SoilCare
SOILCARE FOR PROFITABLE AND SUSTAINABLE CROP PRODUCTION IN EUROPE

Caring for Soil in a Disenchanted Age?

Mapping systemic aspects of soil management practices in Danish agriculture using Fuzzy Cognitive Mapping



Chris Kjeldsen[1],
Tommy Dalgaard[1],
Benjamin Christen[1]

[1] Aarhus University, Denmark

The project

As part of the SoilCare project, the Danish research group is focusing on caring for soils as a systemic phenomenon. We deploy the notion of 'systemic' as an approach which conceptualizes practices of soil management as being embedded within a multiplicity of relations between soils, farmers, extension, private enterprises, public regulation and other entities. In addition to that, a wide range of perspectives should be taken into account, including both scientific as well as non-scientific perspectives.

The case

The case studied is an organic dairy farm, located in north-western rural Denmark. The farmer is supplying a Danish organic dairy, Thise Mejeri.

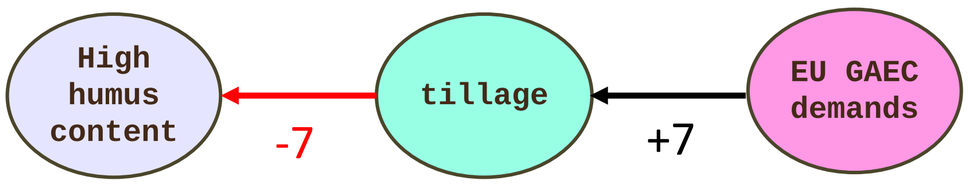
The farming system can be divided into two subsystems: dairy cows and cash cropping. The dairy subsystem is based on the 'feed no food' principle, which is a systems redesign based on feeding dairy cows exclusively with grass, rather than starch or protein. In terms of systems properties, the grass-milk system is an extensification of the dairy subsystem.

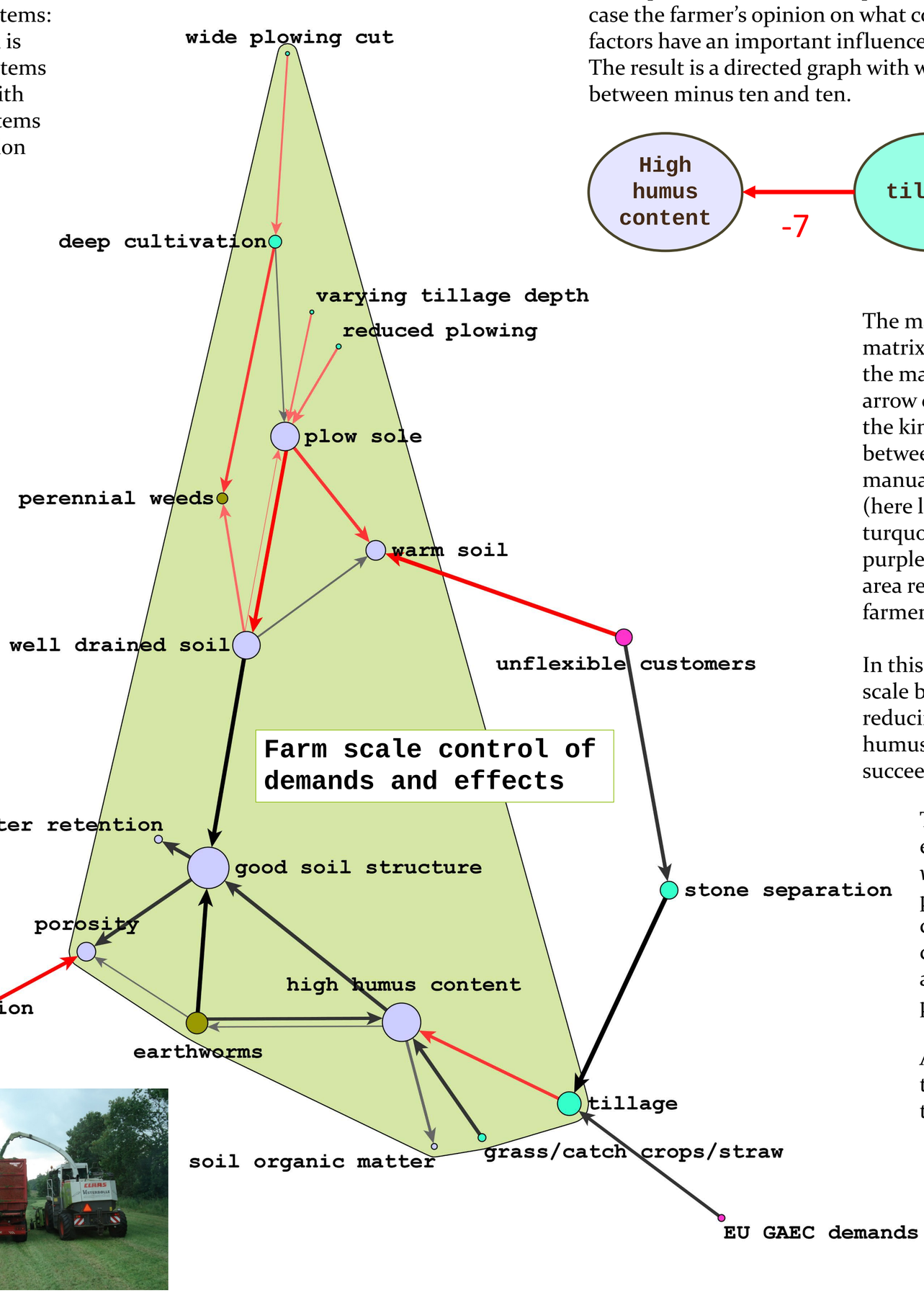
The cows may be less productive, but the farmer has room to allocate more of the farm's area to produce high-value crops for human consumption.

As an example, the farm as a specialized dairy system with 250 cows can produce food for about 1000 people annually, while as a grass-based system with 100 cows, it can produce food for approximately 3500 people.

The method

Fuzzy Cognitive Mapping is a semi-quantitative method to explore individual perceptions of a given phenomenon. A semi-structured interview is conducted with the farmer. During the interview, different 'concepts' are identified that pertain to the system of interest, in this case the farmer's opinion on what constitutes a 'good soil' and which factors have an important influence on this – both on and off farm. The result is a directed graph with weighted influences with values between minus ten and ten.





The map is translated into an adjacency matrix. The 'Visone' software visualizes the matrix as a fuzzy cognitive map where arrow colours and arrow thickness refer to the kind and strength of influence between factors. Concepts are then manually colour coded according to group (here light grey refers to soil properties, turquoise to cultivation methods and purple to external factors). The shaded area represents concepts under the farmer's own control.

In this case it appears that a solely field scale based intervention with the aim of reducing tillage intensity to preserve high humus content in the soil is unlikely to succeed.

The farmer is aware of the negative effects of intensive tillage and *wants* to reduce it, but farming procedures required to deliver on customer demands and stay compliant with EU rules for good agricultural and environmental practice appear to make it difficult.

A field scale intervention to reduce tillage is unlikely to succeed beyond the intervention's duration.

Knowledge and learning perspectives

When reviewing prior projects on soil management, many approaches were found to target field scale as the scale of intervention. Popularly speaking, soil health was across several projects framed as a function of a farmer's ability to translate scientific advice into practice. Instead we wished to focus on the farmer's perception of his own practice, rather than relying on a priori assignments of scale of intervention. We applied Midgley's notion of systemic intervention (Midgley 2000, Midgley 2003) as the framework of our inquiry. We propose that interventions regarding soil care should include careful reflection on both boundary issues (who and what is involved), as well as allowing for theoretical and methodological pluralism in the inquiry process. In our view, identifying relevant action for improvement should not be based on a priori definitions of scale of intervention.

References

Midgley, G. (2000). Systemic intervention: Philosophy, methodology and practice. New York, Kluwer Academic/Plenum Publishers.
Midgley, G. (2003). "Science as Systemic Intervention: Some Implications of Systems Thinking and Complexity for the Philosophy of Science." Systemic Practice and Action Research **16**(2): 77-97.

The **SOILCARE** project is a 5 year project aimed at identifying and evaluating promising soil improving cropping systems and agronomic techniques increasing profitability and sustainability across scales in Europe.

The SOILCARE project consortium consist of 28 partner institutes from 10 European countries
The SOILCARE project is coordinated by ALTERRA, Wageningen UR, The Netherlands.

• Starting date: March 1st 2016. • Ending date: February 28th 2020. • EU contract number: 677407

EU project officer for SOILCARE: **Aneta Ryniak** – aneta.ryniak@ec.europa.eu
Project coordinator: **Dr. Rudi Hessel** – rudi.hessel@wur.nl – tel. +31 317 468530

WWW.SOILCARE-PROJECT.EU
WWW.SOILCARE-HUB.EU
WWW.FACEBOOK.COM/GROUPS/SOILCARE
TWITTER.COM/SOILCARE_EU

This project is funded by the European Commission under the H2020 program

http://www.soilcare-project.eu/copyright-and-disclaimer