Restoration actions and pre-restoration baseline for microbial activity from two forestry drained fens in Northern Finland

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LIFE PeatCarbon sites at Pallas





Välisuo Mire

Catchment area 156 ha

Effective area ca. 24 ha



Restoration

- 1. Tree harvest
- 2. Ditch filling and dams

Aims:

- Pre drainage tree density
- Fill the ditches and build dams to allow water table to rise and original anoxic conditions to return

















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Examples of restoration plan for dams



- PP = wood and peat dam
- TP = peat dam
- OT = filled ditch

- 81 to Matorovansuo
- 15 to Välisuo
- Several visit to sites in summer 2025 to check the restoration process





Dams in July 2024

Ditches filled with harvest material













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Sari Juutinen/FMI

Methods used



'Multiomics'

Metagenomics All DNA

Species in a sample

Genes in a sample \rightarrow what the (microbial) community can do

Assembly \rightarrow longer fragments from short sequence reads

MAG Metagenome Assembled Genome

Metatranscriptomics

Which species are active

Which genes are being transcribed \rightarrow what the (microbial) community is doing

Monitoring sites in Pallas

Monitoring of:

 GHG twice a month during anout free period once a month i Microbes produce and

consume GHGs,

resposible for GHG

- Vegetation
- Nutrients
- Hydrology
- Microbial comr Cycling and activity





The sites have areas that well drained and close to pristine







Metagenomic DNA, community composition

0.1 -status 0.0 -[13.7%] drained undrained Axis.2 site matorova -0.2 valisuo -0.3 --0.2 0.0 0.2 0.4 [38.9%] Axis.1

Normalised counts

Two peatlands Matorovansuo mire and Välisuo mire

Both had drained and undrained areas

Sampling June July August September

Metatranscriptomic RNA, community composition

Normalised counts

Two peatlands

Matorovansuo mire and Välisuo mire

Both had drained and undrained areas

Sampling June July August September



Metatranscriptomic RNA, community functions

Two peatlands

Matorovansuo mire and Välisuo mire

Both had drained and undrained areas

Sampling June July August September



Active microbes on order level

Matorova drained sites order



Matorova undrained sites order



Order

(Actinobacteria) (Bacteria) Acetobacterales Acidobacteriales Bryobacterales Corynebacteriales Frankiales Gemmatales Isosphaerales Pedosphaerales Polyangiales Rhizobiales Solibacterales uncultured WD260





Genes involved in methane cycling

Methanogenesis

mcrA

Methane oxidation

pmoA



And nitrogen cycling and N2O production?



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time 🛱 6_June 🛱 7_July 🛱 8_August 🛱 9_September







Trace gases? H₂, CO, CH₄



time 🖨 6_June 🛱 7_July 🚔 8_August 🛱 9_September

time 🛱 6_June 🛱 7_July 🛱 8_August 🛱 9_September

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CH₄ CH₄

Methane oxidizing genes
< methane producing genes

Seasonal changes, linkage to GHG measurements





LIFE/Peacearbon

Models? FMI



Microbes (species, and functions)

Hydrology (Uoulu)



What happens after restoration?

Vegetation and traits

Remote sensing



































