Leaf Area Index - Fraction of Photosynthetically Active Radiation 8-Day L4 Global 1km MOD15A2

The level-4 MODIS global Leaf Area Index (LAI) and Fraction of Photosynthetically Active Radiation (FPAR) product is composited every 8 days at 1-kilometer resolution on a Sinusoidal grid. Science Data Sets provided in the MOD15A2 include LAI, FPAR, a quality rating, and standard deviation for each variable. The LAI variable defines the number of equivalent layers of leaves relative to a unit of ground area, whereas FPAR measures the proportion of available radiation in the photosynthetically active wavelengths that are absorbed by a canopy. Both variables are used as satellite-derived parameters for calculating surface photosynthesis, evapotranspiration, and net primary production, which in turn are used to calculate terrestrial energy, carbon, water cycle processes, and biogeochemistry of vegetation. Version-5 MODIS/Terra LAI products are Validated Stage 2, accuracy has been assessed over a widely distributed set of locations and time periods via several ground-truth and validation efforts. Version-5 MODIS/Terra FPAR products are Validated Stage 1, meaning that accuracy has been estimated using a small number of independent measurements obtained from selected locations and time periods and ground-truth/field program efforts. Although there may be later improved versions, these data are ready for use in scientific publications.

**Data Set Characteristics**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporal Coverage</td>
<td>February 18, 2000 -</td>
</tr>
<tr>
<td>Area</td>
<td>~10 x 10 lat/long</td>
</tr>
<tr>
<td>File Size</td>
<td>~0.2 MB compressed</td>
</tr>
<tr>
<td>Projection</td>
<td>Sinusoidal</td>
</tr>
<tr>
<td>Data Format</td>
<td>HDF-EOS</td>
</tr>
<tr>
<td>Dimensions</td>
<td>1200 x 1200 rows/columns</td>
</tr>
<tr>
<td>Resolution</td>
<td>1 kilometer</td>
</tr>
<tr>
<td>Science Data Sets (SDS HDF Layers)</td>
<td>6</td>
</tr>
</tbody>
</table>

This image is pseudo-colored to display the Fraction of Photosynthetically Active Radiation (FPAR) calculated over north-central U.S., from the Great Lakes westward across the Northern Great Plains. These data collected between March 6 13, 2007 indicate more vegetation growing furthest to the East, as expected during this time of the year.
### Layers
Science Data Sets for MODIS/Terra Leaf Area Index/FPAR 8-Day L3 Global 1km SIN Grid V005 (MOD15A2):

<table>
<thead>
<tr>
<th>Science Data Sets (HDF Layers) (6)</th>
<th>UNITS</th>
<th>BIT TYPE</th>
<th>FILL</th>
<th>VALID RANGE</th>
<th>MULTIPLY BY SCALE FACTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fpar_1km</td>
<td>Percent</td>
<td>8-bit unsigned integer</td>
<td>249–255</td>
<td>0–100</td>
<td>0.01</td>
</tr>
<tr>
<td>Lai_1km</td>
<td>m²plant/m²ground</td>
<td>8-bit unsigned integer</td>
<td>249–255</td>
<td>0–100</td>
<td>0.1</td>
</tr>
<tr>
<td>FparLai_QC</td>
<td>Class flag</td>
<td>8-bit unsigned integer</td>
<td>255</td>
<td>0–254</td>
<td>na</td>
</tr>
<tr>
<td>FparExtra_QC</td>
<td>Class flag</td>
<td>8-bit unsigned integer</td>
<td>255</td>
<td>0–254</td>
<td>na</td>
</tr>
<tr>
<td>FparStdDev_1km</td>
<td>Percent</td>
<td>8-bit unsigned integer</td>
<td>248–255</td>
<td>0–100</td>
<td>0.01</td>
</tr>
<tr>
<td>LaiStdDev_1km</td>
<td>m²plant/m²ground</td>
<td>8-bit unsigned integer</td>
<td>248–255</td>
<td>0–100</td>
<td>0.1</td>
</tr>
</tbody>
</table>
The QA information below is excerpted from an HDF-EOS file of the MODIS LAI/FPAR product MOD15A2.
There are two QC data sets for LAI/FPAR QC. Table 1 displays the bit legend for the general QC values found in the SDS “FparLai_QC,” while Table 2 shows the more detailed information included in “FparExtra.”

Table 1: MOD15A2.005 LAI/FPAR General QA (8-bit)

<table>
<thead>
<tr>
<th>Bit No.</th>
<th>Parameter Name</th>
<th>Bit Comb.</th>
<th>FparLai_QC</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>MODLAND_QC bits</td>
<td>0</td>
<td>Good quality (main algorithm with or without saturation)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Other Quality (back-up algorithm or fill values)</td>
</tr>
<tr>
<td>1</td>
<td>Sensor</td>
<td>0</td>
<td>Terra</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Aqua</td>
</tr>
<tr>
<td>2</td>
<td>DeadDetector</td>
<td>0</td>
<td>Detectors apparently fine for up to 50% of channels 1,2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Dead detectors caused &gt;50% adjacent detector retrieval</td>
</tr>
<tr>
<td>3–4</td>
<td>CloudState (inherited from Aggregate_QC bits {0,1} cloud state)</td>
<td>00</td>
<td>0 Significant clouds NOT present (clear)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01</td>
<td>1 Significant clouds WERE present</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
<td>2 Mixed cloud present on pixel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11</td>
<td>3 Cloud state not defined, assumed clear</td>
</tr>
<tr>
<td>5–7</td>
<td>SCF_QC (five level confidence score)</td>
<td>000</td>
<td>0, Main (RT) method used, best result possible (no saturation)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>001</td>
<td>1, Main (RT) method used with saturation. Good, very usable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>010</td>
<td>2, Main (RT) method failed due to bad geometry, empirical algorithm used</td>
</tr>
<tr>
<td></td>
<td></td>
<td>011</td>
<td>3, Main (RT) method failed due to problems other than geometry, empirical algorithm used</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>4, Pixel not produced at all, value couldn’t be retrieved (possible reasons: bad L1B data, unusable MODAGAGG data)</td>
</tr>
<tr>
<td>Bit No.</td>
<td>Parameter Name</td>
<td>Bit Comb.</td>
<td>FparExtra_QC</td>
</tr>
<tr>
<td>--------</td>
<td>---------------------------------</td>
<td>-----------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>0–1</td>
<td><strong>LandSea Pass-Thru</strong></td>
<td>00</td>
<td>0 LAND AggrQC(3,5)values{001}</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01</td>
<td>1 SHORE AggrQC(3,5)values{000,010,100}</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
<td>2 FRESHWATER AggrQC(3,5)values{011,101}</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11</td>
<td>3 OCEAN AggrQC(3,5)values{110,111}</td>
</tr>
<tr>
<td>2</td>
<td><strong>Snow_Ice (from Aggregate_QC bits)</strong></td>
<td>0</td>
<td>No snow/ice detected</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Snow/ice detected</td>
</tr>
<tr>
<td>3</td>
<td><strong>Aerosol</strong></td>
<td>0</td>
<td>No or low atmospheric aerosol levels detected</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Average or high aerosol levels detected</td>
</tr>
<tr>
<td>4</td>
<td><strong>Cirrus</strong></td>
<td>0</td>
<td>No cirrus detected</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Cirrus was detected</td>
</tr>
<tr>
<td>5</td>
<td><strong>MODAGAGG_Internal_CloudMask</strong></td>
<td>0</td>
<td>No clouds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Clouds were detected</td>
</tr>
<tr>
<td>6</td>
<td><strong>MODAGAGG_Cloud_Shadow</strong></td>
<td>0</td>
<td>No cloud shadow detected</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Cloud shadow detected</td>
</tr>
<tr>
<td>7</td>
<td><strong>SCF_Biome_Mask</strong></td>
<td>0</td>
<td>Biome outside interval &lt;1,4&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Biome in interval &lt;1,4&gt;</td>
</tr>
</tbody>
</table>
## MOD15A2 Fill Values

### Table 1: For Fpar_1km and Lai_1km

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
</table>
| 255   | Fill value, assigned when:  
* the MODAGAGG surface reflectance for channel VIS, NIR was assigned its _Fillvalue,  
or  
* land cover pixel itself was assigned _Fillvalue 255 or 254 |
| 254   | land cover assigned as perennial salt or inland fresh water |
| 253   | land cover assigned as barren, sparse vegetation (rock, tundra, desert.) |
| 252   | land cover assigned as perennial snow, ice |
| 251   | land cover assigned as "permanent" wetlands/inundated marshlands |
| 250   | land cover assigned as urban/built-up |
| 249   | land cover assigned as "unclassified" or not able to determine |

### Table 2: For FparStdDev_1km and LaiStdDev_1km

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
</table>
| 255   | Fill value, assigned when:  
* the MODAGAGG surface reflectance for channel VIS, NIR was assigned its _Fillvalue,  
or  
* land cover pixel itself was assigned _Fillvalue 255 or 254 |
| 254   | land cover assigned as perennial salt or inland fresh water |
| 253   | land cover assigned as barren, sparse vegetation (rock, tundra, desert.) |
| 252   | land cover assigned as perennial snow, ice |
| 251   | land cover assigned as "permanent" wetlands/inundated marshlands |
| 250   | land cover assigned as urban/built-up |
| 249   | land cover assigned as "unclassified" or not able to determine |
| 248   | no standard deviation available, pixel produced using backup method. |