Geospatial Plot data workflow (GeoPlot)

Dynamic document with frequent updates

Table 1. Parameters and detailed metadata. WEB LINK

Methods

2ndFOR

A total of 2710 georeferenced plot centroids were used (plot database date 07/09/2021) for the 2ndFOR plot network, which is distributed across Central and South America and in Africa.

Geospatial Workflow

The SPECLab's Geospatial Plot Data Workflow (GeoPlot v50 as of 10/10/21 - see http://www.speclab.org/geoplot) uses a blended approach that integrates custom procedures in the IDL, R, and Python coding languages, with Google Earth Engine, ArcMap, and ENVI workflows to calculate a suite of more than 360 biophysical and land-use parameters for georeferenced plot centroids and their surrounding landscapes, with global coverage capability for between -30 to 30 degrees latitude. In addition to plot centers, landscape parameter values are characterized using statistics calculated over radius buffer distances surrounding plot centers of 10, 50, 100, 500, 1000, 2000, 3000, 4000, 5000 meters.

The parameters are divided into X core themes: (a) soils, (b) topographic, (c) land use and land cover, (c) bioclimatic, (d) disturbances, (e) drivers, and (f) aboveground carbon.

Soils

Specifically, the following parameters are calculated: (a) Soil data is obtained from SoilGrids v2 (see https://soilgrids.org), which is provided at a 250 x 250 m resolution, is extracted as the mean value of intersecting with a 100 m buffer around each plot center. There are 10 key parameters obtained, each at 6 depth intervals (0-5, 5-15, 15-30, 30-60, 60-100, and 100-200 cm). The specific parameters are BDOD, Cation Exchange Capacity (CEC), CFVO, Clay, OCD, pH H2O, Sand, Silt, and Soil Organic Carbon (SOC) and N. Detailed description is available at their website and in de Sousa et al. 2020.

Global P

Tot	Total P
lat	degrees N

lon	degrees East
Lab	Labile Inorganic P
org	organic P
Occ	Occluded P
Sec	Secondary Mineral P
apa	apatite P

Bioclimatic

Bioclimatic data is obtained from Chelsea Climate (see https://chelsa-climate.org/bioclim/) and includes Chelsea bioclimatic bands 1-16 at a spatial resolution of 1 x1 km. Parameters and descriptions are provided in Table 1. We also include the Global aridity index and potential evapotranspiration (AI ET) raster (v2; GAIPER) for the 1970-2000 time period, which is obtained from https://figshare.com/articles/dataset/Global_Aridity_Index_and_Potential_Evapotranspiration_ET0_Climate_Database_v2/7504448/3, and which provides information related to evapotranspiration processes and rainfall deficit for potential vegetative growth at a 30-second spatial resolution. The Standardised Precipitation-Evapotranspiration (SPEI), which is a drought index, (monthly 2000 through 2020 present) available for download from https://spei.csic.es/ . Added the mean and standard deviation of the entire monthly stack 2000-2021.

Disturbances

Fire area within each buffer in Ha for the time period 2000-11-01 to - 2021-07-01, (pixel res 500m), but calculated within buffers at a 100m scale.

Hansen deforestation and reforestation

The most updated (year 2020) highest resolution data would be the Hansen at 30m, but will require an equation (if I did not already provide that to you), of:

“Year 2000 ha + reforestation – deforestation = present forest cover Ha in each buffer in the year 2020 at spatial resolution of 30m.”

In terms of column names that is:

Year 2000 Ha = "Hansen_forest_Ha"

Reforestation = "Hansen_gain_Ha"

Deforestation = "Hansen_loss_Ha"

Land use and land cover
LULC in hectares for 2019 (100m data)

LULC 1992-2015 (300m data?)

LULC 2020 10m (pending GeoPlot data release in Nov 2021)
https://esa-worldcover.org/en

Value	Color	Description
10	006400	Trees
20	ffbb22	Shrubland
30	ffff4c	Grassland
40	f096ff	Cropland
50	fa0000	Built-up
60	b4b4b4	Barren / sparse vegetation
70	f0f0f0	Snow and ice
80	0064c8	Open water
90	0096a0	Herbaceous wetland
95	00cf75	Mangroves
100	fae6a0	Moss and lichen

Aboveground carbon
AGB proportion description, for both continuous and categorical parameters, is described in detail at http://www.speclab.org/gap . Also prop, sd, and also the Ha area of 100x100m pixels within each buffer that is within the categories: 0+ (e.g., all), 0<20, 20<40, 40<60, 60<80, 80+ (% values here), which can be interpreted in different ways depending on the objectives, for example, they may correlate to general forest ages.

Outputs metadata

Current outputs are in shapefile polygon format with associated .dbf data files. Each DBF file contains the same duplicated key columns associated with the input plots, specifically:

The shapefile names are as of v50 - 09/30/21

Groups:

AGB Prop
[1] "plot_agb_prop_2ndFOR_stack_1000mBuffer__091821_v82-v3-X-v41.dbf"
[2] "plot_agb_prop_2ndFOR_stack_100mBuffer__091821_v82-v3-X-v41.dbf"
[3] "plot_agb_prop_2ndFOR_stack_2000mBuffer__091821_v82-v3-X-v41.dbf"
[4] "plot_agb_prop_2ndFOR_stack_4000mBuffer__091821_v82-v3-X-v41.dbf"
[5] "plot_agb_prop_2ndFOR_stack_5000mBuffer__091821_v82-v3-X-v41.dbf"
[6] "plot_agb_prop_2ndFOR_stack_500mBuffer__091821_v82-v3-X-v41.dbf"
[7] "plot_agb_prop_2ndFOR_stack_50mBuffer__091821_v82-v3-X-v41.dbf"

[8] "plot_chelsea_bioclim_091821_v11.dbf"

[9] "plot_data1_091821_v11.dbf"

[10] "plot_forest_age_merge_Ha_1000mBuffer_d092021_v45.dbf"
[11] "plot_forest_age_merge_Ha_100mBuffer_d092021_v45.dbf"
[12] "plot_forest_age_merge_Ha_10mBuffer_d092021_v45.dbf"
[13] "plot_forest_age_merge_Ha_2000mBuffer_d092021_v45.dbf"

```
[14] "plot_forest_age_merge_Ha_3000mBuffer_d092021_v45.dbf"
[15] "plot_forest_age_merge_Ha_4000mBuffer_d092021_v45.dbf"
[16] "plot_forest_age_merge_Ha_5000mBuffer_d092021_v45.dbf"
[17] "plot_forest_age_merge_Ha_500mBuffer_d092021_v45.dbf"
[18] "plot_forest_age_merge_Ha_50mBuffer_d092021_v45.dbf"
[19] "plot_GHSL_10m_S2_CNN_Ha_1000mBuffer_d091821_v34.dbf"
[20] "plot_GHSL_10m_S2_CNN_Ha_100mBuffer_d091821_v34.dbf"
[21] "plot_GHSL_10m_S2_CNN_Ha_10mBuffer_d091821_v34.dbf"
[22] "plot_GHSL_10m_S2_CNN_Ha_2000mBuffer_d091821_v34.dbf"
[23] "plot_GHSL_10m_S2_CNN_Ha_3000mBuffer_d091821_v34.dbf"
[24] "plot_GHSL_10m_S2_CNN_Ha_4000mBuffer_d091821_v34.dbf"
[25] "plot_GHSL_10m_S2_CNN_Ha_5000mBuffer_d091821_v34.dbf"
[26] "plot_GHSL_10m_S2_CNN_Ha_500mBuffer_d091821_v34.dbf"
[27] "plot_GHSL_10m_S2_CNN_Ha_50mBuffer_d091821_v34.dbf"
[28] "plot_hansen_stack_Ha_1000mBuffer_d091921_v39.dbf"
[29] "plot_hansen_stack_Ha_100mBuffer_d091921_v39.dbf"
[30] "plot_hansen_stack_Ha_10mBuffer_d091921_v39.dbf"
[31] "plot_hansen_stack_Ha_2000mBuffer_d091921_v39.dbf"
[32] "plot_hansen_stack_Ha_3000mBuffer_d091921_v39.dbf"
[33] "plot_hansen_stack_Ha_4000mBuffer_d091921_v39.dbf"
[34] "plot_hansen_stack_Ha_5000mBuffer_d091921_v39.dbf"
[35] "plot_hansen_stack_Ha_500mBuffer_d091921_v39.dbf"
[36] "plot_hansen_stack_Ha_50mBuffer_d091921_v39.dbf"
[37] "plot_lulc_92_15_discrete_stack_1000mBuffer_091821_v11.dbf"
[38] "plot_lulc_92_15_discrete_stack_100mBuffer_091821_v11.dbf"
[39] "plot_lulc_92_15_discrete_stack_10mBuffer_091821_v11.dbf"
[40] "plot_lulc_92_15_discrete_stack_2000mBuffer_091821_v11.dbf"
[41] "plot_lulc_92_15_discrete_stack_3000mBuffer_091821_v11.dbf"
[42] "plot_lulc_92_15_discrete_stack_4000mBuffer_091821_v11.dbf"
[43] "plot_lulc_92_15_discrete_stack_5000mBuffer_091821_v11.dbf"
[44] "plot_lulc_92_15_discrete_stack_500mBuffer_091821_v11.dbf"
[45] "plot_lulc_92_15_discrete_stack_50mBuffer_091821_v11.dbf"
[46] "plot_lulc_discrete_stack_1000mBuffer_091821_v11.dbf"
[47] "plot_lulc_discrete_stack_100mBuffer_091821_v11.dbf"
[48] "plot_lulc_discrete_stack_10mBuffer_091821_v11.dbf"
[49] "plot_lulc_discrete_stack_2000mBuffer_091821_v11.dbf"
[50] "plot_lulc_discrete_stack_3000mBuffer_091821_v11.dbf"
[51] "plot_lulc_discrete_stack_4000mBuffer_091821_v11.dbf"
[52] "plot_lulc_discrete_stack_5000mBuffer_091821_v11.dbf"
[53] "plot_lulc_discrete_stack_500mBuffer_091821_v11.dbf"
[54] "plot_lulc_discrete_stack_50mBuffer_091821_v11.dbf"
[55] "plot_max_agb_prop_1000mBuffer__091821_v82-v3-X-v40.dbf"
[56] "plot_max_agb_prop_100mBuffer__091821_v82-v3-X-v40.dbf"
[57] "plot_max_agb_prop_10mBuffer__091821_v82-v3-X-v40.dbf"
[58] "plot_max_agb_prop_2000mBuffer__091821_v82-v3-X-v40.dbf"
[59] "plot_max_agb_prop_3000mBuffer__091821_v82-v3-X-v40.dbf"
[60] "plot_max_agb_prop_4000mBuffer__091821_v82-v3-X-v40.dbf"
[61] "plot_max_agb_prop_5000mBuffer__091821_v82-v3-X-v40.dbf"
[62] "plot_max_agb_prop_500mBuffer__091821_v82-v3-X-v40.dbf"
```

```
 [63] "plot_max_agb_prop_50mBuffer__091821_v82-v3-X-v40.dbf"
 [64] "plot_max_agb_prop_stdDev_1000mBuffer__091821_v82-v3-X-v40.dbf"
 [65] "plot_max_agb_prop_stdDev_100mBuffer__091821_v82-v3-X-v40.dbf"
 [66] "plot_max_agb_prop_stdDev_10mBuffer__091821_v82-v3-X-v40.dbf"
 [67] "plot_max_agb_prop_stdDev_2000mBuffer__091821_v82-v3-X-v40.dbf"
 [68] "plot_max_agb_prop_stdDev_3000mBuffer__091821_v82-v3-X-v40.dbf"
 [69] "plot_max_agb_prop_stdDev_4000mBuffer__091821_v82-v3-X-v40.dbf"
 [70] "plot_max_agb_prop_stdDev_5000mBuffer__091821_v82-v3-X-v40.dbf"
 [71] "plot_max_agb_prop_stdDev_500mBuffer__091821_v82-v3-X-v40.dbf"
 [72] "plot_Modis_fire_Ha_1000mBuffer_d091821_v33.dbf"
 [73] "plot_Modis_fire_Ha_100mBuffer_d091821_v33.dbf"
 [74] "plot_Modis_fire_Ha_10mBuffer_d091821_v33.dbf"
 [75] "plot_Modis_fire_Ha_2000mBuffer_d091821_v33.dbf"
 [76] "plot_Modis_fire_Ha_3000mBuffer_d091821_v33.dbf"
 [77] "plot_Modis_fire_Ha_4000mBuffer_d091821_v33.dbf"
 [78] "plot_Modis_fire_Ha_5000mBuffer_d091821_v33.dbf"
 [79] "plot_Modis_fire_Ha_500mBuffer_d091821_v33.dbf"
 [80] "plot_Modis_fire_Ha_50mBuffer_d091821_v33.dbf"
 [81] "plot_plot_agb_prop_2ndFOR_stack_10mBuffer__091821_v82-v3-X-v41.dbf"
 [82] "plot_soils_091821_v11.dbf"
 [83] "plot_stack_AI_ET_P_SPEI_Fcover_LAI_NDVI_WS10m_1000mBuffer_d092021_v45.dbf"
 [84] "plot_stack_AI_ET_P_SPEI_Fcover_LAI_NDVI_WS10m_100mBuffer_d092021_v45.dbf"
 [85] "plot_stack_AI_ET_P_SPEI_Fcover_LAI_NDVI_WS10m_10mBuffer_d092021_v45.dbf"
 [86] "plot_stack_AI_ET_P_SPEI_Fcover_LAI_NDVI_WS10m_2000mBuffer_d092021_v45.dbf"
 [87] "plot_stack_AI_ET_P_SPEI_Fcover_LAI_NDVI_WS10m_3000mBuffer_d092021_v45.dbf"
 [88] "plot_stack_AI_ET_P_SPEI_Fcover_LAI_NDVI_WS10m_4000mBuffer_d092021_v45.dbf"
 [89] "plot_stack_AI_ET_P_SPEI_Fcover_LAI_NDVI_WS10m_5000mBuffer_d092021_v45.dbf"
 [90] "plot_stack_AI_ET_P_SPEI_Fcover_LAI_NDVI_WS10m_500mBuffer_d092021_v45.dbf"
 [91] "plot_stack_AI_ET_P_SPEI_Fcover_LAI_NDVI_WS10m_50mBuffer_d092021_v45.dbf"
 [92] "plot_stack_AI_ET_P_SPEI_Fcover_LAI_NDVI_WS10m_stdDev_1000mBuffer_d092021_v45.dbf"
 [93] "plot_stack_AI_ET_P_SPEI_Fcover_LAI_NDVI_WS10m_stdDev_100mBuffer_d092021_v45.dbf"
 [94] "plot_stack_AI_ET_P_SPEI_Fcover_LAI_NDVI_WS10m_stdDev_10mBuffer_d092021_v45.dbf"
 [95] "plot_stack_AI_ET_P_SPEI_Fcover_LAI_NDVI_WS10m_stdDev_2000mBuffer_d092021_v45.dbf"
 [96] "plot_stack_AI_ET_P_SPEI_Fcover_LAI_NDVI_WS10m_stdDev_3000mBuffer_d092021_v45.dbf"
 [97] "plot_stack_AI_ET_P_SPEI_Fcover_LAI_NDVI_WS10m_stdDev_4000mBuffer_d092021_v45.dbf"
 [98] "plot_stack_AI_ET_P_SPEI_Fcover_LAI_NDVI_WS10m_stdDev_5000mBuffer_d092021_v45.dbf"
 [99] "plot_stack_AI_ET_P_SPEI_Fcover_LAI_NDVI_WS10m_stdDev_500mBuffer_d092021_v45.dbf"
[100] "plot_stack_AI_ET_P_SPEI_Fcover_LAI_NDVI_WS10m_stdDev_50mBuffer_d092021_v45.dbf"
[101] "plot_stack_HFvariables_1000mBuffer_091821_v11.dbf"
[102] "plot_stack_HFvariables_100mBuffer_091821_v11.dbf"
[103] "plot_stack_HFvariables_10mBuffer_091821_v11.dbf"
[104] "plot_stack_HFvariables_2000mBuffer_091821_v11.dbf"
[105] "plot_stack_HFvariables_3000mBuffer_091821_v11.dbf"
[106] "plot_stack_HFvariables_4000mBuffer_091821_v11.dbf"
[107] "plot_stack_HFvariables_5000mBuffer_091821_v11.dbf"
[108] "plot_stack_HFvariables_500mBuffer_091821_v11.dbf"
[109] "plot_stack_HFvariables_50mBuffer_091821_v11.dbf"
[110] "plot_stack_P_SPEI_100km_091821_v12.dbf"
```

Source metadata

Plots from Cata and Masha - version 07/09/21

Buffered in circles for: 10, 50, 100, 500, 1000, 2000, 3000, 4000, 5000 meters

Soil

From SoilGrids v2. This is a 250 x 250 m resolution soil raster for each variable. The names of the columns are the names of the variables.

Soils are the mean value using the 100m buffer area.

Cite: https://soil.copernicus.org/preprints/soil-2020-65/soil-2020-65.pdf which provides all the per variable information and units.

Bioclimate

Chelsea Bioclimatic Variables. As described at: https://chelsa-climate.org/bioclim/

Bio1 = Annual Mean Temperature
Bio2 = Mean Diurnal Range
Bio3 = Isothermality
Bio4 = Temperature Seasonality
Bio5 = Max Temperature of Warmest Month
Bio6 = Min Temperature of Coldest Month
Bio7 = Temperature Annual Range
Bio8 = Mean Temperature of Wettest Quarter
Bio9 = Mean Temperature of Driest Quarter
Bio10 = Mean Temperature of Warmest Quarter
Bio11 = Mean Temperature of Coldest Quarter
Bio12 = Annual Precipitation
Bio13 = Precipitation of Wettest Month
Bio14 = Precipitation of Driest Month
Bio15 = Precipitation Seasonality
Bio16 = Precipitation of Wettest Quarter
Bio17 = Precipitation of Driest Quarter
Bio18 = Precipitation of Warmest Quarter
Bio19 = Precipitation of Coldest Quarter

Bioclimate values are mean values within the 100m buffer area.

Data 1

All variables below are the mean within the 100 meter buffer around each plot.

Biomes (Biome_Num) and Ecoregions (Eco_ID) ID values
from RESOLVE 2017 as is described at: https://ecoregions2017.appspot.com/ and in the article https://academic.oup.com/bioscience/article/67/6/534/3102935

AGB mean values for the layers:

AGB 100m
= CCI UN 2017 aboveground Carbon Mg/Ha

AGB 300m
= Spawn 2010 aboveground biomass Mg/Ha (with a 10 multiplier, so need to divide this by 10 to get Mg/Ha). To get Carbon would need to convert.

AGB 1000m
= from http://lucid.wur.nl/datasets/high-carbon-ecosystems GEOCARBON

CWD
= from (same source as we've used all along):
- website: https://chave.ups-tlse.fr/pantropical_allometry.htm
- link to the raster: https://chave.ups-tlse.fr/pantropical_allometry/CWD.bil.zip

GIEMS inundation index (v15 d10)
as described at: http://www.estellus.fr/index.php?static13/giems-d15

Elevation
from: USGS GMTED 2010

Slope in degrees
calculated from USGS GMTED 2010

Topographic landforms
as calculated by Conservation Science Partners, derived from SRTM elevation data, with the code being:

Value	Description
11	Peak/ridge (warm)
12	Peak/ridge
13	Peak/ridge (cool)
14	Mountain/divide
15	Cliff
21	Upper slope (warm)
22	Upper slope
23	Upper slope (cool)
24	Upper slope (flat)
31	Lower slope (warm)
32	Lower slope
33	Lower slope (cool)
34	Lower slope (flat)
41	Valley
42	Valley (narrow)

Topo Position
Calculated by Conservation Science Partners

Name	Units	Min	Max	Description
`elevation`	Meters	-8129*	7905*	SRTM-derived mTPI ranging from negative (valleys) to positive (ridges) values

Hydrosheds flow accumulation (by WWF)

HydroSHEDS is a mapping product that provides hydrographic information for regional and global-scale applications in a consistent format. It offers a suite of geo-referenced datasets (vector and raster) at various scales, including river networks, watershed boundaries, drainage directions, and flow accumulations. HydroSHEDS is based on elevation data obtained in 2000 by NASA's Shuttle Radar Topography Mission (SRTM).

This flow accumulation dataset defines the amount of upstream area (in number of cells) draining into each cell. The drainage direction layer is used to define which cells flow into the target cell. The number of accumulated cells is essentially a measure of the upstream catchment area. However, since the cell size of the HydroSHEDS data set depends on latitude, the cell accumulation value cannot directly be translated into drainage areas in square kilometers. Values range from 1 at topographic highs (river sources) to very large numbers (on the order of millions of cells) at the mouths of large rivers.

This dataset is at 15 arc-second resolution. The datasets available at 15 arc-seconds are the Hydrologically Conditioned DEM, Drainage (Flow) Direction, and Flow Accumulation.

Human modification index

Global Human Modification, as calculated by CSP, and described in

Kennedy, C.M., J.R. Oakleaf, D.M. Theobald, S. Baurch-Murdo, and J. Kiesecker. 2019. Managing the middle: A shift in conservation priorities based on the global human modification gradient. Global Change Biology 00:1-16. https://doi.org/10.1111/gcb.14549

The global Human Modification dataset (gHM) provides a cumulative measure of human modification of terrestrial lands globally at 1 square-kilometer resolution. The gHM values range from 0.0-1.0 and are calculated by estimating the proportion of a given location (pixel) that is modified, the estimated intensity of modification associated with a given type of human modification or "stressor". 5 major anthropogenic stressors circa 2016 were mapped using 13 individual datasets:

- human settlement (population density, built-up areas)
- agriculture (cropland, livestock)
- transportation (major, minor, and two-track roads; railroads)
- mining and energy production
- electrical infrastructure (power lines, nighttime lights)

Doi_10.5061_dryad.052q5__v2

Table 2. The name, description and type of data included in the HumanFooptrint.zip file.

Name	**Description**	**Format**
Validation.xlsx	Data on visual score of pressures for 3114 $1km^2$ plots using high resolution imagery.	Excel
Appendix1.pdf	Key used to visually interpret human pressures.	PDF
HFP1993.tif	The Human Footprint camp of cumulative pressures on the environment in 1993.	GeoTIFF
HFP2009.tif	The Human Footprint camp of cumulative pressures on the environment in 2009.	GeoTIFF
Built1994.tif	Individual pressure map of built environments in 1994.	GeoTIFF
Built2009.tif	Individual pressure map of built environments in 2009.	GeoTIFF
Croplands1992.tif	Individual pressure map of crop lands in 1992.	GeoTIFF
Croplands2005.tif	Individual pressure map of crop lands in 2005.	GeoTIFF

Lights1994.tif	Individual pressure map of night-time lights in 1994.	GeoTIFF
Lights2009.tif	Individual pressure map of night-time lights in 2009.	GeoTIFF
Navwater1994.tif	Individual pressure map of navigable waterways in 1994.	GeoTIFF
Navwater2009.tif	Individual pressure map of navigable waterways in 2009.	GeoTIFF
Pasture1993.tif	Individual pressure map of pasture lands in 1993.	GeoTIFF
Pasture2009.tif	Individual pressure map of pasture lands in 2009.	GeoTIFF
Popdensity1990.tif	Individual pressure map of human population density in 1990.	GeoTIFF
Popdensity2010.tif	Individual pressure map of human population density in 2010.	GeoTIFF
Railways.tif	Individual pressure map of railways circa 1990.	GeoTIFF
Roads.tif	Individual pressure map of roads circa 2000.	GeoTIFF

Height 2005

NASA JPL derived global tree height in 2005

Height 2019

Potapov, peter calculated global 30 m tree height in 2019 using GEDI + Landsat fusion. As described in:

P. Potapov, X. Li, A. Hernandez-Serna, A. Tyukavina, M.C. Hansen, A. Kommareddy, A. Pickens, S. Turubanova, H. Tang, C.E. Silva, J. Armston, R. Dubayah, J. B. Blair, M. Hofton (2020) Mapping and monitoring global forest canopy height through integration of GEDI and Landsat data. *Remote Sensing of Environment,* 112165.
https://doi.org/10.1016/j.rse.2020.112165

JRC Global Surface Water Mapping Layers, v1.2

https://global-surface-water.appspot.com/download

Jean-Francois Pekel, Andrew Cottam, Noel Gorelick, Alan S. Belward, High-resolution mapping of global surface water and its long-term changes. Nature 540, 418-422 (2016). (doi:10.1038/nature20584)

https://global-surface-water.appspot.com/map

Providing the following bands

'SW_occurence','SW_abs_change','SW_norm_change','SW_seasonality','SW_recurrence','SW_transition', 'SW_max_extent'

SPEI (drought index)
(monthly 2000 through 2020 present)
Added the mean and standard deviation of the entire monthly stack 2000-2021

Fire frequency and area by buffer zone using VIRS

Mean forest age
Eben calculated for a separate paper) - calculated as 5 20% classes using the AGB proportion

NDVI - from
https://land.copernicus.eu/global/products/ndvi

1	Product Portal	PROB A-V	Jan 2014 - Dec 2020	Global, 300m	Within 3 days after synthesis period

For 01-01to10-2021, 08/01-08/10-2020, and 04/01-01/10/2020, then average them.

Windspeed
At 10m and 100m above ground level height (mean annual).
Average of Jan 01-10, April, and August 10 days of each month.

GLAD deforestation area (ha) by year or last decade - DONE

Global human settlement 2017 10m (buildings, structures, etc) - DONE

Maximum AGB potential (Eben calculated for a separate paper) - not provided yet, but the proportion is.

Mean forest AGB uptake rate (Eben calc for a seper pape)

Fraction of green vegetation:
https://land.copernicus.eu/global/products/fcover

The Fraction of Vegetation Cover (FCover) corresponds to the fraction of ground covered by green vegetation. Practically, it quantifies the spatial extent of the vegetation. Because it is independent from the illumination direction and it is sensitive to the vegetation amount, FCover is a very good candidate for the replacement of classical vegetation indices for the monitoring of ecosystems.

Leaf Area Index
Maybe the Leaf area Index (LAI) would be used in combination with the LULC classes to distinguish OGF and SF.
Check out the product also from COpernicus:
https://land.copernicus.eu/global/products/lai

The Leaf Area Index is defined as half the total area of green elements of the canopy per unit horizontal ground area. The satellite-derived value corresponds to the total green LAI of all the canopy layers, including the understory which may represent a very significant contribution, particularly for forests. Practically, the LAI quantifies the thickness of the vegetation cover.

LAND USE AND LAND COVER

Copernicus Global Land Cover Layers: CGLS-LC100 Collection 3

Year = 2019

Buchhorn, M. ; Lesiv, M. ; Tsendbazar, N. - E. ; Herold, M. ; Bertels, L. ; Smets, B. Copernicus Global Land Cover Layers—Collection 2. Remote Sensing 2020, 12Volume 108, 1044. [doi:10.3390/rs12061044](https://doi.org/10.3390/rs12061044)

Land use and land cover discrete classes. The output columns are the area in (Ha) within all buffer groups separately, for the following lulc classes (these are the output columns):

'area','class all','class 0','class 1','class 2','class 3','class 4','class 5','class 6',
'class 7','class 8','class 9','class 10','class 11', 'class 12', 'class 13', 'class 14',
'class 15','class 16','class 17','class 18','class 19', 'class 20', 'class 21', 'class 22'

The column variable names / numbers above align with land use via the following conversion:

lulc_all = lulc_discrete.gte(0) -- generally useful to distinguish which buffer is being used.
lulc_0 = lulc_discrete.eq(0)
lulc_1 = lulc_discrete.eq(20)
lulc_2 = lulc_discrete.eq(30)
lulc_3 = lulc_discrete.eq(40)
lulc_4 = lulc_discrete.eq(50)
lulc_5 = lulc_discrete.eq(60)
lulc_6 = lulc_discrete.eq(70)
lulc_7 = lulc_discrete.eq(80)
lulc_8 = lulc_discrete.eq(90)
lulc_9 = lulc_discrete.eq(100)
lulc_10 = lulc_discrete.eq(111)
lulc_11 = lulc_discrete.eq(112)
lulc_12 = lulc_discrete.eq(113)
lulc_13 = lulc_discrete.eq(114)
lulc_14 = lulc_discrete.eq(115)
lulc_15 = lulc_discrete.eq(116)

```
lulc_16 = lulc_discrete.eq(121)
lulc_17 = lulc_discrete.eq(122)
lulc_18 = lulc_discrete.eq(123)
lulc_19 = lulc_discrete.eq(124)
lulc_20 = lulc_discrete.eq(125)
lulc_21 = lulc_discrete.eq(126)
lulc_22 = lulc_discrete.eq(200)
```

The land-use codes are: These are the ones that are queried to create the column name outputs (e.g., 'lulc_22' is actually the area in hectares of the land use class Oceans, seas. Can be either fresh or salt-water bodies., as is described below).

Value	Description
0	Unknown. No or not enough satellite data available.
20	Shrubs. Woody perennial plants with persistent and woody stems and without any defined main stem being less than 5 m tall. The shrub foliage can be either evergreen or deciduous.
30	Herbaceous vegetation. Plants without persistent stem or shoots above ground and lacking definite firm structure. Tree and shrub cover is less than 10 %.
40	Cultivated and managed vegetation / agriculture. Lands covered with temporary crops followed by harvest and a bare soil period (e.g., single and multiple cropping systems). Note that perennial woody crops will be classified as the appropriate forest or shrub land cover type.
50	Urban / built up. Land covered by buildings and other man-made structures.
60	Bare / sparse vegetation. Lands with exposed soil, sand, or rocks and never has more than 10 % vegetated cover during any time of the year.
70	Snow and ice. Lands under snow or ice cover throughout the year.

80	Permanent water bodies. Lakes, reservoirs, and rivers. Can be either fresh or salt-water bodies.
90	Herbaceous wetland. Lands with a permanent mixture of water and herbaceous or woody vegetation. The vegetation can be present in either salt, brackish, or fresh water.
100	Moss and lichen.
111	Closed forest, evergreen needle leaf. Tree canopy >70 %, almost all needle leaf trees remain green all year. Canopy is never without green foliage.
112	Closed forest, evergreen broad leaf. Tree canopy >70 %, almost all broadleaf trees remain green year round. Canopy is never without green foliage.
113	Closed forest, deciduous needle leaf. Tree canopy >70 %, consists of seasonal needle leaf tree communities with an annual cycle of leaf-on and leaf-off periods.
114	Closed forest, deciduous broad leaf. Tree canopy >70 %, consists of seasonal broadleaf tree communities with an annual cycle of leaf-on and leaf-off periods.
115	Closed forest, mixed.
116	Closed forest, not matching any of the other definitions.
121	Open forest, evergreen needle leaf. Top layer- trees 15-70 % and second layer- mixed of shrubs and grassland, almost all needle leaf trees remain green all year. Canopy is never without green foliage.
122	Open forest, evergreen broad leaf. Top layer- trees 15-70 % and second layer- mixed of shrubs and grassland, almost all broadleaf trees remain green year round. Canopy is never without green foliage.
123	Open forest, deciduous needle leaf. Top layer- trees 15-70 % and second layer- mixed of shrubs and grassland, consists of seasonal needle leaf tree communities with an annual cycle of leaf-on and leaf-off periods.

124	Open forest, deciduous broad leaf. Top layer- trees 15-70 % and second layer- mixed of shrubs and grassland, consists of seasonal broadleaf tree communities with an annual cycle of leaf-on and leaf-off periods.
125	Open forest, mixed.
126	Open forest, not matching any of the other definitions.
200	Oceans, seas. Can be either fresh or salt-water bodies.

LULC 1992-2015

Source: // https://cds.climate.copernicus.eu/cdsapp#!/dataset/satellite-land-cover?tab=overview
// 1992-2015 is from http://maps.elie.ucl.ac.be/CCI/viewer/download.php

https://poles.tpdc.ac.cn/en/data/c205fc4f-4847-4a7d-bb04-7c60f27438ae/

300x300 m pixels

Post-process calculations on data could include rate of change, etc…

Values are Ha of area within the buffer zone

All = GTE 0 value.

// Remapped classes
// 0. NoData (0)
// 1. Water (210, 220)
// 2. Urban (190,200,201,202)
// 3. Cropland (10,20,30)
// 4. Sparse vegetation (130,140,150,151,152,153,11,180)
// 5. Shrub vegetation (100,110,120,121,122,40,12)
// 6. Tree vegetation (50,60,61,62,70,71,72,80,81,82,90,160,170)

Global aridity index and potential evapotranspiration (https://figshare.com/articles/dataset/Global_Aridity_Index_and_Potential_Evapotranspiration_ET0_Climate_Database_v2/7504448/3) done

Soil P

(source: https://daac.ornl.gov/cgi-bin/dsviewer.pl?ds_id=1223; reference: Yang, X., Post, W., Thornton, P. & Jain, A. Global gridded soil phosphorus distribution maps at 0.5-degree resolution. ORNL DAAC (2014)) done

Road density

available as a layer from the Global human footprint map; source: https://datadryad.org/stash/dataset/doi:10.5061/dryad.052q5). To make it easier to include this variable in the data extraction workflow, this variable could be "road density" within the same buffers used for the other variables. (done,)

-

SPEI

Like a Global drought index; confirm these values in teh code and outputs! - SPEI (https://spei.csic.es/database.html)

Fires

frequency

(in the metadata file you wrote: **Fire frequency and area by buffer zone using VIRS) - done**

Dynamic World

Provides the mean 10x10m pixel value for all pixels within the different radius buffer areas around each plot center (using the buffer polygon features). These have a 1000 multiplier, so 1000 is equal to 100%. There are up to 9 land use classes, which are provided as continuous probabilities of each class per pixel, and these are kept up dated in real time as much as possible by Google based AI algorithms. There is also a label which provides the land use with the highest probability (and which can also be approximately interpreted as percentage coverage within that pixel).

Name	Min	Max	Description
water	0	1	Estimated probability of complete coverage by water
trees	0	1	Estimated probability of complete coverage by trees
grass	0	1	Estimated probability of complete coverage by grass
flooded_vegetation	0	1	Estimated probability of complete coverage by flooded vegetation
crops	0	1	Estimated probability of complete coverage by crops
shrub_and_scrub	0	1	Estimated probability of complete coverage by shrub and scrub
built	0	1	Estimated probability of complete coverage by built
bare	0	1	Estimated probability of complete coverage by bare
snow_and_ice	0	1	Estimated probability of complete coverage by snow and ice
label	0	8	Index of the band with the highest estimated probability

WorldPop - 100m resolution and dynamic updated grid total population estimates

https://www.worldpop.org/

Human individual pop count per 100m grid cell

Future data

Exotic tree plantation cover

Not yet included, but we have it mostly preprocessed so should look into it coming up.

Burnt Area product from

Copernicus: https://land.copernicus.eu/global/products/ba
Insufficient temporal coverage to use at this time (perhaps in a year - 09/2022). Perhaps useful in the future.

Terraclimate

https://climatedataguide.ucar.edu/climate-data/terraclimate-global-high-resolution-gridded-temperature-precipitation-and-other-water

References

de Sousa, L.M., Poggio, L., Batjes, N.H., Heuvelink, G.B., Kempen, B., Riberio, E. and Rossiter, D., 2020. SoilGrids 2.0: producing quality-assessed soil information for the globe. Soil Discuss., 1. https://doi.org/10.5194/soil-2020-65

Versioning

v50 - first release of the complete workflow outputs. Current outputs are 109 shapefile polygon layers. Future versions will output easier to immediately use worksheets of data and no duplicated columns.