

Building a Global Consortium of Bryophytes and Lichens: Keystones of Cryptobiotic Communities



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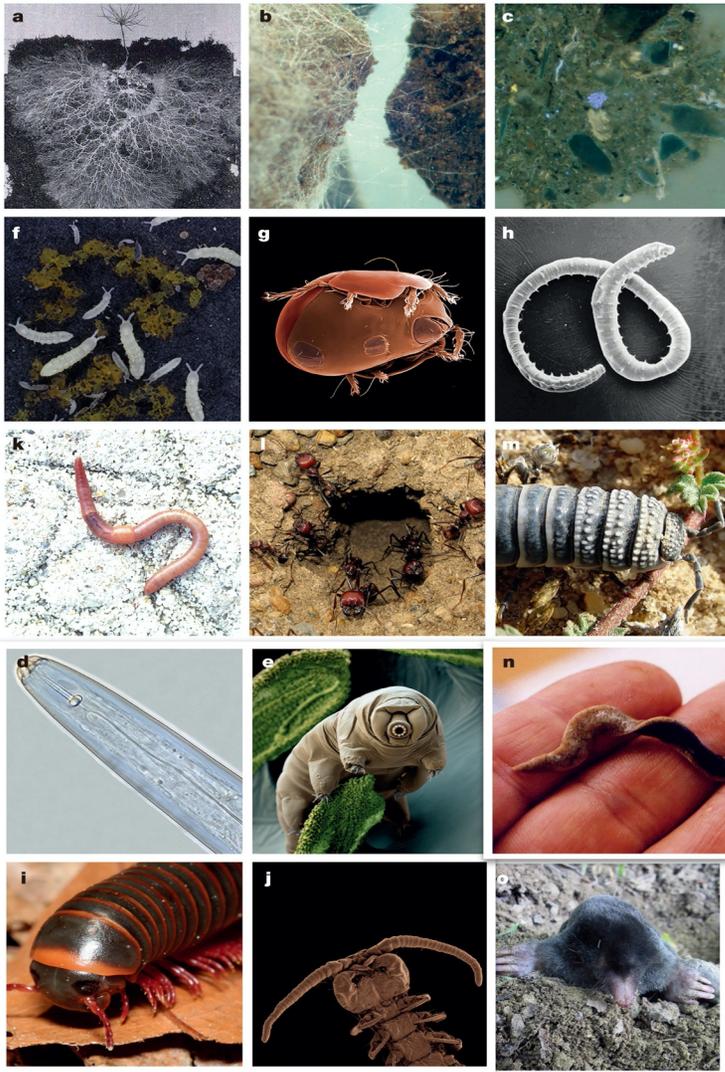


NYBG



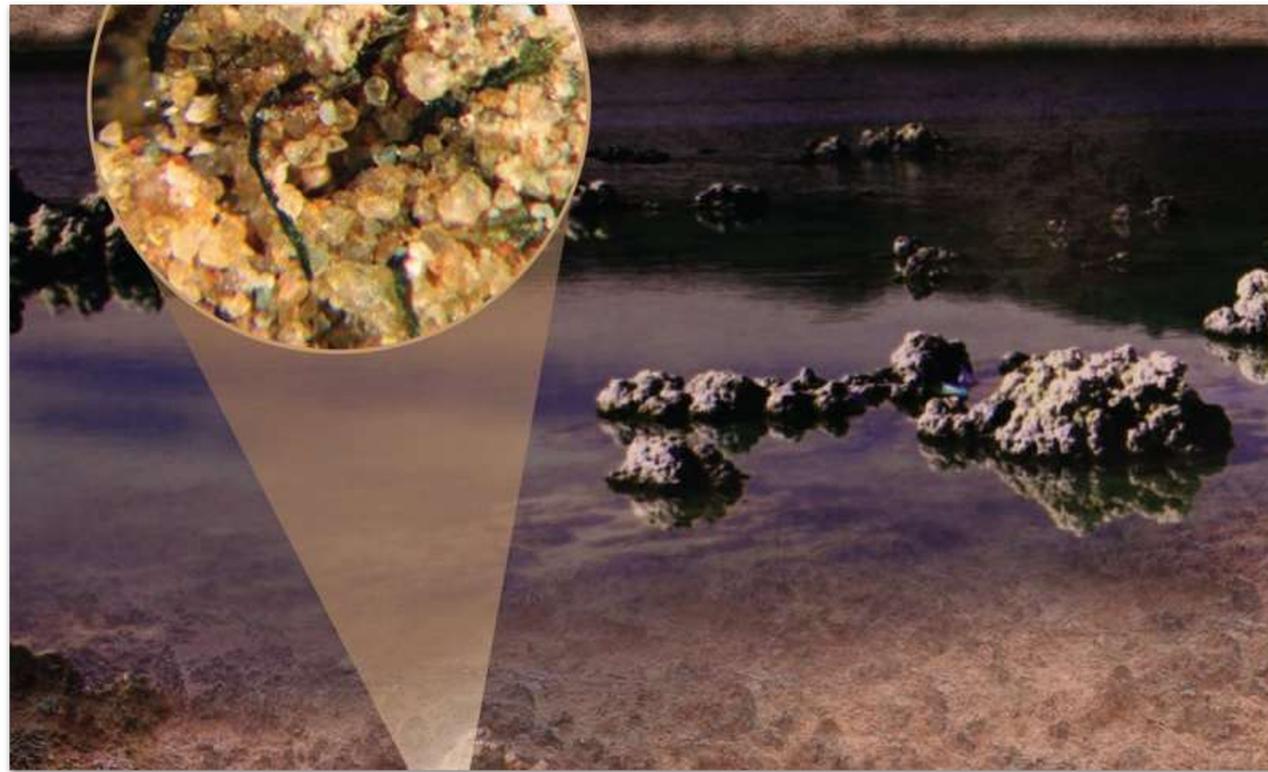
Yale
University
Herbarium





Bardgett & van der Putten, *Nature* 2014

Biocrusts: The Living Skin of Earth covering >12% of the terrestrial surface



Credit: Estelle Couradeau

Building a Global Consortium of Bryophytes and Lichens: keystones of cryptobiotic communities

I. Establish a novel cryptobiotic consortium integrating 6M records.

Consortium of
NORTH AMERICAN BRYOPHYTE HERBARIA



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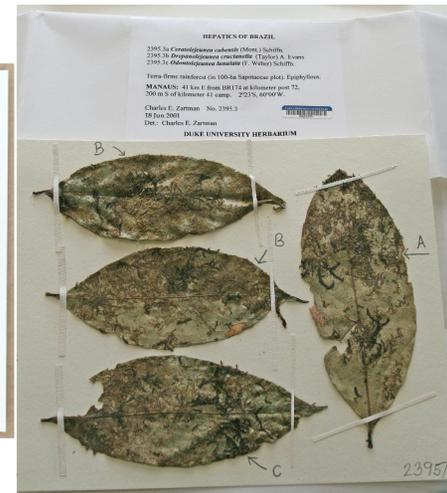
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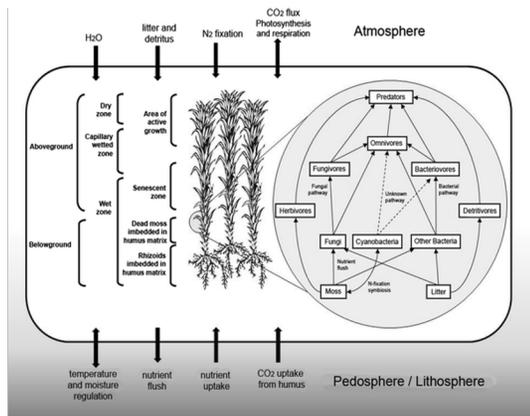
Building a Global Consortium of Bryophytes and Lichens: keystones of cryptobiotic communities

- I. Establish a novel cryptobiotic consortium integrating 6M records.
- II. Digitize label data and specimens for 1.2M bryophytes/lichens focusing on non-North American specimens from 25 US herbaria.



Facilitating critical ecological research on a global scale

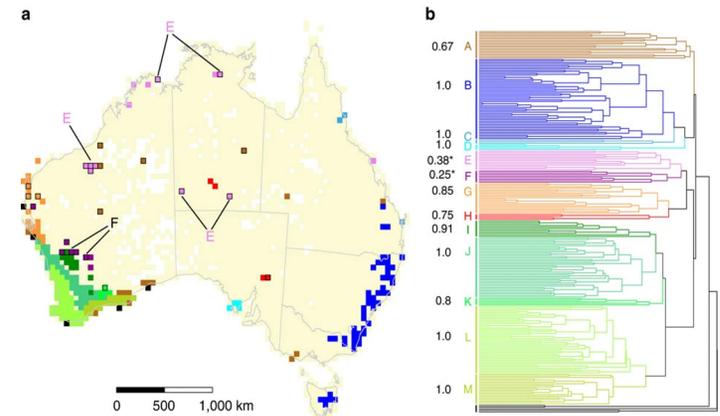
- Studying the impacts of climate change on carbon (C) and nitrogen (N) cycling
- Using lichens/bryophytes as models to understand the evolution of symbiomes
- Exploring co-diversification of endophytes and their hosts
- Evolutionary studies of biodiversity using spatial phylogenetics



Lindo & Gonzalez 2010, *Ecosystems*, 13:612-627



Liepina 2012, *Environmental & Experimental Biology*, 10: 35-40



Mishler et al. 2014, *Nature Communications*, 5: 4473

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- III. Create a connected world: Innovative automation, integration, image tagging, and machine learning.

GloBaL: Creating a Connected World & Tool Development

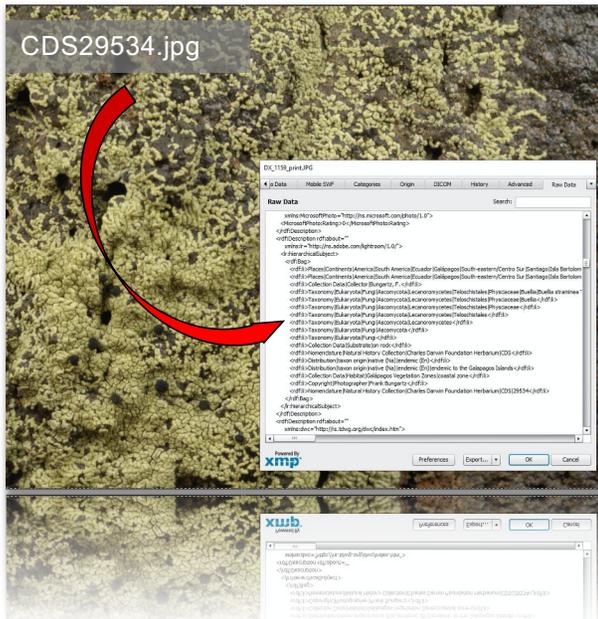
- Symbiota software development
 - Batch processing tools for OCR
 - Display tag clouds
 - New batch georeferencing tool
- Linked data environment
- Machine learning algorithms and image tagging



GloBaL: Facilitating species identification using machine learning & image tagging

- Image Analysis using a Tagged Image Library

tagged image with *Extreme Memory Profiles (XMP) metadata*:



tagging software: *add tags*

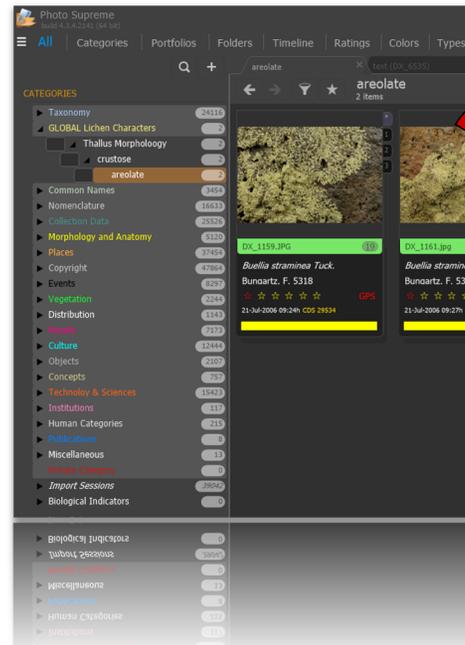
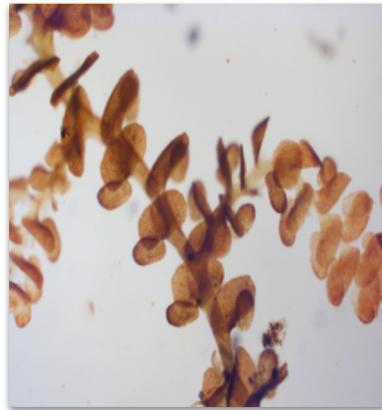


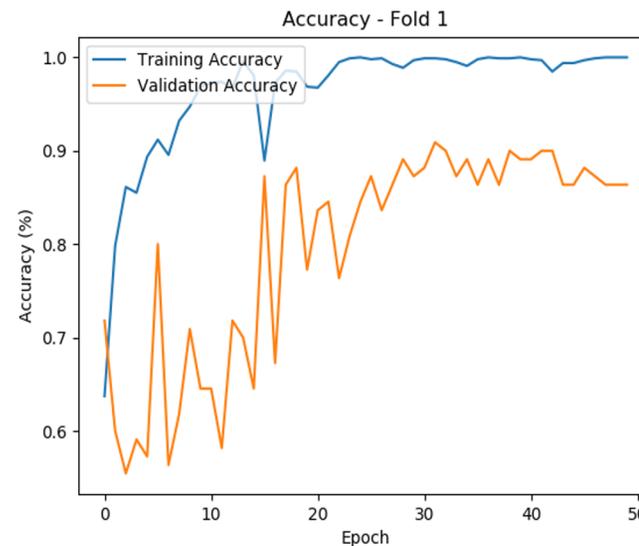
Image identification suggestions based on tagged images matched against character matrix

GloBaL: Deep-learning approaches

- taxonomy
- natural history collection management
- species identification, co-occurrences



von Konrat et al. unpublished



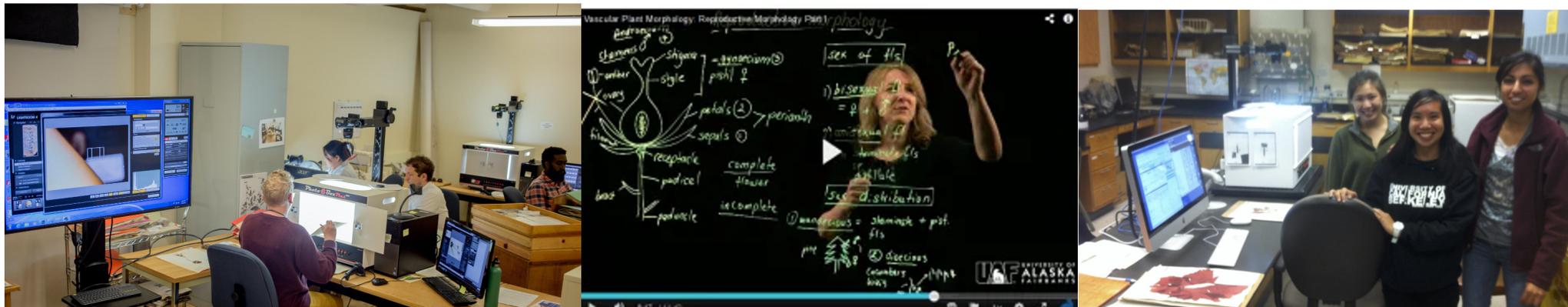
Accuracy
Training: 100%
Validation: 86%

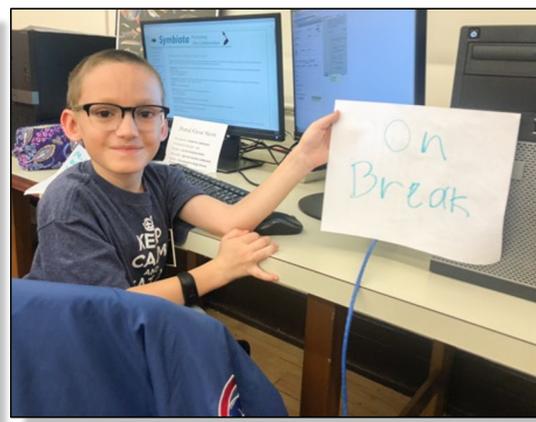
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- III. Create a connected world: Innovative automation, integration, image tagging, and machine learning.
- IV. Focus on public engagement and education.

GloBaL: Broader impacts

1. Increase recruitment of underrepresented students in science and personnel training
2. Promote scientific literacy with a novel digital platform and object-based learning
3. Collaboration with GoFlag, educational videos, educator professional development
4. Engaging volunteers, crowdsourcing from the public, tours and open houses







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My DAUGHTERS EVE & ELISE & I
MET YOU LAST FRIDAY AT THE CITIZEN
SCIENTIST TABLE. EVE WAS THE LITTLE
FOUR YEAR OLD AMAZED THAT SHE WAS
ABLE TO ASSIST YOU- WHO WANTED TO
CONTINUE MEASURING MICROPLANT LEAVES
FOREVER. THANK YOU FOR GIVING HER
SUCH AN INSPIRING EXPERIENCE, WHEN



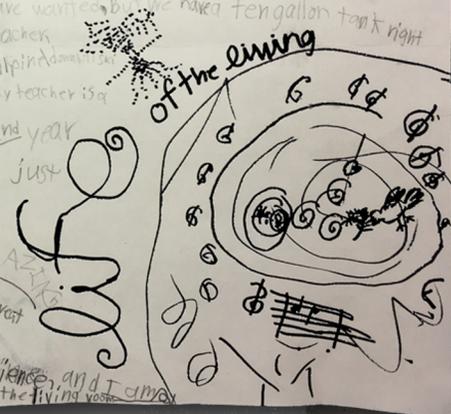
Enticing Young Minds for A Lifetime of Learning Letters from Eve



Enticing Young Minds for A Lifetime of Learning

Letters from Eve

Dear DR Matt ^{3-9-18 Friday}
 I + is Eve. I am seven now and my Birthday is coming up (April 29th) I am still
 VERY interested in moss, lichens, etc and would love to be on TV! I would
 also like to know if I could collect moss, lichens, etc from VT and home
 job? I miss you and have still kept my promise: I will come to work with you when
 I am old enough as a job. Speaking of my Birthday when I was five I got a micro scope
 for my Birthday and this year my big present will be a new 30 gallon
 fish tank for angel fish that I have wanted. But I have a tengallon tank right
 now. I love my school and my teacher.
 I love how my school brings me to pico Alpindom
 read every Friday (today was our last time) and my teacher is a
 very kind and funny woman who it's her 2nd year
 teaching second grad. I am in 2nd grad. I is just
 plan AWESOME in
 Vermont!!!! ☺ But I miss AMAZING
 Evanston to. ☺ you are just a great
 as both of them! I love the leaf science, and I am
 sad Josh left! We have a terrarium in the living room.



and cross country skiing on Saturday. I will still keep my promise till
 I am old enough to live it.
 you can Never break a promise.
 P.S. we had 12 goats the day I sent this
 and by when it gets to you (probably Tuesday) we might
 have more.
 love - Eve & Dad
 P.P.S. I hope you and me
 discover new plants together.
 Please
 write back.



Acknowledgements



National Science Foundation

- Advancing Digitization of Biodiversity Collections

Collectors & Researchers of the past and present

2011 Bryophyte/Lichen TCN: Leadership & Participants

Especially, Tom Nash & Corinna Gries



Collaborating Herbaria: ALA, ASU, BRY, CINC, COLO, DUKE, F, FLAS, ILL/ILLS, LSU, MICH, MIN, MO, MSC, MU, NEB, NY, OS, OSC, PH, TENN, UC, WIS, WTU, YU