SECONDARY TRAIT MATRICES FOR LICHEN COMMUNITY MODELING

Nicholas Zemp

Utah Valley University

Orem, UT

Emily Holt
Utah Valley University
Orem, UT

Peter Nelson
University of Maine – Fort Kent
Fort Kent, ME

FUNCTIONAL TRAIT DATABASES

What is a Functional Trait Database and How is it Useful?

FUNCTIONAL TRAITS DATABASE

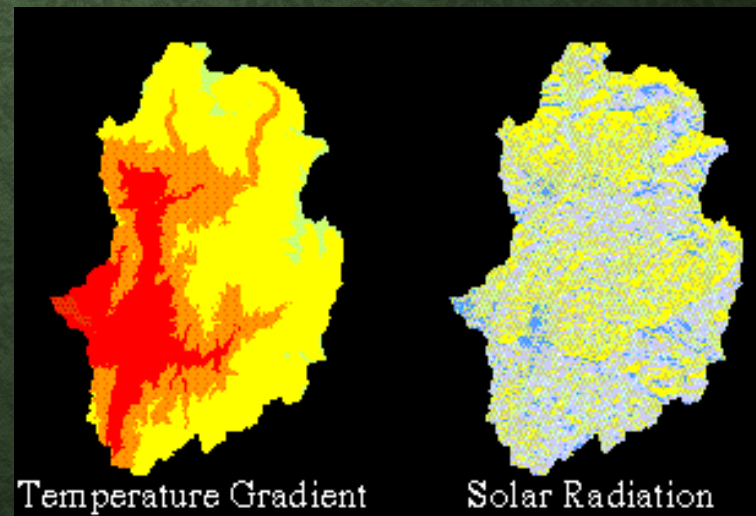## What are they?

- 4 Themes (McGill et al. 2006)

    1. Traits
        - Well defined, measurable property of organisms
        - E.g. thallus size, 2° metab., substrate choice

    2. Environmental Gradients
        - Gradual change through time & space of abiotic factors
        - e.g., temp., altitude, light intensity

Opinion — TRENDS in Ecology and Evolution   Vol.21 No.4 April 2006 — Full text provided by www.sciencedirect.com

ELSEVIER — SCIENCE @ DIRECT *

Rebuilding community ecology from functional traits

Brian J. McGill[1], Brian J. Enquist[2], Evan Weiher[3] and Mark Westoby[4]

Temperature Gradient   Solar Radiation

FUNCTIONAL TRAITS DATABASE

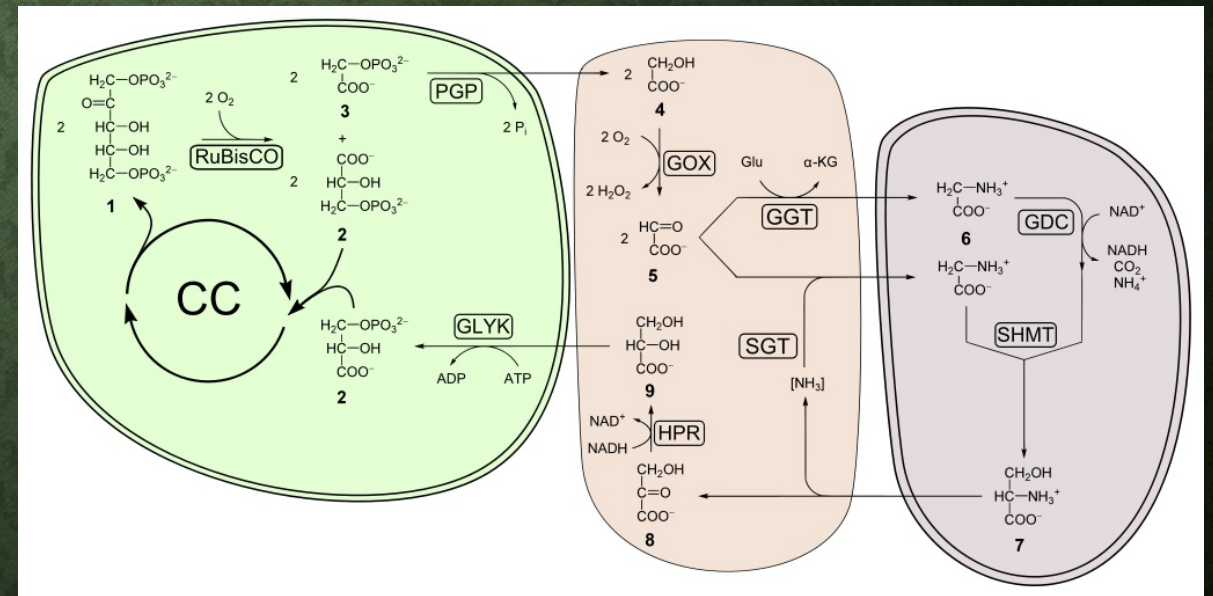## What are they?

- 4 Themes (McGill et al 2006) cont.

    3. Interaction Milieu

        ➢ Biotic background within which an organism interact

        ➢ E.g.

    4. Performance Currencies

        ➢ Common currency that is comparable across species & along gradients

        ➢ E.g. net photosynthesis, cellular respiration

FUNCTIONAL TRAITS DATABASE

Lichen Functional Traits

4 Functional Traits

- Energy Generation – type of photobiont
- Water Relations – inferred from growth form
- Dispersal Capability – vegetative propagules
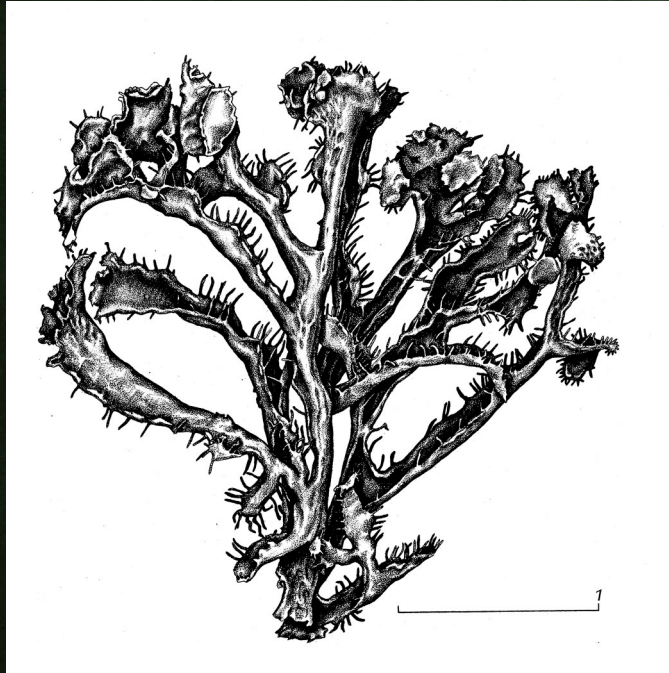- Microsite Specificity – substrate affinity
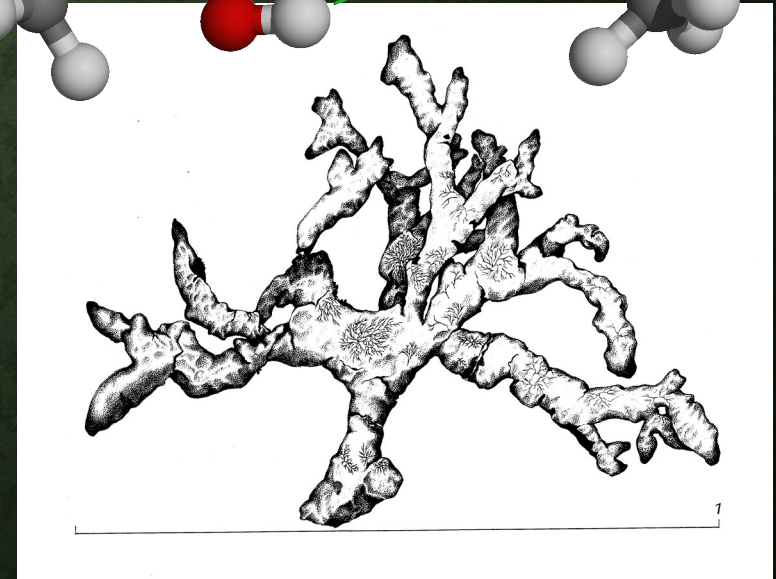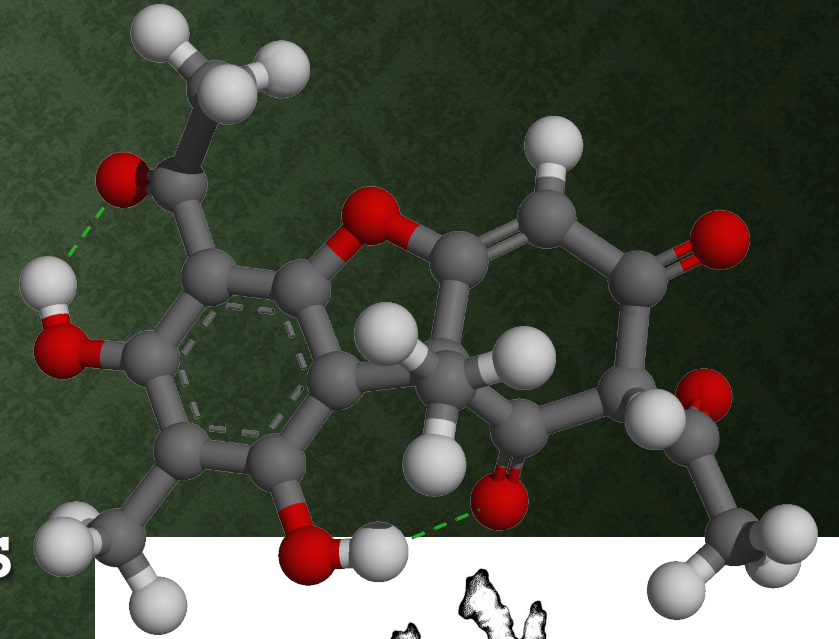
Journal of Vegetation Science ■■ (2015)

Non-parametric methods reveal non-linear functional trait variation of lichens along environmental and fire age gradients

Peter R. Nelson, Bruce McCune, Carl Roland & Sarah Stehn

LICHENS AND SECONDARY METABOLITES

Nature's Biochemists

LICHENS & SECONDARY METABOLITES

Our Project: Goals

Create Data Matrices

- Species x Compound

- Compound x Function

Analyze Data from Arctic NP

- Bering Land Bridge NP

- Noatak NP

- Gates of the Arctic N Park

- Cape Krusenstern NM

- Kobuk Sand Dunes N Park

LICHENS & SECONDARY METABOLITES

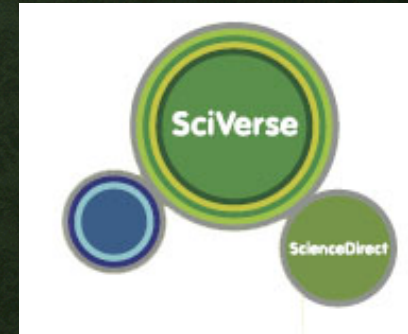## Our Project: Methods

Data Gathered from CNALH

- Used Sonoran Flora

- 2708 species

- 313 unique compounds

➤ Cross checked in the Lichen Checklist

Review of 5 Scientific Databases

- Google Scholar

- JSTOR

- Recent Literature on Lichens

- Science Direct

- BioOne

LICHENS & SECONDARY METABOLITES

SPECIES X COMPOUND

Acarospora schleicheri

- Epanorin
- Pulvinic Acid
- Rhizocarpic Acid
- Vulpinic Acid

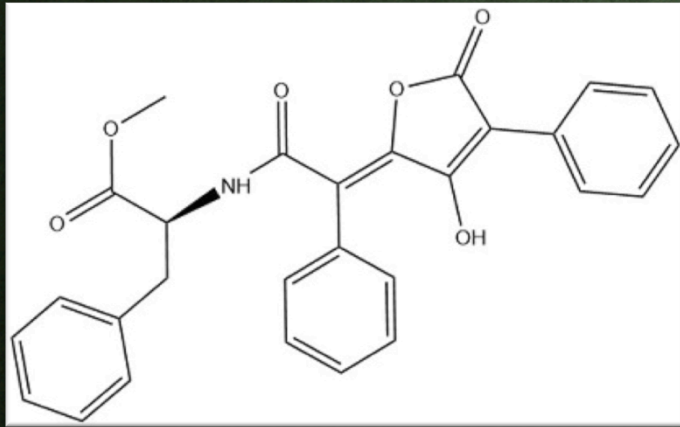*Biatora fallax*

- Argopsin
- Gyrophoric Acid

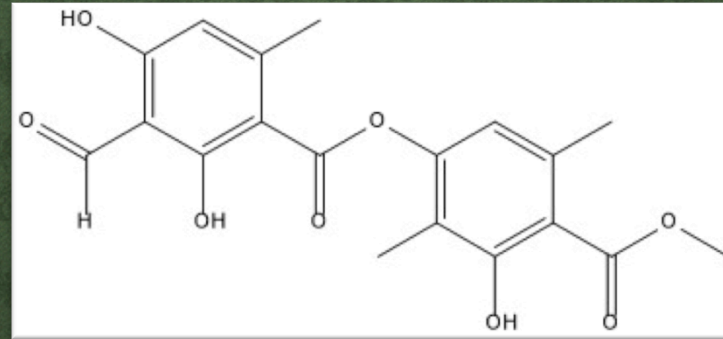*Lecidella anomaloides*

- Atranorin
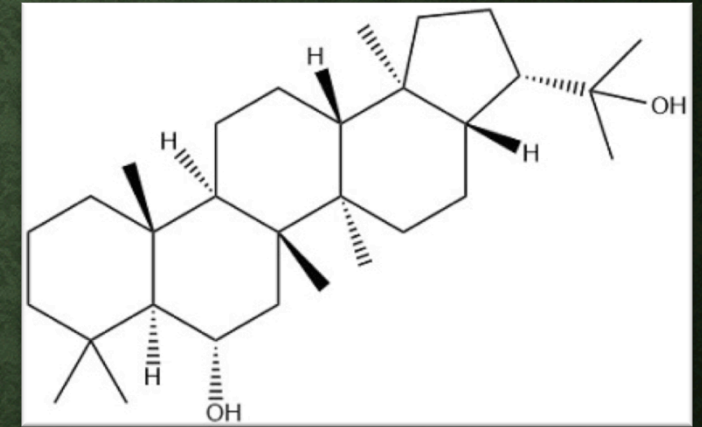- Zeorin

LICHENS & SECONDARY METABOLITES

COMPOUND X FUNCTION

Rhizocarpic Acid

Atranorin

Zeorin

- Sunscreen
- Bioweathering
- Metal uptake

- Sunscreen
- Heavy metal chelation
- Antifungal
- Antiherbivory

- Antiherbivory
  - Because it only has one function or because it is understudied?

LICHENS AND SECONDARY METABOLITES

Our Project: Limitations
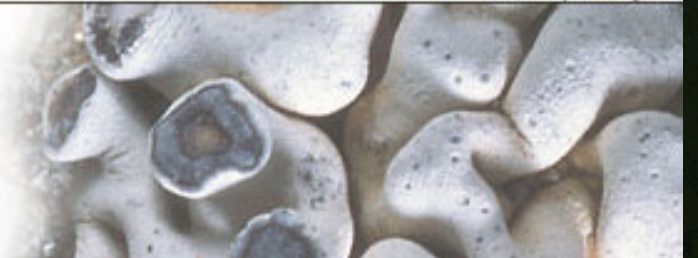
Our Dataset

- Incomplete North American species list

- Includes chemical data from CNALH data dump

Functional Scientific Literature

- Studies limited by number

- Studies limited by scope

- Many chemicals haven't been evaluated

Photos by F.Bungartz

Consortium of NORTH AMERICAN LICHEN HERBARIA

CONCLUSION

- Our data matrices will help deepen knowledge of community dynamics

- Species x Compound matrix will provide compound distribution across environmental gradients

- Compound x Function matrix compiles functional data into compact easily searchable dataset

1 cm

ACKNOWLEDGEMENTS

UVU *Department of* **BIOLOGY**

UTAH VALLEY UNIVERSITY