Table S1. Pearson's correlation coefficients (r) between soil, litter, leaf, and climatic parameters. Correlation analysis was conducted with all five replicates of each of the twelve ecosystems (n = 60).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Soil</th>
<th>Litter</th>
<th>Leaf</th>
<th>MAP</th>
<th>MAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>δ¹⁵N N content</td>
<td>0.70***</td>
<td>-0.52***</td>
<td>-0.81***</td>
<td>-0.24</td>
<td>0.34***</td>
</tr>
<tr>
<td>δ¹³C C content</td>
<td>-0.76***</td>
<td>0.74***</td>
<td>0.28*</td>
<td>-0.26*</td>
<td>0.07</td>
</tr>
<tr>
<td>C/N ratio</td>
<td>0.82***</td>
<td>-0.13</td>
<td>0.72***</td>
<td>-0.06</td>
<td>0.303*</td>
</tr>
<tr>
<td>δ¹⁵N N content</td>
<td>0.14</td>
<td>-0.36**</td>
<td>0.88***</td>
<td>-0.24</td>
<td>0.42***</td>
</tr>
<tr>
<td>δ¹³C C content</td>
<td>0.54***</td>
<td>-0.54***</td>
<td>-0.31*</td>
<td>-0.49***</td>
<td>-0.61***</td>
</tr>
<tr>
<td>C/N ratio</td>
<td>-0.06</td>
<td>-0.38**</td>
<td>0.47***</td>
<td>0.08</td>
<td>-0.49***</td>
</tr>
<tr>
<td>pH</td>
<td>0.56***</td>
<td>0.26*</td>
<td>0.40**</td>
<td>0.26*</td>
<td>0.63***</td>
</tr>
<tr>
<td>soil clay content</td>
<td>0.14</td>
<td>0.33**</td>
<td>-0.23</td>
<td>0.27*</td>
<td>0.44***</td>
</tr>
<tr>
<td>soil silt content</td>
<td>0.01</td>
<td>0.27*</td>
<td>-0.04</td>
<td>0.30*</td>
<td>0.22</td>
</tr>
<tr>
<td>soil sand content</td>
<td>0.02</td>
<td>0.34**</td>
<td>-0.14</td>
<td>0.02</td>
<td>0.52***</td>
</tr>
<tr>
<td>soil pH</td>
<td>0.51***</td>
<td>0.76***</td>
<td>0.65***</td>
<td>0.76***</td>
<td>0.50***</td>
</tr>
<tr>
<td>dN</td>
<td>-0.60***</td>
<td>0.81***</td>
<td>-0.72***</td>
<td>-0.27*</td>
<td>0.33**</td>
</tr>
<tr>
<td>C content</td>
<td>0.19</td>
<td>-0.32*</td>
<td>0.58***</td>
<td>0.61***</td>
<td>0.12</td>
</tr>
<tr>
<td>C/N ratio</td>
<td>0.46***</td>
<td>-0.16</td>
<td>0.26*</td>
<td>0.14</td>
<td>0.02</td>
</tr>
<tr>
<td>N content</td>
<td>0.53***</td>
<td>0.17</td>
<td>-0.25</td>
<td>-0.06</td>
<td>0.05</td>
</tr>
<tr>
<td>MAP</td>
<td>-0.60***</td>
<td>0.81***</td>
<td>-0.72***</td>
<td>-0.27*</td>
<td>0.33**</td>
</tr>
<tr>
<td>MAT</td>
<td>0.73***</td>
<td>-0.54***</td>
<td>0.66***</td>
<td>-0.33**</td>
<td>0.55***</td>
</tr>
</tbody>
</table>

Levels of significance: * P < 0.05, ** P < 0.01, *** P < 0.001
Table S2 Correlation coefficients (r) and P values of selected variables included in the principal component analysis used to identify the main factors driving soil $\delta^{15}$N. Only variables showing $r > 0.5$ were considered

<table>
<thead>
<tr>
<th>Principal component</th>
<th>Variable</th>
<th>r</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC 1</td>
<td>Soil C content</td>
<td>0.93</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Soil N content</td>
<td>0.93</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Soil C/N ratio</td>
<td>0.61</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Soil pH</td>
<td>-0.87</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Soil $\delta^{13}$C</td>
<td>-0.76</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>MAP</td>
<td>0.87</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>MAT</td>
<td>-0.63</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>PC 2</td>
<td>Soil clay content</td>
<td>-0.84</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Soil sand content</td>
<td>0.82</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>MAT</td>
<td>-0.65</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Fig. S1 Variation in $\delta^{13}$C values along the Kilimanjaro land-use and elevational gradient for leaves, litter, and soil. Solid symbols denote semi-natural ecosystems, while open symbols correspond to managed ecosystems. The dotted line represents the theoretical global relationship between altitude and $\delta^{13}$C of plant leaves ($C_3$ vegetation only) developed by Körner et al. (1988) and is shown here for reference. The ecosystem acronyms used are as per Table 1. Mai, Cof, and Hom are managed cropping sites, Gra and Sav are extensively managed grasslands and savannas, while the rest represent semi-natural ecosystems. Reference: Körner, C., Farquhar, G.D., Roksandic, Z., 1988. A global survey of carbon isotope discrimination in plants from high altitude. Oecologia 74, 623–632. https://doi.org/10.1007/BF00380063.
Fig. S2 Relationship between soil $\delta^{13}$C values and mean annual temperature (a), mean annual precipitation (b), soil organic carbon (c), and soil C/N ratios (d) for all ecosystems. Each data point represents the average of five sites, and bars denote standard error of the means. Symbols are as per all previous figures. The ecosystem acronyms used are as per Table 1.
**Fig. S3** Relationship between soil $\delta^{15}$N values and mean annual temperature (a), mean annual precipitation (b), soil nitrogen (c), and soil C/N ratios (d) for all ecosystems. Each data point represents the average of five sites, and bars denote standard error of the means. Symbols are as per all previous figures. The ecosystem acronyms used are as per Table 1.