A new tool for assessing landscape change and resilience

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LanDAT data source

MODIS Normalized Difference Vegetation Index (NDVI), 2000 – 2015

Annual land surface phenology: timing of vegetation change

Appalachian forest pixel, WV

Desert riparian pixel, west Texas
NDVI Within-year variability

Annual phenology metrics

Annual phenological classification

Mean NDVI greenness

Seasonality

Middle of growing season

Phenological classes

500 classes, Random colors
Phenoclasses: phenological similarity shown by color similarity

All years, 2001 - 2015
Phenoclasses: phenological similarity shown by color similarity

2012

Elk Complex Fire
August 2013

Boise, ID
Land surface phenology: annual anomalies

2011 drought-related departure from baseline
Brighter color = greater departure

2011 phenological departure from 2000-2009 baseline

East Texas National Forests
Using information theory to characterize landscape organization and dynamics

Phenological class in 2000, 2001, etc.

\[ P = \text{Transition probability} \]

\[ H = \text{Shannon Entropy} \]

\[ H = - \sum_i (P_i \cdot \log_2(P_i)) \]

\[ MI = \text{Mutual Information} \]

\[ MI = \sum_i \sum_j \left( P_{i,j} \cdot \log_2 \left( \frac{P_{i,j}}{P_i \cdot P_j} \right) \right) \]

\[ \text{Conditional Entropy} = \text{mean } H - MI \]
How ‘dynamic’ are landscapes?

Landscape Activity:
Year-to-year change

Landscape Activity:
Long-term shift

Distance between current phenoclass distribution and projected equilibrium distribution: Kullback-Leibler distance
Climate variability and change

LanDAT
- Vegetation dynamics
- Land surface phenology
- Landscape change

- Forest carbon dynamics
- Forest hydrology
- Wildlife habitat suitability
- Other ecosystem services

Vegetation dynamics mediate many climate-resource relationships
Thank You!

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