Effects of Nitrogen Deposition on Coastal Sage Scrub Invasion and Reestablishment

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• Nitrogen deposition assessment of the Santa Monica Mountains NRA
• Effects of N deposition on coastal sage scrub
• N addition experiment 2012-2013 season data
• Conclusions
• Future directions
Industrials, vehicular, and agricultural emissions contain ionic and particulate nitrogenous compounds.

In southern California, this accumulates as dry deposition during the summer and results in an influx of nitrogen with the first rains of the season.

In the Santa Monica Mountains NRA, N deposition has been modeled at 2-25 kg/ha/yr.
Modeled Nitrogen Deposition in the Santa Monica Mountains

SAMO N Deposition in 2002

Tonneson et al. 2007
Nitrogen Deposition Assessment of the Santa Monica Mountains NRA

- Funded by NPS Air Resources Division

- Collaboration between University of California, Riverside, U.S. Forest Service and Santa Monica Mountains NRA
Effects on Coastal Sage Scrub

- Monitoring coastal sage scrub vegetation across the N deposition gradient
- What are the effects on *diversity*, *invasion* and *native seedling establishment*?
Effects on Coastal Sage Scrub

**Critical load** - quantitative estimate of exposure to one or more pollutants below which no harmful effects occur
Effects on Coastal Sage Scrub

• What are the **critical loads** of N deposition for coastal sage scrub?
  • Diversity
  • Invasion
  • Productivity
  • Ecosystem processes
Experimental Fertilization Plots

- Installed December 2011 in mature stands of coastal sage scrub
- 10 blocks at two sites (20 total)
- Four 5x5m plots per block
- Each plot fertilized annually in the fall at three different levels plus unfertilized controls

- 3.0 g
- 1.5 g
- 0.5 g
- 0 g (control)

5m | 5m
N Addition Experiment 2012-2013 Season Data

- Two sampling dates (February and April)
- Two sites: Rancho Sierra Vista and Deer Creek
- Four 0.125 m² quadrats/plot in shrub interspaces
- Measured plant density, cover, height
- Nonnative biomass
- Harvested *Artemisia californica* seedlings
Nitrogen addition reduces *Artemisia* seedling density.
Nitrogen addition increases percent nonnative cover.
Native seedling density is not significantly correlated with nonnative cover.

\[ R^2 = 0.1413 \]
\[ P = <0.001 \]
Nitrogen addition reduces *Artemisia* seedling root:shoot ratio.
Conclusions

- N addition reduces establishment and alters growth allocation of native shrub seedlings.
- Increased N results in higher cover and aboveground biomass of nonnative plant species.
- Nitrogen deposition may reduce native seedling establishment due to increased nonnative cover and altered seedling physiology.
Conclusions

• N deposition may limit passive re-colonization and active restoration of coastal sage scrub and increase invasibility.

• Levels of N deposition within the SMMNRA may need to be taken into consideration when developing management plans.
Future Directions:

**Post-fire** Effects of Nitrogen Deposition on Coastal Sage Scrub Invasion and Reestablishment
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