UNIVERSITY OF CAMBRIDGE

NatSCA
Natural Sciences Collections Association

CAMBRIDGE UNIVERSITY
Herbarium
DEPARTMENT OF PLANT SCIENCES

@CUHerb

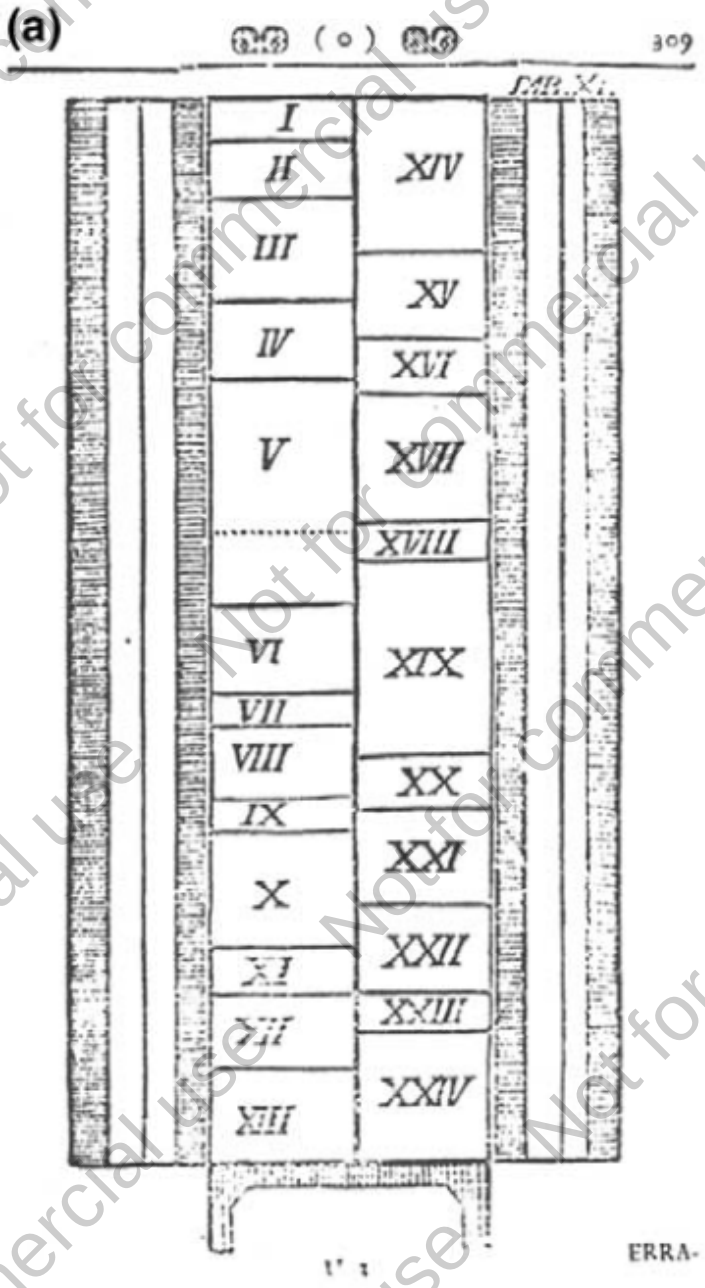
Lauren M. Gardiner

Care and use of herbarium specimens

Natural Science Collections: The Basics

1751

1938



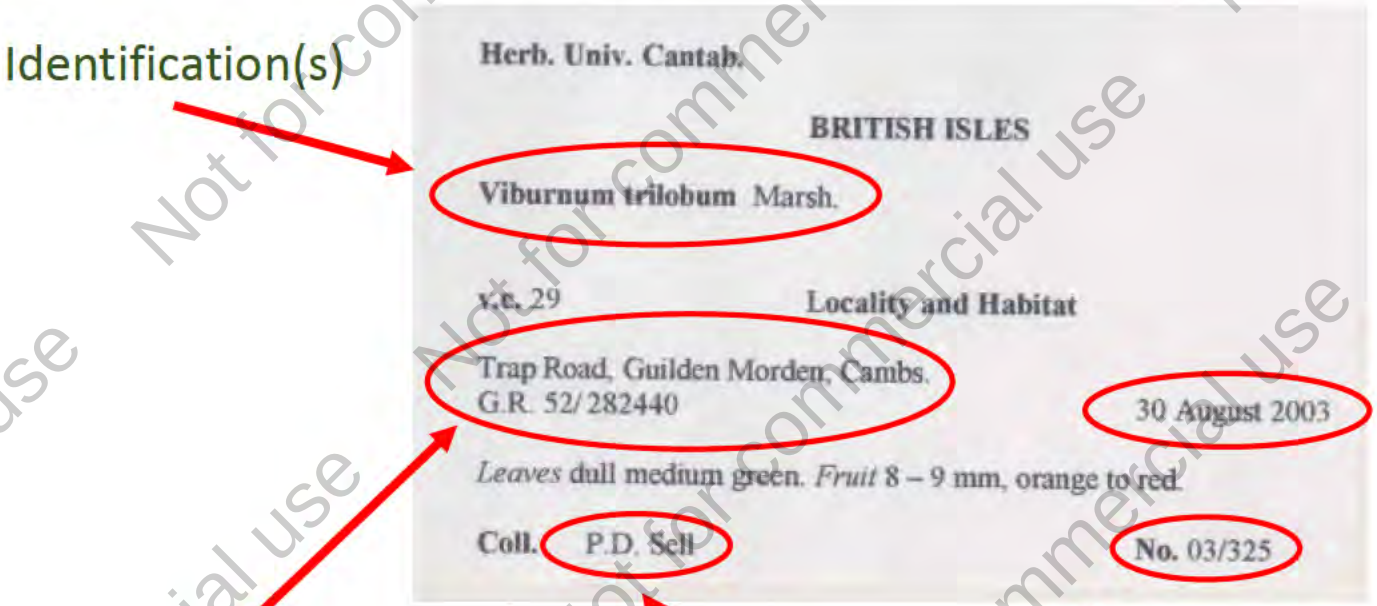
What is a herbarium specimen?

Specimen + associated information = <u>data</u>

Identification
Documentation

Verifiable
Vouchers

Specimen label data



Identification(s)

Date collected

Location information

Collector(s) & collection number

Barcode/unique identifier

What is a herbarium?

A collection of dried pressed plant specimens* with associated data

300+ years of fieldwork

Archive of plant diversity – heritage and scientific

Comparative studies over time, space, taxa (incl morphology, distribution, phenology, phylogenetic relationships, environmental change..)

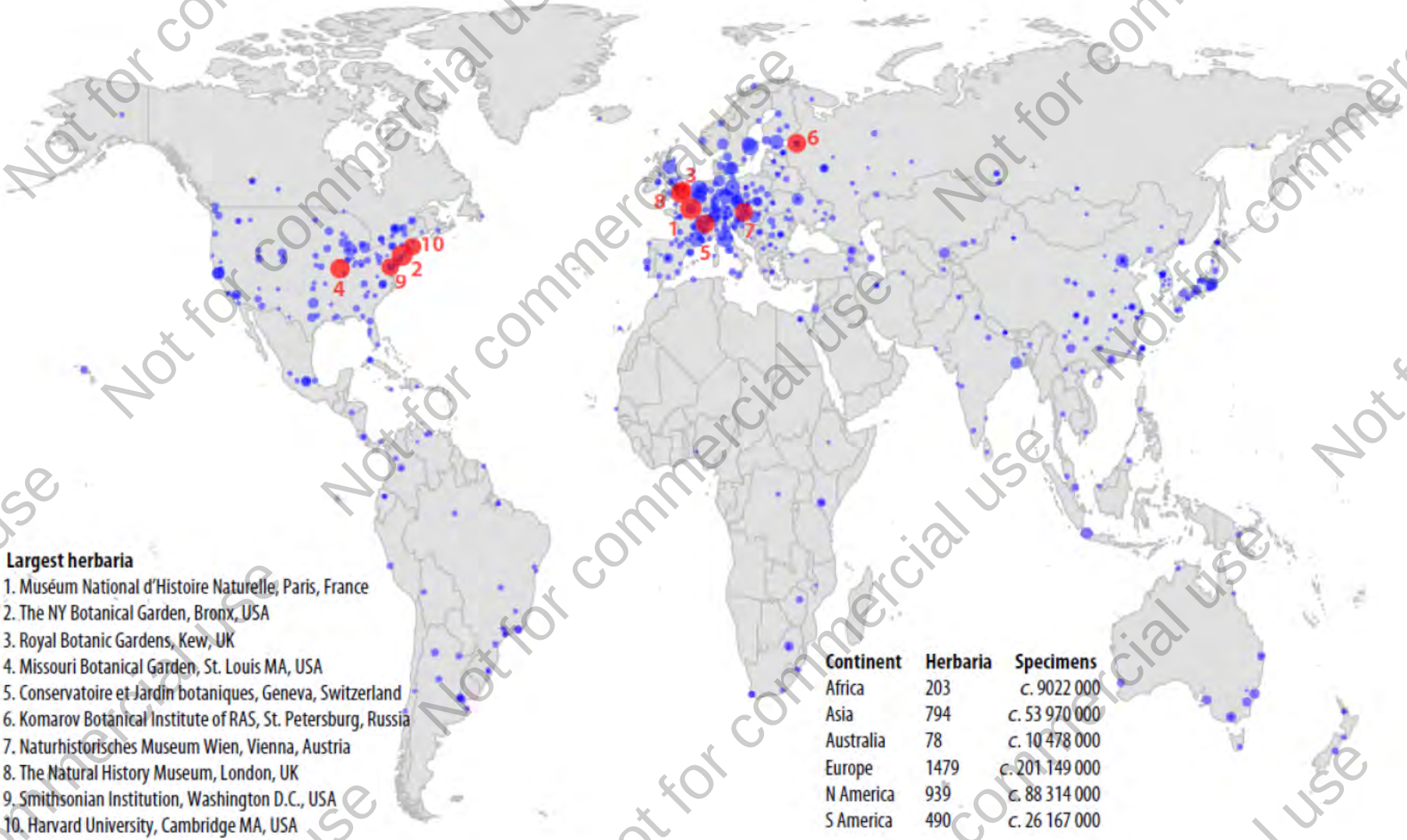
*usually

What is a herbarium?

Cambridge University Herbarium
international code: **CGE**

CGE c. 1.1M specimens = a huge research dataset

Worldwide over 3,000 herbaria c. 380M specimens
= an enormous, powerful collaborative research dataset and network



Largest herbaria

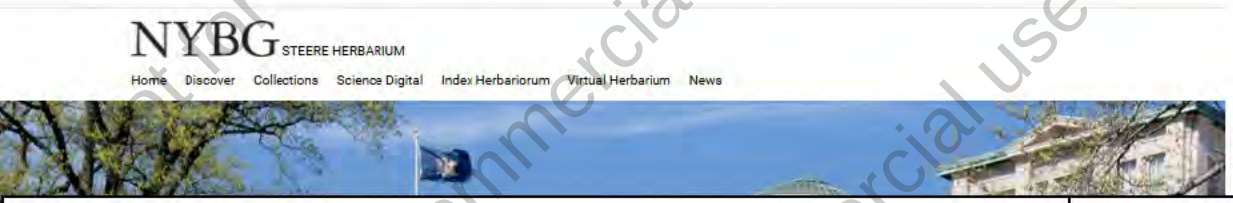
1. Muséum National d'Histoire Naturelle, Paris, France
2. The NY Botanical Garden, Bronx, USA
3. Royal Botanic Gardens, Kew, UK
4. Missouri Botanical Garden, St. Louis MA, USA
5. Conservatoire et Jardin botaniques, Geneva, Switzerland
6. Komarov Botanical Institute of RAS, St. Petersburg, Russia
7. Naturhistorisches Museum Wien, Vienna, Austria
8. The Natural History Museum, London, UK
9. Smithsonian Institution, Washington D.C., USA
10. Harvard University, Cambridge MA, USA

Continent	Herbaria	Specimens
Africa	203	*c.* 9022 000
Asia	794	*c.* 53 970 000
Australia	78	*c.* 10 478 000
Europe	1479	*c.* 201 149 000
N America	939	*c.* 88 314 000
S America	490	*c.* 26 167 000

Lang et al. (2019) *Using herbaria to study global environmental change*. **New Phytologist** 221: 110-122.

Index Herbariorum

http://sweetgum.nybg.org/science/ih/



NYBG STEERE HERBARIUM

Home Discover Collections Science Digital Index Herbariorum Virtual Herbarium News

Home » Index Herbariorum » **Herbarium Details**

Royal Horticultural Society Garden Wisley

EDIT CREATE NEW

Overview | Collections Summary | Staff | Map

Name
Royal Horticultural Society Garden Wisley

Herbarium Code
WSY

Current Status
Active

Correspondents
Yvette Harvey, Yvetteharvey@rhs.org.uk

Contact
[44] 01483 224234
Fax: [44] 01483 211750
Email: yvetteharvey@rhs.org.uk

Address
Herbarium
Royal Horticultural Society Garden Wisley
Woking
Surrey GU23 6QB
U.K.
https://www.rhs.org.uk/science/conservation-biodiversity/conserving-garden-plants/rhs-herbarium

CITES
GB 007

Specialty
Taxonomic Coverage: All groups of cultivated ornamental plants; standard specimens of cultivars
Geography: Mainly from U.K. and Europe

STEERE HERBARIUM

lections Science Digital Index Herbariorum Virtual Herbarium News

um » **Herbarium Details**

Cambridge University

EDIT CREATE NEW

Overview | Collections Summary | Staff | Map

Name
Cambridge University

Herbarium Code
CGE

Current Status
Active

Correspondents
Lauren Gardiner, Curator, lmg32@cam.ac.uk

Contact
Email: lmg32 [at] cam.ac.uk

Address
Cambridge University Herbarium
Plant Sciences Department, Sainsbury Laboratory
Cambridge University
c/o Sainsbury Laboratory, Bateman Street
Cambridge, England CB2 1LR
U.K.
https://data.plantsci.cam.ac.uk/herbarium/ [New website in preparation]

Specialty
Taxonomic Coverage: Historical material, Worldwide, UK material especially Cambridgeshire
Geography: Worldwide

Care and use of herbarium specimens

Natural Science Collections: The Basics

Decontamination: freezing, chemical treatment

Accessioning: logging, databasing

Mounting: techniques, materials

Naming: resources online and in literature, experts

Incorporation: local filing sequence, materials

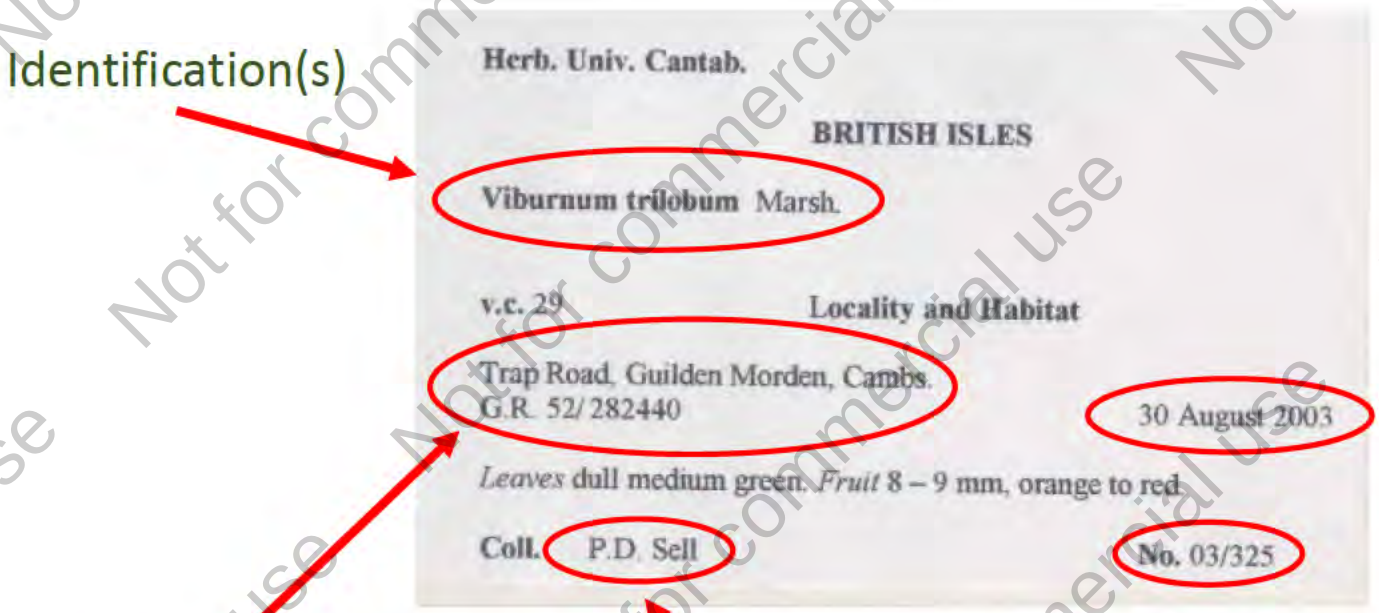
Storage: environment, pest control, handling

Research use: access, loans, digital, sampling

Decontamination

- freeze all incoming material (-30°C for 3 days, bag specimens during to control humidity)

Accessioning and databasing



Identification(s)

Date collected

Location information

Collector(s) & collection number

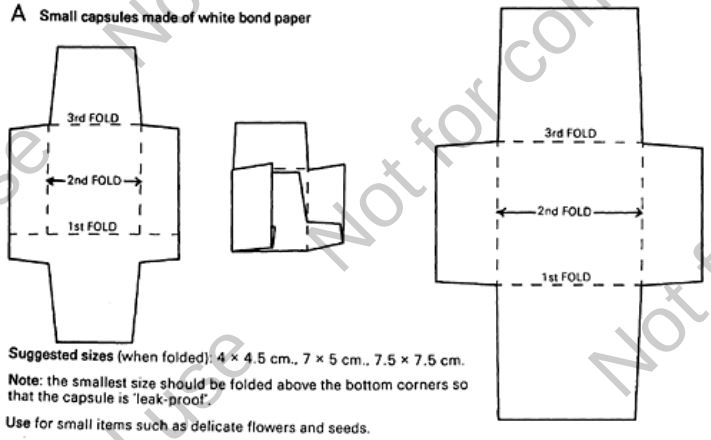
Physical location in collection

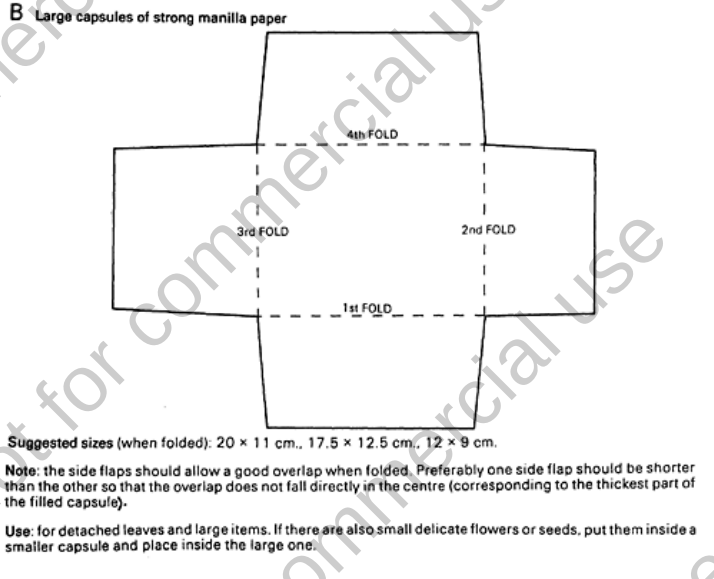
'Stored under' name

Barcode/unique identifier

Mounting and preparing specimens

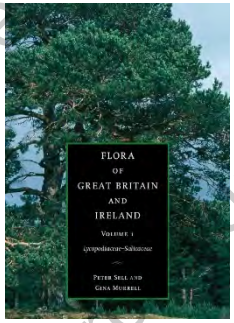
- strapping, gluing, sewing
- capsules/packets for loose and extra material
- associated collections eg. carpological and spirit collections

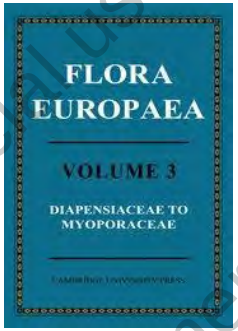


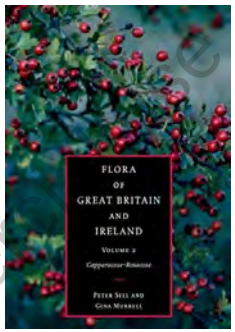


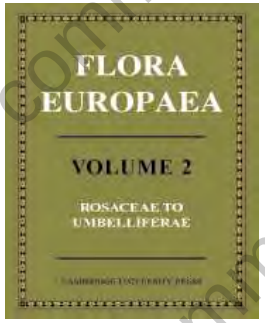
Naming specimens

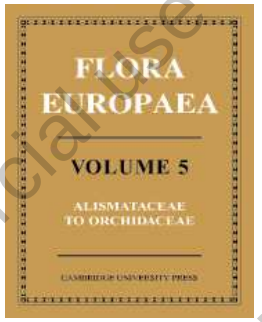
- Nomenclature and accepted names
  - recent/well accepted floras, The World Flora Online, The Plant List, World Checklist of Selected Plant Families, Index Fungorum, etc



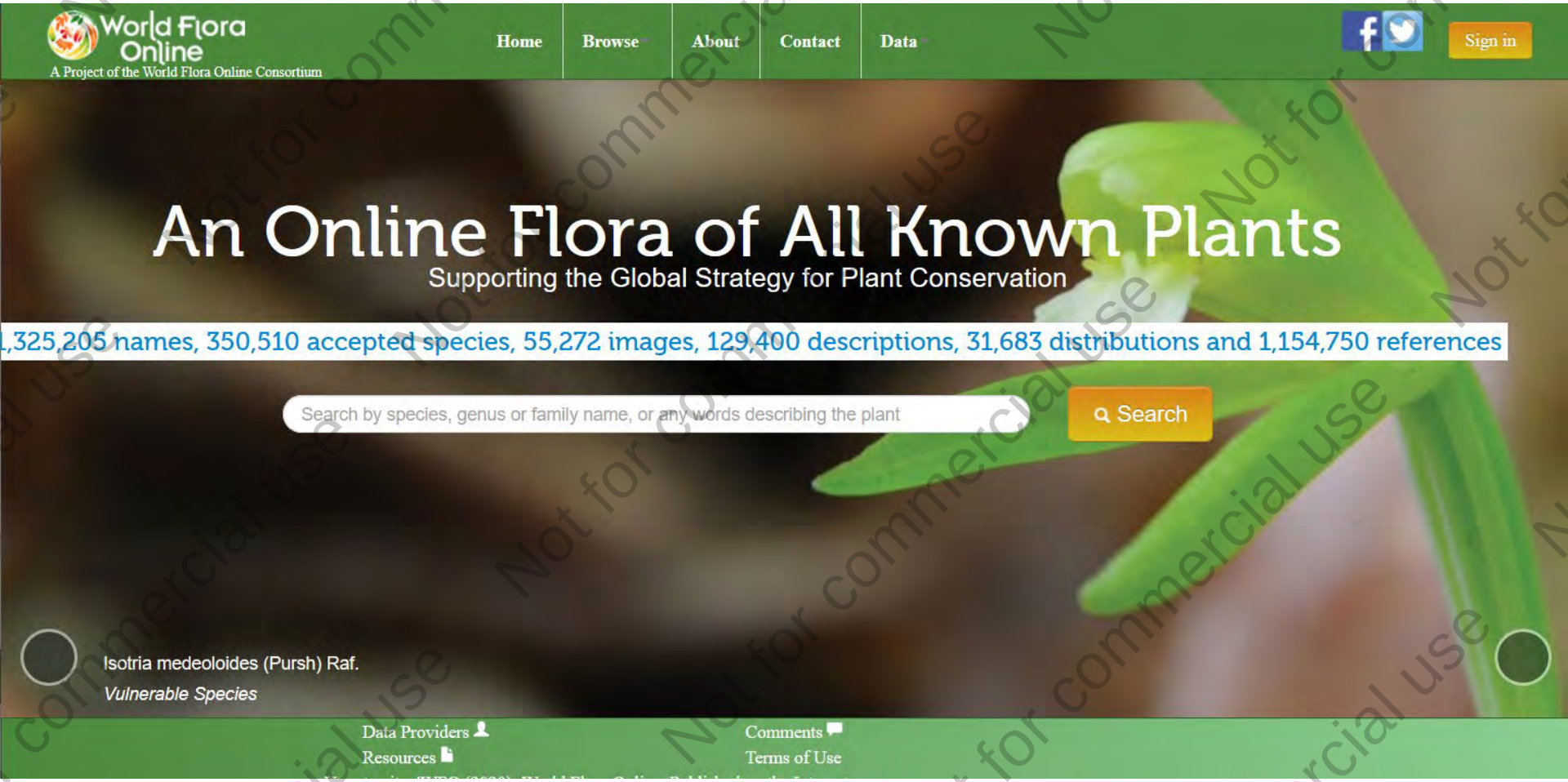








www.worldfloraonline.org



www.theplantlist.org

The Plant List — A working list of all plant species

Home | About | Browse | Statistics | Feedback | How to use this site

Kew

Missouri Botanical Garden

Global Compositae Checklist

The Plant List (TPL) was a working list of all known plant species produced by the botanical community in response to Target 1 of the 2002-2010 Global Strategy for Plant Conservation (GSPC). TPL has been static since 2013, but was used as the starting point for the Taxonomic Backbone of the ***World Flora Online (WFO)***, and updated information can be found at **www.worldfloraonline.org**.

WFO is being developed by a consortium of leading botanical institutions worldwide in response to the 2011-2020 GSPC's updated Target 1: to achieve an online Flora of all known plants by 2020. WFO welcomes feedback from users for improvements to its Taxonomic Backbone which is curated by a growing community of WFO Taxonomic Expert Networks (TENs).

The Plant List is a working list of all known plant species. It aims to be comprehensive for species of Vascular plant (flowering plants, conifers, ferns and their allies) and of *Bryophytes* (mosses and liverworts).

Collaboration between the Royal Botanic Gardens, Kew and Missouri Botanical Garden enabled the creation of The Plant List by combining multiple checklist data sets held by these institutions and other collaborators.

Version 1.1 (September 2013) replaces Version 1.0 which remains accessible here.

Search

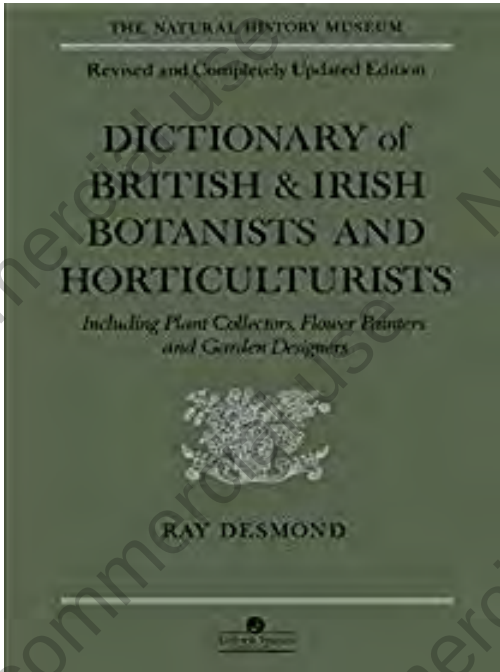
Enter a Genus (eg *Ocimum*) or genus and species (eg *Ocimum basilicum*).

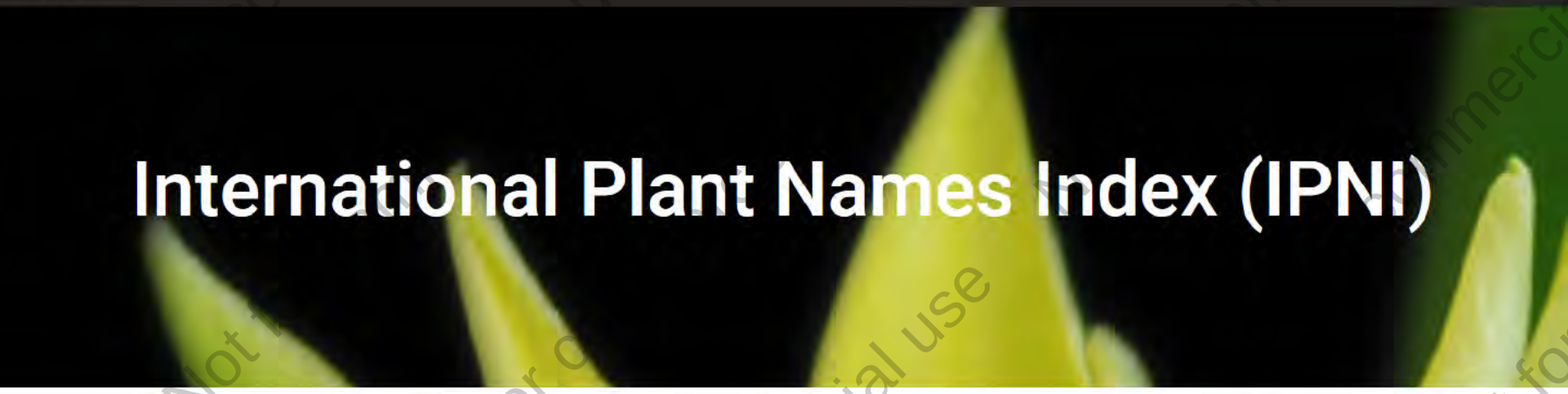
Enter a genus or genus and species | SEARCH

? will match a single character. * will match any number of characters. Use at least three letters in the genus name if you include a ? or *.

Naming specimens

- Nomenclature and accepted names
  - recent/well accepted floras, The World Flora Online, The Plant List, World Checklist of Selected Plant Families, Index Fungorum
- Authorities – International Plant Names Index (IPNI)
- Collectors – Desmond's Dictionary of British and Irish Botanists and Horticulturalists (1994), Harvard University Herbaria and Libraries Index of Botanists





International Plant Names Index (IPNI)

Search by plant name, author or publication

Advanced Search

Welcome to the International Plant Names Index (IPNI) produced by a collaboration between The Royal Botanic Gardens, Kew, The Harvard University Herbaria, and The Australian National Herbarium, hosted by the Royal Botanic Gardens, Kew. IPNI provides nomenclatural information (spelling, author, types and first place and date of publication) for the scientific names of Vascular Plants from Family down to infraspecific ranks. You can search for plant names, authors or publications in the search box above. Click the down arrow for advanced search options. New records are added daily, and the IPNI team are continuously working to improve data standardization.

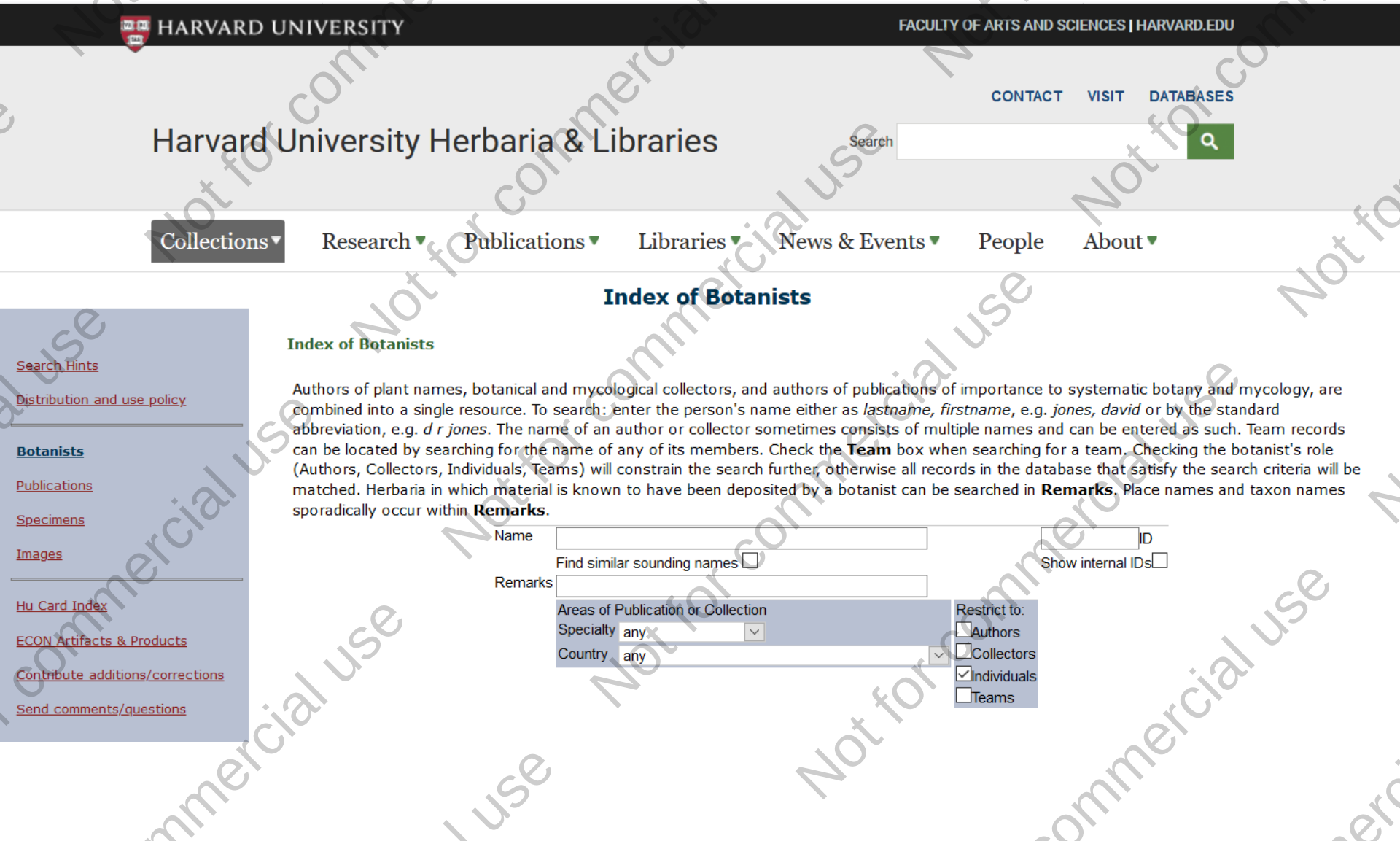
IPNI provides links to protologues in online articles or page scans from the Biodiversity Heritage Library as well as links to taxonomic data (synonymy and native distribution) through the Plants of the World Online.

If you have any questions, comments or feedback the team would be happy to hear from you by email at ipnifeedback@kew.org

Royal Botanic Gardens Kewscience

www.ipni.org

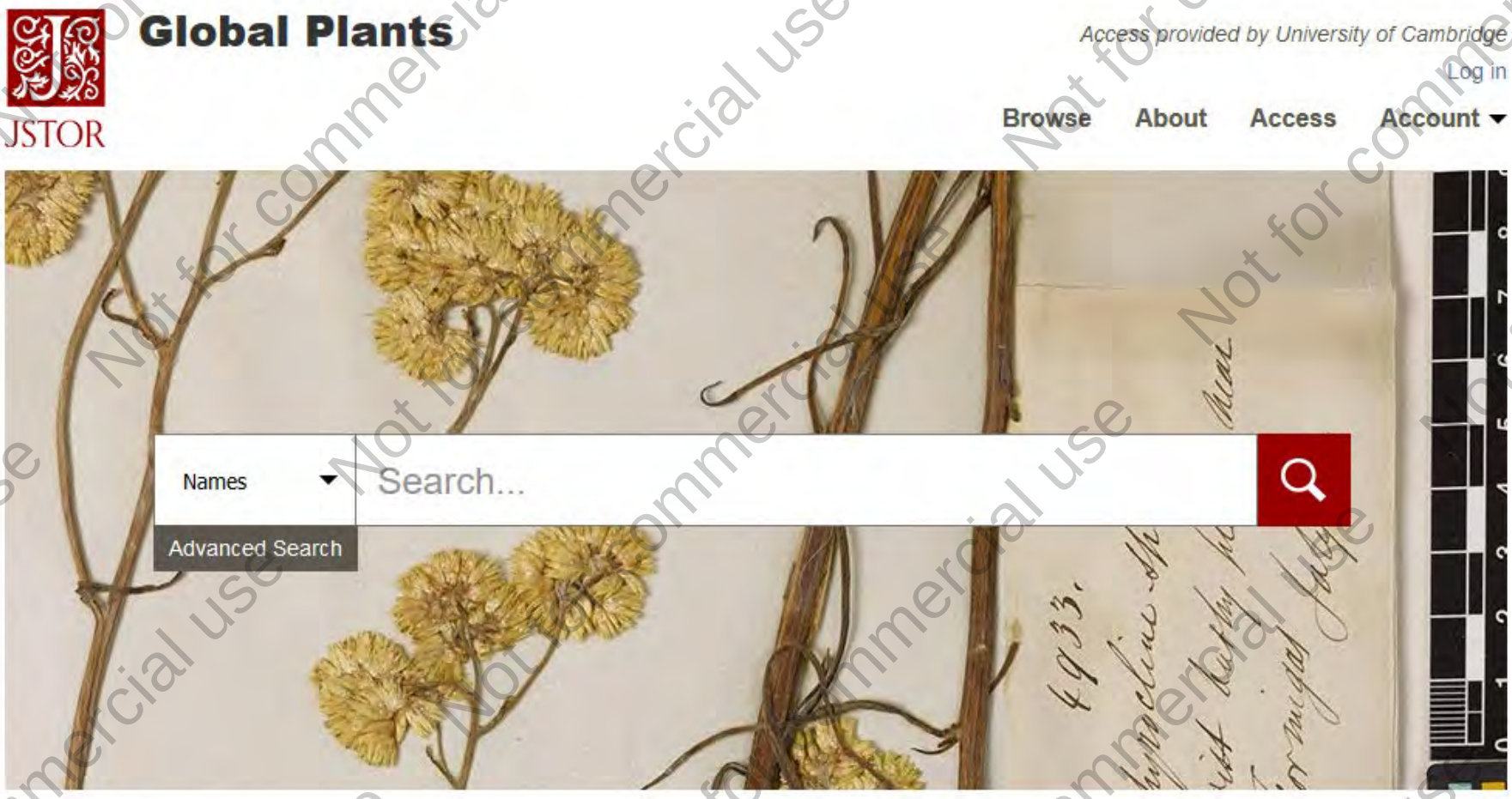
https://kiki.huh.harvard.edu/databases/botanist_index.html



Naming specimens

- JSTOR Plants – Global Plants Initiative
- Biodiversity Heritage Library (BHL)
- Wikipedia and Wikispecies
- Global Biodiversity Information Facility (GBIF)

https://plants.jstor.org/



https://www.biodiversitylibrary.org/

https://species.wikimedia.org/wiki/

WIKISPECIES
free species directory

Main page
Community Portal
Discussions
Templates
Recent changes
Random page
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Meta-Wiki
Wikibooks
Wikidata
Wikimania
Wikinews
Wikipedia
Wikiquote
Wikisource
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Wikivoyage
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Download as PDF
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What links here
Related changes
Upload file
Special pages

Translation

Wikispecies needs translators to make it more accessible. More info on this page. [dismiss]

Welcome to

Wikispecies

The free species directory that anyone can edit.

It covers Animalia, Plantae, Fungi, Bacteria, Archaea, Protista and all other forms of life.

So far we have **711,846** articles

Wikispecies is free, because life is in the public domain!

You can also check us out on Twitter: @Wikispecies
or use the Android app sponsored by Wikimedia.

We also have an IRC Channel #wikispecies[connect]

Taxon Navigation

- Superregnum Archaea
- Superregnum Bacteria
- Superregnum Eukaryota
  - Regnum Protista
  - Regnum Fungi
  - Regnum Plantae
  - Regnum Animalia
- Virus (classification still unclear)

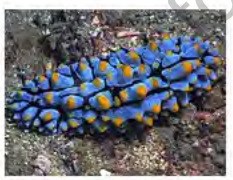
Michotamia aurata

Heliconia angusta

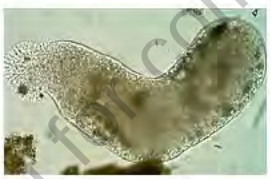
Balistapus undulatus

Chroicocephalus ridibundus

Aepyceros melampus



Phyllidia varicosa



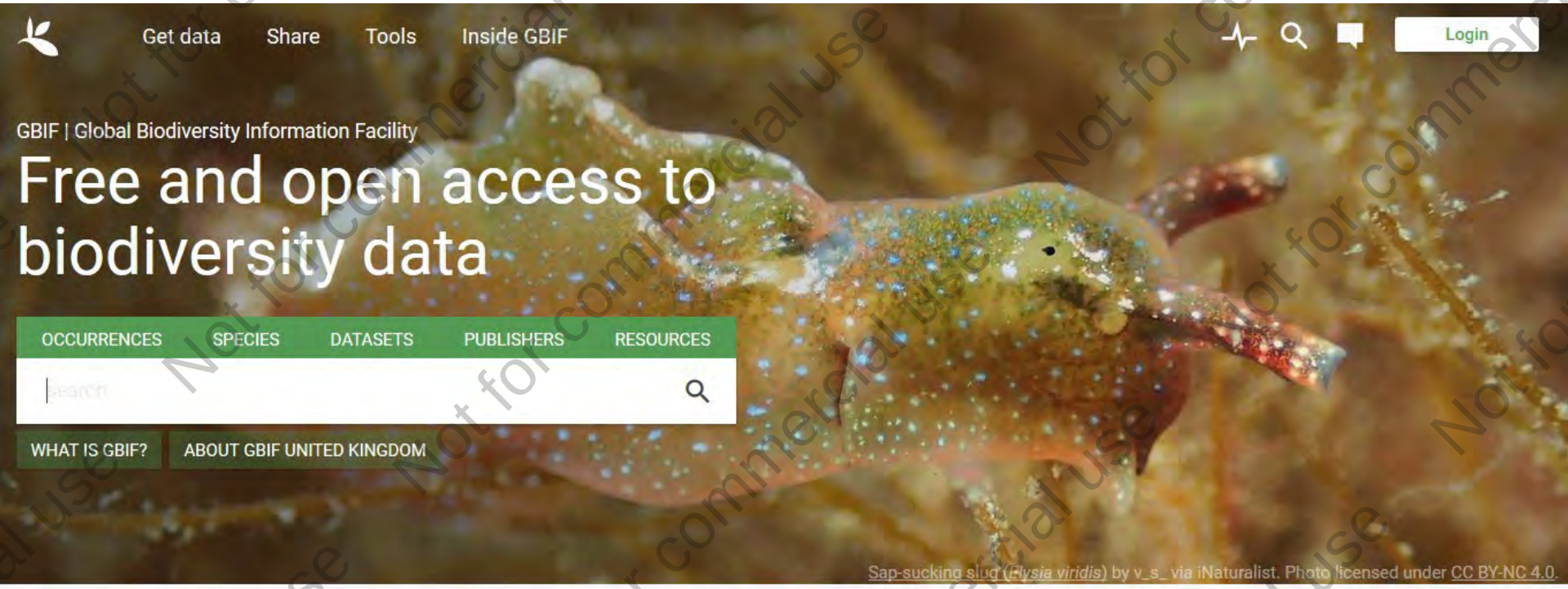
Pelomyxa palustris

Agama sinaita

Explore Wikispecies

Species of the month

www.gbif.org/



Occurrence records
981,624,721

Datasets
38,979

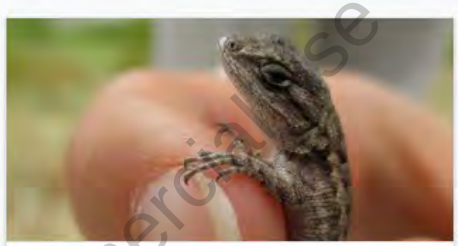
Publishing institutions
1,182

Species
Learn more about the number of species covered by data in GBIF.org.

2018 GBIF Ebbe Nielsen Challenge seeks open-data

Port Stephens, Australia - a sea hare haven?

The world's newest country becomes GBIF's newest



Call for nominations opens for 2018 GBIF Young Researchers

Incorporation of specimens

- flimsies, species covers, genus covers, type folders
- photographs, artwork, paperwork

Physical sequence (and pros & cons)

- alphabetical by family (WSY: all vascular plants)
- alphabetical by genus (CGE: mosses)
- systematically according to a specific floristic or monographic treatment (eg. Sell and Murrell's Flora of Great Britain and Ireland, Flora Europaea, Bentham & Hooker, APGIII or IV..)
- geographically (eg. major subdivisions or within larger treatments)
- by collector or collection (eg. Darwin, Wallich, Lindley)

Storage: environmental conditions

In the collections storage area, aim for:

- temperature below 20°C (ideally below 18°C)
- relative humidity 40-60%, avoiding frequent or rapid fluctuations
- dark/low UV (cover specimens when not in use)
- minimise handling and movement

Storage: pest control and monitoring

- freeze all incoming material (-30°C for 3 days, bag specimens during to control humidity)
- maintain well sealed boxes/cupboards
- keep collection clean (and easy to clean)
- no food/drink in collections
- blunder traps to monitor, ideally quarterly
- re-freeze or treat material if pests detected/suspected

Biscuit beetle
Stegobium paniceum

Cigarette beetle
Lasioderma serricorne

Varied carpet beetle
Anthrenus verbasci

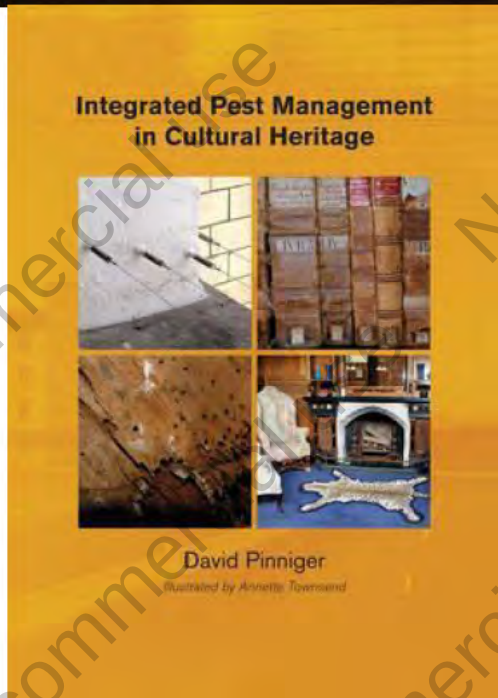
Varied carpet beetle
Attagenus pellio

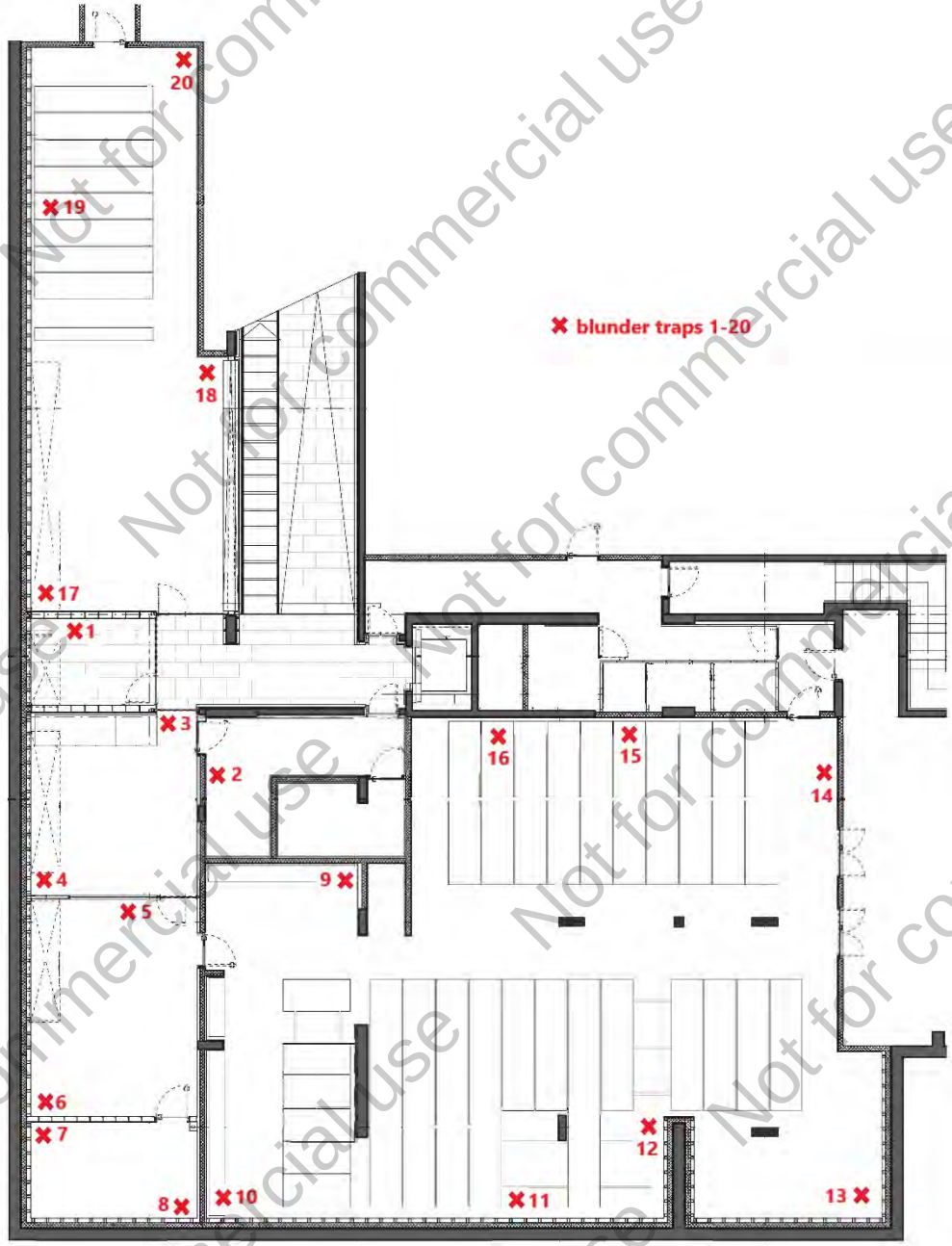
Museum Pests

https://museumpests.net

Historyonics

http://www.historyonics.com





Storage: pest control and monitoring

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- no food/drink in collections
- blunder traps to monitor, ideally quarterly
- re-freeze or treat material if pests detected/suspected

WARNING: beware *previous* pesticide use..

Research use

Policies and procedures needed for:

- Physical access to collections and loans – resourcing, security, specimen handling
- Digital access: ‘digital on demand’ and online specimen portals – resourcing, resolution required
- Destructive sampling – ethics, purpose of collection, ‘value added’

Harris & Marisco (2017)
Applications in Plant Sciences 5(4)

@CUHerb

CGE specimen imaging workflow

(Specimen request received)

Specimen in collection

Specimen imaged

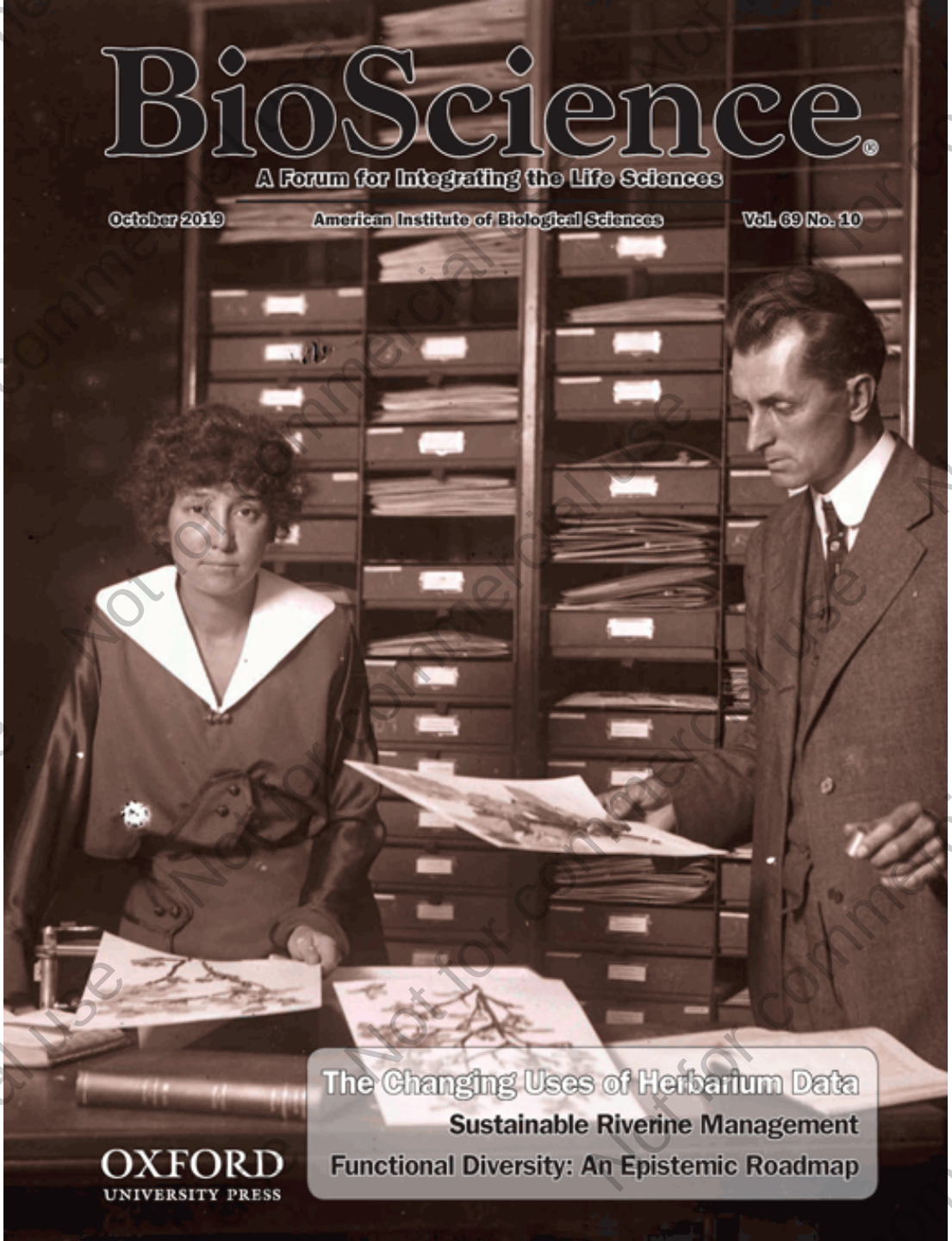
(Image sent to enquirer)

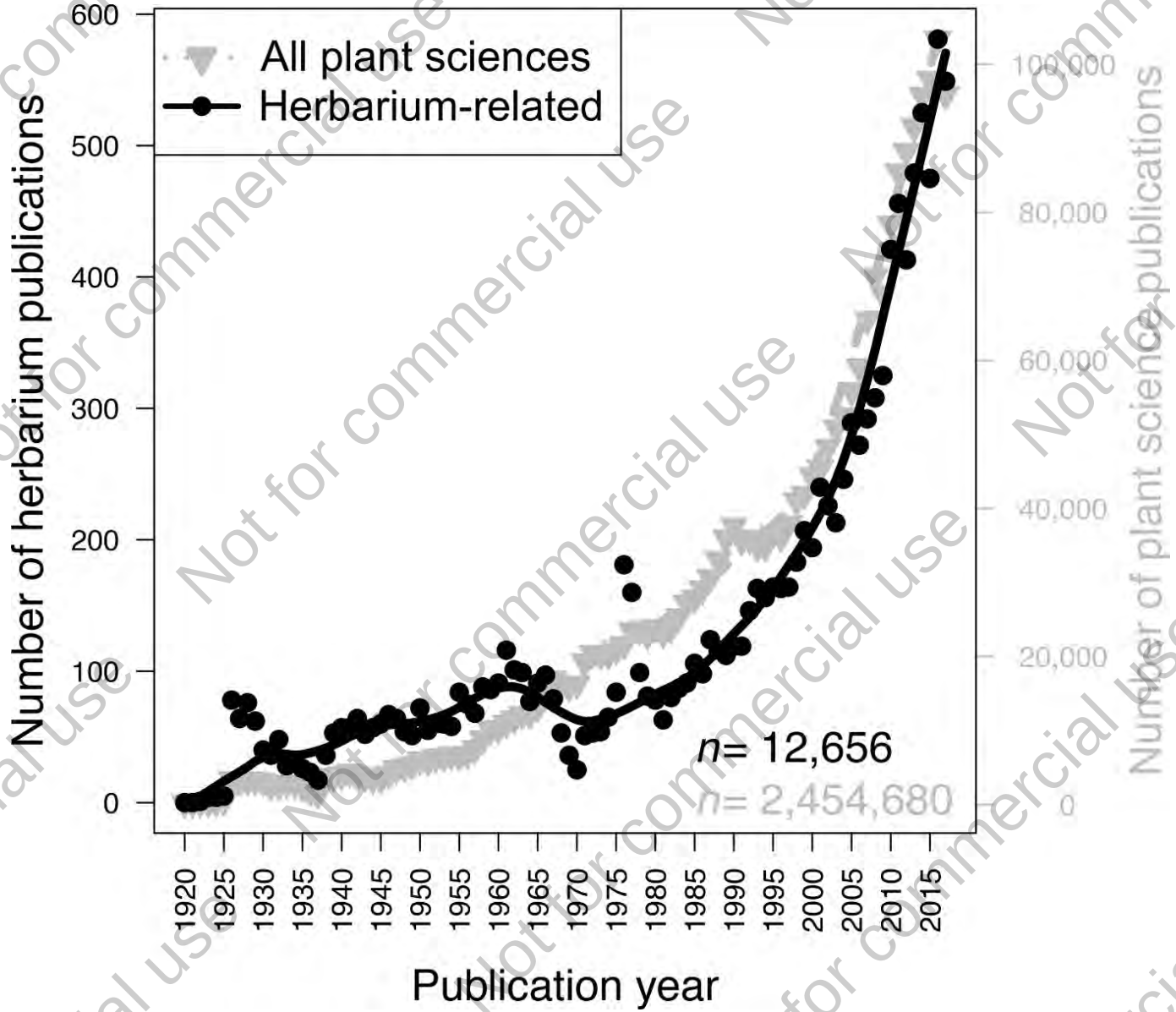
Label data transcribed

Herbarium database populated

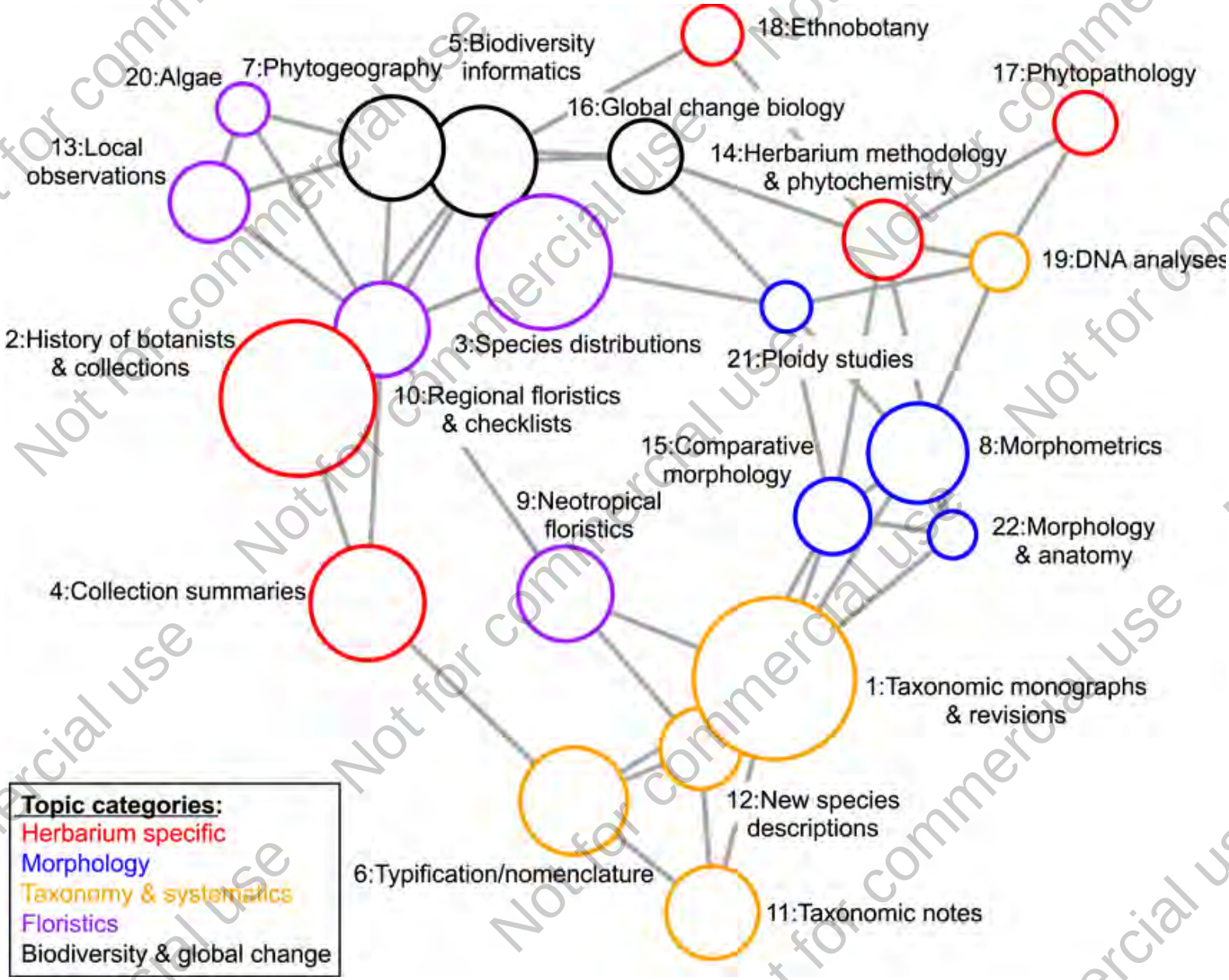
Image and data hosted on specimen portal

Image served to GBIF, JSTOR Plants, etc





Heberling, Prather & Tonsor (2019) *The changing uses of herbarium data in an era of global change: an overview using automated content analysis.* **BioScience** 69: 812-822.



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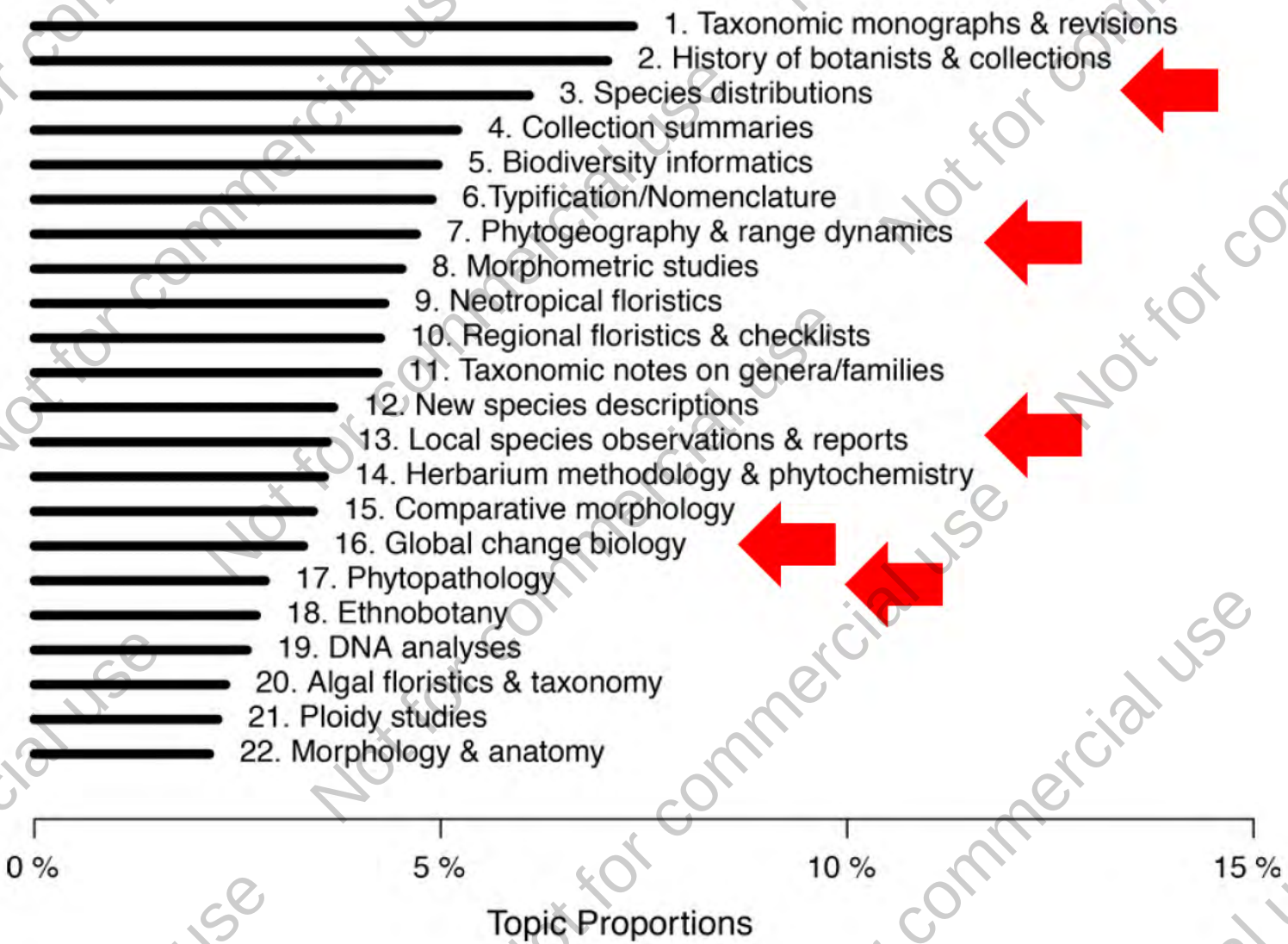
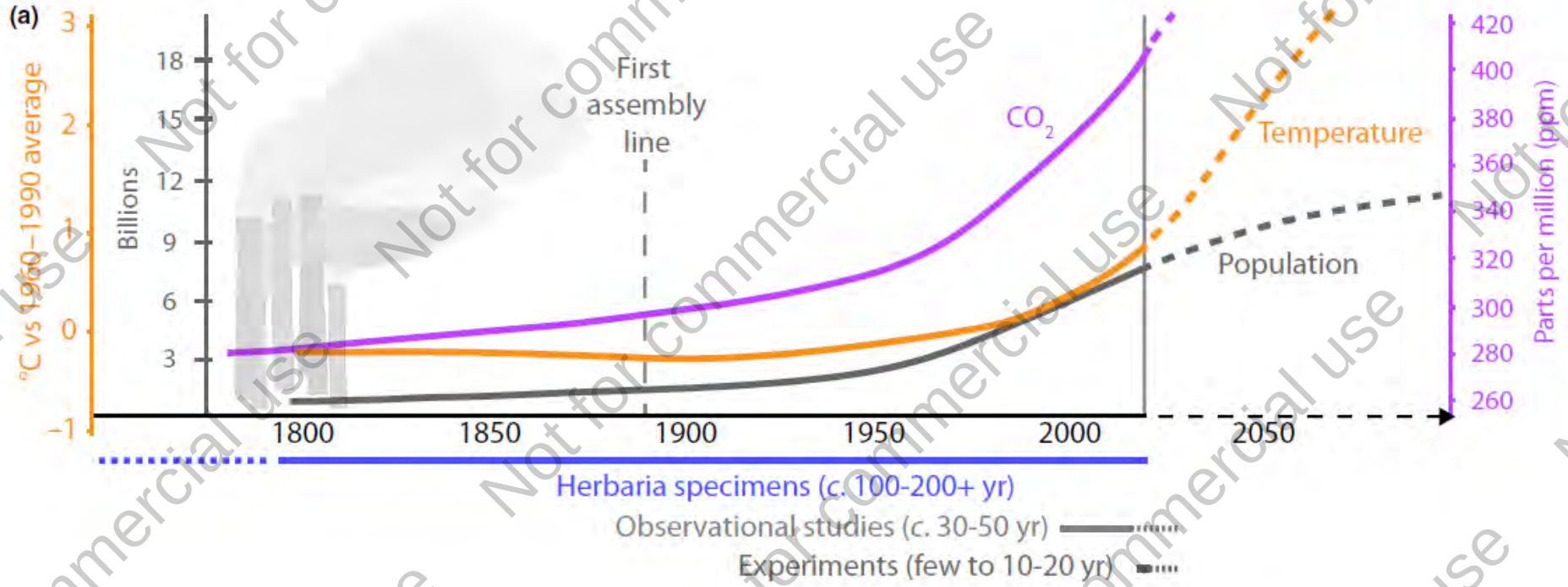


Heberling, Prather & Tonsor (2019) *The changing uses of herbarium data in an era of global change: an overview using automated content analysis.* **BioScience** 69: 812-822.

Hundreds of years of fieldwork...



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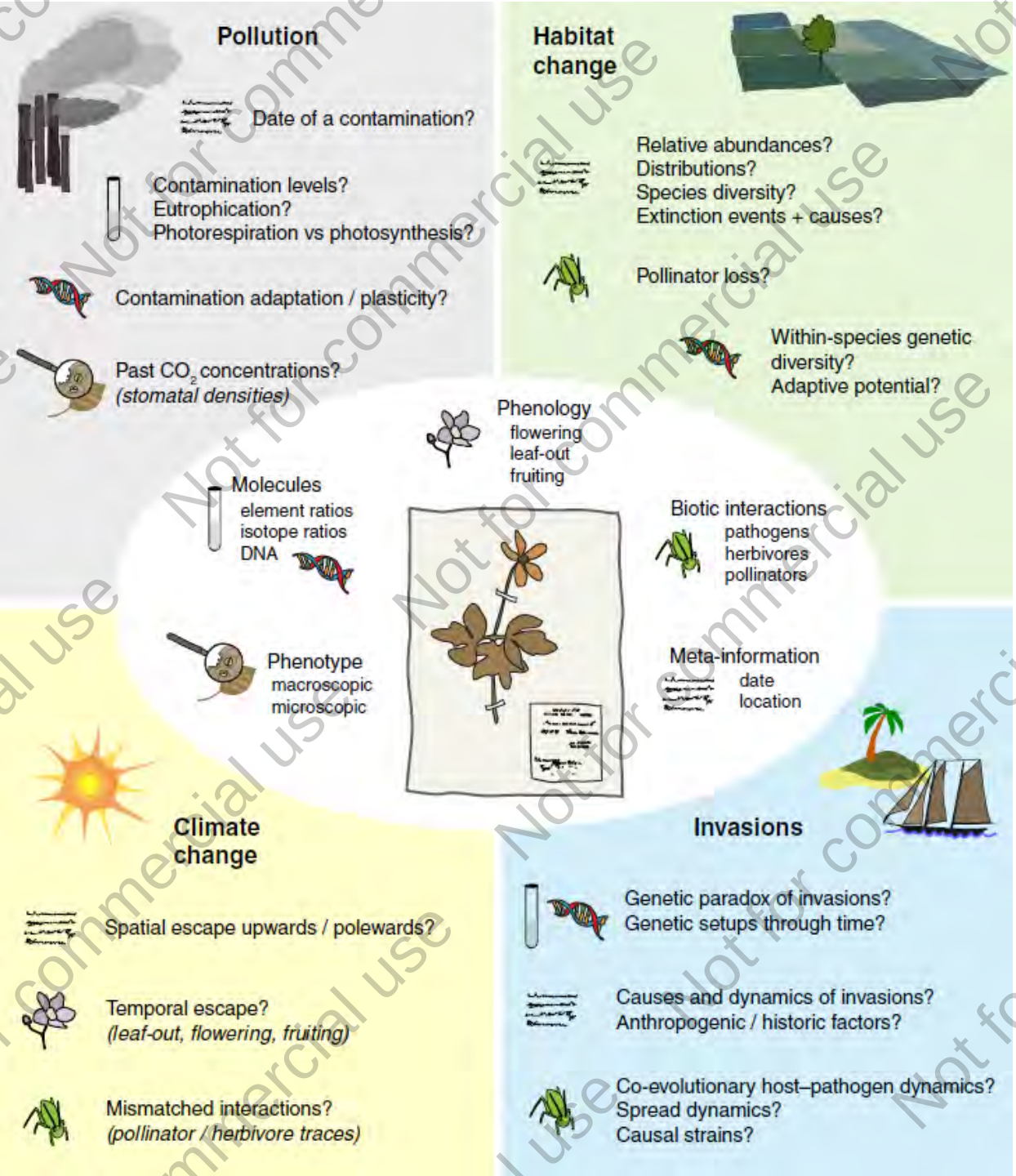

Lang et al. (2019) *Using herbaria to study global environmental change*. **New Phytologist** 221: 110-122.

ISSN 0962-8436 | Volume 374 | Issue 1763 | 7 January 2019

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B

BIOLOGICAL SCIENCES

Biological collections for understanding biodiversity in the Anthropocene

Theme issue compiled and edited by Emily K. Meineke, Barnabas H. Daru, T. Jonathan Davies and Charles C. Davis

THE ROYAL SOCIETY PUBLISHING

15 review papers…
…10 specifically about herbaria

- Using museum specimens to track **morphological shifts** through **climate change**
- Fossil **Atmospheres**: a case study of **citizen science** in question-driven palaeontological research
- **Fungarium** specimens: a largely untapped source in **global change biology** and beyond
- Facets of phylodiversity: **evolutionary diversification, divergence and survival** as **conservation** targets
- The use and misuse of herbarium specimens in evaluating **plant extinction risks**
- Museum specimens provide novel insights into **changing plant–herbivore interactions**
- Bookkeeping of **insect herbivory trends** in herbarium specimens of purple loosestrife (Lythrum salicaria)
- A novel proof of concept for capturing the diversity of **endophytic fungi preserved in herbarium specimens**
- Specimen-based analysis of morphology and the environment in ecologically dominant grasses: **the power of the herbarium**
- The history and impact of digitization and digital **data mobilization on biodiversity research**

With thanks to

- Colleagues at many institutions including WSY, LIV, RNG, BM, K, and many more, especially Yvette Harvey and Heleen Plaisier

- NatSCA colleagues