



# Global Diversity of Aquatic Macrophytes in Freshwater

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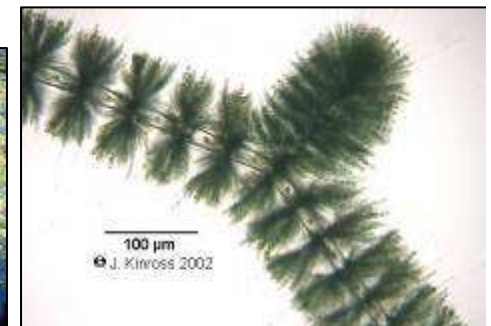
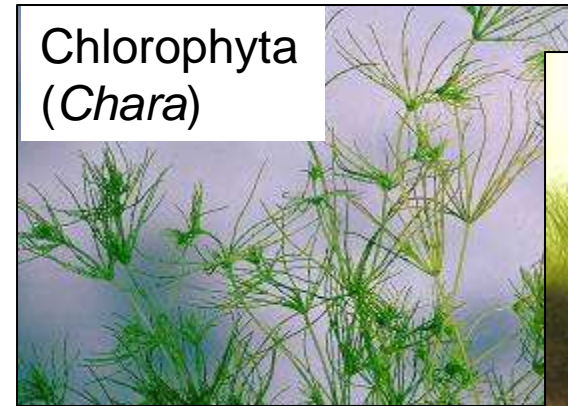
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# Objectives

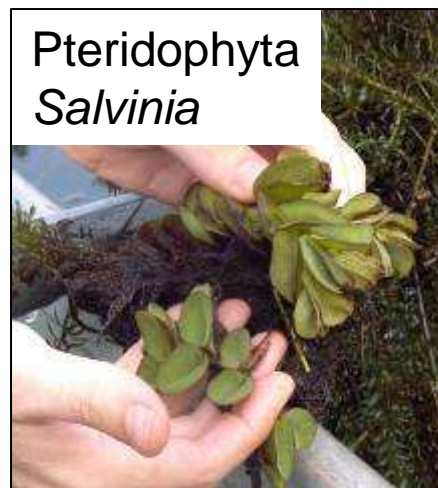
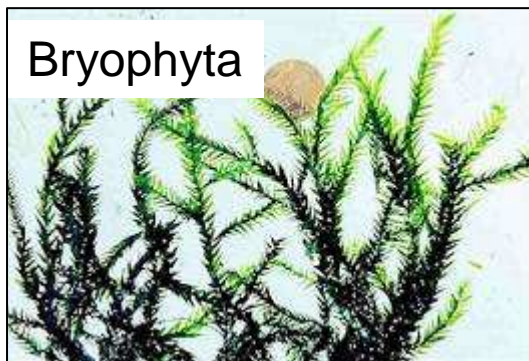
- ✓ Global Macrophyte Assessment
  - Produce an estimate of global species and generic diversity
  - Report on geographic distribution (by major biogeographic regions)
  - Highlight main areas of endemism
  
- Patterns in North American Diversity
  - Identify species and genera occurring in Canadian provinces, USA states and Mexico, and similarities in species composition amongst these geographic units

# Definition

Aquatic macrophytes -- aquatic photosynthetic organisms, large enough to see with the naked eye, that grow permanently or periodically submerged below, floating on, or growing up through the water surface.



Rhodophyta  
(*Batrachospermum*)



# Types of Macrophytes



Emergent



Free floating



Floating Leaved



Submerged



*Victoria amazonica*



*Wolffia* sp.

# Methods

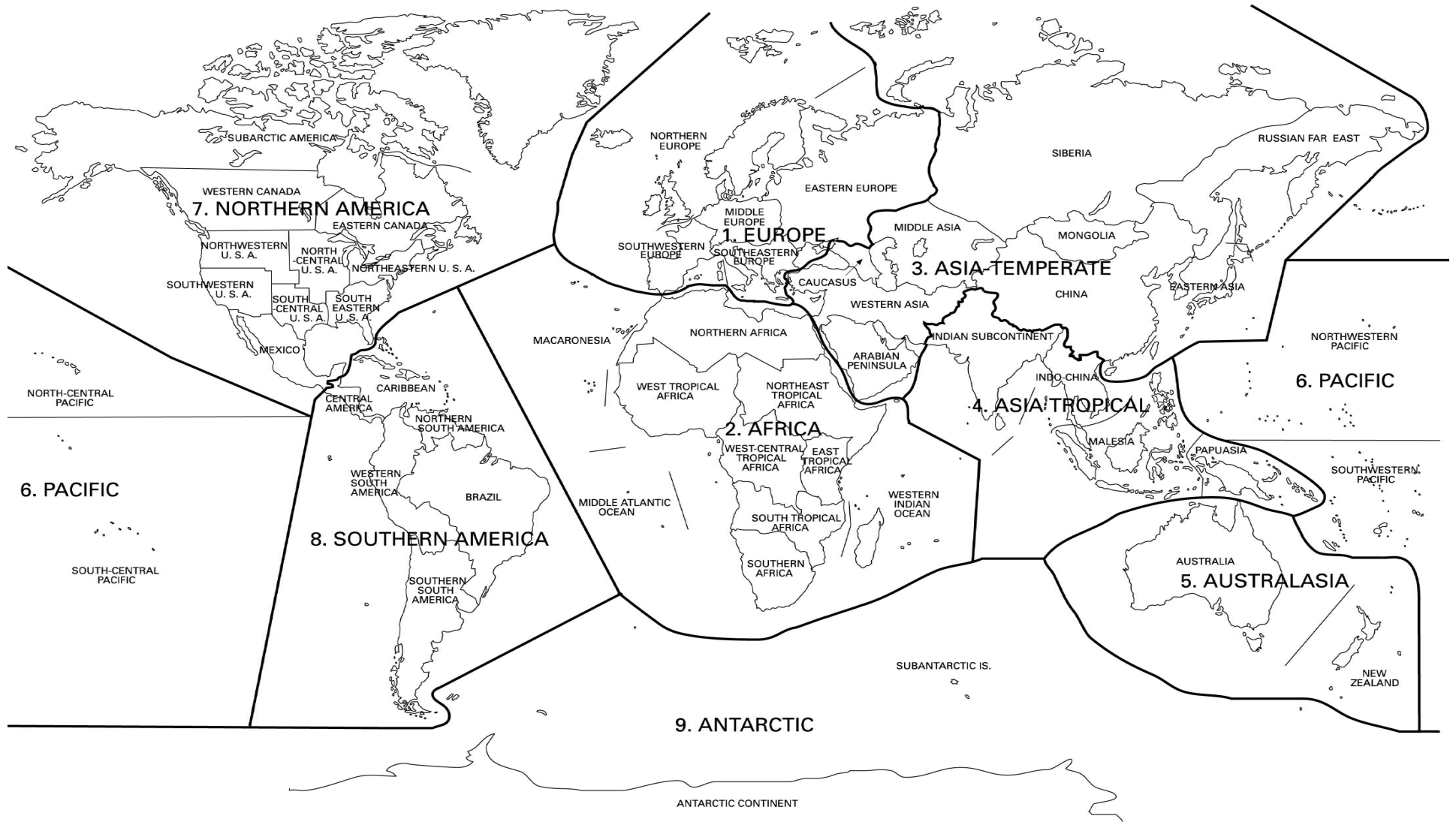
## *Patterns in North America Diversity*

- Reduced dataset to NA data only (as with FADA ms, only considered higher macrophytes)
- Grouped data following International Working Group on Taxonomic Databases for Plant Sciences (TDWG) geographical codes (Brummitt 2001)

### Statistics:

1. Dissimilarity matrix calculated in the multivariate statistical package PRIMER version 5.2.9 (Plymouth Routines in Marine Ecological Research)
2. Cluster analysis conducted to identify states/provinces with relatively homogeneous assemblages
3. Analysis of Similarities (ANOSIM) was used to determine whether the assemblages identified in the cluster were statistically different

# TDWG geographical codes – Continents and Regions





## TDWG geographical codes – Regions & Level 3

For our NA analysis, grouped data by state or province, except:

- larger Canadian provinces (BC, AB, SK, MB, ON, QC) split into north and south portions
- Mexico is not divided by state (but am working on this!)

# TDWG geographical codes – Regions & Level 3





# Methods

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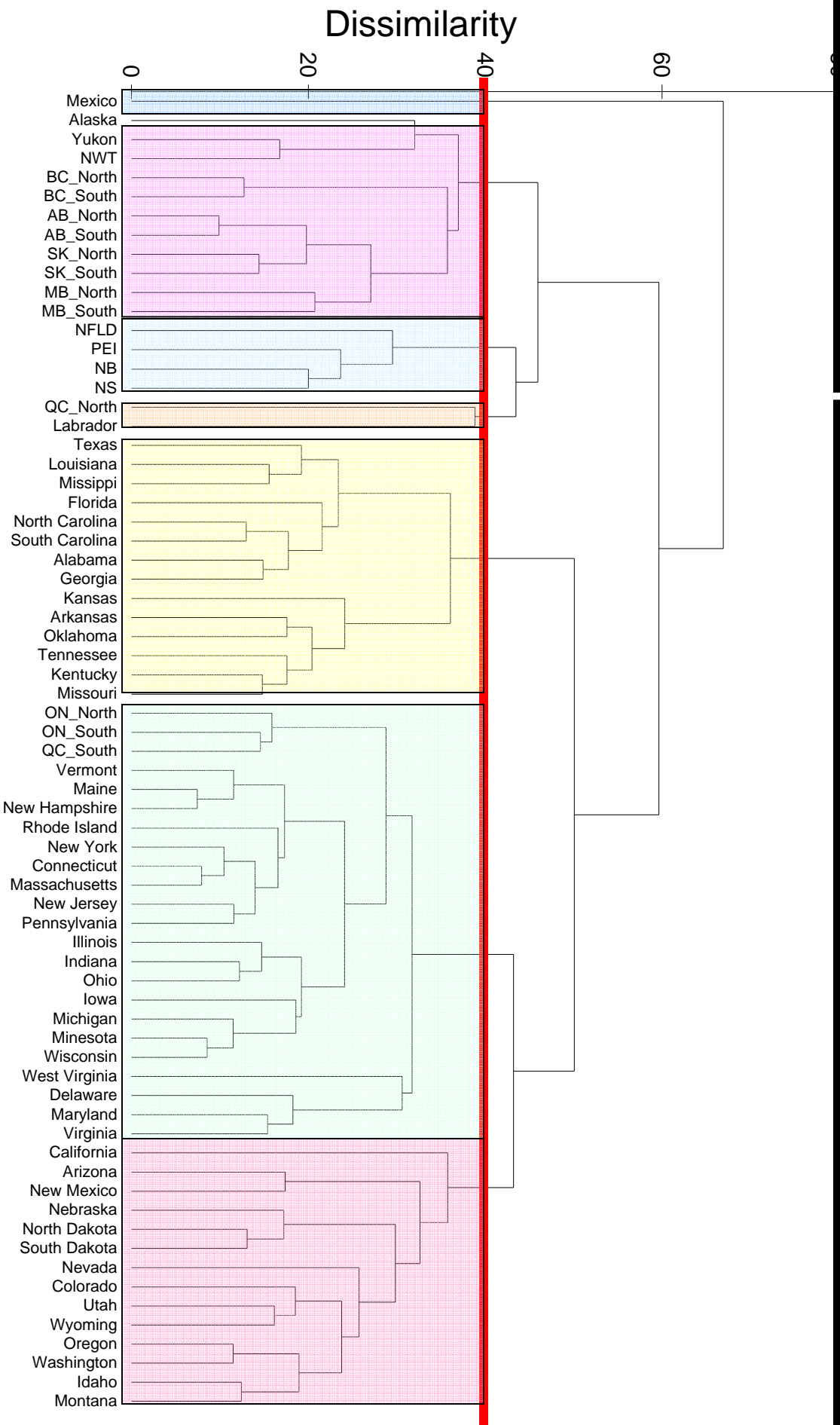
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# How many macrophytes in North America?

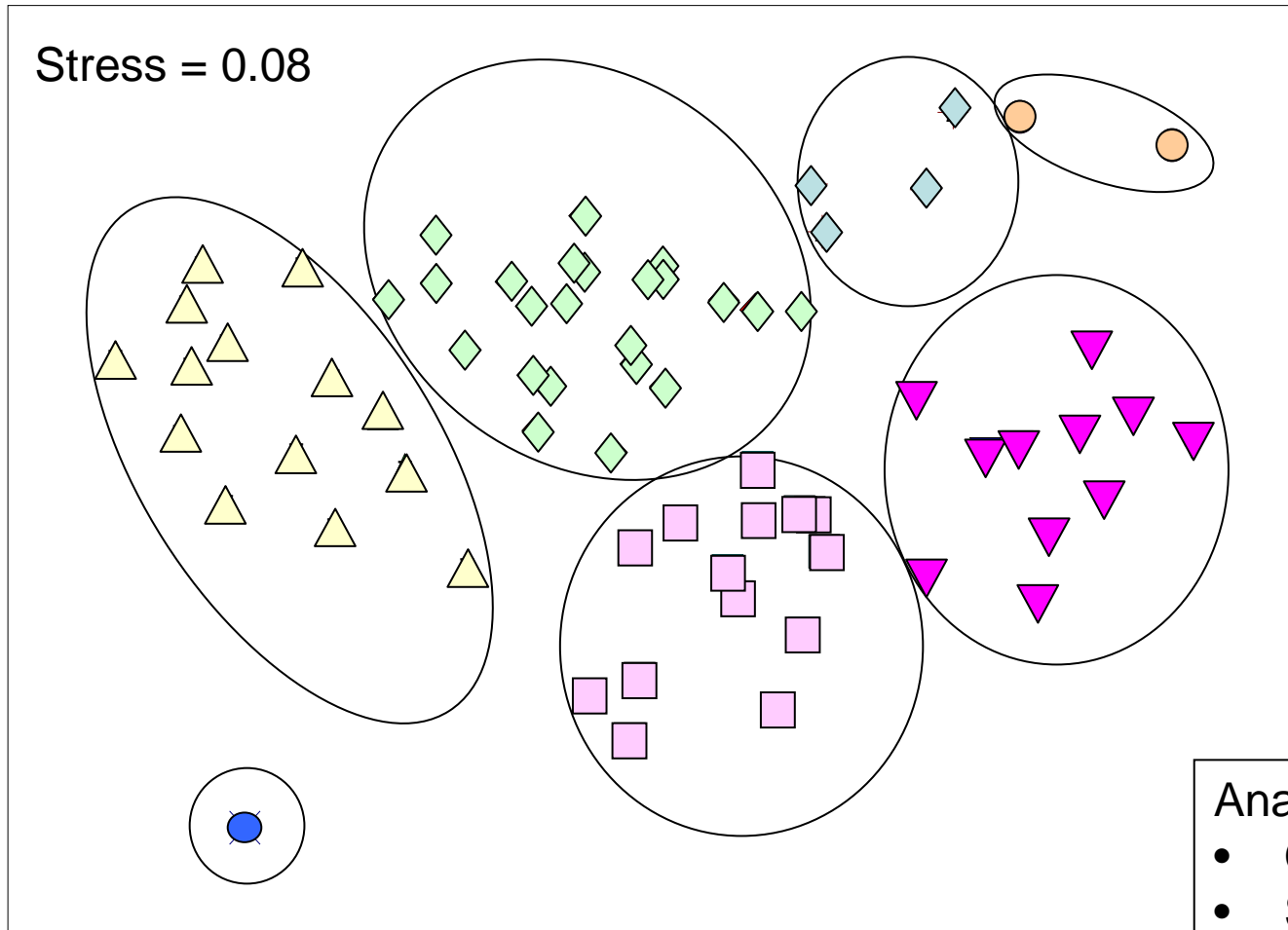
- For the vascular macrophytes (Pteridophyta and Spermatophyta)
  - 27 orders (vs. 33 globally)
  - 63 families (vs. 88 globally)
    - c. 193 genera (vs. c. 412 globally)
    - » c. 639 species (vs. 2614 globally)



# Which states / provinces have similar species occurrence?



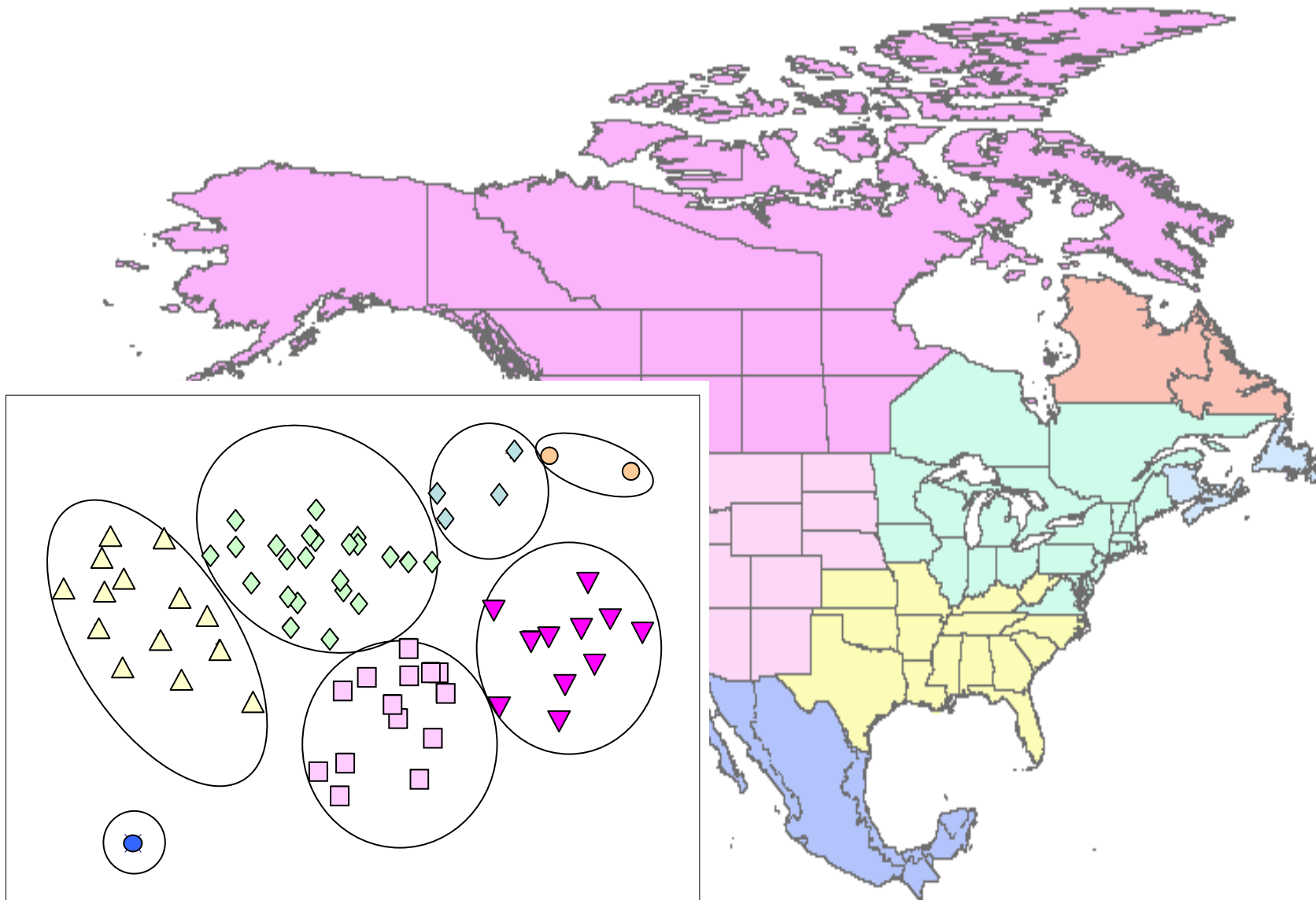
# Similarity relationships in species occurrence



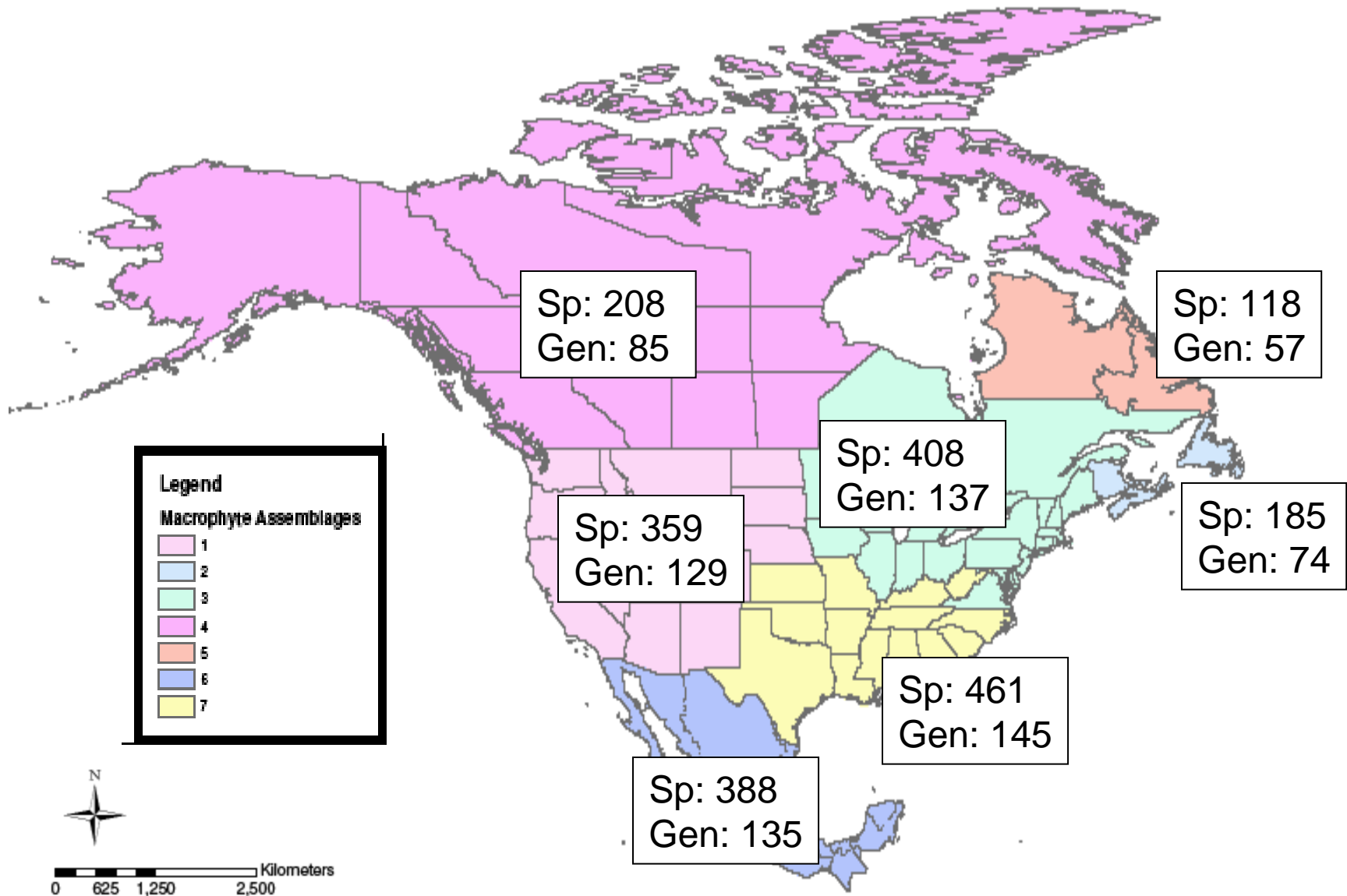
Analysis of Similarities:

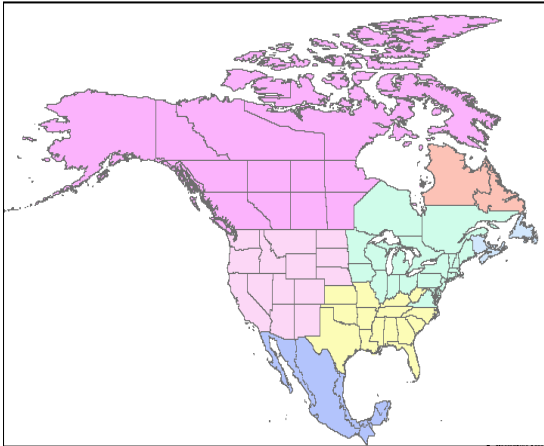
- Global R: 0.892
- Significance level of sample statistic: 0.1%

# North American macrophyte diversity



# North American macrophyte diversity

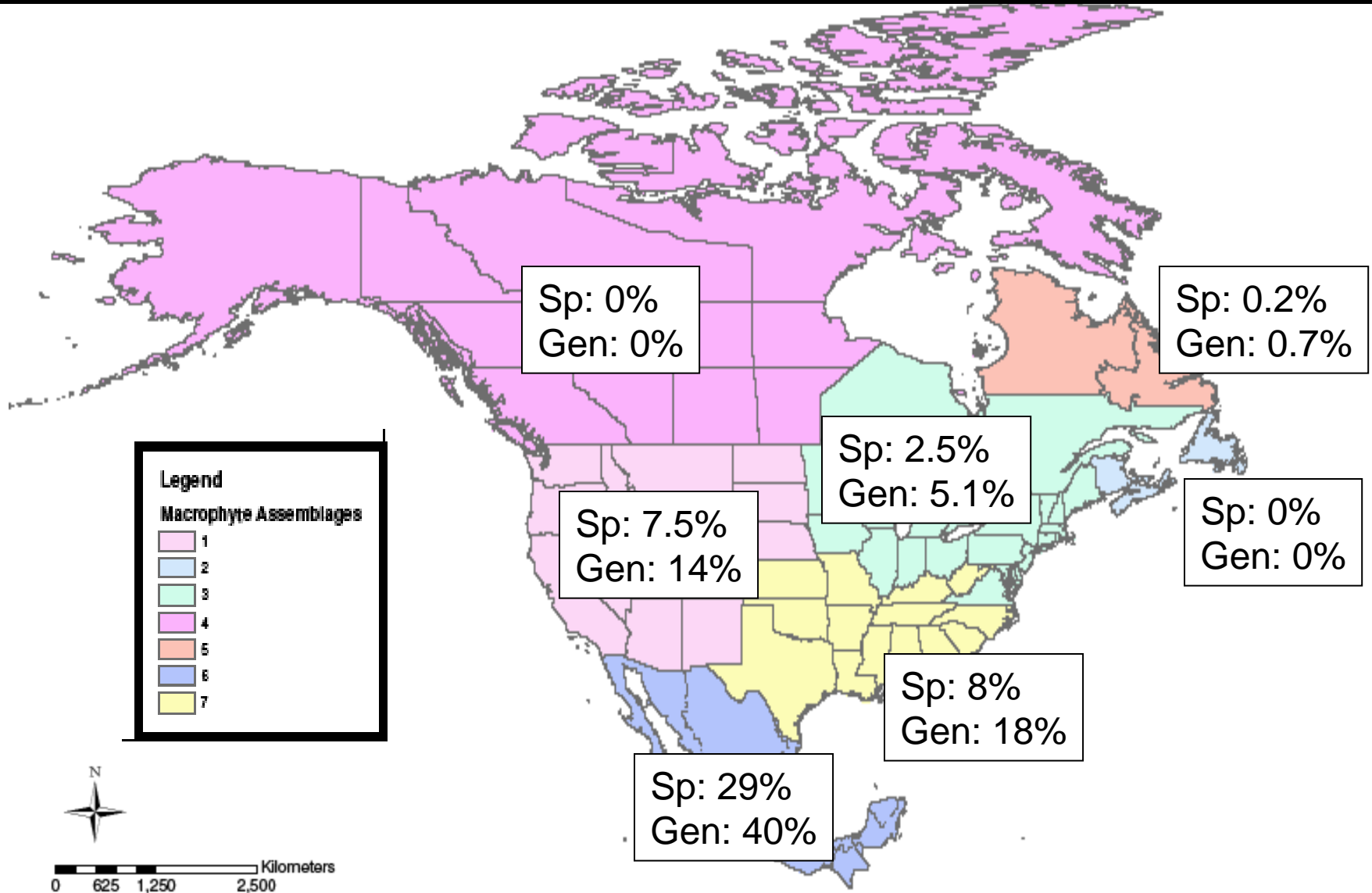




# How accurate are species numbers?

	No. of species	Theoretical no. of species
Western Canada	208	229
Western USA	359	379
Central Canada & USA	408	415
Labrador & Northern Quebec	118	193
Atlantic Canada	185	218
Southeast USA	461	483
Mexico	388	n/a

# Unique species and genera





# What determines broad patterns in species richness and composition?



# Next Steps

- Break down data for Mexico by state (level 3)
- Identify species that are submerged (as opposed to emergent or “semi-aquatic”)
- Re-run entire analysis for Canada, USA and Mexico by state/province for:
  - All macrophyte species
  - Only species that are submerged
- Link broad patterns in species composition and richness to physiogeographic factors such as climate.
- Break down global data into Level 3 (“botanical country”) groups !! And then re-run the entire analysis for all macrophytes species and only submerged species



# Conclusions

- Knowledge of the distribution and diversity of aquatic macrophytes is necessary for:
  - Developing management strategies to control established invasives or prevent new introductions;
  - Assessing potential distribution of endangered plants;
  - Predicting consequences of many of the threats to fresh waters (e.g., climate change, eutrophication).



# Acknowledgements



- Royal Belgian Institute of Natural Sciences for the invitation to contribute to FADA.
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