Regional (to Global) Land Use, Cover, and Condition Change

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Landsat Science Mission

The Landsat mission has provided **global multispectral images** appropriate for use in documenting and monitoring global land change continuously since 1972. Landsat provides the only inventory of the **global land surface** over time at a scale where human vs. natural causes of land change can be differentiated.
Columbia River – Oregon, Washington

1972
Landsat 1 MSS

1975
Landsat 2 MSS

1979
Landsat 3 MSS

1986
Landsat 5 TM

2002
Landsat 7 ETM+

2013
Landsat 8 OLI

MSS — Multispectral Scanner: 80m resolution, 4 spectral bands
TM — Thematic Mapper: 30m resolution, 7 spectral bands
ETM+ — Enhanced Thematic Mapper Plus, 30m resolution, 8 bands
OLI(&TIRS) — Operational Land Imager: 30 m resolution, 11 spectral bands
2011 U.S. Land Cover
NLCD – National Land Cover Database

[Map of the United States showing land cover types]
8.4% of the Great Plains land cover changed between 1973 and 2000.
Urban growth consumes about 0.1% of the Great Plains every 10 years.
A1B Scenario

- Moderate then declining global population
- Focus on economic development
- High demand for agricultural commodities
- High use of biofuels
- Loss of natural land covers
Traditional approach for monitoring and assess land-cover and land-use change

The *snapshot* perspective
Three decadal observations: growing seasons: 1990, 2000, and 2010

Landsat NIR (band 4) cloud-screened observations converted to surface reflectance using LEDAPS. Pixel row 1999, column 3002; WRS-2 path 12, row 31.
Why not use all available Landsat Data?

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

Landsat NIR (band 4) cloud-screened observations converted to surface reflectance using LEDAPS. Pixel row 1999, column 3002; WRS-2 path 12, row 31


Material from C. Holden, Boston University
Spectral history of a location in Fort Collins, Colorado

Crop field

Hay field

In conversion

Developed

Landsat Band 5

Date


Reflectance (scale factor 0.0001)

1000 1500 2000 2500 3000 3500 4000

Time series - row: 3010 col: 5544
Black Hills Study Area

Year of most recent change

Blue = most recent
Orange = oldest

USGS
Year of most recent change – blue=most recent, orange=oldest

Harvest or thin followed by regrowth

Insect damage?
Number of changes – dark orange=1 change, lighter shades more

Harvest? (notice the slope both before and after the change)

Band 5

Multiple harvest or thinnings?

Band 5
The future of land cover, use, and condition mapping and monitoring...

- Land cover and change generated with increased temporal frequency over larger geographic areas
- Land cover and condition generated at any point along the 43+ year long Landsat record
- Near real time identification and classification of broad suite of land cover, use, and land condition change attributes
- Increased frequency enables –
  - Consideration of land use and management
  - Connecting change events to change drivers
  - More accurate measures of change rates
ANIMATIONS
A: forest->barren

B: forest->developed

C: forest->grass