

# Soil improvement fibers in agricultural water protection

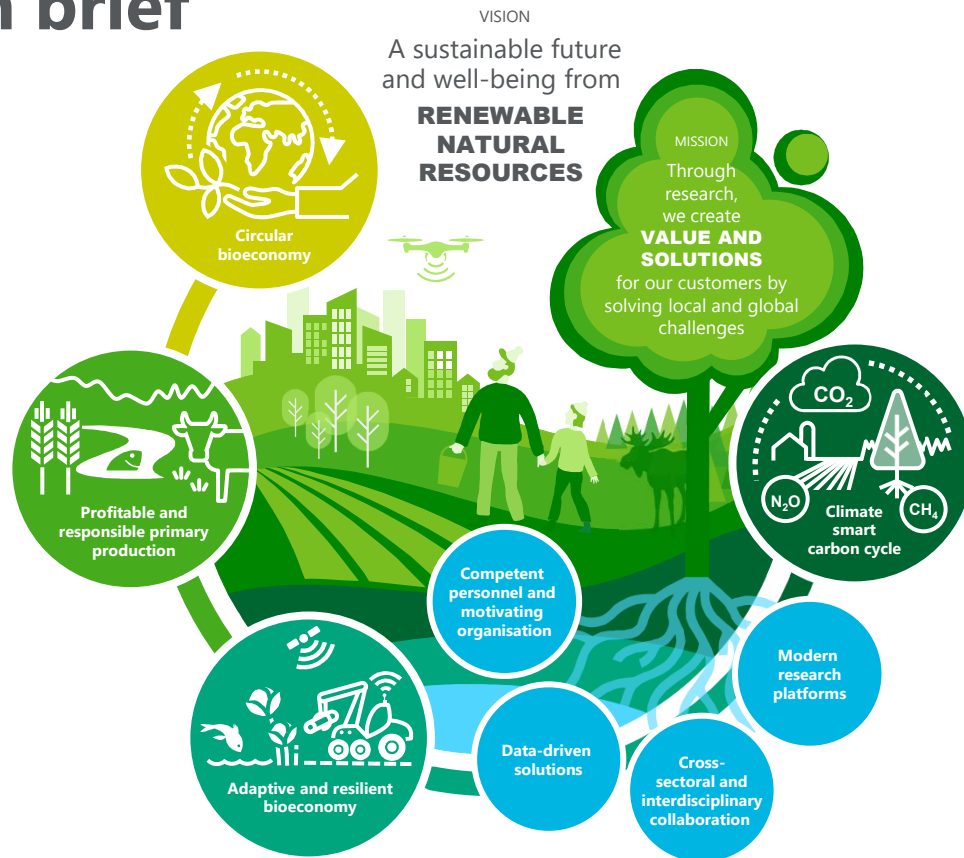
## Kimmo Rasa

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# Luke in brief



**125** M€

Turnover

**73** M€

Budget funding

**52** M€

External funding

**25**

Locations in Finland

HQ in Helsinki

Present in 12 campuses with universities, research institutes and polytechnics

**1288**

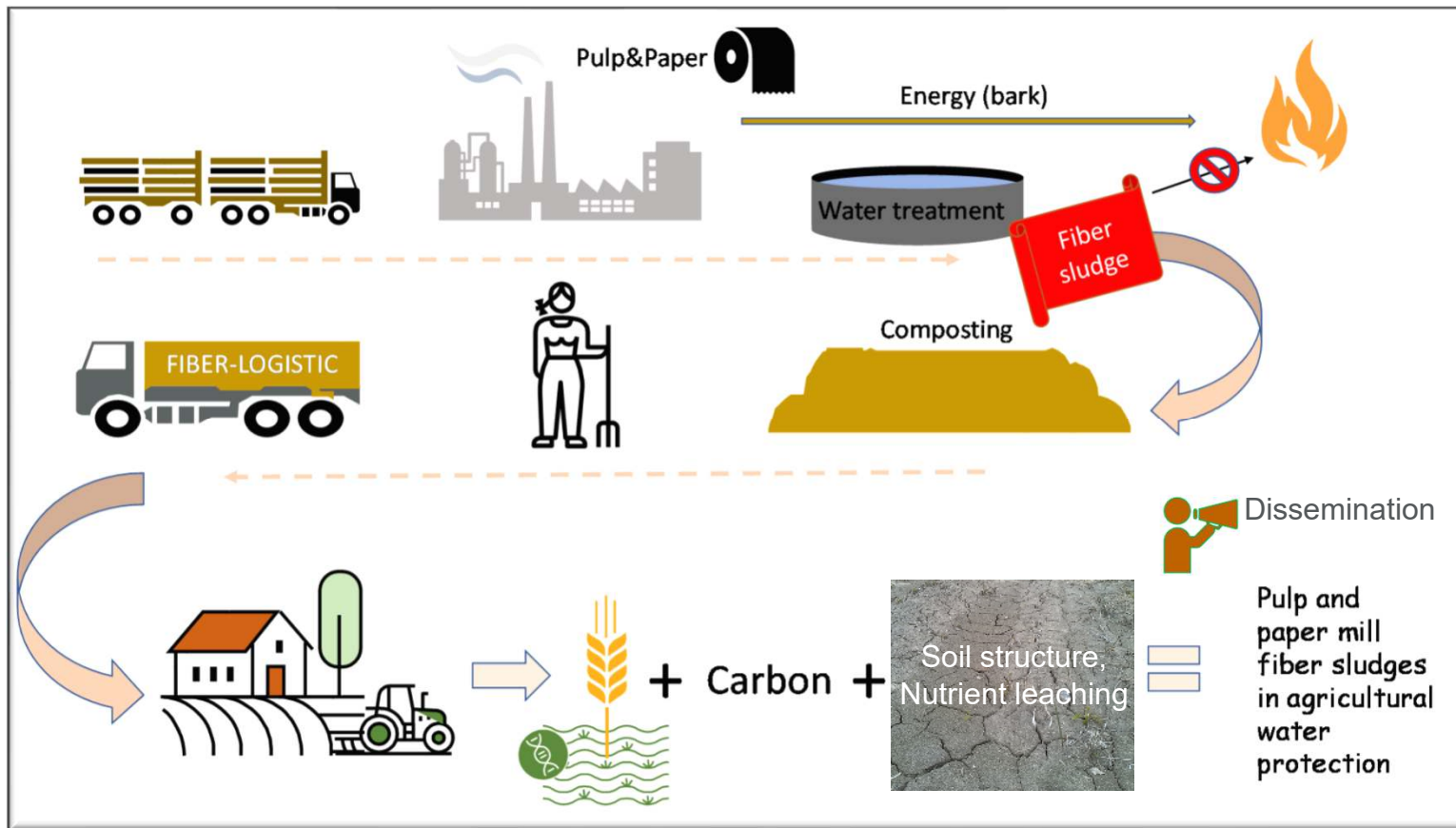
Employees

46 research professors  
622 researchers

*We are one of the four Statistical Authorities in Finland.*

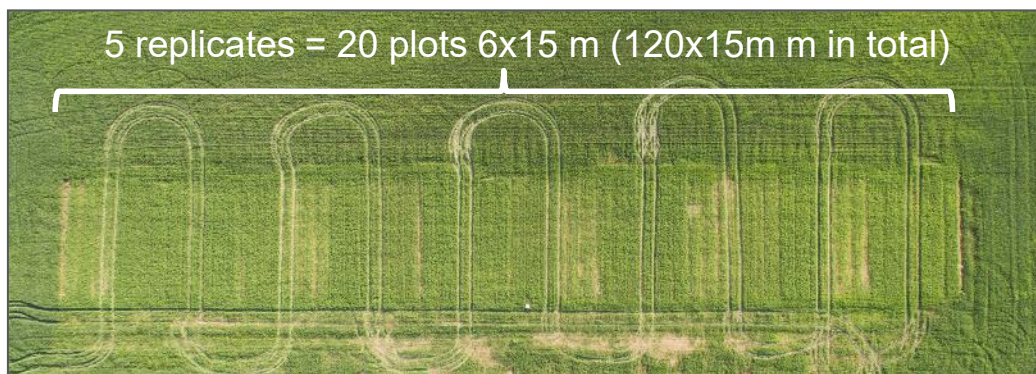
30.9.2021

# From fiber sludge to soil improvement fibers



# Field experiment, three different fiber-type

- Established at autumn 2015
  - Composted pulp mill sludge (CPMS)
  - Lime-stabilized pulp mill sludge (LPMS)
  - Fiber sludge, "zero-fiber" (FS)



Clay soil prone to erosion,  
South-Western Finland.  
Loimijoki catchment, Jokioinen

Fotos: Jaakko Heikkinen

# Soil amendments

- Composted and lime stabilized fibers contain phosphorus, nitrogen and some heavy metals
  - Application rate according to legislation
- Fiber sludge/ zero fiber nutrient poor
- Application rate in practice ~35-40 t ha<sup>-1</sup>

Sludge	Moist t ha <sup>-1</sup>	Carbon t ha <sup>-1</sup>	P-sol kg ha <sup>-1</sup>	N-tot kg ha <sup>-1</sup>	N-sol kg ha <sup>-1</sup>	Cd g ha <sup>-1</sup>
CPMS	52	8	45	211	34	21
LPMS	51	9	53	253	32	16
FS	72	8	2	1	1	0.2



## Rainfall simulation test – soil erosion

- Undisrupted soil monoliths taken from the field in spring
- Simulated rain applied in laboratory
- Percolation water samples were collected and analyzed
  - Erosion and nutrient mobilization
- Procedure repeated each spring 2016-2019 (+2020)



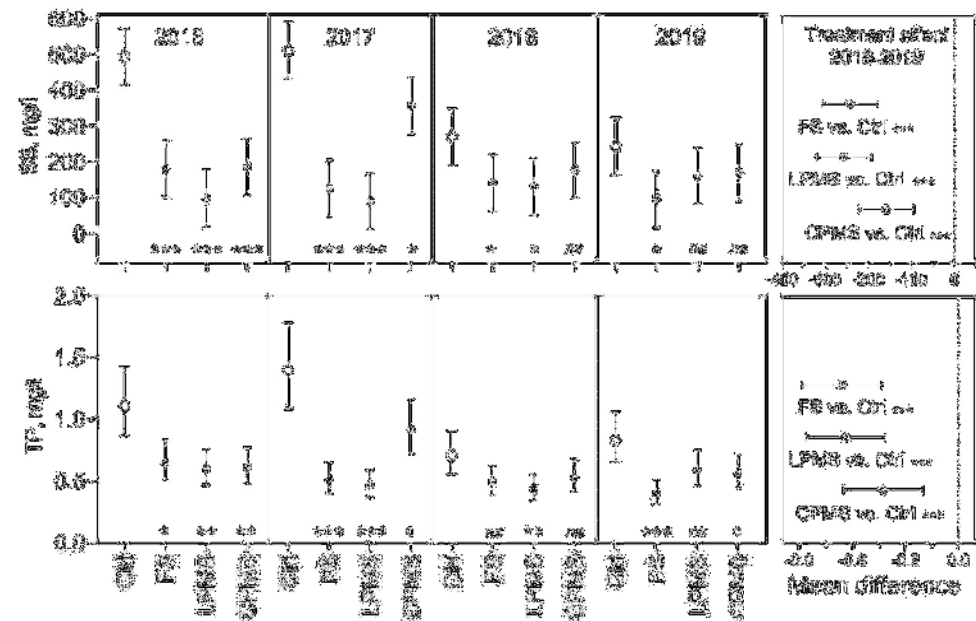
# Suspended solid (SS) and total phosphorus (TP)

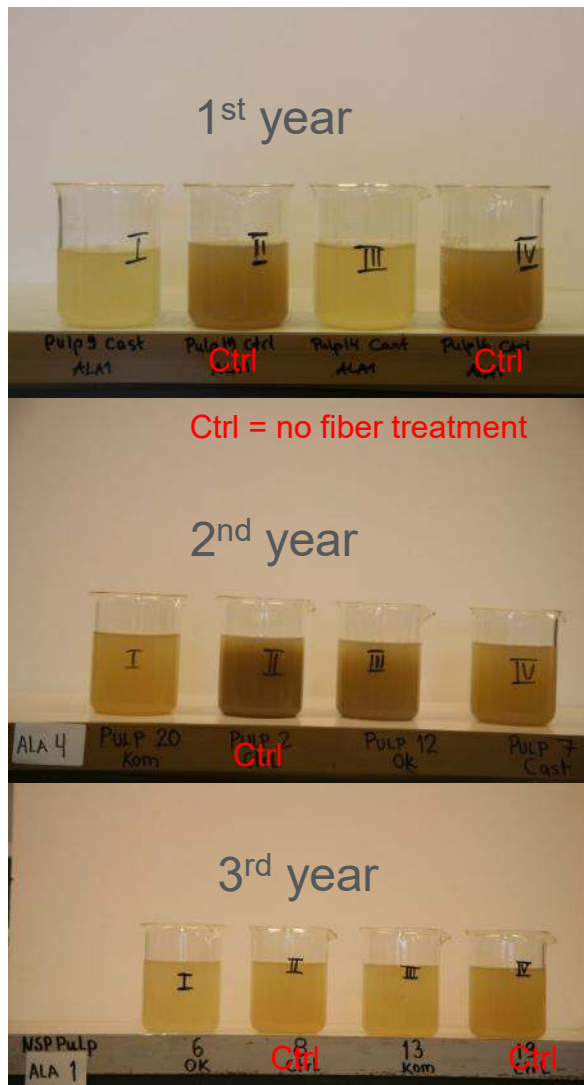
- All products reduced SS concentration (**erosion**) in percolate water over 4-year period
- Reduction of SS in 1<sup>st</sup> year >60% and in 4<sup>th</sup> year >30 %
  - The effect decline over time
- Similar trend in total phosphorus
- Dissolved reactive P not affected by treatments
- 5<sup>th</sup> year unpublished data shows the same trend

## Pulp and Paper Mill Sludges Decrease Soil Erodibility

Kimmo Rasa ✉, Taina Pennanen, Krista Peltoniemi, Sannakajsa Velmala, Hannu Fritze, Janne Kaseva, Juuso Joonas, Risto Uusitalo

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## Results in visual form

- Clear indication that soil improvement fibers have a good potential to reduce nutrient leaching from agricultural soils
- Mechanism is related to organic matter reactions in soil
- Soil microbes decompose introduced organic matter and produce “glue-type compounds” resulting in stabilized aggregate structure (→less erosion)
  - Globally relevant research question, closely related to **soil carbon sequestration and climate change mitigation**  
→ Research work goes on!





# Catchment-scale project

## Soil improvement fibers as an agricultural water protection measure

Kuitulietteet maatalouden vesiensuojelukeinona  
KUITU-project 2019-2021

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Paula Luodeslampi ja Anu Oksanen, **VHVSY**  
Janne Heikkinen, **Keski-Uusimaan ympäristökeskus**





- Two small catchments, other received ~80 ha composted soil improvement fibers 2020-2021
- Fields of 8 farmers located ~ 30 km North of Helsinki
- Water quality measured with automatic sensors since 2019 and it continues end of 2021
  - Financing open for follow up 2022 and beyond
- Web page: [www.luke.fi/kuitu](http://www.luke.fi/kuitu)



Tuusulanjärvi catchment



otos: Luodeslampi&Heikkinen



# Summary

- Organic soil improvement fibers are promising new method to reduce soil erosion
  - At least temporal increase in soil organic carbon
- Several ongoing research project going on in Luke
  - Interest for cooperation in Baltic Sea Region
- New information on use of soil improvement fibers available soon
  - National webinar on use of soil improving materials in agricultural water protection 8.12.2021 (in finnish)
  - Scientific papers in progress
  - Stay tuned, more information:
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# Thank you!

## Contacts

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