**Electronic Supplementary Material**

**Appendix Table A.** Average δ13C values (‰), standard errors, and number of replicates obtained for each species at each site across the Mauna Loa elevation and substrate age gradient. Lava age is designated in the table as ‘young’ (Y) for 1855-1881 flows and ‘old’ (O) for the 3400 year old flow (except ca. 400 year old lava flow at 1760 m site).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Taxon sampled** | **Elevations (m) and soil ages sampled**  **(mean** δ13C **± standard error, *n*)** | | | | | | |
|  | **300** | **700** | **1100** | **1650** | **1750** | **1760** | **2200** |
| *Acroporium fusco-flavum* | Y (-30.6±1.0, 4) | Y (-30.4±0.1, 3)  O (-32.2±1.0, 3) | Y (-29.0±0.1, 3)  O (-31.4±0.2, 3) | O (-29.5±0.3, 4) | O (-29.3±0.1, 3) |  |  |
| *Bazzania cf. trilobata* |  | Y (-30.5±0.9, 3)  O (-30.2±0.9, 3) | Y (-28.9±0.7, 3)  O (-29.5±0.4, 3) | O (-31.0±1.3, 3) | O (-27.1±1.2, 3) | O (-29.4±0.03, 3) |  |
| *Campylopus exasperatus* |  | Y (-25.9, 1) |  |  |  |  |  |
| *Campylopus hawaiicus* |  |  | O (-30.4±0.6, 3) | O (-29.2±0.5, 4) | O (-27.6, 1) | O (-29.4±0.8, 3) |  |
| *Campylopus incurvatus* |  | O (-31.4±0.6, 3) |  |  |  |  |  |
| *Campylopus schmidii* |  |  |  |  | O (-27.5±0.2, 2) |  |  |
| *Dicranum speirophyllum* |  |  | Y (-29.7±1.0, 3) | Y (-28.7±0.3, 3)  O (-29.9±1.2, 3) | O (-29.2±0.6, 3) | O (-29.1±0.6, 3) | O (-29.4±0.3, 3) |
| *Leucobryum gracile* | Y (-31.6, 1) | O (\_31.2, 1) | O (-32.4, 1) | O (-30.2±1, 3) |  | O (-30.6±0.3, 3) |  |
| *Leucobryum seemannii* | Y (-32.5±0.5, 2) | O (-32.6±0.2, 3) |  |  |  |  |  |
| *Macromitrium microstomum* | Y (-29.5±1.7, 3) | Y (-28.7±0.2, 3)  O (-30.0±0.5, 4) | Y (-28.3±0.2, 3)  O (-30.0±0.5, 3) | Y (-28.2±0.2, 3)  O (-30.7±0.3, 3) | O (-29.2±0.1, 3) | O (-29.8±0.1, 3) |  |
| *Pyrrhobryum spiniforme* |  | O (-28.2±0.5, 3) | O (-28.7±0, 3) | O (-29.5±0.7, 4) |  | O (-28.3±1.0, 3) |  |
| *Racomitrium lanuginosum* | Y (-28.9, 1) | Y (-26±0.4, 3) | Y (-25.5±0.3, 3) | Y (-24.7±0.4, 3) | O (-27.1±0.2, 3) | O (-27.4±1.0, 3) |  |

**Electronic Supplementary Material**

**Appendix Table B.** Mean δ 13C values (‰) and Pearson correlations with overstory cover (*OC*) from all samples by substrate type. (All samples were used as replicates rather than species-site averages because a single species could be found on several substrates at a single site). Significance: \**P* < 0.05; \*\* 0.01 ≥ *P* > 0.001; \*\*\**P* ≤ 0.001.

|  |  |  |  |
| --- | --- | --- | --- |
| **Substrate type** | ***n*** | **Mean δ13C ± standard error** | ***r*** |
| Bark | 61 | 29.7±0.2 | **0.45\*\*\*** |
| Humus | 26 | 30.1±0.3 | 0.29 |
| Leaf litter | 28 | 29.0±0.4 | **0.68\*\*\*** |
| Rock | 22 | 27.6±0.4 | **0.68\*\*\*** |
| Rotting wood | 2 | 28.3±0.6 | - |
| Soil | 2 | 29.3±1.2 | - |
| Tree fern trunk | 4 | 31.5±0.5 | 0.72 |