# Nitrogen Deposition Predictions from Hyperspectral Data of Pitcher Plants in Bogs

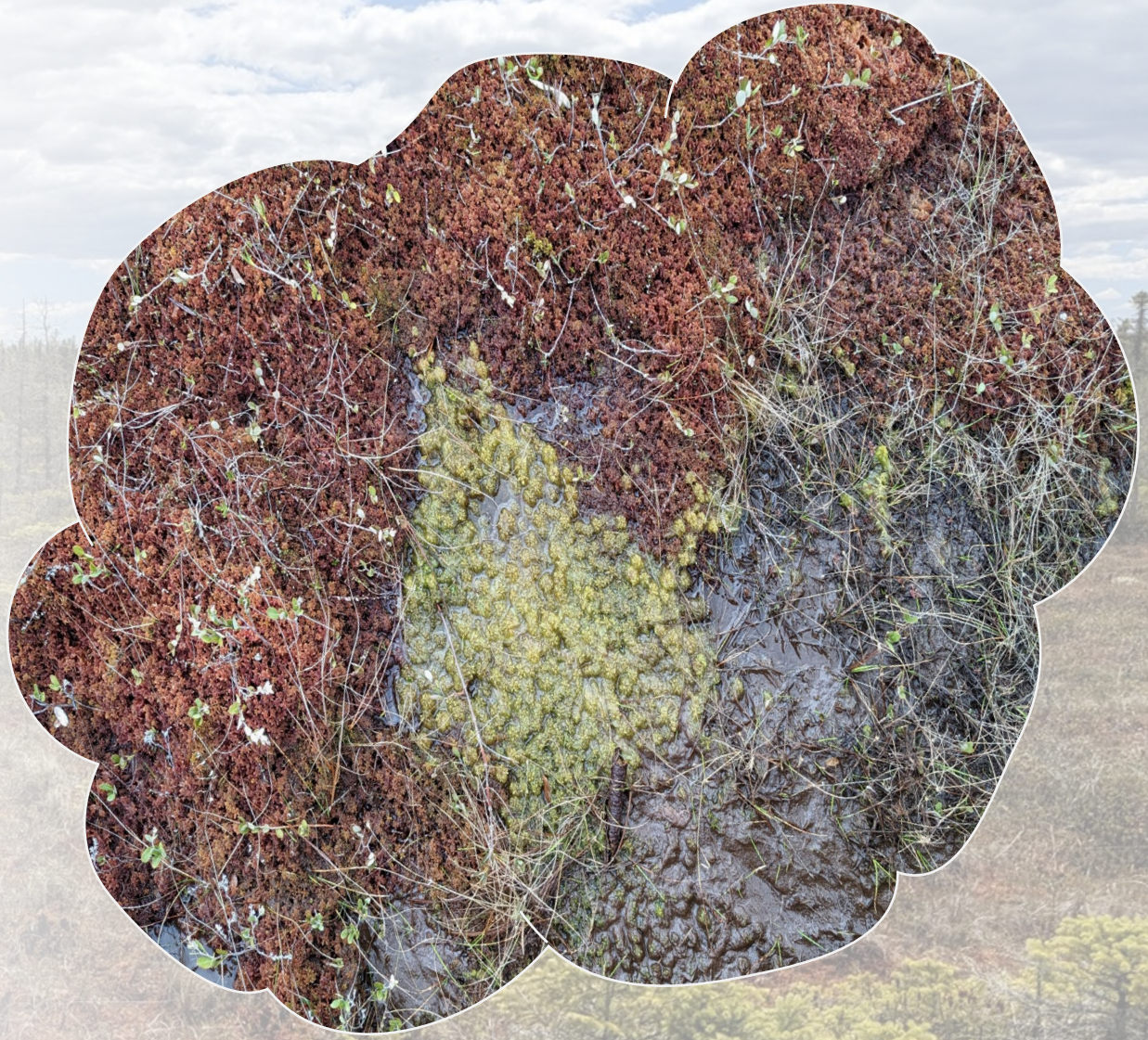
Lizbeth G. Amador

MAWS 2023 stipend award presentation

03.21.2024

# What are bogs?

- Composed of peat
- Low in nutrients
- Acidic



# Home to a diversity of plants and animals!



# Importance of bogs

- Mitigate flood flows
- Carbon sinks
- Vital habitat to many unique species

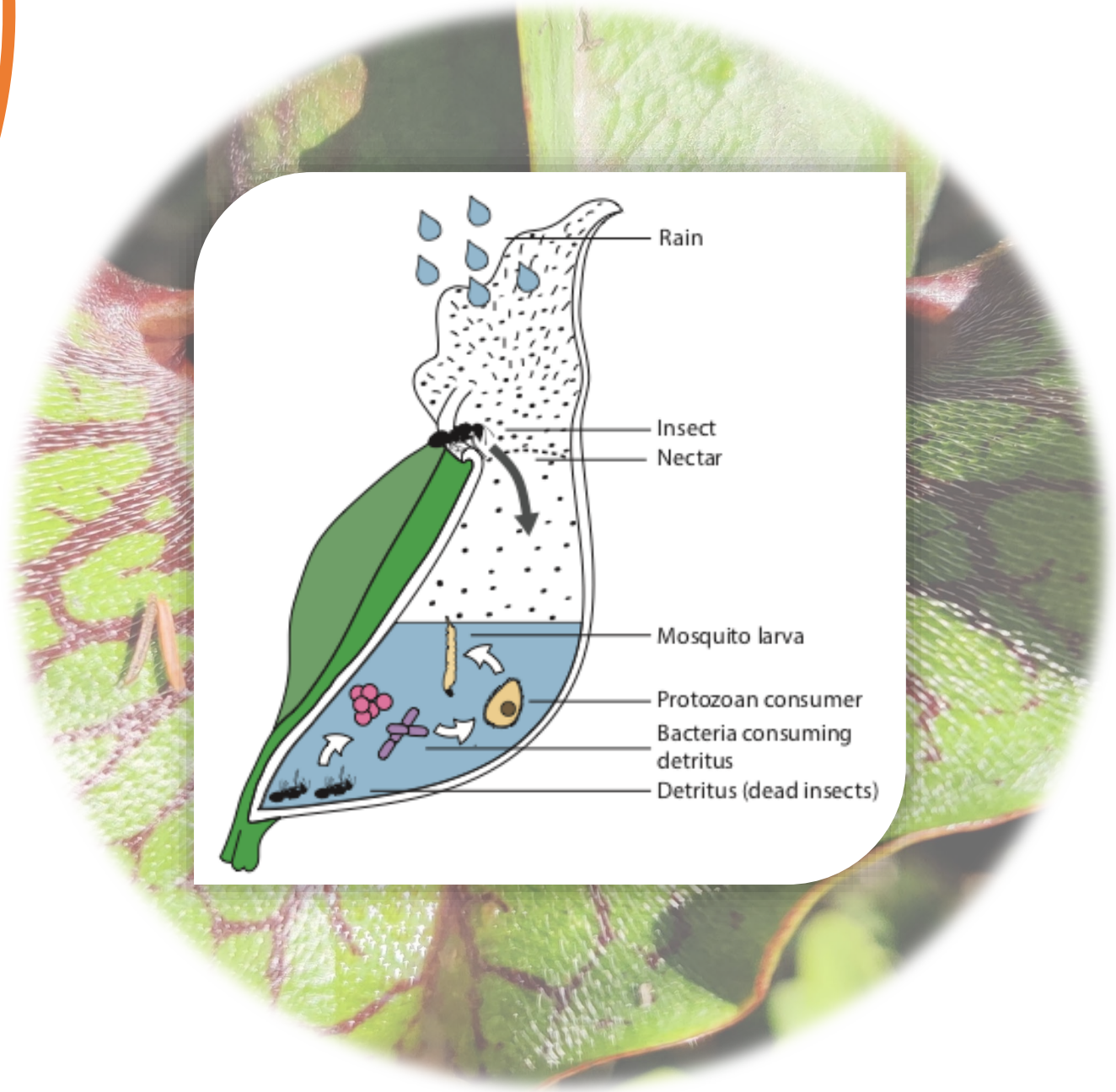
Peat harvesting, ©*F-Focus by Mati Kose*, Encyclopædia Britannica

# Carnivorous plants

# *Sarracenia purpurae*

# *Sarracenia purpurae*

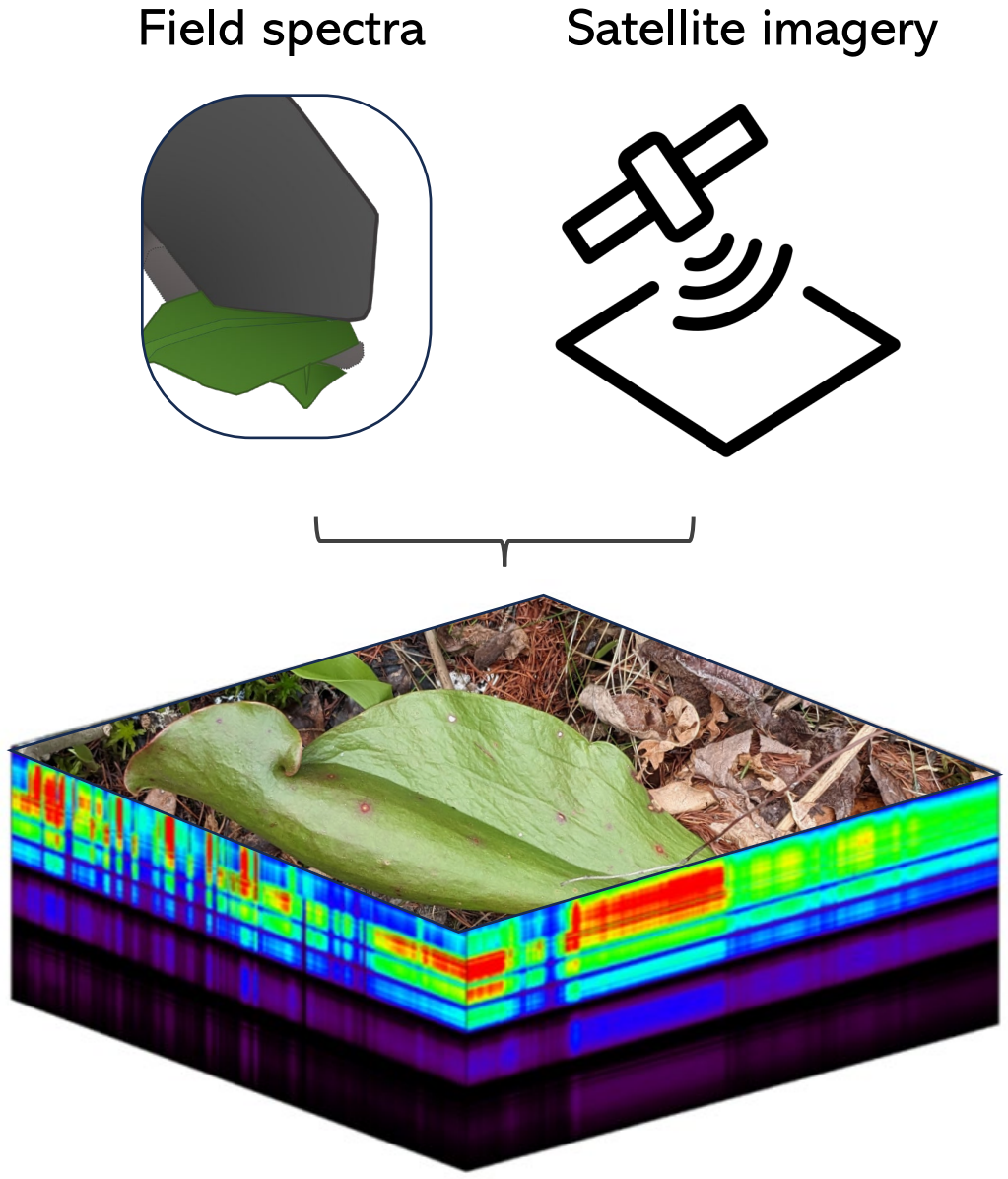
# Nice and cozy metacommunity

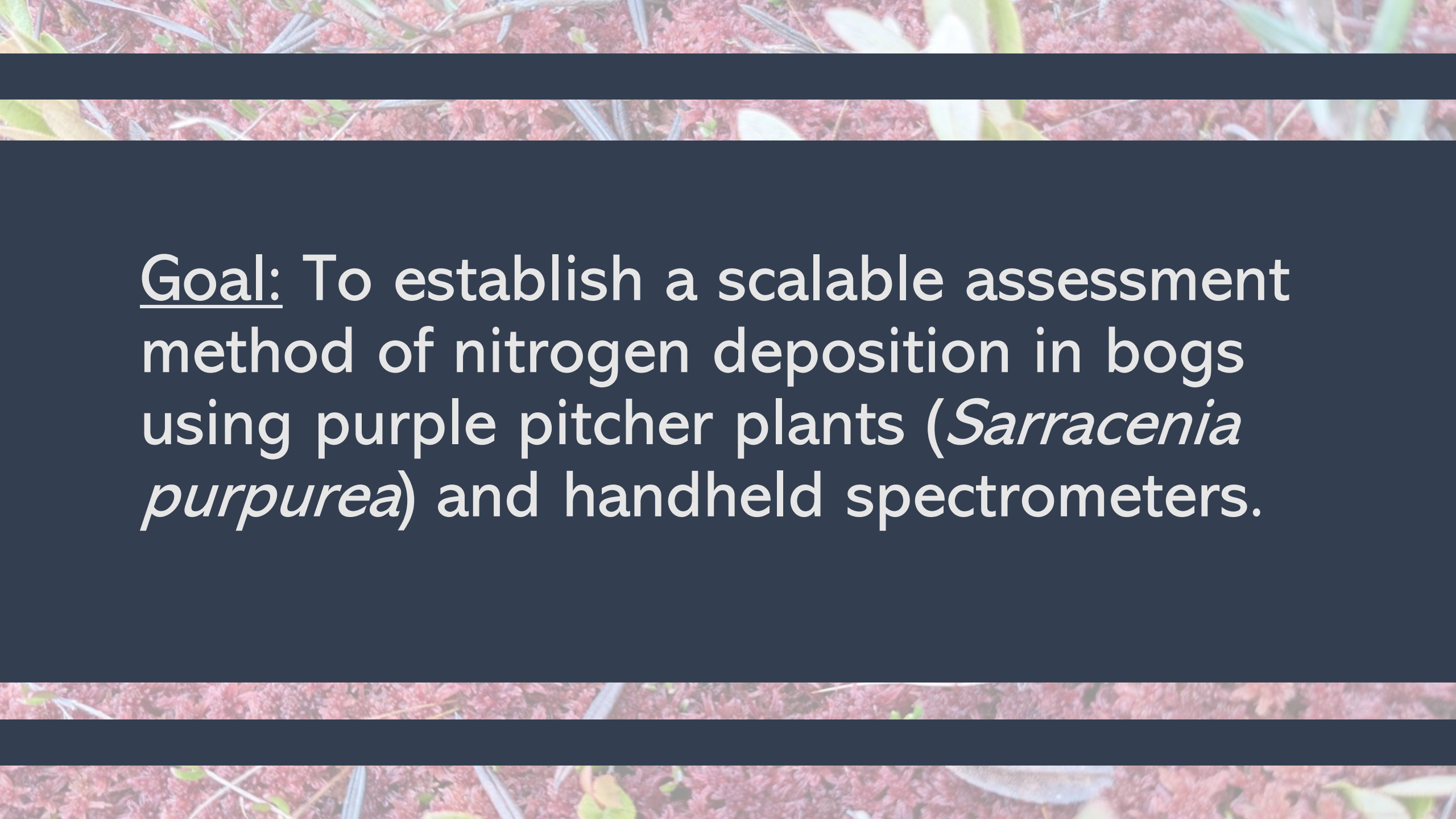



Lily Khadempour, modified from Heidi-Jørdensen

# Hyperspectral sensors

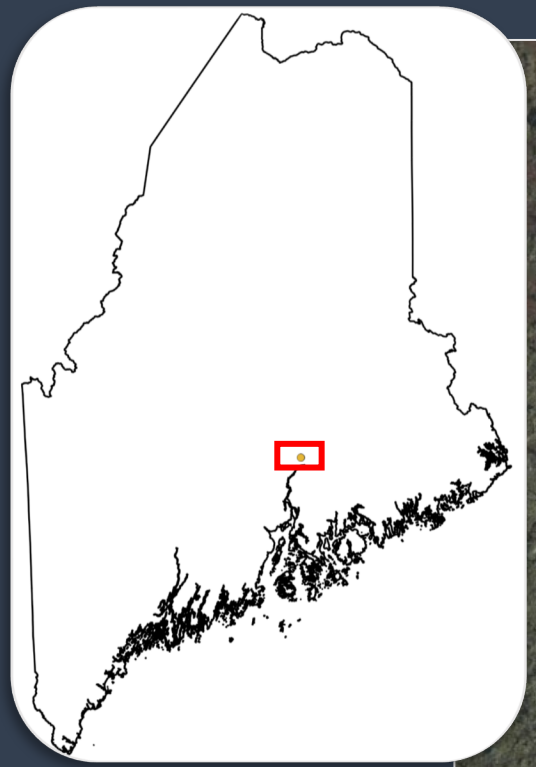
- Remotely detect Nitrogen
- Assess plant status from traits





Goal: To establish a scalable assessment method of nitrogen deposition in bogs using purple pitcher plants (*Sarracenia purpurea*) and handheld spectrometers.

# Orono Bog boardwalk




Layers
3D
Google
100%
Data attribution
8/24/2012
44.869746°N 68.724031°W 43 m

# Spectral measurements

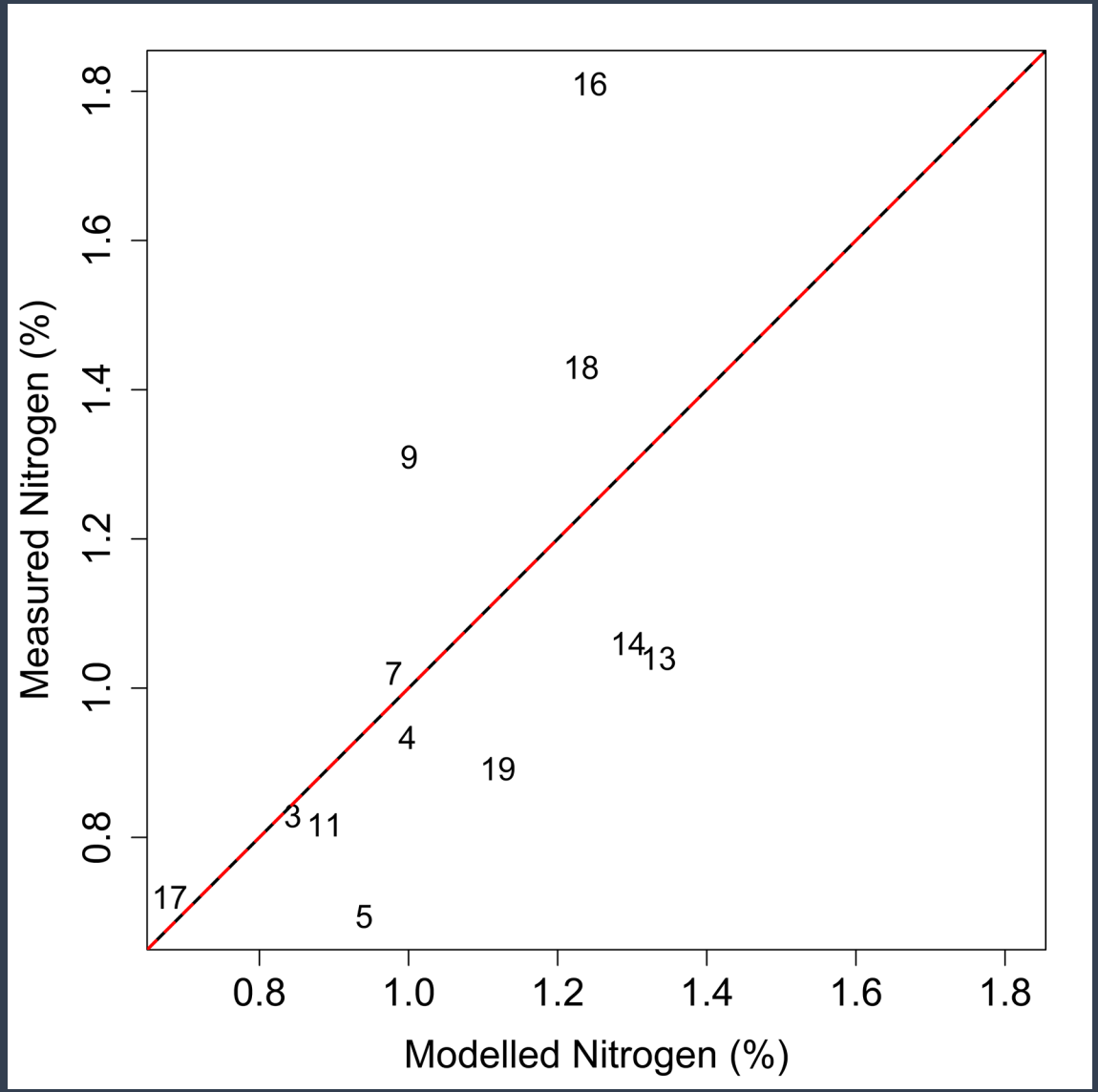
# Partial Least Squares Regression (PLSR)

Biochem N% ~ spectral bands (%) + 1 | optics

# PLSR: Model validation groups

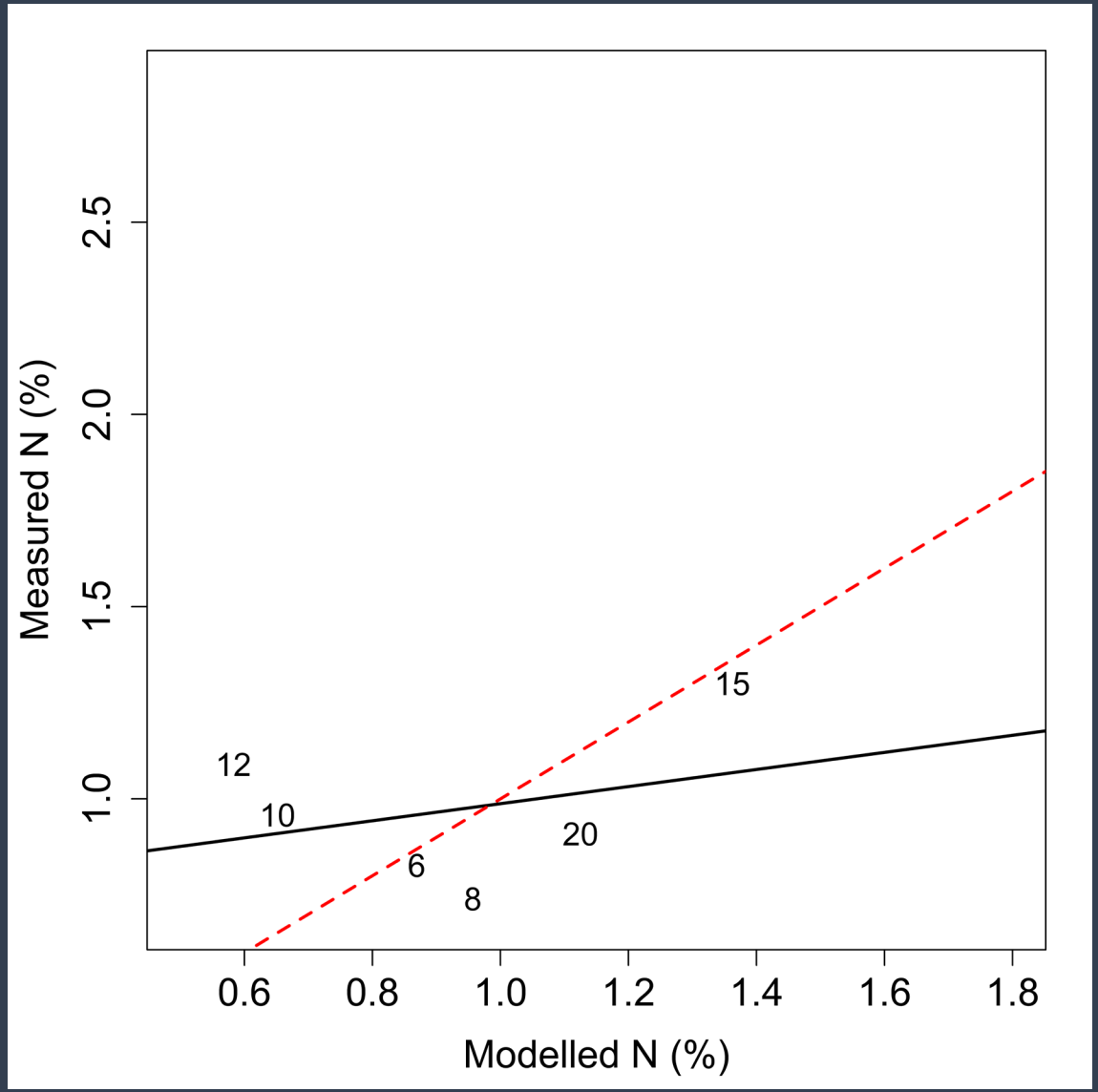
- 70%:30%
- Calibration group to build model
- Validation group to test model

# Training model: fairly strong relationship between the spectra and biochemical N% values




Est. = 1.00, SE = 0.04, p-value = 0.03, mult. $R^2$=0.38

# Testing group does not fit well with the training model




Est. = 0.22, SE = 0.32, p-value = 0.53, Mult. $R^2$=0.11

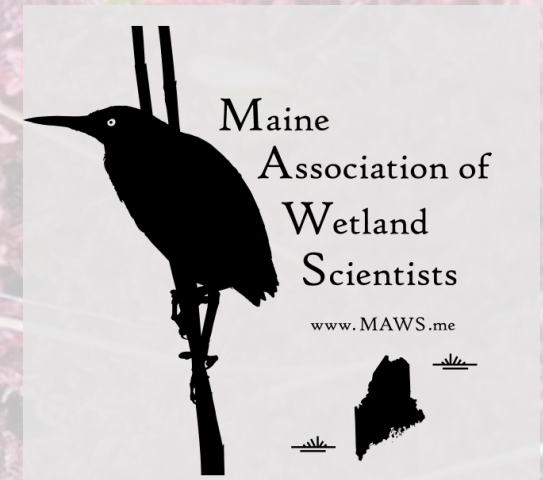
# Challenges in the field

# Future Directions

- Adjust sampling techniques
- Expand spatial and temporal breadth
- Additional samples and measurements

# Acknowledgements


- Jill Fedarick, Marcos Rodriguez, Kiley Chen
- Sydne Record (advisor)
- The Record lab
- Dudu Meireles
- University of Maine Analytical Laboratory & Maine Soil Testing Service



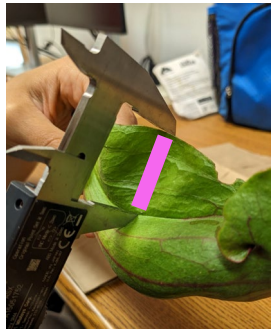

# Thank you!

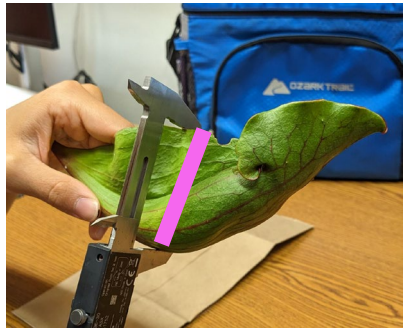
# Questions?

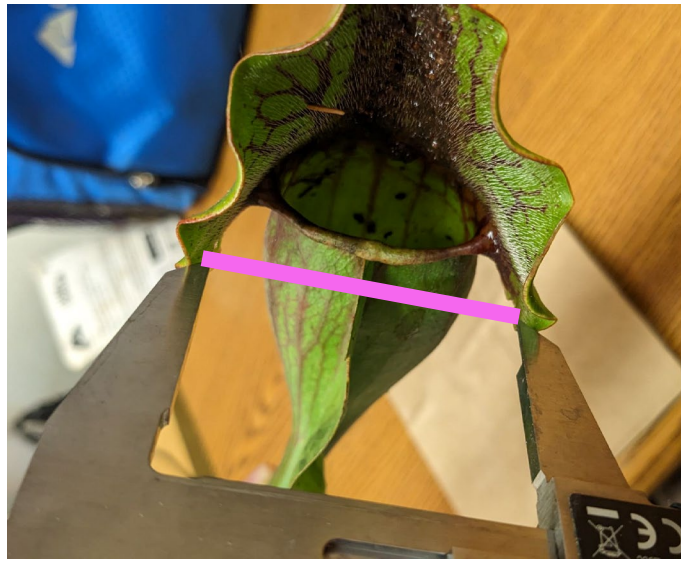
Ecology & Enviro. Sci Ph.D. Student
University of Maine, Orono
lizbeth.amador@maine.edu

# Supplementary slides

# Morphological measurements

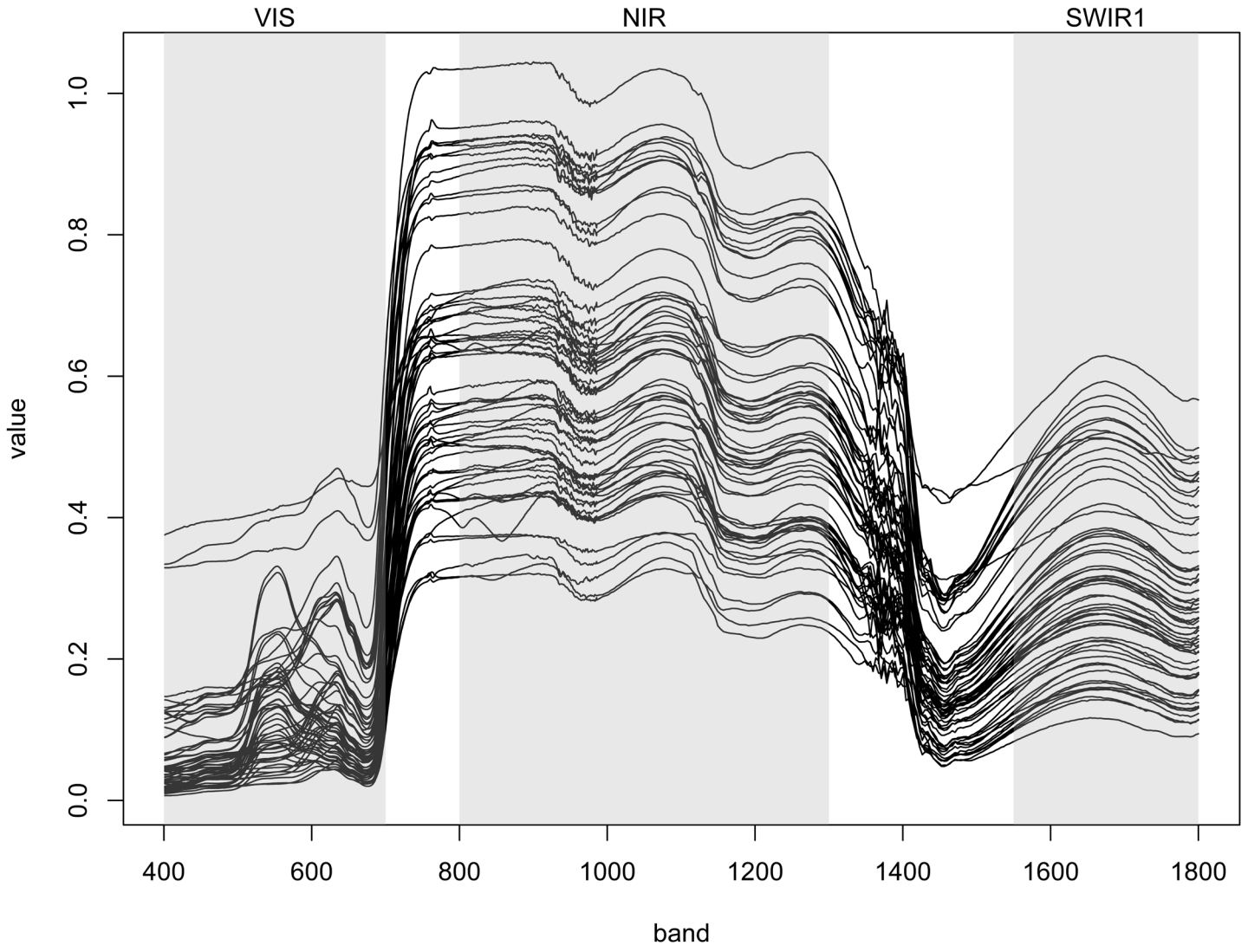




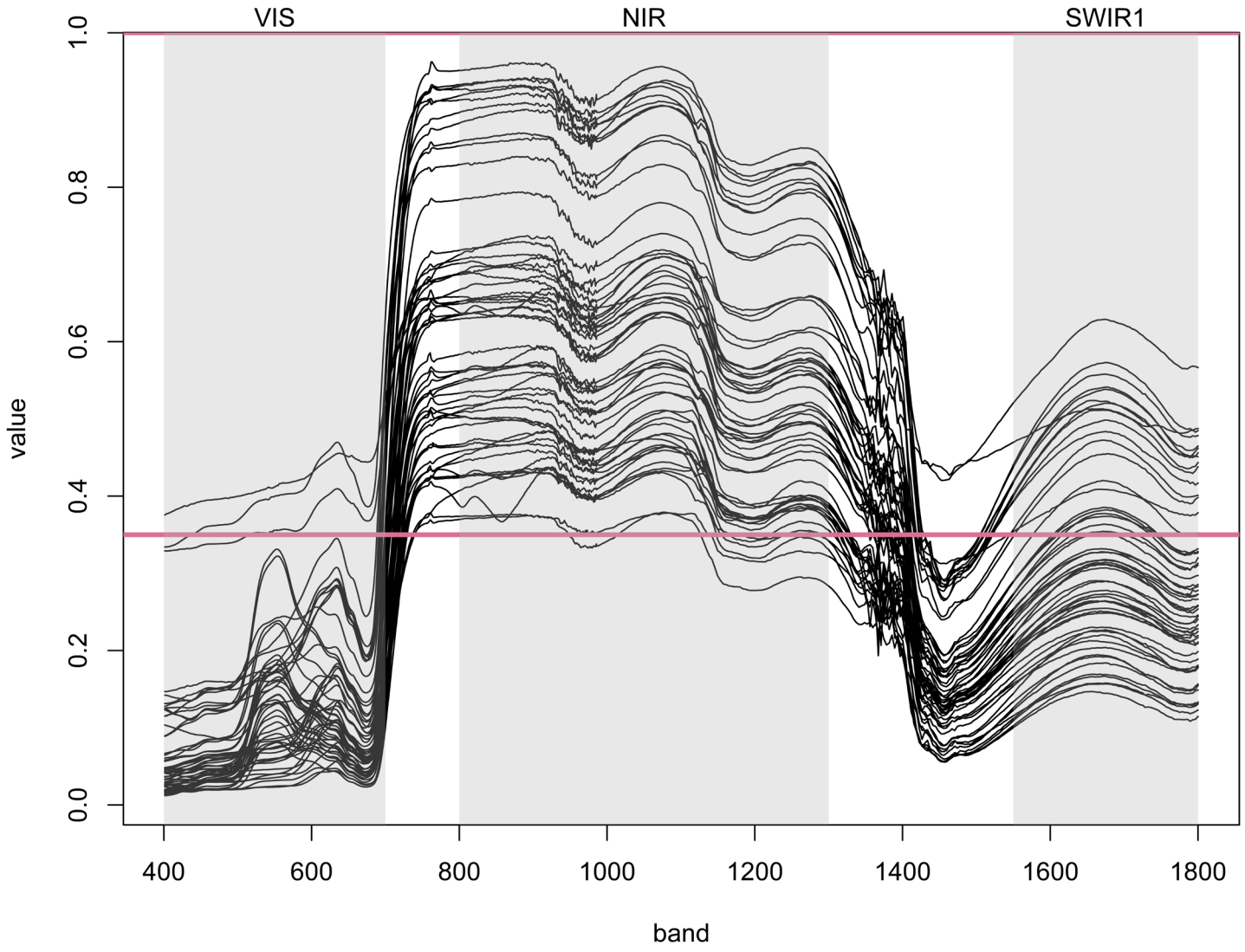


# Observed Predation

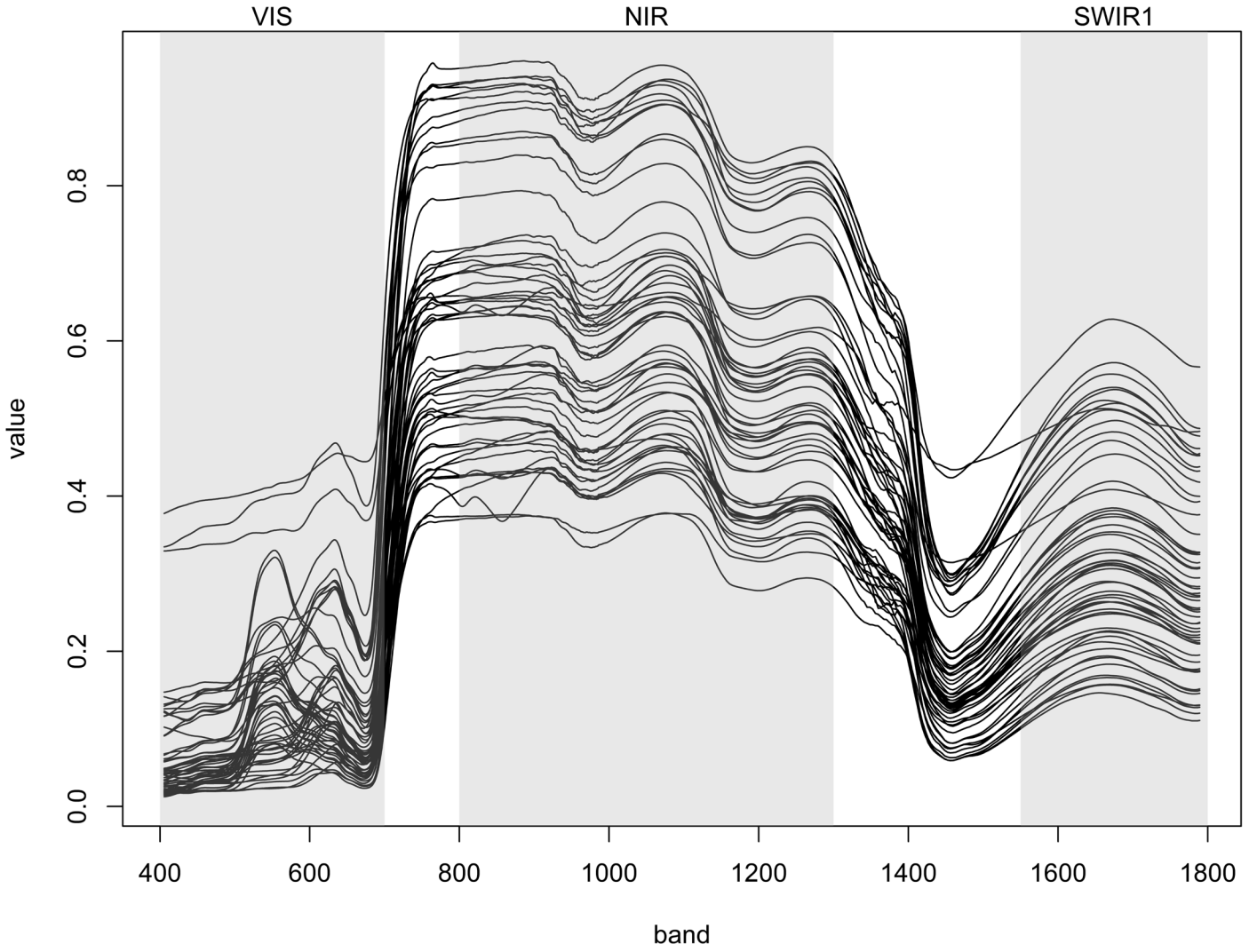
# Processing: Trimming & sensor overlap



# Processing: “bad measurements”



# Processing: Smoothing



# Processing: Averaged spectra