A Change Detection Methodology Sensitive to Subtle Variation in the Missouri Ozark Forests

Clayton Blodgett and Ronnie Lea
Missouri Resource Assessment Partnership
University of Missouri
4200 New Haven Road
Columbia, MO 65201

Mike Schanta
USDA Forest Service
Mark Twain National Forest
401 Fairgrounds Road
Rolla, Missouri 65401

Introduction

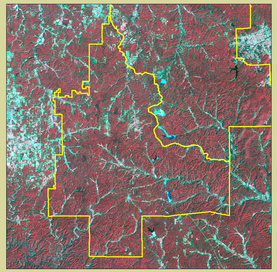
Oak decline and the red oak borer are currently affecting large portions of the Missouri Ozarks. The challenge to resource mangers is that once the decline is visible on the ground, the forest stand is beyond treatment and must be salvage logged. The forest change methodology investigated here is in response to United States Forest Service and Missouri Department of Conservation desires to have a technique that is capable of detecting subtle changes in forest health, so remediation measures can be applied before the stand is totally lost. Actual spatial locations of known mortality are currently unavailable, therefore by dividing U.S. Forest Service stand management data into categories based on extent and nature of activity, we will assess our ability to detect subtle management activities (intermediate cuts and salvage cuts) analogous to mortality caused by oak decline and the red oak borer.

Methods

In this research the "wetness" component from the Tasseled Cap Transformation (TCT) was investigated as a means of determining change from multitemporal satellite scenes. Three satellite scenes were chosen with similar anniversary dates and a two-year time-step between scenes. The TCT was applied to each scene and the wetness components were extracted and composited into a single scene. A forest mask was generated based on previous land cover classifications of Missouri. The composite image was intersected with the forest mask. The resulting scene contained only those areas that were forested when the classifications were produced. Unsupervised classification was then applied to the masked scene. Each cluster was assigned to one of three change classes.

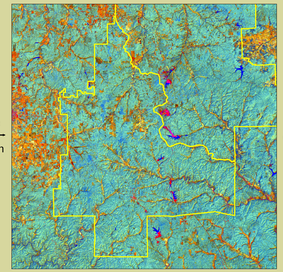
Conclusions

The Tasseled Cap Wetness (TCW) change detection technique sought to detect subtle changes in forest biomass using only the wetness component of the TCT. The TCW technique allowed for successful detection of forest biomass change within the deciduous oak/hickory forests of Southern Missouri. The technique was capable of detecting forest biomass change at multiple spatial extents including relatively subtle changes occurring within salvage cuts. Detection of subtle changes to forest biomass, such as mortality due to the red oak borer of oak decline may be detectable using this technique. Spatial data of known forest mortality due to insect and disease are needed in order to quantifiably answer that question.

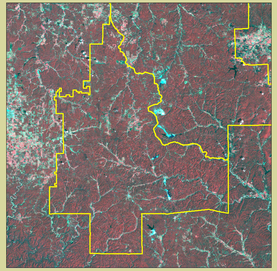


September 2, 1996

Tasseled Cap Transformation

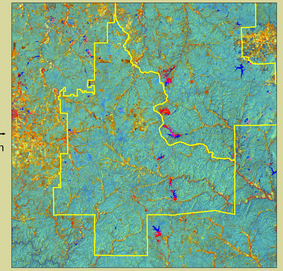


September 2, 1996 Tasseled Cap

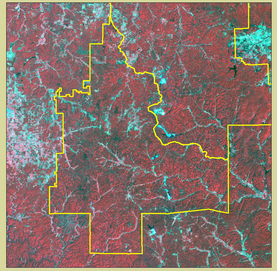


September 2, 1998

Tasseled Cap Transformation

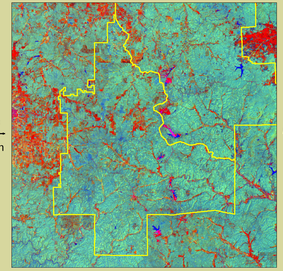


September 2, 1998 Tasseled Cap



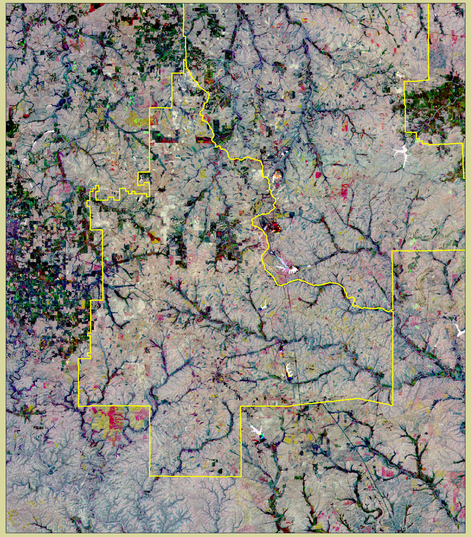
August 30, 2000

Tasseled Cap Transformation

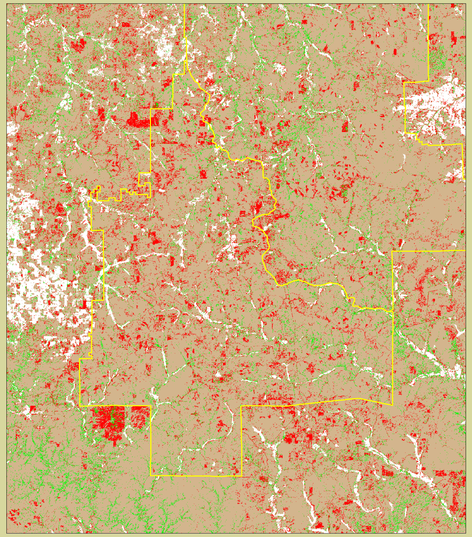


August 30, 2000 Tasseled Cap

Composite Tasseled Cap Wetness Components

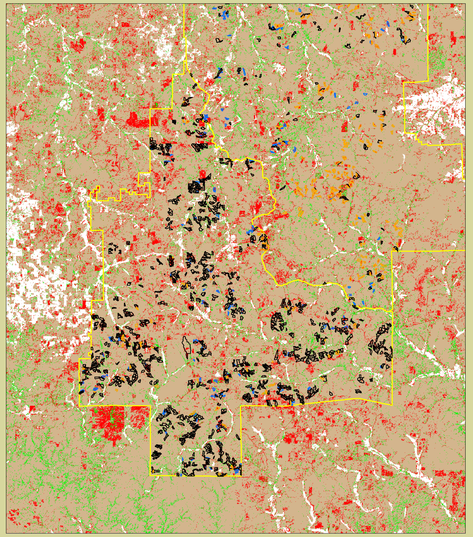


Change Classification

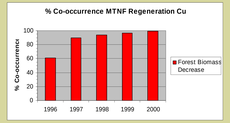


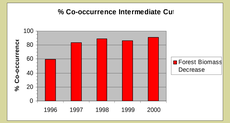
Forest Biomass Decrease
Stable Forest Biomass
Forest Biomass Increase

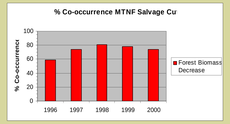
Co-occurrence Assessment

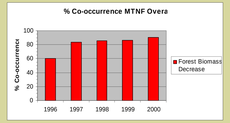


Intermediate Cut
Regeneration Cut
Salvage Cut









Missouri Resource Assessment Partnership (MoRAP). 2005. Forest Change Detection. MoRAP Data Product DP-2005-004.