Supplementary information

SI, Table 1. Pearson correlations of CO_2 respiration rate with soil parameters along the Rwenzori elevational transect under *in situ* and laboratory incubation.

Total CO_2 respiration rate at the start of the rainy season		
Soil parameter	Correlation R value	*P*-value
pH	0.13	0.19
Water-filled pore space	-0.04	0.73
Temperature	0.24	0.02*
Organic carbon	-0.19	0.06
Total nitrogen	-0.29	<0.01*
C:N	0.17	0.09
Total CO_2 respiration rate in the mid rainy season		
pH	0.56	<0.01*
Water-filled pore space	0.25	0.01*
Temperature	0.55	<0.01*
Organic carbon	-0.61	<0.01*
Total nitrogen	-0.59	<0.01*
C:N	-0.40	<0.01*
Specific heterotrophic CO_2 respiration rate from laboratory incubation		
pH	0.79	<0.01*
Temperature	0.73	<0.01*
Organic carbon	-0.73	<0.01*
Total nitrogen	-0.75	<0.01*
C:N	-0.69	<0.01*

A significant P-vale is marked with an asterisk symbol "*"

SI, Table 2. The scores of the principle component analysis with correlations for principle component 1 (PC1) and principle component 2 (PC2). Strong correlation scores above 0.5 by magnitude are shown in bold.

Parameter	PC1 correlation score	PC2 correlation score
Total PLFA (bacteria plus fungi)	**-0.85**	**-0.67**
Fungi	**-0.88**	**-0.63**
Gram-positive bacteria	**-0.82**	**-0.70**
Gram-negative bacteria	**-0.66**	**-0.89**
Bacteria : Fungi	0.39	-0.13
Gram-positive : Gram-negative	-0.22	**0.73**
Soil pH_{KCl}	**0.92**	**-0.58**
Soil organic carbon	**-1.0**	0.26
Soil temperature	**1.0**	-0.34
Soil total nitrogen	**-1.00**	0.25
Soil C:N	**-0.90**	0.34
Bulk density	**0.98**	-0.37

SI, Table 3. Comparison of the *in situ* seasonal soil moisture content at the start and in the mid rainy season, the *in situ* soil temperature at the start and in the mid rainy season, the *in situ* total CO_2 respiration rate at the start and in the mid rainy season, the specific heterotrophic CO_2 respiration rate for control and warmed soil at corresponding field temperature, the specific heterotrophic CO_2 respiration rate for control and warmed soil at uniform reference temperature of 20 °C and 12°C, the temperature sensitivity Q_{10}, and the activation energy at each elevation cluster in the Rwenzori elevational transect.

Elevation (m a.s.l.)	Parameter		*P* value
	In situ WFPS at the start of rainy season (%)	*In situ* WFPS in the mid rainy season (%)	
1250-1300	33.1 ± 1.2[b]	57.2 ± 5.8[a]	<0.01
1750-1850	22.2 ± 2.5[c]	44.8 ± 3.8[b]	<0.01
2100-2200	41.7 ± 2.9[a]	45.4 ± 4.8[b]	<0.01
2700-3000	42.7 ± 8.7[a]	44.5 ± 9.0[b]	0.48
	In situ temperature at the start of rainy season (°C)	*In situ* temperature in the mid rainy season (°C)	
1250-1300	19.56 ± 0.32[a]	20.44 ± 0.41[a]	<0.01
1750-1850	16.16 ± 0.43[b]	16.76± 0.23[b]	<0.01
2100-2200	15.02 ± 0.12[c]	16.04 ± 0.68[c]	<0.01
2700-3000	11.86 ± 0.46[d]	12.32 ± 0.39[d]	<0.01
	In situ total CO_2 respiration rate at the start of rainy season (mg C h^{-1} m^{-2})	*In situ* total CO_2 respiration rate in the mid rainy season (mg C h^{-1} m^{-2})	
1250-1300	80.1 ± 15.8[a]	113.2 ± 35.7[a]	<0.01
1750-1850	79.2 ± 17.3[a]	112.8 ± 20.3[a]	<0.01
2100-2200	95.1 ± 34.6[a]	89.0 ± 22.3[b]	0.46
2700-3000	59.3 ± 16.7[b]	67.7 ± 9.7[c]	0.05
	Specific heterotrophic CO_2 respiration rate at respective field mean annual temperature (µg C h^{-1} g^{-1} SOC)	$\delta^{13}C$ depletion factor of the respired CO_2 (‰)	
1250-1300	17.2 ± 5.3	3.2 ± 0.6	NA
1750-1850	10.8 ± 4.8	2.8 ± 0.9	NA
2100-2200	5.3 ± 2.1	1.7 ± 0.7	NA
2500-2600	3.7 ± 1.9	1.0 ± 1.3	NA
2700-3000	2.4 ± 0.9	-0.3 ± 0.8	NA
Specific heterotrophic CO_2 respiration rate following *in situ* soil warming at corresponding field temperature (µg C h^{-1} g^{-1} SOC)			

	Control	Warmed	
1250-1300	6.15± 0.28	NA	NA
1750-1850	6.56± 0.61	5.48 ± 1.69	0.10
2100-2200	3.22 ± 0.25	3.31 ± 1.17	0.70
2500-2600	3.54 ± 0.53	3.92 ± 1.40	0.06
2700-3000	3.82 ± 0.45	2.74 ± 0.85	0.13

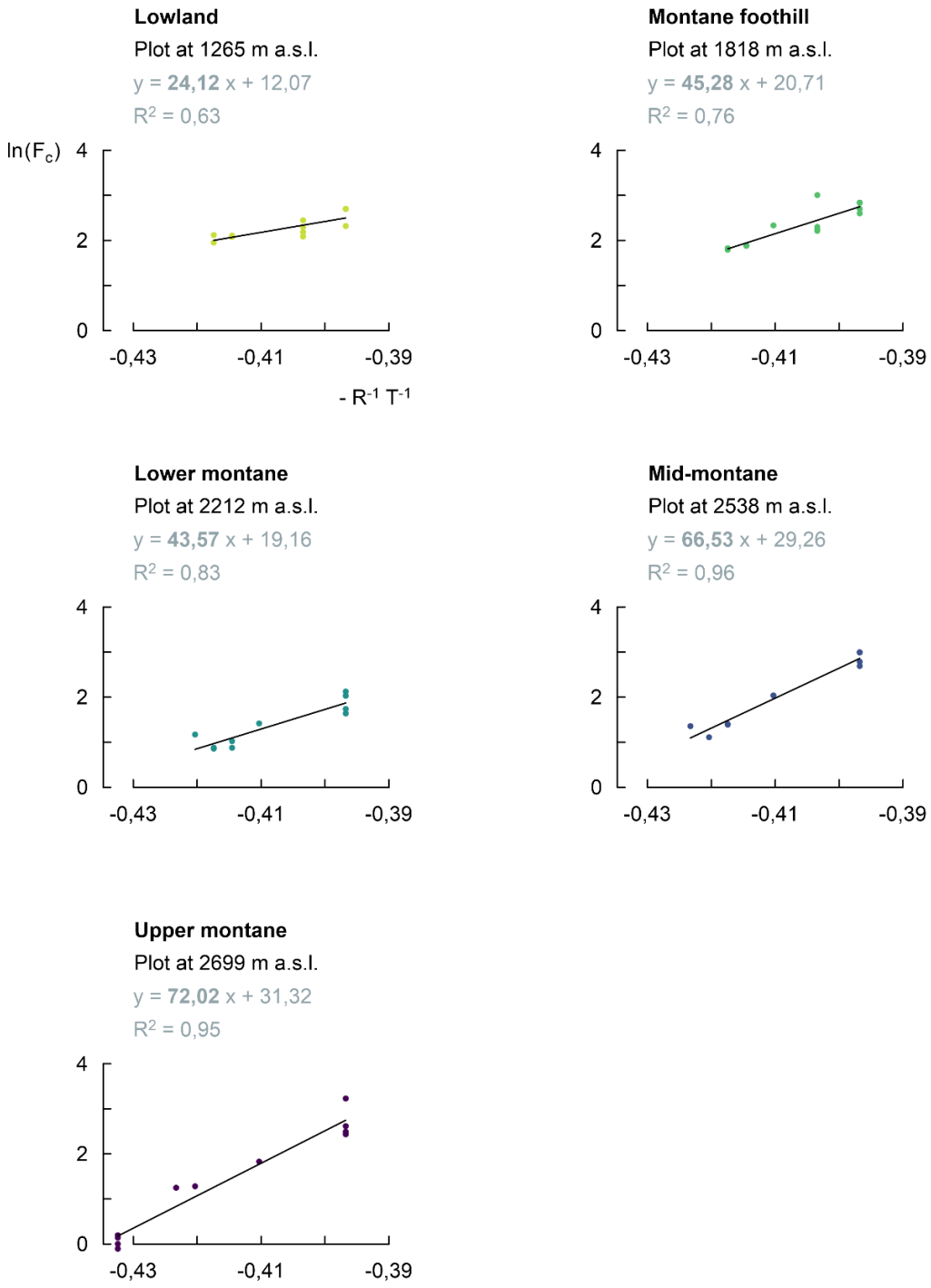
Activation energy (kJ mol^{-1})

	Control	Warmed	
1250-1300	28.5 ± 5.6	NA	NA
1750-1850	49.2± 17.3	30.3 ± 11.0	0.23
2100-2200	60.2 ± 23.1	53.6 ± 9.7	1.00
2500-2600	70.3 ± 6.9	59.8 ± 4.2	0.06
2700-3000	69.9 ± 3.0	73.9 ± 20.7	0.80

The sensitivity of CO_2 respiration to temperature (Q_{10})

	Control	Warmed	
1250-1300	1.50 ± 0.13	NA	NA
1750-1850	1.92± 0.57	1.70 ± 0.24	0.86
2100-2200	2.67 ± 1.28	2.14± 0.44	1.00
2500-2600	2.86 ± 0.40	2.52 ± 0.47	0.20
2700-3000	2.68 ± 0.25	2.46 ± 0.67	0.53

*NA indicate that no comparison between control and warmed soil was made because no translocation took place at elevation cluster 1250-1300 m a.s.l.. Different lowercase letters in superscript (bold) next to values of each elevation cluster (same column) indicate a significant difference among the sites at $P < 0.05$, and $P < 0.05$ (same row) indicates a significant different between seasons or between control and warmed treatments.



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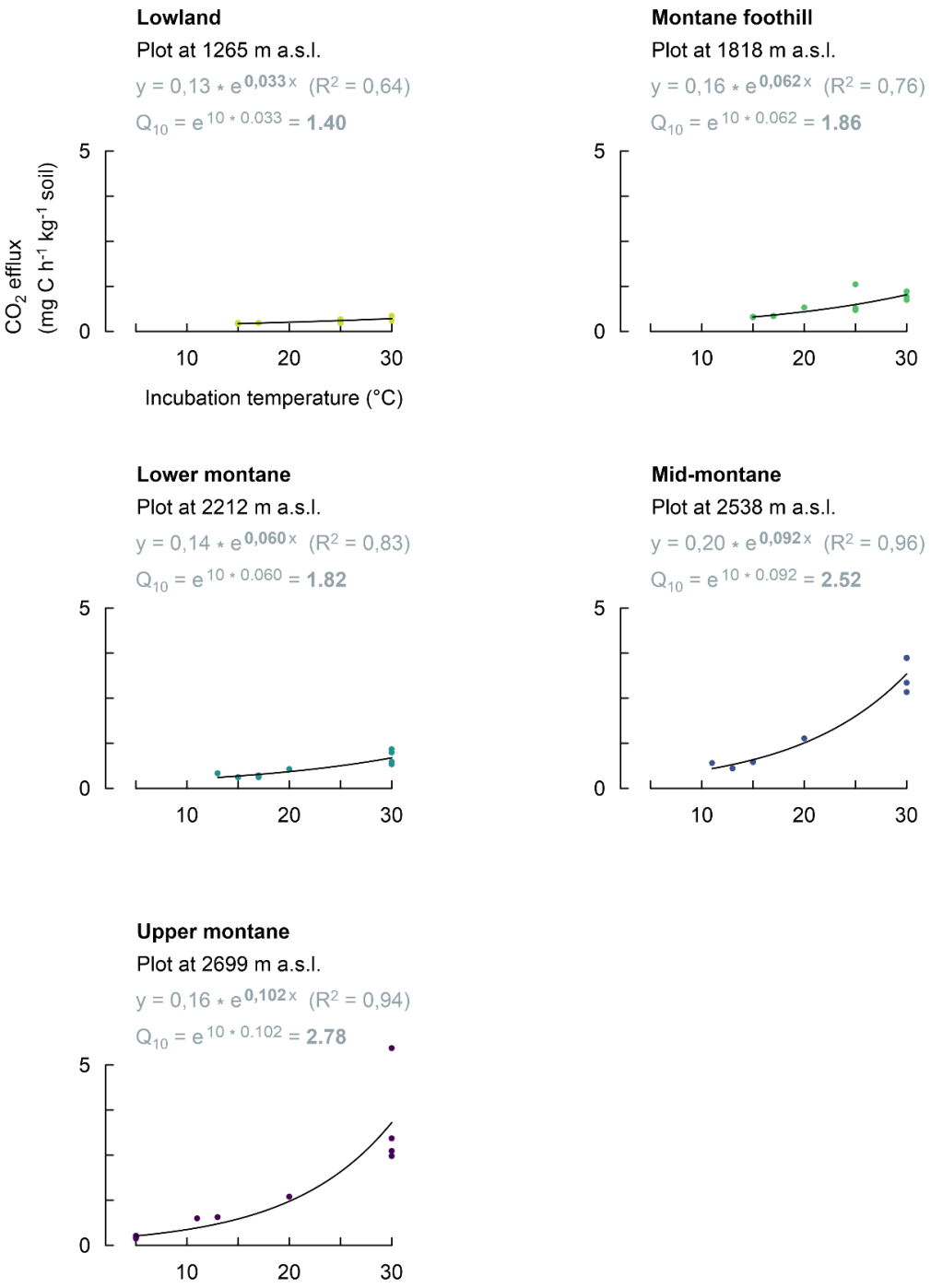
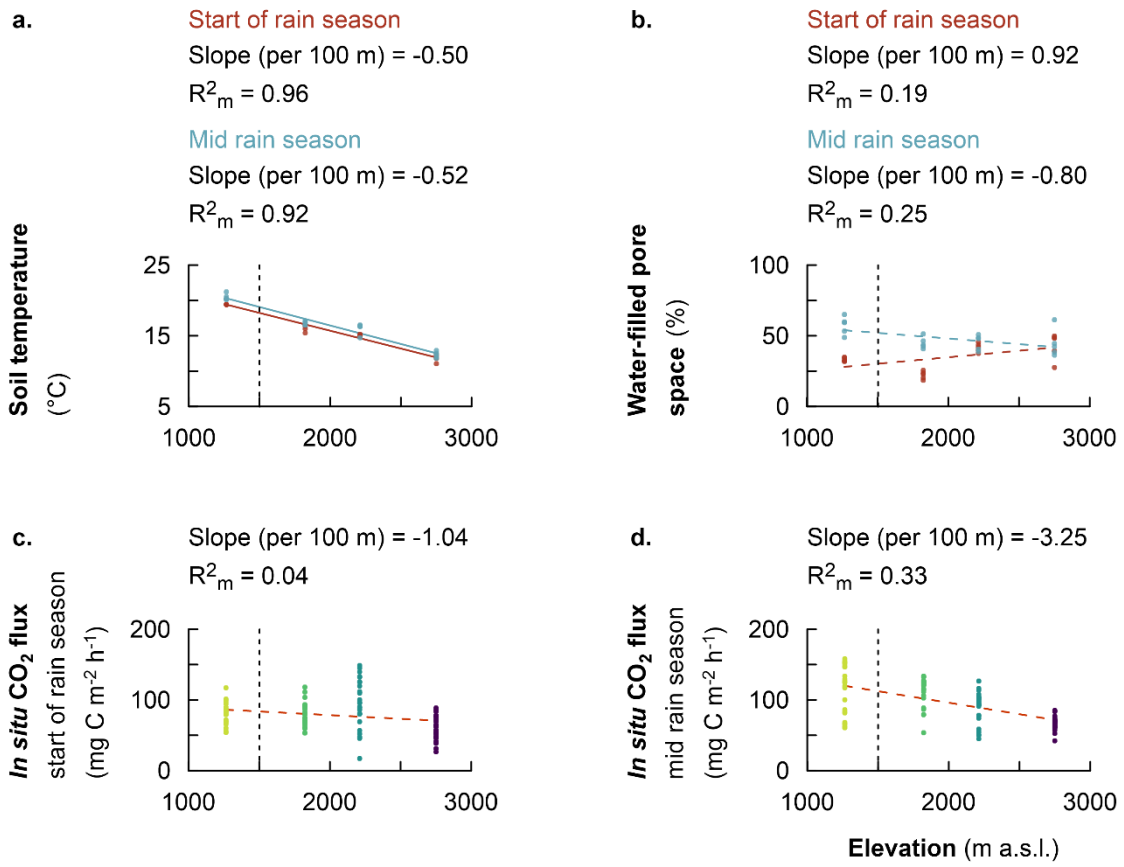
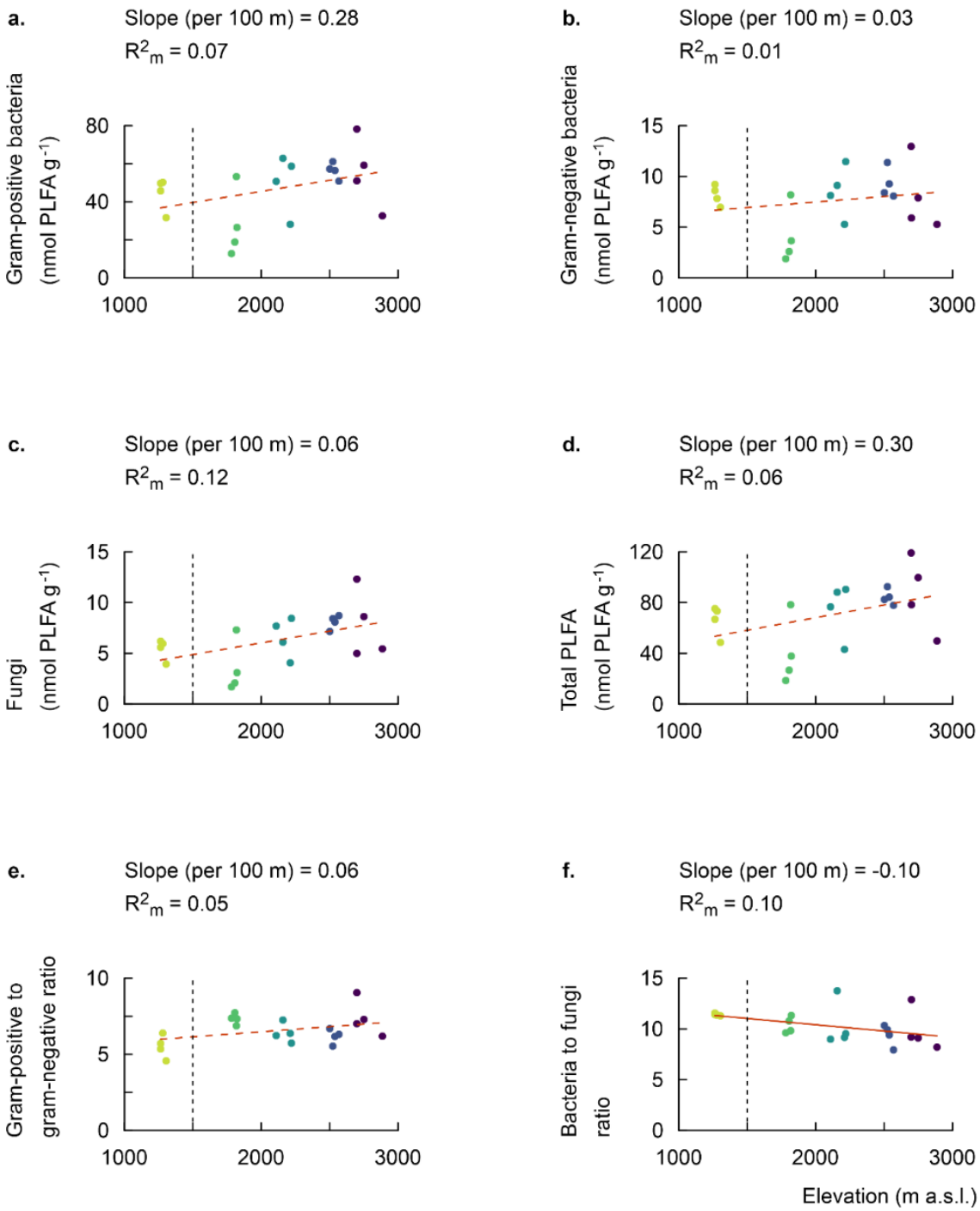
21 SI, Figure 1. Graphs to illustrate the curve fitting for the determination of the activation energy, i.e., as the slope
22 of the linear regression between log-transformed specific heterotrophic CO_2 respiration rate (ln Fc) and the
23 negative inverse of the incubation temperature (T), multiplied with the gas constant (R). Shown here is one
24 representative example (one replicate per plot) per elevation cluster.



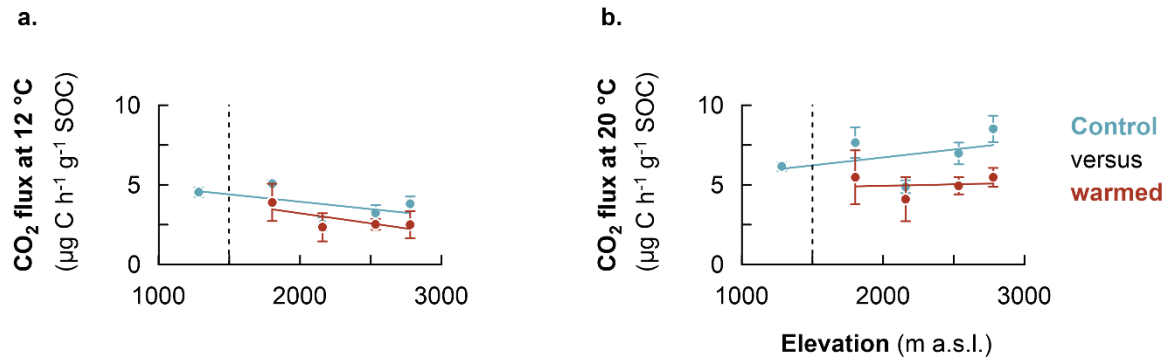
SI, Figure 2. Graphs to illustrate the curve fitting for the determination of the sensitivity of heterotrophic CO_2 respiration rates to temperature (Q_{10}) through exponential curve fitting of specific heterotrophic CO_2 respiration rates at five different incubation temperatures in order to derive parameter k, from which Q_{10} can be determined. Shown here is one representative example (i.e. one replicate plot) per elevation cluster.



SI, Figure 3. Fixed effect estimates of elevation (per 100 m elevation increase) on response variables: soil temperatures at 5 cm depth at the start of rainy season (red solid line) and in the mid rainy season (blue solid line) (**a**), water-filled pore space at 5 cm depth at the start of the rainy season (red dashed line) and in the mid rainy season (blue dashed line) (**b**), *in situ* total CO_2 respiration at the start of the rainy season (**c**) and *in situ* total CO_2 respiration in the mid rainy season (**d**). The slope of the linear mixed effect model estimates per 100 m of elevation increase is indicated (solid line for a significant effect and dashed line for no significant effect), as well as the marginal R^2 (R^2_m), representing the fraction in response variable explained by elevation. Plots from montane forest clusters (from 1750-3000 m a.s.l.) were compared with a nearby premontane forest (separated by vertical dashed line) at an elevation of 1250-1300 m a.s.l..



SI, Figure 4. Fixed effect estimates of elevation (per 100 m elevation increase) on response variables: gram-positive bacteria (nmol PLFA g^{-1}) (**a**), gram-negative bacteria (nmol PLFA g^{-1}) (**b**), fungi (nmol PLFA g^{-1}) (**c**), total phospholipid fatty acids (PLFA) for bacteria and fungi (**d**) (nmol PLFA g^{-1}), ratio of gram-positive to gram-negative bacteria (**e**) and the ratio of bacteria to fungi (**f**). The slopes of the linear mixed effect model estimates per 100 m of elevation increase are indicated (red solid line for a significant effect and red dashed line for no significant effect), as well as the marginal R^2 (R^2_m), representing the fraction in response variable explained by elevation. Plots from montane forest clusters (from 1750-3000 m a.s.l.) were compared with a nearby premontane forest (separated by vertical dashed line) at an elevation of 1250-1300 m a.s.l..



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51 SI, Figure 5. Specific heterotrophic CO_2 respiration rate at uniform reference temperature of 20 °C (mean annual
52 *in situ* temperature in the lowest elevation cluster at 1250-1300 m a.s.l.) (**a**) and 12 °C (mean annual *in situ*
53 temperature in the highest elevation cluster at 2700-3000 m a.s.l.) (**b**).

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