ISSN 1946-7664. MCFNS 2018
Vol. 10, Issue 1, pp. 32–32
Mathematical and Computational Forestry & Natural-Resource Sciences

AVAILABLE ONLINE AT HTTP://MCFNS.COM

Submitted: Mar. 5, 2018
Accepted: Mar. 30, 2018
Published: Mar. 30, 2018
Last Correction: Mar. 30, 2018

ESTIMATION OF FOREST STAND DISTURBANCE THROUGH IMPLEMENTATION OF VEGETATION CHANGE TRACKER ALGORITHM USING LANDSAT TIME SERIES STACKED IMAGERY IN COASTAL GEORGIA

(POSTER RESEARCH SUMMARY)

Shingo Obata
Warnell School of Forest Resources; University of Georgia; Athens, GA 30602 USA

Abstract. The objective of this study was to identify and date forest disturbances between 1984 and 2016, on 30 meter spatial resolution Landsat images of coastal Georgia, through implementation of a modified Vegetation Change Tracker algorithm. The study area consists of seven counties along the coast of the Atlantic Ocean in Georgia, USA. The the dominant coniferous trees species in this area are planted loblolly pine (*Pinus taeda*) and slash pine (*Pinus elliotti*).

The analysis were made on Landsat Time Series Stack (LTSS) comprising annual Landsat 5 TM and 8 OLI imagery, covering WRS2 Path 17/Row 38. The selected images had to be captured during the growing season, which we assumed to be from the beginning of June to the end of August; and between 1984 and 2016 (except 2012). We calculated the inter-band Forest Z score (IFZ) for each image contained in LTSS. IFZ, a vegetation index, was computed for each pixel in each year to reflect the likelihood that a pixel represents a forest cover type. IFZ is computed using the mean and standard deviation of identified forest regions within the satellite imagery. An identified forest region is a group of pixels which were manually selected to represent forest areas. We have tested an algorithm automatically detecting the specific year of forest disturbance at the pixel level. To detect the disturbance the algorithm considers the time series changes in IFZ value for each pixel.

The results of the analysis was summarized in the form of a disturbance year map, in which each pixel is assigned specific year of disturbance as its value. The accuracy assessment for the disturbance map used 100 sampling points determined by a stratified sampling method of 100 sampling points randomly selected and assessed for each class in the disturbance map. A stratified sampling method was applied to generate the points, with 3100 total number of sampling points. User's accuracy was 52%, while producer's accuracy was 59%. When assuming +/- 1 year error as as correct classification, the relaxed user's accuracy was 71% and relaxed producer's accuracy was 80%. Difference in annual user's accuracy is between 40% and 90%. User's accuracy in 1980s are low because pixels disturbed after 2005 are misclassified to subclasses of 1980s. User's accuracy is better than overall accuracy in 1990s and 2000s. In Landsat 8 period (2013-2016), user's accuracy is worse than overall accuracy. The disturbed area for each year ranged between 1117.62 ha to 27988.56 ha. Mean annual disturbance over the period is 10237.60 ha.

Although the result of this analysis largely succeed in detecting the disturbance years for each pixel, there still remains several challenges to be solved. First, some of the Landsat imagery used in this analysis has more than 20% of cloud cover. For these images, significant area within our study was excluded from the analysis. Second, IFZ value may be inconsistent depending on uncontrolled factors. We assumed that frequency distributions of IFZ values between consecutive years are almost identical. However, IFZ in some years had markedly different frequency distributions. Third, grassland and cropland are likely to be confused with forest land. To estimate the precise age of each stand, length of the regeneration and non-clearcut disturbances should be detected as well as major disturbance detected in this analysis.

The results of this research provide a satisfactory age class estimation for the considered area making possible to assess its location-specific information about the forest disturbances and age structure.

Keywords: GIS; Remote Sensing; Satellite imagery; Land change tracking; Vegetation Change Tracker algorithm; Landsat Time Series Stack; LTSS;