Raising Water Table Depth on Peatlands and Impacts on Grazing Herds Welfare

Managing Wetlands for Agriculture

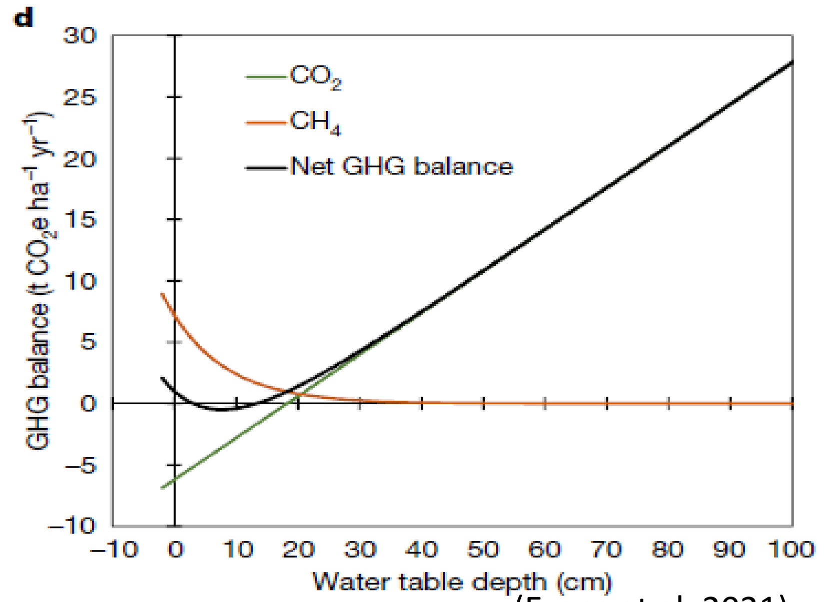
W. Gherca, C. D. Evans, P. Leahy, R. Morrison, and E. Eichelmann

Background

Raising water table on drained peatlands:

- <u>Reduces GHG emissions </u>related to the decomposition of organic material after centuries of carbon accumulation, exposed to oxygen during drainage (Renou-Wilson, F. and Wilson, D., 2018) .
- <u>Impacts local temperature (TA) and relative humidity</u> (RH)
  - ➢ Impacts animal welfare, evaluated by farmers with Temperature-Humidity-Index (THI)

$$THI = 0.8*TA + RH*(TA-14.4) + 46.4$$



(Evans et al, 2021)

TA °C	% RH																	
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85
22.0	64	65	65	65	66	66	67	67	67	68	68	69	69	69	70	70	70	71
23.0	65	65	66	66	66	67	67	68	68	68	69	69	70	70	71	71	71	72
23.5	65	66	66	67	67	67	68	68	69	69	70	70	70	71	71	72	72	73
24.0	66	66	67	67	68	68	68	69	69	70	70	71	71	72	72	73	73	74
24.5	66	67	67	68	68	69	69	70	70	71	71	72	72	73	73	74	74	75
25.0	67	67	68	68	69	69	70	70	71	71	72	72	73	73	74	74	75	75
25.5	67	68	68	69	69	70	70	71	71	72	73	73	74	74	75	75	76	76
26.0	67	68	69	69	70	70	71	71	72	73	73	74	74	75	76	76	77	77
26.5	68	69	69	70	70	71	72	72	73	73	74	75	75	76	76	77	78	78
27.0	68	69	70	70	71	72	72	73	73	74	75	75	76	77	77	78	78	79
28.0	69	69	70	71	71	72	73	73	74	75	75	76	77	77	78	79	79	80
28.5	69	70	71	71	72	73	73	74	75	75	76	77	78	78	79	80	80	81
29.0	70	70	71	72	73	73	74	75	75	76	77	78	78	79	80	80	81	82
29.5	70	71	72	72	73	74	75	75	76	77	78	78	79	80	81	81	82	83
30.0	71	71	72	73	74	74	75	76	77	78	78	79	80	81	81	82	83	84
30.5	71	72	73	73	74	75	76	77	77	78	79	80	81	81	82	83	84	85
31.0	72	72	73	74	75	76	76	77	78	79	80	81	81	82	83	84	85	86
31.5	72	73	74	75	75	76	77	78	79	80	80	81	82	83	84	85	86	86
32.0	72	73	74	75	76	77	78	79	79	80	81	82	83	84	85	86	86	87
33.0	73	74	75	76	76	77	78	79	80	81	82	83	84	85	86	86	87	88
33.5	73	74	75	76	77	78	79	80	81	82	83	84	85	85	86	87	88	89
34.0	74	75	76	77	78	79	80	80	81	82	83	85	85	86	87	88	89	90
34.5	74	75	76	77	78	79	80	81	82	83	84	86	86	87	88	89	90	91
35.0	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
35.5	75	76	77	78	79	80	81	82	83	85	86	87	88	89	90	91	92	93

(Collier, 2012)

- 68 < THI < 72 - Stress Threshold, milk yield loss begin.
- 72 < THI < 80 - Mid-Moderate Stress, respiration rate > 75bpm; mild fever.
- 80 < THI < 90 - Moderate-Severe Stress, respiration rate > 80bpm; fever.
- 90 < THI - Severe Stress. 120-140bpm, strong fever.

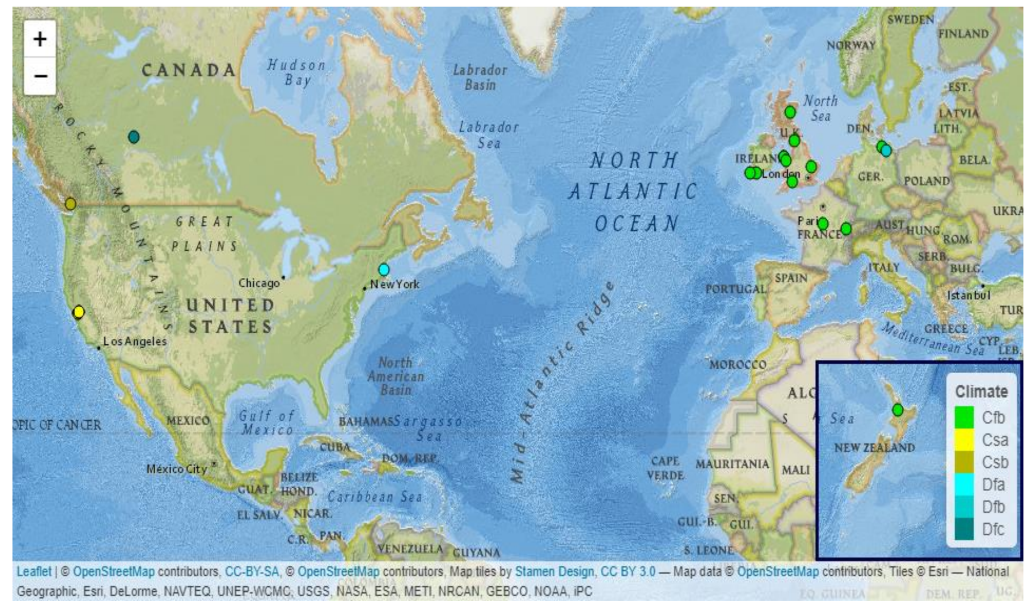
Methods

We compared Temperature TA and Temperature-Humidity Index THI on

- 23 peatland sites, with
- 23 weather stations nearby (distance <40km).

We analysed

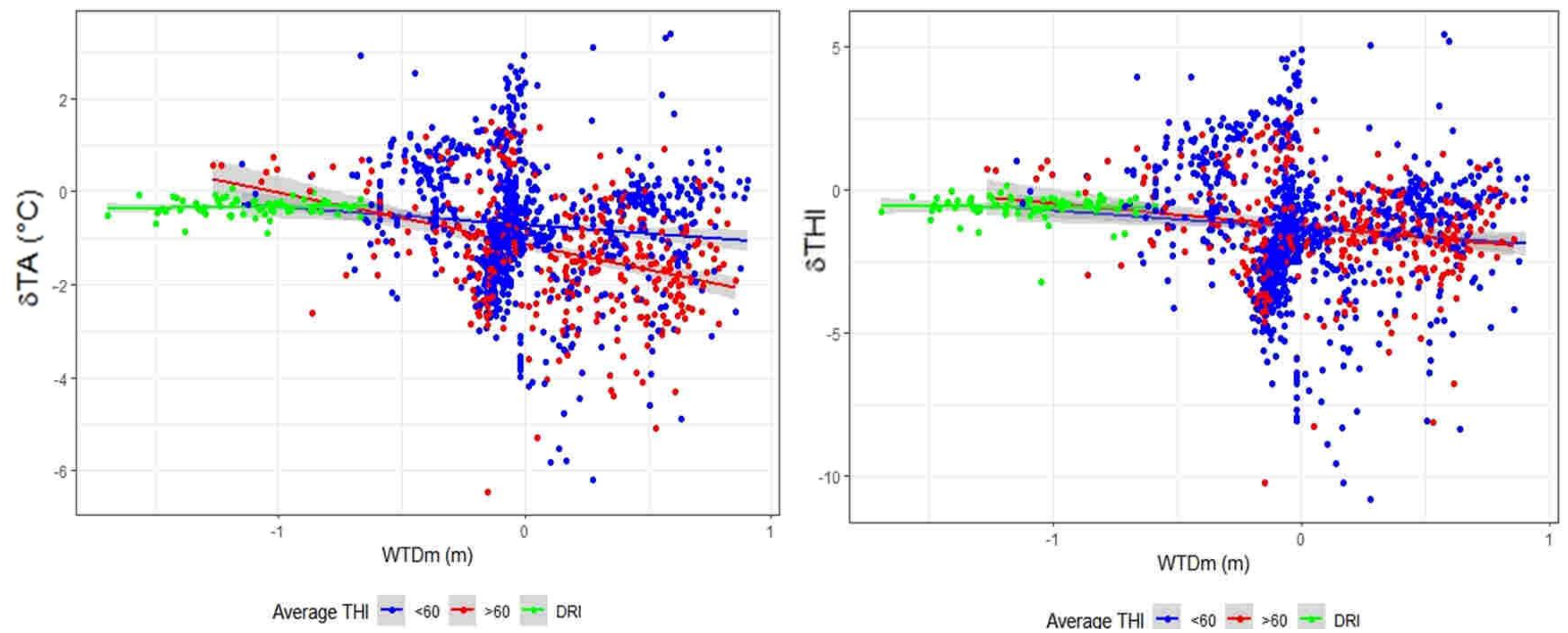
- **δTA and δTHI** i.e. differences between study sites and nearby national weather stations data.
- **δH_{THI72} ,** the number of hours of heat wave per month at and above mid-moderate stress levels for cattle, compared to nearby weather station records.



<u>Fig.</u> 2. Locations of all sites identified for the study, colours from Köppen–Geiger Climate Classification (Beck et al., 2018)

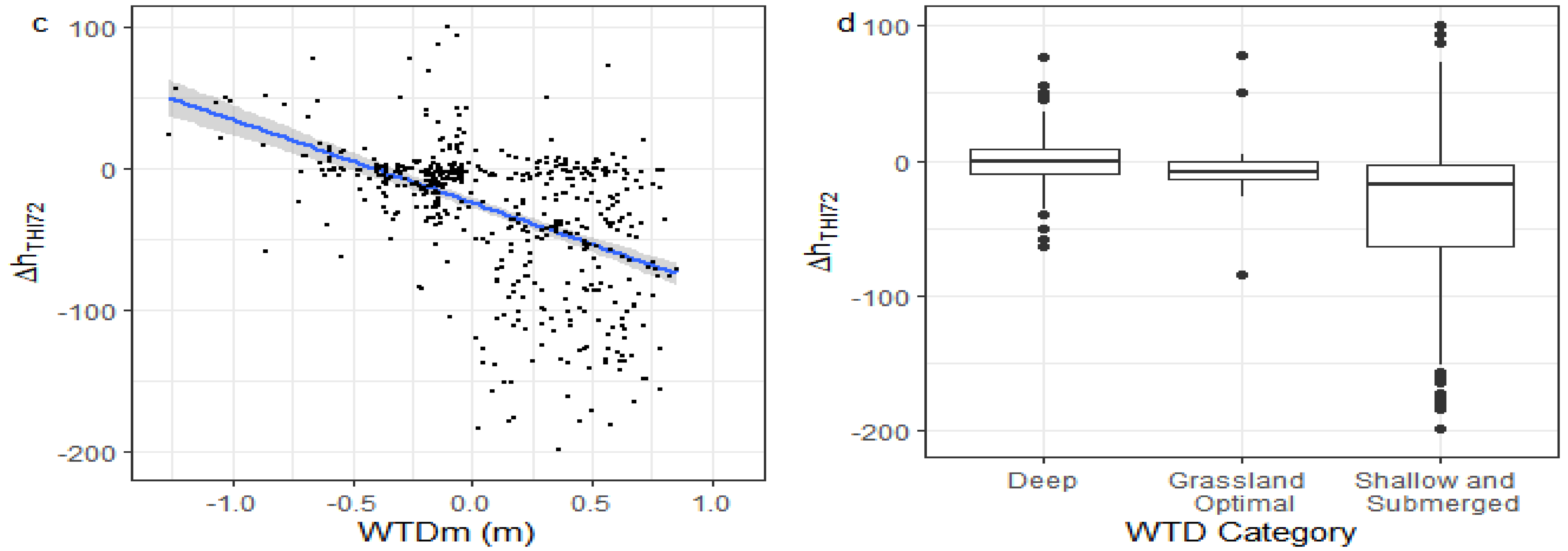
Results

Raising water table depth on peatlands impacts <u>local temperature and THI:</u>



Monthly mean Water table depth (WTDm) impacts on monthly mean Temperature difference (left) and Temperature-Humidity Index difference (right) between peatland and neighbouring weather station (δTA and δTHI>0 for higher TA and THI on peatlands than at meteorological station). Red dots: average THI >60, i.e. more prone to animal stress conditions; blue dots: average THI <60. Dripsey grassland (Ireland) as baseline (green).

Raising water table depth on peatlands impacts <u>frequency of heatwaves </u>impacting animal welfare, especially at shallow and ground levels.



Monthly mean WTDm impacts on frequency of heatwaves with Temperature-Humidity Index (THI) >72 on peatlands, compared to neighbouring Weather Station. Linear representation (left) and comparison pf different WTD categories (right): < -0.30m (Deep); -0.30 to -0.20m (Grassland optimal mitigation) and >-0.20m (shallow and submerged).

Conclusions

Raising water table of drained peatlands used for grazing to optimal grassland, i.e. ~25cm below ground level (Evans et al, 2021):

- Statistically significantly decreases temperatures on the peatlands,
- Statistically significantly decreases slightly THI.
- It also reduces heat wave durations.

Other environmental factor impact variability of the results, including local climate and distance to coastal areas.

A farmer can also create fully rewetted zones to protect cattle against heat waves, i.e. areas with water table at ground level.


(De Puytorac, 2021)

References

Beck et al. (2018) Köppen–Geiger Climate Classification.

Collier (2012) *Quantifying Heat Stress and Its Impact on Metabolism and Performance.*

De Puytorac (2021) Cow on organic farmland with organic soil, with ponds used as drinking water access and as heatwave shelters.

Evans, C.D. et al. (2021) *Overriding water table control on managed peatland greenhouse gas emissions*, Nature, 593(7860)

Renou-Wilson, F. and Wilson, D. (2018) *Vulnerability Assessment of Peatlands: Exploration of Impacts and Adaptation Options in Relation to Climate Change and Extreme Events.*