



Phylogenetics and

Linking Molecular Data with Collections



Pamela S. Soltis

Florida Museum of Natural History

University of Florida



Linking to Phylogeny

The screenshot displays the OneZoom website interface. At the top, a navigation bar includes the OneZoom logo and links for Home, Embed, Software, Impacts, News, About, Gallery, and Future. The main content area features a stylized phylogenetic tree with several branches highlighted in green and brown. The branches are labeled with plant groups: *Gymnosperms*, *Seed Plants*, *Flowering Plants*, *Water-lilies, Water-shields and more*, *Mesangiosperms*, and *Star Anise, Lemon Wood and more*. A large green archway is positioned over the tree. At the bottom of the main content area, a dark grey bar contains the text "Click to see how OneZoom works".

PhyloJIVE

Links biodiversity data to trees
Joe Miller & Garry Jolley-Rogers
phylojive.ala.org.au/



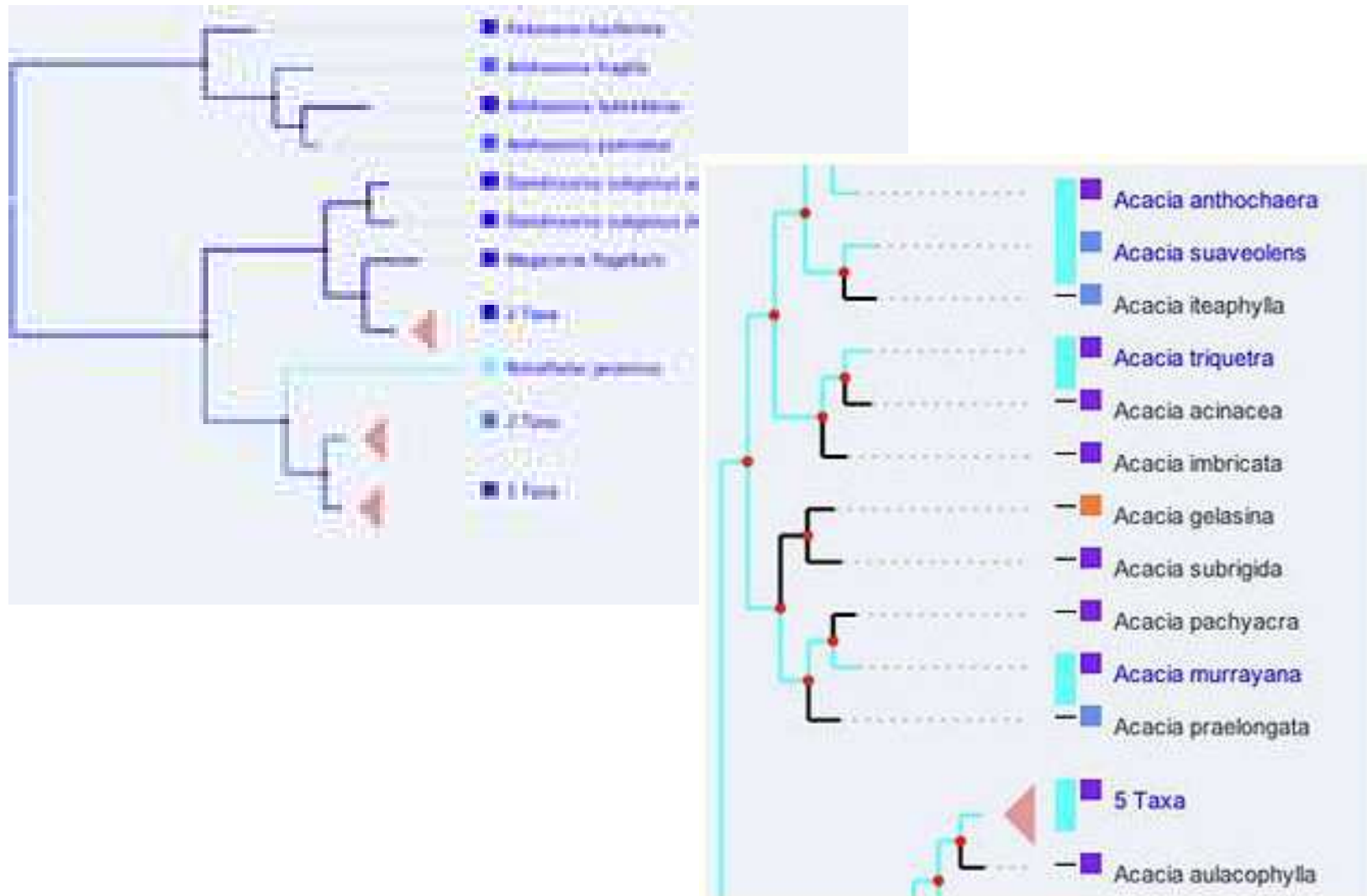
The screenshot shows the ATLAS of LIVING AUSTRALIA website. The header includes the logo and the text "ATLAS of LIVING AUSTRALIA sharing biodiversity knowledge". Below the header is a navigation menu with links for "Species", "Locations", "Collections", "Mapping & analysis", "Data sets", "Blogs", and "Get involved". The "Data sets" link is highlighted. Below the menu, there is a breadcrumb trail "Home → Phylojive". The main heading is "Phylojive". The text below the heading describes PhyloJive as a web-based application that places biodiversity information aggregated from many sources onto compact phylogenetic trees. It mentions that the project is the brainchild of Garry Jolley-Rogers and Joe Miller and was developed by Temi Varghese and Garry Jolley-Rogers as part of the Taxonomy Research & Information Network (TRIN). It also states that the ALA has contributed to the PhyloJive codebase to integrate a number of web services: occurrence data, maps and character data from Identify Life. This work has been undertaken with help and advice from Joe Miller. Finally, it notes that the getting started page outlines the steps for creating a new phylogenetic tree and contains demo data sets that can be used to get up and running.



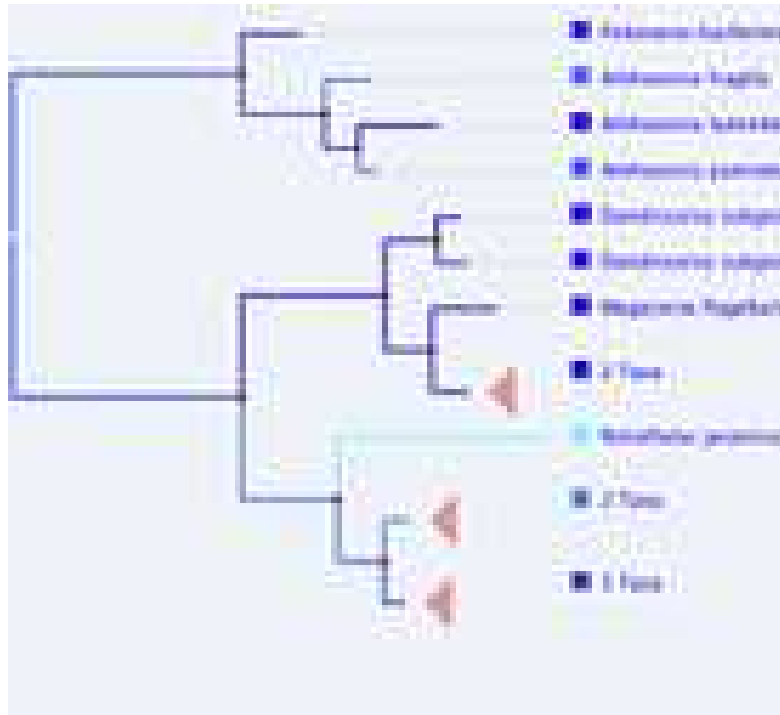
A. buxifolia

Source: Australian Plant
Image Index Image by: Macc

PhyloJIVE: trees and traits

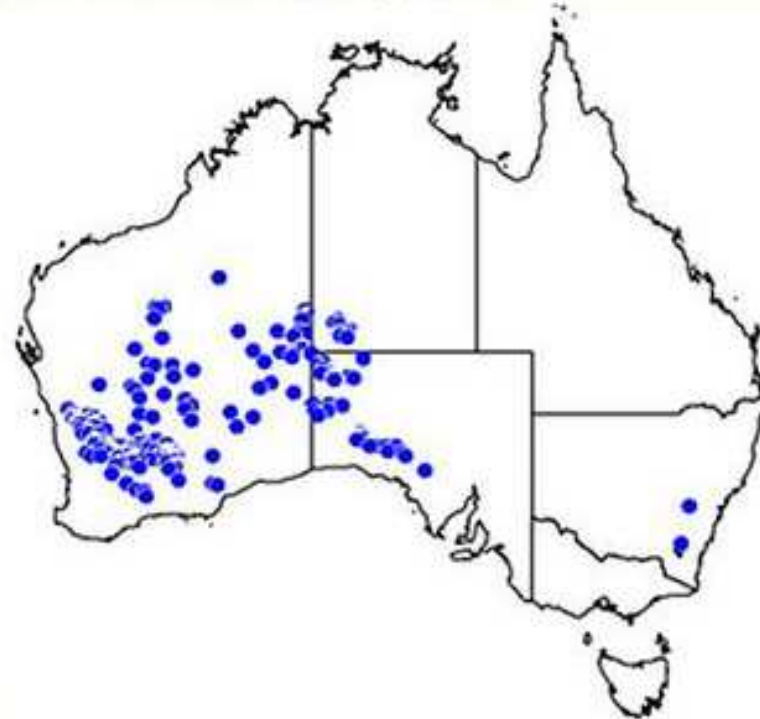


PhyloJIVE: trees and maps

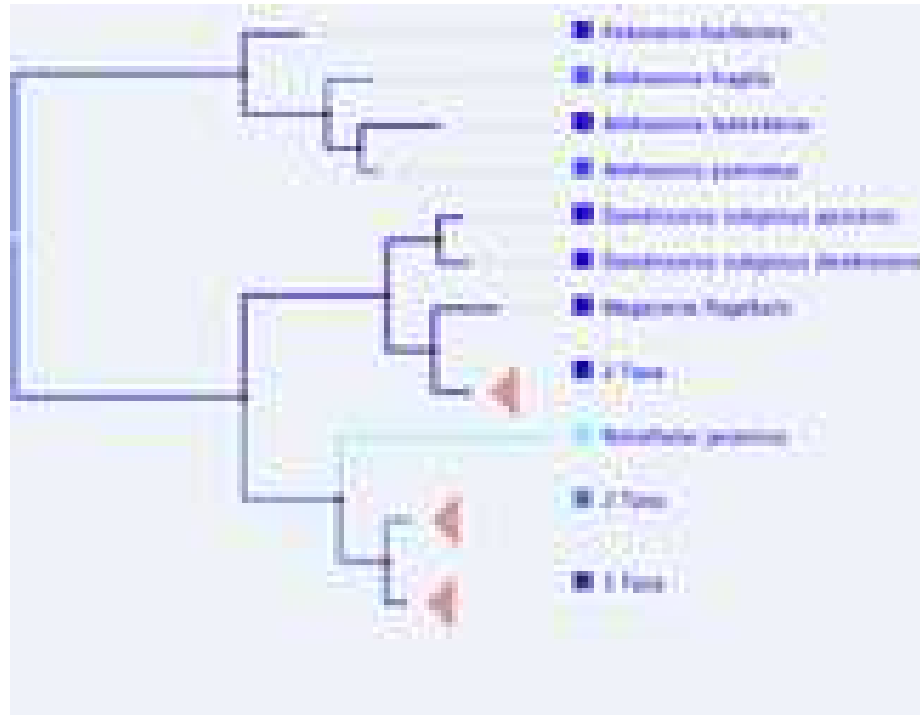


Map

Records for *Acacia prairiia*



PhyloJIVE: trees and maps

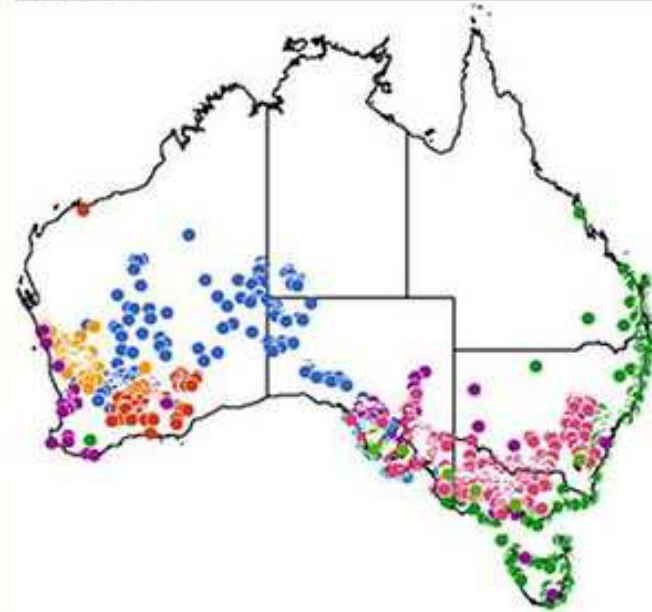


Map

Records for 8 Taxa

Colour by:

Species



[View in Spatial Portal](#)

Legend: Species

■ *Acacia prairi*

■ *Acacia camptoclada*

Combine traits
and distributions

PhyloJIVE

ATLAS of LIVING AUSTRALIA
sharing biodiversity knowledge

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Search the Atlas



Sharing biodiversity knowledge



Contributed by Australia's academic, scientific, environmental communities and you.

[Get involved](#)

Explore

Australia's species



Species by location



Natural history collections



Mapping & analysis



Data sets



FieldData software



Blogs & news

DATA
ClimateWatch now available on the Atlas of Living Australia

1 May, 2014

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PhyloJIVE

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Explore

Australia's species



Mapping & analysis



Making data and images of millions of biological specimens available on the web

14,036,195

Specimen Records

2,290,983

Media Records

235

Recordsets

[Search the Portal](#)



Why digitization matters

More about what we do and why



Digitization

Learn, share and develop best practices



Sharing Collections

Documentation on data ingestion



Working Groups

Join in, contribute, be part of the community



Proposals

New tool and workshop ideas



Citizen Scientists

How can you help biological collections?

Researchers

Learn about research directions



Collections Staff

Learn how your collection can benefit from our work



Teachers & Students

Download lesson plans about using digitized specimens

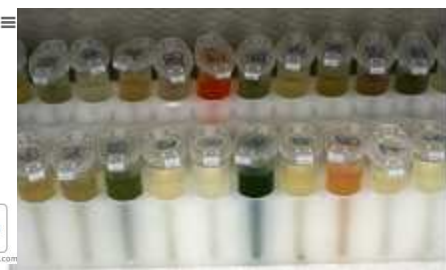
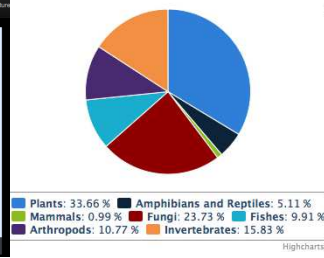
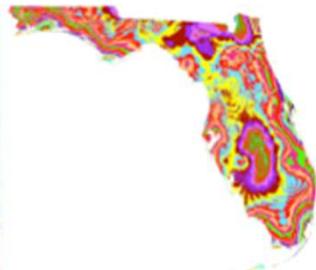


Next-Generation Biodiversity Research

- How are processes such as speciation and extinction associated with niche divergence?
- How have traits and ecological niches changed through time as a function of changes to geographic range and fluctuations in climate and geology?
- How is the evolution of phenotype correlated with changes in ecological niche at deep time scales?
- How is the phylogenetic diversity of a given area related to evolution of phenotype in that area?
- How have diversification processes interacted with climate and geology to shape modern biotas?
- How can fossil locality data inform our understanding of range and ecological niche evolution?
- How do traits change over time? Can within-species phenotype variation with respect to climate and ecology inform our understanding of trait lability and evolution at deep time scales?

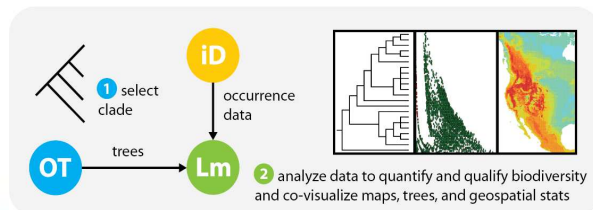
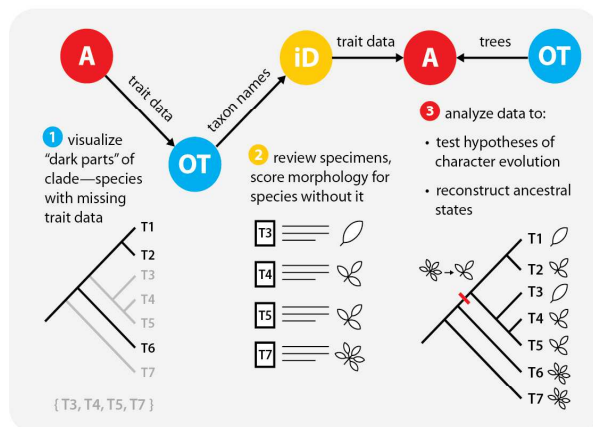
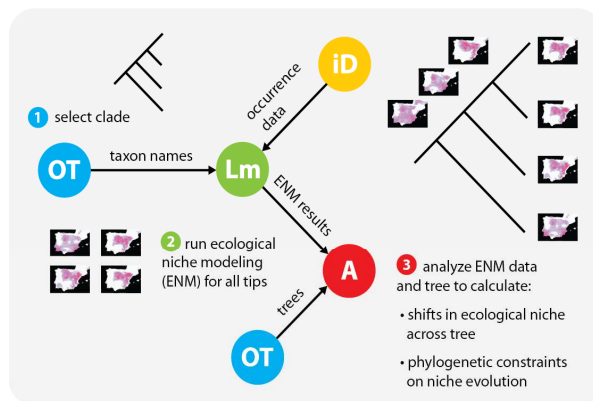
Specimen Data & the Big Data Challenge

- Not just volume of data
- But integration of diverse data types
- For novel applications



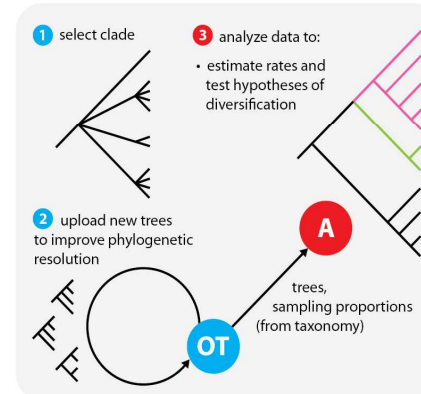
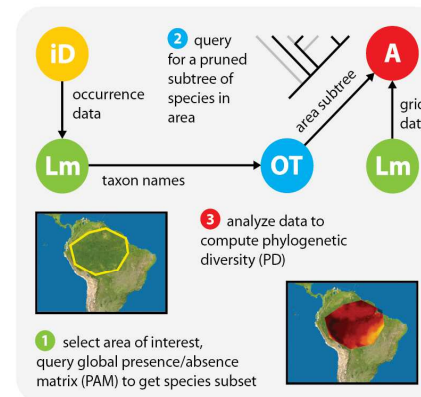
Connecting Trees, Specimens, Tools

EXAMPLE WORKFLOWS:



RESOURCES:

- Lm** Lifemapper
 - ecological niche modeling
 - biodiversity and range analysis
 - visualization
- A** Arbor
 - evolutionary models
 - comparative methods
 - visualization
- OT** Open Tree of Life
 - phylogenies
 - taxonomy / names
 - visualization
- iD** iDigBio
 - trait data
 - specimen data / images
 - fossil data / images



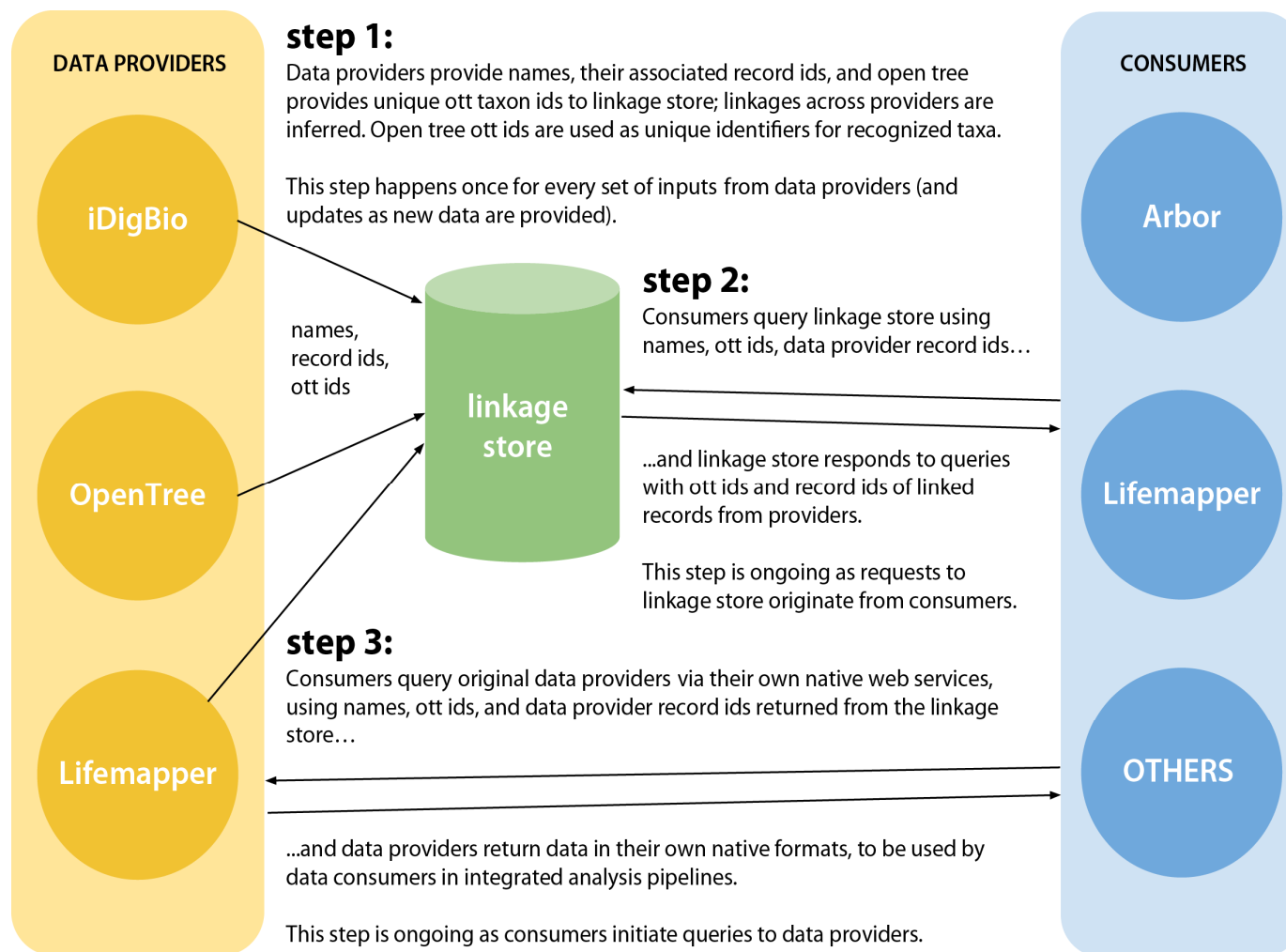
Connecting Trees, Specimens, Tools



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Connecting Trees, Specimens, Tools

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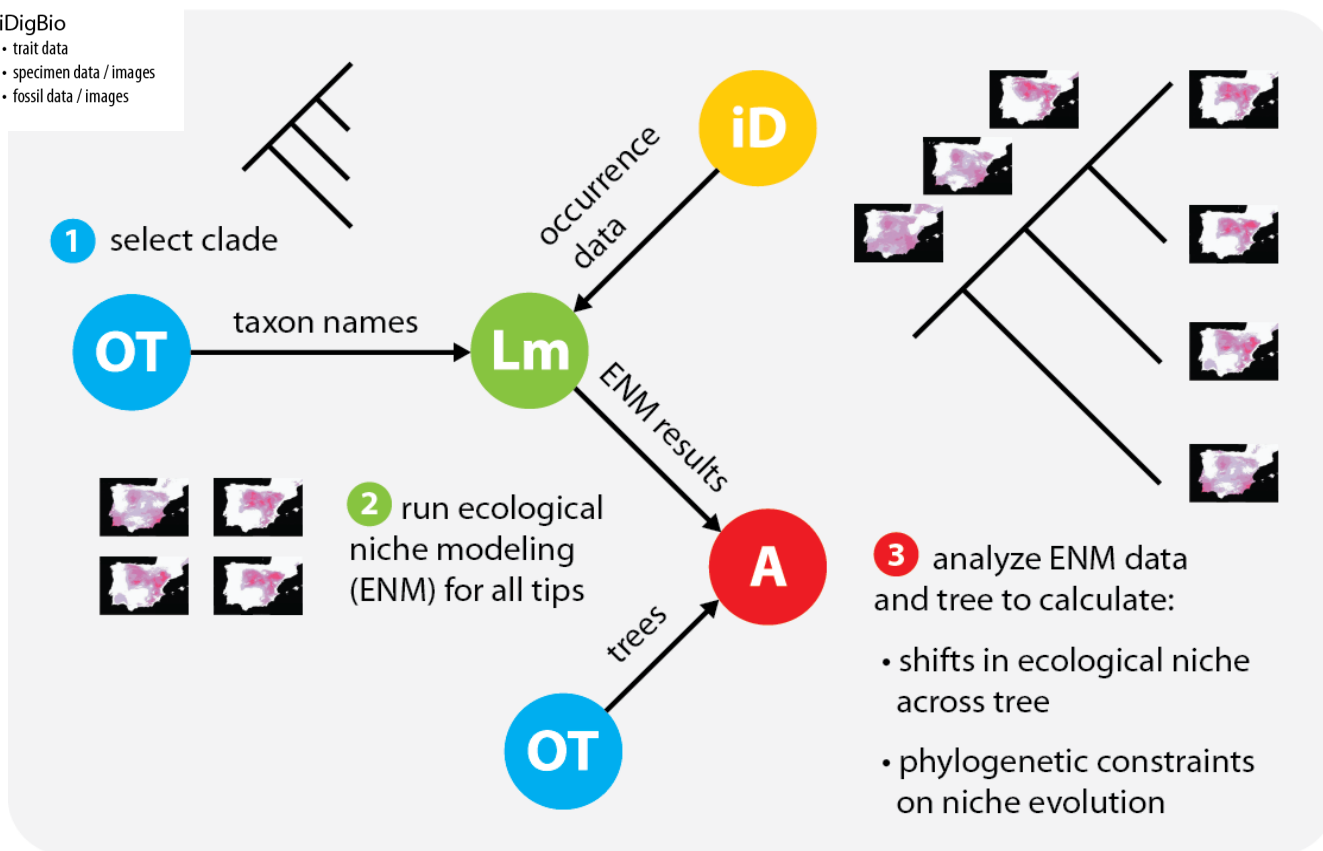
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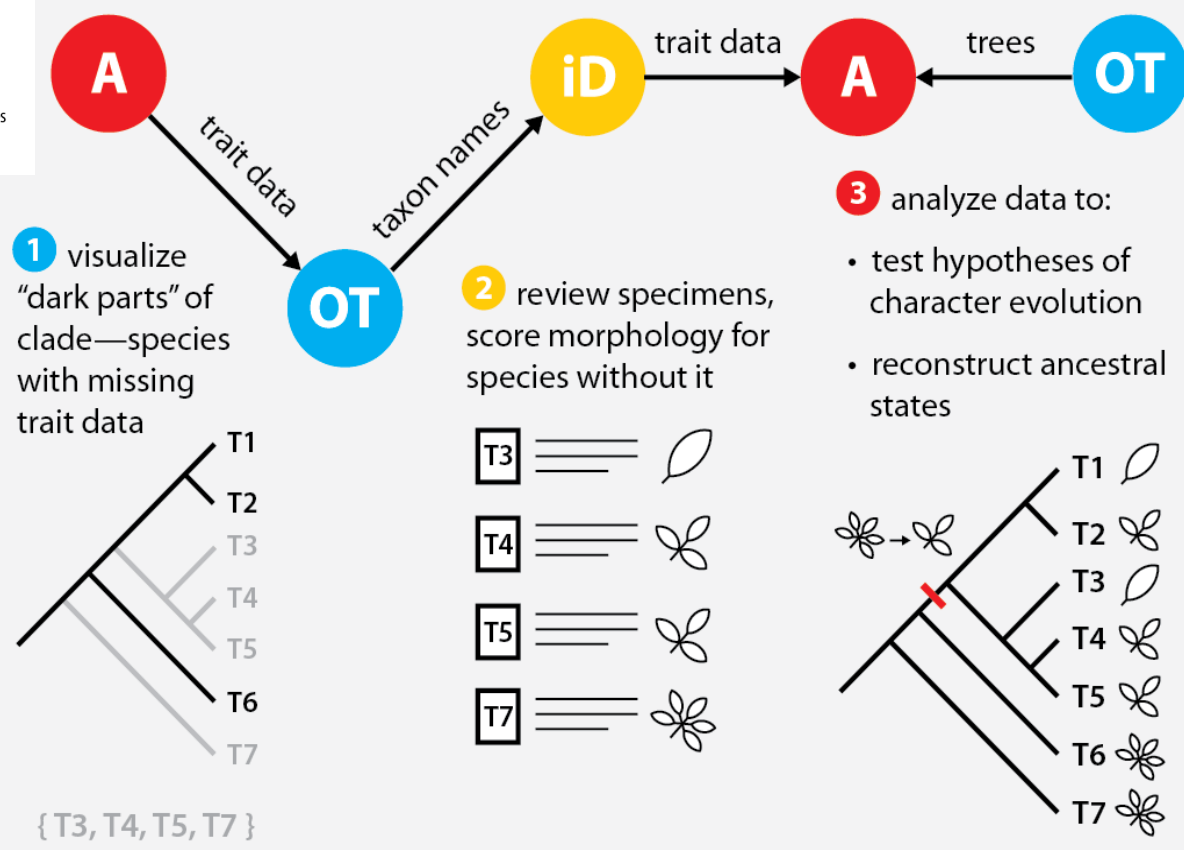
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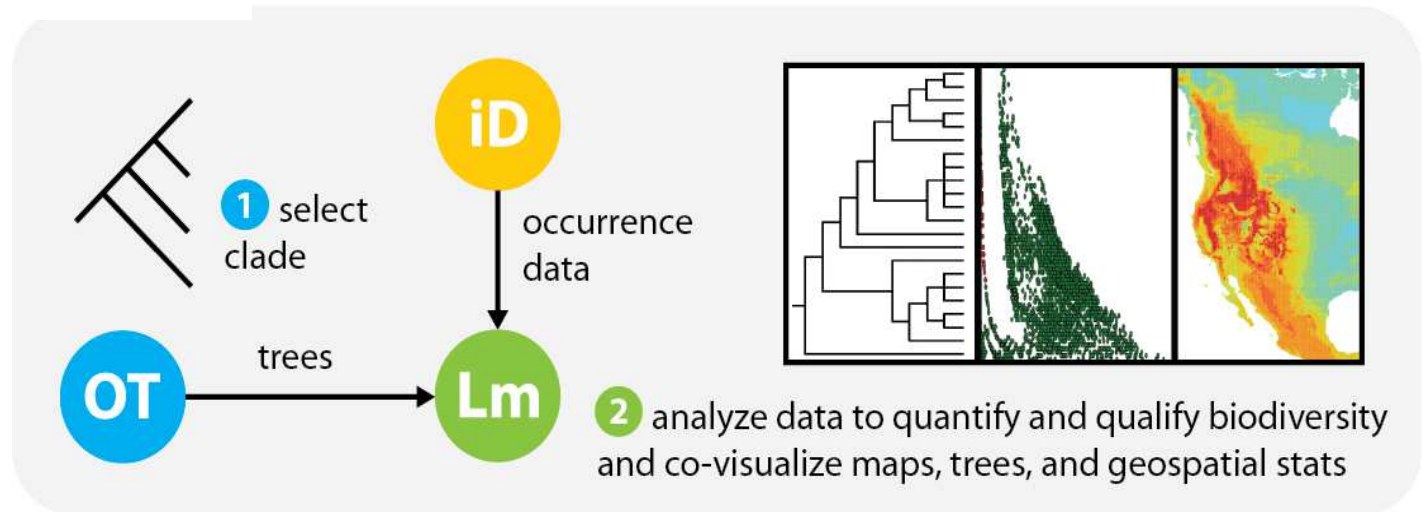
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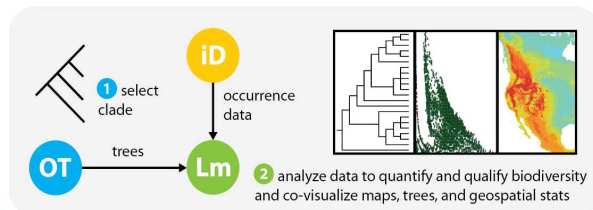
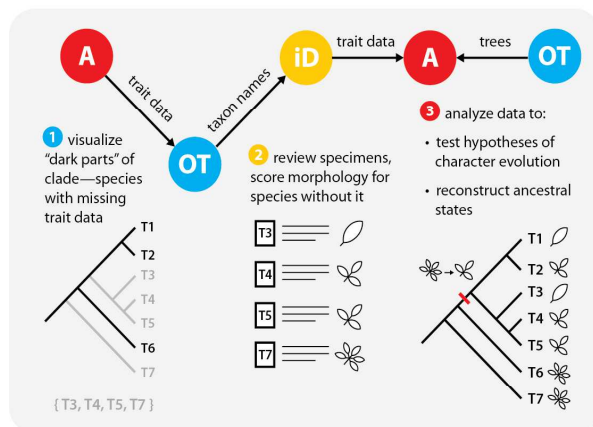
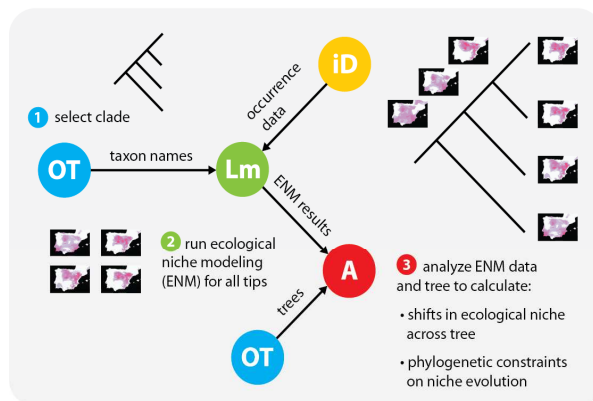
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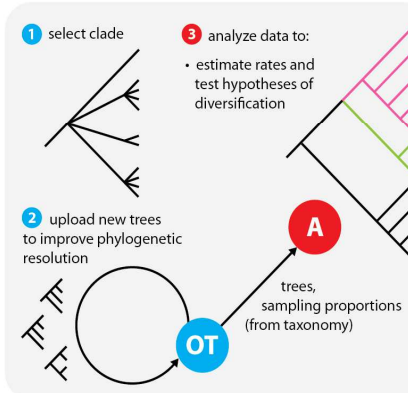
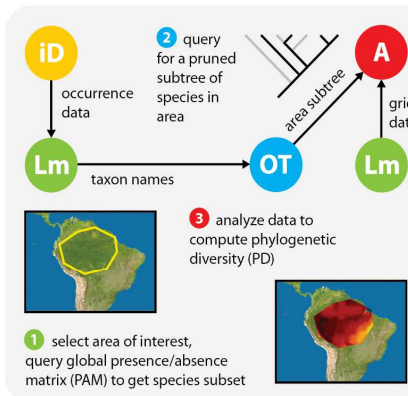
Connecting Trees, Specimens, Tools

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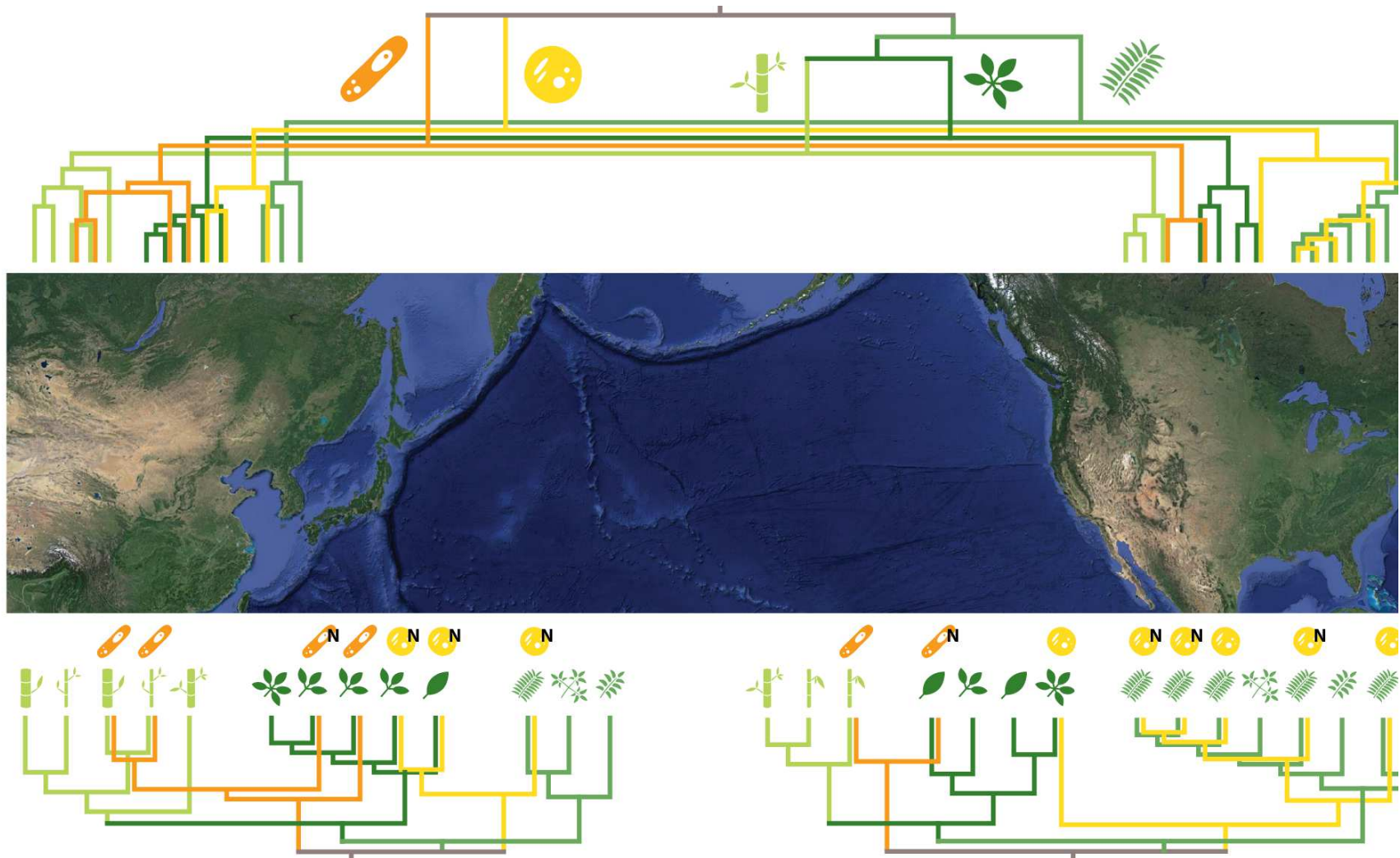


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Integrating Phylogenetics and Plant Trait Data



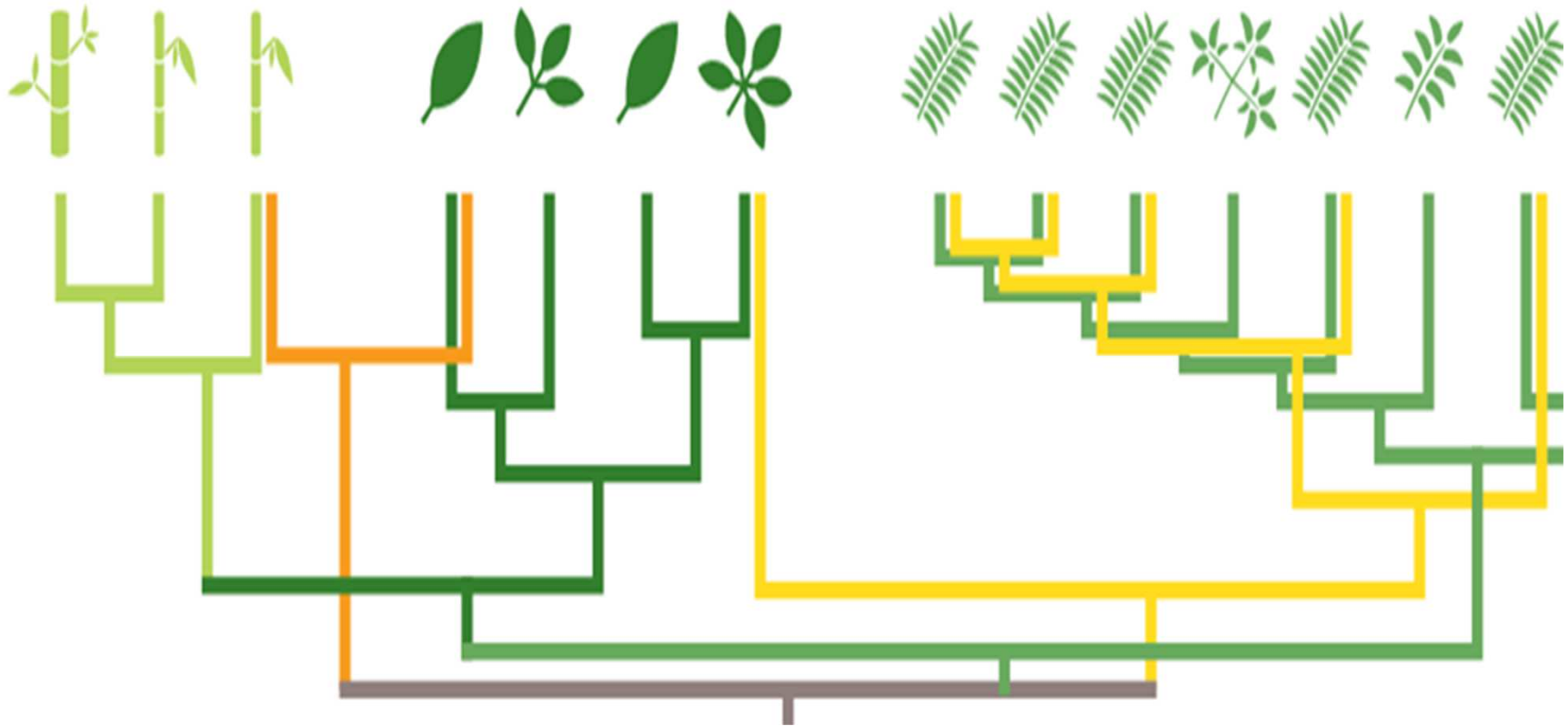
TRY

Plant Trait Database

PhotosyntheticPathway
Respiration LeafArea NfixationCapacity
SLA RegenerationCapacity PlantLifespan
WoodDensity GrowthForm
PhenologyType LeafN
LeafP LeafLongevity PhotosyntheticCapacity
MaxPlantHeight SeedMass

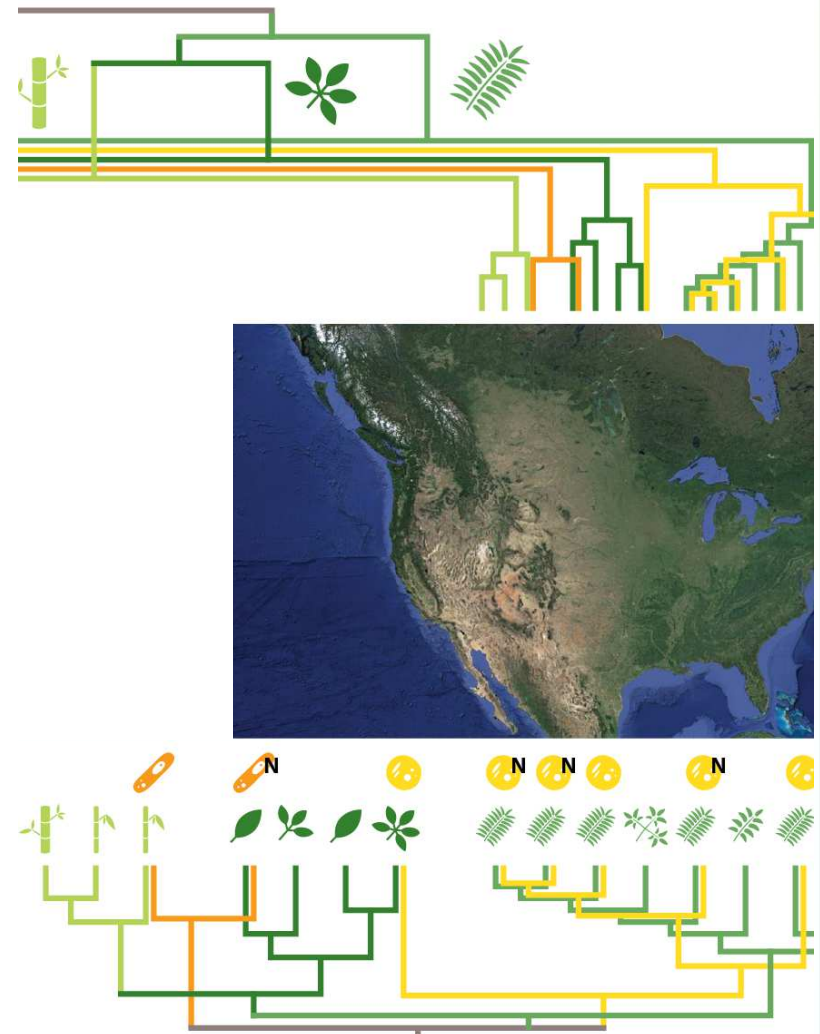
TRY

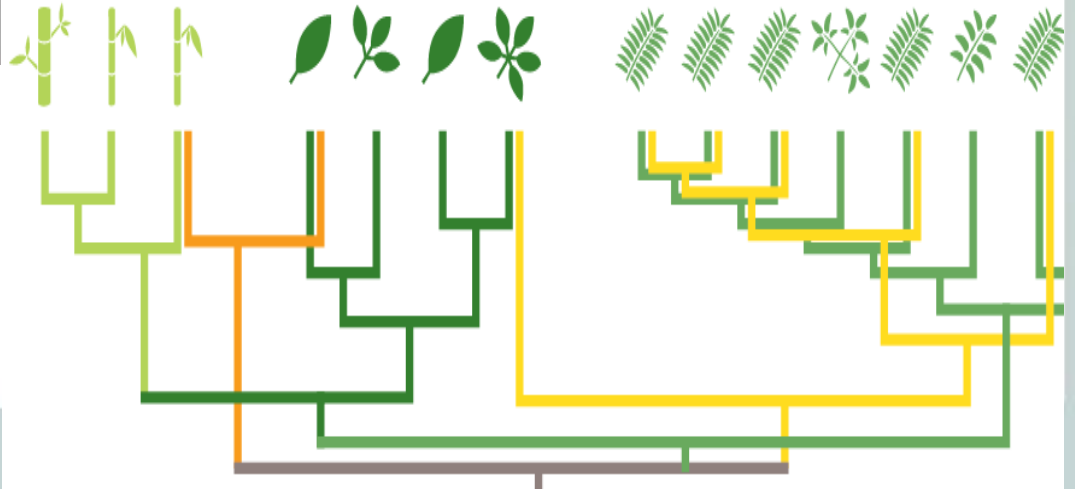
Plant Trait Database



Integrating Phylogenetics and Plant Trait Data

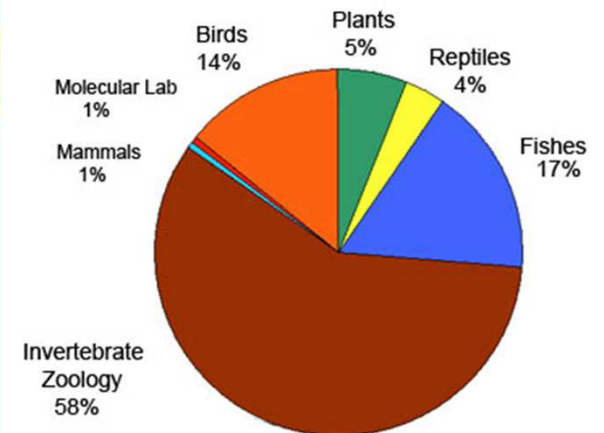
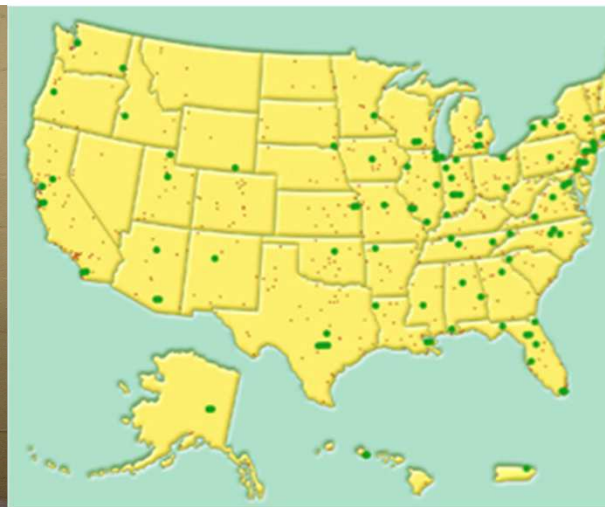
- Community-level phylogenies
 - Comparisons of phylogenetic diversity across spatial scales
 - Correlation of plant functional traits
 - Over- and underdispersion of traits:
 - Are traits phylogenetically constrained or broader properties of communities?
 - Implications for long-term health of communities





Linking Collections to Genomics

- Link specimens to GenBank records
- Use of specimens for genetics/genomics
- National network of genetic resources



TOTAL: 25,210 specimens

FLMNH GRR: the Genetic Resources Repository
Florida Museum of Natural History



GenBank Records



Welcome to NCBI

The National Center for Biotechnology Information advances science and health by providing access to biomedical and genomic information.

[About the NCBI](#) | [Mission](#) | [Organization](#) | [Research](#) | [NCBI News](#)

- **Examples of the /specimen_voucher information:**

```
/specimen_voucher="UAM:Mamm:52179"
```

```
/specimen_voucher="AMCC:101706"
```

```
/specimen_voucher="USNM:field series 8798"
```

```
/specimen_voucher="personal:Dan Janzen:99-SRNP-2003"
```

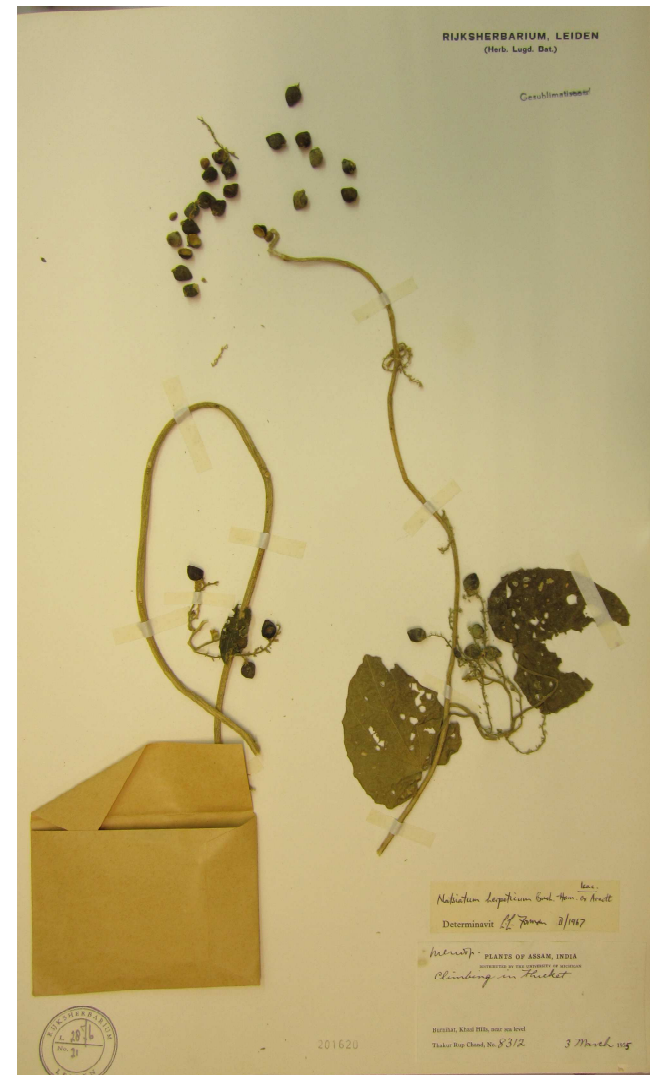
```
/specimen_voucher="99-SRNP-2003"
```

Herbarium DNA and NGS

- Fresh leaf material hard to obtain for many taxa
- DNA from available herbarium material often degraded – Is this a problem?
- Often yes for PCR, but not for NGS
 - Small DNA fragments (e.g., **200-400 bp**) required for most NGS protocols!
- Using herbarium material extensively for NGS in Icacinaceae
 - Herbarium samples as old as 80 years have worked fine

G. Stull

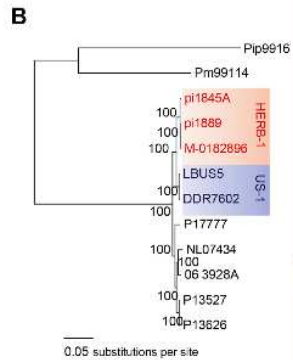
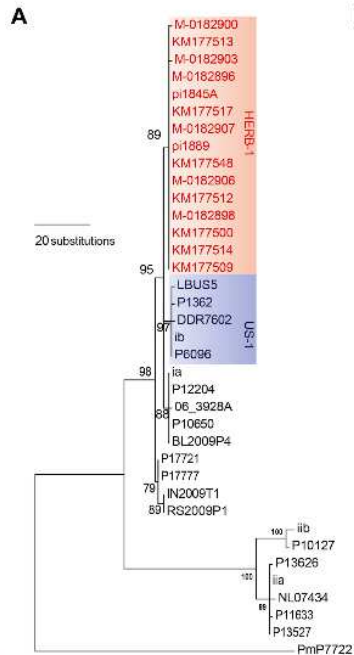
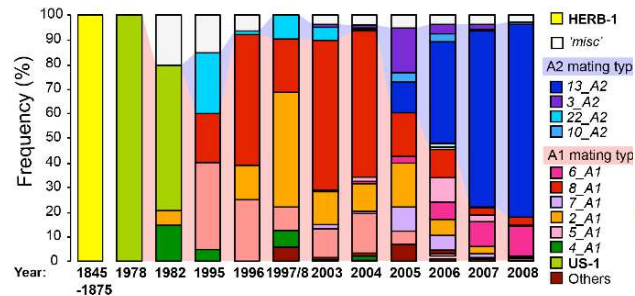
1955



Pearls

Mining Herbaria for Plant Pathogen Genomes: Back to the Future

Kentaro Yoshida¹, Hernán A. Burbano^{2*}, Johannes Krause³, Marco Thines^{4,5,6,7}, Detlef Weigel^{2*}, Sophien Kamoun^{1*}



Linking Collections to Genomics

- Participated in NSF-sponsored workshop on DNA banks at Missouri Botanical Garden, Jan. 2013
- Assembled a file of national DNA and tissue banks
- Developed a common web portal to these collections
- DNA resources ultimately connected to specimen data in iDigBio



Index to DNA Banks in US

Grant Godden



Index to DNA Banks in US



2,788,538
Specimen Records

344,373
Media Records

59
Recordsets

Making data and images of millions of biological specimens available in electronic format for the research community, government agencies, students, educators, and the general public

Search the specimen portal: Try it now [Portal Search](#)

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iDigBio Links DNA Banks and Genetic Resource Repositories with New Web Feature, Requests Community Input

Natural history collections have always played a crucial role in organismal biology, serving both as repositories for biological specimens that document biodiversity in space and time and sources of materials for scientific study.

Google™ Custom Search

« April »

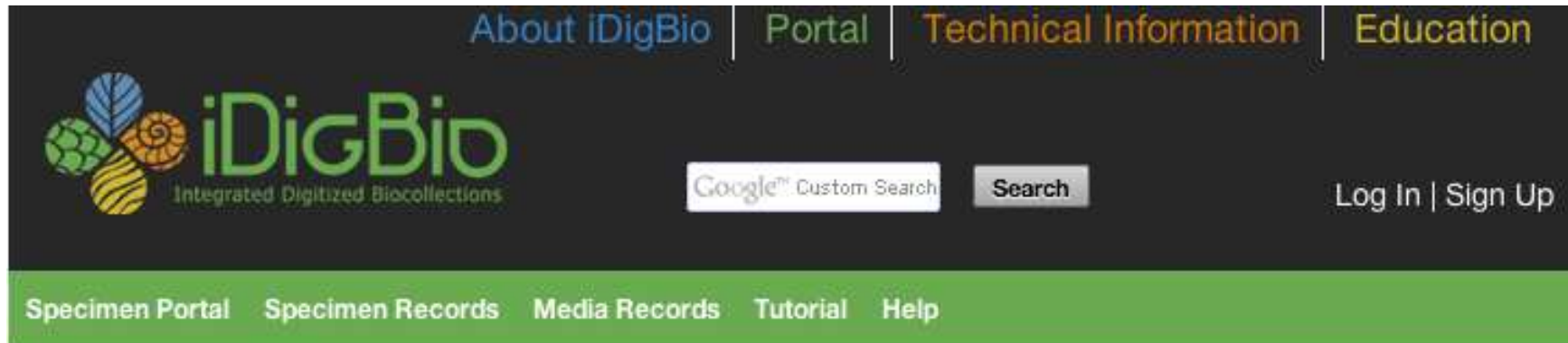
S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

- ### My Top Resources
- [Contact Us](#)
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Index to DNA Banks in US

- <https://www.idigbio.org/genetic-resources>



DNA Banks and Genetic Resource Repositories in the United States

Index to DNA Banks in US



Portal Search

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DNA Banks and Genetic Resource Repositories in the United States

iDigBio is actively compiling a list of DNA banking facilities and genetic resource repositories in the United States that maintain collections of nucleic acid extracts (DNA or RNA) or preserved tissues suitable for genetic and genomic studies of biodiversity.

The following resources (listed alphabetically by institution) represent collections currently known by or reported to iDigBio. Each entry includes the name of the institution, the date listed on iDigBio, a brief description, an institutional link, and searchable keywords: e.g., fields of study; repository type; storage type (cryogenic, ultra-cold, etc.); and resources available (nucleic acid extracts, frozen tissues, silica-dried tissues, etc.).

To report the availability of genetic resources at your institution, or to revise or update an existing entry, please contact Grant Godden.

iDigBio thanks the participants of the DNA Banking Workshop hosted by the Missouri Botanical Garden (January 2013) and Breda Zimkus (Museum of Comparative Zoology, Harvard University), in particular, for assistance in compiling these resources.

	Abstract	URL
Academy of Natural Sciences	The Laboratory for Molecular Systematics and	http://www.ansp.org/research/systematics-evolution/resources/molecular-biology/facilities/

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Search

x

«

April

»

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7	8	9	10	11	12	13
14	15	16	17	18	19	20
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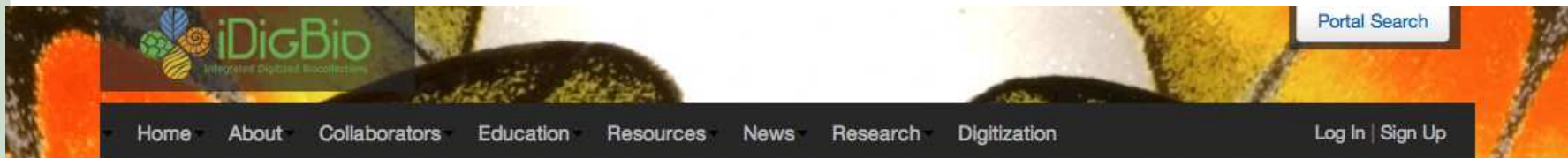
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Upcoming Events



Index to DNA Banks in US: an example



American Museum of Natural History, Ambrose Monell Collection for Molecular and Microbial Research

Tue, 2013-04-02 15:22 -- kevinlove

Title	American Museum of Natural History, Ambrose Monell Collection for Molecular and Microbial Research
Publication Type	Website
Year of Publication	2013
Authors	History AMuseum of
Keywords	-150C , centralized repository , cryogenic collection , DNA bank , frozen tissue specimens , genetic resources , liquid nitrogen , nucleic acid extracts , online database
Abstract	The Ambrose Monell Cryo Collection (AMCC) supports a broad range of comparative genetic and genomic research initiatives focusing on earth's biodiversity, including animal, fungal, plant, and microbial diversity. Collecting kits and equipment are also available for sampling and shipping of genetic materials.
URL	http://research.amnh.org/genomics/Facilities/AMCC

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Upcoming Events



Summary

- Specimens continue as foundation for systematics
- Emerging tools and infrastructure to link phylogenies with specimens – multitude of applications for diverse research questions
- Multiple connections to molecular data:
 - GenBank records
 - Specimens as sources of genomic data
 - Index to DNA Banks
- Exciting time **now** – integrating phylogenetic, genetic, and ecological data in basic and applied research – and into the **future!**

Acknowledgments

- Joe Miller, PhyloJIVE
- Open Tree of Life, Arbor, Lifemapper collaborators
- D. Soltis, J. Xiang, M. Mack, J. Lichstein – phylogenies, plant traits, specimens
- Grant Godden & Kevin Love for Index to DNA Banks



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