Appendix B - List of current carbon stock and flux coefficients used in the model

Table of contents

B1. Carbon stock coefficients

Table B1 Carbon soil and vegetation stock coefficients

Land cover	Carbon stock (t C/ha) Soil/water stock	Carbon stock (t C/ha) Vegetation stock	Percentage error[1]	Veg. stock sequestration (%)	Ref.	Notes
Peat bog - actively eroding Peat bog - drained Peat bog - modified	675	2	22	0	2	Blanket Bog in Shetland measured at on average 169cm based on Hutton Peatland action peat depth map. Scaled 799 at 200cm to 679 at 169cm.
Wetlands, fen, marsh, swamp	610	2	0	0	3	Assumed at 40cm depth on Shetland as areas are near rivers, lakes and coast. Carbon taken to be stored in the soil.
Salt marsh	56	1	66	0	4 5 6 7 8	Stock is average of range of values. Carbon stock is predicted from vegetation and in top 10-30cm of soil profile.
Natural grassland	60	1	90	0	9	Carbon generally taken to be stored in top 15cm of soil.
Upland heath/moorland	94	2	10	0	10	Carbon generally taken to be stored in top 15-30cm of soil. Error based on range of values.
Lowland heath	94	2	10	0	11	Carbon generally taken to be stored in top 15-30cm of soil. Error based on range of values.
Inland water	0	0	0	0		Set as zero. No sequestration or emission assumed.

[1] The errors represent the range for carbon coefficient values related to each land cover class as presented within literature this is detailed further in **Appendix A**. Where there is a cumulative carbon stock or carbon flux measurement calculated, a single error is given. This is calculated using the root mean squared (RMS) error of all calculated carbon stock or flux errors for each land cover type. RMS error is the square root of the arithmetic mean of the squares of the carbon stock or flux error for each land cover type and represents a measurement of the spread of the data around the average (standard deviation).

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[11] Van Paassen, J.G. *et al*. (2020). Legacy effects of nitrogen and phosphorus additions on vegetation and carbon stocks of upland heaths. New Phytologist. 228. 226-237.

Land cover	Carbon stock (t C/ha) Soil/water stock	Vegetation stock	Percentage error[1]	Veg. stock sequestration (%)	Ref.	Notes
Artificial	0	0	0	0		Set as zero. No sequestration or emission assumed.
Bare rock, sand and ground	0	0	0	0		Set as zero. No sequestration or emission assumed.
Agricultural land - pastoral land/intensive/improved grassland	72	1	92	0	12	Carbon generally taken to be stored in top 30cm of soil. Error ranges derived from carbon density values.
Agricultural land - arable land	58	1	52	0	13	Carbon generally taken to be stored in top 30cm of soil. Error ranges derived from carbon density values.
Orchards	74	17	43	0	14	Most carbon stored in soils, generally less than grassland and woodland. Greater carbon store than managed. Carbon stored in top 15cm of soils. Errors based on GHG sequestration.
Woodland - broadleaved	63		60		15	Soil carbon stock assumed in mineral soils (top 15cm). Carbon veg stock and error calculated using Woodland Carbon Code (WCC) Carbon Calculator data.
Woodland - coniferous	70		95		16	Carbon stock in soils assumed to be in mineral soils only (top 15cm). Carbon veg stock and error calculated using Woodland Carbon Code Carbon Calculator data. Error based on range of values.
Woodland - mixed	66		78			Carbon stock in soils assumed to be in mineral soils only (top 15cm). Carbon veg stock and error calculated using Woodland Carbon Code Carbon Calculator data. Mixed forest assumed to 50-50 split of broadleaved and coniferous and therefore values are the average of these.

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[14] Robertson, H. *et al*. (2012). Economic, biodiversity, resource protection and social values of orchards: a study of six orchards by the Herefordshire Orchards Community Evaluation Project. Natural England Commissioned Report NECR090.
[15] Alonso, I., Weston, K., Gregg, R. and Morecroft, M. (2012). Carbon storage by habitat - Review of the evidence of the impacts of management decisions and condition on carbon stores and sources. Natural England Research Reports, Number NERR043. 58pp.
[16] Alonso, I., Weston, K., Gregg, R. and Morecroft, M. (2012). Carbon storage by habitat - Review of the evidence of the impacts of management decisions and condition on carbon stores and sources. Natural England Research Reports, Number NERR043. 58pp.

B2. Carbon flux coefficients

Table B2 Carbon dioxide flux coefficients

Land cover	Carbon flux (t CO_2e/ha/yr)			Carbon flux error[17] (t CO_2e/ha/yr)			Ref.	Notes
	Semi-natural	Degraded	Managed	Semi-natural percentage error	Degraded percentage error	Managed percentage error		
Peat bog - actively eroding		23.84					18	Values and errors for near natural bog and eroded modified bog.
Peat bog - drained		4.54					19	Values and errors for near natural bog and eroded modified bog.
Peat bog - modified	1.08	2.54					20	Values and errors for near natural bog and eroded modified bog.
Wetlands, fen, marsh, swamp	-4.75	1.55		95	95		21	Values and errors for near natural fen and rewetted fen.
Salt marsh	-5.19	-2.35		55	55		22	Error based on value ranges in reference.
Natural grassland	-2.20	3.60		50	36		23 24 25	Semi-natural value based on grassland being grazed. Degraded is drained and nutrient poor. Errors based on ranges in references.

[17] The errors represent the range for carbon coefficient values related to each land cover class as presented within literature this is detailed further in **Appendix A**. Where there is a cumulative carbon stock or carbon flux measurement calculated, a single error is given. This is calculated using the root mean squared (RMS) error of all calculated carbon stock or flux errors for each land cover type. RMS error is the square root of the arithmetic mean of the squares of the carbon stock or flux error for each land cover type and represents a measurement of the spread of the data around the average (standard deviation).
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[19] Crichton Carbon Centre (2015) Annex 1 Field Protocol and Guidance, Developing Peatland Carbon Metrics and Financial Modelling to Inform the Pilot Phase UK Peatland Code' Report to Defra for Project NR0165.
[20] Crichton Carbon Centre (2015) Annex 1 Field Protocol and Guidance, Developing Peatland Carbon Metrics and Financial Modelling to Inform the Pilot Phase UK Peatland Code' Report to Defra for Project NR0165.
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[24] Alonso, I., Weston, K., Gregg, R. and Morecroft, M. (2012). Carbon storage by habitat - Review of the evidence of the impacts of management decisions and condition on carbon stores and sources. Natural England Research Reports, Number NERR043. 58pp.
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Land cover	Carbon flux (t CO_2e/ha/yr)			Carbon flux error[17] (t CO_2e/ha/yr)			Ref.	Notes
	Semi-natural	Degraded	Managed	Semi-natural percentage error	Degraded percentage error	Managed percentage error		
Upland heath/moorland	-1.82	3.60		90	90		26 27	Degraded uses degraded natural grassland figure from Evans et al. (2017). Errors taken from Lowland Heath.
Lowland heath	-0.07	2.56		90	90		28	Semi-natural assumed as maintenance of land, degraded is value for restoration from neglect. Conservative errors based on values in reference.
Inland water	0.00	0.00		0	0			No change assumed.
Artificial	0.00	0.00		0	0			No change assumed.
Bare rock, sand and ground	0.00	0.00		0	0			No change assumed.
Agricultural land - pastoral land/intensive/improved grassland			-0.36			83	29	Values for cropland. Errors based on range.
Agricultural land - arable land			0.29			0	30	Values for intensive grassland. Errors based on range.
Orchards			-4.44			83	31	Assume orchard maintained. Mid range of low intensity and intensive orchard values. Errors based on range.
Woodland – broadleaved	2.00		2.00	20		20	32	Values and errors for woodland. Not divided into specific category. Covers soils, tree carbon omitted.
Woodland – coniferous	2.00		2.00	20		20	33	Values and errors for woodland. Not divided into specific category. Covers soils, tree carbon omitted.

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[27] Evans, C., Artz, R., Moxley, J. Smyth, M-A., Taylor, E., Archer, N., Burden, A., Williamson, J., Donnelly, D., Thomson, A., Buys, G., Malcolm, H., Wilson, D., Renou-Wilson, F. and Potts, J. (2017). Implementation of an emission inventory for UK peatlands. Report to the Department for Business, Energy and Industrial Strategy, Centre for Ecology and Hydrology, Bangor. 88pp.
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Land cover	Carbon flux (t CO_2e/ha/yr)			Carbon flux error[17] (t CO_2e/ha/yr)			Ref.	Notes
	Semi-natural	Degraded	Managed	Semi-natural percentage error	Degraded percentage error	Managed percentage error		
Woodland – mixed	2.00		2.00	20		20	34	Values and errors for woodland. Not divided into specific category. Covers soils, tree carbon omitted.

[34] Evans, C., Artz, R., Moxley, J. Smyth, M-A., Taylor, E., Archer, N., Burden, A., Williamson, J., Donnelly, D., Thomson, A., Buys, G., Malcolm, H., Wilson, D., Renou-Wilson, F. and Potts, J. (2017). Implementation of an emission inventory for UK peatlands. Report to the Department for Business, Energy and Industrial Strategy, Centre for Ecology and Hydrology, Bangor. 88pp.

B3. Methane flux coefficients

Table B3 Methane flux coefficients

Land cover	Methane flux (t CO_2e/ha/yr)			Methane flux error[35] (t CO_2e/ha/yr)			Ref.	Notes
	Semi-natural	Degraded	Managed	Semi-natural percentage error	Degraded percentage error	Managed percentage error		
Peat bog - actively eroding		0		0	0			Values for CO_2e taken from IUCN Peatland Code. No methane flux provided though it is assumed that the flux values include CH_4.
Peat bog - drained		0		0	0			Values for CO_2e taken from IUCN Peatland Code. No methane flux provided though it is assumed that the flux values include CH_4.
Peat bog - modified	0	0		0	0			Values for CO_2e taken from IUCN Peatland Code. No methane flux provided though it is assumed that the flux values include CH_4.
Wetlands, fen, marsh, swamp	3.88	4.24		45	35		36	Data for near natural fen and rewetted fen. Errors derived from Table 2.2, Tier 2 (Evans *et al*. 2017).
Salt marsh	0	0		0	0			No methane flux data available.
Natural grassland	0	0		0	0			No methane flux data available.
Upland heath/moorland	0	0		0	0			No methane flux data available.
Lowland heath	0	0		0	0			No methane flux data available.
Inland water	0	0						No methane flux data available.
Artificial	0	0		0	0			No methane flux data available.
Bare rock, sand and ground	0	0		0	0			No methane flux data available.
Agricultural land - pastoral land/intensive/improved grassland			0			0		No methane flux data available.

[35]The errors represent the range for carbon coefficient values related to each land cover class as presented within the literature, this is detailed further in **Appendix A**. Where there is a cumulative carbon stock or carbon flux measurement calculated, a single error is given. This is calculated using the root mean squared (RMS) error of all calculated carbon stock or flux errors for each land cover type. RMS error is the square root of the arithmetic mean of the squares of the carbon stock or flux error for each land cover type and represents a measurement of the spread of the data around the average (standard deviation).

[36] Evans, C., Artz, R., Moxley, J. Smyth, M-A., Taylor, E., Archer, N., Burden, A., Williamson, J., Donnelly, D., Thomson, A., Buys, G., Malcolm, H., Wilson, D., Renou-Wilson, F. and Potts, J. (2017). Implementation of an emission inventory for UK peatlands. Report to the Department for Business, Energy and Industrial Strategy, Centre for Ecology and Hydrology, Bangor. 88pp.

Land cover	Methane flux (t CO_2e/ha/yr)			Methane flux error[35] (t CO_2e/ha/yr)			Ref.	Notes
	Semi-natural	Degraded	Managed	Semi-natural percentage error	Degraded percentage error	Managed percentage error		
Agricultural land - arable land			0			0		No methane flux data available.
Orchards			0			0		No methane flux data available.
Woodland - broadleaved	0		0	0		0		No methane flux data available.
Woodland - coniferous	0		0	0		0		No methane flux data available.
Woodland - mixed	0		0	0		0		No methane flux data available.

B4. Nitrous oxide flux coefficients

Table B4 Nitrous oxide flux coefficients

Land cover	Nitrous oxide flux ($tCO_2e/ha/yr$)			Nitrous oxide flux error[37] ($tCO_2e/ha/yr$)			Ref.	Notes
	Semi-natural	Degraded	Managed	Semi-natural percentage error	Degraded percentage error	Managed percentage error		
Peat bog - actively eroding		0		0	0			Values for CO_2e taken from IUCN Peatland Code. No methane flux provided though it is assumed that the flux values include N_2O.
Peat bog - drained		0		0	0			Values for CO_2e taken from IUCN Peatland Code. No methane flux provided though it is assumed that the flux values include N_2O.
Peat bog - modified	0	0		0	0			Values for CO_2e taken from IUCN Peatland Code. No methane flux provided though it is assumed that the flux values include N_2O.
Wetlands, fen, marsh, swamp	0.24	0.28		80	80		38	Data for near natural fen and rewetted fen. Coefficient is the sum of Direct N_2O and indirect N_2O. Note that the total flux coefficient in Evans *et al*. (2017) Table 4.1 is incorrect (correct in this model). Errors derived from Table 2.3, Tier 2. Insufficient data for rewetted fen error so use near natural fen error.
Salt marsh	0	0		0	0			No nitrous oxide flux data available.
Natural grassland	0	0		0	0			No nitrous oxide flux data available.
Upland heath/moorland	0	0		0	0			No nitrous oxide flux data available.
Lowland heath	0	0		0	0			No nitrous oxide flux data available.
Inland water	0	0		0	0			No nitrous oxide flux data available.
Artificial	0	0		0	0			No nitrous oxide flux data available.
Bare rock, sand and ground	0	0		0	0			No nitrous oxide flux data available.

[37] The errors represent the range for carbon coefficient values related to each land cover class as presented within the literature, this is detailed further in **Appendix A**. Where there is a cumulative carbon stock or carbon flux measurement calculated, a single error is given. This is calculated using the root mean squared (RMS) error of all calculated carbon stock or flux errors for each land cover type. RMS error is the square root of the arithmetic mean of the squares of the carbon stock or flux error for each land cover type and represents a measurement of the spread of the data around the average (standard deviation).

[38] Evans, C., Artz, R., Moxley, J. Smyth, M-A., Taylor, E., Archer, N., Burden, A., Williamson, J., Donnelly, D., Thomson, A., Buys, G., Malcolm, H., Wilson, D., Renou-Wilson, F. and Potts, J. (2017). Implementation of an emission inventory for UK peatlands. Report to the Department for Business, Energy and Industrial Strategy, Centre for Ecology and Hydrology, Bangor. 88pp.

Land cover	Nitrous oxide flux ($tCO_2e/ha/yr$)			Nitrous oxide flux error[37] ($tCO_2e/ha/yr$)			Ref.	Notes
	Semi-natural	Degraded	Managed	Semi-natural percentage error	Degraded percentage error	Managed percentage error		
Agricultural land - pastoral land/intensive/improved grassland			0			0		No nitrous oxide flux data available.
Agricultural land - arable land			0			0		No nitrous oxide flux data available.
Orchards			0			0		No nitrous oxide flux data available.
Woodland - broadleaved	0		0	0		0		No nitrous oxide flux data available.
Woodland - coniferous	0		0	0		0		No nitrous oxide flux data available.
Woodland - mixed	0		0	0		0		No nitrous oxide flux data available.