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Reviews and syntheses: Greenhouse gas emissions from drained organic forest soils – synthesizing data for site-specific emission factors for boreal and cool temperate regions

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S1. Data composition

Peer reviewed publications were used as the data source. Original data collection in the publications was by (i) inventories integrating change in soil C-stock, and (ii) CO_2 monitoring fluxes by (a) chamber technique and/or (b) by eddy covariance technique. All CH_4 and N_2O fluxes monitored between soil and the atmosphere were by the chamber technique.

Basic criteria for CO_2, CO_2-C, CH_4 and N_2O data inclusion to the database was:

- for soil inventory studies, estimate on soil C stock change averaging change over specified period of years was attainable,
- for eddy covariance studies, at least one annual soil CO_2 balance estimate was attainable,
- for chamber studies, at least one annual soil CO_2 balance estimate was attainable,
- for chamber studies, at least one annual or warm season soil total or soil heterotrophic cumulative CO_2 emission estimate with potential to form respective annual soil CO_2 balance estimate by using existing supplementary site-specific or site-type specific data was attainable,
- at least one annual soil CH_4 balance or warm season cumulative soil CH_4 flux estimate was attainable,
- at least one annual soil N_2O balance or warm season cumulative soil N_2O flux estimate was attainable.

Annual soil CO_2 balance estimates based on soil inventories were added into the database 'as is' basis. CO_2 flux monitoring data based on chamber techniques usually necessitated further processing (e.g., measures on litter production and decomposition rates, evaluation of flux contributions from root respiration and/or ground vegetation dark respiration) before the estimate quantified soil CO_2 balance. Such site specific or site-type specific supplementary data were collated from the relevant literature, authors and other specialists, and incorporated to CO_2 flux data (applied changes are listed in Table S1 and in Data repository). Forming annual soil CH_4 and N_2O balance estimates in the data was less complicated because annualization was the only supplementary measure implemented to the estimates reported as cumulative warm season flux.

Annualization. For studies providing GHG flux estimate based on warm season measurements, we used coefficient to supplement relative cold season fluxes. As in IPCC (2014), this was be made by adding flux-proportion of colder period GHG flux estimate which was based on the cold season (winter) measurements and flux estimates in boreal and subarctic peatlands. The values based on cold season flux proportion provided in Dise (1992), Alm et al. (1999), Aurela et al. (2002), Kim et al. (2007) and Leppälä et al. (2011). As the annualization coefficients we topped seasonal GHG flux estimate by 15.9% for CO_2, by 16.7% for CH_4, and 21.4% for N_2O. Applied changes are listed in Table S1 and Table S2.

Root respiration subtraction from the total respiration. Likely the largest and most coherent database providing both site type specific soil total (R_{tot}) and proportioned heterotrophic (R_{het}) CO_2 emissions in drained organic soils is analysed in Ojanen et al. (2010), and the database was available for our analyses. We split flux data from Ojanen et al. (2010) into ombrotrophic (n= 12) and minerotrophic (n= 53) site types and tested linear regression between CO_{2tot} that includes autotrophic respiration of tree root systems and CO_{2het} from soil. The analysis resulted in following linear regressions (95% confidence limits) for heterotrophic CO_{2het} emission:

emission = $1.1 + 0.39 \times R_{tot}$ ($R^2 = 0.641$, $SE_{model} = 139$, $SE_{coefficient} = 183$) for ombrotrophic sites and
emission = $-1.55 + 0.52 \times R_{tot}$ ($R^2 = 0.723$, $SE_{model} = 217$, $SE_{coefficient} = 124$) for minerotrophic sites.
These equations were applied to form CO_{2het} from the provided CO_{2tot} estimates in data where CO_{2het} was not readily available, and these estimates are listed in Table S1.

Litter production and decomposition rates. Applied changes and data sources are shown in Table S1.

Relative data reliability weighting. We determined a weigh for each annual soil GHG balance estimate formed from closed chamber data on the basis of estimate relative reliability (i.e. 1= no major issues with the estimate and 0.5 = estimate uncertainty increased) by considering spatial coverage of data collection at the field sites and origin and quality of data types used for compiling the estimate. Applied '0.5' weigh was applied to estimate based on low number of spatial replicates (<3) in study, and/or if the estimate included unknown or unquantified CO_2 sources (e.g., ground vegetation remaining inside the closed chamber forming unwanted CO_{2aut} emission source), and/or the estimate value necessitated several (≥2) post-publication changes before forming soil GHG balance estimate. Applied relative reliability scores and changes are listed in Table S1. Annual soil GHG balance estimates from organic soil inventory method and EC method were given weight '1' because data collection and data components forming the estimate are based on quite uniform techniques in both methods, where peat inventory data averages soil C stock development of several years or decades and the data includes on-site collected data components only, and EC flux data has high temporal accuracy when combined with on-site collected biomass C stock data. Analyses utilizing relative data reliability weight, i.e., weighed means, are noted in respective text sections.

GHG flux data covering multiple years or multiple studies conducted at the same site. Each flux monitoring site was marked by an identification code based on coordinates and site description in the source data. If multiple estimates were available for a certain site in a specific year (e.g., from parallelly run monitoring in different projects), only one estimate was accepted based on completeness of the reporting in publications. If there were multi-annual flux estimates (i.e., estimates on separate years) for a site, all estimates were saved. Multi-annual soil GHG balance estimates (year-specific estimates over several years) were used in analyses studying soil GHG balance correlations with soil, vegetation and climate variables, and this is noted accordingly in the respective text sections. In other analyses, arithmetic averages or weighed soil GHG balance averages (single average for each site) were used, and this is noted accordingly in the respective text sections.

Publications included in the assessment are; (1) Ball et al., 2007; (2) Brumme et al., 1999; (3) Christiansen et al., 2012; (4) Danevčič et al., 2010; (5) Eickenscheidt et al., 2014; (6) Ernfors et al., 2011; (7) Glenn et al., 1993; (8) Holz et al., 2016; (9) Huttunen et al., 2003a; (10) Klemedtsson et al., 2010; (11) Komulainen et al., 1998; (12) Korkiakoski et al., 2017; (13) Lohila et al., 2007; (14) Lohila et al., 2011; (15) Lupikis and Lazdins 2017; (16) Maljanen et al., 2003a; (17) Maljanen et al., 2003b; (18) Maljanen et al., 2006; (19) Maljanen et al., 2010; (20) Maljanen et al., 2012; (21) Maljanen et al., 2014; (22) Mander et al., 2008; (23) Martikainen et al., 1992; (24) Martikainen et al., 1993; (25) Martikainen et al., 1995b; (26) McNamara et al., 2008; (27) Meyer et al., 2013; (28) Minkkinen and Laine 1998; (29) Minkkinen and Laine 2006; (30) Minkkinen et al., 1999; (31) Minkkinen et al., 2007b; (32) Moilanen et al., 2012; (33) Mustamo et al., 2016; (34) Mäkiranta et al., 2007; (35) Nykänen et al., 1998; (36) Ojanen et al., 2010; (37) Ojanen et al., 2013; (38) Pihlatie et al., 2004; (39) Pitkänen et al., 2013; (40) Regina et al., 1998; (41) Saari et al., 2009; (42) Salm et al., 2012; (43) Sikström et al., 2009; (44) Silvola et al., 1996; (45) Simola et al., 2012; (46) Uri et al., 2017; (47) Weslien et al., 2009; (48) von Arnold et al., 2005a; (49) Väisänen et al., 2013; (50) Yamulki et al., 2013; (51) Komulainen et al., 1999; (52) von Arnold et al. 2005b; (53) Minkkinen et al., 2018; (54) Ojanen et al., 2019.

Table S1. Publications with quantified annual CO_2 balance (CO_2 and CO_{2e}) estimates from drained organic forest soils in boreal and temperate regions.

Site type/ Climate region and (Country)	**Soil type/ Soil nutrient status[1]/ Dominant tree-stand type**	**Method[2**	**Included C-measures for forming annual soil C balance**	**Additional data needs and (changes made)**	**Notes**	**Weight**	**Reference**	**Reference number in this study**
Forest/ Temperate (Estonia)	Peat/ NuR/ Conifer, Mixed	CH	TOT_{Grs}	Tree root respiration subtraction (as described in the text). Ground vegetation dark respiration subtraction (-).	Annual flux estimate is based on median values. Ground vegetation contribution to the flux forms an uncertainty.	0.5	Salm et al. (2012)	42
Forest/ Temperate (Sweden)	Peat/ NuP/ Conifer	CH	TOT_{Grs}	Tree root respiration subtraction (as described in the text). Ground vegetation dark respiration subtraction (-).	Ground vegetation contribution to the flux forms an uncertainty. Estimates for multiple years.	0.5	Sikström et al. (2009)	43
Forest/ Temperate (Estonia)	Peat/ NuR/ Deciduous	CH	S_{rs}; $L_{in/to}$; $FR_{in/to}$	-	Trenched plots.	1	Uri et al. (2017)	46
Forest/ Temperate (Sweden)	Peat/ NuR/ Conifer	CH	TOT_{Grs}; NPP_{tr}	Tree root respiration subtraction (value from literature is used in the publication).	Forest floor vegetation contributions assumed to be negligible. Exact numbers for some factors available from von Arnold et al. 2005c.	0.5	von Arnold et al. (2005b)	52
Forest/ Temperate (Sweden)	Peat/ NuR/ Deciduous	CH	TOT_{Grs}; NPP_{tr}	Tree root respiration subtraction (value from literature is used in the publication). Ground vegetation dark respiration subtraction (-).	Ground vegetation contribution to the soil C store change is not considered in the estimate.	0.5	von Arnold et al. (2005a)	48
Forest/ Temperate (United Kingdom)	Peat/ NuP/ Conifer	CH	TOT_{Grs}	Tree root respiration subtraction (as described in the text). Ground vegetation dark respiration subtraction (-).	Ground vegetation contribution to the flux forms an uncertainty. Estimates for	0.5	Yamulki et al. (2013)	50

					multiple years.			
Forest/ Temperate (Latvia)	Peat/ NuR/ Conifer	INV	ASB_{CO2}	-	-	1	Lupikis and Lazdins (2017)	15
AF_AG/ Temperate (Sweden)	Peat/ NuR/ Conifer	CH	TOT_{Grs}	Tree root respiration subtraction (value from literature is used in the publication). Ground vegetation dark respiration subtraction (-).	Ground vegetation contribution to the flux forms an uncertainty. Estimates for multiple years.	0.5	Klemedtsson et al. (2010)	10
AF_AG/ Temperate (Sweden)	Peat/ NuR/ Conifer	CH	TOT_{Grs}	Tree root respiration subtraction (as described in the text). Ground vegetation dark respiration subtraction (-).	Ground vegetation contribution to the flux forms an uncertainty.	0.5	Sikström et al. (2009)	43
AF_AG/ Temperate (Germany)	Other organic soil/ NuR/ Deciduous	CH	TOT_{Grs}	-	Annual flux estimate is based on median values. Autotrophic respiration contributions are based on literature values. Gas sampling procedures unclear.	0.5	Mander et al. (2008)	22
AF_AG/ Temperate (United Kingdom)	Other organic soil/ NuR/ Conifer	CH	TOT_{Grs}; Di	Tree root respiration subtraction (as described in the text).	Ground vegetation assumed to be absent in closed canopy sites. Estimates for multiple years.	1	Ball et al. (2007)	1
Forest/ Boreal (Finland)	Peat/ NuR, NuP(0)/ Conifer, Deciduous	CH	S_{rs}; $L_{in/to}$	Multiple values from literature is used in the estimate (-).	Trenching by 25 cm depth reaching collar sleeve.	0.5	Väisänen et al. (2013)	49
Forest/ Boreal (Finland)	Peat/ NuR, NuP/ Conifer	CH	PA_{GV}; GV_{rs}	Annualization (as described in the text).	Trenched plots. Low number of replicate plots.	0.5	Komulainen et al. (1999)	51
Forest/ Boreal (Finland)	Peat/ NuP/ Conifer	EC	NEE; TOT_{Ers}; NPP_{tr}; Di	-	-	1	Lohila et al. (2011)	14
Forest/ Boreal (Finland), Temperate/ (Estonia)	Peat/ NuR, NuP/ Conifer	CH	S_{rs}; Di	Adding above- and belowground litter production and decomposition rates ([3]).	Trenched plots.	1	Minkkinen et al. (2007b)	31

Forest/ Boreal (Finland)	Peat/ NuR/ Conifer	CH	S_{rs}; Di	Adding above- and belowground litter production and decomposition rates ([4]).	Trenched plots.	1	Moilanen et al. (2012)	32
Forest/ Boreal (Finland)	Peat/ NuR/ Mixed	CH	G_{rs}; Di	Annualization (as described in the text). Tree root respiration subtraction (as described in the text).	-	0.5	Mustamo et al. (2016)	33
Forest/ Boreal (Finland)	Peat/ NuR, NuP/ Conifer, Mixed, Deciduous	CH	TOT_{Grs}; S_{rs}; RS_{prop}; Di	Values from Ojanen et al. (2013)	Trenched and non-trenched plots in the study.	1	Ojanen et al. (2010)	36
Forest/ Boreal (Finland)	Peat/ NuR, NuP/ Conifer, Mixed, Deciduous	CH	$L_{in/to}$; $FR_{in/to}$; Di	Values from Ojanen et al. (2010)	-	1	Ojanen et al. (2013)	37
Forest/ Boreal (Finland)	Peat/ NuR, NuP, NuP(0)/ Conifer, Deciduous	CH	G_{rs}; L_{Ars}	Tree root respiration subtraction (as described in the text).	Estimates for multiple years.	1	Silvola et al. (1996)	44
Forest/ Boreal (Finland)	Peat/ NuR, NuP/ Conifer, Deciduous	INV	ASB_{CO2}	-	-	1	Minkkinen and Laine (1998)	28
Forest/ Boreal (Finland)	Peat/ NuR, NuP, NuP(0) / Conifer	INV	ASB_{CO2}	-	-	1	Minkkinen et al. (1999)	30
Forest/ Boreal (Finland)	Peat/ NuP(0) / Conifer	INV	ASB_{CO2}	-	-	1	Pitkänen et al. (2013)	39
Forest/ Boreal (Finland)	Peat/ NuR, NuR(0), NuP, NuP(0)/ Conifer, Deciduous	INV	ASB_{CO2}	-	-	1	Simola et al. (2012)	45
Forest/ Boreal (Finland)	Peat/ NuP/ Conifer	EC	NEE; NPP_{tr};	-	-	1	Minkkinen et al. (2018)	53
Forest/ Boreal (Finland)	Peat/ NuR, NuR(0), NuP/ Conifer, Deciduous	CH	S_{rs}; $L_{in/to}$; $FR_{in/to}$; Di	-	Trenched plots.	1	Ojanen et al. (2019)	54
AF_AG/ Boreal (Finland)	Peat/ NuR/ Conifer	EC	NEE; NPP_{tr}; Srs	-	Peat heterotrophic emission value for the site from publication Mäkiranta et al. 2007.	1	Lohila et al. (2007)	13

AF_AG/ Boreal (Sweden)	Peat/ NuR/ Conifer	EC, CH	NEE; NPP_{tr}; G_{rs}; S_{rs}; L_{Ars}; Di	Adding above- and belowground litter production and de-composition rates in chamber method.	Trenched plots in-cluded. Two calculus ap-proaches in the publica-tion. As-sumed equal annual pro-duction and decomposi-tion of litter from both leaves and roots.	1	Meyer et al. (2013)	27
AF_AG/ Boreal (Finland)	Peat/ NuR/ Conifer, Deciduous	CH	S_{rs}	Adding above- and belowground litter production and de-composition rates ([5]).	Trenched plots.	0.5	Mäkiranta et al. (2007)	34
AF_PM/ Boreal (Finland)	Peat/ NuP/ Conifer, Deciduous	CH	Di; S_{rs}	Adding above- and belowground litter production and de-composition rates ([5]).	Trenched plots.	0.5	Mäkiranta et al. (2007)	34

Abbreviations:
ASB_{CO2} = Annual soil CO_2 or CO_2-C balance
TOT_{Grs} = heterotrophic respiration in soil and litter, and autotrophic respiration contributions from ground vegetation above and belowground parts and from tree roots (i.e. ground level total respiration)
TOT_{Ers} = heterotrophic respiration in soil and litter, and autotrophic respiration contributions from above and below-ground parts of ground vegetation and trees (i.e. ecosystem level total respiration)
G_{rs} = Heterotrophic respiration in soil (excluding recently deposited litter contribution) and autotrophic contributions from tree roots
S_{rs} = Heterotrophic respiration in soil (excluding recently deposited litter contribution)
L_{Ars} = Heterotrophic respiration in litter on the soil surface
RS_{prop} = Proportion between autotrophic respiration from vegetation (trees) and heterotrophic respiration from soil decomposition
GV_{rs} = Ground vegetation autotrophic respiration contributions from above and belowground parts
TR_{rs} = Tree root autotrophic respiration contributions
$L_{in/to}$ = Litter increment and turnover on ground
$FR_{in/to}$ = Fine root production and turnover by trees and ground vegetation
NEE = Net ecosystem CO_2 exchange
NPP = Net primary production in ecosystem
NPPtr = Net primary production in trees
PA_{GV} = Gross primary CO_2 assimilation in ground vegetation
Di = Flux estimate takes into account diurnal temperature variation by data modelling or by diurnal flux monitoring

(1 NuP = Nutrient poor, NuR = Nutrient rich, (0) = Poorly productive site type not classified as forest even if drained (i.e. FAO-forest), FRA (2018).
(2 CH = flux monitoring by dark and light chambers, EC = eddy covariance method, INV = inventory method
(3 Minkkinen et al., (2007b) annual aboveground and belowground litter production and turnover on the sites based on best similarity with the site types in Ojanen et al. (2013), and the original flux was divided by 0.85 which propor-tionated removed loose litter decomposition share (15%) into the flux (see Ojanen et al., 2013).
(4 Moilanen et al., (2012) above- and belowground litter production and turnover was based on *Vaccinium myrtillus* (type II) forest in northern Finland (including 7 sites from Ojanen et al. (2010) data, and the original flux was divided by 0.85 which proportionated removed loose litter decomposition share (15%) into the flux (see Ojanen et al., 2013).
(5 Mäkiranta et al., (2007) litter production in trees based on site tree stock field survey form data available from the authors, which was converted to form tree stock on the sites, and thereafter the tree stock measures was modelled to form above- and belowground litter production as described in Repola (2008) and Repola (2009) and for litter turno-ver as described in Ojanen et al. (2014). Ground level vegetation data was available from Aro et al. (2016), field sur-vey form data and other unpublished materials available from the authors, the original flux was divided by 0.85 which proportionated removed loose litter decomposition share (15%) into the flux (see Ojanen et al., 2013).

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Table S2. Publications quantifying soil annual CH_4 and N_2O flux balances from drained organic forest soils in boreal and temperate regions.

GHG type/ Climate region and (Country)	Site type	Soil/ Site nutrient status[1]	Dominant tree-stand type	Additional data need /(changes made)	Notes	Weight	Reference	Reference number in this study
N_2O/ Temperate (Germany)	Forest	Peat/ NuR/	Deciduous			1	Brumme et al. (1999)	2
CH_4, N_2O/ Temperate (Slovakia)	Forest	Peat/ NuP/	Mixed			1	Danevčič et al. (2010)	4
CH_4/ Temperate (Canada)	Forest	Peat/ NuR/	Deciduous, Mixed	Annualization		1	Glenn et al. (1993)	7
CH_4, N_2O/ Temperate (Estonia)	Forest	Peat/ NuR/	Conifer, Mixed			1	Salm et al. (2012)	42
CH_4/ Temperate (Sweden)	Forest	Peat/ NuP/	Conifer			1	Sikström et al. (2009)	43
CH_4, N_2O/ Temperate (Sweden)	Forest	Peat/ NuR/	Deciduous			1	von Arnold et al. (2005a)	48
CH_4, N_2O/ Temperate (Sweden)	Forest	Peat/ NuR/	Conifer			1	von Arnold et al. (2005b)	52
CH_4, N_2O/ Temperate (United Kingdom)	Forest	Peat/ NuP/	Conifer		Estimates for multiple years.	1	Yamulki et al. (2013)	50
N_2O/ Temperate (Germany)	AF_AG	Peat/ NuR/	Deciduous			1	Eickenscheidt et al. (2014)	5
N_2O/ Temperate (Sweden)	AF_AG	Peat/ NuR/	Conifer		Estimates for multiple years.	1	Ernfors et al. (2011)	6
N2O/ Temperate (Sweden)	AF_AG	Peat/ NuR/	Conifer		Estimates for multiple years.	1	Holz et al. (2016)	8
CH_4, N_2O/ Temperate (Sweden)	AF_AG	Peat/ NuR/	Conifer		Estimates for multiple years.	1	Klemedtsson et al. (2010)	10
CH_4, N_2O/ Temperate (Sweden)	AF_AG	Peat/ NuR/	Conifer			1	Sikström et al. (2009)	43
CH_4, N_2O/ Temperate (Sweden)	AF_AG	Peat/ NuR/	Deciduous		Estimates for multiple years.	1	Weslien et al. (2009)	47
CH_4, N_2O/ Temperate (United Kingdom)	AF_AG	Other organic soil/ NuR/	Conifer		Estimates for multiple years.	1	Ball et al. (2007)	1
CH_4, N_2O/ Temperate	AF_AG	Other organic soil/	Deciduous			1	Christiansen	3

(Denmark)		NuR/					et al. (2012)	
CH_4, N_2O/ Temperate (Germany)	AF_AG	Other organic soil/ NuR/	Deciduous			1	Mander et al. (2008)	22
CH_4/ Temperate (United Kingdom)	AF_AG	Other organic soil/ NuR/	Conifer			1	McNamara et al. (2008)	26
CH_4, N_2O/ Boreal (Finland)	Forest	Peat/ NuR/	Conifer, cleared conifer		Low number of replicate plots.	0.5	Huttunen et al. (2003a)	9
CH_4/ Boreal (Finland)	Forest	Peat/ NuR/	Conifer, cleared	Annualization	Seasonal flux estimates listed as annual estimates. Estimates for multiple years. Low number of replicate plots.	0.5	Komulainen et al. (1998)	11
CH_4/ Boreal (Finland)	Forest	Peat/ NuR/	Mixed		Estimates for multiple years.	1	Korkiakoski et al. (2017)	12
CH_4, N_2O/ Boreal (Finland)	Forest	Peat/ NuP/	Conifer			1	Lohila et al. (2011)	14
CH_4/ Boreal (Finland)	Forest	Peat/ NuR/	Deciduous			1	Maljanen et al. (2003a)	16
N_2O/ Boreal (Finland)	Forest	Peat/ NuR/	Deciduous			1	Maljanen et al. (2003b)	17
CH_4, N_2O/ Boreal (Finland)	Forest	Peat/ NuR, NuP/	Conifer			1	Maljanen et al. (2006)	18
CH_4, N_2O/ Boreal (Finland)	Forest	Peat/ NuR/	Mixed			1	Maljanen et al. (2010)	19
CH_4, N_2O/ Boreal (Finland)	Forest	Peat NuP(0), NuP/	Conifer		Estimates for multiple years.	1	Maljanen et al. (2014)[(2]	21
CH_4/ Boreal (Finland)	Forest	Peat/ NuR, NuP/	Conifer		Low number of replicate plots.	0.5	Martikainen et al. (1992)	23
N_2O/ Boreal (Finland)	Forest	Peat/ NuR, NuR(0), NuP, NuP(0) /	Conifer				Martikainen et al. (1993)	24
CH_4/ Boreal (Finland)	Forest	Peat/ NuR/	Conifer		Estimates for multiple years.	1	Martikainen	25

							et al. (1995b)	
CH_4/ Boreal (Finland)	Forest	Peat/ NuR, NuP(0) /	Conifer			1	Minkkinen and Laine (2006)	29
CH_4, N_2O/ Boreal (Finland)	Forest	Peat/ NuR/	Mixed	Annualiza-tion	Low num-ber of rep-licate plots.	0.5	Mustamo et al. (2016)	33
CH_4/ Boreal (Finland)	Forest	Peat/ NuR, NuP, NuP(0)/	Conifer, Deciduous		Estimates for multi-ple years. Low num-ber of rep-licate plots at some sites.	0.5 & 1	Nykänen et al. (1998)	35
CH_4, N_2O/ Boreal (Finland)	Forest	Peat/ NuR, NuP/	Conifer, Mixed, Deciduous			1	Ojanen et al. (2010, 2018)	36
N_2O/ Boreal (Finland)	Forest	Peat/ NuR/	Mixed			1	Regina et al. (1998)	40
CH_4, N_2O/ Boreal (Finland)	Forest	Peat/ NuR/	Cleared conifer		Estimates for multi-ple years.	1	Saari et al. (2009)	41
CH_4, N_2O/ Boreal (Finland)	Forest	Peat/ NuR, NuP(0) /	Conifer, Deciduous		Number of replicate plots at the sites un-clear.	0.5	Väisänen et al. (2013)	49
CH_4/ Boreal (Finland)	Forest	Peat/ NuP/	Conifer			1	Minkkinen et al. (2018)	53
CH_4, N_2O/ Boreal (Finland)	Forest	Peat/ NuR, NuR(0), NuP/	Conifer, Deciduous			1	Ojanen et al. (2019)	54
N_2O/ Boreal (Finland)	AF_PM	Peat/ NuP/	Conifer, Deciduous		Low num-ber of rep-licate plots at some sites.	0.5 & 1	Maljanen et al. (2012)	20
CH_4, N_2O/ Boreal (Finland)	AF_PM	Peat/ NuP/	Conifer, Deciduous			1	Mäkiranta et al. (2007)	34
N_2O Boreal (Finland)	AF_AG	Peat/ NuR/	Conifer, Deciduous			1	Maljanen et al. (2012)	20
CH_4, N_2O/ Boreal (Finland)	AF_AG	Peat/ NuR/	Conifer		Low num-ber of rep-licate plots.	0.5	Meyer et al. (2013)	27
CH_4, N_2O/ Boreal (Finland)	AF_AG	Peat/ NuR/	Conifer, Deciduous			1	Mäkiranta et al. (2007)	34
N_2O/ Boreal (Finland)	AF_AG	Peat/ NuR/	Conifer			1	Pihlatie et al. (2004)	38

(1 NuP = Nutrient poor, NuR = Nutrient rich, (0) = Poorly productive site type not classified as forest even if drained (i.e. FAO-forest), FRA (2018)
(2 According to given site classification sites are nutrient poor but characteristics indicate nutrient rich site

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S2. Summary of EFs in categories formed, summary of environment parameters in categories formed, and soil annual GHG balance correlations with climatic parameters and site type characteristics.

Table S3. Data composition in different EF categories and category application in analyses.

Category abbreviation	Data composition	Use in analyses
Temperate	IPCC (2014) assessment pooled all data from the temperate zone. This data includes drained organic forest soils data from more site type specific categories (NuP, NuR, AF_AG, and Other organic soils) in the temperate zone.	Comparison with IPCC (2014) EFs.
FAO	IPCC (2014) applied this category for data from low productivity drained forest land, including shrubland and drained land that may not be classified as forest and nutrient-poor sites fulfilling minimum criteria in the FAO forest definition (FRA, 2018) in the boreal zone. Content is comparable with the data from forestry drained low productivity nutrient poor sites in the boreal zone (Low_NuP category).	Comparison with IPCC (2014) EFs.
NuP	IPCC (2014) used this category for data from nutrient poor sites in the boreal zone. Category is comparable with more site type specific categories of forestry drained typical productivity nutrient poor sites (Typical_NuP) and afforested peat extraction sites (AF_PE). In this study, NuP category is available both for boreal and temperate zone data.	Comparison with IPCC (2014) EFs, included in more site type specific EF categories, and in correlation analyses.
NuR	IPCC (2014) used this category for data from nutrient rich sites in the boreal zone. Category is comparable with pooled data from forestry drained low- and typical productivity nutrient rich sites (Low_NuR, Typical_NuR), and afforested agricultural sites (AF_AG). In this study, NuR category is available both for boreal and temperate zone data.	Comparison with IPCC (2014) EFs, included in more site type specific EF categories, and correlation analyses.
Low_NuR	Data from forestry drained low productivity nutrient rich sites. Category is applied to the boreal zone data.	Included in more site type specific EF categories, and in correlation analyses.
Low_NuP	Data is from forestry drained low productivity nutrient poor sites fulfilling minimum criteria in the FAO forest definition (FRA, 2018). In this study, this category is applied to the boreal zone data.	Included in more site type specific EF categories, and correlation analyses.
Typical NuR	Data is from forestry drained typical productivity nutrient rich sites. In this study, Typical NuR category is available both for boreal and temperate zone data.	Included in more site type specific EF categories, and

		in correlation analyses.
Typical NuP	Data is from forestry drained typical productivity nutrient poor sites. In this study, Typical NuP category is available both for boreal and temperate zone data.	Included in more site type specific EF categories, and in correlation analyses.
AF_AG	Data is from afforested agriculture lands. In this study, AF_AG category is available both for boreal and temperate zone data.	Included in more site type specific EF categories.
AF_PE	Data is from afforested peat extraction sites. Category is applied to the boreal zone data.	Included in more site type specific EF categories.
Other org. soils	Data is from forests growing on soils fulfilling organic soils definition but not defined as peat. Category is applied to the temperate zone data.	Included in more site type specific EF categories.
Extremely poor	Data is from forestry drained low productivity forests on extremely nutrient poor sites. These sites fulfil minimum forest criteria as in FAO (FRA, 2018). Category is applied to the boreal zone data.	Included in more site type specific EF categories, and in correlation analyses.
Poor	Data is from forestry drained low productivity forests on nutrient poor sites. Ground vegetation is 'shrubby'. Category is applied to the boreal zone data.	Included in more site type specific EF categories, and in correlation analyses.
Moderately rich	Data is from forestry drained typical productivity forests on nutrient rich sites. Ground vegetation is 'shrubby'. Category applied to the boreal zone data.	Included in more site type specific EF categories, and in correlation analyses.
Rich	Data is from forestry drained typical productivity forests on nutrient rich sites. Ground vegetation is rich with herbs and/or ferns. Category is applied to the boreal zone data.	Included in more site type specific EF categories, and in correlation analyses.

Table S4. CO_2, CH_4 and N_2O emission factors (EFs) in this study applied on categories used in IPCC (2014) for boreal and temperate zones, as the average (Avg), uncertainty (95% confidence limits, CI) and number of observations (i.e. the number of sites) in the category (*N*) are shown.

Forest site type and climate zone	EF CO_2 (g m^{-2} yr^{-1})			EF CH_4 (g m^{-2} yr^{-1})			EF N_2O (g m^{-2} yr^{-1})		
	Avg[2]	95% CI	*N*	Avg[2]	95% CI	*N*	Avg[2]	95% CI	*N*
Forest land, drained, including shrubland and drained land that may not be classified as forest[1] and nutrient-poor sites in the boreal zone	100.0	–37.8 to 237.7	64	–			–		
Nutrient-rich sites in the boreal zone	241.9	109.0 to 374.8	111	0.32	–0.06 to 0.69	86	0.570	0.306 to 0.834	53
Nutrient-poor sites in the boreal zone	55.9	–118.3 to 230.1	43	0.52	0.14 to 0.89	29	0.192	0.069 to 0.316	21
All sites in the temperate zone	698.3	535.7 to 860.9	35	0.31	–0.08 to 1.11	26	0.828	–0.022 to 1.678	22

[1] Sites with poor tree growth due to extremely low nutrient availability, nutrient imbalance or wetness, but still fulfilling the minimum criteria as in FAO's Forest Resources Assessment (FRA, 2018).
[2] Based on weighed means

Table S5. CO_2, CH_4 and N_2O emission factors (g m^{-2} y^{-1}) for boreal and temperate drained organic forest soils in different site type categories. CO_2 estimates are presented by pooled flux data and inventory data, and separately for these two data types for more site specific categories. Data from each measuring site was pooled if multiple GHG flux estimates were available.

Inventory and flux data combined					CO2 soil (g m-2 a-1)							
Climate zone	**Productivity(1**	**Site type (2**	**Nutrient status(3**	**N groups**	**Mean**	**S.D.**	**Min.**	**Max.**	**Cl.95%**	**Cl.95%**	**Tot. estimates**	**Reference (number of GHG estimates from publication) (4**
Boreal	Low	FO	NuR	9	83,93	120,85	-450,77	655,36	-152,94	320,79	10	45(9), 54(1)
		FO	NuP	10	269,22	194,92	-509,70	1549,56	-112,82	651,26	11	28(1), 30(1), 39(1), 45(5), 49(1), 51(1), 54(1)
	Typical	FO	NuR	96	260,34	70,00	-1357,87	2881,63	123,14	397,54	103	28(10), 30(2), 31(4), 32(3), 33(1), 36&37(55), 44(9), 45(9), 49(3), 51(1), 54(6)
		FO	NuP	29	79,17	95,99	-1110,84	1722,08	-108,97	267,31	37	14(1), 28(2), 30(1), 31(1), 36&37(13), 44(8), 45(6), 53(1), 54(4)
		AF_AG		7	68,21	285,17	-1229,80	920,00	-490,72	627,14	7	13(1), 34(6)
		AF_PM		6	-86,12	247,34	-814,48	740,27	-570,90	398,66	6	34(6)
Temperate	Typical	FO	NuR	15	591,38	85,85	-30,00	1074,33	423,10	759,65	16	15(1), 31(1), 42(3), 46(5), 48(3), 52(3)
		FO	NuP	4	534,95	78,13	423,01	762,99	381,81	688,08	5	43(3), 50(2)
		AF_AG		4	932,31	270,26	555,87	1267,35	402,60	1462,02	9	10(2), 27(1), 43(6)
		Other org. soils		3	959,98	351,07	462,34	1689,67	271,88	1648,08	5	1(4), 22(1)

Inventory data					CO2 soil (g m-2 a-1)							
Climate zone	**Productivity(1**	**Site type (2**	**Nutrient status(3**	**N groups**	**Mean**	**S.D.**	**Min.**	**Max.**	**Cl.95%**	**Cl.95%**	**Tot. estimates**	**Reference (number of GHG estimates from publication) (4**
Boreal	Low	FO	NuR	8	133,68	125,18	-450,77	655,36	-111,66	379,03	9	45(9)
		FO	NuP	8	369,11	227,05	-1110,84	1722,08	-75,90	814,12	8	28(1), 30(1), 39(1), 45(5)
	Typical	FO	NuR	21	343,70	216,22	-1357,87	2881,63	-80,09	767,48	21	28(10), 30(2), 45(9)
		FO	NuP	9	42,29	294,51	-1110,84	1722,08	-534,95	619,52	9	28(2), 30(1), 45(6)
		AF_AG										
		AF_PM										
Temperate	Typical	FO	NuR	1	-30,00						1	15(1)
		FO	NuP									
		AF_AG										
		Other org. soils										

Flux data					CO2 soil (g m-2 a-1)							
Climate zone	**Productivity(1**	**Site type (2**	**Nutrient status(3**	**N groups**	**Mean**	**S.D.**	**Min.**	**Max.**	**Cl.95%**	**Cl.95%**	**Tot. estimates**	**Reference (number of GHG estimates from publication) (4**
Boreal	Low	FO	NuR	1	-319,23						1	54(1)
		FO	NuP	2	-204,77	168,90	-194,33	12,75	-535,81	126,27	2	49(1), 51(1)
	Typical	FO	NuR	76	211,17	56,07	-790,94	2570,00	101,26	321,07	82	31(4), 32(3), 33(1), 36&37(55), 44(9), 49(3), 51(1), 54(6)
		FO	NuP	21	85,57	64,89	-397,22	627,21	-41,62	212,75	28	14(1), 31(1), 36&37(13), 44(8), 53(1), 54(4)
		AF_AG		7	68,21	285,17	-1229,80	920,00	-490,72	627,14	7	13(1), 34(6)
		AF_PM		6	-86,12	247,34	-814,48	740,27	-570,90	398,66	6	34(6)
Temperate	Typical	FO	NuR	14	636,43	78,75	140,00	1074,33	482,08	790,78	15	31(1), 42(3), 46(5), 48(3), 52(3)
		FO	NuP	4	534,95	78,13	423,01	762,99	381,81	688,08	5	43(3), 50(2)
		AF_AG		4	932,31	270,26	555,87	1267,35	402,60	1462,02	9	10(2), 27(1), 43(6)
		Other org. soils		3	959,98	351,07	462,34	1689,67	271,88	1648,08	5	1(4), 22(1)

					CH4 (g m-2 a-1)							
Climate zone	**Productivity(1**	**Site type (2**	**Nutrient status(3**	**N groups**	**Mean**	**S.D.**	**Min.**	**Max.**	**Cl.95%**	**Cl.95%**	**Tot. estimates**	**Reference (number of GHG estimates from publication) (4**
Boreal	Low	FO	NuR	2	2,76	2,21			-1,58	7,09	2	18(1), 54(1)
		FO	NuP	3	2,48	0,58	-0,28	3,47	1,34	3,61	13	11(9), 21(2), 49(1), 54(1)
	Typical	FO	NuR	79	0,36	0,21	-0,97	12,50	-0,05	0,76	105	9(4), 11(9), 12(2), 16(1), 18(2), 19(1), 21(4), 23(1), 25(12), 29(3), 33(1), 35(1), 36(55), 41(3), 49(3), 54(3)
		FO	NuP	24	0,63	0,22	-0,28	3,47	0,19	1,06	35	14(1), 18(2), 21(4), 23(1), 29(1), 35(8), 36(13), 53(1), 54(4)
		AF_AG		7	-0,11	0,11	-0,32	0,26	-0,33	0,11	8	34(8)
		AF_PM		5	-0,04	0,01	-0,07	-0,03	-0,06	-0,03	5	34(5)
Temperate	Typical	FO	NuR	12	1,03	0,63	-0,64	5,64	-0,20	2,26	20	4(1), 7(3), 42(3), 48(6), 52(7)
		FO	NuP	4	0,94	0,21	0,69	1,25	0,53	1,35	5	43(3), 50(2)
		AF_AG		5	-0,33	0,08	-0,47	-0,08	-0,49	-0,18	14	10(2), 27(3), 43(6), 47(3)
		Other org. soils		5	0,07	0,05	-0,05	0,20	-0,02	0,16	7	1(4), 3(1), 22(1), 26(1)

					N2O (g m-2 a-1)							
Climate zone	**Productivity(1**	**Site type (2**	**Nutrient status(3**	**N groups**	**Mean**	**S.D.**	**Min.**	**Max.**	**Cl.95%**	**Cl.95%**	**Tot. estimates**	**Reference (number of GHG estimates from publication) (4**
Boreal	Low	FO	NuR	3	0,12	0,03	0,08	0,19	0,06	0,19	3	18(1), 24(1), 54(1)
		FO	NuP	2	0,07	0,04	0,03	0,11	-0,01	0,14	4	21(2), 49(1), 54(1)
	Typical	FO	NuR	42	0,34	0,11	0,02	2,90	0,14	0,55	52	9(4), 17(1), 18(2), 19(1), 21(4), 24(4), 33(1), 36(22), 40(1), 41(3), 49(3), 54(6)
		FO	NuP	15	0,14	0,07	0,01	1,14	-0,01	0,28	21	14(1), 18(2), 21(4), 24(4), 36(6), 54(4)
		AF_AG		11	1,38	0,41	0,11	3,46	0,57	2,20	23	20(20), 34(2), 38(1)
		AF_PM		6	0,35	0,12	0,08	0,75	0,11	0,59	10	20(8), 34(2)
Temperate	Typical	FO	NuR	10	1,26	0,93	0,00	9,52	-0,56	3,08	18	2(1), 4(1), 42(3), 48(6), 52(7)
		FO	NuP	1	0,08						1	50(1)
		AF_AG		7	0,75	0,44	0,15	3,23	-0,11	1,61	25	5(2), 6(5), 8(4), 10(2), 27(3), 43(6), 47(3)
		Other org. soils		4	0,16	0,08	0,02	0,33	0,01	0,31	6	1(4), 3(1), 22(1)

(1 "Low" refers to sites with poor tree growth (due to extremely low nutrient availability, nutrient imbalance or wetness, but still fulfilling the minimum criteria as in FAO's FRA (2018), and 'Typical' refers to forests with typical tree growth for forestry practices.
(2 "FO" includes forestry drained sites, "AF_AG" includes afforested sites used previously in agriculture, "AF_PE" includes afforested sites used previously for peat extraction.
(3 "NuP" includes nutrient poor site types (often indicated by ombrotrophy), and "NuR" includes nutrient rich site types (often indicated by minerotrophy, or caused by fertilization)
(4 References are listed in S1

Publications in the assessment; (1) Ball et al., 2007; (2) Brumme et al., 1999; (3) Christiansen et al., 2012; (4) Danevčič et al., 2010; (5) Eickenscheidt et al., 2014; (6) Ernfors et al., 2011; (7) Glenn et al., 1993; (8) Holz et al., 2016; (9) Huttunen et al., 2003a; (10) Klemedtsson et al., 2010; (11) Komulainen et al., 1998; (12) Korkiakoski et al., 2017; (13) Lohila et al., 2007; (14) Lohila et al., 2011; (15) Lupikis and Lazdins 2017; (16) Maljanen et al., 2003a; (17) Maljanen et al., 2003b; (18) Maljanen et al., 2006; (19) Maljanen et al., 2010; (20) Maljanen et al., 2012; (21) Maljanen et al., 2014; (22) Mander et al., 2008; (23) Martikainen et al., 1992; (24) Martikainen et al., 1993; (25) Martikainen et al., 1995b; (26) McNamara et al., 2008; (27) Meyer et al., 2013; (28) Minkkinen and Laine 1998; (29) Minkkinen and Laine 2006; (30) Minkkinen et al., 1999; (31) Minkkinen et al., 2007b; (32) Moilanen et al., 2012; (33) Mustamo et al., 2016; (34) Mäkiranta et al., 2007; (35) Nykänen et al., 1998; (36) Ojanen et al., 2010; (37) Ojanen et al., 2013; (38) Pihlatie et al., 2004; (39) Pitkänen et al., 2013; (40) Regina et al., 1998; (41) Saari et al., 2009; (42) Salm et al., 2012; (43) Sikström et al., 2009; (44) Silvola et al., 1996; (45) Simola et al., 2012; (46) Uri et al., 2017; (47) Weslien et al., 2009; (48) von Arnold et al., 2005a; (49) Väisänen et al., 2013; (50) Yamulki et al., 2013; (51) Komulainen et al., 1999; (52) von Arnold et al. 2005b; (53) Minkkinen et al., 2018; (54) Ojanen et al., 2019. These publications are listed as references in S1.

Table S6. ANOVA test for significance (*p*) in separate univariate linear mixed model for each covariate, and marginal coefficient of determination (pseudo-R^2) of those models.

Predictor	unit / categories	CO_2		CH_4		N_2O	
		p	**R^2**	***p***	**R^2**	***p***	**R^2**
Nutrient status	’NuP’,’NuR’	0.157	0.019	**0.004**	0.067	0.108	0.036
Nutrient status	’Extremely poor’, ’Poor’, ’Moderately rich’,’Rich’	0.163	0.053	**0.001**	0.212	0.531	0.059
Soil C	%	**0.001**	0.308	0.393	0.019	0.192	0.046
Soil N	%	0.445	0.015	**0.000**	0.282	**0.011**	0.134
Soil C:N		**0.000**	0.125	**0.040**	0.047	0.051	0.081
Soil P	mg kg^{-1}	0.463	0.053	**0.025**	0.083	0.316	0.057
Soil P:N		0.466	0.051	0.629	0.002	0.542	0.015
Soil bulk density	g cm^{-3}	**0.045**	0.037	0.423	0.004	**0.005**	0.041
Soil pH		0.320	0.034	0.575	0.007	**0.037**	0.107
Forest productivity	’Typical’, ’Low’	0.123	0.024	**0.002**	0.126	0.429	0.009
Productivity and soil nutrient status	’Typical NuP’, ‘Low NuP’, ‘Typical NuR’, ’Low NuR’	0.433	0.030	**0.001**	0.195	0.393	0.054
Stand type	’Conifer’,’Deciduous’, ’Mixed’	**0.000**	0.208	**0.050**	0.030	**0.003**	0.073
Shrubbyness	’No’, ’Yes’	0.050	0.033	0.507	0.003	0.550	0.005
Basal area of trees	m^2 ha^{-1}	0.826	0.005	**0.011**	0.200	**0.000**	0.360
Stand volume of trees	m^3 ha^{-1}	0.511	0.004	**0.000**	0.220	**0.029**	0.090
Stem number of trees	stems ha^{-1}	0.815	0.004	**0.002**	0.331	**0.000**	0.286
Climate zone	’Boreal’, ’Temperate’	**0.001**	0.087	0.183	0.014	0.051	0.060
Altitude	m	0.422	0.005	**0.002**	0.073	0.313	0.015
Southward distance from polar circle	km	**0.003**	0.073	0.467	0.003	**0.000**	0.149
Mean temperature of measurement year	ºC	**0.039**	0.037	**0.010**	0.048	0.155	0.026
Temperature sum	degree days	**0.006**	0.050	0.140	0.013	0.740	0.001
February mean temperature	ºC	0.242	0.010	**0.008**	0.035	0.912	0.000
July mean temperature	ºC	**0.020**	0.028	0.649	0.001	**0.049**	0.029
Mean temperature over 30 years	ºC	**0.005**	0.067	0.624	0.002	**0.004**	0.101
Temperature sum over 30 years	degree days	0.326	0.009	**0.006**	0.053	0.414	0.010
February mean temperature over 30 years	ºC	0.**009**	0.062	0.608	0.002	**0.024**	0.066
July mean temperature over 30 years	ºC	0.076	0.026	**0.014**	0.034	**0.000**	0.233
Precipitation during measurement year	mm yr^{-1}	0.524	0.003	0.421	0.004	**0.000**	0.100
Mean precipitation over 30 years	mm yr^{-1}	0.**024**	0.055	0.545	0.003	**0.000**	0.144

Note that the R^2 values are not comparable between covariates, because the models may be based on very different subsets of the data depending on the availability of covariates.

Table S7. Multiple linear model parameter estimates with standard errors (SE) and marginal coefficient of determination (pseudo-R^2) for N_2O obtained from stepwise regression by including two vegetation characterizing predictors and one soil parameter. The *p*-values for the significance of the difference of the parameter estimate from 0 are based on Wald tests, and the numbers of data points (*n*) and sites (n_{sites}) used for the model are also indicated.

Predictor	**unit / category**	**Estimate**	**SE**	***p***	***n***	n_{sites}	R^2
log(N_2O+ε)							0.83
pH		-0.474	0.208	0.048	21	11	
Stand type	Conifer[a]	0					
	Deciduous	0.503	0.297	0.124			
	Mixed	0.668	0.147	0.000			
Stand volume of trees	m^3 ha^{-1}	0.003	0.001	0.003			

[a] The reference category

Table S8. Selected soil and water parameters and tree stand characteristics (mean ± S.D.) in typical and low productivity site type categories (data in Data repository). Note that parameters are infrequently reported in publications and thus are only indicative for the site types.

Parameter	Climate zone	Site productivity	Site type	Mean	S.D.	Min.	Max.	*N* (values in reports)	*N* (data in category)
Soil C (%)	Boreal	Low	NuP	47	2	45	51	4	23
			NuR	53		53	53	1	12
		Typical	NuP	49	4	41	55	8	59
			NuR	84	123	49	512	14	161
			AF_AG	12		12	12	1	38
			AF_PE	-	-	-	-	0	21
	Temperate	Typical	NuP	49	2	47	51	3	10
			NuR	45	8	25	54	13	37
			AF_AG	30	16	10	44	5	34
			Other org. soils	33	18	15	50	3	8
Soil N (%)	Boreal	Low	NuP	0.69	0.28	0.53	1.10	4	23
			NuR	2.03	0.47	1.70	2.36	2	12
		Typical	NuP	1.31	0.84	0.40	3.10	20	59
			NuR	2.18	0.59	0.90	3.40	30	161
			AF_AG	0.55		0.55	0.55	1	38
			AF_PE	-	-	-	-	0	21
	Temperate	Typical	NuP	1.51	0.19	1.38	1.72	3	10
			NuR	2.40	0.67	1.23	3.20	13	37
			AF_AG	1.92	0.68	1.10	2.99	5	34
			Other org. soils	1.33	0.59	0.77	1.95	3	8
Soil C/N	Boreal	Low	NuP	68	22	42	87	5	23
			NuR	31		31	31	1	12
		Typical	NuP	34	11	16	53	21	59
			NuR	28	22	16	205	70	161
			AF_AG	18	3	13	27	18	38
			AF_PE	24	1	23	27	10	21
	Temperate	Typical	NuP	33	3	30	34	3	10
			NuR	20	7	12	40	13	37
			AF_AG	20	7	8	25	8	34
			Other org. soils	27	1	26	28	2	8
Soil P (mg kg^{-1})	Boreal	Low	NuP	567	115	500	700	3	23
			NuR	1160		1160	1160	1	12
		Typical	NuP	714	219	367	1200	14	59
			NuR	922	238	580	1340	17	161
			AF_AG	1659	807	500	2900	9	38
			AF_PE	525	50	500	600	4	21
	Temperate	Typical	NuP	605	78	550	660	2	10
			NuR					0	37
			AF_AG	897	80	820	980	3	34

			Other org. soils	-	-	-	-	0	8
Soil P/N	Boreal	Low	NuP	0.104	0.024	0.089	0.132	3	23
			NuR	0.049		0.049	0.049	1	12
		Typical	NuP	0.069	0.021	0.041	0.100	14	59
			NuR	0.042	0.010	0.027	0.059	17	161
			AF_AG	0.133		0.133	0.133	1	38
			AF_PE	-	-	-	-	0	21
	Temperate	Typical	NuP	0.043	0.006	0.039	0.048	2	10
			NuR					0	37
			AF_AG	0.043	0.014	0.027	0.054	3	34
			Other org. soils	-	-	-	-	0	8
WT annual (cm)	Boreal	Low	NuP	-24	-11	10	-36	12	23
			NuR	-34	-34		-34	1	12
		Typical	NuP	-29	-11	11	-58	35	59
			NuR	-35	-1	16	-80	98	161
			AF_AG	-50	-25	8	-65	18	38
			AF_PE	-60	-50	14	-84	11	21
	Temperate	Typical	NuP	-32	-32		-32	1	10
			NuR	-30	1	18	-65	22	37
			AF_AG	-46	-46		-46	1	34
			Other org. soils	-56	-42	14	-69	3	8
Stem number (per ha^{-1})	Boreal	Low	NuP	-	-	-	-	0	23
			NuR	-	-	-	-	0	12
		Typical	NuP	1670		1670	1670	1	59
			NuR	-	-	-	-	0	161
			AF_AG	-	-	-	-	0	38
			AF_PE	-	-	-	-	0	21
	Temperate	Typical	NuP	800	0	800	800	2	10
			NuR	1402	639	500	2752	12	37
			AF_AG	960	87	850	1031	6	34
			Other org. soils	-	-	-	-	0	8
Stand volume (m^3 ha^{-1})	Boreal	Low	NuP	55	73	7	200	10	23
			NuR	27	17	4	60	11	12
		Typical	NuP	67	51	6	185	40	59
			NuR	153	77	20	301	101	161
			AF_AG	80	66	2	193	18	38
			AF_PE	189	116	24	365	10	21
	Temperate	Typical	NuP	110		110	110	2	10
			NuR	151	49	77	225	7	37
			AF_AG	356	108	135	400	6	34
			Other org. soils	-	-	-	-	0	8
Basal area (m^2 ha^{-1})	Boreal	Low	NuP	-	-	-	-	0	23

		NuR	-	-	-	-	0	12
	Typical	NuP	18	1	17	18	2	59
		NuR	-	-	-	-	0	161
		AF_AG	-	-	-	-	0	38
		AF_PE	-	-	-	-	0	21
Temperate	Typical	NuP	-	-	-	-	0	10
		NuR	31	21	2	67	12	37
		AF_AG	47	9	36	53	6	34
		Other org. soils	-	-	-	-	0	8

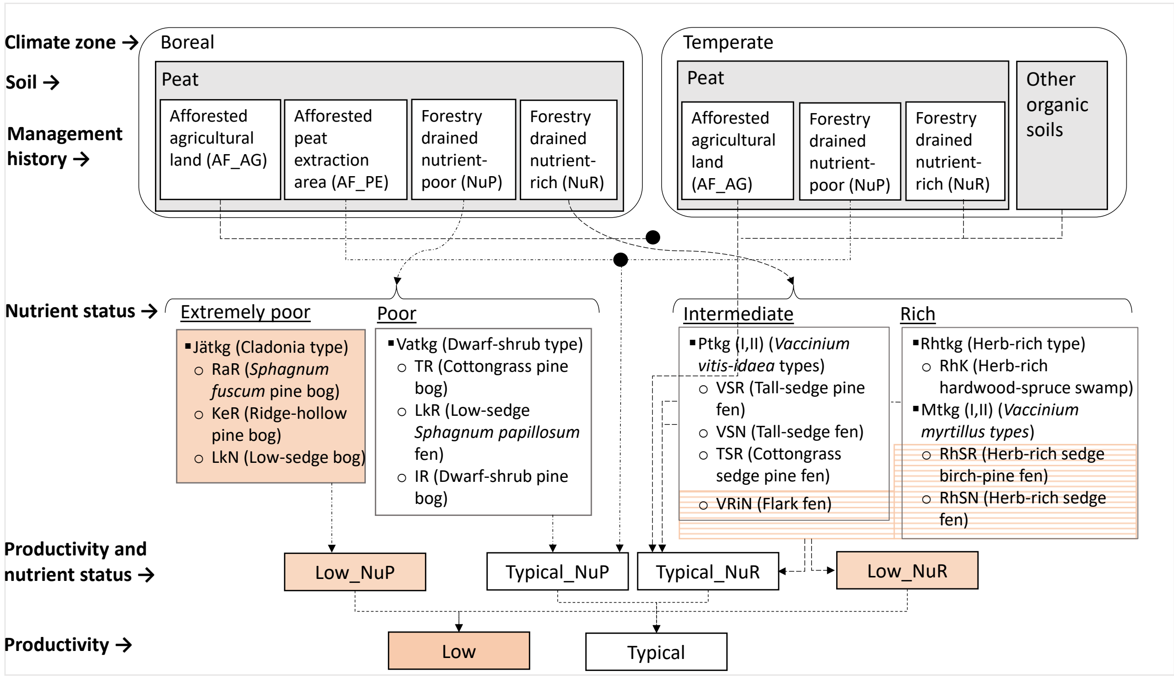

Figure S1. Finnish forestry drained site type classification (grouping together sites with similar ecology, soil and vegetation characteristics) based on Päivänen and Hånell (2012) and added classification on climate, soil, management history and forest productivity.

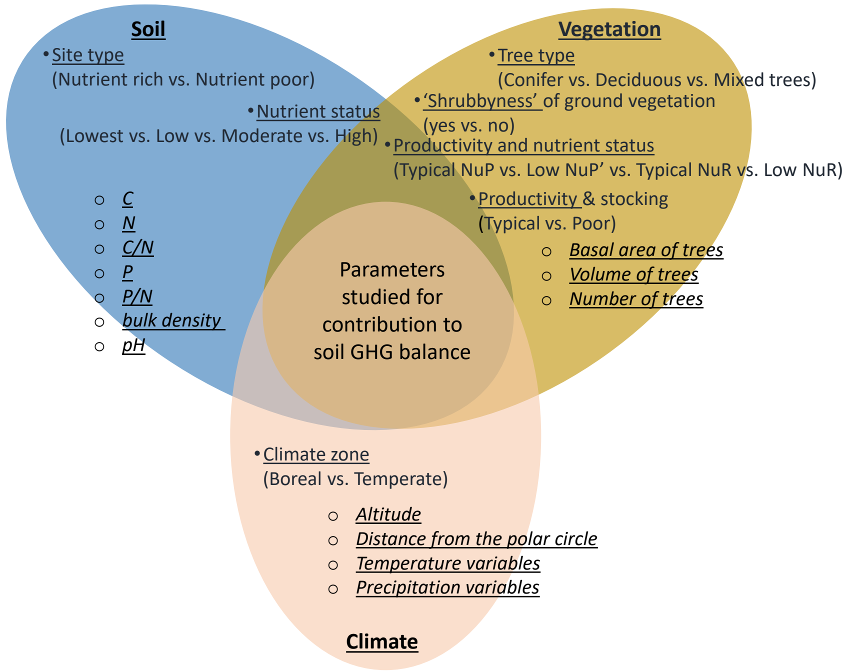

Figure S2. Schematic presentation of climatic, soil and site type characteristics related parameters tested for potential correlation with soil greenhouse gas balance estimates.

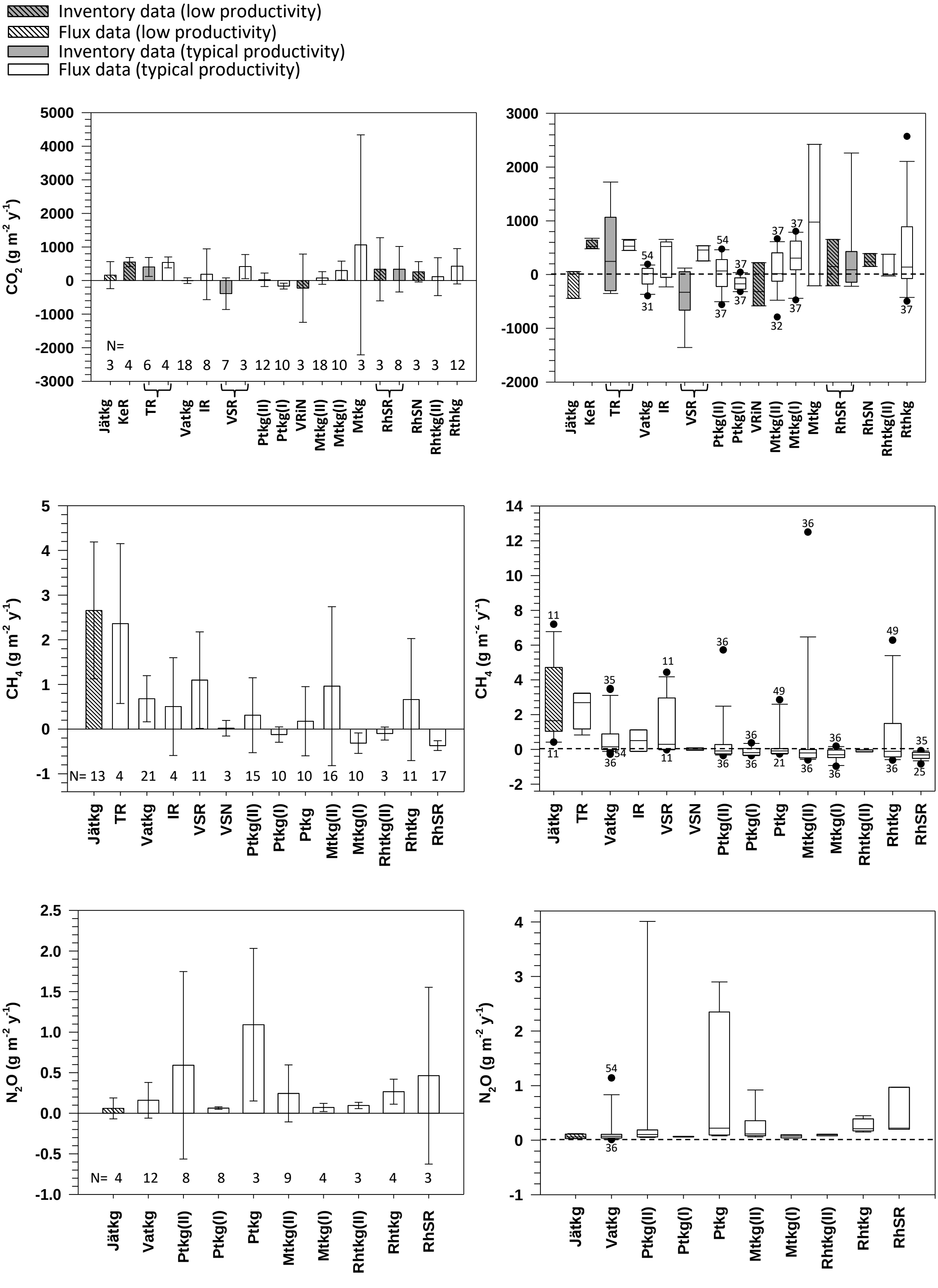

Figure S3. Forestry drained peat annual CO_2 (top), CH_4 (middle) and N_2O (bottom) EFs (g m^{-2} y^{-1}) in specific site types shown as mean ± 95% confidence intervals (left) and as box plot (right) by including data with n ≥ 3. High and low values in the box-plot graphs refer to publications listed in the tables S1 and S2. Site full names and relative positions within categories are in Figure S1.

References

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