

# The Vasculum

## The Society of Herbarium Curators Newsletter Volume 6, Number 1 - January 2011

### FROM THE EDITOR

Greetings fellow SHC members! I won't be making any introductory comments in this issue, as there's simply not space with all of the articles that follow. Let me just say that I'll look for you at this year's business meeting in Alabama!

- Conley K. McMullen, James Madison University

### SHC NEWS

#### A Message from the President

Greetings from the frigid, ice-clad Midwest. It has been a tough winter for much of the continent, which makes us long even more than usual for those beautiful spring flowers that warm our hearts. The coming of spring also portends the coming of the annual ASB meeting, to be held this year in Huntsville, Alabama. It should be a great place to be in April. I hope to see many of you there.

Among the things we may be discussing at the SHC meeting in Huntsville, I hope we have an opportunity to discuss our current by-laws, in order to bring them more in line with a broader-based membership, and more in line with the electronic communications to which most, if not all, members now have access. So, please think about the by-laws and if any updates might be necessary there, and also about any other topics you may wish brought up there. Send any ideas for the meeting to me at [vincenma@muohio.edu](mailto:vincenma@muohio.edu), and I will see what we can include in the business meeting agenda.

In this day of severe budgetary constraints, many of us may be facing financial stresses on several levels. So, how can we work to protect our collections against potential crises? One thing I have been cogitating about is the value of herbarium specimens, not in terms of the value of individual sheets per se, but more in terms of their value as scientific and perhaps even cultural objects. Most curators have no problem seeing the value of the specimen, but what about administrators and the public at large? We have all probably run across the random

administrator who asks "why can't you just take pictures of them and throw them away?" How can we respond to such uninformed comments?

Much has been written on how our specimens can be used. Vicki Funk published a poster a few years ago entitled "100 Uses for a Herbarium (well at least 72)" (see <http://www.virtualherbarium.org/vh/100UsesASPT.html>) which presents very interesting ideas on some of the uses to which herbarium specimens can be put. There have been many fascinating studies published recently that point out just how valuable our holdings can be. Many of these have been brought up in discussions on the TAXACOM list-serve and the NHColl list-serve. If these are not already listed on the SHC web site, I'll ask Derick Poindexter to post the links. Many of us have allowed researchers doing molecular phylogenetic studies access to our specimens as sources of DNA, or host-parasite range data, and so on. Below are some examples of other branches of scientific research that benefit from the existence of our herbarium specimens. I will compile a list of these papers, and they will be posted on the SHC web site. If you have more examples than those I mention below, please send me the citations so we can include them in our list.

Michael Denslow wrote a great piece in the SERNEC Newsletter (<http://www.serneec.org/files/R.A.O.Dec-2008.pdf>) titled "Herbarium Specimens in Support of Global Change Research". Another interesting report is an abstract from the Botany 2001 meeting in Albuquerque, by Petersen and Funderburk, entitled "A History of Ozone Pollution (1850-1990) in Eastern United States Based on the Use of *Osmunda cinnamomea* L. Herbarium Specimens." A more recent example is how phenological changes have occurred in the last 200 years in response to global warming. Several excellent papers have been published by Daniel Primack and collaborators, Robbirt and others, and so on, showing changes in phenology in the eastern United States and in Europe. Still other papers show how stomatal densities have increased as atmospheric temperatures have risen.

A very exciting use for herbarium specimens is the potential they may hold on endangered species research. While propagules of many species may not survive the processing techniques used for herbarium specimens, under some circumstances some may, as has been dem-

onstrated by Bowles and colleagues for *Astragalus neglectus* seeds from specimens as old as 100 years.

Invasive species are also studied from herbarium specimens, and many of us are familiar with studies done to show patterns of invasions of such species as *Phragmites australis* and *Fatoua villosa*. These studies are vastly different, in that the former utilized molecular markers from herbarium samples, while the other was based simply on distributional data from labels.

A final example is a paper published in *PNAS* in 2005, where Zangerl and Berenbaum showed that shifts occurred in phytochemicals in *Pastinaca sativa* after its introduction to North America and the subsequent accidental introduction of its herbivore, the parsnip webworm. The chemical studies were based on extractions from herbarium specimens.

We know intuitively that the collections we curate are valuable. We must now do all we can to learn to demonstrate their value to those with their fingers on the purse strings!

- Michael A. Vincent, Miami University

## HERBARIUM NEWS

### Featured Herbarium: USCH – The A.C. Moore Herbarium, University of South Carolina

The A. C. Moore Herbarium of the University of South Carolina (Fig. 1) celebrated its 100th year in 2007, the same year in which its 100,000th specimen was accessioned, and, coincidentally, the 300th anniversary of Linnaeus' birth. Recognized by its acronym "USCH", this herbarium has a variety of functions, roles, and indeed challenges which it surely shares with other herbaria. This short essay will describe our history and will present some of our unique and promising features.



Figure 1 – Fruiting sweetgum (*Liquidambar styraciflua*) is the logo of USCH.

**Background and History** - Specimens from South Carolina were arriving in London as early as 1700 (Sanders & Anderson 1999), a practice that continued through the early part of the 18th century through the efforts of John Lawson, William Sherard and Mark Catesby, followed by Johann Schoepf, Alexander Garden, John and William Bartram, Louis Bosc, and John Drayton. Thomas Walter's name will probably be the longest-enduring as a strictly South Carolina botanist, and surely as the namer of more new species in the area than any other botanist before or since, although André Michaux may be more widely known. Stephen Elliott's *Sketch of the Botany of South Carolina and Georgia* was published from 1816-1824; although Elliott never studied or taught at (then) South Carolina College, he was named one of its trustees (and a building on our old quad is named after him). Other notable naturalists with considerable botanical leanings were James MacBride, John Bachman, and Louis R. Gibbes. Before and following the Civil War, F. P. Porcher and Joseph H. Mellichamp were serious botanists. Henry W. Ravenel was the premier botanist of post-war South Carolina, most notable for mycology: his five-volume *Fungi Caroliniani Exsiccati* was widely distributed from 1852-1860 (a set is at South Caroliniana Library at USC). J. K. Small (1917) was involved in at least one serious collecting trip (for cacti, with Laura M. Bragg and Paul Rhea from the Charleston Museum) around the Charleston area; his published exploits on this reveal a recognition of the importance of the Charleston area to American botany up to that point, recognizing both its botanists and flora. The 1930s and 1940s saw major additions to our knowledge of the flora of the state, with the activities of W. C. Coker (a native South Carolinian) and S. A. Ives and their students. At Furman, Ives produced the likes of Leland Rodgers, W. T. Batson, and A. E. Radford. The contribution and importance of vouchered material from South Carolina generated by Radford, H. E. Ahles, and C. R. Bell within the development of the *Atlas* (1965) and the *Manual* (1968) of the *Vascular Flora of the Carolinas* has not diminished over time. This list of contributors to botanical knowledge is obviously limited, and there are many other important contributors since then. While all the contributors apparent in this list were not necessarily directly involved with USCH, all present-day botanists in South Carolina, whatever their institutional situation, may trace their various successes back through this legacy. At USCH, we hope we can continue contributing.

The years of Reconstruction in South Carolina, as punishing as they were, were just as dreary for the cause of botany, formerly such a flourishing field of study (Bragg 1912). The Herbarium at the Charleston Museum was intact, as was the herbarium of Henry W. Ravenel (moved to Converse College), but botanical activity had largely ceased. Whatever botanical legacy remained at South Carolina College (the institution went through a number of name changes, finally and permanently chartered as the "University of South Carolina" in 1906), was more or less ended when its agricultural college was relocated to

the auspices of the new Clemson College, and its resultant herbarium, begun 1906 (Sanders & Anderson 1999).

Andrew Charles Moore (Fig. 2), a native South Carolinian (from Spartanburg County) graduated from South Carolina College (B.A. 1887) and continued botanical studies (especially embryology and physiology) at the University of Chicago. (Interestingly, Moore is recognized as the first user of the term “meiosis” in its scientific sense, while at Chicago.) In 1900 he returned to Columbia as assistant professor of biology, geology, and mineralogy at South Carolina College. He was promoted to full professor in 1903 and became the first chairperson of its newly christened “Department of Biology” in 1906. Moore was deeply involved with the University outside biology, serving as its Dean, and as the long-term editor for its Alumni Record, and as acting President for two separate years. It is heartening to know that the first Curator at USCH was such a “people-person” as well as a serious biologist and champion of botany. (Neither “Plant Science” nor “Plant Biology”, but **BOTANY!**) He famously quipped to his Department that “Someone has facetiously defined a biologist as a zoologist who knows enough botany to give an introductory course in that subject” (A. C. Moore papers, South Caroliniana Library), a sentiment that, curiously, remains telling in this latter day. Moore's final days were spent within Lieber College (then a faculty tenement), where he died in 1928. (Tradition has it that his death occurred during a storm, and that a tree crashed into the building after he died.)



Figure 2 – Andrew C. Moore, while an undergraduate student at South Carolina College, about 1896.

The Herbarium entered a period of quiescence until 1935, when Paul J. Philson began serving as its Curator and main contributor. Philson was hired as an instructor within the Department of Biology from 1935 until 1940; although hired as an instructor, he had a considerable research role within the Herbarium, studying (and publishing) on algae of both Carolinas (Philson 1939, 1940). General herbarium activity was reduced during the years of World War II; the same is true for local plant collecting. This changed in the early 1950s upon the arrival of W. T. Batson (Fig. 3).



Figure 3 – Dr. Wade T. Batson.

Wade T. Batson was born in Marietta, South Carolina (Greenville County) in 1912. He received his B.S. from Furman in 1934, and his doctorate from Duke (as a student of H. L. Blomquist) in 1952. Batson joined the Biology faculty at USC in 1952 and instantly changed the profile of the previously moribund Herbarium. His voluminous collections (nearly 4,500 specimens) and keen sense for careful, detailed observations translated into a new “generation” of herbarium collections. Batson quickly gained a reputation for developing the area around Columbia as a “living laboratory”: the best kind of tool for teaching. His series of “Flora” courses soon developed significant and enduring popularity with undergraduates, not restricted just to Biology majors, and his classes were regularly packed (Porcher & Rayner 2001). The 1960s and 1970s saw a surprising upswing in local interest in botany and the local flora, and well after the popular Ecology movement of the time. His students included David Rembert, Richard Porcher, John Frier-son, Harry Shealy, Janice Coffey, John Fairey, Mike

Dennis, Doug Rayner, David Crewz, Dan Zurosky, Alan Crandell, Shaukat Siddiqi, Karen Elder, Steve Larson, Fred Yeats, Patti Guess, Bruce Smith, Terry Lucansky, John Logue, Becky Frierson Sox, Gerald Pitts, Cynthia Aulbach, Victoria Hollowell, John Barry, Jon Benson, L. H. Buff, Steve Dial, Jackie Jacobs, Sara Lindsay, Fred McElveen, Betty Borom, Richard Stalter, Larry Swails, Susan Mitchell, Tammy Kovar, Hubert Hill, Jerry Long, Martha Massey, Jake Bickley, John Nelson, Mark Dutton, Jon Jones, Bert Pittman and Randy Westbrooks, among many others. Batson's primary impact on the Herbarium involved the vouchering of many thousands of specimens collected during biological inventory of the developing Savannah River Plant within Aiken and Barnwell Counties. Additionally, his students regularly added material to the collection from their floristic surveys and other projects. Batson retired in 1983 as Distinguished Professor. As a way of indicating Batson's expanded influence, the W.T. Batson Endowment at Clemson University has been established to provide financial assistance to students completing a degree involving field botany studies within South Carolina. "Dr. B" will celebrate his 100th birthday on May 7, 2012!

Cynthia A. Aulbach assumed the role of Curator formally in 1980. During her decade of leadership, the Herbarium grew to 50,000 specimens. Cindy was the first to use digitization efforts within the collections, amassing data from the collections within other herbaria, and developed the first updated county-level distribution maps for South Carolina plants since the publication of Radford, Ahles & Bell's distributional studies (1968) of plant life in the Carolinas. This body of work, now revamped, maintained and regularly edited within the Heritage Program of SC Department of Natural Resources, provides the best local source on current plant distributions in the state. Cindy added approximately 5,000 specimens herself and effectively transformed the Herbarium into a "modern" collection, greatly expanding its involvement with exchanges and loans. One of the major benefits to the Herbarium during her curation was the first serious attempt to have our material studied and annotated, a trend that continues to the present. In 1989, the Herbarium was formally named in honor of A. C. Moore.

Presently, John Nelson serves as the Curator of USCH, since assuming that position in 1990. The collection contains approximately 120,000 specimens of vascular plants (464 families, 3,263 genera, and 11,500 species), bryophytes lichens, and algae. The collection is especially rich in material from the midlands and coastal plain of South Carolina, as well as the rest of the southeastern USA. All US states (and the District of Columbia) are represented; outside the Southeast, most USA material is from California, Missouri, Texas, Kansas, New York, and Illinois, in that order, with Utah and Idaho essentially tied for the next spot. Outside North America, western and central Europe is especially well-represented, and the collection includes a considerable number of sheets from the alpine Austria and Germany.

## CURRENT AND ONGOING ACTIVITIES

**New emphasis on collections digitization** - USCH began digitizing specimen label data in 2002. More recently, our assistant Curator, Herrick Brown, has overseen a sophisticated application of "Specify" as a software entity for our collections management; we are now employing Specify version 6. Currently an archived data set covering approximately 63% of our accessioned specimens is available for convenient searching online, and soon we will debut one of the first online search tools to interface with our Specify 6 database.

**We are committed to public service** - At USC, the herbarium exists institutionally within the Department of Biological Sciences, which itself is positioned as a part of the College of Arts and Sciences. In addition to its over-arching commitment to research and teaching, the College considers public service a vital aspect of its contact with the people of South Carolina. To that end, USCH is dedicated to a policy of providing plant identifications, free of charge, for whoever requests them. Over the last two calendar years, USC has received nearly 1500 separate requests, and has responded to each one.

**The Henry W. Ravenel Collection of Converse College resides here** - In 2004, Converse College entrusted USCH with the entirety of the magnificent vascular plant collection amassed by Henry William Ravenel (1814-1887). This collection, containing 6,125 original sheets, includes a large proportion of plant specimens from Ravenel's contemporaries, notably M. A. Curtis, A. W. Chapman, S. T. Olney, George Engelmann, S. B. Buckley, George Vasey, and Asa Gray, among many others. In addition to its worth as a priceless botanical collection, it has unrealized value as an indicator of botany of the mid-19th Century South, and of its social circumstances, particularly involving cultivated plant material. To date, a number of types or probable types have been identified within it. The collection is being restored and made ready for standard loans, and we eagerly encourage our colleagues to borrow material from this collection.

**Our Herbarium has an active Endowment** - One of the greatest friends of the A. C. Moore Herbarium is our own John M. Herr, who, in 2001, formally devised and enacted the W. T. Batson Endowment for the A. C. Moore Herbarium. The endowment was designed as a way of providing funds, through gifts and donations, for day-to-day operational expenditures within and associated with the Herbarium. Many generous donors have helped us, and returns from the Endowment have been steady. Funds generated in this way have become increasingly useful in this economically trying period.

**We have a strong working relationship with the South Carolina Department of Natural Resources** - Our longstanding relationship with the Heritage Trust Program of the SC Department of Natural Resources continues to be of mutual benefit. While numerous



vouchers from Heritage survey activities are accessioned into our collection, we provide cozy office space for a member (Herrick Brown) of Heritage staff at USCH. In addition to processing vouchers from Heritage surveys, Herrick also works continuously to bridge the gap between the Herbarium and Heritage Trust databases by providing 'crosswalk' data that link Element Occurrence Records (EORs) with corresponding specimens and sleuthing out previously undocumented EORs based on historical vouchers.

**Our Newsletter is called the "Florascopé"** - It is available on-line through our website ([www.herbarium.org](http://www.herbarium.org)); we send a paper version to our donors.

**Plantman is our mascot** - It is true: we have a legitimate, universal botanical superhero associated with our Herbarium. Plantman came to earth --in a pod-- from Planta, an earth-like planet that was destroyed by its inhabitants' blatant disregard to global ecosystems and biodiversity (Fig. 4). With his able assistant and sidekick, "Sprout", Plantman's job is to alert the public, commonly through local and state-wide meetings, festivals, and other events, to the importance of recognizing, and indeed, cherishing, the fabulous plant life found around us, and to an understanding of the importance of taxonomy. He has appeared at schools in the Columbia area, and is often booked for speaking engagements; he is always glad to speak. Of course, his extremely tight agenda makes scheduling something of a challenge. (Legends abound of other escape pods from Planta that brought mysterious passengers to earth. Perhaps one landed near your Herbarium, still waiting to be discovered...).



*Figure 4 – Plantman appeared at the Botany 2010 meeting in Providence last summer. Here he is with one of his fans, Kate Goodrich.*

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- John Nelson, University of South Carolina

### Report on the US Virtual Herbarium Effort

With funding from the National Science Foundation, the US Virtual Herbarium workshop was held on Feb 23-25, 2010 at the Missouri Botanical Garden, St. Louis, Missouri, USA.

**Workshop organization** - Sixty-four participants from across the United States with expertise in botany, taxonomy, systematics, biology, ecology, specimen curation, biodiversity conservation, biological informatics, information technology, and computer science worked together to refine the US Virtual Herbarium (USVH) concept by identifying issues and tasks associated with its development and defining the organizational and technological structure needed to support it. Participants represented each of the four largest free standing herbaria (New York Botanical Garden, Missouri Botanical Garden, The Field Museum, and Smithsonian Institution), small and mid-sized herbaria, existing herbarium networks, the iPlant Project, the National Park Service (NPS), and the US Geological Survey's National Biological Information Infrastructure (NBII) program, the US node of the Global Biodiversity Information Facility (GBIF).

**USVH goals and the path to accomplishing these goals** - The group recognized that the goal of the USVH effort should be to help digitize herbarium collections throughout the US. To accomplish its digitization goal, the USVH project will focus on helping herbaria digitize the more than 70 million specimens that they hold. This will result in a significant national dataset and provide substantially more specimen information to GBIF and

other consumers than is currently available. The project will also encourage development of tools that will attract and serve the needs of a broad user-base for the information. By developing procedures for developing and providing high quality plant data to GBIF and the public, the USVH project will also benefit other natural history collections in their efforts at data mobilization.

Other issues addressed by the group included how technology and software development could be accelerated through a modular and collaborative approach; ways to make the value of digital herbaria evident to different user groups; how to develop the human infrastructure required to build and maintain the USVH; how to fund the project; and the organizational structure that would best serve the project's goal.

The need for supporting human infrastructure development was indicated by a survey conducted for the Southeast Regional Network of Expertise and Collections (SERNEC). The results showed that some of those in charge of herbaria combine multiple responsibilities with little or no experience in curation and collections management. Informal surveys indicate that this is also true in other parts of the country. Even those familiar with herbarium curation may need assistance in appreciating and implementing some of the changes in traditional practices that are critically important to data digitization and aggregation. Another problem for many is that herbarium curation is considered of minor importance by their administrators. In response to these concerns, the participants recommended that USVH make providing opportunities for professional development to all those who work in herbaria an integral part of its mission. Such efforts are critical to development of the human botanical infrastructure required to facilitate and enhance research and land management practices involving plants and plant communities.

The workshop participants also recognized that major herbaria face different challenges from small herbaria, notably the sheer number of specimens that they need to digitize. Most have made significant progress in this area using funding from a variety of sources. One consequence is that, for some of these herbaria, many of their digitized specimens are of specimens collected outside the US because the funding has either come from entities outside the US or has been for projects conducted outside the US. In comparison, those responsible for smaller herbaria face the combination of limited resources and limited awareness of their importance in providing information about plant diversity and inspiring students to engage in its study.

The participants agreed that digitizing of herbarium specimens would be of great value to researchers and policy makers in many different arenas because of their historical nature, along with the fact that many specimens have been collected in landscapes that have since been trans-

formed by human activity. The increased access to specimen images and specimen data will permit experts to view, annotate, and analyze data from far more specimens than is now feasible, thereby increasing the value of the physical specimens. They noted, however, that digitized specimens will not answer all the questions for which herbarium specimens are consulted. Many aspects of plant biology, such as biochemical and anatomical characteristics, require examination of the physical specimens. Thus, although digitizing specimens will facilitate discovery of resources and open up new avenues of research, the participants were unanimous in calling for continued support for the maintenance of physical collections and deposition of voucher specimens. Digitization should be viewed as another step in enhancing the value and extending the reach of our natural history collections, not an end point.

**Organizational structure** - In terms of organization, workshop participants strongly endorsed working with and through the existing structure of regional consortia/alliances/associations of herbaria, several of which are already active and were represented at the workshop. This was seen as the most effective mechanism for disseminating information and sharing and leveraging existing expertise and resources among participating herbaria because it enables the project to build on, and promote, existing collaborations. The basic structure proposed for the USVH consisted of an advisory group composed of individuals nominated by the regional consortia, using procedures of their choice, and representatives of selected groups such as the US National Park Service, that have a vested interest in the herbarium community. In addition there would be a USVH steering committee of 7-9 individuals, most of whom would be elected but with 2 positions reserved for nominees of the NBII, the US node to GBIF. Questions about obtaining recognition for new regional consortia, identifying the groups to be represented in the advisory committee, and the exact composition of the steering committee were left for further discussion.

An issue that came up during the discussion, and in correspondence after the workshop, was the need for the project and its supporting organization to have different names. After considerable post-workshop discussion, the Steering Committee agreed that the project should continue to be called the US Virtual Herbarium project, USVH for short, and that the organization set up to develop it should be called the US Herbarium Alliance.

In the past year since the USVH Workshop, the community has discussed the organizational structure and overall USVH role, especially in light of the NSF ADBC solicitation. The revised organizational structure is currently posted on the USVH website (see below).

**Funding** - In discussing funding issues, a primary concern and a major impediment is that, under the present

system, herbaria (or groups of herbaria) and other natural history collections compete with each other for relatively small amounts of money to digitize their collections, obtain cabinets, install compactors and address other needs critical to the maintenance of natural history collections. This results in an enormous investment of time spent writing and reviewing proposals for very similar activities, most of which have to be rejected because of the limited funding available. The USVH is a project in which proven methods need to be implemented at multiple institutions in order to enable access to the depth and extent of information in US herbaria, not a research project in which the goal is discovery of new information or understanding. This is contrary to the purpose of most major funding sources which emphasize developing new and innovative procedures or testing hypotheses rather than facilitating the application of procedures known to be effective.

Encouraging innovation and development of better procedures is important, but having funding specifically identified for significantly accelerating digitization using current best practices will increase the amount of data available and enable those in charge of herbaria to focus on digitization rather than writing proposals for digitization. As new, more effective procedures emerge, information about them will be disseminated rapidly through the regional network structure so that they can be quickly adopted.

In suggesting how to address the need for funding construction of the USVH, the workshop participants emphasized that the project needs to demonstrate the value of collection information to many different audiences. This can be achieved by drawing on examples and successes from the networks and herbaria that have made the most progress in digitizing their collections; employing existing tools for using the information; and implementing a strong organizational structure that can solicit major funding to accelerate digitization of the remaining specimens in US collections.

**All Biological Collections Initiative** - On the first day of the meeting, Barbara Thiers (NY Botanical Garden, Consortium of Northeastern Herbaria) and Chuck Miller (Missouri Botanical Garden) presented a draft plan for an initiative to form a National Biological Research Collections Resource. Unlike the USVH project, this initiative seeks to digitize all natural history collections in the US, not just the herbarium collections. This effort was part of the impetus for the recent NSF ADBC solicitation (see <http://www.nsf.gov/pubs/2010/nsf10603/nsf10603.htm?org=NSF>) that will seek to build a HUB (Home Uniting Biocollections) and multiple Thematic Collections Networks. The first deadline for this solicitation was December 2010, so we should soon hear of the funding awarded for this effort.

**Looking forward** - At the end of the workshop, ten task forces were created. These were charged with developing plans for and taking steps towards addressing specific actions and issues identified during the workshop. The task force leaders will present these work plans, and the progress that they have made, at the project's annual meeting which will be held on August 1, 2011, in conjunction with the annual meeting of the Botanical Society of America. The current Steering Committee continues to work on follow-up tasks identified during the workshop, including preparation of this report. It will persist until such time as a formal structure for the project has been elaborated and ratified. New task forces may develop or existing ones may be retired as tasks are identified and completed.

**Summary** - The USVH Workshop brought together expertise, skills, and knowledge from a wide range of disciplines and fields to discuss topics relating to the development of a national US Virtual Herbarium concept. With a common set of principles, the participants in this workshop will move forward to solidify USVH objectives, develop a governance structure, work collaboratively towards securing funding and resources, and facilitate the education of professionals and upcoming academic graduates entering into the field. Overall, this workshop facilitated the discussion needed to move the USVH concept forward and enabled professional networking for its participants. More news about this effort can be found at: <http://usvirtualherbarium.org/>.

This information was largely taken from the NSF report submitted by Zack Murrell and Mary Barkworth. The full report can be found at the USVH website listed above.

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## Mounting Fragile Botanical Specimens: An Upside-Down Approach and Template

At Rancho Santa Ana Botanic Garden (RSABG), mounting herbarium specimens is usually a serene and peaceful task. However, there are times when mounters find themselves in a predicament when the next specimen in their pile is a *problem plant*. Such plants include grasses, sedges, cacti and aquatics. These plants can disrupt that perfect ambiance in the herbarium workroom and discourage any mounter from ever attempting to turn these plants into useful research specimens.

Here at RSABG, the mounting volunteers are an innovative bunch. They have tried various ways to improve their mounting techniques, to overcome those specimens that some have labeled "hideous," "monstrous," and even

“ugly!” Being their supervisor and a botanist at heart, I encourage them to try to mount those ugly ‘ducklings,’ because such plants may be a part of someone’s hard-earned grant-funded collection and may fuel another scientist’s next exciting discovery. By understanding the importance of a specimen, they are motivated to overcome the urge to “put the specimen at the bottom of the pile.” I find that holding workshops featuring an instructor who is a botanist specializing in the area of the problem plant motivates the mounters to find improved methods to get those plants securely glued and taped. One such method at RSABG is what we call the ‘C. Frederic Brasch Method,’ basically an inverted gluing technique.

I should begin by explaining the taxonomy of the method, and then I will provide instructions for the method. Chuck Brasch is a retired high school teacher who volunteers as a mounter; two other mounting volunteers, Barbara Booth and Jim Burke were present the day Chuck Brasch came up with the inverted method. He was faced with a finely stringy aquatic plant that was too difficult to dip in glue or to hold and apply glue. Therefore, he placed the plant face down on the original collecting paper and lightly applied glue to the backside. He gently placed a herbarium sheet over the aquatic plant and presented to us a perfectly mounted specimen. However, there were some problems that needed figuring out, such as label placement. Barbara Booth immediately roared with excitement claiming this method needed a name. A graduate student who happened to be present cried out, “How about ‘Up-Chuck’?” Though the name seemed perfectly apt for the method, Jim Burke had a great laugh but shook his head “no” at the same time. It was decided that we would need a more sophisticated, but un-Latinized name instead. The next question for Chuck was, “what’s your middle name?” to which he replied, “Frederic.” Immediately the group determined to appropriately name the innovation, “The C. Frederic Brasch Method.”

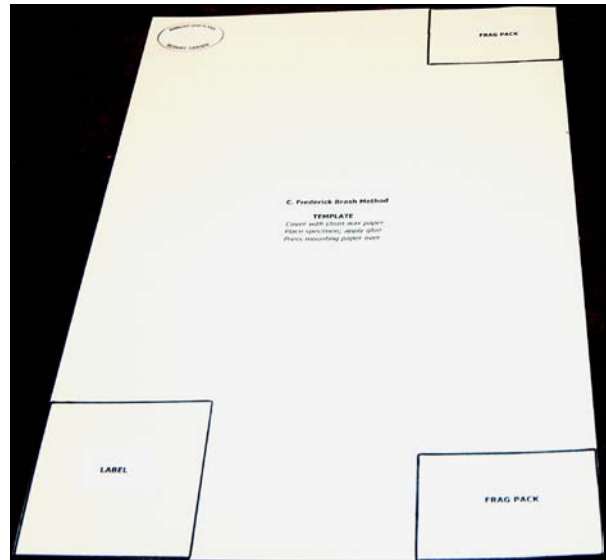
This article demonstrates how the method works with detailed images and descriptions. The method has been used in herbaria likely for many years and it is the actual template created by Barbara Booth that makes our modification of it worth describing here. Having a template to perform this mounting technique reduces the incidence of errors... errors that are difficult to rectify given that we are dealing with “problem plants” to begin with. Our innovation is a low-tech, home-made template that can be recreated by any herbarium.

List of materials:

- Template (Size of most herbarium sheets - 11½ x 16½)
- Roll of Wax Paper
- Herbarium paper
- Glue & glue brush
- Specimens

1) Place the template on the table, facing up. Notice that the template has markings for where the label, accession

stamp, and fragment packet are placed. In the middle of the sheet is a shortened version of the instructions. The template is a mirror image of a mounted specimen.



2) Place a sheet of wax paper on top of the template (this is to avoid getting glue on the template, and you can toss the wax paper out after you apply glue to the specimen. Wax paper is transparent and allows you to see the template underneath.)





3) Decide which side of the plant you will apply glue to and then place the plant with the 'up' side facing down on top of the wax paper.



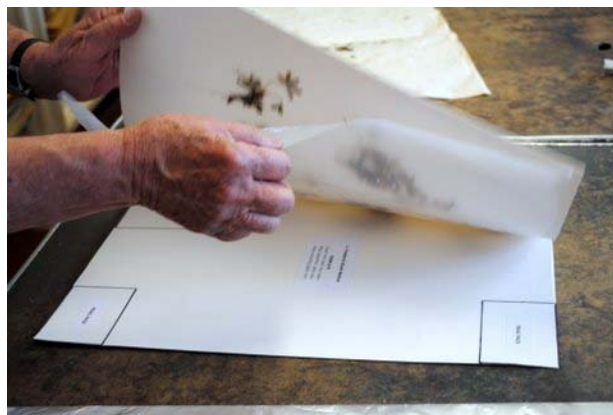
4) Apply glue to the plant (apply glue sparingly if you are working with wiry, fine, or filmy grass and grass-like plants and aquatics).



5) Place herbarium paper carefully over the template, and then with a closed fist rub the backside of the paper to make contact with the glue on the plant.



6) Turn the herbarium paper over, peel the wax paper off and discard the wax paper.



7) The specimen is now securely mounted to the paper.



8) Glue on the label and the fragment packet.



The main challenge may be finding a place to store the template, since it is one herbarium sheet. The template that we use is stored in a thin white box which herbarium sheets of 100 come in. Pre-cut wax paper sheets are also stored in the box but one can keep a roll of wax paper on hand near the template or mounting table. On the side of the box, **TEMPLATE** is written in permanent marker. The template box is placed where people can easily access it during mounting sessions.

In September, I held an in-service session for the mounting volunteers demonstrating this mounting technique. My mounting team is now enriched with creative and novel, but also successful techniques to use when they are faced with those difficult plants that they wish - at first - they had never met. My hope is also to challenge them to bring their own creativity to the mounting table as did Mr. C. Frederic Brasch.

- Erika Gardner, Rancho Santa Ana Botanic Garden, Herbarium Workroom Manager, [egardner@rsabg.org](mailto:egardner@rsabg.org)

## **THE WIRED HERBARIUM**

### **Phenology Data**

The herbarium database digitizes specimen information: identification, location, collector and date, habitat information... and the information keeps getting more and more complex. Consider geographic information: I've seen specimens from the 1800s simply labeled "Puerto Rico". Many of the specimens in the herbarium I curate cannot be located beyond an entire county. Then we started adding township/range/section information, and then GPS coordinates, including estimates of error.

But what about phenological data? We've all been taught that a good herbarium specimen typically is "fertile", i.e. has flowers and/or fruits. Should this information be recorded? To what detail?

Recently, Isaac Park from the Department of Geography at the University of Wisconsin - Milwaukee contacted me to inquire if my herbarium was recording phenological data. I've invited him to describe his conception of how to record this data, and his rationale for adding this extra data. Here's his description:

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In the face of increasing interest in phenological science to examine the impacts of climate change on the biosphere, herbarium records have begun emerge as a vital mechanism capable of producing surprisingly accurate data of historical phenological change. These records provide the phenological researcher with the benefits of a wide spatial scale and an unparalleled diversity of taxa, as well as extending quite far back in time. Particularly

with the advent of the USA National Phenology Network and the concerted push for comprehensive continental phenological assessment of North America, herbaria represent an incredibly powerful and largely untapped resource that can play a unique and critical role in understanding the interactions between climate and the biosphere.

The importance of digital herbarium records came to my notice during a visit to the University of South Carolina Herbarium to conduct more detailed phenological assessments of a small set of species, when it was casually pointed out to me that digital records existed for the entire collection that included both flowering and fruiting status. Since then, and after significant exploration of similar data from several other herbaria, it has become quite clear that herbaria are sitting on a veritable goldmine of information. With only a slight additional effort, this information can be made readily available and play a critical and irreplaceable role in the study of climate change and its impact on the myriad components of the plant biosphere. By including systematic digital records of phenological status as part of the creation of digital archiving efforts, the potential of these records in furthering our understanding of climate-ecosystem interaction can be fully realized.

Due to the broad scale and need for standardized measurements across taxa, the kind of information required for large scale phenological studies need not be complex or require a significant additional investment of time or expertise to include this information in the process of databasing specimens. While special studies focusing closely on specific taxa might involve more complicated assessments tailored to each species, the recording of phenological status, in general, should be kept simple in order to facilitate systematic comparison both among taxa and across herbaria. In the same way that most digital records include fields for country, state, and perhaps closest city, without attempting to codify more precise geographical descriptions that vary significantly among samples, a quick, simple assessment of phenological structure along the lines indicated here would be an easy and uncomplicated addition to any digital archiving effort.

The most common scheme for annotating phenological information digitally, which is sufficient for most phenological analysis, is to include a 'phenology' field that lists samples as either A) flowering, B) fruiting, C) flowering and fruiting, D) sterile, or E) undetermined. This method is relatively straightforward and would be sufficient to provide a wealth of phenological data if commonly adopted. Problematic taxa which require greater care or expertise to classify accurately, such as grasses and sedges, might be classified more generally as sterile or flowering/fruiting if the determination of the exact phenological stage were found to be problematic, or even left as undetermined.

Another concern that is often raised in digitizing phenological data in herbaria, is that of accurately assessing the phenological status of plants as relates to actual fertility status and pollen production, which can be overly complicated and severely curtail the ability of volunteers to digitize samples into online archives. It is worth noting that one of the real strengths of herbarium records as a source of historical phenology is the fact that it includes a wide range of taxa, the phenology of which can be compared and contrasted, and as such, the focus within digital records of phenology should be first and foremost to provide a simple assessment that can be easily compared among species and across herbaria. Such concerns over the precise assessment of the phenological status of specimens may be expected to have a minimal effect on the overall phenological patterns in the data, and should not be allowed to dissuade the inclusion of simple phenological data.

The last issue that often occurs with the usage of herbarium samples for phenological research is that of accessibility. With the current interest in climate change and phenology, herbarium records represent vital data, but many herbaria that include phenological data in their digital records make no mention of it on their websites or online interface. For the data to fulfill its potential, it must first be possible for interested researchers to determine whether or not such data exists for a given herbarium. Additionally, what is often required for large scale phenological research is a complete list of the entire digital archive (or a significant portion thereof), something that is sometimes difficult to acquire through online interfaces, and which some curators cannot easily export. Since much of the utility of this data is to researchers working at regional or continental scales which require the entire record across multiple herbaria, it is important that such records be both accessible and locatable. In general, this would require very minor alterations to the online components of herbaria. A simple notification that phenological records are part of the digital archive and available by request is all that is really needed. However, in cases where herbaria have limited online infrastructure, it would also be possible to archive data through participation in the data sharing function of the U.S. National Phenology Network (USANPN), which archives phenological datasets intended to be stored and potentially shared with other researchers. In cases where there are concerns about freely sharing the entirety of an herbarium's digital database, multiple levels of security or access restriction may also be placed on such data, as well as requirements and permissions for the publication of research using that data.

In short, the records being held in herbaria represent a resource for exploring the ecological effects of historical and future climate changes that is unparalleled, and largely unexplored to date. With a relatively small shift in the approach taken in developing digital records, herbaria will be able to play an increasingly pivotal role in shaping and informing our understanding of the interac-

tions between climate and the biosphere. This is particularly the case as relates to understanding the potential response and range of the majority of the plant community to climatic changes, something no other resource will allow. In addition to studies of ecosystem response to climate change, these phenological records will also be useful to a variety of related fields, including apiarists and pollination biologists, public health researchers interested in historical timing of pollen release for specific species, and biologists interested in the availability of certain fruit-based food sources to various animal species.

I am currently accumulating herbarium data for use in research on historical phenology and on developing new methodologies to utilize herbarium based phenological records. If anyone has any form of digital phenological records included in their archives, I would sincerely appreciate their contacting me at [iwpark@uwm.edu](mailto:iwpark@uwm.edu). Additional resources on phenology and digital distribution of phenological data are available at [www.USANPN.org](http://www.USANPN.org)

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OK. Isaac, you have convinced me! I'm adding a column to my herbarium database, headed Phenology. We will start recording specimens using Isaac's suggested schematic: Flowers; Fruits; Flowers and Fruits; Flowering/Fruiting (i.e. one or the other but which is undetermined); Sterile; Undetermined.

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"Promise of Spring" – *Sanguinaria canadensis* L.  
(*Papaveraceae*) by C.K. McMullen

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