PhyloJIVE (and others): Integrating biodiversity data with the Tree of Life

Joe Miller

Centre for Australian National Biodiversity Research

National Science Foundation

Collaborators

Funding: DEWR, CANBR and ALA

* CANBR
  * Garry Jolley-Rogers
* ALA
  * Temi Varghese
  * Rebecca Pirzl
  * Nic dos Remedios
* iDigBio
  * Andréa Matsunaga
* others
  * Andrew Thornhill-ATH
  * Darren Crayn-ATH
  * John Pickering – DiscoverLife
  * Dan Rosauer-ANU

Our Data

* Biological collection informatics community
  * Individual datasets
  * iDigBio, GBIF, EOL, ALA, Map of Life
  * Dryad, Morphbank, Morphobank, Traitbase, IDLife

* Evolution and phylogenetics community
  * Individual datasets
  * Open Tree of Life
  * Treebase

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Data is not integrated.

Why Integrate Data?

Integrated Data?

Currently done for individual studies

* Currently done for individual studies
  * Manual data generation and curation

* Goal: Community resource
  * Tools to link data

Why Integrate Data?

* To understand our data
* Study biodiversity at all levels, not just species
* Facilitate comparative biology research
  * Visualize patterns
  * Develop and test hypotheses
* Conservation planning
* Evidence-based decision making

Miller and Jolley-Rogers 2014

* “the ability to search multiple databases using the nodes of a phylogenetic tree may be the single most important contribution of systematics to conservation and sustainable use of biodiversity”

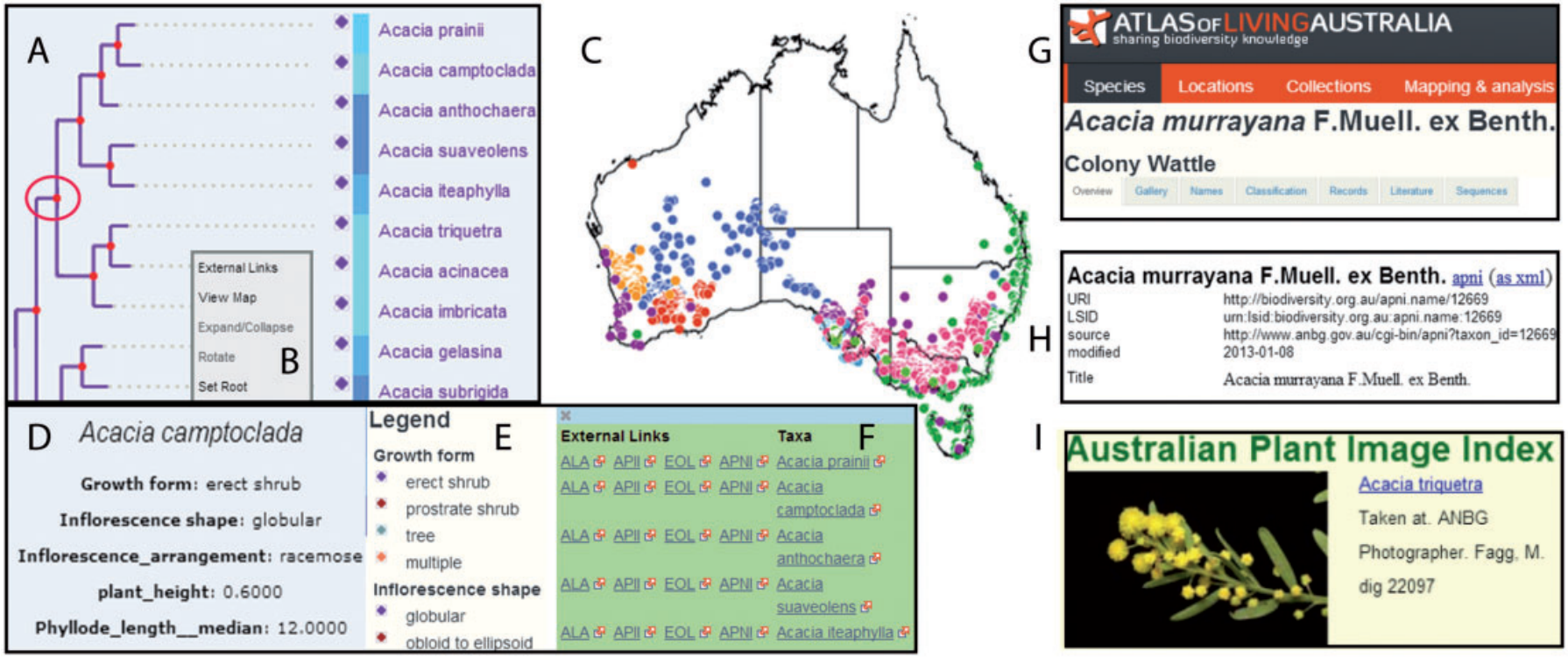
Cracraft (2002)

Outline

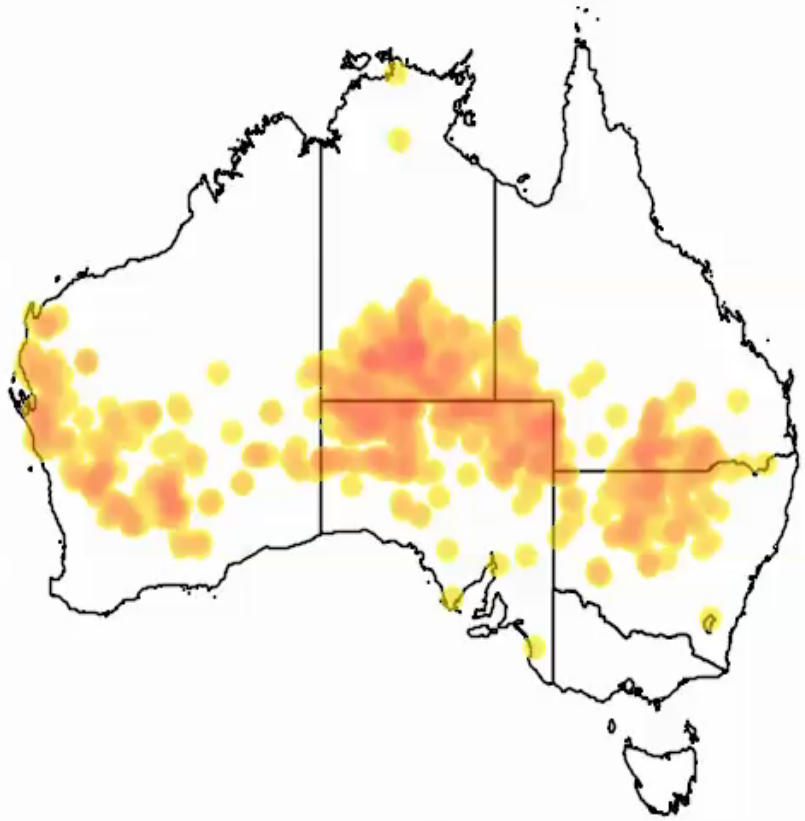
* PhyloJIVE
* Numerous screencasts
* Other integrating and visualization tools

PhyloJIVE

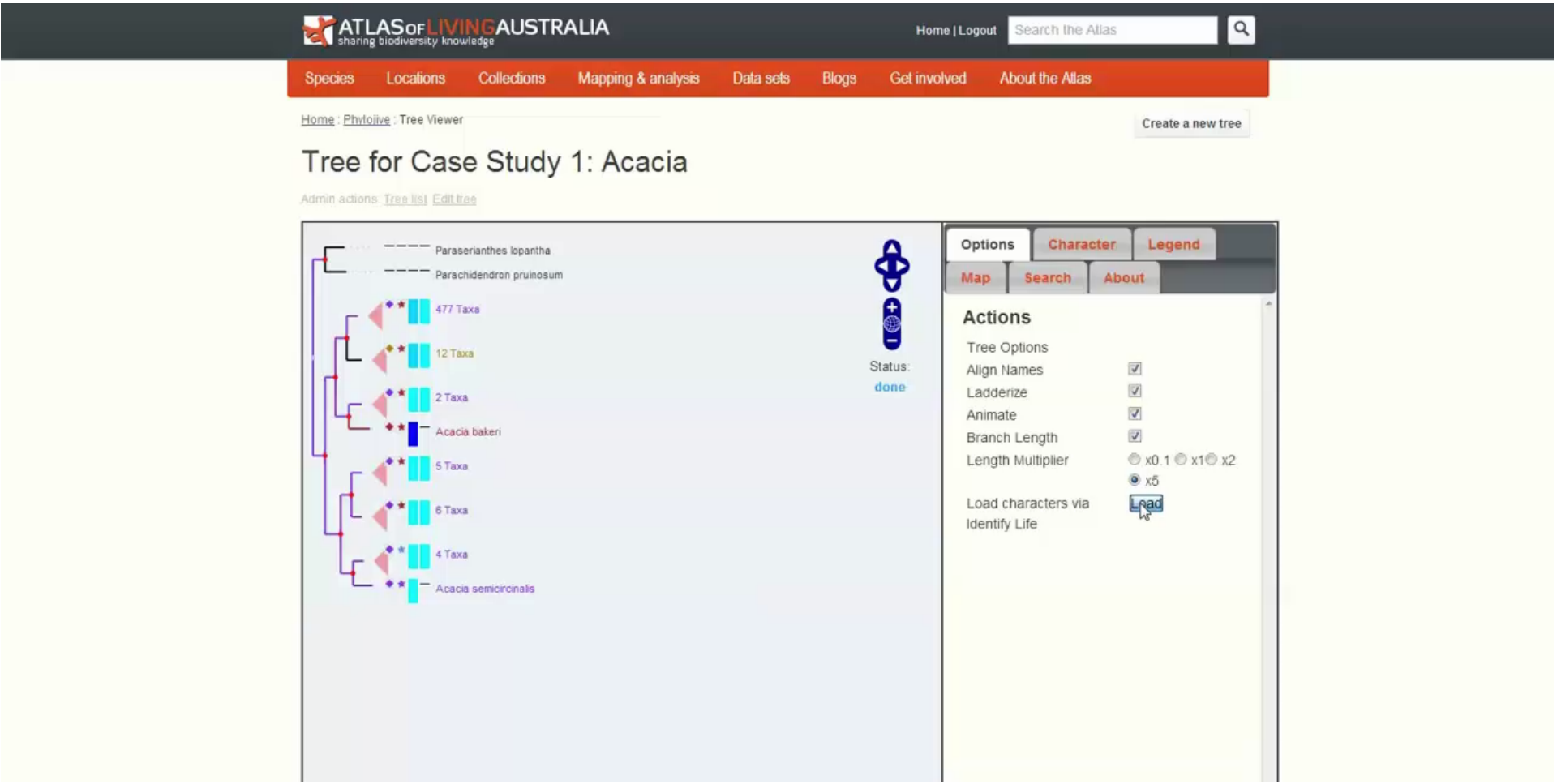
Phylogeny Javascript Information Visualiser and Explorer

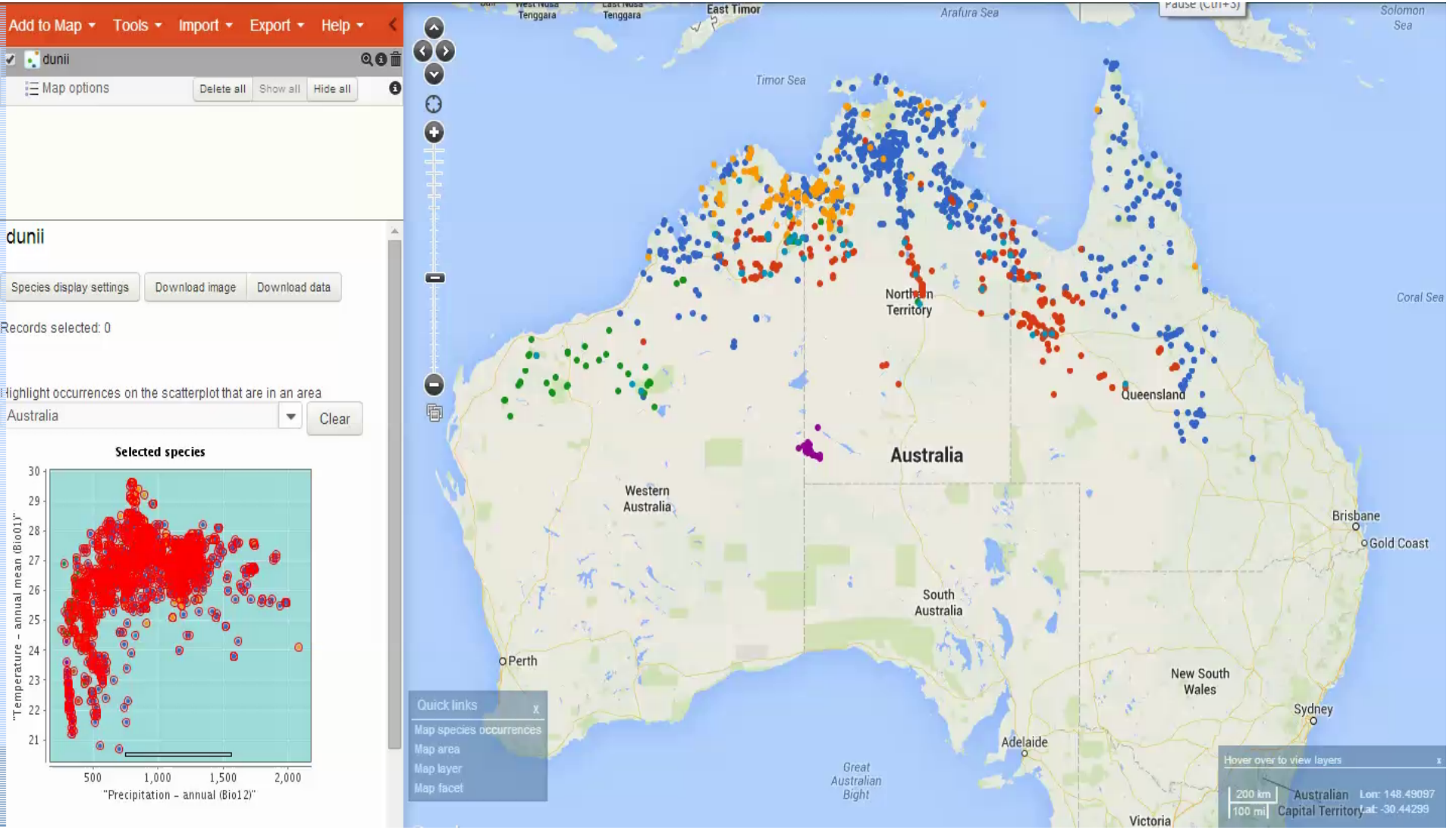


Jolley-Rogers et al. 2014



Acacia murrayana density Map


ATLAS OF LIVING AUSTRALIA
sharing biodiversity knowledge
Home | Logout
Search the Atlas
Species
Locations
Collections
Mapping & analysis
Data sets
Blogs
Get involved
About the Atlas
Home : Phylojive : Tree Viewer
Create a new tree
Tree for Case Study 1: Acacia
Admin actions: Tree list Edit tree
Paraserianthes lopantha
Parachidendron pruinosum
477 Taxa
12 Taxa
2 Taxa
Acacia bakeri
5 Taxa
6 Taxa
4 Taxa
Acacia semicircinalis
Status:
done
Options
Character
Legend
Map
Search
About
Actions
Tree Options
Align Names
Ladderize
Animate
Branch Length
Length Multiplier
x0.1
x1
x2
x5
Load characters via Identify Life
Load

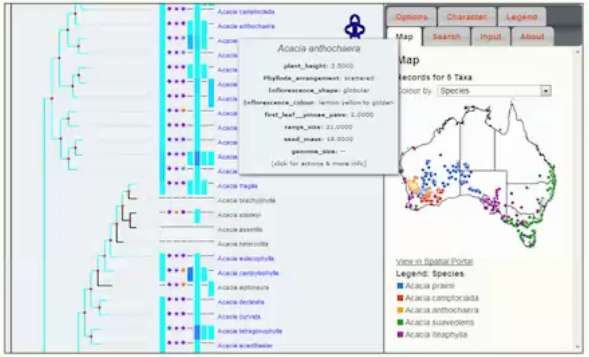

Add to Map
Tools
Import
Export
Help
dunii
Map options
Delete all
Show all
Hide all
dunii
Species display settings
Download image
Download data
Records selected: 0
Highlight occurrences on the scatterplot that are in an area
Australia
Clear
Selected species
"Temperature – annual mean (Bio01)"
"Precipitation – annual (Bio12)"
Quick links
Map species occurrences
Map area
Map layer
Map facet
East Timor
Arafura Sea
Timor Sea
Solomon Sea
Coral Sea
Northern Territory
Queensland
Australia
Western Australia
South Australia
Brisbane
Gold Coast
Perth
New South Wales
Sydney
Adelaide
Great Australian Bight
Victoria
Hover over to view layers
200 km
100 mi
Australian Capital Territory
Lon: 148.49097
Lat: -30.44299

Phylojive

PhyloJive (Phylogeny Javascript Information Visualiser and Explorer) is a web based application that places biodiversity information aggregated from many sources onto compact phylogenetic trees.

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) – see the original project page, original code repository and ALA code repository. 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.

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.



Create a new tree

Trees with character data

- quantitative characters
- demo
- ARFK1
- joe test July 26
- Boletes
- Damien
- Joe's acacia
- kimberley land snails3
- opentree
- Asteraceae coll bias
- treetest
- Tests

"Bare" Trees

- Molluscsa-tree of life
- amphibia - frogs, salamanders and caecilians
- Damien
- Maluridae
- Bird super tree
- kimberley land snails3
- 4000 lizards
- test3
- Characteristics 1-8
- dfd
- Tests
- opentree

iDigBio Implementation

phylojive.acis.ufl.edu/PhyloJive/index.jsp

iDigBio & ALA PhyloJIVE
Integrated Digitized Biocollections

About iDigBio | Portal | Technical Information | Education

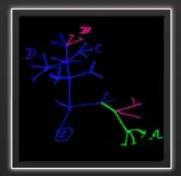
iDigBio Home | iDigBio Portal | PhyloJIVE Home | OpenTree Studies | Sample Trees | Tutorial | Research Tools | Feedback

View on GitHub

PhyloJIVE

integrating phylogenies
... with online biodiversity data sources

for developers, wiki instructions + known problems, download PhyloJIVE

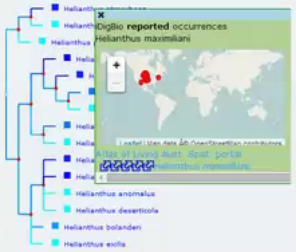


tar.gz .zip

The growing catalogue of online biodiversity data sources has reached a scale where data integration and mashups can be truly useful. Information about species is being aggregated at national and international scales. PhyloJIVE (Phylogeny Javascript Information Visualiser and Explorer) is one such mashup placing biodiversity web-services into an evolutionary context.

Integration with Atlas of Living Australia and iDigBio

Joe Miller's has made detailed instructions on the use of the ALA implementation of phyloJIVE including videos, which are similar to the instructions for the iDigBio instance of PhyloJIVE. Briefly, this instance offers the following additional features:



- linkage to specimens available on iDigBio
- visualization of iDigBio specimen on a world map
- external links to ALA Taxonomy, EOL, Discover Life, ALA maps
- access to a list of phylogenetic studies made available by OpenTree

Pause (Ctrl+S)

Example trees on iDigBio+PhyloJive:

Andréa Matsunaga, iDigBio, UF

OpenTree Study: pg_09

Tank, David C., and Michael J. Donoghue. 2010. Phylogeny and Phylogenetic Nomenclature of the Campanulidae based on an Expanded Sample of Genes and Taxa. Systematic Botany 35, no. 2 (6): 425-441. doi:10.1600/03636441079163

Select another OT study: pg_09

- Click the top button to get the navigation aid
- Click nodes to get maps and external services
- Try choosing characters (if available) to plot on the tree;
- Align-names feature; search; set-root; rotate, etc.

Status: done

OneZoom, James Rosindell

http://www.onezoom.org/

Linking phylogenetic widget into you webpage

www.4apes.com/species/gorilla

Ape Alliance
ACTION FOR APES WWW.4APES.COM

Help save the Great Apes & their habitats

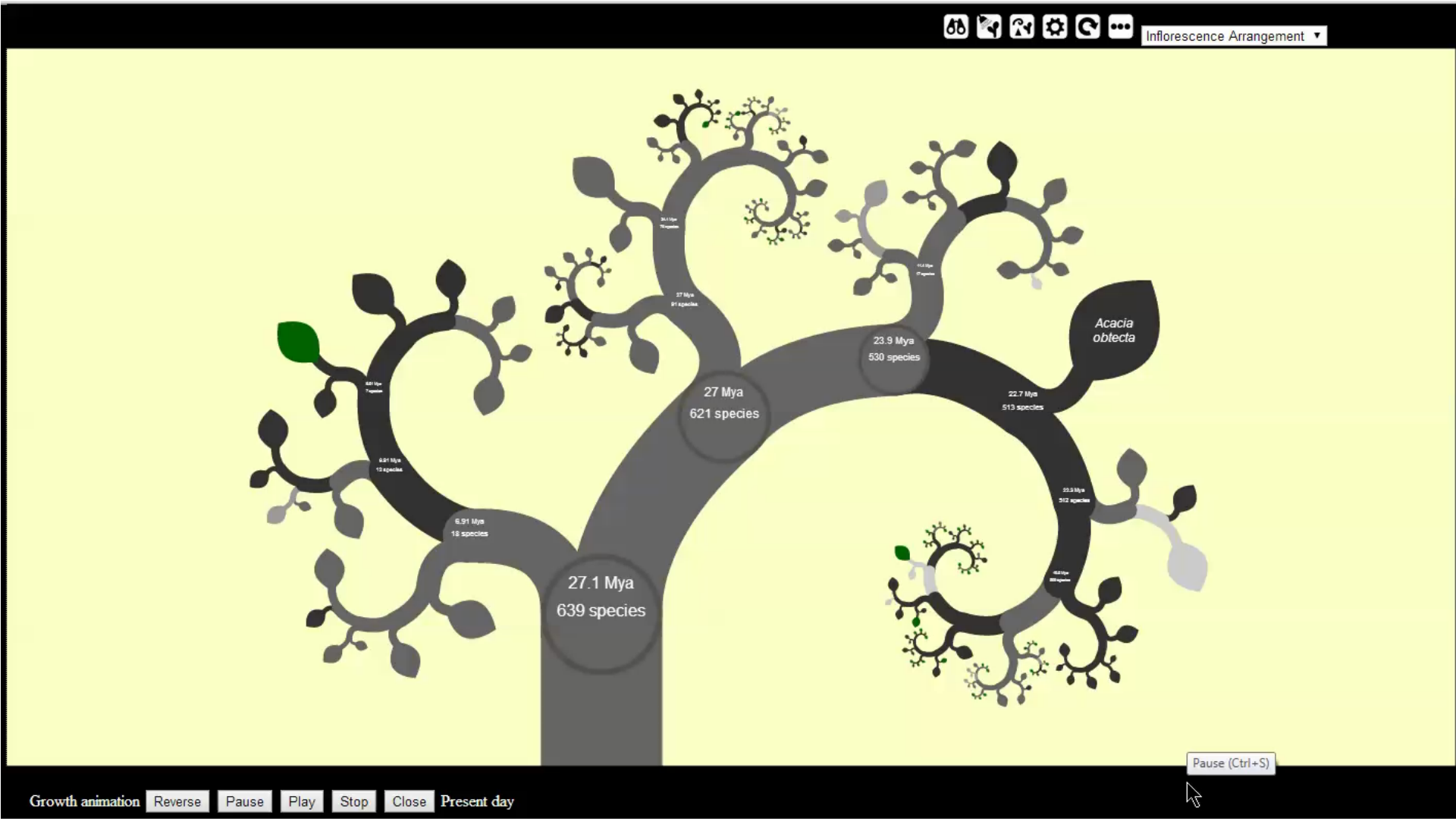
Home | News | Events | Working Groups | Get Involved | Ape Inspired | The Apes | About Us | Shop

Climb for Change

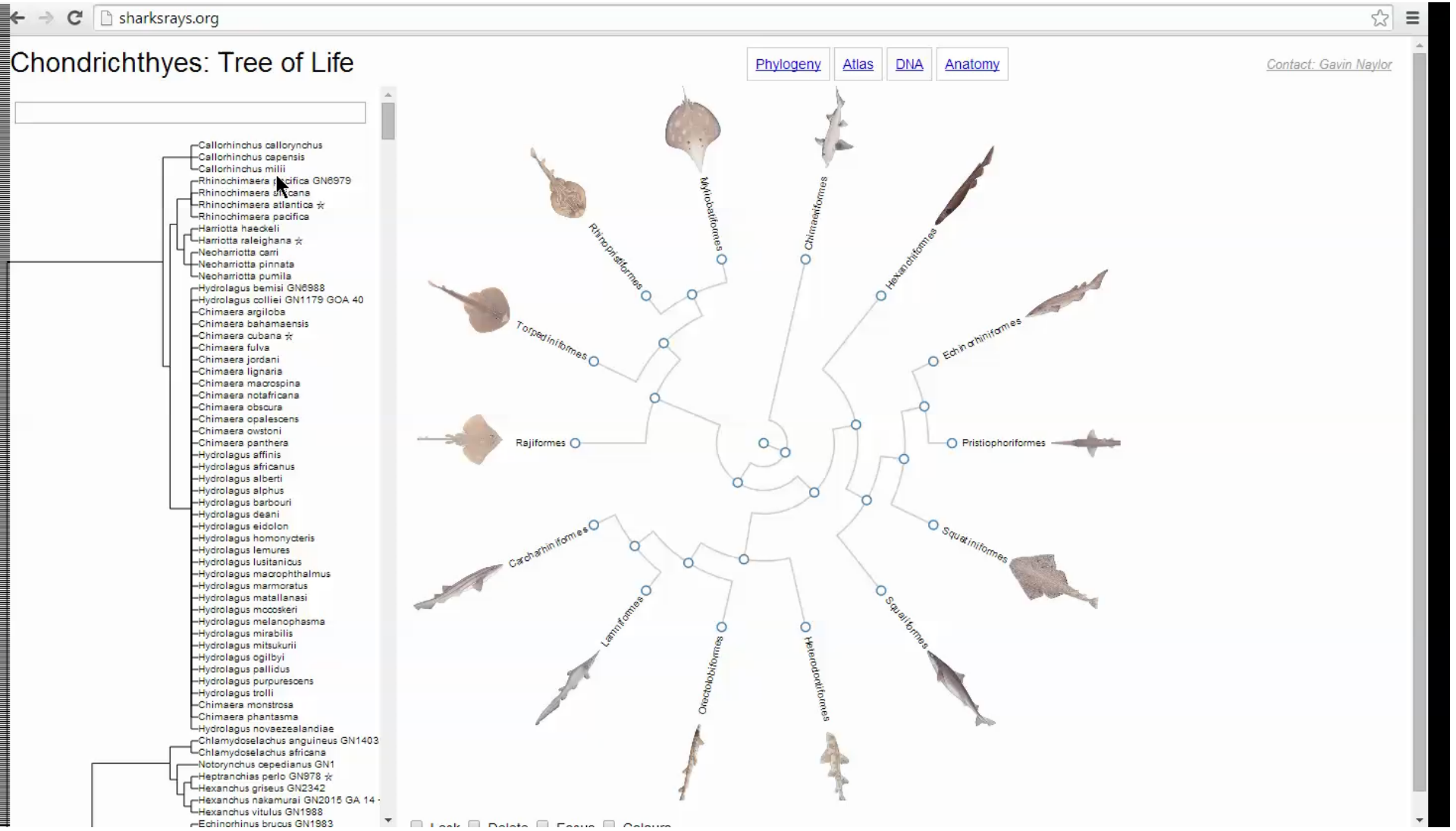
Sponsor Ian, Support the Ape Alliance

Back to Top

OneZoom with PhyloJIVE



Gavin Naylor, shakrays.org



Future

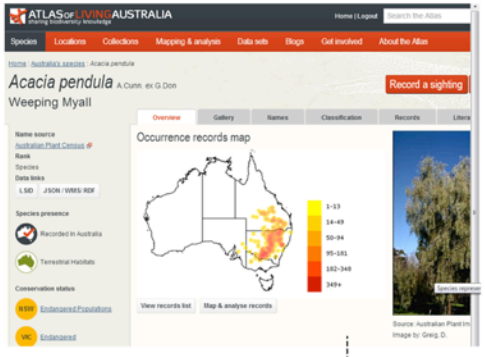
* All data integrated
  * GoLife, Genealogy of Life
* Other integration platforms
  * Arbor
  * ???

* “Physicists acknowledge the power of the fundamental forces, such as gravity, incorporating them into every calculation. To successfully conserve our dwindling global biodiversity which we rely upon economically and aesthetically for sustenance and pleasure, biology must integrate evolution into every assessment of biodiversity.”

Miller and Jolley-Rogers 2014

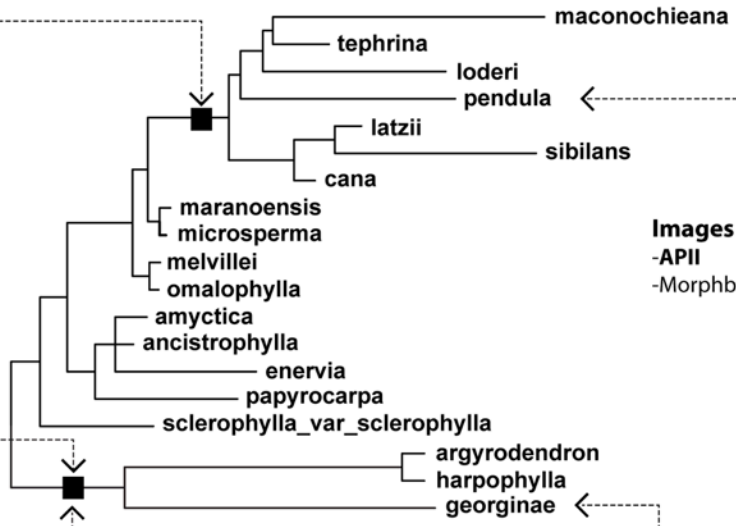
extra

NOMENCATURE
- **APNI**
- IPNI



TAXONOMIC PAGES
- **EOL**
- **ALA**
- GBIF
- Wikipedia
- DiscoverLife
- Google

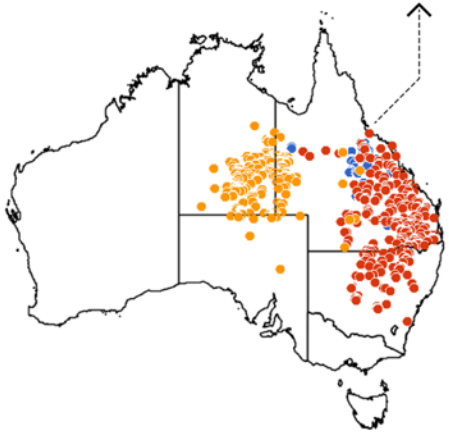
node support
divergence times



ANCESTRAL CHARACTER STATES FOR CLADE
- Foliage=phyllodes
- infloresence type=globular
- Growth form= tree or shrub

Images
-APII
-Morphbank

Australian Plant Image Index (APII)-
Photo No. : a.19340



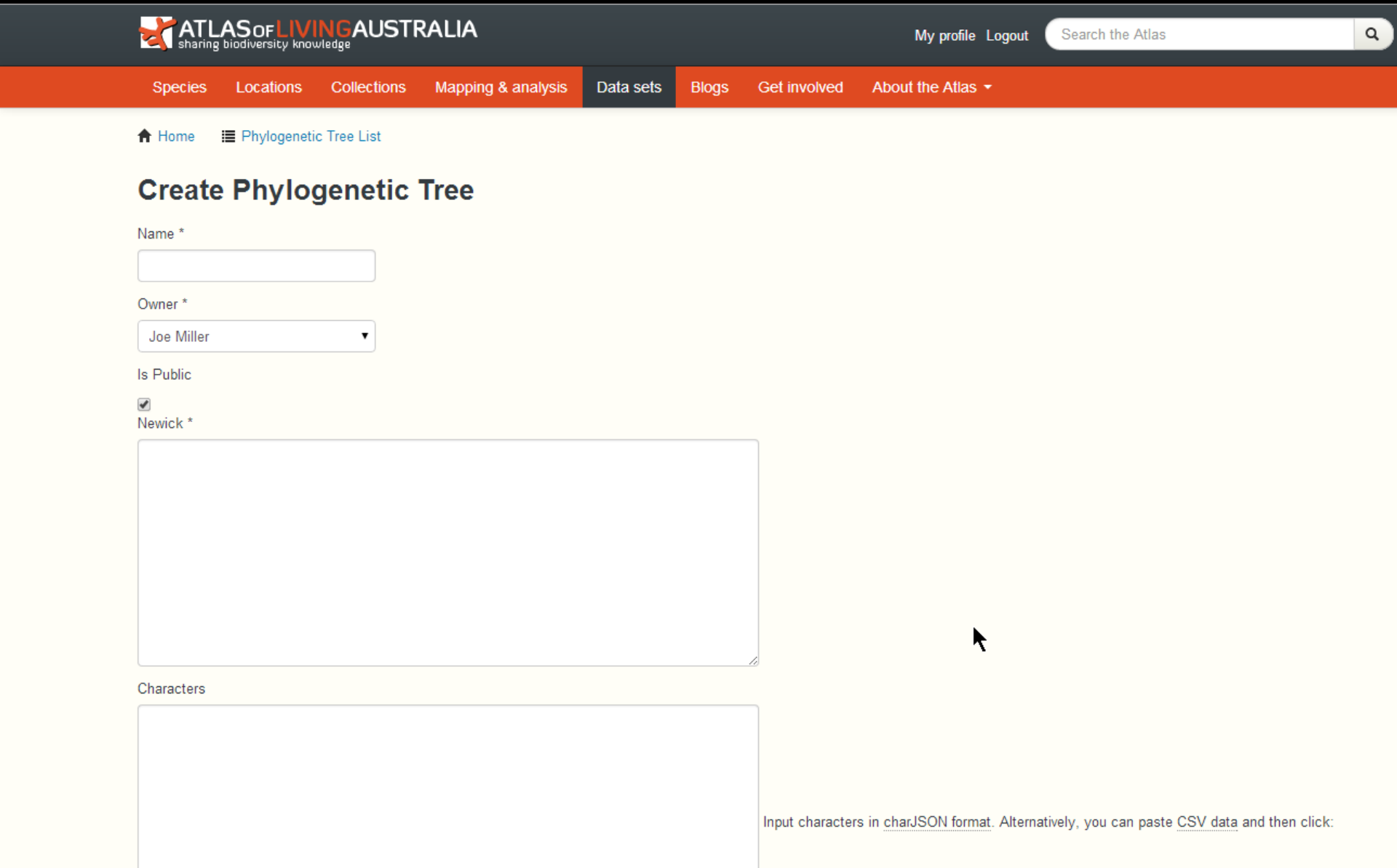
CHARACTER STATES FROM IDENTIFY LIFE
- Foliage=phyllodes
- infloresence type-globular
- Growth form= tree

TRAITS
- **user defined**
- **ID keys Identify Life**
- **webservices**
- text mining
- floras

DISTRIBUTION MAPS (ALA)
- **environemtnal layers (climate and geography)**
- Google earth
- analytical tools (endemism)

Miller and Jolley-Rogers 2014

Generate a new tree



Create Phylogenetic Tree

Name *

Owner *

Joe Miller

Is Public

Tree (nexml or newick)

Search Treebase

Search *Search for a study in treebase*

Treebase Tree ID

eg: Tr2026