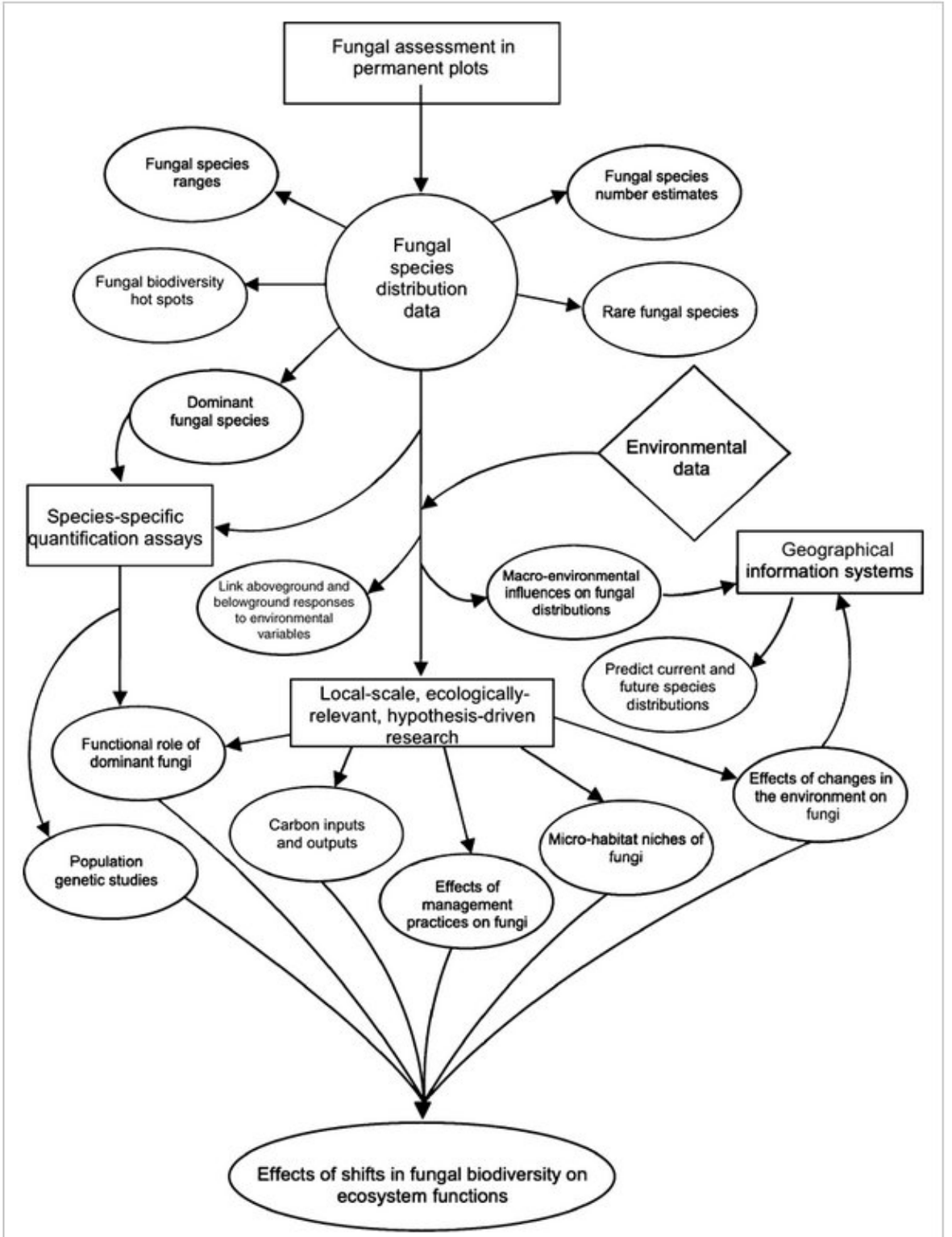
Fungal distributions

Topics (just the very basics):

- Where are fungi found and how do they get around?
- Do they have biogeographic patterns?
- Baas-Becking, moderate endemism, strong biogeography
- Dispersal vs environmental limitations
- The future of fungal distributions and why we might care



"Everything is everywhere, but, the environment selects..."

-- Baas-Becking and Beijerinck

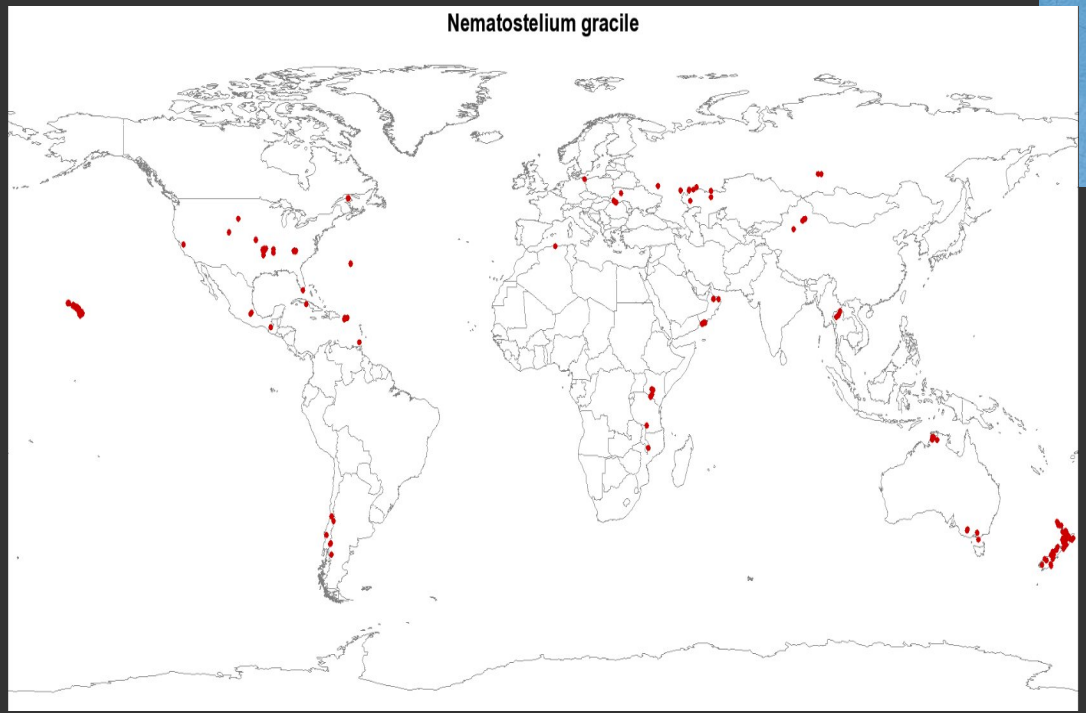
"There are lots of cosmopolitan fungi, but plenty that have restricted geographies..."

-- Moderate endemism model

"The distributions of most fungi reflect the same major dispersal barriers (e.g. oceans and mountains) that drive vicariance events in other organisms..."

-- Strong biogeogrpahy

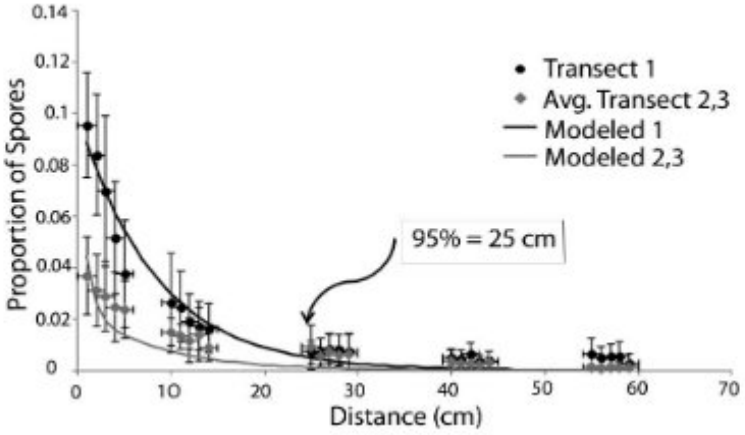
Which hypothesis best explains each of these maps?

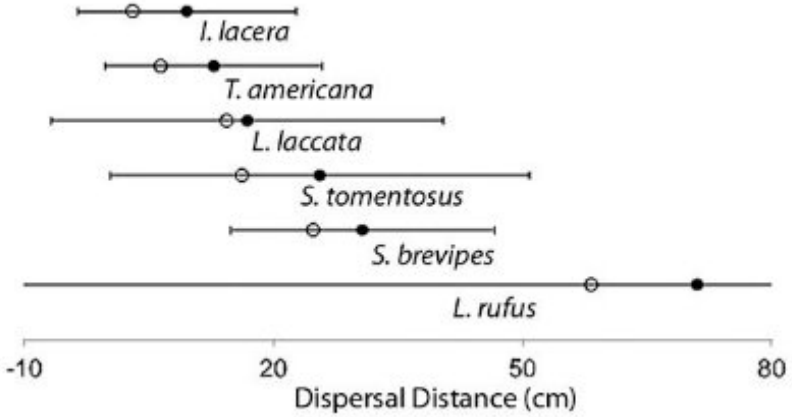


Potential dispersal barriers

Mycologia, 103(6), 2011, pp. 1175–1183. DOI: 10.3852/10-388

95% of basidiospores fall within 1 m of the cap: a field- and modeling-based study





Lack of vectors (wind, water, animals, etc.)
Mountain ranges
Oceans
Deserts

Potential dispersal helpers

Proc Natl Acad Sci U S A. 2016 Mar 15; 113(11): 2833–2838.
PMCID: PMC4801285
Published online 2016 Feb 29. doi: 10.1073/pnas.1509612113
PMID: 26929324
Applied Physical Sciences, Biophysics and Computational Biology

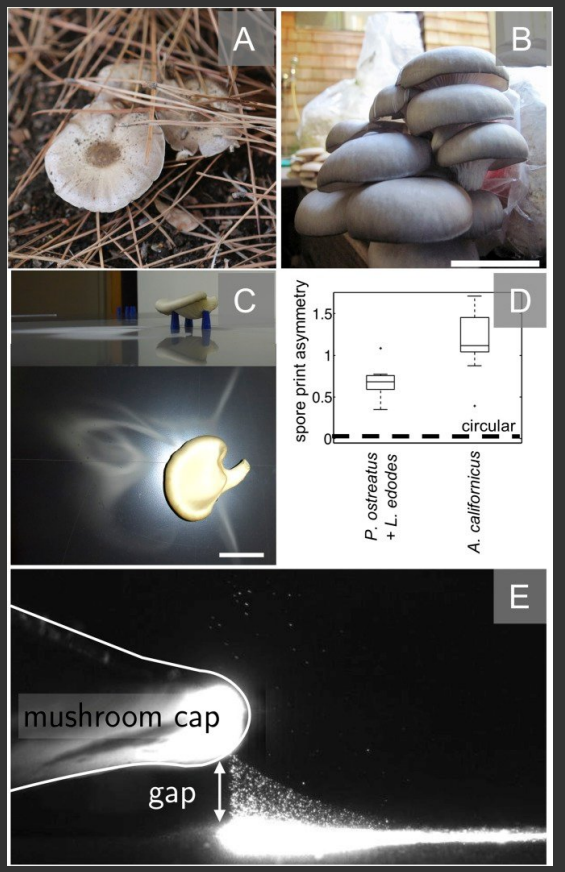
Mushrooms use convectively created airflows to disperse their spores

Emilie Dressaire,[a] Lisa Yamada,[b] Boya Song,[c] and Marcus Roper[c,1]

Insects. 2016 Jun; 7(2): 16.
PMCID: PMC4931428
Published online 2016 Apr 22. doi: 10.3390/insects7020016
PMID: 27110827

Ectomycota Associated with Arthropods from Bat Hibernacula in Eastern Canada, with Particular Reference to *Pseudogymnoascus destructans*

Karen J. Vanderwolf,[1,2,*] David Malloch,[1] and Donald F. McAlpine[1]



Wind
Insects
Birds
Water
Humans

Not poles apart: Antarctic soil fungal communities show similarities to those of the distant Arctic

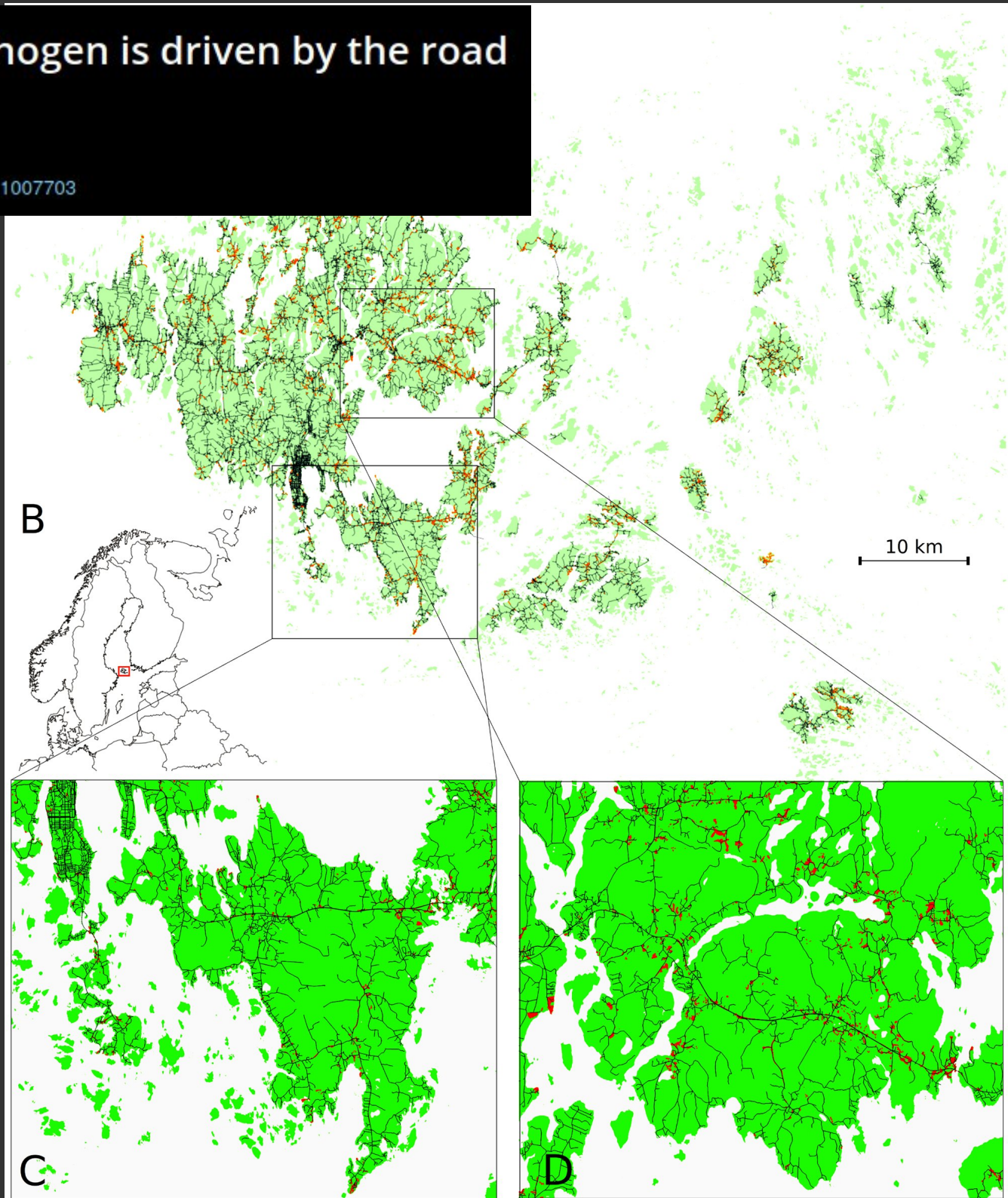
Filipa Cox, Kevin K. Newsham, Roland Bol, Jennifer A. J. Dungait, Clare H. Robinson

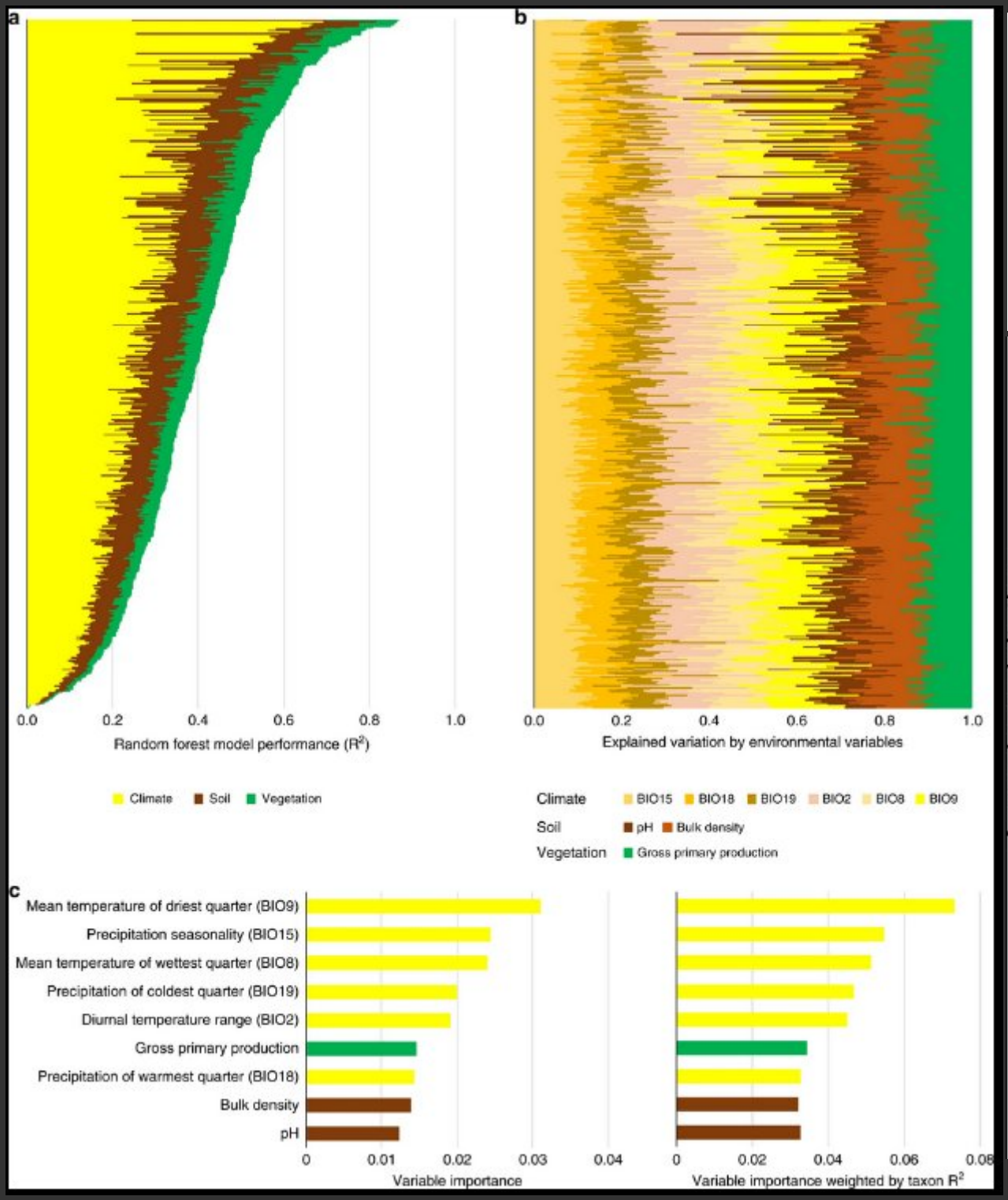
First published: 02 March 2016 | https://doi.org/10.1111/ele.12587 | Citations: 36

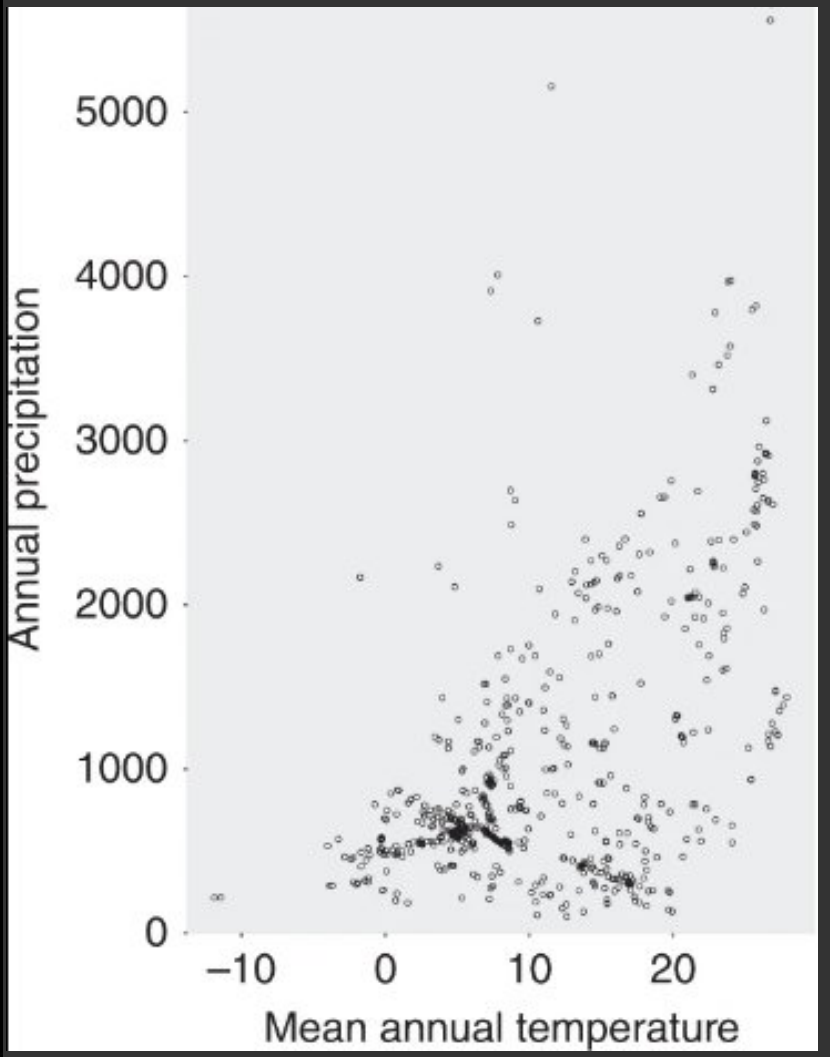
The spread of a wild plant pathogen is driven by the road network

Elina Numminen ✉, Anna-Liisa Laine

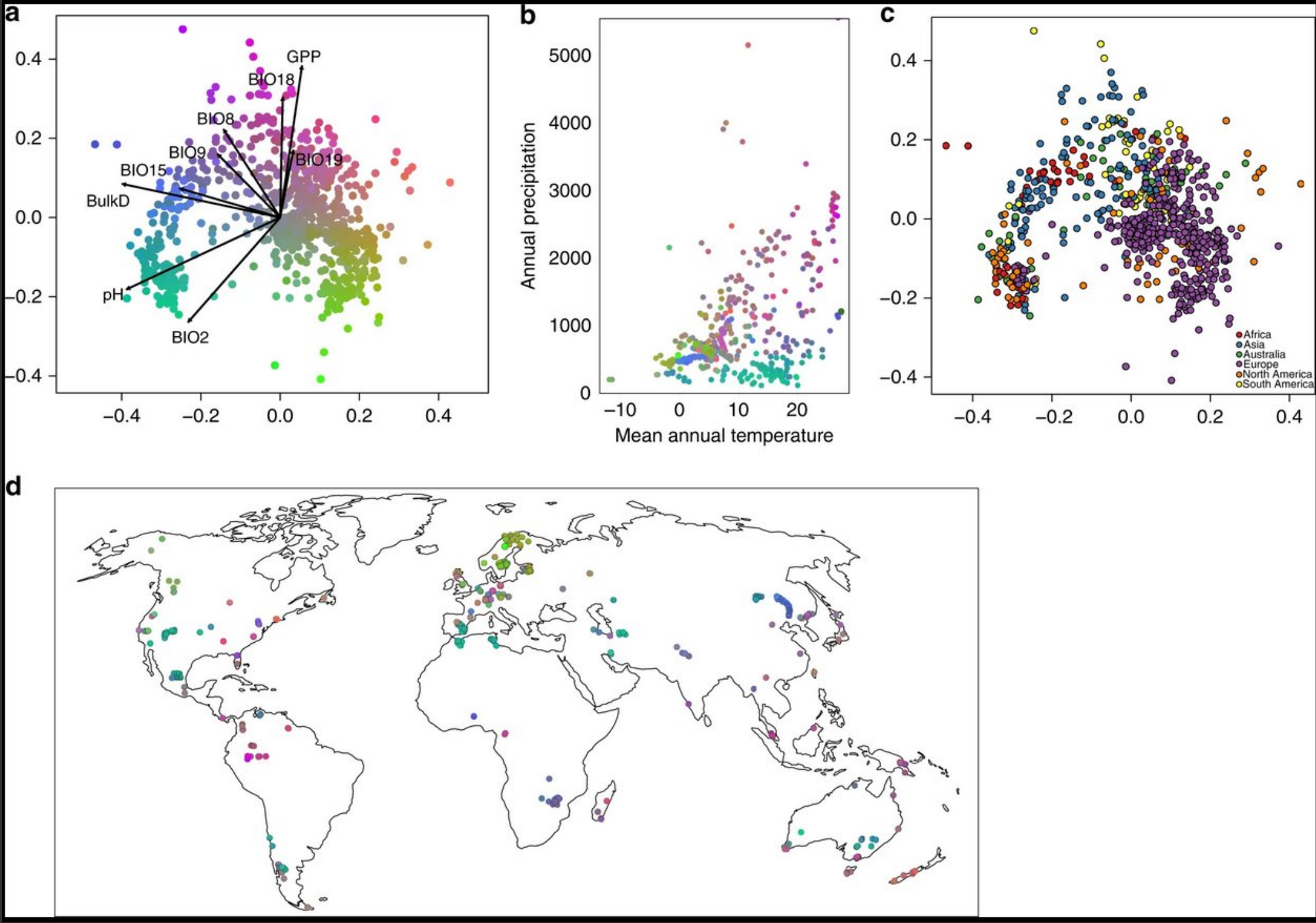
Published: March 31, 2020 • https://doi.org/10.1371/journal.pcbi.1007703







Tomáš Větrovský, et al., 2019



Tomáš Větrovský, et al., 2019

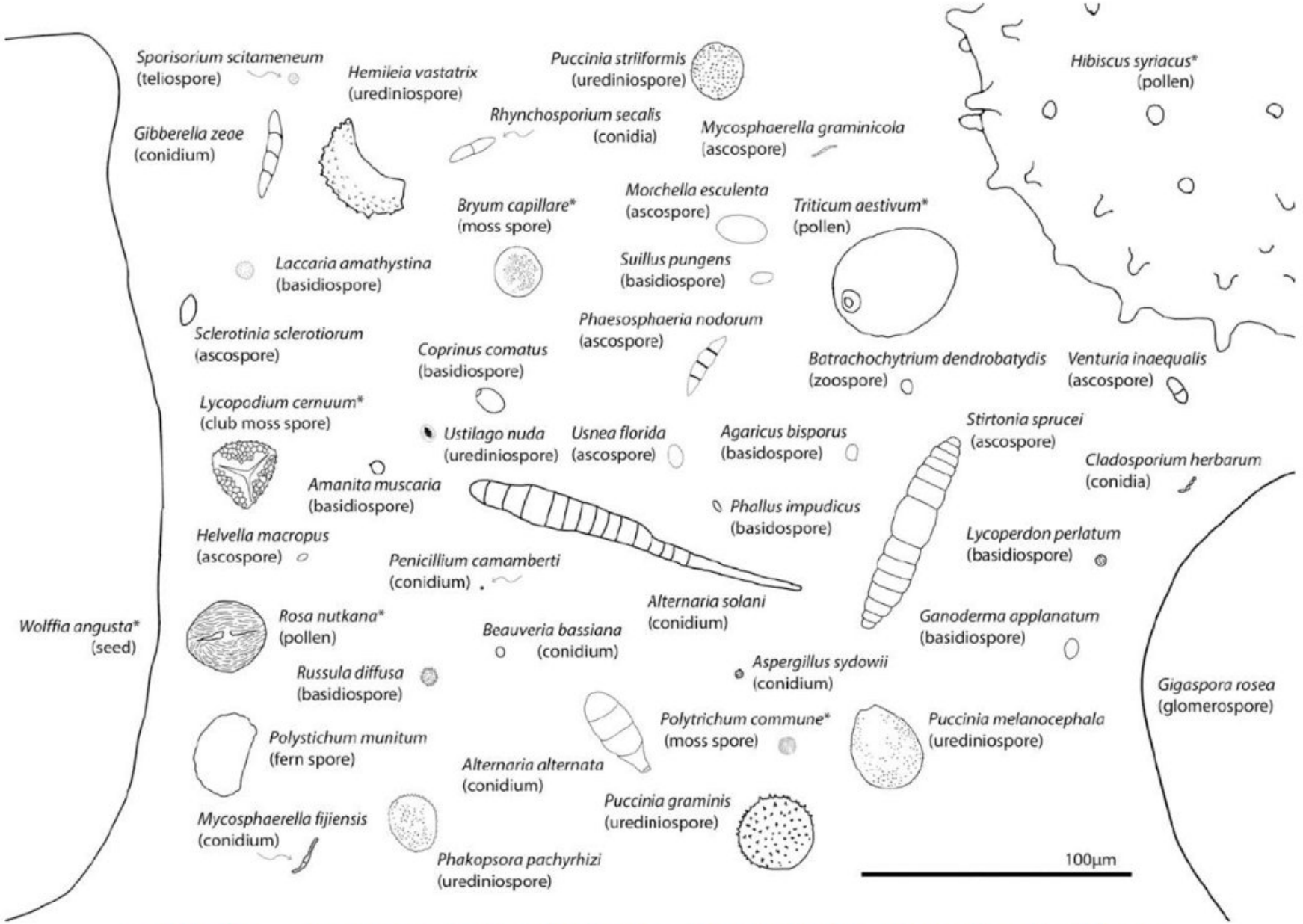


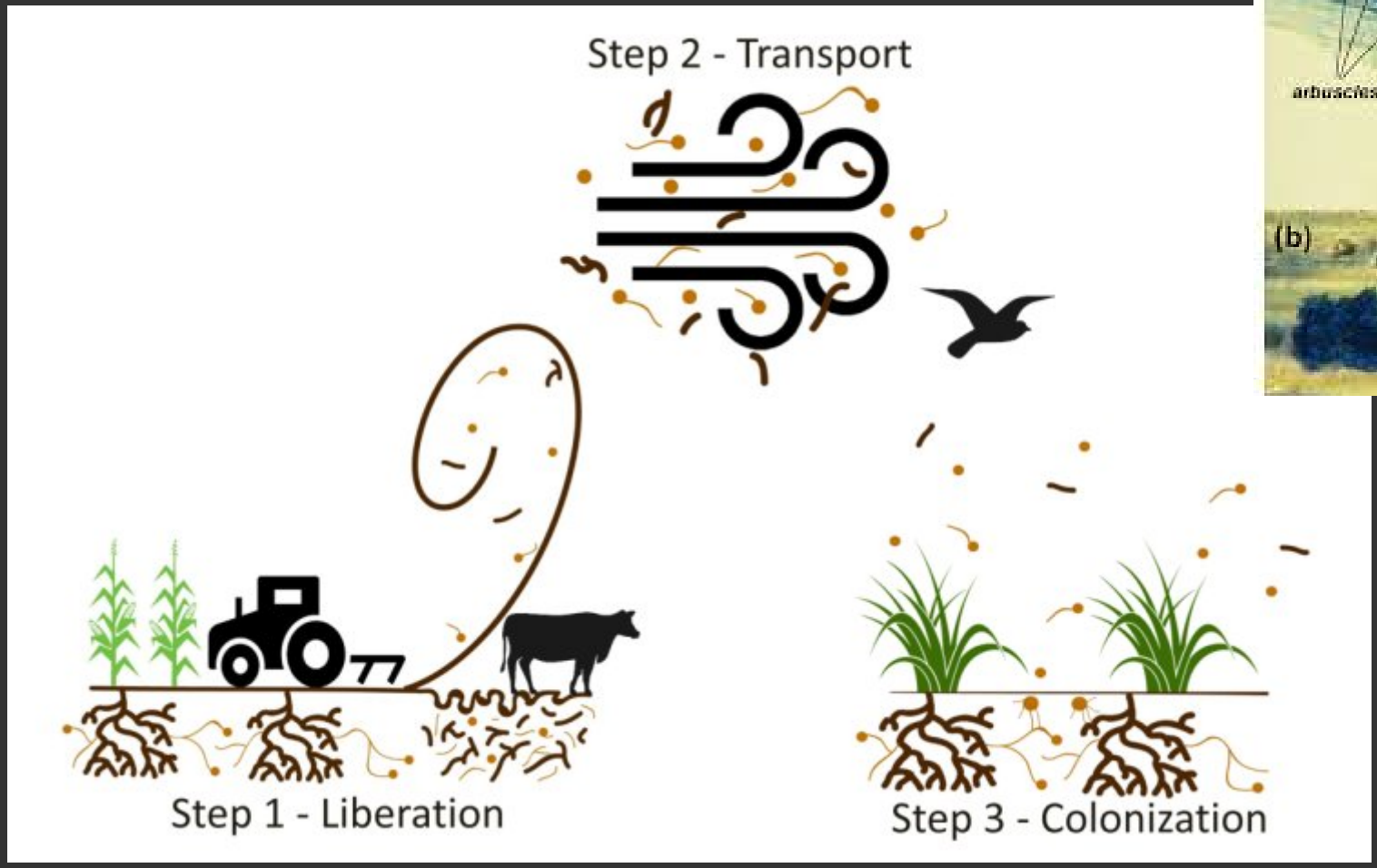
FIGURE 2 Sizes of fungal spores and other airborne particles. Some species are wind dispersed (e.g., *P. graminis*), while others have other means of dispersal (e.g., *Gigaspora rosea*). The smallest plant seed, *Wolffia angusta*, the pollen grains of *Hibiscus syriacus* and *T. aestivum*, and a glomerospore of the arbuscular mycorrhizal *Gigaspora rosea* are provided for comparison. Species labeled with an asterisk are not fungi.

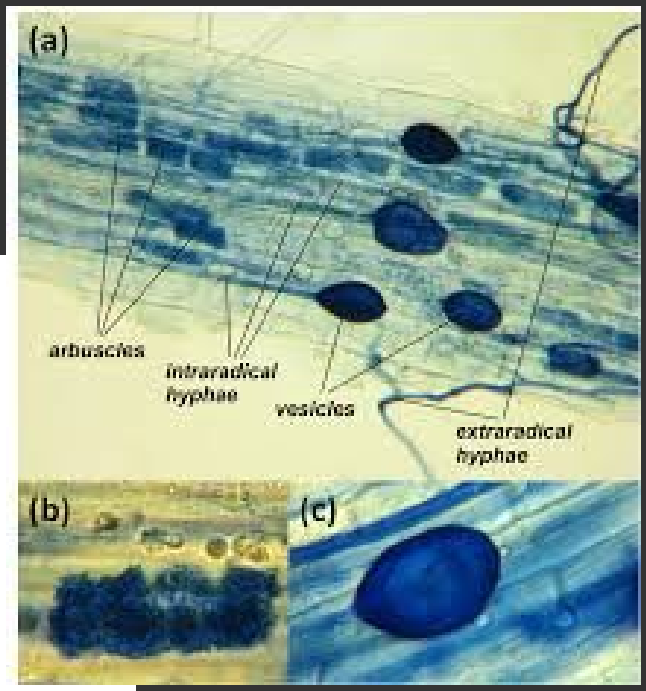
Maybe it just depends on the traits of each species...

Trait-based aerial dispersal of arbuscular mycorrhizal fungi

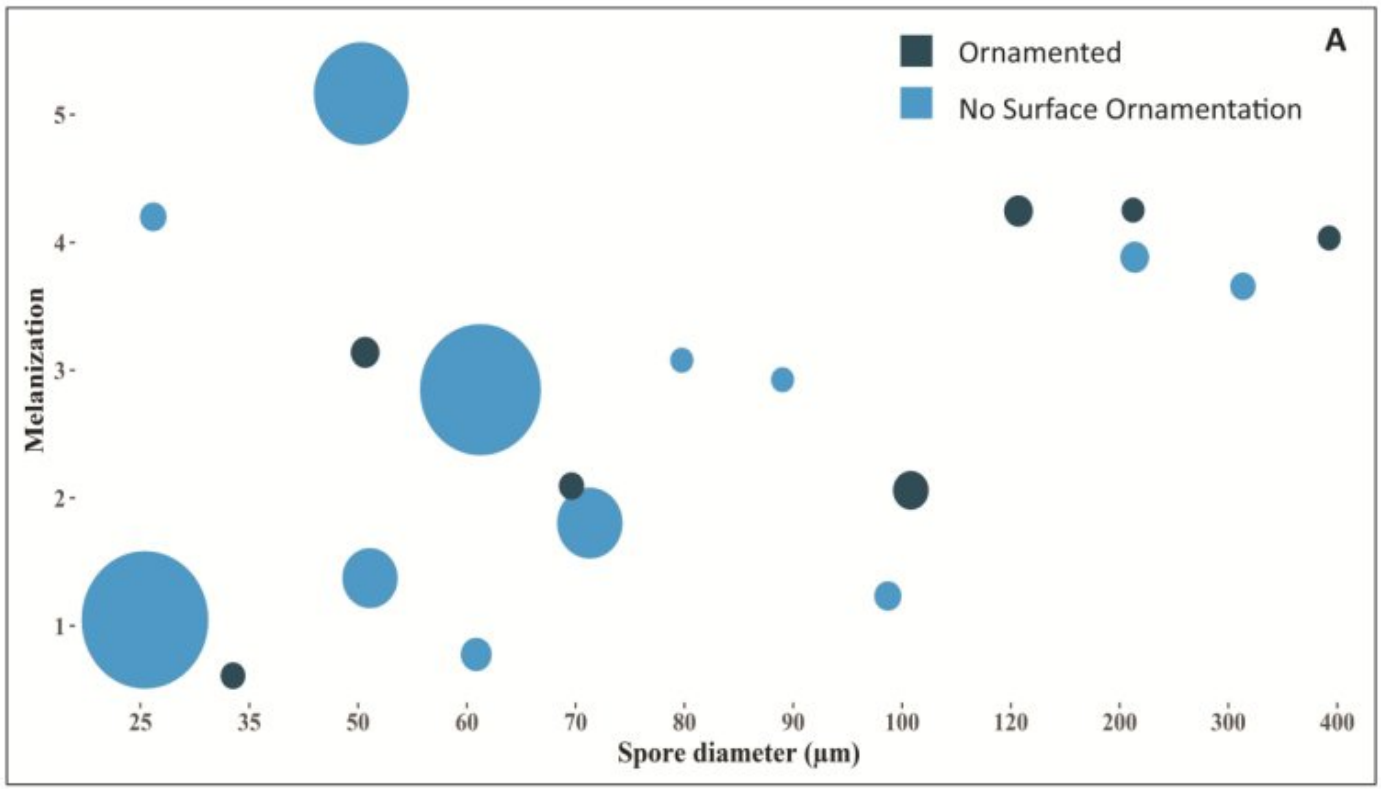
V. Bala Chaudhary, Sarah Nolimal, Moisés A. Sosa-Hernández, Cameron Egan, Jude Kastens

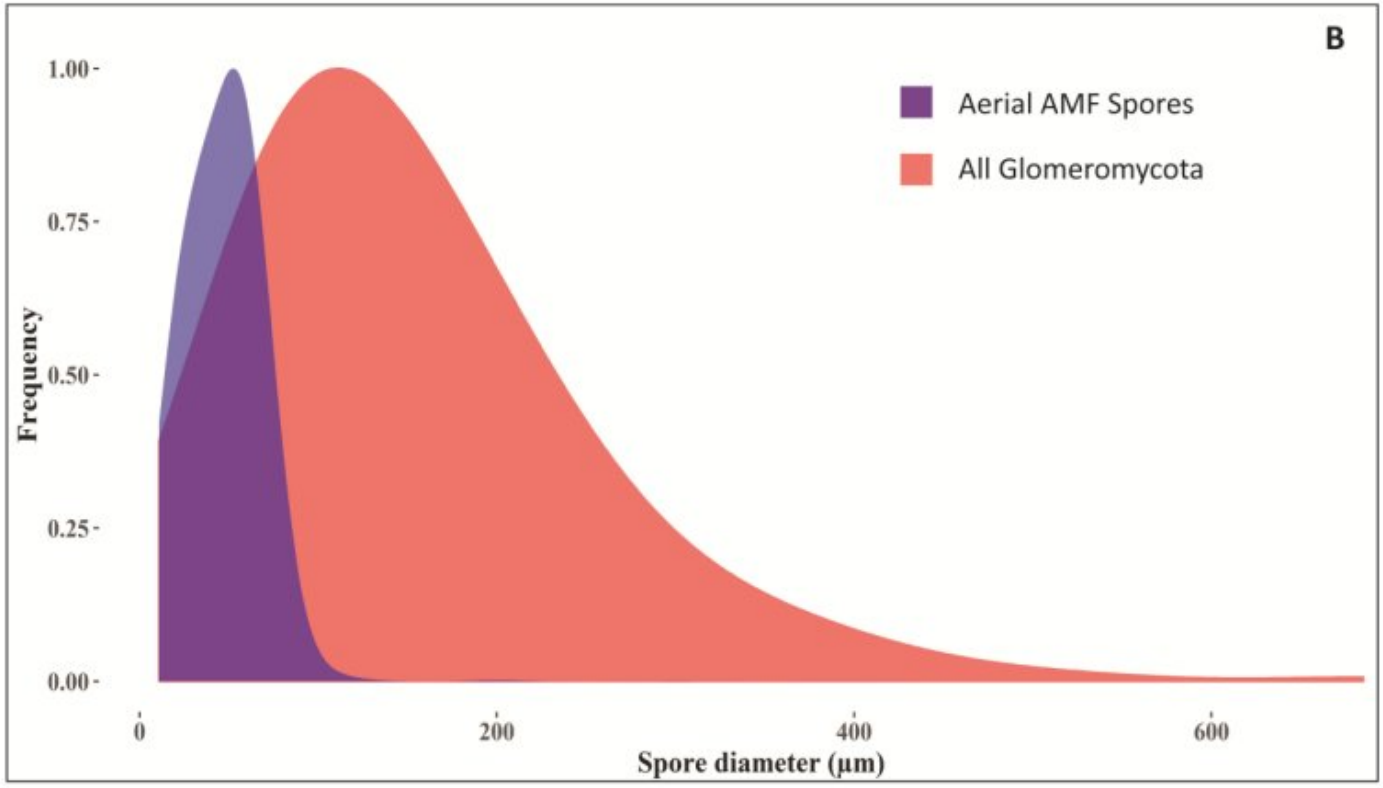
First published: 18 May 2020 | https://doi.org/10.1111/nph.16667 | Citations: 1





Chaudhary et al., 2020





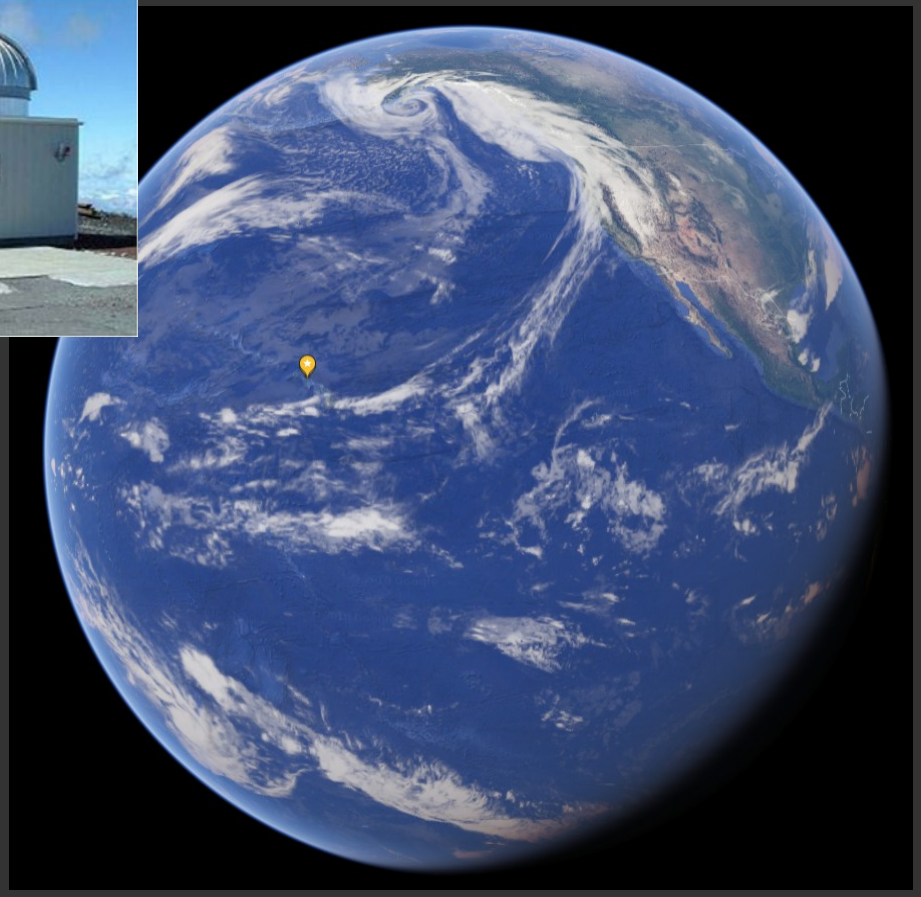
At 20 m elevation, airbourne AMF spores were smaller...

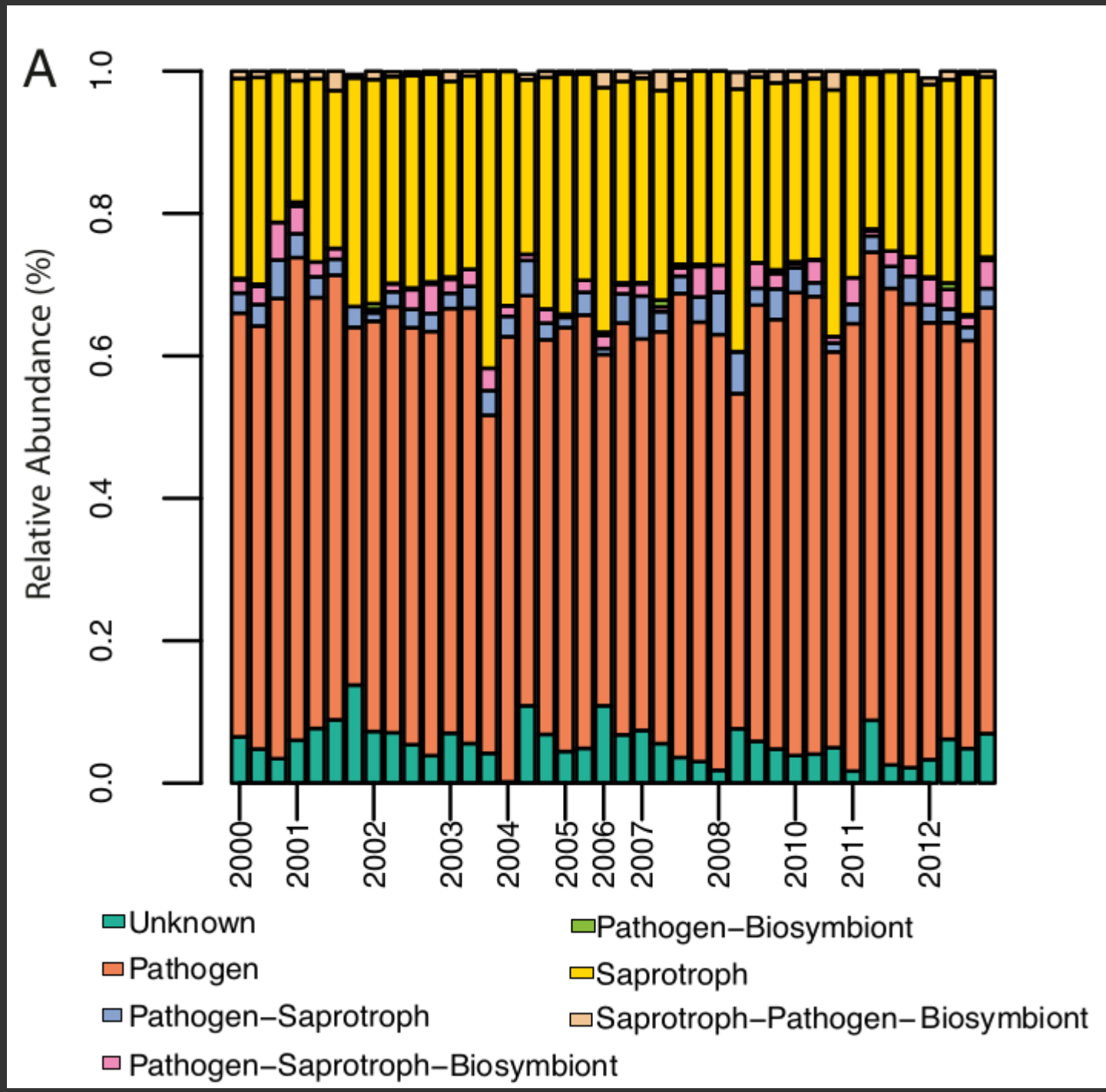
... but not more melanized or ornamented

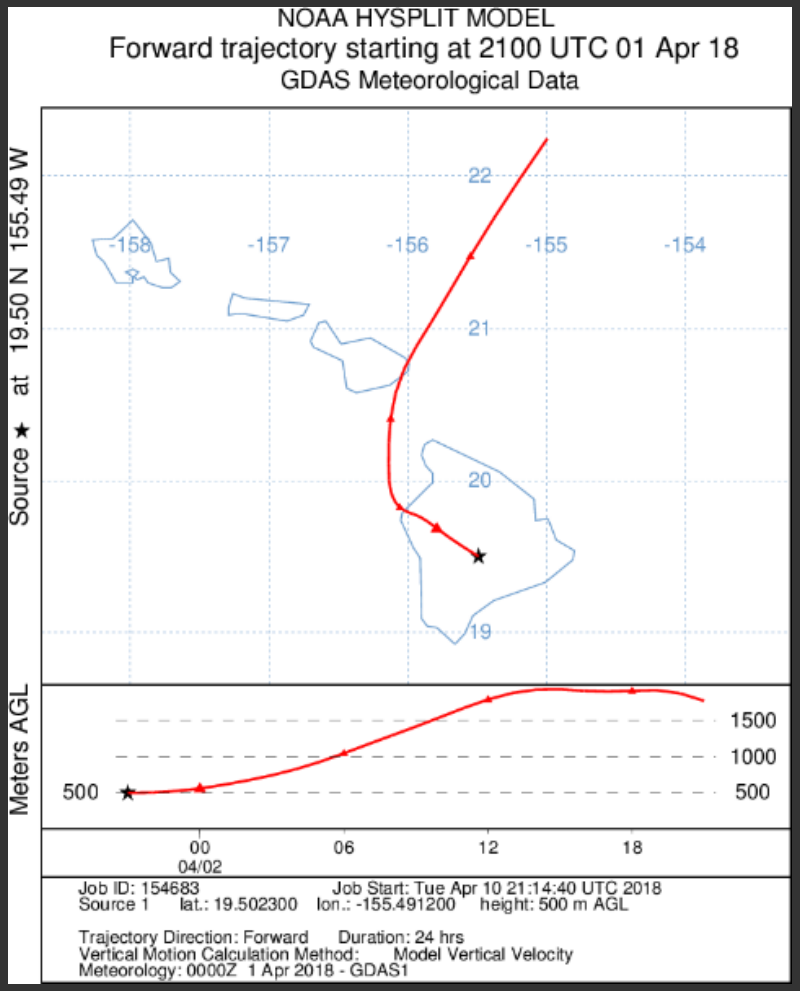
Fungal aerobiota are not affected by time nor environment over a 13-y time series at the Mauna Loa Observatory

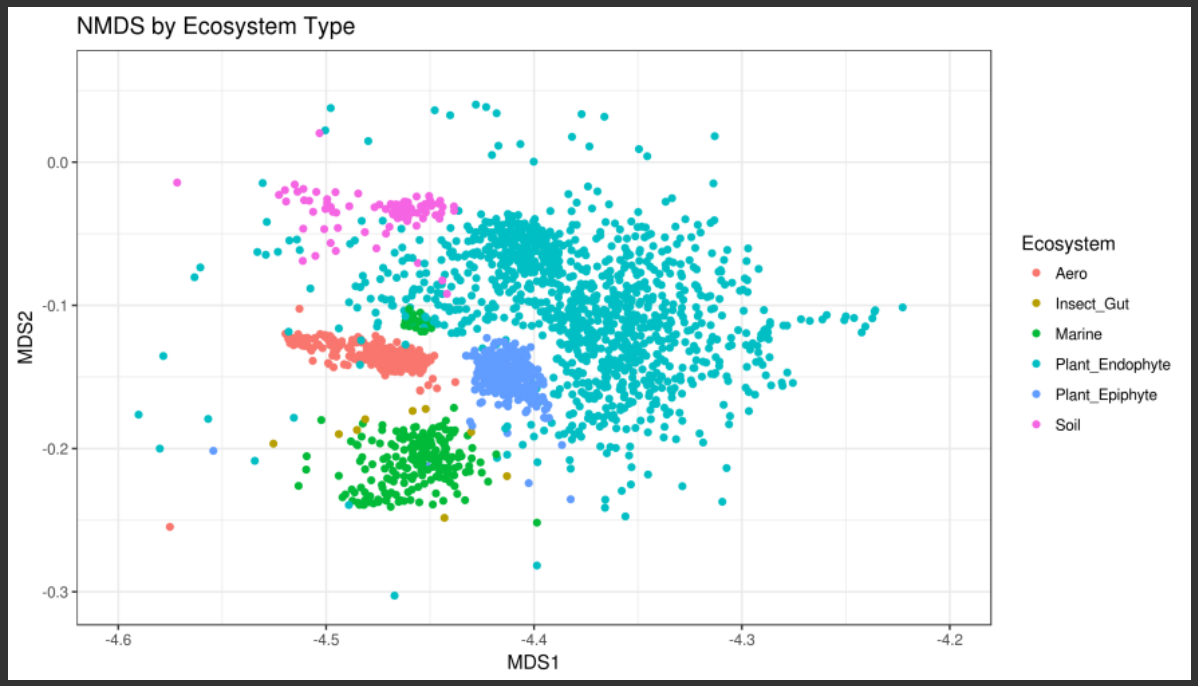
Laura Tipton[a,1], Geoffrey Zahn[b,1], Erin Datlof[c], Stephanie N. Kivlin[d], Patrick Sheridan[e], Anthony S. Amend[f], and Nicole A. Hynson[a,2]

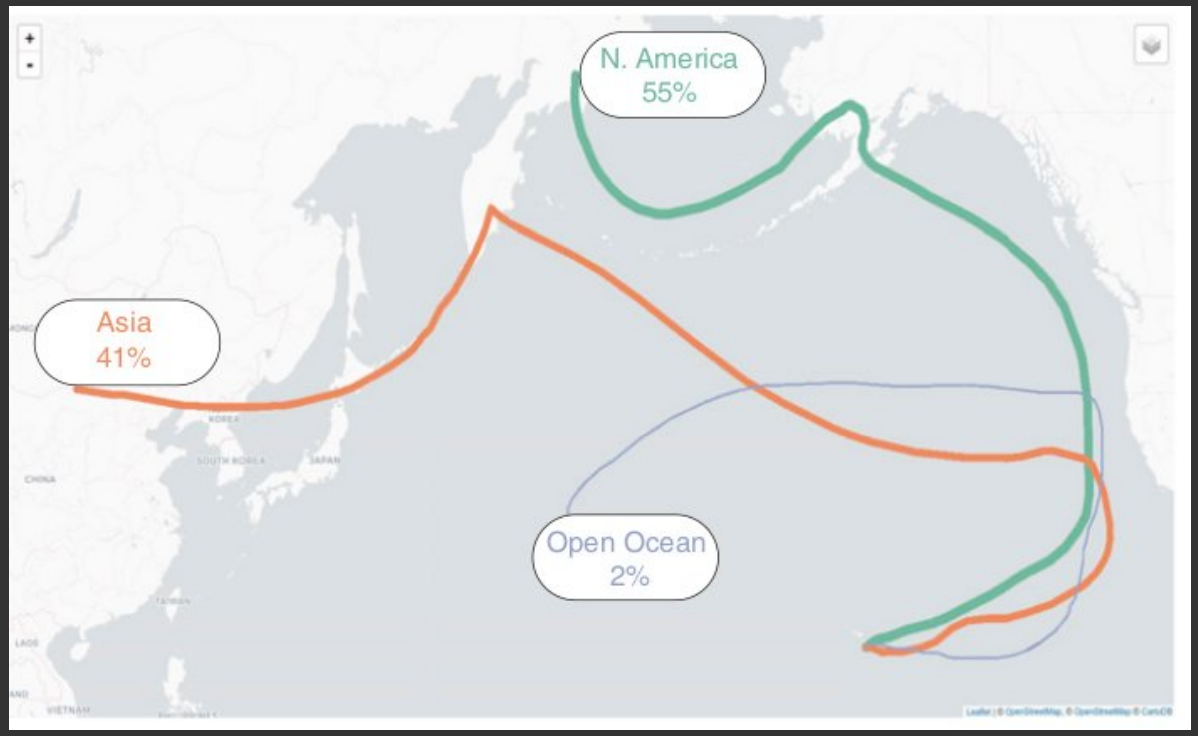
[a]Pacific Biosciences Research Center, University of Hawaii at Manoa, Honolulu, HI 96822; [b]Biology Department, Utah Valley University, Orem, UT 84058; [c]Department of Biology, University of Hawaii at Hilo, Hilo, HI 96720; [d]Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville, TN 37996; [e]Aerosol Group, Earth System Research Laboratory, Global Monitoring Division, National Oceanic and Atmospheric Administration, US Department of Commerce, Boulder, CO 80305; and [f]Department of Botany, University of Hawaii at Manoa, Honolulu, HI 96822




A
Relative Abundance (%)
0.0
0.2
0.4
0.6
0.8
1.0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2010
2011
2012
Unknown
Pathogen
Pathogen–Saprotroph
Pathogen–Saprotroph–Biosymbiont
Pathogen–Biosymbiont
Saprotroph
Saprotroph–Pathogen– Biosymbiont







Backtracking fungal spores over last known land mass

We found absolutely no enrichment for size, color, shape, ornamentation, etc.

Assignments

1. Read Bacigalupe, et al., 2017
   - This is a look at chytrid dispersal, climate change, and amphibians

2. You will have a Canvas quiz on the assigned reading and will also have to participate in a Slack discussion about it.

3. Keep working on your lab assignments