BULK AND COMPOUND-SPECIFIC ISOTOPE ANALYSIS OF TERRESTRIAL PLANT MATERIAL: HOW MANY SAMPLES ARE ENOUGH?

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Both bulk and compound-specific $\delta^{13}C$ stable isotope analysis are significant in the study of terrestrial ecosystems. Yet, sampling sizes are often assigned arbitrarily in the absence of quantitative studies on ecosystem sampling. We determined the $\delta^{13}C$ value of bulk leaves and n-alkanes extracted from leaf waxes for >300 individual specimens representing three species of fern (Cibotiaceae, Marattiaceae, Thelypteridaceae) growing in a tropical rainforest environment on the island of Oahu, Hawaii. These data were used to establish a relationship for determining the sample sizes ($n$) required for achieving the ecosystem average $\delta^{13}C$ value with a desired precision (at the 95% confidence level). Using this relationship we determined that a sample size of $n \geq 8$ and $n \geq 67$ was required to achieve precision better than ±1.0 and 0.2‰, respectively, for the ecosystem mean $\delta^{13}C$ value. Data for $\delta^{13}C$ of n-alkanes is currently being processed in preparation for presentation.