Dry Nitrogen Deposition on the Highway Verge

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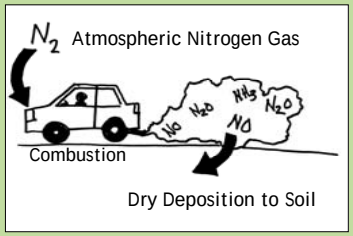
Introduction

The high temperature of fuel combustion causes nitrogen from the air to combine with oxygen and form nitrogenous gas pollutants which are released in car exhaust.



In an arid environment, these pollutants can settle along the roadside through dry deposition.

Research Question:

What is the pattern of nitrogen dry deposition to the soil of the highway verge?

Because nitrogen is a limiting nutrient in the desert, nitrogen input to the roadside ecosystem has serious implications for species composition and plant density.

Methods

•At 20 sites around the valley surface soil samples (0-2cm) were collected along transects at random distances from the highway. At each transect, 5 samples were taken and composited for analysis.

•One site was sampled intensively—103 surface soil samples were taken in a modified grid pattern.

•Both basic parametric and spatial statistics were used to analyze the patterns found.

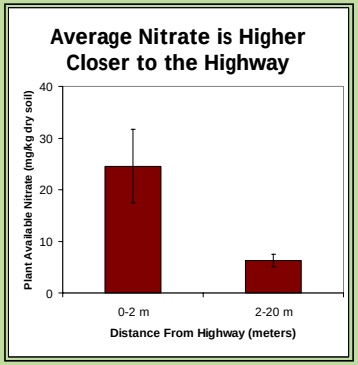
Our site—we selected a site without plants to minimize their confounding effect on nitrogen deposition.

Results

Average Soil Nitrate Levels at 20 Sites Significantly Higher Closer to Highway

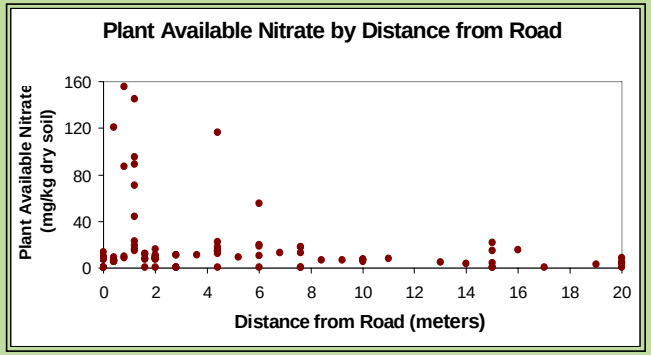
In the samples taken at twenty sites, the average nitrate was found to be significantly higher in the first two meters closest to the highway.

Based on this general pattern, we chose one site for intensive sampling to explore the pattern on a finer scale.



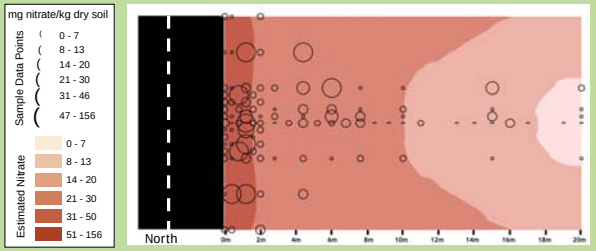
1 tailed t-test, assuming unequal variance, P <0.01; error bars indicate standard error

More Variation Seen at a Finer Scale



The highest nitrogen concentrations were found near the road and decreased with distance as expected. Because of the naturally high variability in soil samples, the linear relationship (R^2=0.04) was not statistically significant.

Estimated Nitrate Concentrations



Simple Cokriging, m=0.019, mean standardized=0.0009875, root mean squared standardized = 0.9895
Graphing Analysis by Bethany Cutts

We used kriging, a statistical model that interpolates data from a known set of sample points to a continuous surface, to estimate nitrogen concentration across the site from our sample data. In addition, distance from the road was used as a covariate.

Conclusions

These results support the hypothesis that dry deposition of nitrogenous pollutants to the roadside causes elevated nitrogen levels near the road edge.

The high variability of the data from the intensive sampling leads to further questions, and more research needs to be done to understand complicating variables such as variability in slope, vegetation, water runoff, and soil type.

These findings are applicable to the study of plant growth and migration along roadsides. For example, elevated nitrogen levels may help explain patterns of plant growth including increased plant density near the road.

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