Vegetation Continuous Fields
Evolution through multiple spatial and temporal resolutions

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AVHRR VCF

Rondonia, Brazil

1 km resolution

* Mixture model algorithm

Kwango, DRC
MODIS VCF C3

Rondonia, Brazil

Kwango, DRC

500 m resolution * Regression tree algorithm
Increased training
MODIS VCF C5

Rondonia, Brazil

Kwango, DRC

250 m resolution * Bagged regression tree algorithm
Increased training * Annual * Fully automated
Water Mask

MODIS C5  *  250 m resolution
Landsat VCF

Rondonia, Brazil

Kwango, DRC

30 m resolution  *  Regression tree algorithm
Training—MODIS VCF and high resolution data
MEaSURES VCF 1982 - 2010

Rondonia, Brazil

30 year time series * Bagged regression tree algorithm
Expanded training * 1/20 degree resolution
## Vegetation Continuous Fields Products -- History

<table>
<thead>
<tr>
<th>Spatial Resolution</th>
<th>Spatial &amp; Temporal Extent</th>
<th>Instrument</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 degree</td>
<td>North America subset, 1989</td>
<td>AVHRR (GVI prototype)</td>
<td>DeFries et al. 1995</td>
</tr>
<tr>
<td>8 km</td>
<td>Global, 1982 – 1994</td>
<td>AVHRR</td>
<td>DeFries et al. 2000</td>
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<tr>
<td>1 km</td>
<td>Global, 1992-1993</td>
<td>AVHRR</td>
<td>DeFries et al. 2000</td>
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<tr>
<td>500 m</td>
<td>Global, 2001</td>
<td>MODIS</td>
<td>Hansen et al. 2003</td>
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<tr>
<td>250 m</td>
<td>Global, 2000-2010</td>
<td>MODIS</td>
<td>DiMiceli, et al. 2011*</td>
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<tr>
<td>1/20 degree</td>
<td>Global, annual, 1982-2014</td>
<td>AVHRR &amp; MODIS</td>
<td></td>
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<tr>
<td>30 m</td>
<td>Global, 2000, 2005</td>
<td>LANDSAT</td>
<td>Sexton, et al. 2013*</td>
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<tr>
<td>30 m</td>
<td>Global, annual, 1999-2013</td>
<td>LANDSAT</td>
<td>Hansen, et al. 2013**</td>
</tr>
</tbody>
</table>

Why do we need both VCF and LAI products?

**VCF**
- Horizontal vegetation structure (openness, gaps)
- Subpixel spatial resolution
- Annual
- Distinguishes tree, non-tree and bare ground fractional cover

**LAI**
- Vertical vegetation structure (number of layers)
- 1 km spatial resolution
- 16-day temporal resolution
- Captures phenology
LAI and VCF

Maximum Annual LAI
MOD15A2-2010

VCF Tree Cover
MOD44B-2010

VCF Non-tree Vegetation
MOD44B--2010
### VCF vs LAI

![Image of 1 km area with VCF vs LAI comparison](Image)

<table>
<thead>
<tr>
<th></th>
<th>VCF</th>
<th>maximum annual LAI (2010, MOD15A2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree cover</td>
<td>32%</td>
<td>5.0</td>
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<tr>
<td>Non-Tree vegetation</td>
<td>56%</td>
<td></td>
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<tr>
<td>Bare ground</td>
<td>12%</td>
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</tbody>
</table>

USDA Farm Service Agency, Northern Michigan
## VCF vs LAI

![Satellite Image](image.png)

<table>
<thead>
<tr>
<th></th>
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<th>maximum annual LAI (2010, MOD15A2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree cover</td>
<td>52%</td>
<td>5.0</td>
</tr>
<tr>
<td>Non-Tree vegetation</td>
<td>34%</td>
<td></td>
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<tr>
<td>Bare ground</td>
<td>14%</td>
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</tr>
</tbody>
</table>

*USDA Farm Service Agency, Northern Michigan*
### VCF vs LAI

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<th>VCF</th>
<th>Maximum annual LAI (2010, MOD15A2)</th>
</tr>
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<tr>
<td>Tree cover</td>
<td>64%</td>
<td>5.0</td>
</tr>
<tr>
<td>Non-Tree vegetation</td>
<td>30%</td>
<td></td>
</tr>
<tr>
<td>Bare ground</td>
<td>6%</td>
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Future Plans

• Further additions to training to improve difficult regions
• Improved data mining models—Random Forest, Gradient Boosting
• Testing on C6 data
• Analysis of improvements with BRDF-corrected data
• VIIRS
• Updated error and uncertainty analysis