

From top to bottom: fluxes of nitrogen from the atmosphere to the forest floor in a redwood forest

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Fog water contains a range of important nutrients and ions that can potentially influence terrestrial forest ecosystems. Nitrogen is present in fog, sometimes in high concentrations and often in much higher concentrations than normally found in rainwater. A defining feature of the redwood forest in coastal California is the presence of fog in the summer months. In this Mediterranean climate region, the fog provides water in a time when there is typically no rainfall. However, it is not known whether redwood trees can access nitrogen directly from fog. The goal of this project is to better understand the links between the water and nitrogen cycles of coastal forest ecosystems.

In this project, we hypothesize that fog water provides redwood trees with nitrogen during the summer months when they would otherwise not be taking up nutrients. We are using natural abundance techniques to determine the source of nutrients for redwood trees throughout the year. Our results show that inorganic nitrogen entering the forest floor via fog is greatest at the forest edge closest to the ocean ($p < 0.05$) where the redwood canopy has the greatest potential for interception, compared to the interior of the forest. Similarly, we found that rain water nitrogen inputs to the forest floor are greatest at the forest edge ($p < 0.05$), but the magnitude of this difference is not as strong. While $\delta^{15}\text{NO}_3$ values were not significantly different between rain and fog water samples, $\delta^{15}\text{NH}_4$ values were significantly greater in fog compared to rain water and throughfall. $\delta^{15}\text{N}$ values of foliage from forest edge trees were significantly greater compared to interior trees ($p < 0.05$), suggesting that the forest edge trees may be obtaining a greater proportion of their nitrogen directly from fog compared to the interior trees.

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