Introduction to Geospatial Analysis in R

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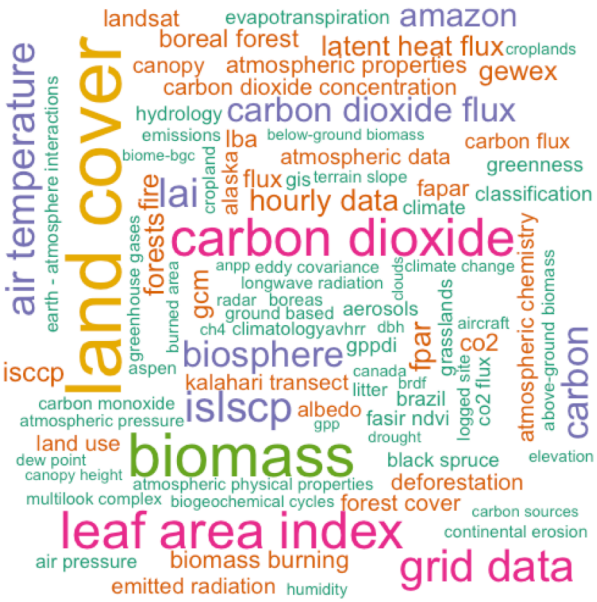
NASA Earthdata Webinar
March 13, 2019

Webinar Goals

- Provide an introduction to the data available at ORNL DAAC
- Demonstrate methods to
  - read and write files
  - overlay layers
  - change projections
  - reduce spatial extent
  - select and reclassify values
  - and make a map of gridded geospatial data using the R language
- Access the R tutorial here: https://daac.ornl.gov/resources/tutorials/r-geospatial-webinar
- Other tutorials at the ORNL DAAC: https://daac.ornl.gov/resources/learning/

About ORNL DAAC

The Oak Ridge National Laboratory Distributed Active Archive Center (ORNL DAAC) archives data produced by NASA's Terrestrial Ecology Program in support of NASA's Carbon Cycle and Ecosystems Focus Area.



http://daac.ornl.gov

Projects Supported

GEDI
ECOSYSTEM LIDAR

ABoVE
ARCTIC BOREAL VULNERABILITY EXPERIMENT

NASA AirMOSS EV-1
Airborne Microwave Observatory of Subcanopy and Subsurface Project

FLUXNET
A Global Network

BOREAS

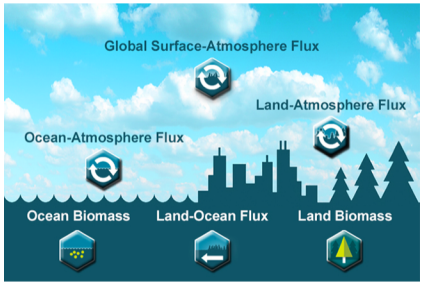
Fluxes
Sources
Sinks
CO_2 & CH_4 Concentration
Atmospheric Carbon & Transport
Transport

NASA ATOM
ATMOSPHERIC TOMOGRAPHY MISSION
EVS-2

CARVE
CARBON IN ARCTIC RESERVOIRS VULNERABILITY EXPERIMENT

ISLSCP

Safari 2000
A Southern African Regional Science Initiative



FIRST ISLSCP FIELD EXPERIMENT
FIFE

A Core Element of the U.S. Global Change Research Program
NORTH AMERICAN CARBON PROGRAM
CONTINENTAL CARBON BUDGETS • PROCESSES • MANAGEMENT

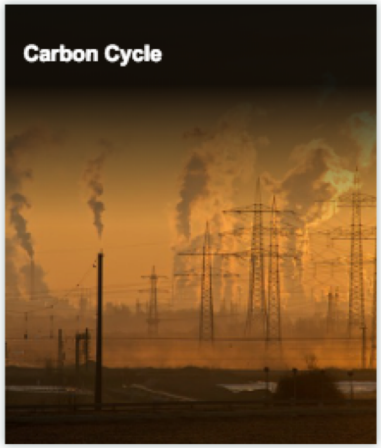
LBA
THE LARGE SCALE BIOSPHERE-ATMOSPHERE EXPERIMENT IN AMAZONIA - LBA

BigFoot

Data Themes

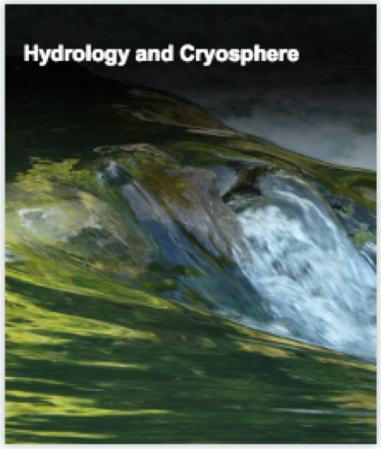

Arctic Ecosystems


Biomass


Carbon Cycle


Climate


Fire


Hydrology and Cryosphere

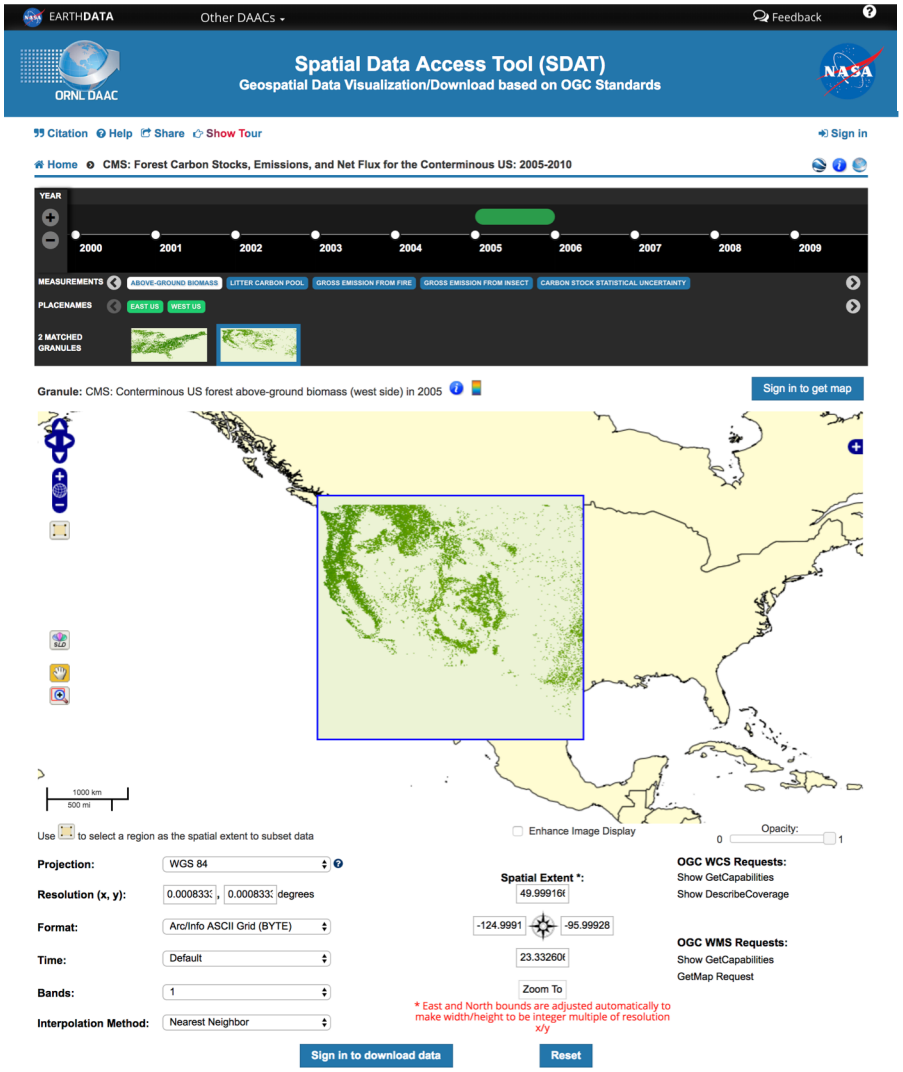

Land Use and Human Dimensions


Soils


Vegetation and Forests

Geospatial data at ORNL DAAC

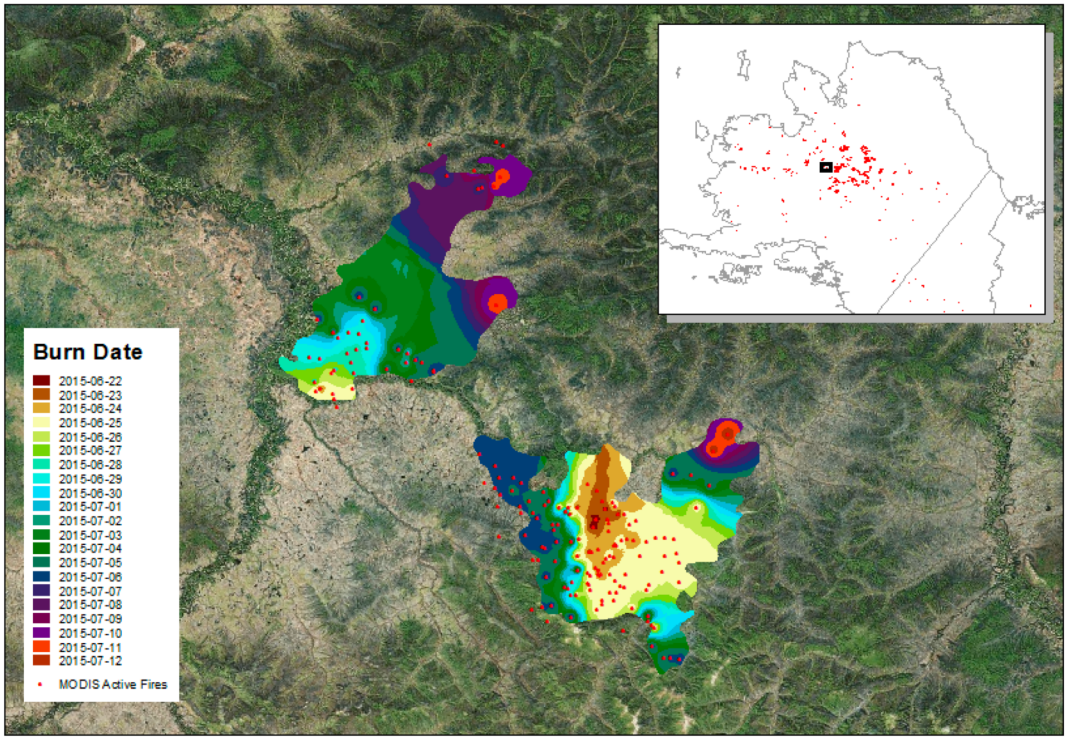
- Most of NASA's Earth data is geospatial
- Use the Spatial Data Access Tool (https://webmap.ornl.gov/ogc) to easily browse and view geospatial data and choose download format and projection



Geospatial data at ORNL DAAC

Types of data:

- Shapefile (*.shp) contains line, polygon, or point data

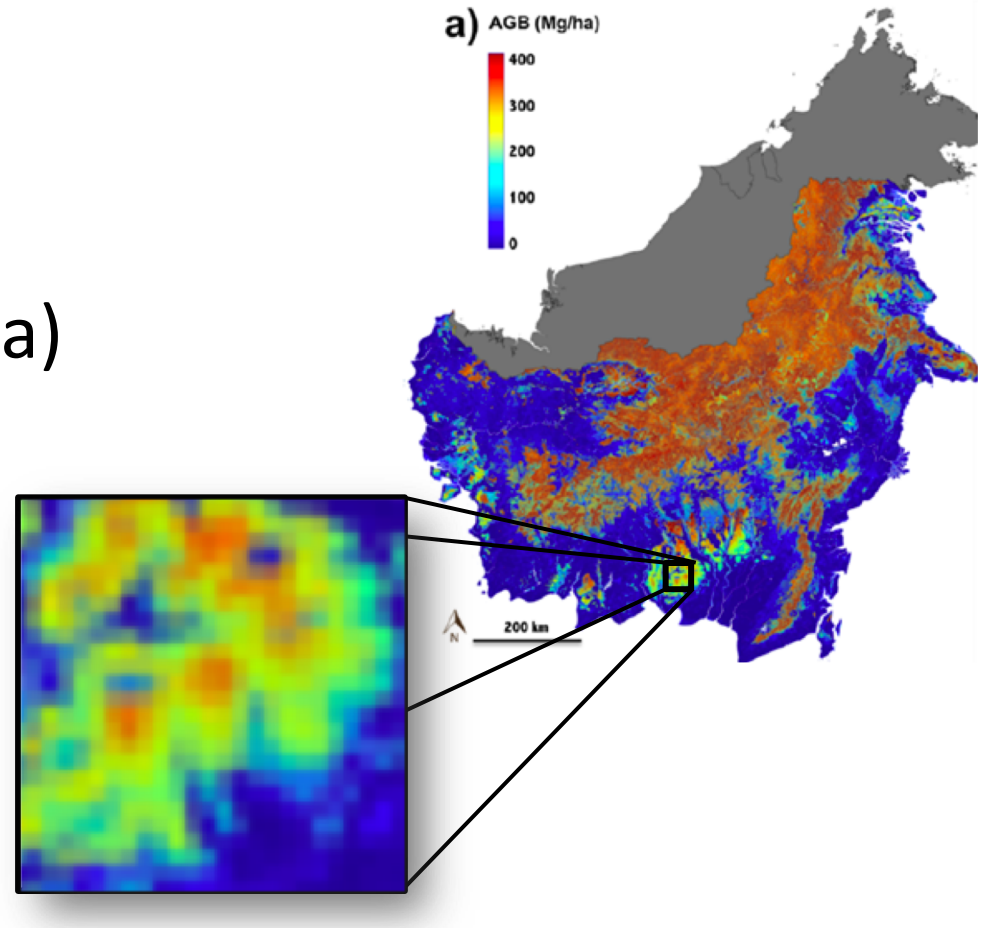


Date of burning for fire scars in Alaska. Dates are coded as polygons to map the progression of a fire over space and time. (From https://doi.org/10.3334/ORNLDAAC/1559)

Geospatial data at ORNL DAAC

Types of data:

- Shapefile
- Raster (gridded data) in *.tif format

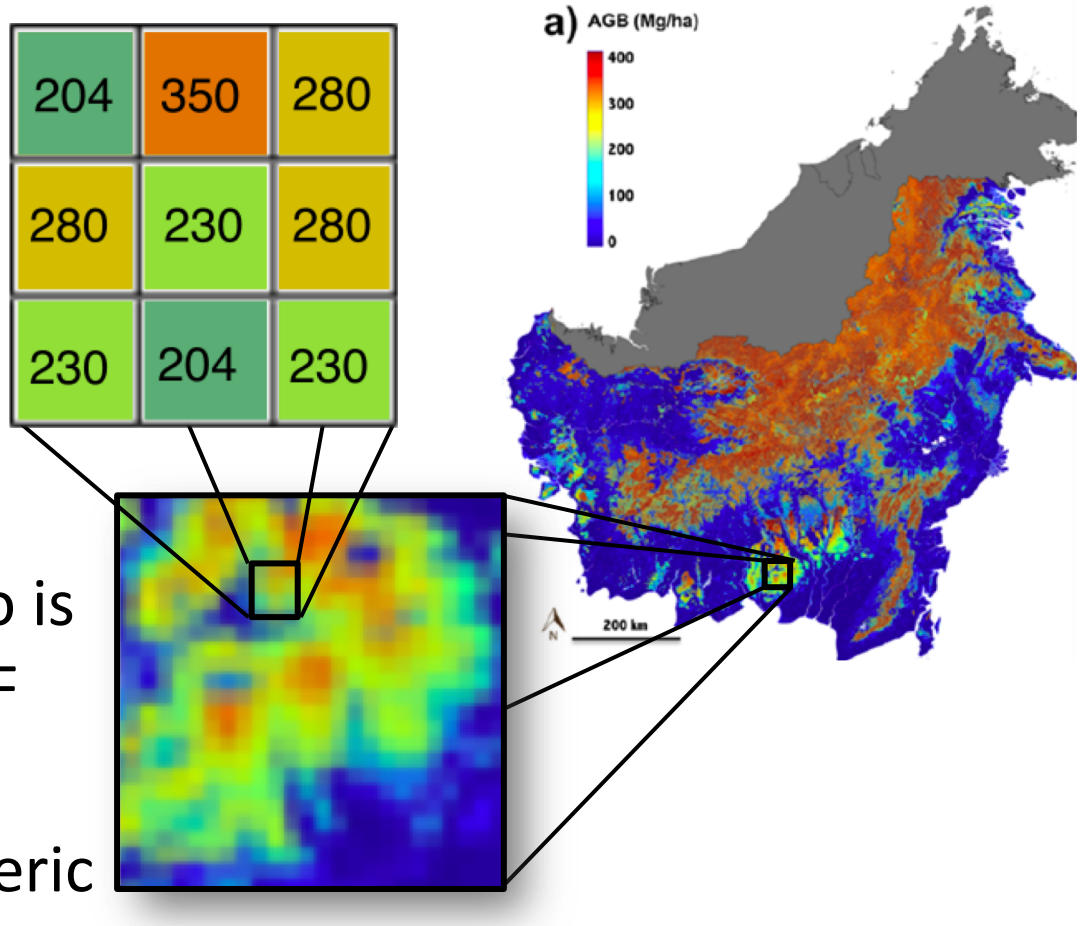


Aboveground biomass for the island of Borneo provided in 1 hectare grid cells.
(From https://doi.org/10.3334/ORNLDAAC/1645)

Geospatial data at ORNL DAAC

Types of data:

- Shapefile
- Raster
  - Tiff with embedded geolocation info is called a GeoTIFF
  - A raster grid contains a numeric data value in each grid cell

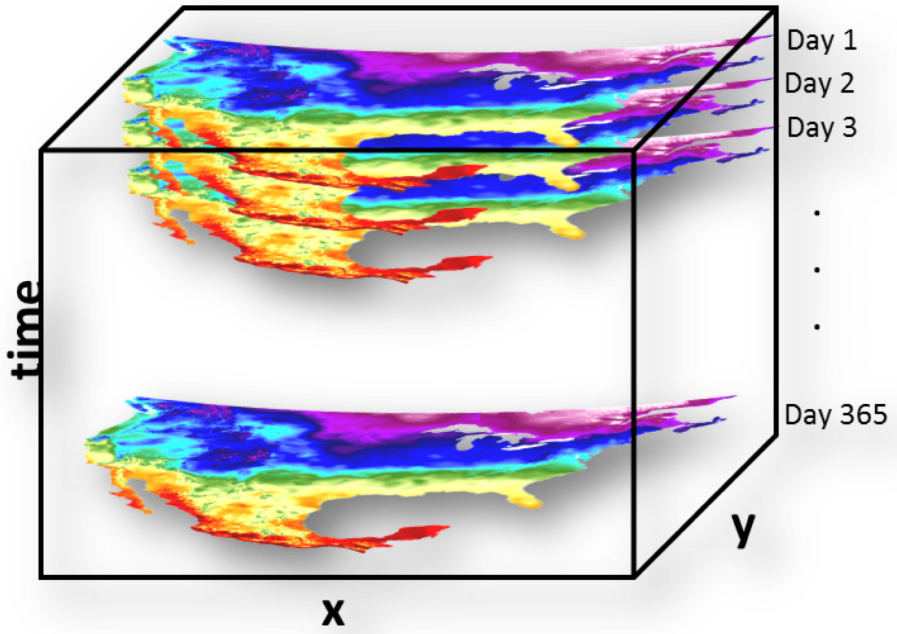


Aboveground biomass for the island of Borneo provided in 1 hectare grid cells.
(From https://doi.org/10.3334/ORNLDAAC/1645)

Geospatial data at ORNL DAAC

Types of data:

- Shapefile
- Raster
- Multidimensional data ("data cube") or model outputs in netCDF (*.nc) format

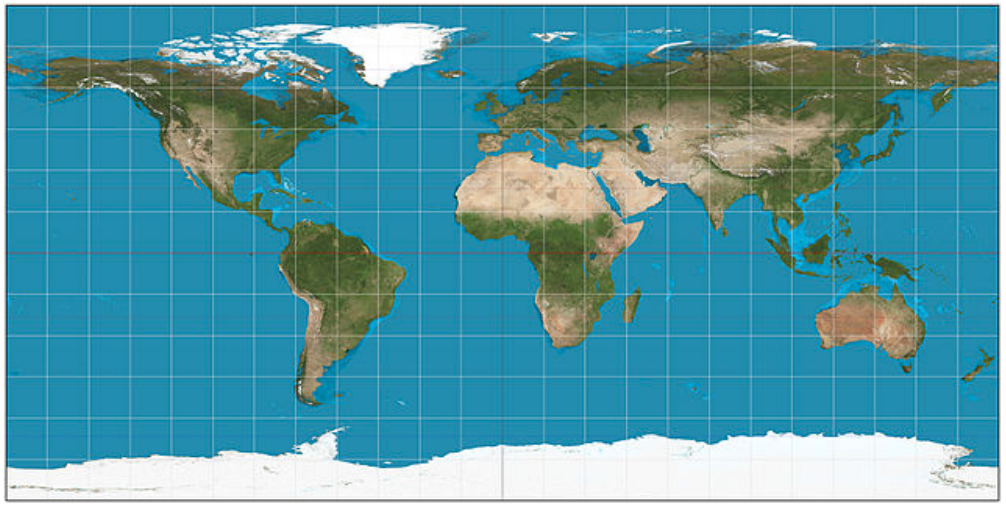


Daymet weather data, such as maximum daily temperature, are gridded at 1 km resolution, but are provided with 365 days "stacked" in one NetCDF file. Daymet data: https://daymet.ornl.gov/

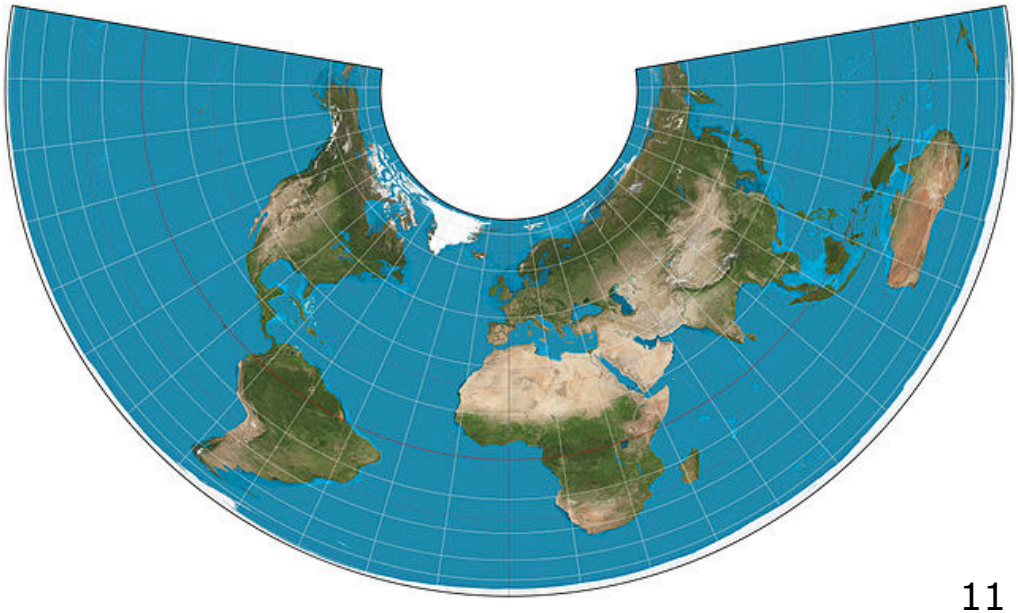
Learn more about NetCDF data: https://daac.ornl.gov/workshops/NetCDF_webinar_08302017.html

Understanding geographic projections

- Geographic Projection
  - Treats latitude and longitudes as equally-spaced in a rectangular grid
  - Most common projection for simple maps and rasters



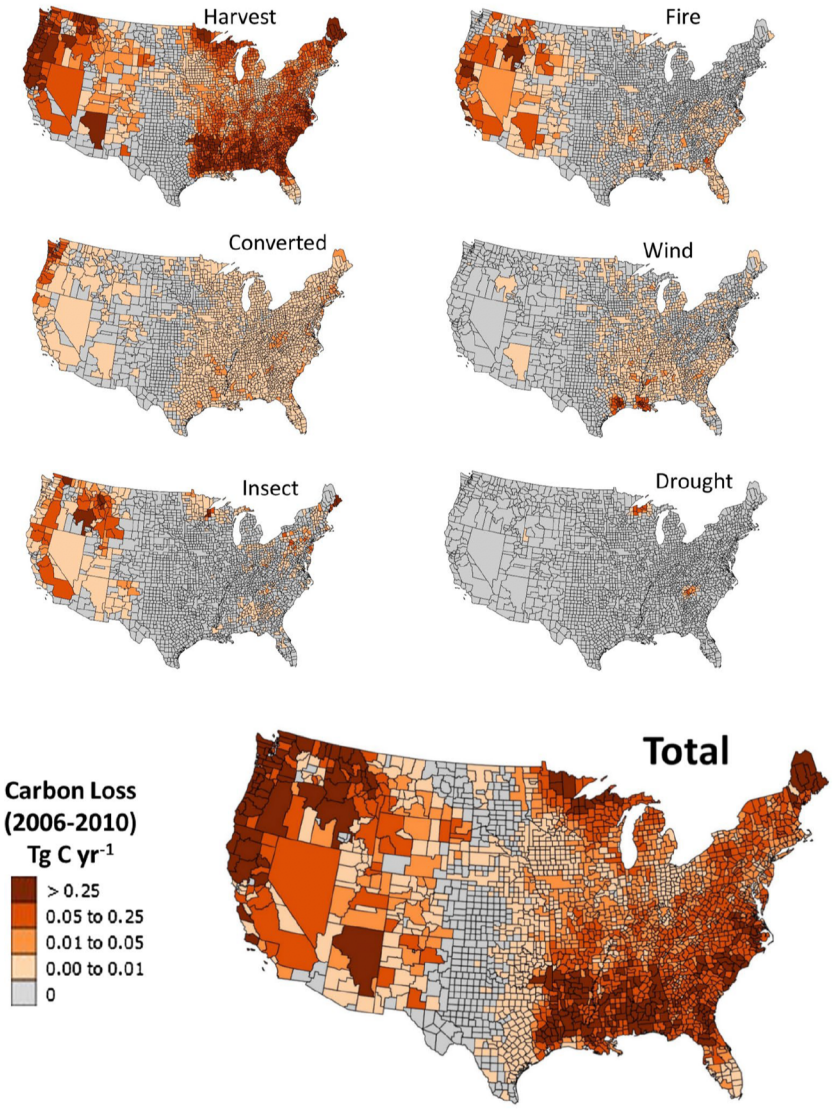
- Albers Equal Area Projection
  - Preserves relative area, but distorts shapes
  - Commonly used in USA and Canada, especially in high latitudes



Graphics by Strebe - https://commons.wikimedia.org/w/index.php?curid=16115228

Example dataset: Forest Carbon Stocks, Emissions, and Net Flux for CONUS

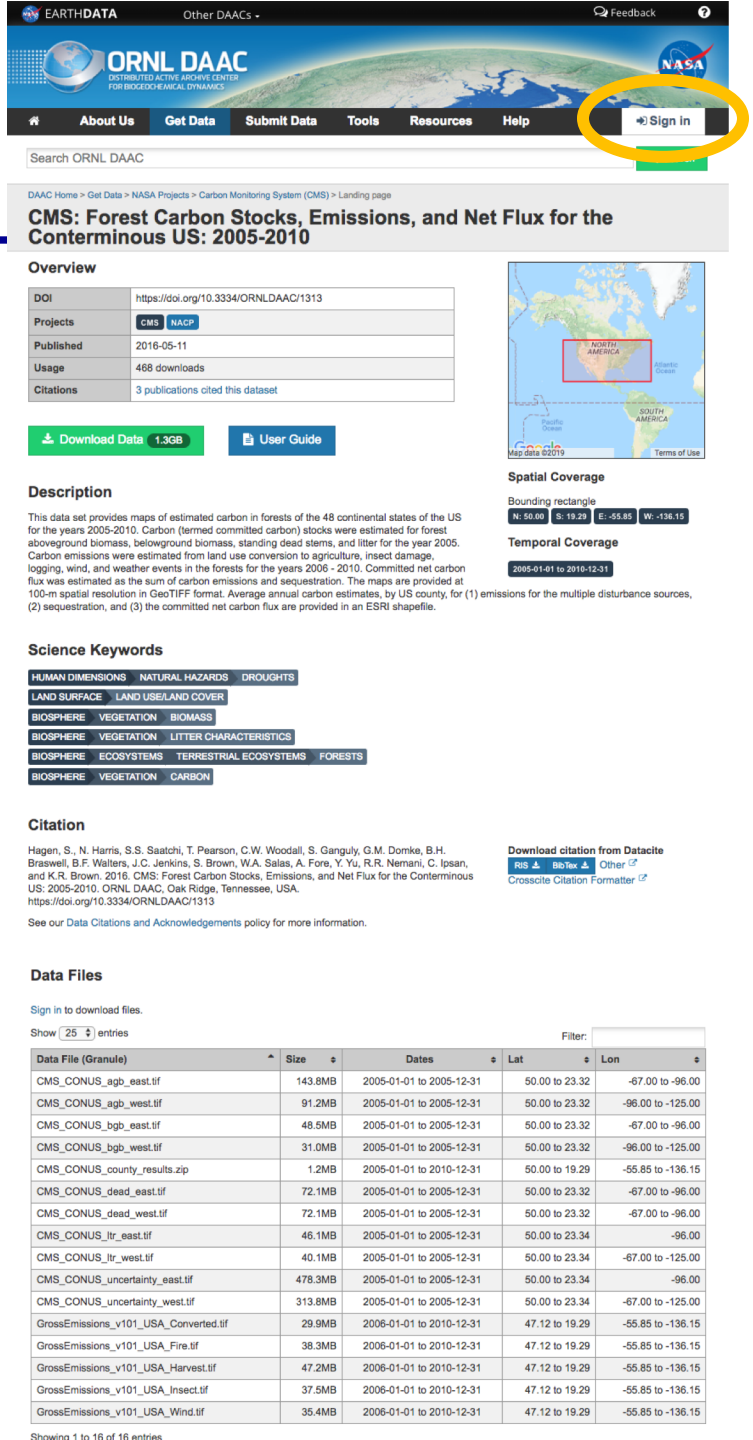
- This dataset provides maps of estimated carbon stocks and emissions in forests of the continental USA for the years 2006-2010.
- Gross carbon emissions (Mg of Carbon / yr) were estimated from land use conversion to agriculture, insect damage, logging, wind, and weather events.
- The maps are provided at 100-m spatial resolution in GeoTIFF format in Albers North American Projection.



Harris et al. 2016. Carbon Balance & Management
https://doi.org/10.1186/s13021-016-0066-5

How to access the data

1. Navigate to CMS: Forest Carbon Stocks, Emissions, and Net Flux for the Conterminous US: 2005-2010 dataset at ORNL DAAC (https://doi.org/10.3334/ORNLDAAC/1313)
2. Click “Sign In” button at top right
3. Create a free NASA Earthdata account and sign in



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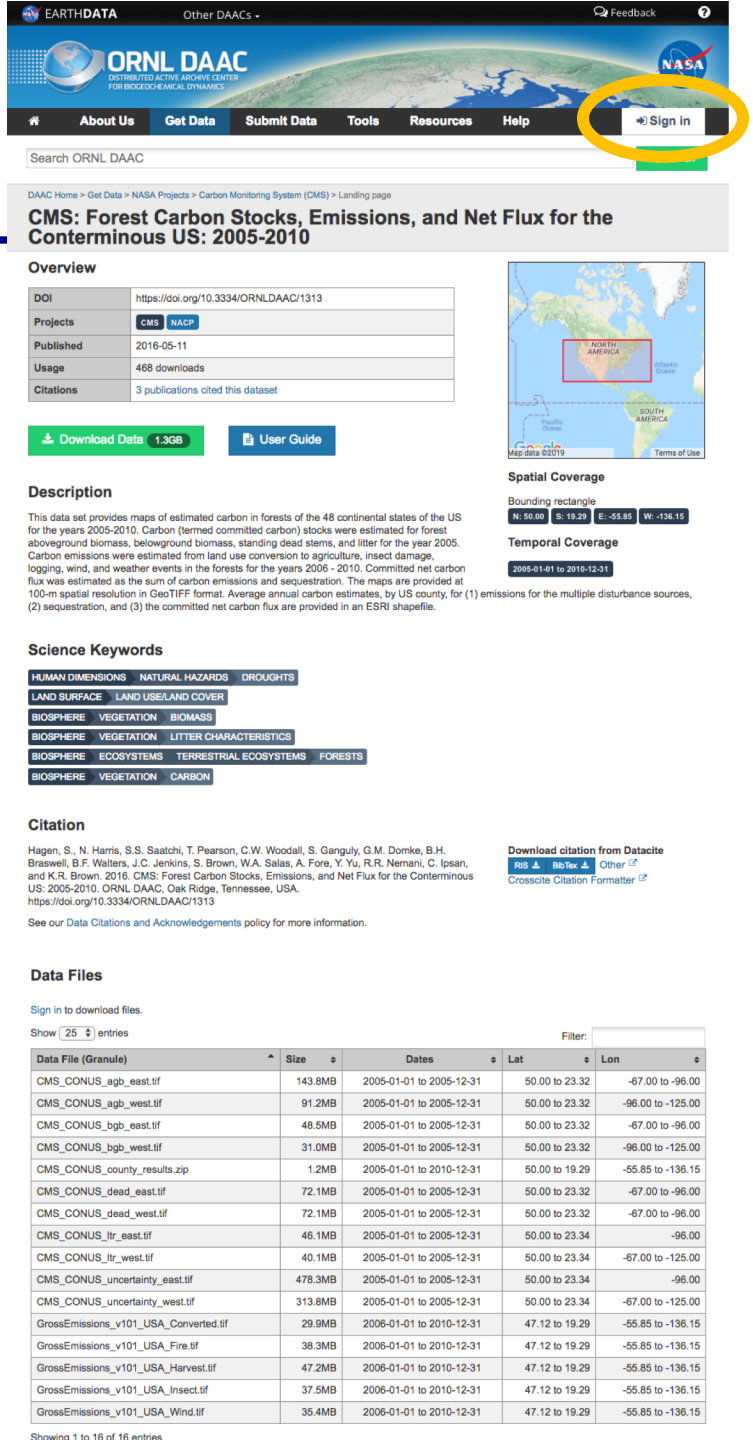

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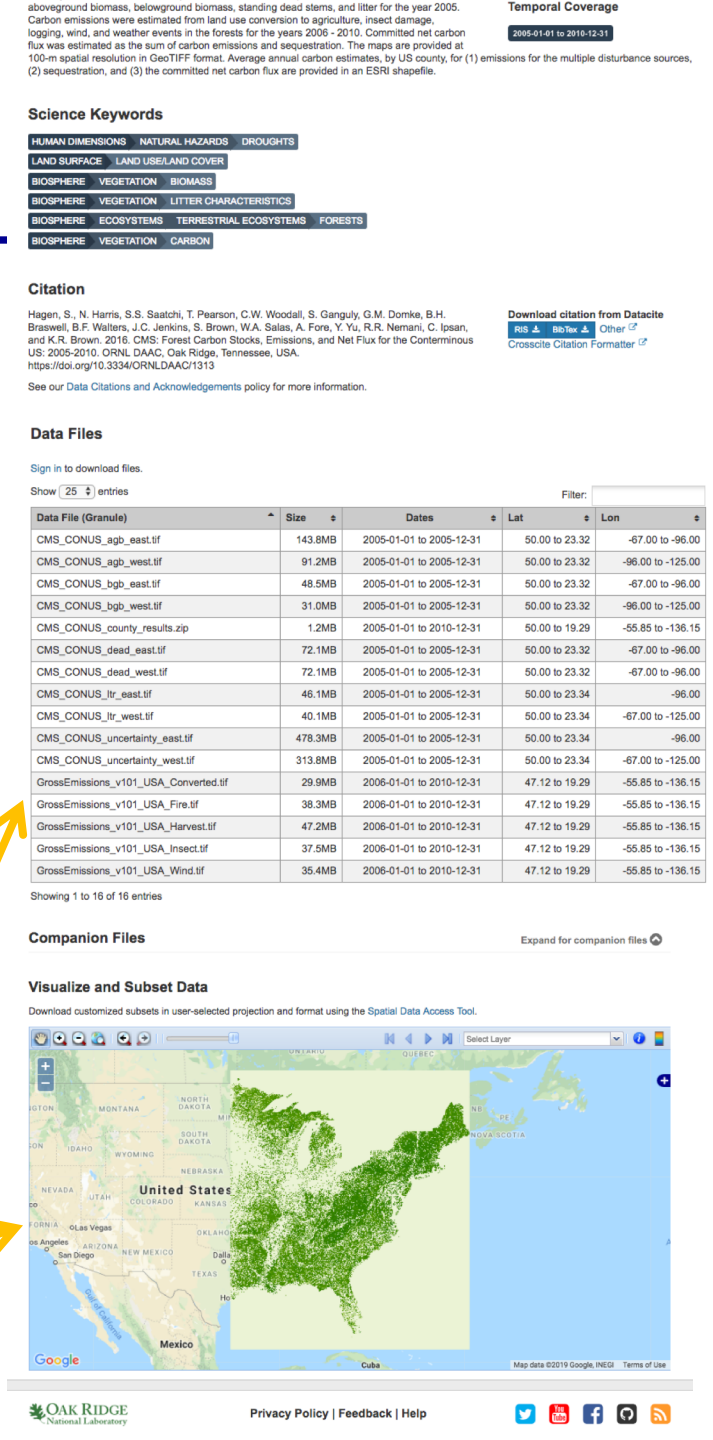
3. Create a free NASA Earthdata account and sign in
4. Scroll down to the list of data files
5. Click to download the two files used in this tutorial
   - GrossEmissions_v101_USA_Insect.tif
   - GrossEmissions_v101_USA_Fire.tif
6. Note direct access to the SDAT mapping tool



aboveground biomass, belowground biomass, standing dead stems, and litter for the year 2005. Carbon emissions were estimated from land use conversion to agriculture, insect damage, logging, wind, and weather events in the forests for the years 2006 - 2010. Committed net carbon flux was estimated as the sum of carbon emissions and sequestration. The maps are provided at 100-m spatial resolution in GeoTIFF format. Average annual carbon estimates, by US county, for (1) emissions for the multiple disturbance sources, (2) sequestration, and (3) the committed net carbon flux are provided in an ESRI shapefile.

Temporal Coverage

2005-01-01 to 2010-12-31

Science Keywords

HUMAN DIMENSIONS NATURAL HAZARDS DROUGHTS
LAND SURFACE LAND USE/LAND COVER
BIOSPHERE VEGETATION BIOMASS
BIOSPHERE VEGETATION LITTER CHARACTERISTICS
BIOSPHERE ECOSYSTEMS TERRESTRIAL ECOSYSTEMS FORESTS
BIOSPHERE VEGETATION CARBON

Citation

Hagen, S., N. Harris, S.S. Saatchi, T. Pearson, C.W. Woodall, S. Ganguly, G.M. Domke, B.H. Braswell, B.F. Walters, J.C. Jenkins, S. Brown, W.A. Salas, A. Fore, Y. Yu, R.R. Nemani, C. Ipsan, and K.R. Brown. 2016. CMS: Forest Carbon Stocks, Emissions, and Net Flux for the Conterminous US: 2005-2010. ORNL DAAC, Oak Ridge, Tennessee, USA. https://doi.org/10.3334/ORNLDAAC/1313

Download citation from Datacite
RIS BibTex Other
Crosscite Citation Formatter

See our Data Citations and Acknowledgements policy for more information.

Data Files

Sign in to download files.

Show 25 entries Filter:

Data File (Granule)	Size	Dates	Lat	Lon
CMS_CONUS_agb_east.tif	143.8MB	2005-01-01 to 2005-12-31	50.00 to 23.32	-67.00 to -96.00
CMS_CONUS_agb_west.tif	91.2MB	2005-01-01 to 2005-12-31	50.00 to 23.32	-96.00 to -125.00
CMS_CONUS_bgb_east.tif	48.5MB	2005-01-01 to 2005-12-31	50.00 to 23.32	-67.00 to -96.00
CMS_CONUS_bgb_west.tif	31.0MB	2005-01-01 to 2005-12-31	50.00 to 23.32	-96.00 to -125.00
CMS_CONUS_county_results.zip	1.2MB	2005-01-01 to 2010-12-31	50.00 to 19.29	-55.85 to -136.15
CMS_CONUS_dead_east.tif	72.1MB	2005-01-01 to 2005-12-31	50.00 to 23.32	-67.00 to -96.00
CMS_CONUS_dead_west.tif	72.1MB	2005-01-01 to 2005-12-31	50.00 to 23.32	-67.00 to -96.00
CMS_CONUS_ltr_east.tif	46.1MB	2005-01-01 to 2005-12-31	50.00 to 23.34	-96.00
CMS_CONUS_ltr_west.tif	40.1MB	2005-01-01 to 2005-12-31	50.00 to 23.34	-67.00 to -125.00
CMS_CONUS_uncertainty_east.tif	478.3MB	2005-01-01 to 2005-12-31	50.00 to 23.34	-96.00
CMS_CONUS_uncertainty_west.tif	313.8MB	2005-01-01 to 2005-12-31	50.00 to 23.34	-67.00 to -125.00
GrossEmissions_v101_USA_Converted.tif	29.9MB	2006-01-01 to 2010-12-31	47.12 to 19.29	-55.85 to -136.15
GrossEmissions_v101_USA_Fire.tif	38.3MB	2006-01-01 to 2010-12-31	47.12 to 19.29	-55.85 to -136.15
GrossEmissions_v101_USA_Harvest.tif	47.2MB	2006-01-01 to 2010-12-31	47.12 to 19.29	-55.85 to -136.15
GrossEmissions_v101_USA_Insect.tif	37.5MB	2006-01-01 to 2010-12-31	47.12 to 19.29	-55.85 to -136.15
GrossEmissions_v101_USA_Wind.tif	35.4MB	2006-01-01 to 2010-12-31	47.12 to 19.29	-55.85 to -136.15

Showing 1 to 16 of 16 entries

Companion Files Expand for companion files

Visualize and Subset Data

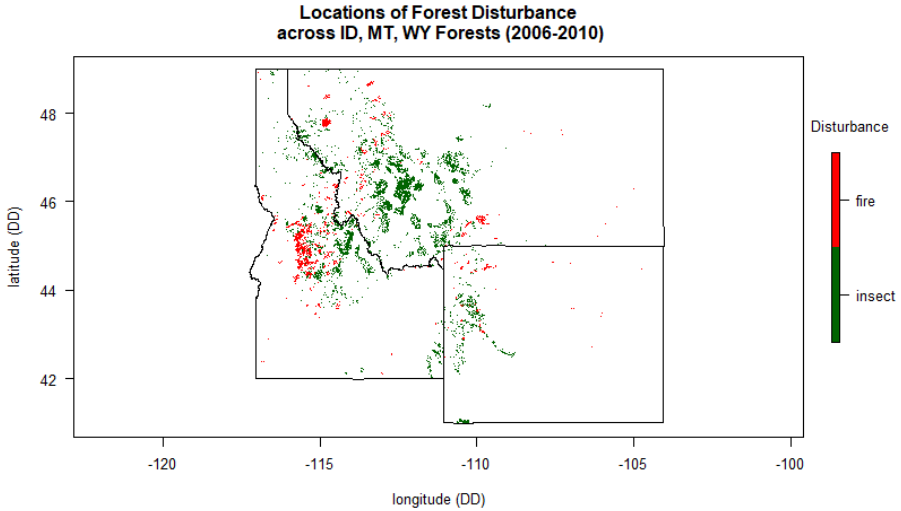
Download customized subsets in user-selected projection and format using the Spatial Data Access Tool.

OAK RIDGE National Laboratory Privacy Policy | Feedback | Help

Tutorial Goals:

Examine carbon emissions from two disturbance types (fires and tree mortality due to insect damage) within three states: Idaho, Wyoming, and Montana

1. Read in data
2. Select raster data within a region (crop and mask)
3. Extract pixel values within a region
4. Re-classify raster data
5. Combine two rasters into one file
6. Make a map



Other resources:

Data Carpentry: https://datacarpentry.org/geospatial-workshop/

NEON: https://www.neonscience.org/image-raster-data-r

Step-by-step Tutorial in R

Tutorial:
https://daac.ornl.gov/resources/tutorials/r-geospatial-webinar/

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