Cattail (Typha) Invasion in Three Great Lakes Marshes: Possible Causes and Consequences

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Introduction

• Within the last century, temperate wetlands have been invaded by aggressive exotic species including cattails, Typha spp.

• Conversion of entire wetlands into a Typha monoculture is not uncommon, but the mechanisms are not well known. It is often associated with nutrient input or change in hydrology (Galatowitsch et al. 1999)

• Fertilizer addition in a temperate marsh increased Typha cover and decreased native sedge cover (Woo and Zedler 2002).

• Few field studies have quantified the community level effects of Typha invasion.

Methods

• 3 coastal marshes surveyed in Northern Michigan
  • 1 transect from inland to lake in each marsh
  • 10-15 m² plots along each transect
  • Environmental and community measurements taken (see flowchart below).

• Species richness, Typha cover
• Soil organic matter
• Distance from lake
• Water depth

Q1: What are the mechanisms of Typha invasion?

H1. High nutrient levels allow Typha to invade a marsh.

-PO₄ yes
-NH₄ yes
-SOM yes

H2a. Typha increases litter depth/cover decreases soil temperature

H2b. Typha decreases species richness directly through live vegetation indirectly through litter production soil temperature

Q2: How does this invasion affect the environment and the native community?

H2a. Typha increases litter depth/cover decreases soil temperature

H2b. Typha decreases species richness directly through live vegetation indirectly through litter production soil temperature

Q2 cont.

H2c. Typha changes community composition directly (live) NS indirectly (litter) yes

The interactions may result from a nonlinear relationship between richness and litter depth/soil temperature.

Species richness

Water depth

Distance from lake

Soil temperature

Soil organic matter

PO₄

NH₄

Litter depth

Species Percent Cover

Species composition

Species richness

Figure 2. A comparison of Typha density and stature with the native sedge-rush community.

Figure 3. Summary of the above findings for species richness, bold indicates significant effects with direction from ANCOVAs.

Conclusions

• Typha invasion is correlated with soil nutrients

• Indirect effects of Typha (litter production, soil temp.) are more important than direct effects in influencing the community

• Litter increases species richness, however community response may be nonlinear

• Typha is associated with a decrease in sedges / rushes and an increase in dicots / grasses

Future Directions

• Experiments are underway to tease out the effects of the many covarying environmental and Typha variables

• Typha may be increasing rates of nutrient cycling via litter production and thereby facilitating its invasion