Dataset name

Land Use/Cover Area Survey framework (LUCAS) Soil Functional Dataset from 2018.

Abstract

The Land Use/Cover Area Survey framework (LUCAS) is collecting information about the land use or land cover type in approx. 270000 point locations across the EU Member States. Since 2009, in a subset of around 26000 locations, additional soil parameters are measured. The sampling campaign in 2018 estimate also soil functional parameters (i.e., enzyme activity, water-stable aggregates, and microbial parameters) in a subset of the soil survey locations (n=881). There are 885 unique samples (BARCODE_ID, SOIL_ID) from 881 sampling locations (LUCAS_ID) in 2018, which correspond to 875 locations in 2009 and 881 locations in 2015.

The dataset consists of one data file (ForESDAC_LUCAS_2018_functions_20241018.csv), that provides the measured and integrated information for each point location (n=881) and each soil sample from 2018 (n=885), and this metadata file (ForESDAC_LUCAS_2018_functions_20241018_metadata.txt). This dataset is NOT the full LUCAS dataset but represents ONLY the subset of the LUCAS sampling locations with soil functional measurements.

Version information

This dataset does contain the most up-to-date information. Coordinates are corrected (Status: June 2022).

Data access policy

Data available on request

License

Data owner

European Commission (Joint Research Centre) among others

Data origin

LUCAS Soil field survey, lab analysis in Berlin, Leipzig and Halle, and geospatial analysis to integrate CORINE Land Cover data and climatic information. Details about the LUCAS project are available here: https://esdac.jrc.ec.europa.eu/projects/lucas.

Date of creation

2024-10-30

How to cite dataset

Zeiss, R., Eisenhauer, N., Orgiazzi, A., Rillig, M., Buscot, F., Jones, A., ... & Guerra, C. A. (2022). Challenges of and opportunities for protecting European soil biodiversity. Conservation Biology, 36(5), e13930.

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Associated publications

Fernandez-Ugalde, O., Scarpa, S., Orgiazzi, A., Panagos, P., Van Liedekerke, M., Marechal A. & Jones, A. (2022). LUCAS 2018 Soil Module - Presentation of dataset and results, EUR 31144 EN. Publications Office of the European Union, Luxembourg. ISBN 978-92-76-54832-4, doi:10.2760/215013.

Smith, L. C., Orgiazzi, A., Eisenhauer, N., Cesarz, S., Lochner, A., Jones, A., ... & Guerra, C. A. (2021). Large-scale drivers of relationships between soil microbial properties and organic carbon across Europe. Global Ecology and Biogeography, 30(10), 2070-2083.

Siles, J. A., Díaz-López, M., Vera, A., Eisenhauer, N., Guerra, C. A., Smith, L. C., ... & Bastida, F. (2022). Priming effects in soils across Europe. Global Change Biology, 28(6), 2146-2157.

Orgiazzi, A., Ballabio, C., Panagos, P., Jones, A., & Fernández-Ugalde, O. (2018). LUCAS Soil, the largest expandable soil dataset for Europe: a review. European Journal of Soil Science, 69(1), 140-153.

Missing values

Missing values (i.e., not measured or issues in measurement) are represented as NA if not indicated differently.

Four sites in 2018 (LUCAS_ID 34082784, 34262824, 37602280, 38802318) had two samples for functional measures and therefore two values for soil aggregates, enzymes and microbial properties.

Content of the data file

Variable	Format	Unit	Definition
LUCAS_ID	numeric	-	The 8-digit ID assigned by the LUCAS project to the specific site; 881 unique values (2018).
SOIL_ID	numeric	-	The 5-digit ID assigned to the specific sample taken in 2018; 885 unique values, because two samples each have been taken for four LUCAS_ID sites (LUCAS_ID 34082784, 34262824, 37602280 and 38802318). No SOIL_IDs for one sample in 2018 (LUCAS_ID 51483142, BARCODE_ID 882).
BARCODE_ID	numeric	-	Running number assigned to the specific sample taking in 2018; 885 unique values, because two samples each have been taken for four LUCAS_ID sites (LUCAS_ID 34082784, 34262824, 37602280 and 38802318).

WHC integer g_g-1 Water holding capacity, amount of water in the sample was calculated as the difference between the saturated and dried weight; the water holding capacity was calculated by dividing this by the sample dry weight, in order to get the weight of water that can be held per unit dry weight of soil. WHC was only measured in 100 samples to assess the effect of adjusting water content to 60% water holding capacity on potential basal respiration. Details can be found in Smith et al. (2021, Global Ecology & Biogeography).

Mean_width_diameter integer mm Calculated by the Rillig lab in Berlin. Specific for BARCODE_ID (sample). Description from Rillig lab: mean width diameter; sum of the proportion of soil size classes (4-2mm, 2-1mm, 1-0.25mm, 0.25-0.1mm, 0.1-0.053mm, <0.053mm) weighted by their size mean (e.g. for fraction 4-2mm => fraction * 3); the larger the value, the higher the amount of large aggregates in a sample; no info on stability of these aggregates.

Water_stable_aggregates integer percent Calculated by the Rillig lab in Berlin. Specific for BARCODE_ID (sample). Description from Rillig lab: percentage of water-stable aggregates (fraction >250µm, sieving machine sieves have 250µm mesh size); corrected for sand and organic matter (coarse matter); WSA= {(water-stable fraction [g] - coarse matter [g])/(used sample weight [g] - coarse matter [g])}*100; the higher the value, the more stable aggregates were present in the sample.

Xylosidase integer nmol_h-1_g-1 Enzymatic potential in nmol per hour per g dry soil; determined at pH 5 and 25ºC; analyzed by Thomas Reitz and others in Halle using LUCAS 2018 soil samples. Specific for BARCODE_ID (sample). No data for three points in 2018 (LUCAS_ID 32961790, 45662242, 55942860).

Cellulase integer nmol_h-1_g-1 Enzymatic potential in nmol per hour per g dry soil; determined at pH 5 and 25ºC; analyzed by Thomas Reitz and others in Halle using LUCAS 2018 soil samples. Specific for BARCODE_ID (sample). No data for 1 point in 2018 (LUCAS_ID 45662242).

N_actylglucosaminidaseinteger nmol_h-1_g-1 Enzymatic potential in nmol per hour per g dry soil; determined at pH 5 and 25 degree C; analyzed by Thomas Reitz and others in Halle using LUCAS 2018 soil samples. Specific for BARCODE_ID (sample). No data for 1 point in 2018 (LUCAS_ID 45662242).

Beta_glucosidase integer nmol_h-1_g-1 Enzymatic potential in nmol per hour per g dry soil; determined at pH 5 and 25 degree C; analyzed by Thomas Reitz and others in Halle using LUCAS 2018 soil samples. Specific for BARCODE_ID (sample). No data for 1 point in 2018 (LUCAS_ID 45662242).

Acid_phosphatase integer nmol_h-1_g-1 Enzymatic potential in nmol per hour per g dry soil; determined at pH 5 and 25 degree C; analyzed by Thomas Reitz and others in Halle using LUCAS 2018 soil samples. Specific for BARCODE_ID (sample). No data for 1 point in 2018 (LUCAS_ID 45662242).

Basal_respiration integer microL_h-1_g-1 Microbial basal respiration measured with O2 microcompensation technique in the Eisenhauer lab; units [µl O2 h-1 g soil dw-1]. Measured using LUCAS 2018 soil samples. Specific for BARCODE_ID (sample). No data for 1 point in 2018 (LUCAS_ID 41383284).

MIRR integer µg_O2_h-1_g-1 Maximum initial respiratory quotient calculated during substrate-induced respiration measurement; used to calculate Cmic. Measured using LUCAS 2018 soil samples. Specific for BARCODE_ID (sample). No data for 1 point in 2018 (LUCAS_ID 41383284).

Cmic integer microG_g-1 Microbial biomass measured with substrate-induced respiration; units [µg Cmic g soil dw-1]. Measured using LUCAS 2018 soil samples. No data for 1 point in 2018 (LUCAS_ID 41383284).

qO2 integer µl_O2_h-1_µg-1] Respiratory quotient or amount respiration per unit microbial biomass, calculated by basal respiration / microbial biomass. Specific for BARCODE_ID (sample). No data for 1 point in 2018 (LUCAS_ID 41383284).

FAME_Gram_positive numeric nmol_g-1 Concentration of fatty acids of Gram-positive bacteria estimated using measurement of ester-linked fatty acid methyl esters (FAMEs) as indicators of bacterial and fungal biomass; unit [nmol g-1 soil]. Data from Felipe Bastida measured in Centro de Edafología y Biología Aplicada del Segura-Consejo Superior de Investigaciones Científicas (CEBAS-CSIC, Murcia, Spain). Data only for 559 sites in 2018 campaign.

FAME_Gram_negative numeric nmol_g-1 Concentration of fatty acids of Gram-negative bacteria estimated using measurement of ester-linked fatty acid methyl esters (FAMEs) as indicators of bacterial and fungal biomass; unit [nmol g-1 soil]. Data from Felipe Bastida measured in Centro de Edafología y Biología Aplicada del Segura-Consejo Superior de Investigaciones Científicas (CEBAS-CSIC, Murcia, Spain). Data only for 559 sites in 2018 campaign.

FAME_Fungi numeric nmol_g-1 Concentration of fatty acids of Fungi estimated using measurement of ester-linked fatty acid methyl esters (FAMEs) as indicators of bacterial and fungal biomass; unit [nmol g-1 soil]. Data from Felipe Bastida measured in Centro de Edafología y Biología Aplicada del Segura-Consejo Superior de Investigaciones Científicas (CEBAS-CSIC, Murcia, Spain). Data only for 559 sites in 2018 campaign.

FAME_Bacteria numeric nmol_g-1 Concentration of fatty acids of Bacteria estimated using measurement of ester-linked fatty acid methyl esters (FAMEs) as indicators of bacterial and fungal biomass; unit [nmol g-1 soil]. Data from Felipe Bastida measured in Centro de Edafología y Biología Aplicada del Segura-Consejo Superior de Investigaciones Científicas (CEBAS-CSIC, Murcia, Spain). Data only for 559 sites in 2018 campaign.

FAME_Saturated numeric nmol_g-1 Concentration of saturated fatty acids estimated using measurement of ester-linked fatty acid methyl esters (FAMEs) as indicators of bacterial and fungal biomass; unit [nmol g-1 soil]. Data from Felipe Bastida measured in Centro de Edafología y Biología Aplicada del Segura-Consejo Superior de Investigaciones Científicas (CEBAS-CSIC, Murcia, Spain). Data only for 559 sites in 2018 campaign.

FAME_Monosaturated numeric nmol_g-1 Concentration of monosaturated fatty acids estimated using measurement of ester-linked fatty acid methyl esters (FAMEs) as indicators of bacterial and fungal biomass; unit [nmol g-1 soil]. Data from Felipe Bastida measured in Centro de Edafología y

Biología Aplicada del Segura-Consejo Superior de Investigaciones Científicas (CEBAS-CSIC, Murcia, Spain). Data only for 559 sites in 2018 campaign.

FAME_Actinobacteria numeric nmol_g-1 Concentration of fatty acids of Actinobacteria estimated using measurement of ester-linked fatty acid methyl esters (FAMEs) as indicators of bacterial and fungal biomass; unit [nmol g-1 soil]. Data from Felipe Bastida measured in Centro de Edafología y Biología Aplicada del Segura-Consejo Superior de Investigaciones Científicas (CEBAS-CSIC, Murcia, Spain). Data only for 559 sites in 2018 campaign.

FAME_Total numeric nmol_g-1 Concentration of total fatty acids estimated using measurement of ester-linked fatty acid methyl esters (FAMEs) as indicators of bacterial and fungal biomass; unit [nmol g-1 soil]. Data from Felipe Bastida measured in Centro de Edafología y Biología Aplicada del Segura-Consejo Superior de Investigaciones Científicas (CEBAS-CSIC, Murcia, Spain). Data only for 559 sites in 2018 campaign.

FAME_ratio_Gram_pos_neg numeric - Ratio of the concentration of fatty acids of Gram-positive to fatty acids of Gram-negative bacteria estimated using measurement of ester-linked fatty acid methyl esters (FAMEs) as indicators of bacterial and fungal biomass. Data from Felipe Bastida measured in Centro de Edafología y Biología Aplicada del Segura-Consejo Superior de Investigaciones Científicas (CEBAS-CSIC, Murcia, Spain). Data only for 559 sites in 2018 campaign.

FAME_ratio_Fungi_Bacteria numeric - Ratio of the concentration of fatty acids of Fungi to fatty acids of Bacteria estimated using measurement of ester-linked fatty acid methyl esters (FAMEs) as indicators of bacterial and fungal biomass. Data from Felipe Bastida measured in Centro de Edafología y Biología Aplicada del Segura-Consejo Superior de Investigaciones Científicas (CEBAS-CSIC, Murcia, Spain). Data only for 559 sites in 2018 campaign.

FAME_ratio_Sat_Monosat numeric - Ratio of the concentration of saturated to monosaturated fatty acids estimated using measurement of ester-linked fatty acid methyl esters (FAMEs) as indicators of bacterial and fungal biomass. Data from Felipe Bastida measured in Centro de Edafología y Biología Aplicada del Segura-Consejo Superior de Investigaciones Científicas (CEBAS-CSIC, Murcia, Spain). Data only for 559 sites in 2018 campaign.