SCCWRP #837

Estimating Wet and Dry Deposition of Nitrogen to Southern California Streams: Final Report of IA DW-12-92326401-0

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ABSTRACT

The purpose of this report is to summarize the findings of a research study designed to characterize the flux of atmospheric nutrients to southern California watersheds conducted with the support of the U.S. Environmental Protection Agency under Interagency Agreement DW 12923264010. Atmospheric deposition (wet and dry) is potentially one source of "background" nutrients to streams. The load of nutrients to aquatic habitats from atmospheric deposition, relative to other potential sources of nutrients, are not well characterized in California. In particular, little data are available on the dry deposition of atmospheric nutrients, which may constitute roughly 90% of the total annual atmospheric loads in semi-arid regions. Studies were conducted to address the following research objectives:

- Evaluate methods for assessment of wet and dry deposition rates of nitrogen and phosphorus from the atmosphere.
- Estimate the spatial and temporal variability in nitrogen and phosphorus deposition from the atmosphere to five, relatively undisturbed catchments in Southern California.
- Evaluate the utility of stable isotopic tracers, specifically the dual isotopes of nitrate ($\delta^{18}O$ and $\delta^{15}N$) to assess the contribution of atmospheric nitrate to reference streams.

Following are the major findings of this study:

1. Of the surrogate surfaces tested under controlled circumstances, the water surface samplers seemed to produce the most reliable results.
2. Across all sites, dry nitrogen and phosphorus deposition was a significant fraction of the total annual atmospheric deposition of nutrients (average nitrogen dry deposition is ~70% and average phosphorus dry deposition is ~30% of the total load), demonstrating the importance of characterizing this fraction when assessing atmospheric nutrient loads.
3. In Southern California there has been an assumption that nitrogen deposition should be dominated by oxidized forms of nitrogen due to domination by automobile exhaust; however this study shows that is not necessarily the case.
4. The dual isotopic signatures of $\delta^{18}O$ and $\delta^{15}N$ in atmospheric nitrate deposition in Southern California is consistent with literature values for atmospheric nitrate showing characteristically high $\delta^{18}O$ values. The distinctiveness of the high $\delta^{18}O$ value for atmospheric nitrate across all sites suggests that the dual isotopic composition of nitrate could be an excellent tracer for direct deposition of atmospheric nitrate into water bodies.

However, this is not to say that atmospheric deposition is not a significant source of nitrate to streams; rather, atmospheric deposition of nutrients is more likely indirectly accumulated in streams, by first depositing on the landscape and entering the streams through surface runoff or groundwater.

Full Text:

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