FEDIOL General Assembly Conference

Reaching positive carbon and biodiversity impact during arable farming: a scientific viewpoint

Gerard H. Ros (WU, NMI)

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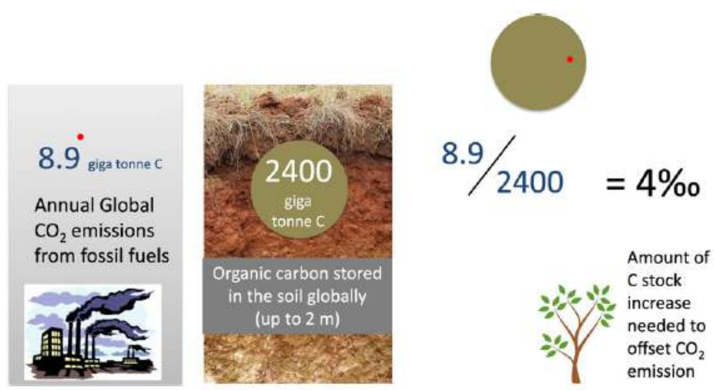
Soil Carbon and international ambition

Initiative of French Minister of Agriculture for COP21



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Source: Minasny et al (2017)

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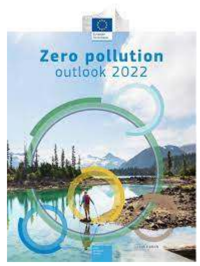
The current EU ambition: carbon neutrality



Long term GHG emissions ambition for EU (COM (2018 773)): reduce from 5000 Mton CO_2-eq to zero before 2050, with 50% reduction in agriculture

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How is the ambition realised for agriculture?

- CAP and trade schemes: limit total GHG emission
- National policies in connection with environmental constraints
  - Regulations on use of catch crops and manure
  - Regulations on crop rotation schemes, preservation nature
  - Regulations on soil management practices to boost SOC
- Voluntary markets (following strict protocols)

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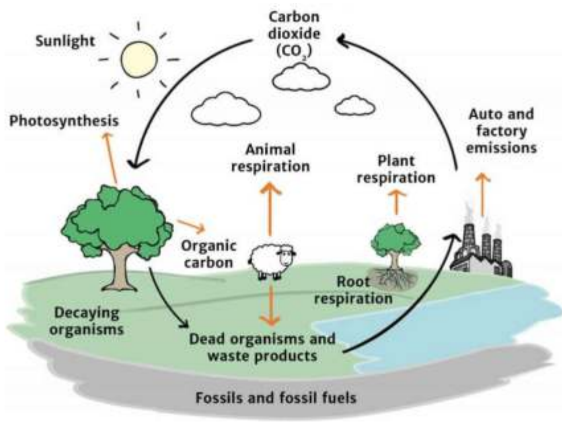
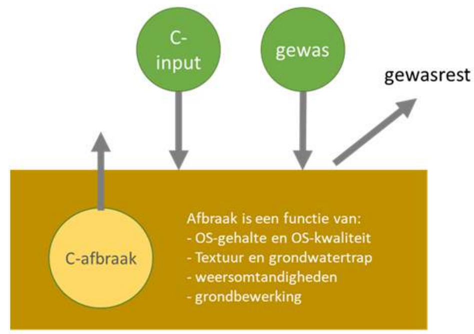
Carbon sequestration in arable systems: the basics





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The benefits of SOC for farming

Soil organic matter improves:

- aggregate-stability
- water storage capacity and infiltration rate
- nutrient supply
- soil biodiversity
- (soil) disease resistance
- degradation pesticides, retention pollutants

In particular when SOC is lower than 2%

Example: Terra Preta Soils

Main driver Soil Fertility

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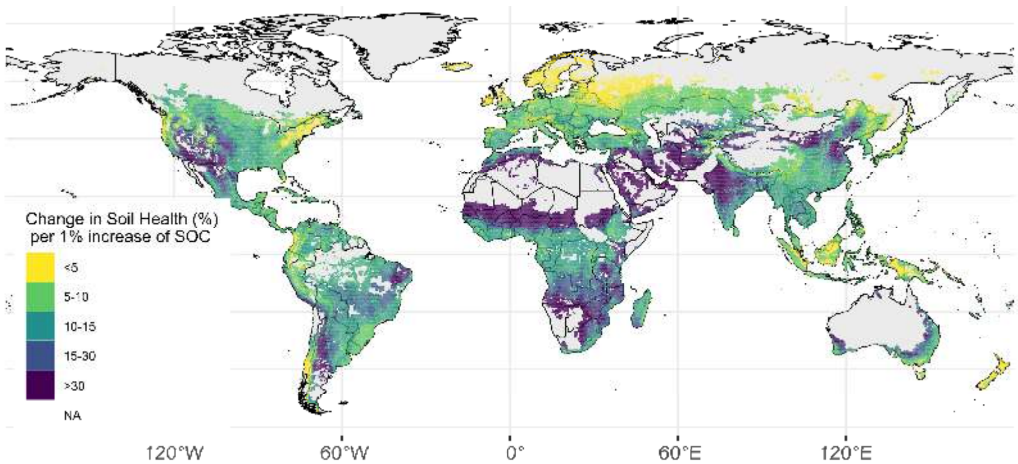
Change in soil health (%) per % change in SOC



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Ros & de Vries (2023) in prep.

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Carbon sequestration (impacts): scientific challenges

- Soils saturates with carbon and losses increase with SOC
- Land sharing versus land sparing
- Optimising management in view of impacts on
  - Greenhouse gas emissions CO_2, CH_4 and N_2O
  - Ammonia and biodiversity
  - Nutrients and water quality
  - Soil health
- Economic benefits are weakly underpinned
- Managing expectations: changes in SOC are rather slow

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Four recent examples highlighting current debate

Received: 9 December 2020 | Revised: 15 January 2021 | Accepted: 19 January 2021
DOI: 10.1111/ejss.13090

ORIGINAL ARTICLE

European Journal of Soil Science WILEY

Inconsistent effects of agricultural practices on soil fungal communities across 12 European long-term experiments

Silja Emilia Hannula[1,2] | Dominico Paolo Di Lonardo[2,3] | Bent T. Christensen[4] | Felicity V. Crotty[5] | Annemie Elsen[6] | Peter J. van Erp[2] | Elly M. Hansen[4] | Gitte H. Rubæk[4] | Mia Tits[6] | Zoltan Toth[7] | Aad J. Termorshuizen[2,8]

Outlook on Agriculture
Volume 50, Issue 1, March 2021, Pages 13-25

https://doi.org/10.1177/0030727021998063

SAGE journals

Perspective

Regenerative Agriculture: An agronomic perspective

Ken E Giller[1], Renske Hijbeek[1], Jens A Andersson[1], and James Sumberg[2]

PEOPLE AND NATURE
BRITISH ECOLOGICAL SOCIETY

RESEARCH ARTICLE | Open Access

The costs of delivering environmental outcomes with land sharing and land sparing

Lydia Collas, Romain Crastes dit Sourd, Tom Finch, Rhys Green, Nick Hanley, Andrew Balmford

First published: 20 December 2022 | https://doi.org/10.1002/pan3.10422 | Citations: 1

OPINION

Global Change Biology WILEY

Carbon for soils, not soils for carbon

Gabriel Y. K. Moinet[1] | Renske Hijbeek[2] | Detlef P. van Vuuren[3,4] | Ken E. Giller[2]

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Carbon sequestration: agricultural challenges

- Improvement of SOC above agronomic target
  - Requires long-term perspective
  - Crops boosting SOC are economically often less attractive (W-EU)
  - Mitigation of trade-offs to environment

- Monitoring SOC requires affordable and robust measurement methods
  - Satellite based: fail on local and farm scale
  - Wet chemistry based: too costly
  - Sensor fusion: high perspective (and in development)

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Sustainable vegetable oil


Contents lists available at ScienceDirect
Science of the Total Environment
journal homepage: www.elsevier.com/locate/scitotenv

More sustainable vegetable oil: Balancing productivity with carbon storage opportunities

Thomas D. Alcock [a,b,⁎,1], David E. Salt [a,c], Paul Wilson [c], Stephen J. Ramsden [c,2]

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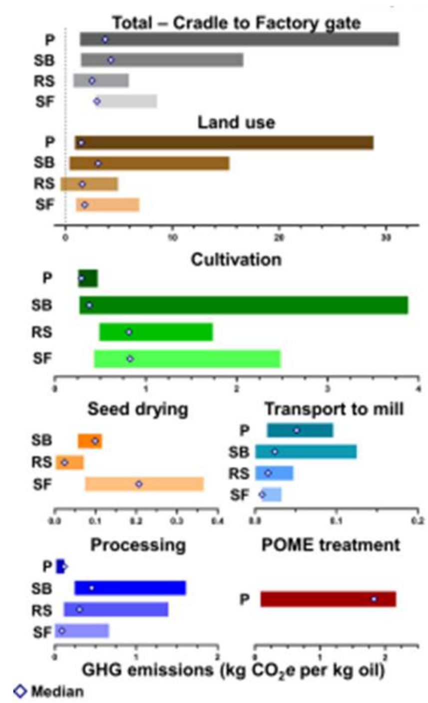
[b] Crop Physiology, School of Life Sciences - Weihenstephan, Technical University of Munich, 85354 Freising, Germany
[c] School of Biosciences, University of Nottingham, Sutton Bonington Campus, Loughborough LE12 5RD, UK



P = palm
SB = soybean
RS = rapeseed
SF = sunflower

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Thanks!



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The sustainable production of oilseeds

Table 1. Agronomic principles and practices considered to be part of Regenerative Agriculture and their potential impacts on restoration of soil health and reversal of biodiversity loss.

Principles	Practices	Restoration of soil health	Reversal of biodiversity loss
Minimize tillage	Zero-till, reduced tillage, conservation agriculture, controlled traffic	***	–
Maintain soil cover	Mulch, cover crops, permaculture	***	*
Build soil C	Biochar, compost, green manures, animal manures	***	–
Sequester carbon	Agroforestry, silvopasture, tree crops	***	**
Relying more on biological nutrient cycles	Animal manures, compost, compost tea, green manures and cover crops, maintain living roots in soil, inoculation of soils and composts, reduce reliance on mineral fertilizers, organic agriculture, permaculture	***	–
Foster plant diversity	Diverse crop rotations, multi-species cover crops, agroforestry	**	***
Integrate livestock	Rotational grazing, holistic [Savory] grazing, pasture cropping, silvopasture	**	?
Avoid pesticides	Diverse crop rotations, multi-species cover crops, agroforestry	*	***
Encouraging water percolation	Biochar, compost, green manures, animal manures, holistic [Savory] grazing	***	–

Based on McGuire (2018), Burgess et al. (2019) and Merfield (2019).

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