NAFD forest disturbance analysis using a LTSS-VCT approach

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The North American Forest Dynamics (NAFD) Project

~30 LTSS for Phase I (2005-2008), ~30 more for Phase II (2008-2011)

Forest Change Analysis using LTSS – Overview

LTSS Production

- Select/order images
  - best quality
  - leaf-on dates

- LEDAPS ingestion and processing
  - Orthorectification
  - Calibration
  - Atmospheric correction

- Masking and clipping

- Quality checking
  - Movie loops
  - Spectral profiles

Change Analysis (VCT)

Vegetation Change Tracker (VCT)

- Time series analysis
- Individual image analysis
- Vegetation Change Tracker (VCT)
- Landsat time series stacks

- Annual image analysis
- Confident forest
- Forest index

- Forest index time series
- Year disturbed
- Post-disturbance Regrowth

- Disturbance map
- Forest index series
Individual Image Analysis – Forest Sample Delineation

Automatic delineation of forest pixels reported in:

The closer to 0 a pixel’s $FI$ value, the more likely that pixel being a forest pixel. The higher the value, the more likely a nonforest pixel.
Detect forest disturbance using FI

Year of disturbance

Year

FI


0 2 4 6 8 10 12 14 16 18

Table 3
Confusion matrix for the VCT derived disturbance year map for WRS path 21/row 37.

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<td>Overall</td>
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</table>

The overall accuracy is 79.7%. Per class agreements are in bold face. Class code is defined as follows: 1 — persisting non-forest, 2 — persisting forest, 14 — pre-observation disturbance, 15–36 — disturbance year by adding 1970 to the code (e.g. 17 indicates a 1987 disturbance).
Table 2. Overall accuracy and and average producer’s and user’s accuracy values of the VCT disturbance year products assessed for all land cover and disturbance year classes of those products

<table>
<thead>
<tr>
<th>WRS2 Path/row</th>
<th>Location</th>
<th>Overall accuracy</th>
<th>Average producer’s accuracy</th>
<th>Average user’s accuracy</th>
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<td>12/31</td>
<td>Massachusetts</td>
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<td>15/34</td>
<td>Virginia</td>
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<td>27/27</td>
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<td>0.64</td>
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<td>45/29</td>
<td>Oregon</td>
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</table>

Available LTSS-VCT Products (current and near future)

NAFD Phase I & II Sample
5 samples in Canada
5 samples in Mexico

State level:
Utah, Mississippi, Alabama, Maryland, North Carolina
LTSS-VCT Summary

- Highly automated creation of Landsat time series stacks
- Efficient algorithm to identify stable forest pixels throughout the stack
- Calculation of a “forestness index” describing deviation from the population of pixels
- Robust detection of forest disturbance in a range of forest types
Extras
Fig. 10. Bad observations such as cloud/shadow contamination (a, WRS path 16/row 36, acquired on August 14, 2000), missing scan lines (b, WRS path 16/row 36, acquired on September 25, 1986), or duplicate scan lines (c, WRS path 45/row 29, acquired on August 13, 1984) in individual images leave little or no signs in the disturbance maps produced by the VCT (d, e, and f, produced with a, b, and c, respectively, as part of the inputs). When preceding a 1988 disturbance, however, the missing scan line in (b) caused the 1988 disturbance to be mapped as a 1986 disturbance (circled in (e)). The images in (a-c) are shown with bands 4, 3, and 2 in red, green and blue. See Fig. 7 for the legend for the disturbance maps.
Funding agencies

- NASA
- USGS EROS