Creating a 21st Century Virtual Herbarium at the University of Maryland

Tanja M. Schuster  
Nikolaus G. Anderson  
Maile C. Neel

University of Maryland

COLLEGE OF  
AGRICULTURE &  
NATURAL RESOURCES
Outline

- Background MARY
- Virtual Herbarium
- Collaborations
- Future Goals
MARY - History

- 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
MARY - Current Team

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

Images:
- 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

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

**Strengths:**
1. Polygonaceae
2. Malvaceae
3. Marcgraviaceae
Importance of Herbaria

- Plant Identification
- Understanding Evolution
- Documenting research
- Conservation

Medicinally important black cohosh
- Vetted species ID
- Morphological data via high-res images
- Geo-referenced locality data → export
- Label data databased → export
Virtual Herbarium - Workflow

- Concepts
  - Imaging
  - Training
- Databasing
  - Species ID
  - Proofing
  - Specify taxon tree
- Proofing
- Geo-referencing
- Specify upload

Roles:
- Director
- Curator
- DB Asstnt
- GS student
- FWS student
**VH - Tools & Software**

- 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 1st
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).

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
Stats

History

Collectors

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.

<table>
<thead>
<tr>
<th>Group</th>
<th>~Total Number of Specimens</th>
<th>~Number of Maryland Specimens</th>
<th>Number of Mid-Atlantic Specimens</th>
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</tr>
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<tr>
<td>Totals</td>
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<td>30000</td>
<td>30000</td>
<td>20000</td>
<td>7000</td>
</tr>
</tbody>
</table>

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.
- Georeferenced locality data
- Export data to spreadsheet
- Excludes threatened species
**Persicaria arifolia** (L.) Haraldson

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

**Application:**
GMap ‘ImageCutter’
Bartlett Centre of Advanced Spatial Analysis
<table>
<thead>
<tr>
<th>Accession Number</th>
<th>Genus</th>
<th>Specific Epithet</th>
<th>Common Name(s)</th>
<th>Collector</th>
<th>Date Collected</th>
<th>State</th>
<th>County</th>
<th>Locale</th>
</tr>
</thead>
<tbody>
<tr>
<td>5485</td>
<td>Persicaria</td>
<td>maculosa</td>
<td>lady-thumb</td>
<td>Oliver H. Thompson</td>
<td>8/27/1972</td>
<td>Maryland</td>
<td>Queen Anne</td>
<td>Brackish marsh 10 miles south of Chestertown and 1 mile northeast of the confluence of the Chester River and Langford Creek</td>
</tr>
<tr>
<td>28558</td>
<td>Persicaria</td>
<td>maculosa</td>
<td>lady-thumb</td>
<td>P. Gladu</td>
<td>7/30/1965</td>
<td>Maryland</td>
<td>Kent</td>
<td>Delario Bay, Worton Creek Spit</td>
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<tr>
<td>28907</td>
<td>Persicaria</td>
<td>arifolia</td>
<td>lady-thumb</td>
<td>E. H. Walker</td>
<td>6/28/1930</td>
<td>District of Columbia</td>
<td></td>
<td>Shaw Lily Ponds</td>
</tr>
<tr>
<td>30098</td>
<td>Persicaria</td>
<td>sagittata</td>
<td>arrow-leaf thumb</td>
<td>P. Worthington</td>
<td>7/24/1908</td>
<td>Maryland</td>
<td>Prince Georges</td>
<td>College Park</td>
</tr>
<tr>
<td>5488</td>
<td>Persicaria</td>
<td>maculosa</td>
<td>lady-thumb</td>
<td>L. L. Stuart</td>
<td>10/12/1940</td>
<td>Maryland</td>
<td>Baltimore</td>
<td>Catonsville</td>
</tr>
<tr>
<td>30099</td>
<td>Persicaria</td>
<td>sagittata</td>
<td>arrow-leaf thumb</td>
<td>P. Worthington</td>
<td>7/16/1968</td>
<td>Maryland</td>
<td>Prince Georges</td>
<td>College Park</td>
</tr>
<tr>
<td>32287</td>
<td>Persicaria</td>
<td>maculosa</td>
<td>lady-thumb</td>
<td>J. E. Bruechet</td>
<td>9/25/1909</td>
<td>Maryland</td>
<td>Montgomery</td>
<td>Montgomery County</td>
</tr>
<tr>
<td>5495</td>
<td>Persicaria</td>
<td>maculosa</td>
<td>lady-thumb</td>
<td>E. G. Worley</td>
<td>10/13/1949</td>
<td>Maryland</td>
<td>Anne Arundel</td>
<td>Patuxent Refuge</td>
</tr>
<tr>
<td>32289</td>
<td>Persicaria</td>
<td>sagittata</td>
<td>arrow-leaf thumb</td>
<td>J. E. Benedict, Jr.</td>
<td>8/2/1909</td>
<td>Maryland</td>
<td>Montgomery</td>
<td>Montgomery County</td>
</tr>
<tr>
<td>5496</td>
<td>Persicaria</td>
<td>maculosa</td>
<td>lady-thumb</td>
<td>C. S. Ridgway</td>
<td>7/21/1903</td>
<td>Maryland</td>
<td>Anne Arundel</td>
<td>Bay Ridge</td>
</tr>
<tr>
<td>5497</td>
<td>Persicaria</td>
<td>maculosa</td>
<td>lady-thumb</td>
<td>Norton</td>
<td>8/16/1904</td>
<td>Maryland</td>
<td>Washington</td>
<td>Along Canal, Antietam</td>
</tr>
<tr>
<td>5498</td>
<td>Persicaria</td>
<td>maculosa</td>
<td>lady-thumb</td>
<td>Jane Engh</td>
<td>8/1/1964</td>
<td>Maryland</td>
<td>Howard</td>
<td>Woodbine</td>
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<tr>
<td>5499</td>
<td>Persicaria</td>
<td>maculosa</td>
<td>lady-thumb</td>
<td>Jane Engh</td>
<td>8/9/1964</td>
<td>Maryland</td>
<td>Howard</td>
<td>University Farm on Folly Qtr Rd.</td>
</tr>
</tbody>
</table>
- Genera databased
- Families listed

### Databased Genera
- Abelmoschus
- Acer
- Allanthus
- Allaria
- Amaranthus
- Amphilayarpea
- Apios
- Araich
- Aralia
- Astragalus
- Atriplex
- Baptisia
- Bassia
- Berberis
- Beta
- Broussonetia
- Callitriche
- Cannabis
- Caragana
- Celastrus
- Celosia
- Centrosema
- Cercis
- Chamaecrista
- Chenopodium
- Cladiras
- Citrus
- Crotalaria
- Daucus
- Desmodium
- Dysphania
- Egeria
- Eleagnus
- Ergenia
- Eryngium
- Euonymus
- Fallopia
- Foeniculum
- Frangula
- Froelicia
- Galactia
- Gleditsia
- Glycine
- Gomphrena
- Gymnocalcus
- Hedera

### Databased Families
- Aizoaceae
- Amaranthaceae
- Apiaceae
- Araliaceae
- Berberidaceae
- Brassicaceae
- Cannabaceae
- Caprifoliaceae
- Celastraceae
- Compositae
- Eleagnaceae
- Fabaceae
- Haloragaceae
- Hydrocharitaceae
- Lamiaceae
- Lythraceae
- Malvaceae
- Melliaceae
- Menyanthaceae
- Moraceae
- Oleaceae
- Onagraceae
- Plantaginaceae
- Polygonaceae
- Potamogetonaceae
- Ranunculaceae
- Rhamnaceae
- Rosaceae
- Rutaceae
- Sapindaceae
- Simaroubaceae
Key usage explained

- In Interactive Key tab

Application: ‘NaviKey’
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 parts, the genus name and the specific epithet.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Standard ending</th>
<th>Example 1</th>
<th>Example 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kingdom</td>
<td>-phyta</td>
<td>Plantae</td>
<td>Plantae</td>
</tr>
<tr>
<td>Division</td>
<td>-phyta</td>
<td>Magnoliophyta</td>
<td>Ginkgophyta</td>
</tr>
<tr>
<td>Class</td>
<td>-opsida</td>
<td>Magnoliopsida</td>
<td>Ginkgoopsida</td>
</tr>
<tr>
<td>Order</td>
<td>-ales</td>
<td>Magnoliales</td>
<td>Ginkgoales</td>
</tr>
<tr>
<td>Family</td>
<td>-aceae</td>
<td>Magnolaceae</td>
<td>Ginkgoaceae</td>
</tr>
<tr>
<td>Genus</td>
<td>-phyta</td>
<td>Magnolia</td>
<td>Ginkgo</td>
</tr>
<tr>
<td>Species</td>
<td>-phyta</td>
<td>Magnolia virginiana</td>
<td>Ginkgo biloba</td>
</tr>
</tbody>
</table>

In this key, we have provided 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.
Forms:
- Rules & Regs
- Destructive sampling
- Requesting loans

Directions
Collaborations

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

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

Persicaria perfoliata
Thanks go to...

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

Questions?