Effects of raised temperature and northward species migration on experimental tidal freshwater marsh communities from European and American estuaries

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Tidal Freshwater Marshes (TFM) are wetlands dominated by herbacious plant communities with:
- tidal influence
- low salinity (< 0.05 ppt)

IPCC projects an average global warming between 1.8-4.0°C at the year 2100

Future global warming could favor northward species migration
Introduction

• Effects of elevated temperature and northward species migration on TFM?

• **Hypothesis 1**
  Elevated temperature increases germination

• **Hypothesis 2**
  Elevated temperature increases biomass production

• **Hypothesis 3**
  Migration increases species richness
Methods

Sampling

• Seed bank samples; 6 estuaries; Europe and North America
• 3 TFM per estuary (6600 cm³ soil / site)

Source: google maps, modified
Methods

Experimental setup
• Temperature (ambient; increased)
• Migration (no, limited, complete)

Measurements
• Initial seedling emergence
• Aboveground biomass
• Species richness

Picture credit: Florian Rink
Temperature Treatments

Mean difference: 2.85 °C
Migration Treatments

No Migration Treatment

- Homogenized samples from each site were used separately

Limited Migration Treatment

- Samples from all sites of an estuary were mixed

Complete Migration Treatment

- Samples from all sites of all estuaries were mixed
Effect of Temperature on Germination

- **EUR + NA**: effect of temperature after 5 days (p<0.01)
- **NA**: effect of temperature after 10 days (p<0.01)
Effect of Temperature on Biomass

Forbs & grasses:

• **EUR+NA**: effect of temperature on biomass ($p<0.05$)
Effect of Temperature on # Species

• **NA:** effect of temperature on number of forbs, and on total number of species (p<0.05)
Effect of Migration on # Species

Europe (EUR)

North America (NA)

- Forbs  
- Grasses  
- Fabaceae

- No  
- Lim  
- Com

- -T  
- +T

- EUR+NA: effect of temperature on number of forbs (p<0.05)
**Effect of Migration on Biomass**

- **EUR+NA:** no significant effect of migration on biomass
Effect on Community Structure

- Few species benefitted from elevated temperatures
- *Lythrum salicaria* had significantly higher biomass production
Patterns between Continents and along Latitudinal Gradients

Number of seedlings, biomass production, & number of species
• increased from North to South
• was higher at North American estuaries
Hypotheses 1 & 2:
Elevated temperature
• increased germination
• increased biomass production

• Reduced the number of species

Hypothesis 3:
• Migration increased the number of species
Thanks for your attention!