BOREAL

RESPONSIBLE PARTNER

Luke, (Finland)

COORDINATION

Doctor (PhD) Krista Peltoniemi is a senior scientist and has expertise on soil microbiomes. She has experience on studies of soil microbial communities (fungi, bacteria, actinobacteria, methanogenic archaea and methanotrophic bacteria), their diversity after environmental changes and their relationships in various environments. Her main task in the projects is to act as a regional coordinator for Boreal region on behalf of all Finnish partners Luke, Petla, Kilpiä and Tyynelä farms. She is involved in all WPs, and her expertize will be utilized in the soil microbiological anayses concerning WP3 and WP5.Deputy coordinator of WP3.

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Objective

Early potato is one of the most important crops grown in the Boreal region. Since it has a very short growing period, there is always a long period of time after the harvest when the soil is left bare without vegetation cover. Therefore, the soil in early potato fields is especially vulnerable to erosion and therefore also loss in carbon and nutrients which in turn are actively recycled or retained by soil organisms. With SoildiverAgro we aim to enhance the biodiversity and functionality of soil micro- and macroorganisms responsible for carbon and nutrient cycles.

Two different approaches are investigated in boreal case studies with early potato to maintain soil biodiversity which in turn enhance soil health and productivity:
1) keep the fields covered with cover (or catch) crops,
2) use of organic forest-based amendment to prevent carbon and nutrient loss after the early potato harvest.

Traditionally most of the cultivated soils in the Boreal region have been under intensive conventional tillage which often means mouldboard ploughing. Ploughing is used to control weed growth and to aerate soil before sowing, although it also disrupts the natural soil layers and structure. Intensive tillage may result in compaction and degradation of soil causing losses of soil organic matter affecting soil biodiversity and water availability and thus to overall soil health and productivity. In SoildiverAgro we aim to tackle these problems by investigating less intensive tillage management practices combined with direct sowing in the fields of the Boreal region. Case study fields under tillage experiments are focused to finding the best management practices to create a good soil structure that will enhance the environment for soil biodiversity and microbial activity, and thus also better nutrient cycling and their availability for crop plants.

The overall goal of SoildiverArgo is to enhance sustainable agriculture also in the Boreal region, where northern location and long wintertime create extra challenges for farmers.

Stakeholders consultations

DISCUSSION GROUP

05.03.2020 | Finland

Implementation of possible more sustainable agricultural management practices in Finland

22 PARTICIPANTS: Farmers, researchers, agribusiness, policymakers, industry advisors

REGIONAL MEETING

25.7.2019 | Finland

Overview and decisions about the final experimental design of the boreal case studies in Finland.

17 PARTICIPANTS: Boreal region partners (farmers, project members)

FIELD DAYS

25.7.2019 | Finland
Cover and companion crops were introduced to participants. Active discussion related to crop rotation, soil structure or protective and companion crops
75 PARTICIPANTS: Farmers

21.10.2019 | Finland
Introduction to winter crops, including case study where winter wheat is directly drilled into the green manure crop
30 PARTICIPANTS: Farmers

23.07.2020 | Finland
Trial establishment and intermediate crops
240 PARTICIPANTS: Farmers

TRAINING DAYS

To be confirmed

OTHERS

To be confirmed

NEXT STEPS

A minimum of 2 field days per year will be organised to inform and consult stakeholders and everybody interested.

CASE STUDY 13

Increase of soil biodiversity through amendment of forest based organic material in potato crops.

OBJECTIVE

The objective is to test if forest based carbon addition increases soil biodiversity and carbon stocks in the soil.

PROPOSED PRACTICES

We will compare potato harvest, compare microbiome diversity, carbon storage and disease occurrence between treatments in relation to forest based carbon addition.

STATE OF THE ART

Potato cultivation in the boreal area is intensive using deep ploughing, irrigation and mineral fertilization. Eutrophication risk of nearby waters/ground water is high.

PROGRESS WITH THE CASE STUDY IN RELATION WITH THE STATE OF THE ART

Finding adequate forest based material addition is the first step of a new fertilization improving biodiversity and carbon storage of soil.

PROBLEM TO SOLVE

Potato cultivation has the risk to loose soil organic carbon due to deep ploughing and irrigation. Addition of forest based organic products adds carbon to soil.

CROPS

LOCATION

Laitila (Finland)

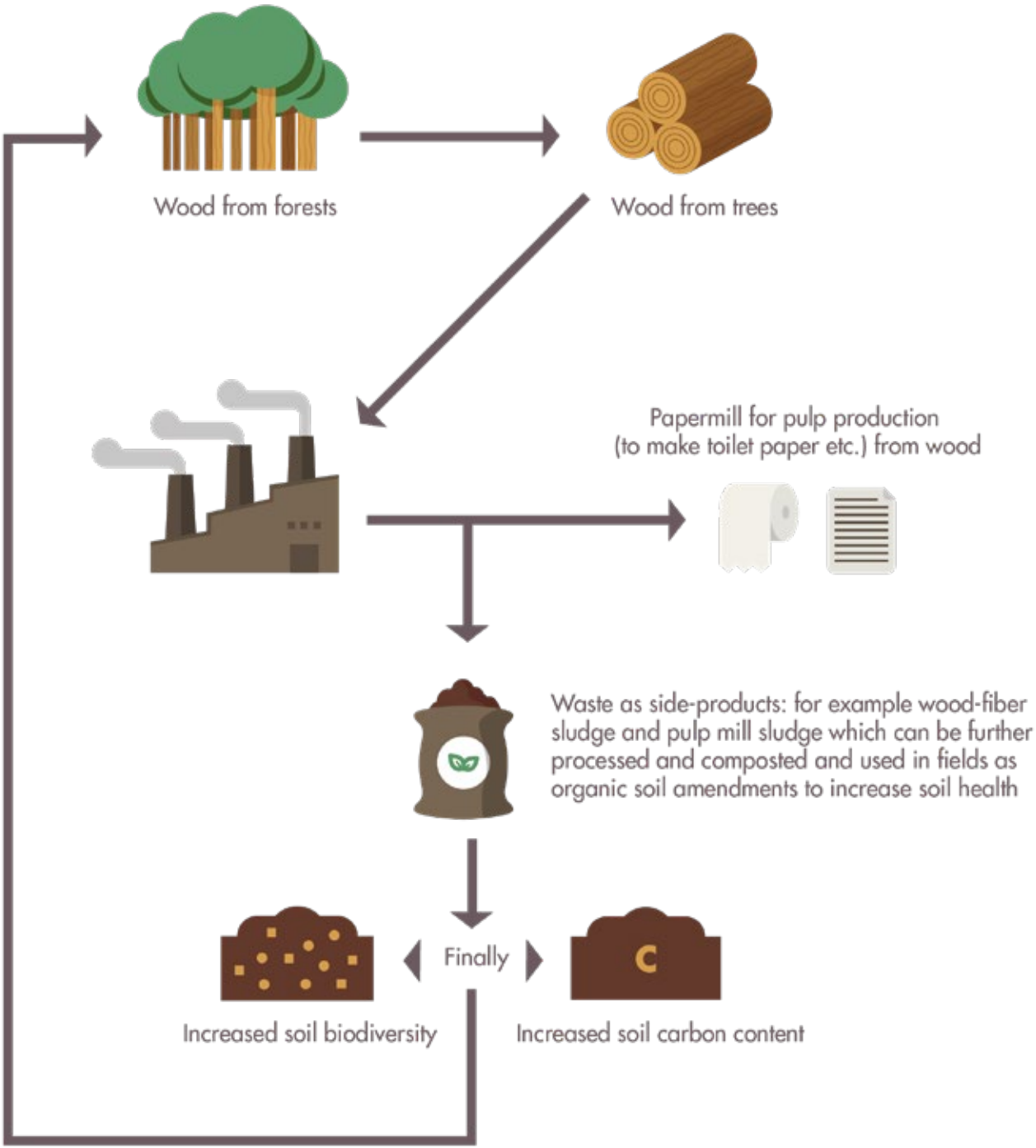
PARTNERS

PETLA

LUKE

CROPPING SYSTEMS

Addition of forest based amendments.


Wood from forests
Wood from trees
Papermill for pulp production
(to make toilet paper etc.) from wood
Waste as side-products: for example wood-fiber sludge and pulp mill sludge which can be further processed and composted and used in fields as organic soil amendments to increase soil health
Finally
C
Increased soil biodiversity
Increased soil carbon content

→ *Infographic for case study 13: Increase of soil biodiversity through amendment of forest based organic material in potato crops*

CASE STUDy 14 A

Contrasting continuous plant cover with inversion tillage in wheat fields.

OBJECTIVE

The objective is to experiment and quantify what inversion tillage does to a soil ecosystem, and how it influences plant nutrient uptake and health.

PROPOSED PRACTICES

The test fields have been managed with organic farming with continuous plant cover and minimum tillage. The experimental plots will be ploughed and the control will continue as it has.

STATE OF THE ART

In spite of the drawbacks, organic agriculture relies heavily on mouldboard plough to control weeds. Farmers have misconceptions on its effectivity, some even suggesting that it improves soil health by increasing water infiltration and storage. Some farmers have tested non-inversion tillage in organic farming, but the benefits have not been quantified.

PROGRESS WITH THE CASE STUDY IN RELATION WITH THE STATE OF THE ART

Providing evidence on the damage that inversion tillage does to soil structure, health and biology.

PROBLEM TO SOLVE

Organic agriculture relies on mouldboard ploughing for weed control. Inversion tillage and related overwinter fallow is seen to be detrimental to soil organisms and soil health, but the results are not conclusive. The case study will provide results on what happens to soil health when a continuous plant cover crop rotation with shallow tillage is interrupted with mouldboard ploughing.

CROPS

LOCATION

Uusimaa (Finland)

PARTNERS

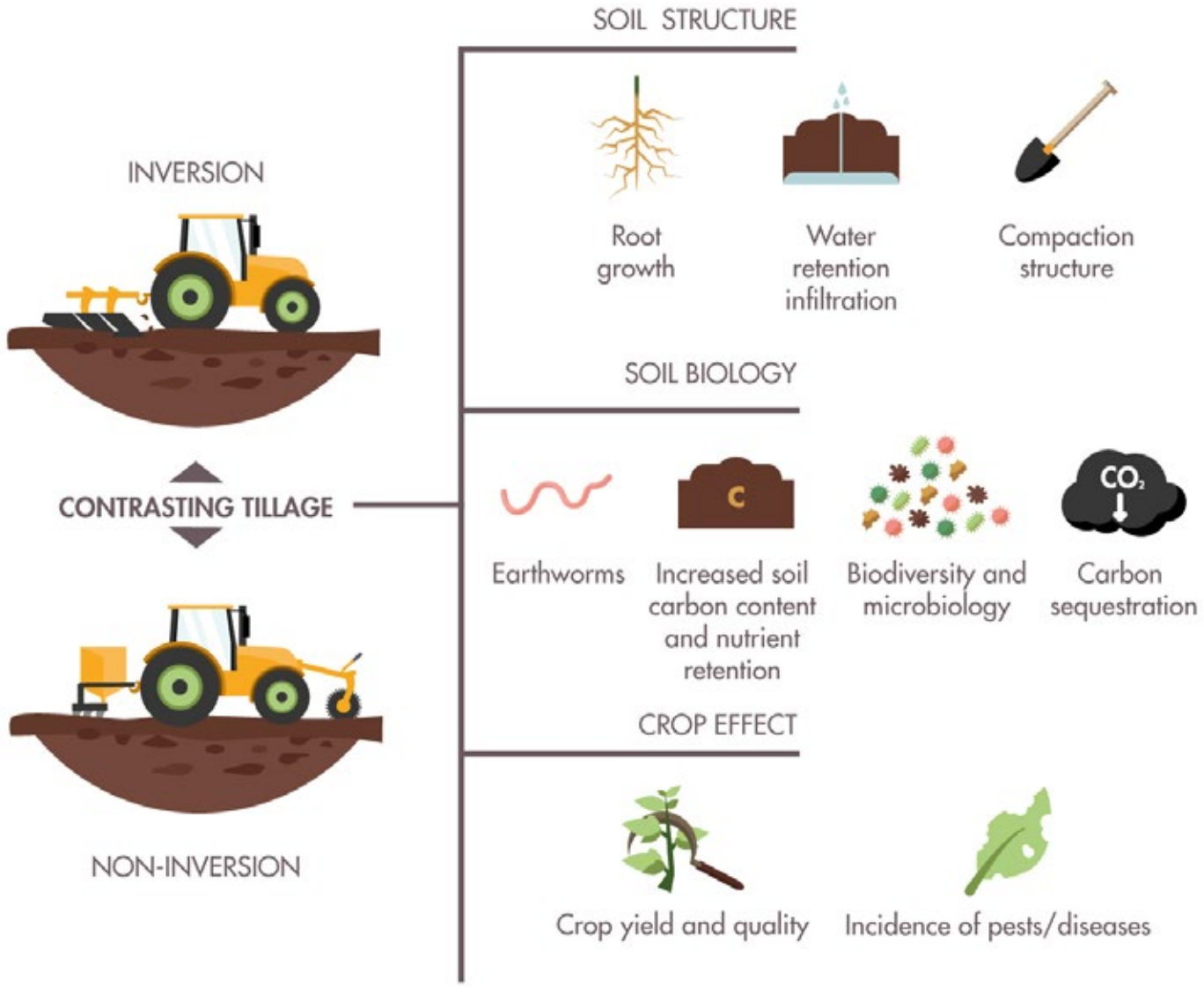
MTJ

TT

LUKE

CROPPING SYSTEMS

Minimum tillage, and inversion tillage.


SOIL STRUCTURE
INVERSION
Root growth
Water retention infiltration
Compaction structure
SOIL BIOLOGY
CONTRASTING TILLAGE
C
CO_2
Earthworms
Increased soil carbon content and nutrient retention
Biodiversity and microbiology
Carbon sequestration
CROP EFFECT
NON-INVERSION
Crop yield and quality
Incidence of pests/diseases

→ *Infographic for case study 14 A and 14 B made by MTJ & TT*

CASE STUDY 14 B

Contrasting minimum tillage with inversion tillage in wheat fields.

OBJECTIVE

To study differences between minimum tillage and ploughing on soil properties and microbiology on organic farming system.

PROPOSED PRACTICES

The test fields have been managed with organic farming with continuous plant cover and minimum tillage. The experimental plots will be ploughed and the control will continue with developed minimum tillage practices.

STATE OF THE ART

Minimum tillage and direct drilling are not common practices in organic farming but could be utilized with a crimper roller and continuous crop cover.

PROGRESS WITH THE CASE STUDY IN RELATION WITH THE STATE OF THE ART

Minimum tillage is presented as a key method for improving soil biological diversity and functioning.

PROBLEM TO SOLVE

Organic agriculture relies on mouldboard ploughing for weed control. Inversion tillage and related overwinter fallow is seen to be detrimental to soil organisms and soil health, but the results are not conclusive. The case study will provide results on what happens to soil health when a continuous plant cover crop rotation with shallow tillage is interrupted with mouldboard ploughing.

CROPS

LOCATION

South Carelia (Finland)

PARTNERS

MTJ

TT

LUKE

CROPPING SYSTEMS

Minimum tillage, and inversion tillage.

CASE STUDY 15

Use of catch crop in farmed potatoes fields.

OBJECTIVE

The objective is to test how catch crops benefit soil biodiversity and biological soil fertility and related ecosystem functions.

PROPOSED PRACTICES

Catch crops will be sown after the harvest.

STATE OF THE ART

Catch crops benefit soil quality especially after the harvest, as they take up nutrients through the summer and autumn, add carbon to soil, contribute to good soil structure, and promote microbial and faunal function and restrict erosion of soil.

PROGRESS WITH THE CASE STUDY IN RELATION WITH THE STATE OF THE ART

Finding out whether catch crops would improve soil structure and quality by decreasing nutrient and carbon loss that hypothetically affect soil biodiversity and biological soil fertility.

PROBLEM TO SOLVED

Growing season for early potato cultivation is short. Thus is expected that practices conducted in fields after harvest would be important for soil community maintaining favorable soil conditions.

CROPS

LOCATION

Laitila (Finland)

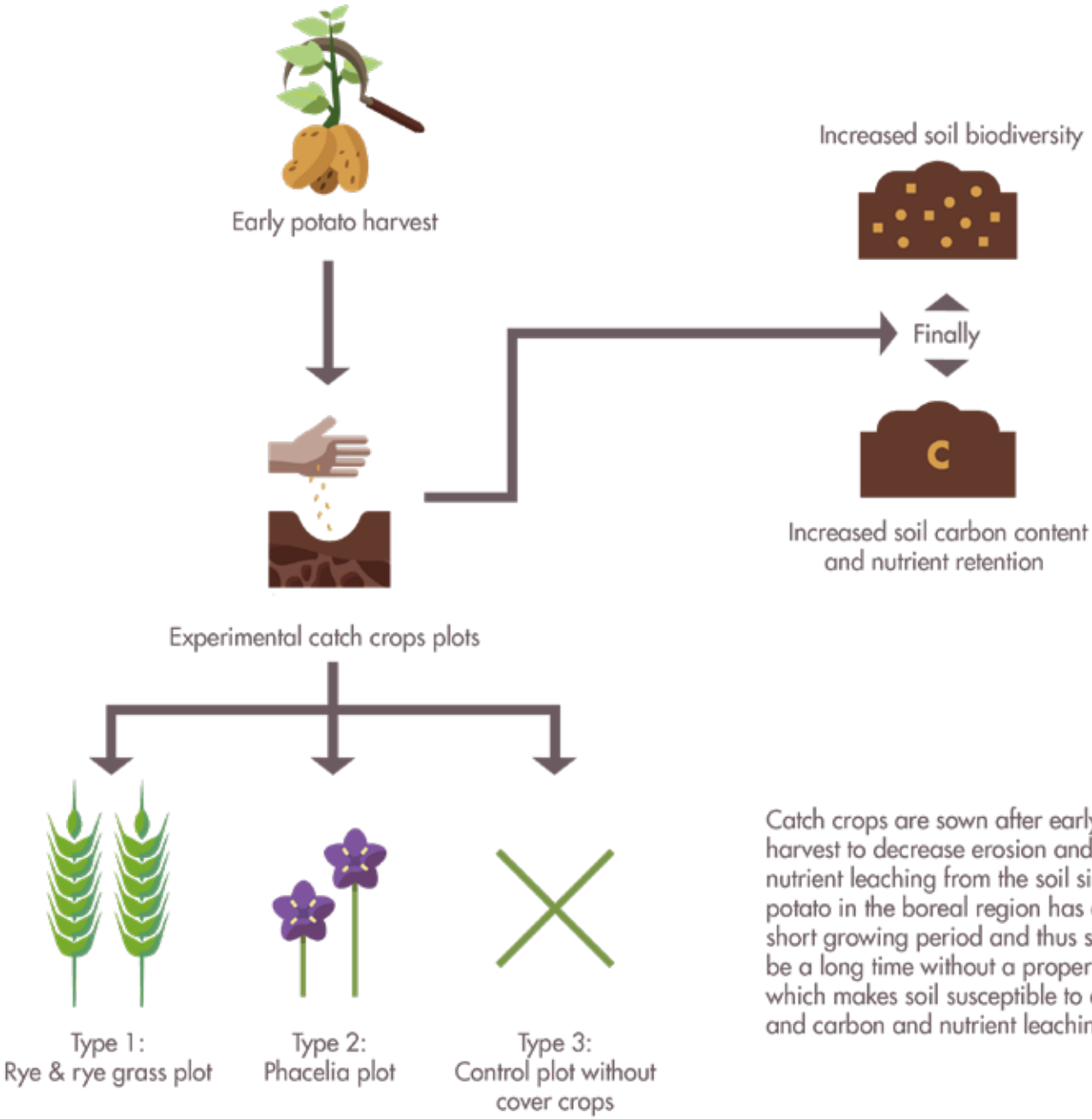
PARTNERS

PETLA

LUKE

CROPPING SYSTEMS

Use of catch crops



Catch crops are sown after early potato harvest to decrease erosion and nutrient leaching from the soil since early potato in the boreal region has a very short growing period and thus soil will be a long time without a proper crop which makes soil susceptible to erosion and carbon and nutrient leaching.

→ *Infographic for case study 15: Use of catch crop in farmed potatoes fields*