AARHUS
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Effect of ground water level on greenhouse gas emissions from rewetted peatland cultivated with reed canary grass

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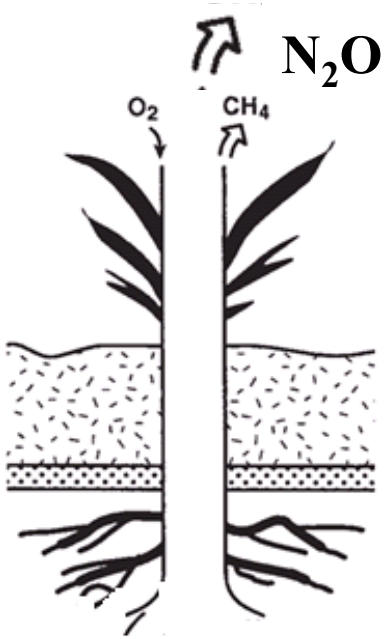
Paludiculture

CO_2 ⇩ ⇧ CH_4

Rewetting of peatland



2

Materials and Methodology

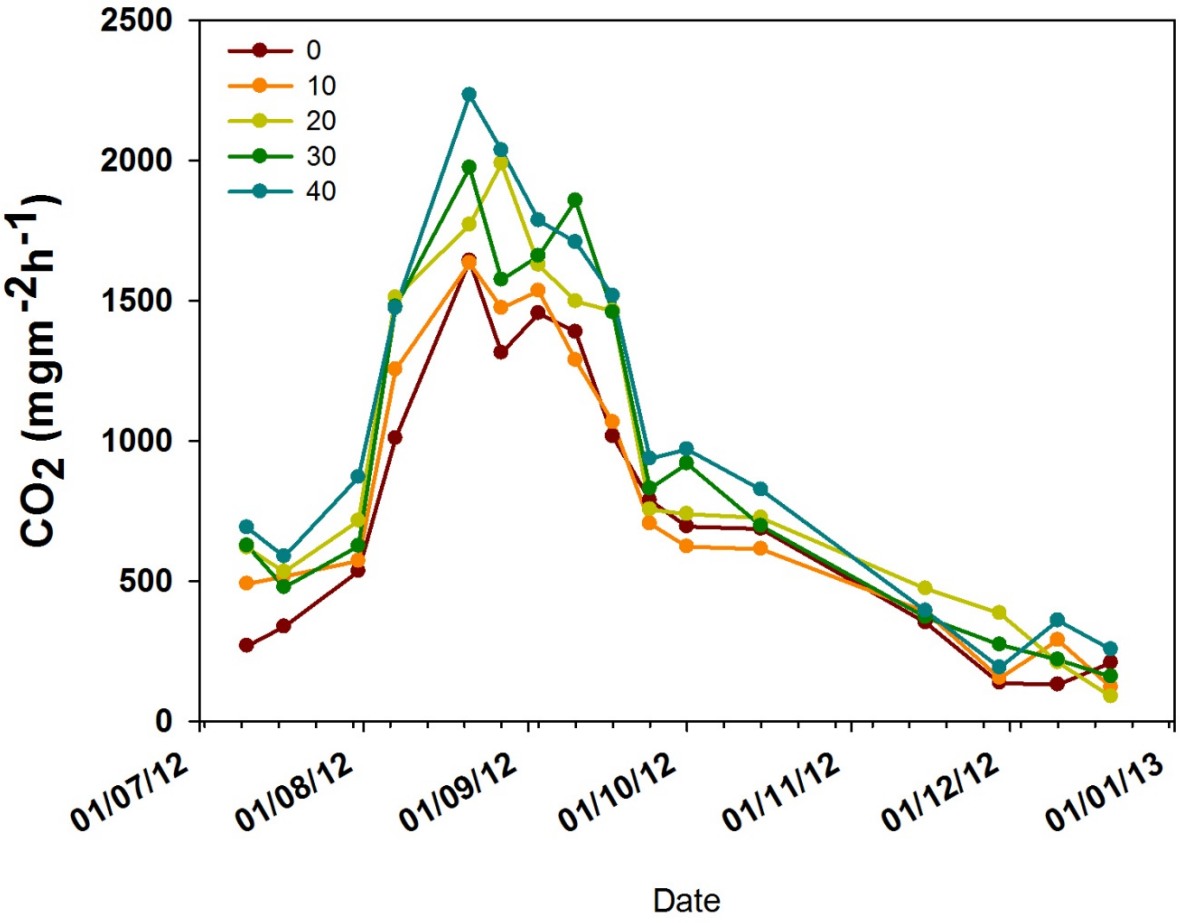
- 5 different water table - 0,10, 20, 30 and 40 cm below the soil surface
- 5 replicates

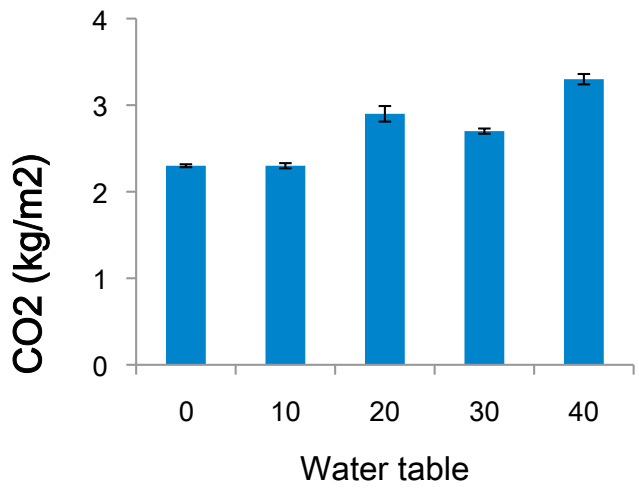

WOOL

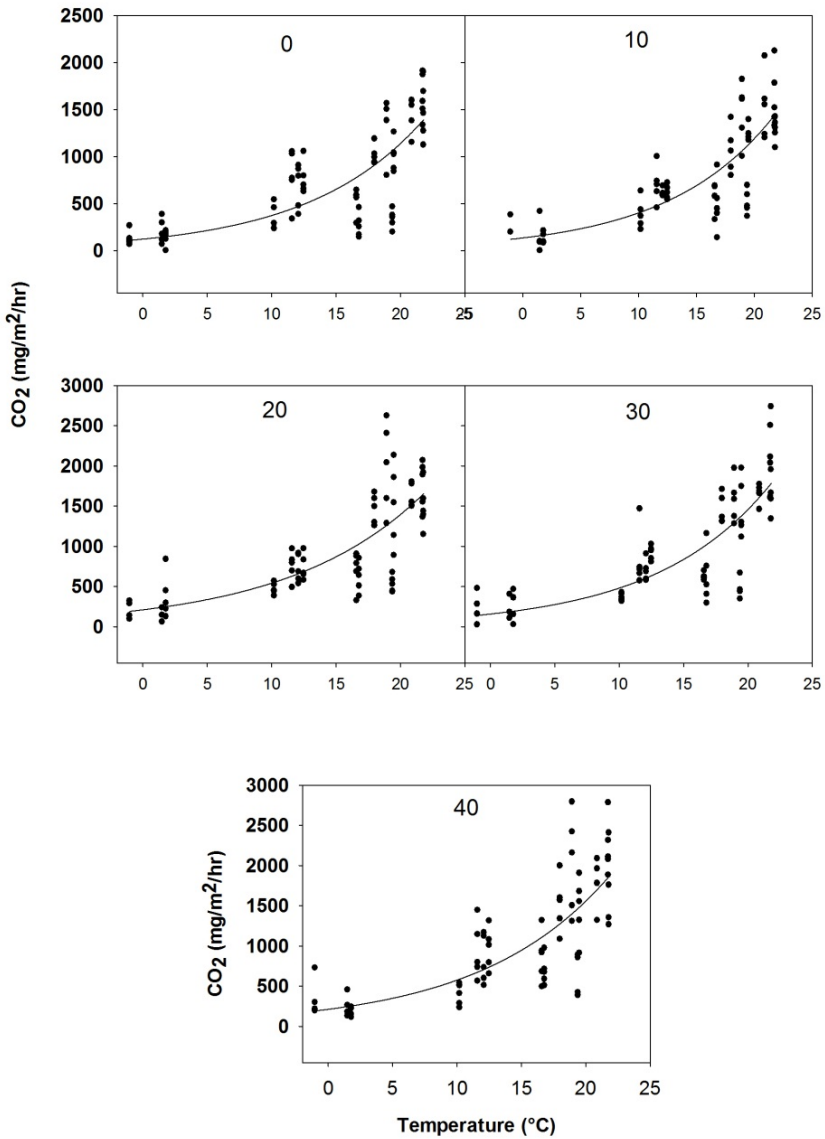
Measurements

- Ecosystem respiration, methane and nitrous oxide emission
  - Gas Sampling: 4 times in 15 minutes interval
  - HMR method: flux calculation
- Biomass Measurement- Ratio vegetation index
- Soil temperature at 5 cm and soil moisture

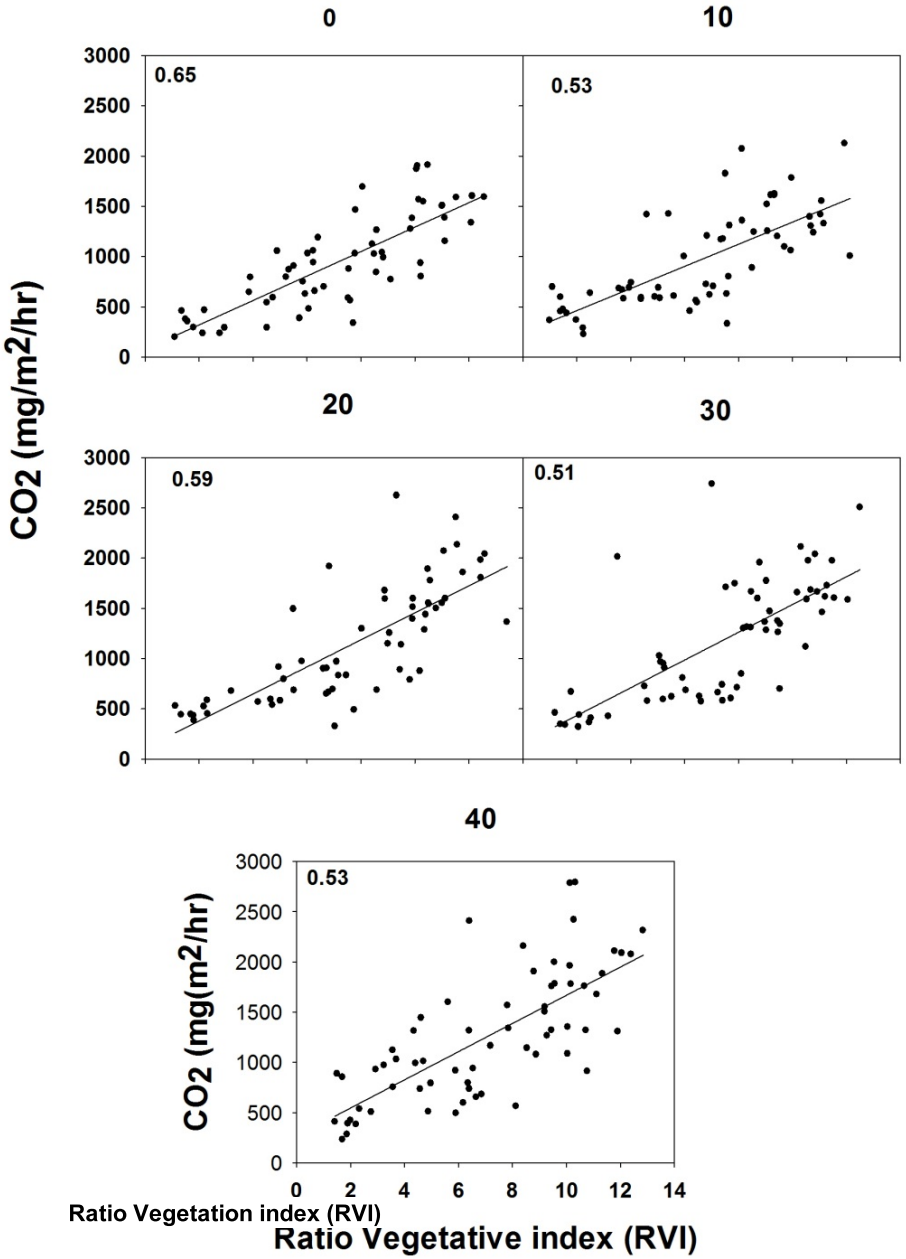
Results


2500
2000
1500
1000
500
0
0
10
20
30
40
CO_2 (mgm^{-2}h^{-1})
01/07/12
01/08/12
01/09/12
01/10/12
01/11/12
01/12/12
01/01/13
Date


4
3
2
1
0
CO2 (kg/m2)
0
10
20
30
40
Water table



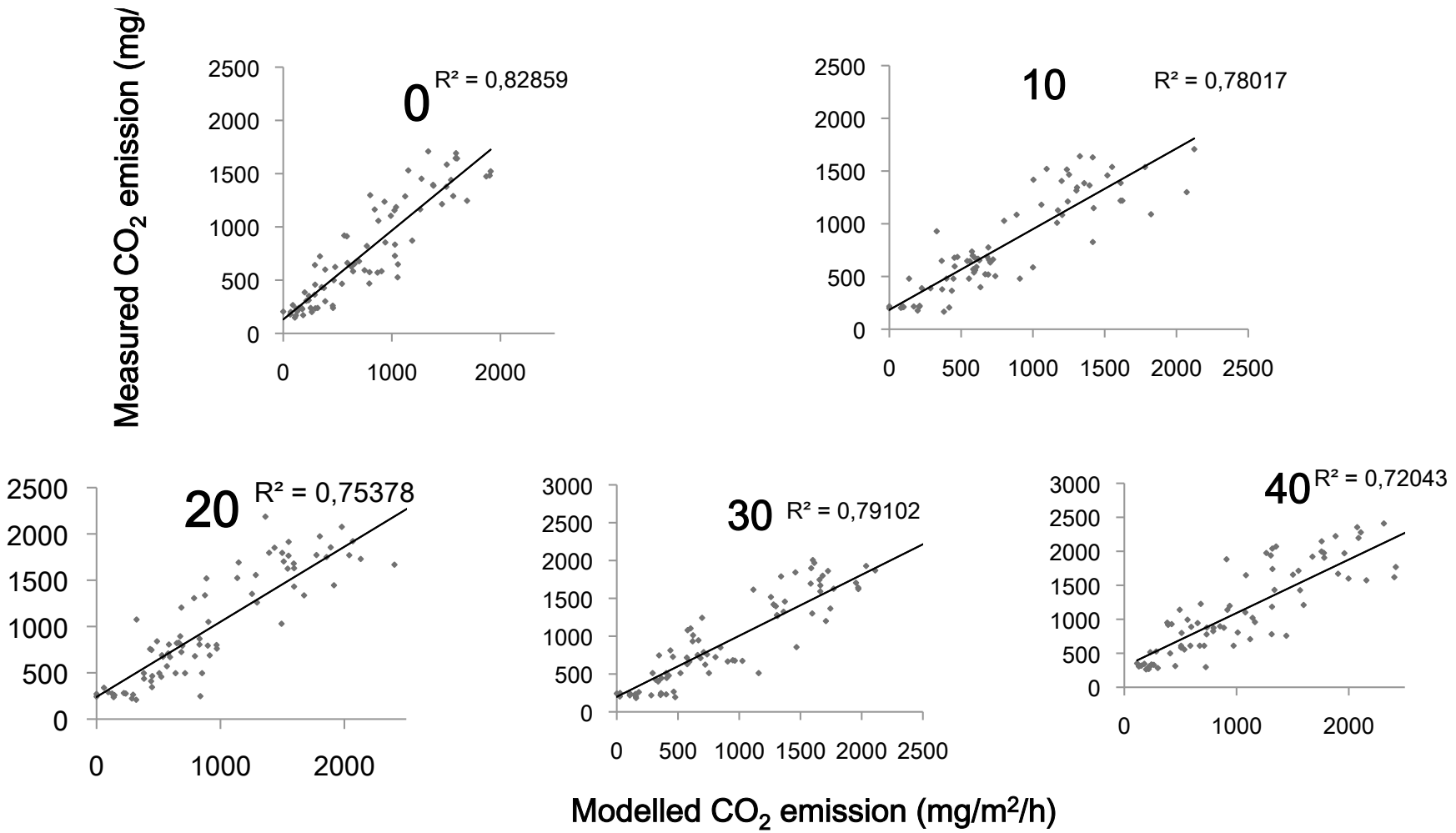
r^2—58-67%

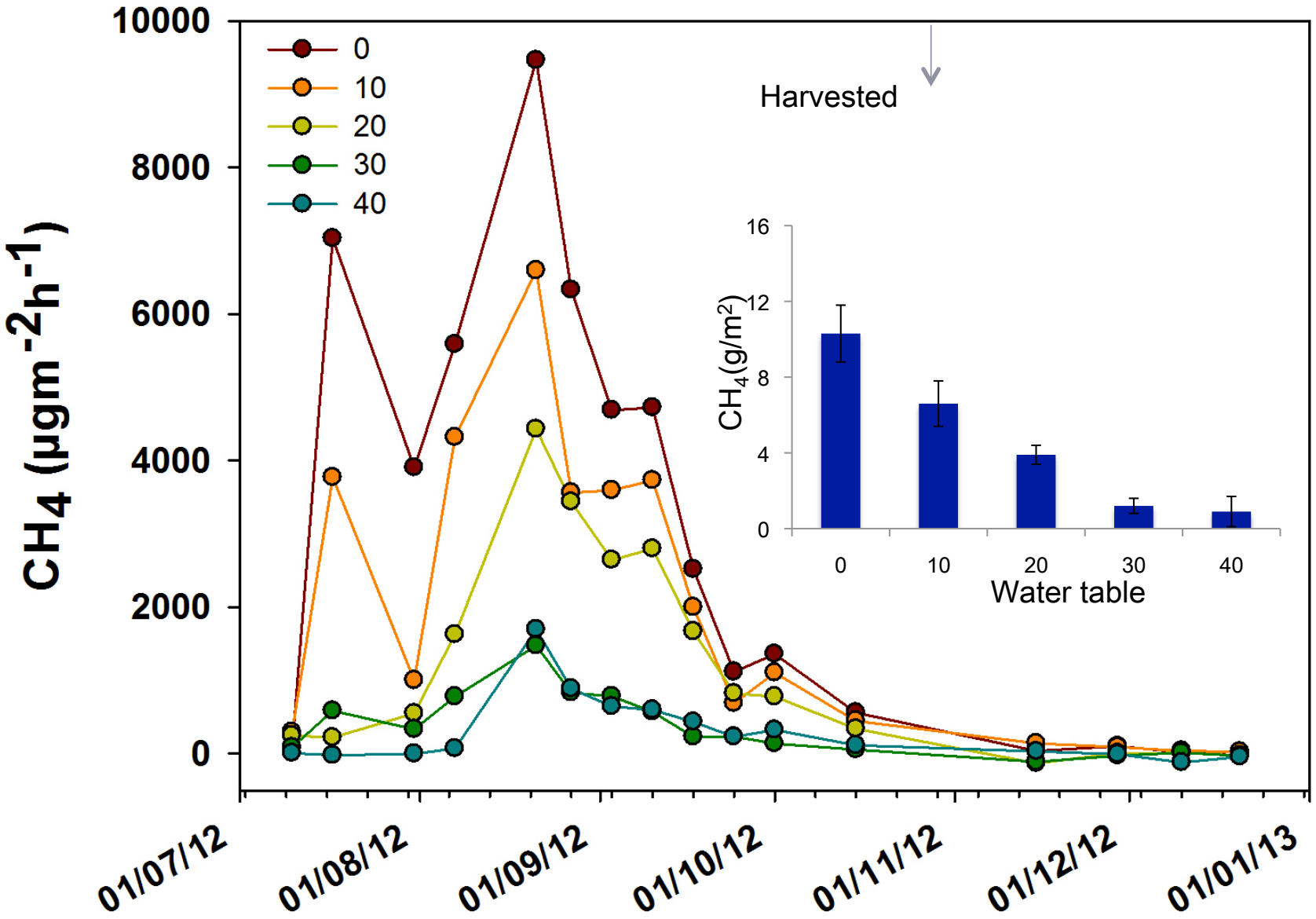

0
10
20
30
40
0.65
0.53
0.59
0.51
0.53
CO2 (mg/m2/hr)
CO2 (mg(m2/hr)
3000
2500
2000
1500
1000
500
0
0
2
4
6
8
10
12
14
Ratio Vegetation index (RVI)
Ratio Vegetative index (RVI)

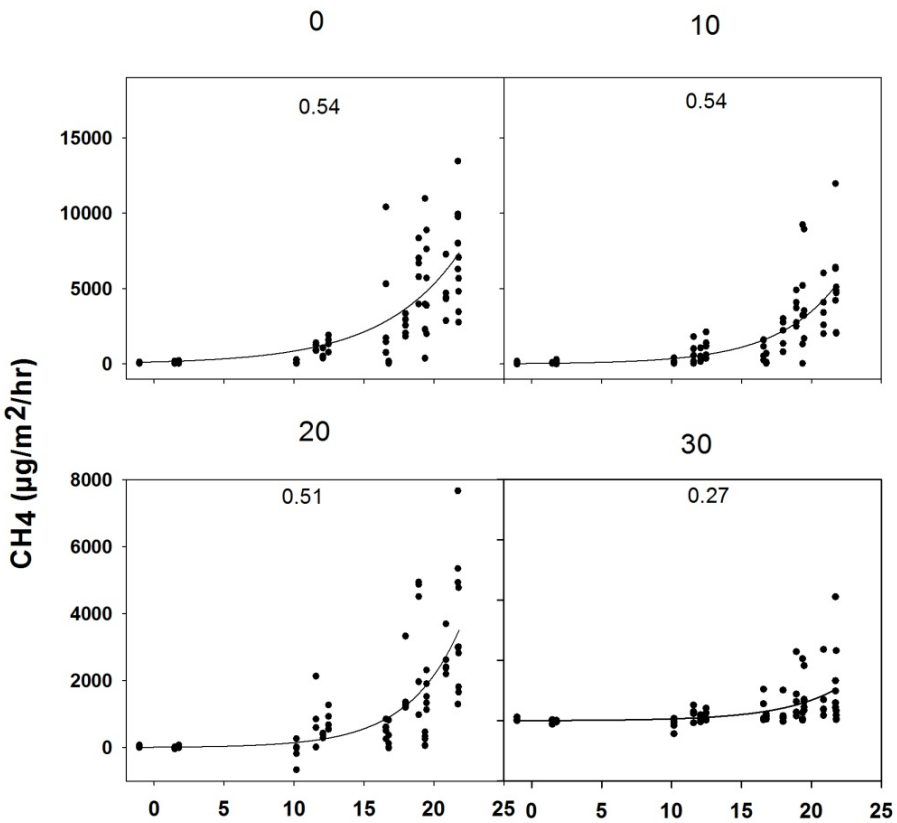
Modelling of CO_2 fluxes

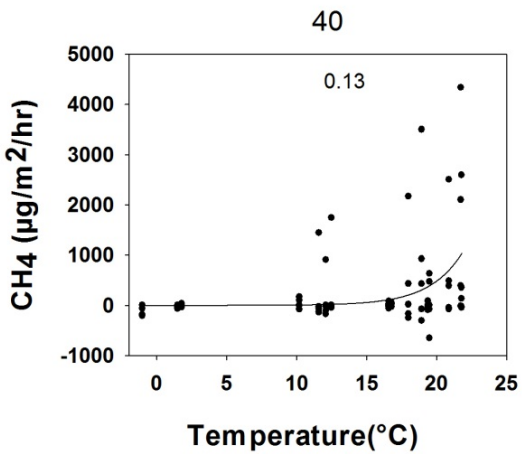
$$R_E = (R_{base} + R_{fb}) = R_0 e^{bT} + (\beta \times RVI) e^{bT}$$

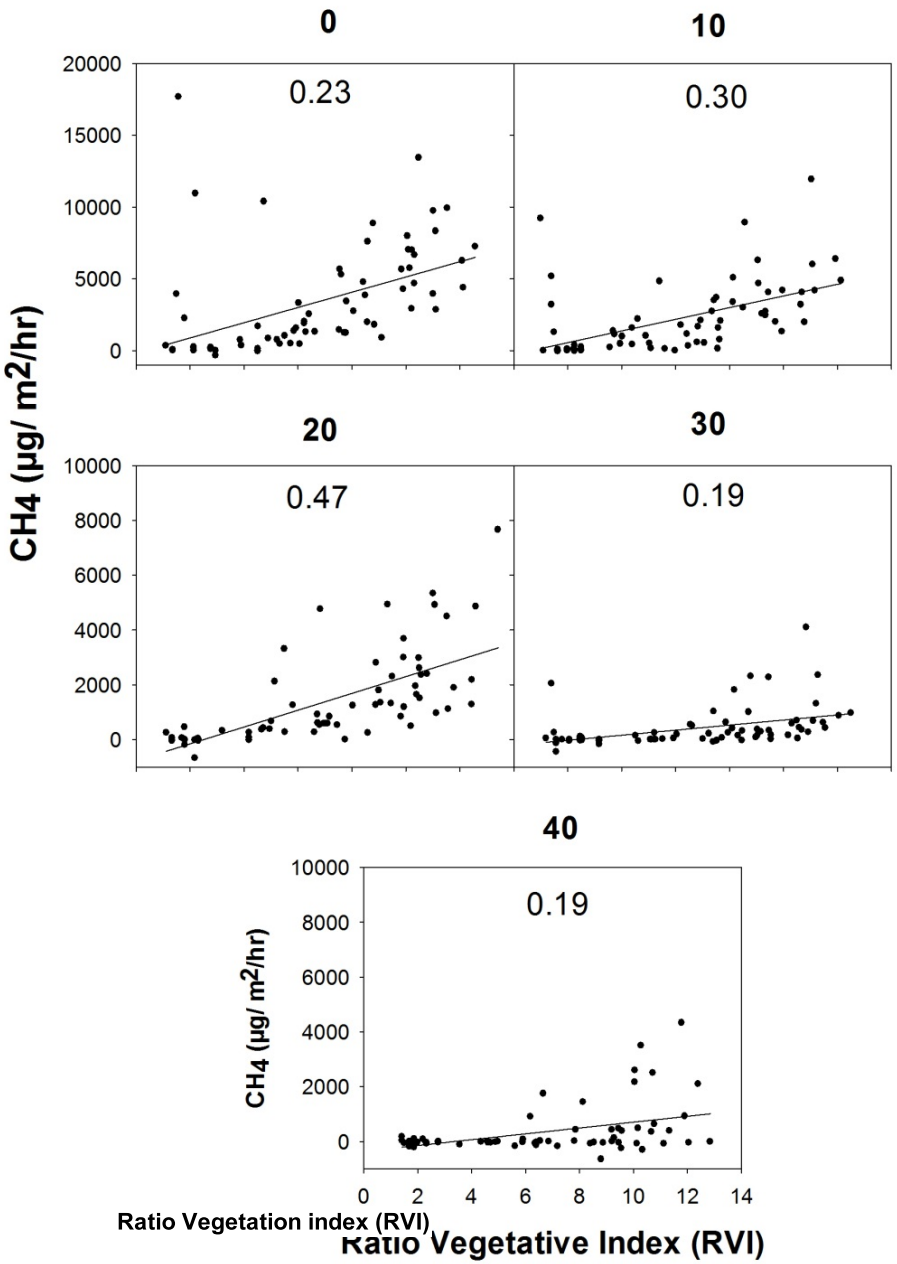
Kandel et al.2012 GCB Bioenergy

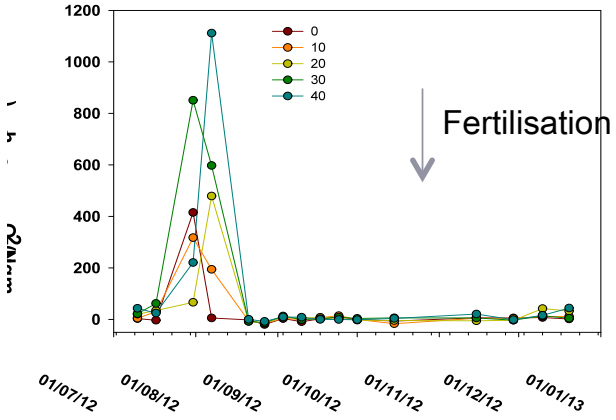


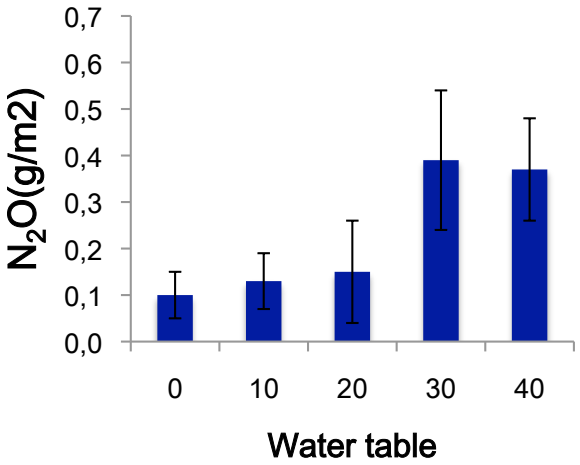

10000
8000
6000
4000
2000
0
CH_4 ($\mu gm^{-2}h^{-1}$)
0
10
20
30
40
Harvested
16
12
8
4
0
CH_4 (g/m^2)
0
10
20
30
40
Water table
01/07/12
01/08/12
01/09/12
01/10/12
01/11/12
01/12/12
01/01/13


0
10
20
30
0.54
0.54
0.51
0.27
CH4 (µg/m2/hr)
15000
10000
5000
0
8000
6000
4000
2000
0
0 5 10 15 20 25
0 5 10 15 20 25

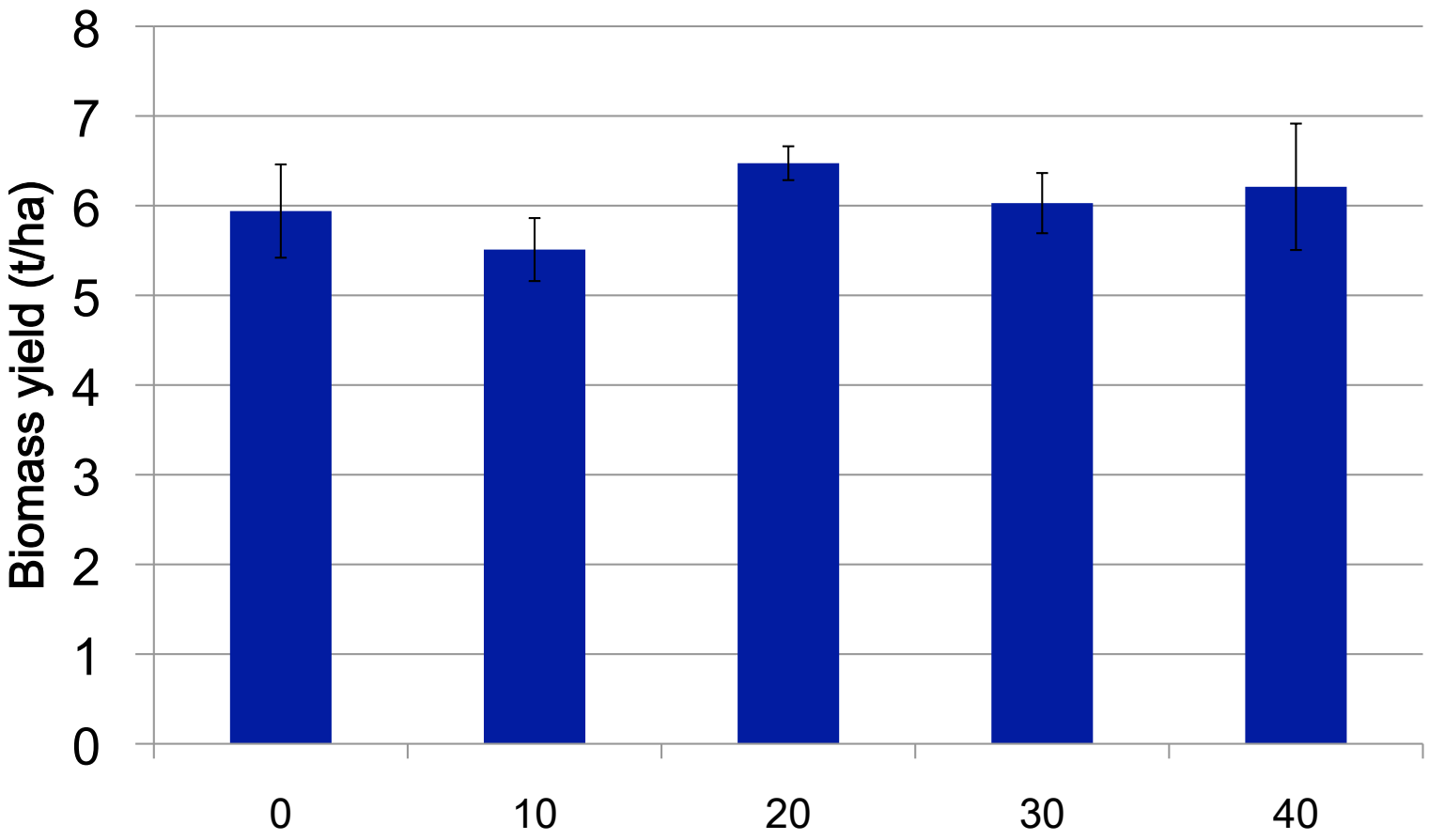

40
0.13
CH4 (µg/m2/hr)
5000
4000
3000
2000
1000
0
-1000
0 5 10 15 20 25
Temperature(°C)


0
10
20
30
40
0.23
0.30
0.47
0.19
0.19
CH4 (µg/ m2/hr)
Ratio Vegetation index (RVI)
Ratio Vegetative Index (RVI)


1200
1000
800
600
400
200
0
0
10
20
30
40
Fertilisation
01/07/12
01/08/12
01/09/12
01/10/12
01/11/12
01/12/12
01/01/13

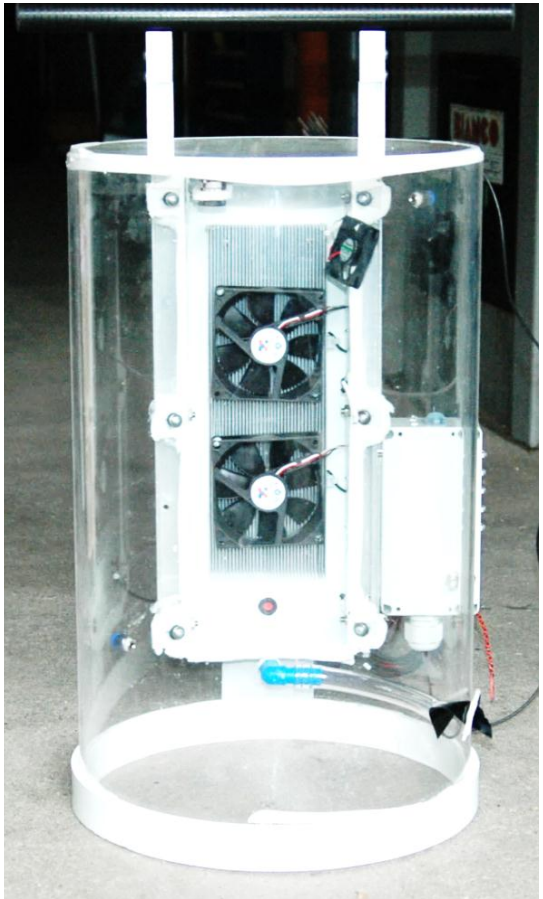

0,7
0,6
0,5
0,4
0,3
0,2
0,1
0,0
N2O(g/m2)
0
10
20
30
40
Water table

Biomass Yield

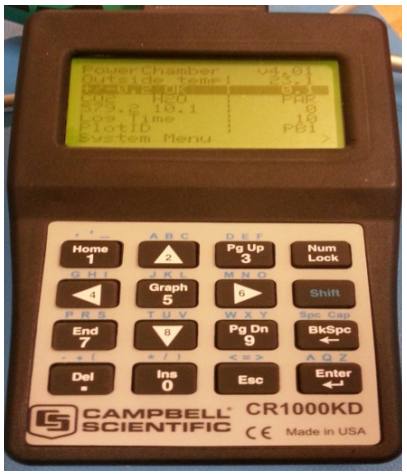


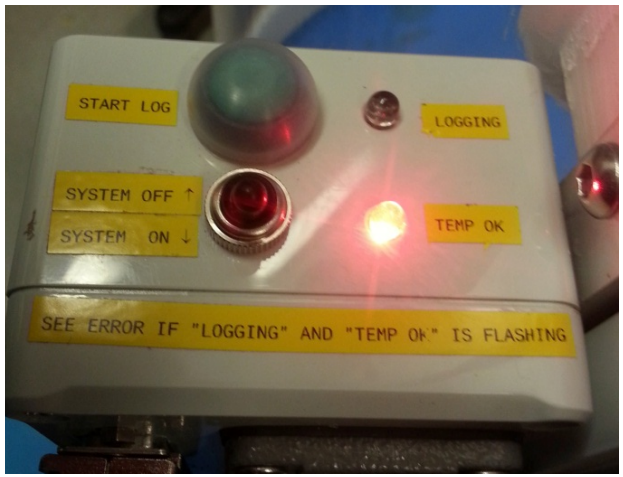
Cumulative greenhouse gas emission in CO_2 equivalent

Water table below the soil surface (cm)	Cumulative Greenhouse gas flux over 183 days in CO_2 eq. (kg/m^2)						
	R eco	GPP	CH_4	N_2O	Total	Yield	Total
0	2.3	-3.6	0.26	0.03	-1.0	0.3	-0.7
10	2.3	-3.6	0.17	0.04	-1.1	0.3	-0.8
20	2.9	-3.6	0.1	0.05	-0.5	0.3	-0.2
30	2.7	-3.6	0.03	0.12	-0.7	0.3	-0.4
40	3.3	-3.6	0.03	0.11	-0.1	0.3	0.1




PowerChamb


PowerChamber V4.01
Outside temp: 23.1
Reading: PM2
Vx 1.50 PM2
573.2 10.1 0
Time 0
PlotID PB1
System Menu
Home 1
Pg Up 3
Num Lock
Graph 5
Shift
End 7
Pg Dn 9
BkSpc
Del .
Ins 0
Esc
Enter
CAMPBELL SCIENTIFIC
CR1000KD
Made in USA


START LOG
LOGGING
SYSTEM OFF ↑
SYSTEM ON ↓
TEMP OK
SEE ERROR IF "LOGGING" AND "TEMP OK" IS FLASHING

Conclusion

- CO_2 - major gas - emission is lowest at high water table but no difference at 0 and 10 cm of water table.
- CH_4 emission is highest at high water table – contributes very less in terms of GWP.
- N_2O emission is low- negligible contribution to GWP
- Overall rewetting and growing of reed canary grass reduces the overall greenhouse gas emission from peatland

Thank You