The Ecological Society of America

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AIMS

The Ecological Society of America was founded in 1915 for the purpose of unifying the sciences of ecology, stimulating research in all aspects of the discipline, encouraging communication among ecologists, and promoting the responsible application of ecological data and principles to the solution of environmental problems. Ecology is the scientific discipline that is concerned with the relationships between organisms and their past, present, and future environments. These relationships include physiological responses of individuals, structure and dynamics of populations, interactions among species, organization of biological communities, and processing of energy and matter in ecosystems.

MEMBERSHIP

Membership is open to persons who are interested in the advancement of ecology or its applications, and to those who are engaged in any aspect of the study of organisms in relation to environment. The classes of membership and their annual dues for 2004 are as follows:

<table>
<thead>
<tr>
<th>Income level</th>
<th>Dues</th>
<th>Student member:</th>
<th>Dues</th>
<th>Life member:</th>
<th>Dues</th>
<th>Emeritus member:</th>
<th>Dues</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;$40,000</td>
<td>$50.00</td>
<td>$25.00</td>
<td>Life member:</td>
<td>Contact Member and Subscriber Services (see below)</td>
<td>Free</td>
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<tr>
<td>$40,000–60,000</td>
<td>$75.00</td>
<td>Free</td>
<td>Emeritus member:</td>
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<td>&gt;$60,000</td>
<td>$95.00</td>
<td>Subscriptions to the journals are not included in the dues.</td>
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Special membership rates are available for individuals in developing countries. Contact Member and Subscriber services (address below) for details.

PUBLICATIONS

The Society publishes a bulletin, four print journals, and an electronic data archive. The Bulletin of the Ecological Society of America, issued quarterly, contains announcements of meetings of the Society and related organizations, programs, awards, articles, and items of current interest to members. The journal Ecology, issued monthly, publishes essays and articles that report and interpret the results of original scientific research in basic and applied ecology. Ecological Monographs is a quarterly journal for longer ecological research articles. Ecological Applications, published six times per year, contains ecological research and discussion papers that have specific relevance to environmental management and policy. Frontiers in Ecology and the Environment, with 10 issues each year, focuses on current ecological issues and environmental challenges; it is international in scope and interdisciplinary in approach. Ecological Archives is published on the Internet at [http://esapubs.org/Archive](http://esapubs.org/Archive) and contains supplemental material to ESA journal articles and data papers.

No responsibility for the views expressed by the authors in ESA publications is assumed by the editors or the publisher, the Ecological Society of America.

Subscriptions for 2004 are available to ESA members as follows:

<table>
<thead>
<tr>
<th>Publication</th>
<th>Regular</th>
<th>Student</th>
<th>Frontiers in Ecology</th>
<th>Free to members</th>
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<tbody>
<tr>
<td>Ecology</td>
<td>$65.00</td>
<td>$50.00</td>
<td><a href="http://esapubs.org/Bulletin">http://esapubs.org/Bulletin</a></td>
<td>Free to members</td>
</tr>
<tr>
<td>Ecological Monographs</td>
<td>$30.00</td>
<td>$25.00</td>
<td><a href="http://esapubs.org/Society">http://esapubs.org/Society</a></td>
<td>Free to members</td>
</tr>
<tr>
<td>Ecological Applications</td>
<td>$50.00</td>
<td>$40.00</td>
<td><a href="http://esapubs.org/Ecological">http://esapubs.org/Ecological</a> Archives</td>
<td>Free</td>
</tr>
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Application blanks for membership may be obtained from the Ecological Society of America, Member and Subscriber Services, 1707 H Street, NW, Suite 400, Washington, DC 20006, to which all correspondence concerning membership should be addressed. Checks accompanying membership applications should be made payable to the Ecological Society of America.

Cover Photo: Temperate deciduous forests of the northeastern United States are believed to be undergoing a shift from mixed-oak (Quercus sp.) to red maple (Acer rubrum) domination. As temporary ponds are common in the forests of the Northeast, and rely upon inputs of leaf litter as the primary source of energy for their food webs, this system may be susceptible to changes in the composition of the forest. The larger wood frog (Rana sylvatica) in the picture spent its larval period in a mesocosm with oak leaves as the primary energy input, while the wood frog on the right developed in a mesocosm with red maple leaves as the primary energy input. These results suggest that litter composition can impact consumer performance by altering the processing of energy in this system. Therefore, “subtle” compositional shifts in the forest have the potential to influence species populations and the communities that rely upon leaf-litter inputs as a primary source of energy. The photograph, by J. M. Kiesecker, taken in central Pennsylvania, is from the paper, “Leaf-litter composition and community structure: translating regional species changes into local dynamics,” by M. J. Rubbo and J. M. Kiesecker, to be published in the September 2004 issue of Ecology 85(9).
MEETINGS
105  Meeting Reviews

CONTRIBUTIONS
110  Commentary
120  ■ Nature’s Surprises. B. Zeide
Candidates for ESA offices 2005 will be posted here in the coming weeks

Names of candidates for Society offices will appear in this space as soon as they are available. Offices to be filled for terms that begin in 2005 include President-elect, Vice President for Finance, Vice President for Public Affairs, Member-at-Large of the Governing Board, and members of the Board of Professional Certification.

Check the Meeting Website – [http://www.esa.org/portland](http://www.esa.org/portland) for more information and registration.
SEEDS News of Note

The SEEDS program is pleased to announce the six recipients of the 2004–2005 SEEDS Undergraduate Research Fellowship: Stevland Charles, Howard University; Ricardo Colón, University of Puerto Rico; Julie James, Haskell Indian Nations University; Bruce Machona, Wiley College; Thalia Tooke, University of Kansas; Lucero Vasquez-Radonic, University of Texas, El Paso. The six selected students display great promise in successfully pursuing a career in the profession of ecology, and the SEEDS Fellowship will be an excellent opportunity to help these students fulfill their goals.

The SEEDS Advisory Board met in late February to provide input into the next funding proposal to the Andrew W. Mellon Foundation. A proposal was submitted in early April for the second phase of funding for the next two years.

The SEEDS Program is also busy planning a student field trip to the University of Calgary Kananaskis Field Stations, and coordinating student and faculty travel awards to the 2004 ESA Annual Meeting. Twenty-three students from across the country were selected to participate in the June 2004 field trip. The field trip, which will feature the research of the Kananaskis Field Stations, will focus on the theme “determining global change in wildland ecosystems.” ESA members Ed Johnson and Mike Mappin are coordinating the field trip along with ESA Education staff. A selection committee is reviewing ESA Annual Meeting travel award applications, and recipients will be announced at the end of April.

ESA Publications News

NOW AVAILABLE

On January 1, 2004 we switched to a new Web-Based Manuscript Submission and Peer Review System.

No more paper copies or diskettes will be required!
Submit manuscripts and reviews to *Ecology, Ecological Applications* and *Ecological Monographs* journals online.
For details: [esapubs.org/esapubs](esapubs.org/esapubs)
Resolution of Respect

Stanley I. Auerbach

1922–2004

Dr. Stanley Irving Auerbach, 82, died Saturday, 1 May 2004 in Nashville, Tennessee, following an extended illness. He was a scientist, research administrator, educator, and professional leader. Most of all he was devoted to his wife of 50 years and their four children. He was a mentor and colleague to many at Oak Ridge National Laboratory (ORNL) and across the country. Stan Auerbach, a founder of the science of radioecology and always a champion of modern ecological science, was one of those pioneers from the post-WW II era to whom we owe a great deal for the legacy that they created.

Stan grew up in Chicago, Illinois, where his parents had a movie theater in which he worked part-time. In 1942, he enlisted in the U.S. Army to serve in World War II as a second lieutenant until 1944. In 1946 he earned a bachelor’s degree in zoology, and in 1947 a master’s degree in zoology from the University of Illinois. His MS studies were carried out under the tutelage of world-famous ecologist Victor E. Shelford. Stan earned his doctorate in 1949 at Northwestern University, specializing in invertebrate ecology under Orlando Park. With this superb academic training, Stan began his career teaching zoology and ecology at Roosevelt University in Chicago, Illinois, and was also active in the Chicago Academy of Sciences.

The story of how Stan came to Oak Ridge National Laboratory is humorous. Sometime in late 1954 (the Cold War was raging) he got a call from his major professor, who asked if they might have a meeting. Orlando picked him up in his car and they drove for a long time through Chicago with little conversation. Finally, they arrived at a large, deserted parking lot in an industrial area. Orlando looked all around and said in a hushed voice, “Stanley, I have something to talk with you about that is of the utmost secrecy.” It turned out that Orlando, a renowned Sherlock Holmes aficionado who enjoyed intrigue, had been serving as a consultant to ORNL’s Health Physics Division. Thus Stanley learned for the first time about Oak Ridge National Laboratory, the Atomic Energy Commission (AEC), and found out that Orlando had recommended him as ORNL’s first full-time ecologist.

This was the early 1950s, and the Laboratory was becoming more sensitive to its waste management and waste disposal practices. It was discovered that liquid and solid waste disposal to
trenches for soil retention had serious deficiencies; radioactivity was appearing in surface waters and was being taken up by surrounding trees. More intensive study was necessary. Several years earlier, while at Northwestern University pursuing advanced study, Ed Struxness, himself a pioneer in the area of health physics, had by chance taken an ecology course (this was then a relatively new field in academia) offered by Orlando Park. So Struxness naturally turned to Professor Park for a recommendation, and Stan Auerbach’s life was forever changed.

Auerbach arrived in Oak Ridge at the end of 1954. He immediately set about conducting laboratory radiation experiments and laboratory studies of the biological uptake of strontium. By the summer of 1955 a team of 10 researchers was assembled by Auerbach, consisting mostly of visiting scientists, consultants, and students. Park visited other national laboratories and found that they were experiencing similar environmental problems. Stan solicited the Atomic Energy Commission (AEC) to research the environmental fate and effects of radionuclides. Auerbach and Park got the Ecological Society of America to raise awareness in the scientific community, and ESA created the Radiation Ecology study section. (Stan would eventually become ESA Secretary from 1965 to 1970 and President in 1971–1972.) As a result, the AEC established the Division of Biology and Medicine in 1955 and set up a national ecology program in Washington, D.C., under the direction of John Wolfe, an ecologist from Ohio State University.

Stan leaves behind not a body of ecological knowledge for which he is primarily responsible, nor is there a legacy of graduate students who carry on this line of research. Rather his legacy lies in his influence on government programs, such as radioecology in the Atomic Energy Commission, or the Biome Programs that presaged ecosystem studies supported by the NSF. Stan’s career epitomizes the conundrum, does man make history or does history make the man? This remains unanswered, but what we can say is that Stan took the right courses of action when presented with the events of his time.

Two significant events shifted Stan’s career and his eventual ecological legacy in the mid-1950s. In early 1956, John Wolfe made his first visit to Oak Ridge, and as a consequence emphasis was placed on field-oriented research in contrast to laboratory studies. In the same year, Auerbach was able to add a second full-time ecology position and redirected the research program to the waste disposal sites and the contaminated sediments of the drained White Oak Lake bed. Thus began many decades of pioneering research at ORNL. By the end of 1959, the Radiation Ecology Section was created and Auerbach, as its Chief, had assembled his initial team of early Oak Ridgers: Dan Nelson, Jerry Olson, Paul Dunaway, D. A. Crossley, John Witherspoon, Don Jacobs, and Gordon Blaylock, among others, with Gene Odum as a consultant. The scientific field of radioecology had emerged. Large-scale field studies of ecological systems were the focus.

This post-Sputnik period of the late 1950s was characterized by dynamic planning at the Laboratory, and these young ecologists were encouraged to actively participate. ORNL was and is first and foremost a physical sciences laboratory. That ecology gained a foothold in this scientific environment is testimony to Stan’s doggedness. Because of the complex pathways for movement of radionuclides in the environment, ecologists were forced early on to think in terms of environmental systems. Staff continued research on radionuclide uptake by the vegetation and radiation effects on native mammal populations on the White Oak Lake bed, and colleagues in the Waste Disposal Section of the Health Physics Division were completing one of the first studies of the transport of low-level radionuclide discharges to the Clinch River. (A companion study was underway at Hanford on
the Columbia River.) In 1964 the ecologists were conducting the first experimental “tagging” of a natural ecosystem—the Cesium-137 forest. In 1967, Walker Branch Watershed was established to study natural biogeochemical cycles, and Walker Branch continues to serve as an ecological research platform today.

Under Stan’s visionary leadership, his growing cadre of young ecologists gained recognition internationally as the leading center of the emerging area of ecosystem research and systems ecology. Stan had recruited Jerry Olson, who used a Ford Foundation grant to train students at the University of Tennessee in systems ecology. Stan also recruited Bernie Patten, a University of Georgia professor, the late George Van Dyne (later to become director of the Grasslands IBP Site at Fort Collins), and later Bob O’Neill, to form the nucleus of his systems ecology group. In 1968, the National Science Foundation selected Auerbach to direct its pioneering, multi-university/laboratory research program on forest ecosystems and aquatic ecosystems of the Eastern Deciduous Forests. This multi-biome effort was the largest and most complex interdisciplinary ecological research program ever attempted up to that time. The new NSF research program was part of the International Biological Programme (IBP), and it brought ORNL to the center of ecological research, as well as bringing ecology into the realm of big-scale, multi-institutional and multidisciplinary science. IBP’s important legacy was a new Ecosystem Studies Program at the National Science Foundation. Ecosystem analyses and simulation modeling of ecological processes at ORNL moved to the cutting edge of ecological research. Stan pressed interactions with university colleagues—a move that at the time was new to national laboratories, which had lived behind security fences in the Cold War era. The Environmental Sciences Division’s program of university collaborations expanded dramatically to become a model for the Laboratory. By 1969 Stan was working with The University of Tennessee to establish the Graduate Program in Ecology, now the Department of Ecology and Evolutionary Biology.

Creation of the National Environmental Policy Act (NEPA) in 1969 changed the course of environmental research in Auerbach’s program forever. The AEC directed that all aquatic research staff drop their research and immediately support the AEC in the preparation of environmental impact statements. To many directors, this directive would have elicited (and did) angst and a “woe is me” attitude, because their carefully honed scientific agenda had to be changed. Not Stan. He saw this as an opportunity to bring the still largely descriptive field of ecology to bear on an immediate societal issue. Additional scientists were hired to meet these demands, including Steve Hildebrand, who now occupies Stan’s former position. For many, it was their first employment after graduate school. In later years, when they were able to return to research, their perspectives on environmental issues were changed, as were those of their colleagues. Ecology at ORNL now became acclaimed not only for the quality and innovation of the basic research, but also for the relevance of its application to real-world problems. The first evidence of this was the creation of the ORNL thermal effects research program on aquatic biota and ecosystems, led by Chuck Coutant.

About this time, Stanley began a remarkable personal transformation in leadership style, a transformation which few pioneers in science have made successfully. From the very hard-driving, authoritative, and centric leader, he became open, inclusive, and sharing of decisions with his subordinates. He championed workplace diversity long before it was recognized as important. He was training the next generation of leadership, but he still retained his dogged leadership style. His protegés occupy and have occupied important academic and governmental leadership positions...
across the country as well as at ORNL.

Dave Reichle remembers the atmosphere in the research group. In the early years, Stan, who had a knack for hiring bright and creative people, was also inheriting their individualism and rebellious attitudes to authority. Stan once remarked in response to Dave’s frustrations with bureaucracy and personnel issues, “Dave, if it weren’t for these problems, we would not have jobs.” It was like herding cats, in a laboratory environment that was serious about the one and only right way to get things done. Staff got him into trouble more than a few times, but like responding to an Army drill sergeant, they knew who the boss was—they complained a lot, but they congealed as a team.

The internationally renowned ecology program under Stan’s leadership grew rapidly. In March 1970, the Laboratory established the new Ecological Sciences Division, and very shortly thereafter, in 1972, it evolved into the Environmental Sciences Division. In 1973, the AEC became the Energy Research and Development Administration (ERDA). By the middle of the decade, the Division had a staff of 127. Eight years later the Department of Energy was established, and Assistant Secretary for the Environment Ruth Clusen dedicated the Oak Ridge National Environmental Research Park on 2 October 1980.

Formation of ERDA and the experience of the NSF programs provided Stan with yet another opportunity to extend the scope of environmental research at ORNL. Radionuclides were no longer to be defined as the only environmental pollutants. Natural biogeochemical cycles were seen as the basis of ecosystem functioning. A new ERDA Synfuels program introduced organic toxicants. The Environmental Sciences Division also brought a new style of research to ORNL. Instead of “secret” research inside the security fences, ORNL ecologists were moving across the country analyzing the function of different ecosystems, as the nation recognized that varying geographic scales were a critical part of environmental problems. By the time the Department of Energy was created, Stan had positioned the Environmental Sciences Division as one of the leading research centers for studying hazardous wastes, the ecological effects of global change, and renewable energy. New scientific fields were pioneered by the new staff recruited to Oak Ridge in answer to Stan’s vision and determination to keep ecological sciences at the forefront; these included landscape ecology (notably including Bob O’Neill and later Virginia Dale) and ecological risk analysis (with Glenn Suter and Larry Barnthouse).

Dave Reichle, Stan’s “mentoree,” who remained his close friend, remembers what it was like to work for Stan. “You always knew where you stood with Stan. Clarity in communication was not one of his weaknesses. Stan was a visionary and a builder. Stan would never ask you to do something that he wouldn’t be willing to do himself, nor would he work less hard than you. Stan did not constrain initiative, and he helped you to learn your limits. He prized good science. He always supported his staff, gave credit to others and celebrated their accomplishments, but he expected you to remember who was the boss.”

At Stan’s retirement, in 1986, he was recognized by scientists around the world. Over the course of his career he received many awards and recognitions of his service to science, federal agencies, and other organizations, including the Distinguished Service Awards from both the Department of Energy and the Ecological Society of America. Stan left behind a tremendous legacy of science, a premier research organization then consisting of over 225 staff, and a cadre of future leaders at ORNL. Most significantly, he retained the respect and affection of colleagues. The Environmental Sciences Division at ORNL and large-scale ecological research around the world remain today as a strong tribute to Stan Auerbach.

Stan and his wife, Dawn, moved to Nashville in 1993 to be close to their two daughters, Allison
Society Section and Chapter News

Applied Ecology Section Newsletter

Greetings! The Applied Ecology, Agroecology, Rangeland Ecology, and Soil Ecology Sections are once again planning a joint mixer for the ESA 2004 meeting in Portland, Oregon. The mixer will be held on Wednesday, 4 August, from 6:30 to 8:00 pm, at the Oregon Convention Center, Portland Ballroom 251. The Applied Section will hold a business meeting toward the end of the mixer to discuss the 2004 election results. Special thanks to Deborah Ulinski Potter for serving as Chair of the Nominating Committee and for preparing the ballot for this year’s election. I also thank the 2002–2004 officers, Jon Keeley, Vice Chair, and Dan Binkley, Secretary, for their service to the Section. I have enjoyed my tenure as Chair, and I thank the members of the Section for giving me the opportunity to serve.

The Applied Ecology Section has selected Justin Touchon, a Ph.D student in the Department of Biology at Boston University, to receive a $750 Student Travel Award to attend the 89th ESA Annual Meeting this summer. He will be presenting his research on the interactions of biotic and abiotic risks affecting eggs and larvae of the neotropical tree frog *Hyla ebraccata* in the symposium, “Ecological Implications of Phenotypic Plasticity.” Congratulations Justin!

This year we are also sponsoring the symposium “Ecological Implications of Fuel Reduction Treatments to Reduce Fire Hazards in Forested Landscapes.” The symposium will be held Thursday, 5 August, 1:30-5:00 pm, in Oregon Ballroom 204 of the Oregon Convention Center.

Many forests today are denser, contain fewer large trees, and have higher fuel loads and greater fuel continuity, increasing the probability of unnaturally severe wildfires. Until recently, little data that would allow managers to evaluate the ecological comparability of different fuel reduction treatments had been collected. This symposium brings together researchers affiliated with several large multidisciplinary fuel reduction and stand structure manipulation experiments nationwide. Speakers will present findings from different study disciplines to provide the best current understanding of the ecosystem-level impacts that fuel reduction treatments are likely to have.

Hope to see you in Portland!

Paulette Ford, Chair
Rocky Mountain Research Station
333 Broadway SE, Suite 115
Albuquerque, NM 87102-3497 USA
(505) 766-1044
Fax: (505) 766-1046
E-mail: plford@fs.fed.us

and Ann. Their son Andrew and family live in Wichita, Kansas, and their son Jonathan in Colorado. But Stan’s heart has always remained in Oak Ridge, with his friends and his legacy of science at ORNL. He missed Oak Ridge and the fields and forests of the Ridge and Valley Province very much, and we who knew and worked with him and for him will miss him even more.

David E. Reichle
Oak Ridge, TN

and

W. Franklin Harris
University of Tennessee
Knoxville, TN

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Southeastern Chapter Newsletter
Issue 2004–2

Chapter Officers

Email: Paul.Schmalzer-1@ksc.nasa.gov
Vice-Chair: Joan Walker (2003–2005)
Email: joanwalker@fs.fed.us
Email: jagerhi@ornl.gov
Web-Master: Mark Mackenzie
Email: mackenzi@forestry.auburn.edu
Chapter Homepage:
http://www.auburn.edu/seesa/

Welcome to New Officers

We elected two new officers for the 2004–2006 term. Congratulations to James Luken, who was elected chair, and will replace Paul in August, and to Nicole Turrill Welch, who was elected Secretary/Treasurer.

Spring 2004 Chapter Meeting in Memphis

The minutes of our business meeting and luncheon, held at the meeting of the Association of Southeastern Biologists (ASB) in Memphis, are posted on our web site. The ESA Southeastern Chapter cohosted a symposium, “Invasive Plant Awareness and Research: Priority Status,” coordinated by Pat Parr and Jack Ranney.

2004 Odum Award

We presented the 2004 Eugene P. Odum award to two student recipients: Nicole M. Hughes of Appalachian State University for her paper, “Functional role of anthocyanins in high light winter leaves of the evergreen herb, Galax urceolata,” coauthored with Howard S. Neufeld, and Christopher Winne of Savannah River Ecology Laboratory for his paper “Daily activity patterns of whiptail lizards (Squamata: Teiidae: Aspidoscelis): a proximate response to environmental conditions or an endogenous rhythm?” coauthored with Michael Keck.

Membership Renewal and Award Support

Please remember to renew your membership in the Southeastern Chapter when you renew your ESA membership. Your donations to the Eugene P. Odum Fund support the best student paper award and those to the Quarterman-Keever Fund support the best poster award. Thanks to your donations, and two generous contributions by Bill Martin and Joe Winstead at the business meeting, we have reached our goal of $10,000 for the Odum Fund. Brooks-Cole Publishers has also expressed interest in contributing to the fund.

We voted on and passed a proposed bylaws amendment to establish the Quarterman-Keever Award for the best student poster at our April 2004 meeting. Apparently, the growth of the new fund will need to be quite rapid in order for ESA to maintain it. A new committee was formed to oversee the Quarterman-Keever Award consisting of Howie Neufield (chair), Andy Ash, and Cliff Hupp.

Upcoming Meetings and Symposia

ESA 2004 Meeting: The Annual Meeting of ESA will be in Portland, Oregon on 1–6 August. The Chapter will have a brown bag lunch meeting on Tuesday, 3 August.

ASB 2005 Meeting: ASB will meet on 13–16 April 2005 in northern Alabama. Proposals for symposia at this meeting will be due in early September 2004. The ASB standing committees request members for a list of committees. Please see Claudia Jolls if you are interested.

ESA 2005 Meeting: ESA will meet with INTECOL in Montreal, Canada on 7–12 August 2005. Proposals for symposia at this meeting will also be due in early September 2004.

SEAFWA 2004: The South Carolina Department of Natural Resources invites you to the
58th Annual Southeastern Association of Fish and Wildlife Agencies Conference, Hilton Head, South Carolina, 30 October–3 November 2004. <www.dnr.state.sc.us/seafwa>

Keeping in Touch

Check the Chapter home page: [http://www.auburn.edu/seesa/](http://www.auburn.edu/seesa/) for updates and additional information. Join the Southeastern Chapter of ESA ListServer: to join the ListServer, send a message to majordomo@mail.auburn.edu with “subscribe scesa” in the body of the message. Please send news or announcements to scesa@mail.auburn.edu for distribution to the listserv, or to jagerhi@ornl.gov for inclusion in the next quarterly newsletter.

Respectfully,
Yetta Jager
Newsletter Editor

Other Notices

*Urban Habitats*
Electronic Journal Launched

The premier issue of *Urban Habitats*, a new electronic journal that focuses on current research on the biology of urban areas, is now available online. Papers cover a range of related subject areas, including urban botany, conservation biology, wildlife and vegetation management in urban areas, urban ecology, restoration of urban habitats, landscape ecology and urban design, urban soils, bioplanning in metropolitan regions, and the natural history of cities around the world. *Urban Habitats* is a peer-reviewed, fully indexed, scientific journal, written and edited for a wide audience of researchers, restoration ecologists, park and preserve managers, government officials, and naturalists.

Dr. Steven Clemants, vice president for Science, Brooklyn Botanic Garden, and codirector of the Center for Urban Restoration Ecology, is a coeditor. “Urban areas are often overlooked as important habitats for plants and wildlife. We feel there is a global need to increase awareness and interest in urban habitats. To make this knowledge available to science professionals, educators, policymakers, and the general public, we have taken advantage of our long experience in publishing and the incredible opportunities for dissemination globally via the Web to launch *Urban Habitats*,” Clemants says. The journal is published by the Center for Urban Restoration Ecology, a collaboration between Rutgers University and Brooklyn Botanic Garden.

“We are particularly interested in featuring papers that take advantage of the unique possibilities of the e-journal format, such as color illustrations, animated models, video, sound, downloadable databases, and interactive discussions,” Dr. Clemants explains. Articles are welcomed from scientists, scholars, and practitioners in urban habitat restoration, conservation biology, urban botany, landscape architecture and design, and other fields related to urban ecology.

Janet Marinelli, coeditor of *Urban Habitats*, Director of Publishing for the Brooklyn Botanic Garden, and member of the steering committee for the Center for Urban Restoration Ecology, says of the new publication, “We’re publishing studies covering cities from Brooklyn to Beijing.” She adds, “For the first time, more people live in cities than in rural areas worldwide, and urban areas are growing fast. Cities are the future of this planet. In *Urban Habitats*, we’re exploring their evolution and ecological potential.”

The premier issue of *Urban Habitats* presents “Urban Floras,” Volume 1, Number 1, December 2003. The e-journal is available free at [www.urbanhabitats.org](http://www.urbanhabitats.org).
2004 Wildlife Population Assessment Training Workshops, St Andrews, Scotland

The Centre for Research into Ecological and Environmental Modelling (CREEM) at the University of St Andrews, Scotland, is hosting a series of three linked training workshops on wildlife population assessment. The target audience is ecologists, wildlife managers, and conservation biologists, but the workshops will also be of interest to applied statisticians working in these fields.

Workshop 1: Estimating Animal Abundance, 24–28 August

This workshop will introduce participants to the most important methods of estimating animal abundance in a rigorous but accessible way. We cover plot sampling, distance sampling, mark–recapture, removal methods and, later in the course, more advanced and recently developed methods.

Workshop 2: Introduction to Distance Sampling, 1–3 September

Distance sampling is the most widely used method for estimating density and abundance of wildlife populations. The objective of this workshop is to give participants a solid grounding in the basic methods for design and analysis of distance sampling surveys, and the use of the software Distance.

Workshop 3: Advanced Techniques and Recent Developments in Distance Sampling, 6–8 December

This workshop will cover the latest advances in distance sampling research and software, including the use of covariates for modeling the detection function, double-observer methods for when detection at the line or point is not certain, spatial modeling of density, automated survey design, and adaptive sampling.

For more information and registration forms, see [http://www.creem.st-and.ac.uk/conferences.php](http://www.creem.st-and.ac.uk/conferences.php) or contact the workshop organizer:

Rhona Rodger
(+44) (0)1334 461842
E-mail: rhona@mcs.st-and.ac.uk

Forest Biodiversity: Lessons from History for Conservation

Suitable for researchers within the areas of forestry, ecology, conservation, and environmental history, this book focuses on the diverse impact of forest history in general, and of forest continuity, fragmentation, and past management in particular, on the diversity and distribution of species. The implications for the conservation of biodiversity in forests are also addressed. Chapters have been developed from papers presented at a conference held in Leuven in January 2003. The emphasis is on temperate forests in Europe and North America, but the information may also be applicable to other regions or biomes. As a special offer to members of the Ecological Society of America, CABI Publishing are offering a 20% discount on this title. North and Central America book orders are handled by our exclusive books distributor, Oxford University Press, 2001 Evans Road, Cary, North Carolina 27513-2009, (800) 451-7556, fax: (919) 677-1303, E-mail: orders@oup-usa.org.
Interest in the use of agricultural products and wastes for energy and industrial materials is growing throughout the world. Optimists foresee a new system of production that will produce a virtuous cycle of benefits for the environment and society. Envisioning a return to renewable raw materials in lieu of feedstocks and fuels based on petrochemicals, they predict a reduction in demand for fossil fuels, a decrease in greenhouse gas emissions, as well as the mitigation of a host of other environmental threats.

A more pessimistic outlook for the bioeconomy also exists, which foresees the increased use of synthetic fertilizers, a related reduction in water quality, and an increase in soil erosion and greenhouse gas emissions.

Emerging research, published in the prestigious *Journal of Industrial Ecology* (full text available free at <http://mitpress.mit.edu/jie/bio-based>) examines the environmental implications, good and bad, of increased use of biobased materials and fuels using the concepts and tools of industrial ecology.

Articles in the special issue analyze the opportunities, processes, and environmental impacts of biofuels, bioplastics, biolubricants, and biosurfactants. Government initiatives to support biobased products are summarized, and leading biobased product companies are profiled. The special issue also features a look at the predecessor to today’s efforts to make greater industrial use of agricultural crops and residues, the American chemurgy movement of the 1920s and 1930s.

Research published in this issue suggests:

- New analysis methods can, without detailed product-specific information, predict the environmental performance of bioproduction strategies such as capacity to displace fossil fuel use. These tools can rapidly screen new processes and identify promising opportunities.

- Surprisingly, making composite materials and plastics from biobased resources is superior to energy production from energy crops, in terms of energy savings and greenhouse gas emissions, when these impacts are computed per unit of agricultural land rather than per unit of product.

- Using ethanol fuel made from corn stover, the residues left over in cornfields after the grain is harvested, to produce a mixture of ethanol and gasoline (known as “E85”), can yield important benefits. For each kilometer fueled by the ethanol, the car uses 95% less petroleum. Total fossil energy use (coal, oil, and natural gas) and greenhouse gas emissions are lower on a life cycle basis. However, air quality impacts are mixed, with some pollutants increasing and others decreasing.

Robert Anex, associate professor of agricultural and biosystems engineering at Iowa State University in Ames, Iowa, served as the guest editor for the special issue.
Technological Tools

A New Means of Presenting the Results of Logistic Regression

Introduction

The use of logistic regression analysis in ecological studies has greatly increased in recent years. It is a popular and useful statistical tool for predicting the probability of occurrence of a categorical dependent variable (e.g., presence or absence, male or female) based on predictor variables. The results of logistic regression have been presented in a number of ways in the scientific literature: equations with statistics (e.g., Sydeman et al. 1991, Stewart et al. 1996, Bolger et al. 1997, Gross and Kapuscinski 1997, Morrison 1998, Wiser et al. 1998a); probability response curves (e.g., Sydeman et al. 1991, Van Sickle et al. 1996, Wiser et al. 1998a); and bar charts of the percentage deviance explained by different models (e.g., Wiser et al. 1998b). However, these traditional means of presenting the results have many limitations in the information that they provide. We propose a new method for presenting logistic regression data, describe how it can be achieved with current software, and suggest that it should be routinely incorporated in future updates of statistical packages.

Traditional presentation

Fig. 1a shows one of the commonest current methods of presenting logistic regression output, using hypothetical data that describe the probability of a pool being occupied by an invertebrate in relation to pH. The two main limitations of this type of figure are:

1) The observed data for the dependent variable, i.e., presence and absence in pools, are arranged at zero and one on the Y axis, making it impossible to ascertain the number of pools at each interval along the X axis. This makes the distribution of the data difficult to visualize. The influence of the observed data on the slope...
and shape of the logistic regression curve are also unclear.

2) Sample size cannot be ascertained from the figure alone because the number of pools at each interval along the axis is not apparent.

New presentation

Fig. 1b shows the same hypothetical data as shown in Fig. 1a, but in this case the observed data are presented in the form of frequency histograms for each category of the dependent variable, with the associated scale on the right-hand axis. These changes overcome the limitations of the traditional method, outlined above, because the frequency of the observed data at each interval along the axis is now clearly displayed. It is now easy to interpret the summed effect of these points on the logistic regression curve. For example, in Fig. 1a it is impossible to determine how many unoccupied pools have a pH of between 5 and 6. However, we can see from Fig. 1b that there are ~80 pools within this category. It is also now possible to assess the sample size from the figure alone, as the observed data points are displayed against a scale.

Method for the new presentation of logistic regression graphs

At present, combination graphs of this type are not available on any of the standard statistics or graphing packages of which we are aware. Although the presentation of this type of graph is therefore more time consuming, we would argue that, in terms of ease of interpretation, it is worth the extra time and effort. We are sure that there are many different methods and design packages available that could ultimately be used to produce these graphs, but as an example we describe here our step-by-step method, which uses a combination of SPSS v. 11.0 and Microsoft Power Point.

SPSS

1) The data view should have three variables, (a) the dependent variable (e.g., coded 0 and 1), (b) the observed data for the predictor variable, and (c) the predicted probability of group membership saved from the logistic regression analysis.

2) Produce two histograms from the predictor variable by using the dependent variable as the panel variable (Graph-Interactive-Histogram). In the options, it is important to change the maximum scale range to approximately twice the maximum category value.

3) Create a scatterplot with the predicted probability on the y axis and the predictor variable on the x axis (Graph-Interactive-Scatterplot). Under the Fit option select Smoother.

Microsoft PowerPoint

1) Copy and paste the two histograms and the scatterplot onto a PowerPoint slide.

2) Ungroup all three graphs and remove any redundant objects. Regroup the remaining objects in each graph separately.

3) Resize each graph so that the dimensions of all three are equal. Use the flip option to flip vertically the histogram of the higher value on the predicted probability axis (i.e., 1 [presence] in this example). Then overlay the two histograms and the scatterplot, ensuring that the logistic regression curve is brought to the foreground.

4) Add text boxes for the right-hand y axis labelling and create a scale for both histograms.

5) Edit the graph for final presentation.

Future directions

The new method for graphical representation of the results of logistic regression analysis presented here greatly increases the information that can be extracted from these figures, and should therefore improve the ease of interpretation of the output. However, the manual production of these figures can be time consuming. If software manufacturers
incorporate this type of combination graph in future software updates, we hope that this type of figure will become a common feature of logistic regression analyses.

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Jennifer Smart,1,3 William J. Sutherland,2 Andrew R. Watkinson,1,2 and Jennifer A. Gill2
Schools of Environmental1 and Biological Sciences2
University of East Anglia
Norwich NR4 7TJ UK
3Correspondence: jennifer.smart@uea.ac.uk

WinSSS: Stochastic Spatial Simulator

Introduction

WinSSS is a Windows-based program for simulating stochastic spatial models that are individual-based, have discrete spatial structure, and continuous time. This class of models is commonly referred to as interacting particle systems or asynchronously updated probabilistic cellular automata. It is ideally suited for developing insight and making predictions in spatial ecology. Ecological examples can be found in Dieckmann et al. (2000) and Durrett and Levin (1994).

WinSSS features an elaborate graphical interface that allows one to choose from various models, specify parameters such as birth/death rates and interaction strengths, initialize with various starting configurations, and view spatial dynamics as well as time series and phase diagrams corresponding to spatial windows of various sizes. One can download the program freely at the URL below. This includes a ready-to-run simulator, with pre-programmed models and an HTML tutorial and help window. For those who would like to code their own models, the C++ code can also be obtained from the authors.

The models in WinSSS include mechanisms for invasion of new territory and competition for resources, head-to-head competition, pathogen spread, and various types of successional dynamics. For example, one can easily run simulations of the “Rock-Scissors-Paper” model that recently appeared in Nature (Kerr et al. 2002) describing spatial coexistence of three competing strains of bacteria. The HTML tutorial gives a brief introduction to these spatially extended individual-based models and provides some references for further reading.

Model specification and parameters

To describe the models and simulations, we
begin by noting that all the action takes place on a two-dimensional rectangular lattice (or grid) of sites, with a number of options for the lattice size.

Each site in the lattice can be in a number of different states (represented as colors), depending on the specific model. One can think of a site as an individual or a group of individuals, say in a habitat patch. The state of a given site can change to other states at rates that depend in general on the configuration of states at “neighboring” sites. These changes occur in continuous time and very quickly, so when watching the simulation one typically observes sites changing all over the lattice. However, the changes are asynchronous, due to the continuous-time nature of this (Markov) process. The way to think of this is that every site has associated with it an (exponential) alarm clock whose rate depends on the state at that site and the states at neighboring sites. The site whose alarm rings first makes the appropriate change and all neighboring sites recalculate their rates. All the alarm clocks then start over and we wait for the next one to ring. (We remark that the behavior of synchronously updated cellular automata can be similar in some respects but very different in others. For example, updating all the sites at once can lead to very rigid behavior that produces patterns not typically seen in biological populations.)

Rates and interaction neighborhoods

There are two basic types of rates that allow one to build most models of interest. These are “contact” and “spontaneous” rates. Contact rates are for events that depend on the types at neighboring sites. For example, a vacant site might become occupied by an offspring from a given species at a rate that is proportional to the number of individuals of that species currently within some distance of the vacant site. Contact rates can depend linearly or nonlinearly (e.g., a threshold event) on the states at neighboring sites. There are several options for neighborhood size in the simulator. Spontaneous rates are for events that occur independently of nearby sites. For example, an individual might die or change its life stage after some random time through no effect from other individuals.

Window size and time series

The overall lattice size can be selected from a number of options ranging from $100 \times 100$ up to $500 \times 500$. The densities of the different species appear, color-coded, in a separate window below the main simulation. These densities are averages over a spatial window that the user chooses. They can be recorded in an accessible file and used to obtain information about spatial length scales, as in Rand and Wilson (1995). The user can also choose to watch the phase plane trajectories corresponding to any two species. All of these observations of densities under various window sizes yield perspective on the effects of randomness, correlations between sites at various distances, and comparisons with the corresponding mass-action ordinary differential equations.

Implementation

The models in WinSSS were developed using Visual C++. The graphical interface employs OpenGL, the premier environment for developing portable, interactive two-dimensional and three-dimensional graphics applications.

To run WinSSS at reasonable speeds with lattice size $250 \times 250$ and above, a Pentium III 866 with 256M RAM is recommended. WinSSS has been tested on Windows 2000 and Windows XP. Other operating systems in the Windows family (e.g., Windows 98 and Windows NT) should also work, but we have not tested them. We plan to initiate improvements and extensions based in part on user feedback.
Acknowledgments

Although most of the C++ code and the graphical interface for this simulator were written independently, we were inspired by the pioneering efforts of Ted Cox and Rick Durrett, who created the Unix-based simulator S3. Y. Guan and S. M. Krone were supported in part by NSF grant EPS-00-80935 and NIH grant P20 RR016448.

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Yongtao Guan and Stephen M. Krone
Department of Mathematics, University of Idaho
Moscow, ID 83844-1103
E-mail: krone@uidaho.edu
Availability: http://www.webpages.uidaho.edu/~krone

Homebrew Camera Traps

Subscribers to ECOLOG-L post queries a few times a year about camera traps (shutter-trip systems that automatically photograph passing wildlife), asking for recommendations about particular models, or how to find the least expensive options. During one recent exchange a reader suggested the web site below, which has complete instructions about how to build your own camera trap. In this case, the builder was able to make one for about $80. If you’re competent with a soldering iron and know a little about electronics, it looks like a relatively easy project.

http://www.jesseshuntingpage.com/homebrew-cams.html

David Inouye
University of Maryland
Meeting Review

Plant Invasions and Vegetation Succession: Closing the Gap

“Plant Invasions and Vegetation Succession: Closing the Gap,” a workshop held in České Budějovice, Czech Republic, 26–28 November 2003. The workshop was organized by the Institute of Botany, Academy of Sciences of the Czech Republic, Průhonice, and University of South Bohemia, České Budějovice, Czech Republic, and was sponsored by the European Science Foundation.

The recent turmoil in biological invasions research has resulted in the publication of many compendia (Drake et al. 1989, Mooney and Hobbs 2000). A solid knowledge base comprising both formal frameworks (Williamson 1996, Richardson et al. 2000b) as well as theories of species invasiveness and community invasibility (Rejmánek 1996, Tilman 1999, Davis et al. 2001) has been established. However, as pointed out recently by Davis et al. (2000), there is a gap between some of the most dynamic fields of contemporary ecology, namely, plant invasions and vegetation succession. Despite powerful development of both fields and ecological proximity between both phenomena/processes, the two fields communicate poorly. Incorporating insights from succession ecology can be expected to help invasion ecology become more quantitative and predictive (Davis et al. 2000). Moreover, both fields are contributing ideas or findings that may help solve environmental problems. Nevertheless, the field of invasion biology has been largely resistant to incorporating knowledge from successional ecology. As a step toward bringing these fields closer together, the workshop entitled „Plant invasions and vegetation succession: closing the gap“ was held with the goal of opening communication among workers and evaluating the available data to identify relationships between invasion and succession.

A formal framework for studies of vegetation change

In his introductory talk to the first session, Mark Davis (Macalester College, Minnesota, USA) reviewed the milestones in vegetation succession and biological invasions and pointed out that the seed for the dissociation of both fields was sown by Charles Elton (1958), who focused explicitly on population outbreaks caused by invasions of foreign species. Davis stressed that reassociation of the two fields is desirable; reciprocal awareness, explicit integration, and the metaperspective are convenient tools to achieve this goal. Successional models such as that of Connell and Slatyer (1977) can be applied to all combinations of alien and native species involved in succession.

Goals of this first session were to (a) develop a conceptual framework to better integrate succession and invasion ecology, (b) identify key research questions that should guide future research, and (c) describe the types of studies needed to answer these questions. The following concepts were identified, defining crucial areas of research: (1) Interactions with other plants and other trophic levels are central...
for the establishment and spread of native and introduced plant species. (2) Vegetation dynamics depend on the spatial context and history of the site, comprising both natural and anthropogenic activities. (3) Global change, e.g., warming, nitrogen deposition, and shifting precipitation, can affect patterns of species establishment and spread. (4) The evolutionary history of the species involved influences the establishment and spread of native and introduced plant species. (5) Transient windows of opportunity are critical for the establishment and spread of native and introduced plant species.

To treat these issues adequately, future studies should focus on clarifying mechanisms of establishment and spread, and studying cause and effect. The same mechanisms influence the establishment and spread of both native and introduced species and the impacts of these spreading species on their new communities and ecosystems. The following categories of studies should be involved in future research linking the dynamic fields of plant invasions and succession: (a) comparative studies of distribution and abundance (phylogenetically corrected approach; geographic approach: recipient habitat vs. source habitat, gradients of latitude, altitude, climate, land use intensity); (b) for small-scale systems, manipulative experiments are needed (deletion/addition studies) focusing on effects of resident populations, communities, and ecosystems on arriving species, and of arriving species on resident populations, communities, and ecosystems; (c) for large-scale systems, observational and correlative studies of existing “natural experiments” are necessary. (d) Modeling studies of establishment and spread are needed, using knowledge gained from field data. Findings from studies based on these approaches will provide society with a greater understanding of the consequences of establishment and spread of both alien and native species on land use, biodiversity, ecosystem services, and trophic interactions.

Participation of alien species in succession

The second session focused on the role of alien species in successional seres worldwide. Petr Pyšek (Institute of Botany Průhonice, Academy of Sciences of the Czech Republic) assembled 55 data sets documenting native and alien species numbers and cover values during primary succession; most data come from Central Europe and North America. The average proportion of alien species in a sere was 25%, ranging from 2% to 81%. Aliens are best represented in successional seres in ruderal (urban) habitats and old fields. Preliminary statistical analysis revealed the following. (a) In most seres, alien species decrease during succession (Rejmánek 1989). The rate of this decrease does not differ between species number and cover but does vary among seres. (b) Aliens contribute more in terms of species number than cover; this might reflect the fact that many of them are casuals (Richardson et al. 2000b) and are on average less abundant in the landscape than native species. (c) Residence time, i.e., how long the alien species have been present in the region, plays an important role in determining their dynamics in succession. In European seres, archaeophytes (introduced after the beginning of agriculture but before European exploration of the Western Hemisphere) and neophytes (introduced after that date) differ among habitat types, as demonstrated for old fields and dumps from coal mining, and so do successional trends: neophytes seem to be more capable of becoming dominants.

Karel Prach (University of South Bohemia, České Budějovice, Czech Republic) analyzed the pattern of succession in Central European human-made habitats; soil pH seems to be the most important factor determining the course and character of succession. In seres with a low initial pH, annual ruderal species prevail, while in those with high initial pH, succession is dominated by clonal perennials.

Among the best data available are long-term observations from old-field succession in Cedar
Creek (reported by Johannes Knops, University of Nebraska, USA) and the Buell-Small Succession Study (reported by Scott Meiners, Eastern Illinois University, Charleston, USA). Similar data sets are available for eastern European old fields (presented by a group represented by Sandor Bartha, University of Vacrátot, Hungary); these data permit studying species behavior during succession in their native and introduced ranges, by comparing species that occur in the data as native in one region and alien in another. Such comparison is feasible on data from Europe and North America where the reciprocal exchange of species on an historical time scale has been extensive.

Jan Lepš (University of South Bohemia, České Budějovice, Czech Republic) demonstrated how a random event can completely change the successional pathway and pointed out the importance of knowledge of site history when interpreting the vegetation pattern in successional sites. The course of succession in old fields that Lepš studied was crucially affected by whether willows established in the first year following abandonment, which in turn depended on the weather conditions during a rather short period of germinability of willow seed. Divergent successional pathways were still obvious after 20 years of succession.

Discussions during this second session outlined factors that determine the representation of alien species in successions starting on bare ground. Availability of propagules of both alien and native species is determined by a number of related factors such as floristic history, human activities in the region, as well as at the time of initial disturbance, since modern landscapes tend to be progressively more invaded by alien species (Pysěk et al. 2003). Other important factors include habitat type and landscape character, and the frequency and intensity of disturbances. Preliminary analysis with habitats classified according to the character of surrounding landscapes indicated that industrial habitats have a high proportion of aliens at the beginning, but their decrease in rate of succession is faster than in habitats located in agricultural landscapes. In natural habitats, aliens are poorly represented; hence their decrease with continuing succession is not so profound.

Colonists and invaders: getting the traits and comparisons right

The last session dealt with comparison of traits of alien and native species colonizing sites of various successional status. Ken Thompson (University of Sheffield, UK) pointed out that current analysis of traits promoting invasions is limited by the availability and quality of information on traits involved. Comparative analyses tend to employ traits on the basis of whether they are readily available or can be rapidly abstracted from floras, rather than on any assessment of their intrinsic importance. Thus we know a lot about patterns of plant height, growth form, seed mass, and (apparent) dispersal syndrome, but very little about growth rate, palatability, or seed production. Alien/native comparisons are also frequently drawn too narrowly (e.g., single pairs of species) or too broadly (e.g., whole native and introduced floras). Finally, we should beware of trying to answer ecological questions with inappropriate data from other fields, for example using economic impact as a measure of “success” of aliens, and of the dogmatic application of unproven hypotheses, e.g., the supposed trade-off between colonizing and competitive abilities.

Some talks discussed rather underexplored phenomena in invasion biology: David Richardson (University of Cape Town, South Africa) stressed that to obtain a better picture of invasion patterns, mutualistic relationships with organisms of other trophic levels must be taken into account. Invasions are to a large extent idiosyncratic and the outcome is often determined by factors that are impossible to control in comparative analyses, e.g., the availability of dispersers, pollinators, and
root symbionts (Richardson et al. 2000a). This was demonstrated in detail by Johannes Kollman (Royal Veterinary and Agricultural University, Copenhagen, Denmark) who concluded that invading native and alien fleshy-fruited species in temperate ecosystems use similar mutualistic interactions during dispersal and regeneration stages of succession.

Discussion during this session indicated the following. Further progress in comparative studies to reveal the determinants of species invasiveness is only possible by improving the quality of input data, both by obtaining more detailed information on species traits and by clearly defining what we mean by species “success.” Since different traits may be associated with different measures of species invasiveness or “success,” we should distinguish among alien species’ (a) frequency or range size, (b) local abundance as a measure of ability to dominate vegetation locally, and (c) persistence, i.e., ability to invade seminatural vegetation. As distribution of early- and late-successional species in these three dimensions depends on different suites of traits, this approach has potential to increase understanding of the role of individual traits in plant invasions.

Future perspectives on linking invasion and succession ecology

The workshop discussions indicated that the gap between studies on plant invasions and vegetation succession is detrimental and fosters intellectual isolation, resulting in investigators paying insufficient attention to ideas and findings in related subdisciplines. This is particularly worrying since these two specialties, while focusing on different questions and patterns, are actually studying the same mechanisms. Efforts to reunify specialty areas in plant ecology have the potential to substantially enhance ecologists’ ability to discover and describe the mechanisms responsible for vegetation change. Experiments designed to link invasion and succession are urgently needed to make some progress in this area.

There are numbers of successional seres with detailed, high-quality data available from various geographical regions and habitat types, but they have not been systematically analyzed up to now. Their analysis has potential to outline general patterns of alien species participation in succession, test the hypothesis of alien species decrease in succession (Rejmánek 1989), and permit investigation of the variation of this process and relate it to the underlying factors.

Researchers would benefit greatly from the intellectual synergy that would inevitably result from better communication among research specialty areas. Outputs from such studies are urgently needed for a broad spectrum of professionals working in biological invasions, vegetation succession and associated applied fields (e.g., land-managers, conservationists, governmental and NGO policy-makers involved in landscape restoration and control of invasive species).

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Petr Pyšek
Institute of Botany, Academy of Sciences of the Czech Republic, CZ 252 43 Průhonice
E-mail: pysek@ibot.cas.cz

Mark A. Davis
Department of Biology, Macalester College, 1600 Grand Avenue, Saint Paul, MN 55105 USA
E-mail: davis@macalester.edu

Curtis C. Daehler
Department of Botany, University of Hawai‘i, 3190 Maile Way, Honolulu, HI 96822 - 2279 USA
E-mail: daehler@hawaii.edu

Ken Thompson
Department of Animal and Plant Sciences, The University, Sheffield S10 2TN, UK
E-mail: Ken.Thompson@sheffield.ac.uk

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Frontiers... Not Just a Must-Read but a Want-to-Read

Promoting the science of ecology
Commentary

A History of the Ecological Sciences, Part 13: Broadening Science in Italy and England, 1600–1650

The number of European scientists and their publications increased steadily during the 1500s to the point that science needed social organization beyond what universities provided. Scientists corresponded with each other (Hatch 2000), and botanical gardens and museums were founded, often connected to a university or a city (Impey and MacGregor 1985, Findlen 1994, 2000, Cooper 2000). Italy led the way. In the later 1500s, a Neapolitan nobleman and natural philosopher, Giambattista della Porta (1535–1615) established the first scientific society, Academia dei Segreti (Academia Secretorum Naturae), while still a teenager (Rienstra 1975, Eamon 2000). He was inspired by the literary academies of Naples. He and his group investigated a wide variety of science topics, such as magnetism, optics, distillation, mechanics of water and steam, making plants bloom or fruit out of season, physiognomy, and topics now called pseudo-sciences, such as physiognomy and strange cures—all of which they called natural magic. Porta was a prolific author, whose most famous work, Magia Naturalis, included results from the Academia’s investigations; it first appeared in four “books” in 1558, but grew through many later editions to 20 “books” by 1589. Besides the 12 Latin editions, there were four in Italian, seven in French, two in German, and two in English. The English translation was not published until 1658 and the second edition appeared in 1669.

Although Porta reported discovering small black “seeds” in fungi in his Phytognomonica (1588:240; quoted in English by Ainsworth 1976:14), this did not lead him to conclude that fungi only reproduce by the “seeds” we call spores (Porta 1658:60). One historian of science claimed that in Phytognomonica Porta “set out the first ecological grouping of plants according to their geographical locale and distributions”
(Price 1957), but this claim could only be made by someone unfamiliar with the botanical works by Theophrastos (Egerton 2001). Porta’s discussions of physical sciences in Natural Magic is based to some extent on actual experiments, but his accounts of the generation of animals and production of plants is merely a repetition of traditional beliefs (Porta 1658:27):

*Plants and living Creatures agree both in this, that some of them are generated of seed, and some of them Nature brings forth of her own accord, without any seed of the same kind: some out of putrified earth and plants, as those Creatures that are divided between head and the belly; some out of the dew that lies upon leaves, as Canker-worms; some out of the mud, as shel-creatures; and some out of living Creatures themselves, and the excrements of their parts, as lice.*

There is no explicit evidence that he performed any of the experiments that he explained for making plants bloom or fruit out of season, all of which seem culled out of authorities he cited, and some of which seem unlikely to work, such as grafting grapevines onto cherry trees (Porta 1658: 74–78).

Although the Inquisition shut down Porta’s academy for several years, its activities and his publications later caught the attention of another teenaged nobleman, Federico Cesi (1585–1630). Despite strong opposition from his father, but with his mother’s support, Cesi formulated an ambitions program for the development of science (Drake 1971, Freedberg 2002:1–8). His means for implementing his program was to establish in Rome the second scientific society, Accademia dei Lincei, in 1603 (De Renzi 2000, Miniati 2000). Porta had used the lynx as an emblem on the title page of *Magia Naturalis* (1589) because of its alleged ability to see through walls, and Cesi adopted it as a symbol of his academy’s desire to penetrate the mysteries of nature (Lüthy 1996:7–9). Initially, it consisted of Cesi and three friends in Rome, but Porta joined in 1610 and Galileo in 1611, and after that it grew to about 30 members. The addition of Galileo broadened the Accademia’s agenda beyond natural history to include astronomy and physics; Galileo also introduced his fellow Linceans to the microscope and microscopic studies of animals (Singer 1953, Freedberg 2002:151–154). Galileo’s own “microscope” was merely his inverted telescope, and his account of an insect eye was reported by a Scot, John Wodderborn, who was in Padua in 1610 (Lüthy 1996). The Accademia, however, was so busy publishing Galileo’s telescopic studies and defending his views, that its members did not begin their microscopic studies until 1624, by which time improvements by Kepler or by Drebbel were in use. Also in 1624 a Lincean, Johannes Faber, coined the word “microscope” (Freedberg 2002:183).

The Linceans chose to focus their attention and their microscopes first on the honey bee, which was readily available, but especially because there were three bees on the coat of arms of the Barberini family, one of whom had become Pope Urban VIII in 1623. They wanted his support at a time when various churchmen were already complaining about Galileo’s publications. In 1625 Johan Friedrich Greuter produced for the Linceans the first printed illustration made with a microscope, entitled *Melissographia* and magnified about 20 times (Fig. 2). Also in 1625 Cesi published an accompanying *Apiarium*, a synthesis of everything known about honey bees. Although the Linceans published books of conventional size by Galileo, Cesi chose to publish *Apiarium* as four gigantic sheets, 107 × 69.5 cm (Freedberg 2002:160–192). This awkward format, with small Latin print, greatly limited its dissemination and preservation. The Lincei also used magnification to elucidate various aspects of plants. They discovered that the brown grains on the underside of fern leaves are actually “seeds,” and next they discovered the “seeds” of mosses (Freedberg 2002:225–232).
Despite these discoveries, Cesi, like Porta, still believed that some plants can arise by spontaneous generation (1630; cited from Thorndike 1958: 59). Cesi’s ambitious plans to publish on botany were cut short by his death. A Lincen who did publish important botanical works was Fabio Colonna (1567–1650), though he had published a substantial part of them before he joined the Accademia in 1612 (Greene 1983:Chapter 23, Freedberg 2002).

Another important Lincen project was publication of an abridgement of a natural history of Mexico by Francisco Hernández (1517–1587). Freedberg (2002:246) calls this “the central project of Cesi’s life, as well as that of his fellow Lincens.” Hernández was a Spanish physician who was interested in his country’s natural history.

He began an annotated Spanish translation of Pliny’s *Natural History* in 1566, which he finished while in Mexico in the 1570s, and it was published in Madrid in 1624 (reprinted as Volumes 4, 5, and 5a in Hernández 1959–1976). Felipe II, who had a general interest in science (Pierson 2000), made Hernandez the chief medical officer for Mexico on 11 January 1570, and then sent him there to study its plants, animals, and minerals, with emphasis on medicinal uses (Somolinos d’Ardois 1960, Vernet 1972, Lopez-Piñero 2000a, Varey et al. 2000). Hernández’ heterodox religious–philosophical views might have been a factor in the king’s decision (Benito-Vessels 2000). They assumed that it would take about five years, but in his fourth letter to Felipe, on 30 April 1572, Hernández (2000a:50) reported it might take nine or ten years.
Finally, he accumulated a vast collection of 10 folio volumes of colored paintings and six of verbal descriptions of 3000 plants, 40 quadrupeds, 229 birds, 58 reptiles, 30 insects, 54 aquatic animals, and 35 minerals, and also dried Aztec plants (Chabrán and Varey 2000:4, Freedberg 2002:246–247). Seeds and plants he brought back were planted in Spanish botanic gardens, particularly at Aranjuez (Weiner 2000:8). Although he took notes on geography and climate (Weiner 2000:5) he focused primarily on collecting and describing specimens, presumably intending to organize the collection for publication after he returned. He lived another decade after returning to Spain but never did organize it. That he returned in poor health was perhaps relevant, though there is also the possibility that his heterodox outlook was a factor (Benito-Vessels 2000, Weiner 2000:8). In 1580 he retired, and Felipe II gave his successor, Nardo Antonio Recchi (d.1595), the responsibility of preparing the immense amount of written and illustrated manuscripts for publication. In 1582 Recchi completed his task and returned to his native Naples, carrying his reorganized manuscript with him, under the assumption that he would publish it. But he never did that either. Hernandez had left a copy of his materials in Mexico City, and some of it was published there in 1579 and more in 1615. The latter, entitled Quatro libros de la naturaleza, is now in English (Hernández 2000b:117–156); it may be the earliest natural history book published in the New World. Porta wrote to Ulisse Aldrovandi in 1589 that Hernandez had died of a broken heart when Felipe II’s Council of the Indies told him that his illustrations and descriptions of 4000 plants and animals were of little use “since they were of Indian plants that could not be used in Spain; and besides, the book had no order to it” (Freedberg 2002:248). If Porta’s information was correct, Felipe did not take the advice seriously, since he continued to want to have it published, but the Council might have delayed its publication (Weiner 2000:8–9).

In 1610 Cesi went to Naples to view Recchi’s redaction, which Recci had left to a nephew. He was able to obtain a copy of the text and gained access to the illustrations in 1611. Publishing it occupied Cesi and other Linceans for the rest of their lives (Freedberg 2002:254). The great magnitude of the undertaking caused delays beyond anyone’s imagining. They printed almost 900 pages and 800 illustrations in 1628, and a few copies were published in 1630, but Cesi’s death in that year was a big setback. Colonna published his own botanical works with etchings that show fine details, but there were only 37 of them in his Phytobasanos (1592) and 210 in Ecphrasis (1616). The Linceans could not afford 800 etchings and
made do with simpler woodcuts having less detail. Despite Recchi’s work, their editorial tasks were demanding. There were corrections to be made and commentaries to write (many of which were longer than necessary), and when three churchmen returned from Mexico with additional information on plants and animals, the Linceans were glad to add their contribution (Freedberg 2002:261). The long struggle for publication ended successfully in 1651, but the whole process was so complex that no two copies of *Rerum Medicarum Novae Hispaniae Thesaurus seu Plantarum Animalium Mexicanorum Historia ex Francisci Hernandez* are the same (Varey 2000:xvii–xix, Freedberg 2002:272,). It is reprinted in Hernández’s *Obras Completas* under the title *Historia Natural de Nueva España* (Volumes 2–3).

Another project that occupied the Accademia dei Lincei was a collection of a vast “paper museum” (Freedberg’s term)—well-executed color drawings of plants, animals, and fossils. Unfortunately, due to Cesi’s early death, this impressive contribution to natural history lay buried in European libraries until its recent publication by Freedberg (2002:15–64). Linceans also became quite interested in fossils. Cesi wanted to find a way to classify them. The Linceans commissioned an impressive series of drawings of fossils, and since they published few of them, they were also part of its “paper museum.” Cesi had hoped to publish their findings, and Francesco Stelluti did finally publish a regional study, *Trattato del Legno Fossile Minerale* (1637), in which he implied that he spoke from a consensus of Linceans. He believed that fossil wood “is not generated from the seed or root of any plant whatsoever, but only from a piece of earth, containing much clay” (1637:6, translated by Freedberg 2002:332–333). Freedberg wonders if the struggles Galileo was having with the Catholic Church in the 1620s may have caused Cesi to postpone publication of his own thoughts on the origin of fossils, and then the writer died before he could publish.

An impulse to organize science also arose in England around the same time, but took a different form. Francis Bacon (1561–1626) became both a philosopher and advocate of science, and his influence was as great or greater than Porta and Cesi’s combined, although it came almost entirely after his death (Hesse 1970, Rees 2000a, b, Van Helvoort 2000). Bacon’s education included three years in France to learn Roman law and French, but while there he read the writings of radical education reformer Pierre de La Ramée (1515–1572), famous for his attacks on the sterile teachings of the Aristotelians (Mahoney 1975). Bacon’s prominent career in government undoubtedly lent weight to his pronouncements on science. He attacked the education of the time in *The Advancement of Learning* (1604), but his own attempt to steer science toward meaningful
research was unsuccessful. His posthumous *Sylva Sylvarum* (1627) is largely a compendium of traditional knowledge, as for example: “The moss of trees is a kind of hair; for it is the juice of the tree that is excerned [exuded], and doth not assimulate” (Bacon 1857–1874, Volume 2:511).

Such notions led William Harvey to famously comment that Bacon wrote natural philosophy “like a Lord Chancellor” (Crowther 1960:11). Nevertheless, Bacon was influenced by Porta’s *Natural Magic* to conduct a series of experiments to increase plant growth rate; he grew several plants in water and found they sprouted more quickly than in soil (Bacon 1857–1874, Volume 2:477–478). Bacon’s “Catalogue of Particular Histories by Titles” served later as a list of desirable projects for English scientists; among the titles were (1857–1874, Volume 4:266–267):

19. Natural History of Geography; of Mountains, Valleys, Woods, Plains, Sands, Marshes, Lakes, Rivers, Torrents, Springs...


21. History of the other Accidents of the Sea; its Saltiness, its various Colours, its Depth; also of Rocks, Mountains and Valleys under the Sea, and the like


35. Chemical History of Vegetables.

36. History of Fishes, and the Parts and Generation of them.

37. History of Birds, and the Parts and Generation of them.

38. History of Quadrupeds, and the Parts and Generation of them.

39. History of Serpents, Worms, Flies, and other insects; and of the Parts and Generation of them.

One of the few experiments Bacon actually performed killed him—he took a gutted chicken outside and stuffed snow in it to test its preservative properties, and later died from the effects of his exposure to the cold (Aubrey 1949:16).

![Fig. 6. A much later illustration of Bacon’s Solomon’s House, which he described in *The New Atlantis* (1627).](image)

Animal physiology may not be an ecological science, but the contributions by William Harvey (1578–1657) are nevertheless of interest here. To establish his discovery of the circulation
of the blood, he needed to refute the teachings of Galen, and the only way to do that was to experiment. Ancient and medieval science were overwhelmingly observational sciences. Occasional experimentation, including several experiments by Galen, did not revolutionize scientific methodology. However, when Galileo and Harvey set out to refute Aristotelian physics and Galenic physiology, respectively, the only way to convince skeptics was to perform repeatable experiments (Bylebyl 2000). In doing so, they not only revolutionized their own sciences, but also influenced the methodology of some other sciences. Sciences relevant to ecology were slower than others to adopt experimentation, although Francesco Redi set an example that some of these sciences could have followed. In De motu cordis (1628, 1957), Harvey described experiments he had conducted on dogs, rabbits, snakes (vivisectional), and humans (nonvivisectional). Harvey seemed ambivalent about spontaneous generation of some species. His book on reproduction and embryology (1651) carried a phrase on the frontispiece, “ex ovo omnia” (all are from eggs), that caught the interest of Redi and others, but he nevertheless seemed to accept spontaneous generation for some species (Keynes 1966:352, Lopez-Piñero 2000b). When Harvey investigated the mating habits of the red deer, Cervus elaphus, he could draw upon first-hand experience. As the King’s physician, he often accompanied Charles I on his almost weekly hunts of bucks during the summer and hinds in the fall, and he had opportunities to observe mating and to study and describe deer genitals and embryos. He also gleaned information from the King’s game wardens (Harvey 1847:474–476, Egerton 1961).

A younger fellow physician, Thomas Browne (1605–1682), had an English and Continental medical education comparable to Harvey’s, but he did not aspire to practice among the élite of his hometown, London. He settled instead in Norwich—becoming a big fish in a small pond rather than a little fish in a big pond. Browne’s interests were much broader than Harvey’s, but because of that, his scientific investigations were also more superficial. Browne addressed his broad interests in a very popular book, Pseudodoxia epidemica: or Enquiries Into Very Many Received Tenents and Commonly Presumed Truths (published 1646; Browne 1964). Many contemporaries approved of his desire to separate fact from folklore, but it was a difficult project when one cast one’s net as broadly as he did. Worthy predecessors who had met with only limited success included Pliny, Albertus Magnus, and Gessner. One of the “errors” Browne investigated was the claim by Pliny, Virgil, and others that “Viscus Arboreus or Misseltoe is bred upon Trees, from seeds which Birds, especially Thrushes and Ring-doves let fall thereon…” (Browne 1964, Volume 2:146). If that were true, he wondered, why does it only grow on some of the species in which they perch?

…it groweth upon Almond-trees, Chestnut, Apples, Oaks, and Pine-trees... Crab[apple]s, and White-thorn; sometimes upon Sallow, Hazel, and...rarely upon Ash, Lime-tree, and Maple; never, that I could observe, upon Holly, Elm, and many more.

Browne was inclined to agree with Bacon that mistletoe is “an arboreous excrescence, or rather super-plant, bred of a viscous and superfluous sap which the tree it self cannot assimilate.” Browne collected galls from oaks and other plants in November and found that little maggots in them became flies in June. From these observations he concluded that “…if the putrifying juices of bodies bring forth plenty of Flies and Maggots, they give testimony of common corruption, and declare that the Elements are full of the seeds of putrifaction, as the great number of Caterpillars, Gnats, and ordinary Insects do also declare (Browne 1964, Volume 2:151–152). He easily dismissed such claims as elephants having no joints in their legs, horses having no gall, and badgers having legs on
one side longer than on the other side. When he tackled the claims of great longevity for animals he employed several kinds of evidence.

Aristotle had noted some correlation between gestation period, maturation period, and longevity. An elephant, which might live to be a hundred, has a gestation period of a year and takes 20 years to mature. Sheep and goats, which live only 8 or 10 years, have a gestation period of five months and reach maturity in two years. Therefore, “Deer that endureth the womb but eight moneths, and is compleat at six years, from the course of Nature, we cannot expect to live an hundred; nor in any proportional allowance much more then thirty” (Browne 1964, Volume 2:181). Furthermore, animals like deer that have “excess of venery” do not live as long as those that do not. Some species (as Aristotle noted) can also be aged by their horns and teeth. In the case of deer, “From the horns [antlers] there is a particular and annual account unto six years: they arising first plain, and so successively branching: after which the judgment of their years by particular marks becomes uncertain. But when they grow old, they grow less branched, and first do lose their propugnacula; that is, their brow-antlers…. In old age they have few or none [teeth] in either jaw” (Browne 1964, Volume 2:183). Later editions of Pseudodoxia Epidemica appeared in 1650, 1658, 1669, and 1672—all containing revisions and additions. That book was not the end of his writings, however. He also wrote “Miscellany Tracts,” which were not refutations of “errors”; these essays were only published posthumously in 1683. Among them was “Of Hawks and Falconry, Ancient and Modern,” which is an intelligent summary of lore from many sources, except that he was obviously unaware of Frederick II’s De arte venandi cum avibus, which had been printed in 1596 (Browne 1964, Volume 3:60–64, Egerton 2003:43). International communication among scholars was improving, but was still quite modest by modern standards. Browne’s Garden of Cyrus (1658) will be discussed in Part 14 of the History of the Ecological Sciences.

Italy and England provided good environments for the expansion of science, 1600–1650, but so did France and The Netherlands. Germany was suffering through the Thirty Years War, 1618–1648.

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Frank N. Egerton
Department of History
University of Wisconsin-Parkside
Kenosha, WI 53141
E-mail: frank.egerton@uwp.edu
Nature’s Surprises

A great conceptual, ecologically inspired revolution in environmental management has occurred during the last half century. It has rejected the unscientific, exploitive, and shortsighted traditional approach of dividing species into useful and harmful, and doing everything possible to get rid of obnoxious weeds, bugs, and vermin. The new approach, associated with the names of Aldo Leopold, Rachel Carson, and Edward Wilson, unites all life into the harmonious whole of biodiversity, a term which has become the scientific equivalent of nature distilled from romantic and mystic connotations.

It is not only in politics that revolutions are challenged by reaction. We have two problems on our hands: to document the harm of the old way and justify the benefit of the new. Neither problem can be solved easily. Unfortunately, along with our food and fluffy birds, biodiversity includes chiggers, ticks, SARS viruses, and other pests. Attaching value in billions of dollars to whales and ocean breeze without accounting for droughts, hurricanes, pestilence, and other calamities caused by “ecosystem services” is not entirely honest. Any audit would bring to court such sloppy bookkeeping.

The traditional approach, which we have practiced since the origin of our species, also has two sides, expected and unexpected. Its expected achievements are spectacular: monocultures of wheat, rice, and other mostly exotic plants have brought unprecedented welfare. What is not expected is that, despite all our efforts and the miracles of chemistry, genetics, and other sciences, we have hardly eliminated a single harmful species (except, perhaps, smallpox, one of the world’s most dreaded plagues, presently confined in test tubes somewhere). Nor have we produced any useful species.

While these biological surprises deal with nature outside us, a host of other mysteries involve our inner nature. They are critical for our existence and yet barely recognized. It is curious to compare things that concern us with those we do not care about. What worries us now is the very attempt to divide nature into useful and harmful parts. These worries about biodiversity condense into an apocalyptic question about us: can we survive by picking and choosing which plants and animals will cohabit the earth?

New answer

While the traditional answer was the unreflective, “Yes,” the answer that has resulted from the intellectual and management revolution of the last decades is the informed “No.” Biodiversity is not just the total number of species or even organisms, but is, as defined by Wilson (1994: 359), who introduced the term “biodiversity,” “the totality of hereditary variation in life forms, across all levels of biological organization, from genes and chromosomes within individual species to the array of species themselves and finally, at the highest level, the living communities of ecosystems such as forests and lakes.” To maintain biodiversity, we must preserve not only living organisms but their environments as well, which includes such extraterrestrial factors as sunlight. In short, as Wilson acknowledged in 1997, biodiversity embraces everything. The reasons for preserving biodiversity in its entirety can be summarized as follows.

1. Interconnectedness of life

What are referred to as “ecological laws” usually mean that everything is connected with everything else. This is why all of biodiversity is necessary; it is indivisible like a living organism. As Aldo Leopold (1966:176–177) put it: “The land is one organism” ... it is “an organic community and a sacramental whole” ... “To keep every cog and wheel is the first precaution of intelligent tinkering.”

There are many stories about the unpredictable
and often calamitous consequences of the removal or introduction of a species. The most influential of these stories, told by Darwin, is about humble bees, which, he believed, was the only species in England capable of pollinating red clover. The number of bees depends on the number of field mice, which destroy bee’s combs and nests. In its turn, the abundance of mice is controlled by cats. This story illustrates so neatly the interconnectedness in nature that it merited in Darwin’s writings a rare exclamation point: “Hence it is quite credible that the presence of a feline animal in large number in a district might determine, through the intervention first of mice and then of bees, the frequency of certain flowers in that district!” (Darwin 1859:74).

Extending this reasoning, it was suggested that some ecological knowledge would make the life of Englishwomen happier (Egerton 1973). A large proportion of cats belonged to spinsters who kept them for company; the women remained unmarried because eligible men served in the navy where they ate dried beef that came from cattle, which grazed in the clover fields pollinated by humble bees. By keeping their cats confined, the women could bring the men home and the British Empire down long before it actually fell, because as the mice increased, the number of bees, clover, cattle, and sailors would all dwindle.

2. Mutual benefits of species coexistence

The interconnectedness of life may go beyond the good of an abstract community and benefit each member as well. Being indispensable to the functioning of the whole, each species is useful to any other. “If the land mechanism as a whole is good, then every part is good, whether we understand it or not” (Leopold). Even foresters, traditionally imbued with the notion of competition, have recently started changing their minds. As reported in a leading journal of science, Nature (Read 1997:518), foresters discovered that the disadvantaged fir seedlings vegetating “in the gloom of the forest floor” are “subsidized by fully illuminated overstory plants, through pathways provided by their fungal symbionts.” This “wood-wide web” “would be expected to reduce dominance of aggressive species, so promoting coexistence and greater biodiversity.

3. Superior ethics

Beyond biological and utilitarian reasons, there are higher, ethical considerations for preserving life in its entirety. Even if it was sanctioned in ancient books, our exploitative domination over other species is unfair and unjust. The underlying belief in the superiority of humans is similar to racism and is as outrageous. It is time to discard the outmoded anthropocentrism in favor of ecocentrism, which proclaims that all entities (including humans) should have the freedom to unfold in their own way, and fully realize their inherent potential, unhindered by human domination. Ecocentrism enhances and expands upon the most cherished values: unselfishness, justice, and equality. It picks up the torch of moral righteousness dropped with the collapse of Communism.

Are the reasons reasonable?

To preserve biodiversity we need to know what is and is not biodiversity. However, being everything, biodiversity can neither be defined nor lost. When one species disappears, others proliferate. Another problem is that diseased organisms, full of parasites and pathogens, are more biologically diverse than healthy ones. And corpses are still more “biodiverse.” As modern scientists have shown, living tissue made of many species constitutes as much as 20% of rotten logs. In contrast, living cells of a single species account for only 5% of a healthy tree (the rest being dead wood). As one of these scientists said, “Somebody made a mistake. The tree that’s green and standing up is the one they should have called “dead.”
tree down on the ground is the one that’s really alive.” (Luoma 1999: 80). Following his logic, this scientist and each of us should be pronounced dead until we are alive.

Biodiversity is often compared with a library full of unique books. Losing a species is like burning a book before we can read it and create wealth from the recipes on its pages. There are several problems with this attractive image. One is that we cannot exist just by reading books; biodiversity is not only our library but our pantry as well. Another problem is that some of these recipes are far from benign: they spell out how to kill or hurt us. In addition to being our library and pantry, biodiversity is also a factory producing many creatures according to those deadly recipes. It is true that biodiversity is our greatest treasure; equally, it is our greatest curse. The life of any organism is a constant struggle to separate the good side of nature from its bad side. We owe our lives to the success of this separation. The biodiversity movement misleads and disarms us by lumping harmful and useful species together.

1. Is everything connected?

If indeed everything were interconnected, the loss of a species would destroy an ecosystem. Facts show something else: while an organism disintegrates or becomes dysfunctional with the loss of a single limb, a field is not ruined when not just one but all native plants and animals are replaced by a single introduced species, such as wheat in the Great Plains. In fact, the eradication of competing vegetation is a prerequisite for growing agricultural crops and our existence.

Nature is not so much a coordinated system, a superorganism, as a collection of loosely connected components, many of which are redundant or accidental. Unlike organisms, in which resources are distributed and members grow according to a genetically coded blueprint, no central control exists in ecosystems. Each part of an organism benefits the others and they usually survive or die together. In contrast, many components of an ecosystem thrive at the expense of others. Each biotic part of an ecosystem, an organism, is much more complex than the ecosystem itself. The reverse is true for the organism: its parts are simpler than the whole. The belief that “everything is connected with everything” makes ecology similar to astrology and as plausible.

Checking the validity of Darwin’s story illustrates the limits of environmental determinism. It was found that one of the two species of red clover is self-pollinated, while the other is pollinated by common honey bees, in addition to humble bees (Egerton 1973). Field mice only infrequently bother humble bees, and even less frequently honey bees. In reality, kingdoms and empires are lost for the want of a nail less frequently than in fairy tales.

2. Are benefits mutual?

Lice and polio viruses may find humans useful, but their return contribution to our welfare is less obvious. Similarly, although insect excrements may enrich the soil and thus benefit plants, those feces are hardly a fair compensation for the harm done by infestation. Returning to the example of sharing among trees, the study reported in Nature did not document that illuminated trees voluntarily donated their lifeblood to disadvantaged neighbors, as implied by Nature’s commentary entitled “The ties that bind” (Read 1997). Until such proof is found, the presumed “donation” is as valid as the claim that we willingly feed mosquitoes or gadflies. It seems that Nature mistook elementary parasitism for altruism. A more appropriate title for Nature’s commentary would be “The ties that blind.”

3. Human ethics

Consider two main propositions of ecocentrism: (1) all species and organisms have inherent value and various rights, of which the right to exist is
paramount; and (2) as the only species capable of formulating and recognizing these rights, we humans have the obligation to respect them. These two propositions are contradictory. To exercise our right to exist, we have to eat, which means killing or exploiting other organisms—the actions prohibited to us by the second proposition.

In its diluted form, ecocentrism recognizes the rights of species rather than individual members. Like any equivocal position, it brings too many awkward questions. Is it ethical to love an abstract species and to kill tangible individuals? What proportion of a target species can be harvested without transgressing ecocentrism? Whatever answers are given to these questions, diluted ecocentrism sounds more like hypocrisy than ethical teaching. The only viable position for us is anthropocentrism. It does include care and responsibility for other creatures, except fleas, ascarides, and the like. By emitting much smoke, torches of moral righteousness are often dirty, and, in addition to physical pollution, obscure judgment.

What to heal?

Ostensibly, the biodiversity movement is concerned with problems in nature outside us. Yet the suicidal tendency implicit in the propositions of ecocentrism points to problems in our inner nature, which encompasses the characteristics—pivoted around the instinct of self-preservation—that make us adapted. Each generation hears alarms about the end of the world and admonitions to behave. The orthodox cause was internal: moral degradation. This time it is external: environmental destruction. Although the cause is spurious, the current alarm is not false. The end is in view, at least for the still sizeable part of humanity that has created the civilization, which for the first time in history relieved us from hunger and a wretched life. The majority of people in the world owe their very existence to the achievements of this civilization, such as tractors and antibiotics.

It is incredible that we are on the brink of extinction precisely when, after surviving millennia of starvation and misery, we have created the world of plenty. The fertility of the peoples who developed ethics, science, and technology of the civilization of freedom and abundance is below the replacement rate (presently, 2.1 children born to a woman during her lifetime). The fertility rate has fallen to 1.2 in Italy, one of the oldest centers of our civilization. In all of Western Europe and Japan the rate is 1.5. This means that in less than seven generations the number of those peoples will dwindle to one-tenth of the current number. The least fertile (that is, most self-destructing) are the same urban intellectuals who worry most about environmental destruction.

Equally strange is our indifference to these well-known and incontrovertible facts. We are more concerned with a presumed plight of obscure insects in a remote Peruvian valley than with our own fate. There are government and nongovernmental organizations and regulations dealing with declining populations of kangaroo rats, but not of humans. We behave as if some evil spell anaesthetized our basic instinct of self-preservation (which includes raising children and grandchildren). It is hard to chase away this spell because it is another side of our prosperity. We crave it but are not adapted to it.

To exist, any organism constantly struggles to separate the good side of nature from the bad side. Due to the brilliance of our species, we are more successful than others in disarming the external forces that harm us. Damage to nature done in the process is greatly exaggerated; the constructive destruction of evolution goes on as ever. Inadvertently, as if to reassert or restore some kind of interconnectedness and balance in the world, real damage is done to our inner nature. It needs healing badly.

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Boris Zeide
School of Forestry
University of Arkansas
Monticello, AR 71656-3468
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Please note that all material for publication in the *Bulletin* must be sent to the Editor. Materials sent to any address except that of the Editor, given below, must then be forwarded to the Editor, resulting in delay in action on the manuscripts. Send all contributions, except those for Technological Tools, Ecology 101, and Obituaries/Resolutions of Respect (see addresses below), to Allen M. Solomon, Bulletin Editor-in-Chief, U.S. Environmental Protection Agency, 200 S.W. 35th Street, Corvallis, OR 97333. Phone: (541) 754-4772. Fax: (541) 754-4799. E-mail: bulletin@esa.org.

**MANUSCRIPT PREPARATION:** The manuscript should be submitted as a WordPerfect or Microsoft Word (for Mac or DOS) manuscript, preferably as an e-mail message attachment to bulletin@esa.org. E-mailed photographs and diagrams must be in .tif or .eps format. Other forms of electronic copy (text embedded in e-mail messages, diskettes sent by post) or hard copy can be submitted if absolutely necessary. If formatting could be troublesome (e.g., tables, European alphabet characters, etc.), hard copy also should be sent via fax to Allen M. Solomon at (541) 754-4799, or via post. Hard-copy manuscripts should be double-spaced, with ample margins. Plain formatting must be used on hard-copy and electronic manuscripts. PLAIN FORMATTING consists of a single font of a single size, left justification throughout, line spacing the same throughout, and up to three different weights of headings. Other formats will not be accepted for publication. The author should THOROUGHLY PROOF the manuscript for accuracy, paying special attention to phone and fax numbers and web site and e-mail addresses, which are frequently incorrect.

**COVER PHOTOGRAPHS:** The photo should illustrate ecological processes or an ecological research design. The covers of the June, September, and December 1993 issues are good examples. It helps if the colors in the photo are bright, although black and white photos are especially sought if they are well composed with good contrast, as in the March 1993 issue.

Send a single 5 x 7 or 8 x 10 photo to the *Bulletin*. On an accompanying photocopy, give your name, address, a photo legend up to 100 words, and, if the photo describes a paper in ESA or in another journal, the literature citation or title of the accepted manuscript. If you wish unused photos to be returned please include a self-addressed return envelope.

**LETTERS TO THE EDITOR AND COMMENTARIES:** Please indicate if letters are intended for publication as this is not always obvious. The *Bulletin* publishes letters, longer commentaries, and philosophical and methodological items related to the science of Ecology. There are no page limits but authors may be asked to edit their submissions for clarity and precision. Previously published items from other sources can be republished in the *Bulletin* if the contributor obtains permission of the author and the copyright holder, and clearly identifies the original publication.

**MEETINGANNOUNCEMENTS:** Submit a brief prose description of the upcoming meeting, including title, a short paragraph on objectives and content, dates, location, registration requirements, and meeting contact person’s name, street address, and phone/fax/e-mail address. Please do not submit meeting brochures in the expectation that the Editor will write the prose description; he won’t. Compare the publication deadlines above with the meeting deadlines to be sure the announcement will appear in time.

**MEETING REVIEWS:** The *Bulletin* publishes reviews of symposia and workshops at the annual ESA meeting, as well as important and appropriate meetings that are unrelated to the annual ESA meeting. The reviewer should strive for a synthetical view of the meeting or symposium outcome, i.e., how the various presentations fit or conflict with each other and with current scientific thought on the topic. Review length is open, although about four double-spaced pages should be enough to capture the essence of most meetings.

The following advisory items are provided to help focus your review.

a) Meeting title, organizer, location, sponsoring organizations?

b) What were the meeting objectives, i.e., what scientific problems was the meeting organized to solve? Who cares (i.e., what was the relevance of this scientific problem to related ones under examination)?

c) How well did the meeting meet the objectives? Were there specific papers delivered or roundtables/discussion groups that were exemplary in reaching the objectives? You may concentrate the review on only the outstanding papers to the exclusion of all others, or give a comprehensive view of all presentations/meeting activities, or examine a selection of papers that neither describes all, nor focuses on a very few.

d) What new was discussed? What previously weak hypotheses were strengthened, confirmed or supported? Were any breakthroughs, or new or innovative hypotheses presented, that forced participants to rethink current concepts?

e) Was there anything else important that the meeting accomplished that may not have been part of its explicit objectives?

f) What subjects relevant to the meeting objectives were missing or left out? Did the scientific components of the problem that were included produce a strong slant or serious void by virtue of blind spots by the organizers, failure of invitees to appear, or similar difficulties?

g) Are there plans for a proceedings issue or meeting summary document, and if so who is editing it, who is publishing it, and when is it planned to appear (i.e., where can interested folks learn more about the meeting?)

**TECHNOLOGICAL TOOLS:** Submissions for this section should be sent to the Section Editor in charge of the section: Dr. David Inouye, Department of Zoology, University of Maryland, College Park, MD 20742. E-mail: di5@umail.umd.edu

**ECOLOGY 101:** Submissions should be sent to the Section Editor in charge of this section: Dr. Harold Ornes, College of Sciences, SB 310A, Southern Utah University, Cedar City, UT 84720. E-mail: ornes@suu.edu

**FOCUS ON FIELD STATIONS:** Correspondence and discussions about submissions to this section should be sent to Allen M. Solomon, Bulletin Editor-in-Chief, U.S. Environmental Protection Agency, 200 S.W. 35th Street, Corvallis, OR 97333. Phone: (541) 754-4772. Fax: (541) 754-4799. E-mail: bulletin@esa.org.

**OBITUARIES AND RESOLUTIONS OF RESPECT:** Details of ESA policy are published in the *Bulletin*, Volume 72(2):157–158, June 1991, and are abstracted below. The death of any deceased member will be acknowledged by the *Bulletin* in an Obituary upon submission of the information by a colleague to the Historical Records Committee. The Obituary should include a few sentences describing the person’s history (date and place of birth, professional address and title) and professional accomplishments. Longer Resolutions of Respect, up to three printed pages, will be solicited for all former ESA officers and winners of major awards, or for other ecologists on approval by the President. Solicited Resolutions of Respect will take precedence over unsolicited contributions, and either must be submitted to the Historical Records Committee before publication in the *Bulletin*. 126 Bulletin of the Ecological Society of America