Ecological Disturbance Monitoring Using Landsat Time Series Data

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Research Goals and Objectives

• Further characterize land cover status and trends across large regions using the Landsat data archive

• This will include analyzing linkages between Landsat-derived change information with climate data to help understand climate change impact on spectral and ecological changes

• Builds off of existing projects (e.g. LANDFIRE, NLCD)
George Xian (ARTS/USGS EROS Center)

Background:

• Ph.D in Atmospheric Science

• Science lead for the National Land Cover Database (NLCD) project

• Mapping and monitoring of urban change

• Land cover classification and change

• Climate assessment
Examples of change

Gradual Changes
- Forest Succession
- Pine Bark Beetle
- Spruce Budworm

Abrupt Changes
- Logging
- Wildfire

Sort of In-between Changes
Some specific Objectives

• Assess spatial patterns of gradual natural vegetation changes in US during previous 28+ years using TM/ETM+ (and LDCM)

• Determine relationships between gradual ecosystem change with climate

• Expand gradual change work into MSS era (e.g. 1972-present)

• Explore potential of Landsat for assessing gradual change at global scale
An example of what we’re looking for….
Southern Arizona

Phoenix
Precipitation Trends from Daymet (1980 to 2010)

Slope (mm/year)

-26 - -15
-6.7 - -5.5
-14 - -12
-5.4 - -4.4
-11 - -9.7
-4.3 - -3.3
-9.6 - -8.2
-3.2 - -2
-8.1 - -6.8
-1.9 - 1.8
Landsat Close-up
Bands 5 4 3
NDVI Slope Image
(Dark=decreasing trends in NDVI)
1984-2011
Comparison between 1984-2011 NDVI trend information and 1980-2000 Daymet precipitation trends data

NDVI Slope (dark areas indicate decreasing annual NDVI levels)

Precipitation Slope (orange/yellow indicate decreasing annual precipitation)
Some General Observations

• Gradual change is pervasive. We have seen evidence of gradual changes in every Landsat path/row assessed thus far.

• Patterns of change that we see can be both intriguing and perplexing. We don’t always know what the changes represent, but we can generally figure it out with additional information.

• Gradual change is often pronounced in ecological transition zones, often associated with mountains.

• We are beginning to see relationships between image and climate trends.