

Missing the input: The underrepresentation of plant physiology in global soil carbon research

Supplemental table/figures

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Number of Supplemental Tables: 2

Number of Supplemental Figures: 3

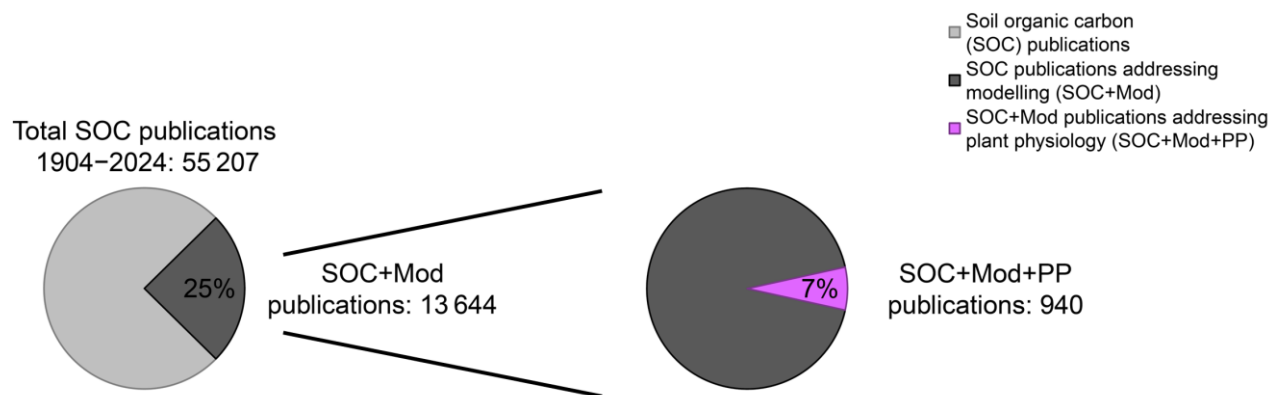
Supplemental Table S1: Keywords and corresponding search terms used to build queries for bibliometric analyses in Web of Science™.

Query	Keywords	Search terms in bibliometric query
Soil organic carbon	Soil organic carbon, soil organic matter	Soil organic carbon, soil organic C, organic carbon in soil*, organic carbon of soil*, organic carbon from soil*, organic carbon soil*, soil organic matter, organic matter in soil*, organic matter of soil *, organic matter from soil*, organic matter soil*
Modelling	Model, modelling	Model, models, modeling, modelling
Plant physiological processes	Photosynthesis, transpiration, stomatal conductance, carbon allocation, carbon translocation, plant growth, leaf growth, shoot growth, root growth, root exudation, lignification, suberisation, cutinisation, barrier formation, barrier development, secondary growth, secondary thickening, plant respiration, leaf respiration, shoot respiration, root respiration, plant senescence, root senescence, leaf senescence, shoot senescence, plant carbon transfer, rhizodeposition, nodulation, rhizobia colonisation, rhizobium colonisation, mycorrhisation, fungal colonisation, mycorrhizal colonisation, tissue stoichiometry, leaf stoichiometry, root stoichiometry, shoot stoichiometry, plant stoichiometry, litter stoichiometry, rhizodeposits stoichiometry, root exudate stoichiometry, tissue element ratio, leaf element ratio, root element ratio, shoot element ratio, plant element ratio, litter element ratio, rhizodeposits element ratio, root exudate element ratio, tissue composition, leaf composition, root composition, shoot composition, plant composition, litter composition, rhizodeposits composition, root exudate composition, plant water uptake, plant water acquisition, plant water translocation, xylem transport, phloem transport, plant nutrient uptake, plant nutrient acquisition, plant nutrient translocation, plant nutrient absorption	Photosynthesis, transpiration, stomatal conductance, carbon allocation, carbon translocation, plant growth, plant height, leaf growth, shoot growth, root growth, root length, root density, root mass, root weight, root penetration, root exudat*, lignification, suberisation, suberization, cutinisation, cutinization, barrier formation, barrier development, secondary growth, secondary thickening, plant respiration, leaf respiration, shoot respiration, root respiration, plant senescence, root senescence, leaf senescence, shoot senescence, plant carbon transfer, rhizodeposit*, nodulation, nodule formation, rhizobia colonisation, rhizobia colonization, rhizobium colonisation, rhizobium colonization, mycorrhisation, mycorrhization, fungal colonisation, fungal colonization, mycorrhizal colonisation, mycorrhizal colonization, tissue stoichiometry, leaf stoichiometry, root stoichiometry, shoot stoichiometry, plant stoichiometry, litter stoichiometry, rhizodeposit* stoichiometry, root exudat* stoichiometry, tissue element ratio, leaf element ratio, root element ratio, shoot element ratio, plant element ratio, litter element ratio, rhizodeposit* element ratio, root exudat* element ratio, tissue composition, leaf composition, root composition, shoot composition, plant composition, litter composition, rhizodeposit* composition, root exudat* composition, plant water uptake, plant water acquisition, plant water translocation, xylem transport, phloem transport, plant nutrient uptake, plant nutrient acquisition, plant nutrient translocation, plant nutrient absorption

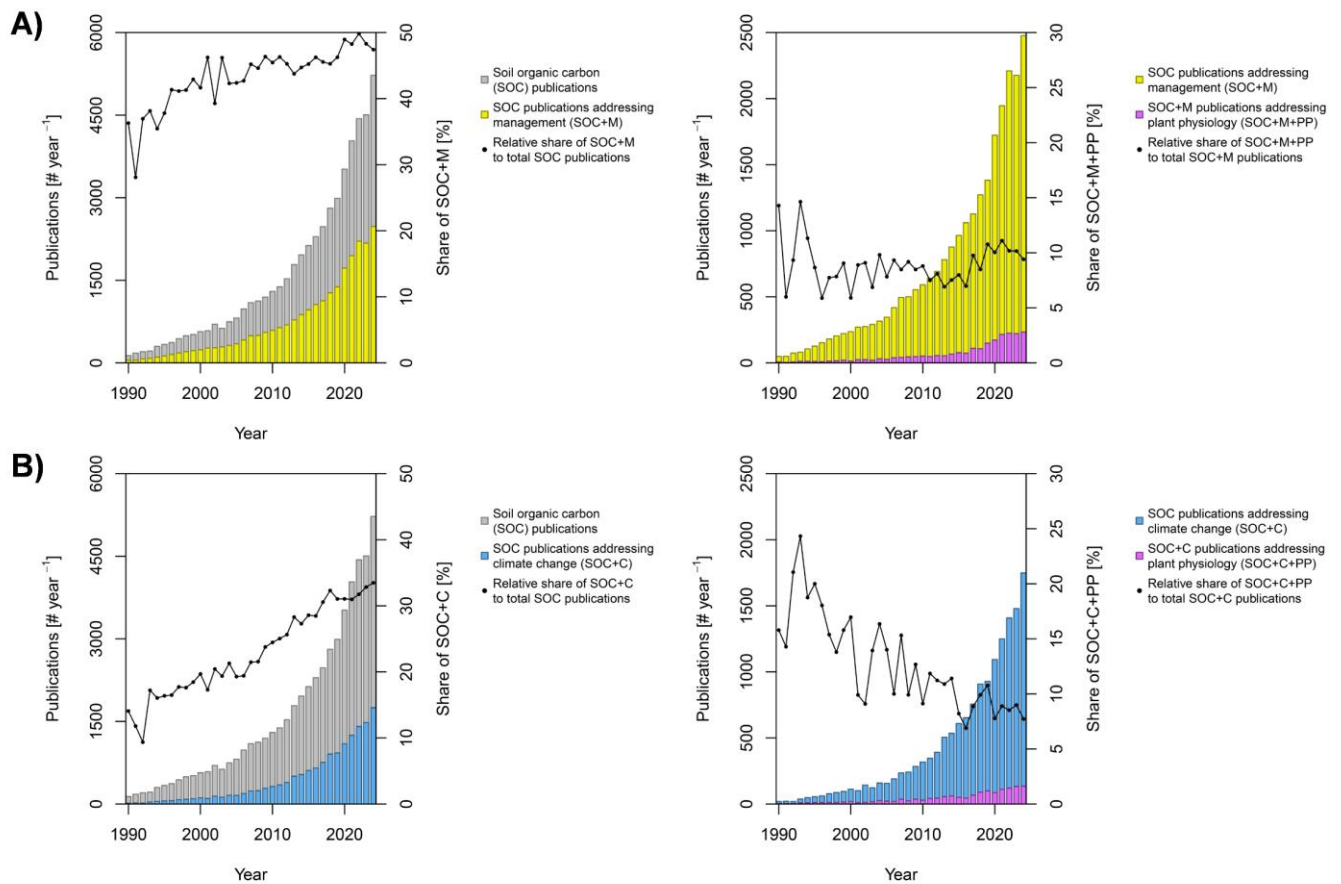
Query	Keywords	Search terms in bibliometric query
Land use and management	Conservation agriculture, regenerative agriculture, sustainable intensification, intensive agriculture, tillage, drainage, irrigation, weeding, weed control, fertilisation, crop rotation, species diversity, cover crops, herbal leys, permanent leys, temporary leys, organic amendments, manure application, compost application, slurry application, burning, residue retention, clear cutting, clearcut felling, clearcut logging, shelterwood cutting, logging, selective cutting, felling, deforestation, afforestation, agroforestry, silvopasture, silvopastoral, clearing, grazing, herbivory, grazing management, rotational grazing, intercropping, strip cropping, multicropping, permaculture, terracing, integrated crop livestock, forestry crop livestock, diversification	Conservation agriculture, precision agriculture, regenerative agriculture, organic agriculture, sustainable intensification, intensive agriculture, tillage, no tillage, zero tillage, reduced tillage, reducing tillage, minimum tillage, strip tillage, drainage, irrigation, weeding, weed control, weed removal, fertilizer, fertiliser, fertilisation, fertilization, crop rotation, species diversity, cover crop*, herbal ley*, leys, permanent ley*, temporary ley*, organic amendment*, manure, compost, slurry, burning, residue retention, residue incorporation, residue mixing, residue removal, clear cutting, clearcut felling, clearcut logging, shelterwood cutting, felling, logging, selective cutting, cutting, deforestation, afforestation, agroforestry, silvopasture, silvopastoral, clearing, grazing, herbivory, grazing management, rotational grazing, intercropping, inter cropping, strip cropping, multicropping, multiple cropping, permaculture, terracing, integrated crop livestock, forestry crop livestock, diversification
Climate change and associated environmental conditions	Climate change, global warming, elevated carbon dioxide, extreme weather, drought, low soil moisture, excess soil moisture, dry spell, wet spell, waterlogged soil, anaerobic soil, anaerobicity, water logging, water filled pore space, saturation level, air filled pore space, flood, inundation, temperature extreme, high temperature, low temperature, heat wave, soil moisture deficit, soil moisture surplus, hypoxia, anoxia, weather, climate variability	Climate change, global warming, elevated CO2, elevated carbon dioxide, extreme weather, weather extreme, drought, low soil moisture, high soil moisture, excess soil moisture, soil moisture Deficit, soil moisture surplus, water scarcity, water deficit, dry spell, wet spell, flood*, waterlogg*, water logg*, anaerobic*, water filled pore space*, air filled pore space*, saturation, inundation, temperature extreme, extreme temperature, precipitation, high temperature, low temperature, heat wave*, warming, hypoxi*, anoxi*, weather variation*, weather pattern*, weather variabilit*, climate variabilit*, climat* extreme*, cold climat*, hot climat*, freez*

- 15 Supplemental Table S2: Grouping of processes included in query covering plant physiology into three subcategories, i.e. aboveground/shoot physiology, belowground/root physiology, whole plant physiology.

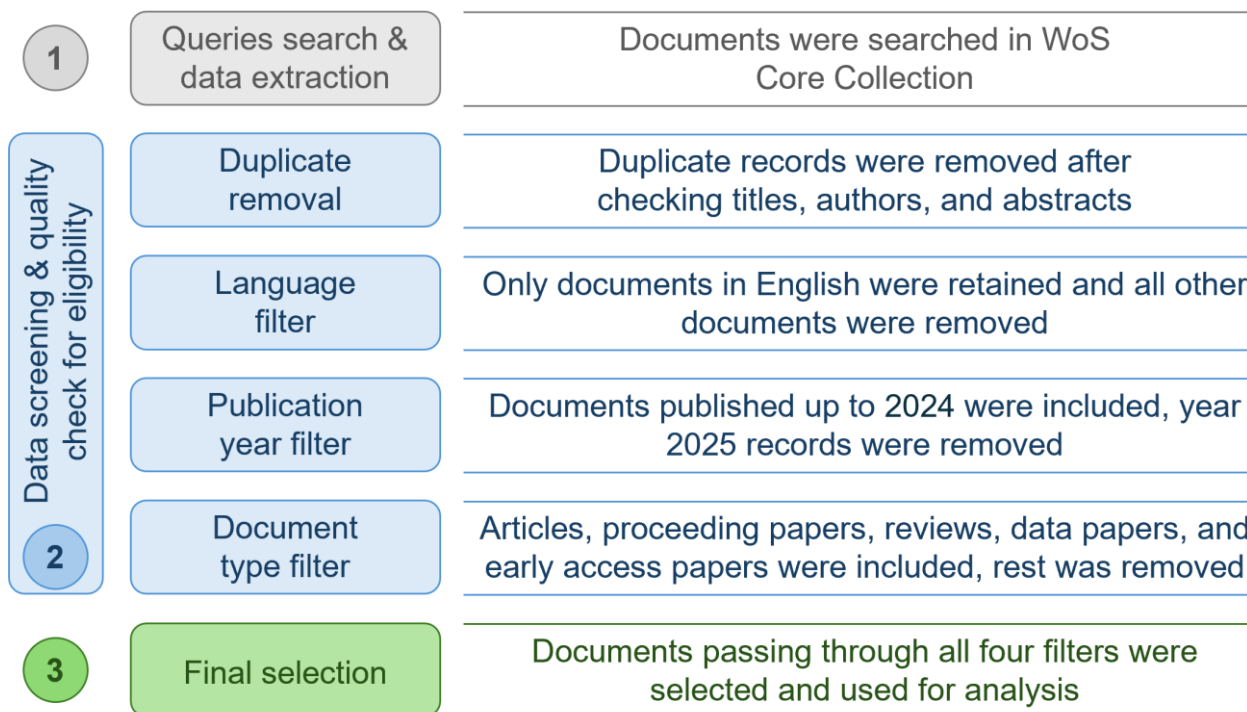
Subcategory	Keywords	Search terms in bibliometric query
Aboveground/shoot physiology	Photosynthesis, transpiration, stomatal conductance, leaf growth, shoot growth, cutinisation, leaf respiration, shoot respiration, leaf senescence, shoot senescence, leaf stoichiometry, shoot stoichiometry, leaf element ratio, shoot element ratio, leaf composition, shoot composition,	Photosynthesis, transpiration, stomatal conductance, Plant height, leaf growth, shoot growth, cutinisation, cutinization, leaf respiration, shoot respiration, leaf senescence, shoot senescence, leaf stoichiometry, shoot stoichiometry, leaf element ratio, shoot element ratio, leaf composition, shoot composition,
Belowground/shoot physiology	Root growth, root exudation, suberisation, root respiration, root senescence, rhizodeposition, nodulation, rhizobia colonisation, rhizobium colonisation, mycorrhization, fungal colonisation, mycorrhizal colonisation, root stoichiometry, rhizodeposits stoichiometry, root exudate stoichiometry, root element ratio, rhizodeposits element ratio, root exudate element ratio, root composition, rhizodeposits composition, root exudate composition, plant water uptake, plant water acquisition, plant nutrient uptake, plant nutrient acquisition, plant nutrient absorption,	Root growth, root length, root density, root mass, root weight, root penetration, root exudat*, suberisation, suberization, root respiration, root senescence, rhizodeposit*, nodulation, nodule formation, rhizobia colonisation, rhizobia colonization, rhizobium colonisation, rhizobium colonization, mycorrhisation, mycorrhization, fungal colonisation, fungal colonization, mycorrhizal colonisation, mycorrhizal colonization, root stoichiometry, rhizodeposit* stoichiometry, root exudat* stoichiometry, root element ratio, rhizodeposit* element ratio, root exudat* element ratio, root composition, rhizodeposit* composition, root exudat* composition, plant water uptake, plant water acquisition, plant nutrient uptake, plant nutrient acquisition, plant nutrient absorption
Whole plant physiology	Carbon allocation, carbon translocation, plant growth, lignification, barrier formation, barrier development, secondary growth, secondary thickening, plant respiration, plant senescence, plant carbon transfer, tissue stoichiometry, plant stoichiometry, litter stoichiometry, tissue element ratio, plant element ratio, litter element ratio, tissue composition, plant composition, litter composition, plant water translocation, xylem transport, phloem transport, plant nutrient translocation,	Carbon allocation, carbon translocation, plant growth, lignification, barrier formation, barrier development, secondary growth, secondary thickening, plant respiration, plant senescence, plant carbon transfer, tissue stoichiometry, plant stoichiometry, litter stoichiometry, tissue element ratio, plant element ratio, litter element ratio, tissue composition, plant composition, litter composition, plant water translocation, xylem transport, phloem transport, plant nutrient translocation,



20 **Supplemental Figure S1: The representation of plant physiology in global research on soil organic carbon modelling from 1904 to 2024.**



Supplemental Figure S2: The representation of plant physiology in global research elucidating associations between soil organic carbon and land use and management or climate change between 1990 and 2024. A) (left) Share of soil organic carbon publications addressing land use and management and (right) share of soil organic carbon publications addressing land use and management and plant physiological processes. B) (left) Share of soil organic carbon publications addressing climate change and associated environmental conditions and (right) share of soil organic carbon publications addressing climate change and associated environmental conditions and plant physiological processes.



Supplemental Figure S3: Flow chart diagram depicting data search and data filtering pipeline. Raw data obtained from search in Web of Science™ (WoS) were passed through four filtering steps (duplicates, language, year, publication type) to isolate publications relevant to the bibliometric analysis presented here.