Biological Sensors for Atmospheric Nitrogen Deposition

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The Integrated Total Nitrogen Input (ITNI) method is a technique for evaluating nitrogen deposition by utilizing plants as collection interfaces. The ITNI method employs a plant-liquid-sand system (PLS system) in which a plant is hydroponically grown in silica sand and labeled with ^{15}N tracer while growing in a greenhouse. After plants are labeled, they are deployed into the environment where the ^{15}N tracer in the plant tissues is diluted as a result of atmospheric nitrogen deposition input via gaseous, leaf and root uptake. At the end of the sampling period, all components of the plant and system are harvested and analyzed on a mass spectrometer to determine the degree of dilution of the tracer. The ^{15}N values obtained will be incorporated into a mass balance equation that accounts for the total deposition occurring on the PLS system surfaces and yields the total nitrogen uptake from the atmosphere. In this study, we will employ Coastal Sage Scrub (CSS) species, a declining native California plant assemblage, to determine total nitrogen deposition occurring in the Inland Empire of Southern California. Traditional nitrogen deposition collection devices such as throughfall and ion exchange resins will be co-located with the ITNI PLS systems to compare and assess the accuracy of such traditional collectors. We will also be simultaneously investigating prominent invasive species to determine, by rate of isotope dilution, if nitrogen deposition is assimilated more readily in invasives than natives. This will explore the notion that increased nitrogen deposition rates to CSS assemblages increase invasive species proliferation and subsequent displacement of native CSS species. Previously calculated ecosystem critical loads of nitrogen deposition will be evaluated relative to the ITNI deposition rates. CSS and invasive species specific nitrogen deposition rates will be determined and compared with relative isotope dilution rates within the respective PLS systems. Lastly, isotope dilution data will be constructed into a gradient map for comparison against existing deposition data in California.

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