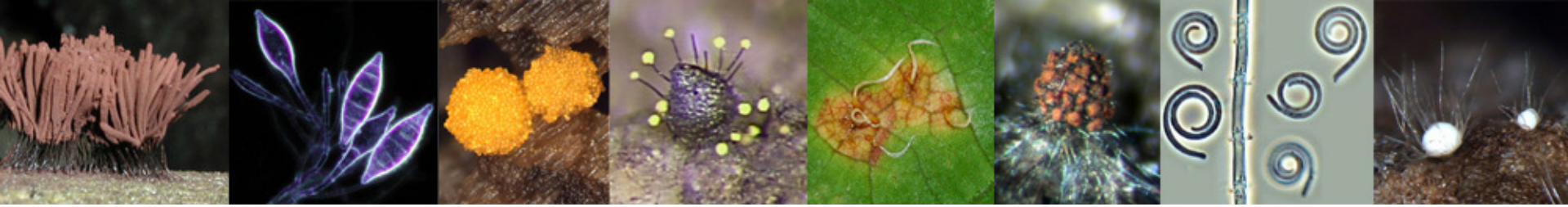

The Microfungi Collections Consortium: A Networked Approach to Digitizing Small Fungi with Large Impacts on the Function and Health of Ecosystems

Using Biodiversity Specimen-Based Data to Study Global Change Workshop

December 2-3, 2015

Mia Maltz

University of California Irvine

Andrew N. Miller, Elizabeth Lippoldt, Phil Anders

University of Illinois Urbana-Champaign

Illinois Natural History Survey

MiCC Microfungi Collections Consortium

What are microfungi?

~4500 genera
~56,000 species

Kingdom Amoebozoa
- **Phylum Mycetozoa**
  - **Class Myxogastria (5 orders, 14 families, 62 genera and 888 species)**
  - **Class Dictyostelia (1 order, 2 families, 4 genera, 93 species)**

Kingdom Stramenipila
- **Phylum Oomycota (1 class, 13 orders, 25 families, 106 genera, 956 species)**

Kingdom Eumycota (Fungi)
- **Phylum Ascomycota**
  - **Subphylum Pezizomycotina**
    - **Class Arthoniomycetes (1 order, 4 families, 78 genera, 1608 species)**
    - **Class Dothideomycetes (11 orders, 90 familes, 1302 genera, 19,010 species)**
    - **Class Eurotiomycetes (10 orders, 27 families, 281 genera, 3401 species)**
    - Class Geoglossomycetes (all macrofungi)
    - **Class Laboulbeniomycetes (2 orders, 5 families, 151 genera, 2072 species)**
    - Class Lecanoromycetes (all lichens)
    - **Class Leotiomycetes (5 orders, 19 families, 641 genera, 5587 species;** ~100 species of macrofungi in Leotiales)
    - Class Lichinomycetes (all lichens)
    - **Class Orbiliomycetes (1 order, 1 family, 12 genera, 288 species)**
    - Class Pezizomycetes (all macrofungi)
    - **Class Sordariomycetes (15 orders, 64 families, 1119 genera, 10,564 species;** ~1000 species of macrofungi in Clavicipitales, Hypocreales, and Xylariales)
  - **Subphylum Saccharomycotina (1 class, 1 order, 13 families, 88 genera, 906 species)**
  - **Subphylum Taphrinomycotina (4 classes, 4 orders, 5 families, 10 genera, 140 species)**
- **Phylum Basidiomycota**
  - Subphylum Agaricomycotina (all macrofungi)
  - **Subphylum Pucciniomycotina (8 classes, 18 orders, 36 families, 247 genera, 8324 species)**
  - **Subphylum Ustilaginomycotina (1 class, 3 orders, 12 families, 62 genera, 1113 species)**
- **Phylum Blastocladiomycota (1 class, 1 order, 5 families, 14 genera, 179 species)**
- **Phylum Chytridiomycota (2 classes, 4 orders, 14 families, 105 genera, 706 species)**
- **Phylum Glomeromycota (1 class, 4 orders, 9 families, 12 genera, 169 species)**
- **Phylum Neocallimastigomycota (1 class, 1 order, 1 family, 6 genera, 20 species)**
- **Phylum Zygomycota (4 subphyla, 10 orders, 27 families, 168 genera, 1065 species)**

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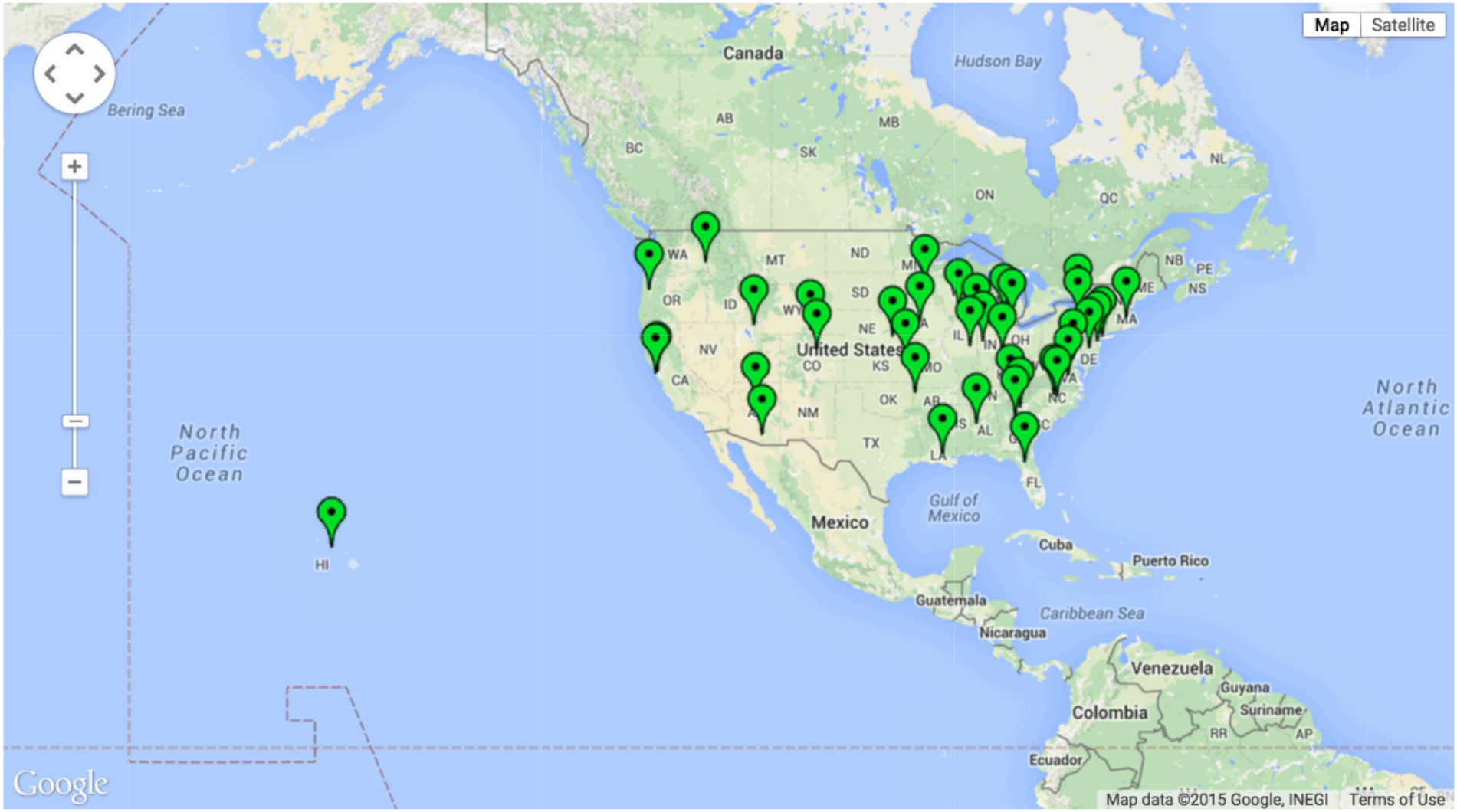
MiCC Participants Map



– 1.2 million microfungi specimens
– 380,000 existing records
– 53,000 existing images
– 264,000 specimen slides
– 38 institutions in 31 states

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State	Institution Name and (Herbarium Code)	Specimens in MyCoPortal	Specimens Databased	Specimens to Digitize
Alabama	University of Alabama (UNA)	0	500	0
Arizona	Rocky Mountain Research Station (FPF)	0	4,622	0
Arizona	**University of Arizona (ARIZ)**	**8,474**	**11,526**	**20,000**
Arkansas	**University of Arkansas (UARK)**	**0**	**40,000**	**10,000**
California	San Francisco State University (SFSU)	0	500	0
California	**University of California (UC)**	**297**	**0**	**56,500**
Colorado	Denver Botanical Garden (DBG)	2,774	0	0
Florida	**University of Florida (FLAS)**	**104**	**0**	**40,000**
Georgia	**University of Georgia (GAM)**	**0**	**0**	**40,000**
Hawaii	Bishop Museum (BISH)	0	7,973	0
Illinois	**The Field Museum (F)**	**3,898**	**6,102**	**70,000**
Illinois	**University of Illinois (ILL/ILLS)**	**37,929**	**10,177**	**55,000**
Indiana	**Purdue University (PUR/PUL)**	**0**	**96,480**	**55,570**
Iowa	**Iowa State University (ISC)**	**9,000**	**1,000**	**35,800**
Kansas	University of Kansas (KANU)	0	2,971	0
Louisiana	**Louisiana State University (LSUM)**	**945**	**0**	**10,000**
Maryland	U.S. National Fungus Collections (BPI)	518,290	0	0
Massachusetts	**Harvard University (FH)**	**7,719**	**5000**	**54,000**
Michigan	**Michigan State University (MSC)**	**0**	**0**	**31,500**
Michigan	**University of Michigan (MICH)**	**8,856**	**0**	**65,000**
Minnesota	**University of Minnesota (MIN)**	**5,569**	**931**	**50,000**
Nebraska	University of Nebraska (NEB); specimens digitized by University of Illinois	0	2000	50,000
New Jersey	**Rutgers University (CHRB)**	**0**	**0**	**40,000**
New York	**Cornell University (CUP)**	**26,590**	**60,000**	**18,000**
New York	**New York Botanical Garden (NY)**	**65,511**	**25,000**	**248,000**
New York	**State University of New York (SYRF)**	**0**	**0**	**18,000**
North Carolina	**North Carolina State University (NCSLG)**	**518**	**1,892**	**0**
North Carolina	University of North Carolina (NCU); specimens digitized by University of Florida	318	0	18,000
Ohio	**Miami University (MU)**	**0**	**0**	**50,000**
Oregon	Oregon State University	10,624	19,376	0
Pennsylvania	**Academy of Natural Sciences (PH)**	**0**	**9,335**	**32,000**
South Carolina	Clemson University (CLEMS); specimens digitized by University of Florida	0	0	4,800
Tennessee	University of Tennessee (TENN)	11,170	5,000	0
Utah	Utah State University (UTC)	1,481	0	0
Virginia	University of Richmond (URV); specimens digitized by NYBG	0	0	3,000
Washington	Washington State University (WSP)	0	70,156	0
Wisconsin	**University of Wisconsin (WIS)**	**0**	**0**	**120,000**
Wyoming	**University of Wyoming (RM/RMS)**	**0**	**0**	**28,200**
	Totals:	720,067	380,541	1,223,370
			GRAND TOTAL:	2,323,978

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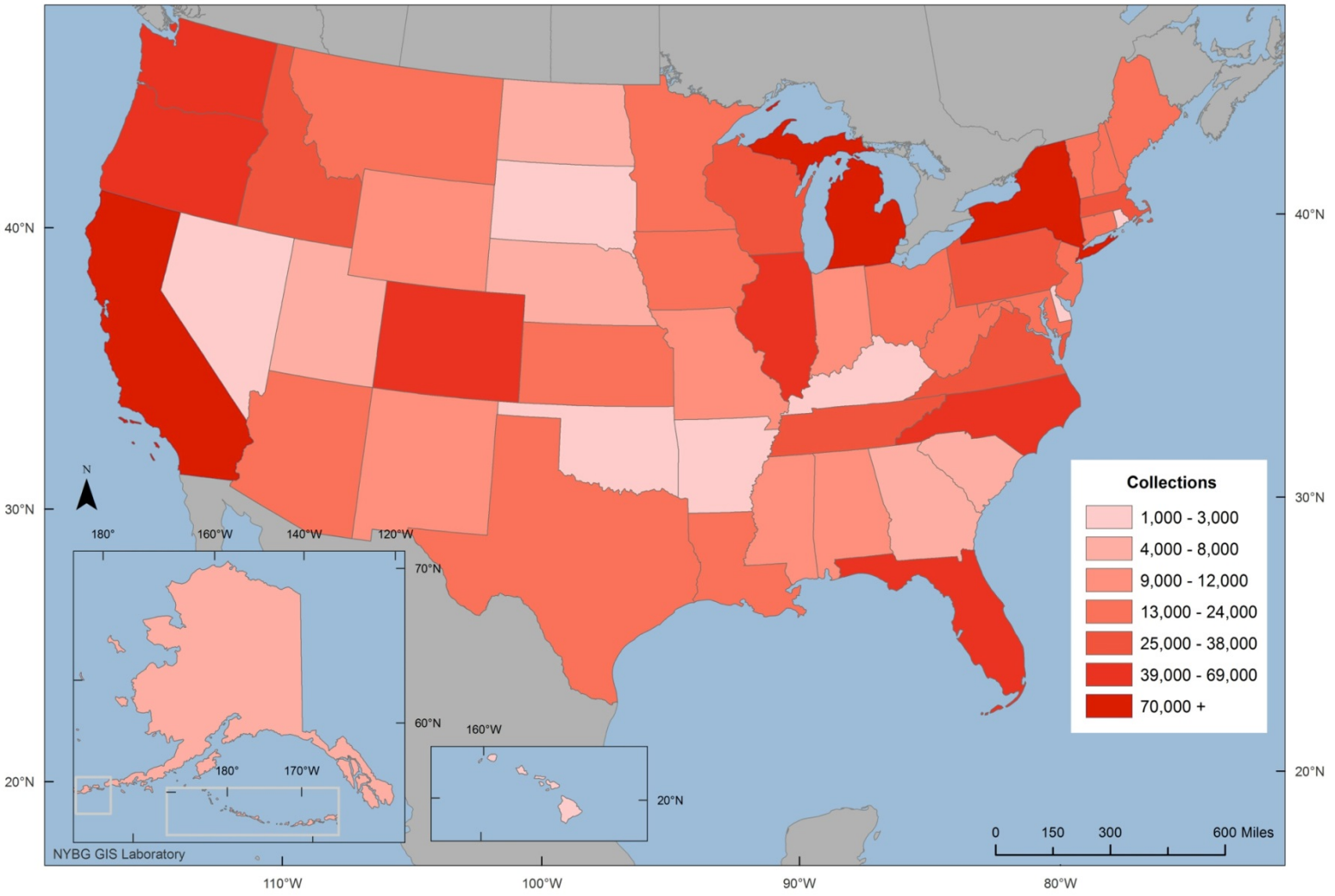
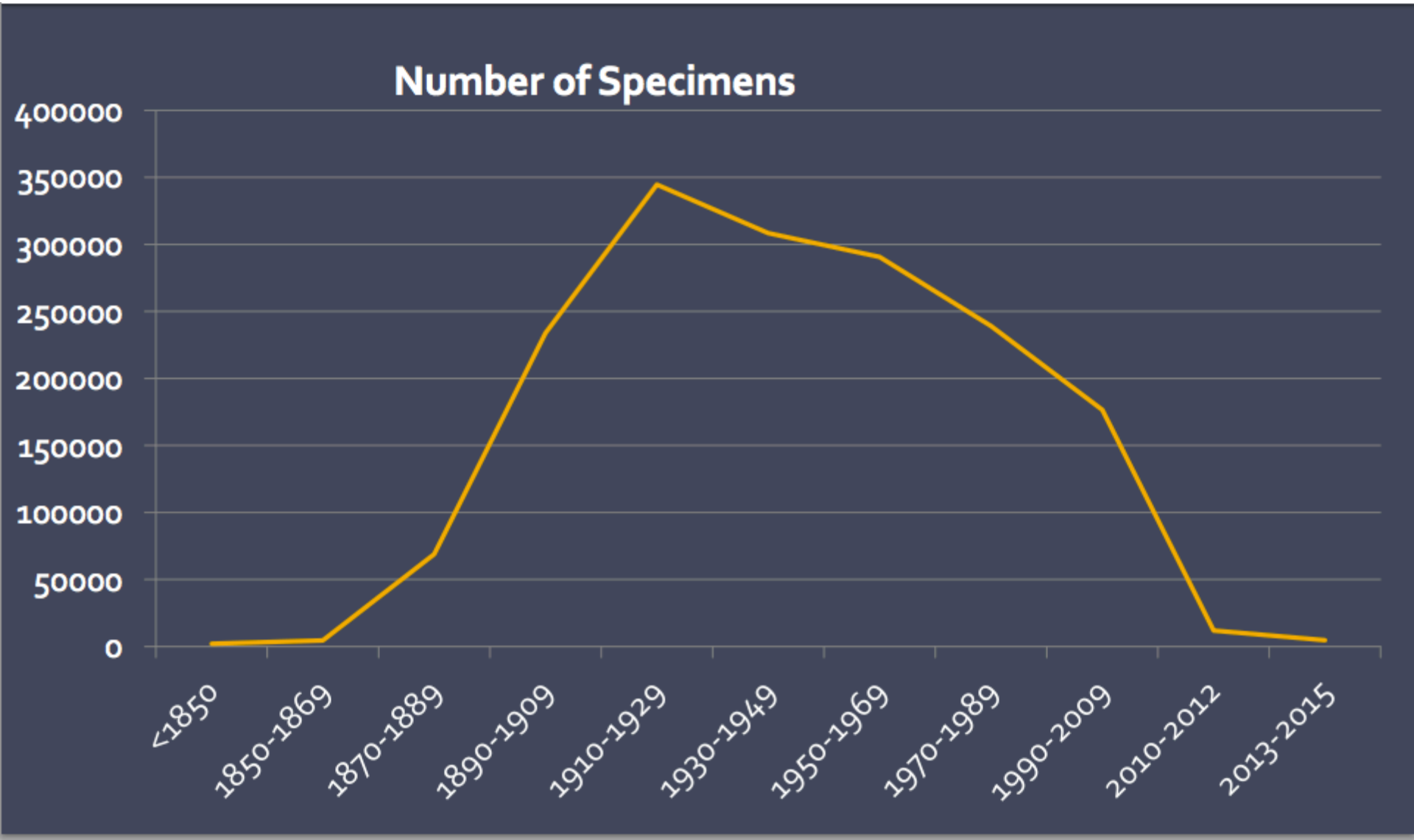
Gap Analysis:Geographic Coverage



Gap Analysis:Temporal Coverage



Data Management

MYCOLOGY COLLECTIONS PORTAL

Home | Explore | Crowdsource | Checklist Projects | Other Resources | Acknowledgements

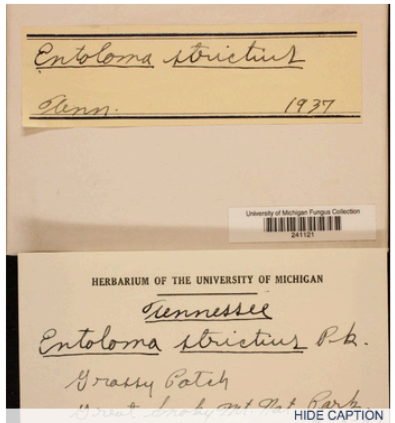
Welcome Andrew! My Profile Logout Sitemap

Welcome to the Mycology Collections data Portal

The Mycology Collections data Portal (MyCoPortal) is more than just a web site - it is a suite of user-friendly, web-based data access technologies to aid taxonomists, field biologists, ecologists, educators, and citizen scientists in the study of fungal diversity. The data are derived from a network of universities, botanical gardens, museums, and agencies that provide taxonomic, environmental, and specimen-based information. Using the Symbiota (http://symbiota.org) system of virtual online floras, these data are directly accessible to dynamically generate geo-referenced species checklists, distribution maps, and interactive identification keys, all linked with a rich collection of digital imagery documenting fungal diversity of North America.

Fungus of the Day

What is this fungus?
Click here to test your knowledge



HIDE CAPTION
Entoloma strictius; 241121; A. H. Smith 7343.
Courtesy of: University of Michigan Herbarium.

News and Events

- **NSF Press Release** (#15-092) - NSF awards fifth round of grants to enhance America's biodiversity collections
- **NSF Press Release** (#12-082) - US National Science Foundation awards support for The Macrofungi Collection Consortium, a collaboration of 35 institutions in 24 states for the purpose of databasing some 1.4 million dried scientific specimens of macrofungi (NSF ADBC 1206197).
- **December 2013** - 1,546,358 occurrence records supplied by 31 different data providers have been integrated into MyCoPortal.
- **NEW** - MaCC records are now part of the Zooniverse project *Notes from Nature*. Please help us by transcribing specimen labels (link).
- Image provided by New York Botanical Garden.

Please join the Mycology Collections Portal as collaborators or regular visitors, and send your feedback to mycoportal.contact@gmail.com.

MiCC Microfungi Collections Consortium

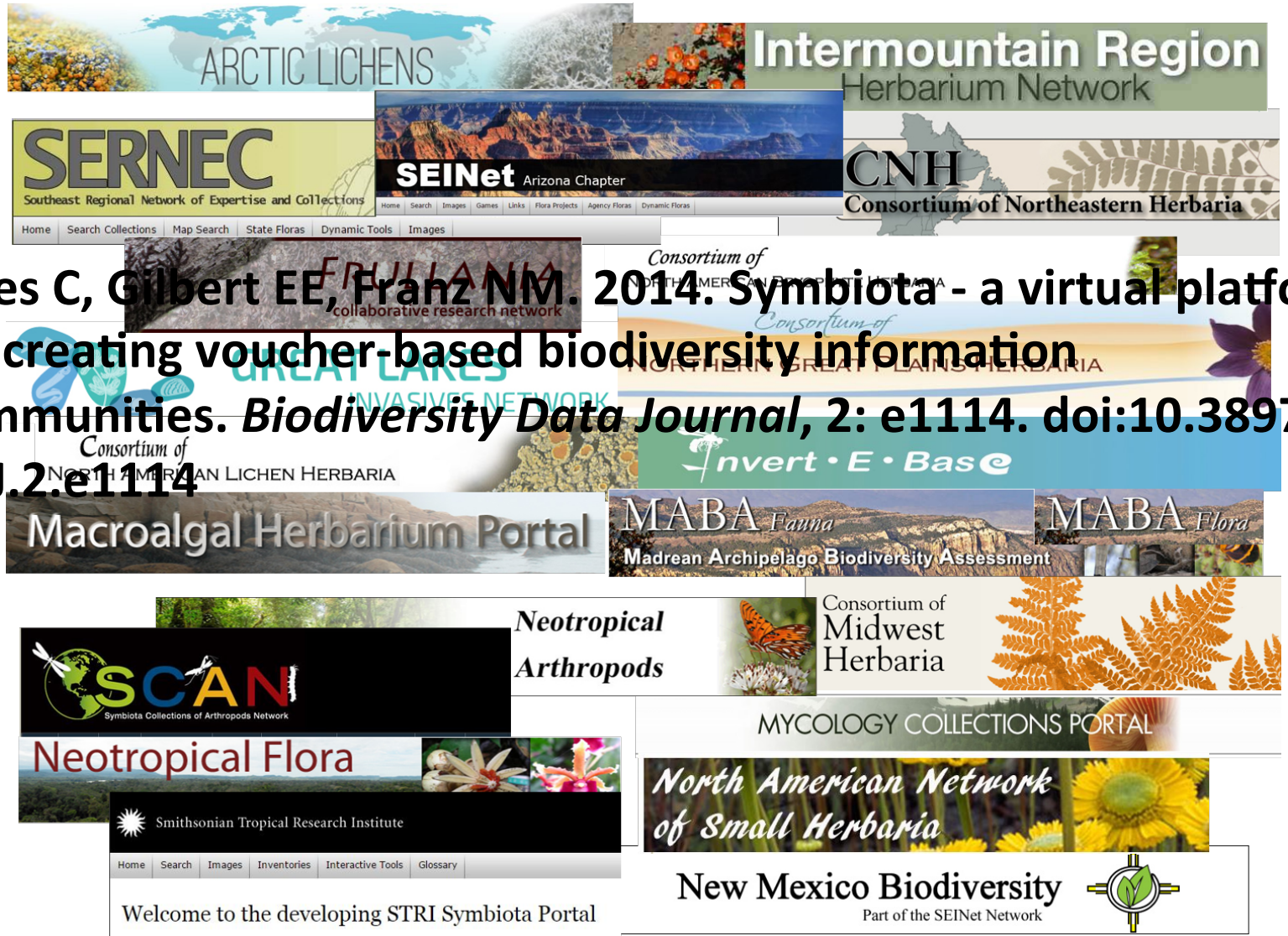
www.mycoportal.org

Symbiota Portals: 18 million records served through 621 collections in 22 Portals (9 TCN Portals)

Data Management

Open access of data

Management & Oversight



Gries C, Gilbert EE, Franz NM. 2014. Symbiota - a virtual platform for creating voucher-based biodiversity information communities. *Biodiversity Data Journal*, 2: e1114. doi:10.3897/BDJ.2.e1114

Research Questions

1) What are the effects of anthropogenic disturbance to the environment on the temporal and spatial distribution and phenology of microfungi?

2) Can we use historic and current distributional patterns of microfungi as models for the early detection of invasive species to reduce their potential deleterious effects? Can we use these same data to detect endemism and biodiversity hotspots in microfungi?

3) How do climatic changes influence the dispersal, distribution, and functioning of soil microfungi?

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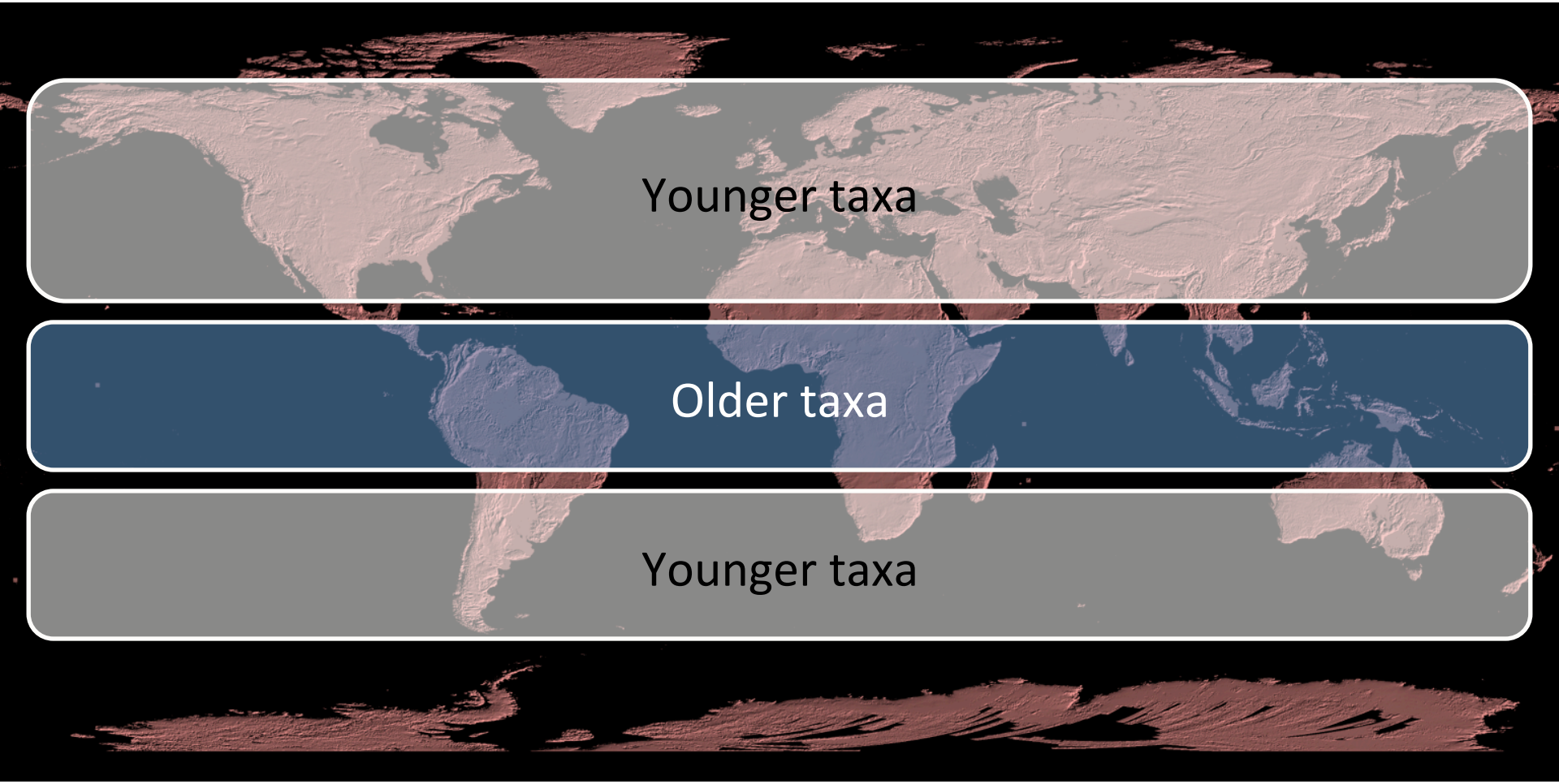
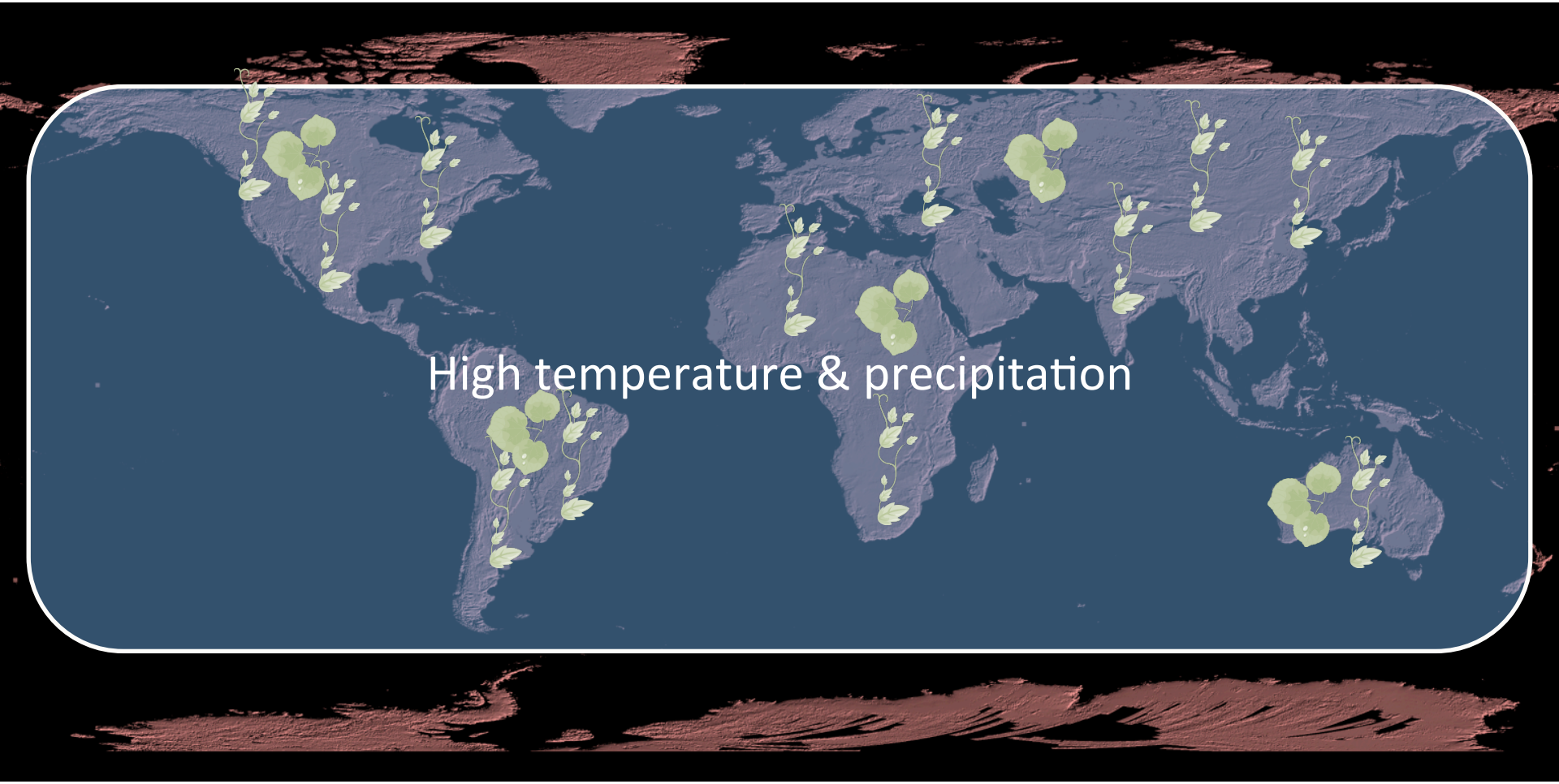
Plants and animals: Older taxa restricted to lower latitudes



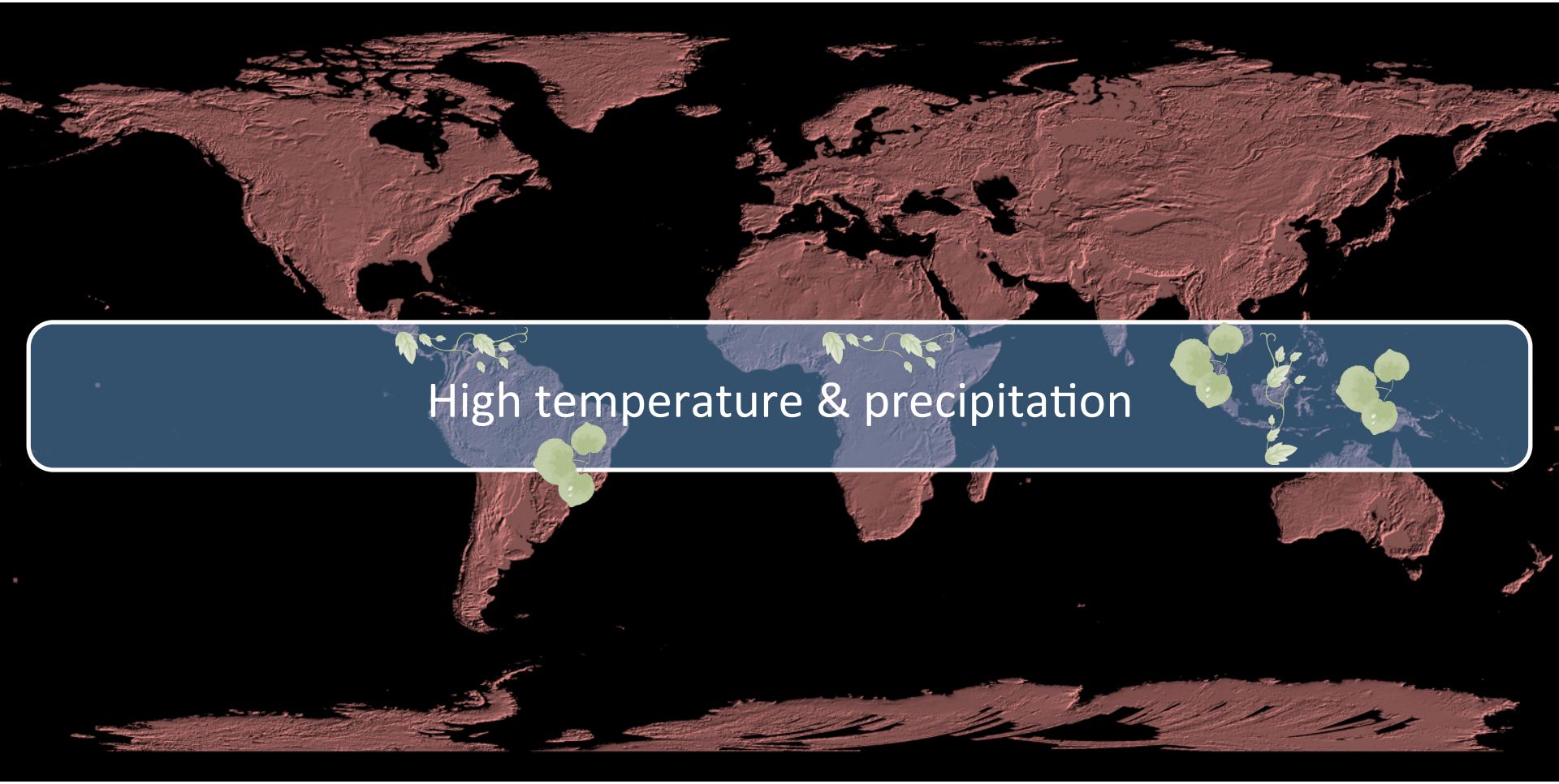
Treseder et al. *Ecology Letters* 2014

Niche conservatism



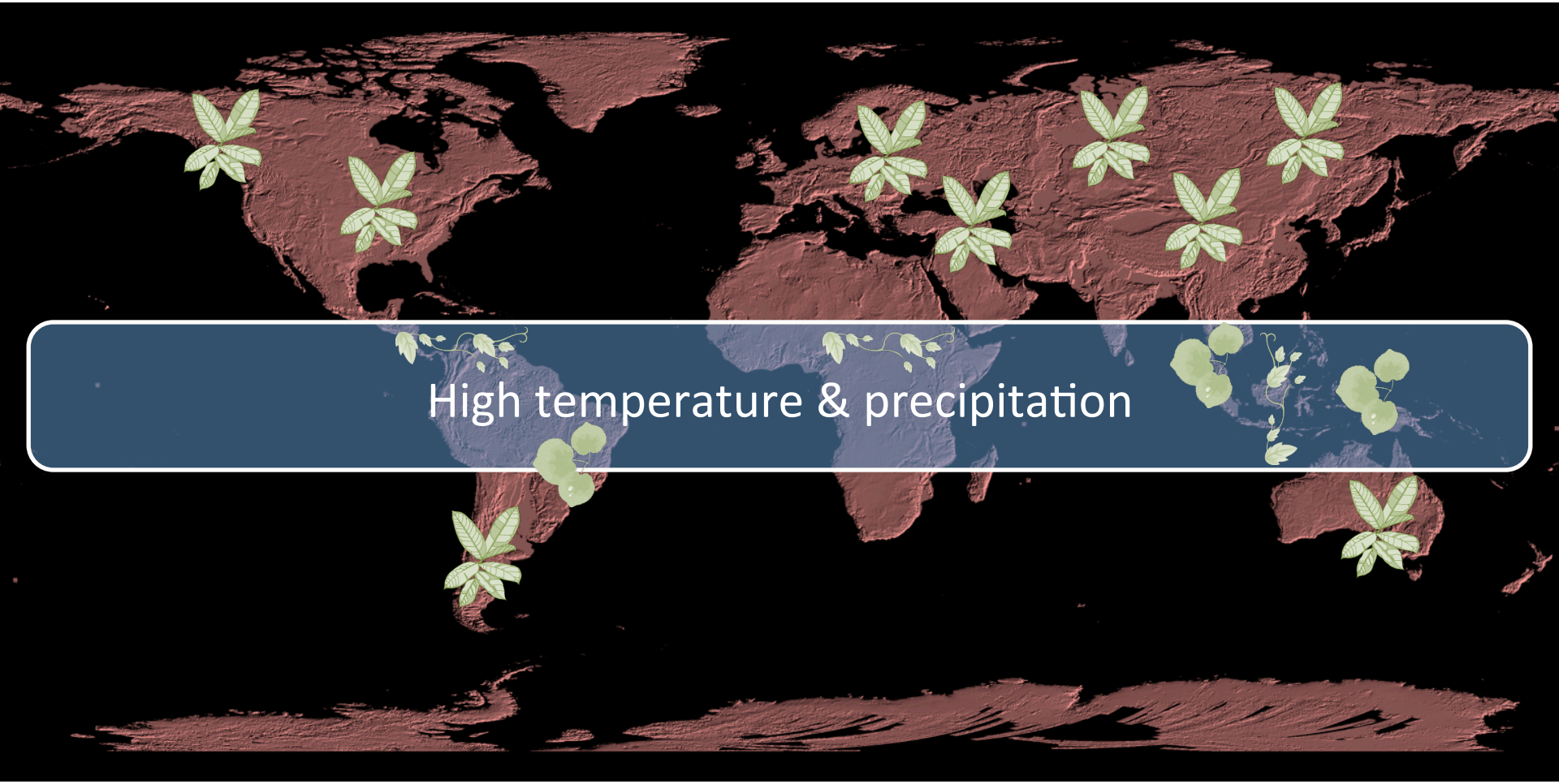
Ancestral climate

Niche conservatism



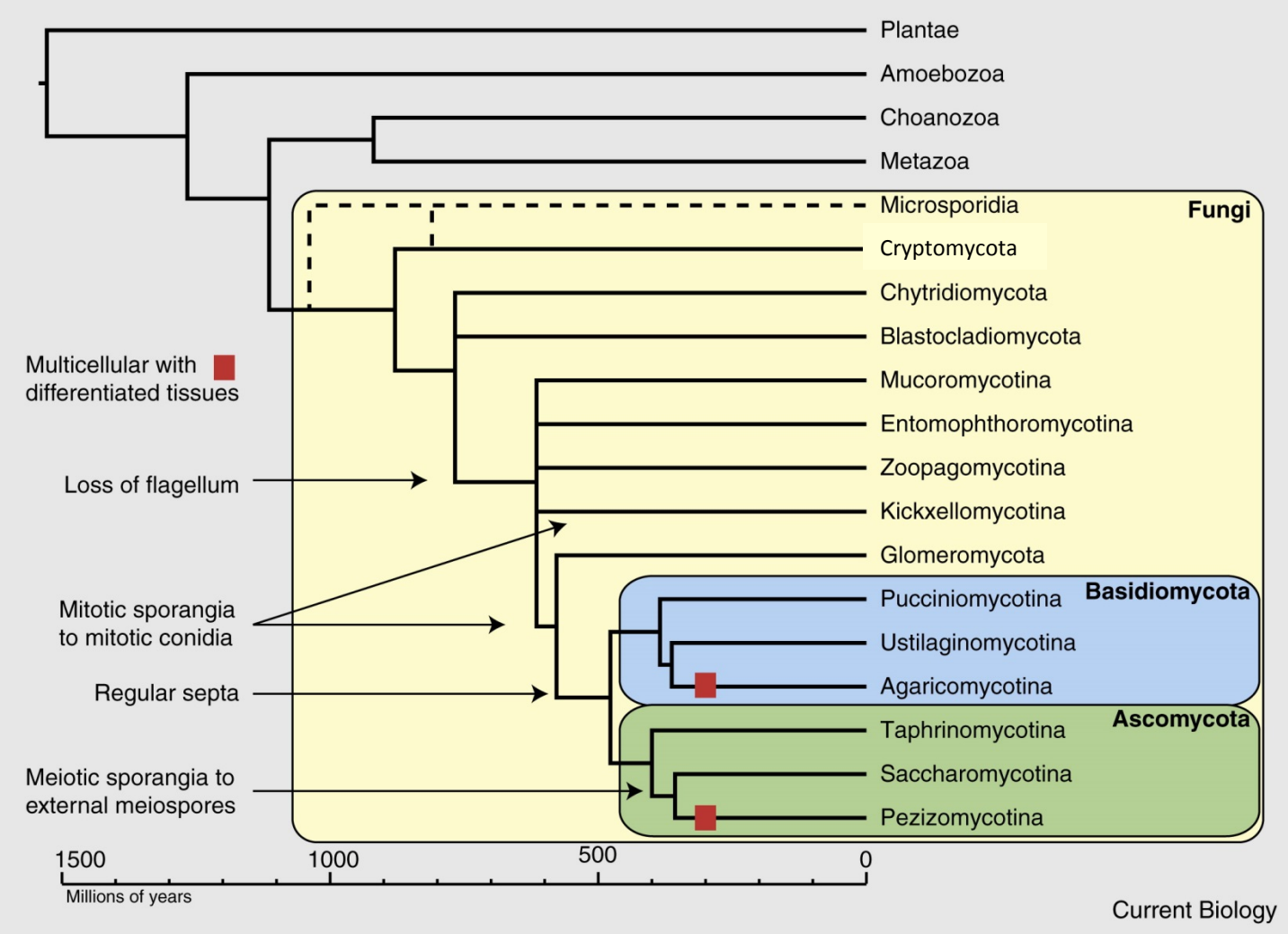
Current climate

Niche evolution



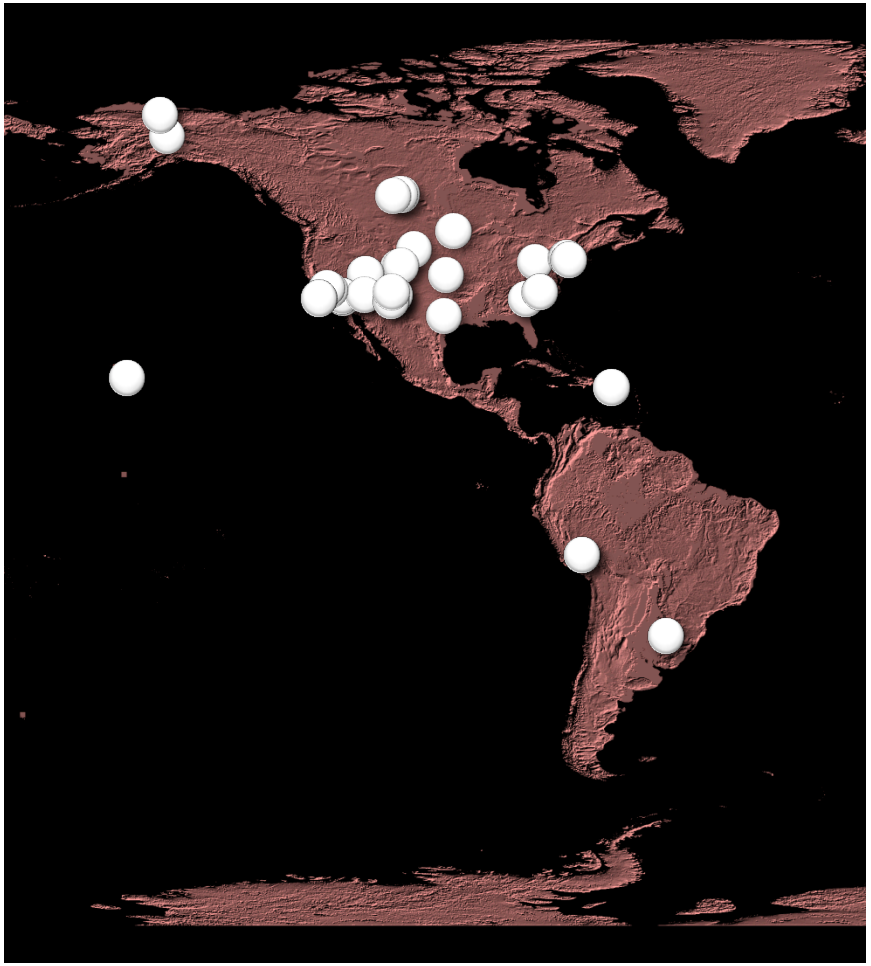
Current climate

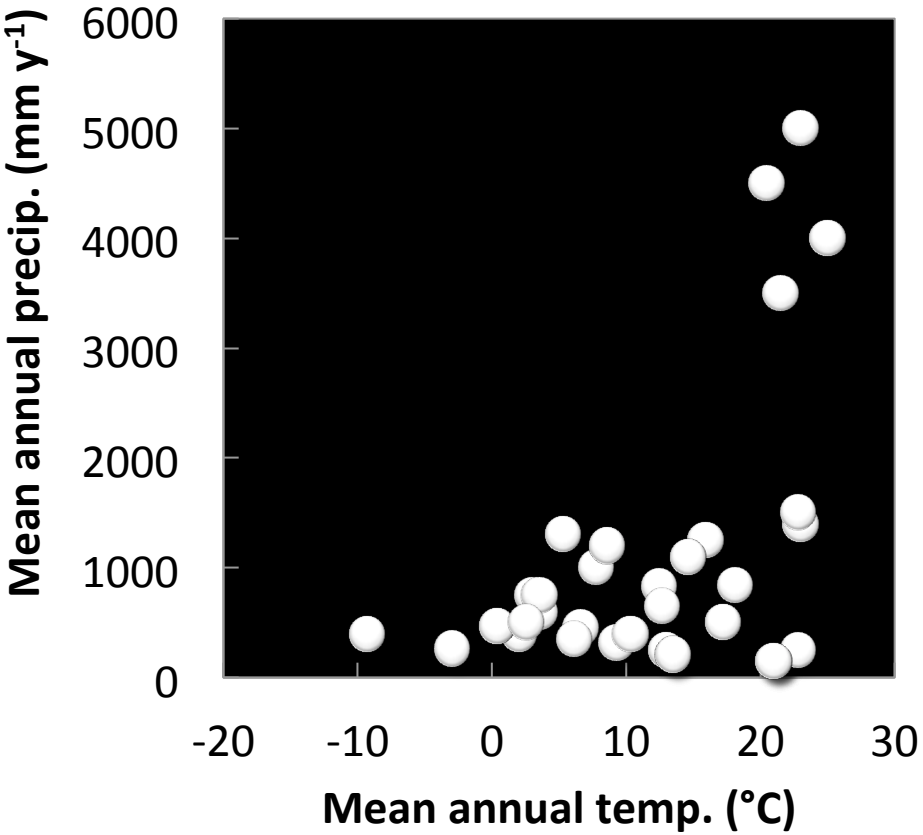
Evolution of fungi



Stajich et al. 2009

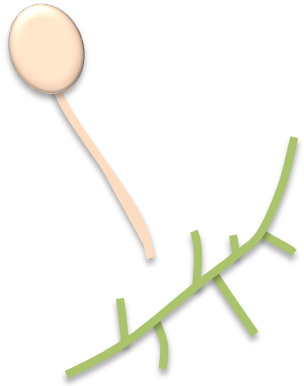
Western Hemisphere soils





Fierer & Jackson 2006

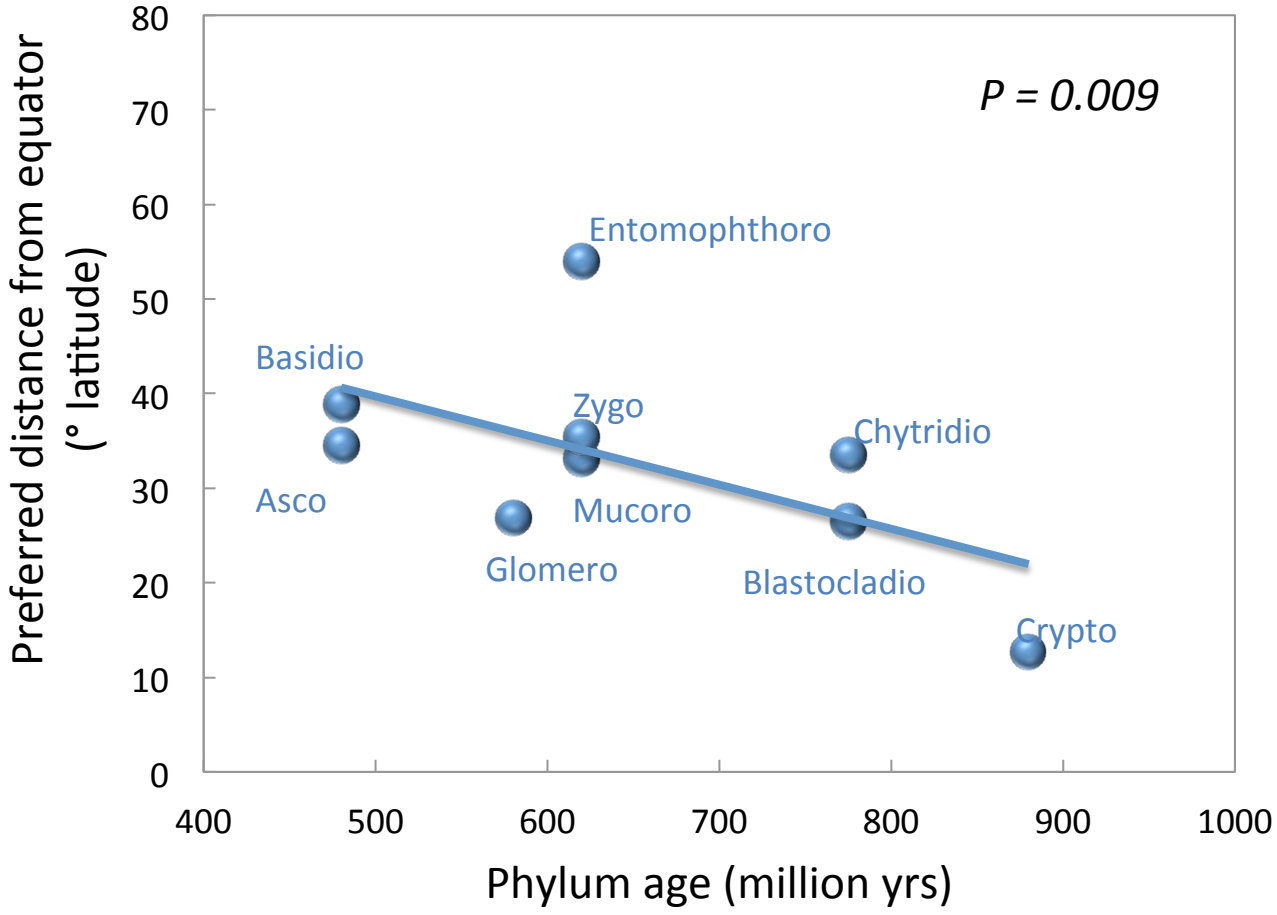
517 fungal taxa (~families)



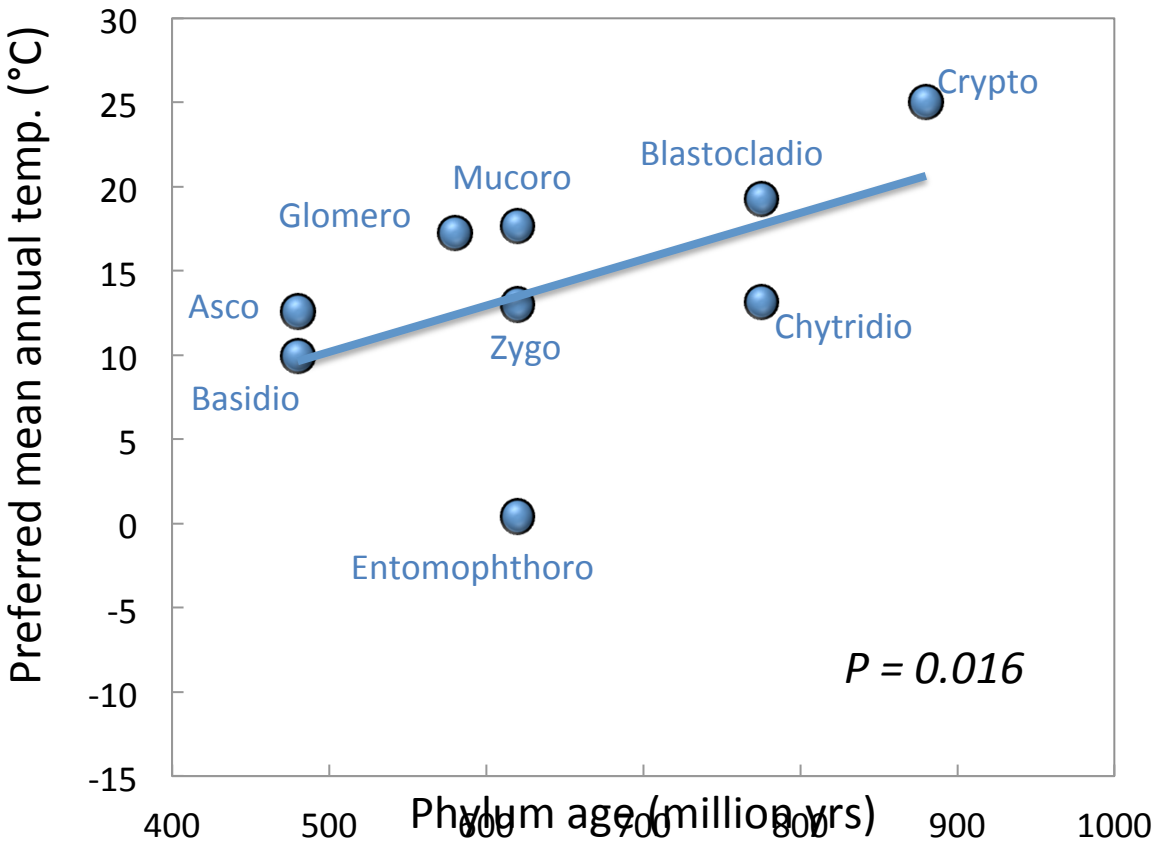
For each fungal taxon:

- Assigned to phylum (nine phyla)
- Calculated environmental “preferences”
  - Average latitude
  - Average temperature
  - Average precipitation
- Phylogenetic independent contrasts with phylum age

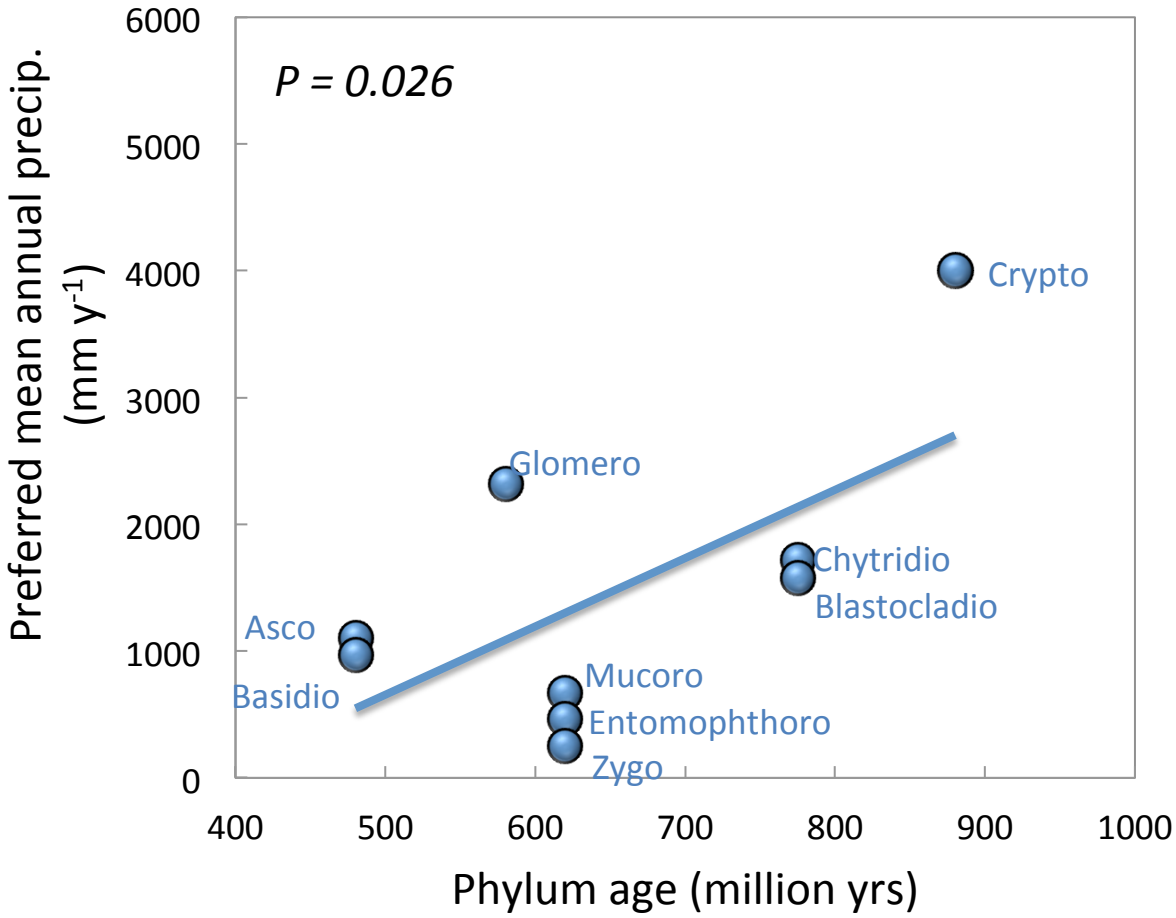
Younger phyla reside in higher latitudes



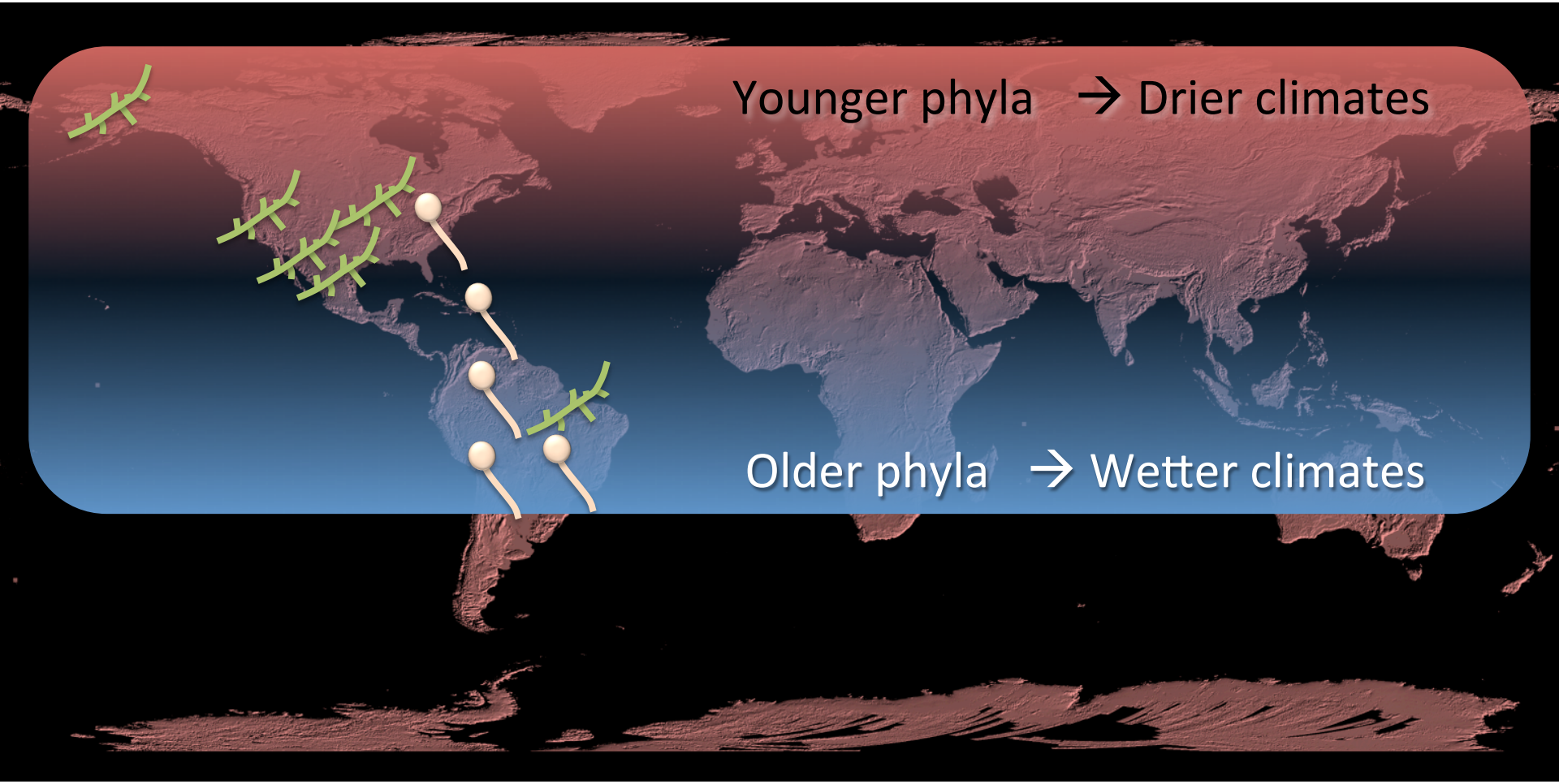
Younger phyla can tolerate lower temperatures



Younger phyla require less precipitation



Summary



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Management of the network

INHS Team

Andrew Miller
PI

Elizabeth Lippoldt
Project Manager

Phil Anders
Biological
Informatician

Alexander Kuhn
Digitizer

Scott Bates
Project
Consultant

Lee Crane
Exsiccati and
Nomenclature
Expert

Tiffany Bone
Digitization
Expert

Agilda Dema
Transcriber

MiCC
Microfungi Collections Consortium

Management – oversight

Past Year Totals

Institution	Object	2014-10	2014-11	2014-12	2015-1	2015-2	2015-3	2015-4	2015-5	2015-6	2015-7	2015-8	2015-9	2015-10
Ada Hayden Herbarium, Iowa State University	Specimens	14	7	0	0	0	0	0	0	0	0	128	150	446
	Stage 1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Stage 2	0	0	0	0	0	0	0	0	0	0	128	149	409
	Stage 3	0	0	0	0	0	0	0	0	0	0	0	0	0
	Images	0	0	0	0	0	0	0	0	0	0	0	411	970
Arthur Fungarium, Purdue University	Specimens	0	0	0	0	0	0	0	0	0	0	0	0	236
	Stage 1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Stage 2	0	0	0	0	0	0	0	0	0	0	0	0	0
	Stage 3	0	0	0	0	0	0	0	0	0	0	0	0	0
	Images	0	0	0	0	0	0	0	0	0	0	0	0	0
Bernard Lowy Mycological Herbarium (Louisiana State University)	Specimens	23	1050	341	218	112	0	0	2	0	0	1	245	208
	Stage 1	0	0	0	0	0	0	0	0	0	0	0	14	2
	Stage 2	7	562	180	117	43	0	0	0	0	0	1	209	201
	Stage 3	15	482	155	100	69	0	0	2	0	0	0	22	2
	Images	1068	215	615	0	4154	7	5	24	1	0	1	0	415
Field Museum of Natural History	Specimens	39	90	0	0	0	0	0	0	0	0	476	1047	830
	Stage 1	1	0	0	0	0	0	0	0	0	0	1	0	0
	Stage 2	0	0	0	0	0	0	0	0	0	0	246	405	276
	Stage 3	14	16	0	0	0	0	0	0	0	0	0	0	0
	Images	0	0	0	0	0	0	0	0	0	0	55	772	736
Julian H. Miller Mycological Herbarium	Specimens	0	0	0	0	0	0	0	0	0	0	0	559	765
	Stage 1	0	0	0	0	0	0	0	0	0	0	0	0	660
	Stage 2	0	0	0	0	0	0	0	0	0	0	0	559	105
	Stage 3	0	0	0	0	0	0	0	0	0	0	0	0	0
	Images	0	0	0	0	0	0	0	0	0	0	0	592	1845
University of Illinois Herbarium	Specimens	156	203	71	0	0	0	0	0	31	6109	2775	3406	1017
	Stage 1	0	0	0	0	0	0	0	0	0	159	0	0	4
	Stage 2	154	164	71	0	0	0	0	0	31	80	0	1033	1012
	Stage 3	0	0	0	0	0	0	0	0	0	1	0	0	0
	Images	0	0	0	0	0	0	0	1	15	8328	12423	6515	1362
University of Nebraska State Museum, C.E. Bessey Herbarium	Specimens	0	0	0	0	0	0	0	0	0	0	0	0	2135
	Stage 1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Stage 2	0	0	0	0	0	0	0	0	0	0	0	0	0
	Stage 3	0	0	0	0	0	0	0	0	0	0	0	0	0
	Images	0	0	0	0	0	0	0	0	0	0	0	0	2135
University of Wisconsin-Madison Herbarium	Specimens	0	0	0	0	0	0	0	0	0	0	1805	3631	2423
	Stage 1	0	0	0	0	0	0	0	0	0	0	0	1	2
	Stage 2	0	0	0	0	0	0	0	0	0	0	1775	3609	2414
	Stage 3	0	0	0	0	0	0	0	0	0	0	0	0	0
	Images	0	0	0	0	0	0	0	0	0	0	0	820	1330
Wilhelm G. Solheim Mycological Herbarium	Specimens	0	0	0	0	0	0	0	0	0	0	0	195	349
	Stage 1	0	0	0	0	0	0	0	0	0	0	0	194	349
	Stage 2	0	0	0	0	0	0	0	0	0	0	0	0	0
	Stage 3	0	0	0	0	0	0	0	0	0	0	0	0	0
	Images	0	0	0	406	0	0	442	0	0	0	0	0	0

Download CSV

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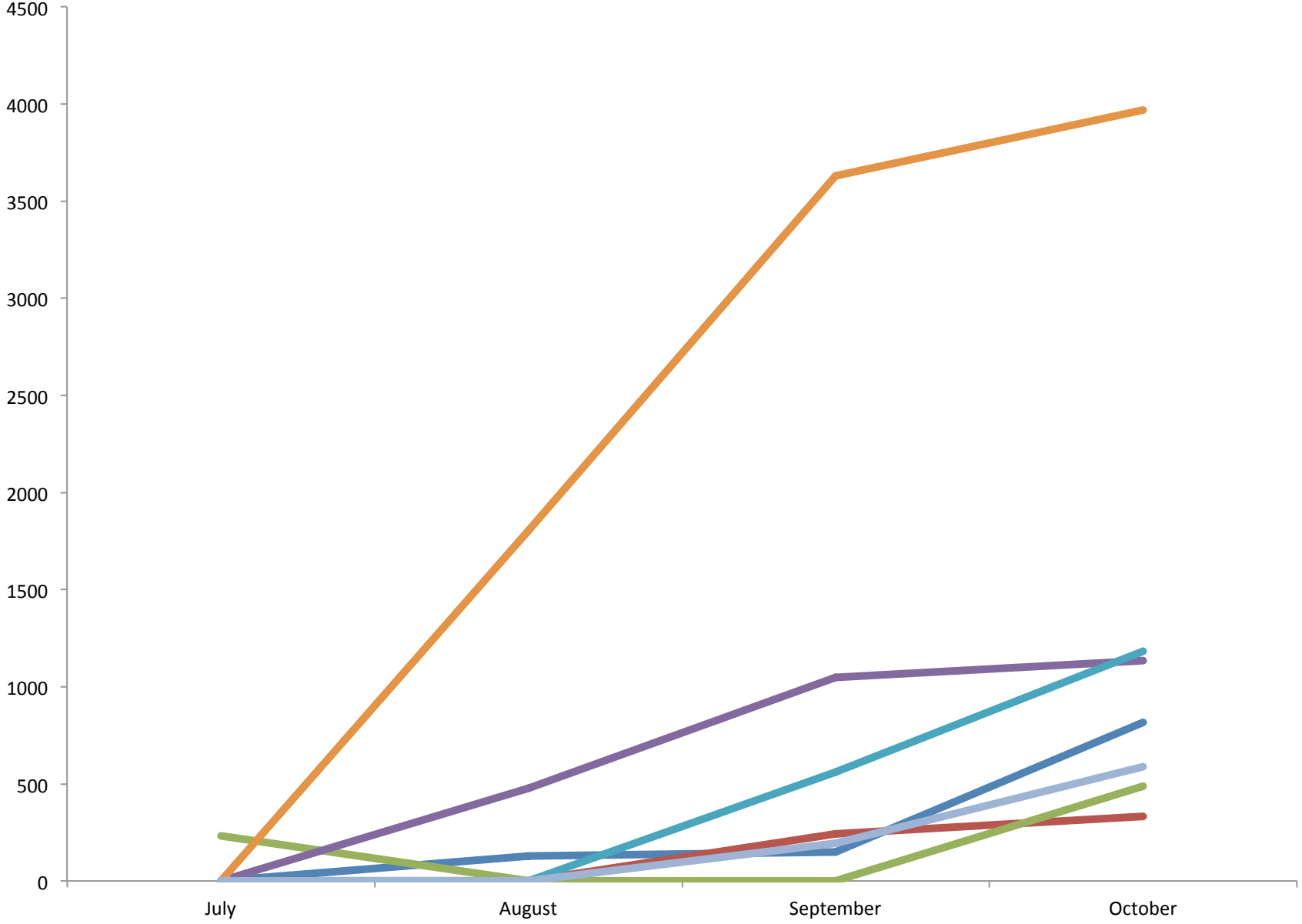
Specimen records



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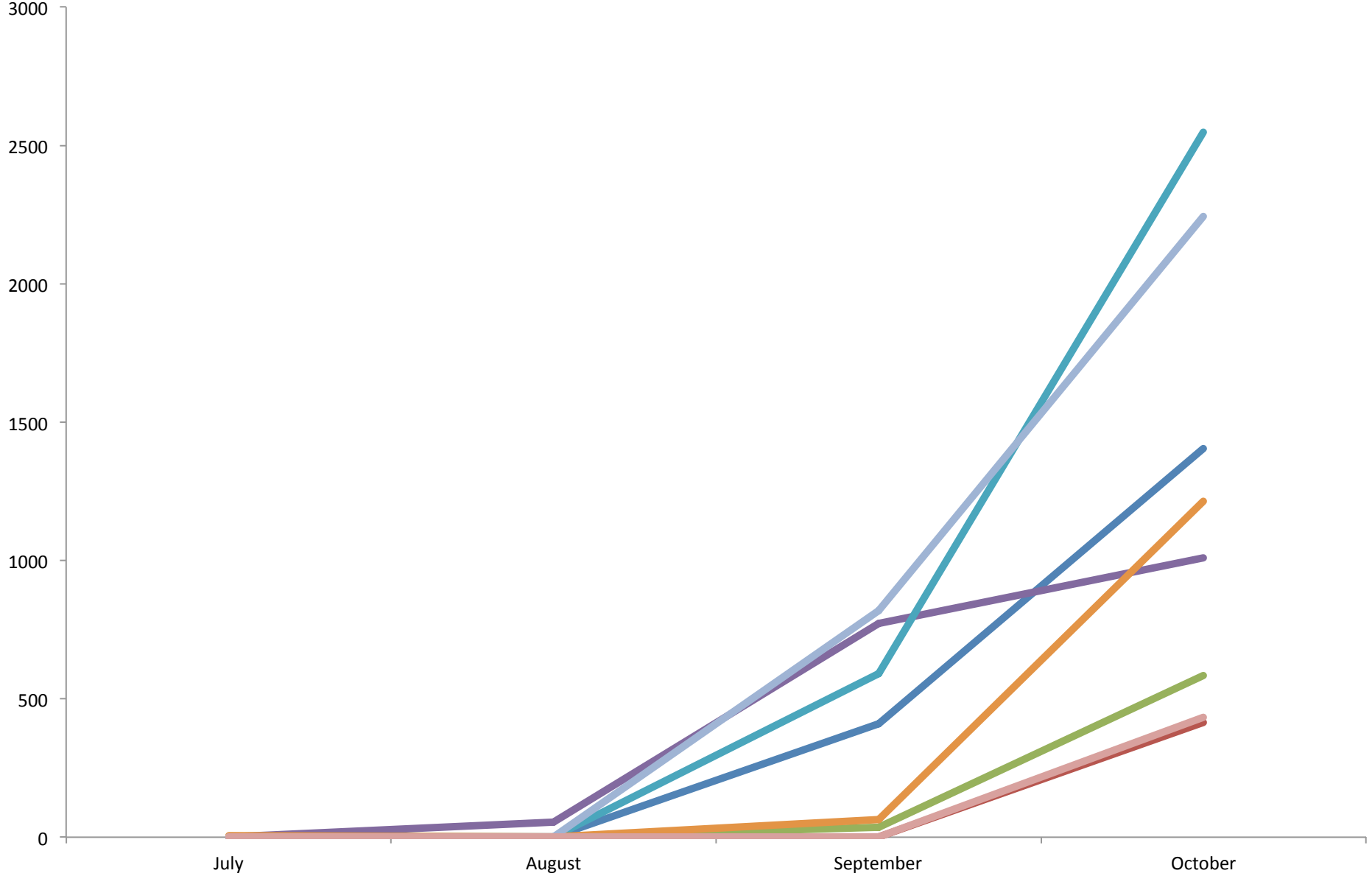
Images



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- Home
- MyCoPortal
- iDigBio
- Participants
- INHS Team
- Resources
- News
- Blog

credits

Microfungi comprise a loosely defined artificial group of Fungi and fungal-like organisms that include such things as bread molds, plant pathogens, powdery mildews, rusts, slime molds, and water molds. In general, these fungi are difficult or impossible to see with the unaided eye. A **taxonomical classification of microfungi** suggests the group contains 4468 genera and 55,989 species.

Microfungi are ubiquitous throughout the world and some cause major economic impacts as pathogens of animals, plants, and other fungi. Many **microfungi** are harmless saprobes, breaking down large complex chemical structures such as lignin found in wood into usable simple compounds. Despite their importance, little is known about the diversity, distribution, ecology, or host relationships of microfungi throughout the United States.

The Microfungi Collections Consortium (MiCC) is a collaborative effort among **38 US institutions** to digitize specimen label data from 2.3 million North American microfungi specimens and make these data available online to the broader community through the **MyCoPortal** website. A proposal submitted in October 2014 to the National Science Foundation's **Advancing Digitization of Biodiversity Collections** program was **granted in July 2015**. **Dr. Andrew N. Miller** of the **Illinois Natural History Survey** serves as the Project Leader.

www.microfungi.org

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212 likes +7 this week
Scott T. Bates and 50 other friends

68 post reach this week

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Connect with more of the people who matter to you
Promote Page

ABOUT

Microfungi comprise a loosely defined artificial group including bread molds, plant pathogens, powdery mildews, rusts, slime molds, and water molds.

http://www.microfungi.org/ Promote Website

PHOTOS

Status | Photo / Video | Offer, Event +

Write something...

Microfungi
Published by Elizabeth Micc [?] · Yesterday at 7:28am ·

Mycorrhizal fungi at work!

Fungi can help monarchs self-medicate
By changing milkweed chemistry, soil microbes alter the spread of a crippling monarch parasite
NEWS.SCIENCEMAG.ORG

64 people reached Boost Post

Like · Comment · Share

Christina Leb likes this.

Write a comment...

Microfungi
Published by Elizabeth Micc [?] · September 30 at 4:51pm ·

"We propose that the current rapid warming in the maritime Antarctic...will facilitate the colonization of soil by a wider diversity of fungi than at present,

www.facebook.com/microfungi.org

microfungi_inhs

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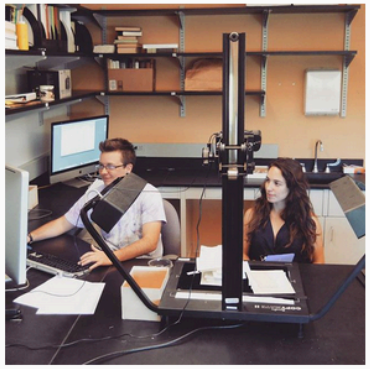
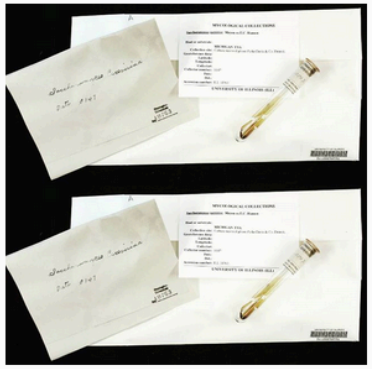




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