Long term C balance in Irish grasslands

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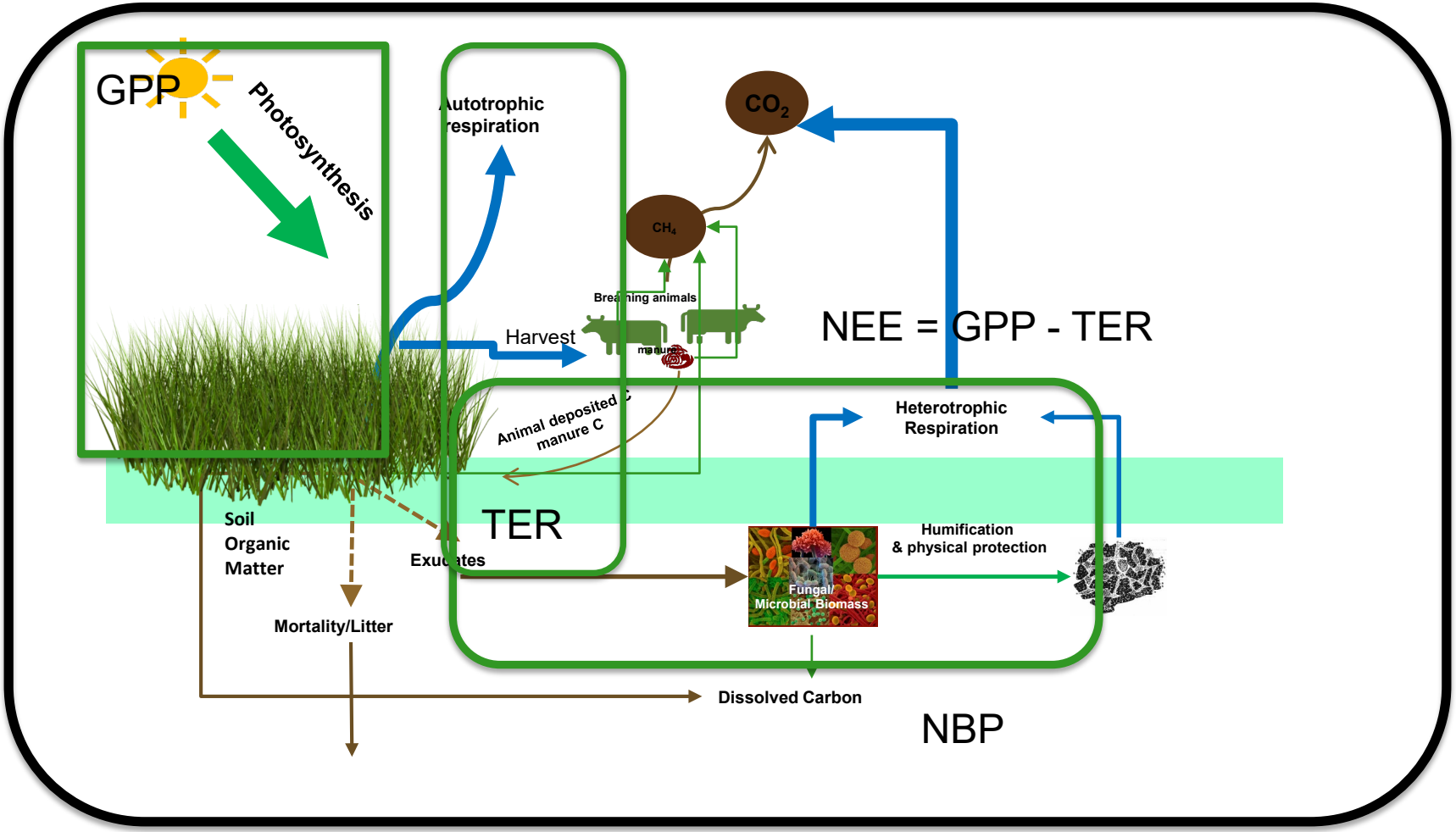
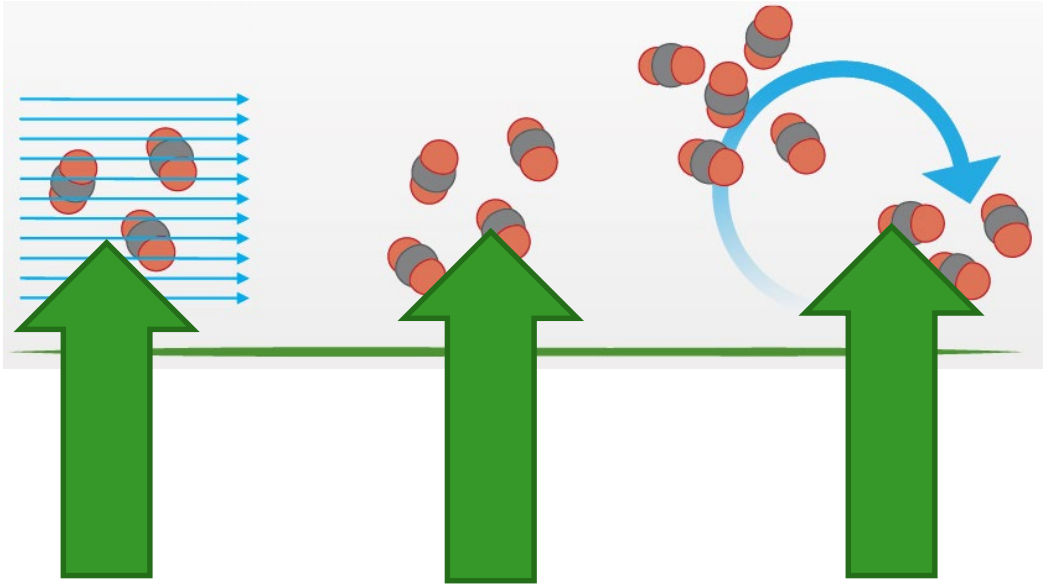
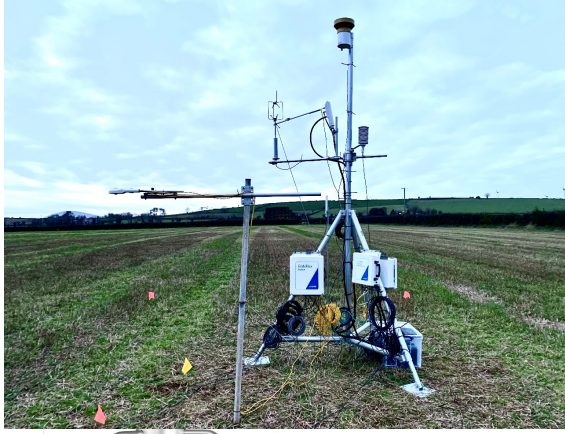
University College Cork, Ireland

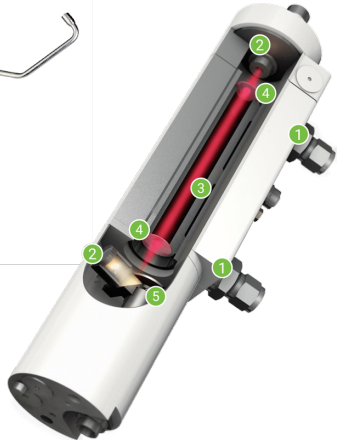
NASC

The main processes in the Carbon cycle







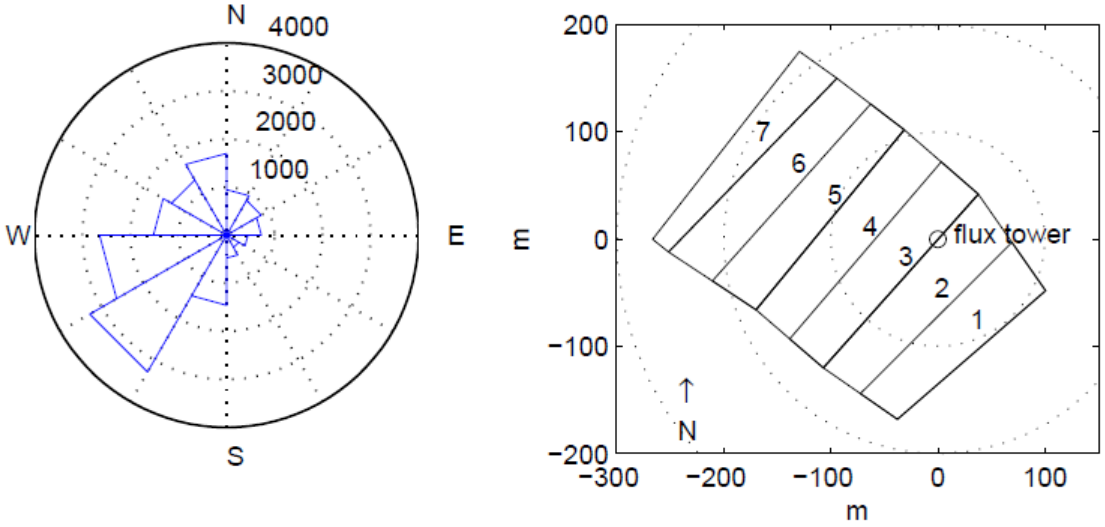


Mean windflow carries CO_2/ H_2O/CH_4 etc molecules over the measurement area

Measured area adds molecules into the mean flow (= flux)

Upward eddy motions carry more molecules than downward motions

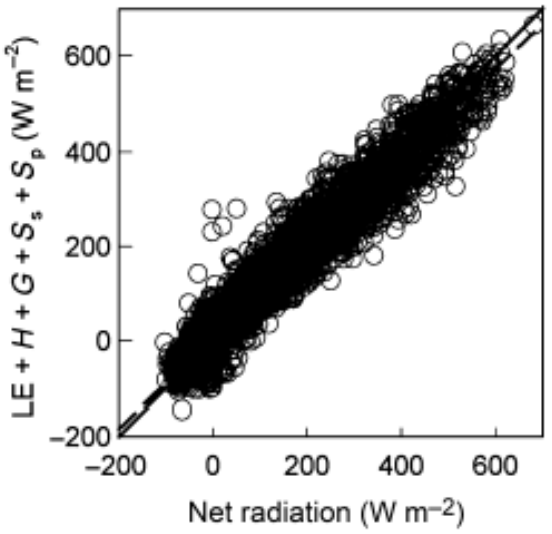
What you measure over depends on wind direction and windspeed



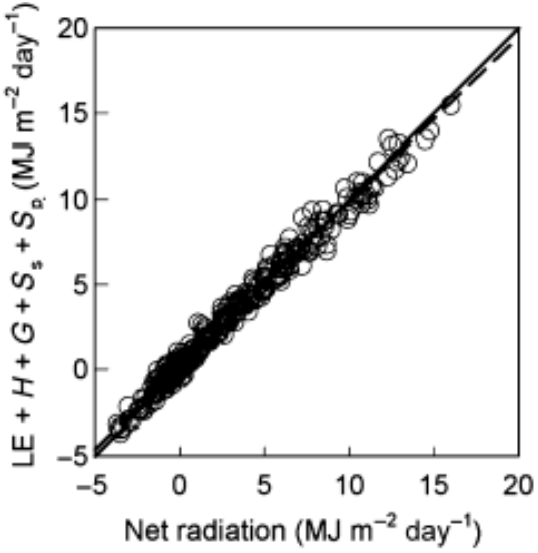
QaQc: Ensuring the integrity of the data

- Use energy balance closure to ensure that water fluxes are being calculated correctly -

Year	slope	intercept	R2
2004	0.96x	0.2	0.99
2005	0.95x	0.4	0.98
2006	0.91x	0.3	0.99
2007	0.93x	0.5	0.94
2008	0.92x	0.4	0.88
2009	0.93x	0.3	0.96
2010	0.88x	0.6	0.81
2012	0.90x	0.5	0.99
2013	0.91x	0.4	0.95
2014	0.89x	0.2	0.89
2015	0.93x	0.5	0.88
2018	0.91x	0.6	0.83
2019	0.92x	0.3	0.94
2020	0.91x	0.4	0.96
2021	0.94x	0.5	0.95



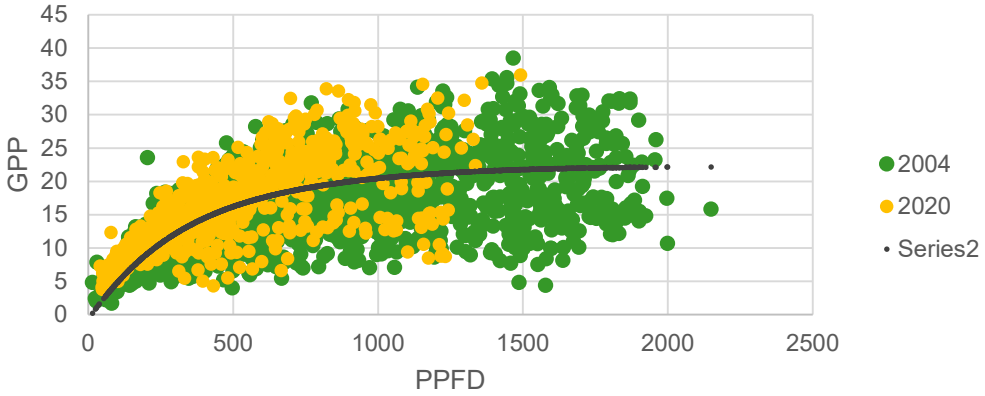
Half-hourly values



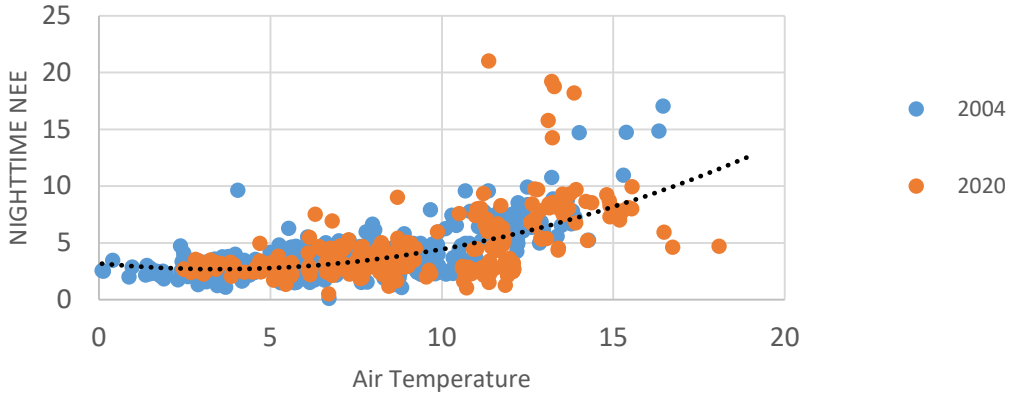
Daily values

PARTITIONING NEP into Gross Primary Production and Total Ecosystem Respiration

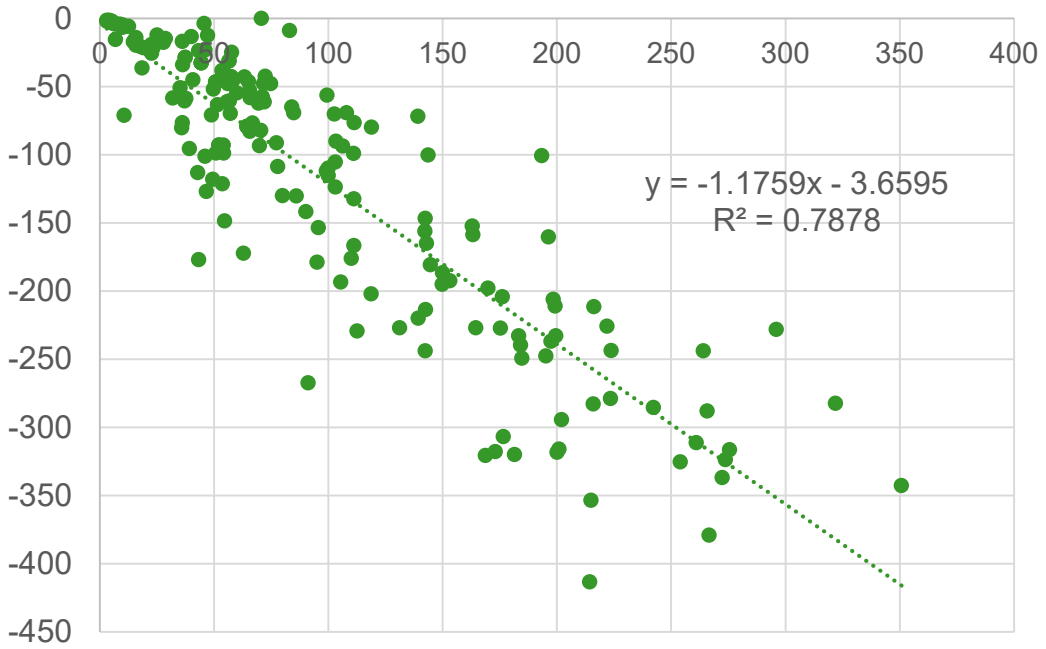
$$\mathrm{GPP} = \frac{\alpha Q_{\mathrm{PPFD}} A_{\max}}{\alpha Q_{\mathrm{PPFD}} + A_{\max}}$$



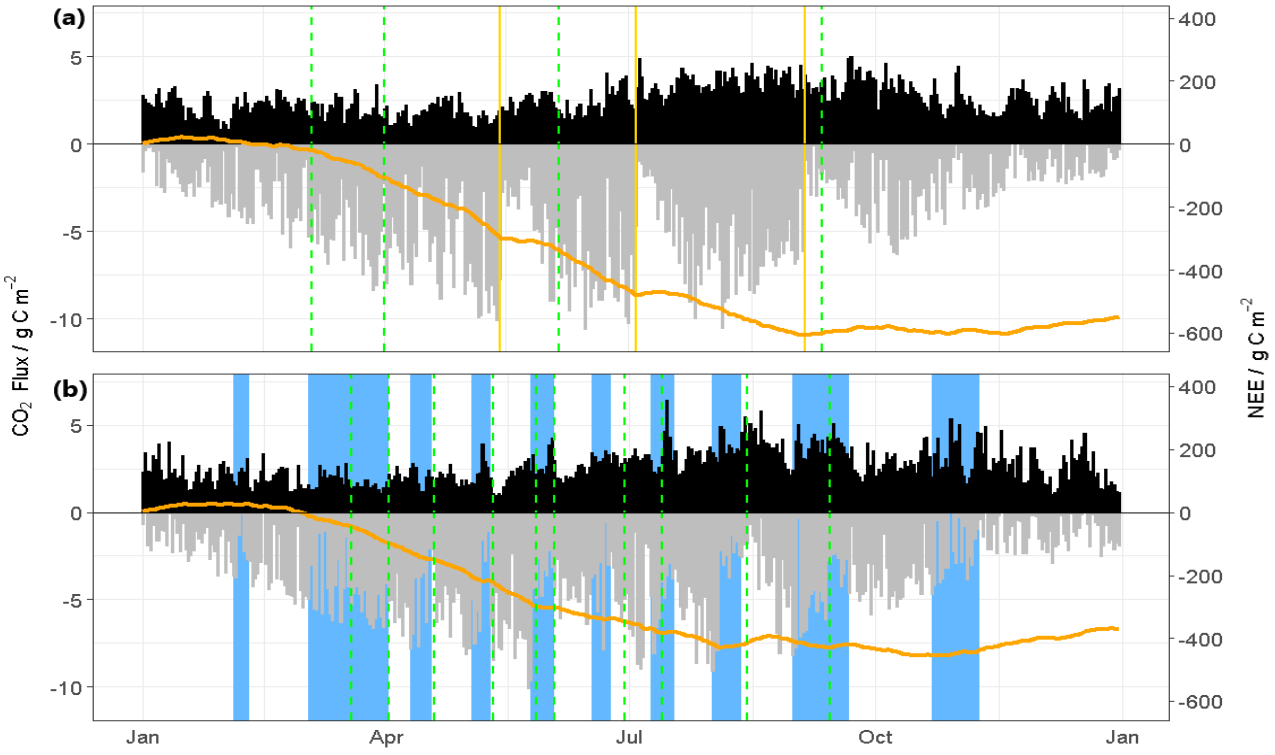
$$\mathrm{TER} = R_{10} e^{E_0 (1/(283.15 - T_0) - 1/(T - T_0))}$$



Correlation between GPP and Reco

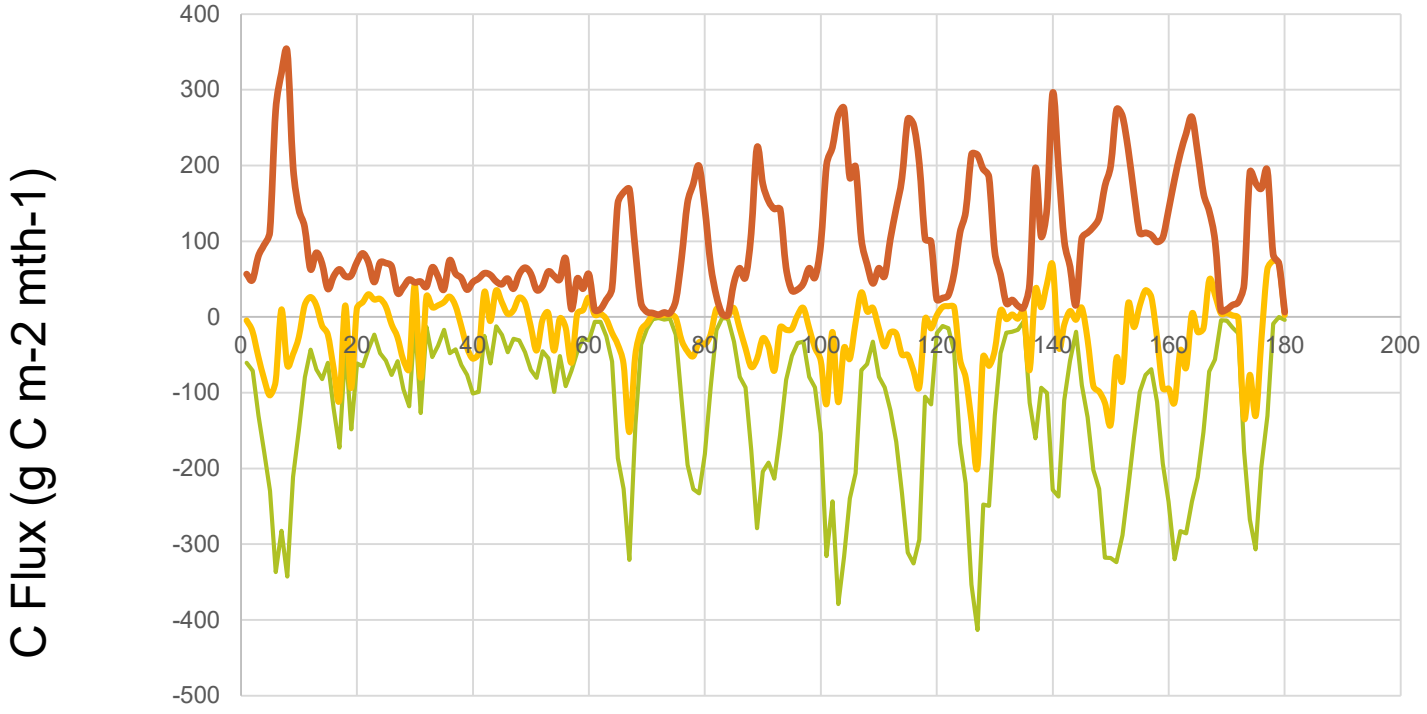


Half-hourly data gives good temporal indication of management impacts

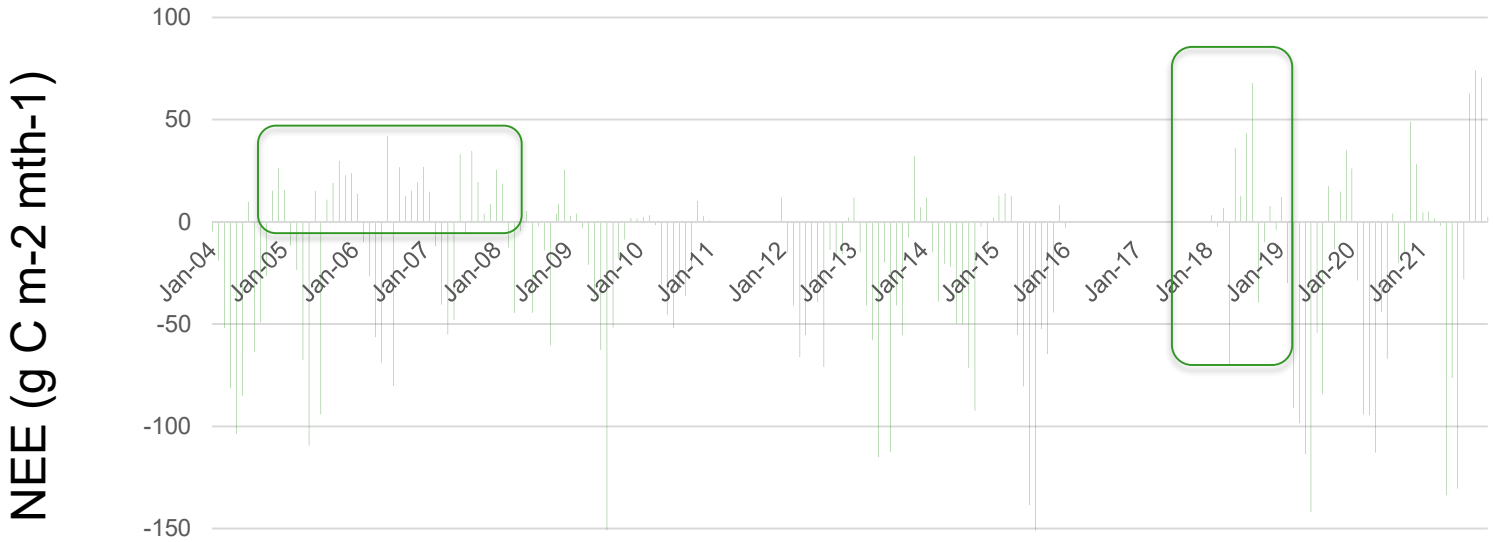


2019

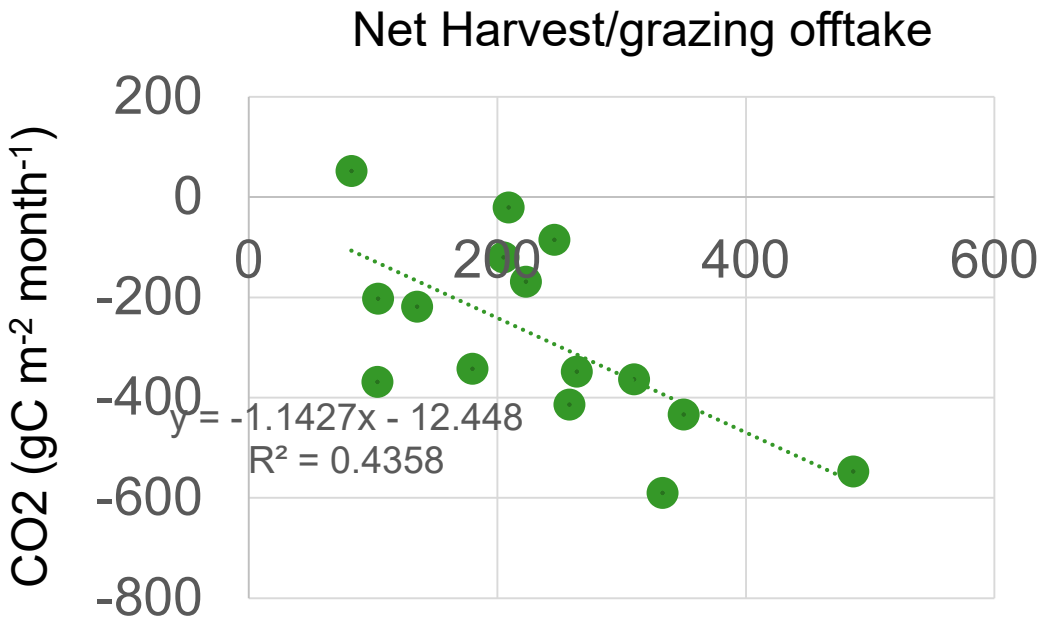
2020


C Flux (g C m-2 mth-1)
400
300
200
100
0
-100
-200
-300
-400
-500
0
20
40
60
80
100
120
140
160
180
200

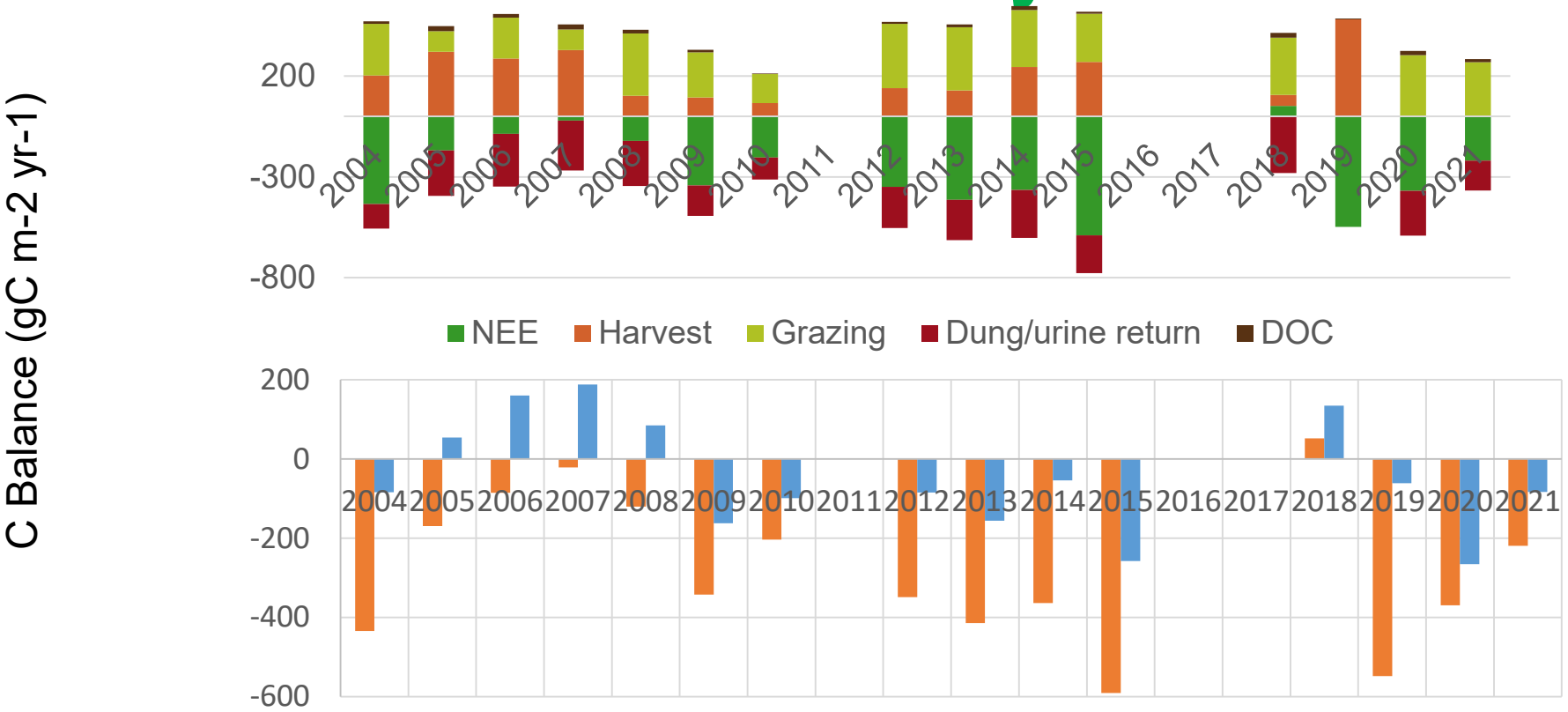
Long term Carbon budget of grassland at Johnstown Castle



- Higher Net productivity – mean higher offtake
- Will not neccesarily lead to higher NBP



Getting the final balance- Net Biome Productivity



Net grassland balance

- In JC grassland – net C balance ranged from a source of 1.87 tC ha-1 yr-1 to a sink of 2.65 tC ha-1 - driven mainly by land management decisions
- Net balance while in winter kale was +1.21 ±0.63 tC ha-1 yr-1 and -1.06 ±0.83 tC ha-1 yr-1 when in grass
- However in bad drought year – grassland was a source of 1.38 tC ha-1 yr-1

Acknowledgements