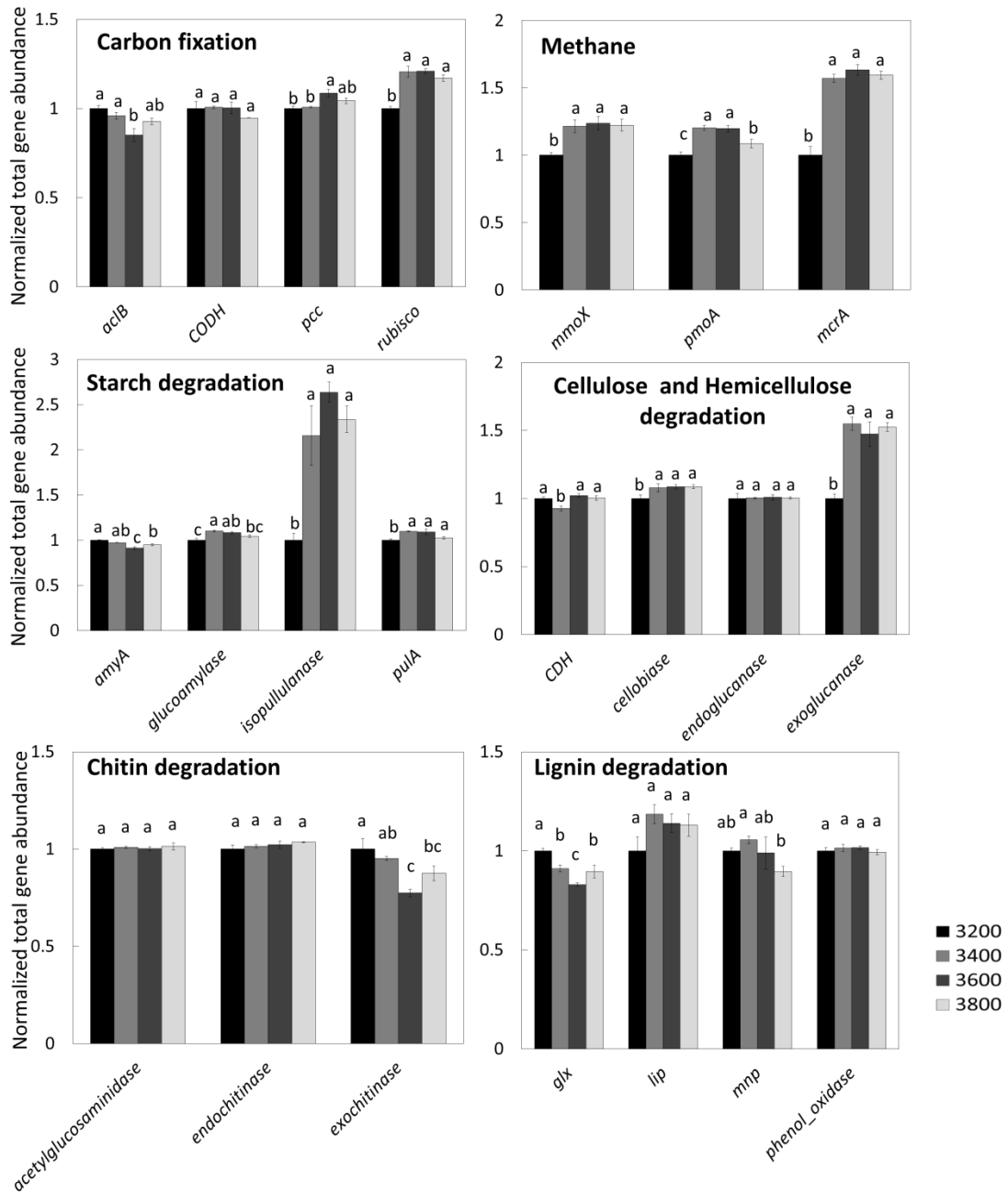
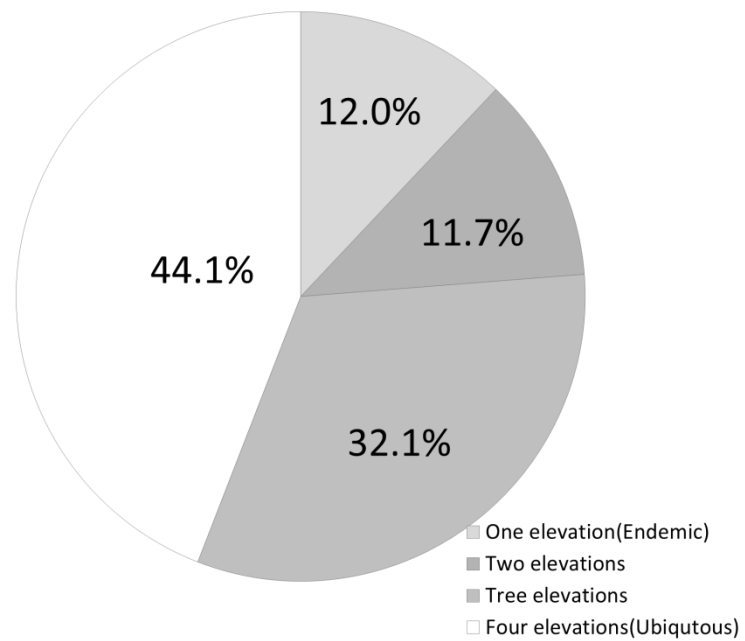


## Supplementary materials

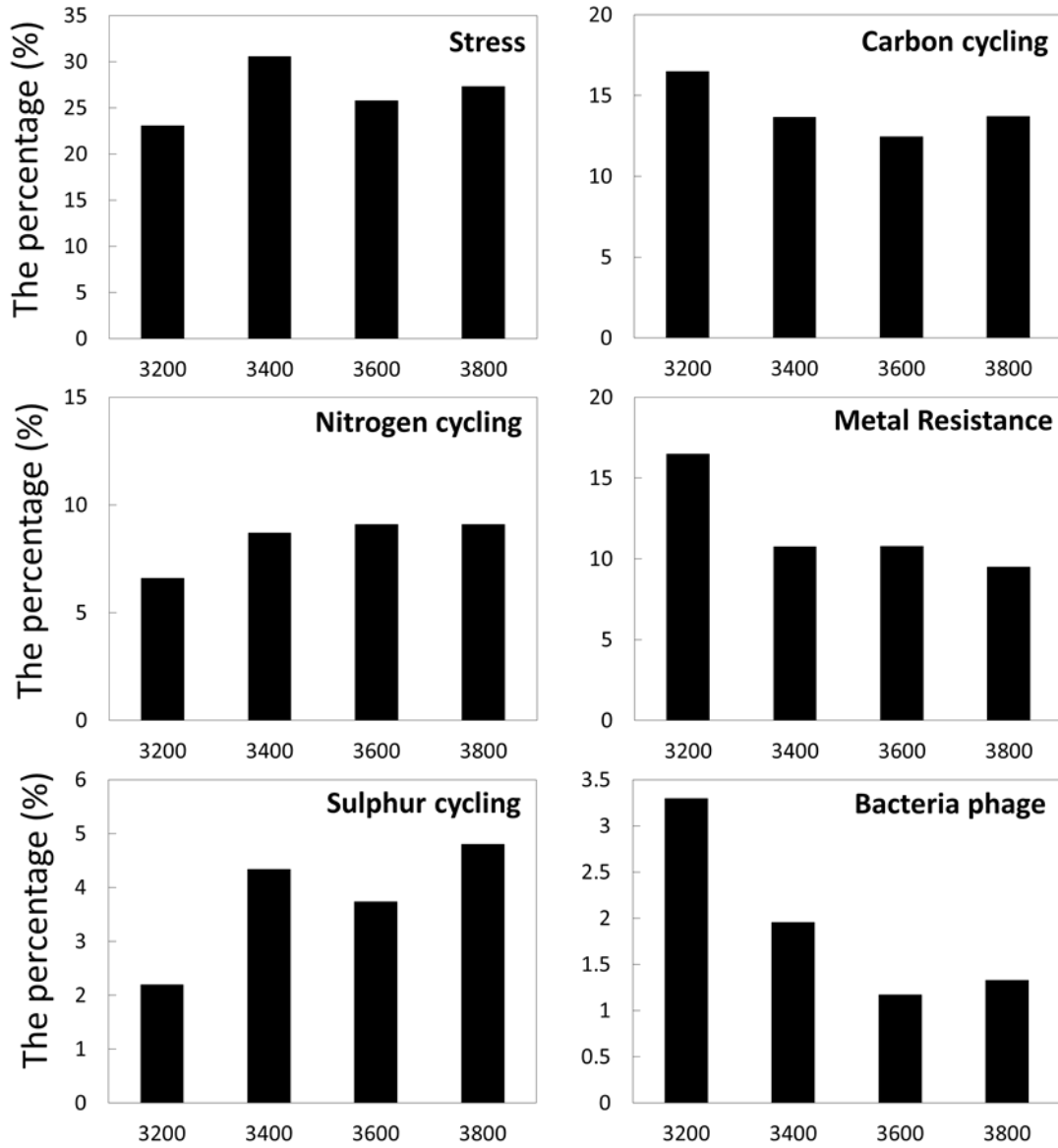
**Figure S1.** Total gene abundances, normalized to the abundance at 3200 m, of C-cycling gene families at each elevation. All data are presented as mean  $\pm$ s.e. calculated from biological triplicates. Significant ( $P<0.05$ ) differences among elevations are indicated by alphabetic letters above the bars.



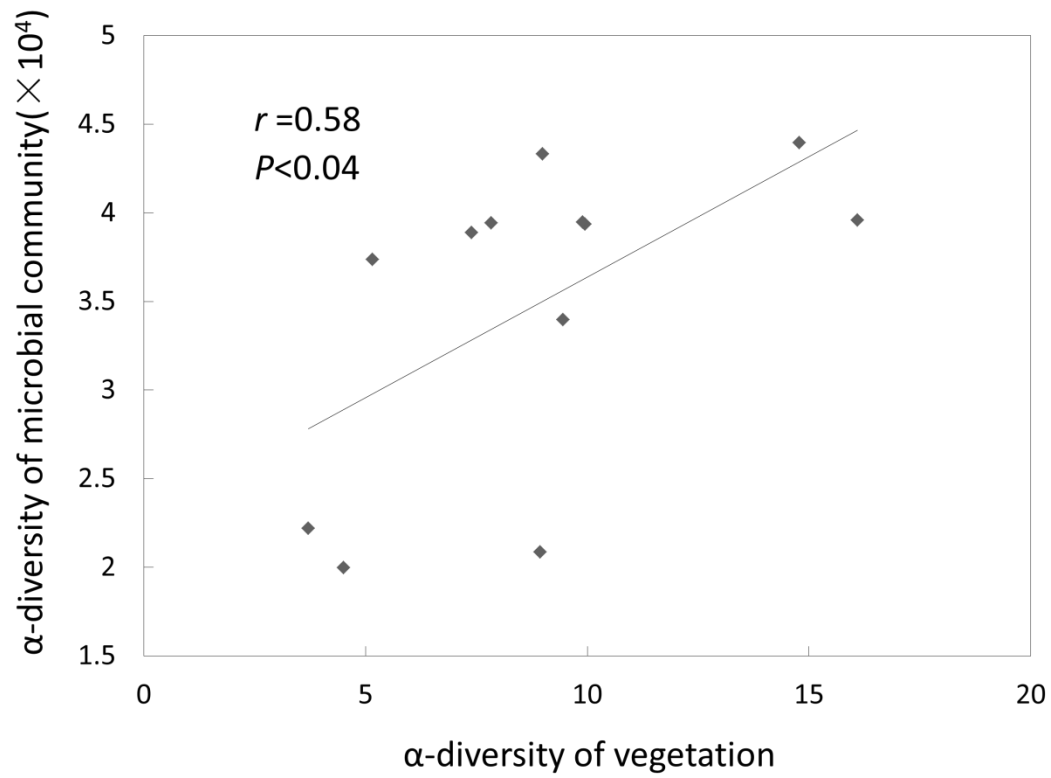
**Figure S2.** Percentages of genes detected at one (endemic), two, three and four (ubiquitous) elevations, which are shown as 12.0%, 11.7%, 32.1% and 44.1%, respectively.



**Figure S3.** Changes of percentages of endemic genes along four elevations, as calculated by dividing the number of endemic genes in different categories by the total number of endemic genes.



**Figure S4.** The correlation between alpha-diversity of microbial community and that of vegetation. The alpha-diversity was calculated by Simpson index. The Pearson correlation coefficient ( $r$ ) and the confidence level of  $P$ -value are indicated.



**Table S1.** Diversity indices of all functional genes in soil samples

	<b>3200 m</b>	<b>3400 m</b>	<b>3600 m</b>	<b>3800 m</b>
<b>Richeness<sup>a</sup></b>	23369	45685	42282	41338
<b>Shannon Index<sup>b</sup></b>	9.95 <sup>c</sup> <sup>d</sup>	10.65 <sup>a</sup>	10.54 <sup>b</sup>	10.56 <sup>ab</sup>
<b>Simpson Index<sup>c</sup></b>	21009.73 <sup>c</sup>	42282.21 <sup>a</sup>	37603.16 <sup>b</sup>	38563.35 <sup>ab</sup>

<sup>a</sup>Detected gene number.

<sup>b</sup>Shannon–Weiner index. Higher number represents higher diversity.

<sup>c</sup>Simpson’s index. Higher number represents higher diversity.

<sup>d</sup>Significant differences among elevations are indicated by alphabetic letters.

**Table S2.** Differences of microbial community among elevations as examined by the dissimilarity test of adonis.

Sites (m)	Statistic $R^2$	$P$ -value
3200-3400	0.89	<b>0.01<sup>a</sup></b>
3200-3600	0.84	<b>0.01</b>
3200-3800	0.89	<b>0.01</b>
3400-3600	0.49	<b>0.04</b>
3400-3800	0.63	<b>0.01</b>
3600-3800	0.46	0.07

<sup>a</sup>Boldface values indicate significant differences ( $P < 0.05$ ).

**Table S3.** The numbers and percentages of overlapping and unique genes among four elevations

Sites	3200	3400	3600	3800
3200	<b>91(0.4)<sup>a</sup></b>	<i>23108(50.3)</i>	<i>22311(51.5)</i>	<i>22516(53.4)</i>
3400		<b>3529(7.7)</b>	<i>39559(81.7)</i>	<i>38975(81.1)</i>
3600			<b>1364(3.2)</b>	<i>38122(83.8)</i>
3800				<b>978(2.4)</b>

<sup>a</sup>Values in parentheses are percentages. Italicized values indicate the number of overlapping genes between sites; boldface values indicate the number of unique genes at each site.

**Table S4.** Summary of environmental attribute measurements.

<b>Environmental attribute (unit)</b>	<b>3200</b>	<b>3400</b>	<b>3600</b>	<b>3800</b>
<b>Elevation (m)</b>	3200	3400	3600	3800
<b>T5<sup>a</sup> (°C)</b>	13.99	12.36	10.64	9.36
<b>T10 (°C)</b>	12.43	9.15	8.88	6.84
<b>AT (°C)</b>	8.87	8.61	7.87	6.78
<b>Moisture (%)</b>	22.4a <sup>b</sup>	21.94a	25.63a	31.73a
<b>NO<sub>3</sub><sup>-</sup>-N10 (mg kg<sup>-1</sup>)</b>	0.93b	0.84b	1.59a	1.38a
<b>NH<sub>4</sub><sup>+</sup>-N10 (mg kg<sup>-1</sup>)</b>	3.7a	2.08b	1.98b	1.5b
<b>TOC10 (%)</b>	6.84a	6.3b	5.99c	5.59d
<b>TN10 (g kg<sup>-1</sup>)</b>	5.35b	5.54a	5.12c	4.71d
<b>TOC20 (%)</b>	3.44d	3.73c	4.93a	4.51b
<b>TN20 (g kg<sup>-1</sup>)</b>	3.45c	3.49c	4.09b	4.21a
<b>SIN (mg kg<sup>-1</sup>)</b>	4.63a	2.92b	3.57b	2.88b
<b>Total coverage of vegetation (%)</b>	97.33a	98a	72b	77b
<b>Vegetation species</b>	23.33a	25a	16.67b	13.67b
<b>Vegetation diversity<sup>c</sup></b>	1.91d	2.58a	2.36b	2.06c
<b>Vegetation biomass (g)</b>	88.55a	33.7b	41.88b	28.38b
<b>Released CH<sub>4</sub> (µg m<sup>-2</sup> h<sup>-1</sup>)</b>	-23.85ab	-38.80b	-	-12.98a
<b>Released CO<sub>2</sub> (µg m<sup>-2</sup> h<sup>-1</sup>)</b>	799.02a	843.48a	-	408.59b
<b>Released N<sub>2</sub>O (µg m<sup>-2</sup> h<sup>-1</sup>)</b>	13.02a	0.16b	-	1.38b

<sup>a</sup>Abbreviations: T – temperature; AT – air temperature; TOC – total organic C; TN – total N; SIN – soil inorganic N; 5, 10 and 20 – soil characteristics measured at depths of 5, 10 or 20 cm;

<sup>b</sup>Significant differences among elevations are indicated by alphabetic letters.

<sup>c</sup>Vegetation diversity was calculated by Shannon index.



**Table S5.** The numbers and total abundances of endemic genes at different elevations.

<b>Endemic genes</b>	<b>3200</b>	<b>3400</b>	<b>3600</b>	<b>3800</b>
<b>Gene number</b>	91	3529	1364	978
<b>Total gene abundance</b>	328407	5709897	1989096	1564756