Supplement of Earth Syst. Sci. Data, 12, 1295–1320, 2020
https://doi.org/10.5194/essd-12-1295-2020-supplement

Supplement of

The PROFOUND Database for evaluating vegetation models and simulating climate impacts on European forests

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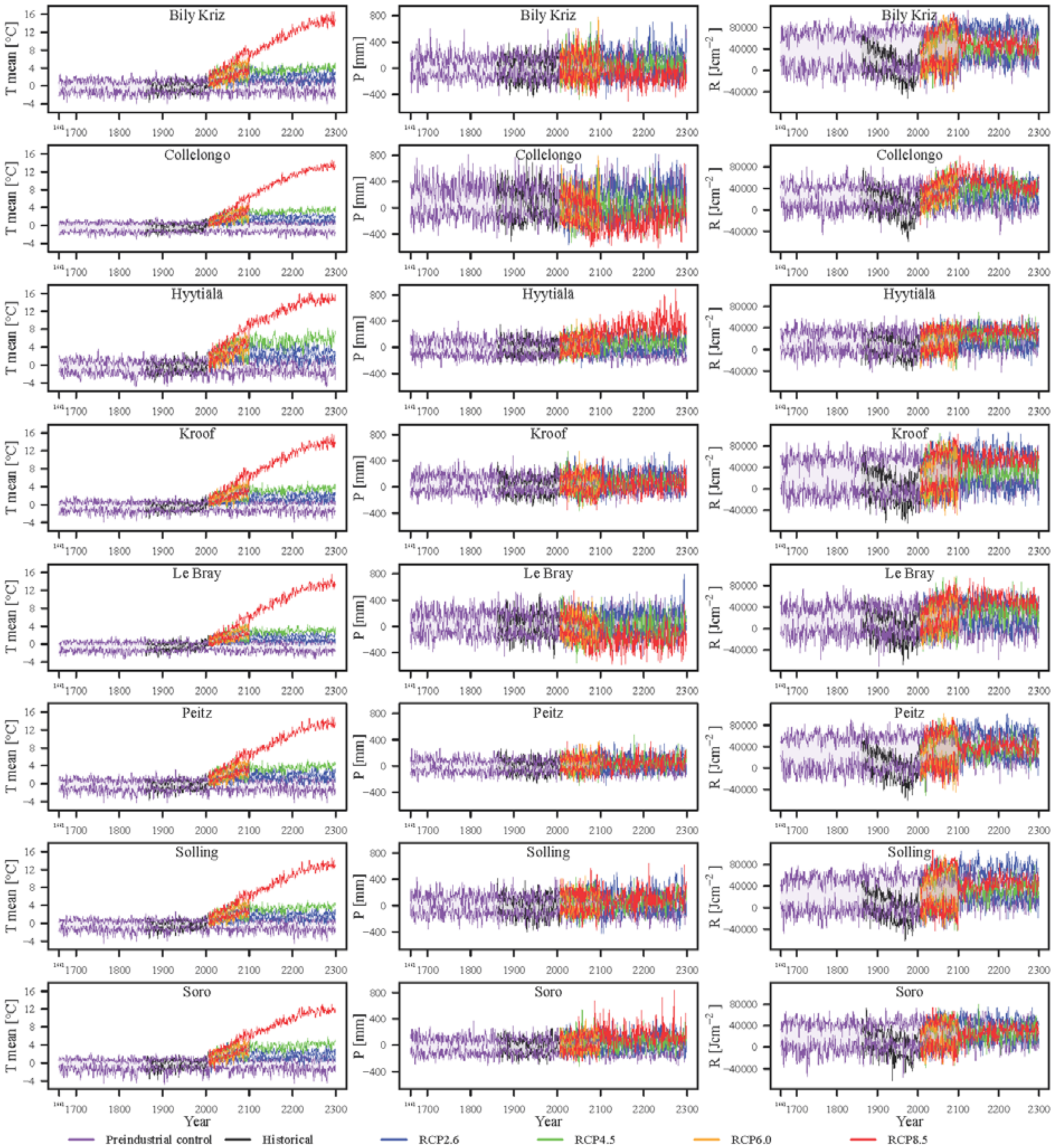

Figure SOM1: Change in mean annual temperature (T mean), annual precipitation sum (P) and annual sum of global radiation (R) over the time period 1661-2299 relative to the 1980-2005 average for the ISIMIP2b scenarios. Please note that the two Solling sites have the same climate.

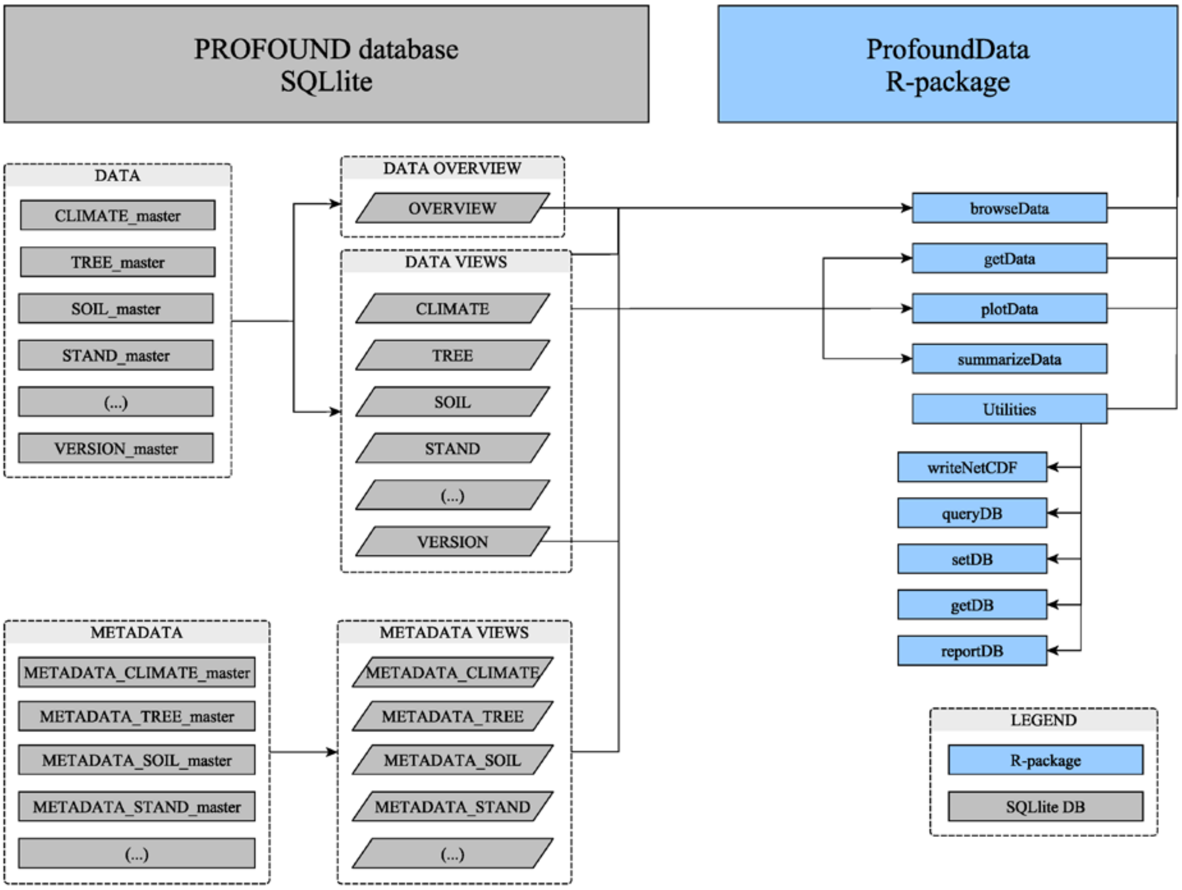

Figure SOM2: The main structure and links between the PROFOUND DB (grey) and the PROFOUNDData R-package (blue).

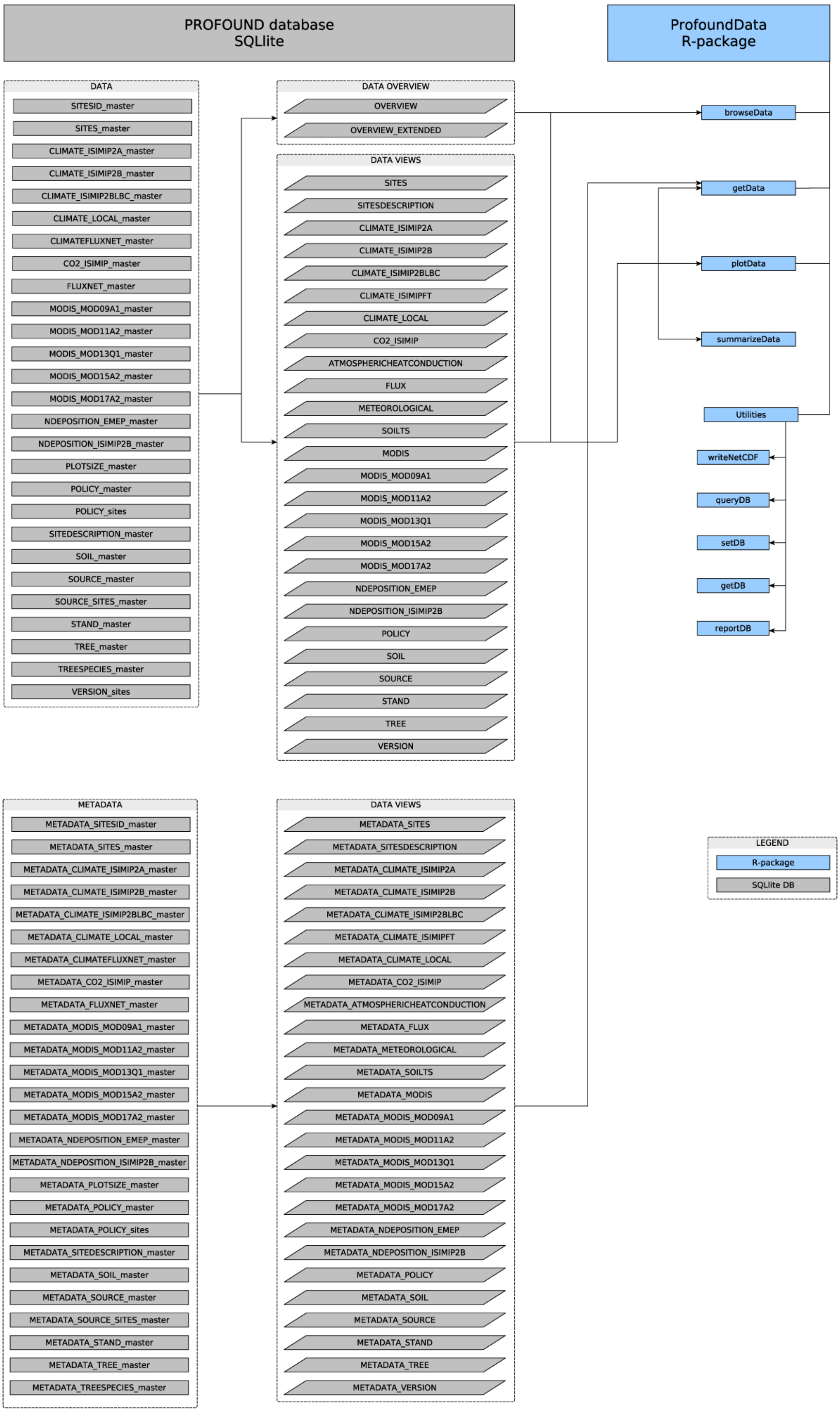

Figure SOM3: The full structure and links between the PROFOUND DB (grey) and the PROFOUNDData R-package (blue).

Table SOM1: Description of SITES variables included in the database.

variable	type	units	description
site	TEXT	adimensional	Site name
site_id	INTEGER	adimensional	Site code as decimal number (01-99)
aspect_deg	REAL	degree	Direction of slope inclination. Degrees against North. No Value indicates no exposition.
country	TEXT	adimensional	Country
elevation_masl	REAL	m	Elevation above sea level as recorded by PI
epsg	INTEGER	adimensional	EPSG Coordinate System
lat	REAL	degree decimal	Latitude
lon	REAL	degree decimal	Longitude
natVegetation_code1	TEXT	adimensional	Code of the vegetation mapping unit group in the\"Map of the Natural Vegetation of Europe". BOHN, U.; GOLLUB, G. & HETTWER, C. (2000) Karte der natuerlichen Vegetation Europas. Massstab 1:2.500.000 Karten und Legende. Teil 1-3.. Bundesamt fuer Naturschutz, Bonn, Germany.
natVegetation_code2	TEXT	adimensional	Code of the vegetation mapping unit in the "Map of the Natural Vegetation of Europe". BOHN, U.; GOLLUB, G. & HETTWER, C. (2000) Karte der natuerlichen Vegetation Europas. Massstab 1:2.500.000 Karten und Legende. Teil 1-3.. Bundesamt fuer Naturschutz, Bonn, Germany.
natVegetation_description	TEXT	adimensional	Description of natVegetation_code2. BOHN, U.; GOLLUB, G. & HETTWER, C. (2000) Karte der natuerlichen Vegetation Europas. Massstab 1:2.500.000 Karten und Legende. Teil 1-3.. Bundesamt fuer Naturschutz, Bonn, Germany.
slope_percent	REAL	percent	Mean slope within the plot

Table SOM2: Description of SOIL variables included in the database.

variable	type	units	description
record_id	INTEGER	adimensional	Record ID as decimal number
site	TEXT	adimensional	Site name
site_id	INTEGER	adimensional	Site code as decimal number (1-99)
date	TEXT	adimensional	Unformatted date of inventory as provided for the inventory. See site specific metadata for further information on date.
bs_percent	REAL	percent	Percentage of alkaline and earth alkaline metals at CEC
cMax_percent	REAL	percent	Maximum soil carbon content
cMin_percent	REAL	percent	Minimum soil carbon content
cOrgSigma_percent	REAL	percent	Soil organic carbon content error estimate as standard deviation
cOrg_gcm3	REAL	g cm-3	Soil organic carbon content
cOrg_percent	REAL	percent	Soil organic carbon content
cSigma_kgm2	REAL	kg m-2	Soil carbon content error estimate as standard deviation
c_kgm2	REAL	kg m-2	Soil carbon content
c_percent	REAL	percent	Soil carbon content
cec_µeqg	REAL	µeq g-1	Soil cation exchange capacity
claySigma_percent	REAL	percent	Soil clay particle content error estimate as standard deviation
clay_percent	REAL	percent	Soil clay particle content
cn	REAL	adimensional	Soil C:N ratio
densitySigma_gcm3	REAL	g cm-3	Soil bulk density content error estimate as standard deviation

density_gcm3	REAL	g cm-3	Soil bulk density
fcapv_percent	REAL	percent	Soil field capacity
fineRoot_percent	REAL	percent	Distribution of fine roots accross soil horizons
gravel_percent	REAL	percent	Soil gravel particle content
horizon	TEXT	adimensional	Name of soil horizon
humus_tCha	REAL	tC ha-1	Humus carbon content
hydCondSat_cmd1	REAL	cm d-1	Soil hydraulic conductivity at saturation
layer_id	INTEGE R	adimensional	Layer code as decimal number (1-99)
lowerDepth_cm	REAL	cm	Lower soil horizon limit
mbCSigma_mgg	REAL	mg C g-1 dry soil	Soil microbial biomass carbon error estimate as standard deviation
mbC_mgg	REAL	mg C g-1 dry soil	Soil microbial biomass carbon
mbNSigma_mgNg	REAL	mg N g-1 dry soil	Soil microbial biomass nitrogen error estimate as standard deviation
mbN_mgNg	REAL	mg N g-1 dry soil	Soil microbial biomass nitrogen
minRSigma_mgkgh	REAL	mg N kg-1 h-1	Soil mineralisation rate error estimate as standard deviation
minR_mgkgh	REAL	mg N kg-1 h-1	Soil mineralisation rate
nMax_percent	REAL	percent	Maximum soil nitrogen content
nMin_percent	REAL	percent	Minimum soil nitrogen content
nOrgSigma_percent	REAL	percent	Soil organic nitrogen content error estimate as standard deviation
nOrg_percent	REAL	percent	Soil organic nitrogen content

n_kgm2	REAL	kg m-2	Soil nitrogen content
n_percent	REAL	percent	Soil nitrogen content
ofhC_percent	REAL	percent	The organic fermentative-humic (Ofh) subhorizon consists of forest litter (leaves, bark, twigs etc) showing considerable decay.
ofhN_percent	REAL	percent	Carbon content in a gram of OFH sample
ofh_gDWm2	REAL	g DW m-2	Litter layer (leaves not decomposed)
ol_gDWm2	REAL	g DW m-2	Nitrogen content in a gram of OFH sample
phSigma_h2o	REAL	adimensional	Soil pH determined with H2O error estimate as standard deviation
phSigma_kcl	REAL	adimensional	Soil pH determined by KCl error estimate as standard deviation
ph_cacl2	REAL	adimensional	Soil pH determined with CaCl2
ph_h2o	REAL	adimensional	Soil pH determined with H2O
ph_kcl	REAL	adimensional	Soil pH deterimed with KCl
porosity_percent	REAL	percent	Soil water content at saturation in the bulk soil
rainGroundWater	REAL	adimensional	Whether the soil is mostly influenced by rain or ground water
sandSigma_percent	REAL	percent	Soil sand particle content error estimate as standard deviation
sand_percent	REAL	percent	Soil sand particle content
siltSigma_percent	REAL	percent	Soil silt particle content error estimate as standard deviation
silt_percent	REAL	percent	Soil silt particle content
table_id	INTEGER	adimensional	Table code as decimal number (1-99)
texture	TEXT	adimensional	Soil texture
thicknesSigma_cm	REAL	cm	Soil thickness error estimate
thickness_cm	REAL	cm	Soil thickness

type_fao	TEXT	adimensional	Soil type after ISSS-ISRIC-FAO (1998) World reference basis for soil resources. World Soil Resources Reports 84. FAO, Rome. 92 p.
type_ka5	TEXT	adimensional	Soil type after AG Boden (2005) Bodenkundliche Kartieranleitung. Bundesanstalt für Geowissenschaften und Rohstoffe, Hannover
upperDepth_cm	REAL	cm	Upper soil horizon limit
whcSigma_mm	REAL	mm	Soil water holding capacity error estimate
whc_mm	REAL	mm	Soil water holding capacity
whcp_percent	REAL	percent	Water holding capacity for plant available water
wiltp_percent	REAL	percent	Soil wilting point

Table SOM3: Description of CLIMATE variables included in the database.

variable	type	units	description
record_id	INTEGER	adimensional	Record ID as decimal number
site	TEXT	adimensional	Site name
site_id	INTEGER	adimensional	Site code as decimal number (01-99)
date	TEXT	adimensional	Date in format YYYY-MM-DD
year	INTEGER	YYYY	Year with century as decimal number (0000-9999)
mo	INTEGER	MM	Month as decimal number (01-12)
day	INTEGER	DD	Day of the month as decimal number (01-31)
airpress_hPa	REAL	hPa	Mean daily air pressure
p_mm	REAL	mm	Total daily precipitation
rad_Jcm2	REAL	J cm-2	Total daily global radiation
relhum_percent	REAL	percent	Mean daily relative humidity
tmax_degC	REAL	degree Celsius	Maximum daily temperature
tmean_degC	REAL	degree Celsius	Mean daily temperature
tmin_degC	REAL	degree Celsius	Minimum daily temperature
wind_ms	REAL	m s-1	Mean daily wind speed

Table SOM4: Description of CLIMATE_ISIMIP additional variables included in the database.

variable	**type**	**units**	**description**
site	TEXT	adimensional	Site name
forcingConditions	TEXT	adimensional	This category refers to the conditions underlying the climatic forcing, e.g. following historical CO_2 time series, preindustrial picontrol runs or representative concentration pathways (rcp).
forcingDataset	TEXT	adimensional	This category refers to data taken from bias-corrected general circulation models (e.g. hadgem) or historical global meteorological forcing data based on bias-corrected reanalysis data (e.g. watch)

Table SOM5: Description of CO2_ISIMIP variables included in the database.

variable	**type**	**units**	**description**
record_id	INTEGER	adimensional	Record ID as decimal number
site	TEXT	adimensional	Site name
site_id	INTEGER	adimensional	Site code as decimal number (01-99)
forcingConditions	TEXT	adimensional	This category refers to the conditions underlying the climatic forcing, e.g. following historical CO2 time series or representative concentration pathways (rcp).
year	INTEGER	YYYY	Year with century as decimal number (0000-9999)
co2_ppm	REAL	ppm	CO2 mean global concentrations for the different different forcing conditions: RCP and historical values (1975-2013)

Table SOM6: Description of NDEPOSITION and NDEPOSITION_ISIMIP2B variables included in the database.

variable	**type**	**units**	**description**
record_id	INTEGER	adimensional	Record ID as decimal number
site	TEXT	adimensional	Name of the site
site_id	INTEGER	adimensional	Site code as decimal number (01-99)
year	INTEGER	YYYY	Year with century as decimal number (0000-9999)
nhx_gm2	REAL	g m-2	Total deposition of reduced nitrogen (Dry+Wet RdN)
noy_gm2	REAL	g m-2	Total deposition of oxidized nitrogen (Dry+Wet oxN)
forcingConditions	TEXT	adimensional	This category refers to the conditions underlying the climatic forcing, e.g. following historical CO2 time series, preindustrial picontrol runs or representative concentration pathways (rcp).

Table SOM7: Description of TREE variables included in the database.

variable	**type**	**units**	**description**
record_id	INTEGER	adimensional	Record ID as decimal number
site	TEXT	adimensional	Site name
site_id	INTEGER	adimensional	Site code as decimal number (01-99)
species	TEXT	adimensional	Species name
species_id	TEXT	adimensional	Species text code
year	INTEGER	YYYY	Year with century as decimal number (0000-9999)
dbh1_cm	REAL	cm	Diameter at breast height
height1_m	REAL	m	Tree height
size_m2	REAL	m2	Plot size

Table SOM8: Description of STAND variables included in the database.

variable	type	units	description
record_id	INTEGER	adimensional	Record ID as decimal number
site	TEXT	adimensional	Site name
site_id	INTEGER	adimensional	Site code as decimal number (01-99)
species	TEXT	adimensional	Species name
species_id	TEXT	adimensional	Species text code
year	INTEGER	YYYY	Year with century as decimal number (0000-9999)
aboveGroundBiomass_kgha	REAL	kg ha-1	Above ground biomass
age	INTEGER	years	Mean stand age
ba_m2ha	REAL	m2 ha-1	Basal area per hectare
branchesBiomass_kgha	REAL	kg ha-1	Branches biomass
dbhArith_cm	REAL	cm	Arithmetic mean diameter
dbhBA_cm	REAL	cm	Average diameter weighted by basal area calculated as dbhBA = (ba1*dbh1 + ba2*dbh2 + ... + bak*dbhk) / (ba1 + ba2+ ... + bak), where bai and dbhi are the basal area and dbh, respectively, of the tree i, and i = 1, 2, . . . , k
dbhDQ_cm	REAL	cm	Mean squared diameter or quadratic mean diameter calculated as dbhDQ = sqrt((dbh1^2 + dbh2^2+ ... + dbhk^2) / N), where dbhi is the diameter at breat height of tree i, i = 1, 2, . . . , k, N is the total number of trees, and sqrt is the square root
density_treeha	REAL	tree ha-1	Number of tree per ha
foliageBiomass_kgha	REAL	kg ha-1	Foliage biomass

heightArith_m	REAL	m	Arithmetic mean height
heightBA_m	REAL	m	Average height weighted by basal area or Loreys height calculated as heightBA = (ba1*h1 + ba2*h2 + ... + bak*hk) / (ba1 + ba2+ ... + bak), where bai and hi are the basal area and height, respectively, of the tree i, and i = 1, 2, . . . , k
lai	REAL	adimensional	Leaf Area Index
rootBiomass_kgha	REAL	kg ha-1	Root biomass
stemBiomass_kgha	REAL	kg ha-1	Stem biomass
stumpCoarseRootBiomass_kgha	REAL	kg ha-1	Stump and coarse roots biomass

Table SOM9: Description of FLUX variables included in the database.

variable	**type**	**units**	**description**
record_id	INTEGER	adimensional	Record ID as decimal number
site_id	INTEGER	adimensional	Site code as decimal number (01-99)
date	TEXT	adimensional	Date in format YYYY-MM-DD hh:mm:ss. Derived from TIMESTAMP_START
year	INTEGER	YYYY	Year with century as decimal number (0000-9999). Derived from TIMESTAMP_START
mo	INTEGER	MM	Month as decimal number (01-12). Derived from TIMESTAMP_START
day	INTEGER	DD	Day of the month as decimal number (01-31). Derived from TIMESTAMP_START
gppDtCutRef_umolCO2m2s1	REAL	umolCO2 m-2 s-1	Gross Primary Production, from Daytime partitioning method, reference selected from GPP versions using a model efficiency approach. Based on corresponding NEE_CUT_XX version
gppDtCutSe_umolCO2m2s1	REAL	umolCO2 m-2 s-1	Standard Error for Gross Primary Production, calculated as stdev(gppDtCut_XX) / sqrt(40). SE from 40 half-hourly gppDtCut_XX
gppDtVutRef_umolCO2m2s1	REAL	umolCO2 m-2 s-1	Gross Primary Production, from Daytime partitioning method, reference version selected from GPP versions using a model efficiency approach. Based on corresponding neeVut_XX version
gppDtVutSe_umolCO2m2s1	REAL	umolCO2 m-2 s-1	Standard Error for Gross Primary Production, calculated as stdev(gppDtVut_XX) / sqrt(40. SE from 40 half-hourly gppDtVut_XX
gppNtCutRef_umolCO2m2s1	REAL	umolCO2 m-2 s-1	Gross Primary Production, from Nighttime partitioning method, reference selected from GPP versions using a model efficiency approach. Based on corresponding NEE_CUT_XX version
gppNtCutSe_umolCO2m2s1	REAL	umolCO2 m-2 s-1	Standard Error for Gross Primary Production, calculated as stdev(gppNtCut_XX) / sqrt(40). SE from 40 half-hourly gppNtCut_XX
gppNtVutRef_umolCO2m2s1	REAL	umolCO2 m-2 s-1	Gross Primary Production, from Nighttime partitioning method, reference version selected from GPP versions using a model efficiency approach. Based on corresponding neeVut_XX version

gppNtVutSe_umolCO2m2s1	REAL	umolCO2 m-2 s-1	Standard Error for Gross Primary Production, calculated as (stdev(gppNtVut_XX) / sqrt(40)). SE from 40 half-hourly gppNtVut_XX
neeCutRefJointunc_umolCO2m2s1	REAL	umolCO2 m-2 s-1	Joint uncertainty estimation for neeCutRef, including random uncertainty and USTAR filtering uncertainty [sqrt(neeCutRef_RANDUNC^2 + ((NEE_CUT_84 - NEE_CUT_16) / 2)^2)] for each half-hour
neeCutRef_qc	INTEGER	adimensional	Quality flag for neeCutRef. 0 = measured; 1 = good quality gapfill; 2 = medium; 3 = poor.
neeCutRef_umolCO2m2s1	REAL	umolCO2 m-2 s-1	Net Ecosystem Exchange, using Constant Ustar Threshold (CUT) across years, reference selected on the basis of the model efficiency
neeVutRefJointunc_umolCO2m2s1	REAL	umolCO2 m-2 s-1	Joint uncertainty estimation for neeVutRef, including random uncertainty and USTAR filtering uncertainty [sqrt(neeVutRef_RANDUNC^2 + ((neeVut_84 - neeVut_16) / 2)^2)] for each half-hour
neeVutRef_qc	INTEGER	adimensional	Quality flag for neeVutRef. 0 = measured; 1 = good quality gapfill; 2 = medium; 3 = poor.
neeVutRef_umolCO2m2s1	REAL	umolCO2 m-2 s-1	Net Ecosystem Exchange, using Variable Ustar Threshold (VUT) for each year, reference selected on the basis of the model efficiency
recoDtCutRef_umolCO2m2s1	REAL	umolCO2 m-2 s-1	Ecosystem Respiration, from Daytime partitioning method, reference selected from RECO versions using a model efficiency approach. Based on corresponding NEE_CUT_XX version
recoDtCutSe_umolCO2m2s1	REAL	umolCO2 m-2 s-1	Standard Error for Ecosystem Respiration, calculated as stdev(recoDtCut_XX) / sqrt(40). SE from 40 half-hourly recoDtCut_XX
recoDtVutRef_umolCO2m2s1	REAL	umolCO2 m-2 s-1	Ecosystem Respiration, from Daytime partitioning method, reference selected from RECO versions using a model efficiency approach. Based on corresponding neeVut_XX version
recoDtVutSe_umolCO2m2s1	REAL	umolCO2 m-2 s-1	Standard Error for Ecosystem Respiration, calculated as stdev(recoDtVut_XX) / sqrt(40). SE from 40 half-hourly recoDtCut_XX
recoNtCutRef_umolCO2m2s1	REAL	umolCO2 m-2 s-1	Ecosystem Respiration, from Nighttime partitioning method, reference selected from RECO versions using a model efficiency approach. Based on corresponding NEE_CUT_XX version
recoNtCutSe_umolCO2m2s1	REAL	umolCO2 m-2 s-1	Standard Error for Ecosystem Respiration, calculated as stdev(recoNtCut_XX) / sqrt(40. SE from 40 half-hourly recoNtCut_XX

recoNtVutRef_umolCO2m2s1	REAL	umolCO2 m-2 s-1	Ecosystem Respiration, from Nighttime partitioning method, reference selected from RECO versions using a model efficiency approach. Based on corresponding neeVut_XX version
recoNtVutSe_umolCO2m2s1	REAL	umolCO2 m-2 s-1	Standard Error for Ecosystem Respiration, calculated as stdev(recoNtVut_XX) / sqrt(40. SE from 40 half-hourly recoNtCut_XX
timestampEnd	TEXT	YYYYMMDDHHMM	ISO timestamp end of averaging period - short format
timestampStart	TEXT	YYYYMMDDHHMM	ISO timestamp start of averaging period - short format

Table SOM10: Description of MODIS variables included in the database.

variable	type	units	description	comments	source
record_id	INTEGER	adimensional	Record ID as decimal number		
site	TEXT	adimensional	Site name		
site_id	INTEGER	adimensional	Site code as decimal number (01-99)		
date	TEXT	adimensional	Date in format YYYY-MM-DD		
year	INTEGER	YYYY	Year with century as decimal number (0000-9999)		
mo	INTEGER	MM	Month as decimal number (01-12)		
day	INTEGER	DD	Day of the month as decimal number (01-31)		
aB01_rad	REAL	radian	Angle in red. Spatial resolution: 0.5 km. Temporal resolution: 8-day composite.	Calculated from MOD09A1 after Khanna, S., A. Palacios-Orueta, M. L. Whiting, S. L. Ustin, D. R. no, and J. Litago, 2007. Development of angle indexes for soil moisture estimation, dry matter detection and land-cover discrimination. Remote Sensing of Environment 109:154 – 165. Note: The observations with values larger than (average + 1standard deviation) or smaller than (average – 1standard deviation) in a window size of 5 observations have been filtered and substituted with the average value of the window.	MOD09A1
aB02_rad	REAL	radian	Angle in near infrared. Calculated with MOD09A1. Spatial resolution 0.5 km	Calculated from MOD09A1 after Palacios-Orueta, A., M. Huesca, M. L. Whiting, J. Litago, S. Khanna, M. Garcia, and S. L. Ustin, 2012. Derivation of phenological metrics by function fitting to time-series of spectral shape indexes AS1 and AS2: Mapping cotton phenological stages using modis time series.	MOD09A1

				Remote Sensing of Environment 12:148–159. Note: The observations with values larger than (average + 1standard deviation) or smaller than (average – 1standard deviation) in a window size of 5 observations have been filtered and substituted with the average value of the window.	
aB05_rad	REAL	radian	Angle in SWIR 1.Spatial resolution: 0.5 km. Temporal resolution: 8-day composite.	Calculated from MOD09A1 after Palacios-Orueta, A., M. Huesca, M. L. Whiting, J. Litago, S. Khanna, M. Garcia, and S. L. Ustin, 2012. Derivation of phenological metrics by function fitting to time-series of spectral shape indexes AS1 and AS2: Mapping cotton phenological stages using modis time series. Remote Sensing of Environment 12:148–159. Note: The observations with values larger than (average + 1standard deviation) or smaller than (average – 1standard deviation) in a window size of 5 observations have been filtered and substituted with the average value of the window.	MOD09A1
aB06_rad	REAL	radian	Angle in SWIR 2. Spatial resolution: 0.5 km. Temporal resolution: 8-day composite.	Calculated from MOD09A1 after Palacios-Orueta, A., M. Huesca, M. L. Whiting, J. Litago, S. Khanna, M. Garcia, and S. L. Ustin, 2012. Derivation of phenological metrics by function fitting to time-series of spectral shape indexes AS1 and AS2: Mapping cotton phenological stages using modis time series. Remote Sensing of Environment 12:148–159. Note: The observations with values larger than (average + 1standard deviation) or smaller than (average – 1standard deviation)	MOD09A1

				in a window size of 5 observations have been filtered and substituted with the average value of the window.	
evi16	REAL	adimensional	Enhanced Vegetation Index. Valid range: -0.2 - 1. Fill value: NA. Spatial resolution: 250 meters. Temporal resolution: 16-day composite.	Data are provided every 16 days at 250-meter spatial resolution. Each value corresponds to the best observation during a 16 day period.	MOD13Q1
evi16_qc	REAL	adimensional	Indicates the level of the product quality that is classified as follows: 0 = good quality, index produced; 2 = other quality, index produced, but check other qc and index produced, but most probably cloudy; 3 = index not produced due to other reasons than cloud, thus fill values were substituted by an interpolated values when the previous and the following values were available index = (indext-1 + indext+1)/2.		MOD13Q1
evi8	REAL	adimensional	Enhance Vegetation Index. Spatial resolution: 0.5 km. Temporal resolution: 8-day composite		MOD09A1
fpar	REAL	adimensional	Proportion of available radiation in the photosynthetically active wavelengths. Valid range: 0 - 1. Fill value: NA. Spatial resolution: 1 km. Temporal resolution: 8-day composite.		MOD15A2
fpar_qc	INTEGER	adimensional	Indicates the level of the product quality that is classified as follows: 0 = Good quality (main algorithm with or without saturation); 2 = Other quality (back-up algorithm or fill values)		MOD15A2
gpp_gCm2d	REAL	gC m-2 d-1	Gross Primary Production. Valid range: -375 – 375. Fill value: NA. Spatial resolution 1 km. Temporal resolution: 8-day accumulation.	This has been calculated by dividing each 8-day values by 8 for the first 45 values/year and by 5 or 6 for the final period.	MOD17A2
gpp_qc	INTEGER	adimensional	Indicates the level of the product quality that is classified as follows: 0 = good quality, the estimates were done using the main algorithm		MOD17A2

			with or without saturation; 2 = other quality, the estimates were done using back-up algorithm.		
lai	REAL	adimensional	Leaf area index. Valid range: 0 - 10. Fill value: NA. Spatial resolution: 1 km. Temporal resolution: 8-day composite.		MOD15A2
lai_qc	INTEGER	adimensional	Indicates the level of the product quality that is classified as follows: 0 = Good quality (main algorithm with or without saturation); 2 = Other quality (back-up algorithm or fill values)		MOD15A2
lstDay_degK	REAL	degree Kelvin	Daytime land surface temperature. Valid range: 150 – 1310.7. Fill value: NA. Spatial resolution: 1 km. Temporal resolution: 8-day composite.	The level-3 MODIS global Land Surface Temperature (LST) and Emissivity 8-day data are composed from the daily 1-kilometer LST product (MOD11A1) the average values of clear-sky LSTs during an 8-day period. In this data set the daytime and nighttime LSTs, are provided. Products are validated to Stage 2, which means that their accuracy has been assessed over a widely distributed set of locations and time periods via several ground-truth and validation efforts.	MOD11A2
lstDay_qc	INTEGER	adimensional	Indicates the level of quality of the product that is classified as follows: 0 = good quality; 2 = other quality; 3 = interpolated, 4 = pixel not produced (NA)		MOD11A2
lstNight_degK	REAL	degree Kelvin	Nighttime land surface temperature. Valid range: 150 – 1310.7. Fill value: NA. Spatial resolution: 1 km. Temporal resolution: 8-day composite.	The level-3 MODIS global Land Surface Temperature (LST) and Emissivity 8-day data are composed from the daily 1-kilometer LST product (MOD11A1) the average values of clear-sky LSTs during an 8-day period. In this data set the daytime and nighttime LSTs, are provided. Products are validated to Stage 2,	MOD11A2

				which means that their accuracy has been assessed over a widely distributed set of locations and time periods via several ground-truth and validation efforts.	
lstNight_qc	INTEGER	adimensional	Indicates the level of quality of the product that is classified as follows: 0 = good quality; 2 = other quality; 3 = interpolated, 4 = pixel not produced (NA)		MOD11A2
ndvi16	REAL	adimensional	Normalized Difference Vegetation Index. Valid range: -0.2 - 1. Fill value: NA. Spatial resolution: 250 meters. Temporal resolution: 16-day composite.	Data are provided every 16 days at 250-meter spatial resolution. Each value corresponds to the best observation during a 16 day period.	MOD13Q1
ndvi16_qc	REAL	adimensional	Indicates the level of the product quality that is classified as follows: 0 = good quality, index produced; 2 = other quality, index produced, but check other qc and index produced, but most probably cloudy; 3 = index not produced due to other reasons than cloud, thus fill values were substituted by an interpolated values when the previous and the following values were available index = (indext-1 + indext+1)/2.		MOD13Q1
ndvi8	REAL	adimensional	Normalized Difference Vegetation Index. Spatial resolution: 0.5 km. Temporal resolution: 8-day composite	Calculated from MOD09A1 after Tucker, C.J., 1979. Red and photographic infrared linear combinations for monitoring vegetation. Remote Sensing of Environment. 8, 127–150. Note: The observations with values larger than (average + 1standard deviation) or smaller than (average – 1standard deviation) in a window size of 5 observations have been filtered and substituted with the average value of the window.	MOD09A1

ndwi	REAL	adimensional	Normalized Difference Water Index. Spatial resolution: 0.5 km. Temporal resolution: 8-day composite	Calculated from MOD09A1 after Gao, B., 1996. NDWI—a normalized difference water index for remote sensing of vegetation liquid water from space. Remote Sensing of Environment. 58, 257–266. Note: The observations with values larger than (average + 1standard deviation) or smaller than (average – 1standard deviation) in a window size of 5 observations have been filtered and substituted with the average value of the window.	MOD09A1
psNet_gCm2d	REAL	gC m-2 d-1	Net Photosynthesis (GPP – maintenance respiration). Valid range: -375 – 375. Fill value: NA. Spatial resolution 1 km. Temporal resolution: 8-day accumulation.	This has been calculated by dividing each 8-day values by 8 for the first 45 values/year and by 5 or 6 for the final period.	MOD17A2
psNet_qc	INTEGER	adimensional	Indicates the level of the product quality that is classified as follows: 0 = good quality, the estimates were done using the main algorithm with or without saturation; 2 = other quality, the estimates were done using back-up algorithm.		MOD17A2
refl_qc	INTEGER	adimensional	Indicates the level of quality correction of the product (the seven bands) that is classified as follows: 0 = Highest quality, corrected product produced at ideal quality all bands; 2 = corrected product produced at less than ideal quality some or all bands, some bands could not be completely correct; 3 = interpolated, when corrected product has not been produced in one or some bands and they have been interpolated with the value Rt = (Rt-1 + Rt+1)/2; 4 = corrected product not produced, when product has not been completely corrected in one or some bands		MOD09A1

			and could not be interpolated. Data may be wrong or filled with NA; 5 = Missing data, indicates that the product was not available for that date. Some of them correspond to specific continuous periods. All the columns filled with NA.		
reflB01_percent	REAL	percent reflectance	Surface Reflectance Band 1 (620–670 nm) Red. Fill value: NA. Spatial resolution: 0.5 km. Temporal resolution: 8-day composite.		MOD09A1
reflB02_percent	REAL	percent reflectance	Surface Reflectance Band 2 (841–876 nm) NIR. Fill value: NA. Spatial resolution: 0.5 km. Temporal resolution: 8-day composite.		MOD09A1
reflB03_percent	REAL	percent reflectance	Surface Reflectance Band 3 (459–479 nm) Blue. Fill value: NA. Spatial resolution: 0.5 km. Temporal resolution: 8-day composite.		MOD09A1
reflB04_percent	REAL	percent reflectance	Surface Reflectance Band 4 (545–565 nm) Green. Fill value: NA. Spatial resolution: 0.5 km. Temporal resolution: 8-day composite.		MOD09A1
reflB05_percent	REAL	percent reflectance	Surface Reflectance Band 5 (1230–1250 nm) SWIR1. Fill value: NA. Spatial resolution: 0.5 km. Temporal resolution: 8-day composite.		MOD09A1
reflB06_percent	REAL	percent reflectance	Surface Reflectance Band 6 (1628–1652 nm) SWIR2. Fill value: NA. Spatial resolution: 0.5 km. Temporal resolution: 8-day composite.		MOD09A1
reflB07_percent	REAL	percent reflectance	Surface Reflectance Band 7 (2105–2155 nm) SWIR3. Fill value: NA. Spatial resolution: 0.5 km. Temporal resolution: 8-day composite.		MOD09A1
sani_rad	REAL	radian	Shortwave Angle Normalized Index. Valid range: -3.14 - 3.14. Spatial resolution: 0.5 km. Temporal resolution: 8-day composite.	Calculated from MOD09A1 after Palacios-Orueta, A., Khanna, S., Litago, J., Whiting, M.L., Ustin, S.L., 2006. Assessment of NDVI	MOD09A1

				and NDWI spectral indices using MODIS time series analysis and development of a new spectral index based on MODIS shortwave infrared bands. 1st International Conference on Remote Sensing and Geoinformation Processing in the Assessment and Monitoring of Land Degradation and Desertification, Trier, Germany, pp. 207–209. Note: The observations with values larger than (average + 1standard deviation) or smaller than (average – 1standard deviation) in a window size of 5 observations have been filtered and substituted with the average value of the window.	
sasi_rad	REAL	radian	Shortwave Angle Slope Index. Spatial resolution: 0.5 km. Temporal resolution: 8-day composite	Calculated from MOD09A1 after Khanna, S., A. Palacios-Orueta, M. L. Whiting, S. L. Ustin, D. R. no, and J. Litago, 2007. Development of angle indexes for soil moisture estimation, dry matter detection and land-cover discrimination. Remote Sensing of Environment 109:154 – 165. Note: The observations with values larger than (average + 1standard deviation) or smaller than (average – 1standard deviation) in a window size of 5 observations have been filtered and substituted with the average value of the window.	MOD09A1

Table SOM11: Description of CLIMATE_LOCAL quality variables from FLUXNET included in the database.

variable	type	units	description
site	TEXT	adimensional	Site name
airpress_qc	REAL	adimensional	fraction between 0-1; indicating percentage of measured and good quality gapfill half-hourly data used to create the daily value
p_qc	REAL	adimensional	fraction between 0-1; indicating percentage of measured and good quality gapfill half-hourly data used to create the daily value
rad_qc	REAL	adimensional	fraction between 0-1; indicating percentage of measured and good quality gapfill half-hourly data used to create the daily value
relhum_qc	REAL	adimensional	fraction between 0-1; indicating percentage of measured and good quality gapfill half-hourly data used to create the daily value
tmax_qc	REAL	adimensional	fraction between 0-1; indicating percentage of measured and good quality gapfill half-hourly data used to create the daily value
tmean_qc	REAL	adimensional	fraction between 0-1; indicating percentage of measured and good quality gapfill half-hourly data used to create the daily value
tmin_qc	REAL	adimensional	fraction between 0-1; indicating percentage of measured and good quality gapfill half-hourly data used to create the daily value
wind_qc	REAL	adimensional	fraction between 0-1; indicating percentage of measured and good quality gapfill half-hourly data used to create the daily value

Table SOM12: Description of ATMOSPHERIC_HEAT_CONDUCTANCE variables included in the database.

variable	type	units	description
record_id	INTEGER	adimensional	Record ID as decimal number
site_id	INTEGER	adimensional	Site code as decimal number (01-99)
date	TEXT	adimensional	Date in format YYYY-MM-DD hh:mm:ss. Derived from TIMESTAMP_START
year	INTEGER	YYYY	Year with century as decimal number (0000-9999). Derived from TIMESTAMP_START
mo	INTEGER	MM	Month as decimal number (01-12). Derived from TIMESTAMP_START
day	INTEGER	DD	Day of the month as decimal number (01-31). Derived from TIMESTAMP_START
hCORRJOINTUNC_Wm2	REAL	W m-2	Joint uncertainty estimation for h as sqrt(hRANDUNC^2 + ((hCORR75 - hCORR25) / 1.349)^2)
hCORR_Wm2	REAL	W m-2	Sensible heat flux, corrected hFMDS by energy balance closure correction factor
hFMDS_Wm2	REAL	W m-2	Sensible heat flux, gapfilled using MDS method
hFMDS_qc	INTEGER	adimensional	Quality flag for hCORR. 0 = measured; 1 = good quality gapfill; 2 = medium; 3 = poor.
leCORRJOINTUNC_Wm2	REAL	W m-2	Joint uncertainty estimation for le
leCORR_Wm2	REAL	W m-2	Latent heat flux, corrected le_FMDS by energy balance closure correction factor
leFMDS_Wm2	REAL	W m-2	Latent heat flux, gapfilled using MDS method
leFMDS_qc	INTEGER	adimensional	Quality flag for leCORR. 0 = measured; 1 = good quality gapfill; 2 = medium; 3 = poor.
timestampEnd	TEXT	YYYYMMDDHHMM	ISO timestamp end of averaging period - short format

timestampStart	TEXT	YYYYMMDDHHMM	ISO timestamp start of averaging period - short format

Table SOM13: Description of SOILTS variables included in the database.

variable	type	units	description
record_id	INTEGER	adimensional	Record ID as decimal number
site_id	INTEGER	adimensional	Site code as decimal number (01-99)
date	TEXT	adimensional	Date in format YYYY-MM-DD hh:mm:ss. Derived from TIMESTAMP_START
year	INTEGER	YYYY	Year with century as decimal number (0000-9999). Derived from TIMESTAMP_START
mo	INTEGER	MM	Month as decimal number (01-12). Derived from TIMESTAMP_START
day	INTEGER	DD	Day of the month as decimal number (01-31). Derived from TIMESTAMP_START
timestampEnd	TEXT	YYYYMMDDHHMM	ISO timestamp end of averaging period - short format
timestampStart	TEXT	YYYYMMDDHHMM	ISO timestamp start of averaging period - short format
swcFMDS1_degC	REAL	percent	Soil water content, gapfilled with MDS (numeric index \"#\" increases with the depth, 1 is shallowest)
swcFMDS1_qc	INTEGER	adimensional	Quality flag for tsFMDS#. 0 = measured; 1 = good quality gapfill; 2 = medium; 3 = poor.
swcFMDS2_degC	REAL	percent	Soil water content, gapfilled with MDS (numeric index \"#\" increases with the depth, 1 is shallowest)
swcFMDS2_qc	INTEGER	adimensional	Quality flag for tsFMDS#. 0 = measured; 1 = good quality gapfill; 2 = medium; 3 = poor.
swcFMDS3_degC	REAL	percent	Soil water content, gapfilled with MDS (numeric index \"#\" increases with the depth, 1 is shallowest)
swcFMDS3_qc	INTEGER	adimensional	Quality flag for tsFMDS#. 0 = measured; 1 = good quality gapfill; 2 = medium; 3 = poor.
swcFMDS4_degC	REAL	percent	Soil water content, gapfilled with MDS (numeric index \"#\" increases with the depth, 1 is shallowest)
swcFMDS4_qc	INTEGER	adimensional	Quality flag for tsFMDS#. 0 = measured; 1 = good quality gapfill; 2 = medium; 3 = poor.
swcFMDS5_degC	REAL	percent	Soil water content, gapfilled with MDS (numeric index \"#\" increases with the depth, 1 is shallowest)

swcFMDS5_qc	INTEGER	adimensional	Quality flag for tsFMDS#. 0 = measured; 1 = good quality gapfill; 2 = medium; 3 = poor.
tsFMDS1_degC	REAL	degree Celsius	Soil temperature, gapfilled with MDS (numeric index \"#\" increases with the depth, 1 is shallowest)
tsFMDS1_qc	INTEGER	adimensional	Quality flag for tsFMDS#. 0 = measured; 1 = good quality gapfill; 2 = medium; 3 = poor.
tsFMDS2_degC	REAL	degree Celsius	Soil temperature, gapfilled with MDS (numeric index \"#\" increases with the depth, 1 is shallowest)
tsFMDS2_qc	INTEGER	adimensional	Quality flag for tsFMDS#. 0 = measured; 1 = good quality gapfill; 2 = medium; 3 = poor.
tsFMDS3_degC	REAL	degree Celsius	Soil temperature, gapfilled with MDS (numeric index \"#\" increases with the depth, 1 is shallowest)
tsFMDS3_qc	INTEGER	adimensional	Quality flag for tsFMDS#. 0 = measured; 1 = good quality gapfill; 2 = medium; 3 = poor.
tsFMDS4_degC	REAL	degree Celsius	Soil temperature, gapfilled with MDS (numeric index \"#\" increases with the depth, 1 is shallowest)
tsFMDS4_qc	INTEGER	adimensional	Quality flag for tsFMDS#. 0 = measured; 1 = good quality gapfill; 2 = medium; 3 = poor.
tsFMDS5_degC	REAL	degree Celsius	Soil temperature, gapfilled with MDS (numeric index \"#\" increases with the depth, 1 is shallowest)
tsFMDS5_qc	INTEGER	adimensional	Quality flag for tsFMDS#. 0 = measured; 1 = good quality gapfill; 2 = medium; 3 = poor.

Text SOM 1 Reconstruction of the stand development at Sorø (SOR-DK)

The objective of this section is to describe how we reconstructed the stand development from the available data (Table SOM14), where exact data on thinning were not available. Therefore, we used the yield table to fill the missing information assuming that management at the site was following the general recommendations for this site (Møller 1933). Because of considerable differences in tree densities, we needed to scale the management cycle of Møller (1933) to the empirical data from our stand. We used mainly Møller's thinning schedule, i.e. at which age the stand was usually thinned. For this we reconstructed the stand backward, i.e. starting at 288 trees ha^{-1} at age 90 yr in 2010 until 1921. This tree density (*r*), i.e. numbers of trees per ha, was increased in years when the schedule (*S*) is one, i.e. forcing a thinning event. The degree of thinning is described by the two right hand side terms as a root function depending on the tree density itself. This procedure forced the fitting procedure to stay closely to the measured data at the end of the stand development. The fitted values for the empirical parameters *a* and *c* were 0.047 ± 0.012 (p=0.0045 **) and -1.26 ±0.107 (p=2.44E-6 ***), respectively. The results are displayed in Figure SOM2. Comparison with data after Møller's yield table shows that the reduction of tree density started earlier at Sorø than in the normal stand development. One probable reason for this is that the beech forest at Sorø might have been initiated underneath a canopy of a few remaining old beech trees. This could have fostered more intensive self-thinning than under normal conditions. On the other hand, the assumed initial number of beech trees of 6000 per ha, might be an overestimation given the numbers in 1933, that have been meticulously measured. The tree density values in the first 20 years are very uncertain. On the other hand, we are confident that the thinning scheme of Møller has been adopted by the Danish forestry management at least over a large part of the stand lifetime.

Table SOM14: New version on Management Information available

Year/Periods	**Tree density [ha^{-1}]**	**Source**	**Method**
1921-1930	6000	Møller (1933) + Th Kaspersens notes (assumed)	from yield table + notes from forester
1933	3550	from Munds Målebog	assumed measured in 468 m^2
1944	968	Taksationsbog	From volume and average DBH and height
1977	384	Estimated by Sorø Akademi	from yield table

1992	369	Estimated by Sorø Akademi	from yield table
1995	361	Estimated by Sorø Akademi	from yield table
2005 (03. 2006)	326.3	DTU measurements (P87)	measured
2007	288	DTU measurements (P87)	Measured
2014	199	DTU measurements (P87)	Measured
2017	199	DTU measurements (P87)	Measured

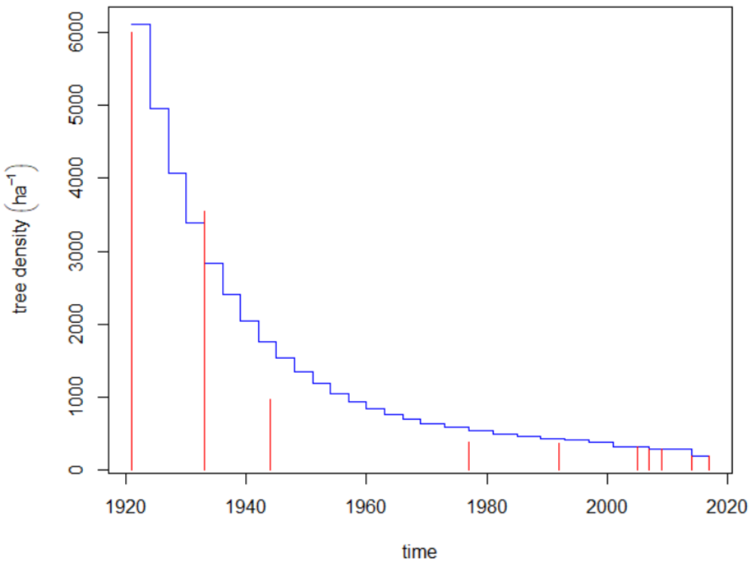

Figure SOM2. Reconstruction of the tree density at Sorø, division 335. During the years from 1921 to, at least, 1944 there was a canopy of old trees. The blue step function is the reconstructed series using the thinning intervals as in Møller (1933) and thinning intensities that match the observations best (red bars, see Table SOM14).

Thinning

Unfortunately thinning of the trees is not anymore documented. Anders Grube, the current forest manager, explained the rule for thinning, which will be applied from now (= 2007 +) on, is thinning interval = tree age / 10 in years. This rule of thumb indicates a slight change from Møller's suggestion, i.e. thinning every 5 years at this stand age. Only a very few examples on how much wood volume was actually thinned can be found. In one example, 2007, thinning was performed in division 336 (planted in 1941, i.e. 66 years) the standing stock was 999 m^3 and he removed 40 m^3, which is 999/4.11 = 243 m^3 ha^{-1} and 40/4.11 = 10 m^3 ha^{-1} for standing stock and harvested wood, respectively. This means for this particular site, a relative extraction of 4 %. This is smaller than Møller's suggestion (ca. 11 %, for this age, Møller (1933)). Measurements of tree growth as part of contemporary forest planning (by Klaus Wunsch (KW-plan, c/o) are only performed on some divisions, none of them in the footprint of the tower. For this reason, we decided to use the available data from the forest owner, Sorø Akademi (Table SOM14), and use yield table information and tree rings to reconstruct thinning events and the stand development. We concentrate on division 335 where the inventory, ecological and meteorological measurements have been taken. With this approach it is not possible to reconstruct the exact thinning activity in a certain year, but instead the general forest development is being reconstructed. The thinning events are only accurate within a 3-5 years period.

Tree-ring data

In addition to estimating tree density through time, we collected tree-ring data from within the flux-tower footprint in Sorø to reconstruct the growth of individual trees and the stand at annual resolution. This was done in two separate sampling campaigns conducted in 2009 and 2017, which were subsequently merged into one homogeneous dataset. Our sampling targeted two fixed plots, a larger one close to the tower (European beech; 58 trees) and a smaller one at a distance of approximately 100 m (European beech and European ash; 12 trees). For each tree within the two plots, we measured the diameter at breast height, as well as tree and crown base heights using a Vertex IV device (Haglöfs, Sweden). In addition, we recorded the position (distance and azimuth) of each tree relative to the plot center. We then collected two increment cores to the pith of each tree, perpendicular to each other to capture circumferential growth variations. These core samples were brought to the lab and prepared according to standard dendrochronological procedures. We measured annual radial growth increment to a precision of 0.01 mm using a Lintab 5 device and the connected TSAP-Win software. The raw ring-width measurements from each sample were visually and statistically cross-dated to assure that the correct calendar year was assigned to each ring. In addition, we estimated the number of missing rings to the pith of the tree ("pith-offset"), which is required in case these data will be used to calculate tree basal area or biomass increment.

Stand-scale data from reconstructed single tree data

After deriving the single tree diameter-at-breast-height (DBH) from the tree-ring data, the individual tree age was calculated. This was done by deriving the tree age at coring from the age of the tree ring and adding 4 years which is assumed to be the time an individual needs to reach breast height (1.3 m) and back projecting the age in time. The individual total tree height was estimated using the site-specific age-dependent height model of Nord-Larsen et al. (2009). In order to derive stand-scale data the reconstructed single tree traits (DBH, height and age) are averaged for seven DBH classes of 10 cm class width. The class assignment of single trees is based on the single tree data in 2009 and kept constant over time. The frequency distribution per DBH class is derived for the period 1994-2017 by interpolation and extrapolation of field measurements in 2005, 2009 and 2017 (table SOM15). This frequency distribution is used to weight the averaged DBH class values in order to calculate stand-scale data of DBH, height and age. Stand-scale tree density is derived as described above.

The full set of reconstructed individual tree data from 1925 to 2017 as well as derived DBH class data and stand data for 1994-2017 can be found in *Soroe_DBH_H_AGE_20200428.RData (*http://doi.org/10.5880/PIK.2020.006/*)*. A description of the data found in this file can be displayed with *cat(Soroe_DBH_H_AGE.l.des)* using the statistical computing software R after loading the data file.

Table SOM15: DBH class frequency distribution per year. Note from 2005 to 2017 this is a per annual assessment (n=87) and before that the diameters were extrapolated from 2005/2009 to 1994. DBH classes have 10 cm width.

year	class 1	class 2	class 3	class 4	class 5	class 6	class 7
1994	0.069	0.241	0.115	0.322	0.195	0.057	NA
1995	0.069	0.241	0.092	0.322	0.218	0.057	NA
1996	0.046	0.264	0.069	0.299	0.264	0.057	NA
1997	0.034	0.264	0.08	0.276	0.287	0.057	NA
1998	0.034	0.264	0.08	0.264	0.299	0.057	NA
1999	0.034	0.253	0.092	0.253	0.31	0.057	NA
2000	0.034	0.241	0.092	0.264	0.31	0.057	NA
2001	0.034	0.241	0.08	0.276	0.31	0.057	NA
2002	0.023	0.253	0.092	0.253	0.322	0.057	NA
2003	0.023	0.253	0.092	0.207	0.368	0.046	0.011
2004	0.023	0.253	0.08	0.195	0.391	0.046	0.011
2005	0.023	0.253	0.069	0.207	0.379	0.057	0.011

2006	0.026	0.218	0.051	0.179	0.436	0.077	0.013
2007	0.026	0.205	0.064	0.167	0.436	0.09	0.013
2008	0.026	0.205	0.064	0.154	0.449	0.077	0.026
2009	0.026	0.205	0.064	0.141	0.462	0.077	0.026
2010	0.026	0.184	0.053	0.158	0.434	0.105	0.039
2011	0.03	0.136	0.045	0.152	0.455	0.136	0.045
2012	0.031	0.138	0.046	0.138	0.492	0.123	0.031
2013	0.031	0.138	0.046	0.138	0.462	0.154	0.031
2014	0.019	0.151	0.057	0.094	0.358	0.283	0.038
2015	0.019	0.151	0.057	0.094	0.453	0.189	0.038
2016	NA	0.17	0.057	0.038	0.396	0.302	0.038
2017	0.019	0.151	0.038	0.057	0.377	0.321	0.038

References

Møller, C. M. (1933). "Bonitetstabeller og bonitetsvise tilvækstoversigter for bog, eg og rødgran i Danmark." Dansk Skovforenings Tidskrift **18**: 457 - 513, 537 - 623.

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