Exploring Seasonal Yeast Biodiversity in Madison's Lakeshore Nature Preserve

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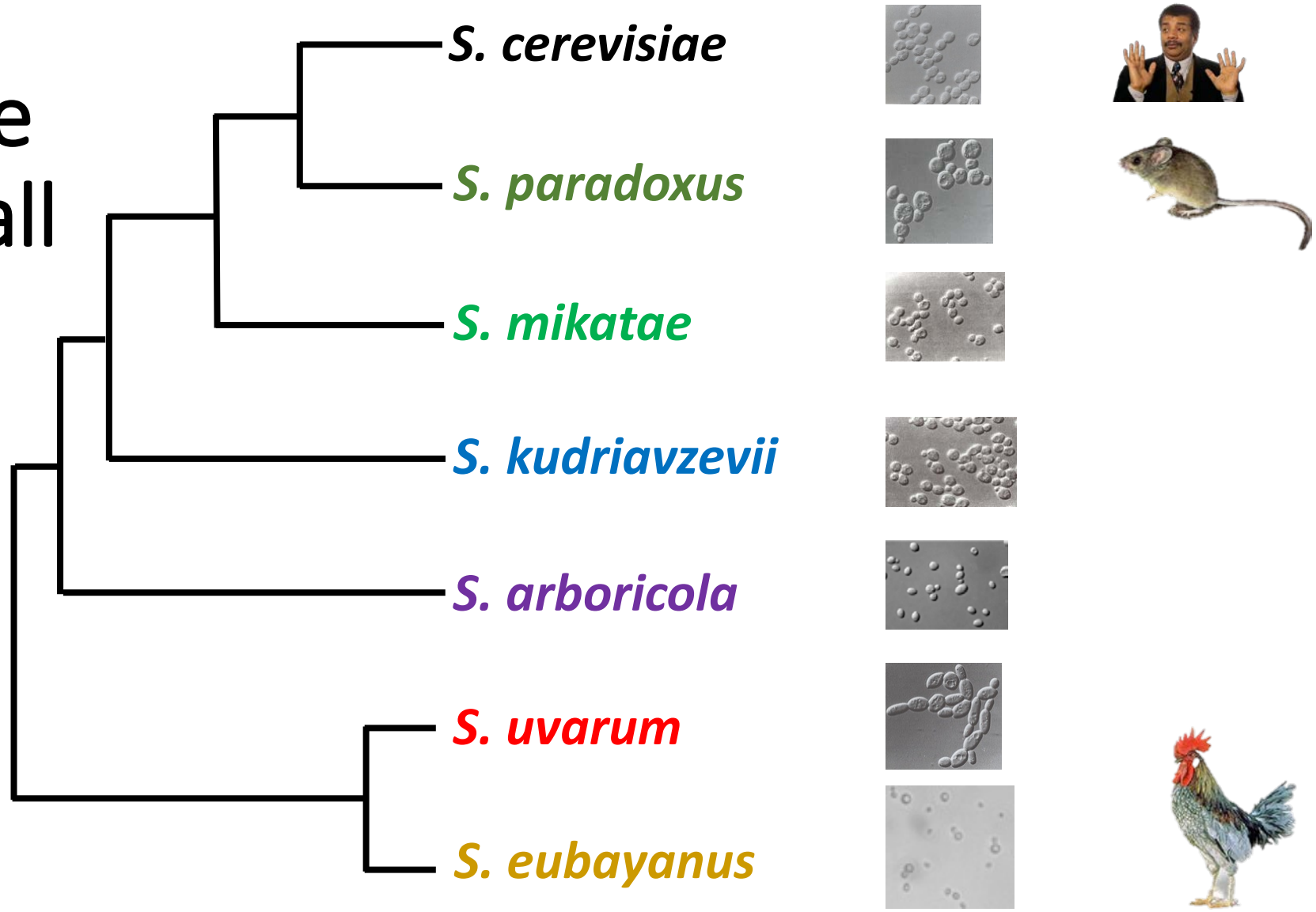
Background

- Yeasts – Unicellular Eukaryotic Fungi
  - *Saccharomyces cerevisiae* a very powerful model organism
  - Long appreciated in Bread, Beer, Wine production
  - Implications in biofuel production
- Massive Diversity amongst 1500+ species currently documented

- Look to ecology for answers

Saccharomyces alone shows more divergence than all vertebrates!



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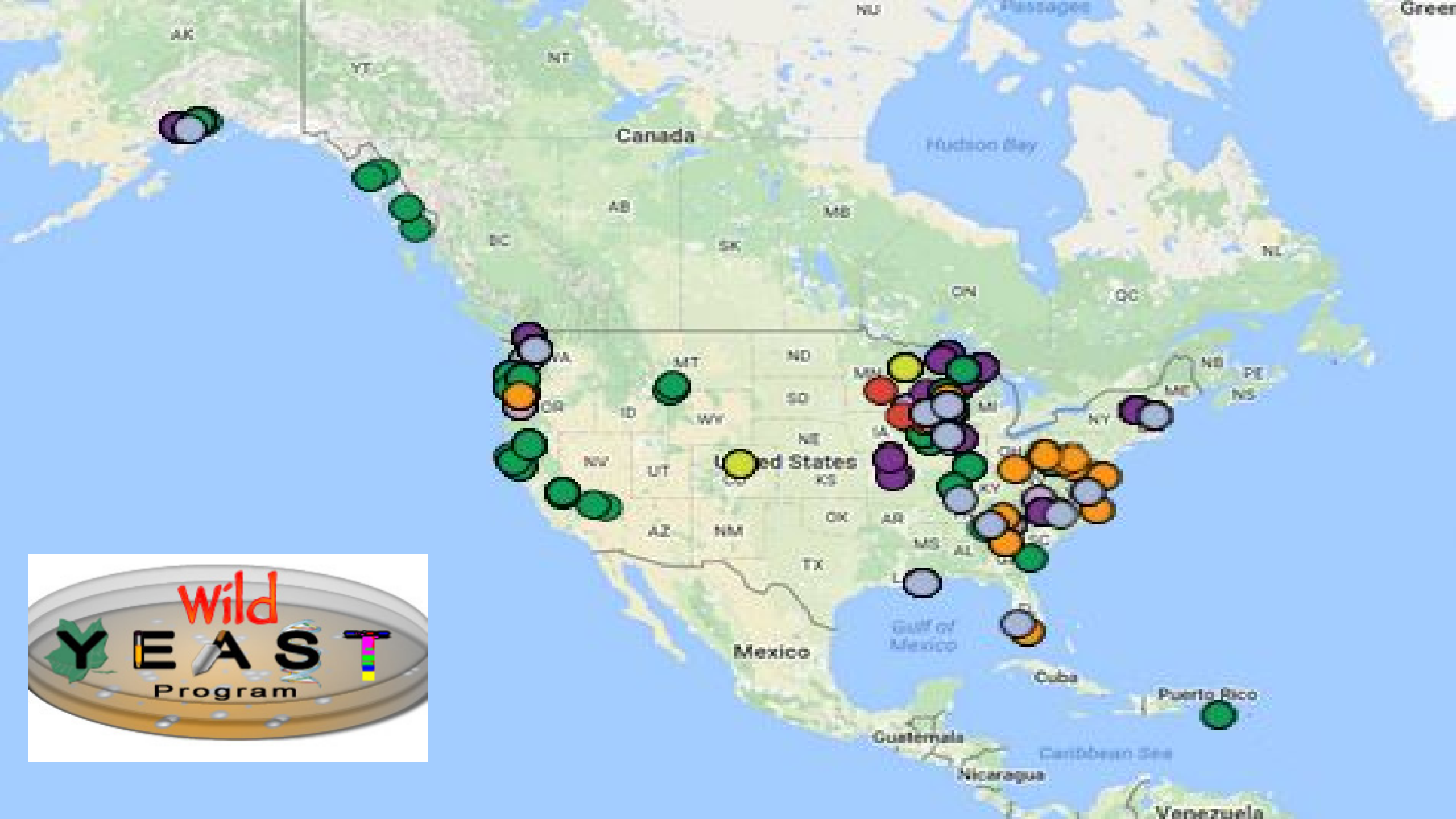
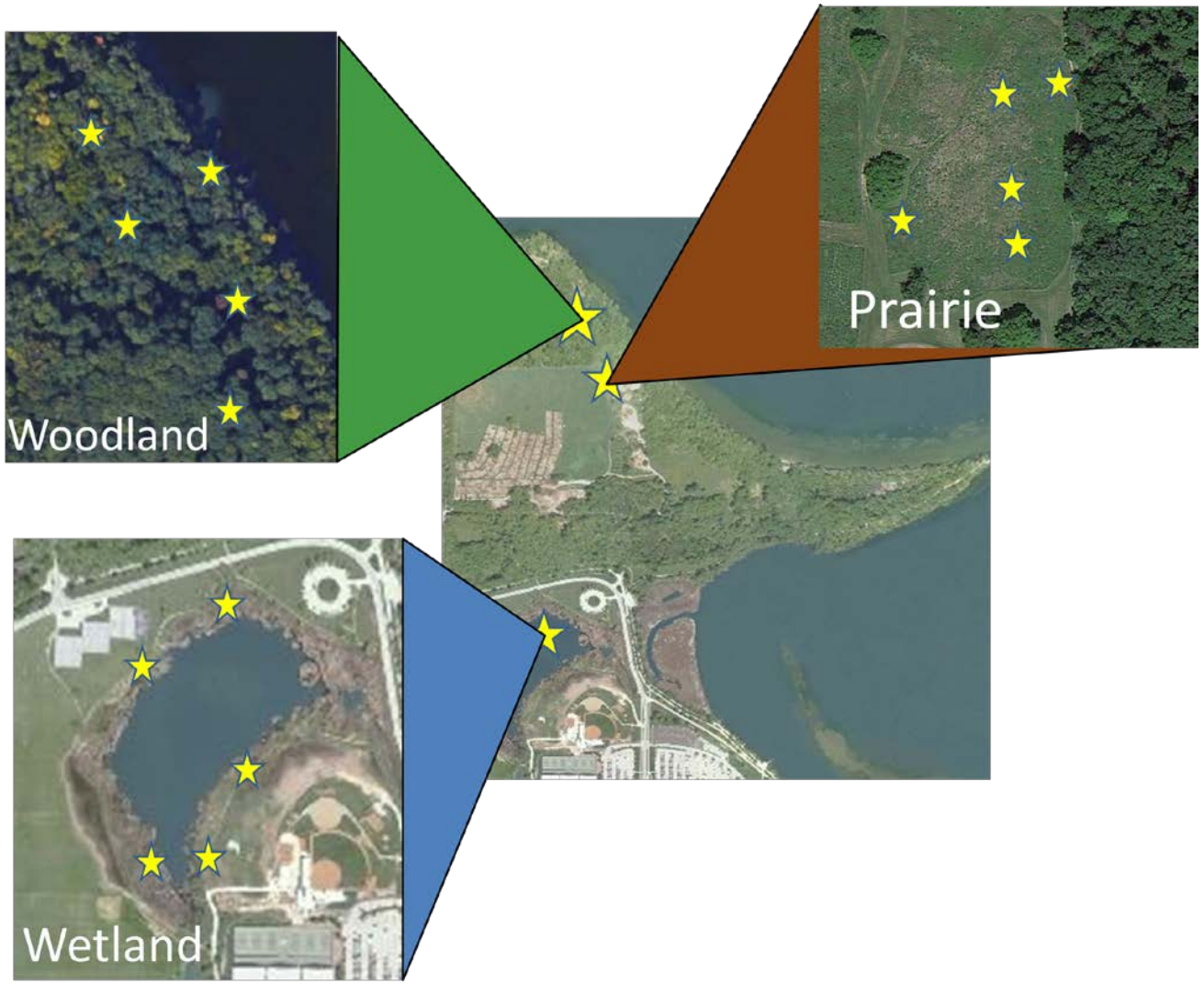
- Look to natural ecology for answers
  - Wild ≠ In-Lab lifecycle
  - Novel phenotypes come from novel environments


Wild
YEAST
Program
AK
YT
NT
NU
Canada
Hudson Bay
BC
AB
SK
MB
ON
QC
NL
NB
PE
NS
ME
NY
MI
MN
ND
SD
MT
ID
WY
NE
NV
UT
CO
KS
OR
CA
OK
AR
AZ
NM
TX
MS
AL
GA
SC
KY
LA
Gulf of Mexico
Mexico
Cuba
Puerto Rico
Guatemala
Caribbean Sea
Nicaragua
Venezuela

Experimental Design

- Monthly soil samples
- Wetland, Prairie, and Woodland communities of Lakeshore preserve
- May-October 2016
- Yeasts isolated from each sample at wide temperature range (30C, 22C/Room Temp, 10C, 4C)
- Identification of species through Sanger sequencing in the NCBI database

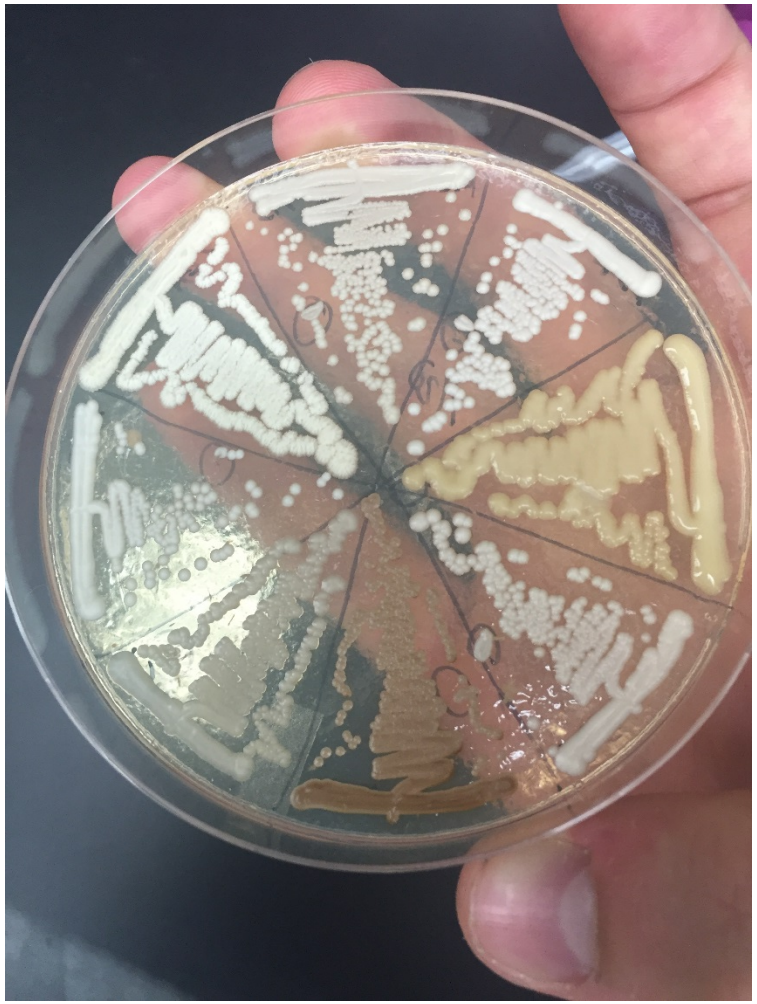


Experimental Design

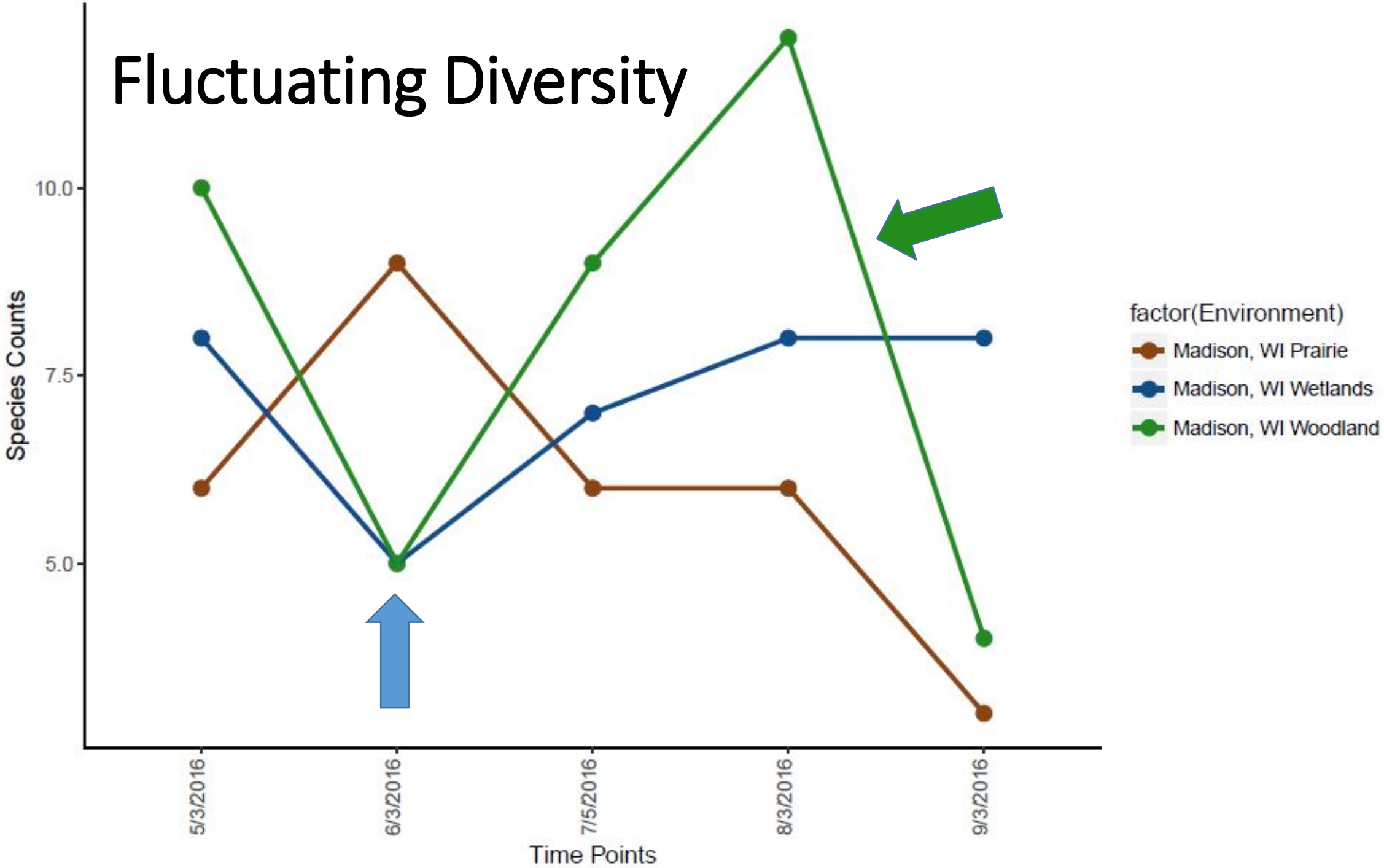
- 15 samples x 4 Temperature treatments x 6 months = 360 separate isolation environments

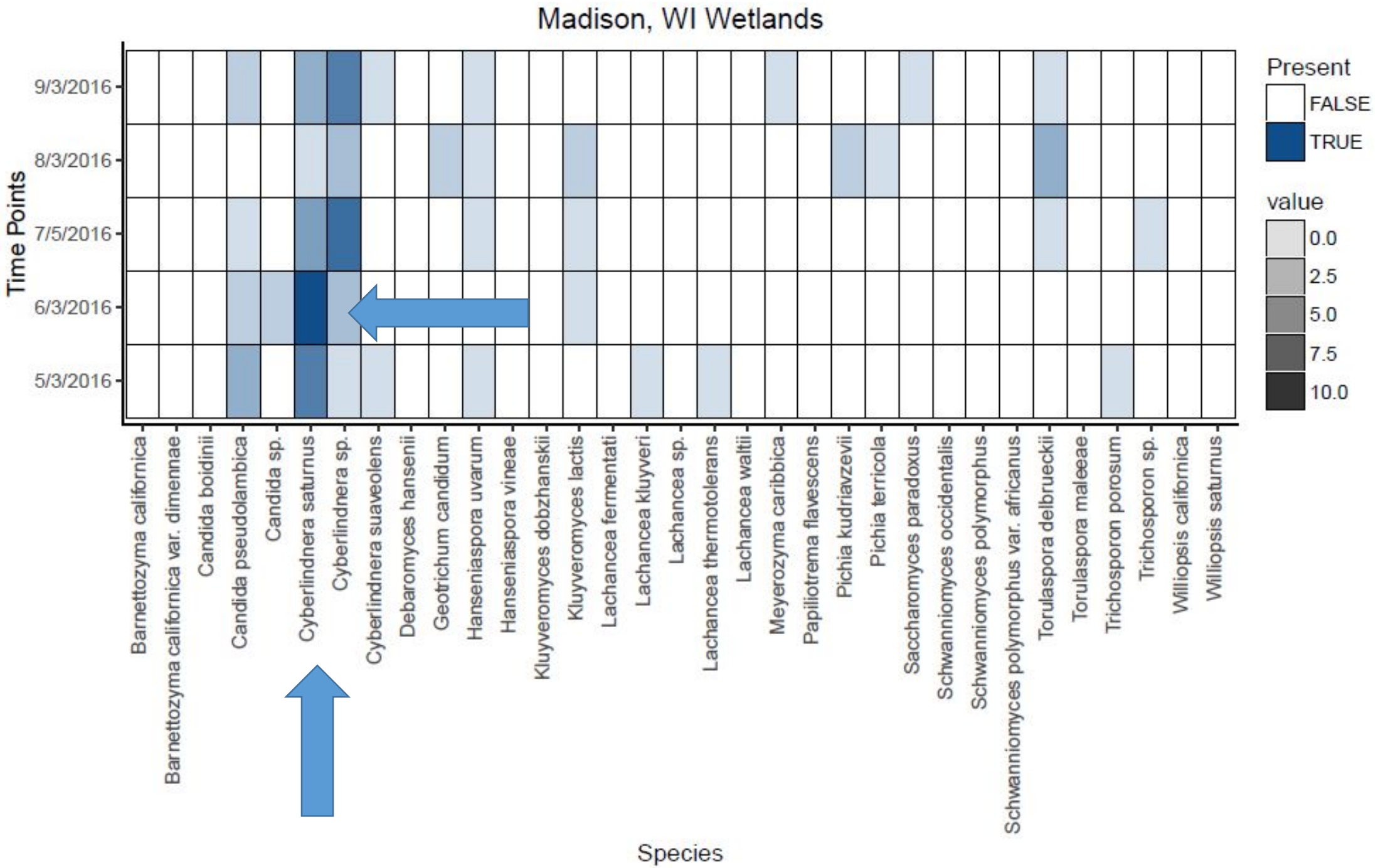
- So far: May-September samples done for 30C and 22C
- May-July done for 10C
- May-June done for 4C

- 329 successful isolations, with many more to come!

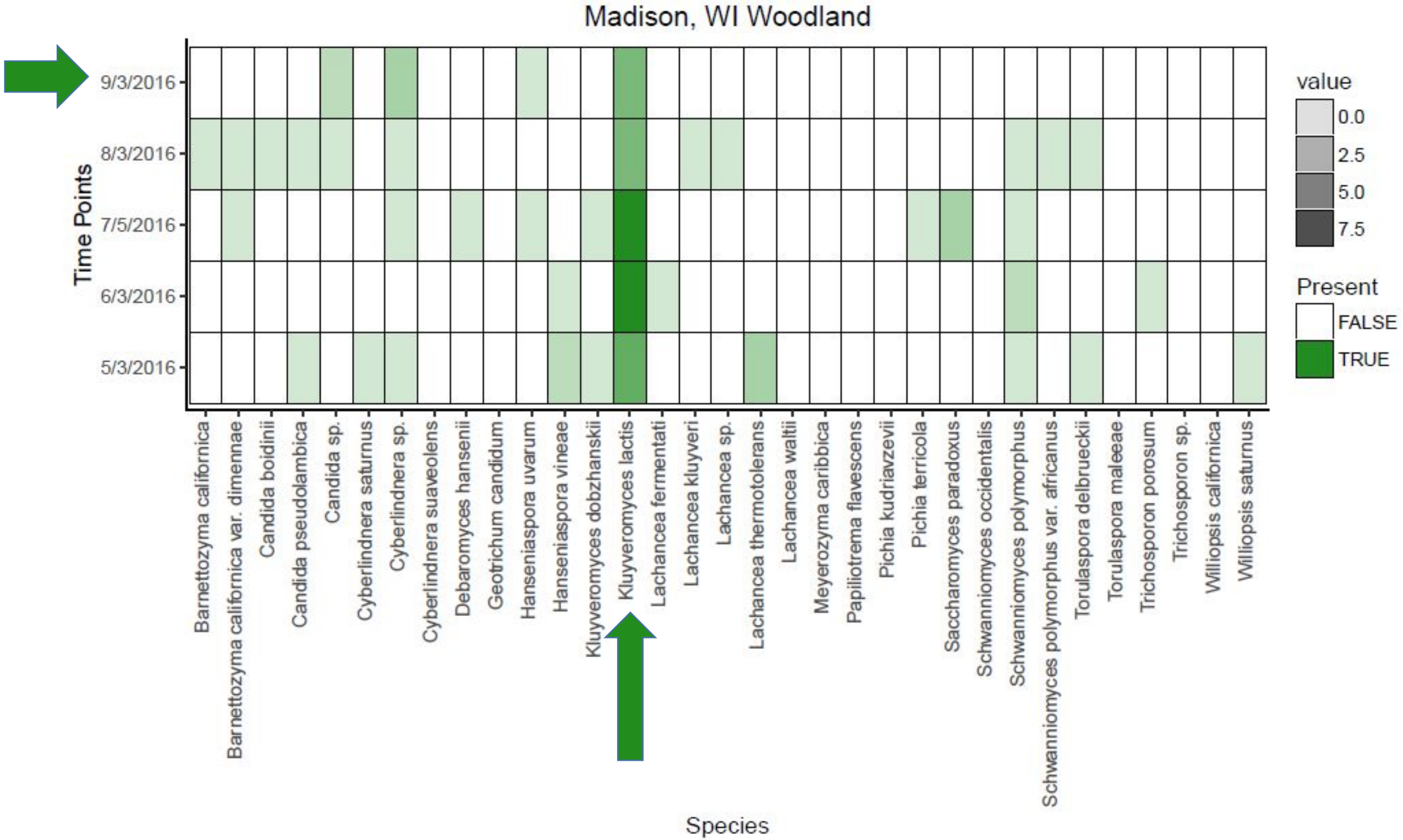


Fluctuating Diversity




Madison, WI Wetlands
Time Points
9/3/2016
8/3/2016
7/5/2016
6/3/2016
5/3/2016
Barnettozyma californica
Barnettozyma californica var. dimennae
Candida boidinii
Candida pseudolambica
Candida sp.
Cyberlindnera saturnus
Cyberlindnera sp.
Cyberlindnera suaveolens
Debaromyces hansenii
Geotrichum candidum
Hanseniaspora uvarum
Hanseniaspora vineae
Kluyveromyces dobzhanskii
Kluyveromyces lactis
Lachancea fermentati
Lachancea kluyveri
Lachancea sp.
Lachancea thermotolerans
Lachancea waltii
Meyerozyma caribbica
Papiliotrema flavescens
Pichia kudriavzevii
Pichia terricola
Saccharomyces paradoxus
Schwanniomyces occidentalis
Schwanniomyces polymorphus
Schwanniomyces polymorphus var. africanus
Torulaspora delbrueckii
Torulaspora maleeae
Trichosporon porosum
Trichosporon sp.
Williopsis californica
Williopsis saturnus
Species
Present
FALSE
TRUE
value
0.0
2.5
5.0
7.5
10.0

Madison, WI Prairie
Time Points
9/3/2016
8/3/2016
7/5/2016
6/3/2016
5/3/2016
Species
Barnettozyma californica
Barnettozyma californica var. dimennae
Candida boidinii
Candida pseudolambica
Candida sp.
Cyberlindnera saturnus
Cyberlindnera sp.
Cyberlindnera suaveolens
Debaromyces hansenii
Geotrichum candidum
Hanseniaspora uvarum
Hanseniaspora vineae
Kluyveromyces dobzhanskii
Kluyveromyces lactis
Lachancea fermentati
Lachancea kluyveri
Lachancea sp.
Lachancea thermotolerans
Lachancea waltii
Meyerozyma caribbica
Papiliotrema flavescens
Pichia kudriavzevii
Pichia terricola
Saccharomyces paradoxus
Schwanniomyces occidentalis
Schwanniomyces polymorphus
Schwanniomyces polymorphus var. africanus
Torulaspora delbrueckii
Torulaspora maleeae
Trichosporon porosum
Trichosporon sp.
Williopsis californica
Williopsis saturnus
value
0
1
2
3
Present
FALSE
TRUE


Madison, WI Woodland
Time Points
9/3/2016
8/3/2016
7/5/2016
6/3/2016
5/3/2016
Barnettozyma californica
Barnettozyma californica var. dimennae
Candida boidinii
Candida pseudolambica
Candida sp.
Cyberlindnera saturnus
Cyberlindnera sp.
Cyberlindnera suaveolens
Debaromyces hansenii
Geotrichum candidum
Hanseniaspora uvarum
Hanseniaspora vineae
Kluyveromyces dobzhanskii
Kluyveromyces lactis
Lachancea fermentati
Lachancea kluyveri
Lachancea sp.
Lachancea thermotolerans
Lachancea waltii
Meyerozyma caribbica
Papiliotrema flavescens
Pichia kudriavzevii
Pichia terricola
Saccharomyces paradoxus
Schwanniomyces occidentalis
Schwanniomyces polymorphus
Schwanniomyces polymorphus var. africanus
Torulaspora delbrueckii
Torulaspora maleeae
Trichosporon porosum
Trichosporon sp.
Williopsis californica
Williopsis saturnus
Species
value
0.0
2.5
5.0
7.5
Present
FALSE
TRUE

Preliminary observations

- *Cyberlindnera sp.* appears well suited to Wetlands and Prairie
- *Kluyveromyces lactis* appears well suited to Woodlands
- Prairie consistently less hospitable to yeasts
- Fluctuations in diversity very difficult to quantify
- More time points and Cold temp. data will aid in telling this story
- Environmental/metagenomic sampling methods may eliminate sampling bias?

Acknowledgements: Special thanks to the Lakeshore Nature Preserve, Laura Wyatt, Professor Robert Goodman, and the family of Professor Henry Hart for helping to fund this project. I hope that this work may continue in the years to come.