LIFE+ LILLE VILDMOSE FINAL CONFERENCE

Comwell Rebild Bakker, September 12-13 2018

# Carbon sequestration in bogs and the importance of peatlands in a climate perspective

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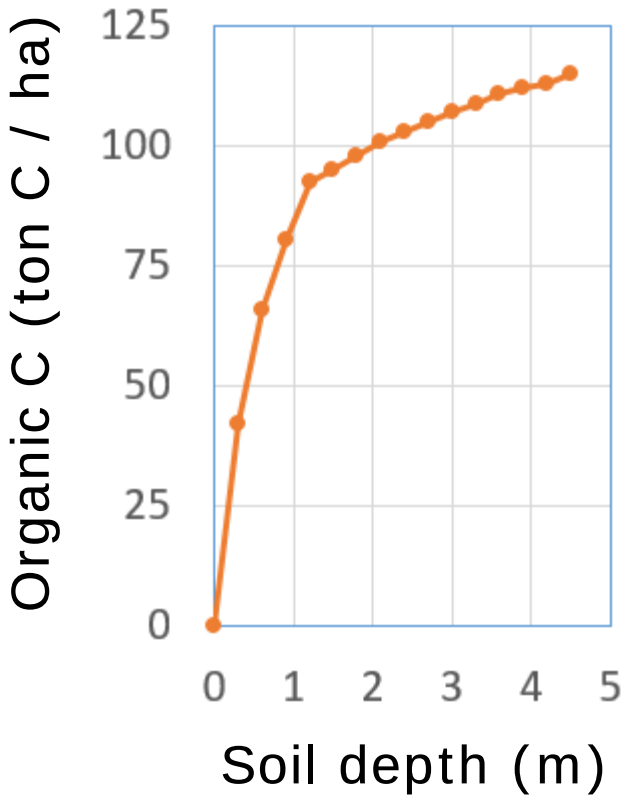
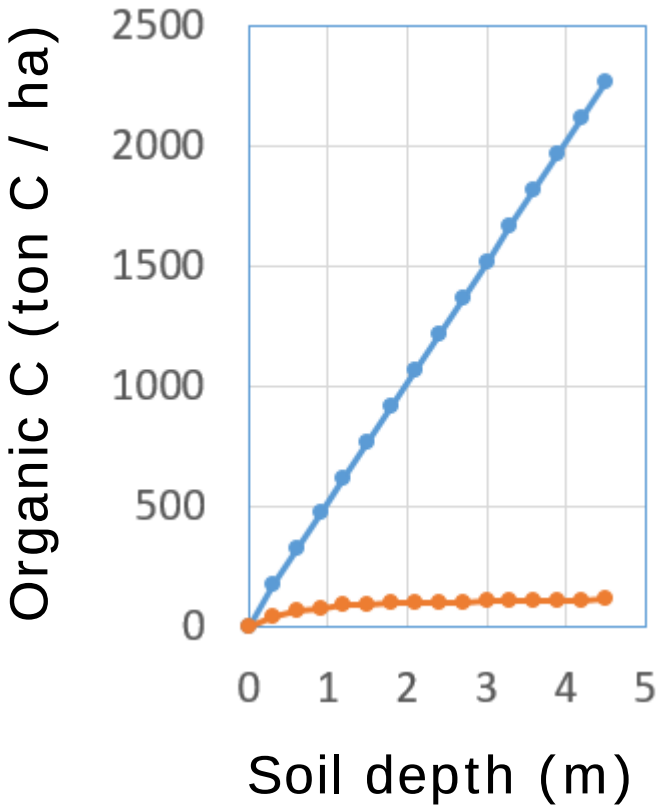
The carbon density (ton carbon per ha) in organic soils is typically 5-20 times higher than in mineral soils

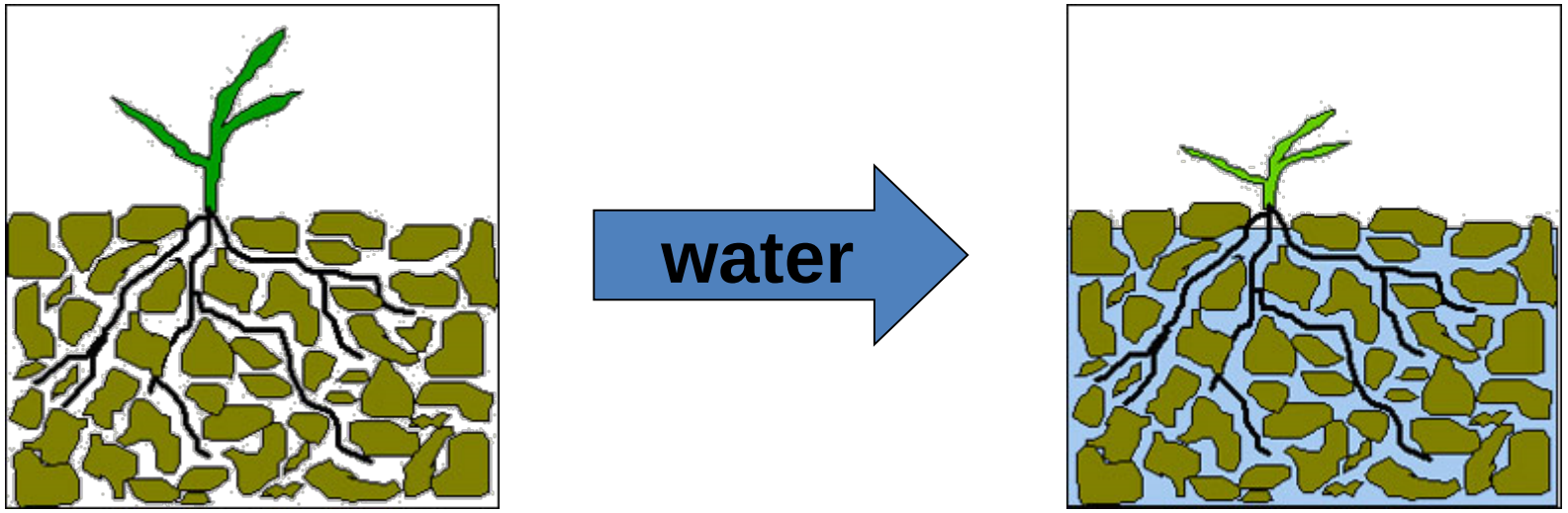
Mineral soil




Organic soil



Water table depth regulates microbial processes, as oxygen diffuses 10.000 times slower in water than in air



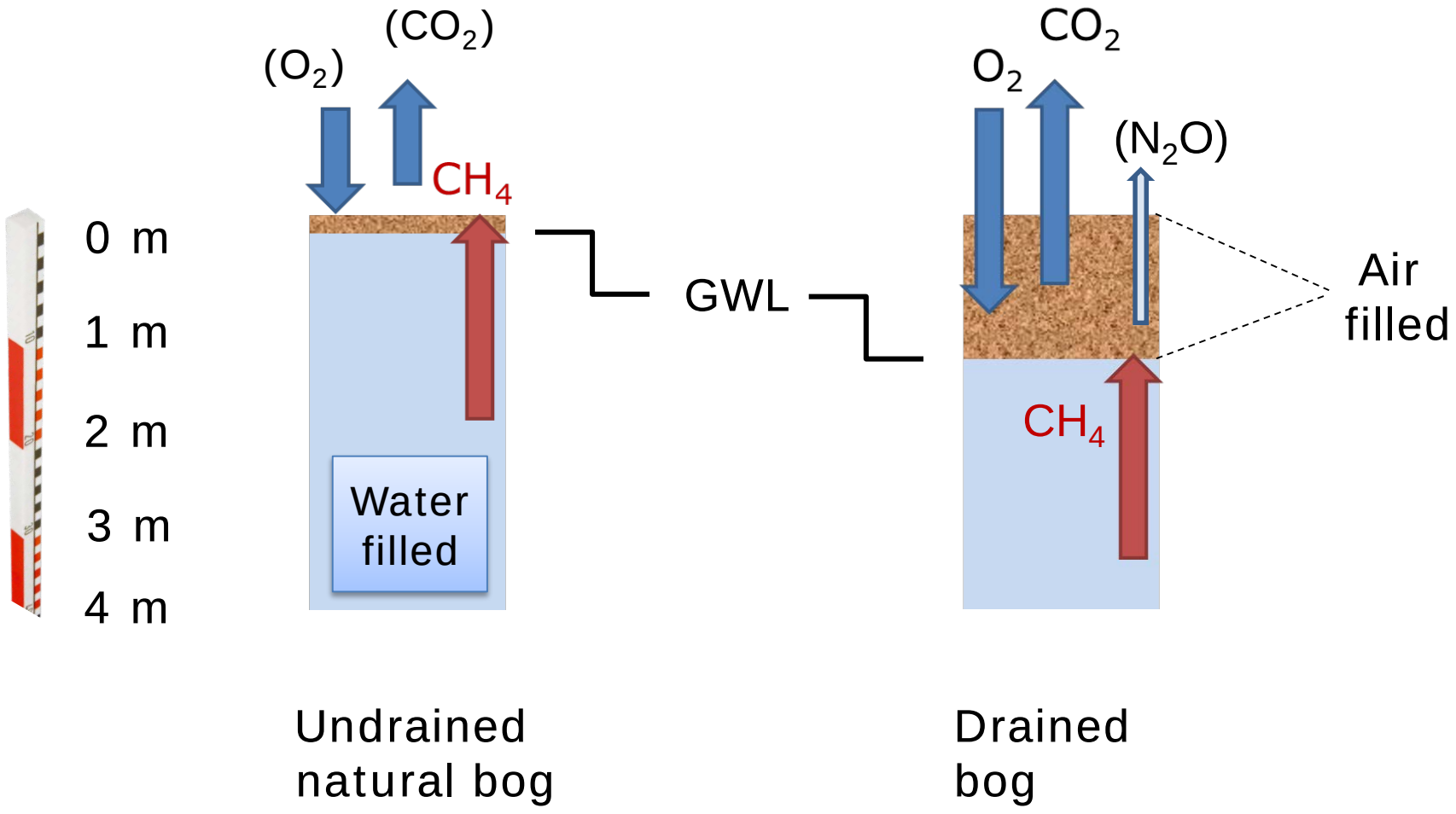

Aerobes:

$CH_2O + O_2 \rightarrow CO_2 + H_2O$

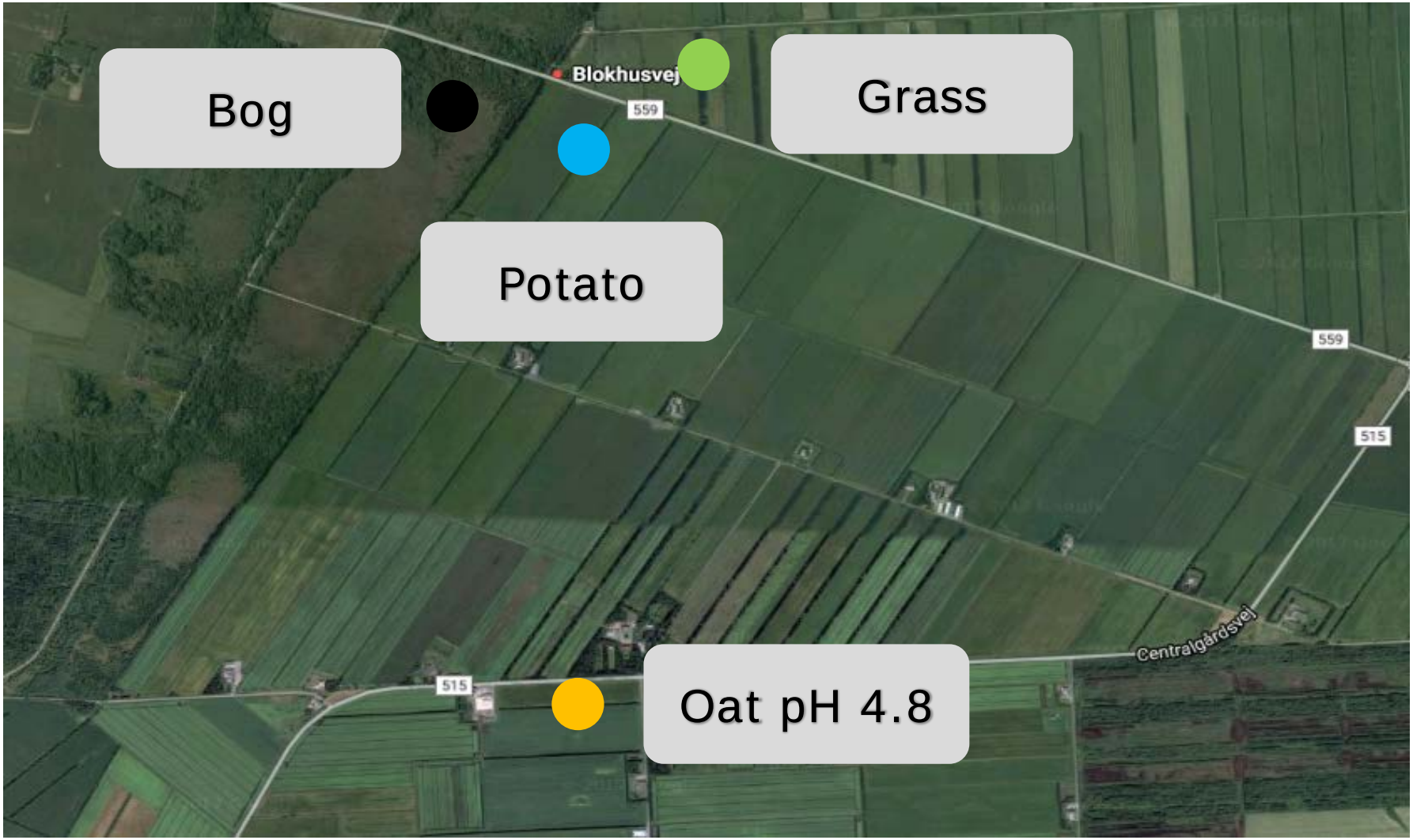
Anaerobes:

$CH_2O \rightarrow\rightarrow CH_4 + CO_2$

# Water table depth (GWL) is a strong regulator of microbial processes that leads to emission of GHG



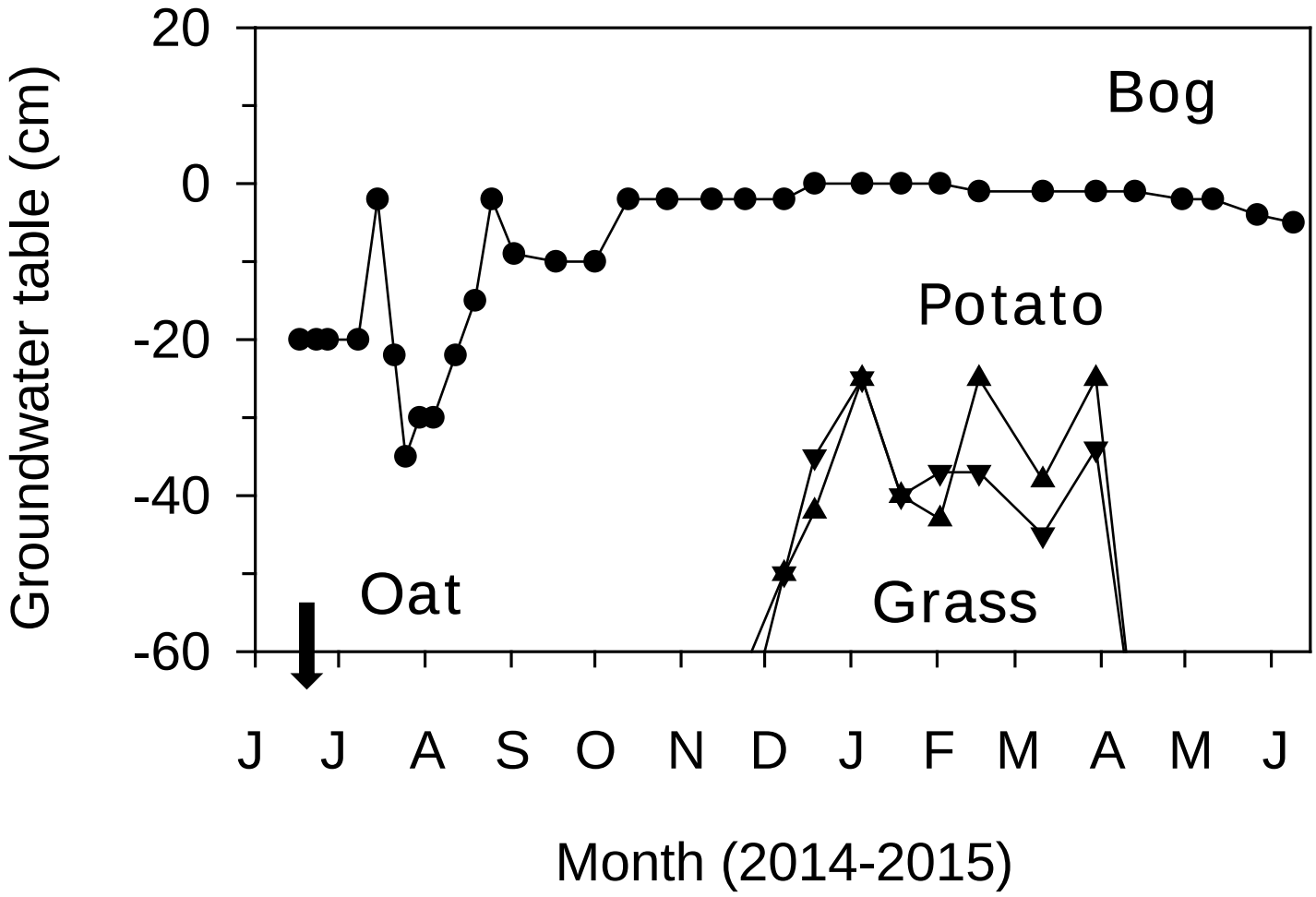
Selected field sites in Store Vildmose, representing undrained bog, arable sites and permanent grass



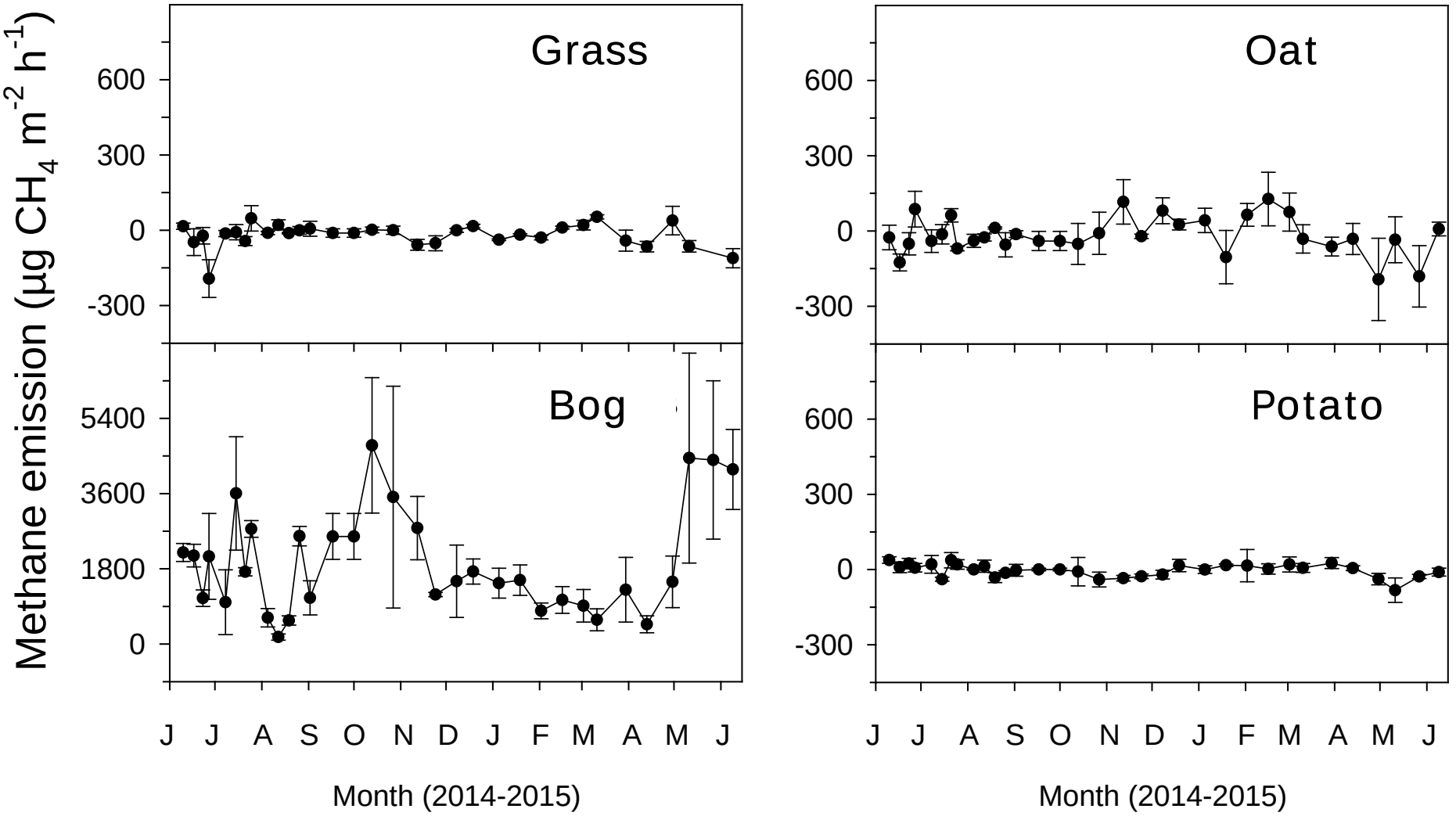
# Peat depth and topsoil properties of the selected field sites in Store Vildmose

| Site | Peat depth (cm) | Bulk density (g $cm^{-3}$) | Organic carbon (%) | C/N ratio | pH |
|---|---|---|---|---|---|
| Bog | >200 | 0.1 | 41 | 32 | 3.4 |
| Grass | 90 | 0.2 | 39 | 21 | 4.3 |
| Oat | 60 | 0.3 | 32 | 24 | 4.8 |
| Potato | 60 | 0.3 | 33 | 24 | 4.0 |

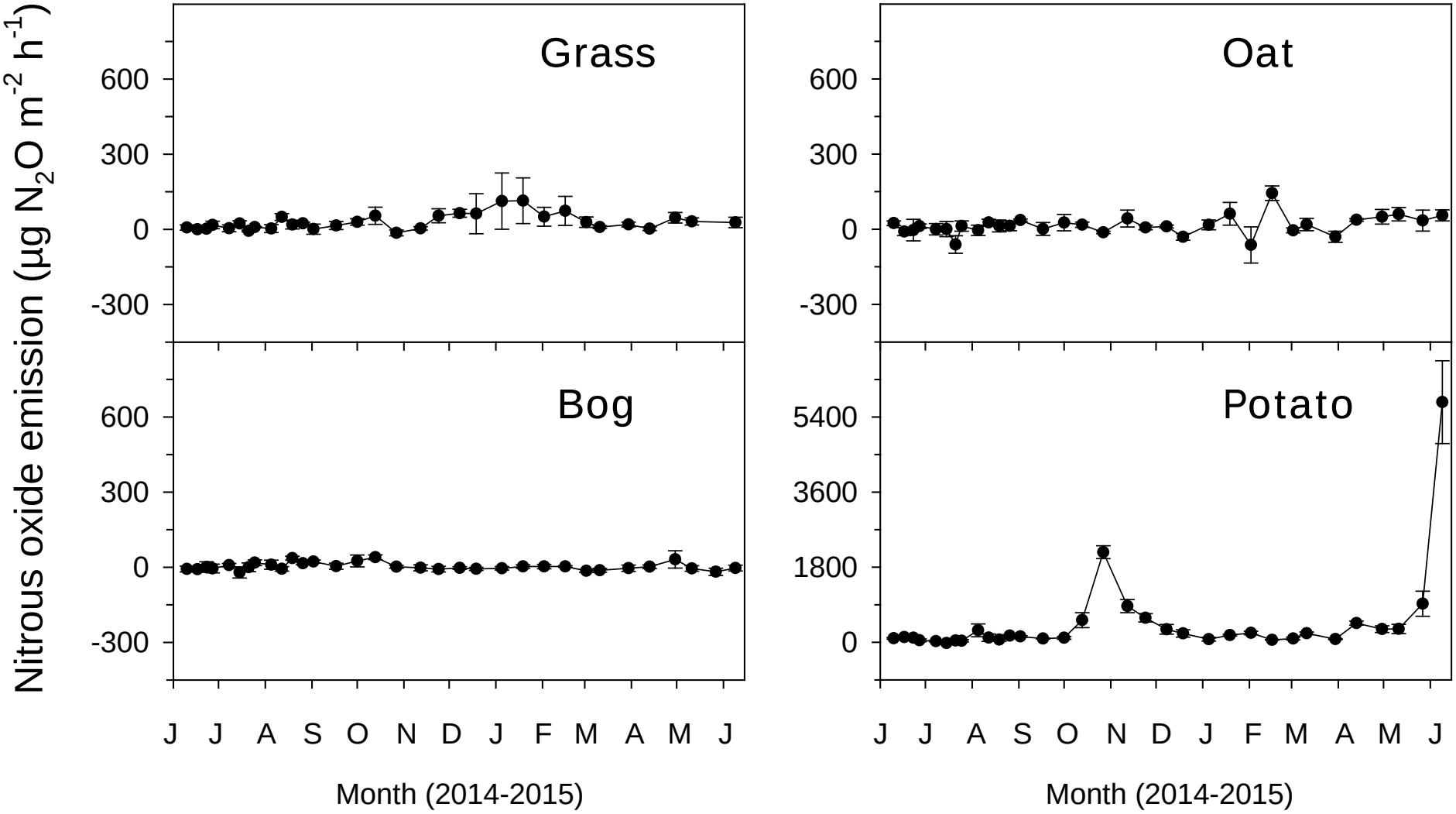
Groundwater table typically at surface at the bog site and below 20-60 cm at the drained sites



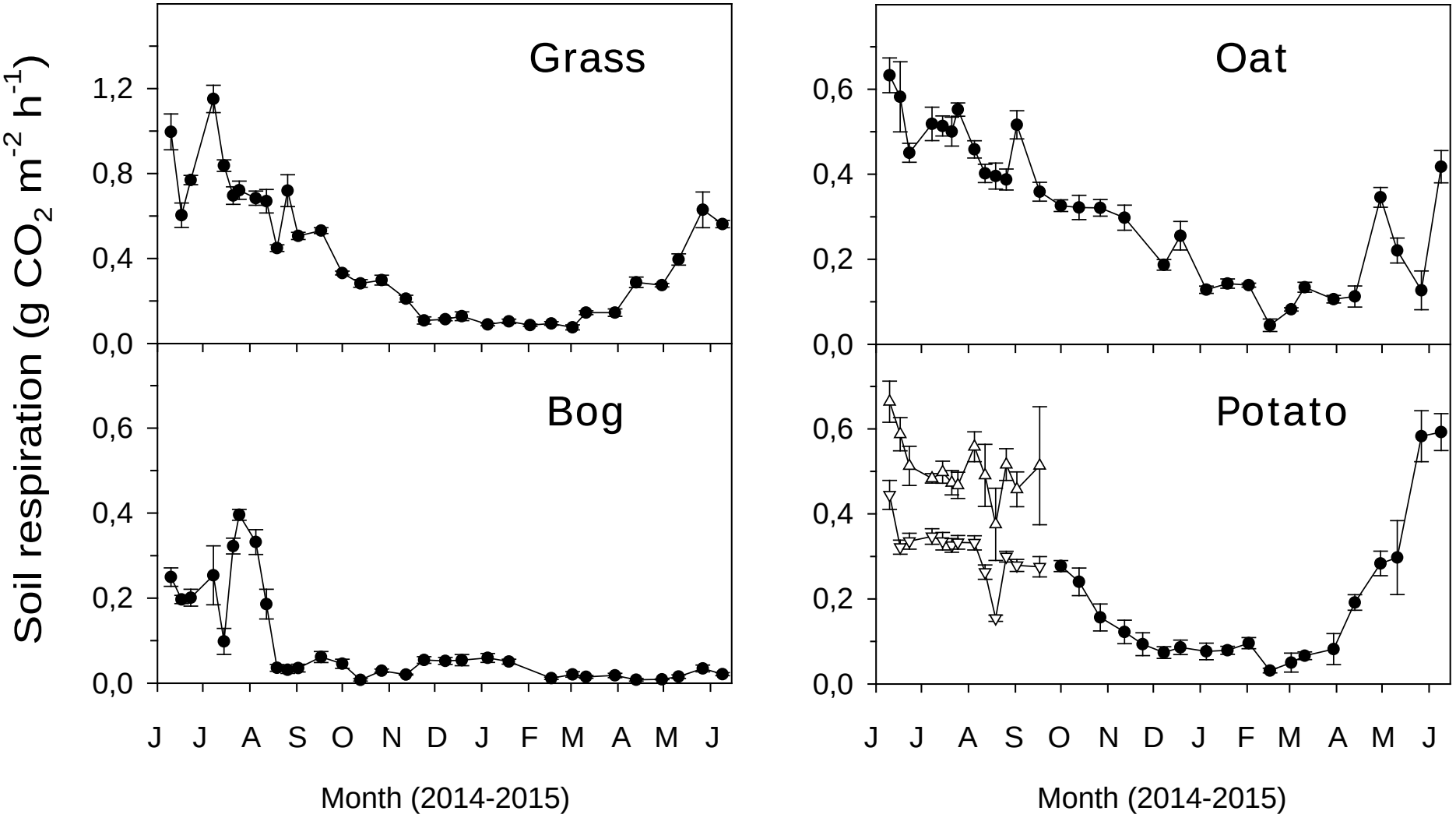
# Methane emissions are negligible at drained sites, but high and varying in time and space at bog site



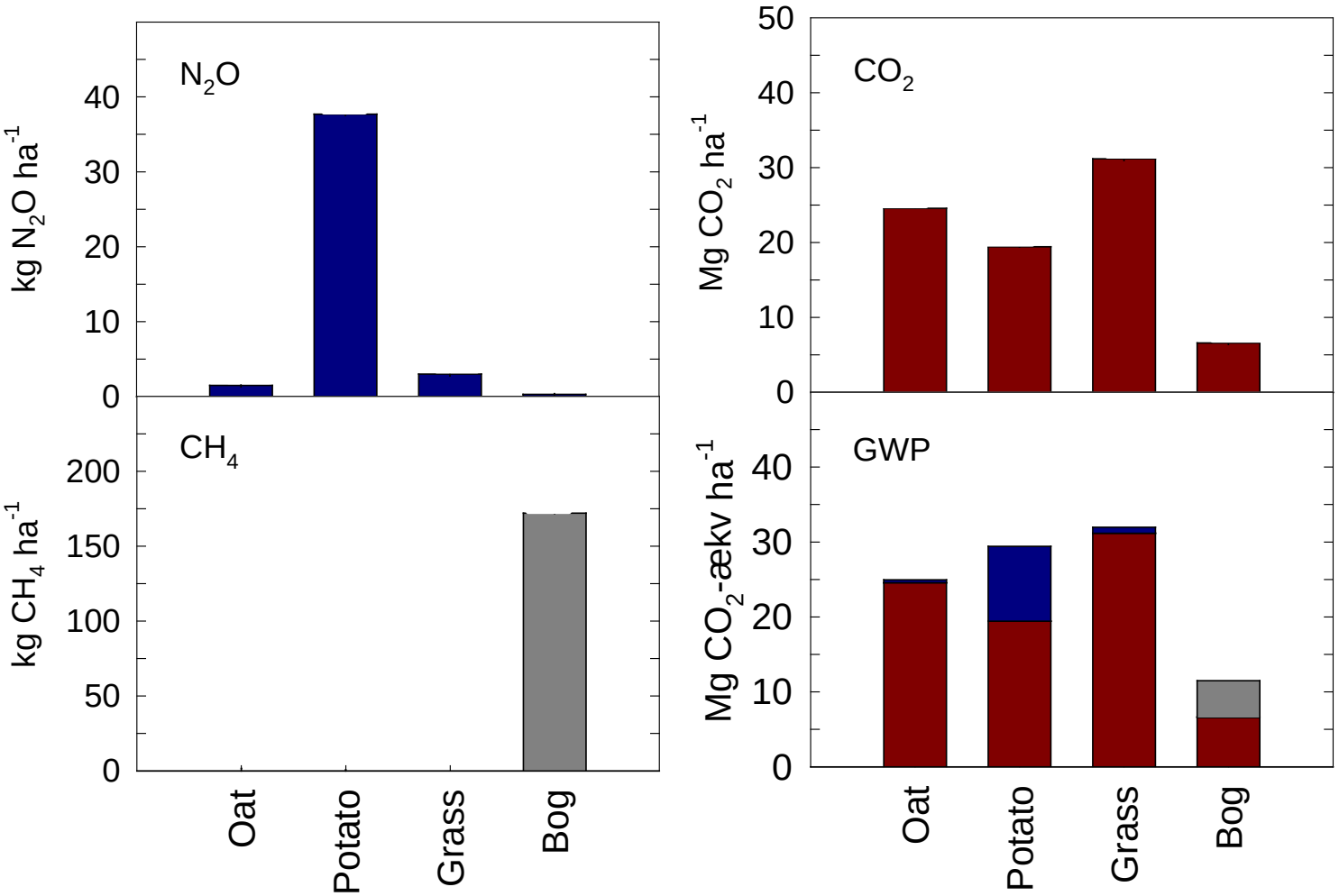
# Nitrous oxide emissions are low or negligible, except at the potato site where high peaks occur



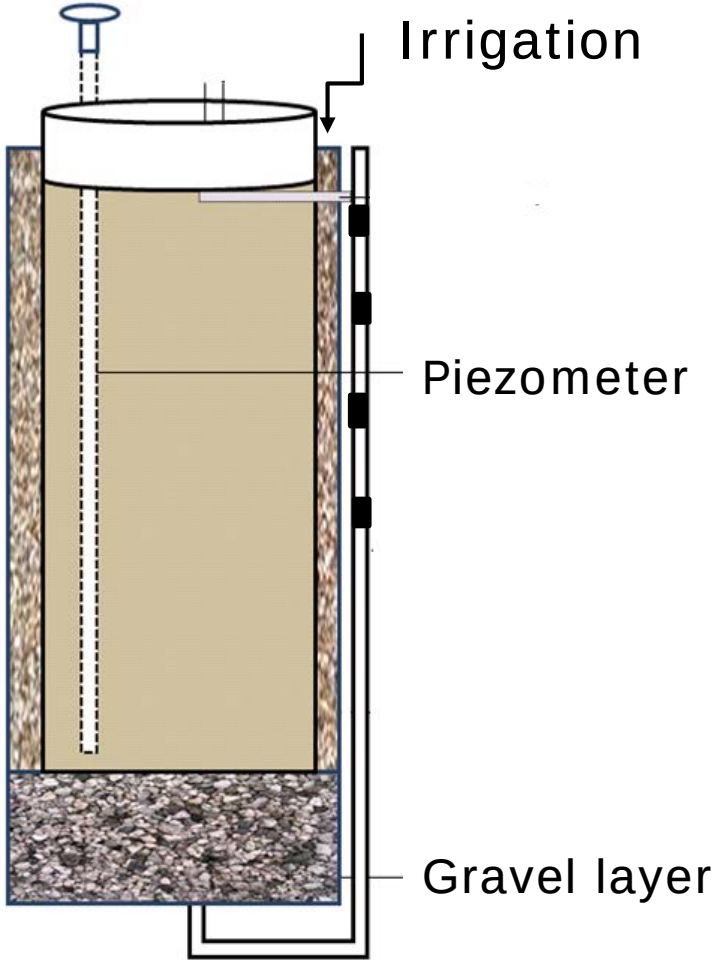
Soil respiration is typically low at low at bog site, but high and rather similar at the drained sites



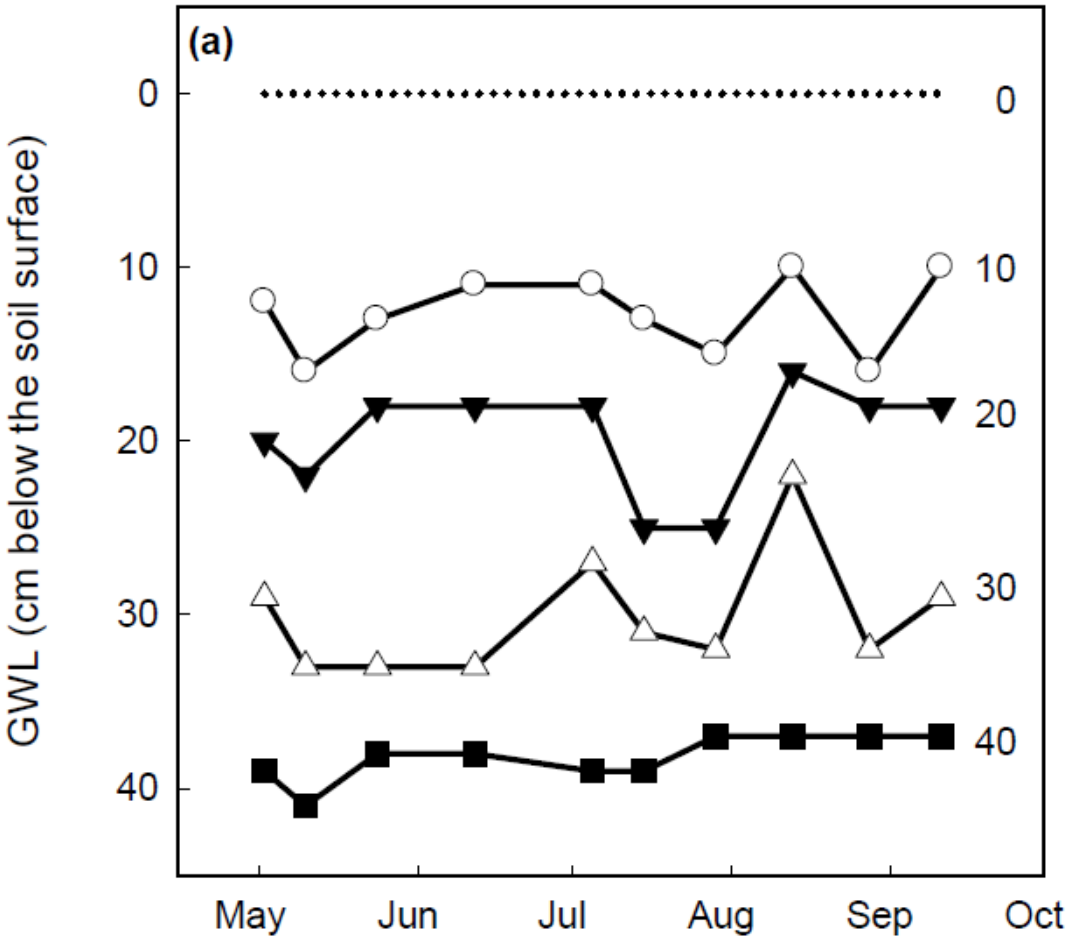
# Cumulative annual fluxes indicate a similar range of soil respiration and GWP at the drained sites



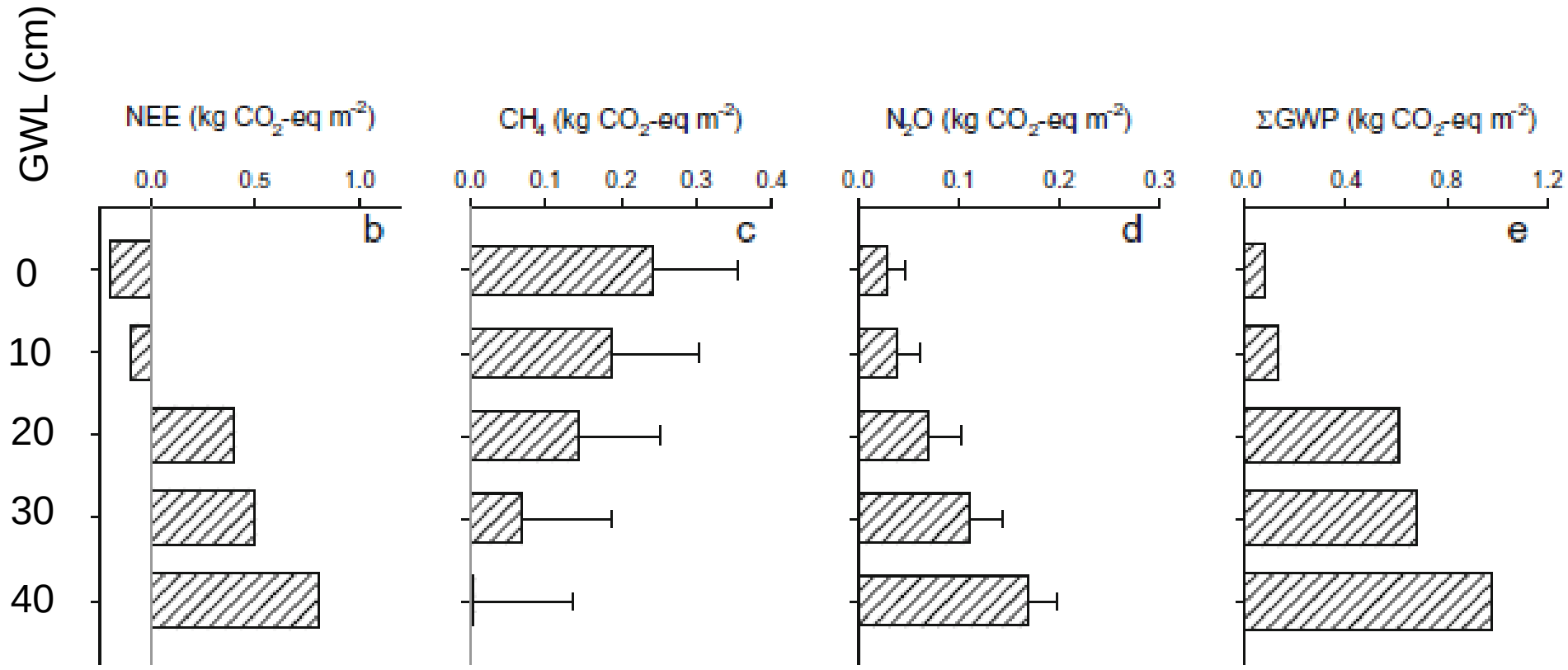
Measurement of greenhouse gas emissions at controlled rewetting has been done with intact soil cores



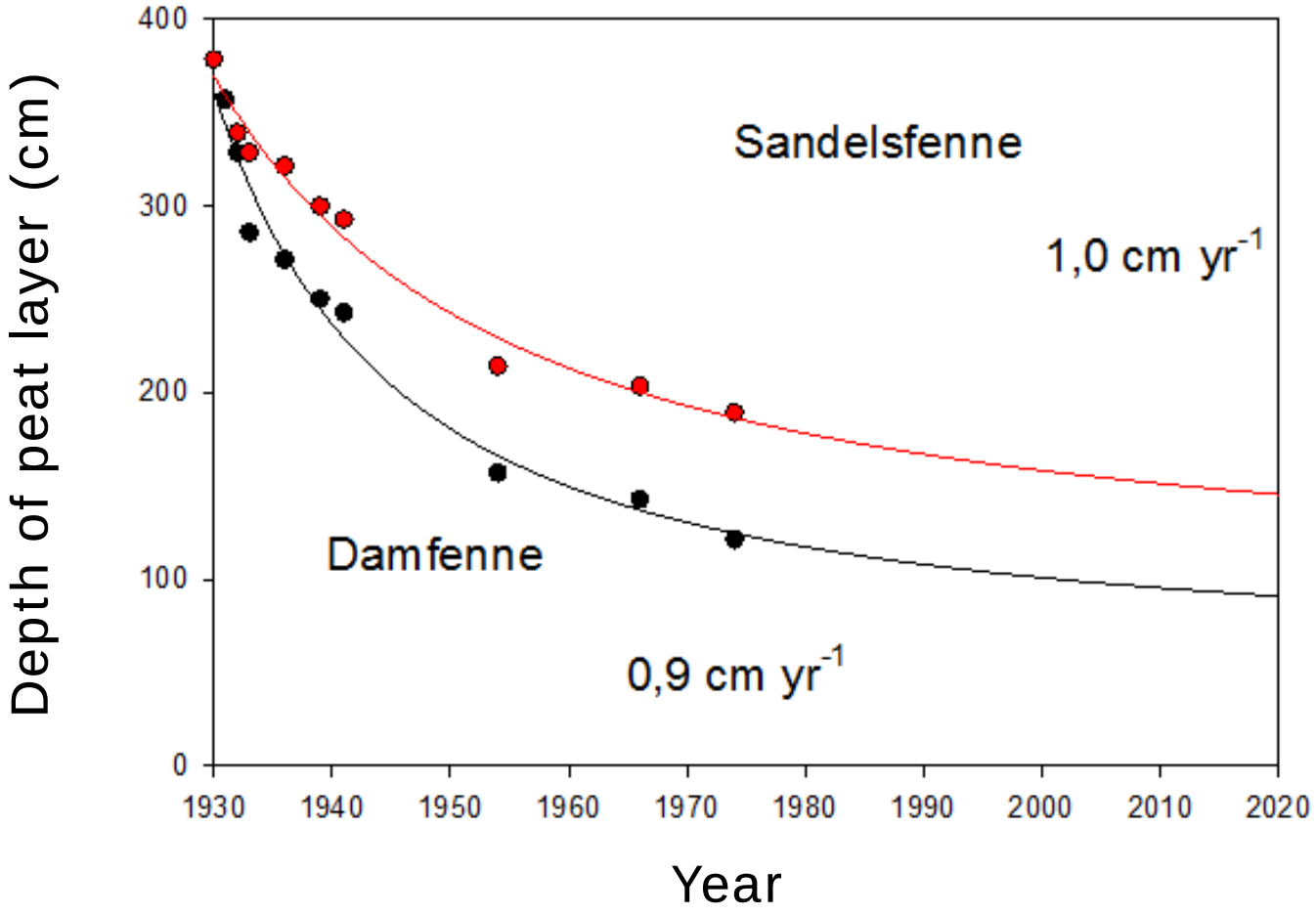
Water table depth (GWL) can be practically controlled during several months, yet with some fluctuations



# Increases in $CH_4$ emissions upon rewetting can be off-set by decline in $N_2O$ and notably net $CO_2$ emissions

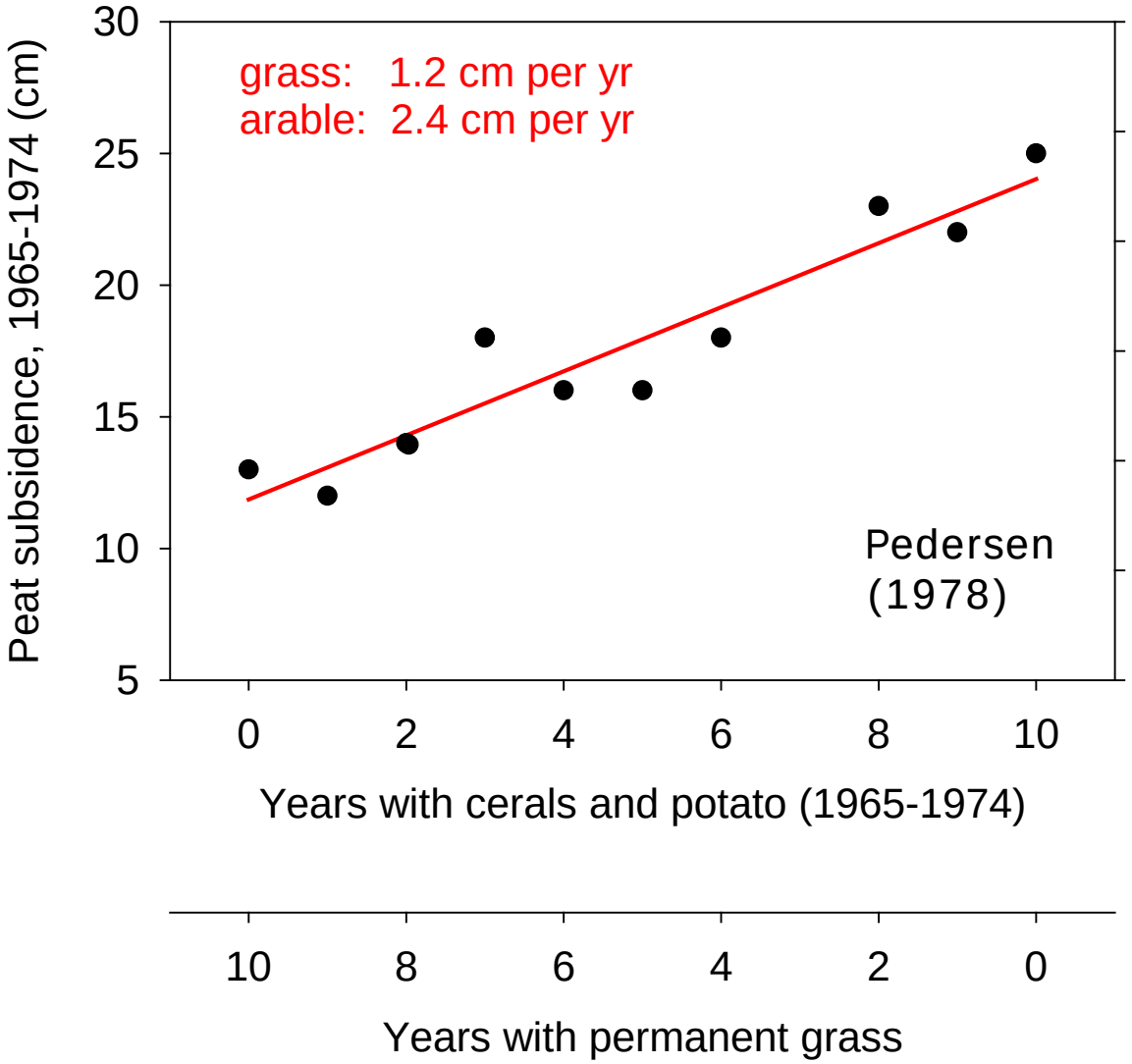


The peat layer decreases continually after drainage, but most rapidly in the first years

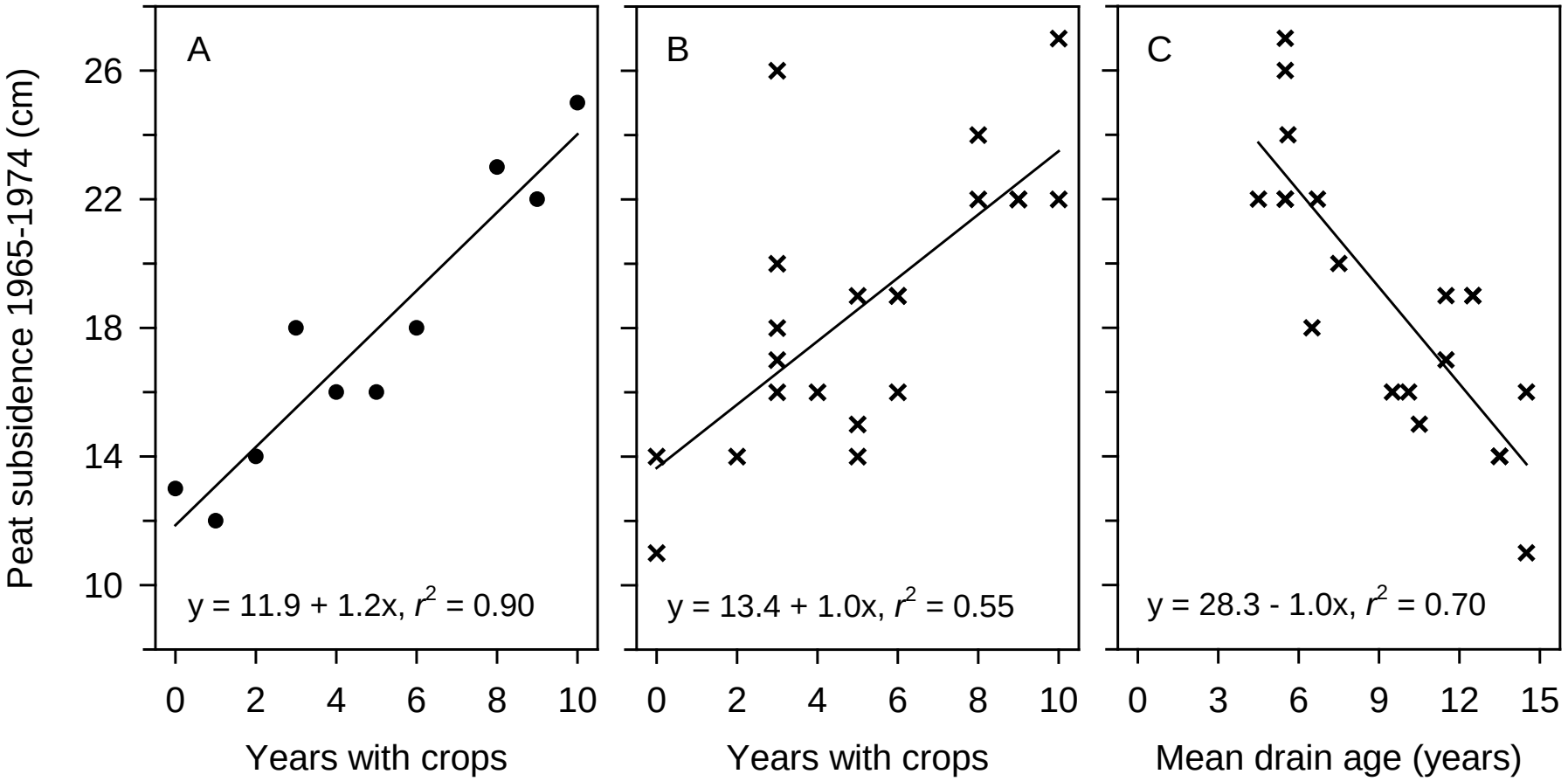



(*after Pedersen, 1978*)

# Historical data suggest that peat losses from arable sites are two times larger than from grasslands



# Re-examining historical data suggests that drainage conditions are as important as land-use



# Conclusions

- Negligible methane emissions from drained sites; high methane emssions from undrained bogs
- Negligible $N_2O$ emissions from undrained bogs, risk of high emissions from drained sites depending on N status
- Low $CO_2$ emissions from undrained bogs, but rapid response to decreasing water table
- Soil respiration and peat losses seem to be coupled to drainage and not specifically to cropping systems. Yet, drainage status and cropping systems could be linked

Thanks to colleagues at AU
& Thanks for your attention