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BOTANICAL SOCIETY OF AMERICA

Many of us are employed at educational institutions and, at least on occasion, are assigned to teach in the freshman courses. This is a challenging assignment, and frequently a daunting one! How can so many students, the future leaders of our communities and country, have so little knowledge of and interest in plants? Why don't they realize how important plants are in the ecosystem? Too many of them don't even realize that plants are alive! It must be the fault of _____.

Did you fill in the blank as you were reading the previous sentence? I know I have - on more than one occasion. The usual effect of this exercise is to re-set my challenge to make a difference in the classroom. It is the beginning of another crusade to "convert the ignorant masses" to the beauty, wonder, and importance of plants. Occasionally there is that notable success, the student who is "turned on" to plants and decides to pursue a career in the botanical sciences. For the most part, though, my reward is from the knowledge that I tried mightily, and my students really learned at least some of the concepts we discussed. Maybe I set my expectations too high. (Maybe my students are right - - my expectations are unreasonably high). But maybe there's an underlying problem that I'm not seeing much better than my fellow teachers at the pre-college levels.

In this issue I've asked James Wandersee to elaborate on some of the work he and his students have been doing for the past several years. Jim is a botanist and science educator whose interests and research specialization are in the field of cognition - how students learn. Recently the lab has been concentrating on visual learning and their results indicate that "there may be more than meets the eye!"

- editor

Introduction to the Problem

We are two botanists and biology educators who are committed to exploring and investigating why people in the US tend to be less interested in plants than in animals, and why they often fail to notice the plants that are present in their own environment (Wandersee & Schussler, 1999a). We think such knowledge, once gained, may be useful in a variety of settings—from teaching an introductory biology course, to planning a public education program at a botanic garden, to writing a children's book about plants, to pursuing new botanical research. We also hope that the answers to these questions will ultimately lead to improvement of the nation's scientific literacy level, and to greater public understanding of plants (Flannery, 1999). The future of US research in the plant sciences depends, to a large extent, on the support of a botanically literate citizenry (Niklas, 1995).

Acknowledging Prior Work

Across the years, others, of much greater stature in the botany community than we, have pondered these same questions. Much of what they have observed and concluded has been both stimulating and helpful to us in beginning our own quest—and we have great respect for the work that they have done (cf. Bernhardt, 1999; Kramer, 1999; Sundberg, 2000). For example, prior explanations for US students' disinterest and inattention to plants have posited such underlying sources as zoochauvinistic introductory biology instructors, zoocentric examples used to teach basic biological concepts and principles, hypertechnical and uninteresting botany lessons, and underemphasis (or utter neglect) of plants in students' biological laboratory and field experiences (e.g., Darley 1990; Hershey, 1993, 1996; Nichols, 1919; Uno, 1994).

The Quest for a New Theory

However, the findings of our own research studies,

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including two recent nationwide studies on public perception of plants (Wandersee & Schussler,2000a), coupled with the general findings of other biology education and visual cognition researchers, suggest to us that the aforementioned sources may well be secondary factors, but the primary factor for explaining why people in the US often have a greater interest in animals than plants, and why they tend to pay little attention to the plants around them, is the way that humans perceive plants—due to the inherent constraints of their visual information processing systems. Theories are logical and principled systems that describe, predict, and explain. What follows represents the current state of our progress toward constructing a theory of plant blindness.

The Pathway Leading to the Introduction of a New Term

Following several years of preliminary discussions, library searches, small-scale investigations, and a fair amount of trepidation, in 1998 we decided to introduce a new term, *plant blindness*, to the US biology education literature (1998a). We did this because we thought the current state of inattention to and under-representation of plants—not just in biology instruction, but in US society in general—might be better explained by using research-based principles of human perception and visual cognition than by earlier, instructional-bias/deficiency-related-hypotheses—such as zoocentrism, zoo-chauvinism, and plant neglect. We also wanted the new term to be free of accumulated and inappropriate connotations, and to serve as a precursor term for use in explaining some of the resultant learning-related problems (cf. the secondary terms mentioned previously).

Delimiting the New Term

We coined the term *plant blindness* by reasoning that most people were already linguistically familiar with the use of the word *blind* as a metaphorical adjective suggesting missing visual information (e.g., blind date, blind seam, blind chance, blind alley, blind spot, snow blindness, need-blind admission). As for the limits of the word *plant* within our new term, our work thus far has been focused on the US public's inattention to and disinterest in understanding most angiosperms. So the term is most appropriately used in reference to the flowering plants.

Defining the New Term

Subsequently, we defined *plant blindness* as: the inability to see or notice the plants in one's own environment—leading to: (a) the inability to recognize the importance of plants in the biosphere, and in human affairs; (b) the inability to appreciate the aesthetic and unique biological features of the life forms belonging to the Plant Kingdom; and (c) the misguided, anthropocentric ranking of plants as inferior to animals, leading to the erroneous conclusion that they are unworthy of human consideration (Wandersee & Schussler, 1998a).

Possible "Symptoms" of Plant Blindness

We have proposed that persons afflicted with the condition known as *plant blindness* may exhibit symptoms such as the following: (a) failing to see, take notice of, or focus attention on the plants in one's daily life; (b) thinking that plants are merely the backdrop for animal life; (c) misunderstanding what kinds of matter and energy plants require to stay alive; (d) overlooking the importance of plants to one's daily affairs (Balick & Cox, 1996); (e) failing to distinguish between the differing time scales of plant and animal activity (Attenborough, 1995); (f) lacking hands-on experiences in growing, observing, and identifying plants in one's own geographic region; (g) failing to explain the basic plant science underlying nearby plant communities—including plant growth, nutrition, reproduction, and relevant ecological considerations; (h) lacking awareness that plants are central to a key biogeochemical cycle—the carbon cycle; and (i) being insensitive to the aesthetic qualities of plants and their structures—especially with respect to their adaptations, coevolution, colors, dispersal, diversity, growth habits, scents, sizes, sounds, spacing, strength, symmetry, tactility, tastes,

and textures (Wandersee & Schussler, 1999a).

Angiosperms, Flowers, and Visual Signal Values

Raven, Evert, and Eichhorn (1986) have pointed out that "the angiosperms make up much of the *visible world of modern plants*" (emphasis added; p. 584). Ghillean Prance, past Director of Royal Botanic Gardens—Kew, has said that his institution's research findings suggest that the earth is home to approximately 320,000 flowering plant species (Tangley, 1998). The key characteristic that sets the angiosperms apart from other plants is the *flower* (Bernhardt, 1999). Unlike animals, flowering plants cannot move from place to place to seek a mate; however, they have transcended their rooted condition via a set of features embodied in their flowers. Pollination by insects is basic in the angiosperms, and the first pollinating agents were probably beetles. The more *attractive* the plants' flowers were to the beetles, the more often they would be visited, and thus, the more seeds they would produce. Any changes in the floral phenotype that made such visits more frequent or more efficient offered an immediate selective advantage. Flower-visiting animals are drawn there by *visual* and/or olfactory attraction. Thus, plants were able to control their relationships with their pollinators, in part, by modifying their *visual signal value* through coevolution. To avoid or minimize herbivory, it is advantageous for the plants in a population to blend together visually. So, it could be said that, in effect, plants modify their *visual signal values* in accordance with the survival values conferred.

Seeing Involves More Than Meets the Eye

Why do many people tend to overlook the plants in their own environment? There is no simple scientific answer. First of all, most of us think that we see all of our surroundings simply by opening our eyelids and looking outward. Alas, there is much scientific evidence to reject that view (Catell, 1895; Nickerson & Adams, 1979). "No matter how hard we look, we see very little of what we look at," concludes Elkins (1996, p.11). Norretranders (1998, p. 126) has calculated that during visual perception, the human eye generates in excess of 10 million bits of data per second as input for visual processing, yet our brain ultimately extracts about 40 bits of data per second from that immense data stream for our conscious vision to consider—of which about 16 bits per second is ultimately fully processed. This means that our sensory bandwidth "…is far lower than the bandwidth of our sensory perceptors." Only .0000016 of the data our eyes produce are actually considered consciously; it is assumed that the rest must somehow subliminally affect our thoughts, feelings, and actions, and this means that most of our mental life must take place subconsciously. It seems that visual consciousness is like a spotlight, not a floodlight. And if that is not shocking enough, we do not see events in real time (Norretranders, p. 210). The computation time involved in processing the visual data we receive has been shown by experiment to take approximately .5 second, making *the present* a self-delusion. Perhaps the most important take-home message we have gleaned from Norretranders' (p. 242) analysis is that, although large amounts of visual data are discarded, "…what is presented [to our conscious attention] is precisely that which is relevant."

Factors That Affect People's Visual Attention

"We [humans] …tend to be surprisingly bad at recalling details of objects we see or use daily," writes acclaimed memory researcher Alan Baddeley (1982). For example, just because we have looked at a lot of pennies during the course of our life doesn't mean we can draw an accurate picture of one. Psychologist Stephen Kosslyn of Harvard University cautions us in the very title of his article that "the mind is not a camera, the brain is not a VCR." Rugg (1998, p. 1151) emphasizes that "all events are not equal; they differ in how they are initially encoded into memory." He claims that two critical factors determine whether or not we will remember an event: the degree of attention we pay to it, and the meaning or importance we assign to it. We think that appropriate botanical education and plant-growing experiences can enhance the quality of both.

Vision as Explained by Gibson's Ecological Optics

Ware (2000, p. 35) urges us to think of the world as an "information display." Human visual perception is about interpreting and understanding patterns of light—light between 400-700 nanometers in wavelength—as absorbed, reflected, refracted, diffracted, scattered, or transmitted within the environment we occupy. Applying J. J. Gibson's (1986) framework for describing our visual environment—a field he called ecological optics—it is the *surfaces* within our environment that are the keys to understanding human visual perception. Light + the environmental surfaces which present themselves yields the *ambient optical array*—a term he coined to represent all the light rays that are arriving from all directions at a particular point in the environment, as structured in space and time. Gibson argues that *surface texture* is one of the fundamental visual properties of an object and it produces *texture gradients* that are very important, along with *surface boundaries* and *cast shadows*, to our judging of space and distance (Ware, 2000, p. 40).

The Surfaces of Plants Affect How We See Them

Plant surfaces are amazingly varied and complex: leaf microtextures, for example, can yield irregular patterns of reflection—causing both the amount and

color of light to vary with ambient and source illumination angles, and with viewing angle. Illumination level variations, such as when the sun temporarily goes behind a cloud and then emerges, further complicates visual information processing. Digital images of plants contain much less information than is present in the ambient optical array, but they can be very useful when linked in a meaningful way with actual laboratory and field experiences (Wandersee & Schussler, 1999b). We think it prudent to note that, when viewing works of art, experts recommend limiting one's viewing of the images to no more than 1 hour per session, and to no more than 150 images in a single session to avoid visual processing fatigue (Berman, 2000).

Some Visual Principles That May Help Explain Plant Blindness

We continue to search the research literature to answer the question of why humans often overlook plants, as opposed to animals, and why they are often less interested in learning about and understanding plants than animals. In seeking a better explanation for *plant blindness* than biased learning approaches and gaps, we have compiled the following list of relevant principles of human visual perception and visual cognition (Wandersee & Schussler, 1999a).

1. People typically tend to know less about plants than animals. Less than 2.5% of the US population is directly involved in raising farm crops (Koning, 1994, p.7). Our research has shown us that persons who have had few meaningful and mindful educational and cultural experiences involving plants demonstrate little basis beyond popular culture for plant recognition. Humans can only recognize (visually) what they already know. Psychologists would say that plants have *low signal value* for many US citizens today. Mack and Rock (1998) have proposed what they call *inattentional blindness,* and they have found that once objects have acquired meaning for an observer, they are more likely to be consciously perceived. Inattention can become attention once an object or event has meaning. We often see what we expect to see, not what's actually there—because seeing involves not just the eye, but the eye-brain system (Solso, 1994, p. 31).

2. When flowering plants are not flowering or possess inconspicuous flowers, the chromatic homogeneity, the spatial homogeneity, and the overlap of their green leaves makes edge-detection difficult. When the azaleas of the Deep South are not in bloom, they are perceived as quite non-descript bushes. When they are covered with red, pink, and white blossoms, no one can ignore them. Gopnik, Meltzof, and Kuhl (1999, p. 65) claim that: "Paying attention to edges is the best way of dividing a static picture into separate objects." Because green plants are typically static objects in the observer's field of view, seeing them and noticing them may pose much greater problems of visual detection than dynamic objects do. In addition, humans tend to get bored and habituate if they look at a relatively constant scene for too long a time (p. 27). If the members of a set of objects are not sufficiently distinct from their surroundings, they blend-in, and nothing is consciously perceived. We cannot visually label them and they do not "pop out" chromatically from their background. The visual cortex continuously filters out more of the data it receives from the retina of the eye than it retains for conscious analysis. Without our conscious intention, attention, and effort to preserve it, most of the visual data our brain receives about plants is likely to be discarded.

3. The members of plant populations typically grow in close proximity to each other, whether cultivated or natural, and they rarely move (except in wind or rain). Static proximity is a visual cue that humans use to group objects into bulk visual categories (Zakia, 1997). Thus, individual plants may tend to be de-emphasized, with the totality being labeled simply as "plants." If there are animals, especially large ones, moving on this living environmental canvas, the animals may become the focus of our attention. This helps to explain the "plants as backdrop" phenomenon. When we watch a game of football, for example, we rarely think about the huge population of grass plants the players are moving upon.

4. In most people's minds, plants are typically rather non-threatening elements of an ecosystem and incidental contact with them can usually be ignored without dire consequences. Visual habit and general familiarity diminish the conscious attention we give to such objects. If our vision operates to minimize expended energy, then low-priority-level attributes may be discarded to make visual processing easier. Human-eating plants do not exist, and we all know it. However, if we are warned that poison ivy may be present in the woods where we are walking, we are quick to develop and employ a template-like search image for compound leaves containing three leaflets in order to screen incoming visual data. In this case, the threat of bodily harm posed by its secondary plant substance, pentadecanedienyl catachol, makes the possible presence of this species in our path intensify our visual vigilance.

5. The brain uses patterns of space, time, and color to structure visual experience (Zakia, 1997). Because they are immobile autotrophs, plants generally offer fewer spacing-based, time-based, or color-based visual cues for humans to observe than

animals do—except, for example, during periods of pollination and dispersal (cf. Wandersee & Schussler, 2000b). The brain is fundamentally a difference detector, and when it finds none, the perceptual field is not perturbed. For example, invasive plants, such as kudzu, capture our visual attention and interest because they grow with great vigor in places where we don't expect or want to see them.

We have argued that, instead of invoking zoological biases as the root cause, there may well be a visual-cognitive-societal basis for why plants (and thus, the plant sciences) are frequently ignored or undervalued by the US public, under-represented in American biology courses, and considered less interesting than animals. Our research suggests that a keen interest in animals does not necessarily preclude an equal interest in plants, and vice versa. In fact, many botanists, including us, are pet owners. In querying students about the reasons they were more interested in learning about animals than plants, they responded that animals: (a) can move quickly via appendages; (b) have to eat regularly just as we do; (c) have human-like eyes for vision, (d) have human-like faces, (e) exhibit many interesting behaviors, (f) have dramatic and easily observable life cycles; (g) mate, give birth, and raise their offspring; and, (g) can interact with, and sometimes even play with, people (Wandersee, 1986).

Plants Versus Animals

Our own research studies (Wandersee, 1986; Wandersee & Schussler, 1998b) and that of other biology educators (Baird, Lazarowitz, & Allman, 1984) have found that, for the groups of school students that were studied, the majority of students (both girls and boys) preferred to study animals over plants. Our 1998 study of 274 US students drawn from grades 4-7 in a major metropolitan area indicated that: (a) student interest in animals led plants by approximately a 2:1 margin; (b) girls were more likely than boys to express an interest in learning about plants; and (c) of the nearly 300 students we queried, only about 7% spontaneously expressed a scientific interest in plants—and of *that* 7%, about two-thirds were *girls*.

The Dominance of Interest in Animals

Paradoxically, plants form the basis of most animal habitats and all life on earth (Abbott, 1998). Although animals frequently steal the spotlight when the specter of extinction is raised, one in eight plant species is currently threatened by extinction. Intellectually, we may know that you can't sustain pandas without bamboo for them to eat, but culturally, facts like this are often forgotten (Abbott, 1998). Few American children's cartoon characters, shaped candies, stuffed toys, team mascots, songs, or games pay homage to plants rather than animals. Children in the US seem to be primarily "animal-socialized."

Perhaps it's not just an American phenomenon, however. Visitors using the main entrance of the world's most famous botanic garden, the Royal Botanic Gardens—Kew (located near London) are greeted by *The Kew Mural*, a great and stunningly beautiful, intricately carved, wall-mounted, wood-relief sculpture depicting the Kew Gardens being assaulted by the powerful wind storm that struck down or damaged over 1,000 trees on 16 October 1987. The many kinds of wood used to make the sculpture came from actual timbers felled by the tempest; the interplay of natural colors, polished wood grains, flowing shapes, and visually palpable textures leave its viewer breathless. Yet, inexplicably, about two-thirds of the sculpture's surface area is devoted to images of *animals* being displaced by the storm. The plants depicted in it are rendered as either fragile or marginalized; the animals are central to the mural, and appear as either forceful opponents or agile survivors. Plants are clearly the backdrop of the visual tale being told.

The Importance of Having a Plant Mentor

In our two national studies covering 27 states (the first, looking at US "Generation Y" youth, and the second, at US mothers of young children) focusing on each demographic group's attention to, interest in, and understanding of plants—one of many interesting findings was that having early experiences in growing plants under the guidance of a knowledgeable and friendly adult was a good predictor of later attention to, interest in, and scientific understanding of plants, as well as of the kinds of plant experiences a young mother will provide for her children (Wandersee & Schussler, 2000a).

Describing Plant Mentorship

But the adult who serves as a *plant mentor* need not necessarily be the child's mother. Lewis (1996, p. xviii) writes: "I bonded with plants at an early age. As a small, curious boy, I once watched my grandmother crush a dried zinnia flower in her hand, then gently blow on the mixed pile of fragments. Petals and other chaff flew off, leaving tiny brown daggers on her palm. 'Seeds to grow next year,' she said…I was awed and excited by the chance to practice this magic, and, *with her guidance* [emphasis added], soon started my own tiny garden." Your authors remember similar "magic moments" as budding plant scientists—one of us recalls an exciting, mentored, personal experiment during her 6th grade year, comparing the germination rates of pea seeds that she placed in a freezer for various intervals to pea seeds that were not frozen; the other recalls using a small vial of gibberellic acid, obtained from a local greenhouse by his father, in a supervised,

personal attempt to grow giant bean plants (ala' Jack and the Beanstalk) for a school science project during his 5th grade year.

A Possible Long-Term Solution to the Plant Blindness Problem

Based on the evidence we have gathered to date, we hypothesize that early and iterative, well-planned, meaningful and mindful education (both scientific and social) about plants —coupled with a variety of personal, guided, direct experiences with growing plants—may be the best way to overcome what we currently see as the human "default condition"—*plant blindness*.

Plants, Culture, and Plant Blindness

We also postulate that the greater the degree of value a culture ascribes to plants, and the greater number of members within it who work directly with plants or plant products, the more likely the prevalence of plant blindness in that culture will be lower (cf. Balick & Cox, 1996). As Charles Lewis (1996, p. 22) contends, "Those who live by hunting or gathering, fishing or farming, must observe nature's signs….Changes in foliage color would be a strong indication that preparation for surviving the long winter should begin."

In addition, Lewis (1996, p. 20) asks: "If dwellers in the savanna [of Africa] did use tree shapes and the visual appearance of the terrain for swift assessment of its potential as a habitat, could they not have evolved innate preferences for particular landscape characteristics (preferences that resonate within us today)? Investigators have found that Americans like park settings that might be characterized as 'savannas'…." Research by Balling (a psychologist) and Falk (an ecologist) found that younger school children (ages 8-11) who were shown slides of five different biomes expressed a significant preference for savanna-like settings, and later found that only after people grow older do they begin to select more varied landscapes—usually of the type familiar to them (1982).

A Botanical "Sense of Place"

Hollingsworth (2001) writes about the value of capturing one's *sense of place* photographically—via a close-up, a detail, a panorama, or a landscape scene that approximates a still- life painting of an importance site in one's personal history. At the beginning of a graduate seminar in botanical education, we also explored this idea, by asking the participating science instructors to prepare and then give brief, 5- to 10-minute talks describing their own *botanical sense of place*—reflecting upon salient memories drawn from childhood days, and specifying several kinds of plants which grew in their yard or neighborhood that played a role in their life while they were growing up—and situating their hometown in its ecological and economic botany settings. It seemed to be a worthwhile exercise in self-discovery for them—realizing who their plant mentor was (if they had one); which plants they often used for play, for shelter, for scent, or for taste; what kind of bioregion they lived in; what kinds of area cash crops became familiar to them; and so forth. More importantly, it brought prior knowledge about and experiences with plants to the fore, and it provided accessible, conceptual anchor points for linking the new botanical knowledge they were learning to their existing knowledge structure about plants (Fisher, Wandersee, & Moody, 2000; Mintzes, Wandersee, & Novak, 1998, 2000).

Some Activist Approaches We Are Trying

"Prevent Plant Blindness." Those three simple words are emblazoned diagonally across our 20" x 30", bulletin-board-sized, full-color, classroom poster which is being distributed to more than 22,000 US science teachers and botany instructors as part of our national campaign to increase students' awareness of and interest in plants. We designed the poster to be initially puzzling, and to elicit inferences about its meaning. This aligns with Solso's (1994, p. 26) tenet drawn from visual cognition research which says "…we gaze longer at interesting or puzzling things…." The poster shows a tree-lined, riverine landscape. Hovering, Magritte-like, in the sky above is a large pair of dark-red-tinted glasses. The implication is that someone wearing those red glasses would not be able to see any of the green plants shown in the scene below—that if one's vision is "filtered," either physically or conceptually, one may actually miss seeing the plants that are present in one's environment. The back of the poster provides a complete definition of plant blindness, lists its symptoms, and offers directions for 20 simple, plant-science-related activities. This poster was subsequently endorsed by BSA's Education Committee.

Besides the plant poster project, we have also written, illustrated, and published a 40-page children's science picture book which presents a plant mystery to children between the ages of 4 and 8 (Schussler & Wandersee, 1999). It is intended to be the first of a series of mystery books involving the two main children's characters, who are portrayed as being best friends, namely—Abby and Tate. The first book subtly introduces its "readers" to some basic principles of plant care and encourages them to try raising an African Violet plant. We have introduced the book to a fair number of elementary teachers, parents, and grandparents, and have made it available at cost on Amazon.com. It has just been translated into Spanish by plant ecologist Sandra M. Guzman, and a Spanish version will be available in about six months.

In addition, in 1998, we founded a science book award, now recognized by children's literature libraries and authors worldwide, called the Giverny Award. It is given each year to the author and illustrator of the book selected by the Award Committee as the best children's science picture book in our selection pool—with preference given to storybooks that teach plant science concepts and principles in an indirect and engaging way. Each year's winning book is described on our research group's web site (http://www.15degreelab.com) We hope that our annual book award, children's plant mystery books, classroom poster design and distribution, research publications, and regular presentations at selected, science teachers' and scientific society meetings will, at least in a small way, help increase the US public's awareness and interest in plants.

Brief Closing Remarks

If we are to liberate American students from the intellectual, perceptual, and visual processing traps that can lead to *plant blindness,* those of us who teach introductory biology and botany courses must work to expand our students' botanical horizons. While biological science departments may be currently reorganizing themselves along the lines of common research themes rather than taxa of organisms studied, plants stand as distinctively different life forms from humans, life forms that have, historically, rewarded our focused study, observation, and investigation. We think there are sound scientific reasons why botany, like the plants it studies, needs to maintain its own visibility and identity (Greenfield, [1955] 1999).

In BSA's strategic plan, *Botany for the Next Millennium* (Niklas 1995, p. 11) we read that, "Functionally, plants are the primary mediators between the physical and biological world." That is no minor feat; that role alone calls out to those who teach biology and botany to help "Prevent Plant Blindness."

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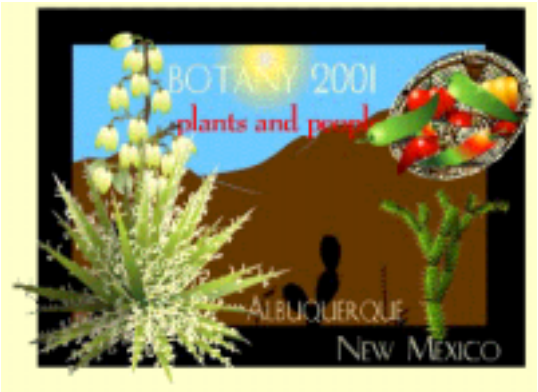
Authors' Note: We have recently discovered that the adjective *plant blind* was used in the past within the British horticultural literature, in reference to plants that had lost their apical shoot tips—either by nature or by human intervention. However, its use is apparently quite uncommon in horticultural publications today, and, to the best of our knowledge, the term *plant blindness* has rarely been used in that literature.

James H. Wandersee, Louisiana State University

Elisabeth E. Schussler,

Southeastern Natural Sciences Academy

News from the Society



CALL FOR PAPERS

ANNUAL MEETING
August 12-16, 2001
Albuquerque Convention Center
Albuquerque, NM

Meeting Overview

The Botanical Society of America (BSA) will hold its annual meeting in Albuquerque, New Mexico from August 12-16, 2001. The theme for the BOTANY 2001 meeting is "Plants and People." In addition to the BSA, other societies participating in BOTANY 2001 include the: American Bryological and Lichenological Society (ABLS), American Fern Society (AFS), American Society of Plant Taxonomists (ASPT), and International Organization

of Plant Biosystematists (IOPB). This *Call for Papers* includes all members of the ABLS and AFS in addition to those of the BSA.

You are invited and encouraged to present some aspect of your research in a contributed paper, contributed poster, invited symposium, or special lecture. The BSA hopes that you will be able to attend BOTANY 2001 and participate in an exchange of formal and informal information and ideas with colleagues.

Contributed papers, or oral/podium presentations, will be 15 minutes in length (inclusive of questions). Contributed posters will fit onto bulletin boards that are 4 ft tall and 8 ft wide. Invited symposium contributions and special lectures are arranged in advance and coordinated by the symposium organizer(s) and/or the BSA section(s). Symposium presentations will be 30 minutes in length (inclusive of questions).

Submission of Abstracts (Deadline: March 9, 2001)
(note: "Recent Topics Posters" may be submitted through July or until available slots are filled)

Each contributed paper, poster, symposium presentation, and special lecture requires an abstract. The same individual should not be a first author on more than three abstracts. The abstracts and final program will be available on-line at the BOTANY 2001 website prior to the meeting and hardcopies will be distributed at the meeting to registrants.

Submission of abstracts, titles, and other relevant information (e.g., keywords) for contributed papers, posters, symposia, and lectures should be carried out on-line using the "Electronic Abstract Submission Form" at the BOTANY 2001 website: <**http://www.botany2001.org/**>. Copies of the titles and abstracts will be sent electronically to the sender, the Program Chair of the BSA Section selected for submission (see reverse), and the BSA Program Director. The submission site will open in January 2001, and the deadline for receiving abstracts is **March 9, 2001**.

'Hardcopy' submission of abstracts is highly discouraged, but acceptable. Because camera-ready abstracts are no longer accepted by the publisher of the Abstract Volume, please seek assistance if you have difficulty accessing the World Wide Web. Please use the electronic submission process! If this is impossible, you may contact the BSA Business Office no later than February 15, 2001 to obtain hardcopy forms: BSA-Meeting, 1735 Neil Avenue, Columbus, OH 43210-1293. Tele: (614) 292-3519, Fax: (614) 292-3519, E-mail: <hiser.3@osu.edu>.

Scientific Program

Questions about the scientific program for BOTANY 2001 should be directed to the appropriate BSA sectional Program Chair listed on the reverse side, or to the BSA Program Director: Jeffrey M. Osborn, Division of Science, Truman State University, 100 E. Normal Street, Kirksville, MO 63501-4221. Tele: (660) 785-4017, Fax: (660) 785-4045, E-mail: <josborn@truman.edu>.

Registration, Housing & Events

A Meeting Circular for BOTANY 2001 will be mailed to members of participating societies in spring 2001, and it will be available online at the BOTANY 2001 website. The Circular will contain detailed information about registration, housing, social events, field trips, workshops, tours, and all costs. Additional information can be obtained from the BSA Meetings Coordinator: Wayne Elisens, Department of Botany & Microbiology, 770 Van Vleet Oval, University of Oklahoma, Norman, OK 73019. Tele: (405) 325-5923, Fax: (405) 325-7619, E-mail: <elisens@ou.edu>.

Program Chairs for Botany 2001
Bryological And Lichenological Section – ABLS
William R. Buck, Institute of Systematic Botany, New York Botanical Garden, Bronx, NY 10458-5126. Tele: (718) 817-8624, Fax: (718) 562-6780, E-mail: <bbuck@nybg.org>.

DEVELOPMENTAL AND STRUCTURAL SECTION
Larry Hufford, Department of Biological Sciences, Washington State University, Pullman, WA 99164-4236. Tele: (509) 335-2183, Fax: (509) 335-3184, E-mail: <hufford@mail.wsu.edu>.

ECOLOGY SECTION
Massimo Pigliucci, Department of Botany, University of Tennessee, Knoxville, TN 37996-1100. Tele: (423) 974-6221, Fax: (423) 974-2258, E-mail: <pigliucci@utk.edu>.

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Felix G. Coe, Tennessee Technological University, Department of Biology, Box 5063, Cookeville, TN 38505-0001. Tele: (931) 372-6257, Fax: (931) 372-6257, E-mail: <fcoe@tntech.edu>.

GENETICS SECTION
Stephen J. Novak, Department of Biology, Boise State University, 1910 University Drive, Boise, ID 83725. Tele: (208) 385-3548, Fax: (208) 385-4267, E-mail: <snovak@boisestate.edu>.

HISTORICAL SECTION
Vassiliki Betty Smocovitis, Department of History, 4131 Turlington Hall, University of Florida, Gainesville, FL 32611-7320. Tele: (352) 392-0271,

Fax:(352)392-6927,
E-Mail: <bsmocovi@history.ufl.edu>.

Paleobotanical Section

Steven R. Manchester, Florida Museum of Natural History, Department of Natural Sciences, University of Florida, Gainesville, FL 32611-7800. Tele: (352) 392-6564, Fax: (352) 846-0287, E-mail: <steven@flmnh.ufl.edu>.

Phycological Section

Richard M. McCourt, Academy of Natural Sciences of Philadelphia, 1900 Benjamin Franklin Parkway, Philadelphia, PA 19103. Tele: (215) 299-1157, Fax: (215) 299-1028, E-mail: <mccourt@acnatsci.org>.

Physiological Section

Denise M. Seliskar, Halophyte Biotechnology Center, College of Marine Studies, University of Delaware, 700 Pilottown Rd, Lewes, DE 19958. Tele: (302) 645-4366, Fax: (302) 645-4028, E-Mail: <seliskar@udel.edu>.

Phytochemical Section

Emanuel L. Johnson, USDA ARS WSL, Building 001, Room 329 BARC-W, 10300 Baltimore Ave., Beltsville, MD 20705-2350. Tele: (301) 504-5323, Fax: (301) 504-6491, E-mail: <eljohnsn@asrr.arsusda.gov>.

Pteridological Section – AFS

Christopher Haufler, Department of Ecology and Evolutionary Biology, University of Kansas, Lawrence, KS 66045-2106. Tele: (785) 864-3255, Fax: (785) 864-5321, E-mail: <vulgare@ukans.edu>.

Systematics Section – ASPT

Lynn G. Clark, Department of Botany, 353 Bessey Hall, Iowa State University, Ames, IA 50011-1020. Tele: (515) 294-8218, Fax: (515) 294-1337, E-Mail: < lgclark@iastate.edu >.

Teaching Section

Rob Reinsvold, Department of Biological Sciences, 501 20th Street, University of Northern Colorado, Greeley, CO 80639. Tele: (970) 351-2716, Fax: (970) 351-2335, E-mail: <rjreins@bentley.unco.edu>.

Tropical Biology Section

Susanne Renner, Department of Biology, 8001 Natural Bridge Road, University of Missouri-St. Louis, St. Louis, MO 63121-4499. Fax: (314) 516-6233, E-mail: <biosrenn@admiral.umsl.edu>.

Call for Proposals: Karling Graduate Student Research Award

Purpose and Eligibility

The purpose of this award is to support and promote graduate student research in the botanical sciences. To be eligible, one must be a member of the Botanical Society of America (BSA), a registered full-time graduate student, have a faculty advisor who is also a member of the BSA, and not have won the award previously.

Proposal Guidelines

The proposal shall consist of 1) a 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) an Abstract; 3) a Narrative (must include: a description of the research, including appropriate conceptual background, purpose or objective, brief outline of methodology, and potential contribution or significance to an area of the botanical sciences); 4) a Budget detailing how the funds will be used (the Abstract, Narrative, Budget and any tables or figures should not exceed five single-spaced pages); 5) a Bibliography (up to two pages); and 6) a Biographical Sketch (up to two pages). Proposals should include one inch margins all around and use a font size of not smaller than 12 point. In addition, proposals should be accompanied by a letter of support from the student's advisor.

Award Level and Announcement

Each award provides $500. Award winners will be announced at the BSA Banquet held in Albuquerque, New Mexico in August 2001. Funds for the awards come from interest on the Karling and the BSA Endowment Funds, and from the sale of BSA logo items. The award process can be quite competetive; the funding level for the 1998 competition was about 22 percent.

Submissions

Proposals and supporting letters should be postmarked no later than March 15, 2001. Students should submit six (6) hardcopies of the complete proposal and arrange to have the letter of support sent to the Chair of the Karling Graduate Student Research Award Committee at the following address:

Kathleen A. Kron
BSA Karling Award Committee
Department of Biology
Wake Forest University
Winston-Salem, NC 27109-7325
kronka@wfu.edu

Announcements

In Memoriam:

Dr. Rupert C. Barneby, Botanical Scholar, Recipient of the Millennium Botany Award, and Curator Emeritus at the New York Botanical Garden, Dies at 89.

Dr. Rupert Charles Barneby, Curator Emeritus in The New York Botanical Garden's Institute of Systematic Botany and one of the Garden's most senior and distinguished scientists, died Tuesday, December 5, 2000. He was 89 years old.

Barneby's association with The New York Botanical Garden spanned nearly a half -century. He arrived as a visiting scholar in the 1950s and shortly thereafter accepted a staff position as Honorary Curator of Western Botany. He went on to become a Research Associate and an Editorial Consultant for *Brittonia*, the Garden's esteemed scientific journal covering systematic botany.

A self-taught botanist, Barneby rose to become a world expert in Leguminosae (the bean family) and Menispermaceae (the moonseed family). He spent his career at the Garden curating and studying the world's best collection of New World Leguminosae.

Gregory Long, President of The New York Botanical Garden, said, "Rupert Barneby was one of the most productive botanists of the twentieth century, a giant in the field of botanical research. Over the last half century, he has been an inspiriting mentor, a meticulous scholar, and a creative editor who has made an enormous contribution to the botanical world. We at The New York Botanical Garden are indeed fortunate that his kind, generous, gentle manner graced our lives."

In 1999, the International Botanical Congress presented Barneby with its prestigious Millennium Botany Award for a lifetime of contribution to science. In 1980, he was the winner of the Henry Allan Gleason Award, an annual award from The New York Botanical Garden for an outstanding recent publication in the field of plant taxonomy, plant ecology, or plant geography. In 1989, the American Society of Plant Taxonomists awarded Barneby with the Asa Gray Award for his contributions to systematic botany. In 1991, The Garden honored Barneby by institutionalizing his legacy through the establishment of the Rupert C. Barenby Fund for Research in Legume Systematics. The Engler Silver Medal, botanical sciences's highest honor for publications, was awarded to Barneby in 1992 for his monographic work *Sensitivae Censitae: A Revision of the Genus Mimosa Linnaeus (Mimosaceae) in the new world.* Since the publication of his first botanical paper in 1941, Barneby published more than 6,500 pages of papers, monographs, and journals. Among his most influential works are: *Atlas of North American Astragalus; Daleae Imagines; Intermountain Flora, Volume 3, Part B*; and *Silk Tree, Guanacaste, Monkey's Earring: A Generic System for the Synandrous Mimosaceae of the Americas, (3 Volumes).*

"Rupert Barneby was an incredible scholar and one of the nicest people I have known. He was one of the most productive and erudite students of botany and horticulture on the staff of The New York Botanical Garden in its 109-year history. He will be remembered by thousands of colleagues for his uncommon generosity in sharing his inexhaustible knowledge and precise editorial skills. He has left an authoritative legacy of publications and will be sorely missed by botanists around the world," said Professor Sir Ghillean Prance FRS, VMH, and former Director of the Royal Botanic Gardens, Kew.

Barneby was known for his talent for discovering or rediscovering rare and local species. In the course of his five decades of research, Barneby described and named over 1,100 different plant species new to science. A botanist is fortunate to have a new species of plant named in his honor. Barneby had not only 25 different species named after him, but also three genera (groups of species sharing common characteristics, such as roses or oaks) of plants - - *Barnebya, Barnebyella,* and *Barnebydendron.*

Barneby was a member of the American Society of Plant Taxonomists, the International Association for Plant Taxonomy, and the New England Botanical Club, and a Fellow of the California Academy of Sciences.

"Rupert Barneby was a great student of plants in the style of George Bentham and the other encyclopedic workers of the nineteenth century, who would tirelessly analyze all we know about enormous groups of plants and reduce that knowledge to lucid prose, working day after day, month after month, and year after year. He always had time to encourage and help students and colleagues, giving them the benefit of his extraordinary classical education, friendly personality, and love for plants. He will be greatly missed," said Dr. Peter Raven, Director of the Missouri Botanical Garden and close friend and colleague.

He lived among literati as easily as he did among scientists. Considered his close friends were W. H. Auden, Christopher Isherwood, Julian Huxley, and others.

Rupert Barneby was born October 6, 1911, in Monmouthshire, England. He attended Cambridge University where he received his B.A. in History and Modern Languages in 1932. He come to the United States in 1937 and established permanent residency in 1941. In 1978, he was awarded an honorary Doctorate of Science degree from The City University of New York. In accordance with his wishes, there was no funeral. The Garden held a memorial celebration in January.

Photo Courtesy Hunt Institute for Botanical Documentation with permission of the Trustees of the Royal Botanic Gardens, Kew

Dr. Gamal El-Ghazaly, 1947-2001

Gamal El-Ghazaly, Director of the Palynological Laboratory at the Swedish Museum of Natural History, Stockholm, died on 13 January 2001 in Stockholm following complications from an illness. He is survived by his wife Polixeni Kotzamanidou and their three sons, Amr, Tarek, and Sammy.

Professor El-Ghazaly was born on 17 June 1947 in Alexandria, Egypt. He graduated from the University of Alexandria, Egypt in 1969 with B.Sc. degrees in both Botany and Chemistry and then completed an M.Sc. in Palynology from the same University in 1974. His master's research focused on the paleopalynology of the Nubia Sandstone of the Kharga Oasis. He earned a Ph.D. in Palynology from Stockholm University, Sweden in 1979, where he conducted a comprehensive palynological investigation of Hypochoeridineae and Scolyminae (Asteraceae) under the direction of Siwert Nilsson. Upon completion of his doctorate, he joined the Faculty of Science at the University of Alexandria, Egypt. In 1982 he began an 18-month Postdoctoral Fellowship at the University of California, Berkeley where he studied pollen ontogeny in *Triticum* with William Jensen. After returning to the University of Alexandria, Egypt, he was promoted to Associate Professor. In 1984, he moved to the University of Qatar, Qatar, where he was promoted to Professor of Palynology and appointed Head of the Botany Department. He also served as Director of the Herbarium, Head of the Electron Microscopy Unit, and Acting Dean of the Faculty of Science at the University of Qatar. In 1989, he was recruited to the Palynological Laboratory of the Swedish Museum of Natural History to serve as First Curator and, in 1998, was appointed Director of the "Pal Lab." While serving as First Curator, he also received a D.Sc. (Docent) in plant systematics from Stockholm University.

Dr. El-Ghazaly's research involved both basic and applied aspects of palynology, including studies of pollen wall development and histochemistry; pollen and tapetum ultrastructure; pollen morphology, systematics and phylogeny; and aeropalynology. In recent years, he focused much of his research on allergen localization. His work on tapetal orbicules of *Betula* and their allergenic effects added a new dimension in studying airborne allergens. Another important component of his recent research involved the improvement and development of techniques to answer palynological questions. In addition to his work with cytochemistry and immuno-labelling, he had been achieving excellent results using low temperature fixations for conventional microscopical applications, as well as cryo-scanning electron, atomic force, and scanning tunneling microscopy.

He was the author/co-author of more than 70 research articles and five books, including *Pollen Flora of Qatar* (1991) and *Medicinal and Poisonous Plants of Qatar* (1995), and he had recently co-edited *Plant Systematics for 21st Century* (2000).

Professor El-Ghazaly was an excellent teacher and mentor to his students. He taught a variety of Palynology, Aerobiology, and Botany courses at universities in Egypt, Greece, Qatar, Sweden, Italy, Cuba, Ecuador, and Kuwait. He had recently established a formal teaching collaboration between the Palynological Laboratory and Stockholm University and had developed an outreach Palynology course designed for beekeepers in Sweden. He had also completed a comprehensive collection of CD-ROMs covering Nordic plants and pollen. Each taxon included a color image of the plant, light and electron micrographs of its pollen, and a brief palynological description.

He was active in several national and international organizations and professional societies. At the time of his death he served as Editor-in-Chief of *Grana*, the "International Journal of Palynology and Aerobiology," as Editor of the monographic series *The World Pollen and Spore Flora*, and as Head of the Swedish Aeropalynological Council. In the latter role, he had recently proposed a major plan to unify the pollen reporting service for all of Sweden. The goal of the plan was to ensure

that the countrywide pollen service was maintained and improved into the future to help allergy sufferers.

Gamal was an incredibly vibrant person whose general optimism and overall love of life was evident to everyone with whom he interacted. He was a well-respected and influential palynologist, whose death is a significant loss to the fields of palynology and botany, as well as a personal loss felt deeply by all who knew him. I feel fortunate to have had the opportunity to work with Gamal and to know him. He was a good friend to many of us, and we shall miss him dearly.

– Jeffrey M. Osborn

Photo courtesy of Jeffrey M. Osborn

(Global Water Policy Project), Jane Lubchenco (Oregon State University), Paul Ehrlich (Stanford University), Kathryn Cottingham (Dartmouth College), Simon Levin (Princeton University), Nancy N. Rabalais (Louisiana University Marine Consortium), and Joy B. Zedler (University of Wisconsin). Panel sessions and workshops will cover topics in research, education, public policy, media relations, and public outreach.

Meeting events will also include a Town Meeting on Teaching Evolution, hosted by AIBS in collaboration with the National Center for Science Education and the National Association of Biology Teachers. The session will focus on how U.S.-based educators can meet the challenges of teaching about evolution and keeping up-to-date with state-wide and nation-wide events affecting science education. The importance of building grass-roots communication networks among educators and researchers will be discussed, and the new U.S.-wide AIBS evolution listserver network will be featured.

Attendance is limited to 350 so register early. To learn more, or to register online now and/or submit a poster abstract, go to http://www.aibs.org/meeting2001/index.html. For more information contact Sue Burk at 703/790-1745, ext. 14, e-mail sburk@aibs.org

.— Casey E. Moulton
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Symposia, Conferences, Meetings

From Biodiversity to Biocomplexity

2001 AIBS Annual Meeting

Register Now for the 2001 AIBS Annual Meeting, „From Biodiversity to Biocomplexity“ Continuing a tradition established last year, the American Institute of Biological Sciences (AIBS) 2001 Annual Meeting, From Biodiversity to Biocomplexity: A Multidisciplinary Step Toward Understanding our Environment, will again bring together preeminent scientists to discuss themes on the forefront of biology. Set for 24-26 March 2001 at the Key Bridge Marriott in Arlington, Virginia (across the bridge from Georgetown, DC), the meeting will feature plenary sessions, workshops, panel discussions, and an array of poster presentations, exhibits, and field trips. Distinguished plenary speakers will include Rita Colwell (National Science Foundation), James H. Brown (University of New Mexico), Sandra Postel

Second International Conference on Plants and Environmental Pollution

15-19 November, 2001
Lucknow, India

The Second International Conference on Plants and Environmental Pollution will be held at the National Botanical Research Institute (NBRI), Lucknow, November 15-19, 2001. The Conference will be jointly organized by the International Society of Environmental Botanists (ISEB) and the NBRI. The NBRI is one of the most prestigious and internationally reputed multidisciplinary plant science research institutes of India, under the aegis of Council of Scientific and Industrial Research, Govt. of India. ISEB is also permanently based at NBRI.

Lucknow, a city of over 2.5 million people, is the capital of the north Indian state of Uttar Pradesh. It is located 500 km South-east of Delhi and is connected directly by air with New Delhi, Mumbai, Calcutta, Chennai, Bangalore, Hyderabad, Patna, Varanasi, and Sharjah (U.A.E.); and be rail/road with all major Indian cities. Besides being a historical sity, it is a major research and educational center with a big concentration of biological, biomedical, agricultural, horticultural, paleobotanical, engineering, technological, and management institutes which are existing in harmony with equally prestigious centers of art, culture, music, literature and education.

Detailed scientific/technical programme will be drawn up by a committee of experts and communicated to interested individuals through the Second Circular. The Conference is expected to cover the following broad themes/areas of R&D. The participants, while filling the preregistration form are required to indicate the serial number of one or more themes/areas in which they are interested.

Registration:
Registration fee is payable, by Bank Draft drawn in favour of "International Society of Environmental Botanists Luchnow (ICPEP-s)" at State Bank of India, Lucknow, Main Branch, NBRI Extension Counter. A 10% concession in registration fee has been granted to all bonofide members of ISEB and will also be admissible to non-members who make payment on or before 30 April, 2001. Fees are as follows:

Category	Indian (Rs.)	Foreign/NRIs (US $)
Members of ISEB	1800	300
Non-members	2000	350
Student members of ISEB	900	150
Students	1000	175
Industry	10000	1000
Accompanying person	1000	150

Delegates are required to arrange their own accommodation and transport during their stay in Lucknow. The organizers will try to arrange accommodation, on request, for a limited number of delegates, in guest houses/hostels of local R&D institutes for which the delegates will have to intimate in advance. The charges for guest house/hostel accommodation for a period of five days are: Rs. 500=00 (US $100) in their bank draft.

Intending participants should send the information mentioned in the pre-registration form by mail/e-mail/fax to: Dr. K.J. Ahmad, Organizing Secretary, ICPEP-2, National Botanical Research Institute, Rana Pratap Marg, Lucknow-226001, India.

Phone: +91-(0)-522-205831-35 Ext 223
FAX: +91-(0)-522-205836/205839
E-mail nbri@lw1.vsnl.net.in
Directornbri@satyam.net.in
afarooqui_2000@yahoo.com
behl@greenmail.net

Website: http://www.icpep.org

Northeast Native Plant Enthusiasts

We are pleased to announce that the annual Joint Field Meeting of the Botanical Society of America (N.E. Section), the Philadelphia Botanical Club and the Torrey Botanical Society will be held at Wesley College in Dover Delaware on June 24-28, 2001.

On Monday, Tuesday and Wednesday there will be all-day field trips to areas of botanical interest rhoughout the Delaware and Maryland coastal plains. Destinations include a cypress swamp, a Carolina bay, coastal dunes, ponds, fields, riparian forest and upland woods. On Sunday through Wednesday there will be evening programs of botanical and ecological interest plus a tour of the Phillips Herbarium at Delaware State University.

The registration fee for the meeting will be approximately $230.00: which includes all events, room (double occupancy), meals (Sunday dinner – Thursday breakfast) and field trip transportation.

Everyone interested in native plants is welcome to attend. The meeting is designed for both professional and amateur botanists. To request a registration form or for further information contact:

Tim Draude
415 Poplar St.
Lancaster, PA 17603
(717) 393-7233

or

Larry Klotz
Department of Biology
Shippensburg University
1871 Old Main Drive
Shippensburg, PA 17257-2299
717-477-1401
LHKlot@wharf.ship.edu

Subtropic Forest Excursion in China

This 11-day excursion in China will begin on July 10 and end on July 20, 2001. It consists of two parts. The first part is a 3-day Beijing tour for visiting the world famous resorts, including the Forbidden City, the Great Wall, Ming Tomb, Summer Palace, the Temple of Heaven, etc. (July 11-July 13). This part is arranged through an international tourist company arranges the first part in Beijing. The second part is a 6-day subtropical Forest Excursion in Longqishan Nature Reserve Fujian Province China (July 14-July 19). Local tourist company arrange the second part in Longqishan. We are responsible for the arrangement of the scientific activities and prepare necessary data of Longqishan Flora for participants and have plant taxonomists as guides of the Subtropical Forest Excursion in southeast China (abbreviated as SFEC).

This forest is distributed in the area of Longqishan Nature Reserve (117°1'E and 26°3'N). The local name of Longqishan includes three Chinese characters, Long is dragon, Qi is living, Shan is mountain. In this forest, we will observe many endemic genera in China, such *as Cunninghamia, Pseudolarix, Cyclocarya, Bostrychanthera, Eomecon, Sargentodoxa*, and some plants living in East Asia as *Cryptomeria, Houttuynia, Rhynchospermum, Skimmia, Vernicia, Cardiandra, Corchoropsis, Euscaphis, Kerria, Macleaya, Platycarya, Serissa, Tripterygium, Choerospondias, Siphonostegi*a and so on. No collecting is permitted in the Nature Reserve but there will be ample opportunities for photography. Longqishan is located within the subtropical monsoon climatic region. The area below 1000m elevation enjoys a mean annual temperature of 14.6-18.8°. In July, it is hot and humid in SE China, but it is cool and comfortable in Longqishan in summer. The SFEC, now in its second year, is organized by Dr. Cheng-Sen Li, Insititute of Botany, Academia Sinica, Beijing in conjunction with the Palaeobotanical Association, Botanical Society of China. Before and after the Conference of International Organisation of Palaeobotany in China in the summer of 2000, we organized a similar tour and the expedition of subtropical forest in southeastern China. All participants made excellent comments on both. Many palaeobotanists and botanists recommended strongly that the both tours would be organized once more for other interested participants. Detailed information about the SFEC with A REPLY FORM is available at<http://paleonews.dartmouth.edu/html/-183691048$103.nsd>. The total package, including registration ($50), lodging, meals, and the travel within China is US $1400. The registration deadline is Deadline for registration: April 15, 2001. Those who would like to participate in the SFEC, please contact Mr. Pinghui Yan directly at the following address:

Mr. Pinghui Yan
Department of Palaeobotany
Institute of Botany, the Chinese Academy of Sciences
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XV Mexican Botanical Congress, October 14-19, 2001.

The XV Mexican Botanical Congress will be held October 14?19, 2001 in Queretaro, Mexico. The scientific program includes symposia on ecology, systematics, education and ethobotany. Contributed posters are encouraged. Field trips are being planned. For further details please check the website at http://www.socbot.org.mx/

Other News

THE RUPERT BARNEBY AWARD

The New York Botanical Garden is pleased to announce that Dr. Colin E. Hughes, currently a Royal Society University Research Fellow at the Department of Plant Sciences, University of Oxford, UK, is the recipient of the **Rupert Barneby Award** for the year 2001. Dr. Hughes will be studying the systematics of Andean *Lupinus* as part of a larger monographic study to establish a new infrageneric classification of the genus and investigate a number of more fundamental biogeographic, domestication, and evolutionary questions.

The New York Botanical Garden now invites applications for the **Rupert Barneby Award** for the year 2002. The award of US$ 1,000.00 is to assist researchers to visit The New York Botanical Garden to study the rich collection of Leguminosae. Anyone interested in applying for the award should submit their curriculum vitae, a detailed letter describing the project for which the award is sought, and the names of 2-3 referees. Travel to the NYBG should be planned for sometime in the year 2002. The application should be addressed to Dr. James L. Luteyn, Institute of Systematic Botany, The New York Botanical Garden, 200th Street and Kazimiroff Blvd., Bronx, NY 10458-5126 USA, and received no later than December 1, 2001. Announcement of the recipient will be made by December 15th.

THE RUPERT BARNEBY FUND FOR RESEARCH IN LEGUME SYSTEMATICS

The Rupert Barneby Fund for Research in Legume Systematics was established at The New York Botanical Garden in 1991 to honor Rupert by institutionalizing his legacy. The Fund has three purposes specifically chosen to reflect Rupert's wishes: first, to support legume research at The New York Botanical Garden; second, to provide monies to bring legume researchers from around the world to the Garden for extended visits to study the collections Rupert so painstakingly worked to improve; and third, to eventually provide an endowed chair for a legume researcher at the Garden.

Annually since 1991, the Fund has sponsored the competitive "Rupert Barneby Award" in the amount of $1000 to bring one or more visiting scientists to the Garden for the study of our collection of legumes.

The money for the Fund comes from a variety of sources, but primarily through private gifts. Anyone interested in making a contribution, large or small, to THE RUPERT BARNEBY FUND FOR RESEARCH IN LEGUME SYSTEMATICS, which supports this award, may send their check, payable to The New York Botanical Garden, to Dr. James L. Luteyn, The New York Botanical Garden, 200th Street & Kazimiroff Blvd., Bronx, NY 10458-5126, USA.

The New York Botanical Garden is a not-for-profit, tax-exempt organization. Each gift to THE RUPERT BARNEBY FUND FOR RESEARCH IN LEGUME SYSTEMATICS will be duly acknowledged by the Garden for its intent and for tax purposes.

Grants for Botanical Gardens

The Stanley Smith Horticultural Trust awards grants of up to $20,000 to support teaching and research in horticulture in botanical gardens, arboreta, and other appropriate institutions. Awards are made annually, in December, and the next deadline for applications is 1 September, 2001. Guidelines for the preparation of applications are available from the Grants Director, William Louis Culberson, Ph.D., PO Box 51759, Durham NC 27717-1759. He may also be reached by telephone: (919) 660-7303.

THE BEE COURSE 2001

A Workshop for Conservation Biologists, Pollination Ecologists, and other Biologists
http:www.geocities.com/beecourse/

Southwestern Research Station (SWRS), Portal, Arizona, August 17-27, 2001.

Jerome G. Rozen, Jr. (American Museum of Natural History). Ronald J. McGinley (Illinois Natural History Survey).

Again in 2001, we are offering THE BEE COURSE, a ten-day workshop to be presented at the Southwestern Research Station, near Portal, Arizona. The main purpose of the course is to provide participants with sufficient knowledge and experience to use effectively The Bee Genera of North and Central America by Michener, McGinley and Danforth, 1994. This book provides well-illustrated keys to all genera of bees found in that geographic region and information about their morphology, distribution, and classification. Persons equipped with the information from this course will be capable of using Charles Michener's magnum opus, Bees of the World, published in 2000 by Johns Hopkins University Press. This new book deals with the classification, evolution, and distribution of bees on a worldwide basis and, for the first time, presents keys to genera, subgenera, and higher taxa for the entire globe.

COURSE OBJECTIVES.—THE BEE COURSE is designed primarily for botanists, conservation biologists, pollination ecologists, and other biologists whose research or teaching responsibilities require a greater understanding of bee taxonomy. It emphasizes the classification and identification of more than fifty bee genera of North and Central America (both temperate and tropical), and the general information provided is applicable to the global bee fauna. Lectures include background information on the biologies of bees, their floral relationships, their importance in maintaining and/or improving floral diversity, and the significance of oligolecty (i.e., taxonomic floral specialization). Field trips acquaint participants with collecting and sampling techniques; associated lab work provides instruction on specimen identification, preparation, and labeling. Information on equipment/supply vendors, literature, and people resources is also presented.

COURSE SIGNIFICANCE.—The field of pollination ecology explores the reproductive biology of plants in general, including the biotic and abiotic agents associated with pollination and seed-set. This is of interest for basic research and understanding of

world communities and also has significant practical impact as it relates to pollination of economically important crop plants, to survival of endangered plants, and to plant reproduction in threatened habitats. Pollen is moved between receptive flowers by wind, water, birds, bats, beetles, flies, etc., but the 21,000 species of bees worldwide play a dominant role in the sexual reproduction of most terrestrial plant communities. This course will empower students with 1) the confident use of The Bee Genera of North and Central America, 2) an appreciation for the biological diversity of bees, and 3) sufficient background to learn more about bees and investigate pollination and conservation problems with greater insight.

SPONSORS
Robert G. Goelet Bee Workshop Fund, American Museum of Natural History. Center for Biodiversity and Conservation, American Museum of Natural History. Disney Wildlife Conservation Fund. Herbert F. Schwarz Fund, American Museum of Natural History. The Bee Works.

BACKGROUND INFORMATION.—THE BEE COURSE was presented for the first time in 1999 at the SWRS, and two similar workshops, held in Mexico in 1985 and 1986, involved most current instructors. The Southwestern Research Station is centered amid the richest bee fauna in North America, and its collections include exemplars of almost all of the local bee fauna. This is an ongoing course, offered annually or every other year.

PARTICIPANT ACCEPTANCE CRITERIA.—THE BEE COURSE is open to all interested individuals. Priority will be given to those biologists for whom the course will have significant impact on their research and/or teaching. An entomological background is not required. THE BEE COURSE, presented in English, is limited to 20 participants.

INSTRUCTORS
Dr. Robert W. Brooks
Snow Entomological Museum
University of Kansas
Lawrence, KS 66045

Dr. Stephen L. Buchmann
The Bee Works
18070 W. Prince Rd., Suite 16
Tucson, AZ 85705

Dr. Bryan N. Danforth
Department of Entomology
Comstock Hall
Cornell University
Ithaca, NY 14853

Positions Available

PLANT BIODIVERSITY AND CONSERVATION BIOLOGY

The Department of Plant Biology seeks to fill a tenure-track position at the Assistant Professor level in the area of Plant Biodiversity and Conservation Biology. The successful candidate must have a Ph.D., a strong record of research accomplishments, and will be expected to develop an externally funded research program in his/her area of expertise. Post-doctoral research training and demonstrated excellence in undergraduate and/or graduate teaching is desirable. The research should focus upon some aspect of applied conservation biology, such as (but not limited to) rare plants, invasive plants, or reproductive biology and should utilize modern genetic techniques applied at the species and/or population level. The research may involve any group of plants or fungi but should have a strong field component. The primary teaching responsibility at the undergraduate level will be in our new program Teaching Excellence in Math and Science (TEMS), specifically a course entitled Integrated Science. Development of upper-level courses in the area of expertise is also expected.. For more information on the Department, visit our website at: http://www.science.siu.edu/plant-biology/index.html. The deadline for receipt of applications is March 15, 2001 and the position is available starting July 15, 2001. Applications should include a curriculum vitae, detailed statements of research goals and teaching interests, representative publications, and three letters of reference sent to: Dr. Daniel Nickrent, Chair of Search Committee, Department of Plant Biology, Southern Illinois University, Carbondale, IL 62901-6509; nickrent@plant.siu.edu.. Southern Illinois University Carbondale is AA/EOE. Qualified women and minorities are encouraged to apply.

Book Reviews

Embryology of Flowering Plants. Terminology and Concepts (in three volumes). ed: T. Batygina, Russian Academy of Sciences, World and Family Press, St. Petersburg. - Encyclopedic treatments of angiosperm embryology, with unique contributions in classical embryology mostly from competent Russian embryologists, are presented in the three volume set, *Embryology of Flowering Plants: Terminology and* Concepts**,** published in 1994, 1997 and 2000 (in press). During the past 10 to 15 years, major funding priorities in embryology worldwide have emphasized molecular embryology. However, progress in molecular embryology, and in many areas of plant breeding, genetics, taxonomy and physiology, rely heavily on accurate cytoembryological characterizations (see 1996 resolution of the International Congress of Sexual Plant Reproduction, Austria). Such accuracy is found in the *Embryology of Flowering Plants*.

The quality of classical Russian embryology is highly respected worldwide and is based on many fundamental findings and cytoembryological elucidations by embryologists such as Navashin, Arnoldy, Baranov, Poddubnaja-Arnoldy, Romanov, Gerassimova-Navashina, Khokhlov and Yakovlev. Their traditions continue to the present day. From 1981 through 1990, findings of these and other embryologists were published in the five volume series *Comparative Embryology of Flowering Plants* (edited by M.S. Yakovlev, vol 1-3, and T.B. Batygina, vol 4-5). The more recent three-volume set, *Embryology of Flowering Plants: Terminology and Concepts,* contains additional significant contributions detailed by scientists intimately associated with the contributions. Most contributors of this set represent the best plant embryologists of the former Soviet Union. Hence, these volumes synthesize a wealth of embryological detail and theory not previously available outside of Russia. Timely contributions by internationally recognized scientists outside the former Soviet Union are also included.

Embryology of Flowering Plants: Terminology and Concepts combines terminology with morphological descriptions of specific structures and processes. These are well documented by photo and electron micrographs. At the same time, the traditional scope of embryology is enlarged. Problems of seed dormancy and germination, ecological aspects of plant reproduction and many other issues are addressed. Care was taken to assure terminological correctness by including concept chapters dealing with specific structures and processes. In each, definitions are given, semantic and historical backgrounds are clarified, and genesis and function information are detailed. Conceptual chapters were reserved for the more complicated embryological questions.

Volume 1, *Generative Organs of Flowers*, represents the work of 35 scientists. It contains 320 pages of test, 186 pages of plates, and additional diagrams within the text that illustrate embryological concepts. Subjects treated include microsporangium, microsporogenesis, microspores, pollen grains, megasporangium, integuments, chalaza, funiculus, embryo sacs, and nutrient transport in ovules. Volume two, *Seeds*, represents the work of 40 scientists. It contains 823 pages of text and 335 pages of plates. Subjects detailed include many processes involved in double fertilization, endosperm formation and embryony. Volume three, *Systems of Reproduction*, represents the work of 51 scientists and over 4000 bibliographic citations. This volume includes detailed descriptions of the many forms of plant reproduction, pollination and breeding systems, seed propagation mechanisms (both amphimictic and apomictic), forms of vegetative propagation, molecular and genetic aspects of reproduction, population and ecological aspects of reproduction, and embryological aspects of reproductive strategies.

Though wonderfully illustrated, most of the chapters are in Russian, and until these chapters are translated, the detailed concepts and thoughts of the various scientists will remain enigmatic to many. Nevertheless, this encyclopedia is one of a kind in its field, and scientists conducting basic and applied research requiring well illustrated descriptive cytoembryological detail will find it invaluable. - John G. Carman, Utah State University, Logan, UT 84322-4820, USA

Methods in Plant Electron Microscopy and Cytochemisty. William V. Dashek, (ed). 2000. ISBN 0-90603-809-2 (comb US$89.50) 312 pp. - Very few books focus on the methodology required for successful plant science research compared to the huge number of tomes dedicated to animal science. In this volume, Dashek brings together a collection of methods useful for a variety of plant science research topics from better visualization of Golgi apparatus to effective use of tissue printing for protein localization in plant tissues.

First, let me give you some overall impressions of this book before getting into detail about the contents. The book will be very useful to researchers just beginning to delve into plant research. It is written for the most part in a very easy to understand way and is not filled with jargon. There are many tables that contain concise summaries of pertinent information about methods, structures, stains, etc. I also found the lists of needed chemicals and equipment in some chapters useful (though I feel that listing a TEM as a needed piece of equipment to **do** TEM a bit much!). Unfortunately, I feel that many experienced microscopists and plant biologists will find very little new information in the book and in some cases find the methods at odds with established procedures in their laboratory.

Another thing that distressed me about the book was the frequency at which readers are referred to the original sources to obtain details about described methods. I feel that a book with "methods" in the title should provide just that….methods, not references. I want to be able to open up to a chapter of interest and find the necessary recipes and the **detailed** procedures I need to use that method. In some parts of the book, this is done. My problem is that the entire book is not written in this way.

A positive aspect of this book is the introductory

chapter. In this chapter, Dashek describes the basic structures found within plant cells, including the size ranges of the organelles. This information is very helpful to those of us who sometimes forget how big a ribosome should be. The included micrographs are nice in that they show the reader what certain structures should look like on the TEM. Again, this information would be of special value to those just starting to do plant science research. I do have a couple of criticisms of this chapter. One is that the micrographs should be bigger, with more detailed labeling of cell structures to help identify them for the reader (especially novice plant scientists). A second criticism regards some of the information presented about basic plant cell biology. Some of the printed "facts" are downright wrong; for example, that microtubules are composed of microfilaments of actin. This kind of error could cause serious harm to researchers using this book as a reference source.

All of the criticism aside, I did find some of the chapters particularly interesting. The chapter written by Herman regarding electron microscope immunogold localization contains good information about the structure of antibodies, how they work, and the methods for employing them at the TEM level, as well as some of the artifacts that need to be watched for. This chapter, in conjunction with the general immunohistochemistry information provided in Chapter 6, will give beginners enough information to get started using this technique.

I was also happy to see the chapter(s) on microautoradiography. I feel this is a very useful technique that is underutilized by current researchers due to the fact that radioactive compounds are used. With some common sense and good lab practices, it is as safe as any other method and provides a wealth of useful biochemical information. The same is true of some of the traditional histochemical and cytochemical techniques listed by Dashek in Chapter 2. These are valuable methods that merit use even though they have been around for many years. They provide good information on "the big picture" of what is happening in plant cells and tissues.

Finally, another easy yet overlooked procedure, tissue printing, is well described by Taylor in Chapter 7. Once again, I feel this is a very useful technique that again is rarely used in modern laboratories since it does not involve molecular techniques per se. The method is described in good detail, making it easy to be followed in any laboratory.

To re-cap, my overall impressions of the book are that it would be a useful addition to the library of a beginning plant researcher. I have some reservations about recommending this book to experienced microscopists and plant scientists, as they will find very little new information. I found that some lack of attention to detail during editing annoying, such as "ER," "SER," and "RER" being shown in small case; and Coplin jars being referred to as "Copland" jars. These kinds of errors detract attention from what otherwise is a nice collection of methods for plant biology research for beginning researchers. - Todd A. Kostman, University of Wisconsin, Oshkosh, Oshkosh. WI 54901-8640.

Root Hairs: Cell and Molecular Biology. Ridge, R.E. and A.M.C. Emons (eds.). 2000. ISBN 4-431-70282-2 (cloth US$225.00) 336 pp. Springer-Verlag. - Root hairs exhibit the localized process of tip-growth. The deposition of new plasma membrane and cell wall is limited to the extreme apex of the cell, and this growth pattern leads to a tubular morphology. Other tip growing cells include pollen tubes, fungal hyphae, moss and fern protonemata. Of these, pollen tubes have received the most attention from cell and molecular biologists, but this new book provides a good overview of the less-studied, but equally interesting, root hair system.

The book consists of 18 chapters that are a series of review articles written by experts in their fields. Both editors are well-respected authorities in the field of root hair biology. The four main topics covered in *Root Hairs* are cell biology, physiology, genetics, and symbiosis. The latter subject is important because root hairs play a key role in symbioses with rhizobial bacteria and mycorrhizal fungi.

Each chapter has a comprehensive list of primary literature references, and, in most cases, these are current to 1999. The half-tone illustrations (e.g., light and electron microscopy, fluorescence, and confocal images) are of the good quality that one expects in Springer scientific publications. This is critical in some of the chapters such as the one on ultrastructure and the two on the root hair cytoskeleton. While most of the authors have done a good job in synthesizing literature for a thorough review, a few of the chapters appeared to be hastily put together. However, this does not detract from the overall high quality of the book.

Root Hairs is written for advanced researchers in plant development and morphology. It would serve as an ideal supplemental text in graduate courses in development and cell biology. Because of the high price, the book probably will be purchased only by workers in the field of tip growth. However, I recommend it for acquisition by research and universities libraries. - John Z. Kiss, Department of Botany, Miami University, Oxford, OH.

North American Terrestrial Vegetation, 2nd edition. Michael G. Barbour and William Dwight Billings (eds). 2000. ISBN 0 521 55986 (paper US$50). 708pp. Cambridge University Press, 40 West 20th Street, New York, NY 10011-4211. - The second edition of North American Terrestrial Vegetation is a valuable resource for field biologists of all flavors. The breadth of vegetation types covered is apparent in the titles to the 18 chapters: Arctic Tundra and Polar Desert Biome, Taiga and Boreal Forest, Forest and Meadows of the Rocky Mountains, Pacific Northwest Forests, Californian Upland Forests and Woodlands, Chaparral, Intermountain Valleys and Lower Mountain Slopes, Warm Deserts, Grasslands, Eastern Deciduous Forests, Vegetation of the Southeastern Coastal Plain, Freshwater Wetlands, Saltmarshes and Mangroves, Alpine Vegetation, Mexican Temperate Vegetation, The Caribbean, Tropical and Subtropical Vegetation of Mesoamerica, and Vegetation of the Hawaiian Islands. Five of these chapters are new to the second edition.

Each chapter begins with a frontispiece map highlighting the distribution of the area under discussion. In addition to summarizing the composition of communities in each biome, from the bogs of the boreal forest region to the alpine habitats of Hawai'i, each chapter integrates information on the physical environment (e.g., topography, climate, soils, etc.), history, and community dynamics to present a comprehensive picture of the ecosystem. A welcome addition to this edition is a discussion in each chapter of habitat loss and conservation goals for each biome. Finally, each chapter concludes with suggestions for future research. These last should provide inspiration for new graduate students for years to come.

Having toted this book along on 15,000 miles of field collecting this past fall, I found it to be the intellectual equivalent of a Swiss army knive; there is almost always a tool that will prove handy, no matter the situation. However, almost daily use revealed the book's major flaw: finding the needed tool isn't always easy! The problem lies mainly in a lack of coordination between the generalized map of the major vegetation formations of the continent, opposite the title page, and the actual coverage of the chapters. Thus, as one travels from biome to biome, it is difficult to follow along in the book and turn to the appropriate new chapter. This could easily be rectified with an introductory map of the North American biomes, as treated in this book, with direct reference to the relevant chapter numbers. - Lea Larkin, University of Texas, Austin, TX.

The Redwood Forest. Noss, Reed F. (ed). 2000. ISBN 1-55963-726-9 (paper US$30.00) 339 pp. Island Press, 1718 Connecticut Avenue, N. W., Suite 300, Washington, D.C. 20009. - Misty January 1989 Eureka, Calif., the moving view on US-101 from Carl¹s Diner is mind boggling. Caravan of tractor trailers hauling ancient redwoods south to the sawmill is a surprising sight for a European. Why would we farm these living fossils and modify their associated ecosystems? Indeed, small isolated redwood ecosystems lose biodiversity in human altered landscapes. Luckily since 1918, the Save-the-Redwoods League has been preserving the redwood forests of California. The league commissioned Reed Noss to edit the contributions of thirty two authors in crafting a book essential to environmental professionals, planners, policy makers, and the public at large sharing a commitment to the conservation and the understanding of this unique world bioregion. The nine chapters cover paleocology, human history, flora, fauna, forest ecology, stream ecology, conservation planning, and forest management. This book provides a wealth of cutting edge research findings on redwood ecosystems.

The introductory chapters deal with the history of the redwood lineage, from the Triassic Period to the present, along with the recent history of redwoods conservation. Redwood (*Sequoia sempervirens*) is actually the sole surviving species of the genus *Sequoia*. This genus has been traced back to the Cretaceous. Mid-latitude tertiary records for redwood show that their extent was far ranging. The paleobotanical section would have benefited from fossil documentation as well as a lineage "tree". After looking at how the bioregion stretches today from the coast of Santa Cruz to the northwestern edge of California, chapter three focuses on the botanical wealth of redwood communities. An extensive Van Damme State Park (Mendocino County) botanical checklist provides information on habitat and conservation status. This is actually not representative of the whole redwood range. The redwood ecosystem is not monolithic and varies depending on latitude and longitude (distance from the Pacific coast). Actually the author distinguishes three major areas: northern, central and southern regions. Little coverage is given to the southern redwood region (East Bay, Santa Cruz Mountains, and the Monterey Coast). Chapter four takes a closer look at redwoods from their crowns down to their genetic diversity. It addresses questions such as what are old growth redwoods? How does water reach the top of a 112 m high giant? How does coastal fog sustain redwood forests? Chapter five treats the wide diversity of terrestrial fauna found in these ancient forests. Actually, the flora and fauna of the redwood region varies considerably from north to south, with the San Francisco Bay acting as a distributional barrier for many species. No species or subspecies are actually endemic to the redwood forest though several are only found in the region at large such as the Point Reyes mountain beaver or the California giant salamander. The authors provide a fairly thorough description of biological communities of epiphytes and invertebrates found in the canopies of old-growth trees, although little focus is placed upon the biological and geochemical edaphic characteristics of old growth redwoods. As well as more depth could have been dedicated to how downed logs have an essential role in fostering forest regeneration and habitat? Chapter six reviews the aquatic ecosystem of the redwood region

drawing specific attention to the effects of logging upon this component of the ecosystem. The authors conclude that much work is needed to protect the aquatic and riparian communities often functioning as biological health warning indicators. Chapter seven and eight review landscape-scale conservation planning and management applied to redwood forests. These two chapters are a must read for any researcher, official, involved in the conservation of this ecoregion. The authors advocate that conservation priorities could be determined by following guidelines adopted in the adjacent Klamath-Siskiyou ecoregion: 1) research focused on rare species, critical watersheds and old growth stands 2) citizen involvement. Alternatives relating to silviculture and management of state and county parks are considered in chapter eight. The last chapter integrates holistically the information presented in the previous chapters. The editor encourages such comprehensive case study for other endangered ecosystem found on the earth.

Some improvements could be suggested. The index found at the end of the book is incomplete in allowing quick retrieval of information on many topics. For example, there is no entry on burls/ snags though it was treated in the book. A helpful tool in this book is the case study feature outlined as boxes throughout the chapters. These studies review a particular component of redwood ecosystems. Conclusions at the end of each chapter are helpful in synthesizing the wealth of information presented. Moreover, the author is forward in presenting research areas that would gain from further work. This book might be an excellent resource for students interested to pursue graduate research in redwood ecosystem.

Despite some minor improvements needed, this book is a tremendous achievement in describing this precious unique ecosystem. The redwood bioregion has benefited from recent public attention with Julia Butterfly camping for two years atop a giant redwood (Luna) in the midst of the old growth Headwaters Forest. This book attempts precariously to balance the demand for redwood lumber and the necessity to protect these living fossils for the seventh generation. The key to perpetuating the redwood magic lies in fostering a profound respect for our natural heritage. Twelve years later there are less logging trucks driving past Carl¹s Diner. Is it due to our maturity as a nation in enacting sustainable policies from our forests to the redwood desk you might be reading this review from?

— Laurent M. Meillier, U.C. Santa Barbara, Department of Geological Sciences, Santa Barbara, CA. USA.

Terrestrial Ecoregions of North America: A Conservation Assessment. Ricketts, Taylor H., Eric Dinerstein, David M. Olson, Colby J. Louks et al. 1999. ISBN 1-55963-722-6 (paper US $75.00) 485 pp. Island Press, 1718 Connecticut Avenue, N.W., Suite 300, Washington, D.C. 20009 – This book is an indispensable addition to the conservation literature. In the synthesis of much information from papers, books, discussions, and workshops on conservation, there is a sense of urgency pervading this work. The authors, a team from World Wildlife Fund, present the awesome diversity of life and the concomitant vulnerability of this diversity. This is all intended to present an idea that is gaining acceptance by conservation ecologists – ecoregion-based conservation. Conservation based on an ecoregion, "…relatively large area of land or water that contains a geographically distinct assemblage of natural communities," is an improvement from the politically charged state-by-state strategy. Although many readers are familiar with the plight of the world's biodiversity, few books have attempted what is presented in Terrestrial Ecoregions of North America: A Conservation Assessment. This carefully written volume deserves attention.

This work is separated into two major sections. In the first third of Terrestrial Ecoregions of North America, the authors establish the rationale for the ecoregion approach, prioritize targets for conservation, and justify procedures. Each component of an ecoregion is thoroughly introduced. Key points and essays from conservation practitioners, an effective textbook style, highlight interesting side notes. For example, Kartesz and Farstad discuss the importance of plant endemism for conservation. Culver describes the special considerations for organisms of cave and karst habitats. Common and rare habitat features are adequately addressed by the ecoregion approach. In most of the remaining two thirds, Appendix F, the 116 ecoregions of North America are described. The descriptions are excellent, concise guides that include information on ecoregion size, distinctiveness, conservation status, activities to enhance conservation, conservation partners, and relationship to other classification schemes. If the work is read cover-to-cover, which I recommend, the components of the ecoregions

The richly colored illustrations are just one of the many virtues of this fine volume. In fact I was struck by the clarity and utility of the many maps illustrating a panoply of ideas from ecoregion locations and biological distinctiveness of habitats to percentage of introduced species per region. Often, a picture told a story. For example, when looking at a pair of maps the reader is reminded of the human influence on biodiversity - the greatest percentage of total introduced vascular plants are found near the megalopoli of both coasts. Additional figures and tables are clear and effective.

Finally, the well-edited book is completed with an effective glossary, thorough index, and a list of contacts and participating agencies (geared toward North America). This facilitates the search for information and provides a foundation for future projects. Although dismissing political boundaries from conservation makes ecological sense, it will be interesting to see if non-scientists accept the ecoregion approach and incorporate it into lasting policy changes. This work should aid in the process.

For readers outside of North America this book will still be useful as a reference for people interested in conserving biodiversity. Although some of the habitat types are localized, the phenomena and threats experi-

enced are universal.

"Terrestrial Ecoregions of North America: A Conservation Assessment" is a timely compendium of information relevant to conservation practitioners, teachers and anyone interested in the status of a continent's biodiversity. It would be useful as a companion text in courses on conservation and habitat restoration or could be the basis of a semester course for advanced undergraduate or graduate students. Actually, this book should be on the shelf of anyone concerned with preserving our natural heritage. - Scott Ruhren, Department of Ecology, Evolution and Natural Resources, Rutgers, The State University of New Jersey, New Brunswick,NJ08901-1582.

Bromeliaceae: Profile of an Adaptive Radiation. Benzing, D. H. 2000. ISBN 0-521-43031-3 (cloth US $120.00) 690 pp. Cambridge University Press, Cambridge, UK. This vast compendium of information on the Bromeliaceae is a thorough review of the evolutionary physiology and ecology of this principally Neotropical family. David Benzing (along with several collaborators) have done a tremendous service to botanists, ecologists, and evolutionary biologists in pulling together a huge amount of natural history information and existing experimental data on the bromeliads. This book will undoubtedly serve as the benchmark reference on this family for many years to come.

According to the preface, Benzing originally envisioned this book as an edited volume. However, the book evolved into a more integrated monographic work with Benzing as the sole author of seven of the 9 core chapters, and senior author on the remaining two. Following a brief introduction to the family, the reader is taken on a detailed run through the vegetative and reproductive structures of the bromeliads, their disparate modes of photosynthesis (C3, various types of CAM), mineral nutrition, life history and reproduction, relationships with fauna, and their overall phytogeography and evolution. These topics, each to a core chapter, are viewed through an adaptationist framework that spans the entire book. This framework is "how and why one family of flowering plants, and a truly exceptional one by virtue of adaptive specialization to counter drought, came to assume such extraordinary importance in the Neotropics" (pp. xi-xii).

Benzing is largely successful in hanging the available information on this adaptive framework. The overwhelming majority of these data are descriptive, and focused on a relatively small subset of the nearly 3000 species in the family. Because of the descriptive nature of the data, it is relatively easy to develop adaptive explanations for observed patterns; the experiments to test these adaptive hypotheses, in almost every instance, have yet to be done. Every chapter (and most pages) provides many open questions about the functional evolutionary ecology of the Bromeliaceae, any one of which could form the basis of a doctoral dissertation.

Throughout the core chapters, the material is well-integrated, but in some ways almost too well- integrated. References are constantly made to figures, tables, and text of chapters already read or chapters to come. I found myself thumbing backwards and forwards through the text to find points referred to (usually by figure or table number, as opposed to page number), which had a tendency to interrupt the reading flow. In many ways, this book would be ideally produced as a web-based, hyperlinked document, where figures and tables could be called up at will in separate windows on a computer screen. Chapters 2-8 are more encyclopedic than synthetic; only chapter 9, on the history and evolution of the family, is a true synthesis of existing information. Given its high price (almost 20 per page), I was surprised that all the photographs of bromeliads are produced in black & white, often with inadequate contrast to discern the relevant details (an electronic version could, perhaps, have color digital photographs). The line-drawings are adequate, but again, given the book's cost, it seems that a gentle artistic hand could have improved them substantially.

In addition to the core chapters, there are also six chapters on "special topics", four on systematics of especially difficult groups (Neoregelia subgenus Hylaeaicum, and Cryptanthus by I. Ramrez; Tillandsioideae, and Tillandsia and Racinaea by W. Till) that provide a "snapshot of the more traditional approach to plant systematics and evolution as applied to the Bromeliaceae" (p. xi). The remaining two special topics chapters, Ethnobotany of Bromeliaceae by B. Bennett; Endangered Bromeliacae by M. Dimmitt are contemporary hot-topics. None of these special topics chapters are well- integrated into the rest of the volume, and they might better have been published on their own either as a second volume, or as a special issue of a journal.

Overall, Bromeliaceae is a must-have book for researchers actively studying this family or other epiphytes. Its high price tag will limit its sales, and one can only hope for either a paperback edition or (better) a CD-ROM version. Bromeliacea is a valuable reference book for any science library, and it will provide the foundation for the next generation of study in this exceptional group of angiopserms. - Aaron M.Ellison, Department of Biological Sciences, Mount Holyoke College, South Hadley, MA 01075-6418.

Pollination Ecology and Evolution in Compositae (Asteraceae). M.S. Mani and J.M. Saravanan. 1999. ISBN 1-57808-058-4 (paper US $49.50) 166 pp. Science Publishers, Inc. P.O. Box 699, May Street, Enfield, New Hampshire 03748 – Despite a long fascination with pollination, botanists and ecologists have so much yet to discover, for example describing trends in ecology and evolution of pollination within a plant family. As one of the largest angiosperm families, Compositae (Asteraceae), with some 19,000 species, possesses great floral diversity yet a unifying feature of Compositae floral biology is the organization of flowers into a head (capitulum) subtended by an involucre of bracts. Mani and Saravanan argue that Compositae floral head evolution is driven by the relationship with pollinators. Despite an apparent abundance of visitors to the inflorescences, what is fascinating is the limited effectiveness of many of these floral visitors. According to the authors, bees and butterflies perform most Compositae pollination and in fact butterflies, not bees, are the most effective. Finally, bee-Compositae-butterfly relationships are driving floral evolution, Mani and Saravanan's main point. This assertion is revisited repeatedly with great effect.

Mani and Saravanan state early on that there has been an overemphasis on structure in Compositae research yet present 6 (of 13) chapters and more than half of the book on the head complex, florets, stamens, style, stigma, nectary, sex polymorphism and pappus. This is probably unavoidable when making the case for floral and pollination syndrome evolution and highlights the wonderful diversity of this plant family. These chapters are dense with morphological terminology but the reader is aided by the helpful illustrations and glossary. Within these chapters their thesis develops: bee-flower relationships have driven Compositae evolution yet butterflies are seen as the ultimate pollinator of this diverse family.

Though there is some subjectivity in the use of terms nectar and pollen robbers by other authors, these concepts are not synonymous with ineffective pollinators as implied repeatedly by Mani and Saravanan. In the glossary (but unfortunately not listed in the index) nectar and pollen robbers are "insects that collect nectar/pollen from the florets with great damage to the latter and playing no role in pollination." By their definition, bees do not fit this "great damage" criteria though they are occasionally listed as robbers in the text. Nectar and pollen robbing which may have detrimental effect on pollination usually involves behavior modified from typical pollination and may or may not leave damage or signs of visitation (e.g., Kearns and Inouye 1993).

Several production concerns are worth noting. As indicated earlier, the index is incomplete. For example, we find "nectary" but no nectar, while "amino acids" and "beetles" are mentioned in the text, but missing from the index. This flaw hinders this book's function as an otherwise useful reference. The numerical referencing system within the text (rather than author/date) chosen by the publisher is frustrating. The more traditional referencing system provides readily available support, context and accessibility. This is not garnered from numbers. Nor are irregularities. For example two works cited as "recent" when checked randomly, dated from 1983 and 1938. Several times the same data is duplicated in a table and accompanying figure. Though the line drawings are wonderful and an indispensable part of the text on morphology, the text and lines within other figures are not always sharp, perhaps a printing problem and Fig. 12 and its labels appear to be hand-drawn. Finally, occasional typographical errors are found throughout.

Despite the incomplete index, *Pollination Ecology and Evolution in Compositae (Asteraceae)* is most effective as a synthesis of years of research on Compositae pollination by the authors and others. In fact the book's greatest utility is as a reference tool; for example, I quickly found many new and interesting points about *Centaurea*, a genus I have worked with.

The readability and clarity improved in the later, concluding chapters dealing with pollination and evolutionary trends. Mani and Saravanan have compiled a daunting amount of information about a complex plant family and present an interesting theory about butterfly-driven Composite floral evolution. Compositae systematists and comparative morphologists will benefit from this book. Other readers will need to pick and choose chapters while wading through the terminology and would probably not benefit from a cover-to-cover reading. - Scott Ruhren, Department of Ecology, Evolution and Natural Resources,Rutgers, The State University of New Jersey, New Brunswick, NJ 08901-1582.

Literature Cited:

Kearns, C.A. and D.W. Inouye. 1993. *Techniques for Pollination Biologists*. University Press of Colorado, Niwot, Colorado. ISBN: 0-87081-281-5

Ethnobotany: a reader. P. E. Minnis, ed. 2000. ISBN: 0-8061-3180-2, 327 + vi pp. (paper $18.95). University of Oklahoma Press, 4100 28th Ave. N.W., Norman, OK 73069-8218. – When botany meets anthropology, art, history or linguistics, the blend is expansive. That is an apt description of this book. The field of Ethnobotany has evolved during recent decades, diverging from its parent Economic Botany, a subject that grew along with colonial practices of gathering samples of economically useful specimens from abroad. Recently, the attention of the discipline has evolved to the kind of examination that is more than a mere cataloging of uses and those are the outlooks represented here.

Designed for use as a textbook in upper division undergraduate and graduate courses, this is a volume devoted to a humanistic view of botany. Culture and ecology are the lenses focused here, rather than the traditional disciplines of genetics and systematics. Among other distinctive messages that are sent by this collection of essays, the authors acknowledge all those native folks

who contributed to the compilation and the interpretation of their data: a virtual celebration of indigenous knowledge and the information providers from villages and hamlets. These offerings give voice and texture to under-represented citizens in remote locations around the world, accessible to just a determined few willing to undertake the difficulties to travel the distances, attempt to learn new languages, and encounter new cultures.

The text brings together previously published articles from the Journal of Ethnobiology that provide diverse perspectives on a wide variety of topics in Ethnobotany. The contents are organized into four sections: Ethnoecology, Folk Classification, Foods and Medicines, and Agriculture. Tangible themes range from edible greens to famine foods, while abstract areas under discussion include evolution in a man-made habitat and botanical resource perception.

The editor admits that no single volume devoted to Ethnobotany can possibly cover all fields within the discipline, as he acknowledges regretfully that there is no coverage of ancient plant use here. Nevertheless, this is a substantial new contribution to the growing number of new textbooks in Economic Botany, because these are reports of original research. The writing is skillful and engaging. There are few illustrations and maps; undoubtedly each author could have supplied many more of each, but elaboration of these would have increased the cost. The publisher should be commended for pricing the reader at a level affordable for students. One minor criticism is that the book covers a limited geographic area, primarily the Americas, and one would wish for more contributions from the Middle East and Africa, the Indian subcontinent, and the Far East.

The readings in this book offer a rich resource for discussions in Ethnobotany, as well as a concentrated mine of ideas for those teaching a course, or leading a graduate seminar about crop evolution and origins of agriculture. For those planning to undertake fieldwork, it can stimulate new questions for investigation. - Dorothea Bedigian, Washington University, St. Louis, MO.

From Ethnomycology to Fungal Biotechnology: Exploiting Fungi from Natural Resources for Novel Products, Singh, Jagjit and K.R. Aneja (eds). 1999. ISBN 0-306-46059-9 (Cloth US$125.00) 305 pp. Kluwer Publishers, P.O. Box 358, Accord Station, Hingham, MA 02018-0358. - This is an edited volume that contains 26 short reviews on diverse topics. The five main sections included in the book are ethnomycology, fungal biotechnology, biological control, mycorrhizal fungi and fungal pests. I was surprised that the editors tried to include all of these broad areas of applied mycology into one small volume. While there are many excellent contributions in the book, no one area is given comprehensive coverage. Instead, the chapters contain a wide assortment of unrelated topics. The largest section, consisting of 8 chapters, is on fungal biotechnology. Each contribution focuses on a very different aspect of biotechnology. The range of topics includes overviews on the improvement of insecticidal fungi, applications of thermophilic molds, mushroom compost preparation, strategies for straw utilization, bioactive products for pharmaceutical utility, and mycoherbicides. Chapters that appear to have a more limited focus include the use of lytic enzymes to produce protoplasts from *Trichoderma,* and potential use of natural products for timber preservation. In general, each of these chapters provides a fine basic review of the specific topic but readers will wonder why these particular topics were selected and so many others were left out. Biotechnological advances involving fungi are rapidly being published and the most useful books on this subject are those that contain up-to-date information. The latest references in these chapters are a few citations to research published 2 to 3 years ago indicating the book has been in preparation or in press for some time.

Chapters in this book on biological control include the use of fungal antagonists to control root-knot nematodes, fungal pathogens, and decay in stored bamboo. An unusual combination of topics but information on mechanisms of biocontrol and achievements in these particular areas are covered well. The section on mychorrizal fungi is different from the rest of the book since most of the contributions are about versicular arbuscular (VA) fungi. They include applying VA mycorrhizae to control fungal pathogens, increasing the yield of aromatic plants, improving reforestation, and for general use as a "biofertilizer".

The most unusual mix of topics can be found in the section on fungal pests. From a plant pathologist's perspective, a book containing only a few chapters that discuss extremely diverse topics of limited scope is disappointing. Short reviews on storage fungi of edible commodities, seed-borne mycoflora of two under-explored legumes from northeastern India, association of patulin with dried fruit slices of quinces, and a comparison of a wood decay fungus found in the Indian Himalayas with a similar fungus in California make up this section. The last chapter on "wild dry rot" in America and the Himalayas is actually one of the more intriguing chapters among this wild assortment of topics in the book.

The section on ethnomycology is also a disappointment. The title of the book suggests an emphasis on ethnological aspects of mycology, but the book contains only 2 chapters that can be considered to have significant information on ethnomycology. One of these chapters, "Ethnomycology and Folk Remedies: Fact and Fiction", is informative, interesting and contains appropriate material. A chapter on ethnological studies from Madhya Pradesh, India is comprehensive for that region and there should have been similar chapters describing studies from a number of other areas. Another chapter included in the ethnomycology section on antimicrobial properties of some Indian spices seems to be an unusual addition for the theme of the book.

This book may contain information that will be useful

to individuals with specific interests but I suggest you carefully check the contents to make sure it covers an area of fungal biotechnology that is of interest to you. - Robert A. Blanchette, Department of Plant Pathology, University of Minnesota

Australia: 300 Years of Botanical Illustration. Hewson, Helen. 1999. ISBN 0-643-06366-8 (Cloth US$89.50) 228 pp. Antique Collector's Club, Ltd., Market Street Industrial Park, Wappinger's Falls, NY 12590. - Hewson gives the reader a comprehensive introduction to the history of botanical art dealing with the flora of Australia. From the first explorations during the seventeenth century to the present day, Hewson recounts and illustrates the work done, first largely by European explorers and more recently by Australians themselves, to help describe the astounding plants of the Island Continent.

The author displays a good appreciation of the dual role of botanical art: "While botanical illustration is the subject of this story it will soon be evident that there is no clear difference between botanical illustration and botanical art." (p.3) This agrees with the insight of the standard work on botanical art, Blunt and Stearn's The Art of Botanical Illustration—good botanical art serves both scientific and aesthetic purposes.

Hewson begins with a brief examination of who is involved in producing botanical art—e.g. in the eighteenth and nineteenth centuries, painter, engraver, and colorist—and the role of each. Throughout, the quality of images is excellent. Usefully, a number of examples of both picture and engravings made from them are shown to help the reader appreciate changes that occur at different stages of botanical illustration.

She then proceeds to consider the art and artists of several periods, from the first recorded European exploration of Australia in the seventeenth century up to the present day. Along the way, many important names from botany and botanical art shine forth, from Banks to Hooker, from Dampier to von Mueller. Continental workers are given their due, even though the history of the exploration and settling of Australia naturally emphasizes the role of the British and those who they hired. More recent names include those of Celia Rosser and Margaret Stones. Images are recent enough even to include a Wollemi Pine (Wollemia nobilis; Araucariaceae), the living fossil discovered in 1994.

The exploration of Australia occurred at an almost ideal time for botanical illustration, before photography took a preeminent place in illustrating new plants and after some of the finest techniques had been devised and mastered. As a result, some of the finest botanical illustrators of all time are represented in Australia 300 Years of Botanical Illustration, though two of the best known names, Ehret and Redouté, do not figure most prominently. Most prominent of the painters emphasized in this work is Ferdinand Bauer, brother of two other noted illustrators of natural history, and accomplished in painting, engraving, and coloring, and unusual trio to find in one artist. Bauer has been the subject of two other fine books in recent years which have emphasized his Australian work, Exquisite Eye The Australian Flora and Fauna Drawings 1801-1820 of Ferdinand Bauer by Watts et al. and Ferdinand Bauer The Nature of Discovery by Mabberley.

Those books also cover the zoological work of Bauer. While the copies of paintings are generally superior in those works, this is not surprising since they were produced to accompany exhibitions of paintings. That the figures in Australia 300 Years of Botanical Illustration reach the number and quality that they do is a credit to author and editor.

One unfortunate flaw, readily overlooked, is seen in the brief Preface which states that prior to the Renaissance "...scientific inquiry was stultified by myth and superstition." (p. 1) This small minded view ignores differences between the cultures of the times and the work of such botanists as Albert the Great.

Who should buy a copy of Australia 300 Years of Botanical Illustration? Certainly institutional libraries and art lovers, as well as anyone who would like to see through the eyes of botanists from an age of great discoveries. Students need more exposure to works like these, and this work would serve well on reading lists in introductory classes. Many institutions have decreased the amount of drawing required by students taking laboratory courses, which is unfortunate since skills involved in careful illustration can make for careful scientists. Exposure to a work such as this might help to inspire students in such work, or perhaps even their instructors. – Douglas Darnowski, Department of Biology, Washington College, Chesterton, MD 21620.

Orchid Fever, A Horticultural Tale of Love, Lust and Lunacy. Eric Hansen. 2000. ISBN 0-679-45141-2 (Cloth US$35.00) *x* + 272 pp. Pantheon Books, New York, USA. - Orchids, with flowers ranging from bizarre and grotesque to beautiful and lascivious (Fig. 1A - 1E) have captivated humans since antiquity (Berliocchi, 1966; Lawler, 1984; Stoessl and Arditti, 1984; Hew Arditti and Lin, 1997). Some species have been used medicinally. However sex (Fig. 1F, 1G) and allure are the properties most often associated with orchids as plants which produce seductive flowers that are pollinated through pseudocopulation, aphrodisiacs, birth control agents, determinants of gender, and in the case a *Lissochilus* species in Transvaal as a foreshadow of Viagra. (for a review see Lawler, 1984). Only few orchids have been or are consumed in large quantities with salep (see below) and vanilla being the most important among these (Lawler, 1884). The most important uses of orchids are as cut flowers, potted ornamentals and plants for collectors and hobby growers. The latter have been responsible for amazing tales, dark intrigues, juicy scan-

dals, occasional corruption, and black humor. *Fever* deals with these and that is what makes it a fascinating read and a remarkable expose.

Over the years orchids have beguiled the nobility and upper classes in several countries; intrigued notable writers (Marcel Proust and Raymond Chandler equated them with prostitutes, but George Bernard Shaw was more tactful with a comparison to courtesans; for a review see Hoffman Lewis, 1990); captivated leaders in the business world (Dunsterville and Dunsterville, 1982; Grove, 1995); enchanted at least two Nobel laureates, chemist Harold Urey and physicist Maria Mayer (for a recollection see Arditti, 1998); and found their way into the hearts of many growers. *Orchid Fever* describes the interactions between orchids and people and tries to fathom the hold these plants have over humans.

Andrée N. Millar, the legendary *Long-Long Misis Bilong Plaua* (Millar, 1978, 1998; Arditti, 1996a; Warren, 2000) was given this Pidgin-English nickname (which means "slightly mad but not dangerous white woman who collects useless plants you can't eat") by the people of Papua New Guinea (Millar, 1994) simply because they, like residents of other orchid-rich areas, consider most orchids to be useless and view those who collect them as being irrational. Hansen sets the tone of his book (which can be best summarized as being "can you believe these guys?", or perhaps "are these weirdos for real?") by recounting the amazement of Penan-tribe guides in the Malaysian state of Sarawak on Borneo when they learned that two Americans spent about $3,500 each for a trip just to see *Paphiopedilum sanderianum* (Rcb. f.) Stein in its native habitat: "'They have come twelve thousand miles to look at a flower?'. . . 'It is true.'. . . 'Can you eat this flower?'. . . 'No.'. . . 'Is it used for medicine?'. . . 'No.'. . . 'What do they want to do with this flower?'. . . 'Take photograph . . . '"When the explorers finally found a flowering plant after days of arduous trekking through the Borneo rain forest [which is not basically different from other jungles or rain forests I walked through], "a chaotic, steaming green hell of leeches, biting insects, giant cockroaches, bad smells, and [vastly exaggerated possibility of] certain death"there was a disaster: "OH, MY GOD . . . WHERE'S MY CAMERA . . . [and] HIGH-SPEED FILM?" Welcome to the wacky world of orchid lovers!

Orchid shows can be thought of as zoos not only because some species resemble birds, insects, other animals and assorted strange beings (Fig. 1B - 1D), but also due to the enthusiasts who attend them. Hansen describes these gatherings as well as orchid collectors, growers, traders, judges and other devotees in chapters 2-4, 8 with a touch of subtle irony and a dollop of sarcasm which leave no doubt that he meant what he wrote at the end of chapter 2: "after three days with the orchid people . . . it was time to be around normal human beings . . . "It probably was. I have often had the same feeling.

Salep, made from *Orchis* tubers (Fig. 1F, 1G) and known since time immemorial, is second to vanilla (derived from *Vanilla* fruits which are capsules, not beans or pods) in the quantities which are consumed by humans. It has also been used extensively as an aphrodisiac and a medicinal preparation (Lawler, 1984; Sezik, 1984; Arditti, 1992). Salep is also responsible for a biochemical term that is now part of everyday language, "carbohydrate"(*Kohlenhydrat*). The German biochemist C. Schmidt coined the term to name a precipitate containing carbon plus hydrogen and oxygen in the same ratio as in water (CH_2O), he obtained while studying the composition of salep (Schmidt, 1844; Ernst and Rodriguez, 1984). At present salep is consumed mostly in the Middle East and Turkey where large amounts of tubers are collected from natural habitats. Hansen followed the salep trail (chapter 6), partook of several ice creams made with it, and even inquired about over-collection, but seems to have been satisfied with an explanation that the mountains are "still covered with the plant."Really? Export alone of the orchid tubers used to make salep is in the tens of metric tons per year (Lawler, 1984). For plants that grow and multiply as slowly as orchids these are very large amounts and I doubt if the relevant orchid species can keep up with the collectors. Hansen should have raised the question more forcefully, if not with his Turkish hosts at least in *Orchid Fever*.

Collectors and explorers, some of which have lost life and limb (Arditti, 1992) in far away, strange and/or dangerous places, have been part of the orchid scene for a long time. Over the years they have included pirates, adventurers and dedicated plant scientists. A few wrote about their exploits (Millican, 1891; Burdett, 1930; MacDonald, 1939; Matschat, 1939; Lohndorff, 1956; Dunsterville and Dunsterville, 1982), but it was not uncommon for them to be less than honest in an effort to magnify their achievements , mislead competitors and/or protect endangered populations. Rudyad Kipling wrote a comic story about the tragic end of a German collector (Kipling, 1951). There is also a light hearted "report" regarding the exploits of an orchid collector in space (Adams and Nightingale, 1976).

All of chapter 5 of *Orchid Fever* deals with a

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collector (chapter 5), but the story is sinister. This collector, "a very complex character . . . Armenian . . . a diplomatic aide in Tehran during the time of the of the Shah . . .,"is named Henry Azadehdel (but also referred to as Armen Victorian in WWW reports regarding his involvement in UFO matters). He was convicted by a British court of smuggling, having been caught with orchids and other contraband at Heathrow airport. *Fever* portrays him sympathetically, but my experience with Azadehdel suggests that this is not warranted. After we developed an effective method for the germination of *Paphiopedilum rothschildianum* (Haas-von Schmude et al., 1986) and advised growers to buy only laboratory-produced plants, Azadehdel called me angrily to complain that our advice hurt his business and was not necessary. His claim that the species was abundant in its native habitat and not in danger of extinction was then and still is inaccurate according to a Malaysian orchid expert I respect. I replied none too kindly with a few pithy suggestions that cannot be repeated here or in polite company.

In the 1800s and early 1900s wealthy growers depended mostly on professional collectors who roamed the world. Orchid taxonomists often collected their own plants at considerable risk. For example, Rudolf Schlechter (1872-1925) engaged carriers; trained "a detachment of 90 . . . inclusive of 10 soldiers"; was attacked by and fought hostile tribesmen; suffered from severe fever, painful foot sores, and serious boils; arranged for canoes to be built; put up with bad weather; and climbed mountains to collect his own plants in German New Guinea (Schlechter, 1982). Perhaps there are orchid systematists who collect their own specimens in our days, but if Hansen allegations are correct, at least some present day prolific taxonomists seem willing to classify and name plants collected by others even if there are uncertainties about origins and legality. Would a taxonomist who named one plant of uncertain legality name another? Anything is possible in the nether world of big-time international orchid taxonomy where naming a new species seems to be a goal that justifies dealings which evoke echoes of exploits not unlike the ones generally associated with Blackbeard, the gnomes of Zürich, and Bonnie's Clyde.

Some years ago on the Fijian island of Vanua Levu I walked through a field strewn with orchid-festooned trees that were cut down to prepare the land for sugar cane. When I suggested that the orchids should be stripped and exported since they will die anyway the answer was that this was against the law. The result: thousands of orchid plants died. More recently near the city of Fortin de las Flores in the Mexican state of Veracruz I watched smoke rise from a forest across a canyon from the pleasant verandah while my hostess served lunch. Her husband explained that part of the forest was being cut and burned to allow for a project. "And, the orchids"? I asked, "Why are they not being collected and exported. "The answer was the same as in Fiji. On a dreary rainy day in the 1970s I visited a government owned orchid nursery in Rangoon, Burma. Their idea was to gather doomed orchids from forests that were being logged and save them through local and export sales. I don't know what happened to the Burmese nursery, but a similar plan would probably run afoul of the law presently.

There may be silly local laws of course, but the real culprit is CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora), a godsend for: 1) the vast bureaucracy which inhabits its secretariat in Switzerland despite claims to the contrary (van Vliet, 1994), 2) countless national bureaucracies and law enforcement organizations throughout the world, 3) a nightmare for at least one highly respected taxonomist (chapter 14) and many honest law abiding orchid dealers everywhere, 4) a gold mine for orchid smugglers and pirates, 5) an impediment for some orchid conservation schemes, 6) a panacea in the minds of dedicated but not necessarily well informed orchid conservationists, 7) a holocaust for orchids, 8) and a means of controlling access to new species for a handful of self appointed (mostly European) power brokers in the orchid world who also happen to be plant taxonomists bent on glorifying themselves by naming as many new species as possible.

Orchid Fever shows CITES for the abomination it is and tackles it boldly and imaginatively. It also exposes the real motives of some of its major supporters and leaves no doubts about their aims. And so: 1) innumerable orchids on felled trees die, 2) law abiding dealers cannot do business while saleable plants rot, 3) local people cannot supplement meager income with doomed species, 4) poachers and pirates get rich, and 5) legitimate taxonomists are denied access to new species. Hansen makes the point, but I wonder if *Orchid Fever* will create a strong enough momentum to overcome the self-interest of the powerful few and bring about a rational revision of CITES.

Exceptions exist, of course, and *Orchid Fever* concludes with the story of Tom Nelson and his salvage of *Cypripedium* acaule Aiton, *C. calceolus* L. and *C. reginae* Walter in Minnesota. The Minnesota State Departments of Agriculture, Transportation and Natural Resources and the U. S. Department of Agriculture there should be congratulated for their enlightened approach. Tom Nelson should be beatified. There is hope it seems, and its magnitude appears to be directly proportional do the distance from the selfish orchid power centers in Europe.

Orchid Fever is not free of weaknesses. Sometimes Hansen seems naive. One example is the salep incident. Another is Hansen's reliance for much of his horticultural information on interviews with commercial and hobby growers whose bloated egos are matched only by the size of their wallets and/or extent of self-interest. Stalwarts of horticultural science of orchids (like Prof. Emeritus Thomas Sheehan at the University of Florida, for example) are not among his sources. He interviewed several orchid

breeders but not the dean of scientific orchid hybridizers, Prof. Emeritus Haruyuki Kamemoto of the University of Hawaii. The third weakness is that several marginal scientists served as sources for Hansen. Not having made many major contributions to basic science through publications in mainline peer reviewed scientific journals these individuals sometimes offer platitudes and/or vituperations and/or argumentation rather than solid science and worthwhile opinions. Hansen interviewed a number of recognized and respected authorities, but should have relied only or at least mostly on high caliber established scientists. Fourth, Hansen seems to assume that some of his sources (unfortunately the wrong ones) are more reliable, impartial and knowledgeable than they really are. In other instances he is less trusting and demands more proof and substantiation. The result of these shortcomings is a book which is somewhat skewed in the wrong direction despite the fact that Hansen also interviewed Gunnar Seidenfaden, a major, highly respected and very credible authority on the orchids of south east Asia. *Orchid Fever* is an important, believable and generally well documented book, but its impact could have been even stronger had Hansen consulted weightier sources, stayed way from questionable characters or at least put them in proper perspective and taken a more jaundiced view of several of the informants who guided him through the orchid world.

In balance, the *Orchid Fever* has many more strengths than weaknesses. It is a fascinating read that is as enlightening as it is entertaining and as frightening as it is convincing. -JOSEPH ARDITTI, Department of Developmental and Cell Biology, University of California, Irvine, CA 92697-2300 USA

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The View from Bald Hill. Carl E. Bock and Jane H. Bock. 2000. ISBN 0-520-22184-2 (paper US$16.95) 197 pp. University of California Press, Berkeley, California. — Less than an hour's drive southeast from Tucson, Arizona, the Sonoran Desert vegetation with its saguaros, chollas, and palo verde trees gives way to rolling grasslands, which form the southwestern edge of the formerly immense North American steppes and prairies that reached from Mexico to Canada. Like other places at the transition between biomes, the grasslands of southeastern Arizona are special in many ways. Flora and fauna are influenced by both the Sonoran and Chihuahuan Deserts and include many endemic species. Several mountain ranges contribute not only to the unique scenery but also their share of species to the semi-arid grasslands below. Even more important for the ecology of these grasslands is the fact that large grazers, such as the bison, never inhabited this landscape since the last ice age, at least certainly not in great numbers and for prolonged periods of time. It is therefore not a great leap of the imagination to assume that the large-scale introduction of cattle in the early 1800s must have had a strong impact on the ecology of this land. In this landscape lies a 7800 acre sanctuary managed by the National Audubon Society, which has been protected from cattle grazing since 1968.

This book is about the ecology and natural history of this sanctuary, known as the Research Ranch. Ecological research by the authors and their students and colleagues spans over 25 years and includes both plants and animals. Naturally, much of their work has addressed the general question how cattle grazing affects these grasslands today, and the Research Ranch has provided the control for many grazing impact studies. But the book goes far beyond the grazing issue and discusses questions such as the impact of climatic variability, fire, and other disturbances on the grasslands, the behavioral ecology of herps and birds, and the impact of alien plant species on native plants and animals.

The book is beautifully written in a style that avoids scientific jargon. One of its strengths is the juxtaposition of the presentation of facts and results of scientific experiments with strongly personal statements by the authors at the end of each chapter that relate their specific findings to more general environmental and ecological questions. This book is a must read for anyone like myself who has had the pleasure and privilege to spend some time at the Research Ranch. That being said, I am not quite sure who else this book was written for. It is clearly not primarily addressed to the scientific community, who would appreciate more specifics, graphs, and tables than this book provides. But being essentially a summary of scientific findings it also does not fit into the niche of popular nature writing. To anyone looking for a book in that genre about the natural and human history of southeastern Arizona I greatly recommend Richard Shelton's beautiful book "Going back to Bisbee" (Tucson, The University of Arizona Press, 1992). But if you are interested in cases studies in grassland ecology you will enjoy this book, and its many references will help you to follow up on specific questions. The book would also make good supplemental reading for a course on range management or grassland ecology. — H. Jochen Schenk, Department of Biology, Duke University, Durham, NC 27708.

Physiology of Plants under Stress. vol. 2. Soil and Biotic Factors. David M. Orcutt and Erik T. Nilsen. 2000. ISBN, 0-471-17008-9 (cloth, US$ 125) 683 pp. John Wiley & Sons, Inc., 605 Third Avenue, New York, NY 10158. - Crops are limited to approximately 25% of their potential yield due to environmental stress. However, the physiology of plants under stress has broad significance beyond this staggering importance for agricultural productivity. Recognizing this, the authors have crafted a set of volumes that will inform and inspire students with broad backgrounds in the plant sciences.

Volume 1 of the set, published in 1996, dealt with plant responses to abiotic stresses. The recently released Volume 2 covers soil and biotic factors, including nutrient deficiency, salinity stress, plant pathogens and parasitic plants, herbivory, heavy metals, pesticides, and atmospheric pollution. Additional chapters on mycorrhizae, allelochemistry, and weeds, contributed by guest authors, provide special depth in these biotic factors that is not to be found in other stress physiology texts.

Choosing a textbook for a Stress Physiology course is

difficult. This type of course usually attracts a wide variety of students from majors as disparate as ecology, agronomy, horticulture, biochemistry, physiology, entomology, landscape architecture, and forestry. The authors recognize the importance of communicating the broader field of plant stress physiology to these specialized students, and have examined how stresses affect plants at all levels of organization. Toward this end they have endeavored to meld the disciplines of physiological ecology and agricultural plant physiology in the text—a very attractive approach.

This volume explores three broad topics: soil processes, biotic factors, and anthropogenic stress, all of which have generally been neglected in previous stress physiology texts. Despite this emphasis, however, the treatment of topics tends to be uneven. Mycorrhizae, for example, are reviewed in an extensive, 68-page chapter; parasitic plants rate 54 pages; and yet SO_2 injury is covered in just 2 pages. Study outlines and questions, which constitute 10-25% of the chapters' text, seem excessive, and I would worry that their presence in the text might actually discourage careful reading and synthesis by students.

The text succeeds in enunciating the need for broad training if a scientist is to work in plant stress physiology research. While all students will come to the field with different holes in their backgrounds, this text is probably more useful for broadening the experience of students who are well-trained in physiology and biochemistry but less familiar with agronomy and ecology. The treatment of physiological and biochemical aspects of plant response to stress could be more extensive in order to enhance learning by students who are weaker in these areas.

The goals and scope of the text are admirable and the authors should be commended for their dedication to a huge project. However, one wonders if editing has gone out of style at Wiley. Grammar, spelling, and usage problems in this text are so frequent that they are distracting.

For ten years I have been looking for a textbook that would work well in my graduate level Plant Stress Physiology class. I would happily give this one (#4) a try if I could use it in concert with Volume 1 of the set, which covers abiotic stresses. However, given the combined price tag of the two volumes ($315), this seems unrealistic. —Mary E. Musgrave, Biology Department, University of Massachusetts, Amherst, MA 01003.

Plant Tissue Culture: Techniques and Experiments, Second Edition, Roberta H. Smith, 2000. ISBN 0-12-650342-7 (paper US$49.95) 231pp. Academic Press. 525 B Street, Suite 1900, San Diego, CA 92101-4495. - This book covers the same ground as several similar works. It seeks to provide for the "need for plant tissue culture laboratory exercises that demonstrate major concepts and that use plant material that is available year round...yet give the student the opportunity to work on a wide array of plant materials." (p. ix). In this goal, the book succeeds, though there are a number of obvious faults that lessen the usefulness of this volume.

Smith begins with an historical introduction, and then turns quickly to chapters dealing with the setup of a tissue culture laboratory, the components of various formulations of media and their preparation, and preparation of explants for culture. Then she considers contamination of cultures and its prevention or elimination, followed by a number of chapters which each deal with a single concept that is covered by several exercises for students. These concepts include a range of topics that will be very useful, from callus induction to generation of haploid plants to protoplast fusion. This is good in that Roberts covers some topics omitted elsewhere—e.g. in the recently-reviewed Plant Tissue Culture Concepts and Laboratory Exercises from CRC Press, embryo rescue is not covered, though it is covered in the work considered here. The range of experiments presented for student use is good, from basic to applied, and the exercises themselves are concise and clear, with useful questions to stimulate the thoughts of students.

The book ends with useful appendices on common measurements for tissue culture and conversion factors, solution preparation, a complete list of suppliers, and a glossary of useful terms commonly used in plant tissue culture. The appendix on the logic of preparing solutions is an especially good idea for use with students, including practice problems that they can use for calculating the contents of different solutions.

Nevertheless, there are several flaws that reduce the value of this work. Overall, Plant Tissue Culture Techniques and Experiments possesses a choppy tone which will not be helpful for students new to this discipline. This tone is less evident in the exercises, but the smooth flow of writing is most obviously absent in the first few chapters. It is in these general explanatory chapters that clarity is most important. Also detrimental to comprehension, complete reliance on line drawings, and not those of the highest quality or clarity, also detracts from the value of this book. Photographs of tools and explants along with relevant micrographs, e.g. of plant embryos, are badly needed.

In part due to the choppiness noted above, the consid-

eration of the history of plant tissue culture is rather dry. For students, especially undergraduate students, this will hurt comprehension. The chapter needs to be made more interesting, which will require either lengthening the chapter or reduction of the number of events considered in future editions to allow these events to be brought to life.

Some technical means are clearly preferred by the author, but other means ought to be mentioned. For example, "wash hands, fingernails, and arms with warm soapy water with a fingernail brush" (p.75) is not something that is always, or perhaps often, done in plant tissue culture laboratories, and in some circumstances may not be practical. The section on adjustment of pH lists NaOH, though many laboratories use KOH instead since many plant cultures dislike exposure to Na+. p. 75 suggests using "hair nets, masks, and a clean laboratory coat" for improving aseptic technique, though these might be dangerous to use in a laboratory full of students who are working with flames. These are often, perhaps usually, omitted in working tissue culture laboratories. Bunsen burners are to be replied upon for flames in sterilizing tools according to Plant Tissue Culture Techniques and Experiments, while unmentioned alcohol lamps and other devices might sometimes be the only available means of providing a flame in a hood.

The most glaring error is, however, the citation of messages from email listservers. While pointing students to these resources is a good idea, citing the unreviewed and informally presented opinion of one or a few persons is a poor idea, whether or not the emails are archived.

Plant Tissue Culture Techniques and Experiments will be useful for a range of institutions, from those using plant tissue culture to demonstrate plant physiology and development to those preparing students for a technical field. The limited number of technical possibilities sometimes mentioned will limit the value of this book for amateurs—e.g. those who might wish to perform their own work with orchids in a home laboratory. Instructors should use another volume on plant tissue culture or their own experience to supplement this book, and libraries might buy a copy, though if several similar volumes in recent editions are already in a collection, this book could be bypassed. – Douglas Darnowski Department of Biology, Washington College, Chesterton, MD 21620.

Aquatic and Wetland Plants of Northeastern North America. G.E. Crow and C.B. Hellquist. 2000. Volume 1. 536 pp. ISBN 0-299-16330-X (US$ 90.00 hardcover). Volume 2. 446 pp. ISBN 0-299-16280-X (US$ 90.00 hardcover). Madison, WI: University of Wisconsin Press. - Aquatic vascular plants comprise an intriguing biological group of species. Their proper identification has become increasingly important with the rise of problematic exotic species introductions. Garrett Crow and Barre Hellquist's work with aquatic and wetland plants is well known and appreciated in the northeastern States, thanks largely to their series of New England aquatic plant identification booklets published in the 1980's. Their latest collaboration offers an exhaustive field manual of aquatic and wetland plant species covering ferns, gymnosperms, and angiosperms of northeastern North America.

This new treatment represents a long-awaited improvement of Norman Fassett's (1957) classic reference that has been sorely outdated for decades. In comparison to the earlier manual, this new one has been broadened to treat 1186 taxa (only 752 taxa in Fassett's manual), adding species of peatland and coastal tidal marsh habitats, as well as an expanded northeastern coverage (adding Newfoundland and all of Virginia). Although being a complete re-write, the authors have retained the useful features of Fassett's original manual—keys that focus largely on vegetative features and an extensive use of illustrations.

The manual is divided into two volumes, each covering native or naturalized species of the region. Volume 1 is dedicated to pteridophytes, gymnosperms, and dicots while Volume 2 is concerned with the monocots. A five-page review of nuisance aquatic genera and species of the region is offered in Volume 1 (and repeated in Volume 2). The general keys are well constructed and frequently reference helpful illustrations of key features. These early figures help the user recognize unfamiliar organ modifications that represent adaptations to the aquatic habitat.

The distinguished benefit of this manual is its comprehensive make-up, which offers full family and genus descriptions, discussions of taxonomy where necessary, species habitat and range information, and plentiful literature references. Another prominent, attractive feature of the manual is its generous use of illustrations. More than 90% of the taxa are illustrated in some way amounting to over 600 full-page plates.

The only criticisms of this manual are those attributable to the publisher. The quality of reproduction of some illustrations is variable. The large size format (8.5 X 11) and price make its potential to be carried into the field low. Nevertheless, this identification manual is essential for anyone needing to identify and understand higher plants in aquatic ecosystems.—Donald J. Padgett, Department of Biological Sciences, Bridgewater State College, Bridgewater, MA 02325.

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Chromosomes Today, Volume 13. Ettore Olmo and Carlo A. Redi, editors. 2000 Birkhäuser Verlag, P.O. Box 133, CH-4001 Basel, Switzerland. ISBN 3-7643-5799-1. Hardbound, 320 pages; US$139 at amazon.com. — This volume is the proceedings of the 13th International Chromosome Conference, Numana and Ancona, Italy, 8-12 September 1998. There are in all 80 contributors listed in the front of the book. The papers comprise all but one of the invited lectures. The title implies this is a kind of serial, but it isn't.

Very few of the authors have English as their first language; nonetheless, the English is grammatical and colloquial throughout. The editors surely deserve much credit for this. Sentences like the following are to be found on the back cover, but not in the text itself: "The cytogenetical studies have been greatly increased in the last years also for a progressive improvement of the methods that have consented a deeper analysis of the molecular organization of the eukaryotic chromosomes and a precise in situ localisation of specific genic sequences."

This is in no sense a primer on chromosomes. The papers are technical, larded with the jargon of the field, laden with unexpanded abbreviations known only to the cognoscenti.

There is little botany here. But the literature citations are very extensive and of course run to 1998. There are numerous color plates, and photographs of many of the authors. There is an index, but a number of Latin generic names are not included. There are "snurposomes" on page 307, but they didn't make it into the index, either. Yes, I am mystified as to what these may be. I've no doubt those in attendance at the conference were familiar with the term; but once the spoken words are in print and available to a wider audience, the language needs explication.

There were presumably twelve earlier volumes with this title; a quick survey of the references accompanying each of the 23 papers revealed one citation for vol. 7 and one for vol. 12. Evidently, these volumes are not major primary sources in the field. – Neil A. Harriman, Biology Department, University of Wisconsin-Oshkosh, Oshkosh, WI 54901, USA; harriman@uwosh.edu

Flora of Steens Mountain. Mansfield, Donald H. Oregon State University Press, 101 Waldo Hall, Corvallis, OR 97331. Paperback, ISBN 0-87071-471-6, 410 pages, US$29.95 - The author is professor of biology at Albertson College of Idaho and curator of the Harold M. Tucker Herbarium. The college is in Caldwell, Idaho, just west of Boise, and within reasonable driving distance of Steens Mountain in SE Oregon. The college's website, www.albertson.edu, includes some fine photographs of the author. The college is not a major research institution, and is to be congratulated for having supported the efforts of the author over many years.

The coverage of the flora is the southern half of Harney County, Oregon. Steens Mountain is a fault-block mountain range. If you visit the Malheur National Wildlife Refuge, there it is, the eastern horizon. It lures you on. And there is a gravel loop road out of Frenchglen, that makes much of it accessible. There are at least 6 taxa endemic to Steens Mountain and nearby ranges.

Because Steens Mountain (and the neighboring area, including the Alvord Desert) is botanically so diverse, the author provides an extensive series of keys. A mere picture book could not possibly do the area justice. I haven't tried the keys yet, but they appear to be entirely conventional and very workable. Because the author is first a teacher, he gives the derivation of each generic name; but the epithets are not translated. This was surely a compromise, to keep the book within reasonable bounds. When you get to "your species," the author gives a capsule description of it, a very usable feature of the book. The sequence of families and genera is alphabetical, an eminently sensible arrangement.

There are abundant line-drawing illustrations, plus 8 unnumbered pages of color photographs inserted between pages 218 and 219. Not every species is illustrated, or you would need a wheelbarrow to carry the book along on field trips. There is an ample glossary, and illustrations of the common terminology of descriptive botany. The index is thorough and complete.

Some of the color pictures give an indication of the terrain. The cover picture probably best illustrates its ruggedness and unspoiled beauty. – Neil A. Harriman, Biology Department, University of Wisconsin-Oshkosh, Oshkosh, WI 54901 USA; harriman@uwosh.edu

Legume (Fabaceae) Fruits and Seeds: Interactive Identification and Information Retrieval. J.H. Kirkbride, C.R. Gunn, A.L. Weitzman, and M.J. Dallwitz. 2000. CD-Rom. ($75.00). Parkway Publishers, Inc. Box 3678, Boone, NC 28607. -This publication is a gold mine for those interested in fruit and seed characters of legume genera. There is a wealth of information provided in the CD, and, once the user becomes familiar with how to use it, it may be a very important publication indeed. This is the first solid attempt to present information on fruits and seeds of all legume genera, and this alone makes it extremely important.

The authors accept 685 genera for the family, with fruit character data included for 647 genera, and seed character data for 634 genera. Fruit data only are available for 12 genera, and no data at all for 20 remaining genera. A total of 142 fruit characters and 138 seed characters are included in the database. Distributional information and cultivation status are also included. A very thorough bibliography is provided. Illustrations

(line drawings and photographs) are presented for almost all genera, and although these are of differing quality, most are very good.

If one is looking for a source of information on legume genera, this is a very good source. When one chooses a genus on which to gather data, the screens are laid out, for the most part, in a clear and easy to use manner. However, the many problems of presentation and utility make this a less than perfect product.

First, the genera are arranged in a systematic fashion. While this arrangement may be clear to some users, I suspect that most of us would find this difficult to use. If the genera were arranged alphabetically, the "user friendliness" of the product would increase dramatically. I spent a great deal of time searching for generic information, in order to compare it with specimens, and was frustrated by the difficulty this presented.

Second, the characters of the fruits and seeds themselves were presented in what appeared (to me, at least) a random fashion. The utility of the product could be dramatically improved if the characters themselves were presented alphabetically.

Third, the keying process itself is difficult. The degree of subjectivity necessary for one to use the keys makes getting a correct answer challenging. I chose specimens of 11 genera, with fruits or seeds, with which to try the key, and was only able to key out 1 genus easily. The remaining 10 were keyed out (narrowed down) to within a few genera, which required me to read the descriptions of those genera, and compare my specimens to descriptions to arrive at a conclusion. I also tried keying out several unknown legume seeds, to see if the process would be possible for those wanting to use it for that purpose (e.g., seed quality control agents, customs officials, and so on...). I was able to arrive at a range of possibilities for each sample, but the level of difficulty of the process was high, and required further comparisons with the descriptions and previously identified samples to come to firm conclusions. While a true expert in the family might be able to use the key with relative ease, most people, I suspect, would not find it so easy.

All of this would change if uncertain characters were well explained clearly, but this is not always the case, and I was unable to get to some of the explanatory options to respond.

Overall, the CD is definitely worth the $75 (plus shipping) price tag, merely as a reference. It is not, unfortunately, the final word in keying out unknown legume fruit and seeds; if thoughtful revisions are made after many test runs, it could become just that. - Michael A. Vincent, Department of Botany, Miami University, Oxford, Ohio, 45056.

Orchids, Revised edition. Stewart, Joyce. 2000. ISBN 0-88192-381-4 (cloth, US$19.95) 124 pp. Timber Press, Suite 450, 133 SW Second Avenue, Portland, Oregon 97204. – This is a book for beginning orchid fanciers. It contains a wealth of information to start the novice along the right track in orchid culture. The author is eminently suited to guide the beginner because of her long experience with orchids, in the field, greenhouse, and home, in Africa and in the United Kingdom. Joyce Steward is President of the World Orchid Conference Trust, was the first Sainsbury Orchid Fellow at the Royal Botanic Gardens, Kew, and the recipient in 1999 of the Victoria Medal of Honour. Currently she serves as Director of Horticulture, Science, and Education at the Royal Horticultural Society's gardens at Wisley.

One moves gracefully and logically through chapters on orchid history and conservation, orchid names, terrestrials and epiphytes, to the principles of orchid growing, cultivation, and propagation. There is a section on pest and diseases, and finally brief descriptions of commonly grown orchid genera, species, and some hybrids. A useful glossary is followed by a helpful bibliography and index. A high point of Stewart's book is the excellent colored illustrations of orchid flowers and the instructive line drawings that complement the text.

Stewart's writing flows evenly, and the "how to" sections are clear and understandable. Although the book is designed to interest orchid newcomers, there is much of relevance for experienced growers as well. This revised edition of the 1988 publication is substantially similar to that work, although a few additions have been made. Name changes have been kept to a minimum, the bibliography has been updated as have dates and figures. The only fault I find is in the persistent use by horticulturists, Joyce Stewart among them, of the term "feeding," as thought green plants need to ingest food instead of being fertilized. This small quirk, however, should not deter any budding orchid enthusiast from purchasing this fine volume. – William Louis Stern, Department of Botany, University of Florida, Gainesville, FL 32611-8526.

Orchids of Southern Africa. Hans Peter Linder and Hubert Kurzweil. 1999. ISBN 90 5410 445 7 (cloth, US$97.50). 492 pp. A.A. Balkema, Rotterdam, The Netherlands.—This is a glorious book by two eminent South African botanists. It encompasses the orchid flora of southern Africa in comprehensive detail. The most recent predecessor of this work was *Wild orchids of southern Africa*, but Linder's and Kurzweil's book should not be considered a revision of that study. For numerous reasons, outlined in their Preface, *Orchids of southern Africa* is a new book, standing entirely on its own. The authors have shared the composition of the text between them, Kurzweil being responsible for the extensive introductory sections including such topics as phytogeography, systematics, pollination, history, and cultivation. Kurzweil also edited the taxonomic text, drew up the glossary and literature references, searched for photographs, and coordinated all parts. The first author, Linder, completed most of the taxonomic accounts, the major portion of the volume. Specialists on certain genera were called in to help, and they are recognized appropriately at the head of each treatment.

Orchids of southern Africa treats every orchid species, subspecies, and variety recorded in South Africa, Namibia, Lesotho, Swaziland, and Botswana. There are 466 species indigenous to the region. The Cape is the area of greatest diversity and most of its species are confined to the region. The astounding diversity of orchids, most of which are terrestrial, in southern Africa is related to the topographic and climatic variation characteristic of the district that varies from near alpine highlands and hot deserts to subtropical rain forests and great stretches of sandy beaches and rocky coasts.

The introductory chapters by Kurzweil could well serve as a separate book. There are chapters on geography, geology, and soil and on climate and vegetation, all accompanied by clearly drawn maps and magnificent color photographs of the landscape. An entire chapter is devoted to the orchid flora with statistics on numbers of genera and species. The origin and affinities of the orchids are discussed as well as life forms and habits of the plants, the latter aided by pen and ink drawings. The biology and structure are treated in some detail together with references for further reading and illustrations of floral parts as line drawings and close-ups in color. Pollination is examined in detail, tribe by tribe.

An extensive section deals with classification and nomenclature, hybrids, synonyms and name changes. There is a piece on the history of orchid classification and, finally, a detailed outline of the classification adopted by the authors based on Robert L. Dressler's 1993 *Phylogeny and classification of the orchid family*. In this section the pertinent features of each subfamily and tribe of orchids represented in southern Africa are outlined.

Last among the introductory chapters are those on the history of southern Africa orchidology, preservation and conservation with a list of species ranked according to conservation status, economic uses, and special cultivation methods for these difficult-to-grow terrestrials. The introductory chapters and front matter occupy 64 pages.

Most of the book, 428 pages, is the taxonomic account mostly by Linder, leading off with an artificial key to the subfamilies and genera of southern Africa. Following this are descriptions of the taxa beginning with subfamily Spiranthoideae. Each genus is described in detail starting with an enumeration of synonyms and their places of publication. The species descriptions come next. Each binomial is followed by the name of the author, and again, the pertinent literature citations and places of publication. Synonyms are organized with authors and places of publication. Citations of voucher deposits with collectors' names and field numbers follow each species description. Species descriptions are associated with distribution maps showing where collections have been made in southern Africa based on actual herbarium specimens. More than 14,800 specimens were used to compile these maps. Color photographs, mostly taken in the field, of 397 species are associated with the descriptions and line drawings of most species accompany the text. Most of the color photographs are of outstanding quality and complement the line drawings. Where available, cladograms appear showing putative relationships.

There is an extensive list of references, a glossary of terminology, biodata for all contributors, and two indices, one to the introductory matter and a second to the taxonomic part with lists of taxa.

It would not be an exaggeration to state that *Orchids of southern Africa* is a monumental study, destined to last for decades as the *sine qua non* of southern African orchids. It belongs on the shelves of serious orchid researchers, and hobbyists will also benefit by reading this book, especially the introductory chapters. The authors are to be congratulated for turning out a masterpiece. –William Louis Stern, Department of Botany, University of Florida, Gainesville, Florida 32611-8526.

The Photo Atlas of Vascular Plants CD-ROM. Woddland, Dennis. (CD US$20.00) University of Wisconsin-Madison, Department of Botany, Attn: Mike Clayton, 430 Lincoln Dr., Madison, WI 53706. This disk, which runs on either Mac or PC platforms, presents a wide variety of photographs of seedbearing and non-seedbearing vascular plants. Its many attractive photographs and easy searching make it a valuable tool, though there are a few drawbacks, some related to available technology.

The various contributors to this CD-ROM give access wide variety of species, in views ranging from artwork to micrographs to pictures of hillsides.

There are over 4,700 ful-color pictures drawn from over 270 families and 1,150 genera. This breadth makes the Photo Atlas of Vascular Plants a valuable resource for educators, by whom the images may be "copied and used in such instructional contexts as lecture presentations or course-specific tutuorials" (liner notes), though they may not use the images for web pages and similar purposes. Some more obscure families such as the Stylidiaceae are represented, and a few remarkable images are offered such as the tuberous sundew *Drosera neesii* (Droseraceae), which is difficult to find even in Australian field guides. There are even ten photographs to illustrate what may be the most recently discovered botanical living fossil, the Wollemi pine (*Wollemia nobilis*; Araucariaceae)

In general, several stages of the lifecycle are represented for a family, often for a particular genus. These can be found using the simple, fast, and effective search tool that comes as part of the software. It should also be mentioned that a copy of the software, "Portfolio," which was used to create this CD-ROM, is included with a free sixty-day trial. It proves to be an easy-to-use program and might be of real value. An instructor might combine images from this CD-ROM with locally generated images to produce a mini-directory for use during one particular week of a laboratory course.

Coverage, while excellent, is not truly encyclopedic. For example, the contributors depict the Citrus family (Rutaceae) with a dozen fine photographs. *Dictamnus albus*, dittany, and the Australian *Eriostemon spicatus* are depicted, though no representative of the more numerous Australian genus *Boronia* occurs in the catalog. More complete coverage during a laboratory in taxonomy might be found in a volume such as Tropica.

Also, the images while typically having very nice brightness and contrast, do not possess very high resolution. This may be a result of the authors aiming for fast searching or a maximum number of images to be included, but this can limit the usefulness of these images. This may be due to technological limitations which could be resolved in future. When enlarged to half-screen size on a 17 inch monitor, pixellation becomes apparent, and would be more obvious if used with a video projector, though it would not render the CD-ROM useless, just less than optimal.

In future editions, non-vascular plants ought to be added. Given that many of the photographs on this edition of the CD-ROM represent multicellular gametophytes of vascular non-seedbearing plants, inclusion of mosses and their cousins would fit well, and would make this CD-ROM even more complete and valuable for teaching. Given the results of molecular taxonomy, certainly at least some of the green algae might also be added to this list. Higher resolution for the images ought also to be a high priority.

The Photo Atlas of Vascular Plants would be of value for those teaching general biology, botany, taxonomy, and perhaps some horticultural courses. It would be of value for students in such courses. High schools and colleges with limited teaching collections might profitably use it to enlarge the experience of their students. Buy a copy. – Douglas Darnowski, Department of Biology, Washington College, Chesterton, MD 21620

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