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SUPPLEMENTARY INFORMATION
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1. Methods and material

1.1 Meta-analyses of manipulation experiments

Data acquisition

We searched for replicated N addition experiments on forest ecosystems, where responses of soil carbon pools or fluxes were reported. Most of the data included in the analysis were extracted from figures and tables in published papers, although some data were not published in peer reviewed literature and were obtained via personal communication. We collected data on total biomass (TB), litterfall (LF), fine root production (FRP), root respiration (Rr), microbial biomass (Cmic), microbial respiration (Rh), litter decomposition rates (LD), soil CO_2 efflux (SCE) and soil C content, resulting in 255 entries for the meta-analysis originating from 57 manipulation experiments (see Appendix S1). When several years of data were reported, we calculated the weighted mean, using the reciprocal of the measurement variance.

We only included studies performed in woody systems, where nitrogen (N) was added as a fertilization treatment. Several studies used different species in the same experiment or included other manipulations, e.g. elevated CO_2, ozone, different soils. Results from different treatments, plant species, soils, or measurement protocols within the same experiment were considered independent measurements. General site information, source references and sampling methods are described in Appendix S2.

DOI: 10.1038/NGEO844

Meta-analysis

Data were analyzed with meta-analytical techniques using MetaWin 2.1 software [1]. In conventional meta-analysis, each individual observation is weighted by the reciprocal of the mixed-model variance [2]. We used standard deviation (SD) values reported in the individual studies, or calculated the SD from the standard error and the number of replicates. Studies that did not report standard error or deviation were not included in the database. The natural log of the response ratio (r = response in treatment plots/response in untreated plots) was used as metric in the analyses, and is reported as the percentage change in elevated CO_2 and/or temperature. The use of the natural logarithm instead of the Hedges d-index has the advantage of linearizing the metric, thereby being less sensitive to changes in a small control group.

A mixed model was used to assess the overall treatment effects on the different C pools and fluxes. Similarly, we tested our dataset for differences between additional treatments, types and amount of N fertilizer and tree seasonal strategy (evergreen vs deciduous).

If the number of studies used to calculate a mean and confidence interval (CI) is lower than 20, the CI can be too narrow [2]. Therefore, we used the CI based on resampling methods for the assessment of statistical differences (2500 iterations). Confidence limits based on bootstrapping tests are wider than standard confidence limits, implying that resampling estimates are more conservative [3]. If the calculated 95% confidence interval did not overlap with zero, then a significant elevated CO_2 and/or warming response was considered. Significant differences between groups (=categorical analyses for treatment comparison, different tree seasonal stategies and type and amount of fertilizer) were identified on the basis of the within and between group heterogeneity. Significant differences are reported at $P<0.05$.

1.2 Analysis of field sites

Data acquisition

To assess the contributions of changes in Rh and SCE to NPP, we conducted a literature and database search [4] to determine the fate of the C sequestered under different N-deposition levels. Observation-based estimates were compiled for C cycle components, including NPP, SCE and Rh. Observed and modelled estimates of wet, dry and total N-deposition were derived from published datasets [5-7]. An arbitrary threshold of 0.55 g N m^{-2} a^{-1} from wet deposition was used to separate a low from a high deposition group. However, the conclusions of this study hold for wet deposition thresholds ranging from 0.55 up to 1.0 g N m^{-2} a^{-1}. We used wet rather than total deposition because the estimates for dry deposition are based on a limited set of observations and questionable assumptions, resulting in large uncertainties [5,6].

Although a wide range of management practices is applied globally, all of them share one key characteristic: woody biomass is exported from the site. Among sites, information on management was of variable quality and detail. Therefore, a coarse classification was used to distinguish between managed and unmanaged sites. We excluded all sites that were recently disturbed, fertilized, irrigated or for which no management information was available. Nevertheless, better data allowing refined management classifications is likely to result in more detailed understanding of the management effect on C-cycling and its interactions with N-deposition.

Uncertainties

Uncertainties of flux estimates are rarely reported in the literature, although measurement errors or gapfilling uncertainties have been sometimes addressed [8-11] (typically ~15-20%).

DOI: 10.1038/NGEO844

Therefore, we estimated the total uncertainty for every flux quantity contained in the data set using a consistent framework based on expert judgment [12]. This framework was designed to account for differences in data quality between sites due to length of time series, methodology and conceptual difficulties (i.e. separation of autotrophic and heterotrophic respiration, etc.). Subsequently, uncertainties were fully accounted for in the statistical analyses by means of 1000 simulations based on Monte Carlo principles [13]. Within each of the 1000 Monte Carlo simulations performed, normally distributed random errors, based on the uncertainty framework of the database, were added to the observed fluxes. Therefore, all results that are based on flux data are reported as the median value and the 68% confidence interval of the probability distribution (± standard deviation).

Statistical analysis

We used a maximum likelihood estimator (MLE) to estimate the parameters of a linear relationship between NPP and Rh. The MLE accounts for uncertainties in both NPP and Rh when estimating the parameters of the relationship.

2. Tables

Table S1: Meta-analysis results of the effect of N addition on soil C inputs and soil C fluxes. n indicates the number of experiments upon which the result is based; the column marked "% Effect" shows the percentage change in the parameter in the fertilized - relative to the unfertilized treatment; columns "Lower limit" and "Upper limit" give the bootstrapped 95% confidence interval.

Parameter	n	% Effect	Lower limit	Upper Limit
Litterfall	16	1	-12	13
Fine root production	9	-6	-19	5
Total biomass	24	36	17	56
Microbial biomass	34	-11	-20	-2
Soil C content	41	10	4	17
Litter decomposition	20	-3	-8	1
Heterotrophic respiration	36	-15	-25	-5
Root respiration	17	-21	-34	-8
Soil CO_2 efflux	57	-10	-17	-4

DOI: 10.1038/NGEO844

3. Appendices

3.1. Appendix 1: Site information and data used in meta-analysis of manipulation experiments

1: Site names, experimental species, location of the site, age of the tree stand

Site Name	Treatments	Species	Latitude		Longitude		Age
Aber forest	Fertilization	Picea sitchensis	53.2	N	4	W	30
Barro Colorado Nature Monument	Fertilization	Tropical forest	9.12	N	79.85	W	>300
Bear Brooks Watershed	Fertilization	Betula alleghaniensis, Fagus grandifolia, Picea rubra	44.87	N	8.01	W	>50
Birmensdorf	CO2xFertilizationxSoil	Picea abies, Fagus sylvatica	47.35	N	8.43	E	2
Boulder	Fertilization	Pinus resinosa	46.17	N	89.67	W	31
Central Alaska	Fertilization	Picea mariana	63.92	N	145.73	W	80
Cedar Creek	Fertilization	Populus grandidentata, Acer saccharum, Tilia americana, Quercus ellipsoidalis, Pinus strobus,	45.4	N	93.2	W	? (not young stands)
Dinghushan Biosphere Reserve	Fertilization	Subtropical pine and mixed forest	23.17	N	112.17	E	70
Dossi	Fertilization	Faidherbia albida, Vitellaria paradoxa	11.37	N	3.27	W	-
Duke_temperateforest	Fertilization	Temperate forest	35.95	N	79.15	W	>50
DukeFACE	CO2xFertilization	Pinus taeda forest	35.95	N	79.15	W	13
EUROFACE	CO2xFertilization	Populus alba, nigra and euramericana	42.37	N	11.8	W	3 year SRC
Escambia County	Fertilization	Pinus taeda	31.17	N	87.33	W	seedlings
Flakaliden	Fertilization	Picea abies	64.12	N	19.45	E	40
Glendevon	CO2xFertilization	Betula pendula, Picea sitchensis, Alnus glutinosa, Pinus sylvestris	56.2	N	4	W	1
Golfo Dulce Forest Reserve	Fertilization	Tropical forest	8.72	N	83.62	W	-
Greene County	Fertilization	Pinus taeda	32.42	N	88.45	W	seedlings
Harvard Forest_Fertilization	Fertilization	Mixed hardwood stand	42.5	N	72.33	W	55
Harvard Forest_Fertilization	Fertilization	Pinus resinosa	42.5	N	72.33	W	75
Heinola	FertilizationxWater	Picea abies	61.22	N	26	E	mature
Hubbard Brook Experimental Forest	Fertilization	Betula allegheniensis	43.93	N	71.75	W	85
Maoxian	WarmingxFertilization	Picea asperata	32.68	N	103.88	E	3
Michigan_A	Fertilization	Acer saccharum	46.87	N	88.88	W	94

Michigan_B	Fertilization	Acer saccharum	45.55	N	84.85	W	88
Michigan_C	Fertilization	Acer saccharum	44.38	N	85.83	W	89
Michigan_D	Fertilization	Acer saccharum	43.67	N	86.15	W	93
Norrliden	Fertilization	Pinus sylvestris	64.35	N	19.75	E	43
Sahalahti	FertilizationxWater	Picea abies	61.43	N	24.4	E	mature
Sambong Exhibition Forest	Fertilization	Larix leptolepis	35.43	N	127.62	E	36
Santa Rosa County	Fertilization	Populus deltoides	30.83	N	87.18	W	7
Santa Rosa County	Fertilization	Pinus taeda	30.83	N	87.18	W	7
Santa Rosa County	FertilizationxWater	Populus deltoides	30.83	N	87.18	W	7
Santa Rosa County	FertilizationxWater	Platanus occidentalis	30.83	N	87.18	W	7
Santa Rosa County	FertilizationxWater	Pinus taeda	30.83	N	87.18	W	7
Santa Rosa County	FertilizationxWater	Quercus falcata	30.83	N	87.18	W	7
SETRES	Fertilization	Pinus taeda	34.84	N	79.48	W	8
Turkey Hill Plantations	Fertilization	Acer saccharum	42.45	N	76.42	W	65
Turkey Hill Plantations	Fertilization	Quercus rubra	42.45	N	76.42	W	65
UMBS_populus(eur.)	CO2xFertilization	Populus x euramericana	45.57	N	84.67	W	cuttings
UMBS_populus(trem.)	CO2xFertilization	Populus tremuloides	45.57	N	84.67	W	seedlings
UMBS_populus(trem.II)	CO2xFertilization	Populus tremuloides	45.57	N	84.67	W	seedlings
USDA Placerville	CO2xFertilization	Pinus ponderosa	38.73	N	120.8	W	3
Virginia	Fertilization	Pinus taeda	36.67	N	76.93	W	33

DOI: 10.1038/NGEO844

2: Data entries in the database and site were these data were obtained

Site Name	Litterfall	Microbial biomass	Total biomass	FRP	Litter decom-position	Rh	Root respiration	SCE	soil C
Barro Colorado Nature Monument					*				
Bear Brooks Watershed (Betula)					*				
Bear Brooks Watershed (Betula)+					*				
Bear Brooks Watershed (Fagus)					*				
Bear Brooks Watershed (Picea)					*				
Birmensdorf (acidic, fert)								*	*
Birmensdorf (acidic, fert x CO2)								*	*
Birmensdorf (calcareous, fert)								*	*
Birmensdorf (calcareous, fert x CO2)								*	*
Boulder	*			*		*		*	
Central Alaska		*						*	
Cedar Creek (acer)		*			*				*
Cedar Creek (Pinus)		*			*				*
Cedar Creek (Populus1)		*			*				*
Cedar Creek (Populus2)		*			*				*
Cedar Creek (Quercus1)		*			*				*
Cedar Creek (Quercus2)		*			*				*
Dinghushan Biosphere Reserve (Pinus)	*				*			*	*
Dinghushan Biosphere Reserve (Pinus)+	*				*			*	*
Dinghushan Biosphere Reserve (Mixed)	*				*		*	*	
Dinghushan Biosphere Reserve (Mixed)+	*				*		*	*	
Dinghushan Biosphere Reserve (Cryptocarya)			*						
Dinghushan Biosphere Reserve (Cryptocarya)+			*						
Dinghushan Biosphere Reserve (Cryptocarya)++			*						
Dinghushan Biosphere Reserve (Cryptocarya)+++			*						
Dinghushan Biosphere Reserve (Schima)			*						
Dinghushan Biosphere Reserve (Schima)+			*						
Dinghushan Biosphere Reserve (Schima)++			*						
Dinghushan Biosphere Reserve (Schima)+++			*						
Dossi (Faidherbia)						*			
Dossi (Vitellaria)						*			

Duke_temperateforest							*	
Duke_temperateforest+							*	
DukeFACE (fert)					*	*		
DukeFACE (fert x CO2)					*	*		
Escambia County			*					*
EUROFACE (alba, fert)	*				*	*	*	
EUROFACE (nigra, fert)	*				*	*	*	
EUROFACE (euramericana, fert)	*				*	*	*	
EUROFACE (alba, fert x CO2)	*				*	*	*	
EUROFACE (nigra, fert x CO2)	*				*	*	*	
EUROFACE (euramericana, fert x CO2)	*				*	*	*	
EUROFACE (alba, CO2xFert pooled)			*					
EUROFACE (nigra, CO2xFert pooled)			*					
EUROFACE (euramericana, CO2xFert pooled)			*					
EUROFACE (all species, fert)		*						
EUROFACE (all species, fert x CO2)		*						
Flakaliden			*		*	*	*	
Glendevon (Betula, fert)								
Glendevon (Betula, fert x CO2)								
Glendevon (Picea, fert)							*	
Glendevon (Picea, fert x CO2)							*	
Glendevon (Alnus, fert)							*	
Glendevon (Alnus, fert x CO2)							*	
Glendevon (Pinus, fert)							*	
Glendevon (Pinus, fert x CO2)							*	
Golfo Dulce Forest Reserve							*	
Greene County			*					*
Harvard Forest_mixed	*			*	*		*	*
Harvard Forest_mixed+	*				*		*	
Harvard Forest_pine	*			*	*		*	*
Harvard Forest_pine+	*				*		*	
Heinola (fert)		*			*			
Heinola (fert x H2O)		*			*			
Hubbard Brook Experimental Forest		*			*		*	
Maoxian (fert)			*					

DOI: 10.1038/NGEO844

Maoxian (fertxwarming)			*						
Michigan_A							*	*	*
Michigan_B							*	*	*
Michigan_C							*	*	*
Michigan_D							*	*	*
Norrliden					*			*	*
Norrliden+					*			*	*
Norrliden2N								*	
Norrliden+N								*	
Sahalahti (fert)		*				*		*	
Sahalahti (fert x H2O)		*				*			
Sambong Exhibition Forest	*				*				
Santa Rosa County (Populus)		*		*				*	
Santa Rosa County (Populus)+		*		*				*	
Santa Rosa County (Populus)++								*	
Santa Rosa County (Pine)		*		*				*	
Santa Rosa County (Pine)+		*		*				*	
Santa Rosa County (Pine)++								*	
Santa Rosa County (Populus, fert x H2O)									
Santa Rosa County (Populus, fert x H2O)+									
Santa Rosa County (Populus, fert x H2O)++									
Santa Rosa County (Platanus, fert x H2O)									
Santa Rosa County (Platanus, fert x H2O)+									
Santa Rosa County (Platanus, fert x H2O)++									
Santa Rosa County (Pinus, fert x H2O)									
Santa Rosa County (Pinus, fert x H2O)+									
Santa Rosa County (Pinus, fert x H2O)++									
Santa Rosa County (Quercus, fert x H2O)									
Santa Rosa County (Quercus, fert x H2O)+									
Santa Rosa County (Quercus, fert x H2O)++									
SETRES_F							*	*	*
SETRES_HF							*	*	
Turkey Hill Plantations (Acer)		*				*		*	
Turkey Hill Plantations (Quercus)		*				*		*	
UMBS_populus(eur. fert)		*	*						
UMBS_populus(eur. fert x CO2)		*	*						
UMBS_populus(trem. fert)			*						
UMBS_populus(trem. fert x CO2)			*						
UMBS_populus(trem.II fert)						*		*	
UMBS_populus(trem.II fert x CO2)						*		*	
USDA Placerville (medium fert)			*	*		*		*	*
USDA Placerville (high fert)			*	*		*		*	*
USDA Placerville (medium fert x CO2)			*	*		*		*	*
USDA Placerville (high fert x CO2)			*	*		*		*	*
Virginia								*	
Total number of entries	***16***	***22***	***24***	***9***	***20***	***31***	***17***	***57***	***27***

3: Short description of the sampling method used per variable per site, the sampling year, and source reference.

Site Name	Data used	Methods	Sampling years	Unit	Source
Barro Colorado Nature Monument	litter decomposition	litter bags	2003	k-value	14
Bear Brooks Watershed	litter decomposition	litter bags	1988-1991	% remaining	15
Birmensdorf	SCE	EGM-1 soil respiration system	1995, 1997-1998	μmol/m2/s	16
	soil C	soil coring + elemental analyzer	1998	%	17
Boulder	litterfall	litter screens	1991-1993	g C/m2/year	18
	Rh	trenching + soda lime method	1991-1993	g C/m2/year	18
	SCE	soda lime method	1991-1993	g C/m2/year	18
Central Alaska	microbial biomass	chloroform fumigation extraction	2006	μg C/g	19
	SCE	EGM-4 infrared gas analyzer	2005-2006	mgC/m2/h	19
Cedar Creek	microbial biomass	chloroform fumigation extraction	1999-2004	μg C/g soil	20
	litter decomposition	litter bags	1999-2004	decay constant	20
	soil C	soil coring + elemental analyzer	1999-2004	mg C/g soil	20
Dinghushan Biosphere Reserve	litterfall	litter traps	2005	g/m2	21
	total biomass	harvest	2003	g	22
	litter decomposition	litter bags	2003-2005	% remaining	23
	root respiration	calculated as SCE-0.45xlitter input (assuming steady state status between soil Rh and litter input and that 45% of litter decomposition released as CO2-C)	2005	g C/m2	21
	SCE	static chamber technique	2005	g CO2-C/m2	21
	soil C	soil sampling + elemental analyzer	2005	mg/kg	24
Dossi	Rh	soil incubation	2004	μg CO2/h/g	25
Duke_temperateforest	SCE	inverse box technique	1992	gC/m2/day	26
DukeFACE	Rh	soil incubation	2005	μg C/g soil	27
	fine root respiration	measured by enclosing intact, attached fine roots in buried gas exchange cuvettes	2005	μmol CO2/m2/year	28
EUROFACE	litterfall	litter baskets	2003	g/m2/year	29
	microbial biomass	chloroform fumigation extraction	2004	μg biomass N/g	30
	total biomass	Harvest	2002	g/m2	31
	Rh	soil incubation/or as fraction of SCE	2004/2003	μmol CO2/m2/s	De Angelis (unpublished)
	root respiration	estimated as fraction of SCE	2003	μmol CO2/m2/s	De Angelis (unpublished)

 DOI: 10.1038/NGEO844

	SCE	gas exchange measurements	2003-2004	µmol CO2/m2/s	De Angelis (unpublished)
Escambia County	soil C	soil coring + elemental analyzer	2001	Mg/ha	32
Flakaliden	total biomass	harvest	1998, 1999	g/m2	33
	Rh	girdling + measured in a closed system using an infrared gas analyzer	2002	g CO2-C/m2/h	34
	root respiration	calculated by substracting Rh from SCE	2002	g CO2-C/m2/h	34
	SCE	measured in a closed system using an infrared gas analyzer	2002	g CO2-C/m2/h	34
Glendevon *	SCE	gas exchange measurements	1994, 1996, 1997	µmol CO2/m2/s	35,36
Golfo Dulce Forest Reserve	SCE	gas exchange measurements	2004-2005	mg CO2-C/m2/h	37
Greene County	soil C	soil coring + elemental analyzer	2001	Mg/ha	32
Harvard Forest_Fertilization	litterfall	litter baskets	1989-2002	g/m2	38
	litter decomposition	litter bags	1989-1992	% remaining	39
	Rh	soil incubation	2001	mg C/kg/h	40
	SCE	portable infrared gas analyzer	2001	g C/m2	40
Heinola	microbial biomass	soil sampling + chloroform fumigation extraction	1999	g C/kg OM	41
	SCE	soil sampling + lab incubation	1999	mg N/kg OM	41
Hubbard Brook Experimental Forest	microbial biomass	soil sampling + modification of chloroform fumigation extraction	2003	µg C/g OM	42
	Rh	soil sampling + lab incubation	2003	µg C/g OM	42
	SCE	gas exchange measurements	2002-2004	µmolCO2/m2/s	42
Maoxian	total biomass	harvest	2007	g DW	43
Michigan_A, B, C, D	fine root respiration	Root harvest + gas exchange in cuvettes	2001	nmol CO2/g/s	44
	SCE	measured using a dynamic chamber	1999, 2001	µmol CO2/m2/s	44
	soil C	soil coring + elemental analyzer	2004	g C/m2	45
Norrliden	litter decomposition	model estimated based on data retained from experimental site	2021	% C remaining	46
	SCE	gas exchange measurements	1996, 1997, 1999	mg C/m2/h	46
	soil C	soil cores analyzed for C with accelerator mass spectrometry (AMS)	1992	Mg C/ha	46
Sahalahti	microbial biomass	soil sampling + chloroform fumigation extraction	1999	g C/kg OM	41
	SCE	soil sampling + lab incubation	1999	mg N/kg OM	41
Sambong Exhibition Forest	litterfall	litter traps	2003-2004	g C/m2/year	47

	litter decomposition	litter bags	2003	g/kg/year	47
	SCE	measured in situ using an infrared gas analyzer equipped with a flow-through closed chamber	2002-2004	g CO2/m2/h	47
Santa Rosa County	microbial biomass	chloroform fumigation extraction	2001	mg C/kg	48
	SCE	soda lime method	2002	g C/m2/year	48
SETRES_F	root respiration	measured with root system in modified PVC chamber	1995	μmol CO2/m2/s	49
	SCE	gas exchange measurements	1995	μmol CO2/m2/s	49
	soil C	soil coring + elemental analyzer	1995	mg/g	49
SETRES_HF	root respiration	measured with root system in modified PVC chamber	1995	μmol CO2/m2/s	49
	SCE	gas exchange measurements	1995	μmol CO2/m2/s	49
Turkey Hill Plantations	microbial biomass	soil sampling + modification of chloroform fumigation extraction	2003	μg C/g OM	42
	Rh	soil sampling + lab incubation	2003	μg C/g OM	42
	SCE	gas exchange measurements	2002-2004	μmolCO2/m2/s	42
UMBS_populus(eur.)	microbial biomass	chloroform fumigation extraction	1993	mg C/g soil	50
	total biomass	harvest	1992	g/m2	51
UMBS_populus(trem.)	total biomass	harvest	1995	g/m2	52
	Rh	litter incubation	1998	mg C	53
	SCE	infrared gas analyzer	1995	μmol/m2/s	52
USDA Placerville	Rh	soil incubation	1993	μg CO2-C/g soil/day	54
	SCE	monitored froom gas wells at 15 and 30 cm depth, SCE was calculated using the profile method	1991, 1993, 1996	kg C/m2	55
	soil C	soil sampling + elemental analyzer	1996	mg/g	55
Virginia	SCE	infrared gas analyzer, with a dynamic closed cuvette	2004	μmol CO2/m2/s	56

 DOI: 10.1038/NGEO844

4: Types and amount of N added to the plots in the different experiments.

Site Name	Treatments	Type	N quantity (g/m2/year)
Bear Brooks Watershed (Betula)	Fertilization	NO3	2.8
Bear Brooks Watershed (Betula)+	Fertilization	NO3	5.6
Bear Brooks Watershed (Fagus)	Fertilization	NO3	2.8
Bear Brooks Watershed (Picea)	Fertilization	NO3	2.8
Barro Colorado Nature Monument	Fertilization	coated urea ([(NH2)2CO])	12.5
Birmensdorf (acidic, fert)	CO2xFertilizationxSoil	NH4NO3	5 (1995-1996), 7 (1997-1998)
Birmensdorf (calcareous, fert)	CO2xFertilizationxSoil	NH4NO3	5 (1995-1996), 7 (1997-1998)
Birmensdorf (acidic, not.fert)	*CO2xFertilizationxSoil*	*NH4NO3*	*0.5 (1995-1996), 0.7 (1997-1998)*
Birmensdorf (calcareous, not fert)	*CO2xFertilizationxSoil*	*NH4NO3*	*0.5 (1995-1996), 0.7 (1997-1998)*
Boulder	Fertilization	NH4NO3	15
Central Alaska	Fertilization	NH4NO3	20 in 2002-2003, 10 thereafter (N)
Cedar Creek	Fertilization	NH4NO3	10
Dinghushan Biosphere Reserve (Pinus)	Fertilization	NH4NO3	5
Dinghushan Biosphere Reserve (Pinus)+	Fertilization	NH4NO3	10
Dinghushan Biosphere Reserve (Mixed)	Fertilization	NH4NO3	5
Dinghushan Biosphere Reserve (Mixed)+	Fertilization	NH4NO3	10
Dinghushan Biosphere Reserve (Cryptocarya)	Fertilization	NH4NO3	5
Dinghushan Biosphere Reserve (Cryptocarya)+	Fertilization	NH4NO3	10
Dinghushan Biosphere Reserve (Cryptocarya)++	Fertilization	NH4NO3	15
Dinghushan Biosphere Reserve (Cryptocarya)+++	Fertilization	NH4NO3	30
Dinghushan Biosphere Reserve (Schima)	Fertilization	NH4NO3	5
Dinghushan Biosphere Reserve (Schima)+	Fertilization	NH4NO3	10
Dinghushan Biosphere Reserve (Schima)++	Fertilization	NH4NO3	15
Dinghushan Biosphere Reserve (Schima)+++	Fertilization	NH4NO3	30
Dossi (Faidherbia anf Vitellaria)	Fertilization	urea 46%N, TSP 21% P, KCl	8, 5 and 4 respectively
Duke_temperateforest	Fertilization	NH4NO3	350 mg N
Duke_temperateforest+	Fertilization	NH4NO3, Na2HPO4.7H20	350 mg N + 70 mg P
DukeFACE (fert)	CO2xFertilization	NH4NO3	11.2
DukeFACE (not fert)	*CO2xFertilization*	*NH4NO3*	*0*
Escambia County	Fertilization	DAP (diammonium phosphate)	4.5
EUROFACE (all species, fert)	CO2xFertilization	balanced fertilizer	21.2 N (in 2002), 29 N (in 2003-2004) (for other elements see paper)
EUROFACE (all species, not fert)	*CO2xFertilization*	*balanced fertilizer*	*0*

Flakaliden	Fertilization	fertilizer mix (see paper)	based on foliar nutrient analysis every year
Glendevon (all species, fert)	CO2xFertilization	N (plus a balanced supply of other nutrients)	7
Glendevon (all species, not fert)	*CO2xFertilization*	*N (plus a balanced supply of other nutrients)*	*0*
Golfo Dulce Forest Reserve	Fertilization	NH4NO3	15
Greene County	Fertilization	DAP (diammonium phosphate)	4.5
Harvard Forest_mixed	Fertilization	NH4NO3	5 (first year only 3.7)
Harvard Forest_mixed+	Fertilization	NH4NO3	15 (first year only 12)
Harvard Forest_pine	Fertilization	NH4NO3	5 (first year only 3.7)
Harvard Forest_pine+	Fertilization	NH4NO3	15 (first year only 12)
Heinola	FertilizationxWater	(NH4)2SO4, urea, NH4NO3	63.3 (total over 35 years)
Hubbard Brook Experimental Forest	Fertilization	macro-/micronutrient mix	see paper (16.7 N)
Itatinga Experimental Station	Fertilization	(NH4)2SO4	12
Michigan_A	Fertilization	NaNO3	3
Michigan_B	Fertilization	NaNO3	3
Michigan_C	Fertilization	NaNO3	3
Michigan_D	Fertilization	NaNO3	3
Norrliden	Fertilization	urea and NH4NO3	6
Norrliden+	Fertilization	urea and NH4NO3, triple superphosphate, KCl	6, 4, 7.6 respectively
Norrliden2N	Fertilization	urea and NH4NO3	12
Norrliden+N	Fertilization	urea and NH4NO3, triple superphosphate, KCl	12, 4, 7.6 respectively
Sahalahti	FertilizationxWater	(NH4)2SO4, urea, NH4NO3	101.4 (total over 35 years)
Sambong Exhibition Forest	Fertilization	urea, superphosphate and KCl	11.2, 7.5, 3.7 respectively
Santa Rosa County (Populus)	Fertilization	N	5.6
Santa Rosa County (Populus)+	Fertilization	N	11.2
Santa Rosa County (Populus)++	Fertilization	N	22.4
Santa Rosa County (Pine)	Fertilization	N	5.6
Santa Rosa County (Pine)+	Fertilization	N	11.2
Santa Rosa County (Pine)++	Fertilization	N	22.4
Santa Rosa County (Populus, fert x H2O)	FertilizationxWater	47% urea, 29% NH4, 24% NO3	5.6
Santa Rosa County (Populus, fert x H2O)+	FertilizationxWater	47% urea, 29% NH4, 24% NO3	11.2
Santa Rosa County (Populus, fert x H2O)++	FertilizationxWater	47% urea, 29% NH4, 24% NO3	22.4
Santa Rosa County (Platanus, fert x H2O)	FertilizationxWater	47% urea, 29% NH4, 24% NO3	5.6
Santa Rosa County (Platanus, fert x H2O)+	FertilizationxWater	47% urea, 29% NH4, 24% NO3	11.2
Santa Rosa County (Platanus, fert x H2O)++	FertilizationxWater	47% urea, 29% NH4, 24% NO3	22.4
Santa Rosa County (Pinus, fert x H2O)	FertilizationxWater	47% urea, 29% NH4, 24% NO3	5.6
Santa Rosa County (Pinus, fert x H2O)+	FertilizationxWater	47% urea, 29% NH4, 24% NO3	11.2

 DOI: 10.1038/NGEO844

Santa Rosa County (Pinus, fert x H2O)++	FertilizationxWater	47% urea, 29% NH4, 24% NO3	22.4
Santa Rosa County (Quercus, fert x H2O)	FertilizationxWater	47% urea, 29% NH4, 24% NO3	5.6
Santa Rosa County (Quercus, fert x H2O)+	FertilizationxWater	47% urea, 29% NH4, 24% NO3	11.2
Santa Rosa County (Quercus, fert x H2O)++	FertilizationxWater	47% urea, 29% NH4, 24% NO3	22.4
Savannah River	FertilizationxWater	balanced liquid fertilizer	between 4 and 120 depending on species
SETRES_F	FertilizationxWater	urea	objective to maintain foliar N of 1.3%
SETRES_HF	FertilizationxWater	urea	objective to maintain foliar N of 1.3%
Turkey Hill Plantations (Acer)	Fertilization	macro-/micronutrient mix	see paper (16.7 N)
Turkey Hill Plantations (Quercus)	Fertilization	macro-/micronutrient mix	see paper (16.7 N)
UMBS_populus(eur. fert)	CO2xFertilization	high N soil	15.1 g/kg soil available N
UMBS_populus(eur. fert x CO2)	*CO2xFertilization*	*low N soil*	*4.55 g/kg soil available N*
UMBS_populus(trem.II fert)	CO2xFertilization	high N soil	mineralization: 89 ng/g/day (low) and 333 (high); soil N: 210 μg/g soil (low), 970 (high); C:N 14.8 (low) and 13.3 (high)
UMBS_populus(trem.II fert x CO2)	*CO2xFertilization*	*low N soil*	*mineralization: 89 ng/g/day (low) and 333 (high); soil N: 210 μg/g soil (low), 970 (high); C:N 14.8 (low) and 13.3 (high)*
UMBS_acer(fert)	CO2xFertilization	high N soil	mineralization: 89 ng/g/day (low) and 333 (high); soil N: 210 μg/g soil (low), 970 (high); C:N 14.8 (low) and 13.3 (high)
UMBS_acer(fert x CO2)	*CO2xFertilization*	*low N soil*	*mineralization: 89 ng/g/day (low) and 333 (high); soil N: 210 μg/g soil (low), 970 (high); C:N 14.8 (low) and 13.3 (high)*
UMBS_populus(trem.III fert)	CO2xFertilization	high N soil	mineralization: 89 ng/g/day (low) and 333 (high); soil N: 210 μg/g soil (low), 970 (high); C:N 14.8 (low) and 13.3 (high)
UMBS_populus(trem.III fert x CO2)	*CO2xFertilization*	*low N soil*	*mineralization: 89 ng/g/day (low) and 333 (high); soil N: 210 μg/g soil (low), 970 (high); C:N 14.8 (low) and 13.3 (high)*
USDA Placerville (medium fert)	CO2xFertilization	(NH4)2SO4	20
USDA Placerville (high fert)	CO2xFertilization	(NH4)2SO4	10
USDA Placerville (not fert)	*CO2xFertilization*	*(NH4)2SO4*	*0*
Vielsalm (fert)	CO2xFertilization	liquid fertilizer	5L per growing season
Vielsalm (not fert)	*CO2xFertilization*	*liquid fertilizer*	*0*
Virginia	Fertilization	urea and superphosphate	11.2 and 8.4 respectively

3.2. Appendix 2: Site information and data used in the comparison of forests exposed to low versus high N deposition

Background information and data for the sites used in the comparison of heterotrophic respiration and soil CO_2 efflux between forests exposed to low and high N deposition (threshold: wet deposition = 5.5 kg N ha^{-1} a^{-1}; Figures 3 and 4). Data provided by Law should not be used without permission (bev.law@oregonstate.edu).

Plot name	Climatic region	Species	NPP g C m^{-2} a^{-1}	SCE g C m^{-2} a^{-1}	Rh g C m^{-2} a^{-1}	Latitude	Longitude	Wet deposition	Source
CA Thompson 1	Boreal	Picea mariana Mill.	261	551	385	55.88 N	98.33 W	2.7	57
DE Bornhoved	Temperate	Fagus sylvatica L.	656	539		54.10 N	10.23 E	9.9	58
DE Hesse	Temperate	Fagus sylvatica L.	939	646	370	48.67 N	7.07 E	12.4	59
DE Lei 1	Temperate	Fagus sylvatica L.	649		321	51.33 N	10.36 E	9.8	59
DE Lei 2	Temperate	Fagus sylvatica L.	886		268	51.33 N	10.36 E	9.8	59
DE Lei 3	Temperate	Fagus sylvatica L.	599		302	51.33 N	10.36 E	9.8	59
DE Lei 4	Temperate	Fagus sylvatica L.	909		328	51.33 N	10.36 E	9.8	59
DE Tharandt 1	Temperate	Picea abies L.	655		323	50.91 N	13.46 E	11.3	59
DE Tharandt 2	Temperate	Picea abies L.	1199		344	50.93 N	13.48 E	11.3	59
DE Tharandt 3	Temperate	Picea abies L.	761		336	50.93 N	13.46 E	11.3	59
DE Waldstein	Temperate	Picea abies L.	665	711	262	50.20 N	11.88 E	12.7	59
DE Wetstein	Temperate	Picea abies L.	777		275	50.45 N	11.46 E	11.7	59
DK Soroe	Temperate	Fagus sylvatica L.	1035		369	55.49 N	11.65 E	9.0	59
IT Collelongo	Temperate	Fagus sylvatica L.	639	879	257	41.85 N	13.59 E	10.0	59
IT Monte di Mezzo	Temperate	Picea abies L.	801	803	406	41.75 N	14.88 E	8.2	60
JP Takayama	Temperate	Quercus crispula Bl.	744	886		36.10 N	137.41 E	5.4	61,62
NL Loobos	Temperate	Pinus sylvestris L.	420		359	52.17 N	5.74 E	13.3	59
RU Zotino	Boreal	Pinus sylvestris L.	214	258		60.72 N	89.13 E	2.7	63
SE Flakaliden 1	Boreal	Picea abies L.	389		260	64.12 N	19.45 E	3.1	59

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SE Flakaliden 2	Boreal	Picea abies L.	156	1214	476	64.12 N	19.45 E	3.1	[64,65]
US Andrews 1	Temperate	Pseudotsuga menziesii Franco	1102	1752	461	44.26 N	122.20 W	1.3	Law (unpublished)
US Andrews 2	Temperate	Pseudotsuga menziesii Franco	1095	2054	653	44.25 N	122.20 W	1.3	Law (unpublished)
US Andrews 4	Temperate	Pseudotsuga menziesii Franco	1160	1590	675	44.25 N	122.20 W	1.3	Law (unpublished)
US Andrews 5	Temperate	Pseudotsuga menziesii Franco	969	1483	670	44.23 N	122.18 W	1.3	Law (unpublished)
US Andrews 6	Temperate	Pseudotsuga menziesii Franco	1044	1362	595	44.25 N	122.18 W	1.3	Law (unpublished)
US Andrews 7	Temperate	Pseudotsuga menziesii Franco	836	1834	352	44.27N	122.22 W	1.3	Law (unpublished)
US Andrews 8	Temperate	Pseudotsuga menziesii Franco	926	2288	524	44.27 N	122.23 W	1.3	Law (unpublished)
US Andrews 9	Temperate	Pseudotsuga menziesii Franco	804	2079	398	44.26 N	122.19 W	1.3	Law (unpublished)
US Cascade Head 4	Temperate	Tsuga heteropylla Sarg.	682	1265	411	45.11 N	123.88 W	3.7	Law (unpublished)
US Cascade Head 5	Temperate	Tsuga heteropylla Sarg.	511	1240	367	45.11 N	123.88 W	3.7	Law (unpublished)
US Cascade Head 6	Temperate	Tsuga heteropylla Sarg.	824	754	469	45.09 N	123.88 W	3.7	Law (unpublished)
US Cascade Head 7	Temperate	Tsuga heteropylla Sarg.	649	896	328	45.09 N	123.88 W	3.7	Law (unpublished)
US Cascade Head 8	Temperate	Tsuga heteropylla Sarg.	893	1131	448	45.09 N	123.88 W	3.7	Law (unpublished)
US Cascade Head 9	Temperate	Tsuga heteropylla Sarg.	657	1216	534	45.07 N	123.89 W	3.7	Law (unpublished)
US Metolius	Temperate	Pinus ponderosa Laws.	405	677	292	44.42 N	121.67 W	1.0	Law (unpublished)
US Metolius 1	Temperate	Pinus ponderosa Laws.	258	501	392	44.44 N	121.57 W	1.0	Law (unpublished)
US Metolius 3	Temperate	Pinus ponderosa Laws.	149	480	206	44.43 N	121.61 W	1.0	Law (unpublished)
US Metolius 4	Temperate	Pinus ponderosa Laws.	356	498	192	44.43 N	121.59 W	1.0	Law (unpublished)
US Metolius 5	Temperate	Pinus ponderosa Laws.	372	533	316	44.44 N	121.59 W	1.0	Law (unpublished)
US Metolius 6	Temperate	Pinus ponderosa Laws.	448	749	337	44.45 N	121.56 W	1.0	Law (unpublished)
US Metolius 7	Temperate	Pinus ponderosa Laws.	543	1039	357	44.43 N	121.67 W	1.0	Law (unpublished)
US Metolius 8	Temperate	Pinus ponderosa Laws.	246	558	290	44.45 N	121.67 W	1.0	Law (unpublished)
US Metolius 9	Temperate	Pinus ponderosa Laws.	639	1019	300	44.46 N	121.66 W	1.0	Law (unpublished)
US Metolius young	Temperate	Pinus ponderosa Laws.	337	541	280	44.43 N	121.57 W	1.0	Law (unpublished)
US Morgan Monroe	Temperate	Acer saccharum Marsh.	976	852	650	39.32 N	86.42 W	5.7	[66]
US UMBS 1	Temperate	Populus grandidentata Michx.	442	782	409	45.59 N	84.71 W	5.4	[67]
US UMBS 2	Temperate	Populus grandidentata Michx.	488	782	432	45.59 N	84.71 W	5.4	[67]
US UMBS 3	Temperate	Populus grandidentata Michx.	524	1090	441	45.59 N	84.71 W	5.4	[67]
US UMBS 4	Temperate	Populus grandidentata Michx.	480	930	440	45.59 N	84.71 W	5.4	[67]

4. Figures

Figure S1: Effect of experimental N-fertilization on decomposition of different litter types, as calculated by meta-analysis. Positive values indicate that N addition increased the factor, negative values indicate a decrease. Error bars indicate the 95% confidence interval. Data listed are the weighted means for n data points, which is listed along the y-axis. Listed are all datapoints, easily decomposable litter from Betula, Acer and Populus, litter that is difficult to decompose from Quercus, Pinus, Larix, Picea and Fagus, forest litter that was not separated between species (Mixed), and tropical litter.

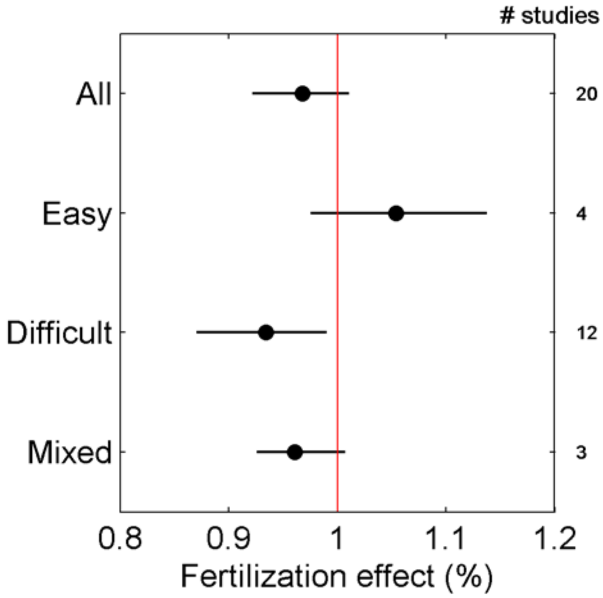

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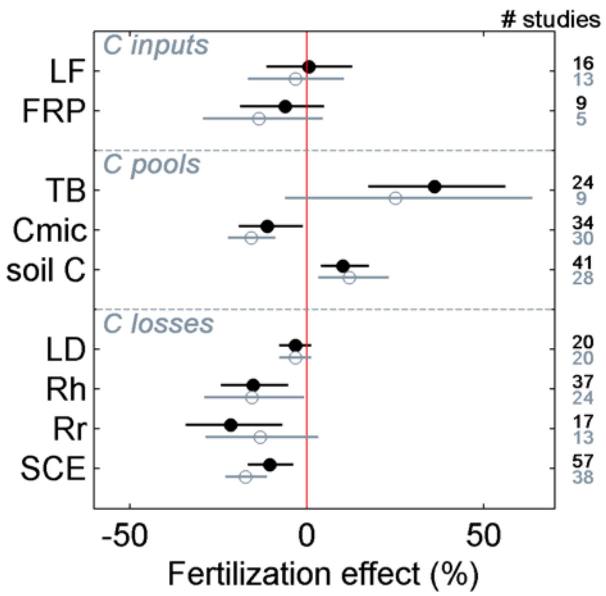
Figure S2: Effect of experimental N-addition on various C pools and fluxes as calculated by meta-analysis. The black circles are exactly the same as in Figure 1 (*i.e. all data included*); the grey circles and error bars are results obtained by excluding all forests younger than 5 years and/or enriched with CO_2 from the meta-analysis. Positive values indicate that N addition increased the factor, negative values indicate a decrease. Error bars indicate the 95% confidence interval. Data are the weighted means for n data points (n is listed along the righthand axis). Parameters listed are C inputs: litterfall (LF) and fine root production (FRP), C pools: total tree biomass (TB), microbial biomass (Cmic) and soil C content (soil C), and C losses: litter decomposition (LD), heterotrophic respiration (Rh), root respiration (Rr) and soil CO_2 efflux (SCE).



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