

# Creating a 21<sup>st</sup> Century Virtual Herbarium at the University of Maryland

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Nikolaus G. Anderson  
Maile C. Neel

University of Maryland



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NATURAL RESOURCES



# Outline

- Background MARY
- Virtual Herbarium
- Collaborations
- Future Goals



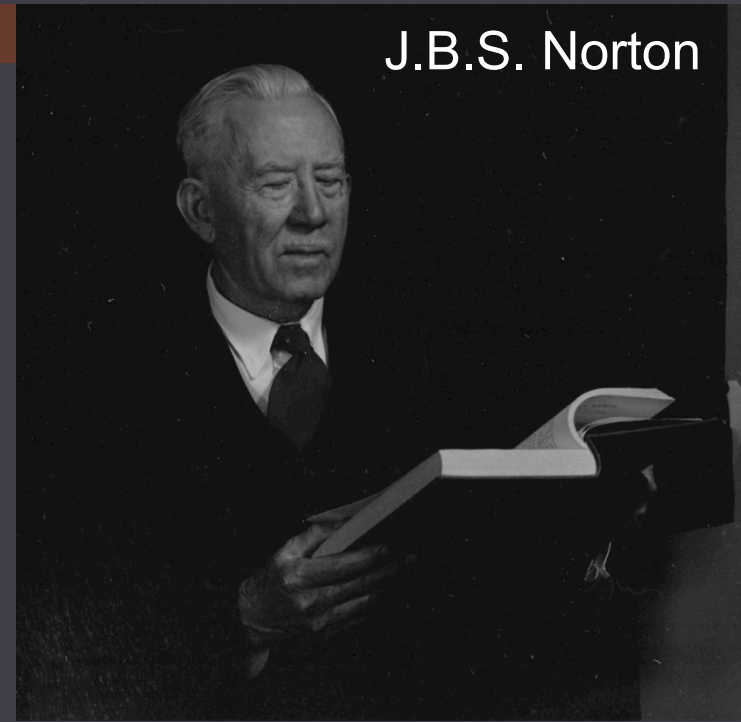
# MARY - History

J.B.S. Norton

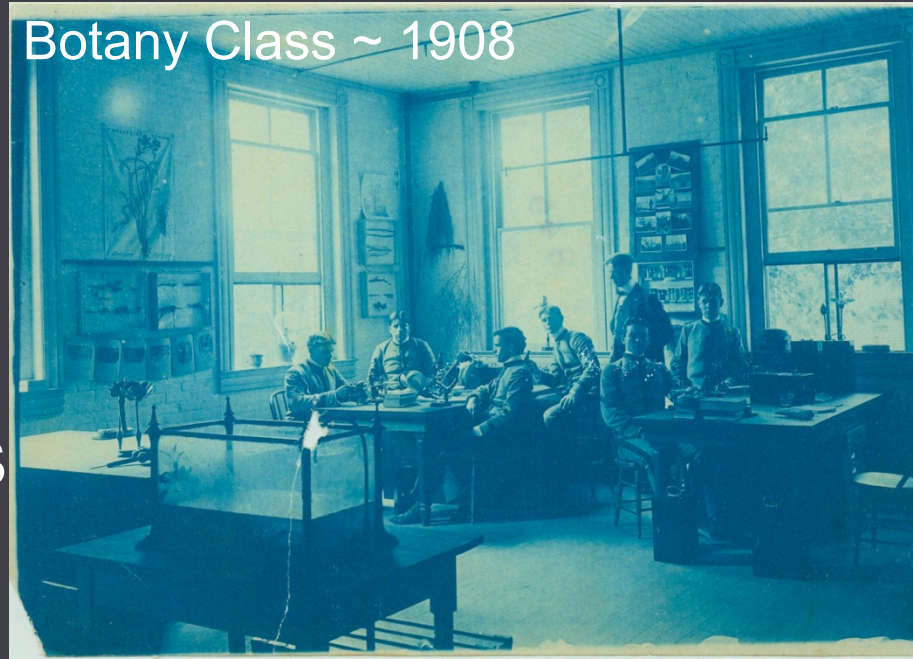
- Norton-Brown Herbarium (MARY) founded 1901 by J.B.S. Norton

- Collections basis for Brown & Brown floras

- J. Reveal, S. Hill etc. build diverse collections



Botany Class ~ 1908



# MARY - Current Team

- Director: Maile Neel
- Curator: Tanja Schuster
- Database Assistant: Niko Anderson
- Graduate RA (1)
- FWS Students (3)



Maile Neel



Niko Anderson



Shanie Gal-Edd



Casey Barry

Kyra Sciaudone



Haiyang Li

# MARY - Stats

- ~ 87,000 specimens
- ~ 22,000! unmounted
- Most representative collection for MD
- Organization: Mod. Engler & Prantl



# MARY - Specimen Stats

Group	~Total #	~ # MD	# Mid-Atlantic	# U.S.	# International
Fungi and lichen	<b>500</b>	200	200	100	0
Algae	<b>850</b>	300	200	300	50
Bryophytes	<b>1700</b>	700	500	300	200
Ferns/fern allies	<b>1200</b>	500	300	200	200
Gymnosperms	<b>750</b>	300	200	100	150
Angiosperms	<b>82000</b>	28000	28600	19000	6400
Totals	<b>87000</b>	30000	30000	20000	7000

## Strengths:

1. Polygonaceae
2. Malvaceae
3. Marcgraviaceae



# Importance of Herbaria

- Plant Identification
- Understanding Evolution
- Documenting research
- Conservation



01785

Medicinally important  
black cohosh

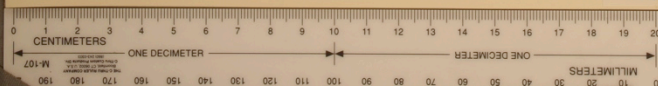
HERBARIUM  
UNIVERSITY  
OF  
MARYLAND

UNIVERSITY OF MARYLAND HERBARIUM  
*CIMICIFUGA RACEMOSA* (L.) NUTT.  
RT. 97 AND JENNINGS CHAPEL RD.  
WOODS

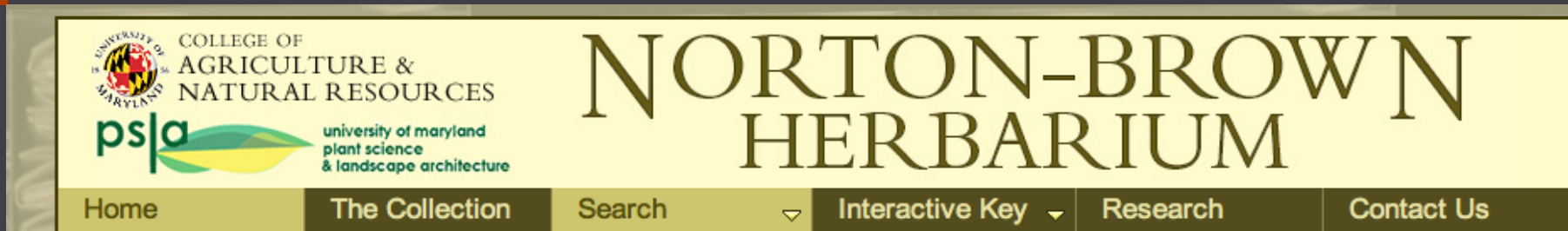
JULY 4, 1965

HOWARD COUNTY

JANE ENGH



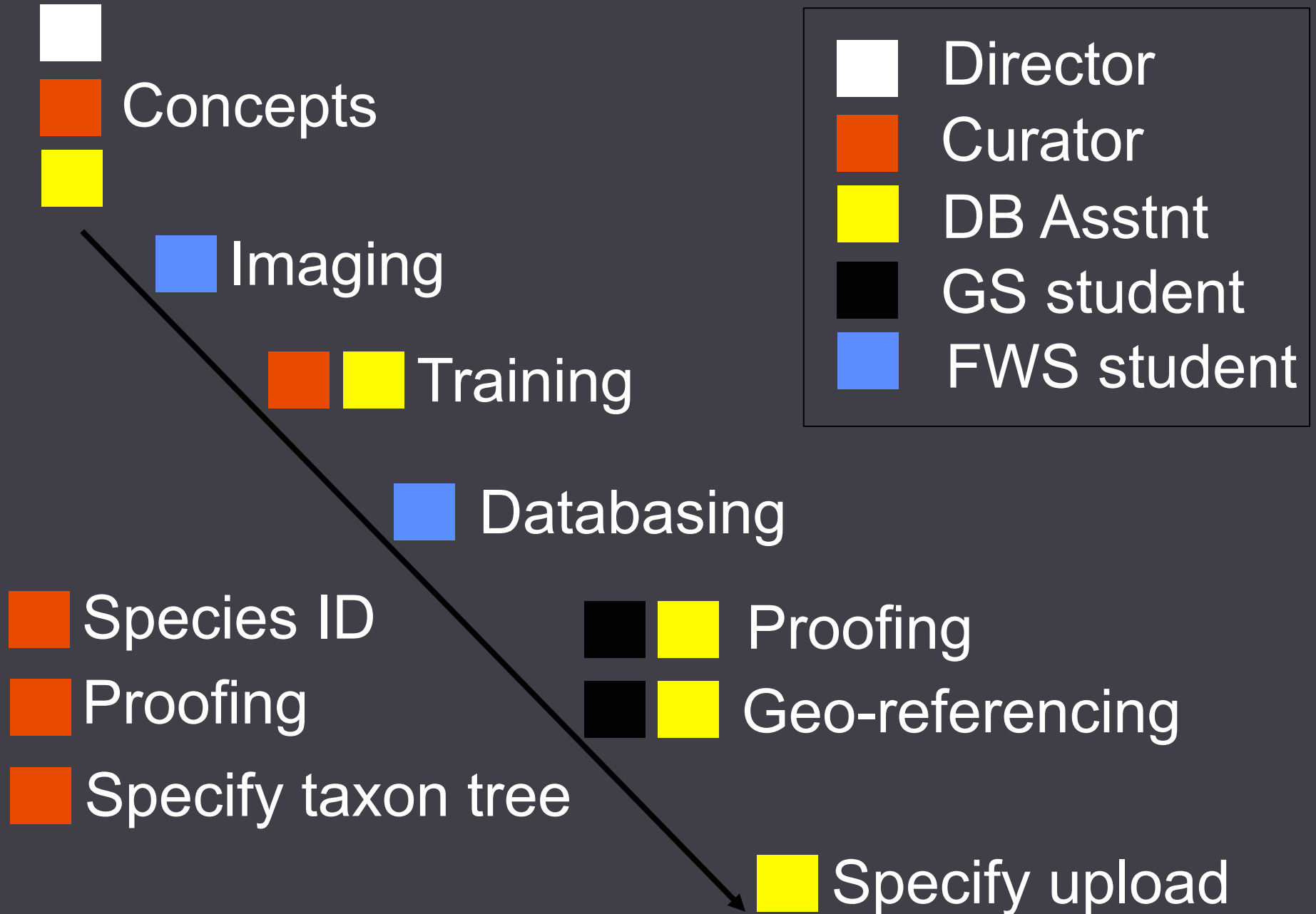
# Virtual Herbarium - Product



- Vetted species ID
- Morphological data via high-res images
- Geo-referenced locality data → export
- Label data databased → export



# Virtual Herbarium - Workflow

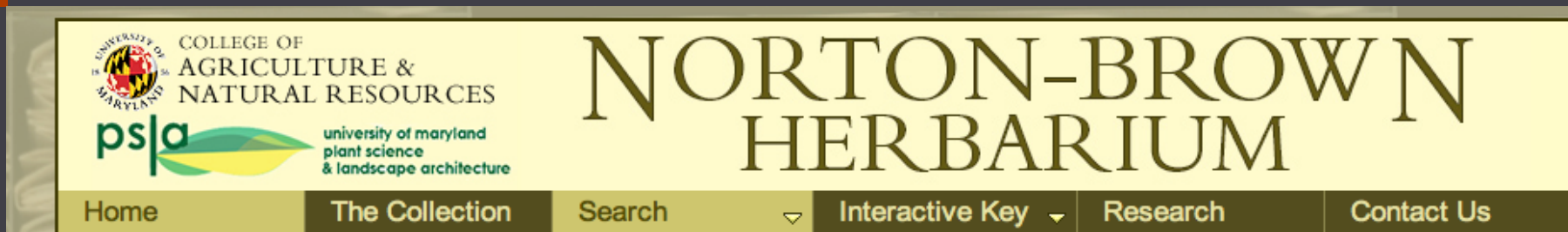


# VH - Tools & Software

BMP, JPG, GIF, TIFF,



- IrfanView (batch rotate images)
- Specify v6 (database)
- Taxon tree imported from SC Herbarium
- MySQL database management system
- Custom PHP scripts (serve digitized data online)
- Geo-referenced data using Google Earth
- Google API (map search)
- ImageCutter (displays image search)
- NaviKey (using Delta) for interactive key
- Google Analytics



- We have a webpage, dedicated server, IT support ...
- ~ 21,000 MD specimens imaged
- ~ 5,600+ specimens served online
- Invasive species up 1<sup>st</sup>

# MARY - Webpage

www.  
nbh.  
psla.  
umd.  
edu



*Viola pedata* L. - Bird's-foot violet flowers

## Welcome to the Norton-Brown Herbarium (MARY)

The Norton-Brown Herbarium (Herbarium code MARY) is administered by the Department of Plant Science and Landscape Architecture in the College of Agricultural and Natural Resources at the University of Maryland College Park. MARY is home to a natural heritage collection that includes ~87,000 specimens of flowering plants, cone-bearing plants, algae, mosses, liverworts, lichen, and fungi. Established in 1901, the Norton-Brown Herbarium holds the largest number of specimens from Maryland, and the mid-Atlantic and also has a diverse collection of preserved plants from all over the world. The collections housed here were instrumental in developing the flora treatments *Woody Plants of Maryland* (Brown & Brown 1972) and *Herbaceous Plants of Maryland* (Brown & Brown 1984).



State Botanist Chris Frye and the herbarium staff doing field work.

The herbarium is used by professionals, students, citizen scientists, and volunteers who represent academic institutions, conservation groups and federal and state agencies. We host in-house and visiting researchers working on treatments of particular plant groups or on regional floras, and undergraduate and graduate students doing research on plants and plant communities. The specimens are also used by arborists, horticulturists, members of garden clubs, conservation groups and consultants. The collections are an irreplaceable source of data on where species occurred at different

## What's New

The Digital Herbarium is  
Online!



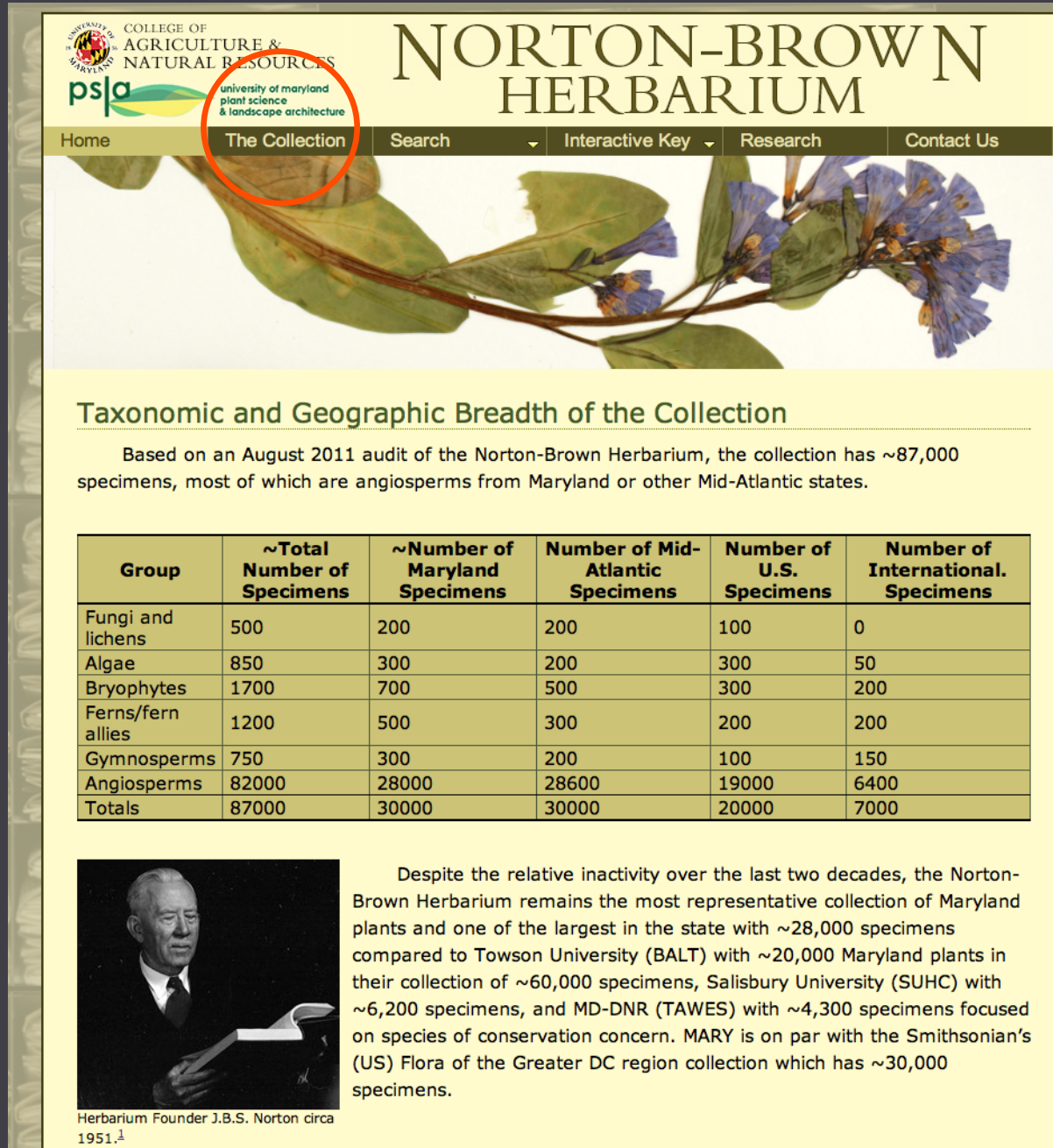
[Search the Herbarium](#)

Bioscience Research and  
Technology Day 2012



# VH - Collection Page

- Stats
- History
- Collectors



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NORTON-BROWN HERBARIUM

Home The Collection Search Interactive Key Research Contact Us

### Taxonomic and Geographic Breadth of the Collection

Based on an August 2011 audit of the Norton-Brown Herbarium, the collection has ~87,000 specimens, most of which are angiosperms from Maryland or other Mid-Atlantic states.

Group	~Total Number of Specimens	~Number of Maryland Specimens	Number of Mid-Atlantic Specimens	Number of U.S. Specimens	Number of International Specimens
Fungi and lichens	500	200	200	100	0
Algae	850	300	200	300	50
Bryophytes	1700	700	500	300	200
Ferns/fern allies	1200	500	300	200	200
Gymnosperms	750	300	200	100	150
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Totals	87000	30000	30000	20000	7000



Herbarium Founder J.B.S. Norton circa 1951.<sup>1</sup>

Despite the relative inactivity over the last two decades, the Norton-Brown Herbarium remains the most representative collection of Maryland plants and one of the largest in the state with ~28,000 specimens compared to Towson University (BALT) with ~20,000 Maryland plants in their collection of ~60,000 specimens, Salisbury University (SUHC) with ~6,200 specimens, and MD-DNR (TAWES) with ~4,300 specimens focused on species of conservation concern. MARY is on par with the Smithsonian's (US) Flora of the Greater DC region collection which has ~30,000 specimens.

# VH - Search Pages



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plant science  
& landscape architecture

# NORTON-BROWN HERBARIUM

Home

The Collection

Search

Interactive Key

Research

Contact Us

[Map Search](#)

[Image Search](#)

[Data Search](#)

Mapped Search

Image Only Search

Data Only Search

Browse the Collection

## Herbarium Database

Family:

State:

Genus:

County:

Specific Epithet:

Collector:

Last Name:

Sort results by:

Family  Genus  Specific epithet

County  Year

Submit

**Digitization Progress**  
~87,000 Collection Specimens  
20,741 Specimens Imaged  
4839 Specimens Databased  
104 Genera in 33 Families  
[Browse the collection](#)  
[About the virtual herbarium](#)

Last updated: November 13, 2012  
Questions, comments, corrections?  
Contact [Nikolaus Anderson](#)

Norton-Brown Herbarium  
Department of Plant Science and Landscape Architecture  
The University of Maryland College Park

# VH - Search Pages - Map

- Georeferenced locality data
- Export data to spreadsheet
- Excludes threatened species

## NORTON-BROWN HERBARIUM

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Home The Collection Search Interactive Key Research Contact Us

Map Search Image Search Data Only

### Digital Collection Map Search

Family:  State:   
Genus:  County:   
Specific Epithet:  Collector:   
Last Name:

Enter a query and press 'search' to plot the returned specimens' locations. Click on a map marker for more details.

**Digitization Progress**  
~87,000 Collection Specimens  
20,741 Specimens Imaged  
3827 Specimens Databased  
75 Genera in 33 Families  
[Browse the collection](#)  
[About the virtual herbarium](#)

Map Satellite

Google Map data ©2012 Google Terms of Use Report a map error

Last updated: November 13, 2012  
Questions, comments, corrections?  
Contact Nikolaus Anderson

Norton-Brown Herbarium  
Department of Plant Science and Landscape Architecture  
The University of Maryland College Park

# VH - Search Pages - Image

Accession # 000037302

## NORTON-BROWN HERBARIUM

[Right Click Here -> Save link As...](#)

*Persicaria arifolia* (L.) Haraldson

<b>Family</b>	Polygonaceae
<b>Collector</b>	Anderson
<b>Date Collected</b>	8/27/1963
<b>Country</b>	United States
<b>State</b>	Maryland
<b>County</b>	Anne Arundel County
<b>Locality</b>	Patuxent River and Maryland Route four
<b>GPS Coordinates</b>	38.8116500000 , - 76.7106000000
<b>GPS Source</b>	Estimated from locale information using google maps
<b>Estimate Precision</b>	1/25th to 1 square mile

**Application:  
GMap 'ImageCutter'  
Bartlett Centre of  
Advanced  
Spatial Analysis**



Image Cutter





# VH - Search Pages - Data



## NORTON-BROWN HERBARIUM



Home    The Collection    Search    Interactive Key    Research    Contact Us

Map Search    Image Search    Data Only

### Database Query

Family:     State:   
 Genus:     County:   
 Specific Epithet:     Collector Last Name:

Sort results by:  
 Family     Genus     Specific epithet     County     Year

**Digitization Progress**  
 ~87,000 Collection Specimens  
 20,741 Specimens Imaged  
 4839 Specimens Databased  
 104 Genera in 33 Families  
[Browse the collection](#)  
[About the virtual herbarium](#)

Accession Number	Genus	Specific Epithet	Common Name(s)	Collector	Date Collected	State	County	Locale
5482	Persicaria	maculosa	ladys-thumb	Oliver H. Thompson	9/10/1973	Maryland	Calvert	Patuxent River brackish marsh, Broomes Isl.
5485	Persicaria	maculosa	ladys-thumb	Oliver H. Thompson	8/27/1972	Maryland	Queen Annes	Brackish marsh 10 miles south of Chestertown and 1 mile northeast of the confluence of the Chester River and Langford Creek
28558	Persicaria	maculosa	ladys-thumb	P. Gladu	7/30/1965	Maryland	Kent	Delario Bay, Worton Creek Spit
28907	Persicaria	arifolia		E. H. Walker	6/28/1930	District of Columbia		Shaw Lily Ponds
5487	Persicaria	maculosa	ladys-thumb	Robert M. Downs	9/1/1969	Maryland	Garrett	Along Potomac River within 1 mile northeast of Kitzmiller.
30098	Persicaria	sagittata	arrow-leaf tearthumb	P. Worthington	7/24/1908	Maryland	Prince Georges	College Park
5488	Persicaria	maculosa	ladys-thumb	L. L. Stuart	10/12/1940	Maryland	Baltimore	Catonsville
30099	Persicaria	sagittata	arrow-leaf tearthumb	P. Worthington	7/16/1968	Maryland	Prince Georges	College Park
32287	Persicaria	maculosa	ladys-thumb	J. E. Bruechet	9/25/1909	Maryland	Montgomery	Montgomery County
5495	Persicaria	maculosa	ladys-thumb	E. G. Worthley	10/13/1949	Maryland	Anne Arundel	Patuxent Refuge
32289	Persicaria	sagittata	arrow-leaf tearthumb	J. E. Benedict, Jr.	8/2/1909	Maryland	Montgomery	Montgomery County
5496	Persicaria	maculosa	ladys-thumb	C. S. Ridgeway	7/21/1903	Maryland	Anne Arundel	Bay Ridge
5497	Persicaria	maculosa	ladys-thumb	Norton	8/16/1904	Maryland	Washington	Along Canal, Antietam
5498	Persicaria	maculosa	ladys-thumb	Jane Engh	8/1/1964	Maryland	Howard	Woodbine
5499	Persicaria	maculosa	ladys-thumb	Jane Engh	8/9/1964	Maryland	Howard	University Farm on Folly Qtr Rd.

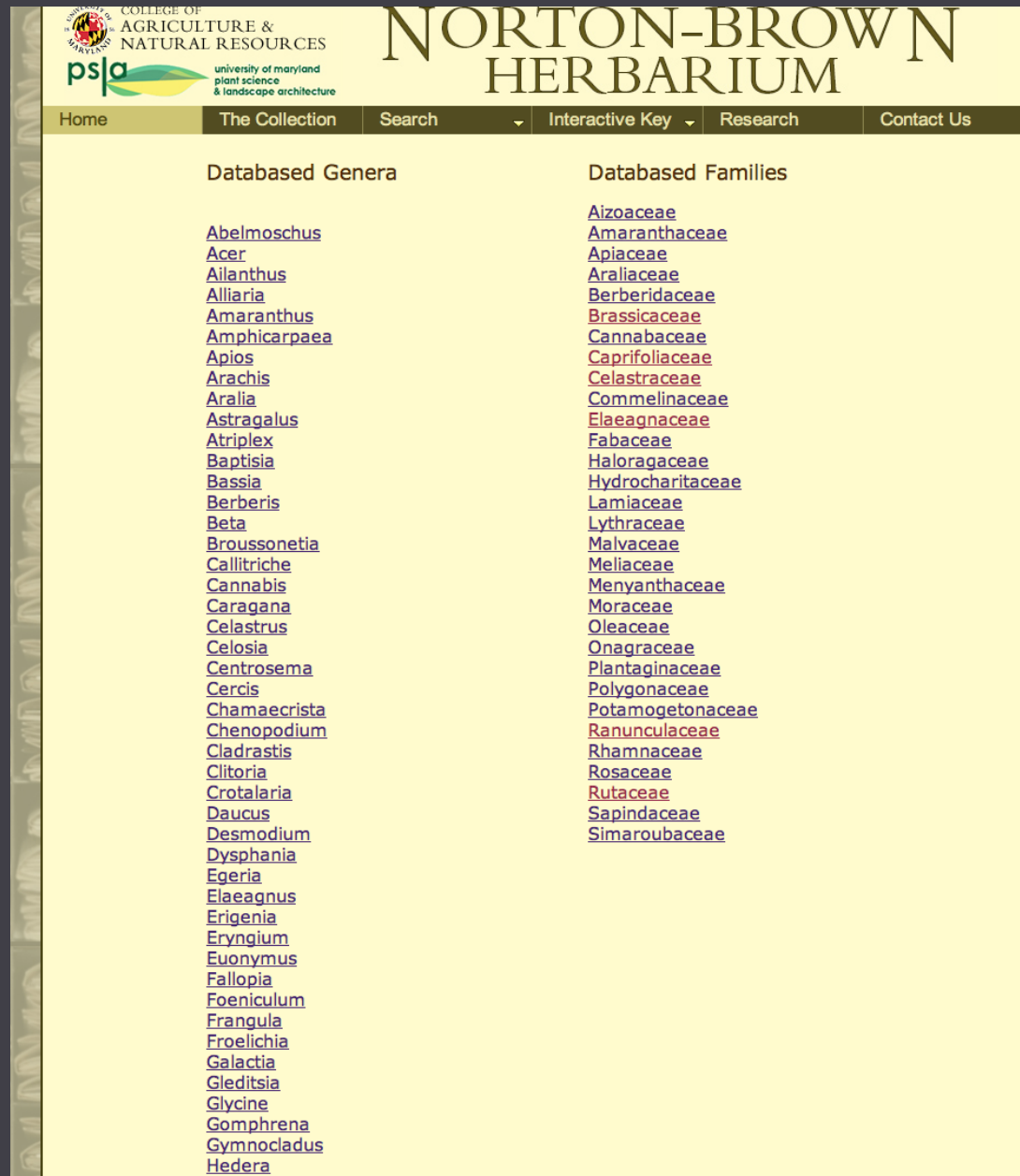
Total 209; Pages:14; Page :1Next

[Export results](#)

# VH - Search Pages - Browse

■ Genera  
databased

■ Families listed



The screenshot shows the website for the Norton-Brown Herbarium, part of the University of Maryland's College of Agriculture & Natural Resources. The page features a navigation menu with options: Home, The Collection, Search, Interactive Key, Research, and Contact Us. Below the menu, there are two columns of links. The left column is titled 'Databased Genera' and lists 50 genera, each with a blue underlined link. The right column is titled 'Databased Families' and lists 20 families, each with a blue underlined link.

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NORTON-BROWN HERBARIUM

Home The Collection Search Interactive Key Research Contact Us

Databased Genera

- [Abelmoschus](#)
- [Acer](#)
- [Ailanthus](#)
- [Alliaria](#)
- [Amaranthus](#)
- [Amphicarpaea](#)
- [Apios](#)
- [Arachis](#)
- [Aralia](#)
- [Astragalus](#)
- [Atriplex](#)
- [Baptisia](#)
- [Bassia](#)
- [Berberis](#)
- [Beta](#)
- [Broussonetia](#)
- [Callitriche](#)
- [Cannabis](#)
- [Caragana](#)
- [Celastrus](#)
- [Celosia](#)
- [Centrosema](#)
- [Cercis](#)
- [Chamaecrista](#)
- [Chenopodium](#)
- [Cladrastis](#)
- [Clitoria](#)
- [Crotalaria](#)
- [Daucus](#)
- [Desmodium](#)
- [Dysphania](#)
- [Egeria](#)
- [Elaeagnus](#)
- [Erigenia](#)
- [Eryngium](#)
- [Euonymus](#)
- [Fallopia](#)
- [Foeniculum](#)
- [Frangula](#)
- [Froelichia](#)
- [Galactia](#)
- [Gleditsia](#)
- [Glycine](#)
- [Gomphrena](#)
- [Gymnocladus](#)
- [Hedera](#)

Databased Families

- [Aizoaceae](#)
- [Amaranthaceae](#)
- [Apiaceae](#)
- [Araliaceae](#)
- [Berberidaceae](#)
- [Brassicaceae](#)
- [Cannabaceae](#)
- [Caprifoliaceae](#)
- [Celastraceae](#)
- [Commelinaceae](#)
- [Elaeagnaceae](#)
- [Fabaceae](#)
- [Haloragaceae](#)
- [Hydrocharitaceae](#)
- [Lamiaceae](#)
- [Lythraceae](#)
- [Malvaceae](#)
- [Meliaceae](#)
- [Menyanthaceae](#)
- [Moraceae](#)
- [Oleaceae](#)
- [Onagraceae](#)
- [Plantaginaceae](#)
- [Polygonaceae](#)
- [Potamogetonaceae](#)
- [Ranunculaceae](#)
- [Rhamnaceae](#)
- [Rosaceae](#)
- [Rutaceae](#)
- [Sapindaceae](#)
- [Simaroubaceae](#)

# VH - Interactive Key

## NORTON-BROWN HERBARIUM

### Woody Plant Interactive Key

[Herbarium home](#)  
[Key user's guide](#)  
[Plant ID guides](#)

- Please visit our guides for more information on using this key.
- **Popups must be enabled** to view the reference images on the left menu
- **\*RIGHT CLICK\*** on a species to view its description and image gallery

#### Quick Trait Reference

Growth habit  
Leaf type  
*Leaf shape*  
Leaf arrangement  
*Leaf margin*  
Leaf base shape  
Leaf apex shape  
Fruit type  
Flower Corolla shape  
Inflorescence type  
Bud scale type  
Cone texture  
Cone detail

#### Characteristic Index

#### Taxon Index

jQuery maphilight documentation

### Leaf Type

1. Simple

2. Once odd pinnately compound

3. Once even pinnately compound

4. Twice pinnately compound (bipinnate)

5. Thrice pinnately compound (tripinnate)

6. Palmately compound

7. Trifoliolate

Palmately compound - leaflets radiate from a common point

Hover your mouse over a trait to view its description.

will be removed.

- You can remove a characteristic by clicking 'remove selection' below, or start over with the 'remove all' button
- Continue to select characteristics until enough plants have been eliminated
- **Right click** on a resulting plant and select [Description] to view a full description or [Images] to view it's gallery (popups must be enabled)

with a characteristic in the left  
numerical value and press the  
matching the descriptions

# VH - Interactive Key Guide

## ■ Key usage explained

## ■ In Interactive Key tab

## Application: 'NaviKey'

### Identification Using Navikey

Following these step by step instructions will get the best results from this key.

The screenshot shows the NaviKey interface with the following content:

- Characters available:** height at maturity in landscape [feet], plant width [feet], plant found in wild in this region?, <aromatic scent> of vegetative parts when bruised, <leaf type>, <leaf arrangement>, leaves <shape>, <leaf length in inches> [inches long], <leaf width> [inches wide], <leaf shape at> apex, <leaf shape at> base, <leaf lobing>, <number of leaf lobes> [-lobed].
- Character states available:** once odd pinnately compound, palmately compound, simple, trifoliate.
- Selection criteria:** growth habit: vine, <foliage duration>: deciduous.
- Resulting items:** Akebia quinata, Ampelopsis brevipedunculata, Campsis radicans, Celastrus orbiculatus, Clematis terniflora, Clematis xjackmanii, Hydrangea anomala ssp. petiolaris, Lonicera japonica, Lonicera sempervirens, Parthenocissus quinquefolia, Parthenocissus tricuspidata, Passiflora incarnata, Polygonum perfoliatum, Schizophragma hydrangeoides.

Buttons: Remove Selection, Remove All. Status: All items: 470, Resulting items: 22.

1. The '**Characters available**' panel lists all available identifying traits (aka character states). As you choose character states you narrow down the possible identities for your specimen; characters that are not relevant for distinguishing among the remaining choices of species will be removed from this list.  
Click on a characteristic in which you have the most confidence. If you are unsure where to begin, use the 'Quick Reference' guide on the left to help identify certain characteristics (*popups must be enabled*).
2. The possible states for the selected characteristic will appear in the '**Character states available**' panel. Click on the most applicable state, or enter a numerical value and click . You can select multiple states by holding '**Ctrl**' while clicking on multiple states. You may also enter a range of values for numerical states (eg. 1.5-2.5).
3. Your selections will appear in the **Selection criteria** panel. You may remove your selections by clicking on a trait, then clicking  below.
4. The '**resulting items**' panel will display the scientific names of all remaining species which fit your selected characteristics. the number of remaining species will appear below this panel. Continue selecting character states until this list has been sufficiently reduced.

# VH - Interactive Key & ID Guides

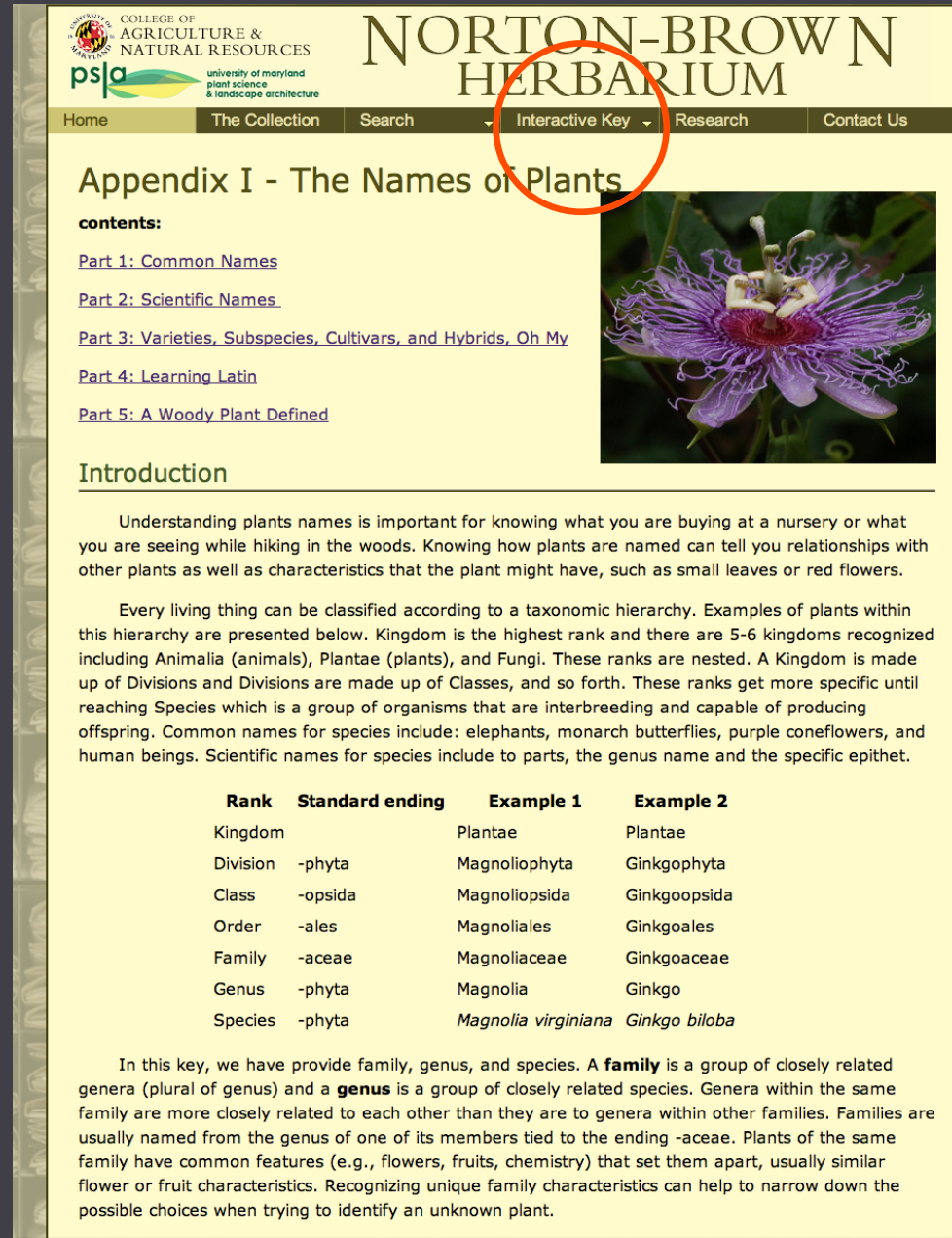
■ Key Guide

■ The Names of Plants

■ Leaves

■ Twigs and Stems

■ Flowers and Fruits



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## NORTON-BROWN HERBARIUM

Home The Collection Search **Interactive Key** Research Contact Us

### Appendix I - The Names of Plants

**contents:**

- [Part 1: Common Names](#)
- [Part 2: Scientific Names](#)
- [Part 3: Varieties, Subspecies, Cultivars, and Hybrids, Oh My](#)
- [Part 4: Learning Latin](#)
- [Part 5: A Woody Plant Defined](#)



### Introduction

Understanding plants names is important for knowing what you are buying at a nursery or what you are seeing while hiking in the woods. Knowing how plants are named can tell you relationships with other plants as well as characteristics that the plant might have, such as small leaves or red flowers.

Every living thing can be classified according to a taxonomic hierarchy. Examples of plants within this hierarchy are presented below. Kingdom is the highest rank and there are 5-6 kingdoms recognized including Animalia (animals), Plantae (plants), and Fungi. These ranks are nested. A Kingdom is made up of Divisions and Divisions are made up of Classes, and so forth. These ranks get more specific until reaching Species which is a group of organisms that are interbreeding and capable of producing offspring. Common names for species include: elephants, monarch butterflies, purple coneflowers, and human beings. Scientific names for species include to parts, the genus name and the specific epithet.

Rank	Standard ending	Example 1	Example 2
Kingdom		Plantae	Plantae
Division	-phyta	Magnoliophyta	Ginkgophyta
Class	-opsida	Magnoliopsida	Ginkgoopsida
Order	-ales	Magnoliales	Ginkgoales
Family	-aceae	Magnoliaceae	Ginkgoaceae
Genus	-phyta	Magnolia	Ginkgo
Species	-phyta	<i>Magnolia virginiana</i>	<i>Ginkgo biloba</i>

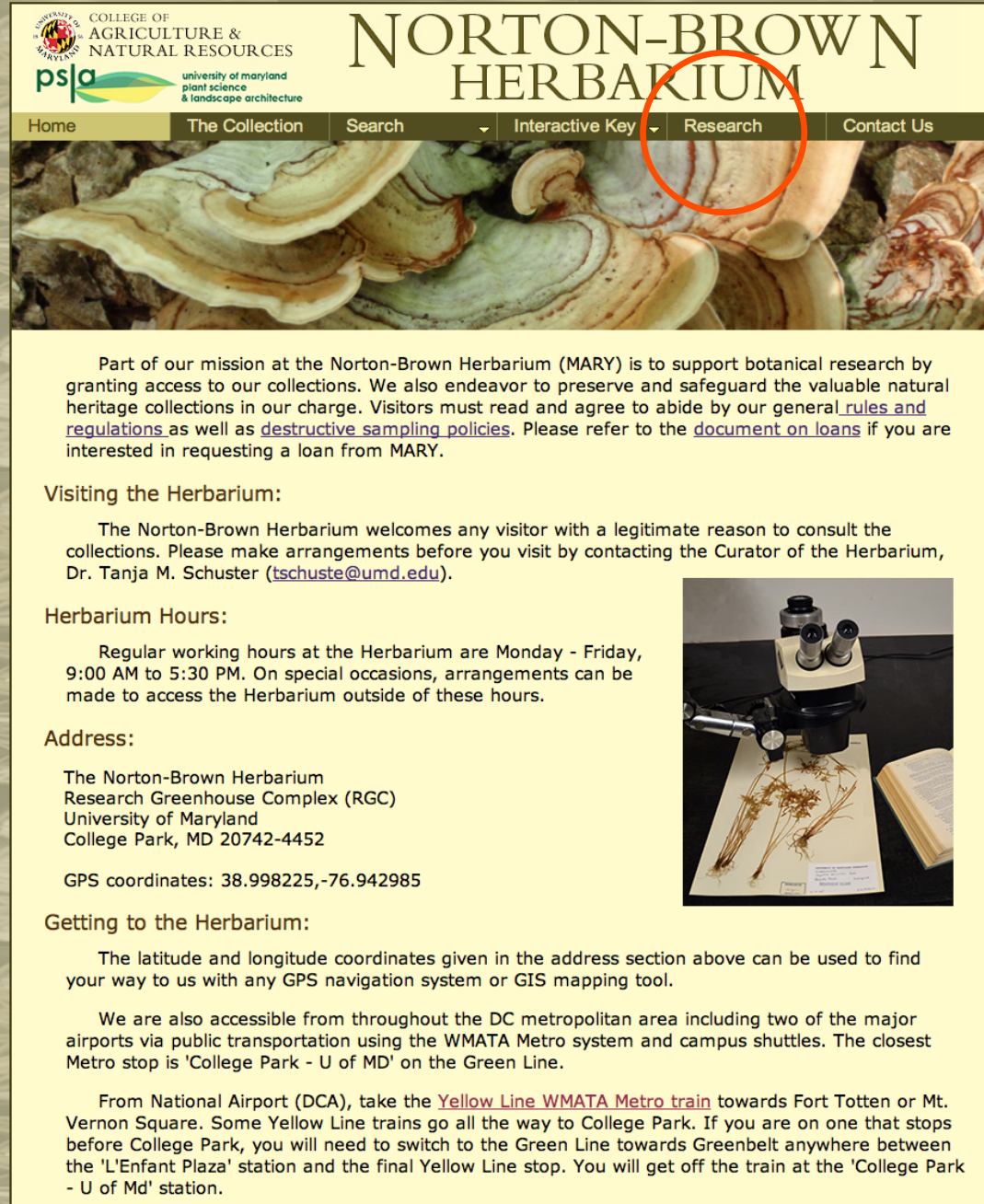
In this key, we have provide family, genus, and species. A **family** is a group of closely related genera (plural of genus) and a **genus** is a group of closely related species. Genera within the same family are more closely related to each other than they are to genera within other families. Families are usually named from the genus of one of its members tied to the ending -aceae. Plants of the same family have common features (e.g., flowers, fruits, chemistry) that set them apart, usually similar flower or fruit characteristics. Recognizing unique family characteristics can help to narrow down the possible choices when trying to identify an unknown plant.

# VH - Research Page

## ■ Forms:

- Rules & Regs
- Destructive sampling
- Requesting loans

## ■ Directions



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# NORTON-BROWN HERBARIUM

Home The Collection Search Interactive Key **Research** Contact Us

Part of our mission at the Norton-Brown Herbarium (MARY) is to support botanical research by granting access to our collections. We also endeavor to preserve and safeguard the valuable natural heritage collections in our charge. Visitors must read and agree to abide by our general [rules and regulations](#) as well as [destructive sampling policies](#). Please refer to the [document on loans](#) if you are interested in requesting a loan from MARY.

**Visiting the Herbarium:**

The Norton-Brown Herbarium welcomes any visitor with a legitimate reason to consult the collections. Please make arrangements before you visit by contacting the Curator of the Herbarium, Dr. Tanja M. Schuster ([tschuste@umd.edu](mailto:tschuste@umd.edu)).

**Herbarium Hours:**

Regular working hours at the Herbarium are Monday - Friday, 9:00 AM to 5:30 PM. On special occasions, arrangements can be made to access the Herbarium outside of these hours.

**Address:**

The Norton-Brown Herbarium  
Research Greenhouse Complex (RGC)  
University of Maryland  
College Park, MD 20742-4452


GPS coordinates: 38.998225,-76.942985

**Getting to the Herbarium:**

The latitude and longitude coordinates given in the address section above can be used to find your way to us with any GPS navigation system or GIS mapping tool.

We are also accessible from throughout the DC metropolitan area including two of the major airports via public transportation using the WMATA Metro system and campus shuttles. The closest Metro stop is 'College Park - U of MD' on the Green Line.

From National Airport (DCA), take the [Yellow Line WMATA Metro train](#) towards Fort Totten or Mt. Vernon Square. Some Yellow Line trains go all the way to College Park. If you are on one that stops before College Park, you will need to switch to the Green Line towards Greenbelt anywhere between the 'L'Enfant Plaza' station and the final Yellow Line stop. You will get off the train at the 'College Park - U of Md' station.



# Collaborations

- *Asclepias* spp. phenophase data for monarch migration study
- Flora of MD



Palomedes butterflies  
on *Asclepias tuberosa*

# MARY - Future Goals

- Transition to APG III
- New imaging system
- Database/geo-reference >>>
- Serve all 87,000 specimens online



*Persicaria perfoliata*



Thanks go to...

*Fallopia scandens*

- ❁ Bill Kenworthy
- ❁ Dept. of PSLA
- ❁ You for listening

Questions?

