

Table S1 Background information and soil health indicators in *SoilHealthDB-V2*

Indicator	Description	Units
Background information		
<i>StudyID</i>	Unique ID for each paper.	
<i>ExperimentID</i>	Each study has several experiment IDs based on various factors, such as site, soil depth, cover crop, etc. Please see more details in the ExperimentID sheet.	
<i>EID_Comments</i>	Details about how experiment IDs were determined.	
<i>Author_F</i>	First author's family name.	
<i>Author_G</i>	First author's given name.	
<i>YearPublication</i>	Paper publication year.	
<i>Journal</i>	Journal name of paper.	
<i>SiteInfor</i>	Site information, detail as possible.	
<i>Country</i>	Country name.	
<i>Latitude</i>	Latitude of site.	° (decimal degree)
<i>Longitude</i>	Longitude of site.	° (decimal degree)
<i>Elevation</i>	Elevation of site.	m
<i>Tannual</i>	Annual average air temperature.	°C
<i>MAT</i>	Mean annual air temperature within a period.	°C
<i>Pannual</i>	Annual accumulate precipitation.	mm
<i>MAP</i>	Mean annual precipitation within a period.	mm
<i>ClimateType</i>	Study site's climate type, can be obtain from climate koeppon.	
<i>Start_year</i>	Experiment start year.	
<i>Sampling_year</i>	Sampling year, should be earlier than publication year, <= experiment end year.	
<i>End_Year</i>	Experiment end year.	
<i>SamplingDepth</i>	Soil sampling depth from top to bottom, formatted as: top-to-bottom, e.g., 10-to-20.	cm
<i>SamplingThickness</i>	Difference between bottom and top, e.g., 10-to-20, fill with 10.	cm
<i>CEC</i>	Cation exchangeable capacity.	
<i>CEC_unit</i>	Unit of Cation exchange capacity.	Cmol_kg, meq_100g
<i>SoilBD</i>	Bulk density.	g_kg
<i>SandPerc</i>	Percentage of sand.	%
<i>SiltPerc</i>	Percentage of silt.	%
<i>ClayPerc</i>	Percentage of clay.	%
<i>Texture</i>	Soil texture according to the Cornell Soil Health Framework.	
<i>SoilKsat</i>	Soil Ksat.	cm_h
<i>SoilFamily</i>	Soil family or soil group information, should be note that there are many soil classification systems in the world.	
<i>SoilpH</i>	Soil pH.	
<i>BG_SOC</i>	Background soil total organic carbon, this is the background soil carbon information, discriminate this column and OC_C, OC_T in the response.	%
<i>SOC_NaturalVeg</i>	Soil organic carbon of nearby natural vegetation land use, can be used as comparison as the potential carbon equilibrium status.	%
<i>BG_N</i>	Background soil total nitrogen.	g_kg
<i>BG_AN</i>	Background soil available nitrogen, total inorganic nitrogen (NH ₄ -N + NO ₃ -N).	mg_kg
<i>BG_P</i>	Background soil total phosphorus.	g_kg
<i>BG_AP</i>	Background soil available phosphorus.	mg_kg

<i>BG_K</i>	Background soil total potassium.	g_kg
<i>BG_AK</i>	Background soil available potassium.	mg_kg
<i>CoverCrop</i>	Cover crop type, some literature called catch crop, green manure.	
<i>CCMiddleGroup</i>	Cover crop grouped by function or family, please see more details in the CoverCropGroup sheet, using middle group.	
<i>CC_plant_year</i>	Year that cover crops were planted.	
<i>CC_plant_DOY</i>	DOY (day of year) that cover crops were planted.	
<i>CC_termination_DOY</i>	DOY of year of killing cover crop	
<i>CC_growth_day</i>	Days of cover crops growth.	
<i>CCTermination_method</i>	Method of killing cover crop, e.g., Mechanical (Mowing/Cutting/Tillage/Rolling); Chemical (Herbicide); Biological (Natural Death/Planting crops with different life cycles so they die off at different times naturally); Integrated (mix of mechanical and chemical).	
<i>CC_return_method</i>	How to treat cover crop biomass, e.g., incorporated, surface, removed.	
<i>CC_irrigation</i>	Irrigation cover crop received.	mm
<i>CC_fertilization</i>	Fertilization cover crop received, ?N-?P-?K-?OC	kg_ha
<i>Grain_plant_DOY</i>	DOY that grain crops were planted, also called cash crop.	
<i>CC_retain_day</i>	How many days cover crops residue retain in soil/surface before plan cash crop.	
<i>GrainCrop</i>	Grain crop type.	
<i>GrainMiddleGroup</i>	Grain crop grouped by function or family, please see more details in the GrainCropGroup sheet, using middle group.	
<i>Rotation_C</i>	Type of rotation/crop sequence for control.	
<i>Rotation_T</i>	Type of rotation/crop sequence for treatment.	
<i>Rotation_note</i>	Whether type of rotation/crop sequence differ between control and treatment, yes or no.	
<i>Tillage_C</i>	Type of tillage group for control.	
<i>Tillage_T</i>	Type of tillage group for treatment.	
<i>Tillage_note</i>	Whether type of tillage group differ between control and treatment, yes or no.	
<i>Fertilization_C</i>	Applied fertilization information for control, ?N-?P-?K-?OC.	kg_ha
<i>Fertilization_T</i>	Applied fertilization information for treatment, ?N-?P-?K-?OC.	kg_ha
<i>Fertilization_note</i>	Whether applied fertilization differ between control and treatment, yes or no.	
<i>Conservation_C</i>	Agriculture management of control, usually is conventional management, e.g., fallow, CK, CT.	
<i>Conservation_T</i>	Conservation management of treatment, e.g., cover crop (CC), No-tillage (NT), organic farm (OF), straw return (SR).	
<i>Conservation_Type</i>	Conservation management difference between control and treatment.	
<i>No_C</i>	Number of plots in control.	
<i>No_T</i>	Number of plots in treatment.	
<i>NoSupsample</i>	Number of subsamples or mixed soil samples.	
<i>ExperimentDesign</i>	Experiment design, e.g., CRD (completely randomized design), RCBD (randomized complete block design), split-design.	
<i>CCFreshBiomass</i>	Fresh biomass (and to be manure) of cover crop.	kg_ha
<i>CCDryBiomass</i>	Dry biomass (and to be manure) of cover crop.	kg_ha
<i>CNOFCoverCrop</i>	Carbon to nitrogen ratio from the dry biomass of cover crop (determine manure quality).	%

<i>BiomassCash</i>	Biomass of cash crop (biomass of grain crop such as stem, leave, root, but not include yield).	kg_ha
<i>Yield</i>	Yield of grain(cash) crop.	kg_ha
<i>BD</i>	Bulk density.	g_cm ³
<i>OC</i>	Organic carbon.	%
<i>TCIC</i>	Total carbon or inorganic carbon.	%
<i>OC_seq</i>	Soil organic carbon sequestration rate compares with beginning of experiments.	Mg_ha_cm_yr
<i>FastC</i>	Fast carbon.	g_kg
<i>SlowC</i>	Slow carbon.	g_kg
<i>PassiveC</i>	Passive carbon.	g_kg
<i>N</i>	Soil nitrogen, e.g., TN (total nitrogen), ON (organic nitrogen), TIN (NH ₄ +NO ₃), NO ₃ , NH ₄ .	mg_kg
<i>P</i>	Soil phosphorus.	mg_kg
<i>K</i>	Soil potassium.	mg_kg
<i>pH</i>	pH.	unitless
<i>CEC_Cation</i>	Soil CEC or cation.	cmolc_kg
<i>EC</i>	Soil electric conductivity.	dS_m
<i>BS_ToS</i>	Base saturation or total bases.	mg_kg
<i>Aggregate</i>	Soil aggregation, there are multiple indicators of soil aggregation, always make notes.	g_kg
<i>Porosity</i>	Porosity, air permeability.	%
<i>Penetration</i>	Penetration resistance, root.	Mpa
<i>Infiltration</i>	Infiltration rate, water.	mm_h
<i>Ksat</i>	Field saturated hydraulic conductivity.	mm_h
<i>Erosion</i>	Water erosion, wind erosion.	t_ha_yr
<i>Runoff</i>	Runoff, drainage.	mm_ha
<i>Leaching</i>	Nitrogen loss, nitrate, soil organic carbon, phosphorus, etc. concentration in the runoff, in the drainage.	kg_ha_yr
<i>ST</i>	Soil temperature.	°C
<i>SWC</i>	Soil water content, Field capacity, Permanent wilting point.	%
<i>AWHC</i>	Available water hold capacity.	g_g
<i>WUA</i>	Crop water use amount.	kg_ha_mm
<i>WUE</i>	Crop water use efficiency.	kg_ha_mm
<i>Weed</i>	Weed biomass, density.	kg_ha
<i>Diseases</i>	Diseases of grain(cash) crop.	Unites varied
<i>Pests_beneficialInsects</i>	Pests or beneficial insects of grain(cash) crop.	mu_g_g soil
<i>SoilFauna</i>	Earthworm, arthropods, nematode (soil should benefit from their exist) of soil.	Units varied
<i>Fungal</i>	Bacterial, fungal, mycorrhizal of soil.	Units varied
<i>MicrobialOther</i>	Phospholipid fatty acids (PLFA), microbial fatty acid methyl esters (FAMES), other microbial functional diversity evaluated by Shannon's diversity index etc.	Units varied
<i>Enzyme</i>	Enzyme activity such as Phenol oxidase, beta-glucosidase, b-glucosaminidase, and Phosphodiesterase of soil.	Unites varied
<i>Cmineralization</i>	Carbon mineralization.	mg_kg
<i>Nmineralization</i>	Nitrogen mineralization.	mg_kg_day
<i>N2O</i>	Greenhouse gas N ₂ O.	g_m ² _yr
<i>CO2</i>	Soil respiration (some literature called CO ₂ efflux, CO ₂ flux).	g_m ² _day

<i>CH4</i>	CH ₄ emission.	g_m ² _yr
<i>MBC</i>	Microbe biomass carbon.	mg_kg
<i>MBN</i>	Microbial biomass nitrogen.	mg_kg
<i>MBP</i>	Microbial biomass phosphorus.	mg_kg
<i>NutrientElement</i>	Macro- and micronutrient.	mg_kg
<i>SQI</i>	Soil quality index, soil health indicator.	
<i>ESS</i>	Ecosystem services indicator.	
<i>Texture</i>	Cover crop effect on soil texture.	

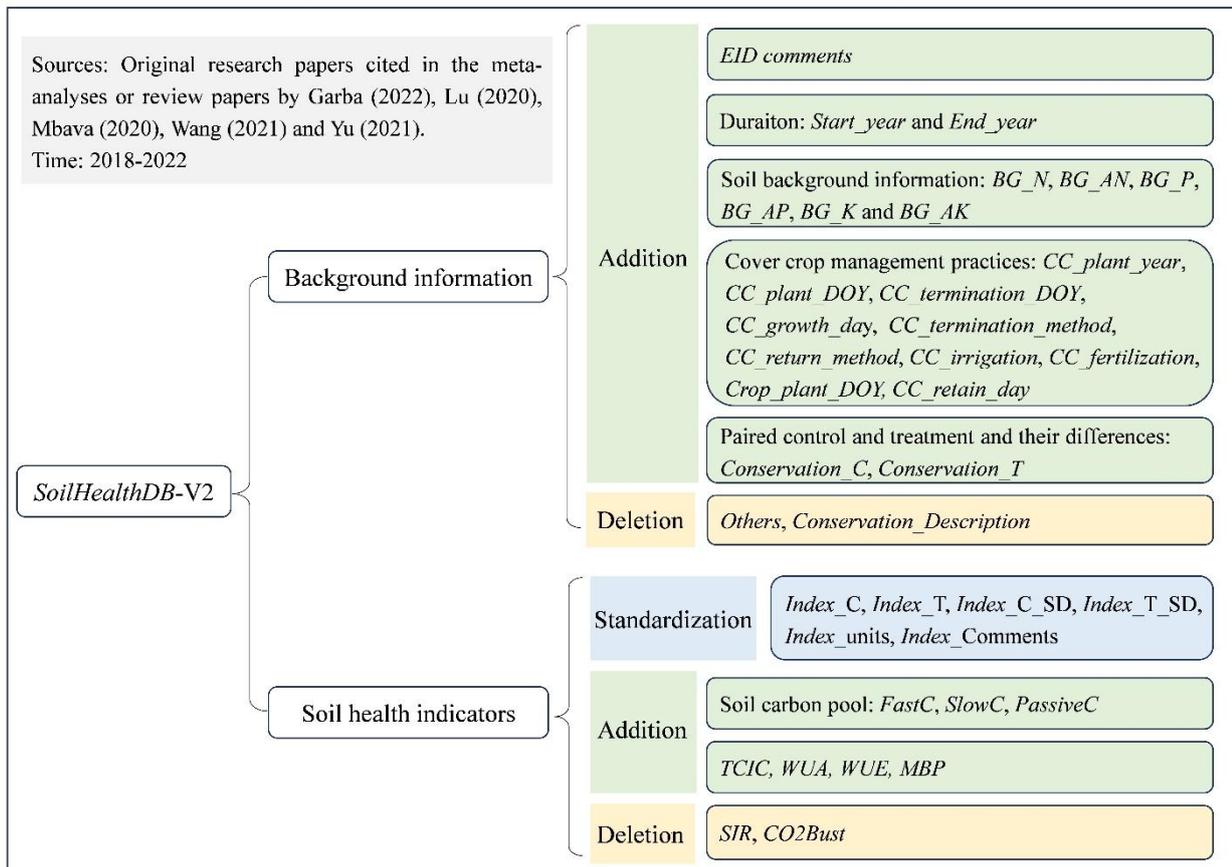


Figure S1. Overview of *SoilHealthDB-V2* update process.

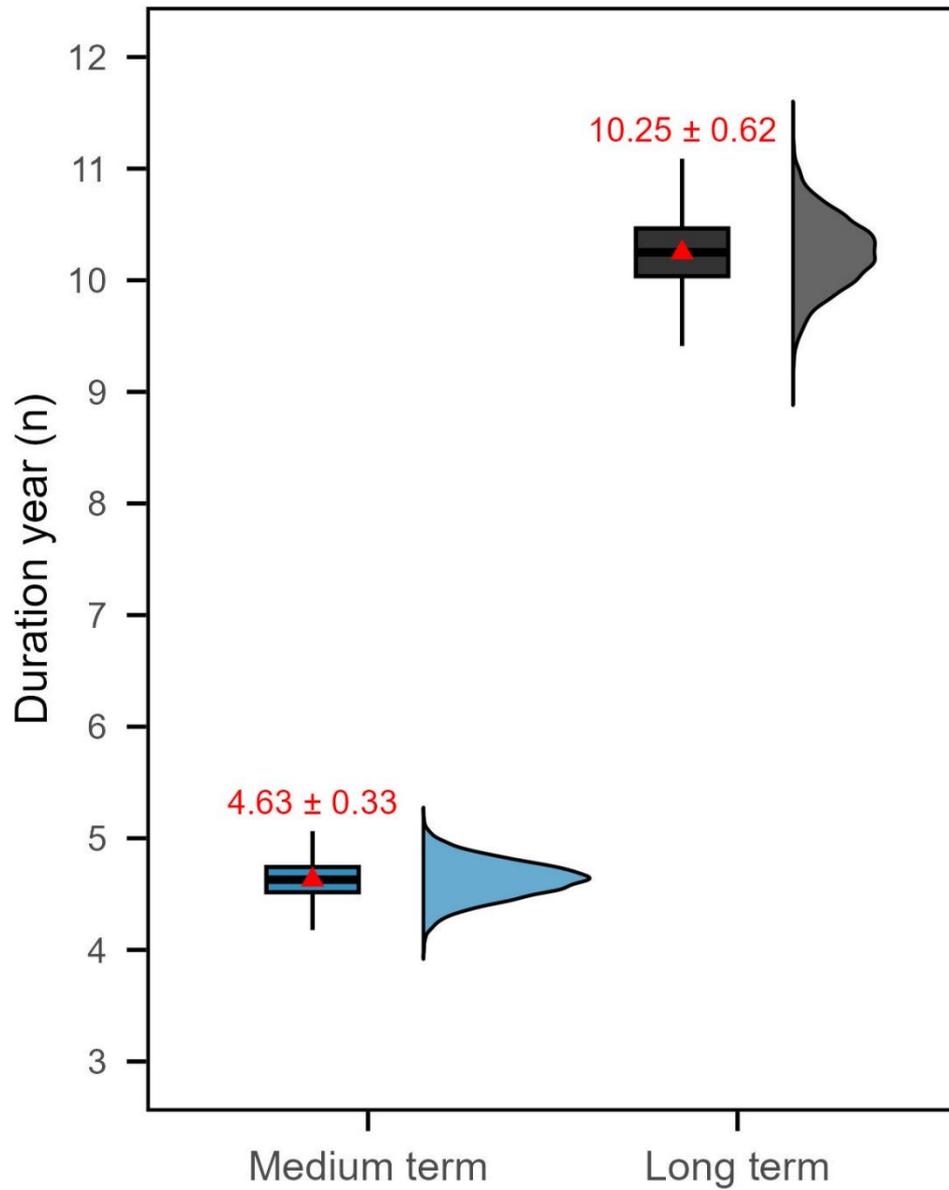


Figure S2. Distribution of reported duration year for medium- and long-term field experiments under conservation management practices. The literature search was conducted in Web of Science using the keywords “cover crop*”, “no till*”, “organic farm”, “agroforestry system*”, or “straw return” and “duration”. The collected papers are primarily review or meta-analysis articles published in peer-reviewed journals. A nonparametric bootstrap resampling approach was applied to the original dataset with 5,000 iterations to estimate the mean and 95 % confidence intervals of duration time for medium- and long-term experiments. Detailed information on the collected studies is provided in the file *medium and long-term duration year.csv*. Red triangles indicate the mean values, and the numbers above represent the mean ± 95% confidence intervals.