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science for a changing world

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

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October 19, 2015

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

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.

October 11, 1991

October 2, 2011

Northeast South Dakota

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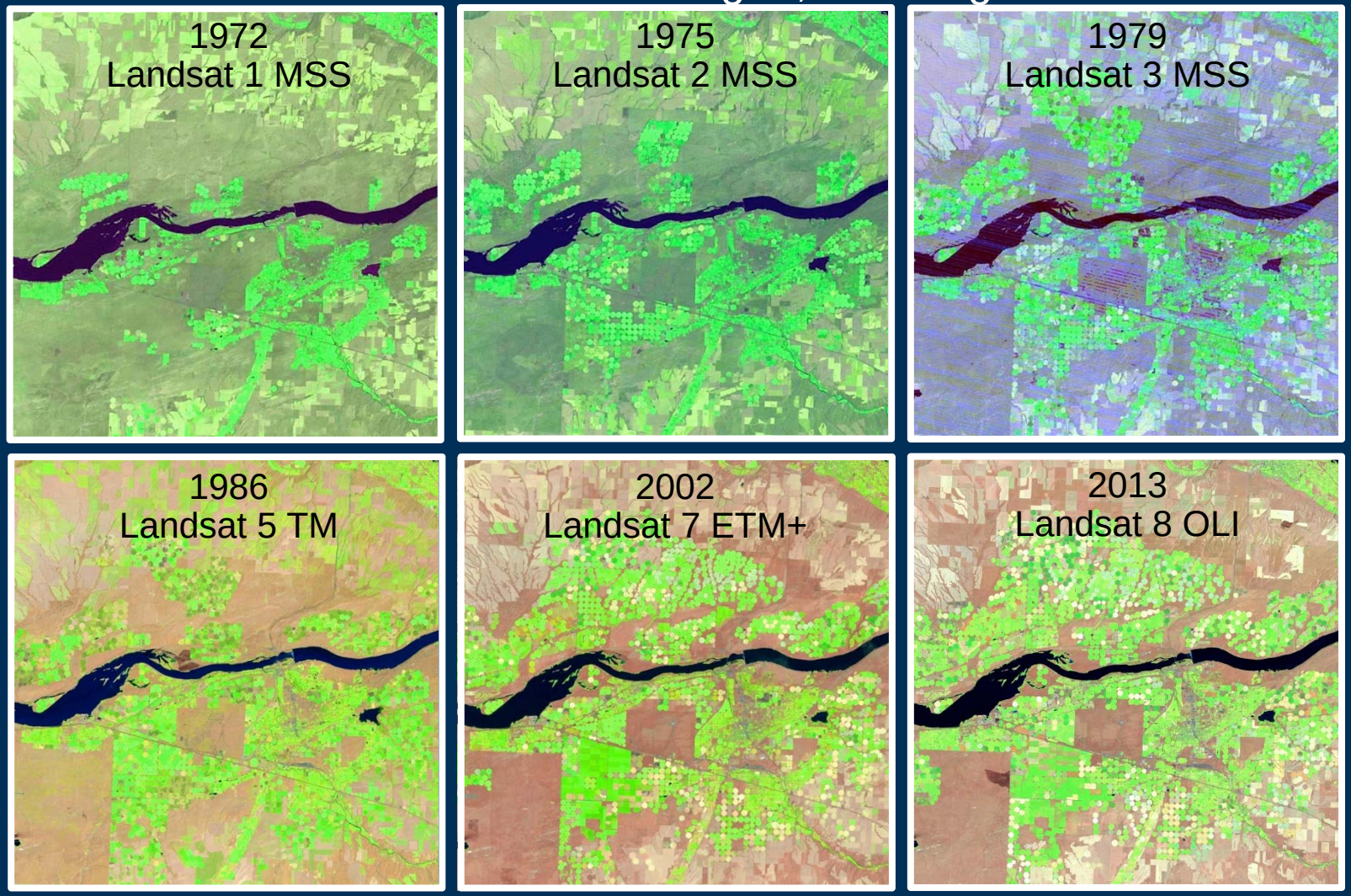
Columbia River – Oregon, Washington



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

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2011 U.S. Land Cover

NLCD – National Land Cover Database

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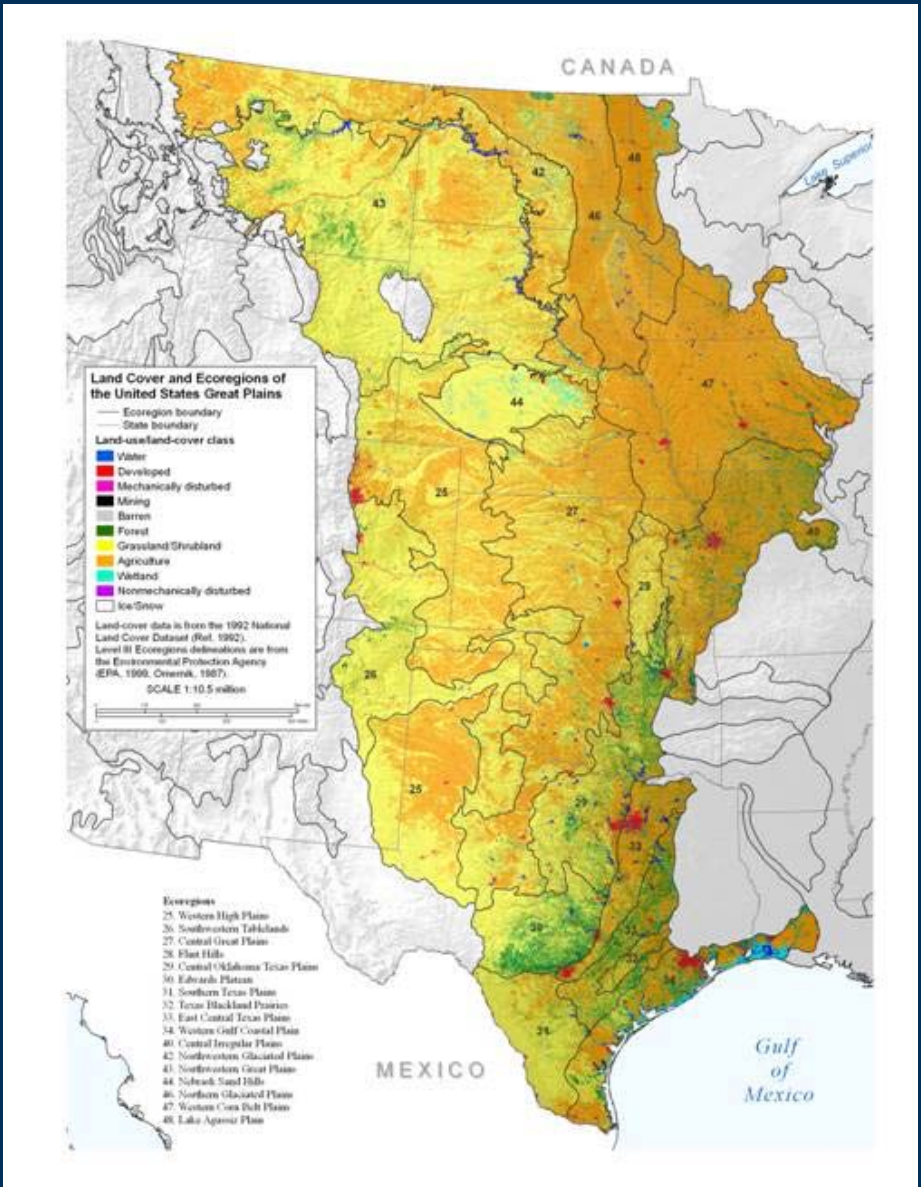

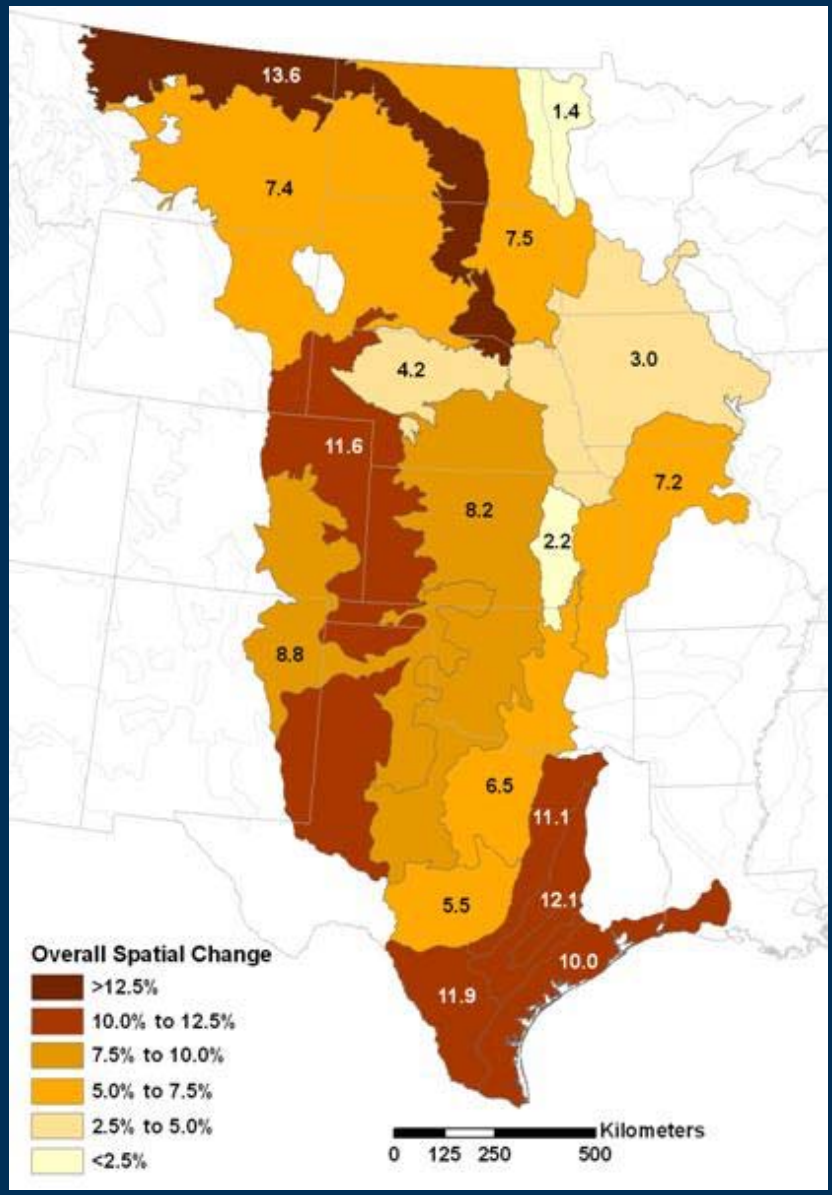

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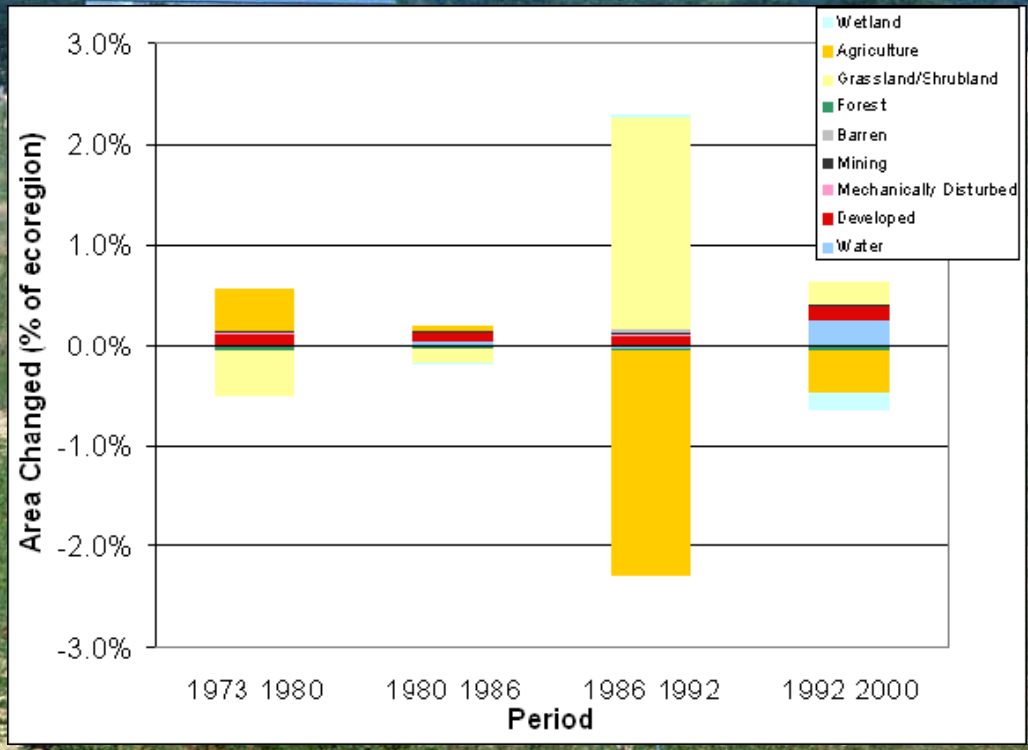
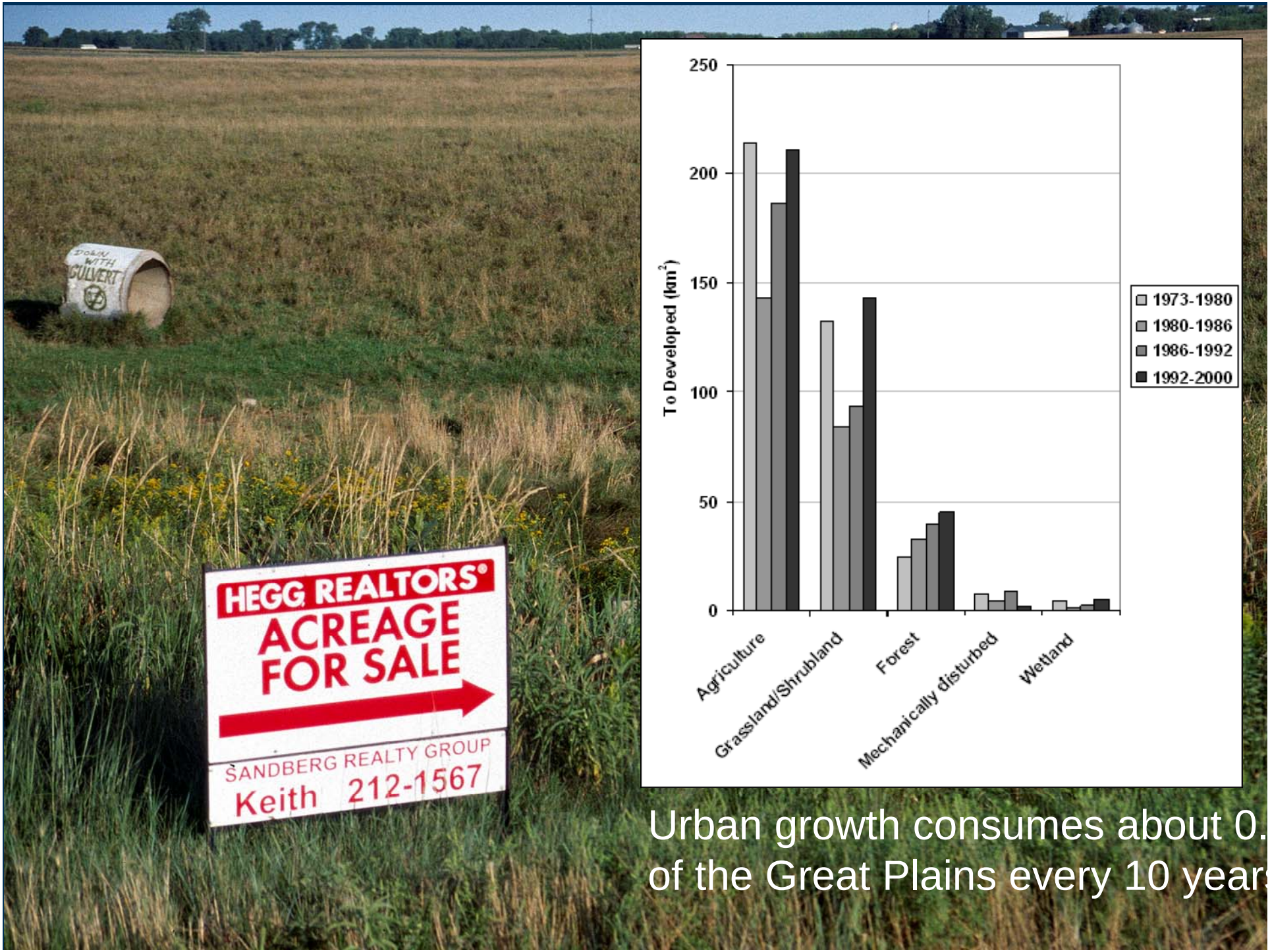
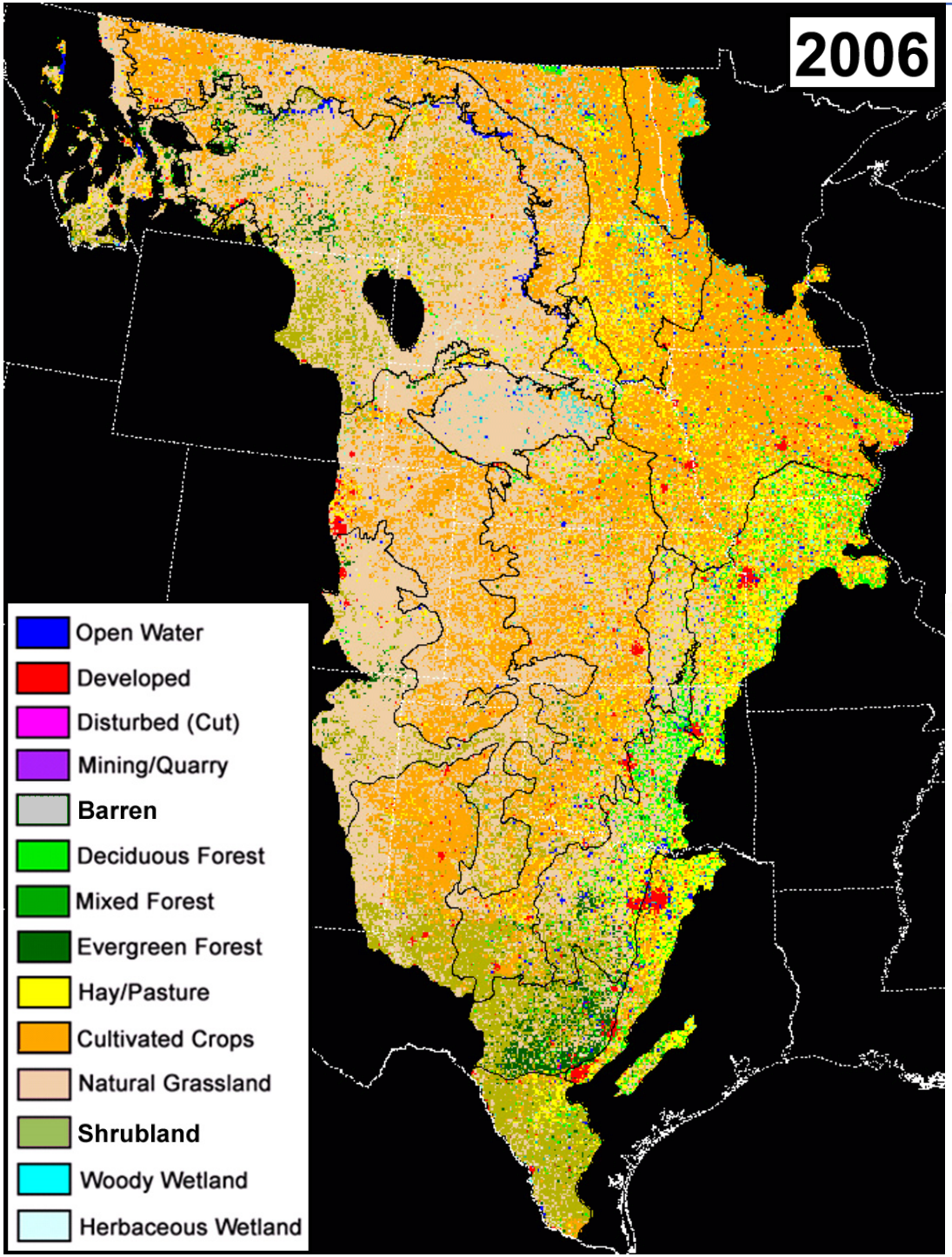
Land Cover Change Rates: 1972-2000

8.4% of the Great Plains land cover changed between 1973 and 2000



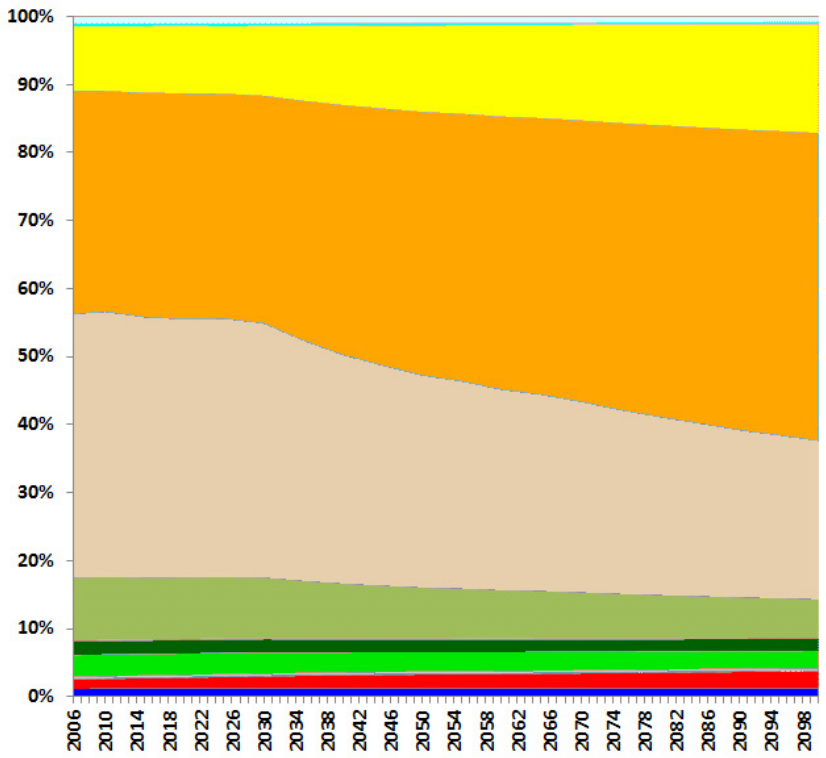


Urban growth consumes about 0.
of the Great Plains every 10 years

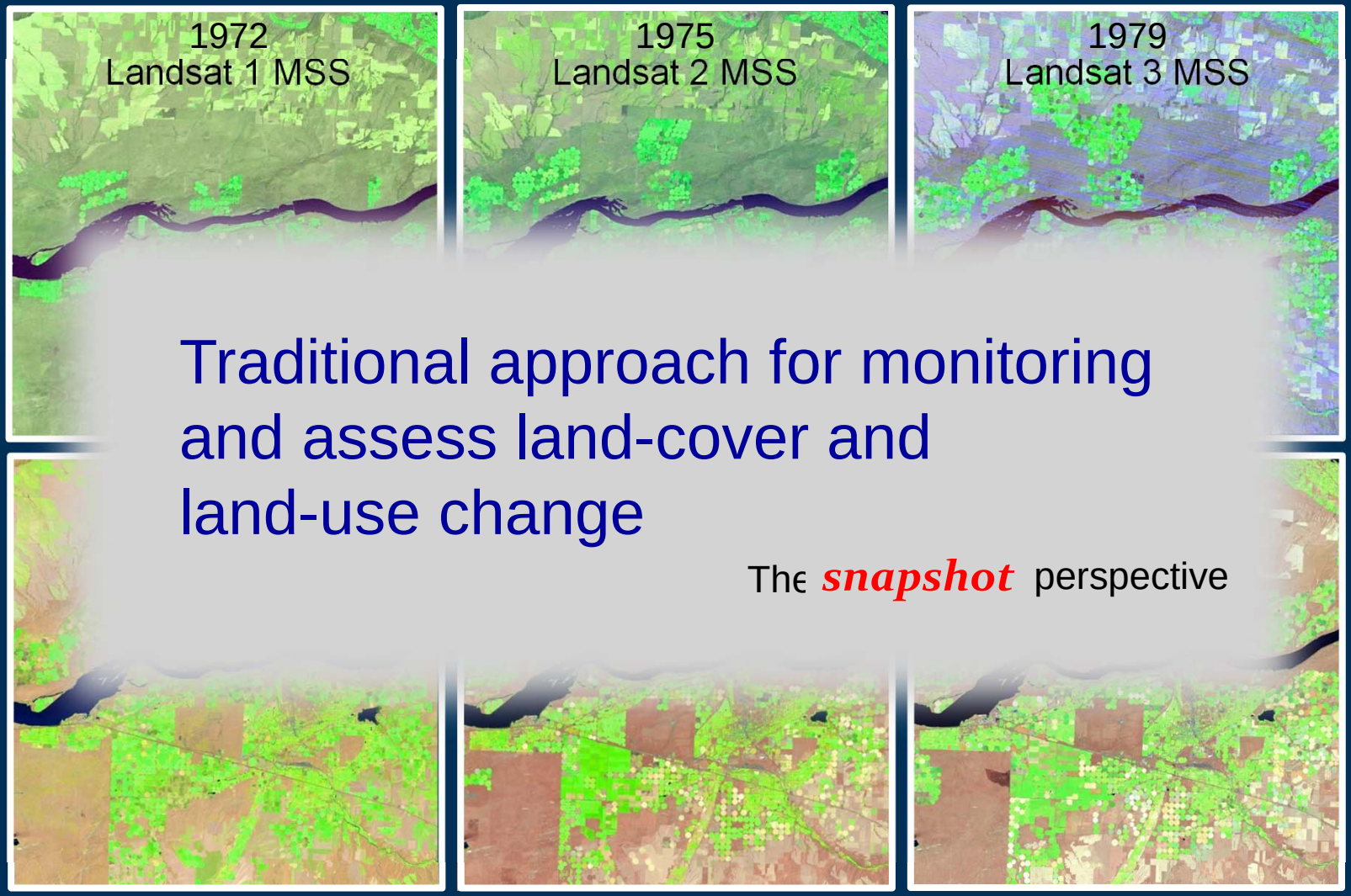


A1B Scenario

- Moderate then declining global population
- Focus on economic development
- High demand for agricultural commodities
- High use of biofuels
- Loss of natural land covers



Columbia River – Oregon, Washington



Traditional approach for monitoring and assess land-cover and land-use change

The ***snapshot*** perspective

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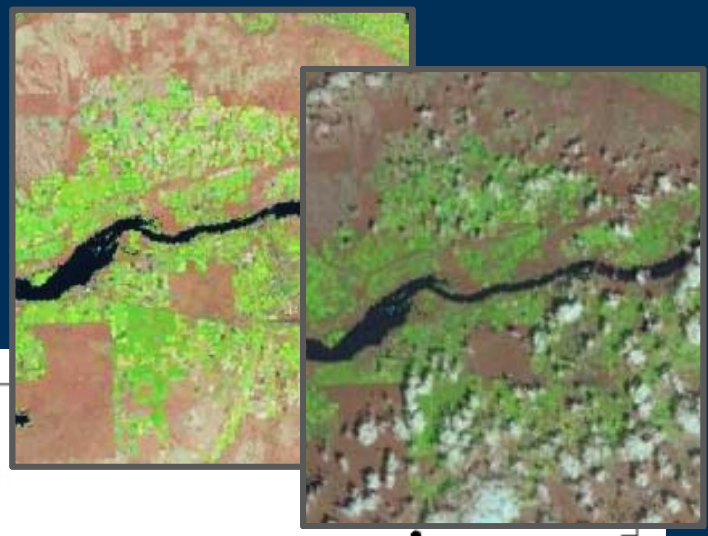
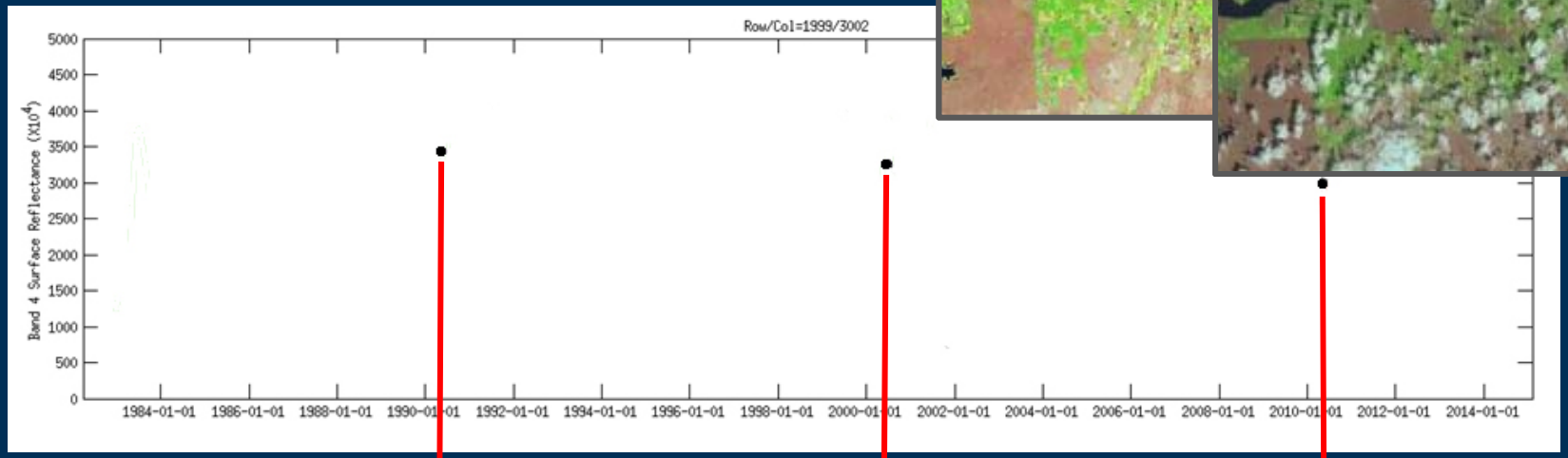
Three decadal observations: growing seasons: 1990, 2000, and 2010





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

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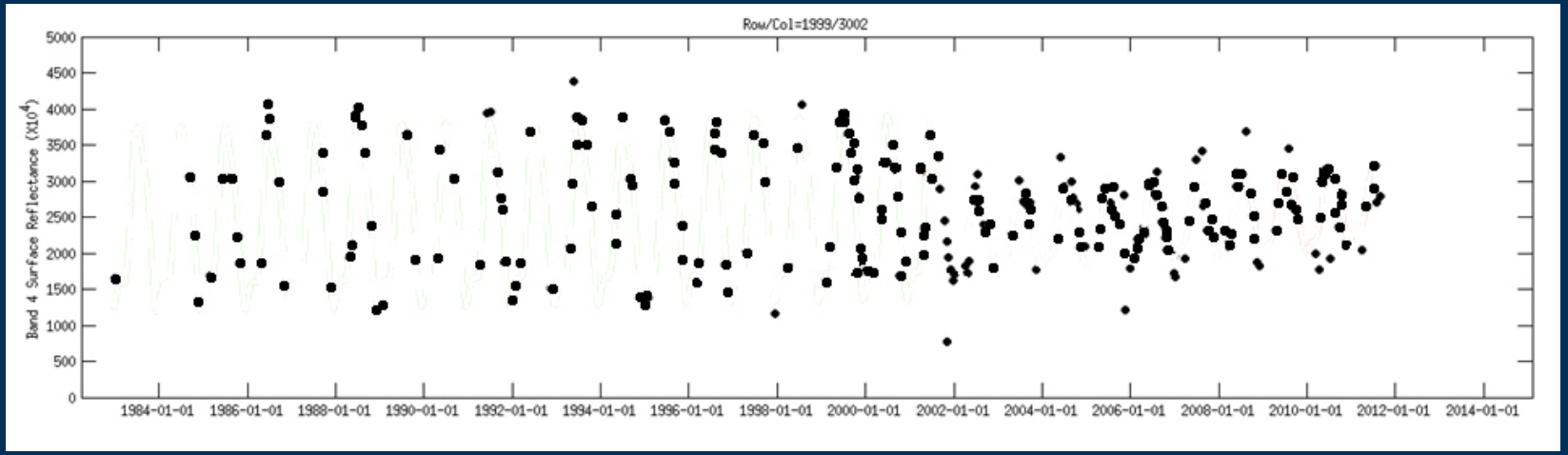
Why not use all available Landsat Data?

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



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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.

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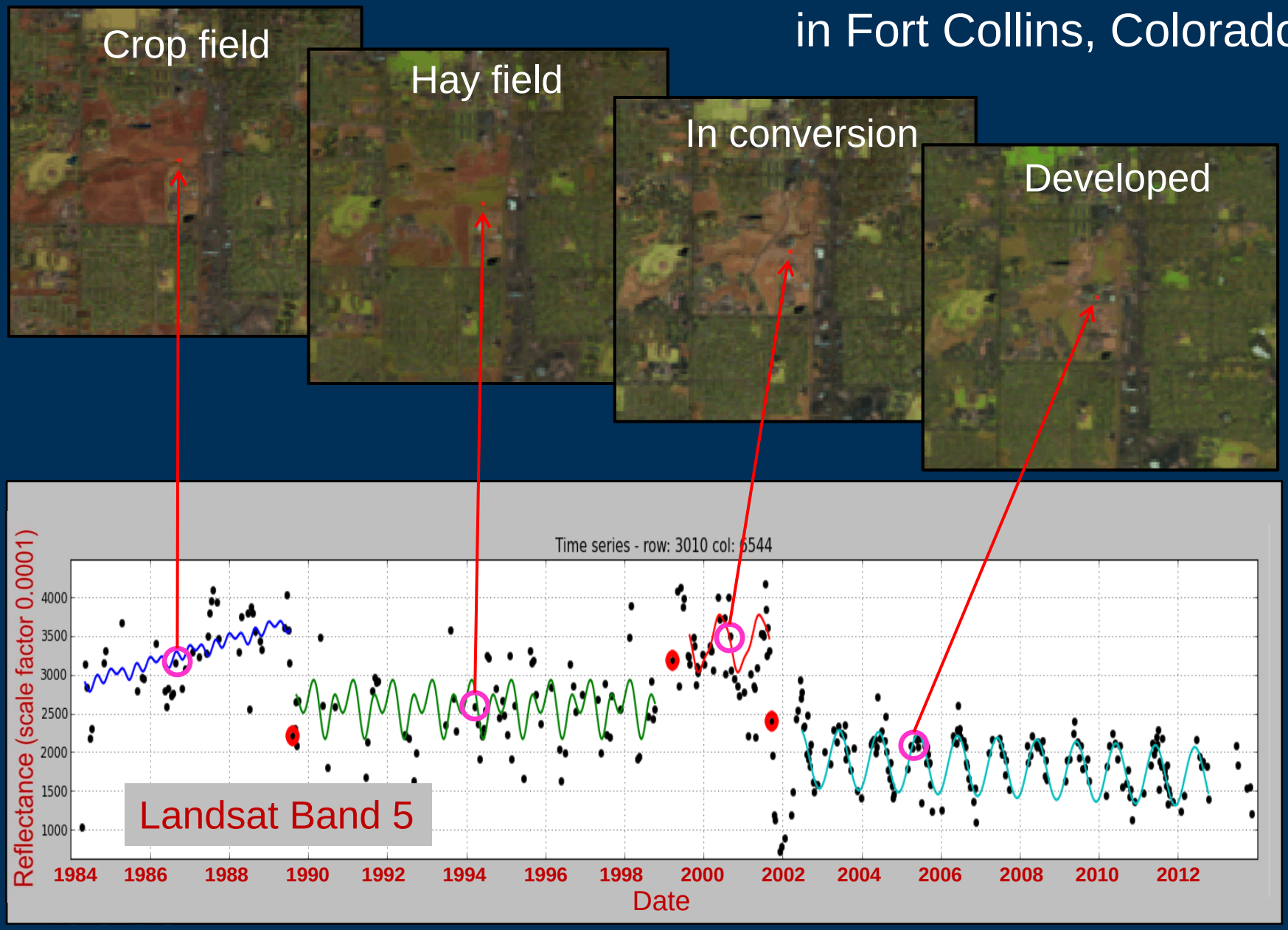
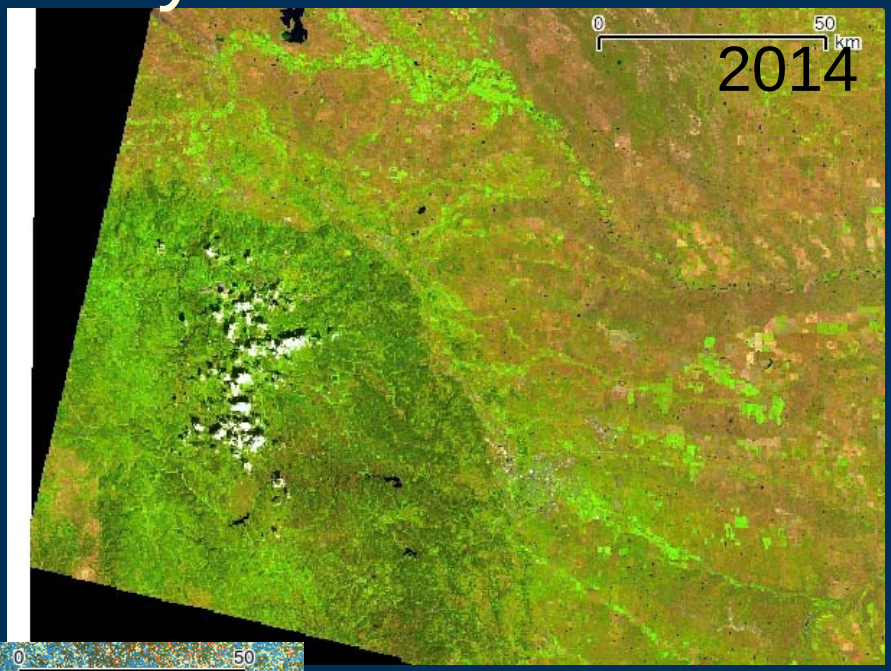
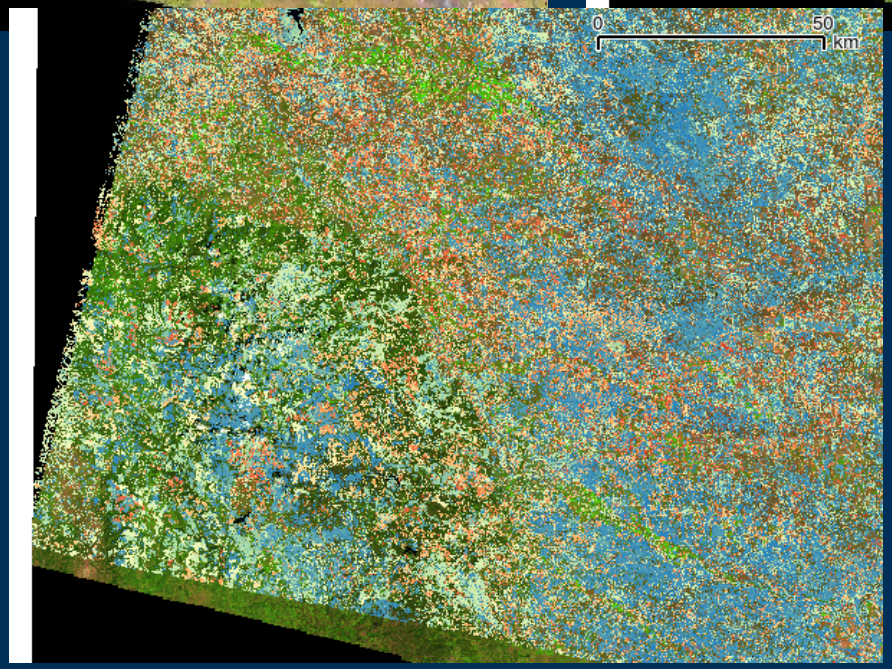
Material from C. Holden, Boston University

Spectral history of a location in Fort Collins, Colorado



Black Hills Study Area





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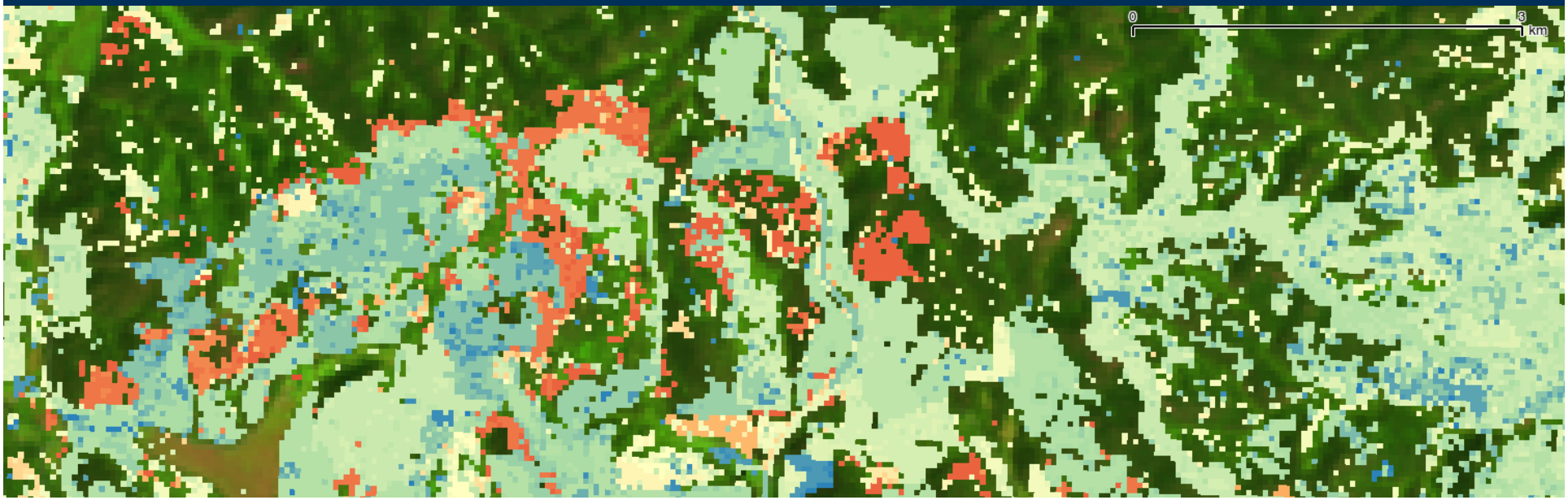
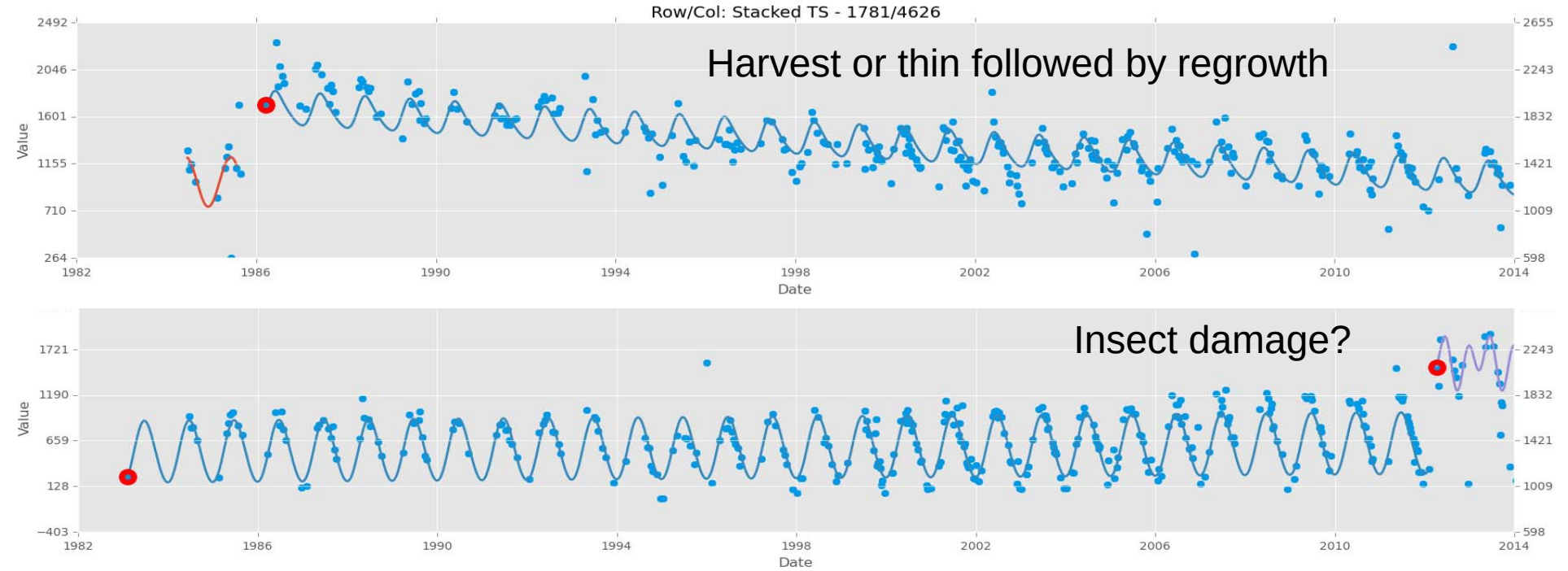
Year of most recent change

Blue = most recent

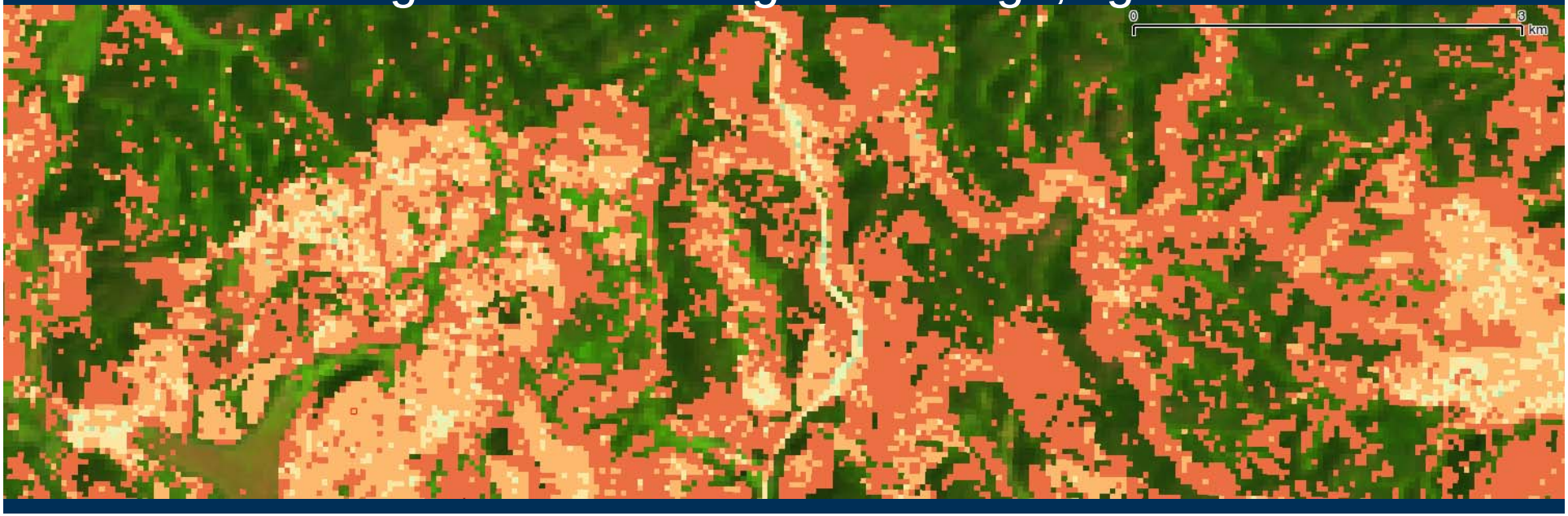
Orange = oldest

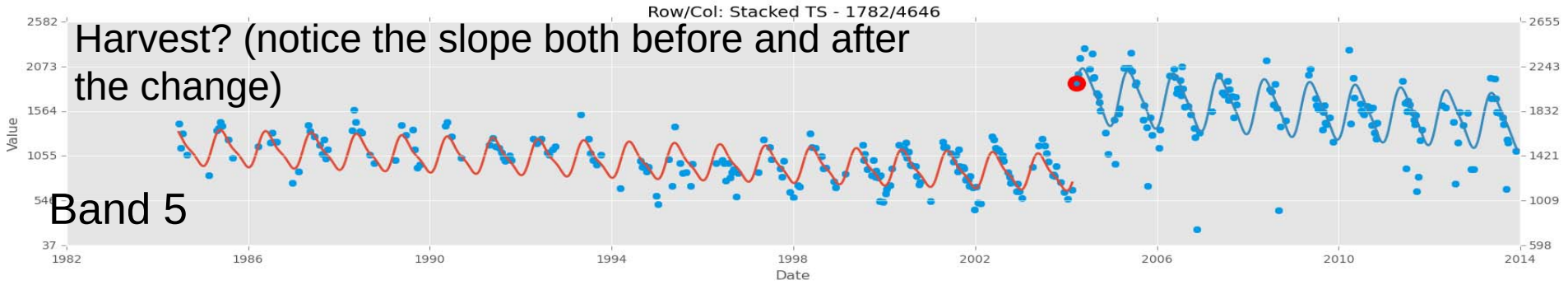
Year of most recent change – blue=most recent, orange=oldest

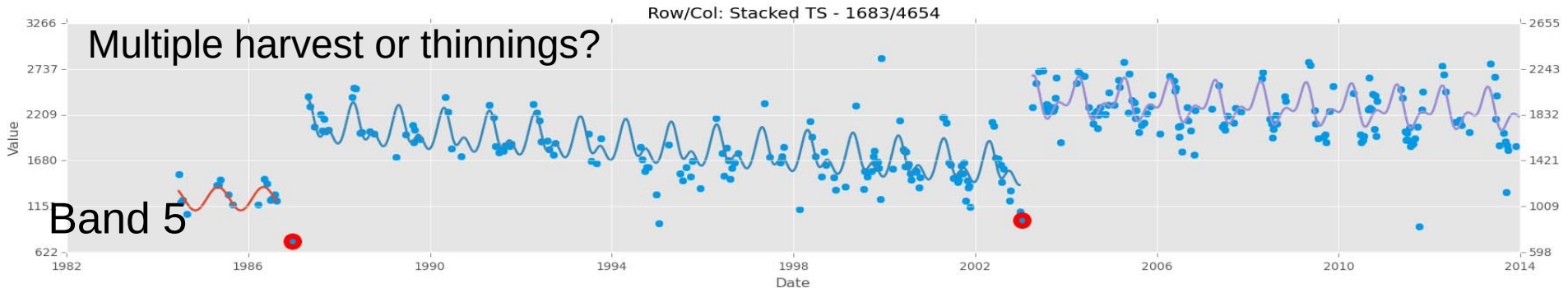




Number of changes – dark orange=1 change, lighter shades more







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

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ANIMATIONS

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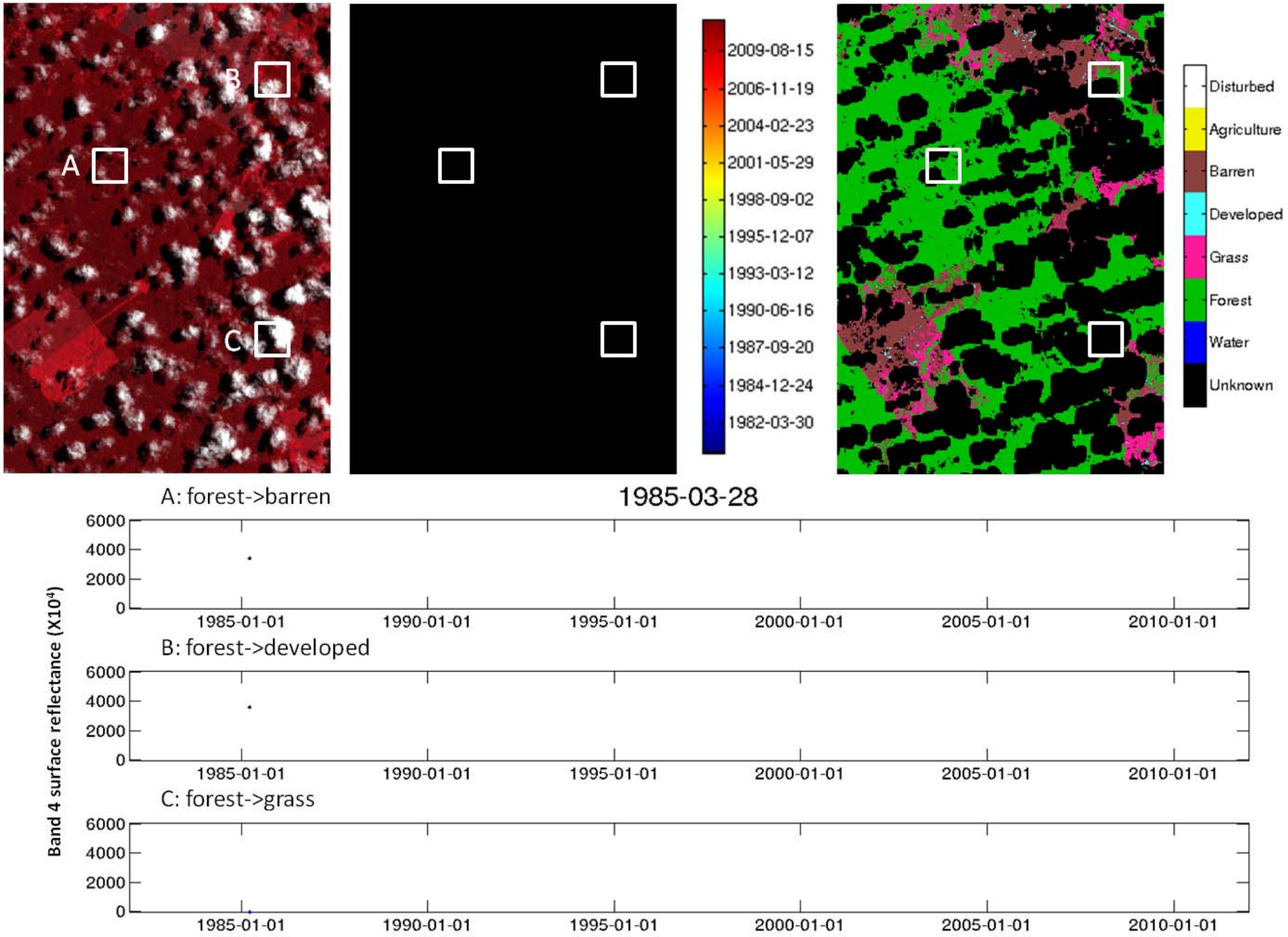
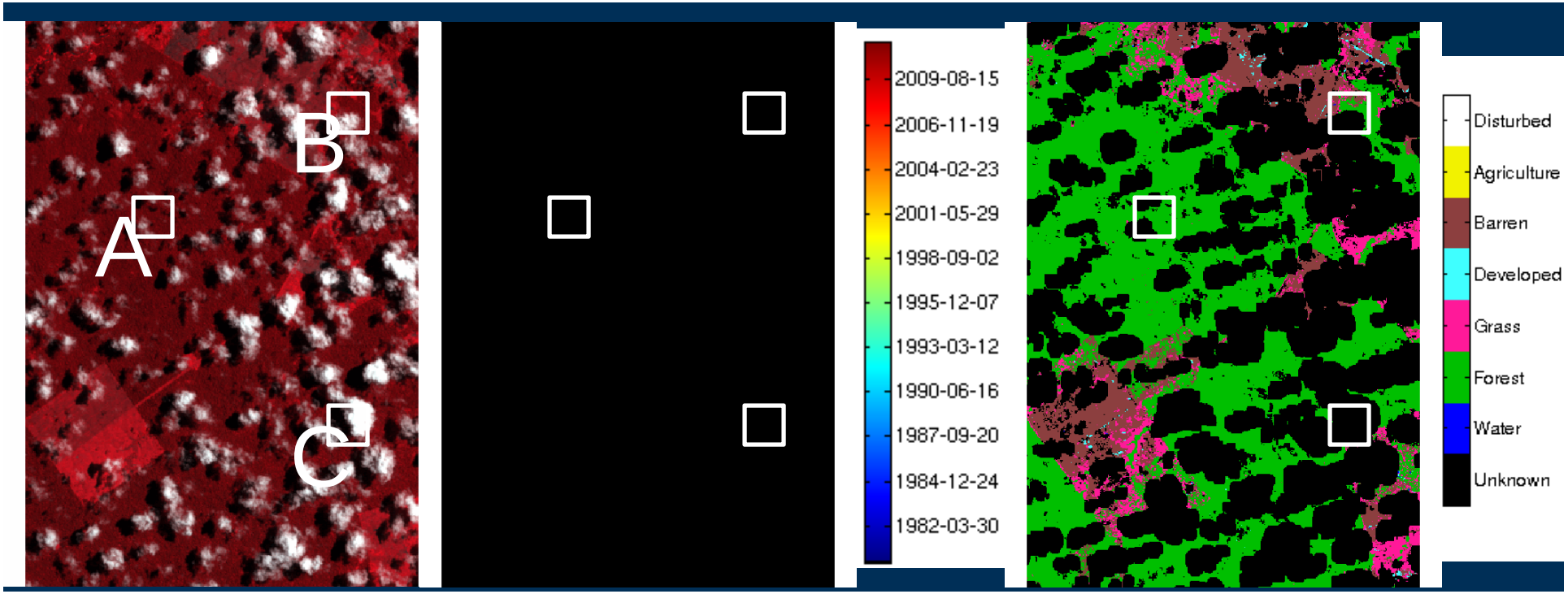

A
B
C
2009-08-15
2006-11-19
2004-02-23
2001-05-29
1998-09-02
1995-12-07
1993-03-12
1990-06-16
1987-09-20
1984-12-24
1982-03-30
Disturbed
Agriculture
Barren
Developed
Grass
Forest
Water
Unknown
A: forest->barren
1985-03-28
B: forest->developed
C: forest->grass
Band 4 surface reflectance (X10⁴)
6000
4000
2000
0
1985-01-01
1990-01-01
1995-01-01
2000-01-01
2005-01-01
2010-01-01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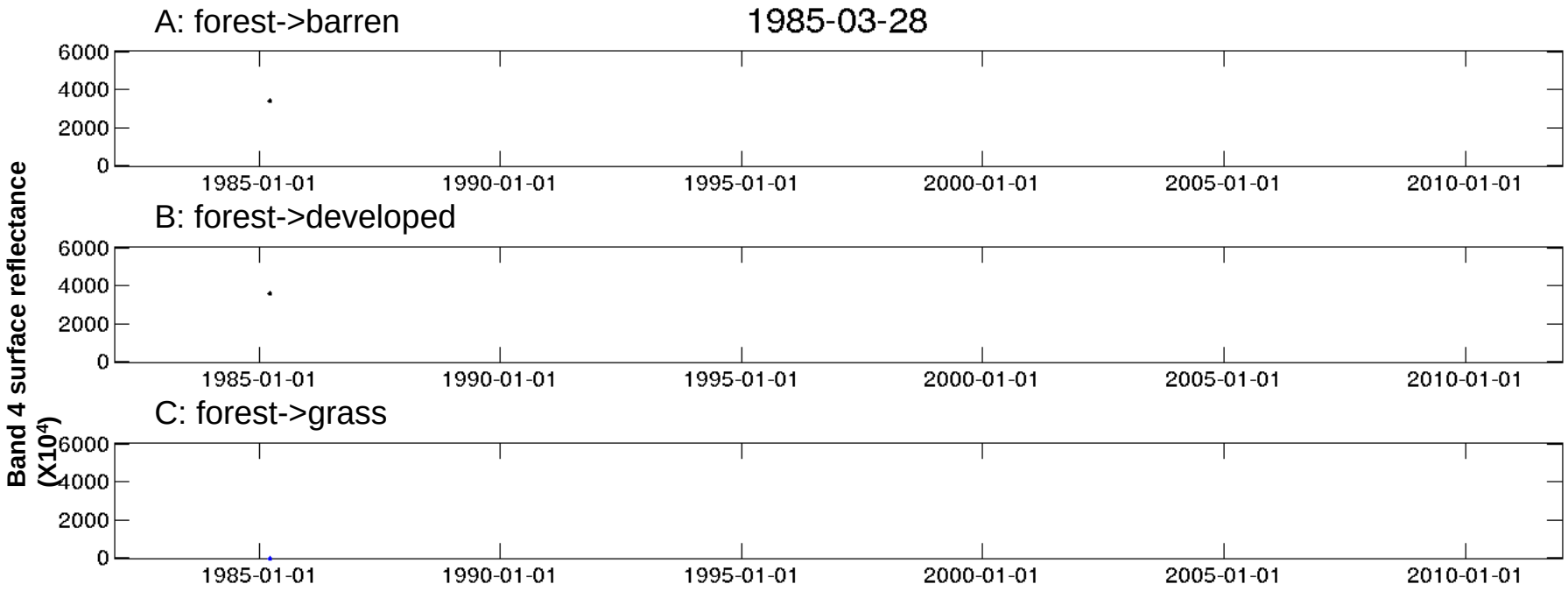
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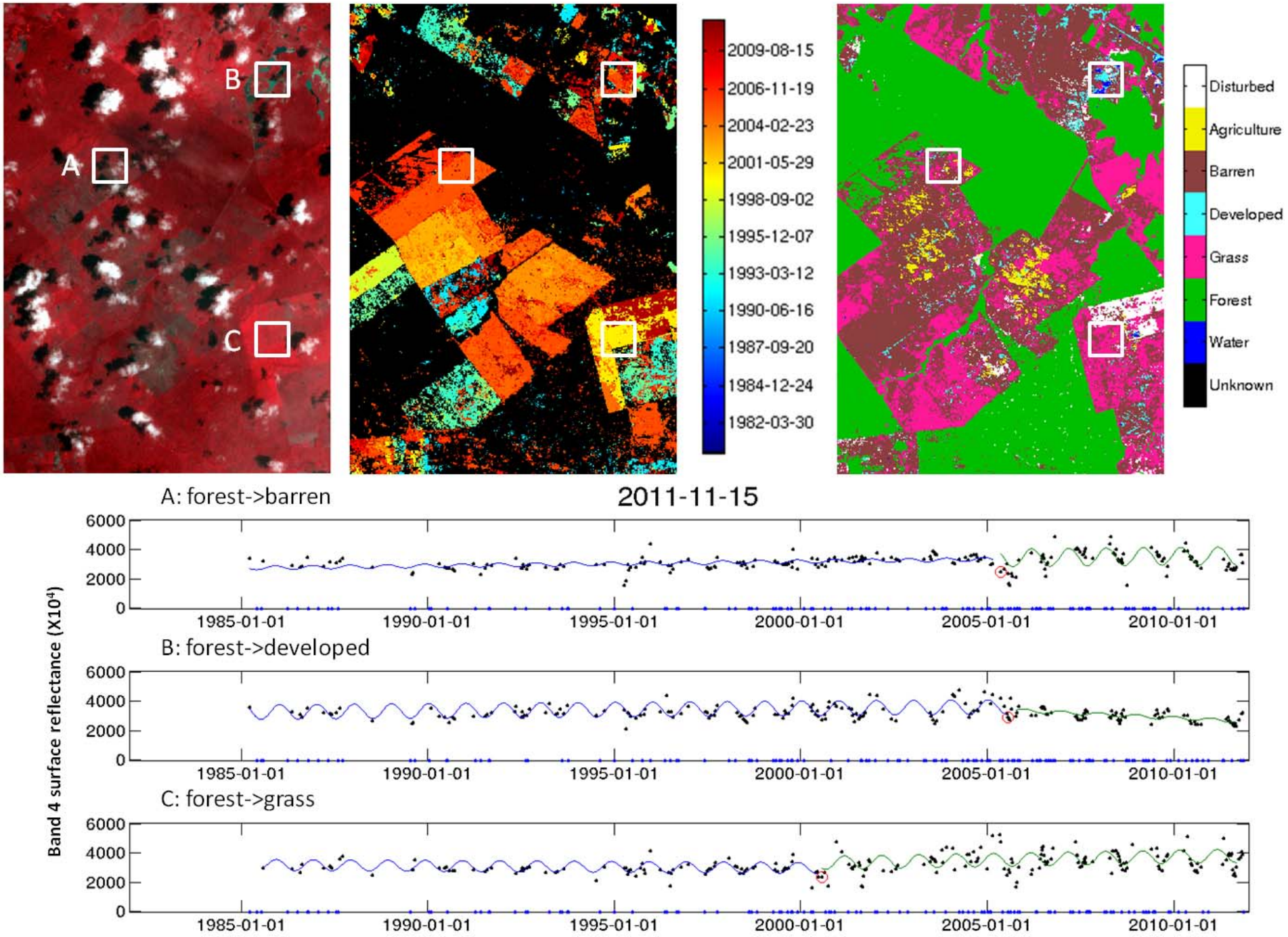
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