Species specific and environment induced variation of delta-13C and delta-15N in alpine plants

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Stable carbon and nitrogen isotope signals in plant tissues integrate plant-environment interactions over long periods. In this study, we hypothesized that humid alpine life conditions are narrowing the scope for significant deviations from common carbon, water and nitrogen relations as captured by stable isotope signals. We explored the variation in δ13C and δ15N in 32 plant species from tissue type to ecosystem scale across a suite of locations at c. Two thousand five hundred meter elevation in the Swiss Alps. Foliar δ13C and δ15N varied among species by about 3–4L' and 7–8L' respectively. However, there was no overall difference in means of δ13C and δ15N for species sampled in different plant communities or when bulk plant dry matter harvests of different plant communities were compared. δ13C was found to be highly species specific, so that the ranking among species was mostly maintained across 11 habitats. However, δ15N varied significantly from place to place in all species (a range of 2.7L') except in Fabaceae (Trifolium alpinum) and Juncaceae (Luzula lutea). There was also a substantial variation among individuals of the same species collected next to each other. No difference was found in foliar δ15N of non-legumes, which were either collected next to or away from the most common legume, T. alpinum. δ15N data place Cyperaceae and Juncaceae, just like Fabaceae, in a low discrimination category, well separated from other families. Soil δ15N was higher than in plants and increased with soil depth. The results indicate a high functional diversity in alpine plants that is similar to that reported for low elevation plants. We conclude that the surprisingly high variation in δ13C and δ15N signals in the studied high elevation plants is largely species specific (genetic) and insensitive to obvious environmental cues.

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