

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

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DER FORSCHUNG | DER LEHRE | DER BILDUNG



Introduction

- **Tidal Freshwater Marshes** (TFM) are wetlands dominated by herbaceous 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

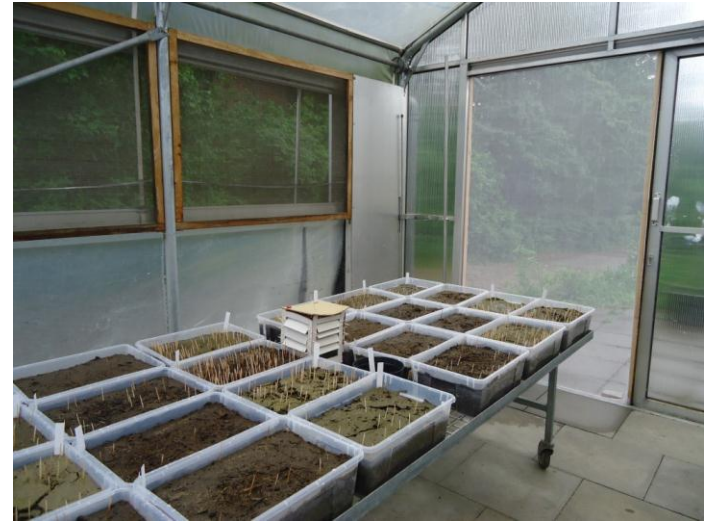
Methods

Experimental setup

- Temperature (ambient; increased)
- Migration (no, limited, complete)

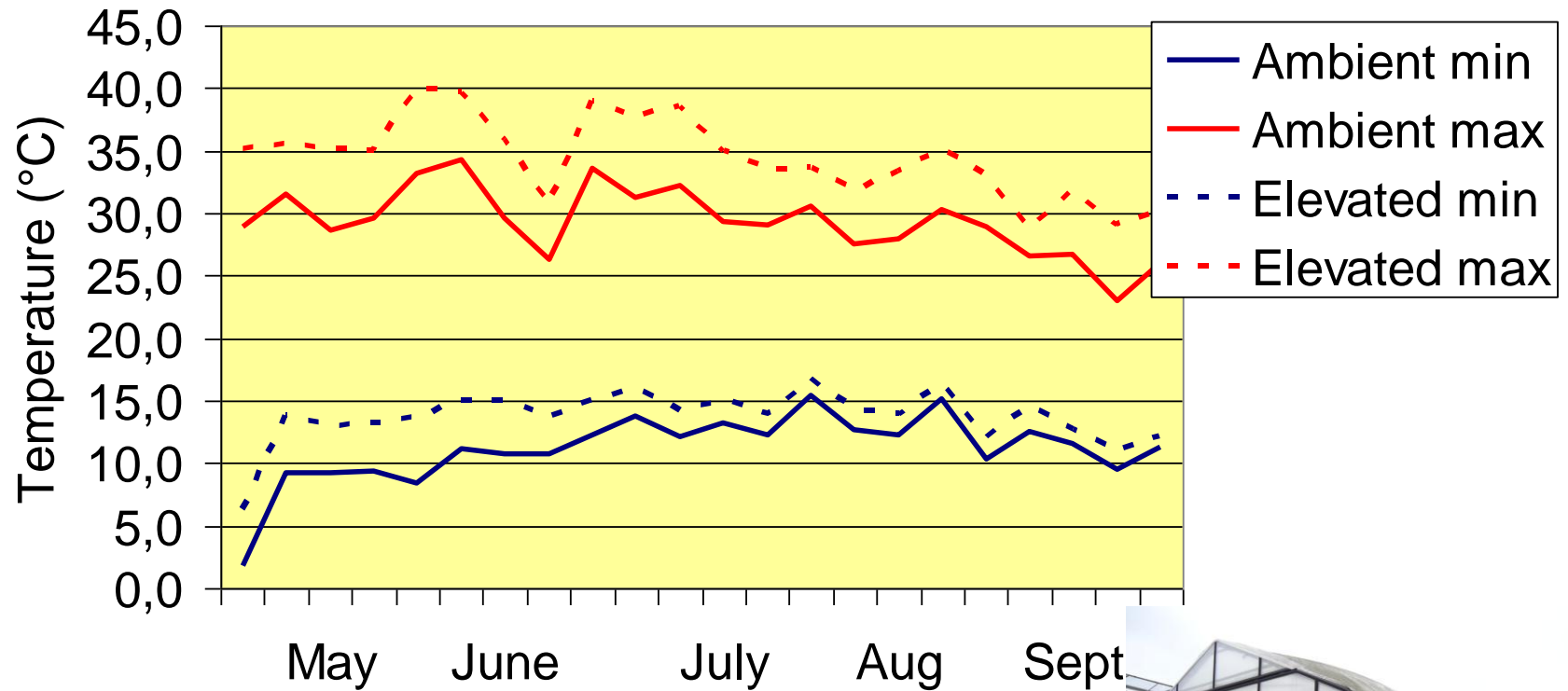
Measurements

- Initial seedling emergence
- Aboveground biomass
- Species richness



Picture credit: Florian Rink

Temperature Treatments



Mean difference: 2.85 °C



Migration Treatments

Elbe (G) samples



Loire (FR) samples



Minho (PT) samples



No Migration Treatment



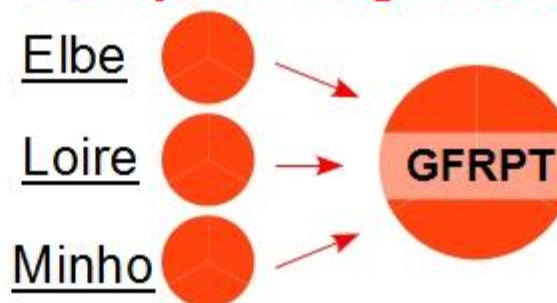
Homogenized samples from each site were used separately

Limited Migration Treatment



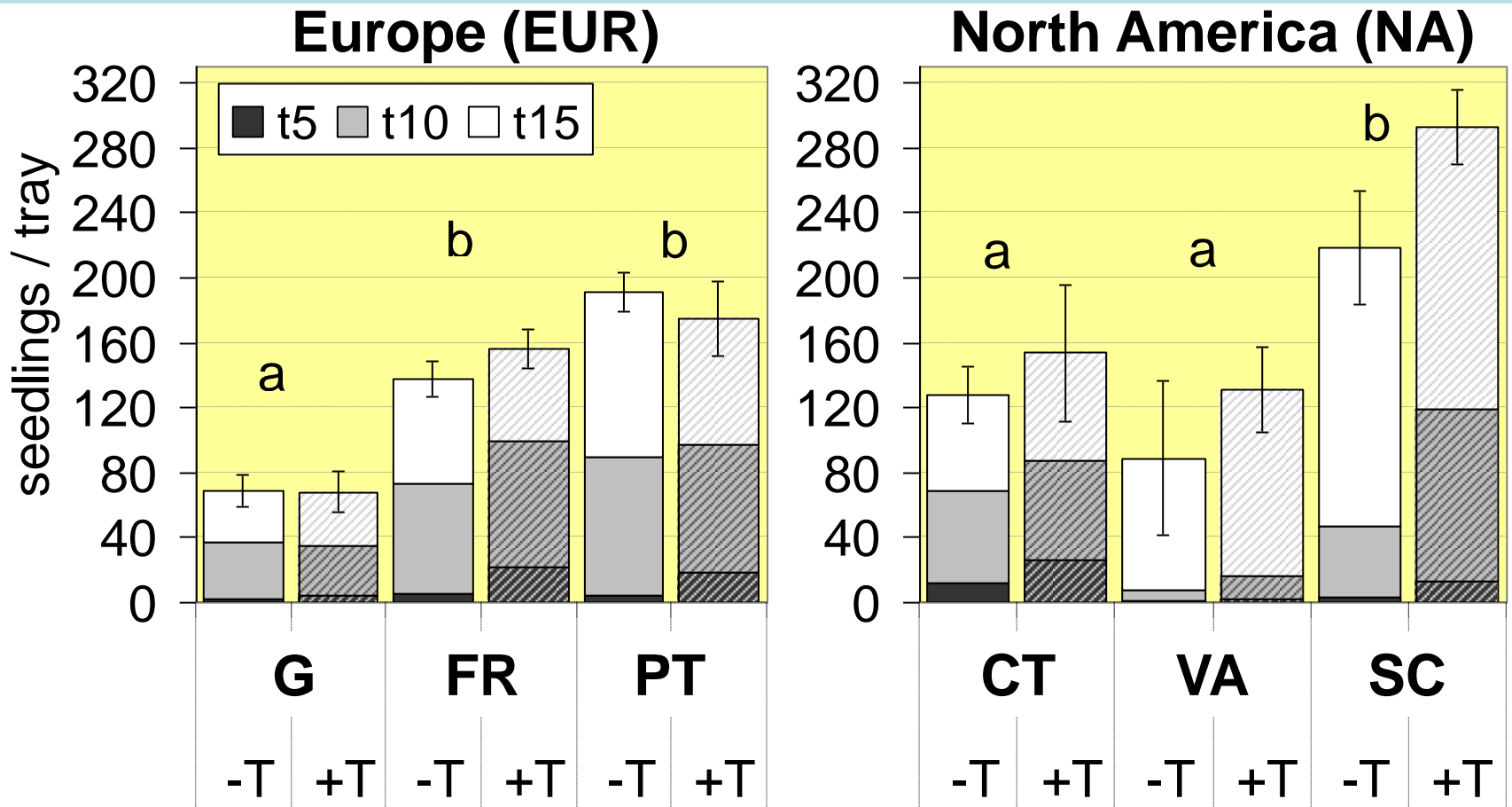
Samples from all sites of an estuary were mixed

Complete Migration Treatment



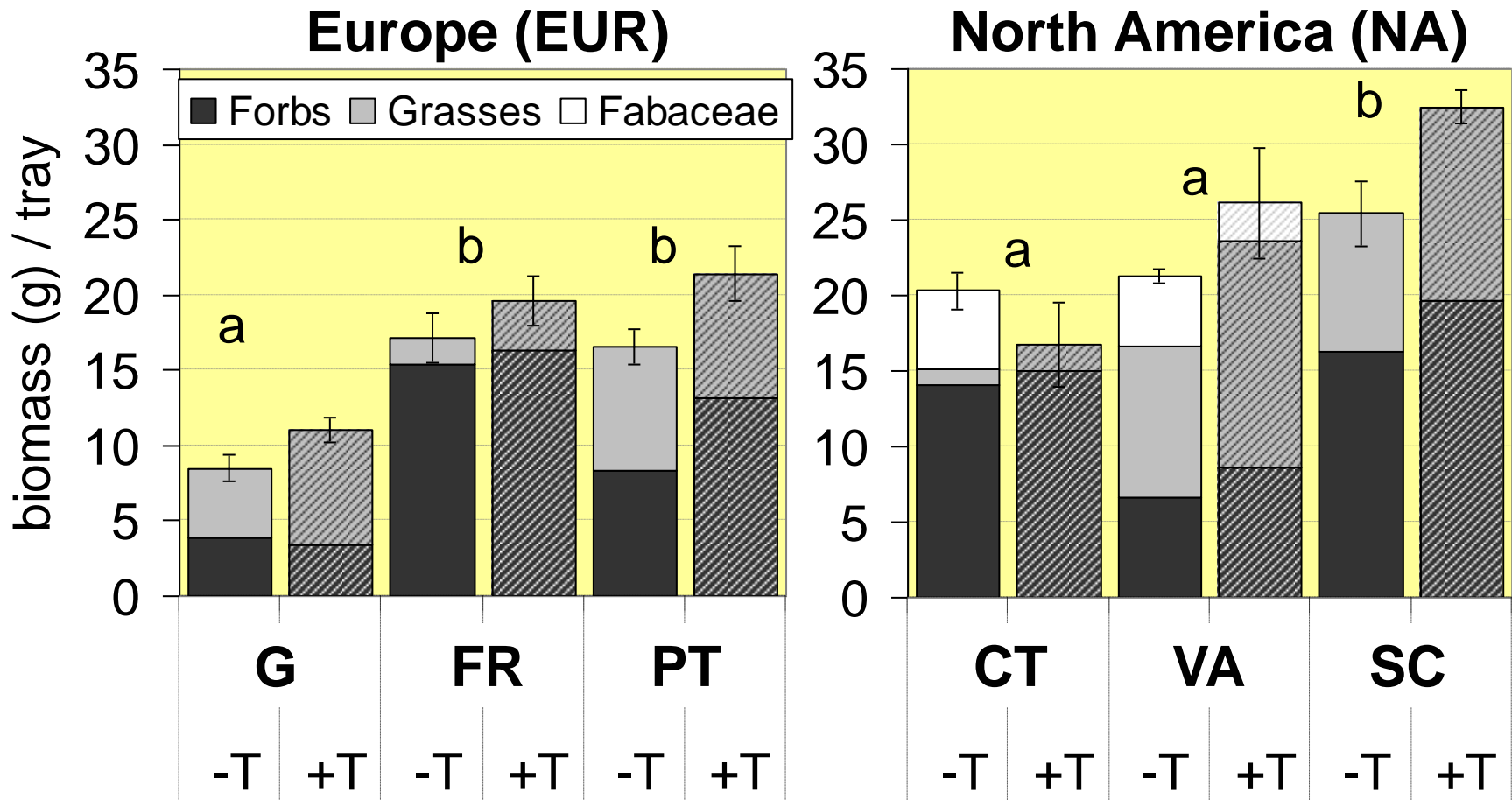
Samples from all sites of all estuaries were mixed

Effect of Temperature on Germination



- **EUR + NA:** effect of temperature after 5 days ($p < 0.01$)
- **NA:** effect of temperature after 10 days ($p < 0.01$)

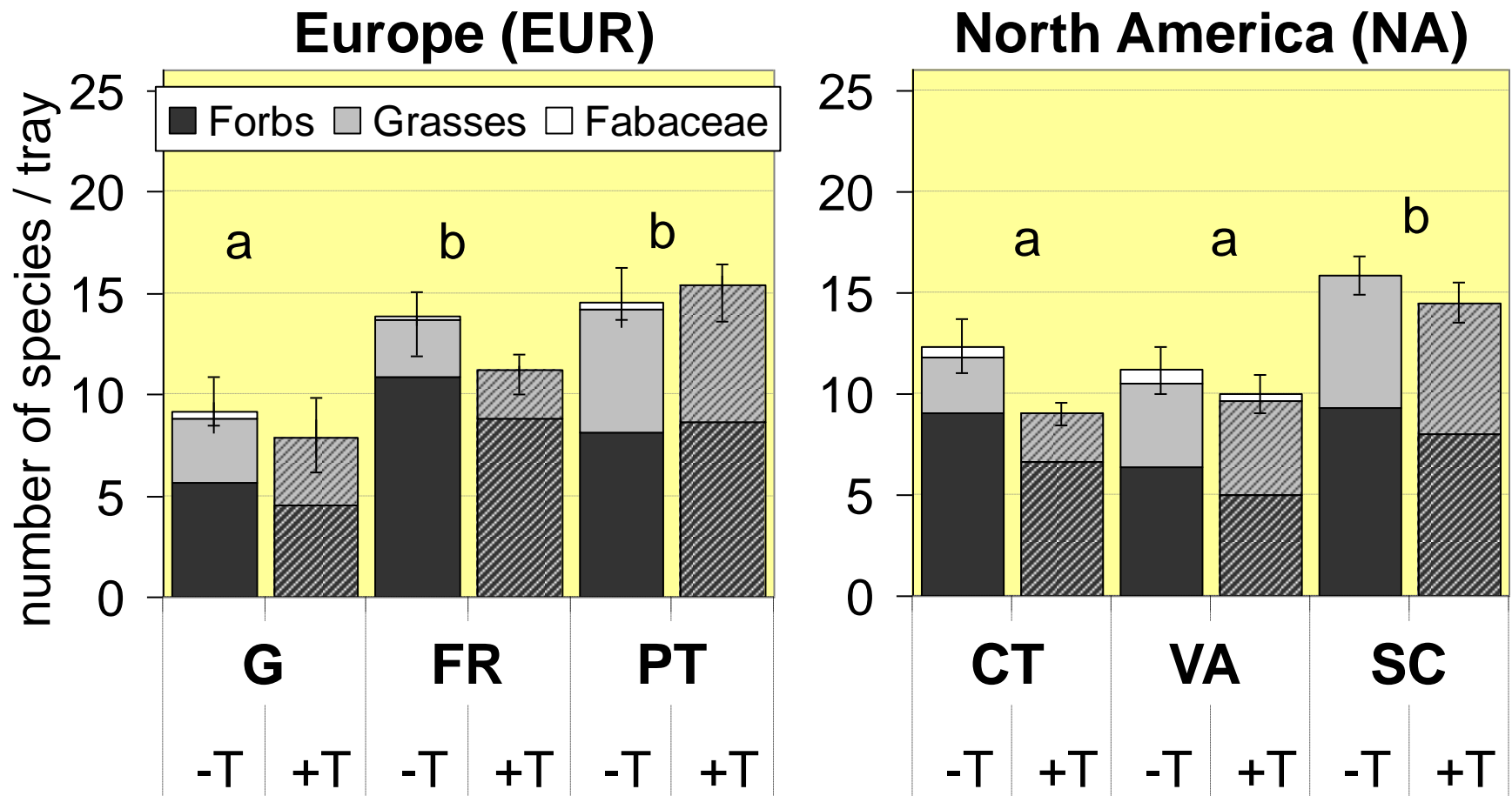
Effect of Temperature on Biomass



Forbs & grasses:

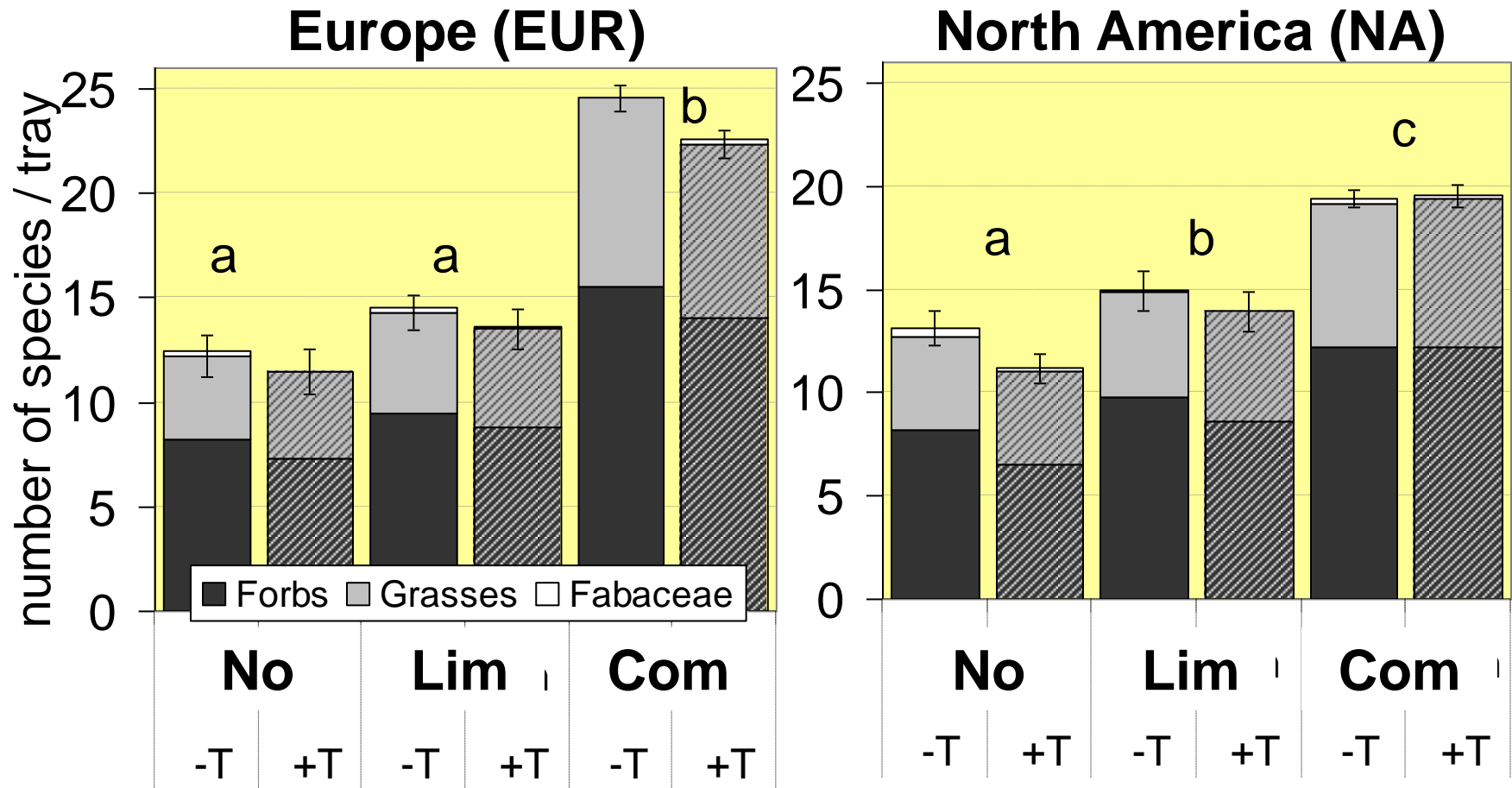
- EUR+NA: effect of temperature on biomass ($p < 0.05$)

Effect of Temperature on # Species



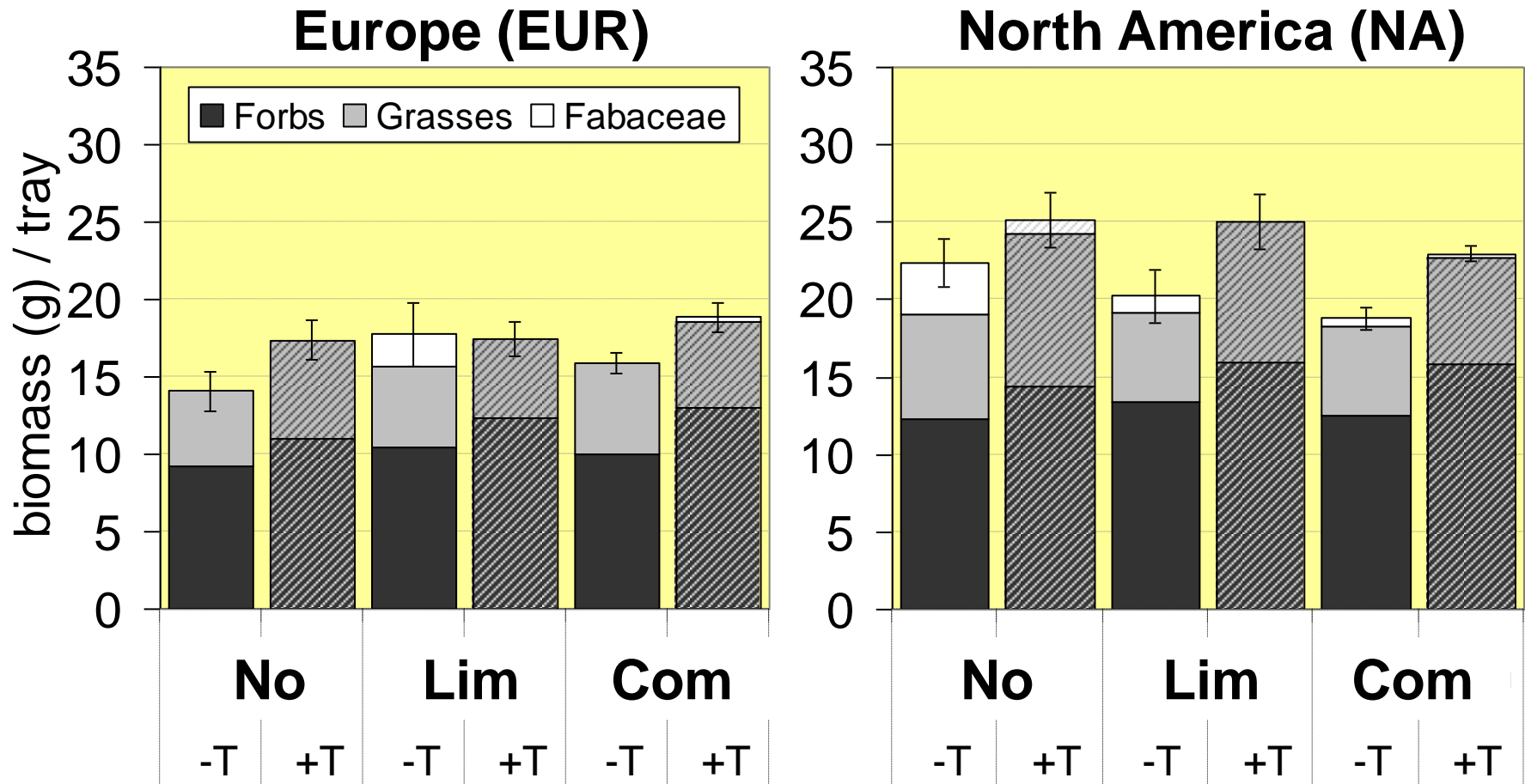
- **NA:** effect of temperature on number of forbs, and on total number of species ($p < 0.05$)

Effect of Migration on # Species



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

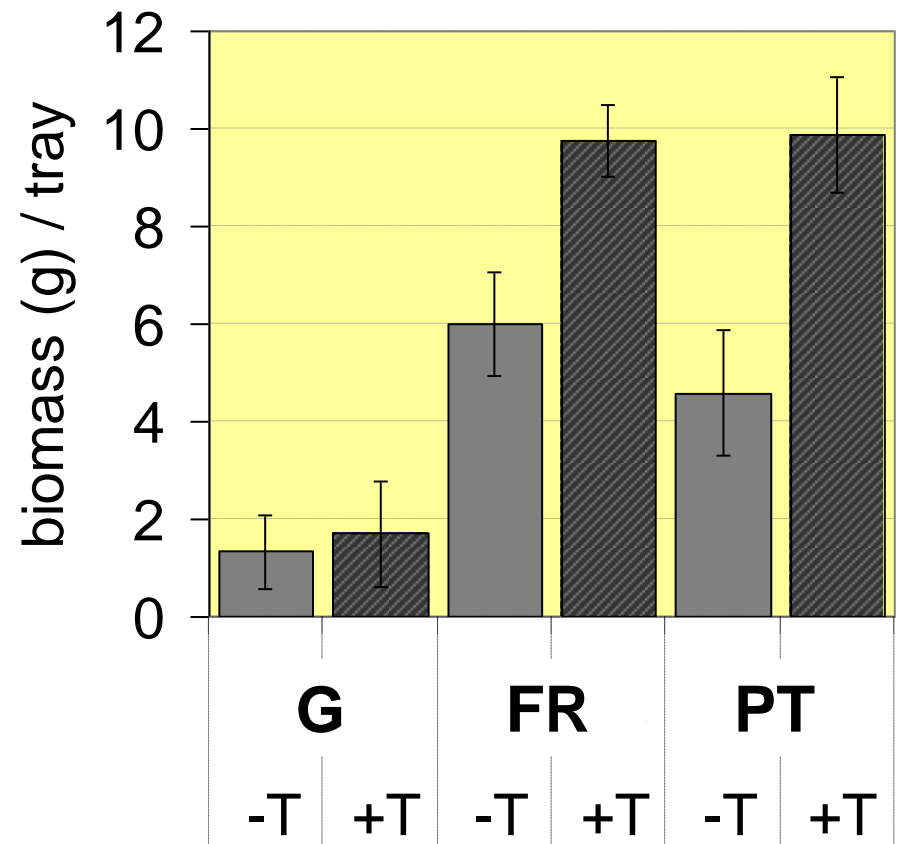
Effect of Migration on Biomass



- 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



Summary

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

Loire (FR)



Ambient

Elevated

Waccamaw (SC)



Ambient

Elevated

Summary

Effects of Temperature and Migration

Hypotheses 1 & 2:

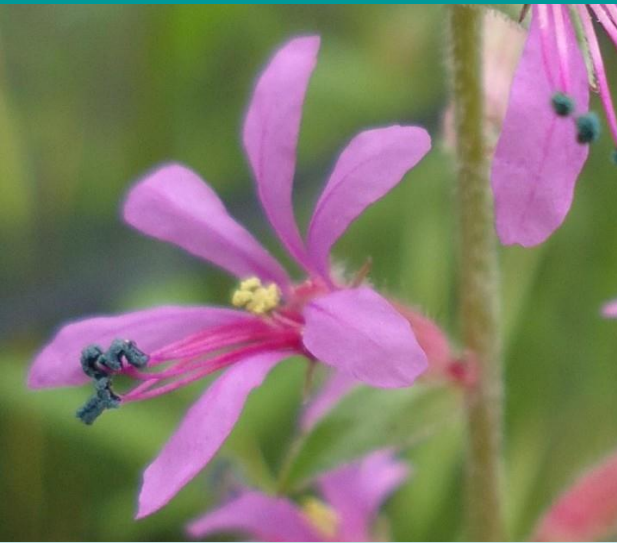
Elevated temperature

- increased germination
- increased biomass production
- Reduced the number of species

Hypothesis 3:

- Migration increased the number of species





Thanks for your attention!

