MYR

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CLIMATE SMART USE OF NORWEGIAN ORGANIC SOILS

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CEH Centre for Ecology & Hydrology NATURAL ENVIRONMENT RESEARCH COUNCIL

GLOBAL CHALLENGE:

– Peatlands are important C stocks. Degrading peatlands are major sources of GHG 's
– None of the mitigation measures for sustainable use of peatlands has been proven efficient.

NORWEGIAN CHALLENGE:

- Need to increase food production
- Need reduce emissions from sectors outside the EU Emissions Trading System (ETS) by 40% by 2030, over 2005 levels (Norwegian Ministry of Climate and Environment) → organic soils are a major element here
- **Lack of national data to estimate national emission factors**
- **Lack of knowledge on mitigation measures**

OVERALL SCOPE OF MYR

TO ESTIMATE GHG EMISSIONS AND POTENTIAL SAVINGS FROM NORWEGIAN ORGANIC SOILS BY 2030/2050

Photo: Hlynur Oskarsson

TEAM

NIBIO: Hanna Silvennoinen, Teresa G. Barcena (Coordination, dissemination, GHG's)

NIBIO: Mats Höglind, Xiao Huang (Agronomy, BASGRA model)

NIBIO: Gunnhild Søgaard (UNFCC reporting)

NIBIO: Knut Bjørkelo, Kjetil Fadnes (mapping)

NTNU: Anders Lyngstad & team (peatland ecology, mapping)

Uni Oulu/NIBIO, Finland: Bjørn Kløve & team (hydrology, dissemination)

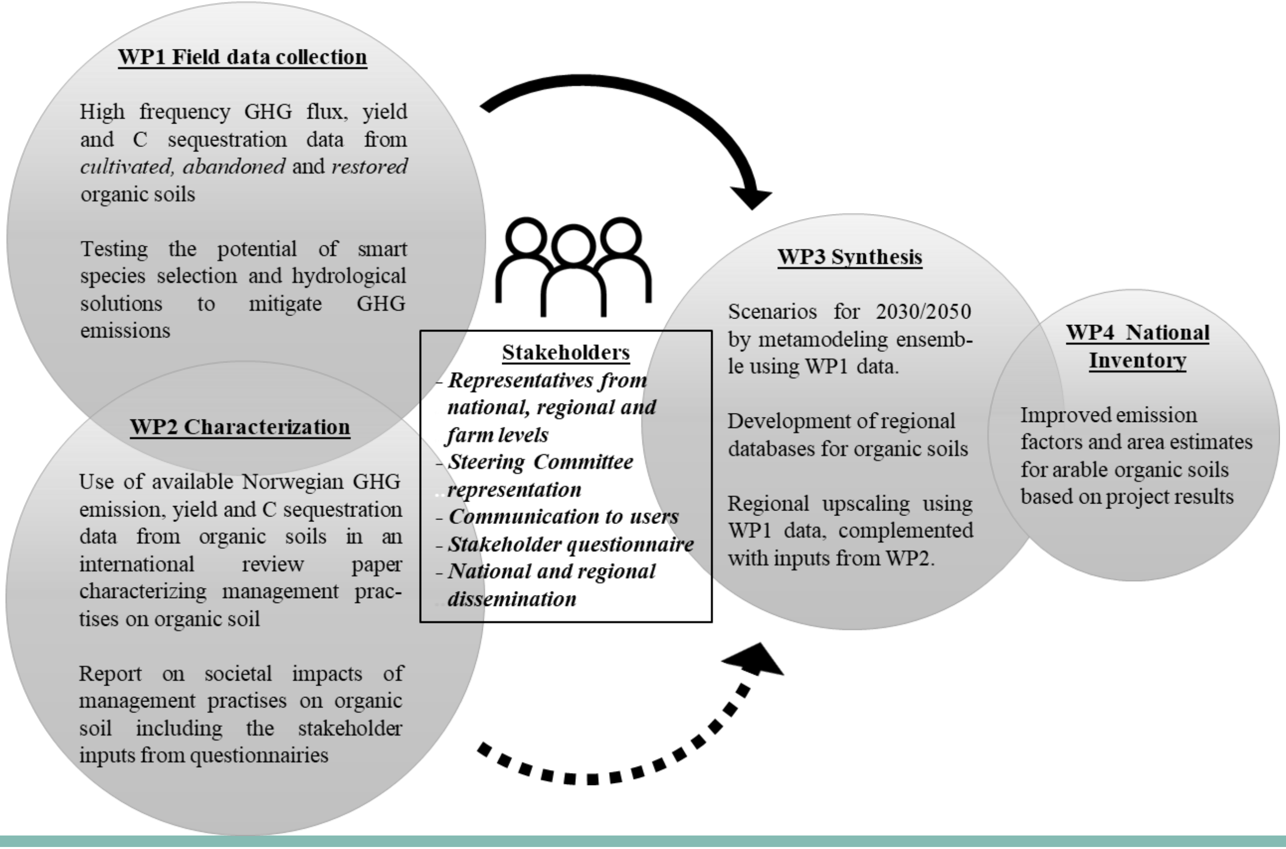
UGOT: Åsa Kasimir & Per-Erik Jansson, Sweden (GHG's, Coup model)

Uni Århus: Torben Christenssen & Mikhail Mastepanov, Denmark (GHG's)

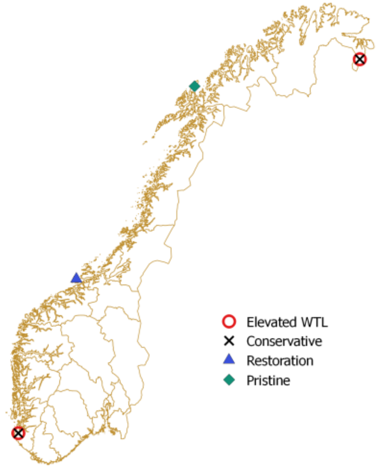
JHI: Jagadeesh Yeluripati & team, UK (DNDC & Ecosse model's)

CEH: Marcel van Oijen, UK (BASGRA model)

GENERAL STRUCTURE OF MYR



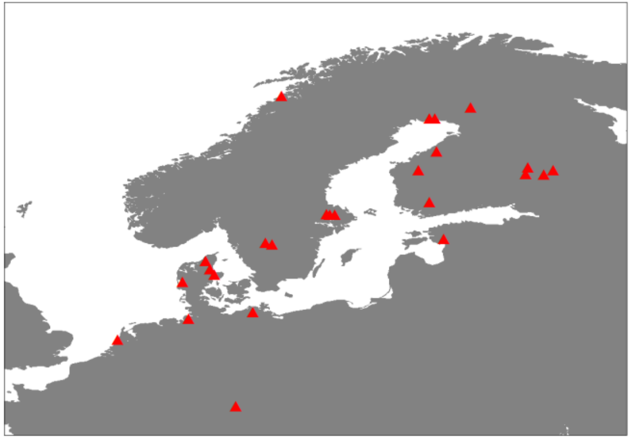
WP 1 & 2 MONITORING & CHARACTERIZATION



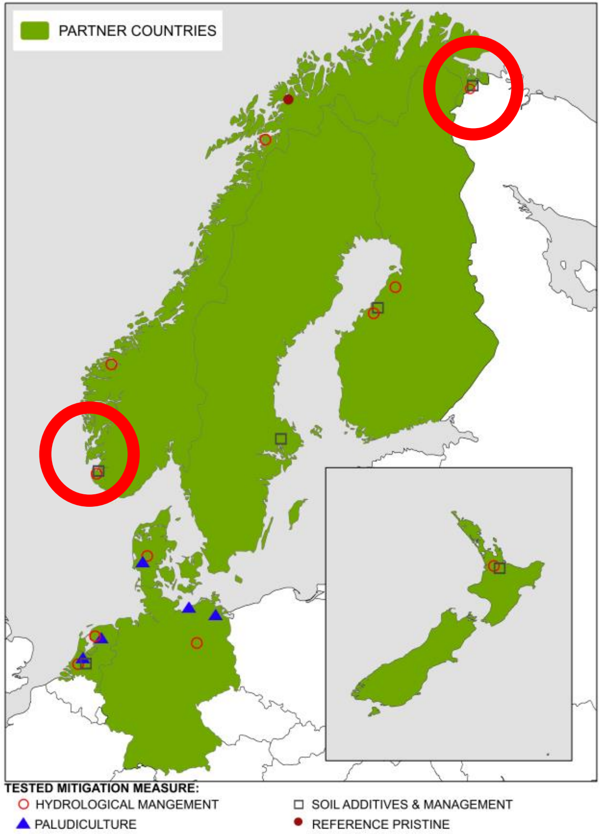
WP1 GHG, agronomy and hydrology data from conventional tile drainage and elevated water table levels (2019-2021). Sites at Svanhovd and Særheim

WP2 Characterization of Norwegian and Northern European management practises on organic soil. Ongoing data collection from Northern Europe.

Data collection



Study sites



Pasvikdalen
Subarctic, continental
Drained since 1970's

Jæren
Temperate, coastal
Drained since mid 19th century

Site description – Pasvikdalen

Description, land use history: Cultivated grassland since 1970. Soil quality (peat and overlying clay). Mixture of timothy and meadow fescue. 3km from NIBIO station.

Climate		Soil quality and agronomy		Hydrology and drainage	
Location	69°28'33.1"N 29°59'25.1"E	**Peat depth**	1.8-1.05m	**Drainage started**	1970
Mean annual precipitation (mm y-1)	480	**Humification (von post)**	3-6	**Drain depth past (cm)**	-
Mean annual T (° C)	-0.5	**Underlying soil**	Sandy clay/glay	**Drain depth present (cm)**	80
AET		**Crops**	Grassland: Phleum pretense Festuca pratensis	**Drain spacing (m)**	Variable, 4m most common
PET		**Rotation**	No rotation	**WTL depth (m)**	-0.15 to -0.8
Mean length of growing season	3-4 months	**Fertilization Kg N ha y^{-1}**	500 (NPK 18-3-15)	**Average Hydrological Conductivity (cm/day)**	@ 25cm: 40 @ 100cm: 0.9
		Harvests	1-2		

Site description - Jæren

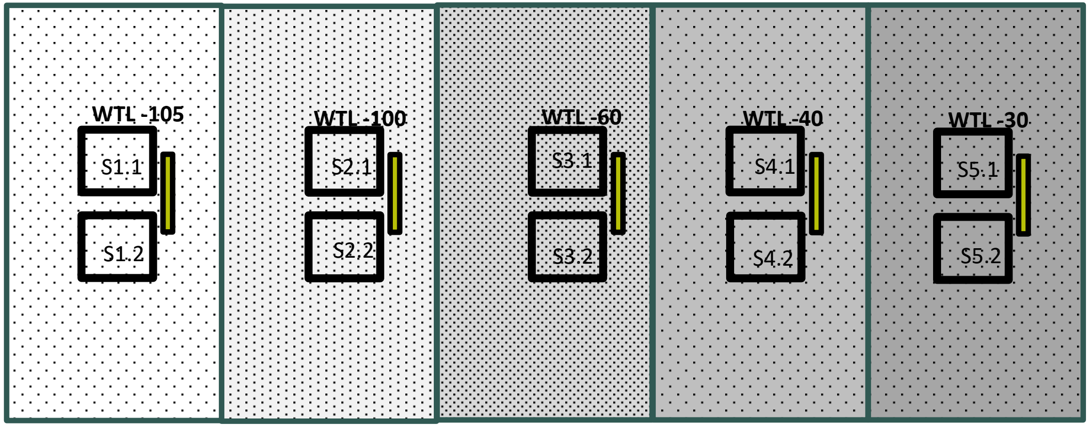
Description, land use history: Peat has been cultivated (grassland) since 19th century, hydraulic conductivity seems very low. 8km from NIBIO station.

Climate		Soil quality and agronomy		Hydrology and drainage	
Location	58°49'54.6"N 5°36'42.2"E	**Peat depth**	130-220cm	**Drainage started**	1800
Mean annual precipitation (mm y-1)	1500	**Humification (von post)**	7-10	**Drain depth past (cm)**	70 (old); 130 (newer)
Mean annual T (° C)	7.4	**Underlying soil**	Sandy clay	**Drain depth present (cm)**	60
AET		**Crops**	Grassland (Phleum pretense)	**Drain spacing (m)**	11-14
PET		**Rotation**	No rotation	**WTL depth (m)**	-0.20 to -1.30
Mean length of growing season	6-7 months	**Fertilization Kg N ha y^{-1}**		**Average Hydrological Conductivity (cm/day)**	@ 25cm: 10 @ 100cm: 0.09
		Harvests	2-3		

Tiedostosta ei löytynyt kuvaosaa, jonka suhdetunnus on rId25.

Experimental set-up

Impact of WTL and management (fertilization
and ploughing) on GHG emissions and agronomic production on
temperate grassland



Monitoring 2019-2022
Continuous, high frequency: Air T, air humidity, wind speed and
direction, precipitation, NEE, Reco, CH_4 and N_2O
Continuous low frequency: Soil chemistry
Once: Soil physics, peat characteristics, peat profile description
Seasonal: yield, forage quality

Hydrology profile - Pasvikdalen

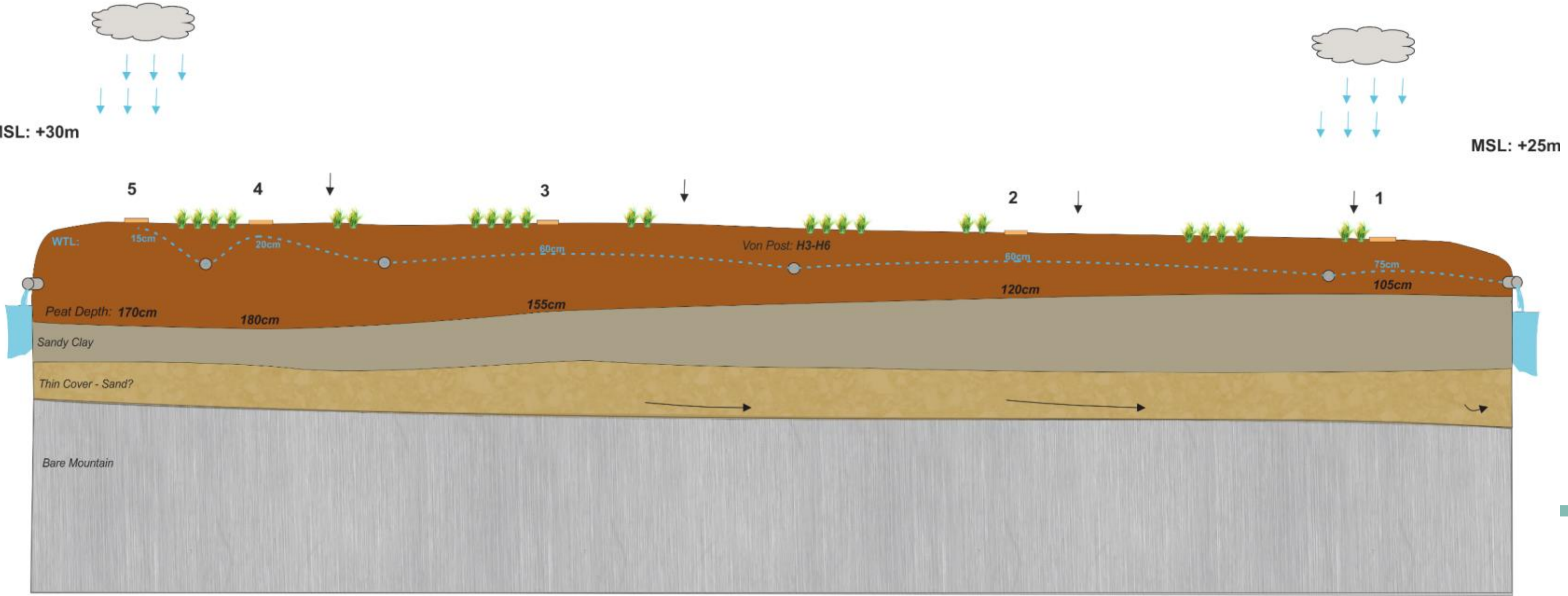
Legend

- Tile drains
- Sampling Unit

Local Hydrogeology (SkrØytnes, conceptual)

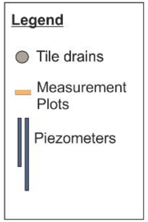
Pristine peatland

More Agriculture/ Watershed drainage



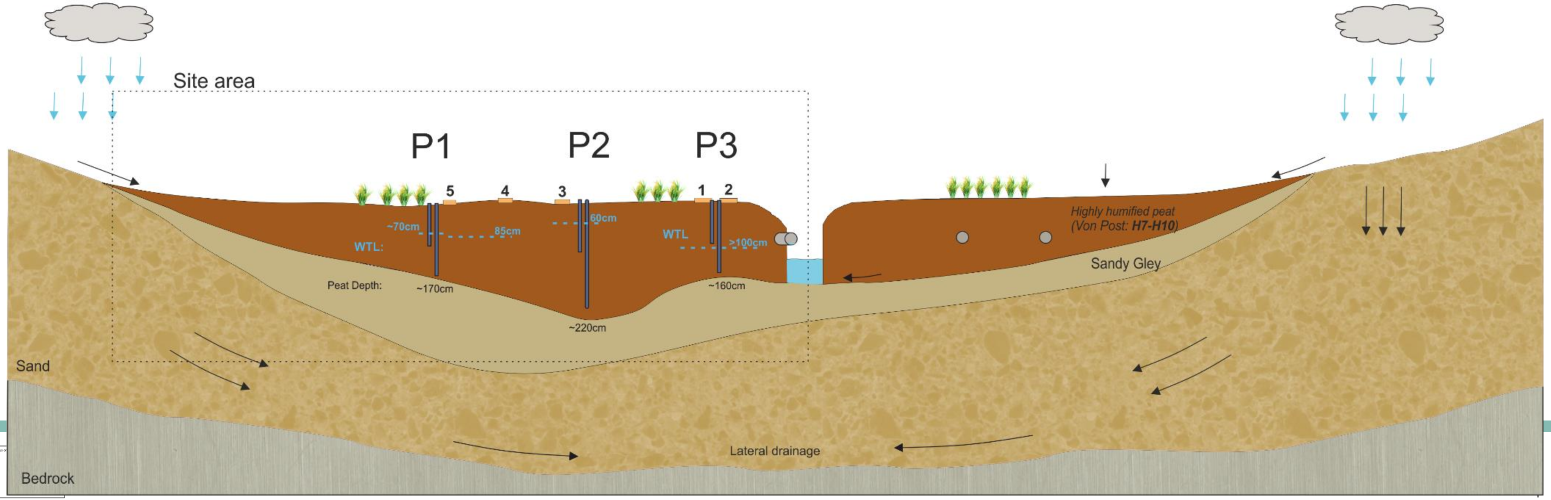
Hydrology profile - Jæren

Local Hydrogeology (Tjelta, September 2018)



Interpretation of Piezometer data from August 2018

		P1 (wet)	**P2** (wet)	**P3** (dry)
Shallow Piezo	Level (cm)	69	70	no water
	Screen depth (cm)	*~65-80*	*~80-95*	*~85-95*
Deep Piezo	Level (cm)	65	89	90
	Screen depth (cm)	*~150-165*	*~190-205*	*~145-160*
	Assumed Head flow:	↑	↓	↑



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Tiedostosta ei löytynyt kuvaosaa, jonka suhdetunnus on rId25.

WP3 UPSCALING - MODELLING

Models to be used

- **ECOSSE**: designed to simulate C/N dyamics in organic soils
- **DNDC**: more detailed C/N processes, most widely used biogiochemical model
- **BASGRA**: productivity of managed grasslands, tiller dynamics, winter survival
- **COUP**: soil physics
- **Drainmod**: specifically for hydrology (WTL)

Research questions:

- **Current emissions and agricultural production?**
- **How much WTL and agricultural management can reduce GHG emissions? (by 2030/2050). How will the yield be affected with different scenarios?**

WP3 UPSCALING - MODELLING

Use of ecosystem models (CoupModel, BASGRA, DNDC, ECOSSE), data from WPs 1 (field specific data) & 2 (published data from collaborators), meteorological data and regional soil data base

In time (by 2030/2050)

– Simulations (**regional resolution**) separately with each model, outputs combined to multi-model ensemble (MME). Allows adjusting biases and taking advantage of complementary individual models.

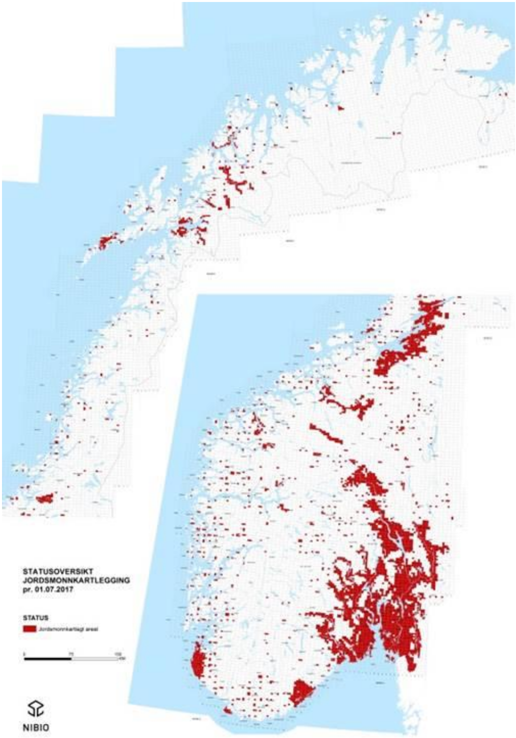
– Uncertain climate predictions accounted for with climate projections from at least three different global climate models (GCMs) and two down-scaling methods.

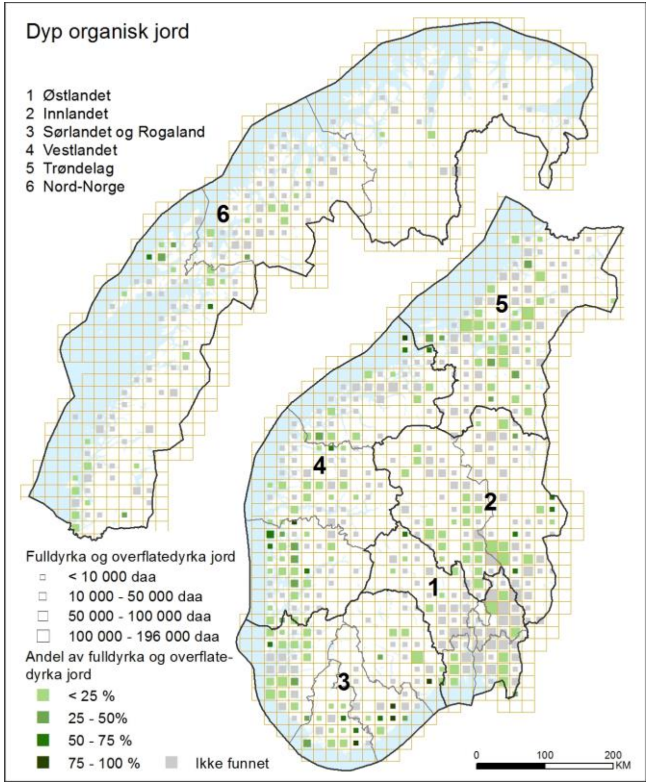
In space – regional scenarios

– MME approach supplemented with regional weather and soil data will be used to simulate the effects of weather, soil type and management practices for the total area of agricultural organic soils in Norway with a **regional resolution** (including all regions in which agriculture is practiced).

– Regressions from the MME will be made available for policy makers

WP3 UPSCALING – REGIONAL SOIL DATABASE

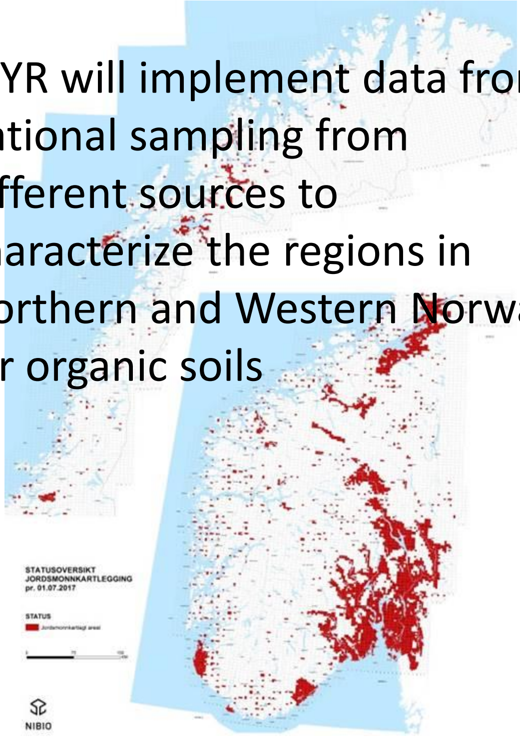


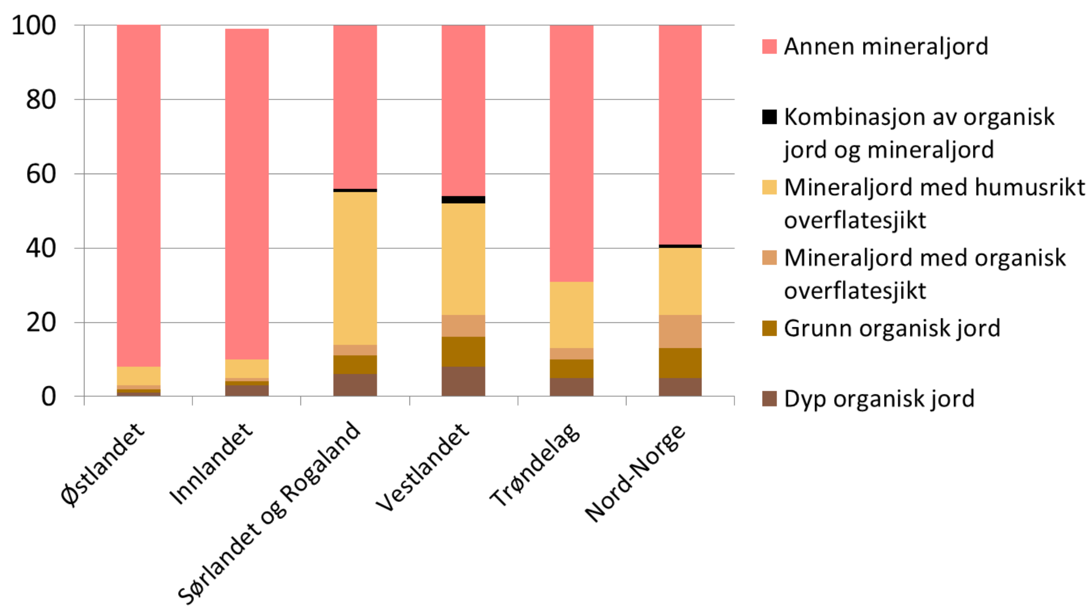


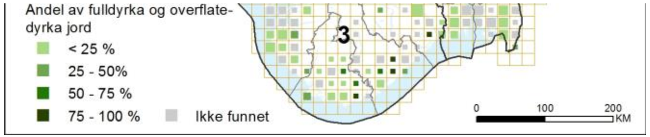
Detailed soiltype maps cover about 50% of agricultural land, **but they have a very low coverage in Northern and Western Norway**

WP3 UPSCALING – REGIONAL SOIL DATABASE

MYR will implement data from national sampling from different sources to characterize the regions in Northern and Western Norway for organic soils







WP3 – META MODEL

– The use of complex soil-crop models offers great advantages, due to the possibility of modeling various factors and their interactions at different levels, influencing the model predictions.

– However, such models are 1) **data-intensive,** and 2) **very costly** to collect the required data from our potential intervention sites representing wide diversity of farming systems and soil and crop management practices.

– Keeping this in mind, We are developing **meta-modelling framework** whereby multi-year model simulations are used to generate meta-model over the range of organic soils, climates and management practices occurring in Norway.

– This user-friendly decision support tool to help farmers, advisory and extension services (farm/landscape level) and policy makers (regional level) to discuss and select the most suitable management practices and technologies adapted to different organic soils and bio-geographic conditions in Norway.

WP4 INTEGRATION WITH UNFCCC REPORTING METHODOLOGY

Drained organic soils under the land use type Cropland in the Norwegian GHG Inventory are a key category due to their large contribution to CO_2 emissions and its relative high uncertainty (National Inventory Report of Norway, NIR 2017).

WP4 INTEGRATION WITH UNFCCC REPORTING METHODOLOGY

To report emissions from drained organic soils Norway uses the following activity data:

Areal estimates -> from the National Forest Inventory in combination with the national resource map AR5.

Default Emission Factors (EFs) from the IPCC Wetlands Supplement, 2014

MYR aims at:

Improving the EFs to adapt them to Norwegian conditions in the context of the Cropland land use category were grass leys represent 59% of the total Cropland area. This could potentially result in an improvement in the methodology (from Tier 1 to Tier 2).

Performing a cross-check of the areal estimates currently used in the NIR with the areal data on drained organic soils that MYR will provide. This could potentially **reduce the uncertainty in the areal estimate.**

WP5 DISSEMINATION AND COMMUNICATION

– Internationally: MACSUR, ICOS, GRA, Wetlands International
– Nationally and regionally, Via stakeholders and stakeholder board (LMD, MilDir, Norsk Bonde og Småbrukarlag, County Governers offices)
– Annual seminars for local stakeholder at NIBIO research stations

PEATWISE – STATUS, TRENDS AND POTENTIAL BOTTLENECKS FOR DEVELOPING GOOD PEATLAND MANAGEMENT PRACTIES

Cheng Chen, Nahleen Lemke, Lasse Loft , Bettina Matzdorf, ZALF

STATUS

Water level	LAND USE and mitigation measure	Implementation status
Rewetting	FORESTRY	established
	WETLAND	established
Water table elevation	GRASSLAND Biomass production	(further) developed
Drainage based land use	GRASSLAND Improved fertilization practices	(further) developed

NORWAY

TRENDS

PEATWISE – STATUS, TRENDS AND POTENTIAL BOTTLENECKS FOR DEVELOPING GOOD PEATLAND MANAGEMENT PRACTIES

STATUS

Water level	LAND USE and mitigation measure	Implementation status
Rewetting	WETLAND	established and (further) developed
Water table elevation	GRASSLAND Biomass production	(further) developed
	FORESTRY	(further) developed
Drainage based land use	CROPLAND Adjusted tilling No-tillage cultivation	 established established and further developed
	GRASSLAND Crop rotation Carbon adding	 (further) developed (further) developed
	FORESTRY Uneven aged forests	 established

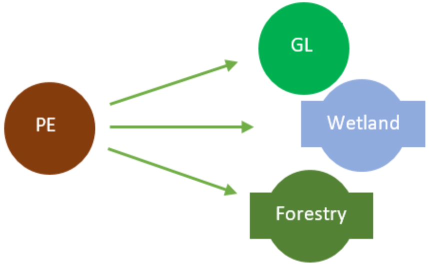
FINLAND

TRENDS

Area of drained peatland in 2050

...for agriculture cropland (CL)/grassland (GL)	**INCREASE**
...for **forestry**	**INCREASE**
...for **peat extraction** (PE)	**DECREASE** (due to restoration)

Changes in land use



PEATWISE – PROMOTING AND HINDERING FACTORS FOR APPLYING GOOD PEATLAND MANAGEMENT PRACTICES AND CONSERVATION

NORWAY

Promoting

- Availability of expert and scientific knowledge
- Availability of land

Hindering

- Policy incentive structure
  - Lacking incentives for landowners
  - Lacking incentives of CO_2 quota systems
- Lack of information and data
- Economic risks and associated costs

FINLAND

Promoting

- Assurance of production options

Hindering

- EU CAP incentive structure
  - Missing compensation mechanisms
  - Missing Consideration of different peatland use options
- Lack of information and data
  - Uncertainty about effectiveness
- Availability of land

Tiedostosta ei löytynyt kuvaosaa, jonka suhdetunnus on rId25.

PEATWISE – POLICY INSTRUMENTS

NORWAY

Climate and Energy Policy

- Prohibition of draining pristine peatland for forestry
- Prohibition of draining pristine peatland for agriculture

FINLAND

Climate and Energy Policy

- National climate and energy strategy
  - AECM perennial grasslands for GHG emission reduction
- Government report on medium-term climate change plan for 2030

Forestry Policy

  - National forest strategy 2025
  - Prohibition of new ditching for forestry on pristine mire areas

Peat extraction Policy

- Prohibition of peat extraction from natural peatlands

PEATWISE –
Policy instruments

- based on a stakeholder survey in 8 peat-rich European countries (DK, FIN, GER, NL, NO, PL, S, UK)
- In addition, the report of Wichmann, S. (2018)* was used
- Measures that maintain productive use of peatlands (no-use options excluded)

		Financing	
	State	[illegible]	[illegible]
Common Agricultural Policy – EAFRD (public)			
AECM grassland extensification, aiming at GHG emission reduction	DK, GER	x	x
AECM conversion to grassland, aiming at GHG emission reduction	GER		
AECM perennial grasslands, aiming at GHG emission reduction	FIN, GER		
AECM fixed weir, aiming at GHG emission reduction	GER-BB	x	x
AES and AECM to improve water quality and quantity, combating climate change, maintaining and enhancing biodiversity	UK-Wales	x	x
Financial support for implementing, maintaining and managing wetland projects	DK	x	x
Financial support for water level control systems	FIN, S	x	x
Financial support for wetland construction and restoration	S	x	(x)
Financial support for peatland management, restoration, and habitat creation	UK-England	x	x
Financial support to improve water quality,	UK-	x	x

Tiedostosta ei löytynyt kuvaosaa, jonka suhdetunnus on rId25.

PEATWISE – Policy instruments PLANNED

Governmental incentive-based programs

- Country selection
    - GER, NL, XX(FI/S)
- ≈ 40 Interviews in total
- Feburary/March 2020

Voluntary incentive-based programs

- Country selection
    - GER, NL, XX(FI/UK)
- ≈ 40 Interviews in total
- June/July 2020

PEATWISE – Policy instruments
PLANNED - **Governmental** incentive-based programs

- Focus on measures with climate mitigation effect
- Data gathering:

  - Review on institutional factors at international/EU level

  - Review, Interviews & content analysis of national/subnational level
- 2-3 representative measures in each of case study countries to conduct an in-depth analysis
- Semi-structured interviews with different actors (national policy making, subnational decision making, science experts, farmers, civil society) per case study country

PEATWISE – Policy instruments
PLANNED - **Governmental** incentive-based programs

- Challenge

  - How to indentify/select the measures with climate mitigation effect

  - How to indentigy the experts in peatland policy for interview

  - Language barriers limit accessibility (RDPs → national language)

  - How to compare the case study countries

PEATWISE – STAKEHOLDERS

Stakeholder network established within PEATWISE countries

- DK, FIN, GER, NL, NO, S

Participation in European survey

Interviews for participatory scenario development (GER)

PLANNED

- 3 PEATWISE countries participation in workshops (March-August 2020)

Thank you!