BULLETIN

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PLANT SCIENCE

The Botanical Society of America: The Society for ALL Plant Biologists

ISSN 0032-0919

THE BOTANICAL SOCIETY OF AMERICA
Leading Scientists
and
Educators
since 1893

BOTANICAL SOCIETY OF AMERICA

2010 International Year of Biodiversity

What better way is there to begin a celebration of the International Year of Biodiversity than to feature the biodiversity of a little-known country, in this case Romania. In our first feature article, the BSA International Affairs Committee presents another in its series of national profiles. Co-authored by one of the Society's newest corresponding members, Anka Sarbu, and by Anitra Thorhaug, chair of the BSA International Affairs committee, Botany in Romania showcases some of the endangered species of this very central and large nation in Eastern Europe that is little known to most botanists and contains one of the few intact forest systems in Europe.

In our second feature article, David W. Lee and Eric von Wettberg present the inaugral peer-reviewed paper published in the *Plant Science Bulletin*. This "bottle biology" project uses commercially available shading materials to differentiate plant responses between shading conditions due to reduced light intensity alone, or in combination with reduced R/Fr simulating shading under plant cover. Modifications would be appropriate for high school level through college plant physiology courses.

The die for peer-reviewed articles in PSB is now cast, but we depend on your contributions for this effort to succeed.

- The Editor

News from the Society

Congratulations to the new BSA "AAAS Fellows"

The Botanical Society of America is pleased to recognize our members who have recently been elected as fellows of the American Association for the Advancement of Science (AAAS).

Election as a Fellow of AAAS is an honor bestowed upon members by their peers in recognition of their efforts to advance science or its applications. Our colleagues will be among the 531 members recognized at the Fellows Forum on 20 February 2010 during the AAAS Annual Meeting in San Diego.

Dr. Darleen DeMason
University of California, Riverside

For pioneering research into germination and development of plants and exemplary leadership in campus administration and professional societies.

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Dr. Susan Singer
Carleton College

For outstanding contributions to science education, particularly inquiry activities involving plants and undergraduate research experiences.

Dr. David Spooner
University of Wisconsin-Madison

For distinguished work in systematics, evolution, and the domestication of potatoes, tomatoes and their wild relatives.

Dr. Stephen Weller
University of California, Irvine

For distinguished contributions to the field of evolutionary ecology, including the evolution of reproductive systems in plants and the quantative genetic basis of sex allocation.

American Journal of Botany launches new section for Primer Notes and Protocols

The *American Journal of Botany* (*AJB*) has just launched a new online-only section: *AJB* Primer Notes & Protocols in the Plant Sciences. This new section will promote the rapid dissemination of protocols used in the genetic analyses of plants.

Articles for this section will include marker notes, which provide primer sequences for microsatellite or other markers in particular taxa, and protocol notes, which describe new methods for isolating, visualizing, or scoring genetic markers.

"It is exciting to now have the opportunity to publish innovative and timely genetic information within such an influential journal as the AJB," said Theresa Culley, Associate Professor at the University of Cincinnati. "Plant biologists now have a new outlet with a rapid response rate and greater flexibility where they can share their important genetic discoveries within the botanical community."

-continued on Page 13

Approaching deadlines for 2010 Award Nominations

March 15th
BSA Awards - General
BSA Merit Award
http://www.botany.org/awards_grants/calls/2007merit.pdf

Charles E. Bessey Teaching Award
http://www.botany.org/awards_grants/calls/2007bessey.pdf

BSA Awards - Students
Young Botanist of the Year
Undergraduate Student Research Awards
John S. Karling & BSA Graduate Student Research Awards
Genetics Section GSRA

April 1st
BSA Award - General
Jeanette Siron Pelton Award
Darbaker Prize

BSA Student Travel Awards
Triarch "Botanical Images" Awards
Vernon I. Cheadle Awards
Section Travel Awards: Developmental and Structural, Ecological Section, Genetic Section, Mycological Section, Phycological Section, Phytochemical Section, Pteridological Section .

Call for Nominations: BSA Corresponding Members

Deadline April 1, 2010

The Corresponding Members Committee is soliciting nominations for Corresponding Members of the BSA. According to the BSA Bylaws, Corresponding Members are "Honorary members working as professional botanists in foreign posts, who by virtue of their contributions, are elected by the membership of the Society." Corresponding Members are granted life membership in the BSA and enjoy all the privileges of regular Active Members.

The nomination should consist of 1) a curriculum vitae of the proposed candidate, 2) a detailed explanation of the qualifications and achievements of the candidate, and 3) at least three (eight to ten are usual) letters of support.

It is preferable for nominations to be made without knowledge of the nominee. **Nominations must be received by 1 April 2010** to be considered for award of corresponding membership at Society business meeting at the Botany 2010 Conference in Providence, Rhode Island, on Tuesday, August 2, 2010.

Please use the nominating form available on the BSA webpage at:
http://www.botany.org/membership/Call-CorrespondingMembers.asp

Please email all other materials as PDF files to the BSA Executive Director at wdahl@botany.org.
Thank you for your contributions. Chair, Corresponding Members Committee - **Dr. Karl Niklas, Past President**

For additional information or questions, contact:
William M. Dahl,Executive Director
Botanical Society of America
E-mail: bsa-manager@botany.org

IF YOU HAVEN'T DONE SO YET...

Please take a few minutes to renew your membership or join the BSA . We also encourage you to give a student gift membership to a student who is interested in joining the BSA! A gift membership for NEW student members is only $10.

Welcome to ChloroFilms!

A WORLD-WIDE, OPEN COMPETITION FOR PLANT BIOLOGY VIDEOS ON YOUTUBE™ CONTEST #3
Deadline: 15 April 2010www.ChloroFilms.org

Addendum

Otto Stein makes a minor correction to a misstatement in PSB 55(4):151 noting that there is another recent Northeast Plant Taxa publication - - Dennis W. Magee and Harry E. Ahls, *Flora of the Northeast.* See PSB 54(4) for a review of this work.

Student News

Botanical Society Undergraduate Student Research Awards

Purpose and Eligibility

This award is designed to promote undergraduate student research in the botanical sciences in conjunction with our efforts to highlight the plant sciences as a study and/or career option. We see this as a simple and effective way of promoting your research, your lab, your university and your passion for the botanical sciences. It is meant to be a fun and informative activity.

To be eligible, one must be a student member of the Botanical Society of America (BSA), a registered undergraduate student, have a faculty research advisor who is also a member of the BSA, and not have won the award previously. **Please note**: Award Recipients will be eligible to participate in the BSA Graduate Student Research Award program as a Graduate Student.

Award Level and Announcement

It is anticipated that 10 awards will be given this year. The award will provide $200 to support each recipient's research proposal. Up to three "proposals of excellence" may be eligible to receive $500. The award winners will be posted online, noted in the ***Plant Science Bulletin*** and announced at the BSA banquet held in conjunction with the Botany 2010 Meeting in Providence, Rhode Island, on August 4, 2010.

Please note: All winning proposals will be peer-reviewed for accuracy and placed online as part of the BSA "**BOTANY - science from students' perspectives**" portfolio. Judges will make decisions on proposals as they come in. Winning proposals will go online immediately following peer review.

Proposal Guidelines

The application shall consist of:

1. Title page - must include: title of proposal, name of student, student's institutional and departmental affiliation, year of student's study, and student's sectional affiliation within BSA.

2. A narrative - must be between 1,200 - 2,000 words, which includes a description of the research, including appropriate conceptual background, purpose or objective, brief outline of methodology, the potential contribution or significance to an area of the botanical sciences, and a bibliography. The narrative should be written in Microsoft Word in Times New Roman 11 point font.

3. Images/Videos - As successful applications become part of the "**BOTANY - science from students' perspectives**" portfolio, we strongly encourage you to support your written narrative with images. Images are to be emailed directly to the BSA office and must be of high quality in a size range from 1-5 MB. We will also support links to videos placed on YouTube. In fact, we encourage you to use a multi-media approach to show the wonders of science.

4. Budget - (one page maximum) detailing how the funds would be used.

5. A letter of support - (one page maximum) from the student's research advisor.

Submissions

Proposals and supporting letters must be received between **January 1 and March 15, 2010**.

Submit required materials by email as a WORD or PDF file to bsa-manager@botany.org.

Please ask advisors to do the same.

Please feel free to contact us if you have any questions - bsa-manager@botany.org.

Student members are encouraged to contribute to the Undergraduate Student Research Award program through the BSA web site. Please contact the Executive Director for further details.

1.) **Time to be acting on award applications**! There are many award opportunities offered to students throughout the BSA. We encourage you to check out what you can apply for and to get your applications in now. If you receive this message in plain text, go the www.Botany.org for more information. Only current BSA members are eligible for these awards so make sure you renew prior to submission. **Due March 15, 2010**

Call for Proposals - Student Research Awards

» BSA Graduate Student Research Awards

» BSA Undergraduate Student Research Awards

» Genetics Section Graduate Student Research Awards

UNDERGRADUATES please note: IN ADDITION TO TEN $200 AWARDS, UP TO THREE ADDITIONAL RESEARCH AWARDS MAY BE PROVIDED via the BSA GSRA program at the $500 level for "proposals of excellence".
Due April 1, 2010
Triarch "Botanical Images" Awards | Vernon I. Cheadle Awards | Developmental and Structural Section STA | Ecological Section STA | Genetic Section STA | Mycological Section STA | Phycological Section STA | Phytochemical Section STA | American Fern Society & BSA Pteridological Section STA

There are already a few TRIARCH submissions coming in. Get your images in early and get in often on this one!

2.) **Nomination for Student Representative to the BSA Board**
Please take a few minutes to consider who you'd like to represent student members on the BSA Board and send your nominations to Bill Dahl at the BSA office - wdahl@botany.org. We'll then submit our nominations as part of the **2010 BSA Elections of Offices ballot** in

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www.Botany.org
www.AmJBot.org
www.BotanyConference.org
www.PlantingScience.org
www.PlantIT.org

BOTANICAL SOCIETY OF AMERICA

January 21, 2010

Office of Science and Technology Policy
Attn: Open Government Recommendations
725 17th Street, NW
Washington, DC 20502

Via Email to: publicaccess@ostp.gov

Dear Colleagues:

I write as President of the Botanical Society of America, a non-profit scientific society with nearly 3300 members worldwide, and I am pleased to respond to your 9 December 2009 request for public comments on Public Access Policies for Science and Technology Funding Agencies Across the Federal Government.

The BSA, founded in 1893, supports and disseminates botanical research through the *American Journal of Botany*, our newsletter the *Plant Science Bulletin*, and annual scientific meetings. In publishing the journal, we also help to support the development of plant scientists, both in the United States of America and abroad. Both the wide dissemination of research and the professional development of scientists are vital to our mission as a not-for-profit scientific society dedicated to ensuring the health of plant science. These are values we share with many other not-for-profit scientific societies.

As a non-profit scientific society publisher, we are committed to sharing research as broadly as possible. Our research is currently free to scientists from all developing nations through programs sponsored by the World Health Organization and the United Nations: Access to Global Online Research in Agriculture (AGORA); the Access to Research Initiative (HINARI); and Online Access to Research in the Environment (OARE). All articles published in the *American Journal of Botany* are freely accessible through our web site (www.amjbot.org) 12 months after publication. Authors and funding agencies can also provide access to papers accepted for publication as soon as they are available for online publication by paying a modest fee. Our policies also ensure that authors can distribute their published papers and use them freely in teaching without additional charge.

To make these things possible, the Botanical Society of America has invested heavily in electronic systems producing digital versions of the *American Journal of Botany*. These processes have significantly improved the time from submission of research to the date of publication. Access to research published in the *American Journal of Botany* via the HighWire Press platform is considered the top of the industry.

The Botanical Society of America is a scientific and educational organization devoted to the fundamental study of the form, function, diversity, evolution and uses of plants and their interactions within the biosphere.

February.

3.) **Remember, it's membership renewal time and we have not received your dues for 2010** You need to be a member for the awards noted above. Please take the time to renew now and keep the benefits of being a BSA member coming. **We also encourage you to give a gift membership to another student who is interested in joining the BSA**! A gift membership for NEW student members is only $10. Thank you for being part of this great community. https://payments.botany.org/joinbsa/

4.) **PlantingScience**
Looking for a great way to participate in BSA activities, helping kids learn about botany, while giving to the scientific community at the same time? We'd love to have you join us as a **PlantingScience mentor**! It looks good on your CV, you become familiar with materials that are effective for teaching botany, and it is a rewarding experience to turn kids on to science. Check out the website at: www.PlantingScience.org and become a mentor at: www.PlantingScience.org/NewMentor/

5.) **ChloroFILMS - We're back!!!**

A federal mandate that required immediate open access to papers published in the *American Journal of Botany* would damage our ability to publish the highest quality research in plant science. Even a mandate that required open access after 6 months poses significant risks to us and to many other non-profit scientific society publishers. Such mandates would require invention of entirely new models of scientific publishing if the results of scientific research are to be made widely available in easily searchable forms that ensure long-term archival access. Professional librarians recognize that non-profit scientific society publishers publish excellent journals at relatively low cost, make the contents of those journals freely available after periods that allow them to recoup their expenses, and foster the development of new generations of scientists. A federal mandate requiring open access to published articles less than 12 months after they have appeared threatens those valuable contributions, unless such mandates are accompanied by significant new federal funding to agencies funding scientific research.

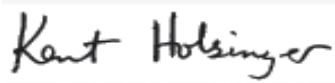
While there is much to recommend the public archiving model adopted by the National Institutes of Health, it may not be appropriate for other fields of scientific research. A model that works well for biomedical science may not work well for physics, chemistry, mathematics, engineering, or environmental biology. Each of these fields has different traditions, different professional society organizations, and different publishing models. A single model will not serve them all.

The *American Journal of Botany* does not charge authors for publication. Although authors have the option of paying a fee allowing immediate access, it is rarely used. Both the funding of botanical research and the immediacy of its results are very different from those of biomedical fields. Many prominent scientists pursue significant parts of their research without the benefit of federal funding, and those who do receive federal funding typically receive smaller awards than our colleagues in biomedical fields. Moreover, research findings in plant sciences are often referred to for several decades after first being reported, and new advances rarely depend on access to results published in the last six months. Assuming that a publishing model appropriate for biomedical research also applies to research in the plant sciences would undermine our ability to disseminate the results of botanical research and to support the training of new scientists.

On behalf of the Botanical Society of America, I am pleased to endorse your efforts to ensure the broadest possible access to the results of scientific research. The Botanical Society of America and many of our non-profit scientific society colleagues have already adopted policies designed to further that goal. We look forward to working with you and your colleagues in various federal science-funding agencies as you develop policies intended to consolidate these advances.

Thank you for your time and consideration.

Sincerely yours,



Kent E. Holsinger, President
Botanical Society of America

Contest THREE is in full swing. Big money was won in contest TWO. Go to www.ChloroFILMS.org for more information and to submit your entry.

Graduating? Look at the Jobs page on www.Botany.org/newsite/Employment/.
See you in Providence this summer!!! Watch for further emails about the meeting.
Your BSA reps, Jim and Rachel
Rachel Meyer Jim Cohen
Rmeyer@nybg.org
jic24@cornell.edu

Student Representatives
Botanical Society of America
BSA - www.botany.org

BSA Science Education News and Notes

BSA Science Education News and Notes is a quarterly update about the BSA's education efforts and the broader education scene. We invite you to submit news items or ideas for future features. Contact: Claire Hemingway, BSA Education Director, at chemingway@botany.org or Marshall Sundberg, PSB Editor, at psb@botany.org.

PlantingScience — BSA-led student research and science mentoring program
Your contributions as a PlantingScience mentor directly touch the lives of the students and teachers in the online learning community! They tell us so:

"I liked that we got to actually plant the plants and do hands on stuff and I liked how we got to talk with the real scientists and learn more." - student in Fall 2009 session

"It has helped me to change the way I teach all grades in the classroom. I don't give answers anymore, I lead discussions and let them research and guide them through their thought processes." – teacher in Fall 2009 session

During the recent Fall 2009 online mentored inquiry session, over 178 scientists mentored 338 student teams from 25 middle school through college classrooms across 18 states. The Wonder of Seeds investigation of germination remains the most popular inquiry module among classrooms, but we continue to develop and field-test new modules each year. Modules in field-testing during the fall included pollination and both the *Brassica* and *Arabidopsis* strands of genetics.

Our thanks to the scientists and teachers who made the Fall session a valuable opportunity for students to experience science in their classroom as it is conducted by working scientists. Over the winter break between sessions, we welcomed over 100 new mentors to the program. The **Spring 2010 Online Session** runs February 15-April 30, 2010. We welcome you to share your passion for plants and botany!

PlantingScience Summer Institute for Teachers
June 21-29, 2010. Texas A&M University.
High school and middle school teachers, we invite you to join botanists **Marshall Sundberg** and **Renee Lopez-Smith** and teachers from across the country to explore new PlantingScience inquiry modules: celery (cell structure, function, response to the environment) and C-Ferns (reproduction and life cycle). The Institute offers you opportunities to immerse in the inquiry experience, engage in the online platform, share strategies for using science talk and notebooks with your students, and develop a plant to take any of new or existing inquiry modules to your classroom.
Apply online by April 9. http://www.plantingscience.org/institute-application.html

Plant IT Careers, Cases, and Collaborations
The Plant IT project (http://www.myPlantIT.org), a collaboration among the Botanical Society of America, BioQUEST Curriculum Consortium, and Texas A&M University, is nearing the end of its funding from the National Science Foundation. This July will be the final opportunities for a two-week teacher summer professional development workshop, open to teachers from across the country, and a one-week student career camp, especially for Texas high school students. We look forward to sharing with you final products and full lessons learned from this project as these become available.

In the meantime, we offer a few tantalizing preliminary findings about the 2009 summer camp students' knowledge and interest in plant careers. Student responses to the question "What do people who work with plants do?"

showed an increase in the average number of plant-related careers from pre- to the post-test. The diversity of careers mentioned also changed, with students aware in the post-test of opportunities in academics, science media, greenhouse management, landscaping and plant retail positions. Of the 25 students, 16 could see themselves as a scientist both when they arrived and departed, and 3 came to view during the course of the session. For these students, the many faces of botany are now revealed and closer in reach. One student cited the many things they learned at MyPlantIT as the reason for wanting to be a scientist.

Final Plant IT Summer Institute for Teachers
July 12-23, 2010. Texas A&M University.
Bioinformatics and textile forensics will be the focus of investigative cases presented by botanist **Ethel Stanley** and high school master teacher **Toni Lafferty** as models for high school and middle school teachers interested in learning to use plant-related cases with their students. Participants will discover new resources, tools, and data for your students, collaboratively develop cases, and practice new skills working with students participating in a summer camp. We invite you to join the fun. **Apply by April 9.** http://www.MyPlantIT.org/institute-application.html

Science Education Bits and Bobs
National Lab Day: An effort to scale hands-on learning across the country — Improving STEM (Science, Technology, Engineering, and Mathematics) education is again a national priority, backed by federally funded and private initiatives. National Lab Day (NDL) is intended to engage volunteers — university students, scientists, engineers, other STEM professionals, and community members — to collaborate with educators and students to improve labs and discovery-based science experiences for students in grades 6-12. The Botanical Society of America was a signatory of the letter to President Obama supporting this endeavor. The NDL website provides a means to match teacher needs with scientists who can help. A celebration of National Lab Day activities is planned for May 2010.

http://www.nationallabday.org/

Making science relevant boosts high school students with low science confidence — In the 4 December 2009 issue of *Science,* Hulleman and Harackiewicz present evidence that a simple writing intervention, in which students were encouraged to make connections between the science course material and their own lives, led to greater interest and higher grades. Students from two high schools in a small Midwestern city were randomly assigned either to simply summarize the science content recently covered in class or to write about how the content is useful in their own lives. The act of making science personally relevant was motivating for students who initially lacked confidence, but did not have a statistically significant impact on students who had a high expectation of success in science prior to the intervention.

http://www.sciencemag.org/cgi/content/abstract/326/5958/1410

Why do students leave college without finishing? — The stress of balancing work and study and carrying the financial burden of college tuition without additional support are two frequent reasons given for students to leave college, according to a recent report by Public Agenda based on nation-wide survey of 22-30 year olds. *With their Whole Lives Ahead of Them* is the first of three anticipated reports supported by the Bill and Melinda Gates Foundation to describe how American youth view higher education.

http://www.publicagenda.org/theirwholelivesaheadofthem

Where are graduate enrollment numbers of international students going? — After several years of steady growth, 2009 saw a flattening of enrollment by international students in U.S. graduate institutions, along with a 6 % increase in American first-year students, according to a recent report by the Council of Graduate Students. Enrollment decreases were striking among students from India and South Korea, while the steady increases among students from China and the Middle East and Turkey was maintained. In the life sciences, the percent change from 2008 to 2009 in international student enrollment numbers differed substantially according to the size of the institution, ranging from 19% at the 10 largest institutions to 6% at all institutions excluding the 100 largest.

Access the report: http://www.cgsnet.org/portals/0/pdf/

R_IntlEnrl09_III.pdf

Learning Outside Classrooms and Dealing with Data: New NAS Publications — Two recent reports from The National Academies Press address characteristics of today's science experience: much learning about science takes place outside the classroom in botanic gardens, museums, and science

Education Committee

In addition to his formal address to the conference, Dr. Ken Miller will participate in a discussion of teaching evolution at Botany 2010. The session is scheduled for Sunday morning and it is free. We are asking that you register to attend. Watch for this option when you register for the Annual Meeting. Bring your success stories and challenges to share in what will surely be a lively and informative discussion.

The Education Committee is taking on new challenges and looking for members who can help us move our ambitious agenda along. Please seriously consider how your skills might help the Society increase the number of quality botanical education resources available to members and non-members alike.

We are developing a format for submission, review and posting of online resources that are substantial and compelling, so that whenever someone wants to add botanical information to a course the first place they think of looking is the Botanical Society's website. We also see this as an excellent way for researchers to meet grant requirements for outreach. Here are two of the projects we are pursuing:

Developing a peer-reviewed, searchable database of K-16 curricular resources
This project could have tremendous impact. We are currently developing guidelines for submission, review and posting. If you would like to help shape this project, we would love to have your help.

Developing a documented, searchable image database with comments and notes that make the images useful to K-12 educators as well as college instructors. If you can add information on particular plants or images to yield better search results, and/or create modified images, perhaps with labels, or with blanks for labeling, this would be a great fit for you. We also would like input on developing a protocol for submission and review images.

If you are interested in participating or have other suggestions for initiatives, please contact Beverly J. Brown, bbrown6@naz.edu.

News from the Sections

Economic Botany Section (EBS)

EBS embraces all aspects of plant use, including classic Economic Botany, Ethnobotany, Ethnopharmacology etc. The last year has been very exciting for the section, helping to establish new links to our sister societies with interests in Economic Botany, and many options for future collaboration.

Within BSA EBS and Historical Section plan to collaborate closer. A first effort will be the organization of a joint symposium focusing on Economic Botanists in the New England States for the 2010 meeting in RI, as well as joint field trips highlighting important collections in the region. Similar efforts will be planned for the meeting in St. Louis 2011.

The last membership assembly voted unanimously to establish a fee for membership in EBS. The new fee is set at US$ 2.00 and will be used to improve student participation by establishing:

-Student travel awards: EBS will award an amount of a total of US$ 500 for two student travel awards. The awards will be given according to the respective actual travel finance needs of two students, and are awarded by the section chair. Preference will be given to undergraduate students.

- Student presentation award: EBS establishes a US$ 100 award to be given for the best student paper presentation. An ad-hoc panel of three (3) members present, selected by the section chair, will serve as judges.

Upcoming Elections:
In 2010 we'll have to elect a new treasurer/secretary, as Felix Coe's term comes to an end. Felix has done a great job during the last years - many thanks for that!! Any suggestions for candidates are welcome.
Dr. Rainer W. Bussmann, Chair
e-mail: rainer.bussmann@mobot.org

Historical Section

HISTORY OF BOTANY IN THE RHODE ISLAND AREA

Botany 2010 symposium

Historical, Economic Botany, Developmental and Structural, Ecology, and Physiological Sections

Dennis Stevenson
"Rhode Island: A historical perspective on its Botany and Botanists"
Susan Danforth
"Botany at the John Carter Brown Library"
Rainer Bussmann
"I know every tree, every single tree one can see…' – The life and legacy of Richard E. Schultes"
Angela Todd
"George H. M. Lawrence (1910-1978) and his international impact on botany"
Gordon Tucker
"Irene Stuckey: a life well spent with plants and people"
Philip Marshall
"*Pinus strobus* L. and the historical utilization and management of southern New England forests, 1600-1938."
Ray Evert & Natalie Uhl
"Thoughts on Vernon I. Cheadle"
Annette Coleman
"Vignettes from the history of Brown botany"

Following the symposium there will be a field trip to the John Carter Brown Library entitled "Science and Economic Empire: European Look at New World Resources in the 17th and 18th Century."
For additional information please contact:
Marissa C. J. Grant,
mgrant39493@lakeland.cc.il.us

Teaching Section

Make a note now that the Teaching Section is sponsoring a symposium "Broader Impact: Linking Basic Research and Education" at the annual meeting. The goal for this symposium is to provide the basic research communities exemplary examples on how their activities can be effectively linked to education, thus fulfilling NSF's Broader Impact criterion.
The speakers will be:

-Elizabeth Kellogg, University of Missouri- St. Louis, Former NSF program officer
-Paul Williams, University of Wisconsin-Madison, Wisconsin Fast Plants: Bringing research a research organism to the classroom
-Anne W. Sylvester, University of Wyoming, Genetics workshops at Little Bighorn tribal college
-Karen Sue Renzaglia: Southern Illinois University, Ceratopteris richardii: From model system to classroom organism
-Dennis Wm. Stevenson, Vice President for Botanical Science, Taxonomy research and education (9-16)
-D. Tim Gerber, University of Wisconsin - La Crosse, Department of Biology, Connecting teachers to basic research

Stokes Baker, Chair, Teaching Section

Northeastern Section

Joint Field Meeting of the: BSA Northeastern Section Torrey Botanical Society Philadelphia Botanical Club

June 20-24, 2010 (Sunday-Thursday)
Buxton School, Williamstown, MA

The 2010 Field Meeting will explore the Botany of Berkshire County, Massachusetts. We will stay at Buxton School in the heart of Williamstown, down the street from the famous Sterling and Francine Clark Art Institute and Williams College.

Accommodations are in the school dormitory rooms in the main building and two other buildings on campus. Men and women will have separate facilities either by building or by floor. Most rooms will have two, three or four occupants and bathrooms are shared. Private rooms for singles or couples will be hard to come by, but we may be able to arrange something depending on the registration number. Also, if anyone would prefer a private room with bath, the Williams Inn is just down the street and will have rooms available for $125 single and $145 double (plus tax) per night. For this, you make your own arrangements. All your meals would be at Buxton.

The price of the field meeting will be $350 including four nights lodging and meals from Sunday night thru Thursday breakfast. Linens are included. Without room, price is $225.

Field trips, by bus, will include Mt. Greylock, the highest mountain in Massachusetts with its own unique sub-alpine boreal forest and rare plants, and Bartholomew's Cobble, National Natural Landmark, where "you'll find one of North America's greatest diversity of fern species" and many interesting plants amid the unusual geology of the cobbles. Other trips will depend on the best botanical locations at the time. There will be a variety of evening lectures.

We are fortunate to have as leaders Pam Weatherbee, Berkshire County Botanist, and Dr. C. Barre Hellquist, Biology Professor Emeritus, Massachusetts College of Liberal Arts.

Please complete attached Registration Form and return to:
Karl Anderson, 46 North Childs Street, Woodbury, NJ 08096-1535
For further information contact: Chairperson Nan Williams, 413-339-5598 or nnwrowe@gmail.com.

2010 Joint Field Meeting Registration Form
Deadline May 15, 2010
Name(s):_____

_____

Address:

_____

_____

Phone:

_____

Number of Participants X $350 basic rate $_____
Number of Participants X $225 without room $_____
Number of participants for day trips (no meals or rooms) X $100 $_____
Private room if available at Buxton? _____

Your check for the full amount made out to Botanical Society of America with the completed Registration Form should be mailed to:

Karl Anderson, 46 North Childs St., Woodbury, NJ 08096-1535.
Phone: 856-845-7075.

Please include here the name of the person(s) with whom you wish to share a room or indicate that we may assign roommates:

_____

Please include here the name and phone number of a person to be notified in case of an Emergency

_____

Check membership(s) of the participant(s) named above in Botanical Organizations:
Botanical Society of America _____
Torrey Botanical Society _____
Philadelphia Botanical Club _____
Other (Organization Name)

_____

In making this application, participants affirm that they are in general good health, are physically able to keep up with the group in the ordinary course of field activities, accept as their personal risk the hazards inherent in any outdoor activity, and will not hold the Botanical Society of America, or other sponsoring organizations, or the trip leaders responsible for the same.
Signature and date:

_____

-continued from page 3.
For more information on the new section or to submit an article for consideration, go to http://www.botany.org/ajb/PNP_Online_instructions.html.

The first article appeared in the January issue, which can be viewed at http://www.amjbot.org/cgi/content/full/97/1/e1. This new section was suggested in 2009 by the BSA Executive Board, and the effort has been spearheaded by "PNP" Editors Kent Holsinger, Pam Soltis, Theresa Culley, and Mitch Cruzan.

This section is intended to promote rapid dissemination of protocols used in genetic analyses of plants. Appropriate subjects include: (1) *marker notes* providing primer sequences for microsatellite or other markers in particular taxa, and (2) *protocol notes* describing new methods for isolating, visualizing, or scoring genetic markers. Protocol notes are expected to provide evidence that the new protocol increases the accuracy or reproducibility of marker scoring, decreases the time or expense of marker scoring, or provides the ability to score new classes of markers.

For a template and the complete instructions for authors for this section, see http://www.botany.org/ajb/PNP_Online_instructions.html

We also have a few changes in the general instructions for authors (http://www.amjbot.org/misc/ifora.shtml). These changes include:

Structured Abstracts: Beginning in January 2010, we are asking authors to write their abstracts in a structured format. This brings the most important aspects of the study to the beginning of the paper - it helps authors focus their ideas and highlight key points, and it helps readers decide quickly whether they want to read further. See http://www.amjbot.org/misc/ifora.shtml#63AbstractPage for further information

Open Access Options: Starting in January 2010 AJB authors have the option to make their accepted paper freely available online immediately upon publication. The fee for Open Access is $1500 (discounted to $500 if the author's institution subscribes to the Journal).

And finally, we are pleased to report that in January, Judy Jernstedt began her second term as Editor-in-Chief. We are grateful for her continued dedicated service.

Personalia

David Dilcher awarded honorary University of Minnesota doctorate.

Alumnus David Dilcher, the world's leading authority on the evolution of flowering plants, received an honorary doctorate from the University of Minnesota on September 26, 2009 at Itasca Biological Station and Laboratories. Dilcher's lifelong passion for plant evolution was sparked during time spent as a student at the field station. After earning B.S. and M.S. degrees at the University of Minnesota in 1958 and 1960, Dilcher went on to earn his doctorate at Yale University. He spent most of his career as professor of botany at the University of Indiana before moving to the Florida State Museum where, now retired, he continues his work as an adjunct professor at the University of Florida.

In 1998, Dilcher and a colleague at a Chinese university uncovered a fossil of what they believe to be the world's oldest flowering plant, which lived at least 125 million year ago. The discovery, which secured Dilcher's reputation for solving what Darwin termed the "abominable mystery" of how flowering plants evolved from green plants and became the dominant plant group on Earth, was featured in an episode of *Nova* titled "First Flower."

Text and photo from: *BiO*: College of Biological Sciences Newsletter, University of Minnesota.

Courses/Workshops

Experience in Tropical Botany

Harvard University Summer School, in collaboration with The National Tropical Botanical Garden, announces the following course in 2010.

Dates: June 13 to July 10, 2010

Location: The Kampong Garden of the National Tropical Botanical Garden, 4013 Douglas Road, Coconut Grove, Miami FL 33133

The Class will use the newly-constructed Kenan Teaching Laboratory at The Kampong (wet bench and microscope facilities) and be accommodated at the comfortable Tyson dormitory (of Scarborough House) on the same property.

Course title:
Biology S-111. "Biodiversity of Tropical Plants"

Instructor: Professor P. Barry Tomlinson Professor of Biology *Emeritus*, Harvard University & Crum Professor of Tropical Botany, National Tropical Botanical Garden.

"Biodiversity" is commonly interpreted as a catalogue of species richness in a given environment and how it might be preserved, but it can mean much more if an investigation considers not just the ***systematics***, of the organisms in a given area, but their ***biology***, i.e., structural features in relation to developmental and functional processes. Clearly biodiversity in this broad context can be studied best in the tropics, where diversity is richest.

South Florida offers a sampling of this richness, conveniently located in the continental United States. And the course offers an opportunity at many levels to become more familiar with tropical plants and their biological mechanisms.

The course is intensive and intended to present an overview of the rich plant diversity in natural environments (e.g. The Everglades National Park, Biscayne Bay National Park) and especially the rich collections of introduced tropical plants at collaborating Institutions, notably Fairchild Tropical Botanic Garden and Montgomery Botanical Center, Coral Gables. Here we have an estimated 10,000 species representing most major biological groups of plants. For example, there are well over 500 species of palms (tropical icons) available, and over 100 plant families not represented in natural environments in the United States.

Emphasis is on morphology and anatomy in a systematic and functional context and involves both field and laboratory study. The course structure is extensively enquiry-based and is intended to develop skills in investigative techniques and philosophical approaches which can be applied subsequently in Graduate Study. Students are introduced to many tropical plant families (especially the iconic Arecaceae) and such topics as, e.g., tree architecture, pollination biology, the morphology of vines and epiphytes as well as distinctive tropical ecosystems like seagrass meadows and mangroves. Laboratory work emphasizes anatomy and dissection of fresh material, using implements ranging from chain saws to scalpels, leading to microscopic study in a well-equipped laboratory.

There are no prerequisites but admission to the course depends on some demonstrated previous familiarity with at least elementary Botany and is intended to cater for students who are already enrolled in a graduate program in Botany or Biology or plan to do so in the near future.

Students will be required to register with The Harvard Summer School and will receive 4 credits.

Estimated Cost: Harvard Summer School Tuition ($2,580); travel to and from Miami; Kampong accommodation at $25 per day; self catering. Tuition and Travel scholarships may be available for qualified students.

For further information:-
P.B. Tomlinson at the above Miami address, or, Harvard Forest, Harvard University, 324 N.Main St. Petersham MA 01366
e-mail: pbtomlin@fas.harvard.edu

Other News

Hunt Institute host annual Linnaeus Link meeting

In early November 2009, Hunt Institute hosted the annual Linnaeus Link meeting for the first time. The Linnaeus Link Project (http://www.linnean.org/index.php?id=323) is an international collaboration among libraries with significant holdings of material relating to the Swedish naturalist Carolus Linnaeus (1707-1778). Hunt Institute has been involved in the project since its beginning,

The Linnaeus Link Project currently has several components. Foremost is a union catalogue of Linnaean collections (http://www.linnaeuslink.org/lluc/) that was launched in 2007. Participating members' library catalogues can be searched collectively for Linnaean holdings and they are in the midst of a digitizing project of Linnaeus-related materials.

Kew discovers new plant species in one of its own glasshouses

The Guardian, Tuesday 22 December 2009

Botanists at Kew unveil a bumper crop of new plant species for 2009 including one that had been growing under their noses for 50 years·

Isoglossa variegata was discovered in the Princess of Wales Conservatory at the Royal Botanic Gardens Kew. Iain Darbyshire stumbled upon a species of plant unknown to science while taking a lunchtime stroll around the Royal Botanic Gardens in west London.

Darbyshire, an expert in African botany at Kew, happened upon the foot-tall plant in full bloom, its striking green and grey heart-shaped leaves set off by tiny white and pink flowers. It was a new species. "It just sat there waiting for someone to study it."

Record books revealed the plants had been donated by Swedish botanists in the 1990s after an expedition to the Eastern Arc mountains of Tanzania. Unsuspecting gardeners had tended them for more than a decade, using them as tropical bedding in Kew's Princess of Wales Conservatory.

Reports and Reviews

Botany in Romania, Highlighting its Endangered Plant Species

By ANCA SARBU, PH.D. Professor University of Bucharest, ROMANIA and Director of the Botanical Garden "D. Brandza" of the University of Bucharest, member of the Royal Swedish Academy of Agriculture and Forestry and **ANITRA THORHAUG**, PH.D. Yale University, School of Forestry and Environmental Studies.

Introduction

Romania is the largest nation in the southeastern portion of the European Union (238,391 square kilometers or 92,043 sq mi which is smaller than Michigan and larger than Minnesota. It would rank 12th in state size if a state within the USA). Within the Romanian borders are found a series of diverse terrains with approximately equal amounts of mountains, coastal plain, and the Danube delta, plus a large oceanic territory. The diverse terrain, plus an historical policy of retention of a section of its forests, has created a significant number of endangered species of whichseveral of the endangered plant species are discussed below. The fauna includes enough brown bears to double EU's bear population.

Romania is located on the Black Sea but is relatively close to the Alps, the Turkish coast of the Mediterranean, and contacts central Europe via the Danube River. Romania sits on the lower Danube delta that is mostly found within Romania. (The Danube delta is the second largest river delta in Europe.) Now after years of strenuous effort by Romanian biologists, a biosphere reserve and a biodiversity World Heritage Sitehave been established to conserve the delta biota. The Danube River separates Romania from Bulgaria on its southern border, and Serbia to its southwest. Romania lies just northeast of the Balkan Peninsula and within the southeast Carpathian Mountains' arch. Romania also shares a border with Hungary to the Northwest, Ukraine to the north and the Republic Moldova to the east, separated by the Prut River. Its final border is the Black Sea (Fig 1). The center of Romania is dominated by the Carpathian mountain ranges which contain fourteen peaks taller than 2000 m. Moldoveanu

Figure 1. Political Boundaries

Peak (2,544 m) is the highest mountain. The Transylvanian mountains are drained by the Mures River (Fig. 2). The Romanian population of 22 million is found chiefly in the coastal plains, and valleys between the mountains. Bucharest, the capital, contains almost 2

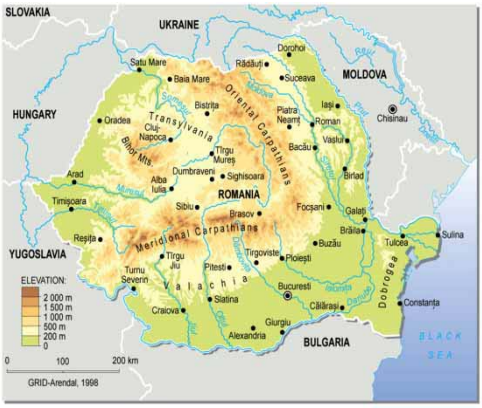


Figure 2. Physical Geography

million citizens in the greater area.

Owing to its distance from the open Atlantic Ocean and position on the southeastern portion of the European continent next to the Black Sea and close to the eastern Mediterranean, Romania has a climate that is transitional between temperate and continental climates with four distinct seasons. The average annual temperature is 11°C (52°F) in the south whereas it is 8 °C (46 °F) in the north. The extreme recorded temperatures range from 44.5 °C (112.1 °F) in Ion Sion (1951) and "38.5 °C ("37 °F) in Bod (1942). Spring is pleasant (cool nights and warm days). Summers are generally very warm. Autumn is dry and cool. Winters can be very cold in the highest mountains, where some areas of permafrost occur on the highest peaks. The winter snows create a large skiing tourism industry. Precipitation is average with over 750 mm (30 in) per year only on the highest western mountains. In the south-central parts around Bucharest, the level of precipitation drops lower (around 600 mm) while in the Danube Delta, rainfall levels are much lower (around 370 mm).

Conservation of Biological Resources

Romania contains a high percentage of minimally impacted natural ecosystems (47% of its terrestrial space). Romania's temperate forests, historically considered important for watershed conservation, have been conserved, leaving Romania with one of the largest undisturbed forest systems in Europe. The botanical resources of the undisturbed forests are of great value in studying European forest systems. There are also almost 400 species of mammals (including 60% of brown bears and 40% of wolves of Europe and the Carpathian chamois), birds, reptiles and amphibians as well as the important and numerous plant species discussed below.

A critical problem of Romanian environmental governance is that illegal logging is occurring at an alarming rate to decimate these forests. Protected areas in Romania contains almost 10,000 km^2 (3,900 sq mi) (almost 5% of the total terrestrial area if Romania). Of these, the Danube Delta Reserve Biosphere is the largest and least damaged wetland complex in Europe, covering a total area of 5,800 km^2 (2,200 sq mi). A prodigious effort by a few Romanian biologists occurred successfully so that the delta was declared a Biosphere Reserve in September 1990, and a Ramsar site in May 1991, with over 50% the delta area placed on the World Heritage List in late 1991. Within the Delta boundaries is one of the most extensive marsh systems in the world, much of it requiring restoration from Central Planning's conversion of the marsh system to agriculture. There are two other Romanian biosphere reserves in Retezat National Park and in Rodna National Park. Major concerns are soil erosion and degradation in the delta and plains, air pollutions from industries in the south, and contamination by the Danube River flowing through Germany, Austria, Slovakia, Hungary,

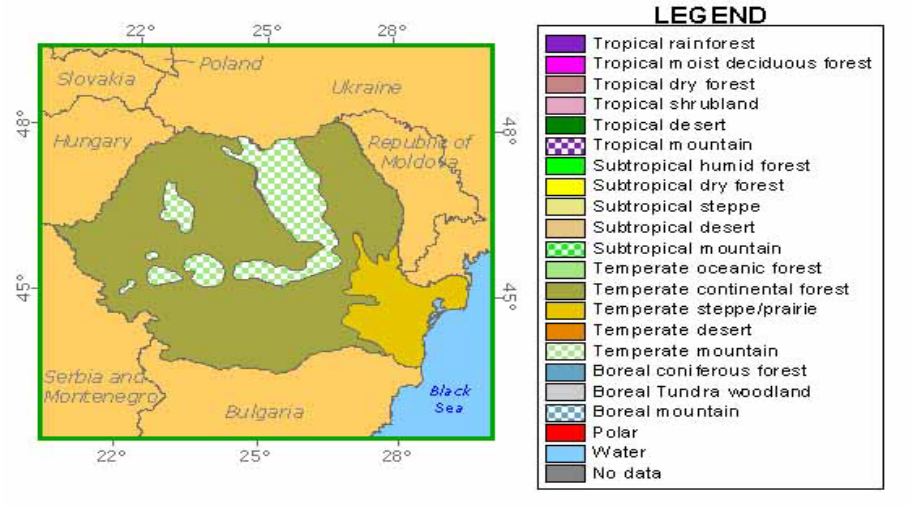


Figure 3. Ecological Zones

Croatia, Serbia, and Bulgaria. The Danube flows 2850 km (1771 miles), draining these upstream nations and their pollution into Romania and the Danube delta.

Romanian Protected areas

There are 427 nature reserves in Romania plus
more than 600 marine and littoral protected areas. The percent of terrestrial land in these protected areas is 2.5% of Romania. There are two wetlands declared Ramsar sites with 665 ha combined area. There are three Biosphere reserves of 662 ha. The higher plants in Romania inventoried in 2004 numbered 3,400 (endangered and threatened plant species discussed below), with 84 mammal species (17 threatened) and 257 breeding bird species (8 threatened), 22 reptiles, 19 amphibians, and 86 fish species.

Ecological Zones in Romania

Romania is characterized by a variety of geological
relief forms (mountains, hills, hillocks, plains, Black Sea coast) and a remarkable diversity of vegetation (Sâvulescu, 1952-1976; Morariu, 1959; Bo_caiu et al., 1994; Ciocârlan, 2000; Coldea et al., 2001). Romania's natural vegetation, which still covers half of the country area, mainly consists of forests and grasslands (about 70% of which forests are 28%) and partially of moor vegetation, rock vegetation, water vegetation, etc.(Fig 3).

The main zones of natural and semi-natural vegetation are correlated with latitude (steppe zone, forest – steppe zone and oak tree forest zone) and altitude levels (nemorose level, boreal level, sub-alpine and alpine levels). It has a significant diversity of plant species and habitats, according to its five bio-geographical zones: Continental, Pannonian, Alpine, Steppic and Pontic (Black Sea).

Romanian Forests

The total forest area is 6,448 ha compared to the total European forest area of 1,035,344 ha. The original Romanian forest is estimated to be 75% of the land area while the present forest area comprises about 28%, mostly natural forest with only 91 ha of forest plantation. The total dry land area is 9,082 ha .The total land of Romania is 23,839 ha which is about 10% of Europe's 2,301,873 ha. The shrub lands, savanna, and grasslands are 1% of the area of Romania, whereas cropland and crop/natural vegetation mosaic are 69%, and urban and built-up areas 0.9% . Wetlands and water bodies (excluding the Black Sea waters)comprise 1%, which includes extensive rivers mostly in the south and east.

Romania Wetlands and Utilization of Coastal Resources

The length of coastline is 696 km with 6 percent of population living within 100 km of the coast.The Romanian area of territorial sea, up to 12 nautical miles from shore,comprises 5,343 km^2, with a claimed Exclusive Economic Zone of18,046 km^2 of the Black Sea. Romania has 11 Marine or Littoral Protected Areas. There

are 6,470 km^2 of major wetlands of International Importance of created as World Heritage and Ramsar sites in 2000-1. 8500 fishermen in the inland and sea fisheries produce 2389 metric tons marine fish, and 9,727 metric tons of freshwater fish. This has been decreasing since 1980. There is not yet a business enterprise of growing marine or aquatic plants.

The Flora of Romania

There is an historical sequence of valuable floral treatises written by professors of Botany at various leading Romanian universities. The first one *"Prodromul florei române"* was written in 1879 by Prof. D. Brandza, followed in 1898 by "*Conspectul florei României*" by Prof. D. Grecescu. In 1923 and 1939, I. Prodan published "*Flora pentru determinarea si descrierea plantelor ce cresc în România*", and in 1948 A. Borza published "*Conspectus Florae Romanae*", in which there are included 3637 species (including hybrids) with their subspecies, varieties and forms. The most critical study, dealing with the vascular plants contained in the territory of Romania, is "*Flora Republicii Populare Române*" in 13 volumes, was published from 1952 to 1976, through a joint effort of 25 botanists (published by the Academy of the Popular Republic of Romania). The volumes present about 3,400 species grouped in 786 genera belonging to 126 families. Other recent publications include: "*Flora României*" vol. I – II (Beldie,1977-1979), "*Flora ilustrat a României*" vol. I – II (Ciocârlan,1988-1990), "*Flora ilustrat a plantelor vasculare din estul României*" (Sârbu, Stefan, Ivãnescu, and Mânzu, 2001),and "*Lista critic a plantelor vasculare din România*" (Oprea,2005).

In 1994, "*Lista Rosie a plantelor superioare din România*" was completed, having been elaborated by a group of specialists (Oltean *et al*., 1994) from the Biology Institute of the Romanian Academy. The list is still being in use today and includes a number of 1436 taxa and infrataxa (1235 species and 203 subspecies) of threatened superior plants (*Pteridophytae*, *Gymnospermae* and *Angiospermae*), which have priority to protection and conservation. From these floras, 110 taxa are endemic for Romania (69 species and 41 subspecies) and 79 taxa are subendemic ones (65 species and 14 subspecies).

Romania has been a participant in the Global Strategy for Plant Conservation (GSPC) and European Strategy for Plant Conservation (ESPC) respectively, for the period 2008-2014. In these efforts there have appeared new reference points for assessing and establishing the priorities in plant protection and conservation. One of the most important decisions for Romania occurred at the sixth Conference of the Signatory States of the Biological Diversity Convention (CBD). This was the adoption in 2002 of the Global Strategy for Plant Conservation (GSPC), which reconsiders the importance of plants in the global context of the conservation of biodiversity.

Endemic and Endangered Plant Species of Romania

Globally threatened (by evaluation and inclusion in the Global Red List of IUCN [1997] Habitat Directive) are 19 endemits (*Armeria maritima* (Mill.) Willd. ssp. *barcensis* (Simonk.) P.Silva, *Astragalus peterfii* Jáv., *Astragalus pseudopurpureus* Gusul., *Astragalus roemeri* Simonk., *Campanula romanica* Savul., *Centaurea jankae* D. Brândz, *Centaurea pontica* Prodan & Nyár., *Delphinium simonkaianum* PawB., *Draba dorneri* Heuff., *Draba haynaldii* Stur, *Draba simonkaiana* Jáv., *Hesperis oblongifolia* Schur, *Lychnis nivalis* Kit., *Ornithogalum orthophyllum* Ten. ssp. *psammophilum* (Zahar.) Zahar., *Pietrosia levitomentosa* Nyár. ex Sennikov, *Primula wulfeniana* Schott ssp. *baumgarteniana* (Degen & Moesz) Lüdi, *Stipa crassiculmis* P. Smirnov ssp. *heterotricha* Dihoru & Roman, *Stipa danubialis* Dihoru & Roman, *Tulipa hungarica* Borbás ssp. *undulatifolia* (Roman) Roman & Beldie) and 2 subendemits (Larix decidua Mill. ssp. carpatica (Domin) Šiman, *Polygala supina* Schreb. ssp. *hospita* (Heuff.) McNeill). These species may be found within the territory of Romania in one or more locations (generally found in nationally protected areas). All of these species are included in EU's Nature 2000 system of protected areas.

We will briefly discuss a few of these plants. Extremely rare and threatened with extinction, but still being considered part of the Romanian flora are the following: *Astragalus pseudopurpureus* Gusul., *Campanula romanica* Svul., *Centaurea jankae* D. Brândz,

Figure 4. *Astragalus pseudopurpureus*

Figure 6. Campanula romanica

Centaurea pontica Prodan & Nyár., *and Pietrosia levitomentosa* Nyár. ex Sennikov. *Astragalus pseudopurpureus* (Fam. Fabaceae) is a globally threatened endemic taxon (Fig. 4). It is a hemicryptophyte perennial species 10-40 cm in height and with delicate purplish-blue flowers which could be found in the Cheile sugãului – Munticelul Natural Reserve (locus classicus), a protected area (90 ha) of national interest, category IV of IUCN (Fig. 5). The thermophilous calcareous substratum and the presence of the petrifying springs favored the development of a rich and diverse flora, predominantly chasmophilous. The site value and uniqueness are given by not only the richness of species (529) and the endemits or subendemits (29) found in various grades of vulnerability, but also the presence of seven different types of habitats, among which two

Figure 5 Munticelul Natural Reserve

are top priority for conservation (Habitat Directive: 7220* - Petrifying springs with travertine forming and 8240* - Calcareous detritus and slabs).

Campanula romanica (Fam. Campanulaceae), a perennial vascular plant, which is globally threatened, contains a xerophyte saxicole with a rhizome and displays blue flowers grouped in panicled inflorescences. This species is endemic in Romania, being vulnerable and rare (Fig. 6). One could find it as an element of rock vegetation only in the south-east of Romania, in the region called Dobrogea. The continental climate with steppic influences and the predominantly calcareous substratum with superficial soil favor the development of significant populations. Even if it is cited in the older literature as having been found in 29 sites, the species has been found in the last five years only in 11 sites. Well-defined and constant size populations have been present in some protected areas as the Macin Mountains National Park, the Alah Bair Hill Natural Reserve, the Agighiol Geological Reserve,and the Cheia Jurassic Reefs Natural

Figure 7
Cantaurea jankae

Figure 8. *Centaurea jankae*

Reserve.

Centaurea jankae (Fam. Asteraceae), a globally threatened taxon, is endemic, and is rare and threatened in Romania. This species could be found in the structure of stony xerophile grasslands in Dobrogea (Fig. 7, Fig. 8). The calcareous substratum, the superficial and stony soil and the extreme continental climate characterizes this type of dry grasslands. *Centaurea jankae* is a perennial xerophyte with a long rhizome, a simple or branched stem of about 30-120 cm in length, large anthodes, red flowers and pinnately-parted leaves. It is very rare in Romania. Even if the specialty literature suggests it as being present in 6 locations, the reconfirmations during the past five years have located it in only three sites where it grows on the dry and stony slopes. Two of them are natural reserves: Dolosman

Figure 9. *Centaurea pontica*

Hill & Dolosman Cape and Dumbrăveni Forest.

Centaurea pontica (Fam. Asteraceae), an endemictaxon for Romania, is very rare and has been evaluated as globally threatened. It grows in stabilized (fixed) coastal dune grasslands, on the river and sea sands in the Danube Delta and in the company of arenicola plants (Fig. 9). It is a biennial vascular plant, with a strong tap root, a straight and branched angular stem about 80-100 cm in length, a stalk with inferior and middle leaves, pinnately-cleft and sessile. The anthodes are abundant, the flowers with a pale purple corolla, and the achenes have no papus. The specialty literature indicated its presence in two sites, situated inside the Danube Delta Biosphere Reserve (Sahalin-Ztoane Zone and East Sulina Sands). These data have been reconfirmed by recent research, which aimed at identification of the most important sites for plant protection and conservation in Romania.

Pietrosia levitomentosa (Fam. Asteraceae) is a Carpathian endemit, a strictly protected and

Figure 10. *Pietrosia levitomentosa*

globally threatened species in Romania (Fig. 10). It is one of the plant species with the smallest areas in the world. In Romania it grows only in the "Pietrosul Brostenilor – Bogolin" Natural Reserve beyond the forest limits. The site is very important because it represents the only place on Earth where the species *Pitrosia levitomentosa* exists. It is localized in the subalpine level (1600-1780 m altitude) on porphyroid-schists with a high concentration in potassium, on slopes with an inclination of 30°-80° and southeastern exposure where the soil is acid (pH = 4.3), the multiannual average of temperatures is of 2°-3° C, and the rainfall average is of 926 mm. *Pietrosia levitomentosa* is threatened with extinction because it presents a small number of individuals, which do not appear to produce viable seeds. This species is a perennial plant, with dense pubescent leaves and large anthodes with yellow flowers, which form offsets, but whose spreading (in the

sense of increasing the number of individuals) is limited by the ecological conditions.

Once Romania has entered the European Union, it is scheduled to put into operation the EU environment legislation, which regulates flora and vegetation conservation. The Habitats Directive of Nature 2000 stipulates that one of the requirements is extending the system of protected areas in EU to the new member states (of which Romania is a new member). In support of this, an identification program of the most important areas of plant protection and conservation in Romania (Important Plant Areas – IPA) was carried out during 2002-2004. On the basis of this two-year study, 276 sites were selected as candidates to the Nature 2000 European Network (Sârbu et al., 2007).

Thus, the IPAs are conceived as key sites, as focal points for "in situ" conservation of threatened species and habitats, and of floristic concentrations of great botanical value, essential for global, European and national conservation of the dowry of vegetation diversity.

Fortunately, in Romania there still are areas of extremely high botanical value, which should be carefully preserved and maintained at their existing level of nature to have maximum value. In the mountainous region, the natural reserves with endemits (*Dianthus callizonus* Schott & Kotschy, *Hepatica transsilvanica* Fuss, *Papaver alpinum* L. ssp. *corona-sancti-stephani* (Zapal.) Borza, *Pedicularis*

Figure 11. *Hepatica transsilvanica* Fuss.

baumgartenii Simok) and the threatened subendemits (*Dianthus spiculifolius* Schur, *Dianthus tenuifolius* Schur, *Heracleum carpaticum* Parcius, *Onobrychis montana* DC. ssp. *transsilvanica* (Simonk.) Jáv. etc.) should

Figure 12. *Papaver alpinum* L. ssp. *corona-sancti-stephani* (Zapal.)

be noted (Fig., 11, Fig. 12, Fig. 13).

A very important region in Romania in terms of extraordinary floristic richness is Dobrogea. One can find here natural reserves and not only over 50% of the endemits and subendemits of

Figure 13. *Dianthus spiculifolius* Schur.

Romania (*Agropyron brandzae* Pancu & Solacolu, *Alyssum caliacrae* Nyár., *Chamaecytisus jankae* (Velen.) Rothm., *Iris brandzae* Prodan, *Linum pallasianum* Schult.

Figure 14. Dovrogea region

ssp. *borzeanum* (Nyár.) Petrova, *Serratula bulgarica* Acht. & Stoj. etc.) (Fig. 14).

The botanical assessments made during the last decade clearly pointed out the driving factors for the continuous degradation of these extremely high value areas: 1.) The increasing anthropogenic pressure; 2.) The lack of an adequate environmental management; and 3.) Potentially climate change.

Present Botanical Research in Romania

Assessment and scientific research on Romania's natural botanical resources and the identification of threatening factors associated with different types of habitats at the present stage of development of Romania represent compulsory prerequisites of the conservation and sustainability of plant diversity.

Botanical research (morpho-anatomical and reproduction, physiology, genetics, floristics, phyto-sociology, etc.) is being carried out in Romania both at the Universities' disciplinary departments (of which there are about 50 botany departments in Universities) and the Romanian Research Institutions (about 30). Among these, the most outstanding universities include the University of Bucurest, Babes-Bolyai University in Cluj-Napoca, the University of Craiova, Alexandru Ioan Cuza University in Iasi, the University of Medicine and Pharmacy in Târgu Mures, Vasile Goldis Western University in Arad, Ovidius University in Constanca, Dunarea de Jos University in Galaci all of which have significant botanical research potential. The outstanding Research Institutes are the National Institute for Biological Sciences Research & Development, the Biology Institutes of Romanian Academy in Bucurest and in Cluj and, the Forest Research and Management Institute.

The Future of Botany in Romania

In 2009-10 Romania is carrying out important assignments regarding the assessment, monitoring and conserving "in situ" and "ex situ" vegetation diversity. The "Red List of Romania" issuance is being implemented, followed by the "Red Book of Romania". At the same time, an inventory of plant diversity and a national data base are being assembled. Romanian Implementation of the European Union three laws of environmental problems (Bird Directive, Habitat Directive and Water Framework Directive) is now underway as is finalization of the "Nature 2000 Site List". All these imply continuous efforts for developing the human capabilities and government policies necessary for the process of assessment, scientific documentation and plant diversity conservation. A new generation of plant scientists is being trained to supply these botanical efforts.

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Using Bottles to Study Shade Responses of Seedlings and Other Plants

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ABSTRACT

We briefly review the nature of light and its effects on plants, and then describe an inexpensive experimental system for studying the effects of shade, specifically the contributions of reduced intensity ("quantity") and the altered spectral distribution of foliage shade ("quantity") on the development of seedlings and other plants. This system has been devised to be safe to construct, inexpensive in its use of readily available materials, and appropriate for a range of student grade levels, from ~grade six to university courses in botany. We conclude by suggesting a range of experiments this system will allow. An advantage of this system is that it promotes the study of the responses of a large range of plants, most completely unstudied for these responses.

Keywords: spectral quality, R:FR, phytochrome, plasticity, development

Being fixed in place, plants are plastic in their response to environmental cues, particularly shade. Plants use two types of light cues, both quantitative and qualitative, as well as the duration of light exposure, in these responses. Here we describe a simple experimental system that can be used to study such plant responses to shade. It uses easily obtained 2 liter soda bottles for the shade enclosures and 1 gallon plastic milk bottles as the containers in which to grow the plants, optimally seedlings. These shade enclosures use films manufactured by the 3M Corporation to reduce light intensity and to mimic the altered light quality produced by foliage growing above and around plants.

The Nature of Light. Light is that portion of the spectrum of electromagnetic radiation that is visible to humans, the colors of blue-violet to dark red. This visible spectrum lies between

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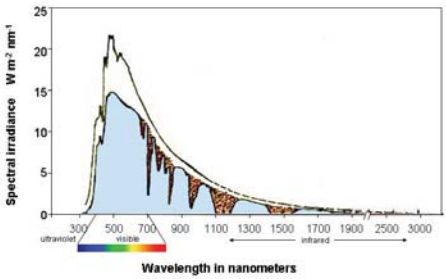

Figure 1. Spectral distribution of electromagnetic radiation above the atmosphere (top curve) and at sea level, as energy, and showing the visible part of that spectrum.

the wavelengths of 400 to 700 nm and represents about half of the energy of that spectrum arriving at the earth's surface from the sun. Gases in the atmosphere absorb bands of radiation, particularly in the infra-red region, giving the solar spectrum a ragged appearance (Fig. 1).

Electromagnetic radiation can be described as both a wave and a particle, or photon. The solar spectrum in its entire range is defined in Fig. 1 as the energy of a wave, measured as watts/m^2/nm. It is useful to measure this radiation as particles when we consider its photobiological action on plants, as in photosynthesis or developmental responses. The units we use in such measurements, as seen in these spectra of light above a forest canopy and light beneath it (Fig. 2), are in particles (photons) per unit area (meter square), per unit time (second), and per wavelength interval (nanometer, nm): µmol/m^2/s/nm.

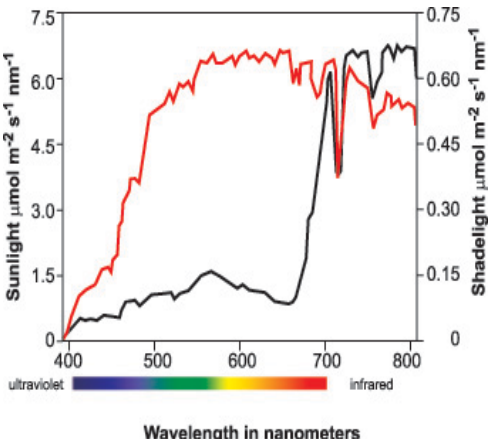

Figure 2. Spectral distribution of radiation above a tropical deciduous forest site in India, immediately after the rains. Note the different scales of the sunlight and shadelight, and the units in photons.

Light and Plant Responses. Being creatures of light, relying on it for the energy and control of development and function, plants respond to light in a variety of ways (Raven, Evert & Eichorn, 2005; Taisz & Zeiger, 2006). For photosynthesis and growth, plants absorb in the range of 400-700 nm, the region of the spectrum that is absorbed by the photosynthetic chlorophyll pigments. Plants also have blue wavelength receptors that are used to control the effects of radiation on the direction of growth, or phototropism. This wavelength is also important in controlling the opening and closing of the stomata, the "lips" of the plant, that regulate the diffusion of gases in and out of the leaf. All of these responses are basically **quantitative**, as the pigments are sensitive to the amounts of radiation absorbed, and blue wavelengths are strongly correlated with the visible spectrum under natural light conditions.

In addition, plants have an elegant system to measure the quality of light, which is sensitive to shifts in the spectral distribution of different wavelengths, or the **quality**. Canopies mostly screen light in the visible portions of the spectrum (Fig. 2), but do not reduce the absorption of those portions just beyond our visual sensitivity, or the far-red region (the shortest wavelengths of infra-red). This change in quality is demonstrated by the change in the ratio of photons received at around 660 nm (red) compared to around 730 nm (far-red). The ratio of the two, or R:FR, varies from ~1.05-1.25 in sunlight (with the value increasing in greater humidity) compared to ~0.25 in canopy shade. A pigment system, phytochrome, is sensitive to this ratio.

In plant tissues exposed to light, light-stable phytochromes are generated in a biologically-inactive red light absorbing form, Pr. Photons of red light shift phytochromes into a far-red light absorbing form, Pfr, which is physiologically active (suppressing stem elongation, for example) unless a photon of far-red light shifts it back into the inactive Pr form. The balance between the two forms matches the red:far-red light experienced by a plant. Since this ratio is influenced by light passing through vegetation or reflected by green plant organs, phytochrome

is a sensor that detects the presence of other nearby plants—or competitors for light.

Plants respond to shade, both low light intensity and quality, with a syndrome of responses that avoids shading. The suite of responses varies among species and life stages. The general shade avoidance response is one of **etiolation**, with a taller and thinner appearance, no branches, fewer and smaller leaves, and less allocation to leaves and roots. Other changes in response to shade include the length of the petiole, the distance between successive leaves, earlier flowering, and the amounts and composition of pigments. Plants vary in their response to reduced light intensity (less "quantity") in comparison to changes in spectral distribution (differences in "quality"). Plants also vary their responses with regard to the direction from which the light arrives, as the difference between diffuse overhead light compared to light from the side that is reflected from adjacent plants. A challenge, met by the simple experimental system described here, is to distinguish between the effects of "quantity" versus "quality", since both components are present in different shade conditions.

Using Shade Films to Construct Shade Environments**.** The simplest way to alter light quantity and quality is to employ commercially available shade films to alter the passage of sunlight, which has abundant portions of visible and far-red radiation. Such films are commercially available, and 3M (Minneapolis, MN) produces the greatest quantity both for automobile and building windows. Films with a thin coating of metal absorb all wavelengths about equally, and thus allow a diminished amount of sunlight (a quantitative change in light) to pass with no alteration in spectral quality. Dye-impregnated films contain molecules that preferentially absorb visible wavelengths of radiation and let more of the far-red portion to pass through the filter. Such films reduce the R:FR in a manner similar to a vegetation canopy (qualitative changes in light). From a survey of shade film products, we have found that films reducing transmission by about 80%, or allowing about 20% of the solar radiation in the visible spectrum to reach the plants. In full sunlight, which may vary from ~1300 to 1800 µmol m^{-2} s^{-1} in the region of 400-700 nm, this shading reduces intensity to 260-360 µmol m^{-2} s^{-1}, adequate for growth of virtually any seedling. A simple experiment of a well-lit

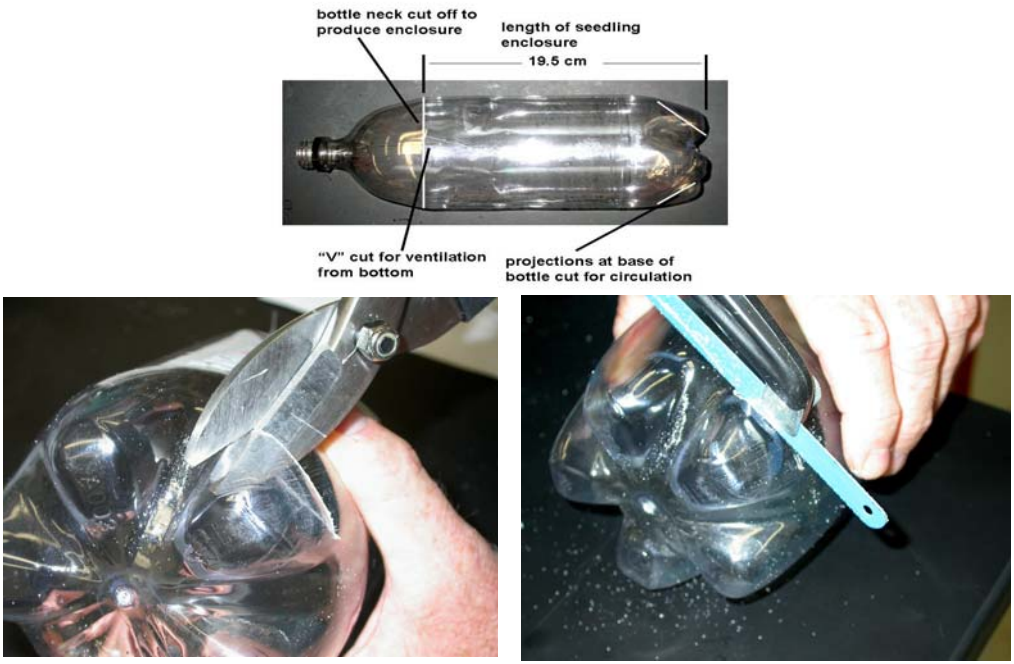

Figure 3. Illustrations of the construction of the bottle shade enclosures. Top, the positions of cuts and the dimensions of the shade enclosure. Bottom, illustrations of the use of safe tools to prepare the enclosures.

control, and low and high R:FR treatments in moderate shade will determine how plants respond to shade. Additional screening (dark window screening further reduces light by ~50%), can produce four shade environments: of moderate shade with high or low R:FR, and deep shade with high or low R:FR. The light sources chosen to produce these effects are also important. Fluorescent bulbs produce little FR radiation, which explains their greater efficiency, and they cannot be filtered to produce a low R:FR condition. High intensity tungsten bulbs are effective but produce a R:FR lower than direct sunlight. Thus, the shade enclosures described in this article work best with exposure to direct sunlight, such as south-facing windows in a school room or, better yet, a greenhouse bench.

Materials and Methods: Using plastic bottles to Produce Shade Environments.
Clear plastic 2 liter soda bottle make excellent shade enclosures. These are very easy to obtain, allow a high percentage of light penetration (over 95%), and are relatively easy to cut to produce the enclosures. After an initial cut with an inexpensive metal saw blade, the sides of the bottles are easily cut with heavy scissors or light metal shears. The bottle should be cut laterally at the point where it begins to narrow towards its mouth (Fig. 3). The raised bases of the bottle can be cut to provide some vertical ventilation, allowing the rising warmer air to move out of the enclosure. The previous technique avoids the use of potentially hazardous sharp blades. We have found that the best procedure is to cut into the base of those swellings with a light metal hack saw, which is easy to do. We then use the metal shears or short-bladed heavy duty scissors to cut through the cuts and along the raised bases, and then remove them by cutting towards the middle of the base of the bottle to sever them. Each enclosure should be 19.5 cm long from the open base to the top. After the film is affixed to the bottle, “V” shaped slits can be cut on two sides of the base, 3 cm deep, after the film is affixed to the bottle, to provide some ventilation.

Similarly, 1-gallon plastic milk cartons provide the soil container and base of the shade enclosure. These containers need to be cut, as above, 9 cm from the bottom of the carton. After cutting, the interior of the containers need to be spray-painted with a flat black enamel to minimize any light reflection into the growing environment.

Using clear tape, affix a rectangular piece of shade film, 18 x 34 cm, from around the base of the clear plastic enclosure, to just beneath its top. Shading at the top is added by loosely taping a square piece of film, 18 x 18 cm, from its corners to the sides of the enclosure. At the bottom of the enclosure, with film attached, gently cut two V notches approximately 3 cm deep on opposite sides. When the experiment is prepared, seedlings are planted in the middle of the base, in potting soil that is approximately 5 cm deep. Then the shade enclosure is pressed into the soil about 2 cm deep, providing an opening at the tips of the V for ventilation. Two conditions are important for the use of the shade environments. First, the small openings at the bottom and top provide ventilation and prevent the build up of heat. Second, there is no leakage of direct light onto the plants to alter the amount and quality of radiation.

These enclosures are designed to be used with two different shade films. Both films are manufactured by 3M, and provide about 80% shade (or prevent 20% of the sunlight passing

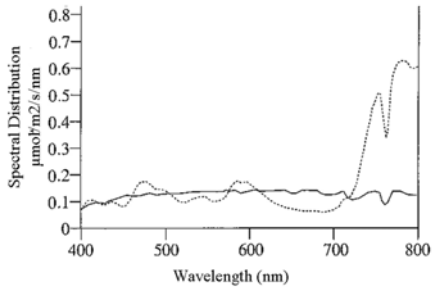

Figure 4. Spectral distribution of radiation within the neutral shade enclosures (solid line) compared to the low R:FR shade enclosures (dotted line: Lee et al., 1995).

through the films, Fig. 4). The spectrally neutral shade film has a metallic sheen to it and goes by the product name of RE20. The reduced R:FR film (at about 0.25) goes by the product number of FXST20. We can provide pre-cut pieces of both films in limited quantities, by contacting the author for correspondence

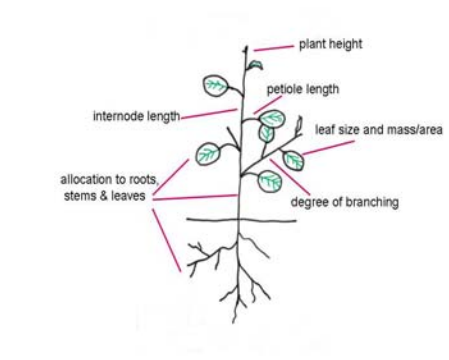

Figure 5. Plant diagram indicating the structures that vary as seedlings grow under different shade conditions. These features can be directly measured with a metric ruler, or by weighing dried plant organs.

through email. Also, it should be feasible to obtain film samples from your local 3M Building Products representative. Overall, the shade enclosures reduce light intensity in the photosynthetic range by 82%. With fairly bright sunlight, it will be possible to further reduce the light by another 50% (to 9%) by surrounding the enclosures with black nylon window screen.

Results and Discussion: Experimenting with Shade

With these simple shade enclosures, you can study the influence of shade light (both quantity and quality) on development of a variety of plants. These include seed germination, seedlings, small adult plants (as Wisconsin Fast Plants or *Arabidopsis*), mosses and liverworts, small ferns. For an example, we've used the growth of seedlings of chickpea (*Cicer arietinum*) to demonstrate the effects of neutral and reduced R:FR shade on the morphology of the plant. We can think of shade responses in general as a searching strategy for more light energy, whereby the plant produces longer and thinner stems, reduced leaf size and reduced allocation to leaves and roots. In general, we might expect to see a variety of effects manifested by young plants growing in different light conditions (Fig. 5).

These responses can be easily measured by cutting up the seedlings into components (like roots, stems and leaves), drying them, and then weighing them on a balance. Leaf area can be estimated by scanning them and using Photoshop or ImageJ to estimate their area, or by tracing the outlines on graph paper, or onto paper and creating a relationship between paper mass and area for calibration. All of the length measurements can be made with a metric ruler (a good way to teach about the metric system, too). The degree of branching can be determined by counting the number of nodes in the branches and main stem, to produce a ratio. Allocation to organs can be estimated by cutting up the seedlings into components (roots, stems and leaves), drying them, and then weighing them with a balance.

In comparing the growth of seedlings (as by measuring heights), it is important to soak the seeds and germinate them a bit in moist toweling before placing them in the soil. This insures that the seedlings are at the same size when placed in the enclosures. We have attached photographs of the results of the experiment with chickpea (Fig. 6). Clearly, leaf size has been altered by reduced light, and even further by reduction in R:FR. These experiments could be performed by students in middle and high school, and perhaps even 5th grade.

Other potential experiments. Shade responses of plants, and plasticity in general, are topics of fundamental importance and considerable contemporary interest (Ballare, 2009; Ballare & Scopel, 2007; Franklin, 2008; Lee et al., 1996; Morgan and Smith, 1979; Novaplansky, 1991; Schmitt et al. 1995; Smith and Whitelam, 1997; Trewavas, 2009; von Wettberg and Schmitt, 2005; Weiner, 1986). Thus, these enclosures could be used at the university level, from first year courses in biology to advanced courses in development, genetics, and plant ecology. We outline some of these potential experiments in the following paragraphs.

Vines are great study organisms for shade responses. Most are **heteroblastic**; they have markedly different morphologies, particularly in leaf size and shape, at different developmental stages. The shade enclosures could be used to study leaf morphology as well as internode length during early seedling development. Morning glory (see Weiner, 1986) and vining legumes (as peas) would be good plants to examine. Seeds are easily obtained and germinate at high rates. One can start by growing single vines per chamber under varied

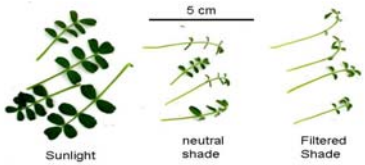

Figure 6. Left, shade enclosures of growing chick pea seedlings. Right, differences in compound leaf morphology in chick pea seedlings under different light conditions. Leaf size has been altered by reduced light, and even further by reduction in R:FR.

light intensities and qualities. Vines will respond differently to moderate light intensity paired with high or low R:FR, and low light intensity paired with high or low R:FR shading. Students can develop hypotheses about expectations of how plant traits (leaf size and shape, stem length, petiole length, total biomass, allocation to roots and shoots, etc.) will respond, and test them.

Vine development can be studied at added layers of complexity. Plants compete against one another for light, as well as for soil resources. In vines, the degree of competition for light is easily varied by the use of stakes. With a shared stake, two vines in the same chamber compete, but with two separate stakes competition for light is reduced. Students can then hypothesize and test how responses to competing vines change with light quantity and quality. For example, do vines without competitors under low red:far-red light conditions have forms similar to those competing for light? To add to the complexity of soil competition, multiple growth chambers can be planted with two seeds in each (or four seeds and thinned to two to ensure at least two seedlings survive). In half of the chambers, divide the soil with a partition and plant so that a seedling is present on each side of the partition. One can then alter the staking in each chamber, so that the two seedlings either have separate stakes or share a stake. This creates four experimental conditions: neither belowground nor aboveground competition, belowground competition only, aboveground competition only, and no competition. Hypotheses, observations and measurements can focus on the effects of different sorts of competition on plant traits.

These chambers can be used in similar way to test other factors affecting seedling and plant growth. Planting density affects plant form, and small plants can be grown at different densities in the shade enclosures, allowing additional analysis of shade effects. These enclosures could be used to distinguish between above ground and below ground competition by placing barriers in the soil to keep the root systems separate. The enclosures could also be modified to control the shading from different directions, as shade from the side with opening above, or shading only from above. Many forest understory herbs are thought to elongate in response to other plants in the understory, but to not elongate much to overhead forest canopy (Morgan and Smith, 1979; von Wettberg and Schmitt, 2005). Students can test this hypothesis with plants native to their own region.

These enclosures will also provide opportunities for laboratory experiments in genetics courses for majors, and advanced courses in plant genetics. This requires plants that are well-characterized genetically. Ideal for these purposes is the mouse ear thale cress, *Arabidopsis thaliana*. It is small in size, grows quickly, has its genome sequenced, and there is a scientific infrastructure that makes available a variety of well-characterized mutants. Seeds are available online from The Arabidopsis Information Resource Center (TAIR) at The Ohio State University (www.arabidopsis.org). Although *Arabidopsis* has a rosette growth form, and thus does not allow the analysis of height growth or internode length, the rosettes vary in petiole elongation. How does change in R:FR affect rosette width with and without competition from other plants?

Several genes control plant responses to shade. Phytochrome is a protein with a tetrapyrrole chromophore attached. In *Arabidosis* there are five types of phytochrome, resulting from changes in the amino acid sequence of the protein; these phytochromes form a gene family. Phytochrome B is the member most involved in shade avoidance. Mutants without the gene for phytochrome B (e.g. stock number CS6211) have longer than normal hypocotyls, longer petioles, and they flower earlier. Overexpression mutants (e.g. CS8037) have shorter petioles and hypocotyls. With both of these classes of mutants, the effects vary with light treatment. Other mutants are also available, as for other phytochrome genes. There is a small overlap in function of these five members, and mutants have been instrumental in clarifying their roles. Advanced experiments could utilize mutants of Phytochrome A, an unusual member of the family that degrades in light and has roles in de-etiolation, and contrast its role to Phytochrome B [see Smith and Whitelam (1997) for details and further suggestions]. Mutants have been isolated in other plants besides *Arabidopsis*, as for the Wisconsin Fast Plant (a patented variety of *Brassica rapa*—canola). Seeds of these mutants can be obtained from www.fastplants.org or from commercial biological supply companies.

Helping to Solve the Challenge of Making Plants Interesting. Most students, at all ages, are less interested in plants than they are in animals. After all, we are animals. This is particularly true for non-majors and the typical pre-med student in a general biology course. However, plasticity in response to an environmental signal, as light, is a plant equivalent to animal behavior (Trewavas, 2009). It takes a few days to observe changes, but the responses can be quite dramatic. Adding the influences of light quantity and quality adds a dimension similar to the social responses of people in a crowded setting, where many will seek to keep some personal space. Plant responses to shade are partly a direct response to nearby plants (because of the alteration of R:FR above, or adjacent to, the affected plant) as when they are crowded. Experiments with these shade environments provide students with a plant behavior that they might understand, and could make plants more interesting to them. Finally, the outcome of these responses of plants to their neighbors affects the yields of our crops when surrounded by weeds, and the structure of forests—aspects of plant biology that are important in today's world.

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Books Reviewed In this issue:

Bryophyte Biology (second edition). Goffinet, Bernard and A. Jonathan Shaw. 2009/ISBN 978-0-521-87225-6 (Hardback) 565 pp. Cambridge University Press, The Edinburgh Building, Cambridge CB2 8RU, UK

Now in its second edition, *Bryophyte Biology* is a comprehensive reference work on all aspects of the biology and ecology of these "small but mighty" plants. But why the need for such a work, on this relatively small group of plants (at least compared to angiosperms!)? The impression might be that this is just another one of those books that is written only for specialists on that group. *Au contraire, Bryophyte Biology*'s appeal and utility are to an audience much broader than bryologists. The role of bryophytes in the evolution of land plants and their importance in ecological processes will make this book valuable to *anyone* interested in plant evolution or ecology. Though suitable for use as a graduate-level text book, it is written more as a broad reference work.

As is often the case with second editions, this edition of *Bryophyte Biology* is a substantial improvement over the first edition. It is nearly 100 pages longer, has more contributors, and is overall broader in scope, as illustrated by the chapter on the origin and phylogenetic relationships of bryophytes in the first edition being replaced by one on phylogenomics and early land plant evolution in the second.

Half of the chapters are updates of chapters in the first edition, some of which have been greatly expanded. An example of this is the chapter on the morphology, anatomy, and classification of the Bryophyta, sixty percent longer and with nearly two and a half times the number of references of the comparable chapter in the first edition. A few other chapters treat similar subject matter as in the first edition, but with different authorship and, in some cases, a different focus. In some cases, topics have been rearranged or consolidated. In short, most of the topics covered in the first edition are also found in the second. The two first edition chapters that have been dropped completely from the second edition are those on chemical constituents and biochemistry (first edition Chapter 5) and the global carbon budget (first edition Chapter 11).

Some of the most exciting new material in this edition includes the chapters on mosses as model organisms (5, Cuming), biochemical and molecular mechanisms of desiccation tolerance (7, Oliver), and bryophyte species and speciation (11, Shaw). Each of these topics is part of a much larger area of current interest in biology. The results of research on model organisms are, by definition, generalizable (at least to some degree), and it is refreshing indeed to learn of moss species worthy of joining *Arabidopsis* as standard-bearers for the plant kingdom. Desiccation tolerance in bryophytes is of interest not only because, as early land plants, they give us insights into how the first land plants probably "figured out" how to live in a terrestrial environment, but also because the unique desiccation tolerance mechanisms in bryophytes show us survival at the very edge of life (vascular plants mostly avoid, rather than truly tolerate, desiccation). By summarizing a large volume of research on bryophyte species and speciation, Shaw has made it accessible for the countless discussions on species concepts and speciation occurring in journals and seminar rooms and everywhere else evolutionary biologists interact. Also of special note is the chapter on hornworts (3, Renzaglia *et al.*), because of the many changes in our understanding of that group that have occurred since the publication of the first edition, thanks in large part to research by these authors.

My few criticisms of this fine work focus on what's not there, rather than what is there. Publisher's page limits always mean tough choices, yet some of the omissions in this case are particularly unfortunate. I was eager to read about the latest thinking on the phylogenetic relationships among mosses, liverworts, and hornworts, but discovered that the excellent discussion and literature review presented in the first edition was completely dropped in the second (other than to note the basal position of *Marchantia*). No phylogeny of either the liverworts or the mosses is presented (the phylogeny of the hornworts, however, is a welcome addition to the second edition). Even though phylogenetic relationships in the mosses and liverworts are far from resolved, summary figures showing what is known at this point would be enormously useful. Finally, given the current widespread interest in carbon, particularly related to climate change, dropping all discussion of the role of bryophytes in the

global carbon budget seems a poor choice.

As with other disciplines, bryology has its own vocabulary; that a major reference work of this sort would be published without a glossary is truly puzzling. Considering the number of taxon names throughout the book, a taxonomic index (separate from the subject index) would also be nice.

Because the second edition represents a major revision, rather than merely an update, of the first edition, anyone who has the first edition will want the second edition as well. Considering both its breadth and its depth, it is an excellent choice for a graduate-level text book in bryology (though not particularly well suited for an undergraduate course). As the most thorough current work on bryophytes, *Bryophyte Biology* will be an important addition to the botanical section of any personal or institutional library. It will be particularly useful for anyone teaching general botany, or even general biology, courses.

Conifer Reproductive Biology. Williams, Claire G. 2009. ISBN978-1-4020-9601-3 (Cloth US$54095) 169 pp. Springer, Heidelberg, 69126, Germany.

This book has nine chapters separated into three sections. At the end of the book are the conclusion, glossary and subject index. References are provided for each chapter, as well as in the conclusion. There are several plates, figures and photos, all in black and white. Section I provides an overview of conifer reproductive biology that starts with an introduction of the conifers, followed by a discussion of the diplohaplontic-type of life cycle. Section II addresses the consequences of heterospory and describes separate female and male meiosis, the female gametophyte inside the ovule, the male gametophyte enclosed in a pollen wall, pollination and fertilization, and syngamy, embryo development and seed dispersal. Section III covers the dynamics of mating (form versus chance) examining two systems, wind pollination and embryo lethality.

Finally, a new book on conifer reproduction! It has been more than three decades since the last book devoted solely to this subject (Embryology of Gymnosperms by Hardev Singh, 1978). We definitely know more about conifer reproduction now than three decades ago, and as expected, we should also have more unanswered questions now than before. Many new laboratory techniques have emerged, there are many new species that have been studied, and the “classical” representative species have been examined in depth. The area of conifer reproductive biology should have also expanded to involve many more fields. What have we learned from genomics and model plant species that help in our understanding of sexual reproduction in conifers? What are the breakthroughs in conifer reproductive biology or what defines the accomplishments of the last 30 years? Where should the research on this subject proceed in the next decade or so? These and other questions were in my mind when I accepted the invitation to review this book.

According to the author, this book is intended as a “text supplement” for plant biology courses. Also, this book “should provide a foundation for conifer reproduction relevant to integrative hypothesis construction,” “that readers should not take away the idea that all conifers are going extinct,” and “such uneven research funding (based on species with commodity significance) skews this book’s content and organization.” The author has alerted the readers that “Available literature on conifer reproduction is vast, spanning more than three centuries so all contributions could not be included in this book.” The reader is encouraged to view this book as only a starting place for reading all of the original literature on a given topic.” Lastly, in the author’s own words “this book’s title should really be “Conifer Reproductive Biology: With Emphasis on the Pinaceae.”

Pros. This book benefits from the authors extensive research experience on *Pinus taeda*, particularly in areas such as seed dispersal, breeding and embryo-lethality. The author’s experience on *P. taeda* is also evident throughout the book, not only because information about this species has been integrated in most of the chapters, but also because most of the figures, photos and tables are derived from studies using *P. taeda*. In a way, this book presents a reproductive biology

of *P. taeda*.

Cons. My comments are numerous but I will only provide a few examples here. The comments are also varied to present my overall impression of the quality of the book.

Wollemi pine has been mentioned a lot in Chapter 1 (pp 3, 4, 5, 6, 7, 13, and 18), but except for the first few mentions, the rest did not really add any new or important information. Starting the topic on "Conifer Families: Classification and Geographic distribution" with a narration on Wollemi pine is awkward. In contrast, how come the bristlecone pines are not mentioned in this or any chapter?

Only two short paragraphs are presented under the heading "Gymnosperms" (p4) and these do not discuss gymnosperms per se, but only define it. The cycads, *Ginkgo*, and gnetophytes should have been appropriately mentioned here, even just briefly. The author alludes to "heterospory" as if it only occurs in seed plants (this feature goes way back to the lycophytes, at least).

Some topics are over-simplified and/or presented without the controversies, which is dangerous since readers might get the impression that these concepts are straightforward and free from disagreements or challenges, e.g., 1) Number of conifer families – The author presents that there are seven families, but there are reports that consider Phyllocladaceae as separate from Podocarpaceae resulting in eight families (see Tomlinson et al., 1997; Farjon 1998, 2008), 2) Placement of conifer families in pp 4-6 are all different – why? What about placement based on the fossil record? On p13, the author mentioned that "Cupressaceae is older than the Pinaceae," but did not mention that Podocarpaceae, Araucariaceae, Sciadopityaceae, Cephalotaxaceae and Taxaceae are older than Cupressaceae (see Farjon 1998, 2008), 3) Terminologies to describe male gametophyte development are those of Singh (1978), but some of the terms have been modified (see Gifford and Foster 1989, Owens and Bruns 2000) – are we also just going to ignore these?, and 4) Is the book of Singh (1978) perfect? How come the author has not pointed out any correction? It is possible that controversies and complexities are beyond the scope of a book, but not when a book aims to provide a sound "foundation for conifer reproduction relevant to integrative hypotheses construction."

Some concepts are inaccurate, e.g. 1) Not all divisions during male gametophyte development are asymmetric – the generative nucleus generally divides equally. Also, not all cells/nuclei that proceed through development are the larger of the two – the generative cell is smaller than the stalk cell, and the antheridial cell is smaller than the tube cell, 2) On p32, it was stated that "… conifers have long delay between pollen germination and fertilization; this delay can last months or even years." The delay is usually in days or weeks and in pine up to one year, but not years, 3) On p71, the author's statement "the spore wall (or pollen wall or exine)" is incorrect. Pollen wall is made up of exine and intine (or whatever system of terminologies you want to follow) – not only exine (but see p74), 4) On the subheading "From microspore to male gametophyte" – isn't the microspore the first cell of the male gametophyte? and 5) Discussion about dormancy of pollen tubes on pp 99-100 is confused since the example used for pine pollen dormancy is taken from a paper on Douglas fir which does not have a dormant pollen tube.

In some cases, statements are hanging or open-ended, e.g. 1) p6 – "the two families (Araucariaceae and Podocarpaceae) also provide a number of interesting reproductive exceptions." What are the exceptions? 2) p7 – "The IUCN's Conifer Specialist Group lists eight of the 18 species as having reproductive problems" What are these species and their problems? 3) p18 – "More than pines, other conifer genera are found in this part of southeast Asia" What are these genera? and 4) etc. Although the "missing" information can be obtained by reading other sources, it is difficult to continue reading when you are thinking about them. The effect is the same by the many questions raised in the book (at the end of some paragraphs) and I was left wondering if the answers will be provided or that this is one of those "points to ponder upon" (To my relief, I eventually found the answers at the end of the book - in the conclusion section).

Information presented in some of the topics

are very short – only two short paragraphs about gymnosperms, one short paragraph each for the topics on "Fossil record of early seed plants," "Examples of other conifers as living fossils," (by the way, if conifers are Mesozoic relicts, aren't they all considered as living fossils?), "Composition and function of the pollination drop," and etc. Pollination mechanisms and the relationship between seed cone orientation, presence or absence of a pollination drop, and saccate or non-saccate pollen are not adequately presented for readers who might want to plan some pollination and breeding experiments. Variation in male and female gametophytes and number and variation in sperm structure in different conifers are not adequately presented thus do not provide sufficient information to understand the basis for different patterns of cytoplasmic inheritance.

Some sentences cite figures or tables which seem unrelated to the text, e.g. 1) Only a few of sporangial cells undergo sporogenesis (Fig. 2.3) – where are the few sporangial cells in this figure? 2) Reproductive features of modern conifers have evolved by the end of the Mesozoic (Table 1.4) – I don't see anything about conifer reproductive features in this table, 3) A closer look at a single male strobilus shows many flexible scales (Photo 5.1) – where are these flexible scales?

The pictures also did not stir me – they are mostly low quality black and white reproductions of photographs (and perhaps scans from other sources) that have resulted in poor images. Some labels and captions are vague or inaccurate, e.g. 1) Photo 6.1 – what is a "pollen drop?" I think the author meant "pollination drop," 2) Photo 6.3B should show an ovule that has sealed after pollination but I think it just shows an off median section of an ovule, 3) Fig. 4.2 says it's a cross-section, but it actually shows a longitudinal section, 4) In the labels of some photos and figures, the arrows point to the terms (Fig. 4.4b), others point to the structures (Photo 6.1, 6.3A, 7.1), some have no arrows but only lines (Fig. 4.2, 4.5, 5.2), and others have only arrow heads (Fig. 4.3). None of the photos have scales to indicate the size.

Whereas only a few of the questions I raised prior to reading this book have been answered (in one way or another), I realized that numerous and varied papers have been published in the last three decades and that it is really an insurmountable task for one person to synthesize most of these. This book is definitely not an exhaustive reference for Conifer Reproductive Biology and yes, its focus is really on the Pinaceae. I do not claim to be knowledgeable in all the topics covered in this book, but for those subjects that I'm familiar with, I found too many errors that make me worry about their impacts. I cannot recommend this book to my students.

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Manual of Leaf Architecture. Ellis, Beth, Douglas C. Daly, Leo J. Hickey, Kirk R. Johnson, John D. Mitchell, Peter Wilf, and Scott L. Wing. 2009. ISBN 798-0-8014-7518-4 (Paper US$29.95) 216 pp. Cornell University Press, Sage House, 512 East State Street, Ithaca, NY 14850.

Of all the land plants, the angiosperms (flowering plants) are the most diverse in leaf morphology. Angiosperm leaves are the most abundant plant material in almost all fossil floras from the Cretaceous to the Tertiary. Although isolated fossil leaves do not provide as much taxonomic information as reproductive material, they do yield important information for us to understand the angiosperm diversity and evolution and paleoclimate changes. Early paleobotanists (for example, Lesquereux 1892; Berry 1916) often erroneously assigned these fossil leaves to modern families and genera (Dilcher 1974; Doyle and Hickey 1976) because of (1) the lack of a clear understanding of leaf architecture and the systematic distribution of leaf architectural features in living angiosperms and (2) the lack of clear and detailed descriptions of leaf architecture. Dilcher (1974) reported that up to 60% of all assignments to modern genera in some floras by early workers were incorrect. This false portrayal of the angiosperm record during the Cretaceous and Tertiary led many people to misunderstand the history of angiosperm evolution.

Since the 1970s (Dilcher 1974; Doyle and Hickey 1976), the paradigm of studying fossil angiosperm leaves, especially those from the

Cretaceous and early Tertiary, has been changing. Paleobotanists have presented floras with assignments to fossil genera (Wang and Dilcher 2006, 2009), with tentative assignments to extant genera (Dilcher and Lott 2005), or applying the more practical morphotyping approach in studying fossil leaf floras (Johnson 2002; Ellis et al. 2003; Barclay et al. 2003). All these approaches require careful studies on leaf morphological characters. A standard and unambiguous terminology to describe these characters and to help communicate between researchers is greatly needed.

The Manual of Leaf Architecture provides exactly the long-desired universal terminology and is a must-have for anyone who wishes to study living or fossil angiosperm leaves. In addition, this book contains about 350 line drawings and images of cleared leaves to illustrate the terms in describing leaf morphological characters. It also provides a template and a set of instructions on how to enter the leaf characters into an Excel scoring template, which can be downloaded at http://www.paleobotanyproject.org. The book is nicely indexed and provides a list of helpful references.

This book is intended for desk-top use while scoring leaves. It would be more convenient if it were either spiral-bound or punched for use in a Notebook binder, as the book does not lay flat without some possible spine damage. Unlike the previous version (Leaf Architecture Working Group 1999), which could be freely downloaded from the web, the dissemination of the newer version to the scientific world and the general public is greatly limited due to copyright issues. Despite these limitations, anyone who wishes to study living or fossil leaves should have a copy of this excellent guidebook handy.

-James Beville and Hongshan Wang, Florida Museum of Natural History, P.O. Box 117800, Gainesville, FL 32611-7800.

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Seedlings of Barro Colorado Island and the Neotropics. Garwood, Nancy C. 2009. ISBN 978-0-8014-4753-2 (Cloth US$99.95) 656 pp. A Comstock Book, Cornell University Press, Sage House, 512 East State Street, Ithaca, NY 14850.

I could not wait to open this long-awaited book, the compilation of years of work that began with the doctoral research of tropical biologist Nancy Garwood, and continued through subsequent stages of her career. The author warmly acknowledges all her collaborators and influences, especially her technicians in Panama, fellow researchers, and colleagues at STRI and NMH. It is wonderful to see this long project brought to fruition, and it was worth the wait.

Robin Foster, the legendary tropical botanist who was her PhD mentor at the University of Chicago, provides enthusiastic praise in the Foreword, commenting that while there are few field guides for New World tropical plants, guides to juveniles are rarer still. This is the first comprehensive guide to juvenile plants of the American tropics. It is a large-format book, for use in the lab or field station, not as a field guide; it is sure to find a place on the desk of every tropical botanist, ecologist, and forester, working around the world (not only Panama and Central America), as well as horticulturalists, gardeners, and others.

Juvenile plants are by definition sterile, and sterile specimens are often not determinable. A book like this can be of enormous help, and the need for many biologists to determine sterile specimens argues for keeping non-reproductive specimens in herbaria. The flora of Barro Colorado Island is one of the best known in the tropics, and accessible through Tom Croat's Flora of BCI; Garwood's book is a companion seedling guide, building on the previous knowledge accrued by Standley, Croat, and Foster, full of data gathered meticulously over years, lavishly illustrated with beautiful drawings by Margaret Tebbs, and also updated with current classification by the Angiosperm Phylogeny Group. It certainly is an essential reference and guide for ecologists!

The illustrations are simple, beautiful, line drawings, and very informative. They all have a cm bar scale to indicate size, the scale shrinking as the plant grows. They all focus on the initial or youngest stage, young plants that retain the initial photosynthetic organs. Each illustration then progresses to the juveniles, where those initial photosynthetic structures have been lost. While photos of seeds, per se, are not included, in many species the seed is visible, still attached to the young plants. Garwood's methods were to either 1) grow seedlings from seeds (in sun vs. shade, where possible); 2) collect seedlings in the field, and grow them larger in captivity; or 3) field collect seedlings. The longer the process, the more complete the picture of the species.

In large plant groups, one would expect it to be harder to distinguish species at the earliest stages. Garwood conducted an experiment with her data, and found that some genera that can readily be distinguished at the earliest stages (larger seeded species, like *Inga*, for example); there are more problems with smaller-seeded species, such as *Miconia, Piper*, or *Cecropia*, in which some species can only be distinguished as juveniles. It is possible to identify seedlings of most species at one locale based on morphology alone, with so many genera easily distinguished that ecologists could focus on these first!

Though this work is intensive, one-site information, Garwood provides a review of Neotropical seedlings, with a wide scope and clear presentation. She developed a shorthand to describe the diversity of morphology encountered, and spends Chapter 4 on elucidating the words and abbreviations with an illustrated glossary. In Chapter 5, the diversity of SMGs (seedling morphology groups) encountered in each family and genus is enumerated, using APG classifications. Fortunately, older family names are retained for indexing purposes! She also gives the number of seedlings illustrated for the family, and relevant references. Each family account ends with a narrative seedling description for the family, with specific examples given. Chapter 6 is the keys to seedlings, taking us to families, then individual species or species groups.

Since my travel budget to aid in the writing of this review is equal to the remuneration for the writing of the review (a nice round sum: 0!), a fieldtrip to Panama to test out the keys was not possible. I took a close look at families I know well (Fabaceae, and other represented in Costa

Rican and south Florida pine rocklands and hardwood forests).

Many examples of *Inga*, easy to tell with their winged petioles, are all distinct, and discernable to species from the youngest stage. The details are well done, with extrafloral nectaries depicted in close-up squares, as well as type of indumenta (pubescence). The legume family is huge, and Garwood treats the three subfamilies separately, with many genera for each.

The Rubiaceae have some genera in common with south Florida, and the *Guettarda* species illustrated has multiple seedlings per 'seed', just as do *Guettarda scabra* and *G. elliptica* from the Everglades. Numerous *Psychotria* species eclipse the single *P. nervosa* species native to Florida, but that species is also included, as is *Hamelia patens*. Many other families have species similar or shared with our Florida species, and I noticed great attention to detail, such as pellucid dots, stipule shape, and seed coat texture. The keys are very helpful, but I love the illustrations, which make up the largest part of the book. The plates are done by family, and illustrations packed in to maximize the number represented in the smallest space.

Robin Foster said this will become the model, the standard to which all subsequent works aspire. It truly is the gold standard, and maximally useful for this well-known tropical forest community, as well as for other similar and more distant tropical communities. I hope that its depth and quality will not deter others from trying to document their knowledge, but rather inspire those who have done seedbank/seedling community studies to write the best guides we can, as any published documentation of new knowledge acquired can prevent its loss with the demise of the scientist. This book is a treasure, and I recommend its acquisition to anyone who likes seeds and seedlings, as well as all motivated to figure out what juvenile plants they have encountered in their tropical forest plots.

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If a Tree Falls: Rediscovering the Great American Chestnut. Buege, Douglas J. 2008. SBN13: 978-1-4363-1609-5 (Cloth US$29.99) 186 pp. Xlibris Corporation, International Plaza II, Suite 410, Philadelphia, PA 19113-1513

If a Tree Falls by Douglas Buege presents provides a generally-well written account of the history of the Chestnut Blight and the disappearance of the American Chestnut from our Eastern forests. The author obviously has a deep connection with the living world (the dust jacket proclaims the author to be a vocal and active supporter of non-humans) though sentences like "The rest of the biotic world needed champions; humans would survive without my support..." smacks of messianic hubris.

That attitude mars an otherwise interesting account of the rise of Chestnut Blight on both sides of the Atlantic and the different results—devastation in Italian chestnut orchards was followed after several years by revival, while the species that had provided one-quarter of the trees in the Eastern woodlands of the US virtually disappeared. The author also spends considerable time examining current efforts to save the few remaining chestnuts and to select resistant American trees with which to begin reestablishment efforts in the US.

One does wonder why the author would bother trying to warn or motivate his fellow humans when he says over and over what a horror we are. If we're so bad, why would we ever listen to him? Especially as he's one of us. That puzzlement is compounded when he cites, on the topic of ethics, people like the truly monstrous Peter Singer of Princeton, a man on a par with the Nazis in some of t he practices he promotes (though as far as I am aware, Singer is far more an advocate of bestiality than any of the Nazis).

While If a Tree Falls might be useful in particular for its history of the disappearance of the American Chestnut from our forests, it is so fraught with pretension and pseudo-scientific ramblings as to be unfit for students. Some might want to buy it for the history, but this reviewer would not recommend it. There are, by far, better sources of information in this area.

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Picturing Plants: An Analytical History of Botanical Illustration. Gill Saunders. 2009. KWS Publishers, Chicago and London. 153 pp. ISBN 978-0-9817736-4-3 (Cloth US$50.00).

Gill Saunders has produced a very pleasing and informative volume that examines the evolution of botanical illustration from c. 1500 to the present day. What distinguishes this compact history of art from others is the author's clear understanding of botany. Scientific illustration must be both beautiful and true to its subject, and Saunders conveys a knowledgeable appreciation for both aestheticism and accuracy.

The book draws on the collections of botanical art from the Victoria and Albert Museum in London. However, Saunders transcends what could have been a narrow focus on a single art collection to produce a comprehensive general treatment. The museum has been acquiring exemplary illustrations since its founding in 1856, so its holdings encompass a broad representation of the many different modes and media used in botanical illustration. This range of collections allows Saunders to chart the development of artistic techniques as well as trends in printing, coloration, book-binding, and other aspects of publication.

Indeed, the publication quality, binding, and layout of this book are stellar, and make the volume both easy to read and a pleasure for the eye. The works themselves are showcased individually on full pages, with an engaging caption appearing to the side that complements the text without being redundant. The color reproduction is vibrant, even for older pieces. The print resolution and production size are appropriate for capturing fine details and sensitively etched lines, while the book overall is manageably sized at 9 x 9 inches (and hence more reasonably priced than most "coffee-table books" in the art history genre). Footnotes appear alongside text and are easy to follow. A bibliography and logical, detailed index are provided at the end of the book.

Following a concise introductory overview, each chapter covers a different setting in which botanical illustrations have been used: herbals; florilegia and pattern books (primarily 17th-century texts for wealthy patrons in which pictures took primacy over text in celebrating plants); books documenting newly-discovered species; botanical treatises (in which illustrations helped inform taxonomy); horticultural illustration of new cultivars (usually shown in catalogues); floras and field guides (for use by amateur and professional botanists); and the "real thing" (photographs, nature prints, and herbarium sheets). Because each of these vehicles attained popularity during different historical periods – with floras ascendant in the early Renaissance and field guides and photos being more prevalent in the past few decades – the treatment is roughly chronological, spanning four centuries. Examples from the 1700s and 1800s receive the most attention, probably reflecting the intensity of museum acquisition during this period. As a result, I found myself longing for more examples of modern illustration; only the last chapter delves much into works more recent than 1940.

The book does not provide exhaustive global coverage, but does range widely in discussing illustrations produced in the European colonies of the 1500s-1700s, including India, South Africa, the United States, and South America. We learn that occasionally, indentured native illustrators were trained to execute drawings in the western style in order to document new finds or stimulate the interest of collectors in the mother country to develop import markets. Saunders traces how colonialism fostered the homogenization of styles among far-flung locales: new modes introduced to China were gradually adopted by Japanese illustrators, even during Japan's period of self-imposed isolation from the West.

Through exploration, scientists have come to understand the botanical diversity and richness of the world; and art has necessarily evolved to keep pace with the tempo of new discovery. Saunders has a keen grasp of the qualities that make a botanical illustration both lovely and useful. She is critical of fanciful drawings that reflect bias or ignorance of anatomy, recognizing that "...what we see depends crucially on what we know" (page 12). She critiques horticultural drawings that spuriously depict late-bloomers alongside spring ephemerals in the same bouquet, no matter how pleasing this phenologically inaccurate picture might be. She discusses the challenges of composing a drawing when a plant far outsizes the paper,

and the need for illustrations to function as detailed, diagnostic snapshots of structures and colors that, unlike herbarium specimens, never decay. Even today, 250-year-old illustrations provide sufficient reliable information to typify specimens and reconstruct past floras (Reveal 2009).

Because the book highlights the interplay between art and science so creatively, I would recommend *Picturing Plants* as a companion text for any introductory course in botany, as much as I would deem it appropriate for beginning scientific illustrators. The exercise of drawing plants is invaluable for helping students actually see and comprehend plant structures (not to mention appreciating their sheer beauty); art and science go hand-in-hand in learning. As both a botanist and illustrator, I learned much, and think that this interesting and economical volume will inspire the artist and scientist inside each of us.

— Elizabeth J. Farnsworth, New England Wild Flower Society, Framingham, MA, USA.

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Paleobotany: The Biology and Evolution of Fossil Plants. Second edition. Taylor, Thomas N., Taylor, Edith L., Krings, Michael. 2009. ISBN 978-0-12-373972-8. (Hardcover US $125) 1230 pp. Academic Press, San Diego/Elsevier, Amsterdam.

At this writing, the Winter Solstice has just come and gone, but a discreet pile of unwanted Christmas gifts still remains under the tree. However, there was one present that I got this holiday season that spent hardly any time under the tannenbaum—the review copy of *Paleobotany: The Biology and Evolution of Fossil Plants* by Taylor, Taylor, and Krings.

Paleobotany: The Biology and Evolution of Fossil Plants is the second edition of the textbook by T. N. Taylor and E. L. Taylor published in 1993, or the third if you count in the first edition of *Paleobotany: An Introduction to Fossil Plant Biology* by T. N. Taylor from 1981. Like the 1981 and 1993 volumes, both of which are now out-of-print, the new *Paleobotany* is a encyclopedic textbook covering the entire glorious history of plants in geologic time. Yet this new book is bigger, brighter, and better than its predecessors. Even in terms of sheer mass, there is no comparison; weighing in at 3.7 kg (over 8 pounds!) as a result of an increased number of pages, a larger page size, and thick, glossy, high-quality paper, the new *Paleobotany* book outshines them all.

Of course, the value of a textbook is not just based on its appearance, but is primarily determined by the selection of topics, presentation of facts, and quality of writing. In these aspects, *Paleobotany: The Biology and Evolution of Fossil Plants* is as authoritative in its scholarship as it is comprehensive in its scope. Indeed, it should not be considered a mere second edition, but as a major landmark in the paleontological literature in its own right.

The book contains a total of 23 chapters. It opens with a discussion about the science of paleobotany and continues on to the beginning of life in the Precambrian some 3.6 billion years ago. Embracing plants in the widest sense, *Paleobotany* describes fossil fungi, bacteria, lichens, algae, in addition to the hornworts and bryophytes. It is the vascular plants, however, that get the lion's share of attention, comprising about three fourths of the text. Thus, the great majority of chapters are devoted to fossil lycophytes, sphenophytes, ferns and fernlike plants, progymnosperms, Mesozoic seed ferns, cycadophytes, ginkgophytes, other enigmatic gymnosperms, conifers, and angiosperms. Each chapter begins with an introduction to the plant group that outlines its essential characteristics and integrates the living members of the taxon. Descriptions of the fossil plant groups are not marched through the book in a long botanical parade through time, but are instead set into context within the framework of plant biology and evolution. Indeed, in addition to asking biological questions about ancient plants, paleobotany is in the unique situation of being able to document the history of long-lived plant lineages and settle evolutionary issues regarding more recently evolved plant clades by providing calibration points for molecular

phylogenetic studies.

Interwoven throughout *Paleobotany* are also special chapters on vascular plant morphology, early land plants, the origin and evolution of the seed habit, fern foliage in the Paleozoic and Mesozoic, and interactions between plants and animals. These chapters do not only provide information but also serve to emphasize and strengthen the connections between paleobotany, botany, and biology.

To me, one of the most exciting features of the new edition is the cornucopia of illustrations that are rendered in brilliant radiant color or crisp black and white. Some of the images of the fossils are so spectacular that one cannot believe that they are two-dimensional snapshots of living organisms taken millions and millions of years ago. Have a look at the intensely glowing grains of pollen caught in the act of being scattered like yellow confetti by an anther embedded in amber on p. 31, if you don't believe that pictures of fossil plants can be dramatic and intellectually rousing. Fascinating, too, are the portraits of eminent paleobotanists and palynologists, and useful are the colorful stratigraphic charts peppered throughout the book.

Judging from the numerous acknowledgments and photo credits in the book, as well as from the buzz of activity among paleobotanists in the book's final phases before printing to get photos to the authors, it appears that the global paleobotanical community contributed with enthusiasm to the making of this publication by offering up-to-date information and exceptional images. Nevertheless, congratulations should be expressly extended to authors Taylor, Taylor, and Krings for unifying the international community, for channeling its energy and knowledge, and especially, of course, for compiling this massive amount of information. According to back cover, the book contains 2100 illustrations, 5000 references, and 950 glossary terms. There are also 1025 pages of text; while I confess to not having read each and every one of them, I have delved deeply enough into several chapters to know that the text is clearly written, well-organized, informative, and accessible to the learned botanist.

At this point, you may be asking yourself, is there anything less than great about this book? Well, because *Paleobotany: The Biology and Evolution of Fossil Plants* is literally and figuratively a heavyweight, it is the wrong book for light bedtime reading or for lugging back and forth to class. This just means that this volume should be kept in a convenient spot on the desk or bookshelf, for graduate students and professionals in paleobotany, botany, paleontology, and geology will find this book indispensable. Wait not for the next Winter Solstice to carry out your new year's resolution to immerse yourself in *Paleobotany*, for this will be the present to yourself that you will be needing all year round.

- Carole T. Gee, Steinmann Institute, Division of Paleontology, University of Bonn, Germany

Plastid Biology. Pyke, Kevin. 2009. ISBN 978-0-521-71197-5 (Paper US$49.00) 203 pp. Cambridge University Press, 32 Avenue of the Americas, New York, NY 10013.

I was quite eager to receive this book for review because I am familiar with the fine work that Kevin Pyke does on plastid biology. The book covers the expected topics of plastid evolutionary origin, types of plastids, gene expression, protein import, photosynthesis, other metabolism, development, and biotechnology. However, it falls short in its aim toward "final-year undergraduate students or Masters students…" because the coverage of many topics is shallow and there are few if any citations to the literature from which the written information is derived.

While I appreciate the readability that results from not cluttering the text with too many references, the lack of references, literature cited, and further reading limits the book's use as an entry to research being done in the field. There is a brief (~1 page) "Further Reading and Resources" section at the end of the book but it is very generalized.

One further criticism is that the writing style of the book is conversational and vernacular. It has stylistic errors like mixed metaphors (e.g., on page 74 "the two photosystems are wired together in series such that electron flow through

the system must occur without logjams or pileups."). The outdated terms "higher" and "lower" plants are used. I got the sense that the author has a great deal of knowledge on the subject, teaches about it a lot, and wrote down his lectures without much editing to convert the text to book style.

Criticisms aside, the book covers a useful range of plastid-related topics. Given his expertise, I am not concerned that the author is misrepresenting the information. Some topics are more comprehensive than others; e.g., the chapter on plastid import is thorough but the chapter on plastid metabolism is cursory. The book would be helpful as a review for people who have some knowledge of the primary literature in the field and want to be reminded of the "big picture".

The book is 15x23 cm, with black and white figures.

-Carolyn Wetzel, Smith College, Northampton MA

Plant Biochemistry, by Caroline Bowsher, Martin Steer, and Alyson Tobin.(2008, Garland Science, Softcover, 500 pages, $110; ISBN-10: 0815341210 ISBN-13: 978-0815341215)

This book is directed to people who already have a basic foundation in general biochemistry and plant biology, so it does not take up space with fundamentals like protein synthesis, plant morphology, etc. At the stated level it is an excellent introduction to plant biochemistry, from photosynthesis to nutrient assimilation. The focus throughout is on metabolism.

The book's 12 chapters start with an introduction to plant biochemistry, a chapter on analysis of metabolic pathways with descriptions of key methodology and theory (including the main "omics"), and review of plant cell structure. There are several chapters on photosynthesis, respiration, and carbohydrates; nitrogen and sulfur metabolism; lipid biosynthesis; and a series of chapters covering alkaloids, phenolics, and terpenoids. Boxed topics include such interesting areas as terpenoids and human health, industrial applications of plant fatty acids, the role of protein phosphorylation in regulating sucrose metabolism, and metabolic control analysis. The prose is quite readable as compared to most biochemistry books and there is ample room left for notes in the book margins.

The book has many strengths. It does an excellent job of providing clear explanations of essential concepts rather than complicating the subjects with an encyclopedia of facts, but does provide enough information to avoid being superficial. I can envision using it in a course that couples text reading with discussion of primary literature, a plan that is facilitated by the useful "Further Reading" section at the end of each chapter. The book is well-organized and each chapter starts with a list of key concepts and a well-written introductory overview that sets the context for the information. Topic sentences heading each section make it easy to find particular subjects when skimming through the chapter. Separate boxes provide more in-depth explanation of examples, applications, and techniques. Pathways are clearly presented with enzymes in blue font and intermediates in black (the entire book is printed in blue and black, with one section of full-color pictures). When immersed in the details of pathways it is easy to lose track of the big picture, but the authors provide many guideposts via references back to higher-levels of organization: for example, at the end of a paragraph describing the complexity of pyruvate dehydrogenase complex subunit composition, the reader is told that this complexity may confer metabolic flexibility in response to stress (p. 160).

Overall, *Plant Biochemistry* is a well-organized, clearly-written book that covers the essentials of plant metabolism. It is recommended for use as a text in an introductory plant biochemistry course or as a supplement in an upper-level course. It would also be useful for students or researchers to have as a reference.

-Carolyn Wetzel, Smith College, Northampton, MA

Intracellular Signaling in Plants. Annual Plant Reviews, Volume 33. Yang, Zhenbiao (ed). ISBN 1-4054-6002-0 (Cloth US$225.00) 430 pp. Wiley-Blackwell, 2121 State Avenue, Ames, Iowa, 50014-8300.

This book, Intracellular Signaling in Plants, is

aimed to educate graduate students and faculty. It is an overview and review of current understanding of signaling networks and pathways in plant cells during development/ growth and encountering abiotic stress (particularly, drought and salt). This particular field used to be called "signaling transduction" but gradually has been divided into *inter*cellular and *intra*cellular signaling. This book emphasizes the *intra*cellular part of signal transduction.

After browsing through the table of contents and each chapter abstract, it seems that the book was a collection of somewhat unconnected chapters. The book covered a lot of material, and to help me get through it, I broke the book into roughly 5 sections based on their relatedness. The first section (chapters 1-3) covers several individual transmembrane proteins. A second section (chapters 5, 6, 13) examines calcium signaling; while a third (chapters 4, 9, 10, 12) discusses signaling involved in development such as mitosis and cytokinesis and cytoskeleton, cell shape, and some discussion of cell fate. A fourth section (chapters 7, 14) is related to abiotic stress, both reactive oxygen and ABA. The final section (chapters 8, 11) discusses lipid signaling such as PIP_2 and organelles. Within these sections, there was a greater degree of relatedness, and perhaps re-ordering of the chapters this way would have been helpful.

Most of the authors are respected scientists and mostly have given current review of the advances in their field. However, few authors seem to no longer be actively publishing in this field but have compiled their earlier work and understanding into a review. Some of these chapters provided a descriptive catalog of proteins without much connection to each other and lacked the big picture and did not address several important issues – such as how to find the unsolved players in network and emerging bioinformatics techniques, only few chapters deal with systems-biology level analysis. Some chapters used many abbreviations and jargon terms without reference or explanation (even upon their first use) which will probably confuse a lot of readers. This book title will target a wide range of graduate students and faculty alike, however without proper abbreviation the usefulness of some chapters will be lower than the authors and editor hoped for. A table listing and expanding these abbreviations and terms somewhere for easy lookup would have been much appreciated. The contents of the book are filled with insight and knowledge but some require editorial review to be understood and to make them enjoyable to read. Some color illustrations contained excellent details but the others could be presented in black and white.

This book could be more insightful if it started with an introductory chapter to convey the relationships between individual chapters, in addition the short preface. Also thoughtful reordering of the chapters or having some connection between sections might have been helpful. A chapter which compared signaling in animals and yeast (other eukaryotes) to plants would have greatly improved the few fungal and animal signaling examples made in some chapters. Animal signal transduction comparisons should have been made to highlight the unique differences but strengthen common pathways between plant and animal systems. Another chapter on trafficking via plasmadesmata and in cell walls seemed missing and could bring readers to understand signaling is not only inside the cell but continues outside the cell, especially plant cell is encaged within cell wall. Finally, although the editor stated a hope to use the systems level to elucidate signaling networks, few related studies were cited by the chapter authors. The book is a very up to date reference work on individual components of plant signaling networks analyzed by mutants, biochemistry and molecular biology with some (but not a lot of) bioinformatics. It does a fine job of cataloging the components but does not tackle the big picture.

-Jane Geisler-Lee, Department of Plant Biology, Southern Illinois University, Carbondale, IL 62901

Introduction to Plant Biotechnology, 3rd ed.
Chawla, H.S. 2009. ISBN 9791578086368 (Paper, US$69.50) 698 pp. Science Publisher, Inc., c/o Enfield Distribution Co. 234 may Street, PO Box 699, Enfield, NH 03748.

Chawla's Plant Biotechnology (3rd Ed.) covers a lot of ground. By comparison to Neal Stewart's volume, on Plant Biotechnology and Genetics, which I reviewed last summer in this journal, it

has a lot more pages and content, but also a lot less readability, mainly because of the large amount of information. For U.S. students, particularly undergraduates, Chawla's book might be satisfactory as a reference book, but they are unlikely to read it.

In the first 150 pages or so, Chawla gives a practical introduction to plant tissue culture. Clearly his own experience in this area gives him useful insights into the how and why of this historically important part of the equation. The second part covering 40 pages or so is a rather light-weight review of genetic material, not particularly in plants, or even exclusively in eucaryotes. This might be sufficient for a student with no other exposure to the material but probably not. One must hope that they acquired an advanced biology or biochemistry course somewhere along the way. At best this may serve as some common basis for the sections that follow, for students of diverse backgrounds.

Approximately 450 pages are devoted to recombinant DNA technology, including everything from basic techniques for separation of DNA fragments, to intellectual property rights. Also included are chapters on the impact of recombinant DNA technology, biosafety concerns and regulations, genomics, and bioinformatics. Chawla is an expert on IPR, particularly in India. This gives a different persepective than is usually provided in U.S. textbooks that mention gene cloning and biotechnology. Likewise, he comes at the biosafety and regulations from a somewhat different direction, because not all the world follows NIH guidelines as written for the U.S. The chapter on impact gives several useful tables for genes that have actually been deployed, in plants and elsewhere, as recombinant DNA. These chapters represent the part most useful for students in the U.S., Canada or Europe, giving a different perspective that is important for a world-wide understanding of biotechnology.

Genomics and bioinformatics are fields that are making explosive growth so the material here cannot help but miss the latest advances. Still, the bioinformatics chapter is not really up to date, with few references more recent than 2002. Similarly, most of the genomics chapter is for work prior to 2003. In fact, the author acknowledges in the preface that only some chapters have been extensively revised, added, or redone for this edition. In such a fast moving field it may not be possible for one person to keep up and write definitively over such a wide range of subject matter. I wonder if one ought to attempt it.

A good case can be made that students don't need all the details, or even the most advanced information, so long as what they do learn is correct. If so, they may well not need so much detail on any of these topics as given here, unless this is intended for a very lengthy course. Careful study of a small fraction of the examples provided here might better prepare them to be life-long learners. On that basis I would vote for a much slimmed down version as text, with Wikipedia used as a supplement and reference for the rest.

The drawings are in black and white, with a supplementary set of color pages, having a couple dozen drawings, added in at the end. A DVD of powerpoint presentations is available for instructors. I have not seen it. My personal opinion is that it is very hard to do a credible job pf presenting someone else's powerpoint material. Teaching the content of this text would really require an instructor to develop their own point of view and hence their own visuals. So I see little value in the DVD, unless it contains a lot of visuals that are unavailable elsewhere. I see no indication of that.

Some careful proof-reading would improve the text in a number of places. There is an index of cited first authors (close to 400), and a general index with 600 or more terms. Numbers of citations to original literature vary widely between chapters with as few as four and as many as 100, but averaging about a dozen. So some chapters are heavily dependent on secondary sources, with very limited use of the diverse resources available on the internet in most instances.

This book can serve as a basis for students to appreciate biotechnology in places where internet access is not a given. That would not include Europe or the U.S. and Canada. It has obviously found a market or it would not have attained a 3rd edition. However, I think any equivalent to a 4th edition will need to be radically reshaped.

-Lawrence Davis, Kansas State University.

A Guide to Florida Grasses. Walter Kingsley Taylor. 2009. ISBN: 978-0-8130-3319-8. 361 pages. University Press of Florida. Gainesville, Florida.

Taylor's book is a handy-sized field guide complete with a cm ruler inside the front cover and an inch ruler inside the back cover (though the book is metric throughout). His preface lays out the goal of the book which is to rectify the unfortunate fact that most wildflower guide books do not include grasses, even though in every sense they are indeed wildflowers. His stated goal is to get the user to know 200 of the 450 or so grasses of Florida from the way they appear in the field and when further examined, with only the aid of a hand lens. Because many grasses have such characteristic growth habits, his hope is that identification can be accomplished by anyone interested in plants without having to resort to difficult keys or detailed measurements of minute characteristics of such unfamiliar characteristics as glumes, paleas and lemmas.

After a generally enthusiastic introduction to grass classification and their uses, there is a chapter which describes the various parts of a grass in which the part names are usefully in bold type. Photographs and drawings supplement the descriptions of terms such as internode, ligule, sheath and collar and even the parts of the spikelet, including the glumes, lemmas, paleas. All of these structural terms also have a brief definition in the glossary, although terms describing growth habit such as reedlike or solitary (e.g. Smooth Cordgrass (*Spartina alterniflora*)) do not appear in the glossary.

The guide then plunges right into the Andropogonaea, the first (alphabetically) of the 16 tribes of grasses in Florida. Each tribe is introduced with a brief description of the important characteristics of the tribe and with a list of the genera and number of species in Florida. Descriptions of a number of species in the tribe then follow alphabetically by genus, with the common name displayed first, even though in his introduction, he does note that many of the common names are not useful, and scientific names should be learned if possible. For each species there is at least one (usually excellent) color photograph of the plant and/or parts of the plant, and for some there are also very good drawings. He lists for each genus a generic description, and for each species: native/non-native, annual/perennial, growth habit, distribution in Florida, habitat and the characteristics of the culm, leaf/sheath/ligule, inflorescence/flower, reproductive phenology, varieties (if any) and recent synonyms. For each species there are usually some additional comments about the distribution, taxonomy or other aspects of the grass that might be useful or interesting.

This is definitely a knowledgeable and well-illustrated field guide. One could, as one often does with a wildflower guide, thumb through and look for pictures of a grass in hand. However, it does present a few problems for identifying plants. Because the total lack of "keys" or at least a summary of "key characteristics", even at the tribe level, it's hard to see how to get started with an unknown grass. Perhaps a symbol with a drawing of the key feature of each tribe could have been listed at the beginning, with the symbol up in the corner of the page as is done in some field guides. For each species a few words here and there in the description are italized in order to emphasize key characteristics. For example, for Shortspike Bluestem (*Andropogon brachystachyus*) the culm has….*many branches…usually arching* and for the racemes, …*about 2 cm long, usually exserted at maturity…* and for Hairawn Muhly (*Muhlenbergia capillaris*) the panicles are ….*usually purple…* (which in late fall is all you really need to know!). I didn't notice this italicizing feature for quite awhile, but these particular words do seem to be key to separating the one species from another in a genus. Perhaps a listing of the categories to be covered for each species with examples of each topic and an explanation of the meaning of the italics would have been helpful before beginning to describe the tribes and species. Finally, the photos (except for varieties) and drawings appear embedded in the text without identification. The text runs throughout the book without page breaks for species, genera, or tribes and the photos can appear before and/or after the species description and therefore do not necessarily appear on the same page with the species name as for Pitted Beardgrass (*Bothriochloa petrusa*). The lack of a species name at the bottom of a image or set of images does make it difficult to find the associated species description, or to quickly look through at the photos.

Because this guide highlights easily seen characteristics and growth forms, it would be very useful as a teaching tool especially starting with "known" grasses to understand the terminology for a variety of growth forms and inflorescence structures. Although titled as a guide to grasses of Florida, because of the wide distribution of many grasses, the concise species descriptions and the many, often beautiful color photos in this guide could be useful in many areas of the country. And it would be a very useful companion volume for those who have worked with an unillustrated grass key such as that found in Richard P. Wunderlin and Bruce F. Hansen's "Guide to the Vascular Plants of Florida" (2003). This well-illustrated book should greatly help in demystifying grass identification, especially as more and more grasses enter the horticultural trade and become generally more familiar and interesting to the public.

-Joanne M. Sharpe, Coastal Maine Botanical Gardens

The Illustrated Moss Flora of Antarctica. Ochyra, Ryszard, Ronald I. Lewis Smith and Halina Bednarek-Ochyra. 2008. ISBN 978-0-521-81402-7 (Cloth US$250.00) 685 pp. Cambridge University Press, 32 Avenue of the Americas, New York, NY 10013.

The Illustrated Moss Flora of Antarctica contains a wide range of information of the moss-dominated flora of the southernmost continent. The three authors have done a truly excellent job. The text is well-written, clear and flowing, and there are many clear and useful illustrations, including several dozen color ones.

They begin by describing the area which they are covering, including the biogeographic regions covered. They include not only the continent of Antarctica but also islands to its north such as the South Shetlands and Macquarie Island. They then turn to the history of the study of mosses in Antarctica, including unusual habitats like geothermally heated sites where subsurface temperatures just below the plants can reach 90ÚC.

Then a chapter on the general diversity and phytogeography of Antarctic moss species is followed by the bulk (~550 of ~650 total pages) of the text, a species-by-species description of the various mosses, proceeding taxonomically by Class. Descriptions include truly lovely plates of black-and-white drawings and French text along with the English and Latin. Worldwide distribution is included to give a frame of reference for the Antarctic occurrences.

While those studying bryophytes will find such a fine work on an area, large parts of the flora of which is dominated by bryophytes, will, of course, be interested in buying a copy, and large college and university libraries should definitely add this to their collections. It is probably more advanced than would be useful in an undergraduate course, except perhaps 400-level courses. Still, it is a truly outstanding work and a pleasure to read.

-Douglas Darnowski, Department of Biology, Indiana University Southeast, New Albany, IN 47150.

Pitcher Plants of the Old World, Volume One. Stewart McPherson, Alastair Robinson and Andreas Fleischmann 2009 . ISBN-13: 9780955891823 (Cloth US$57.00) 630 pp., **Volume Two**, ISBN-13: 9780955891830 (Cloth US$57.00) 766 pp. Red Fern Natural History, 61 Lake Drive, Hamworthy, Poole, Dorset BH15 4LR, ENGLAND, UK

Pitcher Plants of the Old World (volumes I and II) by Stewart McPherson arrives as one more astoundingly beautiful and complete work from this author, who has embarked on a project of documenting most of the world's carnivorous plants. He has already covered, among other topics, the sticky-leaved carnivores (sundews, rainbow plants, etc.) and the pitcherplants of the New World (Sarraceniaceae). Here he covers the Nepenthaceae (Madagascar through some South Pacific islands and many points in between and to the north) and Cephalotaceae (southwestern Western Australia).

McPherson as usual has filled these two volumes with a very large number of stunning (mostly) color photographs, maps, and diagrams. The bulk of the text considers Nepenthes since, in terms of the number of species and geographic extent, it is orders of magnitude larger than the monogeneric, monospecific Cephalotaceae. Nepenthes is considered by geographic region. And even the newest species are included, not much of a surprise since the newest, and one of the three or four largest-pitchered species was recently

named N. attenboroughii after the famous Sir David Attenborough by McPherson and colleagues.

Along the way McPherson also gives plenty of attention to a general consideration of carnivorous plants and pitcherplants, including trapping mechanisms and mutualistic fauna which inhabit trapping pitchers. He also provides coverage of issues which seriously threaten the survival of many Nepenthese species, as well as information on cultivation of various species (highland Nepenthes are notoriously tricky to keep alive, even among those for whom carnivorous plants are more an obsession than a hobby). All-in-all, this is the finest work available on these pitcherplants, by quite a wide margin.

These two volumes belong in all college and university libraries, and all botanists should consider purchasing their own copy. Nepenthes are some of the most popular and recognizable carnivorous plants, and what botanist hasn't been asked about carnivorous plants. The gorgeous photographs should enchant students and professionals alike. Buy a copy today.

-Douglas Darnowski, Department of Biology, Indiana Univesity Southeast, New Albany, IN 47150.

Plants of Bastar, Chhattisgarh. Madhu Ramnath. 2006. The Netherlands Committee for the International Union for Conservation of Nature (IUCN), 568pp., with color photographs, (hardcover). IUCN National Committee of the Netherlands, Plantage Middenlaan 2K, 1018 DD Amsterdam.

Bastar is the southernmost district of the Indian state Chhattisgarh, home to a large number of tribal communities, and represents a particular bio-diverse part of the central Indian plateau. "Plants of Bastar" is the first attempt to provide an overview on the flora of this region, including information on plant use and conservation status.

The scope of the volume is to be a traditional flora. As such the authors attempt to first providing an overview on botanical terminology, interspersed with line drawings illustrating the most important morphological characters used in plant description. This is followed by three well structured dichotomic keys to the plant families of the region, one for vegetative characteristics, one for flower characteristics, and one for fruits. The authors put a lot of effort in providing simple terminology, and the product does serve its purpose, and can be used with minimum taxonomic knowledge. The distinction between "woody" and "non-woody" might not always be easy however.

The main section of the volume provides detailed description of the families encountered, as well as the genera and most important species found in the region. A setback is the lack of keys in this part, which makes it necessary to read the complete descriptions of all genera and species in a family in order to – hopefully – come to a correct identification. This is in parts made easier by a large number of color photographs, which however, are often of insufficient quality, or do not show the distinctive characters needed for a correct identification. The taxonomic information itself is very well researched, although the nomenclature is in many cases outdated.

The species information includes vernacular names in various languages of the region, as well as basic information on plant uses. The drawback is that the authors do not reference these uses back to the respective tribal groups.

The tome concludes with well elaborated indices of vernacular (including English), and scientific names.

Plants of Bastar is a good introduction to the flora of a diverse and under-researched region of India. It surely helps the user to identify a wide variety of species in the region. The taxonomic information clearly suffers from the fact that little in-depth taxonomic work has been possible in India in recent decades, due to very restrictive regulations regarding the exchange of herbarium material. Still, the book is a good addition to have if one plans to botanize in East-Central India. Unfortunately it is hard to get hold of. Published by IUCN Netherlands the work has no ISBN, and no information is available as to where or how to order the book, nor was it possible to find any pricing information for the volume.

-Rainer Bussmann, Director and William L. Brown Curator of Economic Botany, Wm. L. Brown Center
Missouri Botanical Garden

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- Editor

Chinese and Related North American Herbs: Phytopharmacology and Therapeutic Values, 2nd ed. Li, Thomas S.C. 2009 ISBN 978-1-420094-15-2. (Cloth US$189.95) 705 pp. CRC Press, Taylor & Francis Group, 6000 Sound Parkway, NW, Suite 300, Boc Raton, FL 33487.

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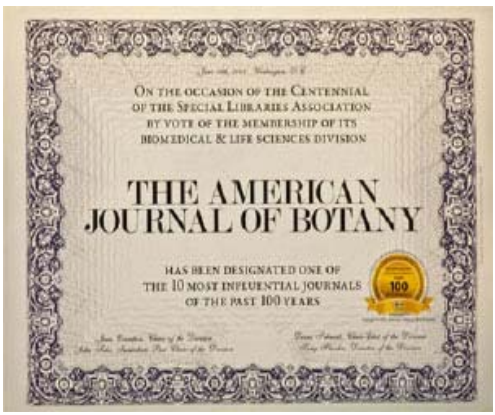

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