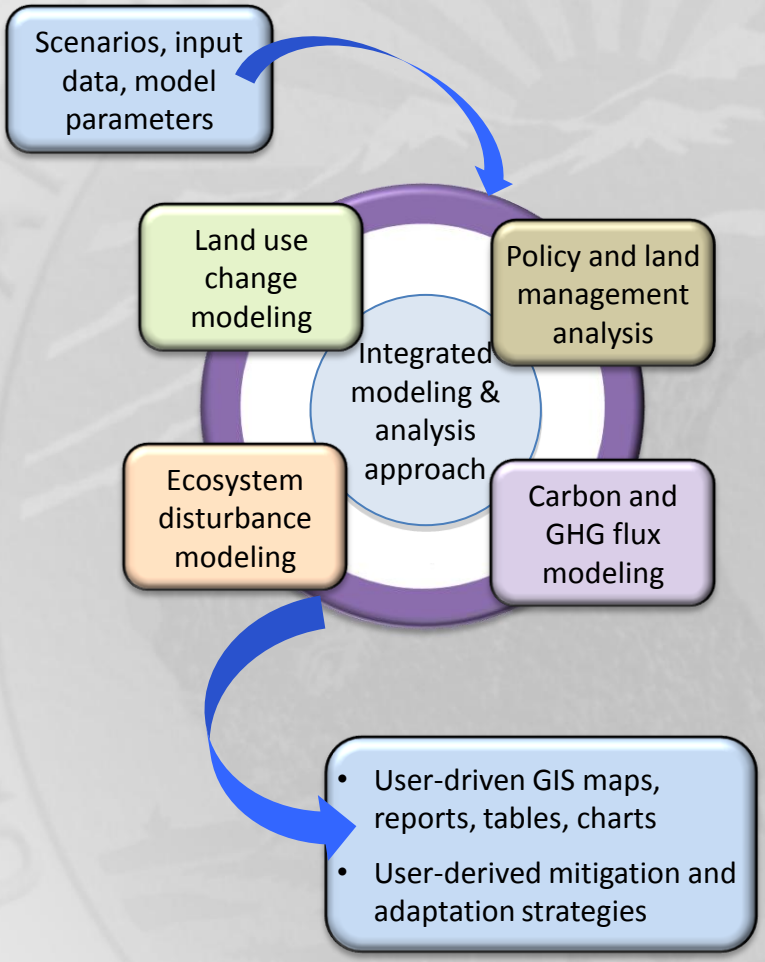
Carbon Sequestration: Overview

- **USGS activities**
  - Working with other Federal partners to assess capacities of ecosystems for carbon sequestration and greenhouse gas fluxes under baseline and potential climate, policy, and land management scenarios.
  - Address land use changes and the effects of disturbances such as wildland fires and drought.
  - Provide science data to inform development of ecosystem mitigation and adaptation strategies including restoration opportunities and effects of other ecosystem services
- **USGS objectives**
  - USGS is to provide science data and tools that can be summarized to various scales to understand the *future* potential behavior of carbon stocks and sequestration by ecosystems, and to support decision-making for *future* policies as well as alternative land management strategies
- **Scientific importance, relevance**
  - Stakeholders such as policy makers or land managers require urgent and credible information about the impacts of climate change and the responses of forests, wetlands, and watersheds.
  - Information needs (such as would be used for a future cap and trade market) are frequently at variable scales, e.g. forests, watersheds, regional or national scales

Carbon Sequestration: USGS Approach



Future scenarios: assess past, present and future capacities of ecosystems given climate, policy, and management scenarios

Data driven: enhancing wall-to-wall data availability in areas of land use change, ecosystem disturbances, and soil content

Comprehensive: address all carbon pools, flux types, ecosystem functions (such as fire) and drivers (such as land changes)

Model based: integrate data with land use model, ecosystem disturbance model, and biogeochemical ensemble models

Mitigation strategies: data/maps packaged to support development of various mitigation or adaptation strategies

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Conclusions, Implications

- **Landsat is a vital tool in supporting evidence-based decisions concerning the mitigation of the impacts of climate change**
- **Biosequestration is not a silver bullet (a single answer), but an important mitigation tool – domestically and internationally.**
- **In the United States, the Department of the Interior can contribute significantly to America's carbon reduction goals through restoration and carbon sequestration projects that require significant scientific and managerial expertise.**
- **Carbon cannot be managed in isolation from other resources; sequestration can and will affect other ecological services.**
- **Carbon sequestration capacities (and rates) are very sensitive to understanding of ecosystem management, disturbance and response.**

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Science is more essential for our prosperity, our security, our health, our environment, and our quality of life than it has ever been.

President Obama
At the National Academy of Sciences
April 27, 2009

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