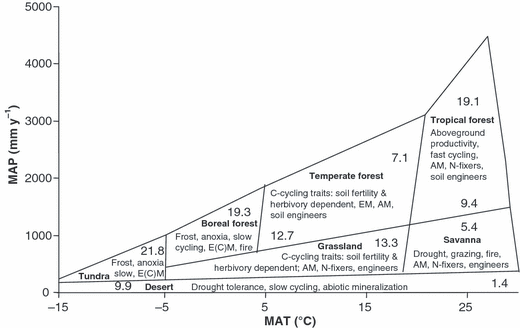
Factors affecting carbon sequestration potential

Plant specie

The maximal potential of soils to sequester carbon is determined by intrinsic abiotic soil factors such as topography, mineralogy and texture, but soil carbon dynamics are also driven by biota and their interaction with climate.

Ecosystem engineers residing in soil affect carbon sequestration through carbon consumption, but probably even more so through modifying soil physical structure. Soil fauna, such as earthworms, ants and termites, promote carbon sequestration by redistributing carbon through the soil profile by channelling, mixing organic and mineral soil components, and by forming relatively stable soil aggregates and casts. Soil aggregates are formed through the occlusion of organic matter in soil minerals by means of ‘gluing’ compounds, e.g. polysaccharides and glycoproteins, or by creating structural networks. Plant litter quality, especially low C : N ratio and adequate size, enhances soil ecosystem engineering by earthworms and termites ([**Lavelle *et al.* 1997**](https://onlinelibrary.wiley.com/doi/full/10.1111/j.1461-0248.2008.01164.x?casa_token=q2FC7WeuSx0AAAAA%3AQzcBmLovc0jL5aWxToC6egrqDScAYjpdCRlkFGCQdJI5tmjcGvnxXnCxQpA7iUx9MpOyLKgpbt1HAa-a#b54); **[Eggleton & Tayasu 2001](https://onlinelibrary.wiley.com/doi/full/10.1111/j.1461-0248.2008.01164.x?casa_token=q2FC7WeuSx0AAAAA%3AQzcBmLovc0jL5aWxToC6egrqDScAYjpdCRlkFGCQdJI5tmjcGvnxXnCxQpA7iUx9MpOyLKgpbt1HAa-a" \l "b26)**), while earthworms are promoted further by high litter Ca ([**Reich *et al.* 2005**](https://onlinelibrary.wiley.com/doi/full/10.1111/j.1461-0248.2008.01164.x?casa_token=q2FC7WeuSx0AAAAA%3AQzcBmLovc0jL5aWxToC6egrqDScAYjpdCRlkFGCQdJI5tmjcGvnxXnCxQpA7iUx9MpOyLKgpbt1HAa-a#b76)).



Soil organic carbon pools (kg C m−2; [**Amundson 2001**](https://onlinelibrary.wiley.com/doi/full/10.1111/j.1461-0248.2008.01164.x?casa_token=q2FC7WeuSx0AAAAA%3AQzcBmLovc0jL5aWxToC6egrqDScAYjpdCRlkFGCQdJI5tmjcGvnxXnCxQpA7iUx9MpOyLKgpbt1HAa-a#b3)) and drivers of plant carbon sequestration traits across biomes with characteristic MAT: mean annual temperature and MAP: mean annual precipitation. Lower and higher values within biomes represent warm- vs. cool-temperate forest, respectively, and drier vs. wet (peaty) tropical forests; EM: ecto-, ECM: ericoid- and AM: arbuscular mycorrhizal fungi; biome location after [**Woodward *et al.* (2004)**](https://onlinelibrary.wiley.com/doi/full/10.1111/j.1461-0248.2008.01164.x?casa_token=q2FC7WeuSx0AAAAA%3AQzcBmLovc0jL5aWxToC6egrqDScAYjpdCRlkFGCQdJI5tmjcGvnxXnCxQpA7iUx9MpOyLKgpbt1HAa-a#b104).

Biomes rich in plant diversity do not necessarily have larger SOC pools than less species-rich systems, as illustrated by comparable SOC concentrations in tundra, boreal and tropical forests, despite large differences in plant species richness ([**Amundson 2001**](https://onlinelibrary.wiley.com/doi/full/10.1111/j.1461-0248.2008.01164.x?casa_token=q2FC7WeuSx0AAAAA%3AQzcBmLovc0jL5aWxToC6egrqDScAYjpdCRlkFGCQdJI5tmjcGvnxXnCxQpA7iUx9MpOyLKgpbt1HAa-a#b3)). However, within biomes, plant trait composition strongly influences soil carbon sequestration. While the relative abundances and productivities of the predominant plant functional types and their traits *per se* are probably the principal factor determining soil carbon dynamics, interactions among plant species, or the avoidance thereof, may also play some important roles.

Plant functional traits and soil carbon sequestration in contrasting biomes

Gerlinde B. De Deyn, Johannes H. C. Cornelissen, Richard D. Bardgett, ecology letters, [**Volume11, Issue5**](https://onlinelibrary.wiley.com/toc/14610248/2008/11/5).

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Climatic conditions

Climatic conditions, namely temperature and precipitation, are key drivers of SOC storage globally as well as at broad (sub-)regional scales, affecting both C input into the soil and SOC decomposition. Precipitation determines net primary productivity (NPP) in many (water-limited) terrestrial environments and thus the input of C into the soil. Furthermore, humid conditions favour the formation of SOC-stabilizing mineral surfaces by intensified weathering of the parent material.

Soil organic carbon storage as a key function of soils - A review of drivers and indicators at various scales

Author links open overlay panelMartin Wiesmeier a b, Livia Urbanski a, Eleanor Hobley a, Birgit Lang c, Margit von Lützow a, Erika Marin-Spiotta d, Bas van Wesemael e, Eva Rabot f, Mareike Ließ f, Noelia Garcia-Franco a, Ute Wollschläger f, Hans-Jörg Vogel f, Ingrid Kögel-Knabner, Geoderma

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Soil texture

The amount of carbon (C) sequestered in soil is related to soil texture, soil management, vegetation, and climatic variation. However, in the Northern Great Plains, little information is available to quantify the effects of soil texture on the C sequestration potential of soils. This work was conducted to develop relationships for C sequestration potential based on soil texture under a variety of agricultural practices. Soil samples were collected from central and southeast North Dakota from sites with differing soil management and cropping systems; this includes native prairie, differing Conservation Reserve Program year classes, no-till, and conventional tillage practices. Particle size analysis was determined on the 0- to 15-cm soil depth using a hydrometer method. Sand fractions were determined by sieving. Carbon analysis was done by a high temperature combustion method. For all sampled soils, total silt (%) was found to be positively correlated (P ≤ 0.01) to organic C content (percent organic C) and organic C mass (kg m−2 depth−1). Sand was found to be negatively correlated (P ≤ 0.10) with % organic C and organic C mass. Soil clay content was correlated with organic C mass (P ≤ 0.05) but not percent organic C. Bulk density was found to be negatively correlated with percent organic C (P ≤ 0.10). The strong correlation between silt content and soil organic C reflects the greater water holding capacity and plant available water of silt-dominated soils, which, in turn, affect plant productivity and influences C sequestration in soil.

Relationships Between Soil Carbon and Soil Texture in the Northern Great Plains

Augustin, Christopher; Cihacek, Larry J.

Author Information

Soil Science 181(8):p 386-392, August 2016.

Precipitation and CS Potential

Excessive grazing pressure is detrimental to plant productivity and may lead to declines in soil organic matter. Soil organic matter is an important source of plant nutrients and can enhance soil aggregation, limit soil erosion, and can also increase cation exchange and water holding capacities, and is, therefore, a key regulator of grassland ecosystem processes. Changes in grassland management which reverse the process of declining productivity can potentially lead to increased soil C. Thus, rehabilitation of areas degraded by overgrazing can potentially sequester atmospheric C. We compiled data from the literature to evaluate the influence of grazing intensity on soil C. Based on data contained within these studies, we ascertained a positive linear relationship between potential C sequestration and mean annual precipitation which we extrapolated to estimate global C sequestration potential with rehabilitation of overgrazed grassland.

Potential soil carbon sequestration in overgrazed grassland ecosystems, Global Biogeochemical cycles

Richard T. Conant, Keith Paustian

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