International Circular bioeconomy Conference

CIRCULAR BIOECONOMY
A SHIFT TOWARDS SUSTAINABLE FOOD PRODUCTION

Tartu, Estonia

SOIL – EITHER A PLACE FOR CARBON SEQUESTRATION OR A RESOURCE FOR FOOD PRODUCTION

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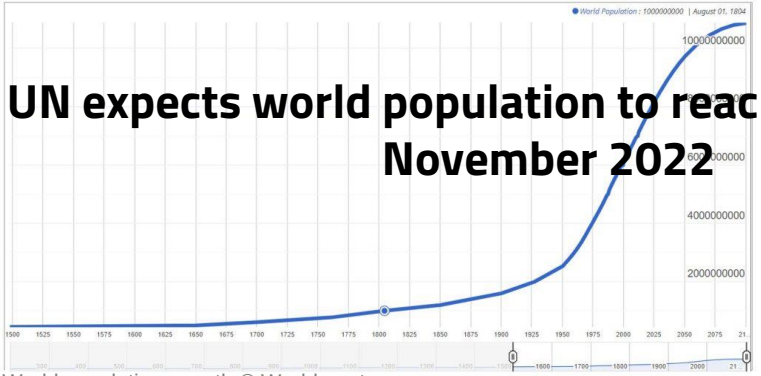
Why do we have dilemma?

Changes in our usual conditions

Bark beetles

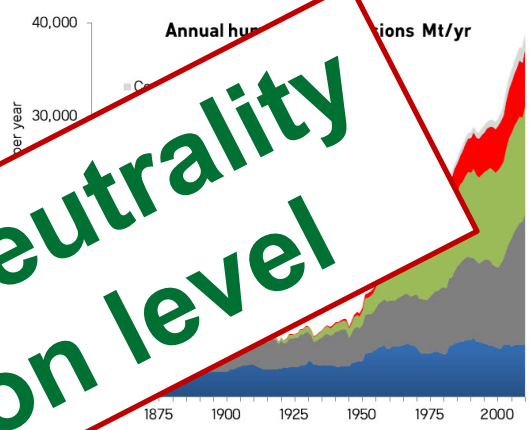


UN expects world population to reach 8 billion on 15 November 2022

World population growth © Worldometers

Emission and fixation

CO_2 in atmosphere 414.45 ppm



https://i.stack.imgur.com/Z54Wc.jpg

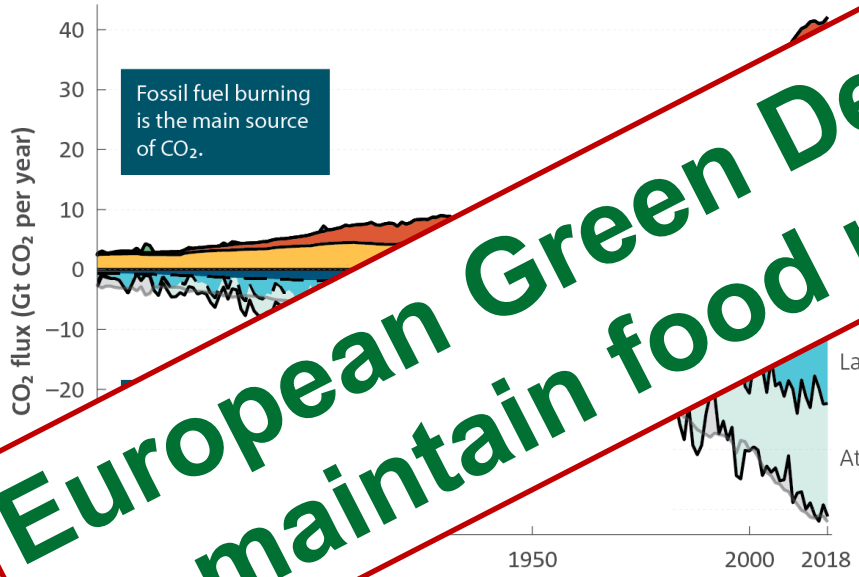
Emission 42.9 ± 2.8 Gt CO_2 2019

C pool:

Atmosphere – Z

Plants – 5

So



6.4 Gt

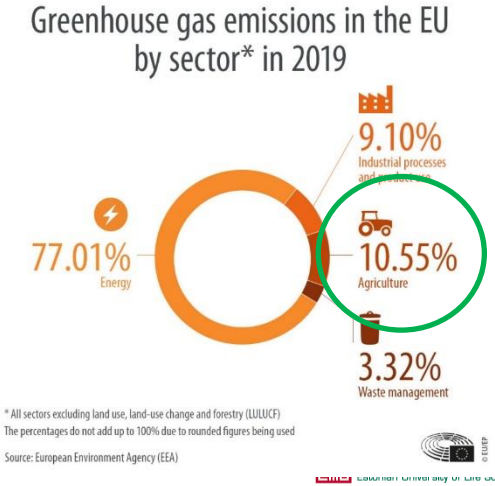
-9 Gt

Land sink

-12 Gt

Atmosphere

+21.9 Gt



European Green Deal – C-neutrality

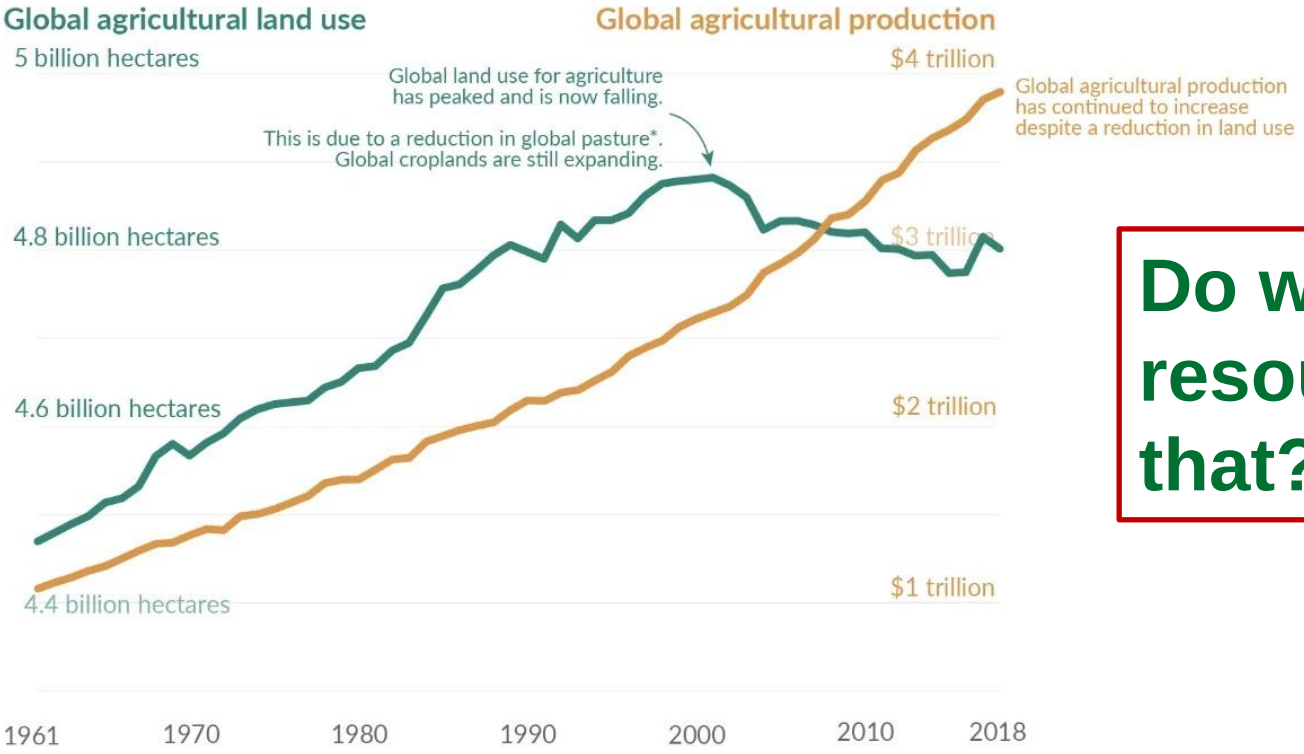
To maintain food production level

http://ww… …n.gov.au/state-of-the-climate/greenhouse-gas-levels.shtml

Global decoupling of agricultural land and food production

Our World in Data

Agricultural land is the sum of cropland and pasture for grazing livestock.
Production is measured in constant 2015 international-dollars, which adjusts for inflation. Includes all crops and livestock.



Do we have resources for that?

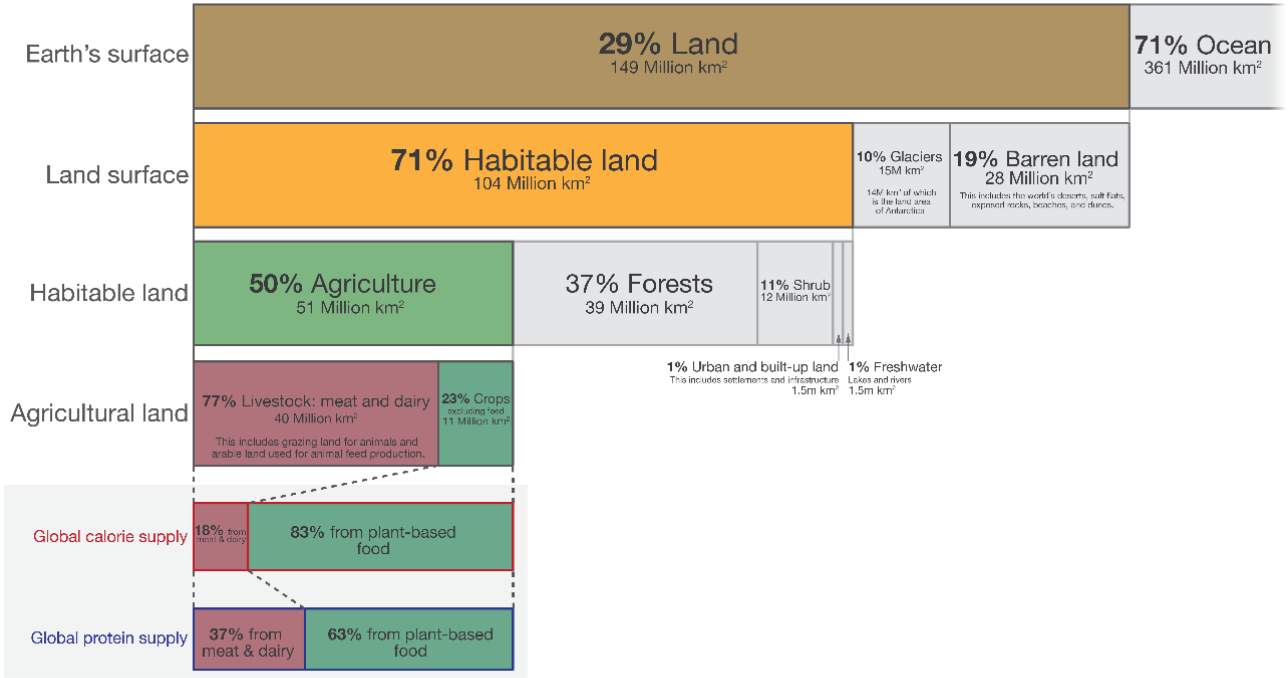
*A peak in global pasture land does not mean that it has peaked everywhere. In tropical regions, it continues to increase, often at the expense of carbon-rich habitats.
Data source: Food and Agriculture Organization of the United Nations.
OurWorldinData.org – Research and data to make progress against the world's largest problems.

https://www.freethink.com/environment/peak-agricultural-land

Lets illustrate

Global land use for food production

Our World in Data



Data source: UN Food and Agriculture Organization (FAO)
OurWorldinData.org – Research and data to make progress against the world's largest problems.

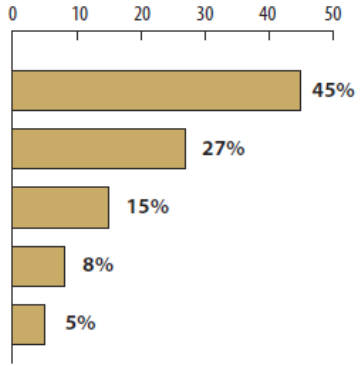
Question rises – where to collect C?

or

or

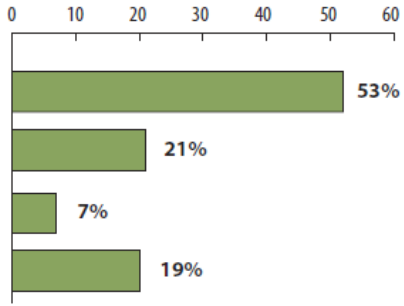
Where locates most of C in Estonia?

Soil groups



Corg total stock 593.8 Tg

Land use



Distribution of C stock

Astover jt. 2012. Mullateadus. Õpik kõrgkoolidele

In agriculture we talk in the context of land use and/or agricultural practices change:

Peat C stock change

- Arable land MOS: -8.31 t/ha y
- Grassland: +0.16 t/ha y

- More influenced by drainage:
- First 5 years: -3.7 cm/y 1m peat layer (5…15 t/ha y)
- Later: -0.3 cm/y 1m peat layer

How much and how quickly do we get a change in temperate mineral soils?

Kh – paepealne muld

K – rähkmuld

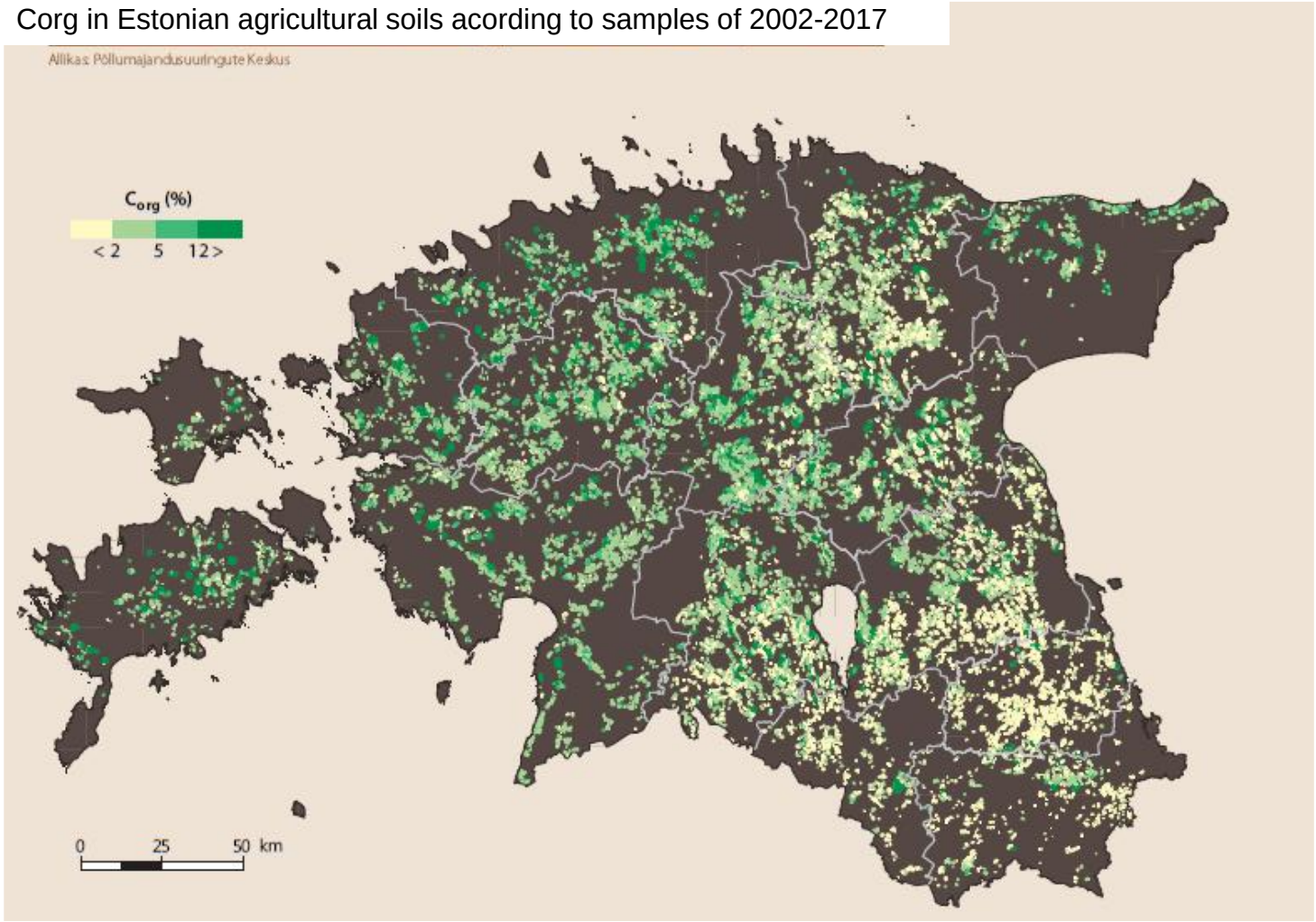
Ko – leostu-nud muld

KI – leetjas muld

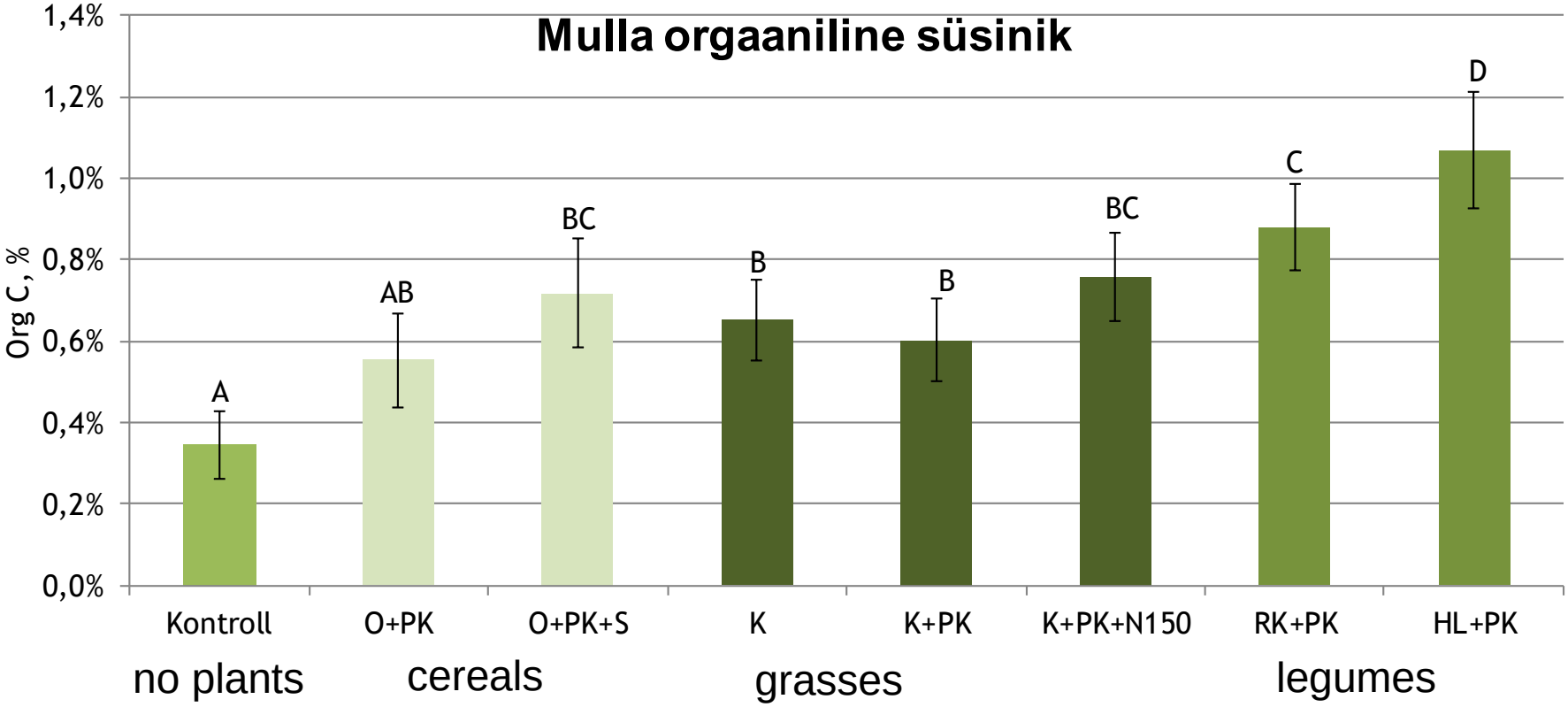
LP – näiv-leetunud muld

LI – leetunud muld

Corg in Estonian agricultural soils acording to samples of 2002-2017



C_{org} content in soil after 50 years

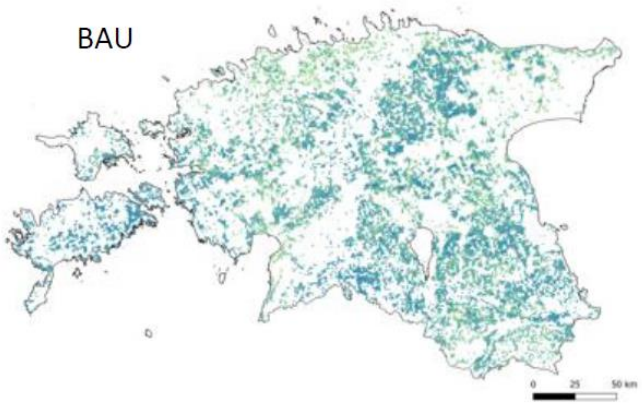


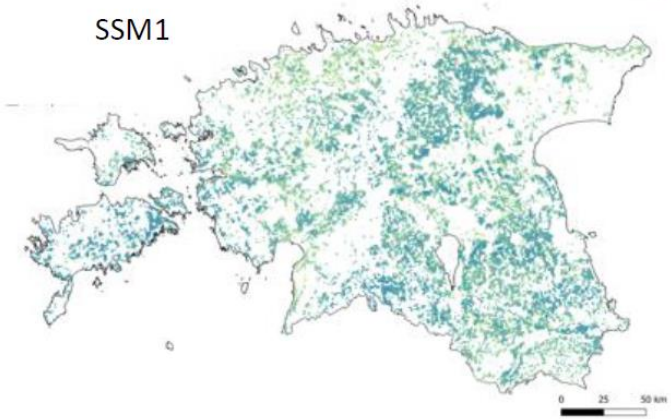
N trend was similar

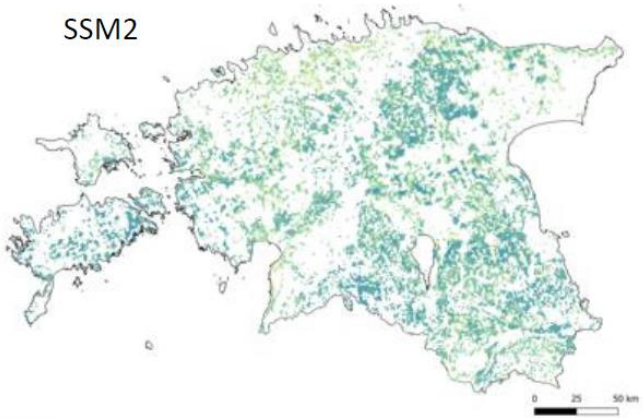
Experiment on till at EMÜ

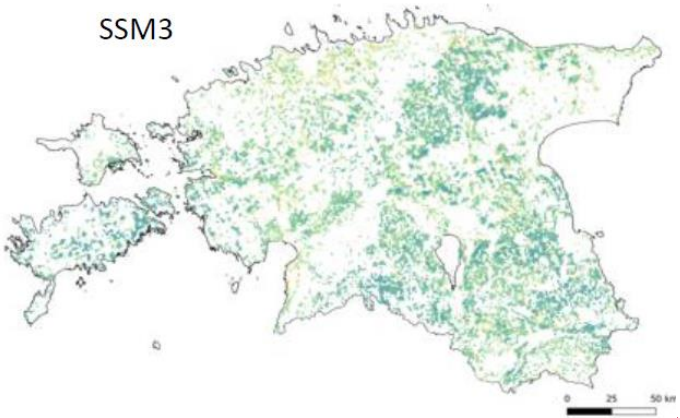
Eesti Maaülikool
Estonian University of Life Sciences

Absolute SOC sequestration ability at different scenarios







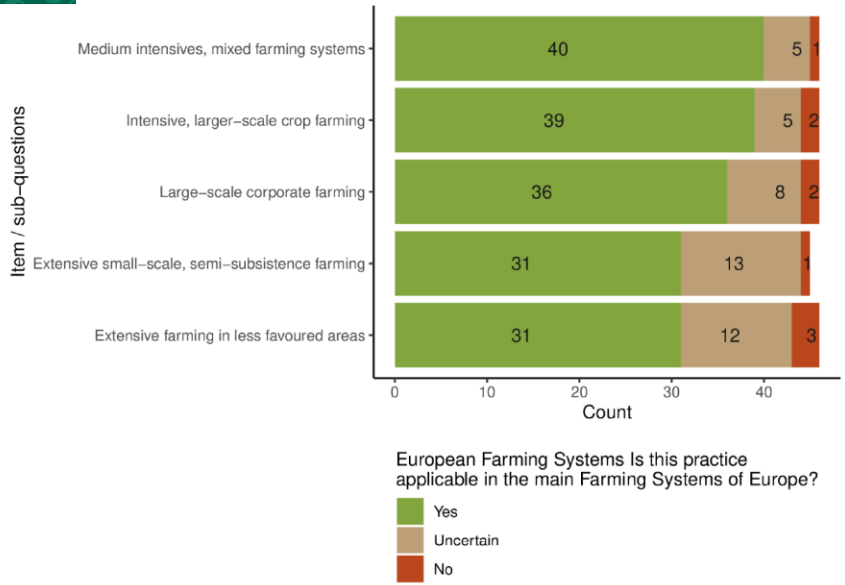


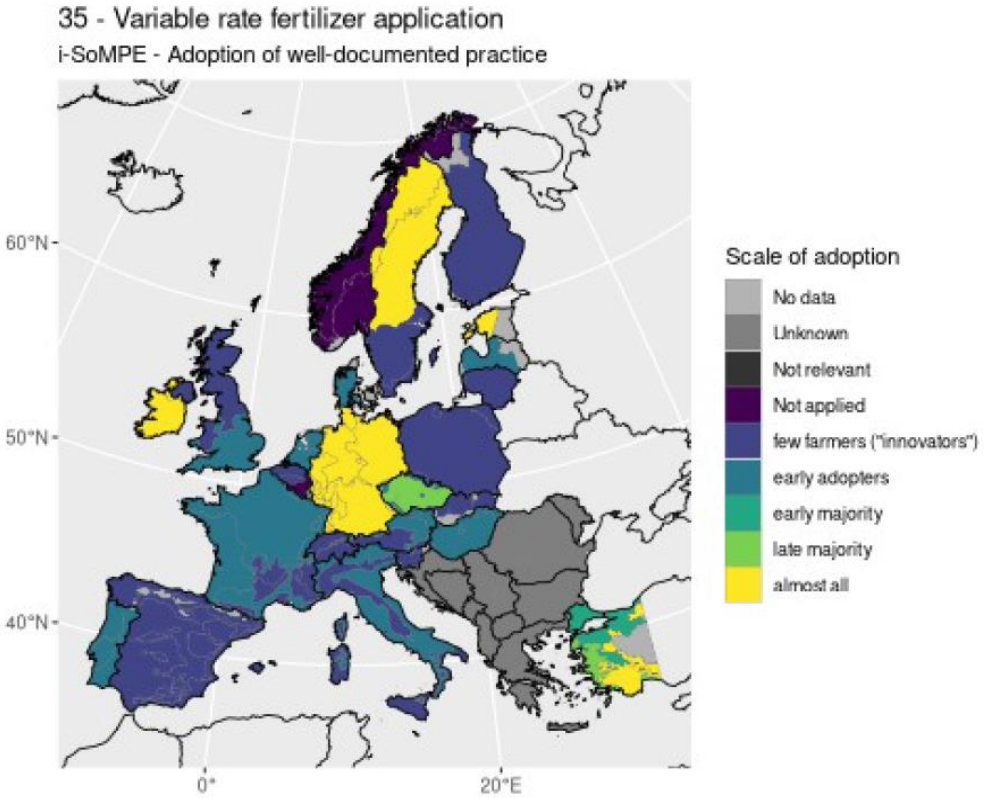
Absoluutne MOS sidumisvõime (t C ha^{-1} a^{-1})

- -0.01
- 0.27
- 0.55
- 0.83
- 1.11
- 1.39
- 1.67
- 1.96
- 2.24
- 2.52
- Country border line

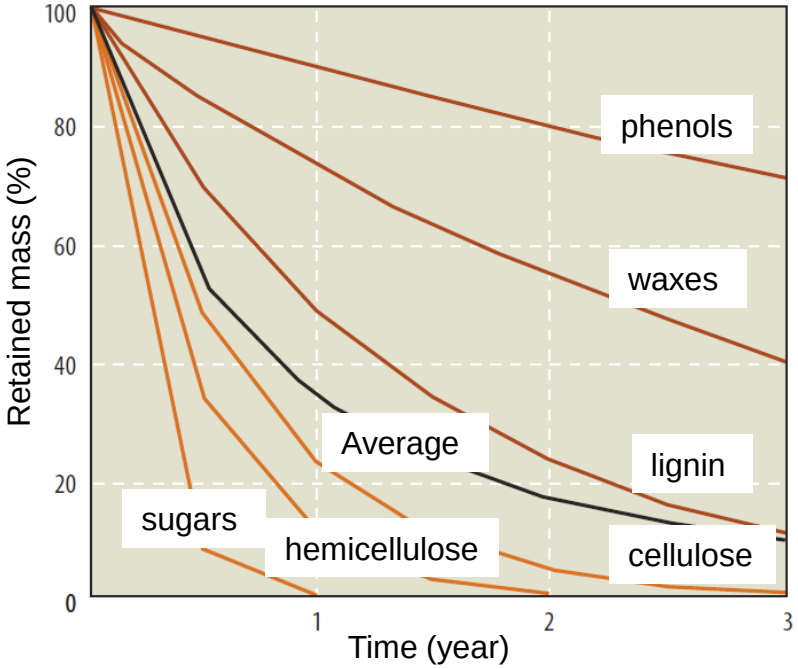
Common: BAU
Low: +5% (SSM1)
Medium: +10% (SSM2)
High: +20% (SSM3)

2 – Current adoption of soil management practices





Why not more?



Decomposition of litter

- **Mineralization** – decomposition into carbon dioxide, water and oxides
- **Humifikation** – transformation into relatively stable humic substances

What does the rate of decomposition depend on:

Material

Temperature

Water content

Aeration

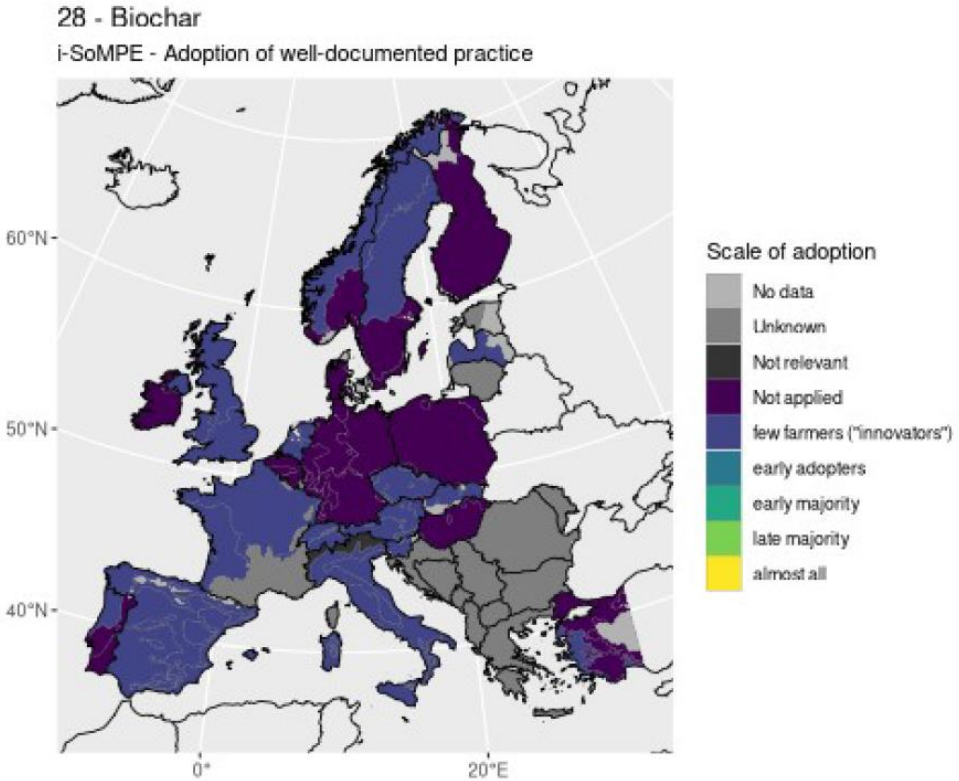
pH

Astover jt, 2012

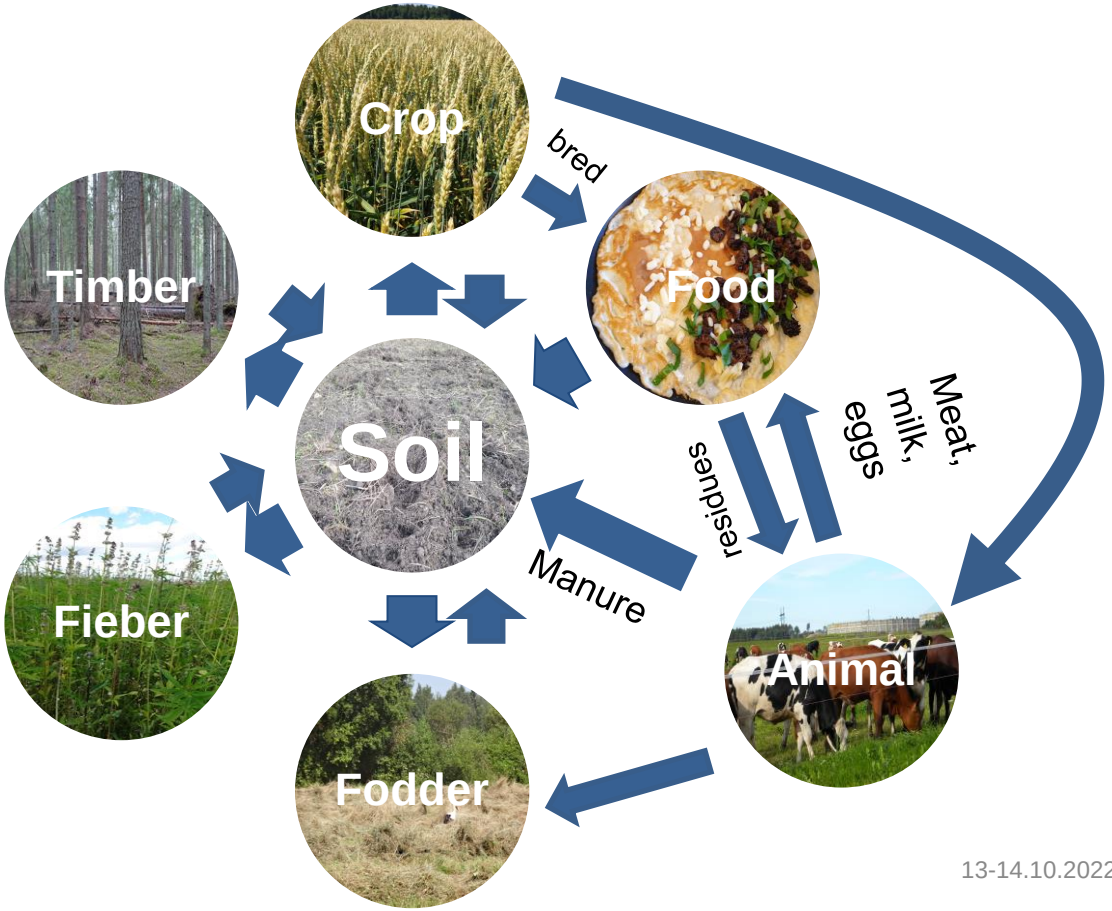
5-20% of organic fertilizers – stabile fraction of C

2 – Current adoption of soil management practices

Biochar



Circular economy – ideal



Global economy – present

waste

waste

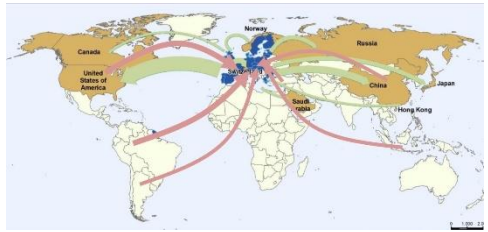
waste

waste

waste

waste

waste



Crop

Timber

Food

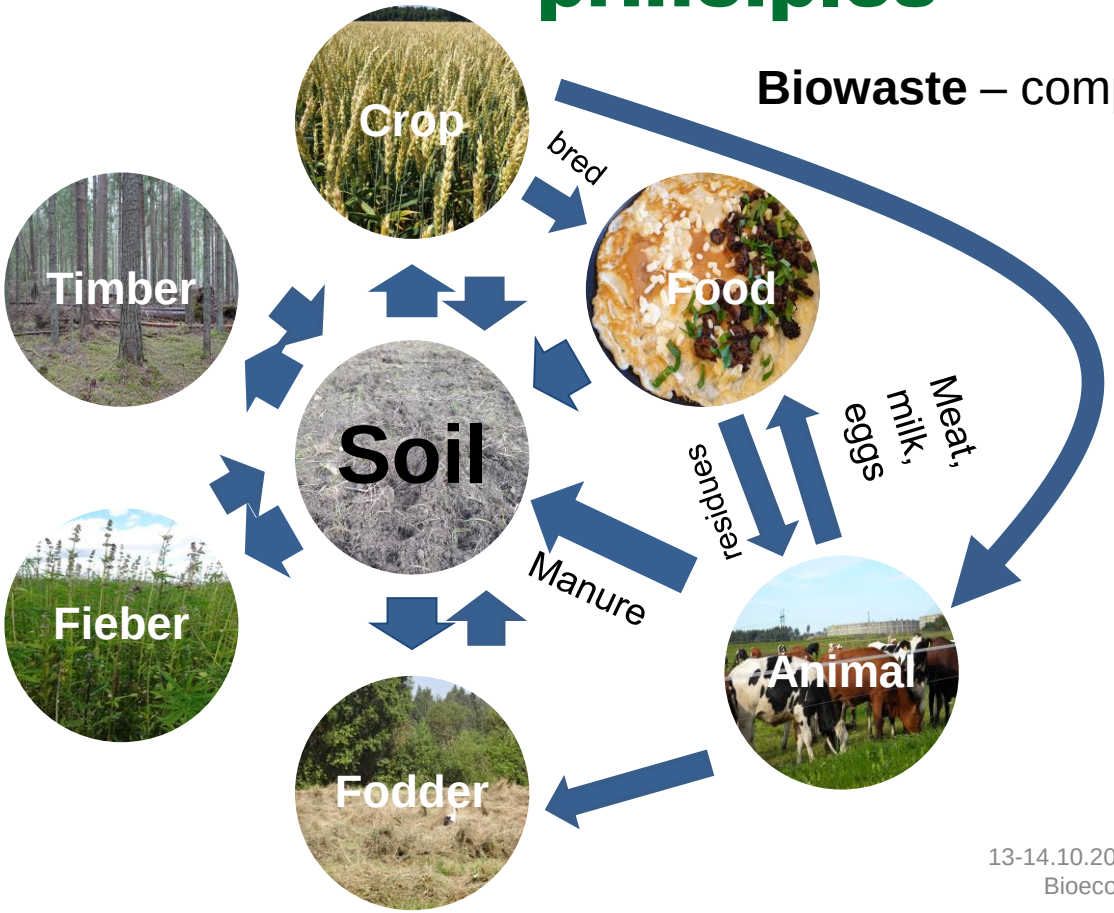
Soil

Fieber

Animal

Fodder

We have to return back to the no waste principles



Biowaste – composting – back to the soil

However, we need:

Materials

Energy



We need to maintain soil and food quality



SoilPlastic – app to register macroplastic

MINAGRIS

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Soil for both – for carbon sequestration and for food production

Thank You for Your Attention!

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Future?!