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Large fluxes and rapid turnover of mineral-associated carbon across topographic gradients in a humid tropical forest: insights from paired ^{14}C analysis

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Introduction

These data tables provide detailed information on the biogeochemical characteristics of individual soil samples; summaries of these data are presented in the figures and tables of the main text. Table 1 provides chemical extraction, fine root, and texture data from the 2012 samples. Table 2 provides modeled C turnover estimates and ^{14}C content from the 2012 samples. Table 3 provides C fraction data and ^{14}C content of the 1988 samples.

Supplemental Table 1

Radiocarbon content and modeled decomposition rates, residence times, and the fraction of mineral-associated C comprised by the slow pool for each sample. Steady state C inputs to the slow pool are calculated as the product of the heavy fraction C stock, the fraction of this C in the slow pool, and the modeled decomposition rate of the slow pool. Standard deviations for decomposition rate constants and fraction slow pool (shown in parentheses) were determined using a Monte Carlo approach as described in the Section 2.4.

Sample	Depth	Position	C content (%)	$\Delta^{14}C$ (‰)	Decomposition rate constant, k (y^{-1}, slow pool)	Residence time (y, slow pool)	Fraction slow pool	Heavy fraction C stock (g m^{-2})	Steady state C input to slow pool (g m^{-3})
1	0 - 10 cm	Valley	3.48	73.4	0.057 (0.009)	18 (3)	0.74 (0.05)	2436	100 (18)
2	10 - 20 cm	Valley	2.69	84.7	0.049 (0.007)	21 (4)	0.77 (0.04)	2196	81 (16)
3	0 - 10 cm	Valley	3.18	75.5	0.055 (0.008)	18 (3)	0.75 (0.05)	1875	78 (14)

4	10 - 20 cm	Valley	2.5	80	0.052 (0.008)	19 (4)	0.76 (0.04)	1489	60 (13)
5	0 - 10 cm	Valley	3.48	100	0.04 (0.007)	26 (4)	0.82 (0.03)	2606	82 (13)
6	10 - 20 cm	Valley	2.94	85.6	0.048 (0.007)	21 (4)	0.77 (0.04)	2181	80 (16)
7	0 - 10 cm	Valley	3.99	73.8	0.057 (0.009)	18 (3)	0.74 (0.05)	3027	124 (22)
8	10 - 20 cm	Valley	3.23	82.8	0.05 (0.008)	20 (4)	0.76 (0.04)	2677	102 (21)
9	0 - 10 cm	Valley	2.64	84	0.049 (0.007)	20 (4)	0.76 (0.04)	1793	68 (14)
10	10 - 20 cm	Valley	1.94	97.7	0.041 (0.007)	25 (4)	0.81 (0.03)	1641	53 (9)
11	0 - 10 cm	Slope	2.78	93.4	0.044 (0.007)	23 (4)	0.79 (0.04)	1889	65 (12)
12	10 - 20 cm	Slope	1.61	51	0.09 (0.017)	9 (5)	0.75 (0.06)	1225	102 (57)
13	0 - 10 cm	Slope	3.82	73.9	0.057 (0.009)	18 (3)	0.74 (0.05)	2496	103 (18)
14	10 - 20 cm	Slope	1.67	30.5	--	--	0.49 (0.09)	1395	36 (36)
15	0 - 10 cm	Slope	3.79	66.2	0.064 (0.01)	16 (4)	0.74 (0.05)	1988	92 (24)
16	10 - 20 cm	Slope	1.8	23.9	--	--	0.45 (0.09)	1453	34 (13)
17	0 - 10 cm	Slope	4.03	109.4	0.035 (0.006)	29 (5)	0.86 (0.03)	2667	79 (14)
18	10 - 20 cm	Slope	4.28	89.6	0.046 (0.007)	22 (4)	0.78 (0.04)	2842	101 (19)
19	0 - 10 cm	Slope	2.29	28.5	--	--	0.48 (0.09)	2029	51 (19)
20	10 - 20 cm	Slope	1.68	5.7	--	--	0.35 (0.1)	1458	27 (11)
21	0 - 10 cm	Ridge	5.17	78.5	0.053 (0.008)	19 (4)	0.75 (0.05)	2562	101 (22)
22	10 - 20 cm	Ridge	3.3	62.7	0.068 (0.012)	14 (5)	0.74 (0.05)	1730	91 (33)
23	0 - 10 cm	Ridge	4.48	72.8	0.058 (0.009)	18 (3)	0.74 (0.05)	2334	96 (17)
24	10 - 20 cm	Ridge	3.21	57.4	0.076 (0.014)	11 (6)	0.74 (0.05)	2278	153 (84)
25	0 - 10 cm	Ridge	4.38	78.4	0.053 (0.008)	19 (4)	0.75 (0.05)	2155	85 (19)
26	10 - 20 cm	Ridge	2.3	28.2	--	--	0.48 (0.09)	1440	36 (13)
27	0 - 10 cm	Ridge	4.98	95.8	0.042 (0.007)	24 (4)	0.8 (0.04)	2120	71 (12)
28	10 - 20 cm	Ridge	3.96	97.6	0.041 (0.007)	25 (4)	0.81 (0.03)	3033	98 (16)
29	0 - 10 cm	Ridge	5.29	78.2	0.053 (0.008)	19 (4)	0.75 (0.05)	2976	117 (26)
30	10 - 20 cm	Ridge	3.16	72	0.058 (0.009)	17 (3)	0.74 (0.05)	2403	105 (20)

Supplemental Table 2

Carbon content by density fraction and ^{14}C from four 1988 samples (0 – 10 cm depth). See Section 2 for further details.

Position	Free light fraction C (%)	Occluded light fraction C (%)	Heavy fraction C (%)	Free light fraction C (mg g^{-1})	Occluded light fraction C (mg g^{-1})	Heavy fraction C (mg g^{-1})	Mineral-associated $\Delta^{14}C$ (‰)
Slope	34.1	31.7	1.7	3.9	4.7	16.9	182.2
Slope	29.6	27.8	2.8	2.9	1.5	28.0	169.2
Riparian Valley	28.1	28.1	2.5	2.2	5.3	24.0	216.3
Riparian Valley	31.7	35.7	1.4	2.8	3.7	14.1	178.0

Supplemental Table 3

Soil characteristics for each sample, listed by depth and topographic position. See Section 2.2 for variable abbreviations and details of soil analyses. These data were used to generate Table 2 in the main text.

Sample	Depth	Position	Fe_{ca} (field extraction, mg g^{-1})	Fe_{ca} (dried heavy fraction, mg g^{-1})	Fe_{ox} (dried heavy fraction, mg g^{-1})	Fe(III)HCl (field extraction, mg g^{-1})	Fe(II)HCl (field extraction, mg g^{-1})	Al_{ca} (field extraction, mg g^{-1})	Al_{ca} (dried heavy fraction, mg g^{-1})	Al_{ox} (dried heavy fraction, mg g^{-1})	Dead fine roots (mg cm^{-3})	Live fine roots (mg cm^{-3})	Clay (%)	Sand (%)	Silt (%)
1	0 - 10 cm	Valley	8.29	0.99	7.16	1.79	1.16	1.39	0.1	1.42	0.67	1.19	22.59	22.24	55.17
2	10 - 20 cm	Valley	7.52	1.29	8.21	1.44	1.89	1.11	0.11	1.31	0.03	0	17.58	36.76	45.66
3	0 - 10 cm	Valley	10.13	1.48	7.42	1.57	0.25	2.14	0.2	1.5	--	--	27.07	15.63	57.3
4	10 - 20 cm	Valley	9.98	1.09	7.93	0.8	0.55	2.04	0.15	1.76	1.47	0.56	33.69	16.3	50
5	0 - 10 cm	Valley	9.5	0.81	6.34	1.24	0.45	1.94	0.11	1.44	0.48	0.74	22.67	20.93	56.4
6	10 - 20 cm	Valley	8.84	0.81	9.14	1.16	0.5	1.83	0.11	2.04	0.29	0.61	17.53	34.91	47.55
7	0 - 10 cm	Valley	14.16	1.06	8.8	1.37	0.11	3.9	0.26	2.08	0.32	1.1	26.43	21.43	52.14
8	10 - 20 cm	Valley	14.57	1.17	8.57	1.2	0.83	3.81	0.22	2.31	0.3	1.26	26.83	21.32	51.85
9	0 - 10 cm	Valley	7.59	0.68	7.1	0.99	0.22	1.65	0.1	1.4	0.41	0.24	17.13	50.72	32.15
10	10 - 20 cm	Valley	6.81	0.57	7.65	0.55	0.39	1.43	0.08	1.53	0.19	0.52	21.61	47.42	30.97
11	0 - 10 cm	Slope	14.14	0.81	6.84	1.65	0.05	3.8	0.13	1.47	0.85	0.63	25.3	18.25	56.45
12	10 - 20 cm	Slope	12.82	0.81	5.49	0.97	0.02	3.09	0.12	1.5	0.56	0.95	32.48	13.33	54.19
13	0 - 10 cm	Slope	18.51	1.27	9.4	2.56	0.09	3.84	0.15	1.45	0.34	0.44	43.97	7.99	48.03
14	10 - 20 cm	Slope	17.19	1.14	6.86	1.5	0.04	3.05	0.17	1.5	0.13	0.37	43.52	21.92	34.57
15	0 - 10 cm	Slope	18.08	1.2	9.1	3.98	0.45	4.38	0.17	1.63	0.77	2.31	37.55	7.78	54.67
16	10 - 20 cm	Slope	12.7	0.82	5.02	1.39	0.11	3.05	0.13	1.7	0.3	0.66	39.25	9	51.75
17	0 - 10 cm	Slope	22.14	1.47	12.94	7.5	3.87	6.29	0.14	1.53	0.71	2.16	23.13	8.93	67.94
18	10 - 20 cm	Slope	21.37	1.52	15.03	2.29	10.72	6.34	0.13	1.76	0.31	1.39	30.5	8.21	61.3
19	0 - 10 cm	Slope	9.21	0.78	4.57	0.48	0.06	2.09	0.1	1.25	0.74	2.08	53.02	7.58	39.4
20	10 - 20 cm	Slope	4.58	0.58	3.96	0.3	0.03	1.54	0.1	1.51	0.12	0.35	47.8	10.84	41.36
21	0 - 10 cm	Ridge	21.78	1.11	7.07	2.17	0.37	8.51	0.29	3.08	1	2.51	41.13	15.63	43.23

22	10 - 20 cm	Ridge	21.36	1.25	6.34	0.82	0.11	5.81	0.15	1.57	0.71	2.45	58.4	10.01	31.59
23	0 - 10 cm	Ridge	29.87	1.22	9.54	3.44	0.3	8.18	0.16	1.68	0.75	4.3	43.92	13.03	43.05
24	10 - 20 cm	Ridge	27.53	1.19	7.08	1.36	0.13	8.65	0.18	1.65	0.24	1.53	50.71	6.71	42.58
25	0 - 10 cm	Ridge	29.4	1.5	11.51	5.36	0.46	9.19	0.21	1.89	0.56	0.71	45.96	9.11	44.93
26	10 - 20 cm	Ridge	27.36	1.49	9.89	1.91	0.18	7.36	0.21	2.07	0.68	1.16	56.38	8.87	34.75
27	0 - 10 cm	Ridge	26.23	1.14	8.81	1.15	0.23	12.53	0.22	2.02	1.59	3.4	35.77	5.74	58.49
28	10 - 20 cm	Ridge	24.85	1.18	7.95	1.33	0.14	10.33	0.22	1.84	1.08	1.52	45.51	7.59	46.9
29	0 - 10 cm	Ridge	22.28	1.07	7.5	0.69	0.19	10.82	0.33	3.28	0.37	1.77	25.23	11.16	63.61
30	10 - 20 cm	Ridge	19.11	0.99	6.83	0.63	0.11	8.15	0.28	2.52	0.38	0.38	34.01	7.74	58.25