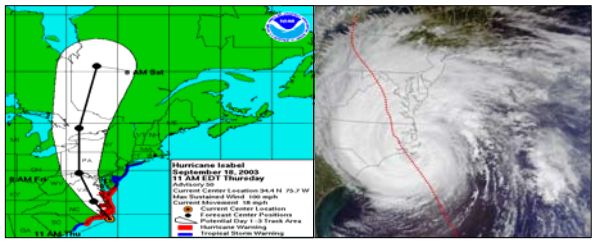
Updating Spatial Datasets after a Landscape Altering Event

National Park Service

Mapping downed woody debris at Petersburg National Battlefield, Petersburg, Virginia

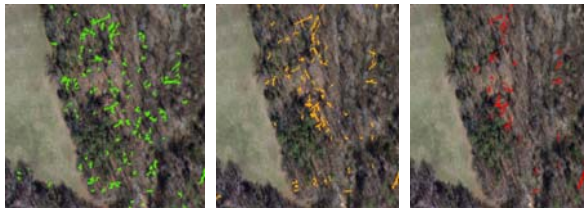
NC STATE UNIVERSITY

Introduction:
On September 18, 2003, Hurricane Isabel slammed into the Outer Banks of North Carolina's coast and continued its destructive path into the interior of Virginia. Soaking rains saturated and 90 mile per hour wind gusts battered central Virginia. Overnight, tracts of evergreen and deciduous forest stands, within Petersburg National Battlefield (PETE) were uprooted.



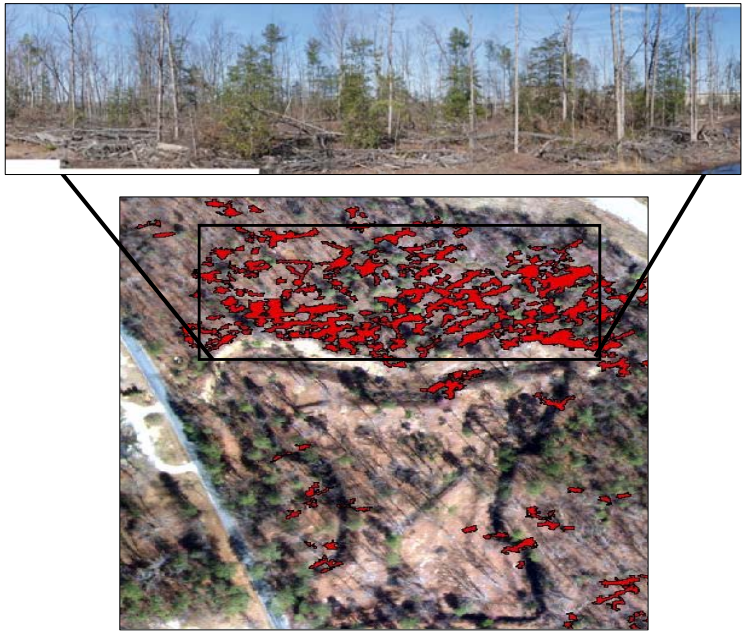
Objectives:
To map the areas of increased downed woody debris as a result of the hurricane.
To update the vegetation and fire fuel model geospatial datasets of PETE.

Research Methods:
Areas of downed woody debris were mapped using an object oriented classifier, Visual Learning System's Feature Analyst, as an extension of ArcGIS ArcMap. "Training sites" were drawn around areas of downed trees and in some instances individual downed trees. As a hierarchical classifier, Feature Analyst classification results were analyzed after each iteration with adjustments made to improve the accuracy of the classifier. To stratify the areas of downed woody debris a density of occurrence function was run. This served two purposes; to clump together downed woody debris of close proximity and to allow the resulting areas to be separated based on density of occurrence.

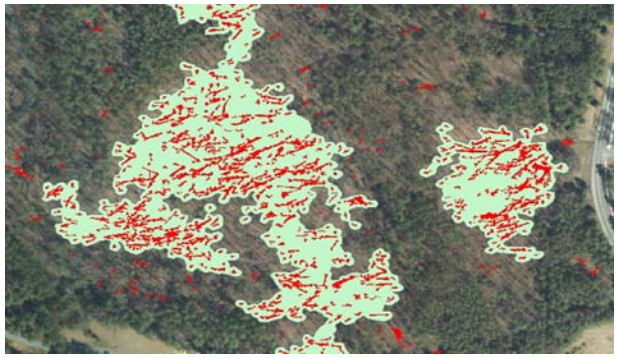


Example of the increased accuracy of Feature Analyst, with the first iteration on the left, an intermediate iteration in the middle and the final classification on the right.

Field Work:
Field measurements were taken at 24 plots following the Brown's Transect's and Burgan-Rothermel Ocular Estimation guidelines. An inventory of, downed woody debris, leaf litter, duff, woody and non-woody vegetation as well as the percent coverage of tree, shrub, and grass species were taken for each plot. The perimeters of several areas of forest damage were walked to validate the delineated forest damage polygons. Six perimeters were walked, three in deciduous forests, two in coniferous forests and one in a mixed forest.



Results:
The accuracy of Feature Analyst of areas called damaged, actually being damaged was 100% and the accuracy for areas called not damaged, actually not being damaged was 90%. The accuracy of the forest damage polygon created to capture 1- , 10-, and 100-hour fuels and help in the quantification of downed woody debris was directly related to the forest canopy cover. As a result, the ability of the forest damage polygons to capture the horizontal continuum of fuels was site dependent. Concentrating on areas indicated by Feature Analyst, field work was carried out to determine the amount of fuel loading present. Field measurements coupled with written descriptions and professional input led to all areas being classified as Fuel Model 10, with an area of downed conifers assigned to Fuel Model 13. Vegetation datasets were not updated since the landscape change did not change the floristic state, just the age of the species found.



Discussion:
As the spatial resolution of remotely sensed data continues to increase, classifying an image based on the ability to use groups of pixels will prove more valuable than reliance on a single pixel. Future research should explore alternative methods of indicating downed woody debris occurring under coniferous cover types, specifically the use of LIDAR data to create a canopy terrain map. Develop alternative methods to grouping non-continuous "jackpots" based on their horizontal distance, slope, fuel model, wind, and other environmental variables. Testing of the learning file, employed by Feature Analyst's on a series of smaller photos versus a different photomosaics

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