Organic matter cycling along geochemical, geomorphic and disturbance gradients in vegetation and soils of African tropical forests and cropland - Project TropSOC DATABASE_v1.0

2.1.1. Forest – Vegetation – Forest inventory

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Doetterl S., Asifiwe R.K., Baert G., Bamba F., Bauters M., Boeckx P., Bukombe B., Cadisch G., Cizungu L.N., Cooper M., Hoyt A., Kabaseke C., Kalbitz K., Kidinda L., Maier A., Mainka M., Mayrock J., Muhindo D., Mujinya B.B., Mukotanyi, S.M., Nabahungu L., Reichenbach M., Rewald B., Six J., Stegmann A., Summerauer L., Unseld R., Vanlauwe B., Van Oost K., Verheyen K. Vogel C., Wilken F., Fiener P. Organic matter cycling along geochemical, geomorphic and disturbance gradients in forests and cropland of the African Tropics - Project TropSOC Database Version 1.0. *Earth System Science Data* XXX, DOI XXX, 2021.

Introduction

The data set comprises a unique plot identifier, an additional subplot identifier and a tree identifier followed by 19 variables that describe forest properties. Missing values are indicated by -9999.

Data structure

No.	Variable	Explanation	Unit
1	plotID	unique identifier of each plot and point where data were collected.	-
2	subplotID	subplot within the plot as indicated by plotID	-
3	treeID	tree identifier unique for every recorded tree	-
4	genus	genus of tree	-
5	species	species of tree	-
6	family	family of tree	-
7	dbh18	diameter at breast height measured in 2018	cm
8	stemH	stem height taken from tree species that represent 80% of the total basal area	m
9	totalH	total tree height; note only taken for trees species that represent 80% of the total basal area	m
10	dbh20	diameter at breast height measured in 2020	cm
11	meanWD	mean wood density of tree	g cm^{-3}
12	predH18	predicted total tree height 2018	m
13	predH20	predicted total tree height 2020	m
14	agb18	above-ground biomass of the tree for 2018	Mg
15	agb20	above-ground biomass of the tree for 2020	Mg
16	agc18	above-ground carbon stock of the tree 2018	Mg
17	agc20	above-ground carbon stock of the tree 2020	Mg
18	forest	name of the national park in which the forest inventory was conducted	-
19	f_date	date of inventory in 2018-2019	dd.mm.yyyy
20	s_date	date of inventory in 2020	dd.mm.yyyy
21	tree_status	1 = tree determined in 2018 still standing and living in 2020; 0 = tree determined in 2018 is dead or has been removed	-
22	comments	specific comments	-

Methods

In 2018 and 2019 as part of our forest soil sampling campaign, a full inventory of tree species abundance and standing above-ground biomass was conducted for all 36 established plots (for details regarding plots and plot design see *2_forest.pdf*). The forest inventory followed an international, standardized protocol for tropical regions (RAINFOR, Matthews et al., 2012). The inventorization was repeated in 2020, in order to detect changes in above-ground standing biomass and to determine tree mortality. First, we identified the species of all living trees with a diameter at breast height (DBH, measured at 1.3 m above ground) greater than 10 cm in each plot. Second, identified trees were classified into the following empirical DBH classes: 10 – 20 cm, 20 – 30 cm, 30 – 50 cm and > 50 cm. Third, to estimate above-ground biomass (AGB), we constructed stand-specific height diameter (H–D) allometric relationships using a representative subset of plot-specific trees (for details see Méchain et al., 2017). To do so, 20 % of all measured, specific trees per plot were selected for height measurement. Depending on tree abundance in each DBH class, the height of three to five individual trees were then measured using a Nikon Laser Rangefinder Forestry Pro II hypsometer (Nikon Forestry Pro, Nikon, Japan). Finally, AGB for each individual tree and biomass carbon stock was estimated using the allometric equation as described by Chave et al. (2014) for moist tropical forests, assuming that biomass has a 50 wt % share of carbon (Chave et al., 2005). To estimate wood density data, we used species averages from the DRYAD global wood density database (Zanne et al., 2009). AGB is calculated as:

$$AGB = 0.0673\ (\rho \times D^2 \times H) \qquad (1)$$

where *AGB* is the tree aboveground biomass (kg), ρ is the wood density (g cm^{-3}), *D* is the tree diameter (cm) and *H* is the tree height (cm)

To extrapolate this information for entire plots, we applied a stand-specific height–diameter regression model; modelHD, available within the R package BIOMASS (Méchain et al., 2017). Tree mortality rate (**λ**) at each plot was assessed following Lewis et al. (2004), using inventories conducted in 2018 and 2020. Tree mortality rate was calculated for all tree stems with DBH>10cm in every plot.

Acknowledgment

TropSOC was funded via the Emmy-Noether-Program of the German Research Foundation (project ID 387472333).

References

Chave, J., Andalo, C., Brown, S., Cairns, M. A. , Chambers J. Q., Eamus, D., Fölster, H., Fromard, F., Higuchi, N., Kira, T., Lescure, J. P., Nelson, B. W., Ogawa, H., Puig, H., Riéra, B., and Yamakura, T.: Tree allometry and improved estimation of carbon stocks and balance in tropical forests, Oecologia, 145, 87–99, 10.1007/s00442-005-0100-x, 2005.

Chave, J., Rejou-Mechain, M., Burquez, A., Chidumayo, E., Colgan, M., Delitti, W., Eid, T., Duque, A., Fearnside, P., Goodman, R., Henry, M., Martínez-Yrízar, A., Mugasha, W., Muller-Landau, H., Mencuccini, M., Nelson, B., Ngomanda, A., Nogueira, E., Ortiz-Malavassi, E., Pélissier ,R., Ploton, P., Ryan, C., Saldarriaga, J., Vieilledent, G. : Improved allometric models to estimate the aboveground biomass of tropical trees, Global Change Biol., 20, 3177–3190, 10.1111/gcb.12629, 2014.

Lewis, S.L., Phyllips, O. L., Sheil, D., Vinceti, B., Baker, T.R.,Brown, S., Graham, A.W., Higuchi, N., Hilbert, D.W., Laurance, W.F., Lejoly, J., Malhi Y., Monteagudo, A, Vargas, P.N., Sonké, B., Supardi, N.M.N., Terborgh, J.W., Martínez, R.V.: Tropical forest tree mortality, recruitment and turnover rates: calculation, interpretation and comparison when census intervals vary. J. ecol., 92, 929-944, doi:10.1111/j.0022-0477.2004.00923.x, 2004.

Marthews, T. R., Metcalfe, D., Malhi, Y., Phillips,O., Huasco, H.W., Riutta, T., Ruiz Jaén, M., Girardin, C., Urrutia, R., Butt, N., Cain, R., Menor, O., and colleagues from the RAINFOR and GEM networks: Measuring tropical forest carbon allocation and cycling: a RAINFOR-GEM field manual for intensive census plots (v2.2), 104p. Manual, Global Ecosystems Monitoring network, http://gem.tropicalforests.ox.ac.uk, 2012.

Méchain, M., Ariane, T., Piponiot, C., Chave, J., and Hérault, B.: Biomass: an R Package for estimating above-ground biomass and its uncertainty in tropical forests, Methods Ecol. Evol., 8, 1163–1167, 10.1111/2041-210X.12753, 2017.

Zanne, A. E., Lopez-Gonzalez, G., Coomes, D. A., Ilic, J., Jansen, S., Lewis, S. L., Miller, R. B., Swenson, N. G., Wiemann, M. C. and Chave, J.: Global wood density database. Dryad Digital Repository, http://datadryad.org/handle/10255/dryad.235, 2009.