

[DAAC Home](#) > [Get Data](#) > [NASA Projects](#) > [Carbon Monitoring System \(CMS\)](#) > [User guide](#)

Annual Burned Area from Landsat, Mawas, Central Kalimantan, Indonesia, 1997-2015

Get Data

Documentation Revision Date: 2019-10-08

Dataset Version: 1

Summary

This dataset provides maps of annual burned area for the part of Mawas conservation program in Central Kalimantan, Indonesia from 1997 through 2015. Landsat imagery (TM, ETM+, OLI/TIR) at 30 m resolution was obtained for this 19-year period, including the variables surface reflectance, brightness temperature, and pixel quality assurance, plus the indices NDVI, NDMI, NBR, NBR2, SAVI, and MSAVI. The MODIS active fire product (MCD14) was used to define when fires occurred. Random Forest classifications were used to separate burned and unburned 30-m pixels with inputs of composites of Landsat indices and thermal bands, based on the pre- and post-fire values.

The burned pixels were processed into shapefiles representing annual burned area. Note that the 1997 map is a special case with fires continuing into and including 1998. No fires were recorded in 2008 and 2010.

There are 16 total data files in shapefile (.shp) format provided as compressed *.zip files. The data in the shapefiles are also provided as companion files in *.kmz format for viewing in Google Earth.

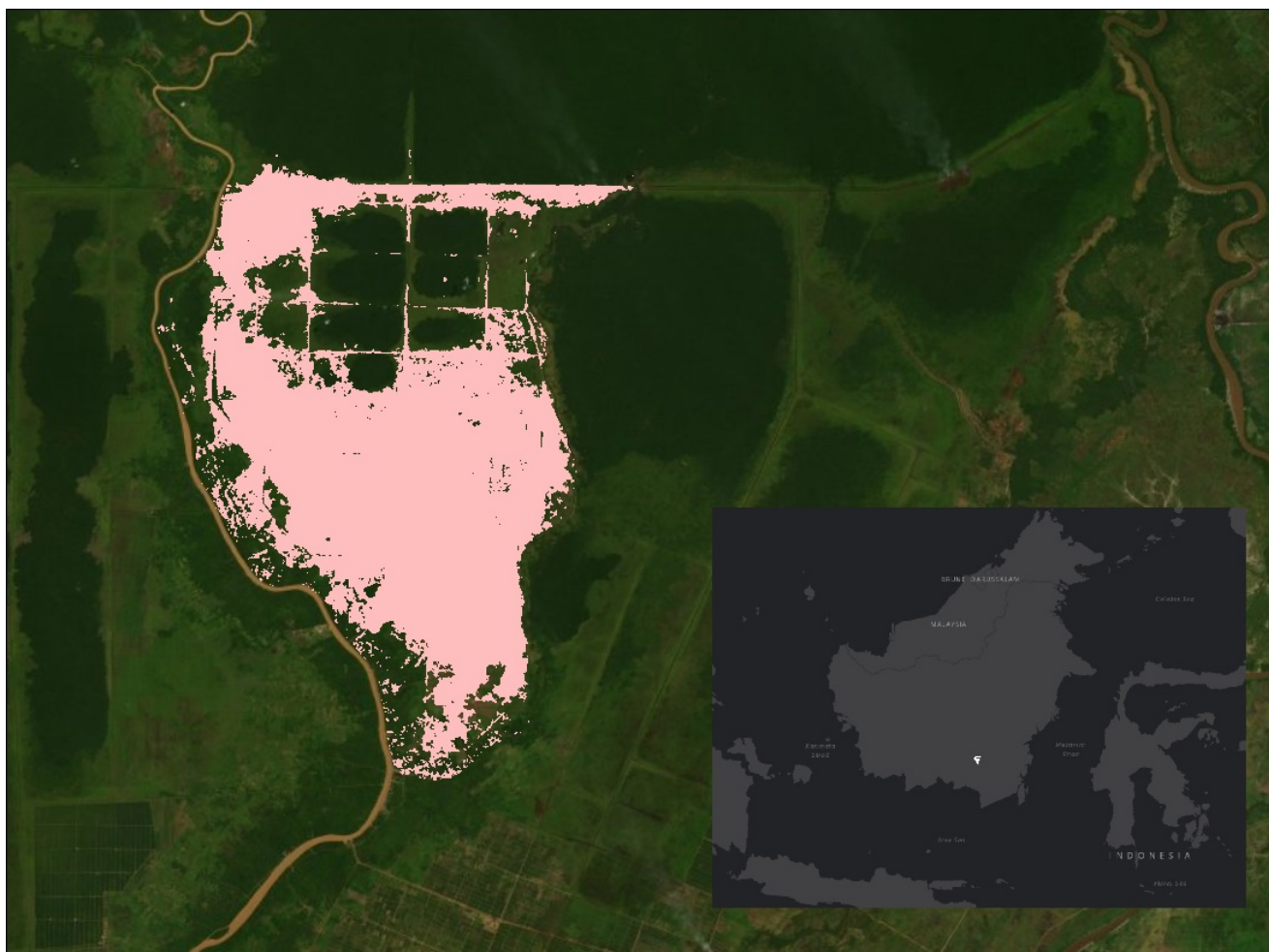


Figure 1. The area burned in 1997 and 1998 in Mawas area, Central Kalimantan, Indonesia is shown in pink. Inset with white dot, shows location of Mawas study site on the Island of Borneo. Source: Mawas.BA.1997.001.shp

Citation

Table of Contents

1. Dataset Overview
2. Data Characteristics
3. Application and Derivation
4. Quality Assessment
5. Data Acquisition, Materials, and Methods
6. Data Access
7. References

1. Dataset Overview

This dataset provides maps of annual burned area for the part of Mawas conservation program in Central Kalimantan, Indonesia from 1997 through 2015. Landsat imagery (TM, ETM+, OLI/TIR) at 30 m resolution was obtained for this 19-year period, including the variables surface reflectance, brightness temperature, and pixel quality assurance, plus the indices NDVI, NDMI, NBR, NBR2, SAVI, and MSAVI (See Table 1). The MODIS active fire product (MCD14) was used to define when fires occurred. Random Forest classifications were used to separate burned and unburned 30-m pixels with inputs of composites of Landsat indices and thermal bands, based on the pre- and post-fire values.

The burned pixels were processed into shapefiles representing annual burned area. Note that the 1997 map is a special case with fires continuing into and including 1998. No fires were recorded in 2008 and 2010.

Project: [Carbon Monitoring System \(CMS\)](#)

The NASA Carbon Monitoring System (CMS) is designed to make significant contributions in characterizing, quantifying, understanding, and predicting the evolution of global carbon sources and sinks through improved monitoring of carbon stocks and fluxes. The System will use the full range of NASA satellite observations and modeling/analysis capabilities to establish the accuracy, quantitative uncertainties, and utility of products for supporting national and international policy, regulatory, and management activities. CMS will maintain a global emphasis while providing finer scale regional information, utilizing space-based and surface-based data and will rapidly initiate generation and distribution of products both for user evaluation and to inform near-term policy development and planning.

Related Dataset:

Ferraz, A., S.S. Saatchi, L. Xu, S. Hagen, J. Chave, Y. Yu, V. Meyer, M. Garcia, C. Silva, O. Roswintarti, A. Samboko, P. Sist, S.M. Walker, T. Pearson, A. Wijaya, F.B. Sullivan, E. Rutishauser, D. Hoekman, and S. Ganguly. 2019. Aboveground Biomass, Landcover, and Degradation, Kalimantan Forests, Indonesia, 2014. ORNL DAAC, Oak Ridge, Tennessee, USA. <https://doi.org/10.3334/ORNLDAAC/1645>

Acknowledgments:

This work was funded by NASA CMS grants NNX13AP46G, NNX17AC95G, and 80NSSC18K0235.

2. Data Characteristics

Spatial Coverage: Mawas area, Central Kalimantan, Indonesia

Spatial Resolution: Derived from 30 m Landsat imagery

Temporal Coverage: 1997-01-01 to 2015-12-31

Temporal Resolution: annual

Study Area: (all latitudes and longitudes given in decimal degrees)

Site	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude
Mawas, Central Kalimantan, Indonesia	114.389621	114.609157	-2.214576	-2.502413

Data File Information

There are 16 total data files in shapefile (.shp) format provided as compressed *.zip files. The data in the shapefiles are also provided as companion files in *.kmz format for viewing in Google Earth.

Note that the 1997 map is a special case with fires continuing into and including 1998. No fires were recorded in 2008 and 2010.

File Naming Convention:

File names are structured as Mawas.BA.YYYY.001.shp, where:

Mawas- refers to the site name

BA - refers to Burned Area

YYYY - refers to the year of burn

001 - refers to the version of the product

Coordinate Reference System:

EPSG: 32750 (UTM Zone 50S (Transverse Mercator))

3. Application and Discussion

The Mawas area is/was a large peatland forest that has undergone numerous historical and recent human manipulations affecting land cover and ground water elevations. Fire disturbance is a major factor shaping this ecosystem and important to ongoing conservation and restoration projects.

4. Quality Assessment

SPOT 5 imagery available from the Indonesian National Institute of Aeronautics and Space (LAPAN) for 2014 and ground truth data from 2015 were used to verify the maps. In the cross-validation of the Random Forest classification, on average, the Out of Bag estimate of error rate was low (~1.5%) with an overall accuracy of ~98% from validating points.

5. Data Acquisition, Materials, and Methods

Landsat data series (TM, ETM+, OLI/TIR) from 1997 to 2015 were used to generate the annual burned areas. All available scenes of level 1T (path/raw 118/62) were selected using the U.S. Geological Survey (USGS) Earth Explorer website and limited to cloud cover less than 80%. All selected scenes were submitted to the Earth Resources Observation and Science (EROS) Center Science Processing Architecture (ESPA) Ordering Interface website for Level-2 product processing. The surface reflectance, brightness temperature, and pixel QA, including indices (NDVI, NDMI, NBR, NBR2, SAVI, and MSAVI; Table 1) were ordered. Only good pixels (i.e., flagged in pixel QA, meaning, cloud and water mask out) were employed to derive the maps.

Random Forest classifications were used to separate the burned and unburned pixels. All band indices and thermal bands in that particular year were employed to derive the annual maps, except for the 1997 event. The 1997 map was generated from Landsat series from 1997 to early 1998 (since burning was considered as a continuous event during the El Nino of 1997-1998). The final inputs used to run the algorithm were composites of indices and thermal bands, based on the pre- and post-fire values (Fig. 2).

The MODIS active fire product (MCD14) was used to define when fires occurred. The highest difference of indices values between pre-fire and post-fire periods was extracted. Post-fire values were the minimum pixel value (indices) and the maximum brightness temperatures (BT) of the Landsat thermal band (Band 6 for Landsat 7; Band 10 and 11 for Landsat 8) from the annual post-fire imagery set. Pre-fire values were the maximum pixel value (indices) and the minimum brightness temperatures (BT) from the annual pre-fire imagery set.

Burned and unburned training data depend largely on visual detection in imagery. A balanced number of training data points for both burned and unburned classes (~3000) were created, with 80% as training points and 20% as validation points. The salt-pepper noise of predicted burned areas was removed using a 3x3 windows majority filter. Owing to high cloud cover or smoke during fire events obscuring the land, some areas burned were likely to be undetected. For a number of fires, burned areas were added using visual interpretation when possible. For the severe fire events of 2015, the annual map was merged with the Sentinel-1 burned area product provided by the European Space Agency (Lohberger et al. 2018).

Table 1. Variables used to derive the burned area maps.

Variable	Abbreviation	Reference
Normalized difference vegetation index	NDVI	Tucker 1979
Normalized difference moisture index	NDMI	Gao 1996
Normalized burn ratio	NBR	Garcia & Caselles 1991
Normalized burn ratio 2	NBR2	Key & Benson 2006
Soil adjusted vegetation index	SAVI	Huete 1988
Modified Soil Adjusted Vegetation Index	MSAVI	Qi 1994
Brightness temperature	Band 6 (Landsat 5/7), Band 10 and 11 (Landsat 8)	USGS 2018

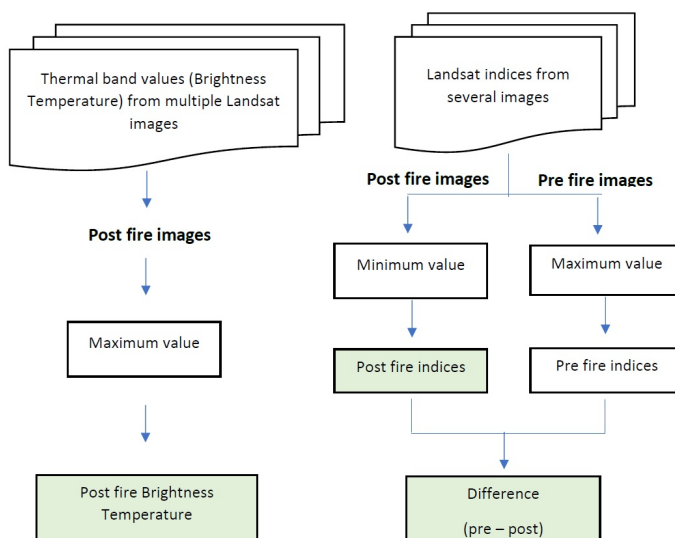


Figure 2. The process to composite Landsat images to derive the input variables for Random Forest algorithm to separate burned and unburned pixels. On the right side, we first identified the post- and pre-fire imagery based on the MODIS active fire product (MCD14) occurring in the year of interest. For each index (NDVI, NDMI, NBR, NBR2, SAVI, MSAVI), we selected the minimum value of post-fire images and the maximum value of pre-fire images. On the left side, we selected the maximum brightness temperature of the Landsat

thermal band (Band 6 for Landsat 5/7; Band 10 and 11 for Landsat 8) for post-fire images. Green boxes represent all input variables used for the Random Forest algorithm.

6. Data Access

These data are available through the Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC).

[Annual Burned Area from Landsat, Mawas, Central Kalimantan, Indonesia, 1997-2015](#)

Contact for Data Center Access Information:

- E-mail: uso@daac.ornl.gov
- Telephone: +1 (865) 241-3952

7. References

Gao, B.-C., NDWI—A normalized difference water index for remote sensing of vegetation liquid water from space. *Remote Sensing of Environment*, 1996. 58(3): p. 257-266. [https://doi.org/10.1016/S0034-4257\(96\)00067-3](https://doi.org/10.1016/S0034-4257(96)00067-3)

Garcia, M.L. and V. Caselles, Mapping burns and natural reforestation using Thematic Mapper data. *Geocarto International*, 1991. 6(1): p. 31-37. <https://doi.org/10.1080/10106049109354290>

Huete, A.R., A soil-adjusted vegetation index (SAVI). *Remote sensing of environment*, 1988. 25(3): p. 295-309. [https://doi.org/10.1016/0034-4257\(88\)90106-X](https://doi.org/10.1016/0034-4257(88)90106-X)

Key, C. and N. Benson, Landscape assessment: remote sensing of severity, the normalized burn ratio and ground measure of severity, the composite burn index, in FIREMON: Fire effects monitoring and inventory system Ogden, Utah: USDA Forest Service, Rocky Mountain Res. Station, D.C. Lutes, Editor. 2006, United States Department of Agriculture.

Lohberger, S., Stängel, M., Atwood, E. C., & Siegert, F. (2018). Spatial evaluation of Indonesia's 2015 fire-affected area and estimated carbon emissions using Sentinel-1. *Global change biology*, 24(2), 644-654. <https://doi.org/10.1111/gcb.13841>

Qi, J., et al., A modified soil adjusted vegetation index. *Remote Sensing of Environment*, 1994. 48(2): p. 119-126. [https://doi.org/10.1016/0034-4257\(94\)90134-1](https://doi.org/10.1016/0034-4257(94)90134-1)

Tucker, C.J., Red and photographic infrared linear combinations for monitoring vegetation. *Remote sensing of Environment*, 1979. 8(2): p. 127-150. [https://doi.org/10.1016/0034-4257\(79\)90013-0](https://doi.org/10.1016/0034-4257(79)90013-0)

U.S. Geological Survey. Landsat 8 User Data Handbooks. <https://www.usgs.gov/media/files/landsat-8-data-users-handbook>, Last updated on October 2018.



[Privacy Policy](#) | [Feedback](#) | [Help](#)

Home

About Us

Mission
Partners
User Working Group
Citation Policy
News

Get Data

Science Themes
NASA Projects
All Datasets

Submit Data

Submit Data Form
Data Scope and Acceptance
Data Authorship Policy
Data Publication Timeline
Detailed Submission
Guidelines

Tools

MODIS
THREDDS
SDAT
Daymet
CARVE Data Viewer
Soil Moisture Visualizer
Land - Water Checker

Resources

Learning
Data Management

[Contact Us](#)