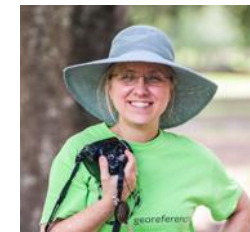
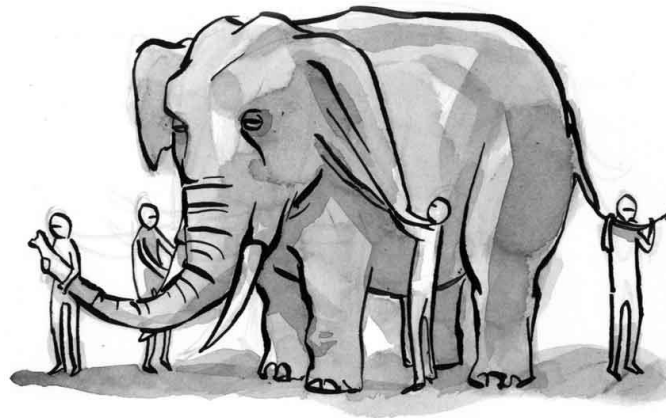




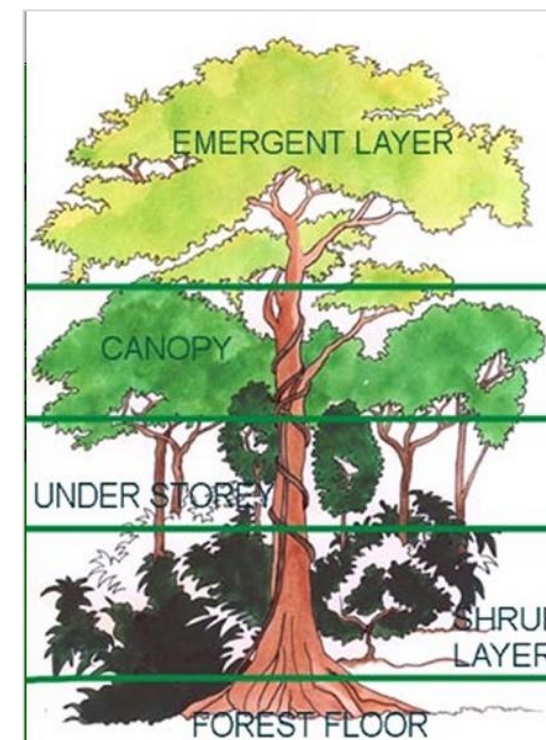
# Connecting Natural Science Collections: a community (r)evolution

Deborah Paul, Greg Riccardi, Gil Nelson  
iDigBio, Florida State University  
Bristol UK Workshop 8 March 2018  
@idbdeb @griccardi @iDigGilNelson @iDigBio



## Topics

- ADBC Model Integrated Collections Network
- Community Building
- Resources developed
- Lessons learned
- Key components of such a program



## How to get digitisation going (c. 2009)

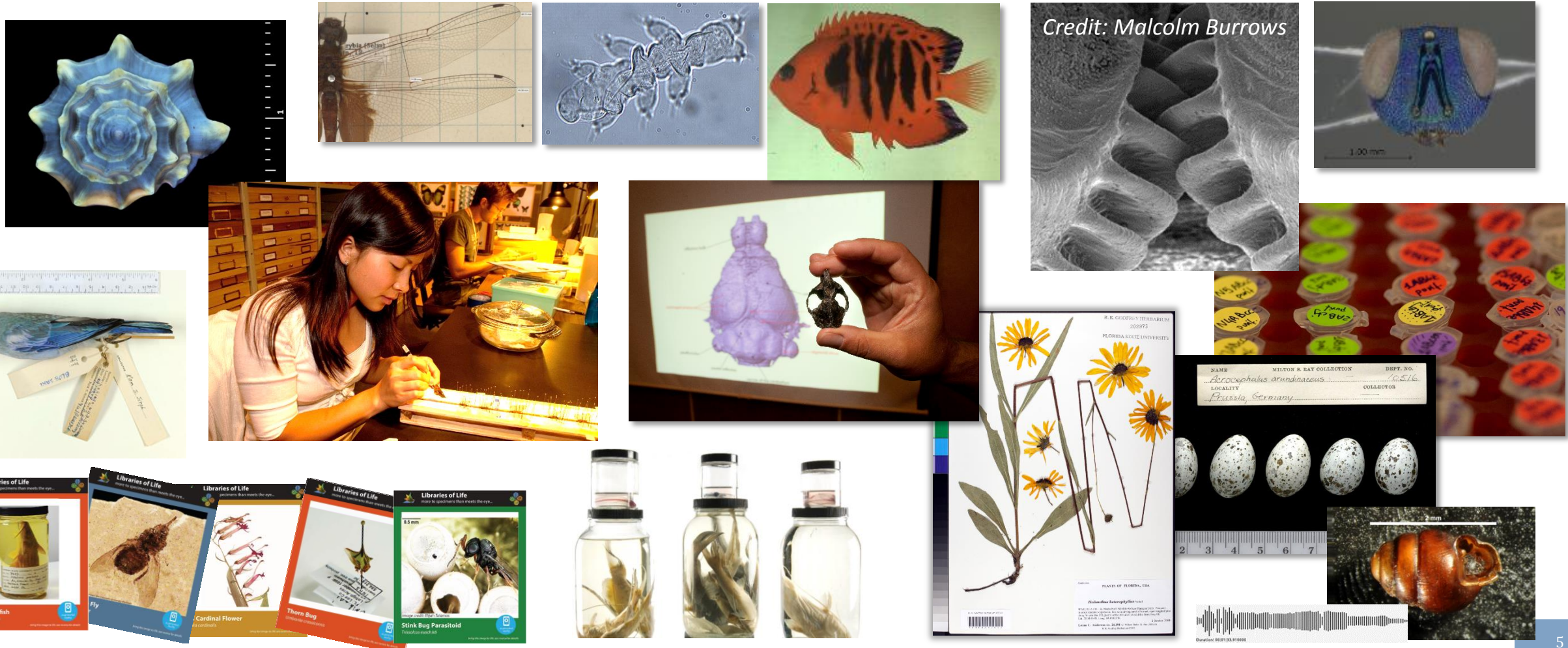
- Step 1: Make a plan and get funding
- Step 2: Create a central coordination program
- Step 3: Fund digitization projects
- Step 4: Digitize and organize
- Step 5: Publish and use data
- ∞: figure out how to keep going



# ADBC: Advancing Digitization of Biodiversity Collections

- A call from the community > NIBA
- US National Science Foundation
  - Budget is \$100 million over 10 years, we are in year 7.
- The goal is to digitize and aggregate
  - 100s of Millions of biological and paleontological records over the 10-year life of the project.
- iDigBio project is the hub of ADBC
  - U of Florida, Florida State U
- Digitization projects
  - Funded by NSF peer review
  - 20 Thematic Collections Networks
- We are encouraged by our funders to collaborate
  - Issues are global, effort needs to be global

# ADBC is iDigBio and the Thematic Collection Networks (TCNs)



Credit: Malcolm Burrows

NAME MILTON S. BAY COLLECTION DEPT. NO.  
*Aeroccephalus arandineus* 16516  
 LOCALITY Fressia, Germany COLLECTOR



# NIBA Strategic Plan 2010

- **Vision Statement: NIBA will**
  - Develop an inclusive, vibrant, partnership of U.S. biological collections
  - Document the nation’s biodiversity resources
  - Create a dynamic electronic resource
  - Serve the country’s needs in answering critical questions about the environment, human health, biosecurity, commerce, and the biological sciences



**Collections**

This is intended to be a comprehensive list of all natural history collections in the United States of America. If you know of institutions or collections that are not shown in the list, please complete [this form](#). If you have any questions or encounter difficulty, please email Kevin Love at [klove@fsmnh.uci.edu](mailto:klove@fsmnh.uci.edu).

Show Map of Collections

Filter Results

Institution ▲	Collection	Contact	Contact Role	Update/Add Information	Show On Map	Recordsets
University, Angelo State Natural History Collections	Ornithology	Benjamin R. Skipper	Curator	Show On Map	Search Recordset(s)	
Angelo State University, Angelo State Natural History Collections	Mammalogy	Robert C. Dowler	Curator	Show On Map	Search Recordset(s)	

108,272,971  
Specimen Records

23,037,024  
Media Records

1,537  
Recordsets

[Search the Portal](#)



Computers and Electronics in Agriculture  
Volume 145, February 2018, Pages 311-318

Original papers  
**Deep learning models for plant disease detection and diagnosis**  
Konstantinos P. Ferentinos

**Closing the gap - building a strong and productive network between amateurs and professionals in Paleontology.**

Leder R  
2015 GSA Annual Meeting

**Nsis and Atlantic Ecosystems Initiative To Make Data Accessible – One Dataset At a Time**

Brown G, Kennedy M, Sherin A et al. [See more](#)  
Proceedings of the Nova Scotian Institute of Science (2017) 49(1) 17-22

**Turning teens into FossilPhiles: Citizen science and advanced visualization of paleontology collections**

Button K, Cross L, Rende K et al. [See more](#)  
Geological Society of America Abstracts with Programs (2017) 49(6)

**Peabody specimens thrive online**

By Mike Cummings | MAY 10, 2016

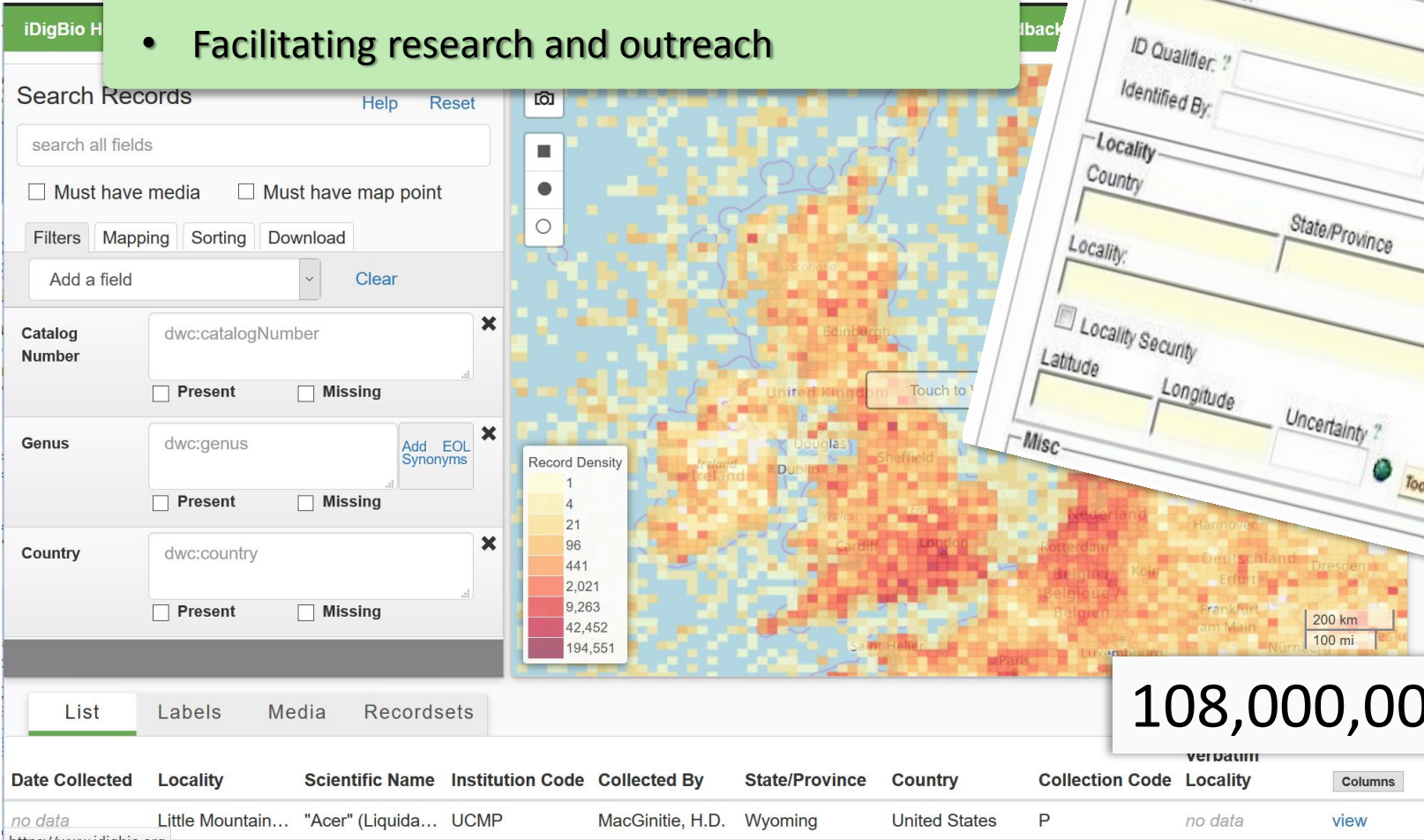
## What does iDigBio do?

- Enable **digitization** of biodiversity collections data
  - Develop efficient & effective standards & workflows
  - Workforce education & training
- Provide portal **access to biodiversity data in a cloud computing environment**
  - Respond to cyberinfrastructure needs
  - Enable access & discoverability
- Facilitate **use of biodiversity data to address key environmental and economic challenges**
  - Researchers, **educators, general public**, policy-makers, ...
- Plan for long-term sustainability of the national digitization network & effort
  - Expand participation: partners, data sources, public, ...
  - **Proliferate and broaden uses of biodiversity data**



# iDigBio Mission to Coordinate:

- Engaging the collections community
- Facilitating digitization & mobilization of data
- Providing portal and API access to data
- Facilitating research and outreach



108,000,000+



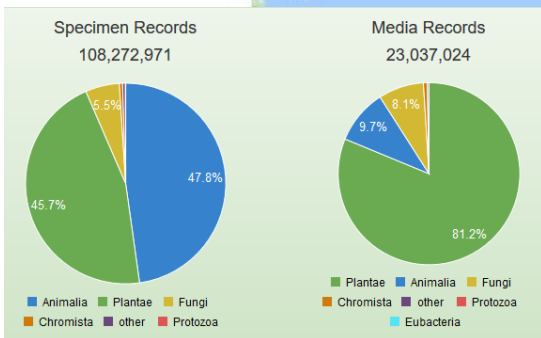


# Advancing Digitization of Biodiversity Collections ADBC National Digitization Network

675 participating collections in 336 institutions (20 TCNs + 23 PENs)

Vertebrates,  
invertebrates,  
plants, fossils, fungi,  
tissues, sounds,  
videos, 2D, 3D, ...

Developing  
networks,  
enhancing  
communication,  
facilitating  
collaboration

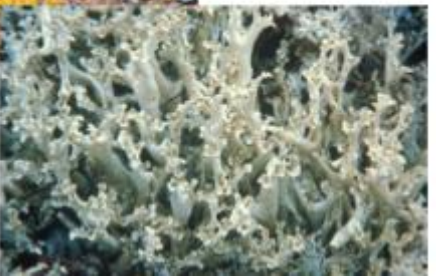
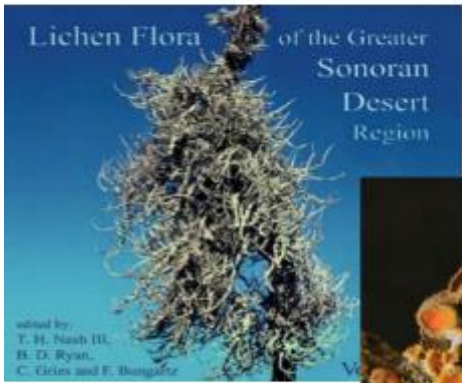


iDigBio Portal has  
1,537 recordsets  
containing 108M  
records for ~318M  
specimens with  
23M associated  
media records

# Thematic Collections Networks (2 of 20)...

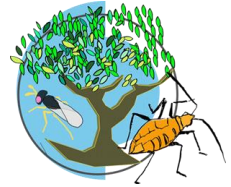


■ Lichens and Bryophytes



Environmental Change

■ Tri-Trophic Relationships



Feed on plants



Lay eggs on aphids



Agriculture



- Southwest Collection of Arthropods TCN *evolves*
  - into Symbiota Collections of Arthropods Network
  - From one project to many projects
  - Supported by a common platform
  - Customized based on community input
- 3 TCNs SCAN, LepNet, and InvertEBase
- Each museum or project is a separate collection in the database
  - but all collections searchable together

Search Criteria

Records and Taxa

Collections Records Taxa

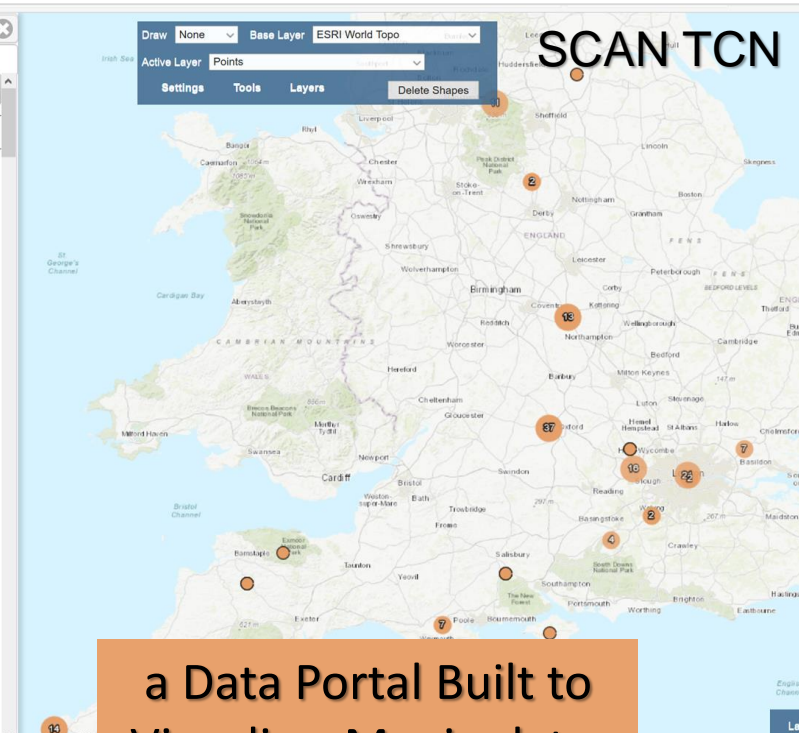
Download

Download Type [v] Download

1 2 3  
Page 1, records 1-100 of 264

Select/Deselect all Records

Catalog #	Collector	Date	Scientific Name
<input type="checkbox"/> fmnhins 0000117 704	R. Miller	03 September 1951	Myrmica rubra
<input type="checkbox"/> fmnhins 0000117 705	R. Miller	15 August 1951	Myrmica rubra
<input type="checkbox"/> fmnhins 0000117 706	R. Miller	15 August 1951	Myrmica rubra
<input type="checkbox"/> fmnhins 0000117 770	R. Miller	03 September 1951	Myrmica rubra
<input type="checkbox"/> fmnhins 0000117 775	R. E. Gregg	08 July 1957	Myrmica rubra
<input type="checkbox"/> fmnhins 0000117 778	R. Miller	06 September 1951	Myrmica rubra
<input type="checkbox"/> fmnhins 0000117 780	E. V. Gregg	29 July 1965	Myrmica rubra
<input type="checkbox"/> fmnhins 0000117 781	R. E. Gregg	08 July 1957	Myrmica rubra
<input type="checkbox"/> fmnhins 0000117 784	E. V. Gregg	30 July 1965	Myrmica rubra
<input type="checkbox"/> fmnhins 0000117 887	R. Miller	22 March 1952	Myrmica rubra



a Data Portal Built to Visualize, Manipulate, and Export Species Occurrences

# Community Building

Search

search all fields

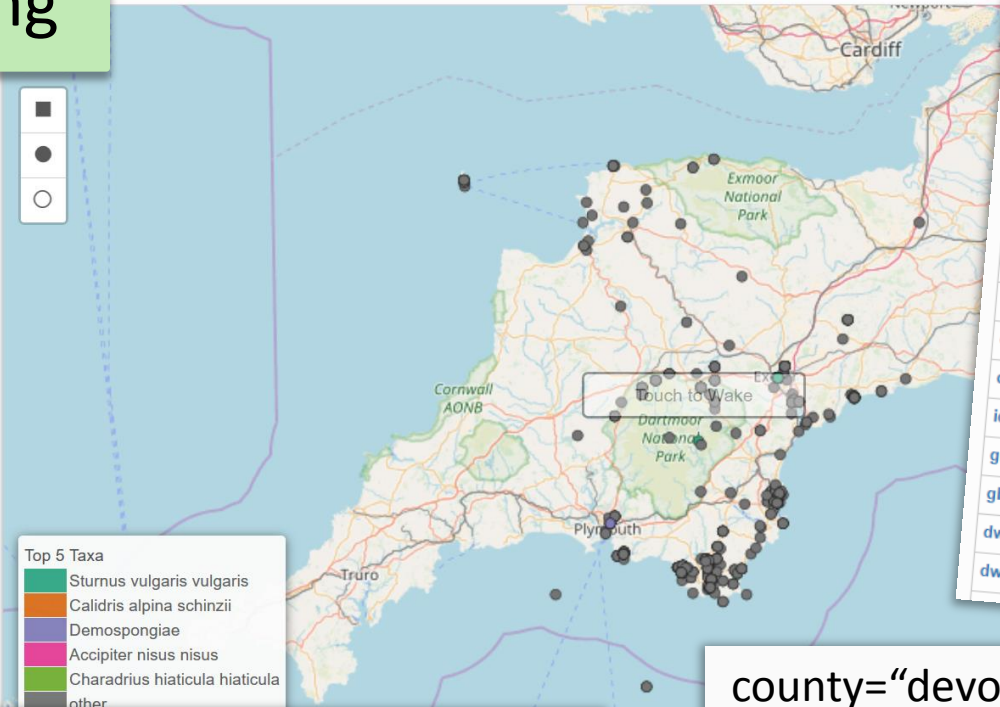
Must have media  Must have map point

Filters Mapping Sorting Download

Add a field  Clear

County/Parish   Present  Missing

Country   Present  Missing



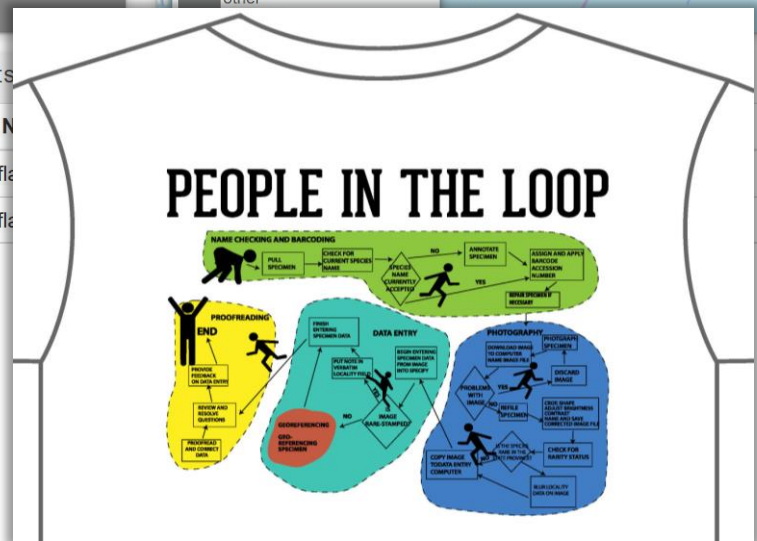
county="devon"  
2,124

Data Corrected	Data Use	Raw
This table shows any data corrections that were performed. This table represents the correction performed. The last two columns show the data quality flags and their descriptions can be found in the recordset.		
Flag		
dwc_datasetid_added		
dwc_parentnameusageid_added		
dwc_taxonid_added		
dwc_taxonomicstatus_added		
gbif_canonicalname_added		
gbif_genericname_added		
gbif_taxon_corrected		
dwc_taxonrank_added		
dwc_kingdom_added		
idigbio_isocountrycode_added		
gbif_reference_added		
gbif_vernacularname_added		
dwc_phylum_added		
dwc_multimedia_added		

- Activities**
- Digitization**
- Workflows**
- Protocols
- Task Clusters
- Dissemination

- Research Use**
- Tool collaboration
- Portal development
- ENM workshop
- Research Spotlight
- Data quality**

- Methods**
- Workshops**
- Webinars**
- Symposia
- Conferences
- Working Groups**
- Short Courses
- Adobe Connect
- Listservs
- Publications
- Social Media



Country	Collection Code
United Kingdom	<b>Education Outreach</b>
United Kingdom	Citizen Science
	K-12 materials
	Undergraduate
	Fossil Clubs
	Mentor teachers

- Training**
- Biodiversity data skills
- Data literacy
- Collections software
- Imaging
- Project Management

## iDigBio Success: Workshop Principles

- Community-driven process
- Each workshop
  - Created in response to need
  - Organized by interested parties
  - Attended by diverse group
- Geographical distribution of sites
- Demographic distribution
- Repository of materials for all



# @iDigBio: many resources for mobilization

## Recommendations for the Acquisition, Processing, and Archiving of Digital Media

iDigBio has created recommendations for capturing, processing, and storing digital media.

[Recommendations for the Acquisition, Processing, and Archiving of Digital Media](#)

## Interest/Working Groups

The following links take you to Interest/Working Groups focused on Digitization. For other working groups please use the following links:

- [International Whole-Drawer Digitization Interest Group](#)
- [NANSH Working Group](#) (North American Network of Small Collections)
- [Fluid-preserved Arthropod and Microscopic Slide Imaging Interest Group](#)
- [Paleontology Digitization Working Group](#)
- [Small Collections Network Working Group](#)
- [Vertebrate Digitization Interest Group](#)
- [Field Station Interest Group](#)

## Digitization Avenue

The following links provide information on the task clusters that are currently being implemented. For more information on these clusters please read the following [Five task clusters that enable digitization](#)

- [Pre-digitization Curation and Staging](#)
- [Specimen Image Capture](#)
- [Specimen Image Processing](#)
- [Electronic Data Capture](#)
- [Georeferencing Locality Descriptions](#)
- [Digitization Workflows and Protocols](#)
- [More on digitization](#)

## Digitization Resources

This page provides resources and information for the series of digitization training materials as well as a plethora of digitization information and resources. Included is a guide to digitization, videos, presentations, and other important information related to biological collections.

**Contents** [\[hide\]](#)

- 1 [iDigBio Introduction](#)
- 2 [Digitization Resources](#)
- 3 [Recommendations for the Acquisition, Processing, and Archiving of Digital Media](#)
- 4 [Interest/Working Groups](#)
- 5 [Digitization Avenue](#)
- 6 [iDigBio Workshops, Reports, and Wikis](#)
- 7 [Videos- Digitization Resources and Workflows](#)

### Researchers

[Browse our specimen portal](#)



### Collections Staff

[Learn how your collection can benefit from our work](#)



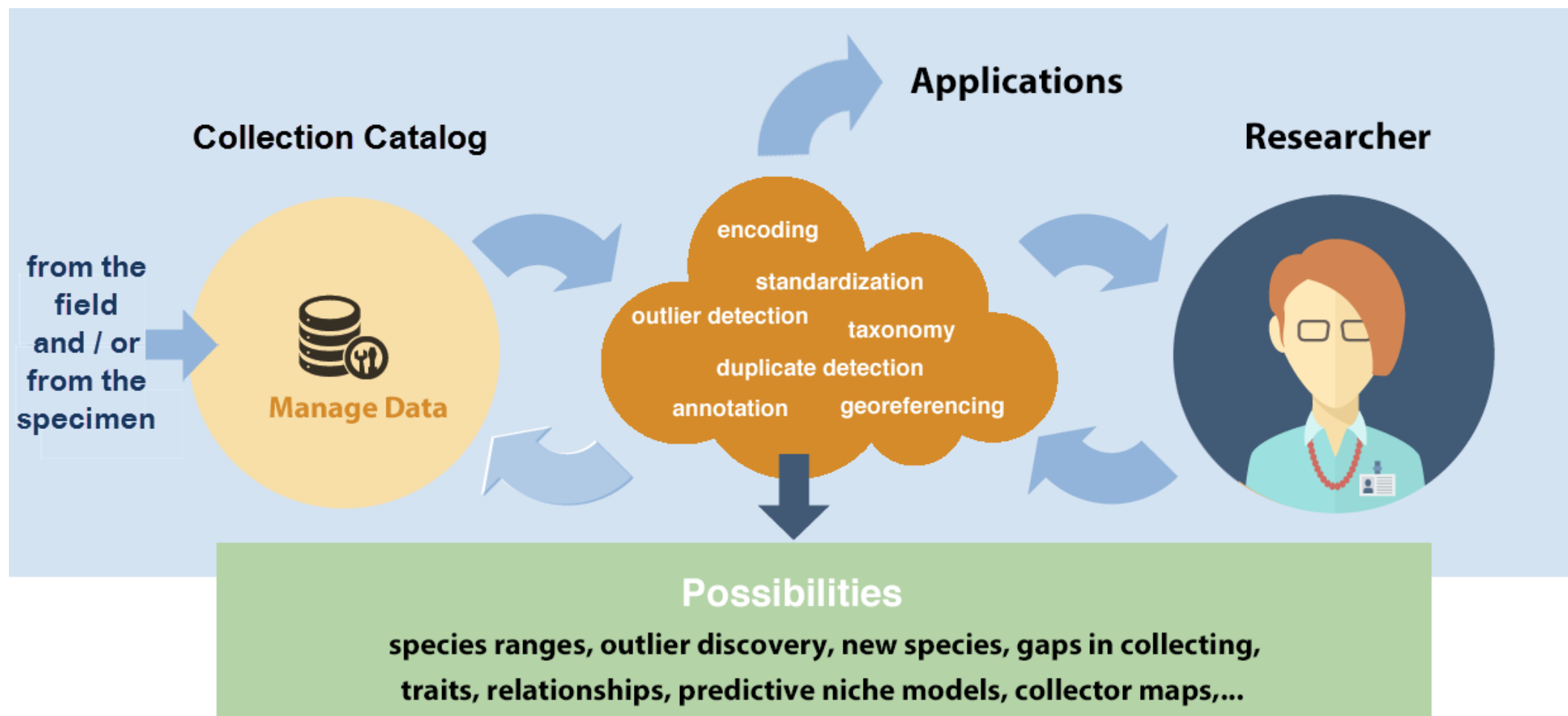
### Teachers & Students

[Learning resources & opportunities to engage](#)



## Workshops reveal pattern of skills needs and knowledge gaps


- What skills are needed to mobilize and use the data?



# Workshops reveal pattern of skills needs and knowledge gaps

- Digitisation workflow workshops
  - Flat Sheets and Packets, Pinned Specimens in Trays and Drawers, Things in Spirits, 3D objects in Trays, Imaging, ...
- Capacity building needs revealed
  - software
  - standards
  - data cleaning and management
  - spreadsheets, text files
  - data visualization and synthesis
  - recognizing automatable tasks
  - limited number of people in the community with the necessary skills

## Actions

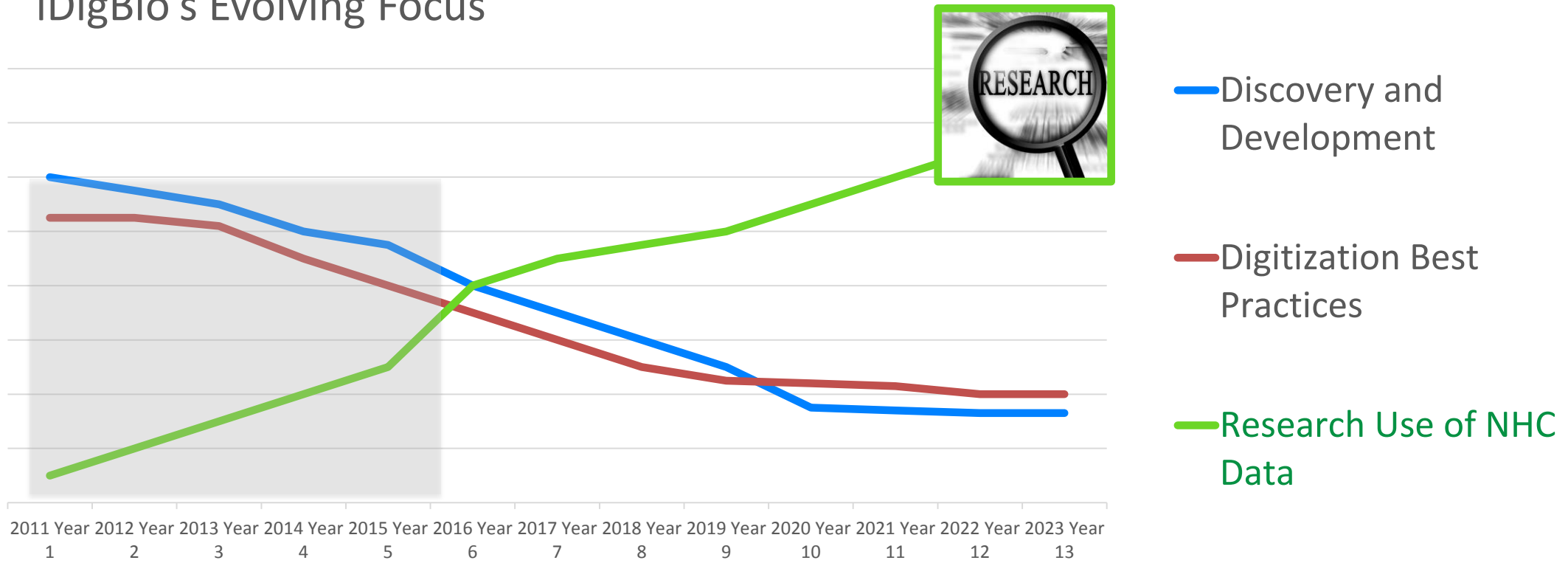
- Partner in developing and implementing Data Carpentry, now  THE CARPENTRIES
- Biodiversity Informatics Workshop Series at iDigBio
  - Data Carpentry
  - Managing NHC Data
  - Demystifying Data Standards and the IPT
  - Field to Database
- Partner in [Biodiversity Informatics 101](#) at SPNHC
- Partner in Darwin Core Hour





# Developing a Collections Digitization and Data Use Community

iDigBio's Evolving Focus



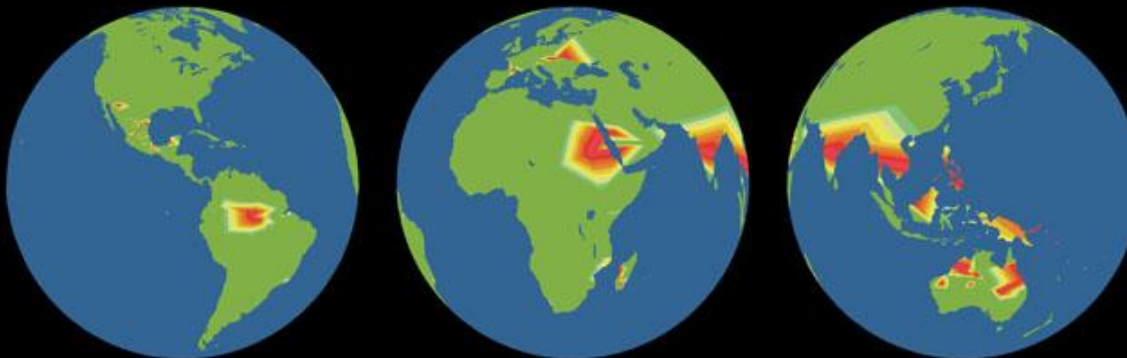
## predicting extinction

Sinervo, B. *et al.* Erosion of lizard diversity by climate change and altered thermal niches.

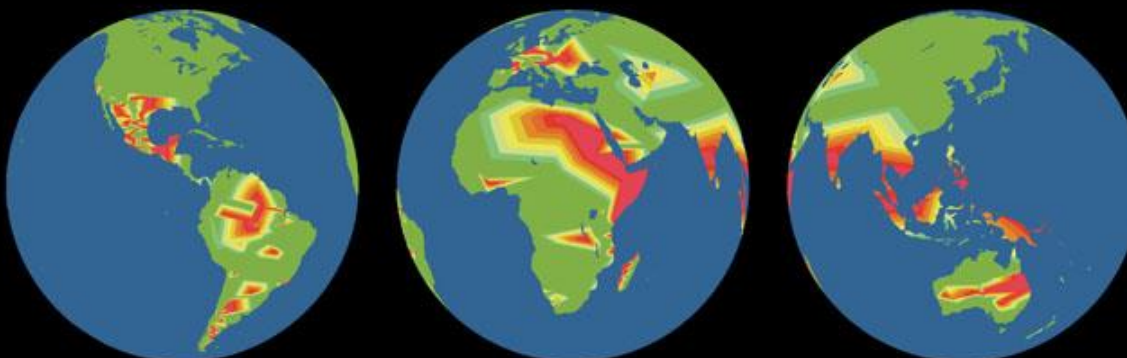
*Science* **328**,  
894-899  
(2010)

used with permission

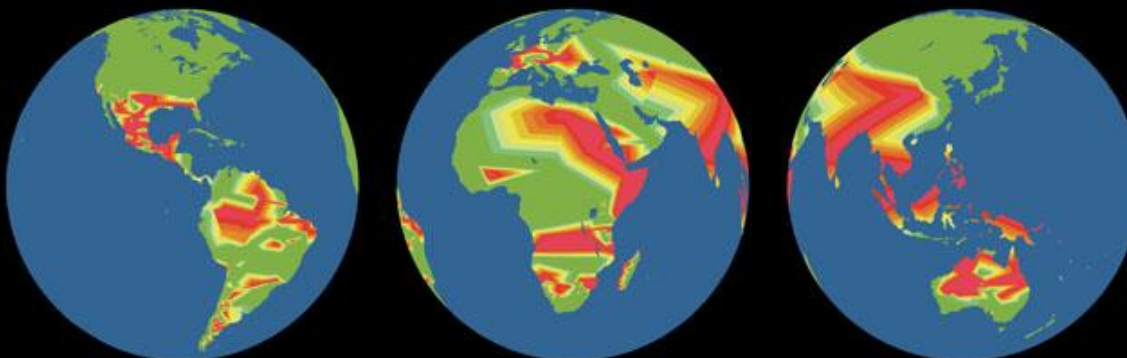
Species locally extinct by 2009



Species totally extinct by 2050



Species totally extinct by 2080



By the numbers:  
2009

- 4% local extinction
- $R^2 = 0.72$  in a global validation with 8 other lizard families

**IN NEW species-level models  $R^2 = 0.86$**

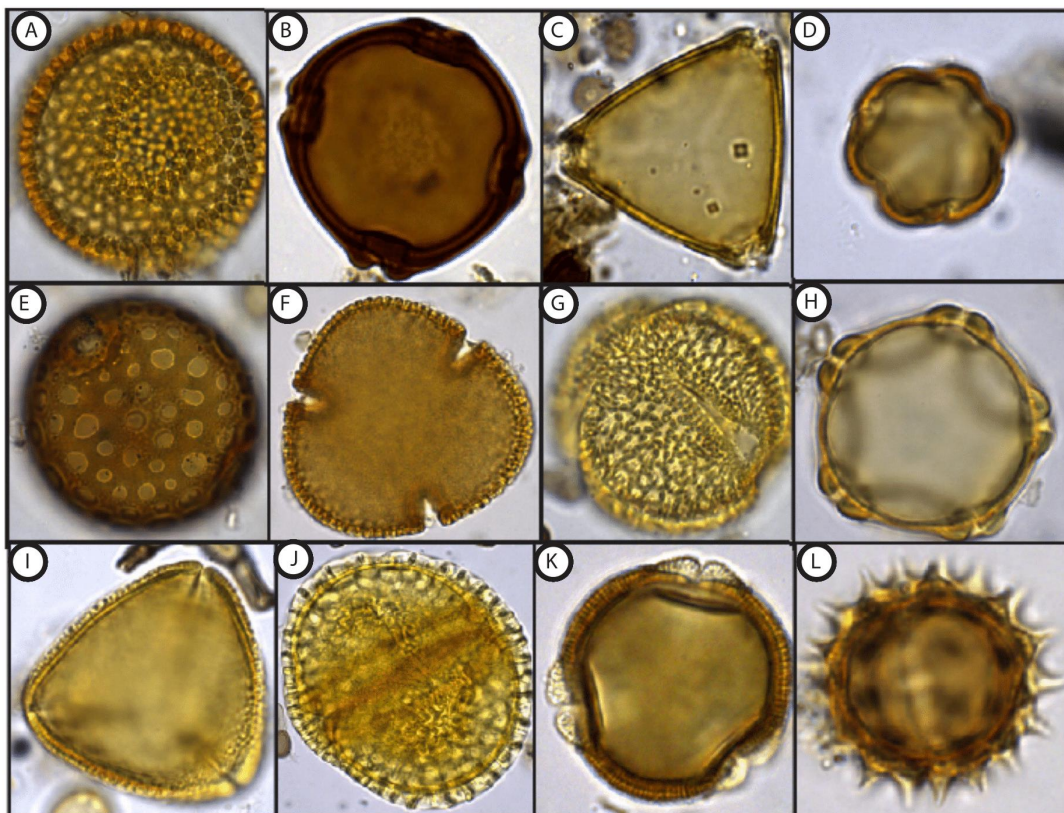
2050

- 6% species extinction
- 100% in some areas

2080

- 20% species extinction
- 100% in many areas

# Using convolutional neural networks to automate tropical pollen counts and identification

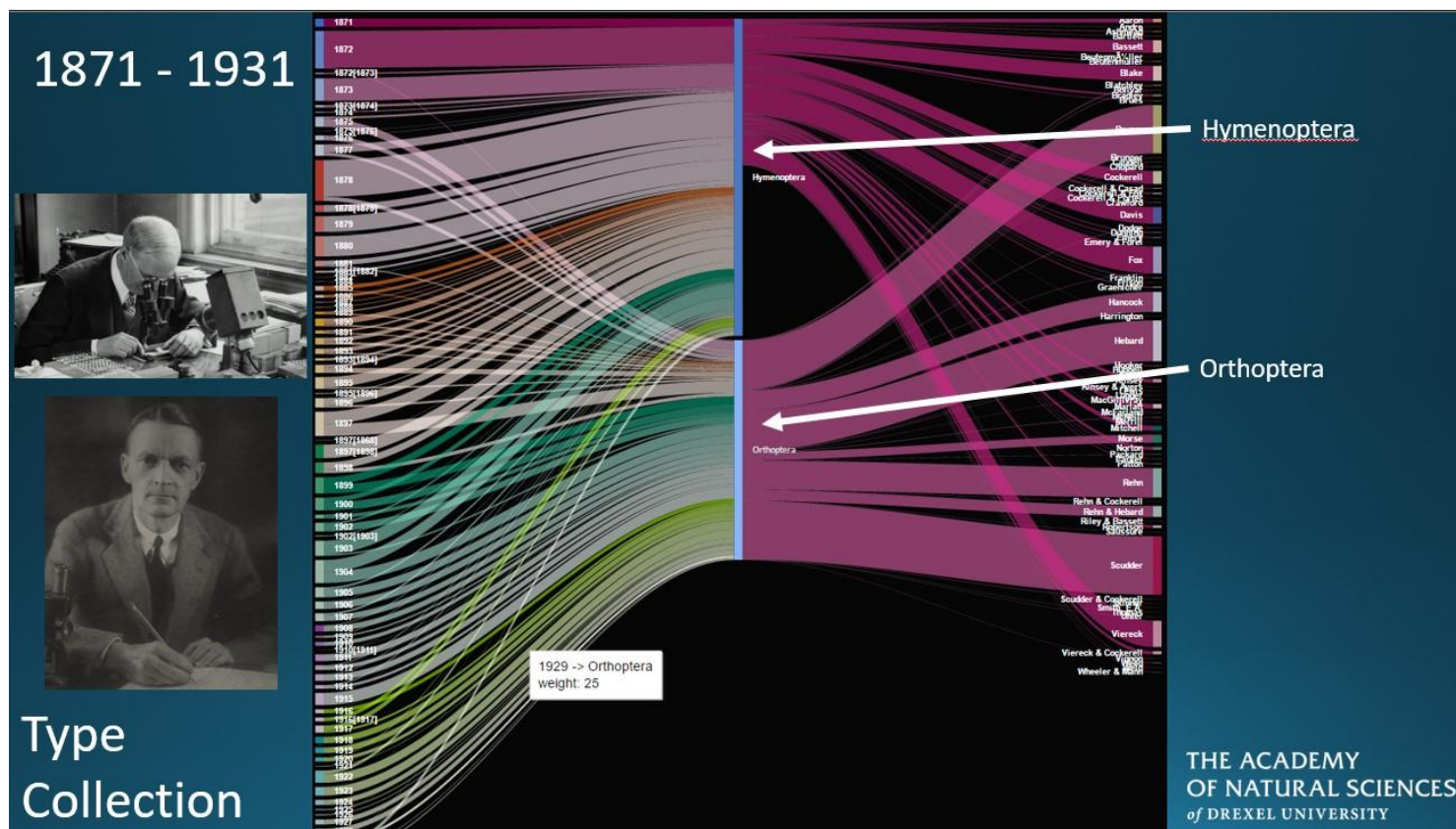


*A sample of different pollen grain morphology*

- Pollen and spore (palytomorph) records provide one of the most comprehensive archives of terrestrial vegetation history, dating as far back as the first land plants approximately 470 million years ago
- ...partnered with Dr. Charles Fowlke's computer vision group at the University of California Irvine to automate pollen counts and identifications using a convolutional neural net (CNN) machine learning approach.
- Microscope slides from both BCI pollen rain records were imaged using a slide scanning microscope
- The CNN and a non-maximum suppression approach were used to scan each image for morphological patterns corresponding to each pollen id.

# Collecting trends: how wars and human history influence biological collections

-- Contributed by Vaughn Shirey, The Academy of Natural Sciences of Drexel University



“My research focuses on the historical biases present in natural history collection data, including identifying collection bias and gaps in data due to human history. Coupling these approaches with interactive visualization aids helps to weave a story about the development of entire natural history collections.”

Figure 2. Contributions to the type collection from 1871-1931. Hymenoptera and Orthoptera are on equal footing as far as the number of specimens added. Large contributors to Orthoptera include A.G. Rehn (top left photo) and Morgan Hebard (bottom left photo).

## What can you do with 300,000 dead bees?

A lot, as it turns out. With biodiversity under threat worldwide, scientists say old-school specimen collections — including an impressive hoard of bees at York University — have a crucial role to play in research.



1. Planning  
s Gunman  
pened

2.



Las Vegas Gunman's  
Girlfriend, Marilou  
Danley, Arrives for  
Questioning

3.



Las Vegas Shooting:  
F.B.I. Still Seeking  
Motive as Gunman's  
Girlfriend Returns

4.



LIVE BRIEFING  
Gunman's Girlfriend  
Arrives in U.S. and Is  
Expected to Be...

5.



OP-ED COLUMNIST  
If Only Stephen  
Paddock Were a  
Muslim

6.



Rex Tillerson, Tru  
Secretary of State,  
Reaffirms Support  
for President

# A Guide to Digitized Natural History Collections

By MICHAEL ROSTON OCT. 19, 2015

Natural history museums around the world have been growing beyond display cases and dioramas for years, and many are digitizing their vast collections. These efforts create lasting records of the natural world that might otherwise be inaccessible, unless you know a friendly curator willing to take you behind the scenes. Below are several notable digitization efforts that you can explore, and even contribute to.

Do you have a favorite digitized science museum collection? Send it to us at [scitimes@nytimes.com](mailto:scitimes@nytimes.com), and we'll look to expand this guide in the future.



# SCIENTIFIC REPORTS

**OPEN** *Macrodinychus* mites as parasitoids of invasive ants: an overlooked parasitic association

Received: 30 January 2016 | Jean-Paul Lachaud<sup>1,2</sup>, Hans Klompen<sup>3</sup> & Gabriela Pérez-Lachaud<sup>1,2</sup>

**Taxonomic and Behavioral Composition of an Island Fauna: A Survey of Bees (Hymenoptera: Apoidea: Anthophila) on Martha's Vineyard, Massachusetts**

Author(s): Paul Z. Goldstein and John S. Ascher  
Source: Proceedings of the Entomological Society of Washington, 118(1):37-92.

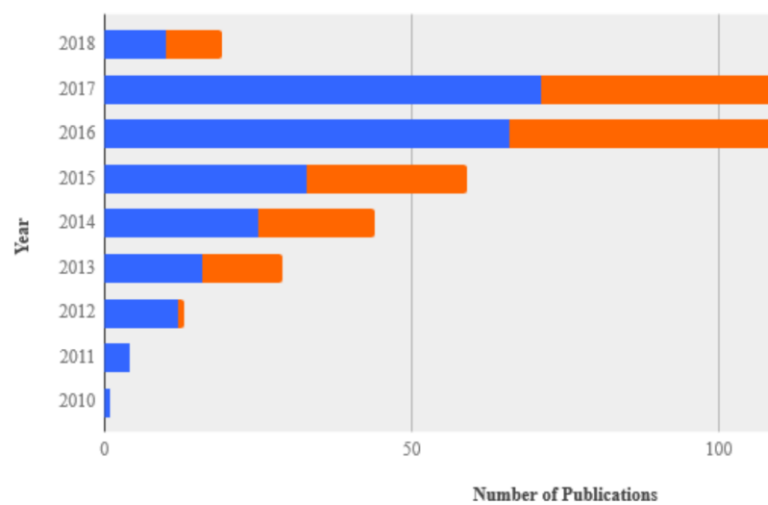
Biodiversity Data Journal 4: e10356  
doi: 10.3897/BDJ.4.e10356

Editorial

**Species Conservation Profiles compliant with IUCN Red List of Threatened Species**

Pedro Cardoso<sup>1,2,3</sup>, Pavel Stoerl<sup>4</sup>, Teodor Georgiev<sup>1</sup>, Viktor Senderov<sup>4,5</sup>, Lyubomir Penev<sup>6</sup>

## ADBC Publications as of 2/13/18



**Beetles (Coleoptera) of Peru: A Survey of the Families. Erotylidae Latreille, 1802**

Author(s): Joseph V. McHugh and Caroline S. Chaboo  
Source: Journal of the Kansas Entomological Society, 88(2):274-282.

**Diagnosis of the genus *Gonorrhynchus* McClelland (Teleostei: Cyprinidae: *G. watanah* (Sykes)**

PATRICK J. CICCOTTO & LAWRENCE M. PAGE

***Scholtzicoris linnavuorii*, new genus and new species of Myrtaceae-Feeding plant bug from Western Australia (Hemiptera: Heteroptera: Miridae: Phyllinae: Semiini: Exocarpocorina)**

Author(s): Randall T. Schuh  
Source: Entomologica Americana, 122(1):156-163.

Most species are not limited by an Amazonian river postulated to be a border between endemism areas

Sergio Santorelli Jr. , William E. Magnusson & Claudia P. D.

**Patterns of abiotic niche shifts in allopolyploids relative to the progenitors**

Methods in Ecology and Evolution

**The effect of repeated, lethal sampling on wild bee abundance and diversity**

Zachariah J. Gezon<sup>1,2\*</sup>, Eli S. Wyman<sup>3</sup>, John S. Ascher<sup>4</sup>, David W. Inouye<sup>2,5</sup> and Rebecca E. Irwin<sup>1,2</sup>

**Computers and Electronics in Agriculture**  
Volume 145, February 2018, Pages 311-318

**Deep learning models for plant disease detection and diagnosis**  
Konstantinos P. Ferentinis

**Mesoamerican Herpetology**  
www.mesoamericanherpetology.com

**The herpetofauna of Nayarit, Mexico: composition, distribution, and conservation status**

GUILLERMO A. WOOLRICH-PIÑA<sup>1</sup>, PAULINO PONCE-CAMPOS<sup>2</sup>, JESÚS LOC-BARRAGÁN<sup>3</sup>, JUAN PABLO RAMÍREZ-SILVA<sup>4</sup>, VICENTE MATA-SILVA<sup>1</sup>, JERRY D. JOHNSON<sup>4</sup>, ELI GARCÍA-PADILLA<sup>4</sup>, AND LARRY DAVID WILSON<sup>6</sup>

Standards in Genomic Sciences  
SIGS

MEETING REPORT Open Access

**Meeting report: Identifying practical applications of ontologies for biodiversity informatics**

John Deck<sup>1,2</sup>, Robert Guralnick<sup>2</sup>, Ramona Walls<sup>3</sup>, Stanley Blum<sup>4</sup>, Melissa Haendel<sup>5</sup>, Andréa Matsunaga<sup>6</sup> and John W.

**Botany**  
Explore this journal >

**Herbarium specimens show patterns of fruiting phenology in native and invasive plant species across New England**

Amanda S. Gallinat , Luca Russo, Eli K. Melaas, Charles G. Willis, Richard B. Primack  
First published: 12 February 2018 Full publication history  
DOI: 10.1002/ajb2.1005 View/save citation

**Palaeontologia Electronica**  
http://palaeo-electronica.org

**The Digital Atlas of Ancient Life: delivering information on paleontology and biogeography via the web**

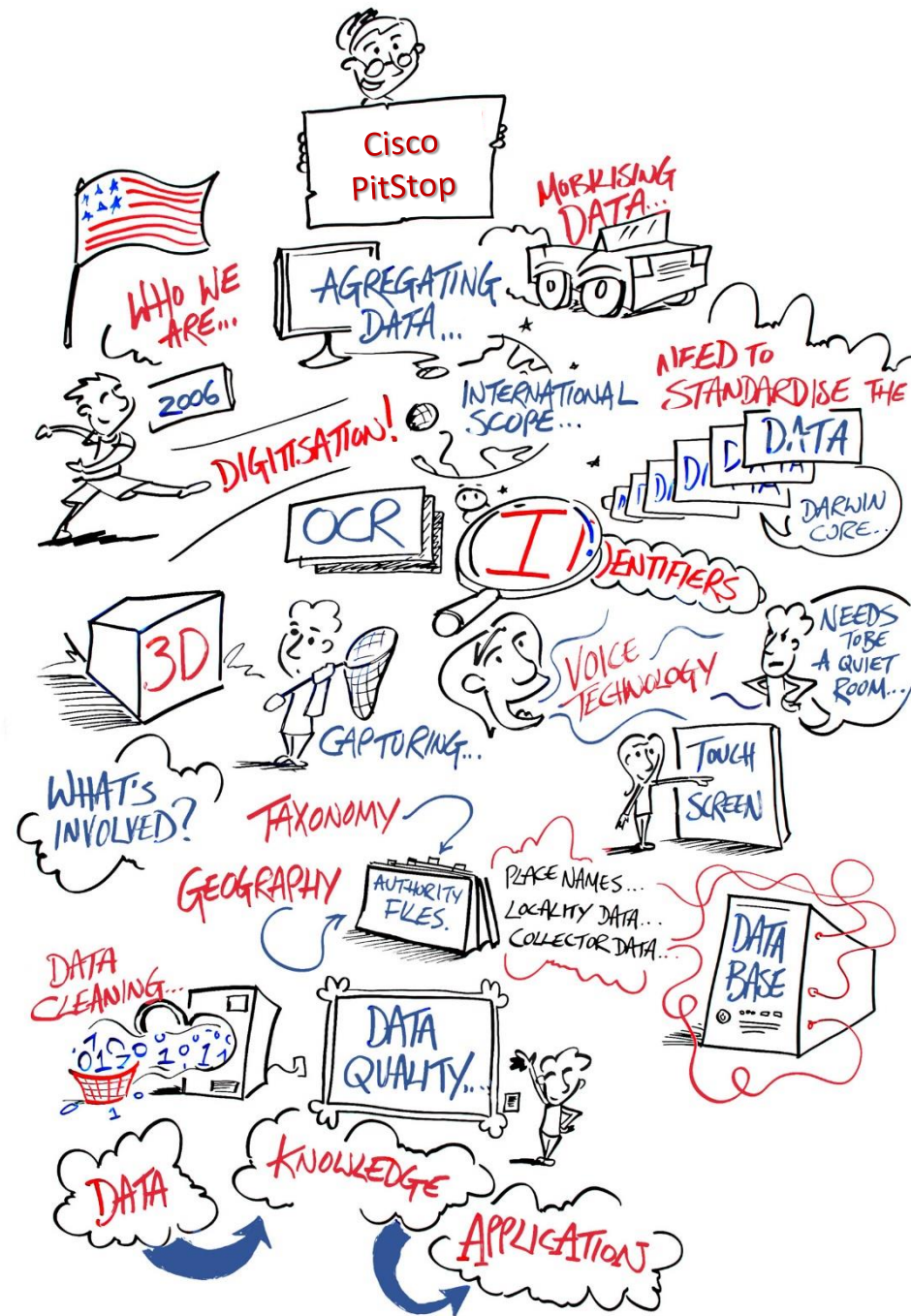
Jonathan R. Hendricks, Alycia L. Stigall, and Bruce S. Lieberman

**Palaeogeography, Palaeoclimatology, Palaeoecology**  
Available online 20 January 2018  
In Press, Corrected Proof

**Quantitative palaeobiogeographical analysis of South American Neogene Chioninae (Bivalvia: Veneridae)**  
Pérez, Damián Eduardo , Ezcurra, Martín Daniel

## More research published

- Workflows
- Digitisation methods
- Imaging, CT, recordings, CNN
- Phenology
- Public participation
- Georeferencing
- Small collection import
  - gap analysis strategic planning, research
  - awareness





## Exemplary initiatives



- Entomological Collections Network

- creates a cohesive entomological collections family



- SPNHC CC Network and EPG

- University affiliated
- creates momentum, addresses limited expertise and money, while capitalizing on opportunities for students and early career professionals to drive change



- We Dig Bio

- Public Participation
- Visibility and engagement in local and worldwide events
  - creates worldwide relevance for your small collection and community

*North American Network  
of Small Herbaria*



- NANSH.org

- offers a complete model from how to organize and
- where to share results



- The Carpentries

- foundational biodiversity informatics skills and literacy for reproducible research

## Where does iDigBio go from here?

- Limited time program (10 years)
- How to sustain activities?
  - Digitization projects?
  - Support for digitization improvements?
  - Data mobilization and use skills?
- How to sustain data infrastructure?
  - Data persistence?
  - Data quality?
  - Data portal?
- How to sustain commitment
  - Governmental?
  - Community?

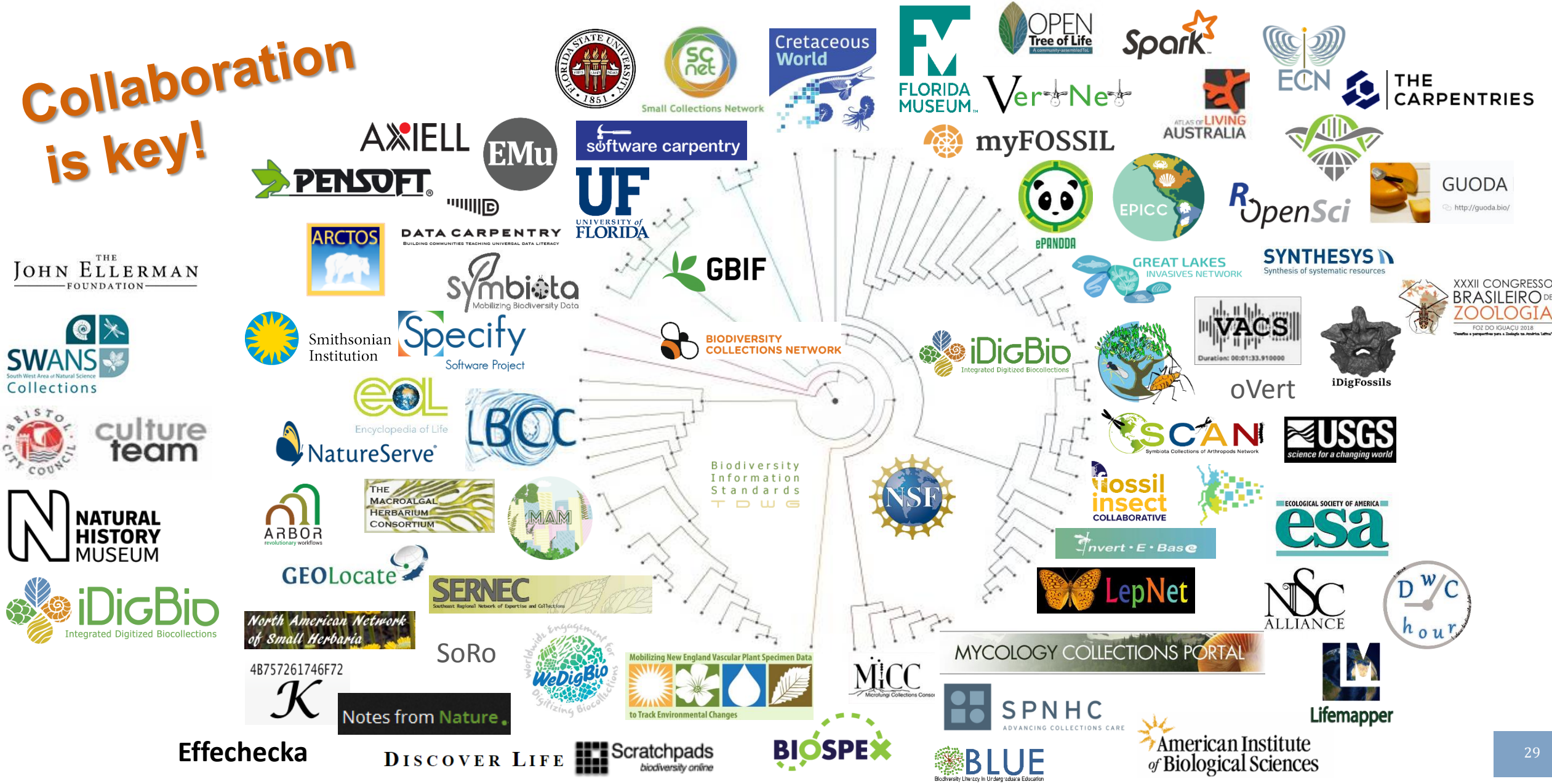


## iDigBio Successes: Using Data

- Take a look at the monthly [Research Spotlight](#) and [Research](#) on our website.
- Watch the presentations and read discussions from the iDigBio workshop [Using Biodiversity Specimen-Based Data to Study Global Change](#).
- Be Ignited by speakers at the Ecological Society of America 2015 session [Enhancing Ecological Research with iDigBio Biological Specimen Data](#).
- Find out more about [Big Data and Bugs: How Massively Collected Biodiversity Data Are Changing the Way We Do Insect Science](#) at the Entomological Society of America 2017.
- Listen to Gil Nelson's talk highlighting Research Outcomes of the ADBC Community's Efforts to Digitize Data for Biodiversity Research at iDigBio's [Summit VII 2017](#).
- Discuss [open research project ideas on GitHub](#) with iDigBio and collaborators.
- Check out [GUODA](#) and [Effechecka](#) and [Fresh Data](#)



Collaboration  
is key!



From iDigBio, thank you very much for the opportunity to be part of developing a UK-wide strategy for cross-region small UK collections.



THE  
JOHN ELLERMAN  
FOUNDATION



culture  
team



[idigbio.org/wiki](http://idigbio.org/wiki)



[facebook.com/iDigBio](https://facebook.com/iDigBio)



[twitter.com/iDigBio](https://twitter.com/iDigBio)



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[idigbio.org/rss-feed.xml](http://idigbio.org/rss-feed.xml)



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