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Benefits of Open Availability of Landsat Data

Presented by

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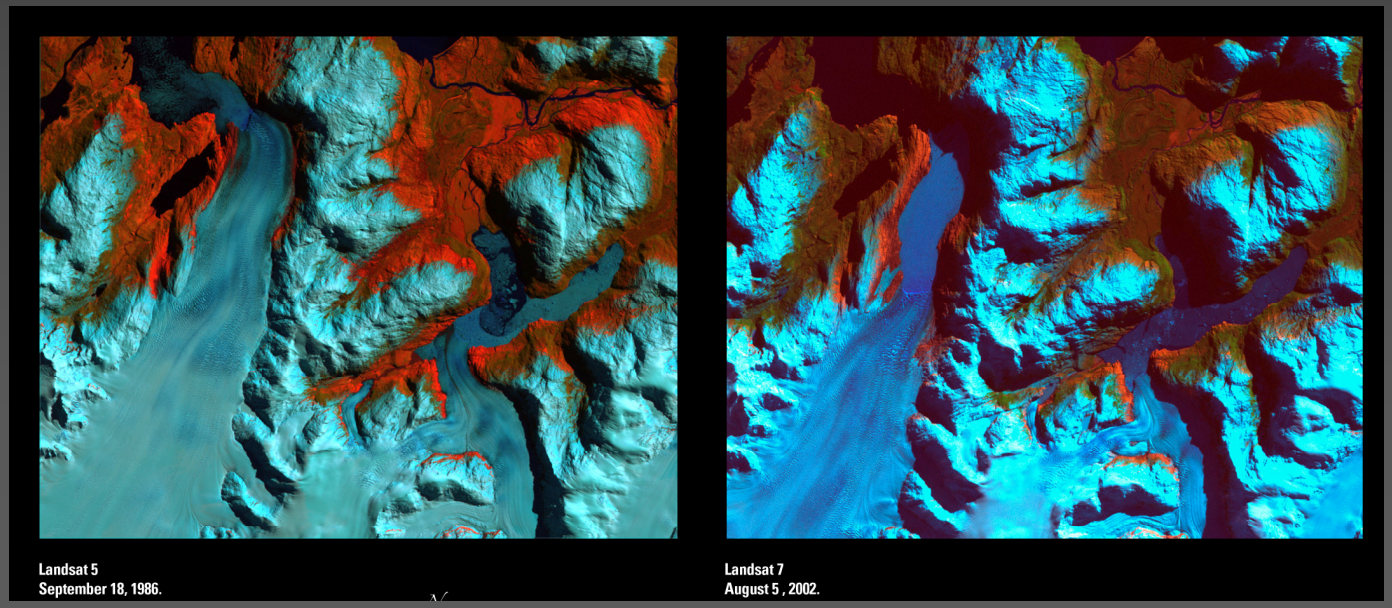

The 1986 image on the left shows the Patagonia region before a major retreat of the glaciers. The 2002 image (right) shows a retreat of the glacier of nearly 10 kilometers as seen in the northwest portion of the image.

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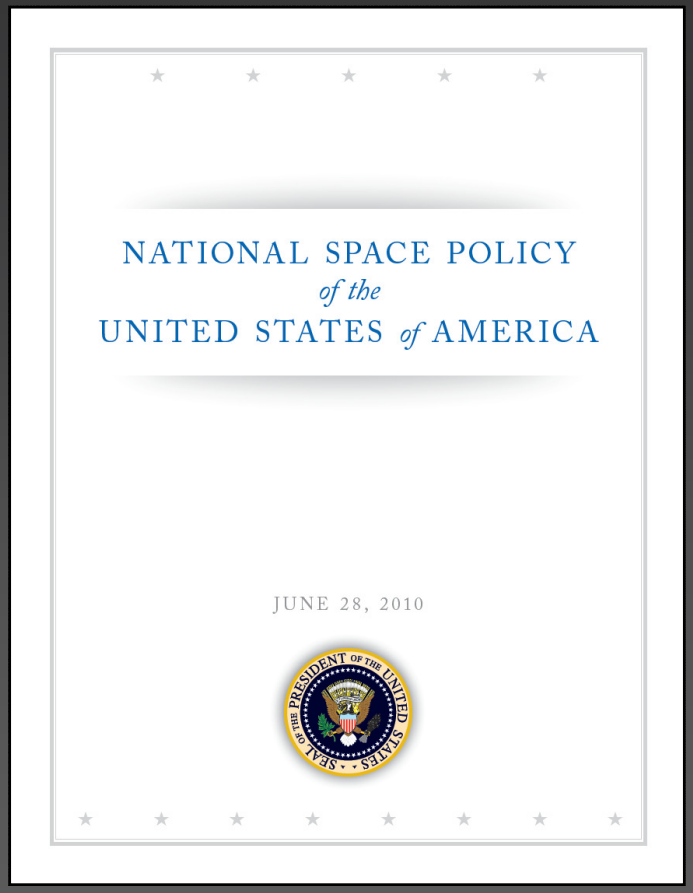
The Role of the Department of the Interior in the U.S. National Space Policy

National Space Policy:
Land Remote Sensing

The Secretary of the Interior, through the Director of the United States Geological Survey (USGS), shall determine the operational requirements for collection, processing, archiving, and distribution of land surface data to the United States Government and other users; and

The Director of the USGS, and the NASA Administrator shall work together in maintaining a program for operational land remote sensing observations



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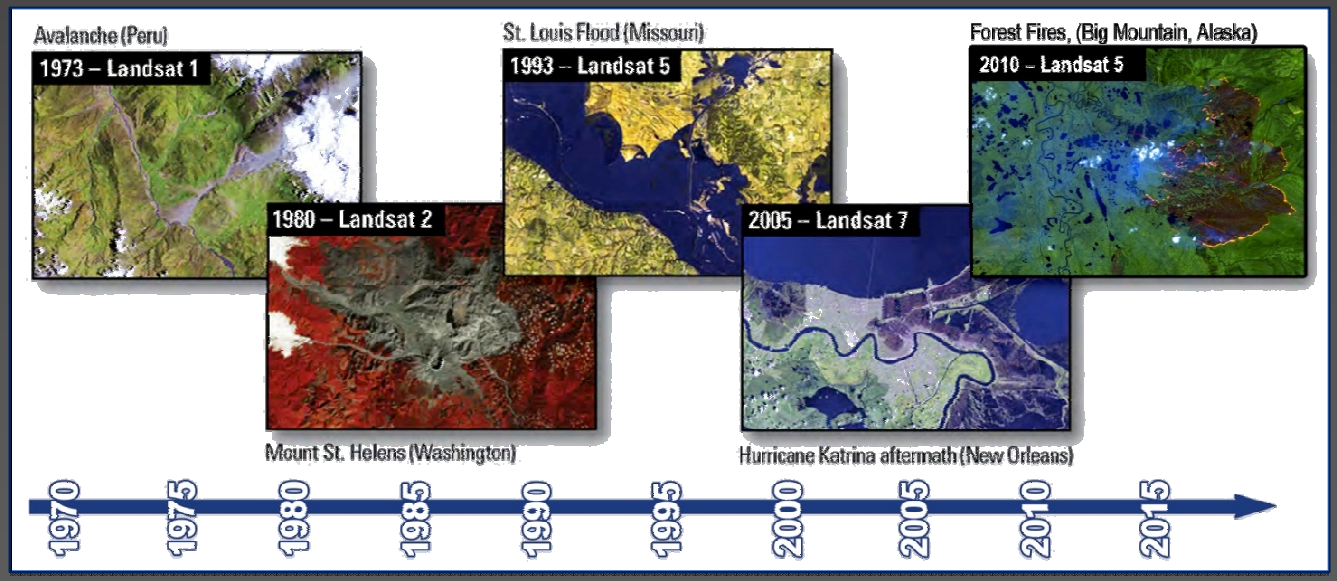
Four Decades of Earth Imaging

- Landsat is a multispectral land remote sensing program dating back to 1972
- Landsat 5
- Launched in 1984 with a 3-year design life
- November 2011: USGS suspended imaging temporarily to investigate electronic problem
- Landsat 7
- Acquiring over 350 images/day worldwide
- Landsat 8 will launch in January 2013



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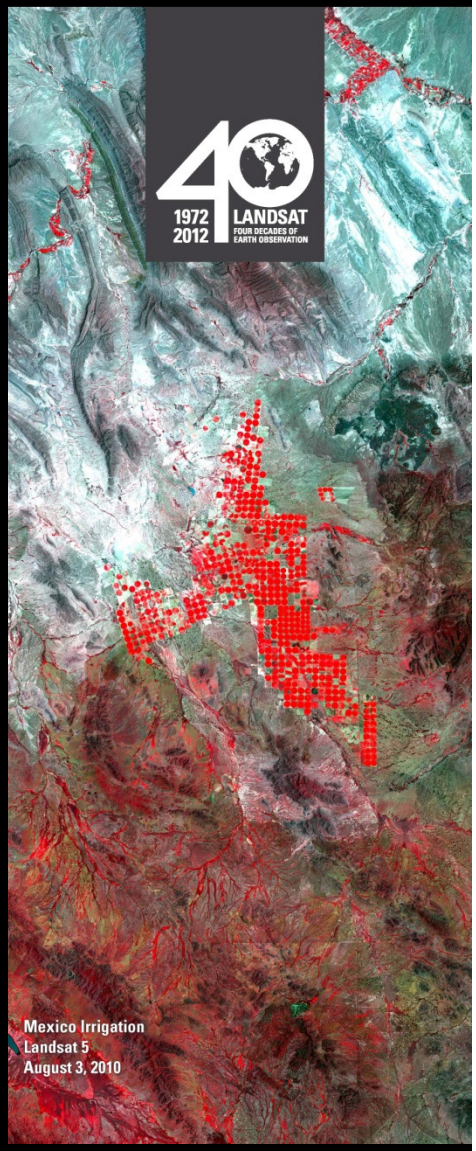
Four Decades of Earth Observation

1972–2012

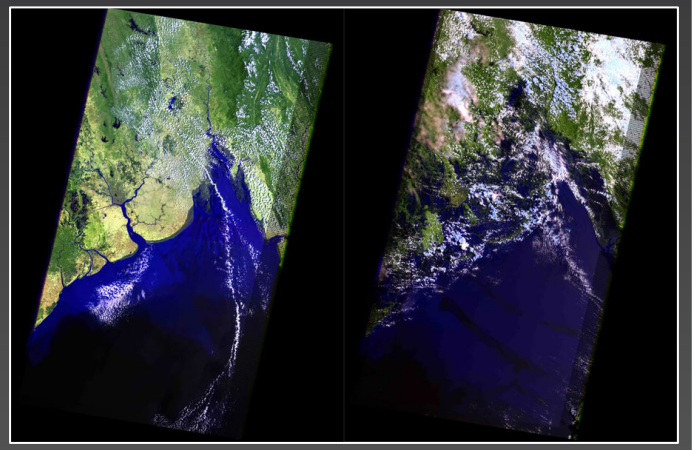
"Because Landsat enables us to see Earth's surface so clearly, so broadly, so objectively, we gain invaluable insights about the complexity of Earth systems and the condition of our natural resources."

— USGS Director Marcia McNutt



Landsat Cost Recovery and Pricing Milestones

- 1972-82: U.S. Government Ownership
  - MSS film products available to everyone at cost of reproduction, digital imagery sold for $200 a scene
- 1980's: Commercial ownership
  - Attempts to fully recover costs, resulting in price increases ranging from $650 for MSS, to over $4000 for TM
  - Dramatic drop in Landsat sales, majority of scenes purchased by US Government agencies
- 1999: US Government ownership
  - USGS prices Landsat-7 ETM+ digital scene at cost of fulfilling user request - $600
- 2008: USGS opens Landsat archive at no charge over Internet;
  - Free data results in explosive data-distribution growth
  - Daily average of scenes jumps from 53 per day to 5776 per day



Cyclone Nargis Hits Burma
L5 scenes from March 3 and March 5, 2008

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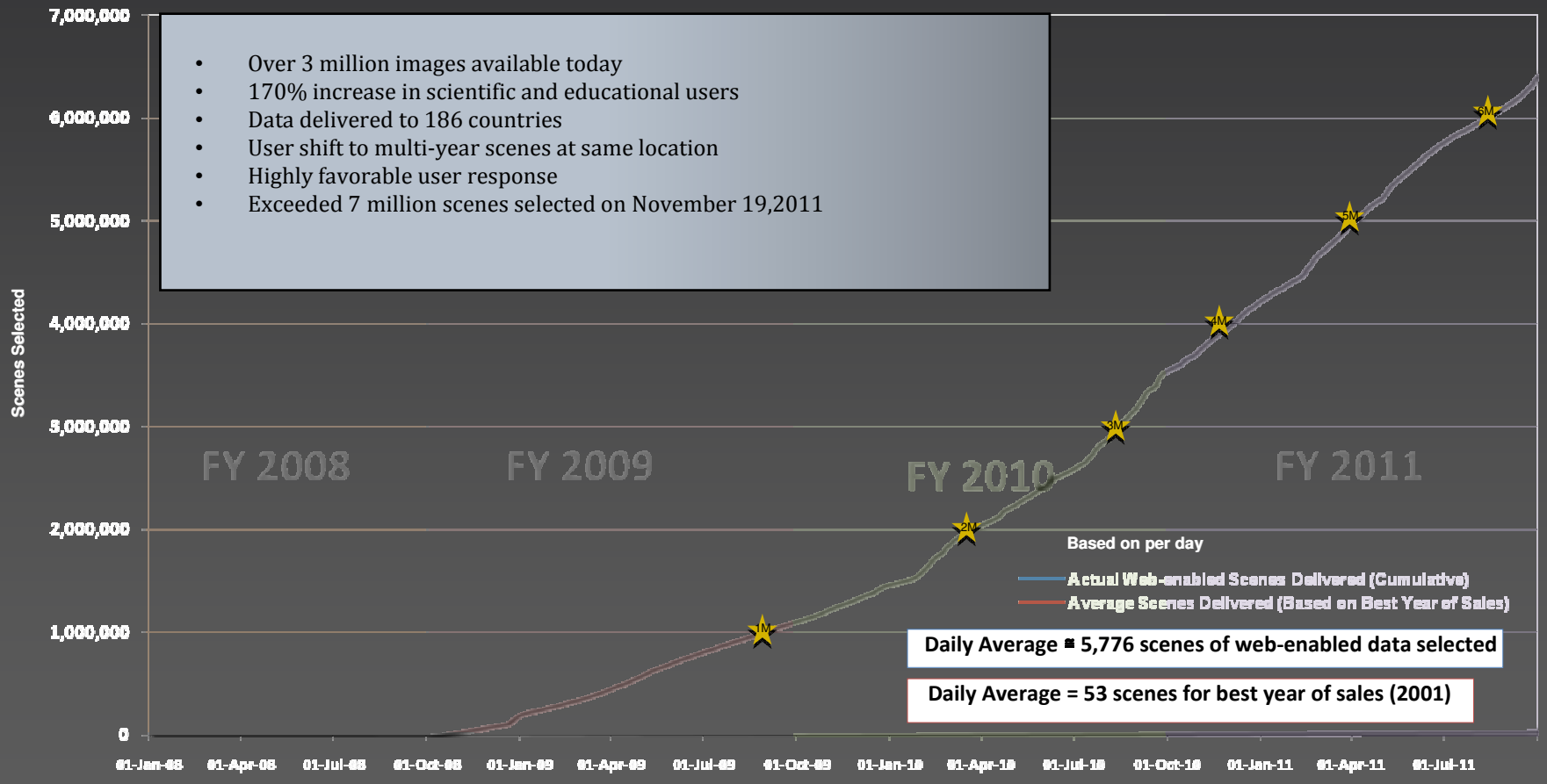
Landsat Internet Data Distribution

39-year archive of global data provided freely on the Internet



- Over 3 million images available today
- 170% increase in scientific and educational users
- Data delivered to 186 countries
- User shift to multi-year scenes at same location
- Highly favorable user response
- Exceeded 7 million scenes selected on November 19,2011

Total Landsat Scenes Selected By Users Since January 1, 2008

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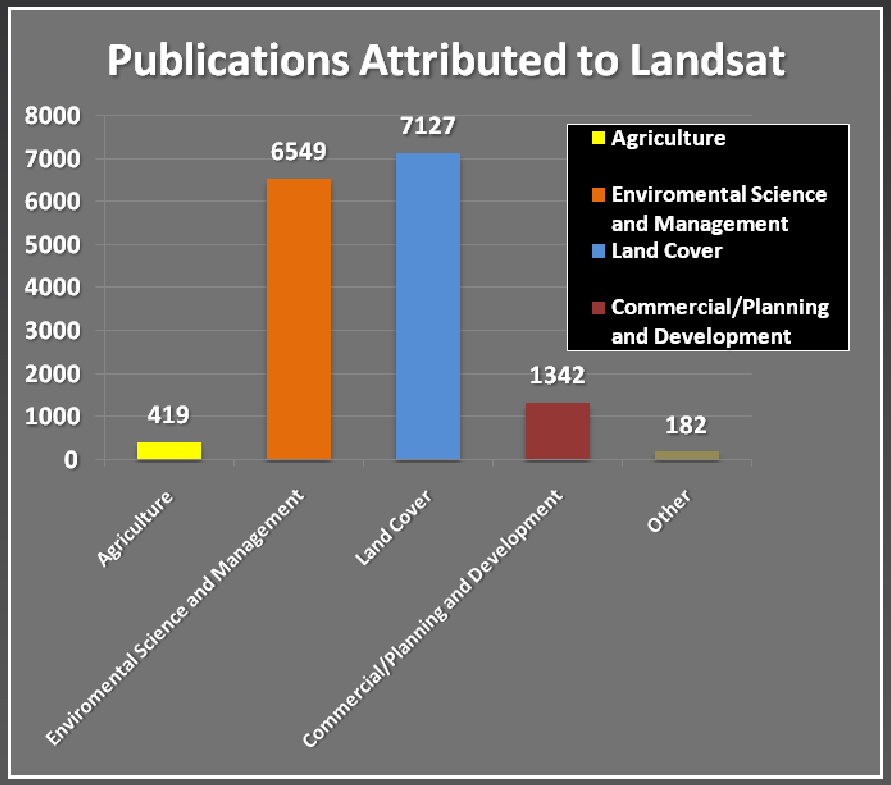
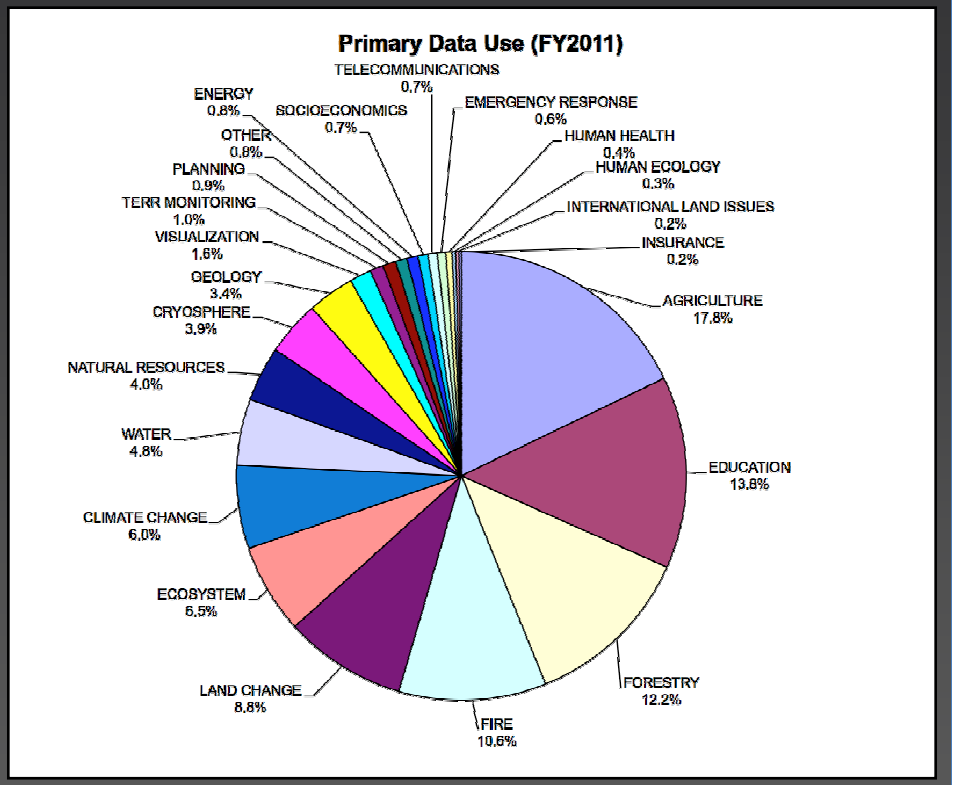
Primary Landsat User Applications 2011





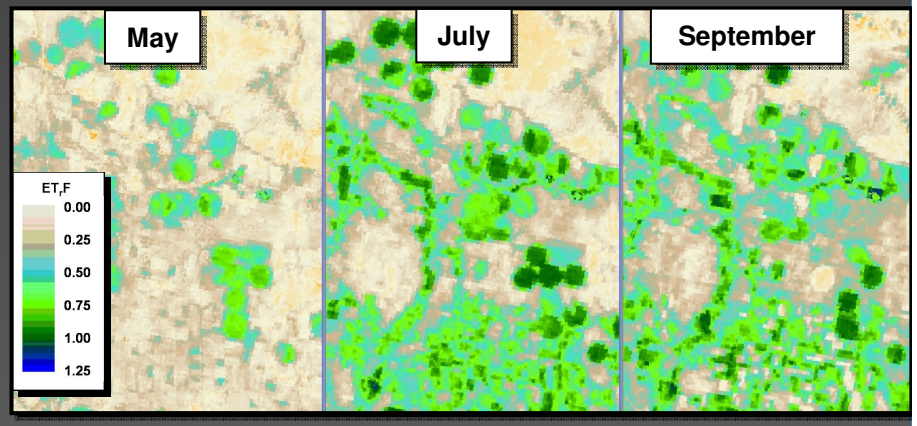
Economic Advantages of Open Availability

Economic cost savings for environmental management

- A 2006 study estimated the value attributable to the loss of Landsat imagery in the event of a data gap at $935M per year (American Society for Photogrammetry and Remote Sensing).
- Water managers will save an estimated $1 billion over the next decade using remotely sensed concise measurement estimates of consumptive water use (Western States Water Council).

Commercial data use has increased under free distribution policy

- Google Earth Engine provides cloud computing technology to analyze large amounts of Landsat data for environmental analysis.
- ESRI "Change Matters" product is based entirely on Landsat imagery.



Progression of evapotranspiration overtime – Nebraska, ***Landsat 5 1997***

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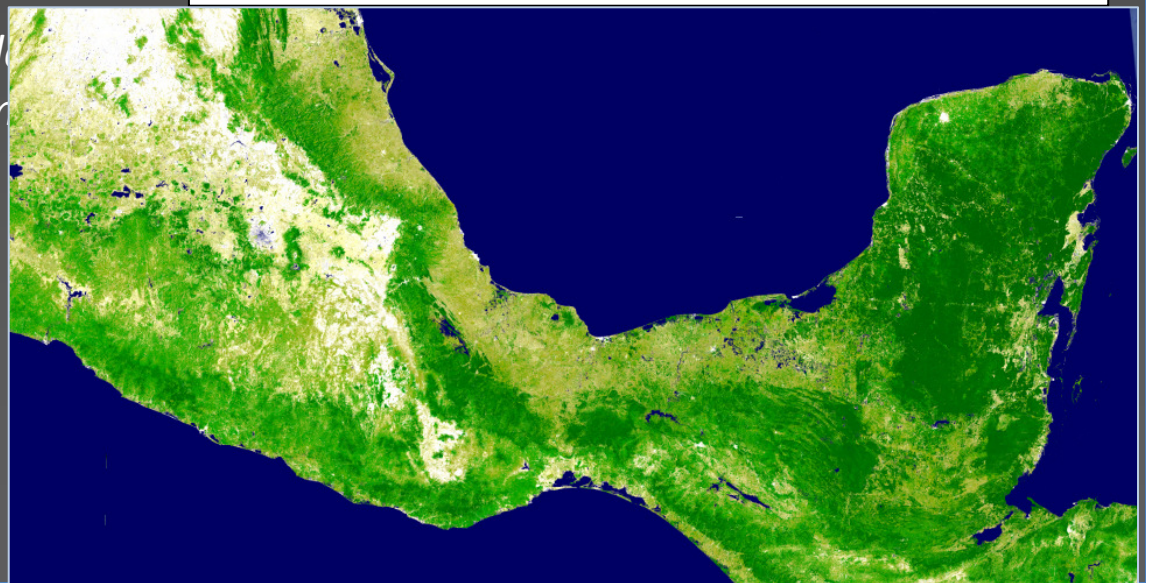
Google Earth Engine

- Google Earth Engine Planetary Platform
  - Leverages Landsat, MODIS, and SRTM elevation data
  - Specific algorithms for removing clouds and haze from satellite imagery
  - Supervised classification conducted rapidly using cloud computing
- Donating 20 million CPU hours to developing countries for REDD applications - earthengine-beta@google.com

To conduct the percent Forest Cover Inventory of Mexico –

- *53,000 Landsat scenes were need*
- *15,000 hours of computational tim*
- *Earth Engine ran it on 1,000 computers.*
- *Elapsed time – less than a day.*

Finest scale Mexico Forest Cover to date



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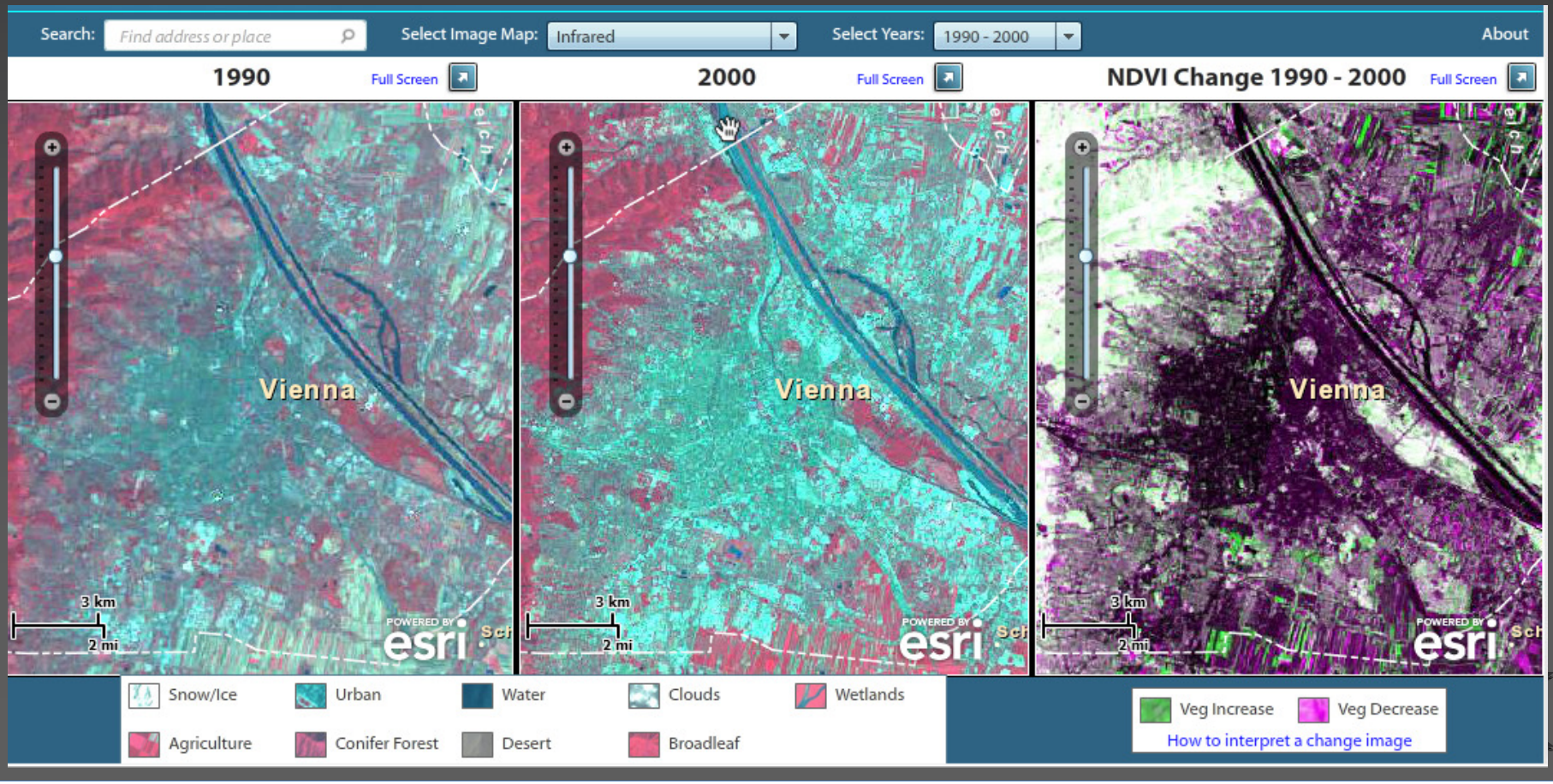
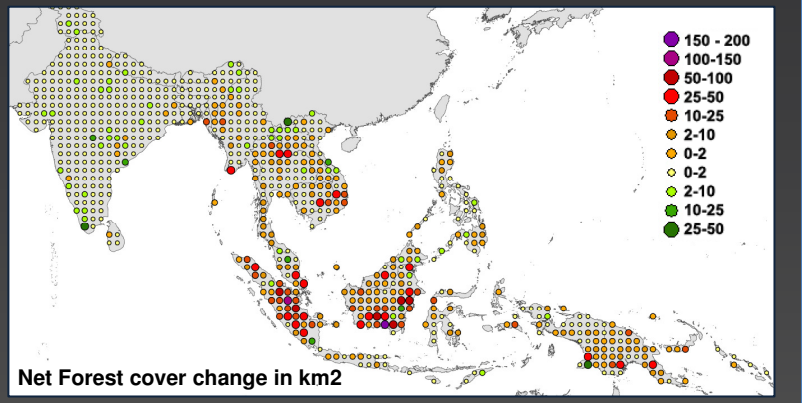
Change Matters ESRI Viewer

Online application to compute normalized difference vegetation index changes
Using Landsat imagery worldwide from 1975 to 2005.
Great educational tool. Encourages research to study why change happens



Landsat Open Data Policy Enhances Climate Change Research

- **Operational Global Climate and Resource Monitoring Initiatives**
  - GEO Initiative: Global land cover to be based on 30m resolution Landsat data
  - Terrestrial based essential climate variable products and climate data records:
    - Derived from Landsat sensors and/or cross calibrated to Landsat archives
    - Includes leaf area index, albedo, surface water, snow/ice, fire disturbance
  - FAO Forest Resource Assessment
  - Major space imagery contributor for GEO Forest Carbon Tracking Initiative
  - UNSPIDER Initiative to study how historical land use changes affect the behavior of natural disasters



South East Asia 1990 – 2000 reporting net forest cover changes

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Innovative Benefits of Open Availability

Studies are being produced on the value of free geospatial data

- *" The Users, Uses, and Value of Landsat and other Moderate-Resolution Satellite Imagery in the United States"* - Results from this study indicate societal value far exceeds the cost of acquiring and distributing data.

Research Applications lead to Innovative Commercial Endeavors

- The Department of the Interior's policy of releasing the full Landsat archive at no cost allows researchers in the private sector and at smaller universities to generate even more data applications — applications that serve commercial endeavors in agriculture and forestry, that enable land managers in and out of government to work more efficiently, that define and tackle critical environmental issues.

Adam Gerrand, Food and Agriculture Organization of the United Nations:

- "The opening of the Landsat archive to free, web-based access is like giving a library card for the world's best library of Earth conditions to everyone in the world."

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Summary: Successes of Open Availability of Landsat

- It is good policy:
  - Consistent with U.S. National Space Policy
  - Supports GEO Data Sharing Action Plan
- It is good value:
  - Societal value exceeds the cost of the satellite
  - Commercial enterprises thrive on availability of free images
  - Provides $100Ms in value to the U.S. economy
- It helps citizens know and protect their planet:
  - Earth observations are part of society's infrastructure
  - Access to information empowers all equally

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