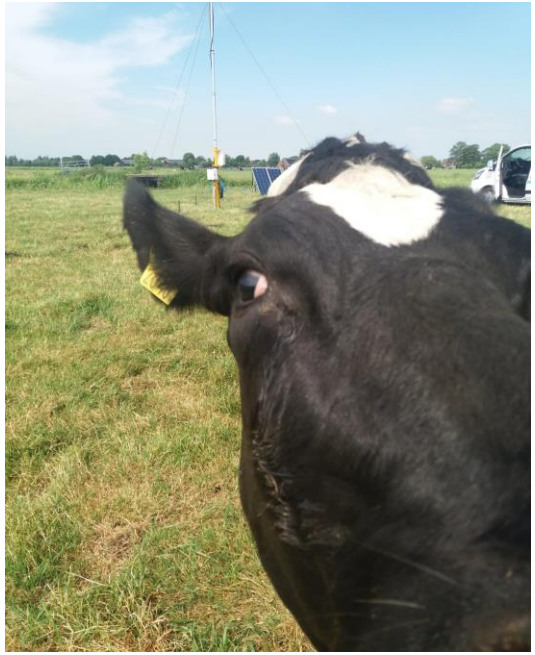

Carbon and GHG emissions from organic soils

Ruchita Ingle, Laurent Bataille, Ronald Hutjes, Wietse Franssen, Wilma Jans, Laura van der Poel, Hong Zhao, Jan Biermann & Bart Kruijt

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22/02/2024

ReLive

About myself

- Researcher with the Earth Systems and Global Change Group
- PhD from Trinity College Dublin
- 12+ years of experience analyzing impacts of climate change and land use changes on diverse landscapes across three continents

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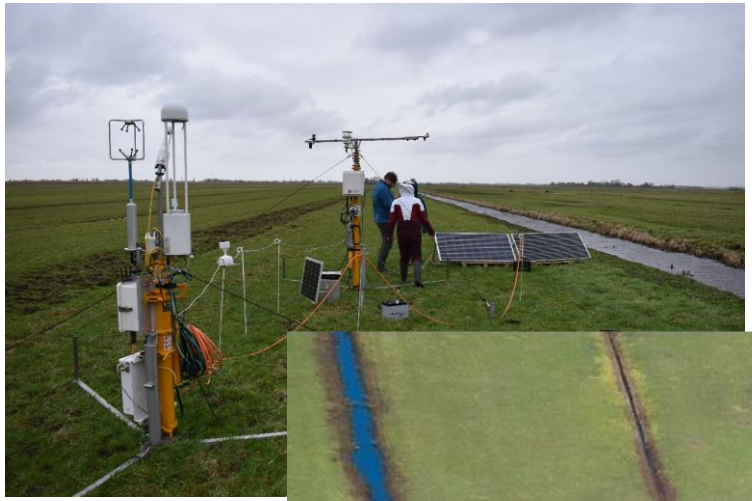
ReLive

About our core research group

- Diverse team
- Carbon and GHG emissions from organic soil



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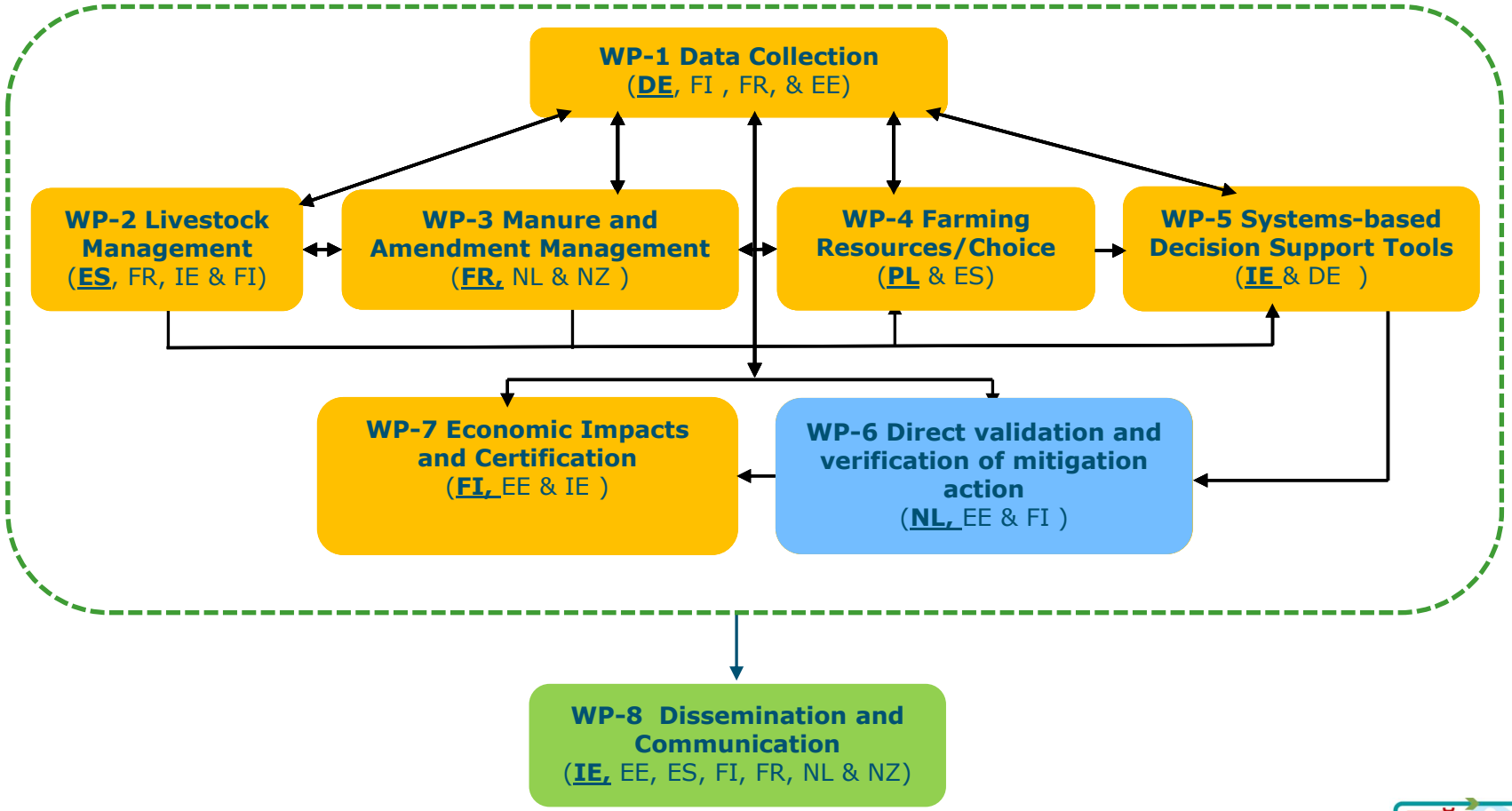
Relive

Back to the Future: Reintegrating Land and Livestock for Greenhouse Gas Mitigation and Circularity

- ERA-NET project: Holistic systems-based approach for sustainable reintegration of livestock and cropping systems to mitigate GHG's by reducing environmental footprints
- 11 partners from EU, Canada, south America and NZ
- Particular attention will be directed at livestock type and dietary feed source management, manure use and storage, crop choice, use of afforestation/agroforestry as an alternative grazing option
- https://relive-era.net/

Source: https://www.freepnglogos.com/images/world-map-12284.html



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Relive

WP-6: Direct validation and verification of mitigation action

Aim:
Field scale monitoring to assess GHG emissions related to circular agriculture

Objective 1: Direct and in-direct tools for validation

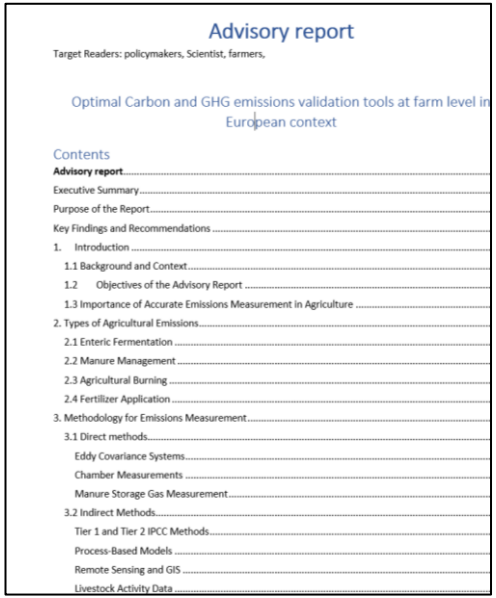
- Use of existing data
- Exploring satellite data and other indirect measurement tools

Objective 2: Effective adaptive management

- Compile learnings from field measurements for adaptive management
- Socio-economic approach
- Recommendations for stakeholders

Objective 3: Small scale farming initiatives

- Existing initiatives inventory (such as food forest…)
- Analyze ways to assess GHG budgets of these initiatives
- Testing of designed methods at field/farm scale



Advisory report

Target Readers: policymakers, Scientist, farmers,

Optimal Carbon and GHG emissions validation tools at farm level in European context

Contents

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Relive

NOBV- The Dutch national research programme on greenhouse gases in peatlands

Funded by Ministry of agriculture, nature and food quality (LNV)

www.nobveenweiden.nl

- Quantify magnitude of NL emissions
- Study effectiveness of measures
- Understand the processes
- Design long-term monitoring network

Also:
prov. Fryslân
Natuurmonumenten

Using a multitude of methods

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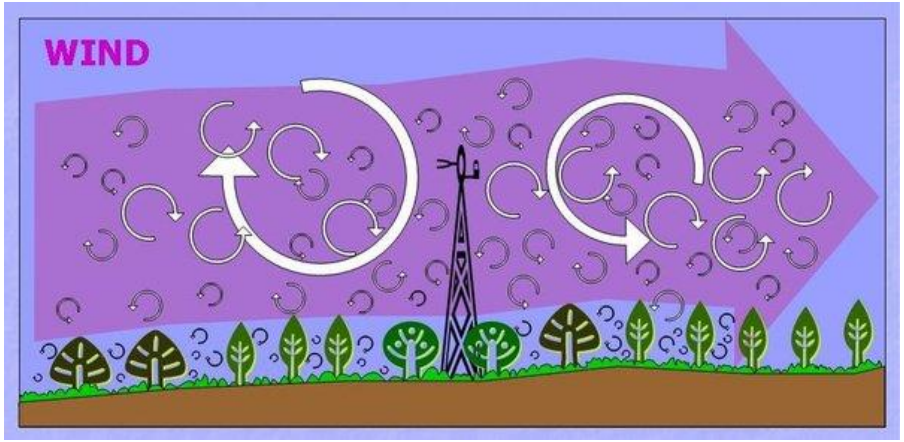
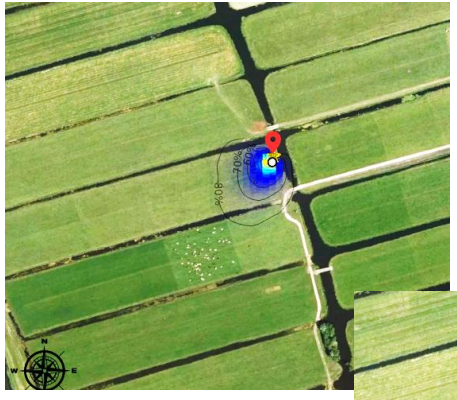
Eddy Covariance technique (EC)

- Measures how much CO_2 and CH_4 travels in or out of a site in wind gusts
- Integrated measure of ecosystem fluxes
- Direct and continuous measurements offering real-time insights into the dynamics of emissions.
- Footprint is influenced by the tower height



Burba, G., 2013

Eddy covariance on small parcels



Mast @ 1.8 m

Mast @ 5.7 m

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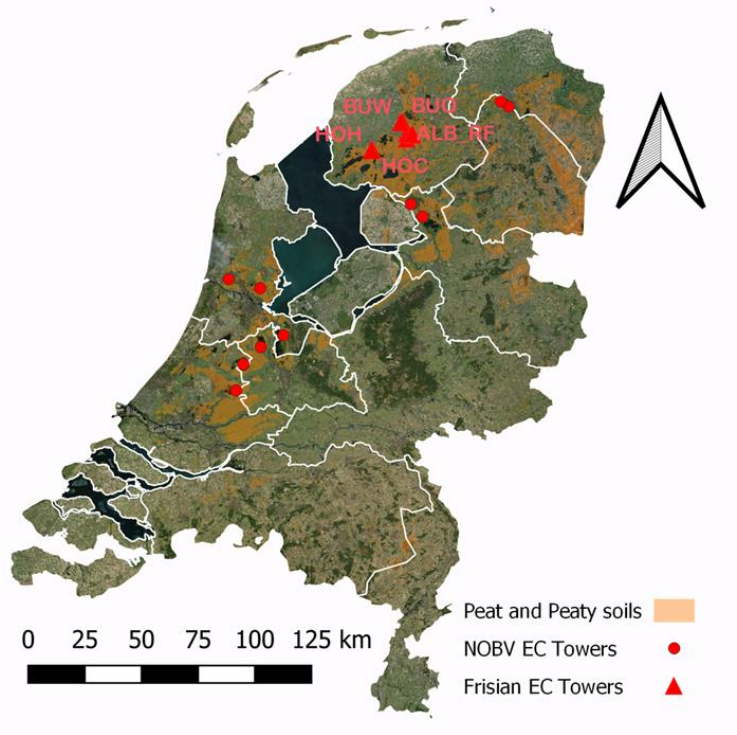
Eddy Covariance applications to agriculture

- **Direct Measurement of Emissions:** high temporal resolution data and captures interannual variability
- **Comprehensive Monitoring:** can measure multiple gases along with hydrological and meteorological parameters providing a holistic view of the field carbon balance.
- **Site-Specific Verification:** captures the variability and complexities inherent to agricultural systems. This ensures that emissions estimates are tailored to the unique characteristics of each field/farm.
- **Identification of Emission Hotspots:** identify emission hotspots within the farm, such as cattle presence and fertilizer application. By pinpointing these hotspots, farmers can prioritize mitigation efforts and implement targeted strategies to reduce emissions effectively.
- **Assessment of Mitigation Measures:** EC can evaluate the effectiveness of mitigation measures implemented on the farm, such as changes in land management practices and improvements in livestock management. This allows farmers to assess the impact of their actions on emissions reduction and make informed decisions to optimize mitigation strategies.
- **Integration with Other Data Sources:** can be integrated with other data sources, such as soil sensors, remote sensing data, and farm management records, to get valuable insights into the key drivers of emissions and its useful for scaling up of the emissions.

20 EC measurement sites with ancillary data

- **EC fluxes CO_2/CH_4 fixed location (9):**
  - Pasture elevated water table 3 x
  - Pasture 'control' 1x
  - Paludiculture (typha, moss) 3x
  - Natural wetland reeds 1 x
  - Open water (shallow lake) 1 x
- **EC fluxes mobile/roving (11):**
  - Pasture elevated water table 4 x
  - Pasture 'control' 3 x
  - Crop (maize) low water table 2x
  - Natural young wetlands 2x



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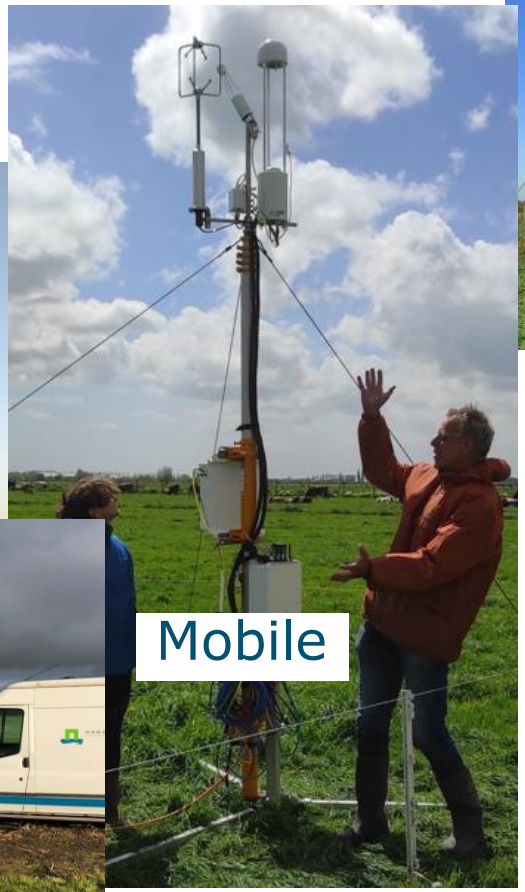
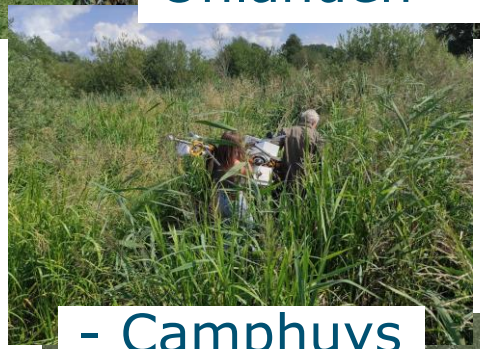
sites..

Lange Weide



Mobile

Onlanden –



- Camphuys

Aldeboarn

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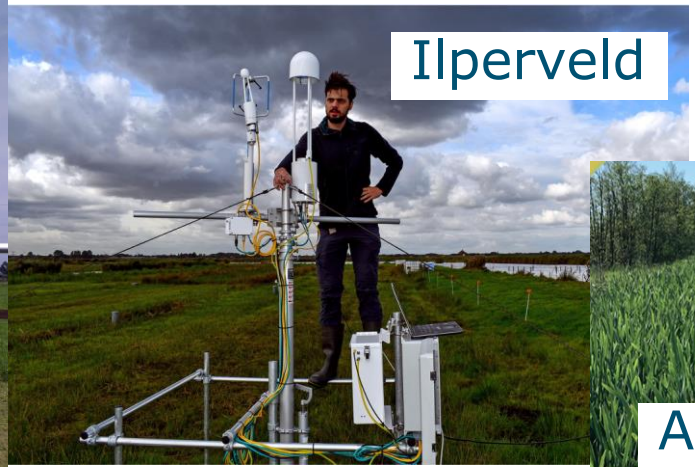
More sites..


Wieden


Zegveld


Weerribben


Assendelft


Ilperveld


Ankeveen

‘Mobile’ Eddy covariance

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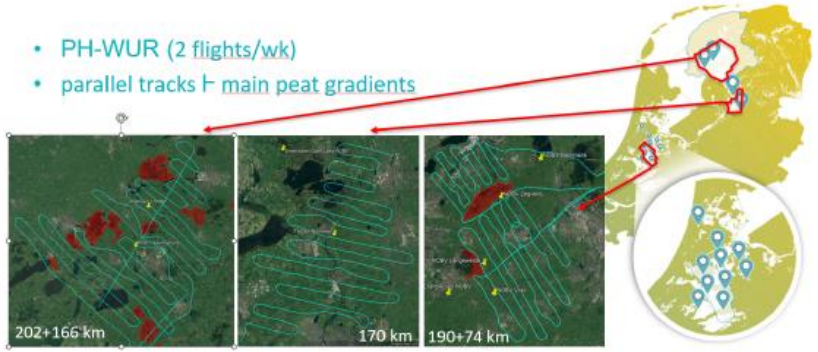
Airborne Eddy Covariance measurements

- PH-WUR - SkyArrow 650 TCNS ERA
- turbulent fluxes (H, LE, CO_2, τ
- Q_{net}, PAR $\uparrow\downarrow$, T_{sfc}
- CH4, N2O (Licor 7810/15/20, Aircore)
- nominal altitude 60 m
- airspeed 100 km/hr



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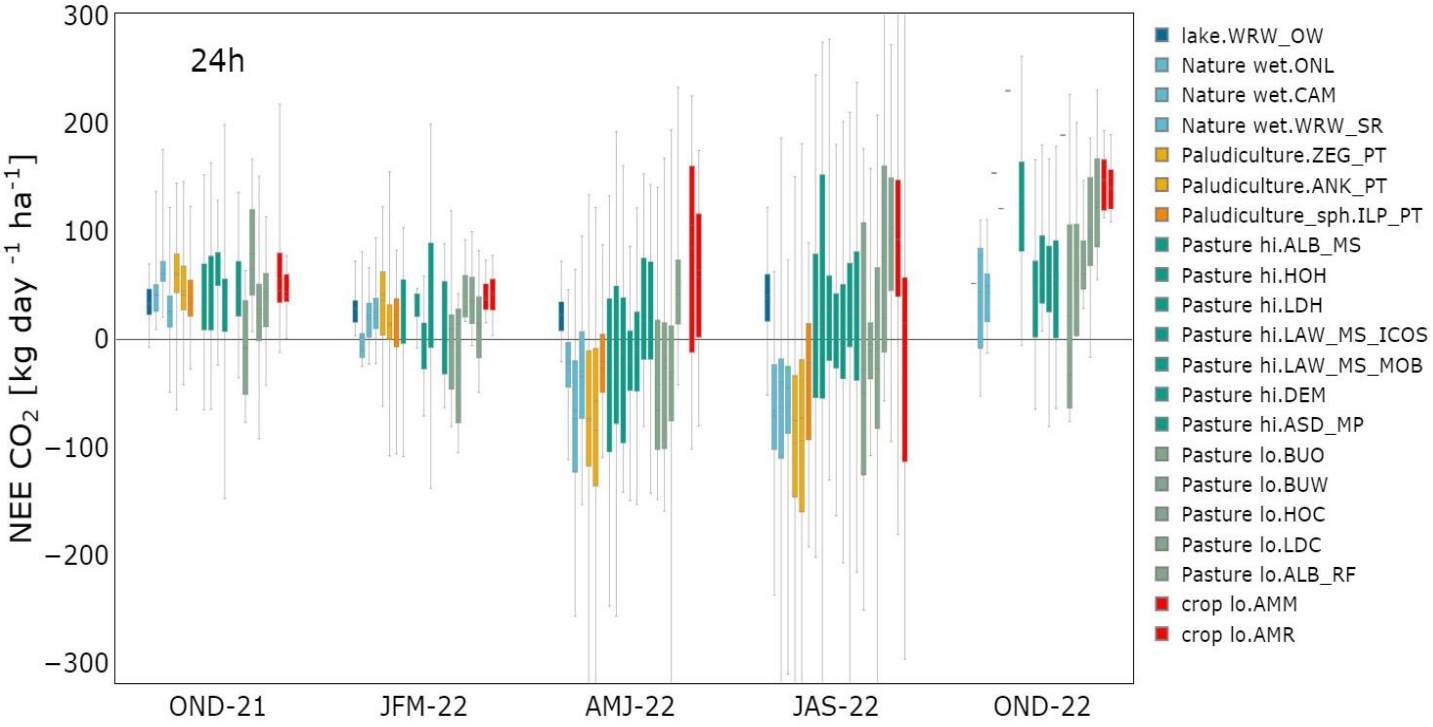
CO_2 flux



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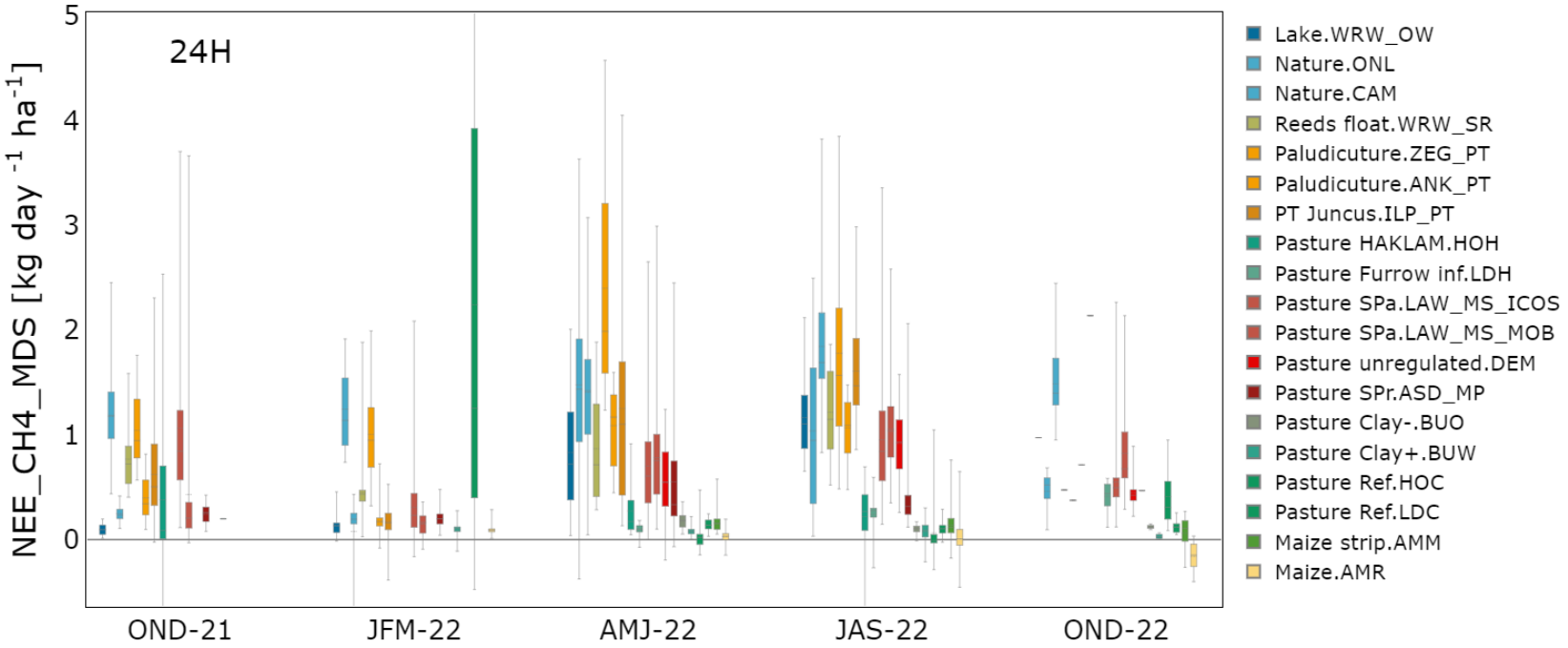
CH_4flux



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EC and circularity indicators

EC can indirectly provide insights into farm circularity at field scale through its ability to monitor ecosystem processes

- **Carbon Footprint:** contribute to assessment of farm net carbon balance.
- **Water Use Efficiency:** water vapor fluxes can help assess water use efficiency within the farm ecosystem. Higher rates of evapotranspiration relative to precipitation may suggest efficient water cycling and utilization within the system.
- **Nutrient Cycling:** EC can help monitor microbial activity involved in nutrient cycling of gases. Elevated emissions of these gases may indicate inefficiencies or losses in nutrient cycling processes within the farm ecosystem.

Discussion points

- Dutch farm/field data: for country specific models (Help!)
- Livestock related data for cattle contribution to field emissions (Help!)
- High spatio-temporal data available for sharing from previous and current projects
- In-house expertise for setting up a fixed or mobile EC network to understand impact of various management practices

Source: https://blog.edmentum.com

Email: ruchita.ingle@wur.nl
NOBV: https://www.nobveenweiden.nl/en/
ReLive: https://relive-era.net/

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