

Live Vegetation Biomass Carbon for the 21st Century (2000-2019)

Summary

This data set provides maps of global live woody vegetation carbon and associated carbon loss and gain for the years 2000-2019. The multi-temporal and spatially explicit global live biomass carbon stocks are retrieved using the following steps: (1) Synthesize a large number of ground inventory plots (> 100,000), airborne and satellite data as a consistent set of measurements sensitive to forest structure and vegetation aboveground live biomass (AGB), and apply models relating the lidar-derived metrics and radar backscatter to AGB estimates from ground plots across global forest types and ecoregions; (2) Generate spatially aggregated samples of vegetation AGB at 10-km spatial resolution using satellite lidar and radar measurements across landscape; (3) Produce annual maps of above- and below-ground biomass and carbon density predictions using spatio-temporal machine learning models by taking a globally consistent set of optical and microwave satellite data at 10-km spatial resolution as independent variables, (4) Estimate carbon fluxes including the gains and losses from changes of vegetation disturbance and recovery process using existing data products of forest cover change and global burned area, and (5) Provide uncertainty and accuracy assessments by quantifying estimation uncertainty and validating retrievals using independent sources at pixel, regional, and global scales.

The maps are provided at 10-km (0.1-deg) spatial resolution in GeoTIFF format. There are 6 data files, including annual carbon density maps of global live woody vegetation (2000-2019), annual maps of carbon emission components from deforestation, degradation, forest fire and nonforest fire, and the global ecoregion map derived from the original MODIS land cover map.

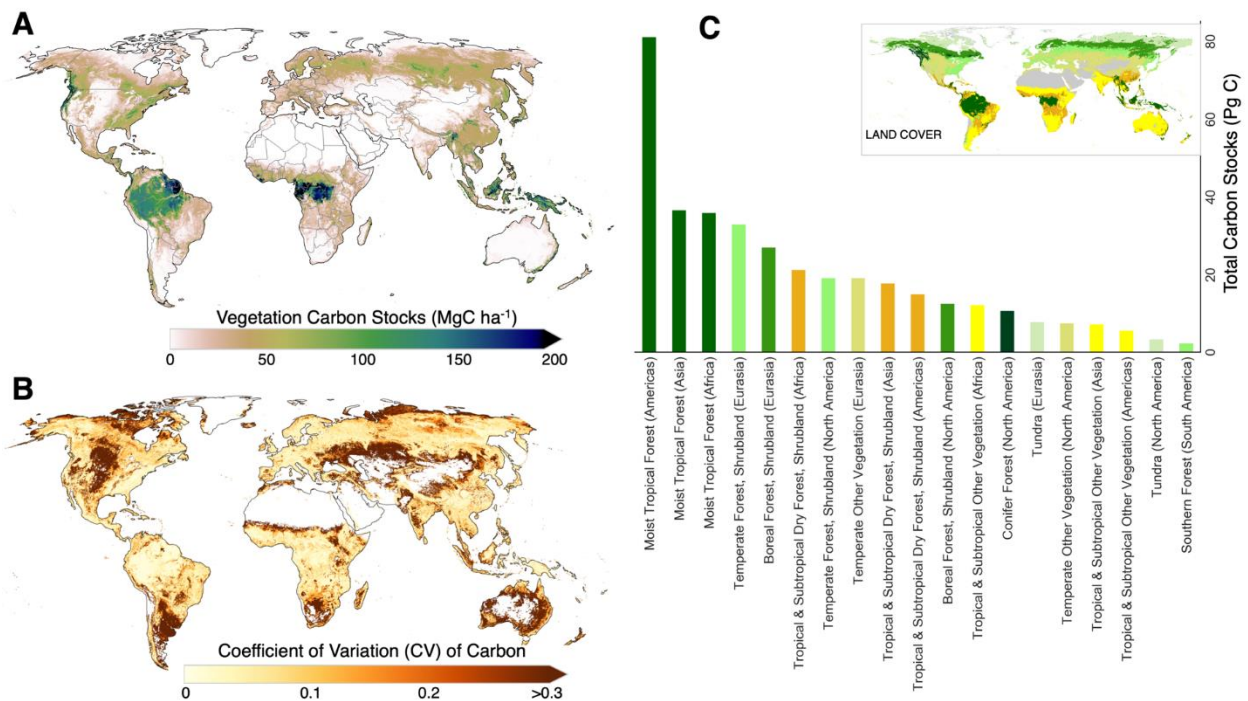


Figure 1. Mean vegetation carbon density map (average from 2000 to 2019). (A) Spatial distribution of mean global vegetation carbon density; (B) Spatial distribution of CV (coefficient of variation) in global vegetation carbon density; (C) Carbon stocks of major land-cover classes (the inset figure shows the definition of land-cover classes).

Data Characteristics

Spatial Coverage: Global

Spatial Resolution: 0.1-deg

Temporal Coverage: 2000-2019

Temporal Resolution: Annual

Data Files

There are 6 data files, including the annual carbon density map of global live woody vegetation (2000-2019), annual maps of carbon emission components from deforestation, degradation, forest fire and nonforest fire, and the global ecoregion map derived from the original MODIS land cover map.

GeoTIFF file descriptions

1. **global_ecoregions.tif:** The ecoregion map used in this study, derived from the MODIS IGBP (International Geosphere-Biosphere Programme) land cover product. Detailed description of each class was in **Table 1**.
2. **test10a_cd_ab_pred_corr_2000_2019_v2.tif:** The annual carbon density map of global live woody vegetation. The pixel unit is MgC ha⁻¹. The bands stand for years from 2000 to 2019.
3. **deforestation_emission_0119_v2_inTg.tif:** The annual carbon emission estimation for forest deforestation. The pixel unit is TgC per pixel. The bands stand for years from 2001 to 2019.
4. **degradation_emission_0119_v2_inTg.tif:** The annual carbon emission estimation for forest degradation. The pixel unit is TgC per pixel. The bands stand for years from 2001 to 2019.
5. **fireforest_emission_0119_v2_inTg.tif:** The annual carbon emission estimation for forest fire. The pixel unit is TgC per pixel. The bands stand for years from 2001 to 2019.
6. **firenonforest_emission_0119_v2_inTg.tif:** The annual carbon emission estimation for non-forest fire. The pixel unit is TgC per pixel. The bands stand for years from 2001 to 2019.

GeoTIFF Spatial Data Properties

Spatial Representation Type: Raster

Data Type: Float32

Rows: 1800

Columns: 3600

Spatial Reference Properties

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  DATUM["World Geodetic System 1984",  
    ELLIPSOID["WGS 84",6378137,298.257223563,  
      LENGTHUNIT["metre",1]],  
    PRIMEM["Greenwich",0,  
      ANGLEUNIT["degree",0.0174532925199433]],  
  CS[ellipsoidal,2],  
  AXIS["geodetic latitude (Lat)",north,  
    ORDER[1],  
    ANGLEUNIT["degree",0.0174532925199433]],
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    AXIS["geodetic longitude (Lon)",east,
        ORDER[2],
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    USAGE[
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    ID["EPSG",4326]]

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Table 1. Land cover types for continental regions. Regions were derived from the MODIS IGBP (International Geosphere-Biosphere Programme) land cover product using data in 2001 as the base map. Description column shows the IGBP classes combined in each LC region.

| Regions | Geotiff Value | Description |
|---|---------------|--|
| Continental Statistics | | |
| Moist Tropical Forest (Americas) | 101 | Evergreen broadleaf forests in Latin America |
| Moist Tropical Forest (Africa) | 102 | Evergreen broadleaf forests in Central Africa |
| Moist Tropical Forest (Asia) | 103 | Evergreen broadleaf forests in Southeast Asia and Australia |
| Tropical & Subtropical Dry Forest, Shrubland (Americas) | 104 | Woody savannas, savannas and closed shrublands in Latin America |
| Tropical & Subtropical Dry Forest, Shrubland (Africa) | 105 | Woody savannas, savannas and closed shrublands in Africa |
| Tropical & Subtropical Dry Forest, Shrubland (Asia) | 106 | Woody savannas, savannas and closed shrublands in South Asia, Southeast Asia, Southern China and Australia |
| Tropical & Subtropical Other Vegetation (Americas) | 107 | Open shrublands, grasslands, wetlands, croplands and cropland/natural vegetation mosaics in the Caribbean, Central America and South America |
| Tropical & Subtropical Other Vegetation (Africa) | 108 | Open shrublands, grasslands, wetlands, croplands and cropland/natural vegetation mosaics in Africa |
| Tropical & Subtropical Other Vegetation (Asia) | 109 | Open shrublands, grasslands, wetlands, croplands and cropland/natural vegetation mosaics in South Asia, Southeast Asia, Southern China and Australia |
| Conifer Forest (North America) | 110 | Evergreen needleleaf forests in North America |
| Temperate Forest, Shrubland (North America) | 111 | Deciduous broadleaf forests, mixed forests, woody savannas, savannas and closed shrublands south of mixed forests in North America |
| Boreal Forest, Shrubland (North America) | 112 | Deciduous needleleaf forests, woody savannas, savannas, wetlands and closed shrublands north of mixed forests in North America |
| Tundra (North America) | 113 | Open shrublands and grasslands north of boreal forests in North America |
| Temperate Other Vegetation (North America) | 114 | Open shrublands, grasslands, wetlands, croplands and cropland/natural vegetation mosaics in the continental region of North America |
| Southern Forest (South America) | 115 | Evergreen needleleaf forests, deciduous needleleaf forests, deciduous broadleaf forests and mixed forests in South America |

| | | |
|---------------------------------------|-----|--|
| Temperate Forest, Shrubland (Eurasia) | 116 | Deciduous broadleaf forests, mixed forests, woody savannas, savannas and closed shrublands south of mixed forests and north of Subtropical Dry Forest in Eurasia |
| Boreal Forest, Shrubland (Eurasia) | 117 | Deciduous needleleaf forests, woody savannas, savannas, wetlands and closed shrublands north of mixed forests in Eurasia |
| Tundra (Eurasia) | 118 | Open shrublands and grasslands north of boreal forests in North America |
| Temperate Other Vegetation (Eurasia) | 119 | Open shrublands, grasslands, wetlands, croplands and cropland/natural vegetation mosaics south of mixed forests and north of Subtropical Dry Forest in Eurasia |