BIEN Botanical Information and Ecology Network

A Research and Collections Collaboration to Investigate the Ecological Impacts of Global Climate Change on Plant Biodiversity

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GOAL:

To integrate existing sets of vegetation data from North and South America into a analytical database that can be used to understand plant biogeography, community structure and changes in species abundance and distribution over time.

National Center for Ecological Analysis and Synthesis

$$\frac{\partial}{\partial t}(\nabla^2\phi) = \frac{\partial\psi}{\partial z}\frac{\partial}{\partial x}(\nabla^2\psi) - \frac{\partial\psi}{\partial x}\frac{\partial}{\partial z}(\nabla^2\psi) + \nu\nabla^2(\nabla^2\psi) + g\alpha\frac{dT}{dx}$$

NSF

iPlant Collaborative™ *Empowering A New Plant Biology*

Research Questions to be Addressed with BIEN

- Q 1: How does climate influence the relative distribution of narrow and widespread species? Do these relationships vary in tropical and temperate environments?
- Q 2: How are abundance and size of geographic range of taxa related? For example, do plants with small ranges tend to be rare relative to widespread species?
- Q 3: What are the physiological, demographic, environmental, and phylogenetic correlates of rarity and commonness across environmental gradients at scales ranging from local to continental? Can these correlates be used to predict vulnerability or resistance to extinction for species and communities under differing scenarios of habitat loss and climate change?

Core BIEN Participants

- **Collectors and managers of botanical survey and inventory data**

P. Jorgensen (Missouri Botanical Garden); R. Peet (Univ. North Carolina); B.Thiers, (New York Botanical Garden); S. Wiser (Landcare, NZ).

- **Informaticians and computer scientists**

S. Dolins (Bradley University); Z. Lu (Cold Spring Harbor); M. Narro (iPlant Collaborative); M. Schildhauer (NCEAS); W. Piel (Yale); N. Spencer (Landcare, New Zealand)

- **Ecologists/ evolutionary biologists/biogeographers**

B. Blonder, B. Boyle, B. Dobrin, J. Donoghue, B. Enquist, N. Matasci, L. Sloat (Univ. Arizona); R. Condit (CTFS, Panama); K. Englemann, N. Holme, B. Sandel, J. Svenning (Univ. Aarhus); E. Fegraus (Conservation International); B. McGill (Univ. Maine); R. Peet (Univ. N. Carolina); I. Simova (Charles Univ., Prague); N. Spencer, S. Wiser (Landcare, NZ); N. Swenson (Michigan State Univ.); C. Voille (CEFE.CNRS, France).

Products:

- **A Taxonomic Name Resolution (web) Service (TNRS)**
  to perform two operations: taxon matching and synonym correction
- **A Plant Observation/Occurrence Database**
  combining data from herbarium specimens and ecological inventories , from which distribution maps can be derived
- **Distribution maps for all New World plant species**
- **An attribute database**
  for the taxa in the database including distributional models, phylogenetic status, and trait information for New World plant species.
- **Research analyses using these data sets**
  many in progress, including many Ph.D. dissertation studies

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Taxonomic Name Resolution Service v3.2

Enter List | Upload and Submit List | Retrieve Results

Enter scientific names to check

Solanum viridum

Click here for support Clear Submit List

Name processing settings

Processing Mode: Edit
Selected mode: Perform Name Resolution

Match Accuracy: Edit
Allow partial matches, Selected minimum threshold: 0.05

Sources: Edit
[TROPICOS, GCC, USDA]

Family Classification: Edit
Selected classification source: TROPICOS

Submitted Name: Solanum viridum

Name matched	Name Source	Score	Author Matched	Author Score	Accepted Species	Unmatched Terms	Taxono...	Select
Solanum viscidum Schweigg.	TROPICOS	.94					No opinion	
Solanum viride G. Forst. ex...	USDA	.93			Solanum viride		Accepted	
Solanum validum Rusby	TROPICOS	.93			Solanum pseudoc...		Synonym	
Solanum vicinum A.R. Bean	TROPICOS	.93					No opinion	
Solanum viride Forst. f.	TROPICOS	.93					No opinion	
Solanum viride R. Br.	TROPICOS	.93					No opinion	
Solanum viride Schur	TROPICOS	.93					No opinion	

Apply selected Cancel

Best match setting

Name Submitted

Solanum viridum

Details

Details

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Plant Observation/Occurrence Database

BIEN 1: proof of concept for combining specimen and plot data

BIEN 2: an extension of BIEN 1 with additional data sources, more extensive validations and richer metadata plus an analytical database consisting of alternative views of the raw data

BIEN 3 (in progress): an entirely new database consisting of a highly normalized core schema containing plot and specimen data and an analytical database, with multiple alternative views of the data in the core database, aggregated and standardized in various ways

Data Sources for Species Occurrence:

Vegetation plots with co-occurrence records

CTFS-Smithsonian plots, RAINFOR (Amazon), ATDN plots (Amazon), SALVIAS plots (Summarized collection of vegetation inventories), VEGBANK plots (North American vegetation), MBG plots (plots from Ecuador, Peru, and Bolivia), USFS-FIA plots (North American trees), USFS-Landfire plot database (not a primary source, but a compilation of North American vegetation plots),Heritage program plots from various states (e.g. , VA, WV;)

Collection records and taxon occurrence records

Tropicos (Missouri Botanical Garden), The Virtual Herbarium New York Botanical Garden, GBIF (not a primary source, but a collection of other herbarium databases), U. Arizona herbarium, U.S. National Herbarium, SERNEC participant collection s (e.g. NCU, NCSC, UNCC)

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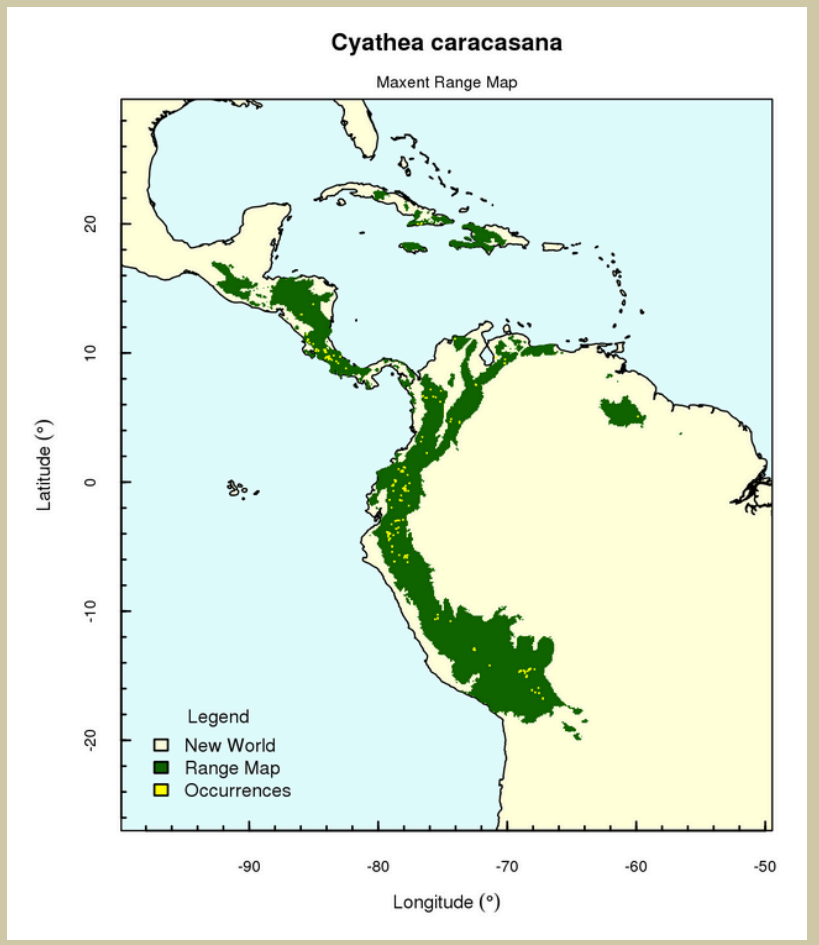

Data Sources for Species Attributes:

- ***Botanical trait data***

  e.g., phenology flowering date, month of peak flowering time); Germination time (number of days required for germination); plant height; leaf area, carbon mass, tissue density, K, N. P content, lifespan, thickness; photosynthetic rates efficiency, seed mass; stomatal conductance; wood density

- ***Sources***

  TRAITNET (aggregation of 65 data sets from 90 contributors), TRY2

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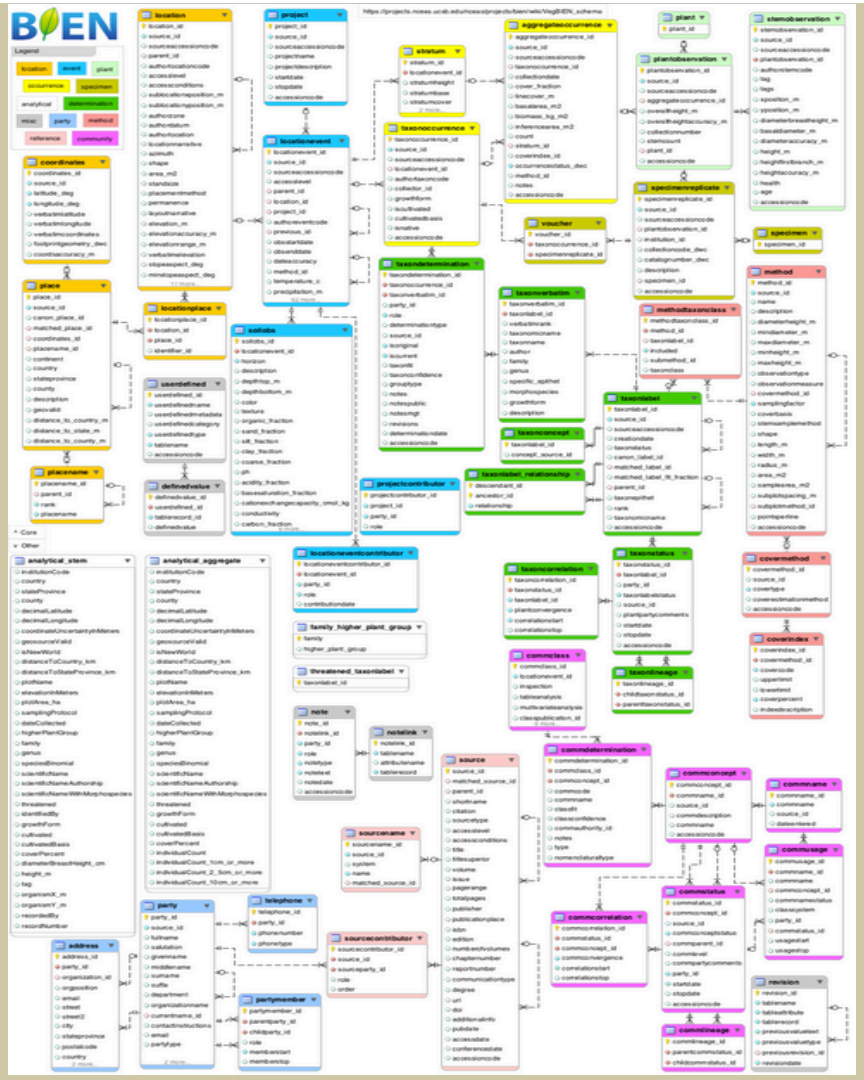

Collection or trait measurement event

Location of collection or observation

Specimen voucher details

Taxon determination

Taxon occurrence (individual or aggregated

Contributors

reference

miscellaneous

Plant cover

Plant community

Plant measurement

Species summary information (aggregate)

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BIEN3 Database Statistics:

- **Species:** 250,905 (vascular plants and bryophytes)
- **Specimens:** >10,000,000
- **Plots:** 329,741
- **Traits:** 34
- **Trait measurements:** 296,958

ACCESS to BIEN:

Now – 2014: primary data are available only to members of the BIEN working group (new members are added continually)

2014 and beyond: Data and derivative products (e.g., species niche models and range maps) become publicly available through BIEN website

BIEN Partnership with Data Providers:

- All data providers asked for permission to use data in BIEN
- Users of BIEN-mediated data and derived products must agree to acknowledge all data providers in their publications, either by citing each data provider or by including a URL for the acknowledgement page on the BIEN website that lists each data provider.
- BIEN recognizes that Information on data usage and publications involving their data is critical to data providers, and will report all use of data to the original data providers. Use of data includes access of data from the BIEN database as well as publication of analyses based on those data.

Future of BIEN:

- BIEN 3 will be completed in 2103; will become publicly available in 2014 with have user-friendly web interface; will link to phylogenetic trees generated through iPLANT efforts.
- BIEN will continue to be an NCEAS working group
- iPLANT is continuing its collaboration with BIEN and NCEAS to develop version 3 of the BIEN database and to assist with the BIEN phylogeny
- Sustainability strategy is currently in development

Learn more about BIEN! http://bien.nceas.ucsb.edu/bien/

BIEN of the Future:

- Projects such as BIEN will find it easier to locate relevant datasets (and there will be more of them)
- More specimen occurrence records will be georeferenced, and the quality and repeatability of the georeferences will be better
- GUIs should make it easier to track the use of data and to repatriate updates or revisions made to data

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