SI Appendix

Supplementary Tables

Table S1. Selected models explaining soil food web parameters.

	Intercept	Spatial filters			Land use			Soil properties		
		Parameter value	Parameter	*P*	Parameter value	Parameter	*P*	Parameter value	Parameter	*P*
S	16.00				2.20	IntensityL	0.04	9.32	moist	0.042
					2.27	IntensityM		-5.71	moist*IntL	
								-8.43	moist*IntM	
								-2.02	Ntot	0.034
DivS	2.06							1.73	moist	0.0005
TLm	3.30							-0.24	pH	0.034
								0.01	pH^2	0.044
TLM	3.92	-0.33	Filter3	0.032						
Log10(PathRD)	-1.70	-1.80	Filter1	0.0024	0.39	IntensityL	<0.0001			
Log10(PathFB)	-0.14	-1.23	Filter1	<0.0001				0.009	TOC	0.42
		0.20	Filter3	0.60				-0.15	Filter3*TOC	0.009
Pathfungi	0.46	-1.92	Filter3	0.0002				0.08	TOC	0.0001
Pathbact		0.05	Filter1	<0.0001	0.01	IntensityL	<0.0001	0.05	moist	0.0011
								0.03	bulkdens	0.0007
								0.04	Ntot	0.01
Total biomass	-0.08	0.08	Filter5	0.21	0.049	IntensityL	<0.0001	0.10	bulkdens	0.0001
								0.008	TOC	0.009
								-0.063	Filter5*TOC	0.014
Log10(Pathroot)		-1.67	Filter1	0.0045	0.57	IntensityL	<0.0001			
Log10(FB)	0.08	-0.79	Filter1	<0.0001				-0.79	moist	0.0016
								0.24	bulkdens	0.016

Abbreviations: S = number of functional groups, DivS = diversity of functional groups, TLm = mean trophic level, TLM = maximum trophic level, PathRD = ratio of standardized biomass of root and detritus energy channel, PathFB = ratio of standardized biomass of fungal and bacterial energy channel, Pathfungi = standardized biomass of fungal energy channel, Pathbact = standardized biomass of bacterial energy channel, Total biomass = total biomass of the soil food web, Pathroot = standardized biomass of the root energy channel, FB = fungal/bacterial biomass ratio, moist = moisture content, bulkdens = bulkdensity, IntL = permanent grassland, IntM = medium intensity rotation, Ntot = total soil N content, TOC = total soil organic C content, WHC = water holding capacity.

Table S2. Selected models for explaining the biomass of individual functional groups of the soil food web.

	Intercept	Spatial filters			Land use			Soil properties		
		Parameter value	Parameter	*P*	Parameter value	Parameter	*P*	Parameter value	Parameter	*P*
Fungi	0.06	-0.06	Filter5	0.008	0.03	IntensityL	<0.0001	-0.07	WHC	0.0001
Bacteria	-0.02	0.05	Filter1	<0.0001	0.01	IntensityL	<0.0001	0.08 0.017	moist bulkdens	<0.0001 0.001
Log10(F/B ratio)		-0.79	Filter1	<0.0001				-0.79 0.24	moist bulkdens	0.0016 0.016
Log10(AM fungi)	-2.93	-1.70	Filter1	0.0046	0.58	IntensityL	<0.0001			
Fungivorous nematodes	$1.88*10^{-6}$							$-3.8*10^{-6}$	moist	0.039
Log10(Bacterivorous nematodes)	-5.25	1.06	Filter1	0.01						
Omnivorous and predatory nematodes	$2.8*10^{-6}$	$-1.9*10^{-6}$	Filter2	0.0055				$-2.2*10^{-7}$ $-6.2*10^{-8}$	pH TOC	0.018 0.035
Plant parasitic nematodes	$-5.8*10^{-6}$	$1.44*10^{-5}$ $-9.9*10^{-6}$	Filter1 Filter2	0.0017 0.011				$1.30*10^{-6}$	pH	0.044
Log10(Plant-associated nematodes)	-6.25	-1.04	Filter4	0.03	0.25	IntensityL	0.047			
Fungivorous mites	$8.1*10^{-7}$	$1.49*10^{-5}$	Filter3	0.033	$2.35*10^{-6}$	IntensityL	0.01	$-3.05*10^{-6}$ $5.17*10^{-7}$ $-1.07*10^{-4}$	WHC LOI Filter3*WHC	0.57 0.029 <0.0001
Fungivorous Collembola	$7.29*10^{-5}$	$-7.3*10^{-5}$ $3.09*10^{-5}$ $4.00*10^{-5}$	Filter3 Filter4 Filter6	<0.0001 0.0031 0.0002						
Log10(Predatory mites	-5.9	-2.80	Filter3	0.0004	0.29	IntensityL	0.04			
Earthworms	-0.0012				0.0012 0.0015	IntensityM IntensityL	0.0024	-0.03 0.10 0.0029	moist $(moist)^2$ bulkdens	0.0082 <0.0001 0.01

	Intercept	Spatial filters			Land use			Soil properties		
		Parameter value	Parameter	*P*	Parameter value	Parameter	*P*	Parameter value	Parameter	*P*
Enchytraeids	0.00008				0.001	IntensityL	<0.0001	-0.00001	pH	
								-0.0001	IntL*pH	<0.0001
								0.0004	moist	0.025
Log10(Flagellates)	-5.93	1.67	Filter1	<0.0001				2.02	moist	0.0004
		-0.98	Filter3	0.0064				0.86	bulkdens	0.0007
Log10(Amoebae)	-6.27	1.28	Filter2	0.0004				2.19	moist	0.0003
								1.37	bulkdens	<0.0001
								0.05	Ctot	0.0039

Abbreviations: LOI = loss-on-ignition, Ctot = total soil C, rest as in table S1.

Table S3. Effect of removal of variable classes from selected models (Tables 1) explaining ecosystem processes on model R-squared values and AIC.

	Pot N min		***N leached***		***N_2O***		***CO_2***		***CH_4***		***DOC leached***	
	Explained variance	AIC	Explained variance	AIC	Explained variance	AIC	Explained variance	AIC	Explained variance	AIC	Explained variance	AIC
Full model	0.45	392.3	0.34	893.9	0.17	156.7	0.53	211.8	0.24	9.63	0.77	759.3
Filters removed	0.14	412.5	0.17	904.4	0.06	162.5	0.41	223.1			0.56	785.1
Soil properties removed	0.14	429.9										
Land use removed									0.11	15.36	0.46	804.8
N and C stocks removed												
Soil food web structure removed	0.32	400.5					0.42	222.9	0.19	11.57		
Ind. group biomass removed			0.12	906.1	0.10	160.2	0.33	230.7	0.19	11.64	0.57	788.7

Table S4. Management and soil properties for the three land use forms in Sweden (Scania, 7.8/6.6/9.6 °C mean/min/max annual temperature, 666 mm mean annual precipitation).

[SE]	**L** **Pasture**	**M** **Rotation**	**H** **Intensive Rotation**
Description of crop/vegetation during sampling (2008/2009)	permanent grassland	ley in rotation	winter wheat
Management regime – history	permanent grassland (not tilled for at least 10 years)	lay for hay or grass seed production or catch crop during winter/ winter wheat or spring barley or lay for hay/ potato or spring barley or winter wheat	before winter wheat: carrot or winter wheat or spring barley/ sugar beets or spring barley or winter wheat
Most important management practices	grazing by cows or horses	cutting/harvesting, no tillage during the year of lay	harvesting, tillage (annually), weed and pest management when necessary
Fertilizer input *	once/year in spring; granules	once/year in spring; granules	once/year in spring; granules
N (kg ha^{-1} y^{-1})	10 (0)	169 (112)	166 (134)
P (kg ha^{-1} y^{-1})	1 (0)	18 (16)	16 (21)
K (kg ha^{-1} y^{-1})	1 (0)	35 (33)	41 (36)
FAO soil type **	Calcaric Cambisol	Calcaric Cambisol	Calcaric Cambisol
Total Organic Carbon (%)	5.21	2.61	2.54
Total Carbon (%)	6.34	2.70	2.86
Total N (%)	0.41	0.21	0.17
C/N	13.84	13.15	16.55
pH	7.60	7.53	7.65
Moisture (g g^{-1})	0.31	0.20	0.19
Bulk Density (g cm^{-3})	0.95	1.31	1.19
Ca (g kg^{-1})	10.93	5.80	7.10
P (mg kg^{-1})	56.20	17.60	38.60
K (mg kg^{-1})	229.20	89.50	123.50
Mg (mg kg^{-1})	314.70	101.40	101.60
S (mg kg^{-1})	27.50	9.60	20.90

*average values for the years of sampling and for the previous three years before sampling (in parenthesis)

**European soil database (http://eusoils.jrc.ec.europa.eu)

Table S5. Management and soil properties for the three land use forms in United Kingdom (Chilterns, 9.5/5.5/13.5 °C mean/min/max annual temperature, 625 mm mean annual precipitation).

[UK]	**L** **Pasture**	**M** **Rotation**	**H** **Intensive Rotation**
Description of crop/vegetation during sampling (2008/2009)	permanent grassland	field beans	winter wheat
Management regime – history	permanent grassland (not tilled for at least 10 years)	continuous 6 or 7 year rotation with wheat/barley and two different break crops (oil seed rape and field beans)	continuous 3 or 4 year rotation with wheat/barley and oil seed rape as the only break crop
Most important management practices	grazing by sheep	harvesting tillage (annually) fungicides/herbicides/insecticides (biannually)	harvesting tillage (annually), fungicides/herbicides (3 times per year), insecticides (annually), growth regulator (biannually) *sewage sludge or municipal compost (at 20% of sampling sites)*
Fertilizer input *	once/year; March; only for one site; granules	once/year; after soil analyses; granules	2 times/year; late March and late April; granules
N (kg ha^{-1} y^{-1})	9 (9)	0 (169)	173 (171)
P (kg ha^{-1} y^{-1})	5 (5)	99 (93)	35 (25)
K (kg ha^{-1} y^{-1})	5 (5)	60 (111)	25 (74)
FAO soil type**	Chromic Luvisol/Leptosol	Chromic Luvisol/Leptosol	Chromic Luvisol/Leptosol
Total Organic Carbon (%)	3.71	2.12	3.00
Total Carbon (%)	6.46	4.11	6.49
Total N (%)	0.39	0.24	0.27
C/N	9.36	8.94	11.04
pH	7.22	7.41	7.64
Moisture (g g^{-1})	0.18	0.16	0.16
Bulk Density (g cm^{-3})	0.82	1.30	1.15
Ca (g kg^{-1})	15.90	11.20	12.80
P (mg kg^{-1})	38.06	21.88	22.16
K (mg kg^{-1})	316.79	179.76	182.52
Mg (mg kg^{-1})	190.03	129.15	134.35
S (mg kg^{-1})	28.15	16.78	17.90

*average values for the years of sampling and for the previous three years before sampling (in parenthesis)

**European soil database (http://eusoils.jrc.ec.europa.eu)

Table S6. Management and soil properties for the three land use forms in Czech Republic (Ceske Budejovice, 7.9/3/13 °C mean/min/max annual temperature, 700 mm mean annual precipitation)

[CZ]	**L** **Pasture**	**M** **Rotation**	**H** **Intensive Rotation**
Description of crop/vegetation during sampling (2008/2009)	permanent grassland	clover	wheat
Management regime – history	permanent meadow (not tilled for at least 10 years)	continuous rotation with clover - barley or oats - wheat or oil seed rape or potato - maize or winter barley.	before wheat: oil seed rape/wheat/barley/potato
Most important management practices	cutting for forage	cutting/harvesting, no tillage in the year of clover	harvesting, tillage (annually), weed and pest management when necessary
Fertilizer input *	once/year; granules	3 times/year (3:2:1) in early spring, during intensive growth, and after spike appearance; granules	3 times/year (3:2:1) in early spring, during intensive growth, and after spike appearance; granules
N (kg ha^{-1} y^{-1})	3 (3)	26 (138)	138 (138)
P (kg ha^{-1} y^{-1})	-	0 (5)	5 (5)
K (kg ha^{-1} y^{-1})	-	0 (5)	5 (5)
FAO soil type**	Stagnic Luvisol/Dystric Cambisol	Stagnic Luvisol/Dystric Cambisol	Stagnic Luvisol/Stagnic Cambiso/Dystric Cambisoil
Total Organic Carbon (%)	5.54	1.91	1.98
Total Carbon (%)	5.54	1.91	1.98
Total N (%)	0.37	0.15	0.15
C/N	13.63	13.11	13.69
pH	6.41	6.74	6.74
Moisture (g g^{-1})	0.27	0.23	0.23
Bulk Density (g cm^{-3})	0.69	1.26	1.29
Ca (g kg^{-1})	3.20	1.30	1.60
P (mg kg^{-1})	8.00	8.60	17.40
K (mg kg^{-1})	488.10	235.20	272.30
Mg (mg kg^{-1})	309.20	174.70	151.80
S (mg kg^{-1})	91.20	7.80	15.40

*average values for the years of sampling and for the previous three years before sampling (in parenthesis)

**European soil database (http://eusoils.jrc.ec.europa.eu)

Table S7. Management and soil properties for the three land use forms in Greece (Kria Brisi, 14/4/31 °C mean/min/max annual temperature, 485 mm mean annual precipitation)

[GR]	**L** **Pasture**	**M** **Rotation**	**H** **Intensive Rotation**
Description of crop/vegetation during sampling (2008/2009)	permanent grassland	clover	barley
Management regime – history	permanent natural grassland (not tilled for at least 20 years)	perennial rotation with clover (*Medicago* for at least 4 years) -tobacco or maize or vetch or barley.	before barley: maize/various legumes/barley/set aside.
Most important management practices	grazing by sheep or horses	cutting (biannually), no tillage during the years of clover	harvesting, tillage (annually), weed and pest management when necessary
Fertilizer input * N (kg ha^{-1} y^{-1}) P (kg ha^{-1} y^{-1}) K (kg ha^{-1} y^{-1})	 - - -	once/year; granules - (65) - (17) - (17)	once/year; granules 80 (53) - (3) - (3)
FAO soil type**	Fluvisol	Fluvisol	Fluvisol
Total Organic Carbon (%)	2.61	2.41	1.79
Total Carbon (%)	3.76	2.63	2.42
Total N (%)	0.21	0.21	0.15
C/N	12.27	12.01	12.33
pH	8.63	8.48	8.60
Moisture (g g^{-1})	0.19	0.26	0.20
Bulk Density (g cm^{-3})	1.26	1.37	1.37
Ca (g kg^{-1})	15.9	12.2	13.9
P (mg kg^{-1})	9.0	16.4	40.3
K (mg kg^{-1})	245.3	140.2	138.2
Mg (mg kg^{-1})	1260.6	607.6	559.8
S (mg kg^{-1})	29.4	21.1	115.9

*average values for the years of sampling and for the previous three years before sampling (in parenthesis)

**European soil database (http://eusoils.jrc.ec.europa.eu)

Table S8. ANOVA table of country and land use effects on soil properties (with farm as a random factor). Underlined values are significant.

	Country		*Land use*		*Country*Land use*	
	$F_{3,16}$	*P*	$F_{2,32}$	*P*	$F_{6,32}$	*P*
Moisture	3.46	0.05	0.91	0.41	1.43	0.24
pH	12.7	0.00017	1.29	0.29	0.62	0.72
Total N	1.49	0.25	6.51	0.0043	0.63	0.70
Total C	1.12	0.37	5.04	0.013	0.63	0.71
Organic C	0.62	0.62	4.41	0.02	0.64	0.70
C/N	9.53	0.0008	2.42	0.10	0.57	0.75
Ca	4.70	0.015	4.70	0.16	0.29	0.94
P	2.99	0.06	0.93	0.41	0.76	0.61
K	5.84	0.007	5.40	0.009	0.31	0.93
Mg	58.2	<0.0001	2.06	0.14	0.415	0.87
S	2.12	0.14	8.65	0.001	0.44	0.85

Table S9: Values for the physiological parameters of the different trophic groups in the food web. For each parameter for each trophic group, we averaged the estimations reported in the literature after review of recent literature on the subject (see references listed below).

Trophic groups	**assimilation efficiency**	**production efficiency**	**death rate (yr^{-1})**
plant parasitic nematodes	0.42	0.31	2.3
phytophagous collembolan	0.34	0.37	1.96
plant associated nematodes	0.42	0.31	6
AM fungi	1	0.44	3.7
saprophytic fungi	1	0.44	3.7
bacteria	1	0.51	9
fungivorous mites	0.5	0.4	1.42
fungivorous nematodes	0.42	0.31	6
fungivorous collembolan	0.34	0.37	1.96
omnivorous collembolan	0.34	0.37	1.96
bacterivorous collembolan	0.34	0.37	1.96
amoeba	0.55	0.58	7.3
flagellates	0.52	0.6	7.3
enchytraeids	0.28	0.29	1.95
earthworms	0.22	0.32	0.14
bacterivorous nematodes	0.54	0.49	14.1
omnivorous and predaceous nematodes	0.55	0.28	5.8
predaceous collembolan	0.34	0.37	1.96
predaceous mites	0.75	0.3	3.44

References used for estimating trophic group physiological parameters:

Barcenas-Moreno G, Gomez-Brandom M, Rousk J, Baath E (2009) Adaptation of soil microbial communities to temperature: comparison of fungi and bacteria in a laboratory experiment. *Global Change Biology* 15:2950–2957.

Berg M et al. (2001) Community food web, decomposition and nitrogen mineralisation in a stratified Scots pine forest soil. *Oikos* 94:130–142.

Bolton P, Phillipson J (1976) Burrowing, feeding, egestion and energy budgets of Allolobophora rosea (Savigny)(Lumbricidae). *Oecologia* 245:225–245.

Brown D, Coiro M (1985) The reproductive capacity and longevity of Xiphinema index(Nematoda: Dorylaimida) from three populations on selected host plants. *REV NEMATOL* 8:171–173.

Burn A (1984) Life cycle strategies in two Antarctic Collembola. *Oecologia* 64:223–229.

Cabrera AR, Cloyd R a., Zaborski ER (2005) Development and reproduction of Stratiolaelaps scimitus (Acari: Laelapidae) with fungus gnat larvae (Diptera: Sciaridae), potworms (Oligochaeta: Enchytraeidae) or Sancassania aff. sphaerogaster (Acari: Acaridae) as the sole food source. *Experimental and Applied Acarology* 36:71–81.

Chen J, Carey JR, Ferris H (2001) Comparative demography of isogenic populations of Caenorhabditis elegans. *Experimental gerontology* 36:431–40.

Chen J, Ferris H (1999) The effects of nematode grazing on nitrogen mineralization during fungal decomposition of organic matter. *Soil Biology and Biochemistry* 31:1265–1279.

Coiro M, Sasanelli N (1995) Life cycle studies of individual Longidorus athesinus (Nematoda) on S. Lucie Cherry. *Nematol medit* 23:329–333.

Coûteaux M, Ogden C (1988) The growth ofTracheleuglypha dentata (Rhizopoda: Testacea) in clonal cultures under different trophic conditions. *Microbial ecology* 15:81–93.

Ferris H, Eyre M, Venette RC, Lau SS (1996) Population energetics of bacterial-feeding nematodes: Stage-specific development and fecundity rates. *Soil Biology and Biochemistry* 28:271–280.

Ferris H, Venette R, Lau S (1997) Population energetics of bacterial-feeding nematodes: carbon and nitrogen budgets. *Soil Biology and Biochemistry* 29:1183–1194.

Gems D (2000) Longevity and ageing in parasitic and free-living nematodes. *Biogerontology* 1:289–307.

Gotoh T, Yamaguchi K, Mori K (2004) Effect of temperature on life history of the predatory mite Amblyseius (Neoseiulus) californicus (Acari: Phytoseiidae). *Experimental & applied acarology* 32:15–30.

Gregoire-Wibo C, Snider R (1977) The intrinsic rate of natural increase: its interest to ecology and its application to various species of collembola. *Ecological Bulletins* 25:442–448.

Hunt H, Coleman D, Ingham E (1987) The detrital food web in a shortgrass prairie. *Biology and Fertility of Soils* 3:57–68.

Kojima K (1985) The life history of Hypogastrura denisana in a culture situation (Collembola: Hypogastrurudae). *Edaphologia* 32:1–10.

Marchant R, Nicholas WL (1974) An energy budget for the free-living nematode Pelodera (Rhabditidae). *Oecologia* 16:237–252.

Mulder C, Baerselman R, Posthuma L (2007) Empirical maximum lifespan of earthworms is twice that of mice. *Age (Dordrecht, Netherlands)* 29:229–31.

Petersen H, Luxton M (1982) A comparative analysis of soil fauna populations and their role in decomposition processes. *Oikos* 39:288–388.

Phillipson J, Abel R, Steel J, Woodell S (1979) Enchytraeid numbers, biomass and respiratory metabolism in a beech woodland-Wytham Woods, Oxford. *Oecologia* 193:173–193.

Rodriguez P, Arrate JA, Martinez-Madrid M (2002) Life history of the oligochaete Enchytraeus coronatus (Annelida, Enchytraeidae) in agar culture. *Invertebrate Biology* 121:350–356.

Rogerson A (1981) The ecological energetics of Amoeba proteus (Protozoa). *Hydrobiologia* 85:117–128.

Römbke J (1991) Estimates of the Enchytraeidae (Oligochaeta, Annelida) contribution to energy flow in the soil system of an acid beech wood forest. *Biology and fertility of soils* 11:255–260.

Rousk J, Bååth E (2007) Fungal and bacterial growth in soil with plant materials of different C/N ratios. *FEMS microbiology ecology* 62:258–67.

Schaefer M (1990) The soil fauna of a beech forest on limestone: trophic structure and energy budget. *Oecologia* 82:128–136.

Scheu S (1991) Mucus excretion and carbon turnover of endogeic earthworms. *Biology and fertility of soils* 12:217–220.

Schiemer F (1983) Comparative aspects of food dependence and energetics of freeliving nematodes. *Oikos* 41:32–42.

Schmidt O, Scrimgeour CM, Curry JP (1999) Carbon and nitrogen stable isotope ratios in body tissue and mucus of feeding and fasting earthworms (Lumbricus festivus). *Oecologia* 118:9–15.

Schrader S, Langmaack M, Helming K (1997) Impact of Collembola and Enchytraeidae on soil surface roughness and properties. *Biology and fertility of soils* 49:396–400.

Six J, Frey SD, Thiet RK, Batten KM (2006) Bacterial and Fungal Contributions to Carbon Sequestration in Agroecosystems. *Soil Science Society of America Journal* 70:555.

Small R, Evans A (1981) Experiments on population growth of the predatory nernatode P~ iolzclzuZus-punctatus in laboratory culture with observations on life history ('). *Revue Nématol* 4:261–270.

Sohlenius B (1980) Abundance, biomass and contribution to energy flow by soil nematodes in terrestrial ecosystems. *Oikos* 34:186–194.

Søvik G, Leinaas H (2003) Adult survival and reproduction in an arctic mite, Ameronothrus lineatus (Acari, Oribatida): effects of temperature and winter cold. *Canadian journal of zoology* 1588:1579–1588.

Standen V (1973) The production and respiration of an enchytraeid population in blanket bog. *The Journal of Animal Ecology* 42:219–245.

Testerink G (1983) Metabolic adaptations to seasonal changes in humidity and temperature in litter-inhabiting Collembola. *Oikos* 40:234–240.

Verhoef H, Prast J, Verweij R (1988) Relative importance of fungi and algae in the diet and nitrogen nutrition of Orchesella cincta (L.) and Tomocerus minor (Lubbock)(Collembola). *Functional Ecology* 2:195–201.

Whalen JK, Parmelee RW (2000) Earthworm secondary production and N flux in agroecosystems: a comparison of two approaches. *Oecologia* 124:561–573.

Wiegert RG, Petersen CE (1983) Energy Transfer in Insects. *Annual Review of Entomology* 28:455–486.

Wolters V (1985) Resource allocation in Tomocerus flavescens (Insecta, Collembola): a study with C-14-labelled food. *Oecologia* 2:229–235.

Wood F (1974) Biology of Seinura demani (Nematoda: Aphelenchoididae). *Nematologica* 20:347–353.

Ydergaard S, Enkegaard A, Brødsgaard H (1997) The predatory mite Hypoaspis miles: temperature dependent life table characteristics on a diet of sciarid larvae, Bradysia paupera and B. tritici. *Entomologia experimentalis et applicata* 85:177–187.

Table S10: Values for the coefficients of feeding preferences used to calculate the diet fraction each prey represents for each predator trophic group (these coefficients were further weighted by corresponding prey biomasses measured in the field). These values were based on estimations reported in the literature (see references listed below).

Predator trophic group j	**Prey trophic groups** i	**Feeding preference** ω_{ij}
plant parasitic nematodes	root	1
phytophagous collembolan	aboveground plant	1
plant associated nematodes	root	1
AM fungi	root	1
saprophytic fungi	detritus	1
bacteria	detritus	1
fungivorous mites	AM fungi	0.5
fungivorous mites	saprophytic fungi	0.5
fungivorous nematodes	AM fungi	0.1
fungivorous nematodes	saprophytic fungi	0.9
fungivorous collembolan	AM fungi	0.475
fungivorous collembolan	saprophytic fungi	0.475
fungivorous collembolan	bacteria	0.05
omnivorous collembolan	detritus	0.25
omnivorous collembolan	AM fungi	0.25
omnivorous collembolan	saprophytic fungi	0.25
omnivorous collembolan	bacteria	0.25
bacterivorous collembolan	bacteria	1
amoeba	bacteria	0.08
amoeba	flagellates	0.9
amoeba	saprophytic fungi	0.01
amoeba	AM fungi	0.01
flagellates	AM fungi	0.05
flagellates	saprophytic fungi	0.05
flagellates	bacteria	0.9
enchytraeids	detritus	0.2
enchytraeids	saprophytic fungi	0.4
enchytraeids	bacteria	0.4
earthworms	detritus	0.2
earthworms	saprophytic fungi	0.4
earthworms	bacteria	0.4
bacterivorous nematodes	bacteria	0.05
bacterivorous nematodes	flagellates	0.95
omnivorous and predaceous nematodes	bacteria	0.0001
omnivorous and predaceous nematodes	amoeba	0.001
omnivorous and predaceous nematodes	flagellates	0.001
omnivorous and predaceous nematodes	plant parasitic nematodes	0.2
omnivorous and predaceous nematodes	plant associated nematodes	0.2
omnivorous and predaceous nematodes	fungivorous nematodes	0.2
omnivorous and predaceous nematodes	bacterivorous nematodes	0.2
omnivorous and predaceous nematodes	enchytraeids	0.2
predaceous collembolan	fungivorous nematodes	0.05
predaceous collembolan	fungivorous collembolan	0.05

predaceous collembolan	omnivorous collembolan	0.05
predaceous collembolan	bacterivorous collembolan	0.05
predaceous collembolan	bacterivorous nematodes	0.05
predaceous collembolan	omnivorous and predaceous nematodes	0.8
predaceous mites	predaceous collembolan	0.2
predaceous mites	omnivorous and predaceous nematodes	0.001
predaceous mites	enchytraeids	0.001
predaceous mites	fungivorous mites	0.2
predaceous mites	fungivorous collembolan	0.2
predaceous mites	omnivorous collembolan	0.2
predaceous mites	bacterivorous collembolan	0.2
predaceous mites	phytophagous collembolan	0.2

References used for estimating coefficients of predator feeding preferences:

Berg M et al. (2001) Community food web, decomposition and nitrogen mineralisation in a stratified Scots pine forest soil. *Oikos* 94:130–142.

Bjørnlund L, Rønn R, Péchy-Tarr M, Maurhofer M, Keel C, Nybroe O (2009) Functional GacS in *Pseudomonas* DSS73 prevents digestion by *Caenorhabditis elegans* and protects the nematode from killer flagellates. *The ISME Journal* 3: 770-779.

Ekelund F (1998) Enumeration and abundance of mycophagous protozoa in soil, with special emphasis on heterotrophic flagellates. *Soil Biology and Biochemistry* 30: 1343-1347.

Hunt H, Coleman D, Ingham E (1987) The detrital food web in a shortgrass prairie. *Biology and Fertility of Soils* 3:57–68.

Schmidt O, Curry JP, Dyckmans J, Rota E, Scrimgeour CM (2004) Dual stable isotope analysis (δ^{13}C and δ^{15}N) of soil invertebrates and their food sources. *Pedobiologia* 48: 171-180.

Table S11. Parameter combinations fitted in the statistical modelling procedure.

Variable class		***Parameter combinations tested***	
1.	Spatial autocorrelation	a)	Filters 1-6
2.	Soil physical and chemical properties	a)	pH, moisture, WHC
		b)	pH+pH^2, moisture+moisture^2, WHC+WHC^2
		c)	All combinations of terms from a and b that were found to improve AIC in phases a and b. (retain quadratic term of any of these two term combinations if found to improve AIC in phase b).
		d)	Interaction terms between parameters that were found to be significant in a and b with parameters from class 1
3.	Land use	a)	H, M, L
		b)	H+M, L
		c)	Interaction terms between parameters that were found to be significant in a and b with parameters from class 1.
4.	C and nutrient stocks	a)	Total C, total N, total organic C, C/N, LOI
		b)	Total C+Total C^2, Total N+Total N^2, TOC+TOC^2, LOI+LOI^2
		c)	All combinations of terms from a and b that were found to improve AIC in phases a and b. (retain quadratic term of any of these two term combinations if found to improve AIC in phase b).
		d)	Interaction terms between parameters that were found to be significant in a and b with parameters from class 1 and 3
5.	Soil food web structure	a)	Number of functional groups, diversity of functional groups, mean trophic level, maximum trophic level, fungal channel biomass, bacterial channel biomass, root channel biomass, total biomass, F/B channel ratio, R/D channel ratio, F/B ratio
		b)	All combinations of terms from a that were found to improve AIC in phase a.
		c)	Interaction terms between parameters that were found to be significant in a and b with parameters from class 1 and 3
6.	Biomass of individual functional groups	a)	fungi, bacteria, AM fungi, nematodes (fungivorous, bacterivorous, omnivorous, predatory, plant-feeding, plant-associated), Collembola (fungal-feeding) , mites (fungal-feeding, predators), earthworms, enchytraeids, protozoa (amoebae, flagellates)
		b)	All combinations of terms from a that were found to improve

	AIC in phase a.
c)	Interaction terms between parameters that were found to be significant in a and b with parameters from class 1 and 3

Supplementary Figures

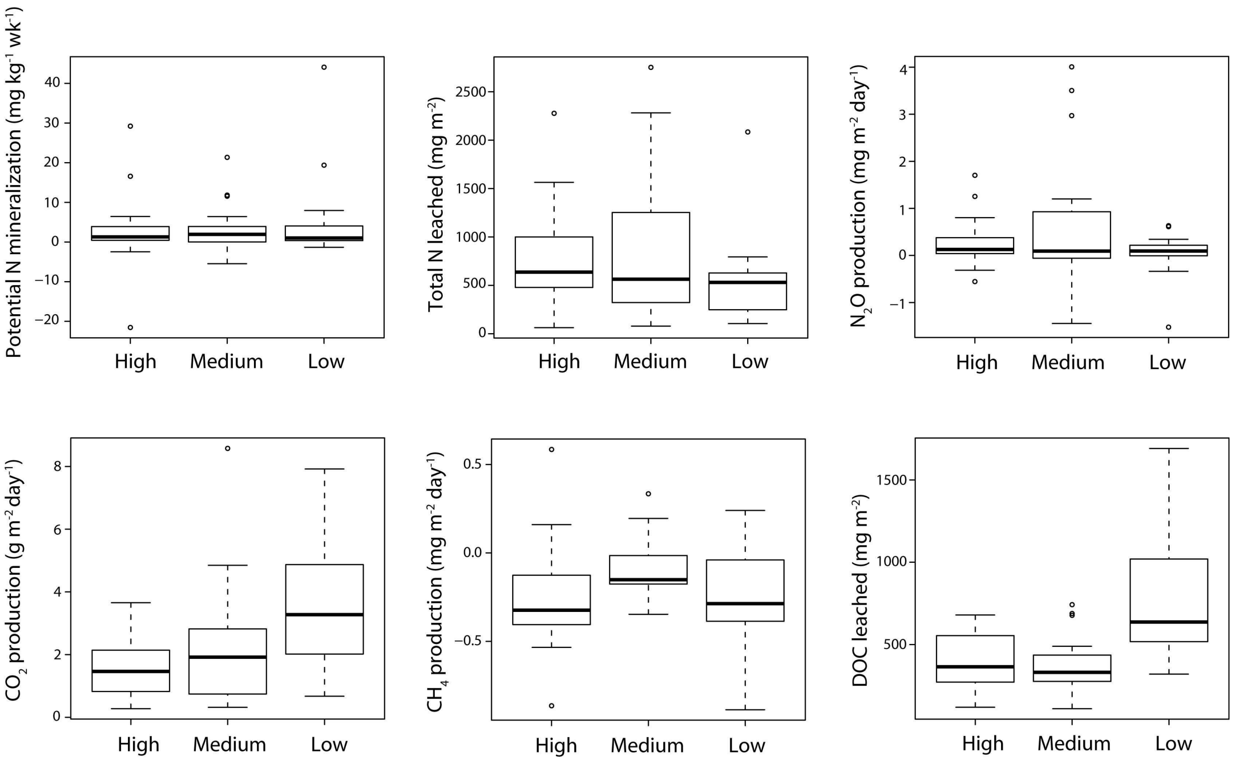

Figure S1. Differences in, and ranges of, ecosystem services and disservices as affected by land use across the four European countries. Boxes represent median and 25th and 75th percentiles, whiskers show maximum and minimum value unless extreme values are present (circles). Intensity effects were significant for CO_2 production ($F_{2,32}$ = 6.94, P = 0.003), CH_4 production ($F_{2,32}$ = 3.35, P = 0.047), and DOC leaching ($F_{2,30}$ = 19.6, P < 0.000).

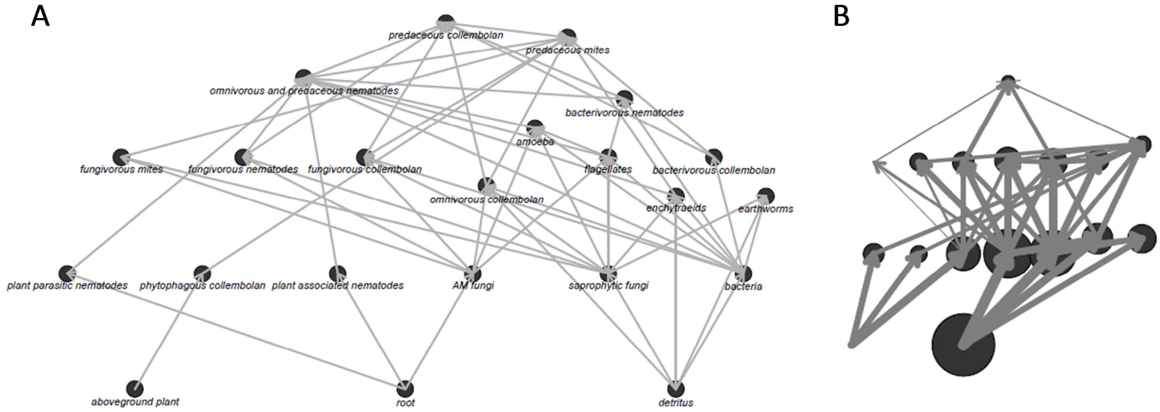

Figure S2: Soil food web diagrams. A. General food web diagram used to estimate the flow-based soil food webs at the different sites. B. Flow-based soil food web in a Swedish farm in a high land use intensity field. Circles represent trophic groups of soil organisms and arrows represent the feeding links between these groups. For panel B, the size of the circles is proportional to the biomass of the trophic groups and the width of the arrows is proportional to the carbon flows between the groups.

Supplementary Methods

Food web analyses and calculations

Biomass calculations

First, the biomass of all measured and counted groups of the soil food web was calculated in terms of kg C m^{-2}. Fatty acids were converted into biomass C using the following factors: bacterial biomass 363.6 nmol PLFA = 1 mg carbon (1). Fungal biomass: 11.8 nmol PLFA = 1 mg carbon (2), AMF biomass: 1.047 nmol NLFA = 1 µg carbon (3). After counting total numbers, nematodes were fixed in 4% formaldehyde and 150 randomly selected nematodes were identified to the genus level (4) and allocated to trophic group (5), and nematode biomass was individually estimated by analysing digital microscope images with a specially developed software tool (6). Collembola were determined to species using keys of Gisin (7), Babenko et al. (8), and Zimbars and Dunger (9). Acari were sorted to suborders using Krantz and Walter (10), and Oribatida were determined to species using keys of Balogh and Mahunka (11) and Weigman (12). Biomass of microarthropods was estimated from body dimensions following (13). Biomasses for all groups were then expressed per square meter using bulk density values.

Estimation of the “flow-based” soil food webs

Carbon flows, expressed as kg C m^{-2} $yr^{-}1$, between trophic groups in soil food webs were estimated as in Hunt et al. (14) from the biomasses of the different trophic groups at a given site (see above), , and from feeding preferences and physiological parameters of the different trophic groups (Table S9 and S10). Feeding rate (kg C m^{-2} yr^{-1}) of trophic group

j on trophic group i is expressed as $F_{ij} = g_{ij} \frac{d_j B_j + \sum_{k=0}^{n} F_{jk}}{a_j p_j}$ where B_j is the biomass of group j, d_j, a_j and p_j are respectively group j death rate, assimilation and production efficiencies, and g_{ij} corresponds to the fraction each prey i represents in diet of trophic group j depending on predator relative feeding preference ω_{ij} weighted by prey biomasses ($g_{ij} = \frac{\omega_{ij} B_i}{\sum_{k=0}^{n} \omega_{kj} B_k}$). The basic assumption underlying this way of calculating feeding rates is that this feeding rate, on an annual basis, balances losses through natural death ($d_j B_j$) and losses through predation ($\sum_{k=0}^{n} F_{jk}$) (14). Parameters used were taken from Hunt et al. (14) and further updated by a review of recent literature on the subject (see Table S9 and S10).

Measures of soil food web structure

We use three types of soil food web measures: diversity indices (number of trophic groups in the food web and Shannon diversity of trophic groups), measures based on trophic position (mean trophic level and maximum trophic level in the food web), and measures based on energy channels (Fungi/Bacteria biomass ratio, fungal channel biomass, bacterial channel biomass, root channel biomass, Fungal/Bacterial channel ratio, Root/Detritus channel ratio).

The trophic position of a species is defined here by the average of the trophic position of the species it consumes weighted by the diet fraction these species represents: $TL_j = 1 + \sum_{i=1}^{S} g_{ij} TL_i$, where TL_j is the trophic level of species j and g_{ij} the fraction of the consumer j's diet derived from the prey i. These "flow-based" trophic levels are computed following the method of Williams and Martinez (15). Average trophic level for each consumer is the sum of all entries in each column of $A = [I - G]^{-1}$ with I the identity matrix and $G = (g_{ij})$.

Fungal, bacterial and root energy channels are measured by the biomass of all the groups belonging to that channel weighted by their contribution to this channel. The contribution of a group to a channel is defined by $C_i = \sum_{j=1}^{S} g_{ij} C_j$ and thus the contribution of each group is equal to the product of A by a vector V, with V_i=1 for the source of the energy channel (either fungi, bacteria or root) and 0 otherwise. We measured two different indices to quantify the fungal and bacterial energy channel. First we summed the biomass of all groups belonging to a given channel weighted by their contribution C_i to this channel. Second, because the order of magnitude of biomasses differs strongly between the trophic groups, we also calculated the energy channels with standardized biomasses of each group by dividing the biomass of one group by the overall mean of that group over all considered food webs (16).

Spatial filters

Two different types of mechanisms can cause spatial structure in a measured variable, (i) known or unknown explanatory variables or (ii) autocorrelation between values of the measured variable. To explicitly incorporate spatial structure into our statistical models we calculated spatial filters using principal coordinates of neighbor matrices (PCNM) (17, 18). This method accounts for the fact that measured variables are structured at different spatial scales; not just at a country scale (which could have been modeled as a random factor), but also within countries and within farms. The following steps were used to create the spatial filters:

1. A distance matrix was calculated from the geographic coordinates of all sites based on Euclidean distances.
2. This distance matrix was truncated at distances above 29.5 km as the minimum spanning tree in the region with the largest spread of field sites (Czech Republic) and all distances larger than 29.5 km were replaced by four times that value prior to PCO as recommended (19)
3. The principal coordinates were computed from this distance matrix.
4. All principal coordinates that corresponded to positive eigenvalues were retained as spatial filters for further analyses as they represent a spectral decomposition of the spatial relationships between sampling sites.

Statistical modeling

Model selection followed a modified version of the procedure described in De Vries et al et al. (20). In this method, we added groups of terms according to a fixed sequential order, compared their influence on model likelihood, selected the variables that gave the greatest improvement to model likelihood, assessed by selecting the model with the lowest Akaike's Information Criterion (AIC), and then retained these terms in the model if they were found to be significant in a chi-squared likelihood ratio deletion test (LRTs) (21). After these tests, another set of variables representing different controls over function were then added and the process was repeated.

The order of addition followed a hypothetical hierarchy of controls over function, starting with spatial filters that either account for autocorrelation between values of the response variable, or for underlying, measured or unmeasured factors such as climate and geology, and ending with soil food web properties. While interrelationships and correlations between predictor variables are unavoidable, we kept the order of the hierarchy such that variables added later in the modelling process were unlikely to influence those that had previously been added. Therefore, if soil food web properties shared explained variance with parameters previously added, but were retained in the model, they explained a unique proportion of variance. In contrast, if they accounted for all the variation explained by a parameter that was added earlier in the modeling process, this parameter then became non-significant. Addition of variables according to this hierarchy of controls does not allow for the disentangling of causative relationships, but if variation accounted for by the more proximate factors was entirely shared by the ultimate causes then these variables would not improve model likelihood when added. For variables for which an optimum of biological activity was expected, quadratic terms were added alongside main terms (e.g. pH, moisture).

First, spatial filters and first order interactions between them were added. For a full list of terms added see Table S11. In the second stage, terms representing hydrology and soil physical properties were added: soil pH, moisture content, and water holding capacity. These variables are largely driven by underlying geology and local hydrology. Once the effects of spatial structure and soil abiotic properties were estimated, we added first order interactions between the retained spatial filters and soil variables, and removed these sequentially by using LRTs, starting with the least significant until only significant interactions remained. The third set of terms consisted of the three land use forms of intensive wheat rotation, extensive rotation, and permanent grassland. The fourth stage of the process was including total N and C stocks, variables that will be affected by management, soils, and climate, but which might explain more or additional variation. Fifth, we estimated soil food web structure effects on processes of C and N cycling, and finally, we tested for effects of individual functional groups of the soil food web on processes of C and N cycling. At the end of each of these steps, interaction terms between retained variables were added to the model and removed by LRTs, until only significant interaction terms remained.

Once this final model was reached we assessed the significance of each term by removing it from the model and performing a LRT. When it was found that terms that were significant earlier in the modelling process were no longer significant in the presence of new variables, the non-significant terms were removed from the model. A measure of model fit of the final model was calculated as the R-squared when fitting a linear regression to the actual data, with the predicted values of the model as the explanatory variable. We also explored how much influence each category of variable had upon overall fit by removing each class of variable from the fitted models and observing the change in AIC and model fit, as calculated above.

References for Supplementary Methods

1. Frostegård Å & Bååth E (1996) The use of phospholipid fatty acid analysis to estimate bacterial and fungal biomass in soil. *Biol Fertil Soils* 22(1-2):59-65.
2. Klamer M & Bååth E (2004) Estimation of conversion factors for fungal biomass determination in compost using ergosterol and PLFA 18 : 2 omega 6,9. *Soil Biol Biochem* 36(1):57-65.
3. Olsson PA, Bååth E, Jakobsen I, & Söderström B (1995) The use of phospholipid and neutral lipid fatty-acids to estimate biomass of arbuscular mycorrhizal fungi in soil. *Mycol Res* 99:623-629.
4. Bongers T (1994) *De nematoden van Nederland (The nematodes of the Netherlands)* (Koninklijke Nederlandse Natuurhistorische Vereniging, Pirola, Schoorl, Utrecht, the Netherlands). In Dutch.
5. Yeates GW, Bongers T, de Goede RGM, Freckman DW, & Georgieva SS (1993) Feeding habits in nematode families and genera - an outline for soil ecologists. *J Nematol* 25:315-331.
6. Sgardelis S, Nikolaou S, Tsiafouli M, Boutsis G, & Karmezi M (2009) A computer-aided estimation of Nematode body size and biomass. in *International Congress on the Zoogeography, Ecology and Evolution of Eastern Mediterranean* (Heraklion, Greece).
7. Gisin H (1960) *Collembolefauna Europes* (Museum d'Histoire Naturelle, Geneve).
8. Babenko A.B., Chernova M.B., Potapov M.B., & S.K. S (1994) *Collembola of Russia and adjacent countries: Family Hypogastruridae* (Nauka, Moscow).
9. Zimbars U & Dunger W (1994) *Synopsis on Palaearctic Collembola: Tullberginae*.
10. Krantz GW & Walter DE (2009) *A Manual of Acarology. Third edition* (Texas Tech University Press, Lubbock, Texas).

11. Balogh J & Mahunka S (1983) *Primitive oribatids of the Palaearctic Region* (Akademia Kiado) p 372.

12. Weigman G (2006) Hommilben (Oribatida). *Die Tierwelt Deutschlands (The animal world of Germany)*. (Goecke & Eversm Keltern), Vol 76, p 520. In German.

13. Lebrun P (1971) Ecologie et Biocoenotigue de Quelques Peuplements d'Arthropodes Edaphiques (Ecology and biocenetic of some species of edaphic arthropods). *Inst. R. Sci. Nat. Belgique* 165:1-203. In French.

14. Hunt HW, *et al.* (1987) The detrital food web in a shortgrass prairie. *Biol Fertil Soils* 3(1):57-68.

15. Williams RJ & Martinez ND (2004) Limits to trophic levels and omnivory in complex food webs: Theory and data. *Am Nat* 163(3):458-468.

16. Holtkamp R, *et al*. (2008) Soil food web structure during ecosystem development after land abandonment. *Appl Soil Ecol* 39(1):23-34.

17. Borcard D & Legendre P (2002) All-scale spatial analysis of ecological data by means of principal coordinates of neighbour matrices. *Ecol Model* 153(1-2):51-68.

18. Legendre P, *et al*. (2002) The consequences of spatial structure for the design and analysis of ecological field surveys. *Ecography* 25(5):601-615.

19. Dray S, Legendre P, & Peres-Neto PR (2006) Spatial modelling: a comprehensive framework for principal coordinate analysis of neighbour matrices (PCNM). *Ecol Model* 196(3-4):483-493.

20. De Vries FT, *et al.* (2012) Abiotic drivers and plant traits explain landscape-scale patterns in soil microbial communities. *Ecol Lett* 15(11):1230-1239.

21. Pinheiro JC & Bates DM (2000) *Mixed effects models in S and S-PLUS* (Springer-Verlag, New York).