Road Salting Linked to Persistent Chloride Concentrations in Bedrock

Road salt application for deicing has increased in the United States since the 1940s, and many studies have shown its environmental impact in surface water and shallow groundwater. However, despite the dependence of many rural communities on bedrock wells as a primary water source, little has been studied on the impacts of road salting on water quality in bedrock.

In an article recently published in the *Journal of Environmental Quality*, researchers investigated the water quality in two crystalline bedrock wells at the University of Connecticut in Storrs over a 13-year period, with particular emphasis on impacts of increased salt application (4–15×) with a change in deicing practices at the university after 2009.

Chloride was found to be highly persistent in the bedrock, with concentrations consistently increasing from 2003 to 2016 despite annual variations in salt application, suggesting some degree of accumulation. A dramatic increase in chloride occurred in the wellbores in response to the change in deicing practices, with an immediate response in fractures having a direct connection to the overburden.

Given the critical importance of bedrock aquifers for water supplies, this study argues that consideration be given to subsurface contamination when developing deicing management strategies, particularly in regions where bedrock is shallow.


Tracking Soil Nitrogen with Stable Isotopes

Understanding the fate of nitrogen applied to soil is vitally important if we are to improve its agronomic use efficiency and reduce its negative effects on the environment. Very few studies have successfully used natural abundance isotope techniques to follow nitrogen transformations in agroecosystems.

In the March–April issue of the *Journal of Environmental Quality*, researchers report on a year-long study using stable isotope ratios to obtain a comprehensive nitrogen biogeochemical dataset before, during, and after dairy manure application to soil and combined this with continuous nitrous oxide emissions.

The team found that 56% of the ammonium (>25% of the total nitrogen application) was volatilized to the atmosphere or assimilated into organic forms within three days of the spring-time application despite immediate incorporation of the manure into the soil. In the three weeks that followed, all the remaining manure-derived ammonium was converted to nitrate (via nitrification) and nitrous oxide (via nitrifier-denitrification).

Using stable isotopes at natural abundance, the team was able to track soil transformations and differentiate gains/losses of manure nitrogen from endogenous soil nitrogen. This approach is an alternative to using artificially enriched isotope materials that are costly to apply at the field scale.


Salt buildup on the sidewalk from deicing practices. *Photo courtesy of S. Vitale.*

The biogeochemical reaction pathways of the nitrogen cycle. *Diagram provided by D. Snider.*