The Role of Nitrogen in Plant Migration Along Freeway Corridors in Phoenix, Arizona

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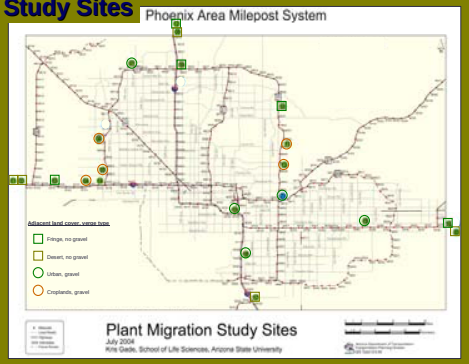
Study Sites



Question

How does nitrogen deposition affect roadside plant community composition?

1. **Is there a gradient of nitrogen deposition to freeway verges from traffic exhaust?**
2. **Are there other sources of N to freeway verges?**
3. **Does adjacent land cover affect plant-available nitrate on freeway verges?**

"Desert" sites: No gravel on verges, adjacent to desert

"Fringe" sites: No gravel on verges, adjacent to landscaped land

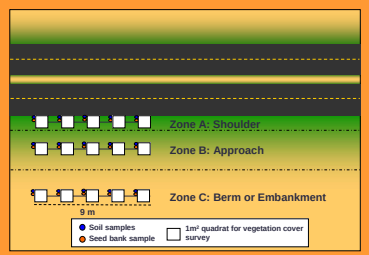
"Cropland" sites: Gravel verges adjacent to croplands

"Urban" sites: Gravel verges adjacent to landscaped land

Land adjacent to "urban" sites generally has higher density development than land adjacent to "fringe" sites.

Sampling and Analytical Methods

- 0-2 cm and 2-12 cm samples
- 5 samples in each zone composited
- Available NO_3 extracted using 2M KCl; shaken for 1 hour
- Analyzed colorimetrically using TrAAcs autoanalyzer
- Subtracted average of sample blanks
- Log transformed data to achieve normality



Results

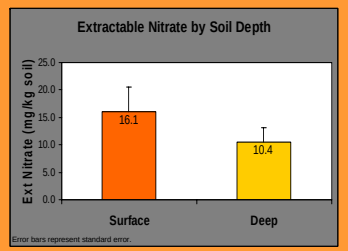
1. Across all sites, Zone A had significantly higher nitrate in surface samples than Zones B and C.

	A	B	C
A	1.000		
B	**0.003**	1.000	
C	**0.003**	0.995	1.000

(ANOVA using log surface soil; n=30, F=5.556, P=0.005; Fisher's multiple comparison)

2. There were significant differences in extractable nitrate between surface (0-2 cm) and deep (2-12 cm) samples.

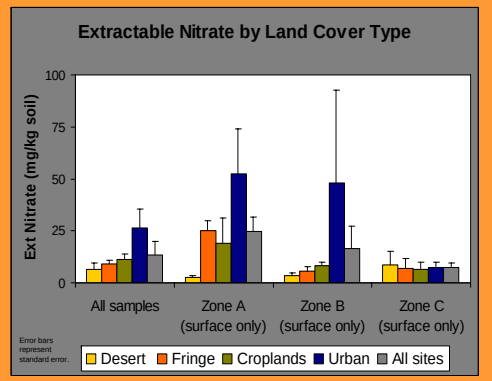
(2 sample t-test using log-transformed data; n=60, P<0.001).



3. There were significant differences in extractable nitrate between landcover types.

Urban > Crop > Fringe > Desert

(ANOVA using log surface soil; n=15, F=123.67, P<0.001; Fisher's multiple comparison all combos P<0.001)



Discussion

1. Nitrogen Deposition from Traffic Exhaust

- Extractable nitrate concentrations were generally highest in surface soils and closest to the road (Zone A)
- These results support the idea that NO_x, NH_3, and N-containing particulates from exhaust are adsorbing/depositing to roadside soil (Padgett and Bytnerowicz 2001; Cape et al. 2004)
- Results also support the finding by Cape et al. (2004) that NO_x and NH_3 gas concentrations decreased by 90% in the first 10-15m from edge of asphalt

2. Other Sources of Roadside N

- Exhaust from traffic on frontage roads
- Ammonia from fertilizers used in both current and abandoned agriculture
- Grey water use in landscape drippers

3. Role of Land Cover/Land Use

- Higher available NO_3 in landscaped verges adjacent to developed areas and agriculture; may be correlation between landscaped areas, higher traffic loads, and grey water use

4. Potential Effects on Plant Communities

- Reduced spatial variation in [soil N]
- Increased minimum values of [soil N]
- Competitive interactions in nutrient limited ecosystems (Grime 1974, 2001)
  - Low nutrient-adapted natives
  - High nutrient-adapted ruderals
- Implications for conservation value and verge management

5. Continuing/Future Work

- Analysis of plant survey data (percent cover, functional groups)
- Complete analysis of total C, N, and P in samples
- Seed bank and seed trapping results

Acknowledgements

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References

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