



*Supplement of*

## **Modelling root exudation and plant-microbe interactions under CO<sub>2</sub> fertilization in a mature forest**

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## **Supplement**

This supplement contains tables for data displayed in figures

Table S1: Comparison of the fate of additional sequestered C (Figure 4)

	<b>flux_class</b>	<b>flux</b>	<b>Percentage of additional GPP</b>
<b>simulated</b>			
	Ra+BP+CEX	BP	32.6
	Ra+BP+CEX	Ra	37.0
	Ra+BP+CEX	CEX	30.3
	R	Rh	27.8
	R	Ra	37.0
	DCpools	dVeg	19.5
	DCpools	dSOC_deep_soil	7.11
	DCpools	dSOC_top_soil	2.96
	DCpools	dlitter	5.57
<b>observed</b>			
	Ra+BP+CEX	BP	8.97
	Ra+BP+CEX	Ra	31.0
	Ra+BP+CEX	CEX	60.1
	R	Ra	31.0
	R	Rh	55.8
	DCpools	dVeg	-0.196
	DCpools	dSOC_top_soil	-12.4
	DCpools	dlitter	14.1

**Table S2: simulated CO<sub>2</sub> effect on sources and sinks for C in soils at EucFACE (Figure 5)**

<b>flux</b>	<b>values (gC m<sup>-2</sup> yr<sup>-1</sup>)</b>	<b>claa</b>	<b>Panel</b>
l_fall	35.8880639	soil C input	ambient~fluxes
CEX	30.4848970	soil C input	ambient~fluxes
Rh_res	13.1355138	Heterotrophic respiration	ambient~fluxes
Rh_CEX	14.9554148	Heterotrophic respiration	ambient~fluxes
Rh_other	32.7647865	Heterotrophic respiration	ambient~fluxes
growth_deep_soil	3.3953828	microbial growth	ambient~fluxes
growth_top_soil	31.1427913	microbial growth	ambient~fluxes
growth_deep_soil	2.3634779	necromass growth	ambient~fluxes
growth_top_soil	21.6206735	necromass growth	ambient~fluxes
l_fall	3.9742372	soil C input	CO[2]~effect~fluxes
CEX	9.1672716	soil C input	CO[2]~effect~fluxes
Rh_res	1.2881477	Heterotrophic respiration	CO[2]~effect~fluxes
Rh_CEX	4.5165578	Heterotrophic respiration	CO[2]~effect~fluxes
Rh_other	2.6053544	Heterotrophic respiration	CO[2]~effect~fluxes
growth_deep_soil	0.4473033	microbial growth	CO[2]~effect~fluxes
growth_top_soil	4.4116995	microbial growth	CO[2]~effect~fluxes
growth_deep_soil	0.2976769	necromass growth	CO[2]~effect~fluxes

20 **Table S3: Simulated annual main fluxes for microbial, enzyme-mediated nutrient acquisition from organic matter for topsoil in (Figure 6 a)**

Year	flux_residue_2_dom_n	treatment
2013	40.32832	ambient
2014	40.06573	ambient
2015	43.05059	ambient
2016	41.81066	ambient
2017	40.32595	ambient
2018	42.61828	ambient
2019	43.03240	ambient
2013	42.01665	elevated
2014	43.29253	elevated
2015	46.53790	elevated
2016	46.09445	elevated
2017	44.66263	elevated
2018	47.41825	elevated
2019	47.51070	elevated

25 **Table S4: Simulated annual main fluxes for microbial, enzyme-mediated nutrient acquisition from organic matter for topsoil in (Figure 6 b)**

Year	Biochem_min	treatment
2013	6.130665	ambient
2014	6.848546	ambient

2015	7.388745	ambient
2016	6.970970	ambient
2017	5.131872	ambient
2018	6.426970	ambient
2019	8.223400	ambient
2013	7.512194	elevated
2014	8.752846	elevated
2015	8.357885	elevated
2016	9.052025	elevated
2017	6.350718	elevated
2018	7.988040	elevated
2019	9.441283	elevated

**Table S5: Simulated uptake sources (C, N, P) for microbial growth at EucFACE in top soil (50 cm) (Figure 7a)**

<b>flux</b>	<b>Flux_class</b>	<b>fraction</b>	<b>CO2 treatment</b>
soluble litter	organic	0.14	ambient
microbial residue	organic	0.29	ambient
polymeric litter	organic	0.15	ambient
microbial recycling	organic	0.12	ambient
exudation blank	organic	0.30	ambient
soluble litter	organic	0.14	elevated
microbial residue	organic	0.27	elevated
polymeric litter	organic	0.14	elevated
microbial recycling	organic	0.12	elevated
exudation blank	organic	0.34	elevated

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**Table S6: Simulated uptake sources (C, N, P) for microbial growth at EucFACE in top soil (50 cm) (Figure 7b)**

<b>flux</b>	<b>Flux_class</b>	<b>fraction</b>	<b>CO2 treatment</b>
NH4 Uptake	inorganic	0.22	ambient
NO3 Uptake	inorganic	0.01	ambient
AsymN fixation	inorganic	0.01	ambient
soluble litter	organic	0.04	ambient
microbial residue	organic	0.38	ambient
polymeric litter	organic	0.02	ambient
microbial recycling	organic	0.32	ambient
exudation blank	organic	0.01	ambient
NH4 Uptake	inorganic	0.23	elevated
NO3 Uptake	inorganic	0.01	elevated
AsymN fixation	inorganic	0.02	elevated
soluble litter	organic	0.04	elevated
microbial residue	organic	0.36	elevated
polymeric litter	organic	0.01	elevated
microbial recycling	organic	0.32	elevated

exudation blank	organic	0.02	elevated
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**Table S7: Simulated uptake sources (C, N, P) for microbial growth at EucFACE in top soil (50 cm) (Figure 7c)**

<b>flux</b>	<b>Flux_class</b>	<b>fraction</b>	<b>CO2 treatment</b>
PO4 Uptake	inorganic	0.45	ambient
soluble litter	organic	0.01	ambient
microbial residue	organic	0.15	ambient
polymeric litter	organic	0	ambient
microbial recycling	organic	0.39	ambient
PO4 Uptake	inorganic	0.46	elevated
soluble litter	organic	0.01	elevated
microbial residue	organic	0.14	elevated
polymeric litter	organic	0	elevated
microbial recycling	organic	0.39	elevated

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**Table S8: Simulated balance for microbial necromass cycling in top soils (50 cm) (Figure 8)**

<b>element</b>	<b>Flux_class</b>	<b>Value [g m<sup>-2</sup> yr<sup>-1</sup>]</b>	<b>CO2 treatment</b>
carbon	res_in	260.	ambient
carbon	res_out	-260.	ambient
carbon	res_in	295.	elevated
carbon	res_out	-283.	elevated
nitrogen	res_in	41.5	ambient
nitrogen	res_out	-41.6	ambient
nitrogen	res_in	47.1	elevated
nitrogen	res_out	-45.4	elevated
phosphor	res_out	-4.02	ambient
phosphor	biomin_loss	-7.55	ambient
phosphor	res_in	10.5	ambient
phosphor	res_out	-4.25	elevated
phosphor	biomin_loss	-10.8	elevated

phosphor	res_in	11.9	elevated
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**Table S9: Allocation of additional GPP under eCO<sub>2</sub> (Figure B 4)**

<b>Simulation</b>	<b>Sink</b>	<b>Fraction of GPP</b>
With RE	Total_veg_C	0.195
With RE	litter	0.0557
With RE	SOM	0.101
With RE	HetResp	0.278
With RE	AutResp	0.370
Without RE	Total_veg_C	0.291
Without RE	litter	0.0609
Without RE	SOM	0.0173
Without RE	HetResp	0.120
Without RE	AutResp	0.510

**Table S10: Simulated fate of additional sequestered C under eCO<sub>2</sub> (Figure B 5)**

<b>flux_class</b>	<b>flux</b>	<b>Percentage of additional GPP</b>
Ra+BP+CEX	BP	49.0
Ra+BP+CEX	Ra	51.0
R	Rh	12.0
R	Ra	51.0
DCpools	dVeg	29.1
DCpools	dSOC_deep_soil	1.88
DCpools	dSOC_top_soil	-0.16
DCpools	dlitter	6.09

**Table S11: Simulated major mineralization fluxes (Figure B 6)**

<b>Year</b>	<b>treat ment</b>	<b>Heterotrophic respiration [g C m<sup>-2</sup> yr<sup>-1</sup>]</b>	<b>Root respiration [g C m<sup>-2</sup> yr<sup>-1</sup>]</b>	<b>NH<sub>4</sub> Net Mineralization [g N m<sup>-2</sup> yr<sup>-1</sup>]</b>	<b>Biochemical mineralization [g P m<sup>-2</sup> yr<sup>-1</sup>]</b>	<b>PO<sub>4</sub> Net Mineralization [g P m<sup>-2</sup> yr<sup>-1</sup>]</b>
1	aCO2	643.79	381.95	9.13	6.13	0.08
2	aCO2	626.97	356.73	7.86	6.84	0.68
3	aCO2	685.83	375.94	7.16	7.4	0.04
4	aCO2	694.24	367.54	7.27	6.97	-0.04
5	aCO2	581.33	372.34	13.17	5.14	0.21
6	aCO2	626.97	324.3	8.78	6.44	0.02
7	aCO2	721.86	331.5	3.88	8.24	0.2
1	eCO2	695.44	401.17	6.22	7.53	0.25
2	eCO2	713.45	392.76	5.06	8.76	0.88
3	eCO2	760.3	426.39	7.42	8.36	-0.14
4	eCO2	804.74	417.98	5.14	9.04	0.18
5	eCO2	665.41	427.59	13.46	6.35	0.22
6	eCO2	726.67	372.34	9.96	7.99	0.37
7	eCO2	833.56	389.16	3.57	9.45	-0.11

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**Table S12: Mean annual available PO<sub>4</sub> (Figure B 7)**

<b>Year</b>	<b>Available PO<sub>4</sub> [g P m<sup>-2</sup>]</b>	<b>treatment</b>
1	0.15	aCO2
2	0.18	aCO2
3	0.22	aCO2
4	0.15	aCO2
5	0.26	aCO2
6	0.13	aCO2
7	0.18	aCO2
1	0.19	eCO2
2	0.23	eCO2
3	0.24	eCO2
4	0.16	eCO2
5	0.34	eCO2
6	0.17	eCO2
7	0.19	eCO2

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**Table S13: Simulated changes in top soil pools (Figure B 10)**

<b>DOM</b> [g m <sup>-2</sup> yr <sup>-1</sup> ]	<b>Mic</b> [g m <sup>-2</sup> yr <sup>-1</sup> ]	<b>Res</b> [g m <sup>-2</sup> yr <sup>-1</sup> ]	<b>aDOM</b> [g m <sup>-2</sup> yr <sup>-1</sup> ]	<b>aRes</b> [g m <sup>-2</sup> yr <sup>-1</sup> ]	<b>treatment</b>	<b>element</b>
-0.46	2.98	0.08	0.36	-1.32	aCO2	carbon
-0.03	6.02	10.4	4.11	-8.11	eCO2	carbon
-0.05	0.69	-0.05	0.04	-0.21	aCO2	nitrogen
-0.01	1.41	1.66	0.31	-1.3	eCO2	nitrogen
-0.01	0.17	-0.17	0.01	-0.02	aCO2	phosphorus
0	0.34	-0.19	0.04	-0.36	eCO2	phosphorus

Table S14: Simulated changes in soil pools (Figure B 11)

<b>DOM</b> [g m <sup>-2</sup> yr <sup>-1</sup> ]	<b>Mic</b> [g m <sup>-2</sup> yr <sup>-1</sup> ]	<b>Res</b> [g m <sup>-2</sup> yr <sup>-1</sup> ]	<b>aDOM</b> [g m <sup>-2</sup> yr <sup>-1</sup> ]	<b>aRes</b> [g m <sup>-2</sup> yr <sup>-1</sup> ]	<b>treatment</b>	<b>element</b>
22.26	3.25	8.50	29.41	-3.98	aCO2	carbon
30.01	6.65	21.33	43.88	-5.85	eCO2	carbon
0.22	0.75	1.33	0.44	-0.76	aCO2	nitrogen
0.30	1.54	3.41	0.87	-1.05	eCO2	nitrogen
0.00	0.18	-0.13	0.03	-0.05	aCO2	phosphorus
0.01	0.38	-0.09	0.08	-0.37	eCO2	phosphorus