



Nitrogen Emissions from Poultry Operations and their Influence on Pitch Canker Incidence in *Pinus Elliottii* Stands



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INTRODUCTION

Concentrated animal feeding operations (CAFO's) produce pollutants that threaten the health of ecosystems. Pitch canker incidence and severity in slash pine (*Pinus elliottii*) plantations near poultry production operations in Florida have been identified as significant problems. Pitch canker is a naturally occurring disease which is exacerbated by high or imbalanced levels of nitrogen (N). High N loadings apparently make plant tissues more susceptible to the invading pathogen (*Fusarium subglutinans*). Trees act as natural filters for aerial N emissions from poultry houses, thus influencing the magnitude of throughfall inputs and ammonia deposition in the stand.

OBJECTIVES

- Quantify spatial variability of accumulated N in soils, forest floor, and foliage in close proximity to poultry houses with attention to spatial relationships
- Quantify temporal and spatial impact of forest stands on filtering N emissions
- Investigate relationships between accumulated N and pitch canker impacts

STUDY SITES

Seven slash pine plantations adjacent to large poultry production operations were selected for study in north central Florida. Two sites are shown in Figure 1 (site 1 and site 2). Poultry houses at each study site were equipped with forced-ventilation fans (Figure 2). One of the seven plantations was selected for intensive sampling. Three additional slash pine plantations, distant from poultry operations, are being evaluated as control sites.

METHODS

In each study plantation, 1/40th ac plots were established on a systematic grid along with randomly selected plots. All trees within each plot were individually assessed for size, mortality, pitch canker incidence, and pitch canker severity. Foliage, forest floor, and soil samples were collected from each plot center and were dried, ground, and analyzed for total Kjeldahl N. Throughfall was also collected on several dates from the intensively studied site and analyzed for ammonia (NH₃-N) using split PVC pipes approximately 1 m in length.

Pitch canker disease index was determined for each plot by integrating pitch canker incidence (% trees with pitch canker) and severity (% of live crown exhibiting pitch canker symptoms).

Maps of study parameters were created using ordinary kriging methods.

Figure 1: DOQQ and plot design of the intensively studied site



Figure 2: forced-ventilation fans on poultry houses.



Figure 3: Ammonia content in throughfall.

June 24, 2003 - during cleaning of house
July 8, 2003 - 2 weeks old chickens
July 24, 2003 - 4 weeks old chickens
September 2, 2003 - cleaning of chicken houses

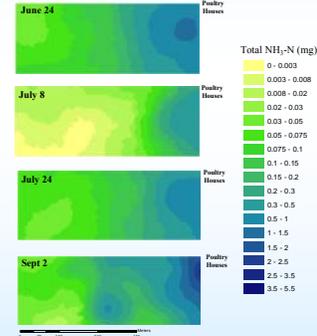


Figure 4: Foliar N

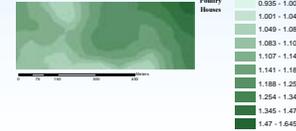


Figure 5: Forest Floor N



Figure 6: Soil N

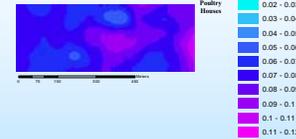


Figure 7: Pitch canker disease index

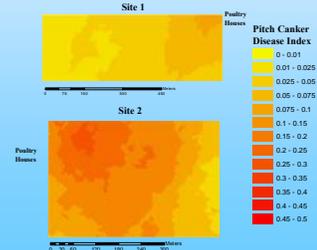
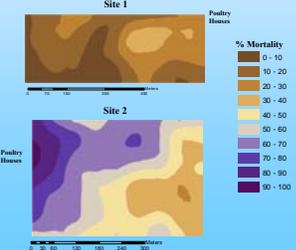


Figure 8: Site mortality



RESULTS

Total NH₃-N in throughfall showed a distinct gradient, with the highest concentrations nearest the houses and a decline with increasing distance (Figure 3). The four dates clearly show a difference in emitted N during the poultry production cycle.

Total N concentrations in tree crowns were highest nearest the poultry houses and showed a clear relationship with distance from the houses (Figure 4). Foliar N declined from a high of 1.64 % near the houses to a low of 0.94 % approximately 400 m away from the houses. Normal background levels are considered to be around 0.9 to 1.0 % N.

Forest floor total N concentration patterns were similar to the foliage patterns with high concentrations near the poultry houses that diminished with distance (Figure 5). The highest concentration was 1.34 % while the lowest was 0.48 %. Background levels normally range from 0.4 to 0.6 % for slash pine.

Soil total N, ranging from 0.02 to 0.12 % N, (Figure 6) displayed similar patterns to those described above. Soil N was the least sensitive and least descriptive of N status.

Pitch canker disease indices were also found to be highest near the poultry houses in the two sites analyzed to date (Figure 7). Similarly, slash pine mortality was also greatest where the highest pitch canker disease indices were found (Figure 8).

SUMMARY

- Data to date clearly demonstrates 1) a clear distributional gradient of N levels in slash pine plantations near poultry production operations and 2) a strong association between these gradients and the impact of pitch canker disease.
- The influence of such N gradients and associated pitch canker impacts is measurable up to approximately 400 m from poultry houses in a least some poultry operations.
- Analysis for the other five study sites and the three control plantations are ongoing.

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