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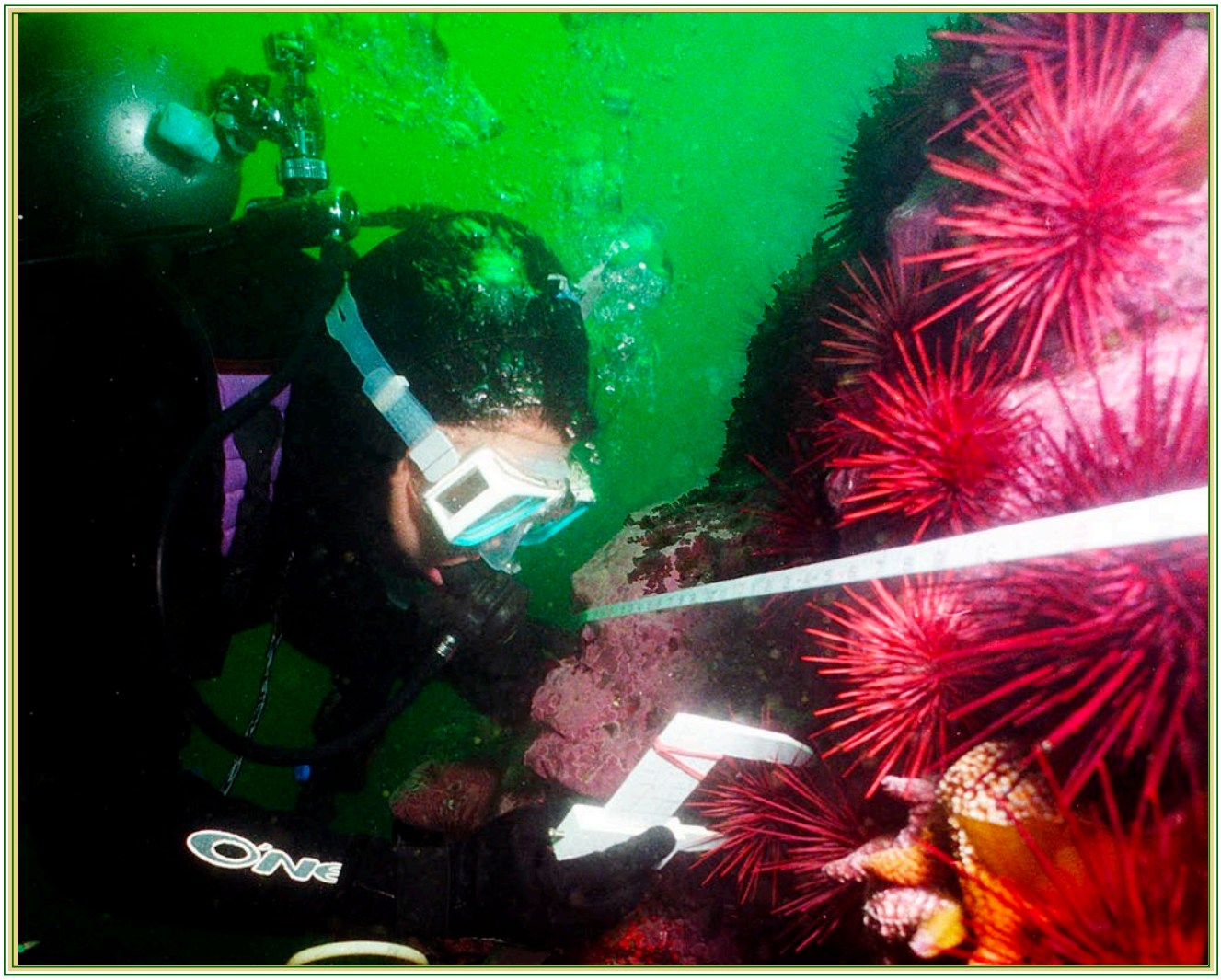
Bulletin

OF THE ECOLOGICAL SOCIETY OF AMERICA



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A quarterly online publication of the Ecological Society of America

‹http://www.esapubs.org/bulletin/current/current.htm›

The Ecological Society of America

GOVERNING BOARD FOR 2005–2006

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 2006 are as follows:

Regular member:		Student member:	$25.00
Income level	Dues	Life member:	Contact Member and Subscriber Services (see below)
<$40,000	$50.00	Emeritus member:	Free
$40,000–60,000	$75.00		
>$60,000	$95.00	Subscriptions to the journals are not included in the dues.	

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› and contains supplemental material to ESA journal articles and data papers.

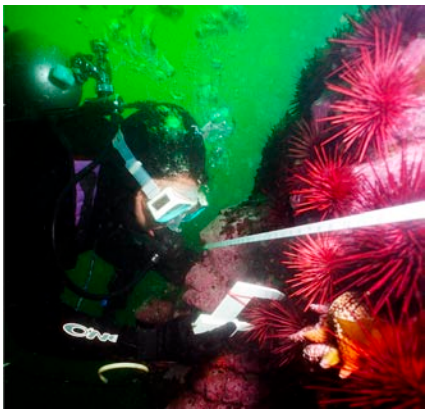
No responsibility for the views expressed by the authors in ESA publications is assumed by the editors or the publisher, the Ecological Society of America.

Subscriptions for 2006 are available to ESA members as follows:

	Regular	Student		
Ecology	$65.00	$50.00	Frontiers in Ecology	Free to members
Ecological Monographs	$30.00	$25.00	Bulletin of the Ecological Society of America	Free to members
Ecological Applications	$50.00	$40.00	Ecological Archives	Free

Application blanks for membership may be obtained from the Ecological Society of America, Member and Subscriber Services, 1707 H Street, N.W., 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.

For additional information on the Society and its publications, visit ESA's home page on the World Wide Web ‹http://esa.org›.



Cover Photo: A SCUBA diver, Jos Selig, measuring red abalone (*Haliotis rufescens*), and red sea urchins (*Strongylocentrotus franciscanus*), along a 30-m transect at Point Cabrillo State Marine Conservation Area, in Mendocino County, northern California. Elasticity analyses of size-based matrix models can be used to determine which size classes of abalone have the most influence on population growth, aiding in the management and conservation of abalone in California. This photo was taken while collecting data used by L. Rogers-Bennett and R. T. Leaf to model red abalone populations. For more information read "Elasticity analyses of size-based red and white abalone matrix models: Management and conservation in California" to be published in *Ecological Applications* **16**(1), February 2006.

Click here for more photographs submitted by our scientific journal authors.

VOLUME 86, NO. 4, OCTOBER 2005

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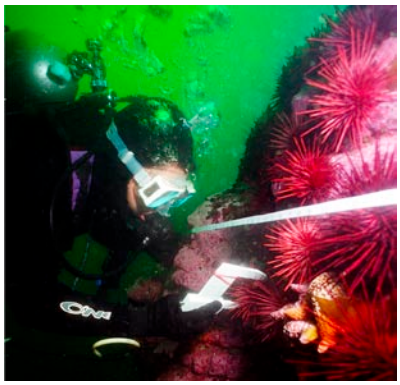


Announcements

Society Notices

Call for Nominations: ESA Awards

The Awards Committee of the Ecological Society of America solicits and encourages nominations from members of the ESA for each of the awards listed below. *ESA especially encourages nominations of candidates from traditionally underrepresented groups, including women and minorities*. In preparing a nomination, it would be helpful to consult with the Chair of the specific award subcommittee or the Awards Committee Chair. More information about the process is available on ESA's web page ‹http://www.esa.org› under ESA Awards.

Nomination schedule

To be given full consideration, nominations for awards should be completed by **30 November 2005**. They should be submitted directly to Chairs of the specific award subcommittees (e-mail addresses below) or to the Awards Committee Chair, Judith L. Bronstein, Department of Ecology and Evolutionary Biology, University of Arizona, Tucson, Arizona 85721, (520) 621-3534, fax (520) 621-9190, ‹judieb@email.arizona.edu›. A complete statement on policies and procedures for the ESA Awards may be obtained by contacting the address above.

Robert H. MacArthur Award

The MacArthur Award is given to an established ecologist in mid-career for meritorious contributions to ecology, in the expectation of continued outstanding ecological research. Nominees may be from any country and need not be ESA members. This award is given in alternate years, and the recipient is invited to address the membership at the Annual Meeting following his/her selection. Recent recipients include Stephen R. Carpenter, James H. Brown, and May Berenbaum. Nominations consisting of a letter of nomination, up to two supporting letters, and a recent CV should be sent to Robert Colwell, Chair of the ESA MacArthur Award Subcommittee ‹colwell@uconn.edu›.

Eminent Ecologist Award

The Eminent Ecologist Award is given to a senior ecologist in recognition of an outstanding body of ecological work or of sustained ecological contributions of extraordinary merit. Nominees may be from any country and need not be ESA members. Recipients receive lifetime active membership in the Society. Recent recipients include Charles Krebs, Richard Root, Sam McNaughton, and Lawrence Slobodkin. To submit a nomination, contact Paul Dayton, Chair, Eminent Ecologist Award Subcommittee ‹pdayton@ucsd.edu›.

Odum Education Award

The Eugene P. Odum Award recognizes an ecologist for outstanding work in ecology education. This award was generously endowed by, and named for, the distinguished ecologist Eugene P. Odum. Through teaching, outreach, and mentoring activities, recipients of this award have demonstrated their ability to relate basic ecological principles to human affairs. Nominations recognizing achievements in education at the university, K–12, and public levels are all encouraged. Recent recipients include Alan Berkowitz, Richard Root, and James Porter. To submit a nomination, contact Charlene d'Avanzo, Chair, ESA Odum Education Award Subcommittee ‹cdavanzo@hampshire.edu›.

Honorary Member Award

Honorary Membership in the Society is given to a distinguished ecologist who has made exceptional contributions to ecology and whose principal residence and site of ecological research are outside of North America. Up to three awards may be made in any one year until a total of 20 is reached. Nominations of women and minority candidates, as well as those from developing countries, are especially encouraged. Recent honorees include Norman Owen-Smith, Madhav Gadgil, Carlos Herrera, and Erkki Haukioja. To submit a nomination, contact Sandra Tartowski, Chair, Honorary Member Award Subcommittee ‹slt2@cornell.edu›.

George Mercer Award

The Mercer Award is given for an outstanding ecological research paper published by a younger researcher (the lead author must be 40 years of age or younger at the time of publication). If the award is given for a paper with multiple authors, all authors will receive a plaque, and those 40 years of age or younger at the time of publication will share the monetary prize. The paper must have been published in 2004 or 2005 to be eligible for the 2005 award. Nominees may be from any country and need not be ESA members. Recent recipients include Jean L. Richardson, John Stachowitz, and Daniel Bolnick. Nominations should be sent to Ellen Simms, Chair, Mercer Award Subcommittee ‹esimms@berkeley.edu›.

W. S. Cooper Award

The W. S. Cooper Award is given to honor an outstanding contributor to the fields of geobotany and/or physiographic ecology, the fields in which W. S. Cooper worked. This award is for a single contribution in a scientific publication (single or multiple authored). Nominees need not be ESA members and can be of any nationality. Recent recipients include David Foster and coauthors; Jack Williams and coauthors; and Daniel Gavin and coauthors. Nominations should be sent to Steven Jackson, Chair, Cooper Award Subcommittee ‹jackson@uwyo.edu›.

Distinguished Service Citation

The Distinguished Service Citation is given to recognize long and distinguished service to the ESA, to the larger scientific community, and to the larger purpose of ecology in the public welfare. Recent recipients are H. Ronald Pulliam, Allen M. Solomon, Jim Reichman, and Jim MacMahon. To submit a nomination, contact Paul Dayton, Chair, Distinguished Service Citation Subcommittee ‹pdayton@ucsd.edu›.

Sustainability Science Award

The Sustainability Science Award is given to the authors of a scholarly work that makes the greatest contribution to the emerging science of ecosystem and regional sustainability through the integration of ecological and social sciences. One of the most pressing challenges facing humanity is the sustainability of important ecological, social, and cultural processes in the face of changes in the forces that shape ecosystems and regions. This ESA award is for a single scholarly contribution (book, book chapter, or peer-reviewed journal article) published in the last 5 years. Nominees need not be ESA members and can be of any age, nationality, or place of residence. Recent recipients are Marten Scheffer and colleagues, and Thomas Dietz and colleagues. To submit a nomination, please contact Terry Chapin, Chair of the Sustainability Science Award Subcommittee ‹terry.chapin@uaf.edu›.

Corporate Award

The Corporate Award is given to recognize a corporation, business, division, program, or an individual of a company for accomplishments in incorporating sound ecological concepts, knowledge, and practices

into planning and operating procedures. This award was designed to encourage use of ecological concepts in business and private industry and to enhance communication among ecologists in the private sector. Educational institutions and government agencies are not eligible for this award. Recent recipients of the Corporate Award include Adam Davis of EPRI Solutions, Cornell University's Department of Utilities and Energy Management, Norm Thompson Outfitters, Taylor Guitars, and Bon Appétit Management Company.

The award can be made each year in any one of the following six categories:

A) Environmental Education:

Organizations producing educational materials in print, film, video, software, or multimedia formats; conducting workshops or training sessions; or providing other types of educational products or services that are primarily concerned with environmental education.

B) Stewardship of Land Resources:

Organizations concerned with the use of land resources, land-use planning, multiple use of land resources, resource extraction, land development, and related activities.

C) Resource Recycling:

Organizations concerned with the recovery, reclamation, or recycling of natural resources such as wood and paper products, glass, metals, waste water, and related residuals.

D) Amelioration of Risks from Hazardous and Toxic Substances:

Organizations concerned with the safe manufacturing, distribution, and use of hazardous and toxic substances, those concerned with the identification and reduction of risks, as well as those in mitigative and restorative activities.

E) Sustainability of Biological Resources in Terrestrial Environments:

Organizations concerned with forestry, wildlife management, range management, and agroecosystems, including areas such as soil conservation, integrated pest management, fertilization, irrigation, hybridization, and genetic engineering.

F) Sustainability of Biological Resources in Aquatic Environments:

Organizations concerned with aquaculture and commercial fishing, including shellfishing and related industries; sports fishing, boating, and related recreational uses; lake management and restoration; wetlands protection and restoration; channelization; dredging; and related activities.

Nominations for the Corporate award may be made by industrial representatives, government officials, the general public, ESA members, or by members of the ESA Corporate Award Subcommittee. To submit a nomination or to obtain more information about the nomination procedure, please contact Laura Huenneke, Corporate Award Subcommittee ‹Laura.Huenneke@nau.edu ›.

STUDENT AWARDS FOR EXCELLENCE IN ECOLOGY

Murray F. Buell Award and E. Lucy Braun Award

Murray F. Buell had a long and distinguished record of service and accomplishment in the Ecological Society of America. Among other things, he ascribed great importance to the participation of students in meetings and to excellence in the presentation of papers. To honor his selfless dedication to the younger generation of ecologists, the Murray F. Buell Award for Excellence in Ecology is given to a student for the outstanding oral paper presented at the ESA Annual Meeting.

E. Lucy Braun, an eminent plant ecologist and one of the charter members of the Society, studied and mapped the deciduous forest regions of eastern North America and described them in her classic book, *The Deciduous Forests of Eastern North America*. To honor her, the E. Lucy Braun Award for Excellence in Ecology is given to a student for the outstanding poster presentation at the ESA Annual Meeting.

A candidate for these awards must be an undergraduate, a graduate student, or a recent doctorate not more than 9 months past graduation at the time of the meeting. The paper or poster must be presented as part of the program sponsored by the Ecological Society of America, but the student need not be an ESA member. To be eligible for these awards the student must be the sole or senior author of the oral paper (Note: symposium talks are ineligible) or poster. Papers and posters will be judged on the significance of ideas, creativity, quality of methodology, validity of conclusions drawn from results, and clarity of presentation. While all students are encouraged to participate, winning papers and posters typically describe fully completed projects. The students selected for these awards will be announced in the *ESA Bulletin* following the Annual Meeting. A certificate and a check for $500 will be presented to each recipient at the next ESA Annual Meeting.

If you wish to be considered for either of these awards at the 2006 Annual Meeting, you must send the following to the Chair of the Student Awards Subcommittee: (1) the application form below, (2) a copy of your abstract, and (3) a 250-word or less description of why/how the research presented will advance the field of ecology. Because of the large number of applications for the Buell and Braun awards in recent years, applicants may be pre-screened prior to the meeting, based on the quality of the abstract and this description of the significance of their research. The application form, abstract, and research justification must be sent by mail, fax, or **e-mail (e-mail is preferred; send e-mail to sacchi@kutztown.edu)** to the Chair of the Student Awards Subcommittee: Dr. Christopher F. Sacchi, Department of Biology, Kutztown University of PA, Kutztown, PA 19530 USA. If you have questions, write, call (610) 683-4314, fax (610) 683-4854, or **e-mail: sacchi@kutztown.edu**. You will be provided with suggestions for enhancing a paper or poster. The deadline for submission of form and abstract is 1 March 2006; applications sent after 1 March 2006 will not be considered. **This submission is in addition to the regular abstract submission.** Buell/Braun participants who fail to notify the B/B Chair by 1 May of withdrawal from the meeting will be ineligible, barring exceptional circumstances, for consideration in the future. Electronic versions of the Application Form are available on the ESA web site, or you can send an e-mail to **sacchi@kutztown.edu** and request that an electronic version be sent to you as an attachment.

Application Form for Buell or Braun Award

Name _____

Current Mailing Address _____

Current Telephone _____

E-mail _____

College/University Affiliation _____

Title of Presentation _____

Presentation: Paper (Buell Award) _____ Poster (Braun Award) _____

At the time of presentation I will be (check one):
_____an undergraduate student _____a graduate student_____a recent doctorate not more than 9 months past graduation

I will be the sole ____ /senior ____ author (check one) of the paper/poster.

Signed (electronic signatures are OK)

Please attach a copy of your abstract and 250-word or less description of why/how the research presented will advance the field of ecology.

2005 Student Awards Judges

The 2005 Student Awards Selection Subcommittee, Christopher F. Sacchi (Chair), Anita Davelos Baines, Judie Bronstein, Peter Kotanen, Paul Marino, and J. Alan Yeakley, thank the following individuals for judging presented papers and posters at this year's Annual Meeting in Montreal, Canada.

Lynn Adler
Peter Adler
Roger Anderson
Sara Baer
Randy Balice
Caroline Bampfylde
Jayne Belnap
Rick Black
Dee Boersma
Dorothy Boorse
David Boose
Jere Boudell
John Briggs
Judie Bronstein
Jill Bubier
Yvonne Buckley
David Busch
Jeb Byers
Prassede Calabi
Hilary Callahan
Chris Caruso
Norm Christensen
Louise Comas
William J. Cromartie
Irina Danielova
Jared DeForest
Joseph Fail
Sylvia Fallon
Joe Fargione
Adrien Finzi
Jeremy Fox
Stephen Freedman
Tadashi Fukami
Janice Golding
Lou Gross
Jeff Herrick
Brett Goodwin
Paul Grogan
Kevin Gross
Caleb Hickman
Karen Holl
Nat Holland
Claus Holzapfel
Jeff Houser
Robert Humston
Jonathan Jeschke
Adam Kay
Catherine Kleier
Brian Kloeppel
Jessica Knapp
Mary Beth Kolozsvary
Nicola Koper
Abby Kula
Sharon Lawler
Josh Leffler
Deborah Letourneau
Kathleen LoGiudice
Stephen Main
Jennifer Mattei
Audrey Mayer
Paul Mayer
Kathy McGrath
Wendy McIntyre
Scott Meiners
Michael Melampy
Beth Middleton
Shahroukh Mistry
Charles Mitchell
Randy Mitchell
S Raghu
Tara Rajaniemi
Kiyoko Miyanishi
Sherri Morris
Karen Nelson
Chris Paradise
Brian Pedersen
Karl Polivka
Evan Preisser
Tom Romdal
Bill Romme
Jay Rosenheim
M Rudnicki
Patricia Saunders
Eric Schauber
Sanna Sevanto
Jonathan Shurin
David Slingsby
Melinda Smith
Allen Solomon
Steve Stein
Jarrod Thaxton
Cassondra Thomas
Daniel Tinker
Nuri Trigo Boix
Chris Tripler
Andrew Tyre
Jana Vamosi
Jenneke Visser
Guntram Weithoff
William E. Williams
Susan Will-Wolf
Stan Wullschleger
Ruth Yanai

Other Notices

One Planet, Many People: Atlas of Our Changing Environment

In celebration of World Environment Day on 3 June 2005 the United Nations Environment Programme (UNEP), in cooperation with NASA, the United States Geological Survey (USGS), and the University of Maryland launched *One Planet, Many People: Atlas of our Changing Environment*, a publication that provides visual evidence of environmental change using satellite images, graphics, and text. The focus is on the environmental status and trends over several decades, both in physical and human geography. The 332-page hardbound Atlas presents visual evidence of global environmental changes resulting from natural processes and human-induced activities. The Atlas demonstrates how our growing number of people and their consumption patterns are shrinking our natural resource base. The challenge is, how do we satisfy human needs without compromising the health of ecosystems? *One Planet, Many People* is an additional wake-up call to this need. Access the Atlas online at ‹www.na.unep.net›. Order your hard copy from ‹www.earthprint.com›.

Reader's Feedback

One Planet, Many People: Atlas of Our Changing Environment*, clearly illustrates that our ozonosphere has been threatened by human activities. It also shows that this problem has been practically solved due to the collaborative efforts of the different sectors of our society. We all need to work together to address the many other problems that affect the health of our planet. As illustrated in this atlas, we need integrated, interdisciplinary approaches to mitigate the adverse effects of human-induced activities on the environment.*

—Mario J. Molina
Institute Professor, Massachusetts Institute of Technology,
Co-Winner of the Nobel Prize in Chemistry for his work
in atmospheric chemistry, particularly concerning the
formation and decomposition of ozone.

One Planet, Many People: Atlas of Our Changing Environment *demonstrates how our growing number of people and their consumption patterns are shrinking our natural resource base. The challenge is how do we satisfy human needs without compromising the health of ecosystems. One Planet Many People is an additional wake-up call to this need.*

–Ola Ullsten
Co-Chair World Commission on Forests and
Sustainable Development
Former Prime Minister of Sweden

One Planet, Many People: Atlas of Our Changing Environment *shows us our home as it really is, not only where it is now but where it has been. It becomes quite evident that we have had a huge and largely negative effect on the rest of life of earth— the biodiversity with which our well-being is intricately tied both directly and indirectly. The atlas provides an indispensable guide for a better future for humanity through maintenance of the splendor and magnificence of biodiversity.*

—Thomas E. Lovejoy
President of H. John Heinz III Center for Science

Thanks for the book, I read it last night and find it both interesting and stimulating . . . .

—Jack Dangermond
President, ESRI, Redlands, California

So great, so wonderful, so outstanding, . . . This will be an asset for all people in the globe who care for the mother earth.

—Medini Bhandari
Founder (in 1985) of the Association for Protection of Environment and Culture (APEC-Nepal)

One Planet, Many People—*what an outstanding publication! Aesthetics, Science, and Message; this book has it all:*

1) First impression: interesting and beautiful pictures, intriguing maps and time sequences, and informative charts and graphs.

2) Next impression: a thorough documentation of the nature and extent of the many ways humans have impacted our planet.

3) Lasting impression: our planet is beautiful, fragile, to a limited degree self healing, but very dependent on our intelligent habitation for our well being and, eventually, our survival.

—Ed Gibson, former astronaut,
Senior Vice President with Science Applications International Corporation

Multivariate Analysis of Ecological Data Using CANOCO

17–28 January 2006, Ceske Budejovice, Czech Republic

This course introduces modern approaches to multivariate data analysis, with much time allocated to practicals, where participants do work with their own data.

In-depth lectures and practical exercises are provided for the following topics:

- Classical ordination methods (PCA, CA, DCA, PCO, NMDS)
- Constrained ordination methods (RA, CCA) including partial analyses and permutation tests of multivariate hypotheses
- Thorough explanation of how to interpret the contents of ordination diagrams.

In addition, we provide an overview of classification methods (cluster analysis, TWINSPAN), modern regression methods (GLM, GAM, CART), and experimental design.

Course lecturers have written a book published by the Cambridge University Press: Lepš, Jan and Petr Šmilauer. 2003. Multivariate Analysis of Ecological Data using CANOCO. Cambridge University Press, Cambridge, UK.

Additional details about the course can be found at the web page ‹http://regent.bf.jcu.cz› or contact the course manager, Petr Šmilauer:
E-mail: petrsm@jcu.cz.

Fellowship in Ecological Restoration to Be Awarded by the Garden Club of America

The Garden Club of America (GCA) announces a competition for a Fellowship in Ecological Restoration, which will be awarded to an exceptional graduate student to assist with study and research. The winning applicant will receive $8000 to support specialized study in ecological restoration at a leading accredited university in the United States. The University of Wisconsin-Madison Arboretum will administer the fellowship.

All applications will be reviewed by a selection panel of research scientists and approved by the GCA Scholarship Committee. Selection criteria will include the degree to which the proposed fellowship work addresses the objectives of the GCA, as well as the excellence of the student's academic and personal qualifications.

This past March, the GCA Scholarship Committee awarded scholarships, fellowships, awards and stipends totaling $162,000 to 55 recipients for 2005–2006 in the fields of conservation, environmental studies, horticulture, botany, and landscape architecture. The GCA, a national nonprofit organization comprising 196 clubs in 40 states and the District of Columbia, is a recognized national leader in the fields of horticulture, conservation, and civic improvement, and is headquartered in New York City. Since its founding in 1913, it has worked to restore, improve, and protect the quality of the environment through educational programs and action in the fields of conservation, preservation, and civic improvement.

For the purposes of this scholarship, "Ecological Restoration" is defined in accordance with the Society for Ecological Restoration (SER): "Ecological restoration is the process of assisting the recovery and management of ecological integrity. Ecological integrity includes a critical range of variability in biodiversity, ecological processes and structures, regional and historical context, and sustainable cultural practices."

Letters of application must be received by the selection committee by 14 January 2006. For guidelines and frequently asked questions, go to the GCA Web site at ‹http://www.gcamerica.org/scholarship/ecorestor.html›

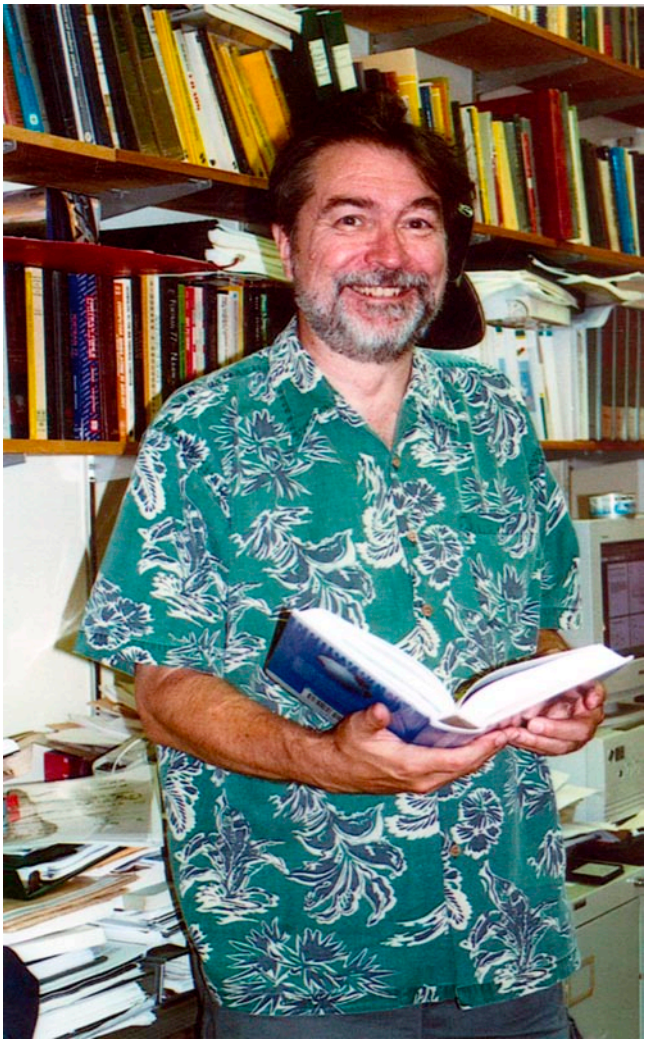
Committee reviews will be completed early in March 2006 and the recipient will be notified, and the award made, by the GCA Scholarship Committee shortly thereafter. For further information, contact:

Dr. Mark Leach, Ecologist
University of Wisconsin-Madison Arboretum
1207 Seminole Highway, Madison, WI 53711
(608) 263-7344
Fax: 608/262-5209
E-mail: mkleach@wisc.edu

Resolution of Respect

Peter Yodzis

1943–2005



Renowned theoretical ecologist Peter Yodzis, Professor Emeritus at the University of Guelph (Guelph, Canada), husband to Susan and father to Hans and Michael, passed away in Guelph, Canada on 28 March 2005. Peter was afflicted with ALS (Amyotrophic Lateral Sclerosis; Lou Gehrig's disease), a crippling and terminal disease that deteriorates the motor neurons in the brain and spinal cord. Peter was an eminent leader in theoretical community and food web ecology. He was an advocate for an energy-based view of the world as a means to simplify the sheer complexity of both mathematical models and nature.

Peter was born on 10 July 1943 in Baltimore, USA. Like a number of theoreticians working in ecology in the 1970s, Peter was first a physicist by training. He received a B.Sc in 1964 from Duke University in North Carolina and a Ph.D in mathematical physics in 1969 from New Mexico State University. Following a series of postdoctoral fellowships in Dublin, Ireland and Hamburg, Germany, he joined the Institute for Theoretical Physics in Bern, Switzerland. While at Bern working on relativity theory, Peter became interested in theoretical ecology, and he shifted his focus to that subject. Peter published his first paper on theoretical ecology in 1976 in the journal *Nature,* and soon after he became a regular lecturer on the subject at the University of Zurich's Zoological Museum, where he became acquainted with his most influential mentor, Professor Hans Burla. Peter made a move to the Department of Zoology at the University of Guelph in 1979, where he enjoyed a successful 25-year career.

Late in his career Peter was diagnosed with ALS, and like many patients, he was ultimately confined to

a wheelchair and had only limited mobility in his lower extremities. Despite the dire physical challenges of the disease, Peter continued to work with the passion and rigor that marked his entire career. In 2004 he retired from an active role and was honored with the status of Professor Emeritus. Following his retirement, Peter continued to collaborate with his colleagues and to pursue his own research directives.

Compared to many accomplished ecologists, Peter's publication record is brief. However, his attention to detail and the rigor with which he conducted research is evident in each of his publications. Peter was a true proponent of the maxim "quality over quantity." During his 25 years at Guelph, Peter supervised only a small number of graduate students, but his ability to inspire and teach is evident when considering that all have continued on to careers in science. Peter believed that ecologists, as scientists, should be familiar with mathematics, and he passed on this idea to graduate and undergraduate students alike. His desire to make biologists mathematically and computationally literate met resistance, but he persevered. In the words he often used to his graduate students, "You've got to fight the good fight." When Peter believed in something, he could not be swayed. He was a true teacher and mentor who cared more about content and rigor than pleasing everyone.

In 1980 and 1981 Peter published two groundbreaking papers on the connnectance and stability of real ecosystems. At this time theoretical ecologists were bewildered by the discrepancy between natural ecosystems, which appeared to be stable and resilient, and the instability exhibited by ecosystem models. These two papers awoke ecologists to the importance of the trophic organization of ecosystems (which had previously been considered somewhat random) and prompted decades of research into the subject. In 1988 Peter published his best known paper, "The indeterminacy of ecological interactions as perceived through press perturbation experiments." The conclusion, that the consequences of a perturbation on a food web are frequently impossible to determine from short-term observations of the system, has resonated consistently through the food web literature. It also suggested that the management of such complex systems may be better understood within a probabilistic framework, since complex systems are prone to a dizzying array of potential responses. In an attempt to deal with such complexity and its baroque consequences, Peter then employed bioenergetic reasoning as a means to simplify food web dynamical models. The 1992 paper "Body size and consumer-resource dynamics," co-authored by physiologist Stuart Innes, has frequently been used as a means to understand the role of energy flow in driving food web dynamics. This paper was one of the first to unite trophic models with organismal physiology.

Peter had a gift for communicating science—an unusual ability to integrate simple explanations and profound mathematical theory with such clarity that he could impress a message upon the most accomplished ecological theoretician and the interested layman with a single line of text. Attesting to this, Peter's 1989 textbook, *Introduction to Theoretical Ecology*, appears often in the syllabi of current courses and is, despite its age, still considered an essential reference for any theoretician. Perhaps his most well-known work to those outside theoretical ecology was published with his long-time friend Alan Held, "On the Einstein-Murphy interaction." Here they provide a satirical test of the claim that "bread always falls butter side down,"

which they argued must contradict either Einstein's theory of general relativity or Murphy's Law—both of which are known to be true.

Toward the end of his career, Peter's battle with ALS limited his travel to conferences and forced him to turn down the many speaking invitations he received. Hearing this, John Vandermeer of the University of Michigan suggested that if Peter could not go to a meeting, then a meeting should come to Peter. Many of Peter's closest colleagues at the University of Guelph and abroad, excited by this idea, hurriedly organized a colloquium in his honour. As a testament to Peter's reputation and broad affiliation, the program was quickly filled by a distinguished list of colleagues: Jim Brown, Don DeAngelis, John Harwood, and Kirk Winemiller. Peter himself delivered the final lecture, entitled "The seven scholia of bioenergetic allometric models," and received a standing ovation for his charismatic and brave performance. The colloquium has since spawned an annual series at the University of Guelph, aptly named the "Peter Yodzis Colloquia in Fundamental Ecology," and a new book series, *Fundamental Ecology,* chronicling the colloquia. (More information about past and upcoming "Peter Yodzis Colloquia in Fundamental Ecology*"* and the book series *Fundamental Ecology* is available on the Internet at ‹http://www.ecologycolloquia.uoguelph.ca/›)

Those of us who had the opportunity to know Peter realized that he possessed an incredibly warm personality and a love of laughter. Peter was an avid practitioner of Aikido, a dynamic martial art that emphasizes control of one's opponent through use of the opponent's energy. Peter was a lover of classical music, debate, and the Japanese art of Haiku poetry. When asked why he made the change from the study of general relativity to theoretical ecology, Peter's recurring answer was, "Because I wanted to change the world." Peter was an outstanding colleague and teacher and a dear friend. He will be sadly missed by all.

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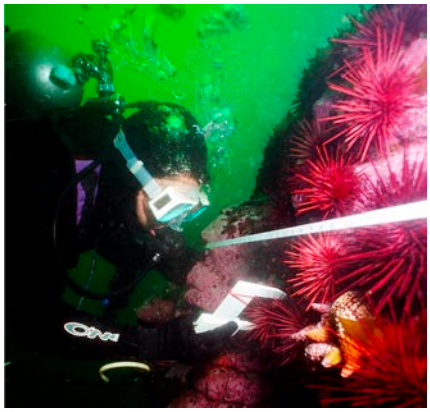


Society Actions

ESA Awards for 2005

Murray F. Buell Award
Sean Menke
University of California, San Diego

Murray F. Buell ascribed great importance to the participation of students at meetings and to excellence in the presentation of papers. To honor his dedication to the Ecological Society of America and to the younger generation of ecologists, this award is presented to a student for the outstanding oral paper presented at the Society's annual meeting.

The winner of the **Murray F. Buell Award** in 2005 is Sean Menke for his paper "Abiotic factors control invasion by ants at the community scale," which is based on his doctoral research at the University of California, San Diego, under the supervision of David Holway. The Buell judges noted that Sean presented a clear, creative, and well-designed study of the influence of abiotic factors on the ability of the introduced Argentine ant to invade native communities. Judges noted that Sean clearly described the background and motivation for this study based on both natural history and principles of community ecology. In his presentation, in a clear and unforced manner, he described the connection between pure ecology and management. Sean provided a thorough explanation of the factors influencing Argentine ant invasion of communities in California. He took an experimental approach to investigate the problem and determined that water, and indirectly, plants, can influence colonization of habitats by Argentine ants. As Argentine ants increased in abundance, Sean could demonstrate that they were more likely to spread to native habitats and to displace native ants. Based on this research, Sean could predict future sites of invasion as a basis for managing xeric habitats under threat of invasion. Sean received his M.S. in Zoology from the University of Oklahoma in 2002, and his B.A. in Biology from the University of Minnesota–Morris in 1999.

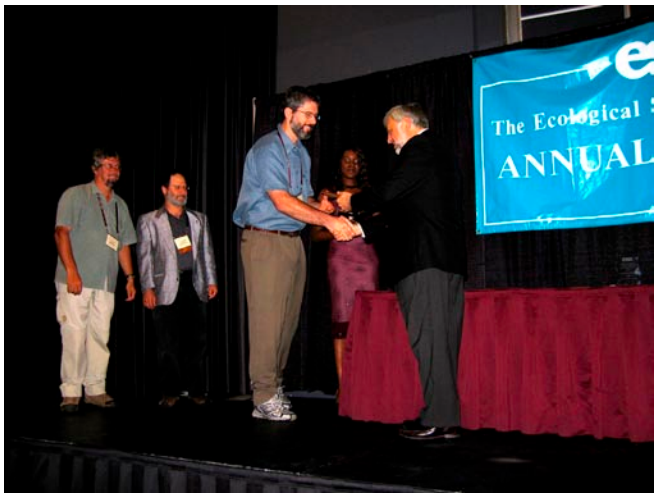
The Buell-Braun Award Selection Committee also selected one student for Honorable Mention for the Buell Award. This recognition was given to Benjamin Houlton of Princeton University for his presentation on "Isotopic constraints on nitrogen acquisition by plant communities across tropical rainforests," which was co-authored by Lars Hedin and Daniel Sigman.

E. Lucy Braun Award
Phoebe L. Zarnetske
Utah State University

E. Lucy Braun was an eminent plant ecologist and the first woman president of the Ecological Society of America. Besides describing and mapping the deciduous forest regions of eastern North America, Lucy Braun served as a dedicated teacher and role model to her students. To honor her, this award is presented to a student for the outstanding poster presentation at the Society's annual meeting.

The 2005 winner of the **E. Lucy Braun Award** is Phoebe L. Zarnetske for her poster "Modeling Forest Bird Species' Habitat with Extant Presence Points and Generated Pseudo-Absence Points in Utah." This work is based on Phoebe's Master's research at Utah State University under the supervision of Thomas Edwards of the USGS Utah Cooperative Fish and Wildlife Research Unit. Judges commented that Phoebe's poster represented a great deal of work on a statistically complex problem; the modeling approach that Phoebe used allowed her to use existing data to extrapolate and generate usable conclusions of direct use to the U.S. Forest Service. Judges who interacted with Phoebe claimed that she provided clear responses to questions that demonstrated her familiarity with the model she developed, and also her awareness of the strengths and weaknesses of the approaches she used in this study. The goal of the project was to model the habitat of management indicator species and estimate their likelihood of occurrence across an extensive landscape. The regression model that Phoebe described used known presence data and generated pseudo-absence points for two bird species. Phoebe concluded that regression models like hers, based on presence and pseudo-absence data, could be powerful tools in habitat modeling and in conservation of species. Phoebe received her B.A. in Biology and Environmental Science from Colby College, Waterville, Maine in 2001.

William S. Cooper Award
Daniel Gavin, Linda Brubaker, and Kenneth Lertzman
University of Washington



The **William S. Cooper Award** is given by the Society in honor of one of the founders of modern plant ecology. It recognizes an outstanding recent contribution in geobotany, physiographic ecology, plant succession, or the distribution of organisms along environmental gradients.

The 2005 recipients are Drs. Daniel Gavin, Linda Brubaker, and Kenneth Lertzman for their paper, "Holocene fire history of a coastal temperate rain forest based on soil charcoal radiocarbon dates," published in *Ecology* in 2003. The paper developed from research done while Daniel Gavin, currently a Research Associate at the University of Vermont, was a graduate student in Linda Brubaker's laboratory at the University of Washington.

Determining the fire history of forest ecosystems is critical to understanding forest dynamics and forecasting ecosystem responses to ongoing and future climate change. Forest ecologists and paleoecologists have devised a number of clever ways to reconstruct fire histories, but they differ in their spatial and temporal resolution and applicability in particular systems. In their paper, Gavin, Brubaker, and Lertzman apply a novel combination of fire-scar analyses and radiocarbon dating of buried charcoal in soils toward reconstruction of fire history in southern British Columbia. Innovative statistical analyses of the charcoal and fire-scar data allowed them to develop an unusually detailed record of fire patterns among landform types. These records reveal evolving patterns of landscape-level fire patterns with Holocene climate change, going from extensive fires spanning multiple landforms in the dry early Holocene to a patchy late Holocene pattern of higher fire frequencies on south-facing slopes. The study sets new standards for paleoecological analyses of fire disturbance, and provides important baselines for scientifically sound management of forest ecosystems in coastal temperate rain forests.

George Mercer Award Daniel Bolnick, Richard Svanback, James Fordyce, Louis Yang, Jeremy Davis, Darrin Hulsey, and Matthew Forister

The **George Mercer Award** is the oldest of the awards granted by the ESA, and is given in memory of a young British ecologist who was killed in action in World War I. The award is given to an author under 40 years of age in recognition of a single outstanding paper in ecology published during the past 2 years.

This year, the Mercer Award honors a paper where all seven co-authors were graduate students at the time of publication. They are Daniel Bolnick, Richard Svanback, James Fordyce, Louis Yang, Jeremy Davis, Darrin Hulsey, and Matthew Forister, who have won the award for their paper, "The ecology of individuals: incidence and implications of individual specialization," published in *The American Naturalist* in 2003. Daniel Bolnick is now an Assistant Professor at the University of Texas.

The paper argues persuasively for the importance of interindividual specialization and niche variation within species, using data assembled from the literature and offering a conceptual framework for describing and thinking about individual niche variation and its consequences. This is not a new idea; in fact, the magnitude and importance of individual variation has been debated for a long time. However, the idea has had relatively little "penetrance" into the way we study ecology, perhaps because empirical and theoretical treatments of interindividual variation have been less than definitive, and even conflicting. The Mercer Award subcommittee noted that Bolnick et al. do a superb and elegant job of articulating why individual niche variation deserves renewed attention, and how one might study it in natural systems.

Several members commented that this kind of paper opens one's eyes to new things to look for in one's own work. Interestingly, several members of the committee also commented that they had not decided exactly if they agreed with all the ideas in the paper—and this seemed a positive indication about the paper and its potential importance! The citation record for this paper is already impressive. ESA commends the authors for turning a graduate reading group into a piece of scholarship that promises to have impact for years to come.

Eugene P. Odum Award
James Porter
University of Georgia

The **Eugene P. Odum Award for Excellence in Ecology Education** recognizes an ecologist for outstanding teaching, research, and mentoring activities, and for demonstrated ability in relating basic ecological principles to human affairs.

This year's recipient of the Odum Award is Dr. James Porter of the University of Georgia. Jim Porter seems to be a natural fit for this award. He spearheaded an effort requiring environmental literacy at the University of Georgia. After this component was added to the curriculum, Dr. Porter set about teaching one of the most important portions of that effort, a nonmajors course with over 400 students per semester. His evaluations from colleagues to students are uniformly glowing. People endeavor not only to get into the class as enrolled students, but also to get a seat in the room as visitors, so that they can hear the lectures. His lectures are variously described as ". . . like an Aztec sacrifice. He rips your heart out with the information he presents"; "a multimedia tour de force"; and "a life-changing experience." One student writes how he did not want to take the course, and how the *Wall Street Journal* said that global warming was baloney. "After Dr. Porter's lecture on this subject, I canceled my subscription to *The Wall Street Journal*." Other students tell how they changed careers based on Dr. Porter's classes, becoming environmental attorneys, scientists, and educators themselves. One colleague further describes Jim as "a teacher who lives his life teaching as if that were all that matters."

Dr. Porter's teaching influence is felt beyond the walls of his classroom. His graduate and undergraduate students have gone on to populate academia, particularly in marine ecology. In addition, his efforts at education have been formally recognized by at least one member of Congress, who was impressed by his many visits to "the Hill" and how much he learned from those interactions.

Jim takes a genuine personal interest in all of his students, and they sense that his concern is real. His intense and passionate style is changing lives. Those lives can, in turn, change the world.

Sustainability Science Award Thomas Dietz, Elinor Ostrom, and Paul Stern

The **Sustainability Science Award** is given annually to the authors of the peer-reviewed paper published in the past 5 years that makes the greatest contribution to the emerging science of ecosystem and regional sustainability through the integration of ecological and social sciences. Unprecedented directional changes in climate, human population, technology, and social and economic institutions are altering the structure and functioning of current ecological and social systems. The Sustainability Science Award recognizes the role that science can play in addressing these challenges.

The subcommittee has selected Thomas Dietz, Elinor Ostrom, and Paul Stern as the 2005 Sustainability Science Award winners for their paper, "The struggle to govern the commons," published in *Science* in 2003. Thomas Dietz is Director of the Environmental Science and Policy Program and Associate Dean of Environmental Science and Policy. Elinor Ostrom is with the Center for the Study of Institutions, Population, and Environmental Change at Indiana University, and Paul Stern is at the Division of Social and Behavioral Sciences and Education at The National Academies in Washington.

This paper provides a groundbreaking synthesis of key concepts from the emerging science of human–environment interactions, linking human institutions to sustainable management of the commons. The challenge they present is to create adaptive governance structures that can link globalization trends with local and regional needs. To meet this challenge, the authors demonstrate how a mix of human institutions (public and private), each operating at different scales, will need to be used in the 21st century to achieve sustainability. In doing so, the authors provide a suite of testable requirements for adaptive commons governance in complex systems, thus setting the stage for new and innovative research in the field of sustainability science.

Corporate Award
Bon Appétit Management Company (BAMCO)
Palo Alto, California

The **Corporate Award** recognizes a corporation, business, division, program, or an individual of a company for its accomplishments in incorporating sound ecological concepts, knowledge, and practices into its planning and operating procedures. This year's winner is the Bon Appétit Management Company (BAMCO). Founded in 1987 in San Francisco, Bon Appétit is an onsite custom restaurant company offering full food service management by providing café and catering services to corporations, colleges and universities, and specialty venues.

Bon Appétit is being recognized for its program known as "Circle of Responsibility." Under this program, Bon Appétit has instituted a variety of socially and environmentally responsible practices, including the following:

- Offering a program that purchases ingredients from local farms or artisans, and that are seasonal and minimally processed;
- offering organic options, which contain at least 95% organically produced ingredients;
- offering options for fair trade, shade-grown, and organic coffees;
- recycling aluminum, glass, and plastics wherever possible;
- observing the guidelines of *Seafood Watch*, a set of guidelines set forth by the Monterey Bay Aquarium for purchasing sustainable seafood choices.

As a major food purchaser in the United States, Bon Appétit has worked with Environmental Defense to take a unique stand on the critical environmental and human health issue of antibiotic resistance, leveraging their purchasing power to influence the way food is raised in the United States. They have adopted the first meat purchasing policy in the United States that prohibits the use of human antibiotics in healthy chickens. They have also extended their policy to pork, beef, and seafood suppliers. Bon Appétit's policy is a unique and effective way to get action on this issue in the face of inaction on other fronts. Because they are a major customer, Bon Appétit's policy requires meat suppliers to pay attention to this issue, and in some cases, make changes to their antibiotics use policies to comply.

Nominators noted that adopting a groundbreaking antibiotics policy is no easy feat and was met with resistance from a number of fronts. The staff, however, were always confident that their CEO, Fedele Baucchio, would back them up on taking a bold stand as long as it was the right thing to do from a business and environmental perspective. This type of support and leadership is unusual and deserves to be commended.

Honorary Member Award
Erkki Haukioja
University of Turku

The ESA's Honorary Member Award recognizes a distinguished ecologist from outside of North America who has made exceptional contributions to the field of ecology. It includes a lifetime membership in the ESA.

The 2005 winner is Dr. Erkki Haukioja. The influence of Professor Haukioja's ideas has been broadly international, not only through his widely cited and highly influential publications, but through leadership in international organizations and personal contacts with colleagues. An integrator of information and ideas across cultures and an open communicator, he is a gracious host and sought-after visitor. He has been a member of the Finnish Academy of Sciences since 1981.

For more than three decades, Professor Haukioja has explored the intricate and tangled complexities of the interactions between Fennoscandian mountain birch and its herbivores. His pioneering work on inducible plant defenses in the 1970s stimulated the establishment of a large and active new area of research, and he has continued to provide intellectual leadership throughout his career. His early appreciation of the role of the host plant in population dynamics of herbivores, and exceptional creativity in testing hypotheses reshaped ecological approaches to studies of plant–herbivore interactions, forest pests, and population dynamics. He has seamlessly integrated the detailed study of mechanisms with the testing of grand hypotheses in a complex model system. Beyond the basic knowledge that they have produced, Professor Haukioja's remarkable breadth of contributions have informed public policy in Finland and elsewhere.

Professor Haukioja has developed one of the premier ecology programs in Scandinavia. He has contributed decades of untiring service to the University of Turku, and the Kevo Subarctic Research Station, which he directed for many years. Professor Haukioja has mentored more than 50 graduate students and post-docs, many of them from outside Finland, who are now making sustained contributions of their own. His success as a mentor and colleague is a credit not only to his keen intellect, broad thinking, and unusually effective application of hypothetico-deductive science, but also to his contagious enthusiasm for natural history and the science of ecology.

Distinguished Service Citation
Jim MacMahon
Utah State University

The **Distinguished Service Citation** is given in recognition of long and distinguished service to the ESA, to the larger scientific community, and to the larger purpose of ecology in the public welfare. We are pleased to present the award this year to Dr. Jim MacMahon of the Utah State University.

Jim's contributions both to ESA and to the field of ecology have been substantial and diverse. He has given a tremendous amount of time, talent, and energy in a way that few of us are able to parallel. This award recognizes the long-term and massive contributions that he has so selflessly offered to the broader community, regionally and nationally, to improve the public profile of ecology and opportunities for ecologists.

Jim became President of the ESA in 1997, a very challenging time for the Society. The budget was in turmoil and ESA had recently moved into a headquarters office in Washington with a new Executive Director and staff. Jim made and articulated the tough decisions that were necessary to set the ESA on its present course of financial solvency, leading to the flexibility to tackle new initiatives. Jim spent an extraordinary amount of personal time working with the existing staff. These were critical times, and Jim did more to keep the Society on an even footing than almost any other President in the ESA's long history.

Jim has long been a leader in foresighted efforts to involve the science of ecology and scientific community with the public welfare. He was a leader in the Sustainable Biosphere Initiative of the Society. He has served for years on the steering committee, insuring that the committee thinks creatively about how the SBI and the ESA leadership can shape ecological sciences. Jim also co-founded the ESA's Annual Fund for the Millennium, the first organized effort for the Society to begin a "development" program. In addition, he has been one of the primary ESA leaders in the field of ecological restoration.

More than most ecologists, Jim spends a great deal of time and effort mentoring people, especially students. He is passionate about ecology and brilliantly communicates this passion to students in the classroom, field, and his writings. Not only does Jim take pride in his mentoring; his students have lavished important awards on him.

Jim MacMahon is one of those rare people who makes a huge contribution almost anonymously, without apparent need of recognition. That is one reason why it is a special pleasure to recognize him with this award.

Eminent Ecologist Award
Lawrence B. Slobodkin
State University of New York at Stony Brook

The **Eminent Ecologist Award** is given in recognition of an outstanding body of ecological work or of sustained contributions of extraordinary merit. It is the highest honor bestowed by the Ecological Society of America. The recipient of the 2005 Eminent Ecologist Award is Professor Lawrence B. Slobodkin of the State University of New York at Stony Brook.

Larry Slobodkin is one of the premier ecologists of our time. He has made lasting contributions to the theoretical and empirical development of ecology. Beyond this, however, many of us have been greatly influenced by the wonderfully original and insightful perspectives that flow from his unfettered mind.

Over the course of his career, Larry Slobodkin published seminal papers that influenced the direction of ecological research, and that attracted scientists across disciplinary fields. His early efforts to model populations of *Daphnia* were instrumental in developing mathematical theory in ecology, and provided the first experimental evidence for the connections between population and ecosystem study. But even though he had a strong role in developing these connections, he never hesitated to comment when he perceived that the theory was not being faithful to the real biology. Some of our best ecologists refer to Larry as both inspirational, and as marching to a different drummer. Larry recognizes fascinating questions, and brings such innovative ideas into routine observations that he forces ecologists to stand back and consider nature from a different angle. His efforts to influence ecologists to take orthogonal views of nature are among his most important contributions. An even broader audience has learned from his forays into the philosophy of ecology and the role of ecological science in public policy.

Another extremely important contribution of lasting impact has been the Department of Ecology and Evolution at SUNY Stony Brook, whose creation Larry spearheaded. Overnight, he created one of the most exciting departments in the world. The legions of ecologists trained at Stony Brook, the students they have mentored, and the many scientists who simply visited that department during the years when Larry was the de facto leader have done much to define and to advance our field. All agree that Larry Slobodkin was not always an easy person, but that he certainly was a great one.

Minutes of the ESA Governing Board 19–20 May 2005 Washington, D.C.

Members present:

Jerry Melillo (President), Bill Schlesinger (Past-President, 19 May 2005 only), Nancy Grimm (President-elect), Alan Covich (incoming President-elect), Gus Shaver (Vice President for Science), Norm Christensen (Vice President for Finance), Bill Parton (incoming VP for Finance), Carol Brewer (Vice President for Education and Human Resources), Rich Pouyat (incoming VP for Public Affairs), Shahid Naeem (Member-at-Large), Dennis Ojima (incoming Member-at-Large, 19 May 2005 only). Unable to attend: Boersma, Palmer, Powers.

Staff Present:

Katherine McCarter (Executive Director), Cliff Duke (Director of Science), Nadine Lymn (Director of Public Affairs), David Baldwin (Managing Editor), Elizabeth Biggs (Director of Finance), Sue Silver (Editor).

Guests:

Jeff Herrick, 19 May 2005
Bruce Hayden, 20 May 2005

Thursday, 19 May 2005

I. ROLL CALL AND AGENDA

A) The GB unanimously adopted the proposed agenda.

II. RATIFICATION OF VOTES TAKEN SINCE THE OCTOBER 2004 MEETING

A) The minutes of the October 2004 meeting were approved.
B) Brief discussion and approval of the 2006 Annual Meeting theme, "Icons and Upstarts in Ecology."
C) Reappointment of David Schimel, EIC for Ecological Applications*, to a 3-year term, beginning January 2005 and ending 31 December 2007, was approved.*

III. REPORTS

A) Report of President Melillo. A reminder of the schedule of program reviews and midterm reviews:

Program	Review	Midterm Review
Science	Fall 2004	Spring 2006
Finance/ fundraising	Spring 2005	Fall 2006
Publications	Summer 2005	Fall 2006 or Spring 2007
Public Policy	Fall 2005	Spring 2007
Education	Fall 2006	Spring 2008

Gus Shaver requested that a document be created summarizing the timetable of events such as creation of the ESA office in Washington, D.C., the SBI program, etc. Katherine and staff will work on this after the Annual Meeting.

Gene Likens has agreed to give a retrospective of the ESA on its 90th birthday. Jerry has been contacting past-presidents to encourage them to attend. Nancy suggested that we consider commissioning a history of the ESA for its 100th anniversary. The ESA archives at the University of Georgia library could be a resource for this.

B) Report of the Executive Director and staff

- See the May 2005 written report. One highlight is the positive reception that several federal agencies gave to Katherine

and Sue Silver about possible financial support for *Frontiers*.

- The Montreal meeting may have 4000 people (registration to open next week); this meeting may be even larger than Portland. Presidents of other ecological societies from around the world are being invited to a breakfast meeting with ESA president Jerry Melillo and BES president Alastair Fitter.

- Cliff Duke reported on the data sharing initiative, and planning and fund-raising for the Mexico meeting.

- Sue Silver reported on discussions with Charlesworth China to introduce *Frontiers* to many libraries in China, and efforts by the Chinese *Frontiers* Board member to solicit articles from Chinese authors for a possible special issue next year. The Mexico meeting may also generate a special issue (there is a proposal in to NSF for funding this).

- David Baldwin reported that submissions are up, and turnaround time at *Ecology* is now at a record low. The success of *Ecological Archives* is responsible for some of this (e.g., there are now >100 submissions associated with papers in *Ecology*, and almost every paper in the August issue has material in EA). The publications office is ready to start making links to a data registry as soon as it is created.

- Liz Biggs reported that Charlesworth China is also exploring marketing of other ESA publications besides *Frontiers*. ESA has had a good year in terms of finances (memberships, meetings). The membership database is now working with on-line access by members. The e-store is also working now for purchase of back issues.

- Nadine Lymn reported that the rapid response teams are mostly mobilized, and Board members will be invited to a lunch meeting with the team members at the Annual Meeting. Congressional Visits Day went well. Plans are proceeding to take a bus-load of congressional staffers on a tour of USGS activities in the Chesapeake Bay area.

- Jerry Melillo reported on a dinner meeting with Lou Pitelka, who is now working part-time at USDA, and discussion of possible collaboration with a few other societies to run a workshop about agricultural ecosystems.

C) Financial updates: Norm Christensen and Katherine McCarter

The fiscal year begins on 1 July, and Katherine reported results through the third quarter (March). The budget is in good shape, in large part because of the success of last year's Annual Meeting (two-thirds of the surplus) and subscriptions and dues (one-third); currently we have a $325,432 surplus. We are trying a different mechanism this year to discourage those who submit abstracts for the meeting and then don't show up (taking credit card numbers but not charging an abstract submission fee to nonattendees until after the meeting occurs).

D) Written reports from President-Elect Grimm and Program Chair Paul Ringold

- Grimm reported on plans for the International Conference on Circular Economy and Sustainable Development, to be held in Hangzhou, China, 1–4 November 2005, sponsored by the provincial government of Zhejiang. Melillo and Grimm will attend.

- Plans for the 2005 meeting in Montreal are proceeding well.

IV. DISCUSSION/ACTION ITEMS

A. Financial review

Liz Biggs led a quick discussion of 10 graphs sent to Board members that show membership and financial data for the past 6 years; the trend has been positive in both areas.

- Reserve funds. An analysis was done of the ESA's requirements for operating reserves. Total risk, should there be significant problems with subscription revenue, cancellation of the Annual Meeting, etc., is about $2.3 million. One suggestion is that we have a reserve of 6 months of operating expenses, which is also about $2 million. The VP for Finance and staff recommend that we use this as a target, with the goal of budgeting $50,000/yr, as well as adding any additional surplus. This could become a quasi-endowment, managed like an endowment, but without the restrictions of endowment spending. We currently have about $600,000 in unrestricted reserves.

- **A motion was moved and seconded: The Ecological Society of America should develop a financial reserve of approximately six months of operating expenses, currently $2 million, through an annually budgeted payment ($50,000) and any surplus from the annual budget. Approved unanimously.**

- Investment of restricted funds. These follow a typical (conservative) pattern for endowment funds. Significant growth will have to come from donations, not from investment income.

- Discussion of a fundraising position, following on previous Board suggestions that we should have one. Katherine presented ideas about how this can be accomplished (using both core funding and Millennium Fund). We have researched a target amount for annual salary for a nonprofit development officer (with up to 50% of this in additional funding for travel, entertainment, publications, etc.).

- Millennium Fund. The Fund is available to the Governing Board for specific projects. Fund balance is about $84,000; Christiansen suggests we shouldn't let it get this large. The proposed budget would fully utilize the account for this year, and let us start over next year.

- *Frontiers* budget. Katherine reported on efforts to raise $500,000 to cover the gap that developed when Packard Foundation was unable to meet its original commitment. About $165,000 is now in hand from a few different federal agencies, and we are waiting to hear from a few more. Advertising revenue is above the goal for this time, and a lot of effort is going into securing additional library subscriptions. We have funding in hand for about three more years (at about $400,000/yr).

- Other publication issues. The plan is to give electronic access to ESA journals to all subscribers, for the previous cost (+ 9%) of print subscriptions. This will result in a savings of about $700/yr to libraries; Schlesinger suggests we use this as an opportunity to push adding a *Frontiers* subscription.

- Membership dues. Have been flat for many years, and we should consider whether to raise them. There is no specific proposal yet.

- Board ethics and management. Sarbanes-Oxley legislation provided guidelines to commercial companies, and while nonprofits are not covered by this, many organizations are beginning to look at a checklist of requirements of Sarbanes-Oxley that may eventually apply to nonprofits. ESA has been doing most of these for some time, but there are two that we should adopt: an audit committee of the Board, and clear conflict of interest policies (e.g., an annual form to be signed by Board members). The plan is for the staff to start work with the incoming VP for Finance, Bill Parton, to work on these changes.

B. The Mexico Meeting

Guest (meeting co-organizer) Jeff Herrick made a presentation about the meeting. Plans are progressing well, and there has been a lot of interest. A call for workshop titles will be issued soon (many have been suggested already). Fund-raising is progressing and looks promising, but the Board decided to assume responsibility for the cost of the meeting (running the meeting and subsidizing registration and travel for international participants) in the meantime so participants can make commitments to attend.

A motion was moved and seconded: The ESA will commit to up to $250,000 in expenses for the Mexico meeting. Approved unanimously.

C. Proposed 2005–2006 budget

Katherine and Liz presented the budget, which the Board discussed. A major new initiative in the proposed budget will be the addition of a development/fundraising position (see discussion above). Printing of WAMIE II report, analysis of undergraduate education survey data, translation of additional Issues in Ecology before the Mexico meeting, and a WAMIE workshop were suggested as additional activities for Board approval. No decision was made about these additions.

D. Public Information Campaign

Vice President for Public Affairs Sunny Powers joined the discussion via speakerphone. Should the ESA undertake such a campaign? Nadine reviewed the chronology of this idea. Sunny summarized discussions of the Public Affairs Committee, and presented a recommendation. Lengthy discussion led to a consensus that a regional focus, perhaps taking advantage of ESA chapters, would be an appropriate way to proceed. This is less daunting than the idea of a national campaign, whose scale (and expense) began to appear formidable. Staff will begin development of a concept paper for review in August.

E. Publications issues

- Journal mission statements. David Baldwin reviewed the origins of these statements. A few suggestions were made that David will convey to Jim Reichman.

- EIC review recommendations. Issues raised in the report of the review

committee for the Editor-in-Chief of *Ecological Applications* were discussed, and some recommendations were made that will be passed on to David Schimel.

F. Data registry proposal / data access

Nancy Grimm presented a possible timeline/process to move from a data registry toward a data repository, and then on to ways to facilitate use of stored data. The Board has already approved a statement for ESA journals encouraging authors to identify a data registry for their data. A prototype for an official ESA data registry at NCEAS can be seen at ‹http://knb.ecoinformatics.org/knb/style/skins/esa/index.html›. **A motion was made: The ESA has approved the data registry at NCEAS and strongly encourages all authors of papers accepted in ESA journals to use this or another ESA-approved registry for data in their papers. Data registration will become a requirement for papers submitted for ESA journals beginning in 2006. Motion is tabled.** The Publications Committee is asked to clarify the steps involved in creating a data archive and implications of requiring that it be used, and to come up with a list of ESA-approved data registries that might used in addition to the ESA registry. The motion will be reconsidered at the August meeting.

Dinner: The Governing Board invited NEON postdocs to join the Board for dinner. Those in attendance were Kit Batten, David Kirschtel, Rank Knight, Meeko Oishi, and Brian Wee.

Friday, 20 May 2005

EXECUTIVE SESSION

G. British Ecological Society proposal

The British Ecological Society intends to invest approximately $1,000,000 in support of ecology in developing countries, and has asked ESA to join in this effort, at least in terms of moral support (and potentially in terms of fund raising in the future). **A motion was made and seconded: The ESA Board supports the idea of collaboration with the British Ecological Society. Approved unanimously.** The details of this collaboration remain to be decided, but because there is some urgency for the BES to proceed, we would like to convey our interest and support at this time.

H. NEON Co-Director Bruce Hayden

Co-Director Hayden gave the Board an update on the status of NEON, and the role of the postdocs that joined us last night for dinner. They are working toward an integrated plan for development that is due in October. He also addressed the issue of funding for big science projects (e.g., what influence might they have on smaller-scale science funding), the relationship between NEON and other science agencies (e.g., NASA), the ratio of funding for infrastructure vs. research, and what the ESA might be able to do to support NEON.

I. Norm Christensen report

Norm Christensen reported on discussions regarding the National Parks Fellowship program. He is very enthusiastic about the impact of this program for science in and for the parks, and the potential to strengthen the relationship between NPS and ESA. Previously funding has come through a collaboration of the National Parks Foundation and the Mellon Foundation, while ESA has served as a subcontractor to organize the selection process. Advisory Committee Chair Kay Gross and Committee member Norm would like the Board to consider having ESA lead both the program in general and fundraising efforts for it. The Advisory Committee will come back with a proposal.

J. Science Committee suggestion for a change in the Bylaws

A proposed Bylaws revision to combine the Research and SBI Committees into a new Science Committee and to clarify the mission of the Office of Science Programs was proposed. This change grew out of the discussions in May about Science Programs. **A motion was made and seconded: The ESA Board supports the proposed change in the Bylaws. Approved unanimously.**

K. Awards nominations

Vice President Brewer presented the slate of proposed award winners from the Awards Committee. **A motion was moved and seconded: The ESA Board supports the slate of proposed award winners. Approved unanimously.**

L. Proposal from VP Powers and the Public Affairs Committee

The Committee proposed pursuing development of a position paper on ecosystem services. There is general support for this idea (including from incoming VP for Public Affairs Pouyat). The Committee is asked to proceed with identifying appropriate people to help develop a position paper.

M. Proposal to adopt a statement on economic growth

A proposal was made by an ESA member (Richard Christian) that the ESA adopt a statement on economic growth as it relates to the long-term health and functioning of ecosystems. Concerns raised by Board members included potential alienation of some ESA members (many of whom come from industry), potential to damage the Society's reputation as an impartial source of advice to government, and the fact that some of the statements of fact in the proposed policy statement may not have a strong scientific basis at this time. There was consensus that this is a subject worthy of further discussion and study, but that it is premature for the ESA to make a policy statement.

N. Presentation of the WAMIE II report

The WAMIE II report was presented by VP Brewer. Extended discussion of the report and its (33) recommendations followed. There is a big gap between what seem to be female-majority graduate students in ecology (although many are not ESA members) and the numbers of females in postdoctoral and faculty positions. How can we identify the barriers and work as a Society to overcome them? Although there seems to be some progress with regard to sex ratios, there has not been much in recruiting from minority ethnic groups. Sentiment was expressed for using the existing committee structure (e.g., the Standing Committee on Education and Human Resources) rather than forming a new one to push for progress on the issues raised by the report. Can we mine previous government studies for data rather than duplicating efforts? Perhaps we should contact other societies such as the Society for Conservation Biology and the Society for Ecological Restoration about their memberships to see whether they are proving to be more attractive to female graduate students. **A motion was moved and seconded: The ESA Board gratefully accepts the WAMIE II report. Approved unanimously.** The EHR Committee was asked to try and find answers to several questions:

1) Why don't more of the female ecology graduate students become members of ESA and consider it their primary professional organization?

2) What can ESA do to address the general issue of retention in the field?

O. ESA links to NEON

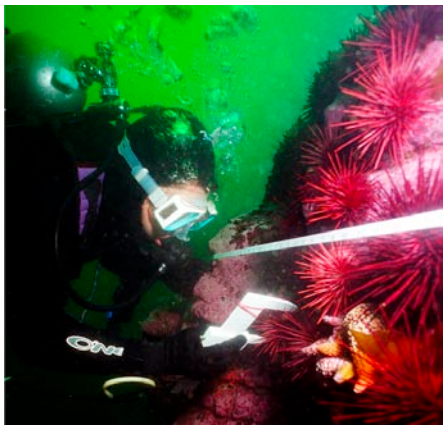
Given that NEON is likely to be funded in the near future, after a build-up phase of 5-10 years, and that this may bring about a cultural change in what ecologists do or are perceived as doing, what can the Society do to bring its membership behind this effort? Suggestions included an editorial in *Frontiers*, having Jerry make some comments at the NEON symposium in Montreal, and letting Bruce Hayden know that the Society would like to know what it can do to strengthen the case for NEON funding.

P. New business— none.

President Melillo reminded the Board about its meetings in Montreal. Board members are reminded about the requirement for a passport or other acceptable documentation for travel to Canada and back.

Meeting adjourned at 11:50 am.

Respectfully submitted,
David Inouye, Secretary



Annual Reports

Annual Reports to Council

Ecological Society of America, August 2005

I. REPORTS OF THE EXECUTIVE DIRECTOR AND STAFF

EXECUTIVE DIRECTOR

The past year has been another highly successful one for the Ecological Society of America. We see our membership steadily increasing, our financial picture strong, and our annual meetings producing record attendance and programs that garner interest not only from scientists, but also from the media.

Our Society has moved forward on many fronts this past year. One new initiative has been the establishment of Rapid Response Teams that allow ESA to play a strong and relevant role in policy discussions. Our publications continue to be among the best in the field and *Frontiers*, in its third year, received its first ISI rating—12 out of 107 journals. The SEEDS initiative has grown and involves ever more students and ESA members as it seeks to support and encourage the interest of underrepresented students in the field of ecology. We have refocused our Science Programs to better advance ESA priorities and to develop a new sustainability science agenda.

ESA continues to become more international in its activities. Our collaboration with INTECOL for the Annual Meeting in Montreal, a gathering of Presidents of ecological societies worldwide during the Annual Meeting, the planning of a themed meeting in Mexico early in 2006, translation of the "Visions" issue of *Frontiers* into Chinese, and our ongoing support of the Federation of the Americas all attest to this fact.

The following staff reports accent these accomplishments—and many more. I am proud to be the Executive Director of such a fine organization and to work with such a professional and dedicated staff. We look forward to continuing our progress as a Society and to bringing the expertise of the membership and the staff to bear on the challenges ahead.

Submitted by:
Katherine McCarter

FINANCES/ MEMBERSHIP/ SUBSCRIPTION SERVICES

ESA continues to grow! The number of ESA members grew from 8116 members in 2003 to 8718 members in 2004 and we have already passed that figure for 2005. We expect to end our 2005 membership year with over 9000 members.

ESA upgraded our membership database for the 2005 membership and subscription year. Members are now able to renew their membership online and update mailing address and other information in real time.

We anticipate ending the 2004–2005 fiscal year with a positive bottom line. The meeting in Portland was well attended, library subscriptions are holding up despite budget problems for many institutions, and

expenses have been kept within normal variances.

Membership and subscriptions for the calendar year 2004 were:

Total membership: 8718
Domestic: 7372
Foreign: 1346

By class:
Regular: 5961
Student: 1907
Developing countries: 291
Life members: 227
Emeritus: 332

Subscriptions:
Ecology total: 5768
Members: 3747
Institutions: 2019
Other: 2

Ecological Applications total: 3317
Members: 2066
Institutions: 1248
Other: 3

Ecological Monographs total: 2795
Members: 1480
Institutions: 1312
Other: 3

Chapter membership:
Rocky Mountain: 278
Southeastern: 486
Mid-Atlantic: 392
Western: 554
Mexico: 52

Section membership
Asian: 92
Applied: 639
Aquatic: 898
International Affairs: 98
Paleoecology: 145
Physiological ecology: 477
Vegetation: 453
Education: 385
Long-term studies: 243
Statistical ecology: 270
Soil ecology: 288
Theoretical ecology: 262
Plant population ecology: 330
Agroecology: 200
Rangeland ecology: 207
Student: 271
TEK: 88
Biogeosciences: 327
Urban ecology: 209

Membership affliation:
Academic: 66%
Government: 12%
Nonprofit: 4%
Consultant: 6%
Other/left blank: 12%

Ethnicity:
White: 75%
Asian: 4 %
Hispanic: 3%
African American: <1%
Native American: <1%
Other/ left blank: 18%

Gender:
Male: 59%
Female: 28%
Left blank: 13%

Administrative staff:
Elizabeth Biggs, CFO, Director of Administration;
Rachel Dellon, Manager Membership Services;
Amy Canonico, Membership Database Coordinator;
Thet Oo, Associate Director, Information Systems;
Zaw Aung, Webmaster; Min Tun, Financial Assistant.

Submitted by:
Elizabeth Biggs

FRONTIERS

Frontiers is now in its third year of publication; the journal continues to receive positive feedback, and

there have been a number of exciting developments.

Impact factor

In June 2005, *Frontiers* received its first impact factor—the journal is ranked 12th out of 107 journals in the Ecology category, with an impact factor of 3.362.

Readership survey

A readership survey was carried out in November and December of 2004. A total of 1559 responses were received. In answer to the question "How interesting do you find each section/feature of *Frontiers*?" (Scale: 5 = very interesting; 3 = slightly interesting; 1 = not interesting), the percentage of readers scoring 4 or 5 (interesting to very interesting) was as follows:

Reviews: 89%; Research Communications: 84%; Dispatches: 77%; Pathways to Scientific Teaching: 61%; Forums: 61%; Laws of Nature: 52%; Finishing Lines: 45%; Write Back: 42%; Websight: 36%.

Please contact Sue Silver (suesilver@esa.org) for a full report of the results.

Special issues

February 2005 saw the publication of the first *Frontiers* Special Issue, "Visions for an Ecologically Sustainable Future." The underlying concept was to show how efforts to solve serious environmental and social problems could benefit from ecological science, and to link the priority actions identified by the Eco-Visions Project with advances in areas such as emerging diseases, fisheries, freshwater, agriculture, and invasive species. In view of the enthusiastic feedback that this issue received, it was decided to make it open access. Permission was also given to translate the text into Chinese.

Articles for a second Special Issue, focusing entirely on ecological and environmental issues in China, and written by Chinese scientists, are currently in peer review. This issue is tentatively scheduled for February 2006.

Articles

As in previous years, journal staff have been actively commissioning articles at conferences and elsewhere, so article numbers reported below are a mixture of solicited and unsolicited.

Articles commissioned as of 14 July 2005

Articles agreed (with deadline dates): 41
Articles in negotiation: 14

Received articles July 2004–July 2005

Total articles received: 103
Articles accepted: 47 (62.67%)
Articles rejected: 28 (37.33%)
Articles withdrawn: 3
Articles currently in peer review: 25

Conferences

As in previous years, journal staff attended a number of conferences, commissioning articles, giving away sample issues, and raising the profile of *Frontiers* and ESA with different audiences. Conferences included the Annual Meetings of the American Society of Agronomy, the Entomological Society, the Wetlands Society, the Special Libraries Association, and the Council of Science Editors, as well as the First National Conference on Ecosystem Restoration.

Finances

Late in 2004, *Frontiers* received the second installments of funding from The Andrew W. Mellon and David and Lucile Packard Foundations. We still have a shortfall of $500,000 as compared to the original figures used in the business plan. In the spring of 2005, Executive Director Katherine McCarter and *Frontiers* Editor-in-Chief Sue Silver therefore visited a number of federal agencies, requesting financial contributions. All the agencies expressed their willingness to help in some way, though in some cases not until the next fis-

cal year. A total of roughly $240,000 has been promised so far, with two agencies still considering proposals.

Negotiations are ongoing with Charlesworth China, a company that specializes in marketing western journals in China, to provide online access and possibly print copies, of both *Frontiers* and the other ESA journals, to over 800 university and other institutional libraries.

Paper

Following a lengthy search for a good-quality, reasonably priced, recycled paper that could be supplied in the relatively small quantities required, the August 2005 issue will be the first to be printed on a new 100% recycled, 10% postconsumer, processed chlorine-free paper.

Frontiers *staff*:
Sue Silver, Director; Ken Ferguson, Assistant Editor; Sika Dunyoh, Marketing and Advertising Associate.

In May 2005, Assistant Editor Chris Emery left Frontiers to return to college for a degree in journalism. The position has been converted to that of Editorial Assistant and Ellen Arnstein has recently taken up the post. Ellen has a degree in Biology from Le Moyne College, Syracuse, and has done a number of publishing internships, including one at *Frontiers* last year.

Submitted by:
Sue Silver

SCIENTIFIC PROGRAMS OFFICE

The Science Programs Office continues its strong efforts in support of the ESA membership, the scientific community, and public agency scientists and decision makers. Following a Science Office Program Review at the October 2004 Governing Board meeting, these activities have been refocused into three broad categories: advancing Visions initiatives, maintaining responsiveness to the ecological science community, and developing a new sustainability science agenda. These efforts, in collaboration with those of ESA's Education, Public Affairs, and Publications programs, maintain ESA's reputation as a source of reliable knowledge in ecological science.

In a parallel effort to strengthen the ability of ESA leadership to provide advice and support to developing and ongoing Science Office projects, a bylaw revision to combine and reform the ESA SBI and Research Committees into a single Science Committee has been submitted to the ESA Council for approval at the 2005 meeting. We appreciate the continuing support of the Society and the direct involvement of Society members in Science activities, and we welcome your advice, ideas, and energy.

Advancing Visions initiatives

Advancing Visions initiatives includes providing the scientific underpinnings for ESA public awareness and rapid response projects, leading international outreach, and promoting standardization of data collection, documentation, and sharing.

Ecological Visions Committee

Science supported ESA's Ecological Visions Committee, chaired by Margaret Palmer, from its first meeting in January 2003 through the publication of the Committee report, *Ecological Science and Sustainability for a Crowded Planet: 21st Century Vision and Action Plan for the Ecological Society of America,* released in May 2004, and the publication of a special issue of *Frontiers in Ecology and the Environment,* "Visions for an Ecologically Sustainable Future" in February 2005. Although the formal efforts of the Committee have been completed, Science staff continue to be involved in implementing the Visions recommendations to support international outreach and data-sharing activities. Science is also contributing to ongoing staff and Governing Board discussions about a public education campaign.

Issues in Ecology

The Science Office continues to provide staff support to the *Issues in Ecology* series under the leadership of Editor Bill Murdoch. Two new *Issues* on climate change are under consideration, one focusing on impacts on terrestrial communities and one on marine communities.

Ecology in an Era of Globalization

The Science Office is playing a major role in helping plan and raise funds for ESA's *Ecology in an Era of Globalization* meeting in Merida, Mexico in January 2006. Cosponsors to date include the InterAmerican Institute for Global Change Research, United Nations Environment Programme, U.S. Department of Agriculture (Agricultural Research Service, Forest Service, and National Research Initiative), the U.S. Environmental Protection Agency, the U.S. Geological Survey, and local partners including the Centro de Investigación Científica de Yucatán, A.C. (CICY) and the Universidad Autonoma de Yucatán. We are also discussing assistance for this meeting with the Ford Foundation, the Nature Conservancy, and other foundations and NGOs. Additional information, including calls for papers and workshop proposals, is available at ‹www.esa.org/mexico›.

Society Summit on Data Sharing and Archiving Policies

Science Office staff organized a 3-day "summit" meeting, 27–29 September 2004, in Washington, of the leadership of 12 major professional societies involved in ecology, evolution, and organismal biology, with the goal of developing a policy statement on data sharing and archiving, and a roadmap for implementation by the societies. ESA was formally represented by Bill Michener and David Baldwin. Participants agreed on a vision statement, a set of goals, and specific near-term strategies that they will recommend for adoption by their respective societies. The strategies include formation of a Joint Working Group to further advance the vision statement and work to accomplish the group's goals. The Science Office will continue to provide logistical support to the group and are leading an NSF proposal to provide support for future activities. An article describing the Society Summit was published in the January 2005 *ESA Bulletin*, and a related ESA editorial policy, "The editors and publisher of this journal expect authors to make the data underlying published articles available," was announced in the first 2005 issues of *Ecology, Ecological Monographs*, and *Ecological Applications.*

Maintaining responsiveness to the ecological science community

This category of activities includes a wide range of projects that help maintain ESA's reputation as a source of scientific expertise and offer ESA members the opportunity to provide input to environmental management decisions. Some activities overlap with the scope of Visions initiatives; for example, the ESA Vegetation Panel's VegBank database links to the promotion of data sharing under advancing Visions initiatives.

Embassy Science Fellows

The Science Office works with the USDA Foreign Agriculture Service to manage their participation in the U.S. Department of State's Embassy Science Fellows Program, which places U.S. government scientists at embassies overseas to provide expertise, advice, and assistance on science- and technology-related issues.

ESA Panel on Vegetation Classification

Science supports the ESA Panel on Vegetation Classification, which is charged with facilitating and supporting the development, implementation, and use of a standardized vegetation classification for the United States; guiding professional ecologists in defining and adopting standards for vegetation sampling and analysis; collaborating with partner organizations to maintain scientific credibility of the classification through a peer review system; and promoting and facilitating international collaboration. The Panel is in

the process of revising the manuscript of its "Guidelines for Describing Associations and Alliances of the U.S. National Vegetation Classification" for publication in *Ecological Monographs*. The Federal Geographic Data Committee (FGDC) Vegetation Subcommittee is working to create a federal standard based on the Guidelines.

The Panel conducted a workshop at the 2004 ESA Annual Meeting, and has continued to develop and refine of the VegBank database ‹www.vegbank.org› and develop of a peer review system for plot data and vegetation types. The Panel continues to serve as a forum for discussion of issues related to the implementation of the developing national classification. For more information on the Panel activities, see the ESA Panel on Vegetation Classification Report to Council or visit ‹www.esa.org/vegweb/›. Other upcoming activities include a workshop on the Canadian National Vegetation Classification system for the 2005 ESA Annual Meeting, and revising a Memorandum of Understanding that guides collaboration on related activities by ESA, FGDC, The Nature Conservancy/NatureServe, and the National Biological Information Infrastructure.

Invasive Plants in Natural and Managed Systems: Linking Science and Management

The proceedings of the conference *Invasive Plants in Natural and Managed Systems: Linking Science and Management*, held 3–7 November 2003, were published in *Weed Technology* in 2004, and a review article by D'Antonio, Jackson, Horvitz, and Hedberg was published in *Frontiers in Ecology and the Environment* in December 2004. Science staff led ESA efforts in this conference, which was co-organized with the Weed Science Society of America.

National Agricultural Air Quality Workshop

The Science Office is working with a team led by Dr. Viney Aneja of North Carolina State University and Dr. William Schlesinger of Duke University to develop the national *Workshop on Agricultural Air Quality: State of the Science*, which will be held 5–8 June 2006 at the Bolger Center in Potomac, Maryland. This workshop, supported by USDA and NSF, will focus on improving agricultural air quality inventories and recommend technological and methodological changes in current modeling and measurement practices. It will be the first such venue where truly multidisciplinary teams of experts will share their knowledge, present new research, and help shape the future of the agricultural practices and agricultural air quality analysis framework for the United States. Further information is available at ‹www.esa.org/airworkshop›.

National Parks Ecological Research Fellowship Program

The National Parks Ecological Research (NPER) Fellowship Program is a partnership of ESA, the National Park Foundation (NPF), and the National Park Service and is funded through a grant from the Mellon Foundation. The program encourages and supports outstanding postdoctoral research in ecological sciences related to the flora of U.S. National Parks, Monuments, Seashores, and other sites administered by the National Park System. The Science Office supports the advertising, application, and review process, while NPF supports the financial management of the fellowships.

The Review Committee, chaired by Kay Gross, met at Point Reyes National Seashore in November 2004 to select new fellows and hear presentations from the current fellows regarding their research. The Committee recommended 2-year fellowship awards to Natalie Cleavett and Shannon Murphy, both of Cornell University; Peter Kennedy, of UC Berkeley; and Jeremy Long, of the Georgia Institute of Technology. The Committee also recommended an additional year of funding for the existing 1-year fellowship of Nicole Barger, of the University of Colorado. Information and application materials for the 2005 NPER Fellowships (due 1 October 2005) are available at ‹www.esa.org/nper/›.

Harmful Algal Blooms Workshop and Plan

The Science Office continues its efforts supporting the National Oceanic and Atmospheric Administration on the revised *National Plan for Marine Biotoxins and Harmful Algae,* first issued in 1993. Under a cooperative agreement, Office staff helped organize and participated in a workshop in Charleston, South Carolina, 21–25 March 2004. The workshop, attended by approximately 50 invitees, reviewed progress made in the last decade toward achieving the goals of the 1993 plan and set the stage for issuing a revised plan. Rhonda Kranz is working with a steering committee chaired by Don Anderson of Woods Hole Oceanographic Institution and John Ramsdell of NOAA's Charleston, South Carolina laboratory, to finalize the revised plan for publication. Cliff Duke serves on the steering committee.

Peer review support

The Science Office is managing the scientific peer review of a set of eight assessments of the historic range of variation of Rocky Mountain Ecosystems for the U.S. Forest Service's Region 2. Duncan Patten chairs the review and each report is reviewed by Patten and four other reviewers. Four reports (Medicine Bow National Forest, Big Horn National Forest, Pike and San Isabel National Forests, and Arapaho and Roosevelt National Forests) have been reviewed and reports submitted to the Forest Service. One other report has been completed and the review is in progress, and three additional reports are being completed by the authors and will be reviewed in the future. The Science Office also facilitated a peer review of a conservation assessment for the Gunnison Sage Grouse in October 2004, for the Western Association of Fish and Wildlife Agencies.

Plant Conservation Alliance

ESA continues as a Cooperator with the Plant Conservation Alliance, a cooperative program of a number of Federal agencies, which seeks to address problems related to native plant conservation and restoration. Science represents ESA at Alliance meetings, which are held every 2 months in the Washington area.

Sustainable Resources Roundtables

Science staff represent ESA on the Sustainable Rangelands Roundtable (SRR) ‹sustainablerangelands.cnr.colostate.edu/› and the Sustainable Water Resources Roundtable (SWRR) ‹water.usgs.gov/wicp/acwi/swrr/›, which are developing sets of indicators for rangelands and water resources, respectively. Cliff Duke serves on the SRR, whose most recent meeting on 20–21 April was devoted to developing a workshop on indicator implementation, which was held in Ardmore, Oklahoma, 23–26 May. Invited participants from federal agencies and nongovernmental organizations were briefed on the current status of rangelands indicator development and will work to develop an implementation plan to collect the monitoring data necessary to support the indicators.

Over the last several months Rhonda Kranz has participated in three public meetings of the SWRR. As a member of the Steering Committee and the Indicator Development Working Group she took part in a set of retreats in which a small group, drawing from the 400 indicators identified over the 2-year SWRR effort, proposed a core set of overarching sustainability indicators. Most recently, SWRR held a meeting in Ann Arbor, Michigan which 80 people attended to discuss sustainability research needs. The meeting, organized by experts from the social, economic, industrial, and ecological communities, focused on identifying key research needs that promote water sustainability and support sustainability indicators. A report of the meeting findings is available. The draft set of core indicators was also discussed and revised. A follow-up meeting was held in June to finalize the list of core indicators. These will be included in a Roundtable Report to be released in October 2005.

Developing a new Sustainability Science Agenda

This effort is intended to develop a series of activities to examine and articulate the intellectual founda-

tions for a new sustainability science. It will begin formally with a special session, *"Ecological Sustainability in a World of Constant Change: Developing a New Research Agenda for ESA,"* organized by Vice President for Science Gus Shaver, President-Elect Nancy Grimm, and Science Director Cliff Duke at the 2005 Annual Meeting. Follow-on efforts under consideration include stand-alone workshops, a symposium at the 2006 meeting in Memphis, and publications.

Annual Meeting activities

Science is organizing or participating in a number of activities at the 2005 Annual Meeting. These include meetings of the newly formed Science Committee, the Vegetation Panel, and the *Issues in Ecology* Editorial Board. Science Director Duke will co-chair the special session noted in the previous paragraph. The National Parks Ecological Research Fellowships Review Committee will host a reception for current Fellows and guests.

Other activities in the scientific community

Science staff also participate in the scientific community in ways that help communicate ESA capabilities to the community and in turn inform the efforts of staff in the projects and activities summarized above. For example, Rhonda Kranz works on the Biodiversity Project, and serves on the Board of the D.C. Environmentors Project. Cliff Duke serves on the Board of Directors of the Chesapeake-Potomac Chapter of the Society of Environmental Toxicology and Chemistry (SETAC) and is a member of the national SETAC annual meeting committee for 2005. He also served as a judge for the 2004 and 2005 Secretary of Defense Annual Environmental Awards and was a reviewer for this year's EPA's National Student Design Competition for Sustainability Focusing on People, Prosperity, and the Planet (P3 Awards). Cliff is also a member of EPA's Board of Scientific Counselors, which advises EPA's Office of Research and Development.

Science Committee

Pending approval of the Council for the proposed merger of the SBI and Research Committees into a single Science Committee, the Science Office welcomes those who have agreed to serve on this committee: Gus Shaver, Chair (Marine Biological Laboratory), Laurie Drinkwater (Cornell University), Susan Harrison (UC-Davis), Mathew Leibold (University of Texas), Mary Power (UC-Berkeley), Phil Robertson (Michigan State University), Ricardo Rozzi (University of North Texas), and Michael Slimak (U.S. Environmental Protection Agency).

Staff:

Cliff Duke, Director; Rhonda Kranz, Program Manager; Devon Rothschild, Program Assistant

Submitted by:
Cliff Duke

PUBLIC AFFAIRS OFFICE

Over the past year, ESA public affairs activities focused on conveying ecological information and resources to the media and to Congress, working with the broad scientific community to foster support for science, publicizing the Society's activities, and outreach to ESA members.

Highlights

1) Launched ESA's newly established Rapid Response Teams providing timely scientific input to pending legislation, especially Endangered Species Act amendments.

2) Met and facilitated meetings with over 20 congressional and Executive Branch offices on issues important to the ecological community.

3) Developed and distributed Society statements on proposed regulatory changes.

4) Co-sponsored three public briefings.

5) On behalf of the USGS Coalition, organized an educational field trip for 20 congressional staff.

Policy

Thanks to the newly formed teams of ESA member experts and to the efforts of the Society's Policy

Analyst, Laura Lipps, the Society was able to play an active role in numerous environmental policy issues over the last year.

- Meetings with congressional and Executive Branch offices: Over the year, PAO staff, Rapid Response Team experts, Public Affairs Committee members, and Governing Board members, met with over 20 congressional and Executive Branch offices, including discussions with representatives of the White House Office of Management and Budget, and National Science Foundation. A sampling of meetings:

  - ✓ ESA Rapid Response Team members Stanley Temple, Virginia Dale, and John Wiens led a series of Public Affairs Office-initiated "dialogues" with House and Senate staff working on endangered species legislation.

  - ✓ Lymn and Lipps participated in a USGS Coalition meeting with White House OMB officials to discuss the role and science contributions of the U.S. Geological Survey.

  - ✓ Lymn participated in discussions with Senate staff regarding science funding outlook under the new leadership and structure of congressional appropriations committees.

- Statements: Working with ESA's President Jerry Melillo and with members of various ESA RRTs, PAO developed and distributed several ESA statements throughout the year. Of particular note these included:

  - ✓ Written testimony on the fiscal year 2006 budgets of seven federal agencies (DOE, NOAA, NASA, NSF, EPA, FS, USGS)

  - ✓ Letters from ESA's President on the Forest Service Planning Rule, the National Marine Fisheries Service Columbia River Basin Salmon, and Proposed Changes to the Forest Service Roadless Rule

  - ✓ Endorsement of a "Pollinators" stamp.

- Input to congressional legislation

  - ✓ This year, ESA had numerous congressional requests for feedback on pending legislation, a direct result of the Society's RRT efforts. Senate and House staff on both sides of the aisle contacted ESA to ask for input on various possible amendments to the Endangered Species Act. Public Affairs staff enlisted the help of various RRT members, as well as Public Affairs Committee members, to respond.

- ESA again this year participated in the annual Coalition for National Science Funding Capitol Hill Exhibition and Reception. The event featured over 30 exhibitors—including ESA member Mark Bush of Florida Institute of Technology—and showcased research made possible by funding from the National Science Foundation. A record 380 congressional staff, Members of Congress, White House, and NSF officials attended the event. Staff and a Congressman from the House Science Committee were particularly interested in the ESA exhibit which featured Bush's work on climate in the field and in the classroom.

- Nadine Lymn, Director of Public Affairs, together with Adrienne Sponberg of the American Institute of Biological Sciences (AIBS), continued to co-chair the Biological Ecological Sciences Coalition (BESC) working to raise awareness among the White House and Congress about the state of funding for the nonmedical biological sciences. Throughout the year, BESC organized a special federal briefing for members of the biological community, met with congressional appropriations staff, and met with the White House's Committee on Environmental and Natural Resources.

- ESA participated in the 10th Annual

Congressional Visits Day. Public Affairs staff and three ESA members, from Pennsylvania (Anika McKessey and David Bowne) and West Virginia (Gera Jochum), met with six congressional offices to encourage support for science funding overall and for ecological research specifically.

- PAO continued to track and report on the status of legislation, federal science appropriations, and environmental policy activities in the national and international arena through its bi-weekly Policy News. In March, Lymn teamed up with staff from AIBS to write a chapter for the annual publication of the American Association for the Advancement of Science*, AAAS Report XXX: Research & Development FY 2006*. The ESA/AIBS chapter analyzed the nonmedical biological science elements of the President's fiscal year 2006 budget.

Press

- Press preparations for the 2005 Annual Meeting have included press releases highlighting symposia and oral sessions and working with university and agency public information officers to generate additional publicity for the meeting. Drinkard has worked with a translation firm to have several of the releases translated into French-Canadian to reach out to members of the Montreal press.

- Coverage of the ESA Annual Meeting held in Portland, Oregon generated over 30 stories. Among the news outlets covering the conference were: *Science Now* and *Science Magazine*, *Seattle Post Intelligencer*, AP, BBC, and *The Oregonian* . (ESA does not have a media clipping service; there was more coverage than we are able to track).

- PAO staff continued to build on its media contacts this year and issued over a dozen press releases highlighting Society journal articles and the Annual Meeting. Drinkard also participated in the National Association of Science Writers Meeting as well as the AAAS meeting.

- The media's growing awareness of the Society as a scientific resource was reflected in the steady influx of reporter-initiated calls throughout the year. Inquiries came from both the popular (NPR) and scientific (Nature) press and covered a wide range of topics from pollinators to tsunamis.

Several ESA press releases were especially popular with the press including:

- ✓ *Where the sage-grouse roam* and *Scientists issue statement on scientific peer review* (600 hits in one month)

- ✓ *Almost good enough to eat* and *Mystery on the Hudson* and *Highlights* in the June 2005 issue of *Frontiers in Ecology and the Environment* (over 700 hits in one month)

- ✓ Highlights from the April issue of *Ecology* (over 1300 in one month).

- A recent sampling of ESA "in the news" includes:

  - ✓ *Kodiak Daily Mirror*, Alaska - Magazine published controversial crab article ‹http://www.kodiakdailymirror.com/?pid=19&id=1649›

  - ✓ *Financial Times*, London—Cod off North America "has fallen by 96%"

  - ✓ CNN—Scientists: Cod Stocks down 96% since 1850's.

  - ✓ Xinhua online China View—Research shows U.S. exports nitrogen pollution beyond borders.

  - ✓ The Sault Tribe News - Ethnobotanists merge past, present and future: Ecology students visit Mary Murray culture camp on Sugar

Island

- ✓ *Denver Post*—Soil Fertility's fall from graze.

Scientific American, ScienceNow, and *Science Magazine*, NPR, Innovations Report (Germany), Associated Press, and Reuters also published stories.

Outreach

- Lymn, together with colleague Adrienne Sponberg (formerly with AIBS, now with ASLO), developed and gave two Policy Training Workshops designed to equip biological scientists with tools to participate in public policy. The first Policy Workshop took place at the request of the Organization of Biological Field Stations (OBFS), and the second at the Chesapeake Biological Laboratory. In each case, Lymn and Sponberg worked with about 20 scientists to coach them in methods to influence policy, concluding with simulated congressional visits. Lymn, Lipps, and Sponberg will be giving a similar Policy Workshop at the ESA Meeting in Montreal.

- Drinkard produced the Society's eighth *Annual Report*, distributed to the membership in January. The report covers all aspects of the Society, including finances; the Public Affairs Program and Publications Offices; and chapters and sections. In addition to providing an overview of Society activities for ESA members, the report is useful for meetings with potential funding sources and with others who are interested in the Society.

- ESA organized or co-sponsored three briefings and one congressional field trip this year:

  - ✓ An invasive species briefing, with a congressional and administration audience of 100.

  - ✓ A briefing on mercury and wildlife, with an audience of 25 congressional staff.

  - ✓ A briefing on ESA's position paper on genetically engineered organisms, with an audience of 25 Environmental Protection Agency staff via audio–video conference.

  - ✓ A field trip for 20 congressional staff showcasing U.S. Geological Survey research on the Chesapeake Bay Watershed and featuring both posters and an interactive trip on a Skipjack.

Staff

The Public Affairs Office is staffed by: Nadine Lymn, Director of Public Affairs; Annie Drinkard, Public Affairs Officer; and Laura Lipps, Policy Analyst.

Submitted by:
Nadine Lymn

EDUCATION OFFICE

This year has been a productive one for the ESA education office, which develops and manages programs that seek to increase the diversity of ecology-related professions and improve the quality of ecology education at all levels. In 2003/2004 we continued to expand on our main education projects including EcoEdNet (Ecology Education Network), Teaching Issues and Experiments in Ecology (TIEE), and SEEDS (Strategies for Ecology Education, Development, and Sustainability), as well as remaining active in education and policy activities occurring both nationally and in the D.C. area. The Education office staff also engages in many outreach activities such as dissemination of education materials through our web site and mail.

Staff update

In early January, Jeramie Strickland joined the Education Office as a student coordinator. Among other duties, Jeramie will help maintain contact with both

current and former SEEDS students. Jeramie is from Chicago and recently completed a Bachelor's of Science degree from Delaware State University. Prior to joining ESA he interned with Michigan State University, Purdue University, Delaware State University, and the USDA.

Felixcia Mendoza, a recent graduate from Howard University, began work as an education intern in March. Felixcia will continue working with the Education Office and SEEDS throughout the summer. Following her internship with ESA she will begin working on her M.S. degree at Louisiana State University.

ESA member activities

Education staff helped with a variety of member-initiated activities, which include:

- Helping the Education Section produce a survey focusing on ecology in the undergraduate curriculum. The survey results are currently being analyzed.
- Working with board members towards planning a public information campaign as outlined in the Ecological Visions report.
- Assisting the Women and Minorities in Ecology (WAMIE) Committee to complete a follow-up to the 1993 WAMIE report.
- Developing a "Profiles of Ecologists" survey with the Education and Human Resource Committee (EHRC).
- Coordinating the 2004 EHRC meeting.
- Meeting with the Environmental Justice task force to help them implement their long-range planning grant.

Collaborations

Taylor collaborated with education staff at the American Institute of Biological Sciences (AIBS) and the Botanical Society of America (BSA) to conduct a survey on the effects of impacts of the National Research Council's report, BIO 2010: Transforming Undergraduate Research for Future Research Biologists. The survey results are currently being analyzed.

ESA continues to participate in the Diversity in Biological Sciences (DIBS) coalition, composed of organizations with interest in promoting diversity in biology research, education, and careers.

SEEDS Program

Campus Ecology Chapters

In late fall, a call for new SEEDS Campus Ecology Chapters was disseminated to minority and majority serving institutions across the country. Currently 29 schools are part of the SEEDS chapter network. SEEDS staff visited numerous Chapter schools (Bethune Cookman College, Dillard University, Johnson C. Smith University, Florida Memorial College, Livingstone College, North Carolina A&T State University, University of Texas-El Paso) in order to build relationships and promote application deadlines. An RFP was disseminated for Special Project Awards and the following projects received funding:

- Bethune Cookman College. Project B.L.E.A.C.H. II – BCC Led Exercise to Advance Coral Health – an expedition to research and educate fisherman on the ecological danger of chlorine bleach fishing.
- College of Menominee Nations. Faculty and student trip to attend the "Greening of the Campus" Conference.
- Livingstone College. Establishing a Teaching Greenhouse to Conduct Research. University of Texas at El Paso. Using the Rio Bosque Wetlands as a field laboratory to encourage volunteering, monitoring, and outreach.
- Haskell Indian Nations University. Native American Pathways: Research and Careers in Ecology, Environmental Issues, and Conservation to introduce Native American college students to career and research opportunities in the fields of ecology, environmental science, and conservation.

Field trips

Hoffman organized a SEEDS Field Trip, 18–21 November, to Lafayette, Louisiana, highlighting the research of the United States Geological Survey's National Wetlands Research Center (NWRC). Attendees included 19 students from 14 schools across the country, two faculty, and three SEEDS staff. Ecologists from the NWRC exposed students to the research being conducted at several sites in south Louisiana, including a prairie, marsh, and swamp. The research foci varied from prairie succession, to wildlife management (nutria), to swamp sedimentation.

From 12–18 June, a field trip was sponsored to the University of Michigan's Biological Station in Pellston, Michigan. Field trip attendees included 18 students from 12 schools across the country, three SEEDS faculty, and four SEEDS staff. Faculty and students from the University of Michigan's Biological Station exposed students to the research being conducted at several sites in northern Michigan. Research highlights included small mammals, limnology, ethnobotany, and biogeochemistry.

The 2005 fall field trip will take place 10–13 November at the Sevilleta Long-Term Ecological Research site. Applications will be disseminated in August.

ESA Annual Meeting

Twenty-nine students and 18 faculty members were supported to attend the 2004 Ecological Society of America Annual Meeting. Three additional faculty members attended with their own support. Several events were planned specifically for SEEDS participants and mentors including a student orientation and outing to downtown Portland, a faculty meeting, a mentors' orientation, a mixer and dinner, a mentors' breakfast, and a participants' workshop. SEEDS participants also took part in EHRC activities such as the Education Mosaic Mixer and Diversity Luncheon. An "Introduction to SEEDS" workshop was held to provide ESA members with information on the program and how to become involved. Students were paired with a meeting mentor in their interest area and a SEEDS alumni mentor. Alumni mentors are former SEEDS students who are in or recently finished graduate school. The mentors provided support for the students during the meetings. Mentors helped students network with other ESA members, guided students through all of the options of sessions to attend, and provided academic and career advice.

The SEEDS Program is sponsoring 35 students, 6 SEEDS alumni, and 20 faculty members through travel awards for the 2005 ESA Annual Meeting.

Fellowships

In early January, Melissa Jurgenson-Armstrong organized a professional development workshop at Haskell Indian Nations University in Lawrence, Kansas for the 2004-2005 SEEDS undergraduate research fellows. Jurgenson-Armstrong, Strickland, all five fellows, and three of their mentors attended the meeting. The aim of this workshop was to provide professional development directed at helping fellows plan and carry out their independent ecological research project. The 2004-2005 fellows will be presenting their research at the ESA Annual Meeting in Montreal.

In the spring, five new fellows were selected for the 2005–2006 cohort. Their fellowship will kick off at the 2005 ESA Annual Meeting.

Advisory Board

The SEEDS Advisory Board met in early March and discussed program assessment, funding opportunities, and future collaborations. The Board will meet again at the ESA Annual Meeting in Montreal.

Digital education projects

Volume 3 of Teaching Issues and Experiments in Ecology (TIEE) was published online ‹tiee.ecoed.net› in early April; a cd version is also available. It demonstrates a high level of ongoing support by scientists and educators for TIEE and includes three new Long

Term Ecological Research (LTER) Data Sets from the Temperate Lakes, Arctic, and Konza LTER sites, a *Frontiers* issue concerning fire ecology, and four new Experiments.

As part of TIEE's evaluation effort, a "research team" was selected through a competitive application process. This team consists of ecology faculty from diverse institutions, who will seek to better understand the effectiveness of TIEE in a wide range of settings and classrooms. These faculty will receive mentoring on basic tools for classroom evaluation, research, and other facets of "scientific teaching." A workshop will be held at the 2005 ESA meeting to identify common goals and outcomes and to plan the study. They will then use some of the TIEE resources in one course during the 2005–2006 academic year and study the effects of TIEE on student learning, while communicating with each other electronically throughout the year. The team will share their findings in a poster session at the 2006 ESA Annual Meeting and contribute to the collective wisdom about inquiry-based, student-active ecology teaching.

In early April the Bioscience Education Network (BEN) collaborative submitted a grant to the National Science Foundation (NSF) for Cycle 3 National Science Digital Library (NSDL) funding to continue and enhance the project.

Meetings

Education staff attended, exhibited, and presented at a number of scientific, minority, and education meetings. Workshops focusing on careers in ecology were conducted at the following conferences: Society for the Advancement of Chicanos and Native Americans (SACNAS), American Indian Science and Engineering Society (AISES), Minorities in Agriculture and Natural Resources and Related Sciences (MANRRS), and the North American Association of Environmental Education (NAAEE) meetings. Hoffman attended a meeting focusing on promoting biology to American Indian teachers, sponsored by the American Physiological Society, and participated in a Global Science Literacy meeting in Costa Rica in the spring. Strickland served as a judge at the 13th Annual EnvironMentors Research Fair in early May. Forty-three District of Columbia high school students presented their environmental-science-related research projects to a team of judges at the fair. Strickland also attended the Environmental Career Event in late April at the Brookside Gardens Visitors Center. During this event he exhibited and disseminated information and resource materials to more than 100 elementary and high school students. Taylor helped organize the "science bowl" at the American Indian Higher Education Consortium (AIHEC) meeting and attended the NASA Earth Explorer Institute at Goddard Space Flight Center. Taylor also attended the AAAS annual meeting and presented a workshop on the Bioscience Education Network along with other BEN partners. Taylor participated in three week-long meetings of the National Ecological Observatory Network (NEON) design consortium as co-chair of the K–12 education subcommittee.

Staff

The Education staff consists of Jason Taylor, Education Director; Katherine Hoffman, Education Program Manager; Melissa Jurgenson-Armstrong, Regional Coordinator; and Jeramie Strickland, Student Coordinator, as well as a number of interns.

Submitted by:
Jason Taylor

PUBLICATIONS OFFICE

Submissions and Production (see Table 1 for summary)

Calendar year 2004 brought another marked increase in submissions to ESA journals relative to the previous year. Between 1 January 2004 and 31 December 2004, the Publications Office logged in 1,786 manuscripts, a 10.2% increase compared to 2003, and a new all-time record. Of the manuscripts received last year, 1229 were submitted to *Ecology/Ecological Monographs* (a 3.4% increase relative to the previous

year), and 557 were submitted to *Ecological Applications* (a 28.9% increase). The data for submissions since 1987 are presented graphically in Fig. 1.

Based on the submissions so far in 2005 (through 30 June; 984 total), submissions in the present year are up 11.3% over 2004. Submissions to *Ecology* account for the lion's share of this year's increase (704 submissions in 2005, as of 30 June). If the trend continues through the year, *Ecology* will receive 14.6% more submissions in 2005 than in 2004!

The acceptance rates (percentage of decisions made during 2003) were 22.4% for *Ecology/Ecological Monographs* and 25.1% for *Ecological Applications* (see Fig. 2). The numbers indicate that ESA's journals are among the most selective journals publishing papers related to ecology. The sharp decline in the acceptance rate for *Ecological Applications* is largely due to fewer decisions being made for Invited Features and Special Issues during 2004 than in 2003.

The continuing decline in the average length of Ecology articles (see Fig. 3) reflects the ongoing effort to encourage authors to submit more concise papers for publication and to promote the use of *Ecological Archives.*

The three print journals published 6462 pages in 2004, including a 322-page supplement to *Ecological Applications* ("The Large-Scale Atmosphere–Biosphere Experiment in the Amazon"), 4.9% more than in 2003 (see Fig. 4).

The page budget was increased in 1999 in an effort to decrease the backlog of papers awaiting publication (thereby decreasing the time between acceptance and publication). The manuscript histories published as footnotes for each published paper indicate that papers are now appearing in an increasingly timely manner. The Governing Board has recently approved another increase in the page budget for *Ecological Applications.*

During 2004 the *Bulletin* published 213 pages, essentially the same as in 2003. Our ability to include color images has added to the visual appeal of the *Bulletin.*

Overall, the journals remain healthy. The large volume of submissions, the high circulations, and the consistently high impact factors for ESA journal articles (according to the ISI Science Citation Reports) reflect the esteem with which the profession views ESA publications.

Time to publication

We have made dramatic progress over the past few years in decreasing the time to publication (as is evident from the manuscript histories printed as footnotes to each published paper). The backlog of accepted papers awaiting publication is essentially a thing of the past, thanks primarily to the increased page budget adopted several years ago. There have also been payoffs resulting from the efforts to encourage authors to submit more concise papers as Reports (*Ecology*) and Communications (*Ecological Applications*), as well as the increasing use of *Ecological Archives* for digital publication of information not integral to accepted papers. Shorter papers can be reviewed, revised, and copy-edited more quickly than the standard articles of the past. In addition, we can publish more of them in a given issue, while still keeping within the page budget. It is increasingly common to see papers published in as short a time as 5–6 months following submission.

Ecological Archives

We have continued to promote the publication of appendices and supplemental materials in ESA's Electronic Data Archive, *Ecological Archives.* During 2004, 174 of the papers published in ESA journals had one or more digital appendices and/or supplements published in *Ecological Archives* (and linked to the online versions of the published papers). Data Archive Manager Jane Bain has done a superb job of keeping up with the accelerated pace of files to be posted. The default is that all appendices and supplementary mate-

rial referred to as being "available" in published papers are posted in digital form in *Ecological Archives* and are not printed. ESA is one of the leaders in the biological sciences in the use of digital archiving in conjunction with its publications.

Online submission and peer review

We successfully implemented a new totally web-based system for manuscript submission and peer review on 1 January 2004. The entire staff, and Publications Coordinator Anne Marie Whelan in particular, have worked very hard to make the system work to the best advantage of our authors, editors, and reviewers. In late June–early July 2005, we suffered a serious setback when our server crashed, but we are happy to report that only 24 hours of data were lost. We regret that we were essentially out of commission for 8.5 days, and we are taking steps to make sure that we have filled in the chinks in our armor. A new server is scheduled for installation in the weeks before the Annual Meeting.

Staff

David Baldwin, Managing Editor, Jane Bain (Data Archive Manager and Features Editor), Gail Blake (Copy Editor), David Gooding (Associate Managing Editor), Dooley Kiefer (Copy Editor), Rachel Lodder (Copy Editor), Regina Przygocki (Graphics/Production Editor), Jane Shaw (Office Manager), Margaret Shepard (Technical Editor), Nancy Sorrells (Copy Editor), Heather Carlo (Office Assistant), Linda Stoddard (Editorial Assistant), and Anne Marie Whelan (Publications Coordinator). Freelance copy editors Ellen Cotter, Jennifer Dotson, Nancy Istock, and Anita Seaberg.

Submitted by:
J. David Baldwin

Table 1

Summary Statistics

Statistic	2003	2004	Percentage change, 2003–2004
MSS submitted, *Ecology/Monographs*	1,189	1,229	+3.4
MSS submitted, *Applications*	432	557	+28.9
Total MSS submitted	1,621	1,786	+10.2
Acceptance rate (%), *Ecology/Monographs*	24.5	22.4	---
Acceptance rate (%), *Applications*	38.6	25.1	---
Pages published, *Ecology*	3,430	3,470	+1.2
Pages published, *Monographs*	664	702	+5.7
Pages published, *Applications*	1,838	1,968	+7.1
Pages published, Supplement	228	322	---
Total pages published, journals	6,160	6,462	+4.9
Pages published, *Bulletin*	212	213	+0.5
Papers with *Ecological Archives* postings	126	174	+38.1

Figure 1

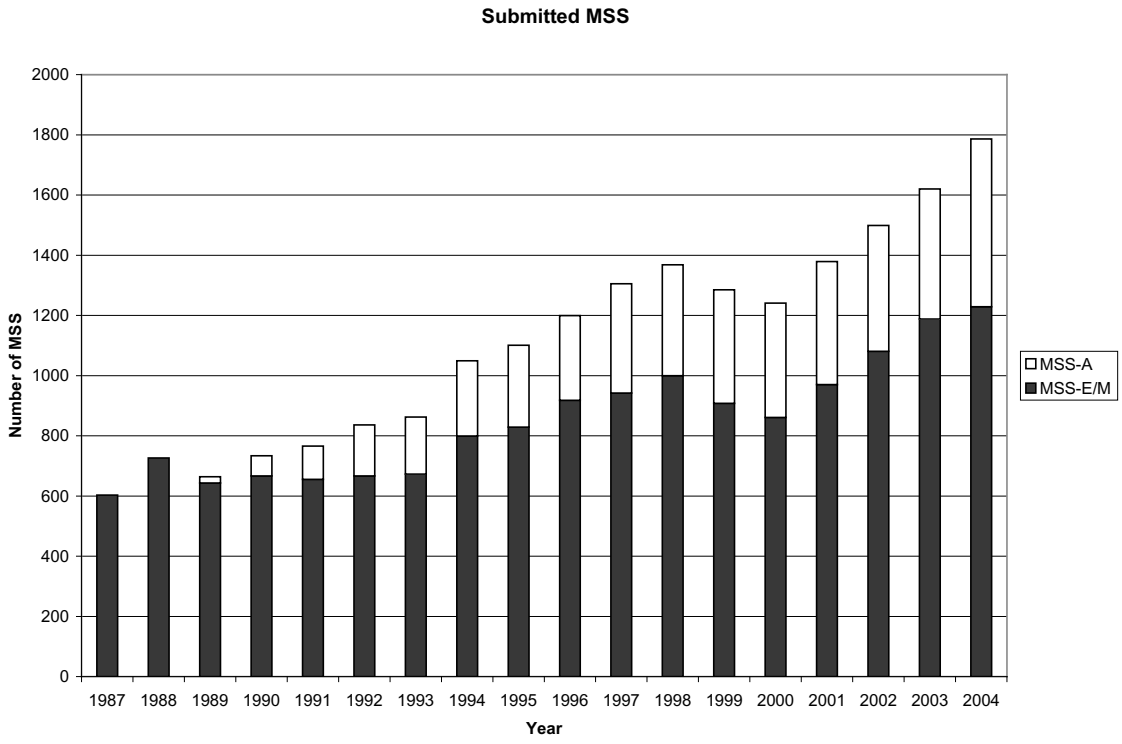


Figure 2

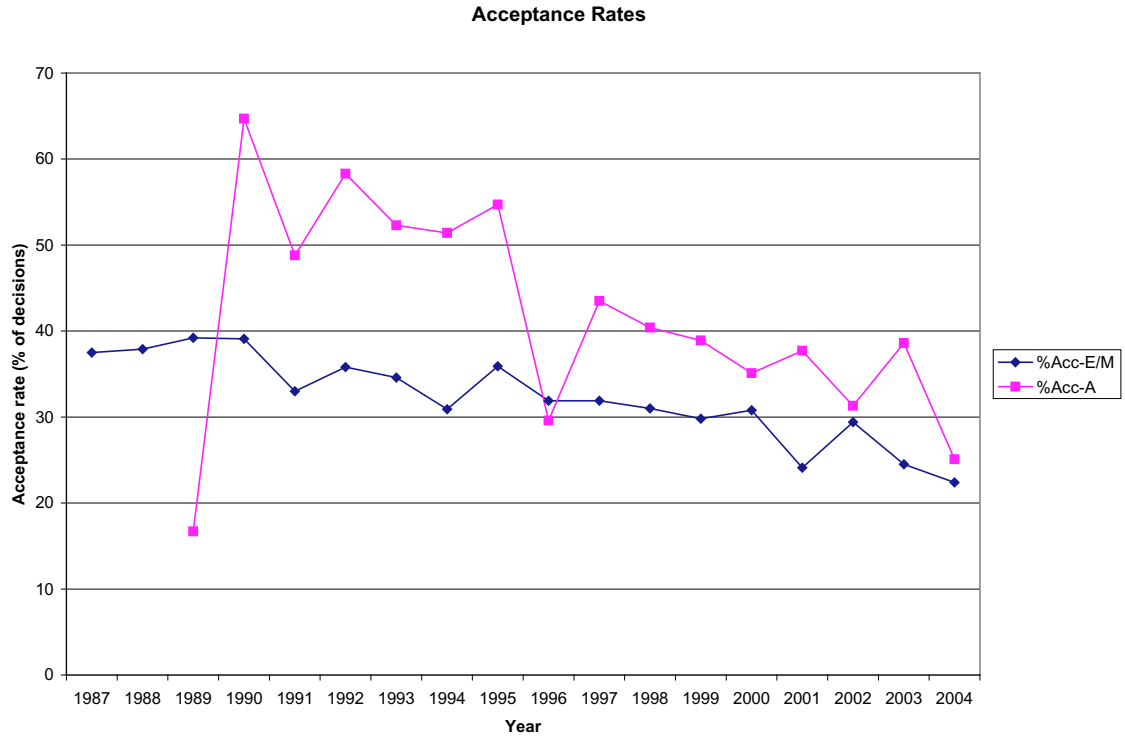


Figure 3

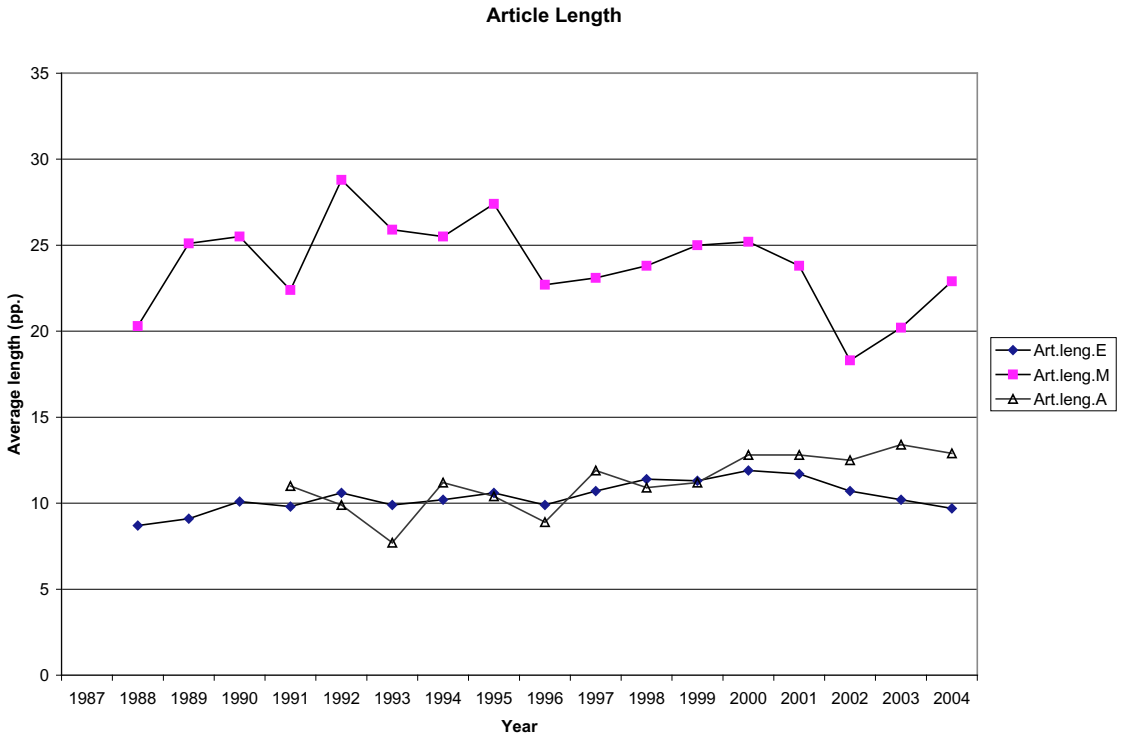
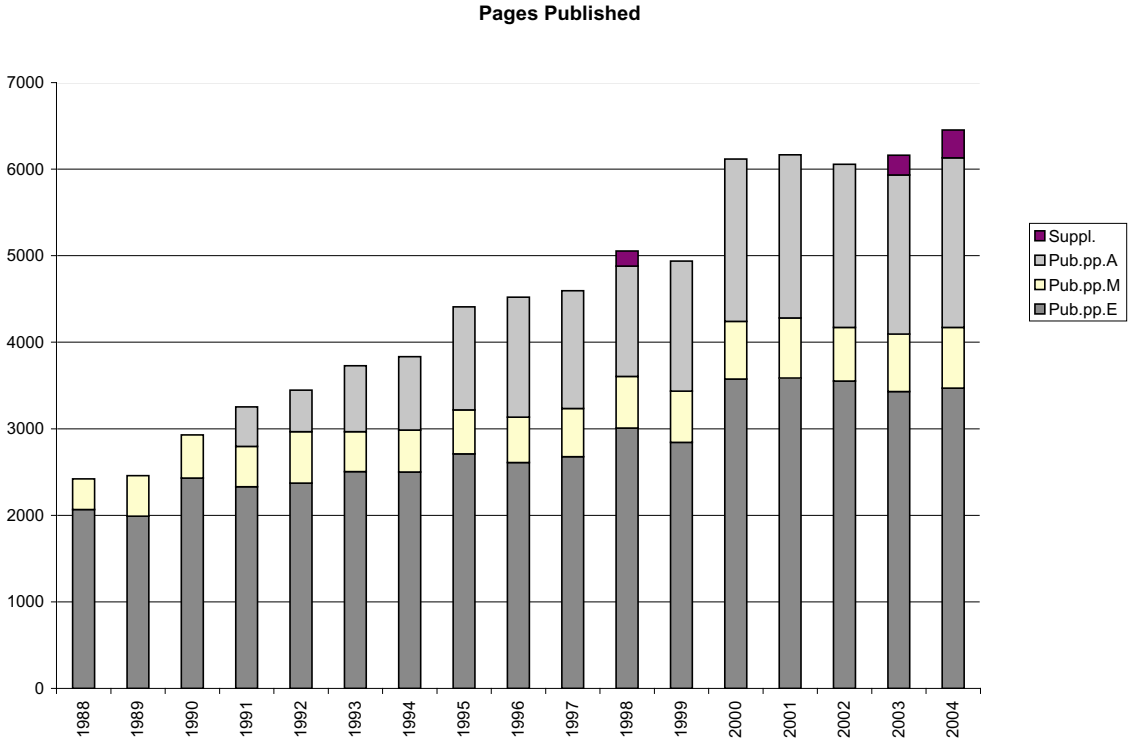


Figure 4



MEETINGS

Overview

Even with the larger Annual Meetings experienced by ESA, the continuity and consistency of those staff undertaking ESA meeting functions, combined with greater coordination and efficiency using a "team" approach to planning, enables our Society to execute increasingly large and complex meetings skillfully, economically, and innovatively.

Our string of successful meetings is emulated by other organizations. During the past year, several nationwide publications for meeting professionals have given prominent coverage to aspects of ESA meetings, especially activities that promote energy conservation and greening; interface with local ecologists, and make imaginative use of natural and historic sites.

HQ meeting planning is coordinated closely and regularly with the work of ESA's Meetings Committee, the Program Chair and Local Host Committee, the staff expertise of the local Convention and Visitors Bureau and Convention Center, as well as a number of individuals and organizations in the destination location. Due to this synergy of energy, knowledge, and skill, ESA is able to accomplish a great deal, without the expense of outsourcing meeting functions to destination management or consulting firms.

Familiarity with the attendees' preferences and patterns enables us to better plan, anticipate, and innovate. Being able to track registration and session statistics over a number of years allows ESA HQ to examine patterns and trends and better advise Program Chairs and Local Hosts.

In addition, with the benefit of the high degree of honest feedback from post-meeting evaluations, and continued improvements in technology, we are able institute changes and experiment with new ways to provide a quality meeting experience.

With every year and every meeting we run, we discover things that we can do to make the experience better for the attendees, the volunteer leadership, and the staff. The constant evolution of ESA's meeting functions are a "work in progress."

89th Annual Meeting—1–6 August 2004—Portland, Oregon

Careful analysis of the Post-Meeting Evaluation from the Portland meeting underscored the overall satisfaction with Portland as a meeting location (32% of meeting attendees responded to the electronic survey).

Of those who responded to the evaluation, the following aspects received the most frequent positive comments:

- Having almost all meeting functions and activities under one roof.
- Portland's light rail system – especially free or very low-cost access from the airport to downtown.
- Program organization and integration.
- Contributed papers and organized oral talks on a 15-minute presentation, 5-minute question schedule.
- Organized Oral Sessions.
- Abstract Kiosks; eliminating printed Abstract books
- Tables for incidental seating/networking within the Oregon Convention Center.
- Opening Mixer—food didn't run out.
- Extended time, location and amounts of free coffee/tea service.
- Longer lunch breaks.
- Social at the World Forestry Center.
- Curbside coffee/pastries for field trips.
- Good student representation.
- Portland's amenity value—Starbucks coffee, microbreweries, good restaurants, scenery, reputation for "greening and recycling."
- Portland State University residence hall lodging.
- Meeting tote bags.

The aspects that were more negatively evaluated:

- Some hotels located nearest the Oregon

Convention Center were poor value and generally unsavory.
- Abstract Submission fee process; fee not refunded or deducted off registration.
- Poster aisles were too narrow and congested to make for ease of viewing.
- Lunch break options outside of Oregon Convention Center hard to find; inside Convention Center, expensive.
- Taxonomic organization/unclear basis of organization of contributed paper and poster sessions.
- Program scheduling conflicts.
- Too many concurrent sessions.
- Monday Plenary makes meeting "longer." Put the "free afternoon" later in the week.
- Keynote speaker.
- Greater international focus in papers and programs
- Alternative food options for "vegans."
- A minority objected to the 15:5 scheduling, longer lunch breaks, evening activities, and wanted the meeting to be shorter.
- Walking distance inside the Oregon Convention Center from one side to another was formidable.
- Problems with POVA Passkey system for lodging reservations.
- Distance to dormitory lodging, especially at Lewis and Clark, value provided for dorm rates, dormitory shuttling schedule and frequency.
- Having to pay individually for wireless Internet access within the Oregon Convention Center.
- Affordability —of meeting, of field trips, of beer, of food in general.
- Meeting theme—Lewis and Clark—offensive and limiting.

While 95.5% of the respondents to the evaluation felt that ESA should meet in Portland again at some future time, many of those felt that ESA should be rotating meeting destinations over a series of years and continuously evaluating new potential destinations.

90th ESA Annual Meeting, held jointly with INTECOL—7–12 August 2005—Montreal, Quebec, Canada

The report by Program Chair Paul Ringold lists the specific statistics for this joint meeting and we will not repeat them here.

Significant innovations at this meeting are:

- ESA HQ used E-IMIS, a real-time system for meeting registrations (including workshops, field trips, and ticketed events), also linked to ESA's IMIS Database.

- The Exhibit/Poster Hall will be configured in "villages" not only to reflect the theme and make finding contact between attendees easier, but moreover, to better integrate exhibitors, posters with spacious aisles and access, beverage and food service, abstract kiosks, and incidental seating. The configuration of the Exhibit Hall also includes grab and go lunch distribution, a job mart "interview" space, eminent ecologists profiles and SEEDS fellows profiles.

- Attendees may post voluntary requests for "poster presentations" during the second hour of the lunch break.

- Recruitment of bilingual student volunteers.

- The popular closing "wrap up" breakfast has been moved to a later "brunch" slot and additional sponsorship has been generated.

- Complimentary Wireless cloud in most meeting spaces in the Convention Centre.

- Increased number of activities for and involving graduate and undergraduate students.

- Half-day "Special Sessions" for policy, land/water management, NEON, Millennium Ecosystem Assessment, ecology technology talks.

From the first, planning for the Joint ESA–INTECOL has presented a number of unique opportunities and challenges for ESA.

The French Canadian location:

- Montreal is a cosmopolitan and highly appealing meeting destination; virtually unmatched in North America. However, Montreal is more urban, with more big-city prices, costs, and complexities than many ESA Annual Meeting second-tier destinations, but also has more direct flights, more adjacent lodging, and many more eateries.

- All rates, prices, costs are provided to us in Canadian dollars. Accounting for the ever-variable exchange rate, less favorable to the United States than when we initially decided to meet in Montreal, has imposed budgetary challenges.

- Transborder shipping, taxes, NAFTA, customs and immigration have ramifications, or at the very least, require more advance preparation for meeting attendees, exhibitors, suppliers, and staff.

- French is the predominant language in Montreal; thus agreements, contracts and negotiations have upon occasion required translation. Additionally, our meeting vendors have had to apply for work permits, and have had to subcontract with bilingual local firms.

Meeting jointly with INTECOL

- Montreal is expected to be a large meeting. A standard ESA Annual Meeting usually generates 2800 abstracts. This year's meeting has generated nearly 3,500, many of which are from overseas authors. In addition, an increased number of proposals for symposia, workshops and organized oral sessions were submitted. This meeting may well end up being 25% larger overall than any previous meeting.

- The approximate 25% increase in the number of abstracts and proposals has resulted in more rigorous review of the scientific program and much more intense and more concentrated work on the part of the Program Chairs, assistant, and the Meeting Planner. The increase also translates into scheduling more concurrent meeting rooms, additional audio-visual setups, the need for more student projectionists, and the expense of more poster boards and more meeting rooms at the Convention Centre.

- This year's scientific program is replete with international studies and case examples, multicontinent research, and presentations by leading international ecologists in a large number of disciplines. The expansion of aquatic ecology, avian, and landscape ecology sessions, for example, and endorsements by a very wide diversity of groups and agencies is particularly significant.

- Attention has been paid to make almost all scientific sessions of interest to attendees from both ESA and INTECOL; however, we have provided a range of scientific sessions of specific interest for INTECOL attendees concurrently with the Opening Plenary, which is almost exclusively for ESA attendees.

Working with an activist Local Host Committee

- On their own initiative, and also by invitation from the Program Chairs, the Montreal Local Committee has taken an active role in meeting review and planning. They have pressed for more "greening" and "environmental" initiatives including a voluntary "carbon exchange." In addition to developing their own bilingual web site, the Montreal Local Committee has been involved in selection of local caterers, entertainment and other vendors, the location

of the Thursday evening social, and a range of requests to orchestrate a fully-integrated bilingual (English/French) meeting.

Mexico Themed Meeting —8–12 January 2006—Merida, Yucatan, Mexico

The Mexico meeting is unlike any mid-sized meeting ESA has previously attempted. Not only selecting a meeting location in Mexico, and learning how to handle language, monetary, logistical, customs, and cultural differences, and working to fully integrate ecologists from Mexico, South, and Latin America with counterparts from the United States, but also creating a meeting such as this on our own initiative, rather than partnering with another society which already has generated a base of underwriting, provides ESA with tremendous opportunity combined with some risk.

ESA—both staff and Co-Chairs—have assumed full responsibility for designing the meeting content, identifying invited speakers, generating sponsorship and financial support, recruiting a program and local host committee, calling for and evaluating abstracts, and undertaking the multitude of tasks that are an implicit part of running a meeting from scratch.

It is anticipated that this meeting will attract between 300 and 500 registrants. Registration fees have been reduced for attendees from Latin America.

The meeting Theme, *Ecology in an Era of Globalization: Challenges and Opportunities for Environmental Scientists in the Americas*, has three specific sub-themes: invasive species, human migration, and production.

- After evaluating three potential locations in Mexico, Merida in central Yucatan was selected because of its culture, history and attractions, scientific institutions, modern airport and ease of access by air, as well as affordability, excellent core hotels and cuisine. The Merida location demonstrates examples of all three of the sub-themes.

- A meeting web site, sections of which are English and Spanish, has been developed and posted, and thus far, preliminary interest has been high.

- The Local Host committee, consisting primarily of ecologists from CICY and the University of the Yucatan, are writing a bilingual local natural history and organizing a number of overnight, one-day, and shorter scientific field trips.

- Co-Chairs Jose Sahrukan and Jeff Herrick are fleshing out the Program Outline and are inviting major theme and subtheme Plenary speakers; Former Secretary of the US Department of the Interior Bruce Babbitt is the keynote speaker.

91st ESA Annual Meeting—Memphis, Tennessee—6–11 August 2006

The program chair for this meeting is Kiyoko Miyanishi, and the local host chair is Scott Franklin. The logo for the 2006 ESA Annual Meeting in Memphis as well as a theme statement—Icons and Upstarts in Ecology—and Call for Symposia and Organized Oral proposals have been developed and posted on the Memphis Meeting web site.

- Hotel contracts and arrangements with the Cook Convention Center are, however, well underway. The Cook Convention Center has recently undergone expansion adding several meeting rooms and a fine new concert hall seating 2,700. Arrangements for dormitory lodging at the University of Memphis cannot be made until a year prior to the actual meeting dates.

- The Memphis Annual Meeting will feature an "ESA musicians" Evening Session in place of the usual "Authors and Poets" Evening Session.

92nd ESA Annual Meeting held jointly with the Society for Ecological Restoration—5–10 August 2007—San Jose, California

Kerry Woods has agreed to serve as the Program Chair for this Annual Meeting, and the Governing Board has approved Rachel O'Malley of San Jose State as the Local Host Chair. Because of the strong interest in restoration at both San Jose State and in the Santa Clara Water District, this seemed like an ideal meeting at which to again meet jointly with the Society for Ecological Restoration (SER), as ESA did with SER in Tucson in 2002. Both Boards have approved holding this meeting jointly. Work has been proceeding on review and approval of hotel contracts and a contract with the McEnery Convention Center.

93rd ESA Annual Meeting—3–8 August 2008—Milwaukee, Wisconsin

Lou Gross has agreed to serve as the Program Chair for this Annual Meeting and Gretchen Meyer has agreed to serve as the Local Host Chair. Both have received Governing Board approval. One of the extremely attractive features of Milwaukee as a meeting destination is that the Midwest Express Convention Center, the hotels and dorms, and the location for the proposed ESA Social in the wonderful Public Museum are all in a compact area and easily walkable distances. Lake Michigan, a network of running and cycling trails, and the new Milwaukee Art Museum make this a very appealing location for this meeting.

Milwaukee has made a major investment of public funds in interactive museums, educational learning centers, and a new Planetarium. The Program Chair has already begun looking at a theme emphasizing educational outreach.

Future meetings

Steve Chaplin, co-chair of the Meetings Committee, is reporting to the Governing Board at this meeting, recommending the selection of Albuquerque, New Mexico, as the location for the 2009 ESA 94th Annual Meeting and Pittsburgh, Pennsylvania, for the 2010 ESA 95th Annual Meeting.

Governance meetings

HQ Meetings Staff continue to make arrangements for all Board, Committee, and special meetings that occur throughout the year in the Washington, D.C., area.

Staff:

Ellen R. Cardwell, Meetings Manager; Patricia Crocker, Meetings Associate/Registrar.

II. REPORTS OF OFFICERS

REPORT OF THE VICE PRESIDENT FOR EDUCATION AND HUMAN RESOURCES

Awards Committee

The ESA Awards subcommittees met virtually during the fall and winter to select a slate of awardees to be recognized at the 2005 Annual Meeting in Montreal. Dr. Judith L. Bronstein and her committees did an outstanding job this year. The following individuals were recommended and approved for ESA awards:

Eminent Ecologist Award	Lawrence Slobodkin
Distinguished Service Citation	Jim MacMahon
Corporate Award	Bon Appétit Management Company
Mercer Award	Daniel Bolnick and colleagues
Cooper Award	Daniel Gavin and colleagues
Odum Education Award	James Porter
Sustainability Science Award	Thomas Dietz, Elinor Ostrom, and Paul Stern
Honorary Member	Erkki Haukioja

Braun Award	Pedro Flombaum
Buell Award	Cynthia Hays

"Profiles of Ecologists" Project

Following in the tradition established in 2002, a diverse set of ecologists plus the 2005 award winners were invited to contribute biographical sketches for the "*Profiles of Ecologists*" Project. The posters will be on display throughout the duration of the Annual Meeting. Each features the story of how an ecologist entered his/her career in ecology, and presents their views on communicating ecology to diverse audiences. The posters will be added to the "Profiles" link on the ESA web site at ‹http://www.esa.org/education/whatdoecologistsdo.htm› to inspire and motivate both current and future ecologists to excel in the field.

*Education and Human Resources at the Annual Meetin*g

Education and Human Resources are well represented at the Annual Meeting in Montreal in 2005. Eleven workshops, one special session, two contributed paper sessions and a poster session, two symposia, and several organized discussions were scheduled featuring education and environmental justice topics.

Education Mosaic Mixer

The SEEDS (Strategies for Ecology Education, Development, and Sustainability) program will have high visibility at the Montreal meeting. The theme for the mixer at the meeting is "Celebrating SEEDS." The SEEDS Program has celebrated many accomplishments since the program received renewed funding from the Andrew W. Mellon Foundation in July 2002. The goal of SEEDS is to increase the number of underrepresented minorities in the ecology profession by promoting ecology opportunities for students and their faculty. The expansion of SEEDS continues and SEEDS is flourishing as the interest of talented students has continued to grow every year.

Diversity luncheon

The theme of the luncheon this year is "Looking at Ecology through Diverse Lenses." Dr. Robin Kimmerer is the featured speaker at the Diversity Luncheon this year. The title of her presentation will be " Advancing Ecology: Why Culture Matters." Dr. Kimmerer is a Professor of Environmental and Forest Biology and Associate Chairman at the SUNY College of Environmental Science and Forestry in Syracuse, New York. She is an enrolled member of the Citizen Band Potawatomi Tribe, and received the 2005 John Burroughs Medal for the outstanding natural history book. She serves on the SEEDS advisory board and is Chair of the Traditional Ecological Knowledge section of the ESA.

Education and Human Resources Committee Meeting

Representatives of the EHRC met in Washington, D.C., in October 2004. This year, EHRC engaged in several important initiatives for the ESA. First, we received and reviewed the committee report on the progress of the ESA on issues related to recruitment and participation of groups who are underrepresented in the field of ecology from the "Women and Minorities in Ecology 2" Committee. Second, we completed a survey to evaluate the "Status of Ecology in the Undergraduate Curriculum." The data from this survey are being analyzed and a report is expected by the end of the year. Third, the committee led the development and implementation of the "Profiles of Ecologists" survey, a decadal survey of ESA members. The survey is currently active and will close on 15 August 2005. Preliminary results of the survey will be available by the end of the year, and a full report is expected in the Spring of 2006. Finally, the committee has continued activities begun last year to develop leaders in ecological education within the membership of the ESA.

Submitted by:
Carol Brewer

REPORT OF THE VICE PRESIDENT FOR PUBLIC AFFAIRS

The Vice President for Public Affairs has three primary areas of oversight: the Public Affairs Committee (PAC), the International Relations Committee (IRC), and liaisons to related societies, such as AAAS, AIBS, AWCI, and NASULGC (National Association of State Universities and Land Grant Colleges). The PAC works with the Public Affairs Office (PAO) to coordinate all aspects of communication with and outreach to the public. The PAC and PAO have worked to increase ESA's visibility in Washington and outreach to other audiences during the year.

Public Affairs Committee

A primary role of the PAC is to provide assistance and guidance to the PAO in representing ecological science to various public entities, including legislators and their staffs, governmental and nongovernmental agencies, and news media. In addition, the PAC reviews and makes recommendations about ESA Position Papers to the Governing Board. This year the PAC also assisted the PAO in developing ESA's Environmental Policy Priorities for FY 2005, which were subsequently approved by the Governing Board.

The PAC met during the Annual Meeting in Portland in August 2004 and in Washington in March 2005. We also communicated by conference calls to provide interim progress reports and coordination of PAC projects. As part of Congressional Visits Day activities, PAC and PAO members visited several House and Senate staffers, as well as individual congressional delegates, to urge support for increasing agency research budgets, particularly NSF, USDA, and USGS.

Our Public Plenary speaker in Portland is Dr. Cristian Samper, Director of the Smithsonian Museum of Natural History. Consistent with the theme of the meeting, Dr. Samper will give a presentation: " Forests in the Clouds: Ecology and Conservation of Montane Forests in the Andes." To enhance communication between ecologists and policy makers, the PAC and PAO have hosted key members of the Congressional staff as visitors to the ESA Annual Meeting for the past two years. In 2004, we brought Amy Carroll, Professional Staff Member of the House Subcommittee on Environment, Technology and Standards, to the Annual Meeting in Portland. The program in Portland was very successful, and Amy expressed great satisfaction with the visit. She participated in a field trip, attended the Public Plenary and opening mixer, and met with a number of ESA officers and members in individual meetings. As a Congressional staffer, we believe that Amy has the potential to serve as a very useful contact for issues that are important to ESA members. At the 2005 Annual Meeting in Montreal, the PAC and PAO will be hosting Kelly Law, Legislative Assistant to the Honourable Bryon Wilfert, Parliamentary Secretary to the Minister of Environment of Canada. We view this as an important step to introduce Canadian policy makers to the activities of ESA and the expertise of its members.

Position papers

Several ESA position papers are currently in progress. The position paper on GMOs with Allison Snow as lead author was published in *Ecological Applications* this year (*Ecological Applications* 15(2):377–404). The position paper on invasive species, chaired by David Lodge, is in the review process and is currently up on the ESA web site for comments from ESA members. Jon Keeley is chairing a committee developing a position paper on fire management and policy, and this paper is in the early stages of the review process. In addition, an ESA Position Statement on biodiversity and ecosystem functioning was drafted by a committee chaired by David Hooper and is also currently being reviewed. The PAC has also proposed a new position paper on ecosystem services.

International Relations Committee

A primary role of the IRC is to consider ways in which we can encourage foreign ecologists to participate in ESA. The IRC evaluates and makes recommendations to the Board for reduced fees for international library subscriptions and international memberships.

Public Affairs Committee members are: Alison Power (Chair), Ann Kinzig, Christy Johnson, Jack Liu, David Lodge, Robert Manson, Evan Notman, Tom Sisk, Patti Bonito; *ex officio* James LaBaugh, Chair, Metro D.C. Chapter

Submitted by:
Alison Powers

REPORT OF THE VICE PRESIDENT FOR SCIENCE

One major activity of the ESA Science Office in 2004–2005 was a general review of Science Office aims and activities, conducted at the Fall 2004 meeting of the ESA Governing Board. The purpose of the review was to help focus and consolidate the diverse Science Office programs, to set priorities for the next 3 years, and to educate new members of the Governing Board about Science Office activities and its mode of operation.

As a result of this review the Science Office activities were reorganized into three major categories:

1) Implementation of the recommendations of the ESA "Visions" Committee. Highest priority activities for immediate action include the development of "Rapid Response" teams with expertise on critical environmental issues, and the development of a program for education of the general public (in cooperation with the Education and the Public Affairs Offices). The Science Office is also involved in International Outreach including the preparation for the upcoming meeting in Mexico in January 2006, in the development of follow-on workshops implementing Visions recommendations, and in the development of *Issues in Ecology* papers.

2) Maintain responsiveness to the ESA membership and to the broader ecological science community: These activities include organization of peer reviews, conferences, agency studies, and plans; examples include a workshop on Agricultural Air Quality, assistance with the development of the VegBank vegetation plots database, collaboration with a variety of societies and NGOs in development of data storage and access protocols for the ecological community, and exploration of a program for Federal scientists communications training.

3) Begin development of a new Sustainability Science agenda for ESA.The general aim here is to develop a new series of activities to examine and articulate the intellectual foundations for a new sustainability science. The first step in this process is a special session to be held at the 2005 Montreal meeting, at which the ESA membership will have an opportunity for input. This will be followed by a symposium at the 2006 Memphis meeting, leading ultimately to a proposed summary paper in Issues in Ecology and, perhaps, a book.

In support of these activities the Governing Board also recommended a reorganization and consolidation of the existing Research and SBI committees into a single Science Committee. The SBI Project Office will be formally renamed the ESA Science Office, with a new and more succinct mission statement. These changes have been recommended by the Governing Board and submitted for approval by the ESA Council at the Montreal meeting.

Respectfully submitted:
Gaius R. Shaver,
Vice President for Science

III. REPORTS OF EDITORS-IN-CHIEF

THE BULLETIN OF THE ECOLOGICAL SOCIETY OF AMERICA

I have now had three issues of the *Bulletin* to get my sea legs after taking over from the able leadership of Al Solomon in October. I have had two immediate goals: how to take advantage of the electronic nature of the *Bulletin*, and to develop a niche for the *Bulletin* with respect to the other ESA journals.

My thoughts at this point are to deal with topics not covered by other ESA journals. The *Bulletin* will continue its coverage of the past with the following

additions or modifications.

We have added a *Photo Gallery* with brief writeups on papers that were recently published or will soon be published in the Society's journals. In the *Commentary*, I would like to start reprinting articles of general interest from other sources. For example, in the July issue we reprinted an article from *EOS*, the newspaper of the American Geophysical Union, on a meeting session on "Environmental Sensor Networks." In the *Departments*, we have changed the name of "Technological Tools" to "Emerging Technologies" to expand the topic beyond computers. This new Department is now edited by D. W. Inouye and S. Scheiner. We have also added "Ecological Education K–12" in addition to "Ecology 101." Ecology 101 is directed at college and university education, while Ecological Education K–12, as the name implies, covers an important area that ESA has, until now, not covered as well. I think this Department, edited by S. Barker and C. W. Anderson, could develop into a useful source for ecological education, particularly since the *Bulletin* is free online. There are several other additions still in the development stages. I would also like to thank David Gooding and Regina Przygocki, who have helped me in innumerable ways in my first year.

Submitted by:
E. A. Johnson, Editor-in-Chief

ECOLOGICAL APPLICATIONS

This year represents my fourth year, and the renewal of my appointment, following the Publications Committee review. I greatly appreciate the kind and insightful words of the committee and will strive to live up to the Society's expectations. This has also been a very good year for the journal. We have a number of new Associate Editors, representing a diverse array of fields and types of institutions. A number of internationally based editors joined the board, testifying to the broad international recognition of the journal. Operationally, the web-based system is working better and better and the overall response is very positive. The system saves me 10–15 hours a week of clerical work compared to the old approach and frees me to invest far more time in my editorial duties and in tasks such as working on special features and issues, with the authors of the "Issues" and position papers, and with the Associate Editors. Intellectually, the journal is growing. We have a steady trickle of interesting human dimensions papers (I call your attention to a paper on the ecological basis of food taboos in the Amazon), and a growing stream of marine papers. About 15% of submissions (20% in some months) are marine/fisheries papers, and we are becoming a significant outlet for a range of marine topics, including fisheries ecology, marine reserves, marine conservation, and basic marine ecology. We have a steady number of methods papers, and two features related to that will be appearing, one on methods for nitrogen cycle studies, and one on "new" or post-frequentist statistical approaches for model selection, spatial statistics, unreplicatable studies, and other previously intractable areas. I still reject many methods papers as being too specific, and our standard for methodological research is, I believe, very high. While a number of topic areas are growing (and few are shrinking), we have not seen significant growth in disease ecology, a topic I had hoped would flourish, although with Tom Hobbs and Rick Ostfeld's editorial help, we publish a small number of intriguing works. Urban ecology is also steady, but I expect with John Marzluff joining the board to increase this as well. The journal's formal and anecdotal performance metrics continue to be strong, and our penetration into management agencies, NGOs, and the private sector is still expanding, based on submissions and other types of inquiry for material.

Submitted by:
David Schimel, Editor–in–Chief

ISSUES IN ECOLOGY

The Board developed a new mission statement that should help authors focus their manuscripts appropriately:

> *The mission of* Issues in Ecology *is to summarize in clear, nontechnical language, the status of scientific knowledge in areas of ecology and to point out the implications of that informa-*

tion for environmental policy and management.

We have developed effective coordination with the Editor-in-Chief of *Ecological Applications,* where papers laying out the scientific basis for *Issues* papers should appear. The issue "Impacts of Atmospheric Pollution on Aquatic Ecosystems" has now been published. We have received a manuscript ("Fundamental Principles of Infectious Disease Ecology") for the remaining *Issues* paper commissioned by the previous Editor-in-Chief (Professor David Tilman) and another on conservation issues related to neotropical migratory birds. Both sets of authors are currently revising their manuscript in light of comments from the board. Charges have been developed and authors invited for two new papers on the ecological effects of climate change.

There is a pressing need to develop new funding sources.

Submitted by:
W. Murdoch, Editor-in-Chief

IV. REPORTS OF STANDING COMMITTEES

AWARDS COMMITTEE

The Awards Committee consists of the Chairs of nine active subcommittees. Each subcommittee is responsible for making recommendations for its own award(s). The compositions of the subcommittees and the recipients of the respective awards for 2004–2005 were:

Student Awards (Murray F. Buell and E. Lucy Braun Awards) Subcommittee

Christopher Sacchi (Chair), J. Alan Yeakley, Paul Marino, and Nancy Eyster-Smith.

Recipients from the 2004 ESA Annual Meeting:

Buell (best student presentation): Cynthia Hays, University of California, Santa Cruz.

Braun (best student poster): Pedro Flombaum, University of Buenos Aires, Argentina.

Cooper Award Subcommittee

Stephen T. Jackson (chair), Laura Hyatt, Sara Hotchkiss, Miles Silman, Scott Collins, and David Peterson.

Recipients:

Daniel G. Gavin, Linda B. Brubaker, and Kenneth P. Lertzman for their 2003 paper, "Holocene fire history of a coastal temperate rain forest based on soil charcoal radiocarbon dates" (Ecology 84:186–201).

Corporate Award Subcommittee

Kate Lajtha (Chair), Scott Stoleson, Joan Ehrefeld, Greg Aplet, and Laura Huenneke

Recipient:

Bon Appétit Management Company (BAMCO).

Eminent Ecologist Award and Distinguished Service Citation Subcommittee

Paul Dayton (Chair), Kay Gross, Nelson Hairston, Jr., Robert Holt, Peter Groffman, Carla D'Antonio.

Recipients:

Eminent Ecologist – Larry Slobodkin, SUNY Stony Brook.

Distinguished Service Citation – Jim MacMahon, Utah State University.

Honorary Member Award Subcommittee

Sandy Tartowski (chair), Michael Auerbach, Richard Ostfeld, Denise Dearing, Janet Lanza, Deborah Clark, Steven Hamburg, Jayne Belnap.

Recipient:

Erkki Haukioja, University of Turku, Finland

MacArthur Award Subcommittee

Robert K. Colwell (Chair), Carla D'Antonio, Judy Meyer, Ann Kinzig, James Reichman, William Murdoch, and Steve Carpenter

Recipient:

No award was made in 2005. May Berenbaum, the 2004 winner, presented the MacArthur Award lecture at the 2005 Annual Meeting.

Mercer Award Subcommittee

Steve Heard (Chair), Sally Holbrook, James Morris, Jean Richardson, Andy Sih, Ellen Simms, and Jay Stachowicz.

Recipients:

Daniel Bolnick, Richard Svanback, James Fordyce, Louie Yang, Jeremy Davis, Darrin Hulsey, and Matthew Forister for their 2003 paper, "The ecology of individuals: Incidence and implications of individual specialization" (*American Naturalist* **161**:1–28).

Odum Education Award Subcommittee

Linda Wallace (Chair), Alan Berkowitz, Margaret Carriero, Charlene D'Avanzo, Peter Feinsinger, and Margaret Lowman

Recipient:

James Porter, University of Georgia

Sustainability Science Award Subcommittee

Terry Chapin (chair), Kathy Cottingham, Gary Kofinas, and Matthew Wilson.

Recipients:

Thomas Dietz, Elinor Ostrom, and Paul Stern, for their 2003 paper, "The struggle to govern the commons" (*Science* **302**:1907–1912).

Submitted by:
Judith L. Bronstein, Chair

BOARD OF PROFESSIONAL CERTIFICATION

The Board of Professional Certification (BPC) continues to welcome the membership of the Ecological Society Of America (ESA) to become aware of and to support the benefits of professional certification. Kevin Erwin completed his term as chair of the BPC at the annual ESA meeting in Portland, Oregon. Gary W. Barrett was appointed chair of the BPC for 2004–2005.

Our Evening Session at the Portland meeting entitled "Ethics and Ecologists," chaired by Erwin, Barrett and Jeff Klopatek, was well attended and very successful. Feature speakers were Paul Ehrlich, Kevin McKelvey, and Sharon Friedman. A business meeting was held on 4 August following the Evening Session. The budget for 2004–2005 will be $5600; Katherine McCarter, Executive Director, has approved an additional $1000 to purchase and develop a display board outlining activities of the BPC. Emeritus classification for professional certification was discussed but later not approved by the ESA Governing Board. Barrett thanked Kevin Erwin and Susan Bicknell for completing their elected terms as members of the BPC. Rebecca Sharitz and William Michener were elected by the ESA membership as new members of the BPC beginning 1 January 2005. Carolyn Hunsaker, Gareth Redfield, Reed Noss, and Wayne Polley are on the ballot (2 to be elected) for 2006.

The BPC met at ESA Headquarters on 3 June 2005 to review new applications for professional certification. Total of applications was 74 for 2005. This included 16 associate ecologists, 27 ecologists, and 31 senior ecologists; the Board requested additional information for 11 applications before a final decision was made. The ESA as of 1 January 2005 had 8718 members of which 386 (4.4 percent) are certified. The BPC has and will continue efforts to increase this percentage — an extremely low percentage compared to numerous other professional societies.

Other business discussed at the 3 June 2005 meeting included the following:

- Katherine McCarter, Executive Director, welcomed the BPC. She noted the display budget ($1000) is drawn from the 2004–2005 fiscal year. The $5600 annual budget is to be used for the 3 June 2005 meeting and the Annual Meeting in Montreal. Chair-Elect Diane Wickland and Board member David Breshears agreed to work with Amy Canonico to accomplish this important task.

- The theme for the BPC sponsored Evening Session to be presented at the ESA annual meeting in Montreal, Canada, 7–12 August, will be "Quick Response to Natural Disasters." Panelists will be Debra Peters, Kevin Erwin, and M. Sanjayan. This ticketed event ($6) will be held on Wednesday evening, 10 August. Chair Barrett expressed concern that doubling the cost of the ticket will keep graduate students and young ecologists from attending this session. The BPC expressed thanks to Ellen Cardwell for her continued support of this event.

- William Michener was elected to serve as Chair-Elect effective following the ESA Annual Meeting in Montreal.

- The BPC agreed that a Newsletter for Professional Ecologists will be prepared and forwarded to certified ecologists following the Annual Meeting. Terms of certification for new applicants will be from 1 July 2005 to 30 June 2010. The PBC express special thanks to Amy Canonico, ESA staff specialist, for her efforts in support of all Board activities.

Board members:

Gary W. Barrett, Chair, Diane Wickland, Chair-Elect, David D. Breshears, Patricia A. Flebbe, Jeffrey Klopatek, William K. Michener, Rebecca R. Sharitz

Submitted by:
Gary Barrett, Chair

HISTORICAL RECORDS COMMITTEE

The Committee is responsible for supervising the collection and preservation of records to be deposited in the Society Archives. These records include important documents, papers of the officers, and other appropriate memorabilia. The Committee also coordinates the solicitation, and approves the publication in the *ESA Bulletin*, of Resolutions of Respect and obituaries of deceased members.

During calendar year 2004, the Committee coordinated Resolutions of Respect that marked the passing of three very influential ecologists: Prof. Frank A. Pitelka, Dr. Stanley I. Auerbach, and Prof. Ramon Margalef. A report on activities involving the ESA archives stored at the University of Georgia follow this report.

During 2005, the Committee is to develop a set of guidelines to direct the collection and archiving of the electronic historic records now being provided by the Society's officers and other contributors. Planning of that effort will take place at the Historical Records Committee meeting to be held during the 2005 meeting of ESA at Montreal.

Additional agenda items include meeting the need to keep the historical records on the ESA web site current, and review and identification of Resolutions of Respect that should have been written (but were not) in the recent past for appropriate individuals. Interested non-committee ESA members will be welcome at the Historical Records Committee meeeting on Thursday, 11 August, 7:00–8:00 am in Meeting Room 512 C Level 5, Palais de Congrès de Montréal.

Finally, the Committee commends the efforts of Dr. R. L. "Buck" Sanford, who stepped down as Chair of the Historical Records Committee in 2004.

Respectfully submitted,
Allen M. Solomon, Chair

The Ecological Society of America Archive, University of Georgia Libraries, Athens GA 1 July 2004–30 June 2005

During FY 2005 we received five new ESA accessions:
ESA 04-020: A. M. Ellison Files, 2001–2004 (1 box)
ESA 04-021: E. J. Heske Files, 1998–1999 (1 box)
ESA 04-040: ESA Managing Editor's Files(16 boxes)
ESA 05-002: Katherine C. Ewel Paper, 1997–2000 (1 box)
ESA 05-007: Richard B. Root Presidential Papers, 1979–1987 (1 box)

As he has done in the past, Mr. Gilbert Head transferred these collections to acid-neutral storage containers for preservation purposes and assigned the control numbers shown above. The materials were then placed in secure storage facilities within the Library, pending transfer to the ESA Archive in the Libraries' Repository.

During the year we were pleased to receive three reference queries regarding the ESA. Although they involved the pre-World War II component of the collections, where holdings are fragmentary, materials of value were found for users.

Perhaps the most significant accomplishment during the year was placing the collections back in numerical order. During major library renovations several years ago it was necessary to move the bulk of the ESA Archive to the University Records security area of the Libraries Repository. During the course of this move, the boxes were shelved in random order, making it extremely difficult and laborious to located specific records. We have now been able to put all boxes back into correct order in their own range of shelves in the facility.

Of related ecological interest, the Manuscripts section of the Hargrett Rare Book and Manuscript Library received significant collections from the home and office of the late Dr. Eugene Odum. It is hoped that these can be organized in the near future. Finding aids for Dr. Odum's earlier papers, which are deposited in the University of Georgia Archives, were placed on the University Archives web site for the convenience of researchers: ‹http://www.libs.uga.edu/hargrett/archives/uga97-045.html› and ‹http://www.libs.uga.edu/hargrett/archives/uga01-019.html› .

In our redesigned web page for University Archives, ‹http://www.libs.uga.edu/hargrett/archives/index.html› , we have created a new section, Learned Society and Non-University Research Collections. We hope to add a page regarding the ESA Archive to this section in the coming year.

Steven Brown
Head, University Archives and Records Management
Hargrett Rare Book and Manuscript Library
University of Georgia Libraries
Athens, GA 30602
E-mail: sabrown@uga.edu
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MEETINGS COMMITTEE

Status of the 2005 Montréal ESA-INTECOL Meeting

This is the largest meeting that ESA has developed. Here is a comparison of the size of the Montréal meeting to the Portland meeting, which was the largest up to that time

	Portland	Montréal	Increase from Portland (%)
Total abstracts accepted	2,722	3361	23%
Abstracts submitted by category:			
Symposia	195	198	2%
Organized oral session	298	499	67%
Contributed oral session	1,326	1767	33%
Poster	915	1126	23%
Number of sessions:			
Symposia	24	24	0%
Contributed orals	142	169	19%
Organized orals	36	53	47%
Special sessions	5	15	200%
Workshops	21	36	71%
Evening sessions	21	20	–5%
Ticketed events	10	9	–10%
Field trips and tours	18	12	–33%
SEEDS	9	10	11%

Table 1. Size of the Montréal Meeting compared to the Portland Meeting. These numbers are based on mid-July reports for both meetings.

Highlights

1) Contributed Oral Sessions

A) Comments from general meeting participants and presiders were ~ 80% in favor of keeping contributed oral sessions in the 15+5 format (as compared to the previous 12 + 3 format). See Fig. 1. Therefore, we decided to maintain this timing.

B) Comments identified numerous opportunities to improve the management of these sessions. Therefore we have developed support materials for presiders and scheduled three brief presider orientation sessions.

2) Review process for 68 Symposium and 35 Organized Oral Session Proposals

A) Simplify review format.

B) Add review of organized oral session proposals.

C) Single round of review with Board oversight on decisions and process invited.

3) Attempt to make poster sessions more attractive by providing presenters with an opportunity to schedule appointments with those interested in their work.

4) Abstract Cancellation Fee process has been simplified for our participants

A) Old process—all presenters paid an abstract submission fee.

B) New process—all presenters provide account to charge if they withdraw after the withdrawal deadline.

5) Local Host Committee

A) Organized 12 field trips.

B) Developed their own guide to the region and made it available via a web page linked to ESA's.

C) Identified opportunities to offset emissions of carbon dioxide arising from travel to Montréal.

D) Participated in review process.

Symposium review process

We received 68 proposals for 24 Symposium slots; this number of slots has been specified by the Governing Board. These 68 proposals exceeded the previous record of 60 for the 2004 meeting in Portland; the record before Portland was 52 for the 2003 meeting in Savannah. Clearly people are attracted to the backbone of the Annual Meeting. As in the past, the implication for the Society is that the review criteria must be appropriate and clear and the review process must be fair and balanced. Reviews were requested from ESA section and chapter chairs, co-chairs of the current and previous local host committee, the current program chairs and the assistant program chair, Ellen Cardwell, next year's ESA program chair, and INTECOL representatives. Most reviewers examined half of the proposals, The average proposal was reviewed by 17 reviewers. This is a time-consuming process, but the large number of reviews ensures that a breadth of expertise is brought to bear in evaluating the proposals, in providing guidance for improving accepted proposals, and in making decisions on the most appropriate outlet (symposium, organized oral session, workshop, special session, or rejection) for each proposal.

A summary of our decisions on Symposium proposals is shown in Table 2.

OOS review process and issues

Organized Oral Sessions differ from symposia in that a perfect Symposium proposal has broad appeal, and some evidence of integration or synergy between the talks; ideally it has a beginning, a middle, and an end; it is not a collection of case studies on a single topic. Organized Oral Sessions were first used at the 2003 Savannah Meeting, where there were five such sessions. The hope in organizing these sessions was that they would attract more mid-career scientists to the meeting. The growth in the number of these sessions, simultaneously with an increasing number of submissions for contributed oral presentations, suggests that Organized Oral Sessions have added to our meeting rather than merely shifted participation among a constant number of participants.

We received 35 proposals for Organized Oral Sessions. By transferring well-reviewed and appropriately structured proposals from other classes of applications we have organized a meeting with 53 Organized Oral Sessions. The Meetings Committee is evaluating the size of the meeting, including the number of Organized Oral Sessions.

We established review criteria and a review process for Organized Oral Sessions. Reviews were requested from members of the current and previous local host committee, the current program chairs and the assistant program chair, Ellen Cardwell, next year's ESA program chair, Cliff Duke, members of the Science Program Steering Committee, INTECOL representatives, and a handful of other colleagues with a history of ESA activity. The average proposal was reviewed by 12 reviewers. This is a time-consuming process, but the large number of reviews ensures that the breadth of expertise is brought to bear in evaluating the proposals, in providing guidance for improving accepted proposals, and in making decisions on the most appropriate outlet (symposium, organized oral session, workshop, special session, or rejection) for each proposal.

			Originally Proposed Class		
			OOS	Symposium	Total
Decision	OOS	Count	28	29	57
		% within Originally Proposed Class	80%	43%	55%
	Reject	Count	1	2	3
		% within Originally Proposed Class	3%	3%	3%
	Special Session	Count	0	5	5
		% within Originally Proposed Class	0%	7%	5%
	Symposium	Count	1	23	24
		% within Originally Proposed Class	3%	34%	23%
	Supp Session -- Not Special Sessions	Count	5	9	14
		% within Originally Proposed Class	14%	13%	14%
Total		Count	35	68	103
		% within Originally Proposed Class	100%	100%	100%

Table 2. List of Symposium and Organized Oral Session proposals provided and offers made by the ESA and INTECOL program chairs.

A summary of our decisions on Organized Oral Session proposals is shown in Table 2.

General review issues

Organized Oral Session and Symposium Proposals were on the same submission and review schedule to facilitate our decision making and exchanges between the two classes of sessions.

Partnership with INTECOL

The operational partnership with INTECOL has been excellent. INTECOL reviewers added a constructive perspective to the reviews of the Symposium and Organized Oral Session proposals. In accordance with direction from the ESA board, our evaluation of proposals, the construction of sessions, and the evaluation of individual abstracts were independent of their affiliation with either ESA or INTECOL. It is noteworthy that international participation is evident in a large number of the sessions.

ESA 2006 Meeting in Memphis

Plans for the 2006 Meeting are well underway. Program Chair Kiyoko Miyanishi has developed the call which will be posted on the ESA web site before the 2005 Annual Meeting.

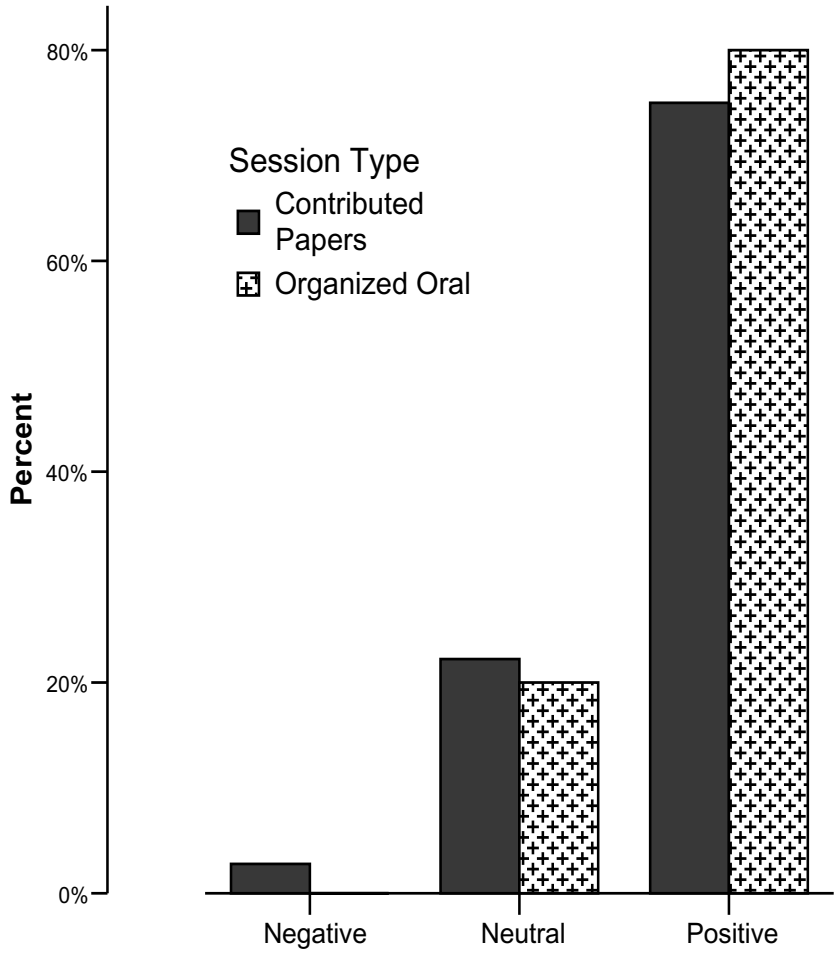


Fig. 1. Response of 2004 ESA Meeting Presiders (n = 140) to the question: "How was the audience/speaker/presider response to the new 15 + 5 minute time slots?"

Meetings Committee

The meetings committee is co-chaired by Steve Chaplin and Paul Ringold for the current Annual Meeting. It is composed of all future, current, and immediate past program chairs and local hosts. It has been an excellent forum to transfer lessons and issues learned from one meeting to the next, and to discuss new ideas. After reorganization in 2003, the committee operated in this format for the first time in 2004.

Issues on the current agenda for the Committee include:

1) Management of Organized Oral Sessions and their development

2) Limits to the overall size, length, and elements of the meeting

3) Increasing the role of sections and chapters in shaping the Annual Meeting

4) Specifications of future meetings sites.

5) Transfer of lessons from the current and past program chairs and local hosts to future program chairs and local hosts.

6) New session ideas including a "Recent advances in …" session to be presented by leading ecologists. These sessions will synthesize the state of

knowledge and direction of a particular hot research field.

For the 2009 and 2010 meetings, Albuquerque, New Mexico, and Pittsburgh, Pennsylvania, respectively, have been recommended as potential sites. Program chairs for the 2007 and 2008 Annual Meetings have been selected. Kerry Woods will serve for the 2007 meeting in San Jose and Lou Gross for the 2008 meeting in Milwaukee.

Personnel notes and acknowledgments

It is once again difficult to overstate our gratitude for the work and guidance provided by Ellen Cardwell in developing the Annual Meeting and in ensuring that all of the details are well managed. David Grow has completed his third year of work in providing a great deal of support to the Society as the Assistant Program Chair. This role will be filled next year by Ms. Devon Rothschild, who will be housed in ESA's Washington, D.C., offices.

Submitted by:
Paul L Ringold and Steve Chaplin**,** Co-Chairs

PROFESSIONAL ETHICS AND APPEALS COMMITTEE

Professional Ethics and Appeals Committee Members for the committee were selected shortly after the August 2004 Annual Meeting: Ralph Boerner, Nathaniel Hitt, Kate LeJeune, Deborah Potter, and Kristina Stinson. The committee reviewed one appeal of certification and forwarded their review to the ESA Council for a final decision.

Committee member Deborah Potter led the review process after committee chair Patricia Flebbe recused herself for conflict of interest.

Submitted By:
Patricia A. Flebbe, Chair

PUBLICATIONS COMMITTEE

The Publications Committee commissioned a review of the Editor-in-Chief of *Ecological Application*, and it was submitted to the Governing Board.

The Committee recommended to the Governing Board that ESA adopt a data registry associated with the Society. The Governing Board discussed the idea and tabled action until their August meeting. The Board is considering implementing the registry for authors of articles in the ESA journals. In the mean time, a registry was developed that is specific for ESA but federated with a larger registry used by a number of other ecological organizations. A presentation will be made at the August Board meeting in hopes of having the registry formally adopted.

The Publications Committee continued to monitor issues pertaining to data access, especially as it relates to the journals of the Society. Assistance was provided to the Headquarters staff and Board members as they addressed journal pricing issues pertaining to electronic and paper access for libraries. This continues to be a rapidly changing phenomenon.

Committee Members: Emily Bernhardt, John Briggs, Aaron Ellison, Susan Harrison, Laura Huenneke, Nancy Huntly, Steve Jackson, Alan Knapp, Robert Peet, David Roberts, Sam Scheiner

Submitted by:
Jim Reichman, Chair

PUBLIC AFFAIRS COMMITTEE (see Report of the Vice President for Public Affairs)

RESEARCH COMMITTEEE (see Report of the Vice President for Science)

V. REPORTS OF SECTIONS

AGROECOLOGY SECTION

The Agroecology Section of ESA is a relatively new section within this Society, started in 2000, but

has been active and successful in its symposium contributions at national meetings. Many of its members are previous or simultaneous members of the Applied Ecology Section. It has a growing membership (approximately doubling over 5 years) representing a wide range of ecologists interested in agro ecosystems, their components, processes, and problems.

Mixer and business meeting at the ESA Annual Meeting, Montréal, Canada

The Agroecology, Applied Ecology, Rangelands, and Long-Term Studies Sections are planning a joint mixer for the 90th ESA Annual Meeting in Montréal, Canada, 7–12 August 2005. The mixer will be held on Wednesday, 10 August from 6:30–8:00 pm. This follows the Agroecology poster pub session and an afternoon organized papers session sponsored by our chapter on Wednesday, 10 August (see description below). The Agroecology Section will hold its brownbag lunch and business meeting on Tuesday, 9 August 2005. We will review the past years' business and accomplishments, discuss the future direction of the section, and gather suggestions for agroecology field trips at the 2006 (Memphis) and 2007 (San Jose) meetings. The chair, in preparation for proposals at the business meeting, is currently researching other items. These include revamping our ailing e-mail list, plans for launching a Section web page (Chair Gliessman reported his efforts on this project in 2002, but there does not seem to be any progress to date), and the possibility of changing the officer and election process. Each of these is aimed at providing better communication and continuity in the section; for example, having overlap between the chair elect and the current chair for information exchange. Our section has in its treasury ~$1400 after food and drink expenses for the upcoming mixer.

Organized Oral Session 35: "Mutualism, competition, and invasion —Applying ecological theory to agriculture" (organized by past-Chair Laurie Drinkwater, Jude Maul, Deborah Letourneau, and Katie Monsen).

Ecological theory emerging from natural systems ecology provides a rich knowledge base for managed ecosystem design, regulation, and stewardship. This synthetic symposium shows how species interaction theory may guide the management of small-scale interactions that can have large-scale spatial, temporal, and biological impacts on production systems and the environment. The topics that will be addressed should be of broad interest to ESA and INTECOL members, because they delve into very basic and long standing questions in ecology—e.g., the nature of competition and mutualism—and at the same time address areas of intense current interest, including belowground microbial ecology and evolution, invasion ecology, and agricultural sustainability. This session was designed to have a tighter theme than some of our previous Agroecology Section symposia, but one that addresses issues of broad interest to the diverse scholarship of the Section and Society.

Elections

Results of the e-mail elections in August 2004 for officers for 2004–2006 are as follows:

Chair: Deborah K. Letourneau, Ph.D, Department of Environmental Studies, University of California, Santa Cruz, California 95064. Fax: (831) 459-4015, E-mail: letour@ucsc.edu

Vice Chair: Timothy Crews, Ph.D, Environmental Studies and Agroecology, Prescott College, 220 Grove Ave., Prescott, AZ 86301. (928) 350-2215, Fax: (928) 776-5137,
email: tcrews@prescott.edu

Secretary: Marc Los Huertos, Ph.D, Environmental Studies, University of California, 1156 High Street, Santa Cruz, CA 95064. (831) 459-4926 voice, (831) 251-8926 cellular, ‹http://people.ucsc.edu/~marcos/›

Submitted by:
Deborah K. Letourneau, Chair

APPLIED ECOLOGY SECTION

The Applied Ecology Section of ESA is the second largest and the third oldest of the active sections within this Society. The section was established in 1971 and has a twofold purpose: (1) to facilitate communication of the application of ecological principles to the solution of practical environmental problems, and (2) to encourage liaisons with specialists in policy, administration, planning, health, agriculture, and natural resource management who use ecological principles in resolutions of their problems.

Mixer and Business Meeting, ESA Annual Meeting, Montréal, Canada

The Applied, Agroecology, Rangelands, and Long-Term Studies Sections are planning a joint mixer for the 90th ESA Annual Meeting in Montréal, Canada. The mixer will be held on Wednesday, 10 August 2005 from 6:30 to 8:00pm. The Applied Ecology Section will hold its brownbag lunch and business meeting on Tuesday, 9 August from 11:30 am–1:00 pm. We will review the past years' business and accomplishments, as well as discuss the future direction of the Section.

Elections

Results of the elections of officers for 2004–2006 are as follows:

Co-Chair: Deborah Ulinski Potter, Ph.D, USDA Forest Service, Southwestern Region EAP-WSA, 333 Broadway Blvd., S.E., Albuquerque, NM 87102-3498. (505) 842-3143, Fax: (505) 842-3152, E-mail: dapotter@fs.fed.us or ulinski@unm.edu
and

Co-Chair: Martin A. Spetich, Ph.D, Research Forester, SRS 4106, Arkansas Forestry Sciences Laboratory, USDA Forest Service, Southern Research Station, P.O. Box 1270 (regular mail), 100 Reserve Street (shipping address), Hot Springs, Arkansas 71902.

(501) 623-1180, Ext. 105, Fax: (501) 623-0186, E-mail: mspetich@fs.fed.us

Vice Chair: Becky Kay Kerns, Ph.D, Research Ecologist, Managing Disturbance Regimes Program, USDA Forest Service, Pacific Northwest Research Station, 3200 SW Jefferson Way, Corvallis, OR 9733. (541) 750-7497 (office); 541-758-7760 (Fax), E-mail: bkerns@fs.fed.us or Becky.Kerns@orst.edu

Secretary: Neal T. Butt , 8204 Rancho Seguro NW, Albuquerque, NM 87120. Work phone: (505) 768-2660, Home phone: (505) 898-6072, Fax: (505) 768-2617, E-mail: Nbutt@cabq.gov City of Albuquerque

Student Travel Award

Four students have been selected to receive scholarships to present their research at ESA's Annual Meeting in Montreal. The amount of each award and the name and address of each student are listed below. Susan Tilley's award comes from the Applied Ecology Section's long-range planning grant that was awarded on 21 December 2004. The other awards come from the Section's overall funds.

- Susan Tilley, Department of Biology, Memorial University of Newfoundland: $450,
- Elise Buisson, Universite P. Cezanne, $450,
- Serge Eric Attignon Laboratory of Applied Ecology, Faculty of Agronomic Sciences, University of Abomey-calavy: $350, Barbara Pamela Graff, University of Buenos Aires: $350

Long-Range Planning Grant

The Applied Ecology Section received a long-range planning grant from the ESA Governing Board to help implement ESA's Long Range Plan. The award was for $1000, to be used for student scholarships, webmaster training, and the business mixer at the 2005 Annual Meeting.

Submitted by:
Deborah Ulinski Potter, Ph.D and Martin A. Spetich, Ph.D, Co-Chairs

ASIAN ECOLOGY SECTION

Fostering international collaboration, particularly with Asian ecologists and ecological societies of America and Asia, is a major goal of the Asian Ecology Section (AES). Here, I proudly report five major achievements that AES fulfilled in 2004–2005.

1) Co-organized "the First Symposium of Plant Ecology Frontiers" in Guilin, China in June 2005 with the Plant Ecology Section of the Chinese Society of Botany. About 100 Chinese plant ecologists attended the 2-day symposium. The presentations covered a wide range of current research topics.

2) Participated in a tsunami relief effort in Southeast Asia. The 2004 December disaster in Southeast Asia connected peoples' hearts all over the world. AES encouraged members to participate in tsunami relief. Dr. Wei Fang and her colleagues and graduate students in the Department of Ecology and Evolution of SUNY at Stony Brook collected 150 ecological books that were sent to the universities affected by the tsunami. AES also helped Dr. Frank Chang, a Senior Geographer with the South Florida Water Management District, travel to Banda Aceh as a GISCorps volunteer in February 2005. He visited many UN and government agencies, the Syiah Kuala University, and NGOs for a field assessment of GIS needs. He made several donations to the faculty and students affected by the tsunami on behalf of AES and Sino-Ecologists Association Oversea.

3) Organized an ESA 2005 symposium on "Ecological Impacts of Asia on Global Sustainability at Multiple Scales" in Montreal. With large populations and rapid economic growth, Asia is a critical battleground for environmental conservation. This symposium, coordinated by Drs. Young Choi and Shili Miao and approved by ESA for the 2005 Annual Meeting, provides a forum for assessing the ecological impacts of Asian population and economy on the global environment. The symposium invites leading ecologists from China, Korea, and the USA to address critical issues such as loss of biodiversity, increased desertification, fossil fuel consumption, carbon cycling, and their policy implications, as well as sustainable grassland management.

4) Organized a panel discussion on "the collaboration between ESA and Asian ecologists and ecological societies: opportunities, challenges, and perspectives," in Montreal. Dr. Sun-Kee Hong, the secretary of the East Asian Federation of Ecological Societies (EAFES) and the Ecological Society of Korea (ESK), talk about "ESK and EAFES: History and Action." Dr. Rusong Wang, the president of the Ecological Society of China, will briefly address the needs and status for the collaboration. A discussion will follow their presentations.

5) Collaborated with the Ecological Society of China and Sino-Ecologists Association Overseas for a joint project that translates the special issue of *Frontiers in Ecology and the Environment* and the EcoVision Report into Chinese. This issue and the report are important ESA documents that need to be communicated to Chinese people in general and Chinese ecologists in particular. AES expects that the Chinese versions of these documents will generate great impacts in China on research, policy, and strategic plan development, and decision-making about global sustainability and global ecology. The translation will be published and distributed in China and made available on the ESA web site.

In addition, AES increased its membership with diverse backgrounds, and updated its web site and published its newsletters regularly.

Submitted by:
ShiLi Miao, Chair

INTERNATIONAL AFFAIRS SECTION

1) A Global Perspective on Pastoralism: International Affairs Symposium at the 2004 ESA Meeting

Last year's International Affairs Symposium brought together ecologists and social scientists working on five different continents to discuss the great-

est challenges to achieving ecological sustainability in pastoralist societies. Many of the symposium contributors were not regular attendees of ESA meetings, and were impressed that such an applied and interdisciplinary symposium topic was being addressed. Presentations ranged from a tour of rangeland restoration projects around the world, to innovative analyses of pastoralist/wildlife conflicts in East Africa, to the consequences of Soviet and post-Soviet government policy on steppe ecosystems in Kazakhstan. A synthesis talk brought together the salient recommendations of the panel of participants, and is now being developed into a manuscript for publication. If you would like more information, contact Lizzie King ‹egking@ucdavis.edu›.

2) International Affairs activities planned for the 2005 ESA Annual Meeting

a) Symposium: From the Gulf of Mexico to the Caspian Sea: Linking Ecological Processes and Environmental Impacts across Scales. This exciting symposium is being organized by Sandy Tartowski, and should have broad appeal among ESA and INTECOL members.

b) Workshop: Command Spanish: Survival Spanish for the NON-native researcher. The workshop is based on the same program used to train police, EMT workers, and others who need Spanish to do their job but don't have time to take a full-blown Spanish class. The focus will be on the fluency one would need to travel to, survive in, and get across a few important concepts about your work in a Spanish-speaking country. The workshop will be on Saturday and Sunday and is number 5 on the list.

c) The business meeting will be held during the mixer, by gathering in one part of the room for a little while. We will have elections for Chair, Vice-Chair, and Secretary at the business meeting.

d) Evening Session: An Ecologist's Guide to the Galaxy. Once everyone is loosened up after the mixer, we'll take on an unusual but very fun topic in an evening session: Life beyond Earth!!!

3) Symposium for the 2006 ESA Meeting: African Lakes Ecology and alternate proposals. The symposium on African Lakes Ecology will explore issues of tropical and wetlands ecology, invasive species (e.g., water hyacinth), biodiversity conservation (cichlid fish, etc.) and transnational natural resource management in the context of the Lake Victoria basin, and possibly other African lakes. If you would like more information, if you are interested in helping develop or participating in this symposium, or if you would like to recommend speakers, please contact Onensimus Otiento ‹ootieno@oakwood.edu›.

Submitted by:
Jacoby Carter, Chair

LONG TERM STUDIES SECTION

The LTSS met at the ESA meeting in Portland, Oregon. The minutes of the meeting are on the LTSS web site ‹http://www.esa.org/longterm›. John Porter established and maintained a Post-Nuke web site for LTSS in 2004–2005. One of the suggested activities of LTSS was to implement a web-based registry of ecological data sets to facilitate discovery and sharing of existing data in the ecological community. After testing and implementation in the Organization of Biological Field Stations and the UC Natural Reserve System, and elsewhere, the ecological data registry was posted on the LTSS web site. Other services for the LTSS members on the web site includes forums, ability to post news items, a calendar, etc.

Members of the LTSS met with others at the LTER network office in early February to discuss implementation of the ecological data registry that had been developed by NCEAS, KNB, and others. Led by Jim Reichman of the ESA Publications Committee, a discussion was held about including the data registry as part of the publication process in ESA journals. We understand this discussion is ongoing.

An annual business meeting will be held in Montreal and will include elections. Request for nominations were e-mailed to the membership in June for a vote at the Annual Meeting. A joint mixer with the Rangeland

Section of ESA is planned for the Montreal meeting.

Submitted by:
Mark R. Stromberg, Chair

PALEOECOLOGY SECTION

The Paleoecology Section held its annual business meeting during the 2004 ESA Annual Meeting in Portland, Oregon. Bryan Shuman chaired the meeting, and Bob Booth acted as secretary in Beth Lynch's absence. Elections for the 2004–2005 officers were held. Bob Booth moved from vice-chair to chair, Sara Hotchkiss was elected vice-chair, Jason McLachlan was elected secretary, and Jason Lynch will continue to chair the Deevey Award Committee.

The Section voted to sponsor a 2005 symposium proposal by Jason McLachlan and Jack Williams entitled "Species range dynamics: past, present, and future," which will bring together perspectives on the dynamics of species ranges from multiple subdisciplines, including paleoecology, macroecology, and molecular ecology. The symposium nicely complements the theme of next year's meeting, and will be linked with an evening session focused on methodological approaches and future collaborative research areas.

The Annual Meeting in Portland was a huge success, and the paleoecology oral and poster sessions were well attended and promoted a great deal of discussion. The Section also sponsored a very successful symposium entitled "Cultural and Environmental Controls on Past Fire Regimes in Inhabited Woodlands," which brought together paleoecological perspectives on fire regime changes and impacts in the Pacific Northwest and elsewhere.

Jason McLachlan, who recently completed his Ph.D in the Biology Department of Duke University, was awarded the 2004 Edward S. Deevey Award for Outstanding Student Presentation in Paleoecology. His presentation was entitled "The importance of small populations in the postglacial dynamics of eastern forests," and was coauthored by James S. Clark and Paul S. Manos. Jason and his coauthors used patterns of genetic variation in modern tree populations and fossil pollen data to reconstruct temporal and spatial patterns of postglacial migration in eastern North America. Philp Higuera received honorable mention for his presentation entitled, "When does a charcoal spike represent a fire? Insights from a simple statistical model."

Our e-mail newsletter continues to reach over 200 members.

Submitted by:
Robert Booth

PHYSIOLOGICAL ECOLOGY SECTION

New Chairman

Stan Smith took over as Chair of the Section on 1 January 2005. Stan is a Professor of Biological Sciences at the University of Nevada, Las Vegas. Gretchen North continues as Secretary of the Section until the end of this year. We are in the process of starting a Call for Nominations and will announce an election for a new Secretary at the annual business meeting in Montreal.

Student Awards

Last year, Maggie Prater won the 2004 Billings Award for her talk, "Evapotranspiration and energy balance of postfire and native sagebrush communities in the Great Basin Desert," with Evan DeLucia as co-author. Maggie's work was conducted through the Department of Plant Biology at the University of Illinois. Tracy Gartner won the 2004 Best Poster Award for her poster "Arrangement of litter types can influence mass and N dynamics in mixed-species litter decomposition experiments" with Zoe Cardon as co-author. Tracy's work was conducted at the University of Connecticut. Honorable mentions were Will Cornwell (Stanford University) for the Billings Award and Catarina Moura (Duke University) for the Poster Award.

This year's competition

We currently have 26 entrants for the Billings and Best Poster Award competitions, and a healthy number of section members (> 25) who have volunteered to be judges this year.

Continuing Section prize support

The Section has again received commitments to support the Billings Award in the form of a $500 contribution by the New Phytologist Trust, and Elsevier (Academic Press) will make available a free book of the student's choice (from an AP list of books <$100) to the winners and honorable mentions of the Billings and Best Poster awards.

Support for the Section web site

The Section was awarded funds from ESA to improve the Section's web site with regard to pedagogy. Russ Monson, as Past Chair of the Section, and Rob Jackson, as current Section Web Guru, teamed for a proposal that was awarded and provided funds for Rob to hire a staff person to contribute to the web site course and teaching sections. Since the funds were only recently awarded, we will update specific changes that were made to the web site in next year's annual report.

Booth at the Annual Meeting

The Section will again maintain a booth at the Montreal meeting in order to consolidate the student awards programs at ESA. The booth will have boxes with ballots and judging information, and will display winning posters shown from the previous year. This enables us to highlight the research that students are doing in the Section, and helps alleviate judging confusion over the Billings, Best Poster, Braun, and Buell Awards.

Annual Meeting Symposia

In 2004, the Section sponsored a symposium organized by Bill Bowman (University of Colorado, Boulder) entitled "Functional Significance of Mountain Biodiversity". The symposium was supported by the Global Mountain Biodiversity Assessment ‹http://www.unibasel.ch/gmba/index.html›, a program within DIVERSITAS and GCTE, and included talks by Richard Bardgett, Steve Schmidt, Christian Rixen, Christian Körner, Bill Bowman, Molly Smith, and Rüdiger Kaufmann.

This summer, the Section is sponsoring two Organized Oral Sessions. One OOS, organized by Howard Neufeld (Appalachian State University) and Nancy Grulke (U.S. Forest Service) is entitled "Understanding the Impacts of Oxidative Stress in Plants: From Genes to Ecosystems," and will be held on Monday, 8 August. The second OOS, organized by Stan Wullschleger (Oak Ridge National Laboratory), Rob Jackson (Duke University), and Todd Dawson (University of California, Berkeley) is entitled "Sensors and Sensor Networks in Ecology," and will be held on Wednesday afternoon.

Submitted by:
Stanley D. Smith, Chair and Gretchen North, Secretary.

In the fall of 2004 the Physiological Ecology Section was awarded $1500 to help improve its Section web site with particular emphasis on adding additional course syllabi to its education component. The web page provides a clearinghouse of information for Section members. It currently receives 125,000 hits per year. In surveys of Section members in 2003–2004 by past-President Russ Monson, there was nearly universal praise for the web site and its utility to those teaching in the area of physiological ecology and global change biology.

Specifically, we used the $1500 to support the part-time salary of a staff member at Duke University to greatly expand the listings of course syllabi, lectures, and notes. Those listings in general ecology (field and lecture), physiological ecology, ecosystem ecology, and global change ecology now contain >80 courses that ESA members can use as they create or update their own courses.

The funds were also used to create and update other areas of the web page.

These include updates to the Diversity Enhancement page, listings of equipment manufacturers relevant to physiological ecology, and journal listings. We also created two new pages of links dedicated to Ethics and Professional Conduct and to Writing Resources.

The jobs page is also continuously updated. The 2004–2005 listings contained hundreds of faculty, postdoc, grad student, and staff positions listed by members. The new 2005–2006 listings were initiated as well.

Submitted by:
Russell Monson, President,
and Rob Jackson, Webmaster

PLANT POPULATION ECOLOGY

This year we continued to support students with travel awards for the Annual Meeting, updated our web site, and initiated an online discussion forum. Below we summarize these and other activities and decisions.

Student Travel Awards to the 2005 ESA Meetings

The Plant Population Ecology Section awarded three student travel awards to the 2005 ESA Meetings in Montréal, Canada ($300 each). Funds for the awards come, in part, from our Section's Silent Auction at the ESA meetings each year. We will recognize these students recognize at the Section's Business and Social Mixer on the evening of 8 August in Montréal. The award recipients are:

- Kristin Anton, Portland State University: "Pollinator preference and pollen transfer efficiency affect formation of hybrids within the *Piriqueta caroliniana* plant complex."
- Richard Lankau, University of California at Davis: "Genetic variation in defensive traits of Brassica nigra interacts with generalist and specialist herbivores to alter competition between plant species."
- Lori Spindler, University of Pennsylvania: "The role of oxidative damage in plant senescence."

Updating the Section's web site

Since the late 1990s, our Section has used its web site to promote collaboration and communication among plant population ecologists. This year Gordon Fox (University of South Florida), the original author of our web site, undertook the time-consuming but much needed task of updating it. Among the improvements he made are to:

a) Modernize the site's look by implementing new software (a "content management system"), which facilitates future expansion, extension, and maintenance.
b) Integrate the member directory with the site so that it can now be maintained and kept reasonably up to date.
c) Include the ability to let registered users post event notices, grant announcements, job ads, and the like.

Online forum

Jonathon Silverton and Gordon Fox have initiated and are now putting the finishing touches on a moderated online discussion forum for current topics in ecology (with an emphasis on plant population ecology). The trial version of the forum is now online at our web site: ‹http://pltecol.cas.usf.edu/index.pl/test8›. There are seven moderators listed there, and one topic ready for discussion. Several comments have already been posted on our initial topic, and the idea seems workable. We intend to announce this trial at the Section meeting in Montreal, and utilize feedback from members to fine-tune the system. After that we will solicit more topics and discussion. We are optimistic that this idea will be popular and useful.

Silent auction of crafts at the 2005 (Montreal) ESA Meetings

Our section will host our Ninth Annual Silent Auction of Crafts booth at the ESA Meetings. The bulk of the proceeds from the Booth are used to fund Student Travel Awards to the ESA Meetings. Items in the auction are donated by Section members or other individuals interested in supporting the Section, and all those attending the meeting are invited to bid on these one-of-a-kind items.

Sponsored symposium at 2005 ESA Meeting

The Section endorsed an Organized Symposium proposal on "Dynamics of invasive plants: individuals to ecosystems," (Oral Session 25) organized by Tiffany Knight and John Drake. This group will meet in Montreal as an organized oral session.

Call For Symposium Proposals for the 2006 ESA Meeting

Each year, the Plant Population Ecology Section is allowed to sponsor one symposium proposal. At our Annual Business Meeting and Mixer, we will discuss ideas for symposium proposals. Because our section is only allowed to endorse one proposal, if there are multiple suggestions, we will have an open discussion on them (although sponsorship is not necessary for inclusion in the final program).

Business Meeting agenda for Montreal

The 2005 Business Meeting and Mixer of the Plant Population Ecology Section will be held on Monday, 8 August. Agenda items include:

Announce new chair (Chris Ivey) and take nominations for a new vice-chair.

- Present the student travel awards.
- Discuss the Section's web site.
- Introduce the Section's new web discussion board for current ideas in Ecology
- Invite symposium proposals for the 2006 ESA Meetings.
- Announcements and new items from the floor.

Current Officers of the Plant Population Ecology Section

Chair (2004–2005). Randy Mitchell: Department of Biology, University of Akron, Akron, OH 44325-3908. E-mail: rjm2@uakron.edu

Vice-Chair (2004–2005). Chris Ivey: Illinois Natural History Survey, Center for Biodiversity, 607 E. Peabody Drive, Champaign, IL 61820. E-mail: ivey@uiuc.edu

Submitted by:
Randy Mitchell, Chair

RANGELAND SECTION

Revisit 2004 activities at ESA

The Rangeland Section was active at the 2004 ESA meeting. We sponsored a symposium that was well attended and we had a workshop/discussion following our mixer/business meeting.

2004 Symposium: Ecological Theory and Rangeland Sustainability: Local Strategies, Global Solutions.Co-organized by Elizabeth King, Jeffrey Herrick and Jacoby Carter

Rangeland degradation has become an environmental problem of enormous proportions worldwide, and is commonly the result of unsustainable livestock production. Degradation threatens not only the ecological integrity of grasslands, shrublands, and savannas, but also the social and economic viability of pastoralist communities that depend on them. Rangeland ecol-

ogy can provide much of the information necessary to assess, restore, and manage degraded rangeland, but implementing sustainable land use strategies will ultimately depend on integrating the ecological information with social, economic, and policy considerations.

In this well-attended symposium, participants discussed common challenges that arise in developing and implementing plans for sustainable rangeland use and broke these challenges down into categories of ecological, social, economic, and policy issues. They presented some important principles that can help promote the role of ecological information in resolving those issues, including the utility of models for understanding degradation, and the necessity of incorporating land restoration or rehabilitation into sustainable land use strategies. In terms of the social challenges, they focused on the importance of pastoralist education and participation in the ecological aspects of sustainable land management, both because of the importance of self-reliance to the long-term success of a project and also because traditional ecological knowledge may not always be adequate or relevant for lands that are degraded far beyond their historical condition. Economically, they explained how the ecological condition of rangelands can be directly linked to economic benefits for pastoralists, but also how perverse incentives can arise to disrupt that linkage.

Finally, the role of local, national, and international policy in the promotion of sustainable land use systems was discussed, comparing the effectiveness of grassroots and top-down approaches to rangeland management programs. Importantly, the participants urged greater involvement in policy advocacy by rangeland ecologists.

2004 Workshop/Discussion. Ranches, Ranchettes, Recreation and Conservation: Strategies for Increasing the Contribution of Science to Land Use Debates

The majority of this session was devoted to an informal discussion of the topic. Organized by Jeff Herrick. Wednesday, August 4. Attendance was good, with about 25 very active participants discussing what interactions scientists and policy makers need to deal with this very critical component of habitat fragmentation. The results of this workshop led very logically to the symposium and workshop that the Section is sponsoring for the 2005 ESA meetings.

2004 Business Meeting/Mixer

The mixer shared with the Soil Ecology Section was a great success. At the business meeting, a committee was established to work on funding for student awards for the best poster and the best oral presentation. The committee consisted of Sam Fuhlendorf, Jack Morgan, and Linda Wallace. The committee approached the Turner Foundation for a donation, without success. In discussions with Katherine McCarter, we found that most sections ask for donations from their members to establish a fund. If, after 3 years a sufficiently large fund does not exist, then the section is urged to make a one-time award and close the effort.

Other symposia and organized oral sessions sponsored by Section members at the 2004 meeting.

- Symposium: Ecohydrology: Towards an Ecologically Meaningful Water Budget. Co-organized by David Breshears and Osvaldo Sala. Tuesday, 3 August

- Organized Oral Session: Interannual climate variability: How temporal signatures can drive ecosystem processes. Co-organized by Linda Wallace and Jay Arnone. Tuesday, 3 August

Plans for ESA Rangeland Section at 2005 Meeting in Montreal

The Rangeland Section will again be busy at the ESA meeting in Montreal. Activities that are sponsored by the Rangeland Section or organized by members that represent our section are listed below.

- Special Session**,** Wednesday, 10 August 10, 1:30– 5:00 pm. Delivering on the promise of ecological science to improve land

management: ecological site descriptions. Organizers: Joel Brown and Jeff Herrick. Jointly sponsored by the Rangeland Ecology Section of ESA and the Society for Range Management. Ecological sites are groupings of soil and landform units that have similar potential to support plant communities and respond similarly to disturbances. For each site, a unique Ecological Site Description (ESD) is developed that includes: (1) a description of ecological processes affecting critical aspects of soil/vegetation relationships; (2) a synthesis of research results and management knowledge to predict site responses; and (3) a discussion of ecosystem services associated with potential stable states. This special session will bring together academic and agency research scientists and technical leaders from the major federal action agencies charged with the management of private and public lands. The primary objective is to provide ESA members with an opportunity to see how ESDs are currently being used to identify critical research questions and to organize, communicate, and apply research results, including vegetation classification systems. A second objective is to identify challenges in resolving key questions of site-scale behavior and in improving cross-scale linkages to extend information to landscapes and regions.

- Business meeting/mixer will be held 6:30–8:00 pm on Wednesday, 10 August. Finger foods and a cash bar will be available. We will be meeting jointly with the Agroecology, Applied Ecology, and Long Term Studies sections, prior to a short business meeting at the end of the mixer.

- Workshop/discussion will immediately follow the mixer. The topic will be: Delivering on the Promise of Ecological Science to Improve Land Management: Ecological Site Descriptions, An Informal Discussion. The workshop will be led by Linda Wallace and Sam Fuhlendorf, giving participants a chance to have longer interactions with many of the speakers in the special session that took place earlier in the day. The workshop is scheduled to take place on Wednesday, 10 August, 8:00–10:00 pm. Symposium 19: Spatial Nonlinearities and Cross-scale Interactions: Cascading effects in the Earth system Thursday, August 11, 1:30–5:00 pm. Organizers: Debra Peters (E-mail: debpeter@nmsu.edu), Brandon Bestelmeyer.

Ongoing activities: Web site development

Section web site ‹http://www.ag.unr.edu/esa/› Rangeland forum web site (informal forum to post, describe and discuss observations, data, and results). Section role: sponsor, lead contact: Bob Nowak ‹nowak@scs.unr.edu›

Requests for evening session and symposium proposals for the 2006 meeting in Memphis, Tennessee

The Ecological Society of America will be holding its 91st Annual Meeting in Memphis, Tennessee, 6–11 August 2006. The Calls for Symposium Proposals and Organized Oral Session Proposals, as well as information about the meeting, the theme, and the city of Memphis are included on the ESA meeting web site, ‹http://www.esa.org/meetings/FutureAnnualMeetings.php›

The deadline for submission of proposals for Symposia and Organized Oral Sessions will be announced shortly; usually it is 15 September. Following submission, all proposals will be peer reviewed and ranked prior to selection by the ESA Program Chair.

The Rangeland Section typically submits a proposal for a symposium, so the membership should be considering potential topics that would fit with the theme at the Memphis Meeting. Multiple topics can be proposed, but the Section can only sponsor one symposium.
Submitted by:
Linda Wallace, Chair

STATISTICAL ECOLOGY SECTION

The Statistical Ecology Section seeks to encourage research in statistical theory and methodology applied to ecological problems; to sponsor forums for presentation of advances in statistical ecology; and to facilitate communication between the disciplines of statistics and ecology so as to enhance statistical design and analysis in ecological research.

At the 2004 Annual Meeting the Section sponsored a full-day workshop, "An Overview of Structural Equation Modeling and Path Analysis," organized by Jim Grace. The workshop was a follow-up to a symposium the previous year. The workshop was very well attended. The participants were very pleased and felt that they had learned a lot about SEM.

The Section launched a new web site ‹http://statecol.evsc.virginia.edu/› to provide a way to communicate with its members and to enhance interactions among statistical ecologists. The site allows for threaded discussions and the posting of papers and software. The Web Master is Masami Fujiwara of UC Santa Barbara.

The Section gives an award for best oral presentation by a student at the Annual Meeting, the E. C. Pielou Award. The award consists of a cash prize of $200 plus a book by Dr. Pielou. No winner was declared for the presentations at the 2004 meeting.

Submitted by:
Samuel Scheiner, Chair

THEORETICAL ECOLOGY SECTION REPORT

The Section was formed in 1993 to (1) foster theoretical research in all areas of ecology; (2) sponsor meetings for the presentation of results; (3) foster communication and research collaboration between theoreticians and experimental/field ecologists; and (4) encourage the application of ecological theory to the resolution of societal problems.

Officers: Michael Neubert will be stepping down as Chair at the end of the Section's business meeting in Montreal. Priyanga Amarasekare (the current Vice-Chair) will take his place. The Section's Secretary, Gregg Hartvigsen, will also end his term after the Montreal meeting. Ottar Bjornstad has been elected Vice-Chair; Kim Cuddington will be the new Secretary.

Awards

The Theoretical Ecology Section awards the Alfred J. Lotka and Vito Volterra prizes for the best presentations given by students during the ESA Annual Meeting. The award is open to graduate or undergraduate student ESA members who, as sole or first author, present a talk or poster at the Annual Meeting on original research in theoretical ecology. All suitable approaches that yield theoretical insight to ecological phenomena are considered. Prizes are awarded on the basis of merit, originality, and clarity of presentation. The winners in 2004 were Allison Shaw (Brown University) for the best poster and Katia Koelle (University of Michigan) for the best talk.

Symposium

This year the Section is sponsoring a symposium, "Bridging the Gap between Theory and Empiricism in Ecology," organized by Priyanga Amarasekare. This symposium will explore a range of topics at the forefront of current ecological thinking—disease dynamics, invasion ecology, spatial dynamics, multi-species interactions—for all of which a tighter integration of theory and data is necessary, both from the basic scientific and more applied point of view. The goals of the symposium are to find ways in which existing theory could be made amenable to experimental verification, and to stimulate new theory that is rooted in biology and natural history.

Submitted by:
Michael Neubert, Chair

TRADITIONAL ECOLOGICAL KNOWLEDGE SECTION

The Traditional Ecological Knowledge section of ESA has experienced a good year in the development of our new Section. Our secretary reports a membership/mailing list of ~120 members. Section programs have been well attended and lively sessions. We have received strong feedback that the presence of the TEK section within the ESA organization has had a positive influence in diversifying the participation in ESA. A number of meeting participants, from a wide array of ecological fields, including tribal colleges, have commented that the existence of the TEK section has encouraged them to join ESA and contribute their energies to our shared mission. We feel that there is a good synergy with the successful activities of the SEEDS program, which has brought new faces and interests to the ESA meetings, who then find that the TEK Section engages their interest. We are looking forward to continuing the building of our membership and continuing to sponsor thought provoking programs.

Notable activities for the year include:

1) Annual Meeting activities in Portland

- Sponsored "Sense of Place" special session which attracted a large crowd to listen to native leaders from the Pacific Northwest. Our featured speakers included Chief Louis Pitt from the Confederated Tribes of Warm Springs, David Hatch from the Confederated Tribes of Siletz and the Elahee Alliance and Ed Edmo (Shoshone-Bannock).

- Evening session "Columbia River Natives Encounter Lewis and Clark" 2-hour discussion/slide show/basketry as a medium for discussion of environment and culture with Pat Courtney Gold .

- TEK contributed papers session with six presenters.

- TEK Business meeting and brown bag lunch

- The Sense of Place session yielded favorable press coverage for ESA in a leading Native American newspaper .

2) Leadership Retreat /Long-Range Planning Grant

The TEK Section applied for and was successful in receiving a grant from the Ecological Society to engage in the process of long-range strategic planning for the future of the Section. A planning retreat was held in advance of the ESA meeting, 30–31 July 2004 in Portland to more clearly define our shared goals and strategies for implementation.

The retreat was a much-needed opportunity to envision the activities on which we collectively want to spend our energies-including symposium planning, education, advocacy, outreach, workshops, publications. Eight Section members participated. Our discussions were productive and yielded a long list of goals and steps proposed to implement them. We identified key members who would serve as catalysts and facilitators for each of the major goals. Among the projects that received highest priority were:

- Development of partnerships with tribal environmental professionals

- Development of educational materials on TEK to be presented in a workshop at the ESA Annual Meeting and subsequently made available on the model of TIEE

- Development of annual symposium proposals

- Creation of linkages with other professional societies concerned with TEK issues, such as Conservation Biology, Ethnobiology

- Enhanced funding to bring more tribal people to ESA meetings

- Development of "position papers" relating TEK and ecological science

- Broadening the membership and leadership capacity of the Section beyond the original group

While the retreat successfully accomplished our fundamental goals, it is also important to recognize ways in which the process could be improved. Our original long-range planning grant proposal requested funding for a meeting at a time and location that the Section leadership determined would maximize participation and foster opportunities for partnerships with tribal professionals. However, the grant review panel allocated a lower sum and stipulated that the retreat be held in conjunction with the Annual Meeting in Portland. As a result, many of the members were already committed to pre-meeting activities, including SEEDS programs, and were unable to participate in the retreat except for a few hours. The requirement for the meeting to be held with the ESA Annual Meeting also limited the participation of potential tribal partners. Thus, the retreat was less effective in broadening our leadership group than we had hoped. In the future, we would recommend that funding for the leadership retreats not be restricted to the very busy days adjacent to the Annual Meeting and in locations which are not most effective for the Section goals.

3) TEK will have a significant presence at the Montreal Annual Meeting including:

- Opening words by Haudenosaunee Leader Henry Lickers
- Special "Sense of Place: Indigenous Homelands of Eastern Canada" Session on Monday afternoon
- Evening discussion " Ethical Issues and Intellectual Property Rights in tribal partnerships"
- TEK contributed papers session
- TEK Section meeting and luncheon
- There will also be an array of student-centered SEEDS activities, including students and mentors from Tribal Colleges.

4) Grant received from U.S. Forest Service

The TEK Section received a generous grant from the U.S. Forest Service , through the activities of ESA and Section member Kheryn Klubnikan. Those funds will be used to support development of symposium, workshop, and Section activities.

5) TEK Section web site online

Thanks to Mark Fulton for his efforts at successfully creating the Section web page.

Submitted by:
Robin Wall Kimmerer, Chair

URBAN ECOSYSTEM ECOLOGY SECTION

The Section is currently attempting to build membership and overhaul the Section web site. The new web site will better facilitate networking among urban ecologists/graduate students/urban planners and highlight ESA events relevant to section members. We will use the business meeting in Montreal to unveil the new web site, recruit more volunteers for further work on the site, and set goals for the next year. At a minimum, our goals for the new year will include an urban ecology field trip at the 2006 Annual Meeting and a 25% increase in membership.

Submitted by:
Roarke Donnelly, Chair

VEGETATION SECTION

Business meeting, Annual Meeting, Portland, Oregon

The annual business meeting of the Vegetation Section was held Monday, 2 August 2004 during the 89th Annual Meeting of the Ecological Society of America in Portland, Oregon. At that meeting Scott Franklin became the section Vice-Chair. Approximately 50 in-

dividuals attended the business meeting and mixer.

Issues before the Section

Term limits: A proposed change in the Section Bylaws was voted on and approved unanimously. The term of Chair-Elect and Chair will be changed from 1 year to 2 years. The purposes of changing the term of service of the Chair and Chair-Elect are to (1) provide additional continuity for Section business from one year to the next, (2) provide the Chair and Chair-Elect an extended opportunity to discuss and potentially enact changes, if voted on by the members, (3) afford a longer period of time to promote Section activities, and (4) provide greater continuity of representation on the ESA Council. Some sections (e.g., Aquatic Section, Applied Ecology Section) currently elect officers for 2-year terms.

Section Membership and Financial status: Dues from members contribute to an annual increase in the Section budget. Options for utilizing the surplus include allowing the budget to increase, spending additional funds for the business meeting, contributing to the Ton Damman award, supporting an intern to develop the web site further, or providing travel support.

The Ton Damman Award in Vegetation Science

Thanks to the kindness and generosity of Loretta Johnson, an ecologist at Kansas State University, in 2003 the Vegetation Section of ESA announced the Ton Damman Award in Vegetation Science. This award is given to a graduate student or very recent post-graduate scientist for the best oral presentation in Vegetation Science at the ESA Annual Meeting. Students competing for the Damman Award must meet all the criteria for ESA's Buell Award. The Ton Damman Award recognizes the lifetime dedication of Ton Damman to the advancement of Vegetation Science. A candidate for this award need not be a member of the Vegetation Section, but does need to be senior author of the abstract and give the oral presentation at the Annual Meeting. Jason McLachlan was the 2004 recipient of the Ton Damman award for his presentation, co-authored by J. S. Clark and P. S. Manos, "The importance of small populations in the postglacial dynamics of eastern forests" at the ESA meeting in Portland. The award will be presented to him at the annual business meeting in Montreal.

Vegetation Section web site

A web site ‹http://www.uga.edu/srel/esavegsec/› has been established for the Vegetation Section. The web site has information on the Section's mission, news and announcements, and activities. Students interested in the Ton Damman award can find information on eligibility requirements and application procedures.

Submitted by,
Beverly Collins, Chair

VI. REPORTS OF CHAPTERS

MEXICO CHAPTER

The Mexico Chapter of the Ecological Society of America was established in April 2003. It held its first meeting on 6 August 2003. At this first gathering, the members agreed to pursue four activities. The corresponding advances are described as follows:

a) Symposium: María Luisa Martínez, Robert Manson, and Patricia Balvanera organized the symposium entitled "The evolution of ecology in Mexico: research challenges and the role of Mexico–US collaboration" for the 2004 Annual Meeting. The symposium included seven presentations that discussed the history of ecology in Mexico, further describing current research in North America and presenting the future challenges posed by the state of the environment and ecology as a science in Mexico. The authors are currently working on publication of the ideas presented at the symposium. They will submit a manuscript to "*Frontiers in Ecology and the Environment.*"

b) Directory: the Chapter directory is posted on the Mexico Chapter web page and includes 49

members, both from Mexico and elsewhere.

c) Web site: Erick De la Barrera is the web master for the Chapter. The web page ‹http://www.ibecmx.org/esa-mexico/› includes the minutes of the first meeting, member directory, interesting links to other societies, and an internet forum for Chapter members. It also posts job opportunities in Mexico.

d) Symposium in Mexico: While at the first meeting of the Chapter the idea of an event in Mexico was discussed, the 2004 Chapter symposium created the synergy that led to organizing a conference in Mexico. The "Ecology in an Era of Globalization: Challenges and Opportunities for Environmental Scientists in the Americas" conference will take place in Mérida, Yucatán, Mexico, 8–12 January 2006. Several Chapter members are involved in organizating the event. The Chapter is recruiting volunteers to help translate abstracts from English into Spanish and vice versa, as well as to review proposals for student travel awards.

e) Promotion of our Chapter. We developed a poster on the Mexican chapter. It can be used by any member who wants it, for example when they attend conferences. It was tried out last year at the Mexican Botanical Society Meetings (Oaxaca, October 2004). We hope this will help to promote our chapter widely.

The Mexico Chapter will gather at the 2005 ESA Meeting and select new officials. Coordination and synergy with the newly established Mexican Society for Ecology will be explored.

Submitted by:
Rodolfo Dirzo, Chair

MID-ATLANTIC CHAPTER

The Mid-Atlantic Chapter is into its third year, following its conversion from the Washington, D.C., Chapter. We now include ESA members from New York, New Jersey, Pennsylvania, Delaware, Maryland, the District of Columbia, West Virginia, and Virginia plus some from outside the geographic area. Presently, in summer 2005, the membership has grown to over 330. As stated in our bylaws on the ESA web site, "the objective of the Chapter shall be to encourage education and research, to sponsor meetings for the discussion of ecological education and ecological research activities, and to promote communication among professional ecologists of the Mid-Atlantic region of the United States."

Following a very successful March 2004 Mid-Atlantic Ecology Conference at Franklin and Marshall College in Lancaster, Pennsylvania, which was built around the topic of "Sustainable Landscapes," we repeated with a second conference this year at the University of Maryland, Baltimore County, subtitled "Urban Landscapes." One of the primary objectives at both conferences was to provide a regional venue suitable for undergraduate and graduate students to present their work mixed in with contributed papers by senior ecologists. There were opportunities for both poster and platform presentations. This year the plenary talk was given by Charles Nilon, Associate Professor, University of Missouri, on "The Ecology of Nearby Nature" which supported the theme of urban ecology. The dinner speaker was Laura Hungerford, DVM, MPH, Ph.D, Professor and Interim Head at the University of Maryland, who spoke on "Epidemiology and Ecology: Synthesis in Method and Meaning." This was a thought-provoking talk on recognition of the importance of ecological data and interactions to the understanding of human disease and the occurrence of epidemics. The 2005 business meeting of the Chapter was held at this conference.

One of our conference planning goals is to make these meetings as low cost as possible in order to promote attendance by students and faculty from schools with low travel budgets. A second goal is to try to arrange the schedule on a Saturday so that many can attend from the region as a day trip, or with only one overnight stay being required. For those who wished to extend their participation, field trips are scheduled on Sunday following the conference day. In 2004,

Rich Pouyat arranged for visits to some of the Baltimore Ecosystem LTER sites as examples of urban ecological studies.

Juliette Winterer, Franklin and Marshall College, is completing her term as Section Chair and Dirk Vanderklein, Montclair State University, will assume that role for 2005–2006. We have tentatively scheduled the Spring 2006 meeting for northern New Jersey, and a natural community/ecosystem oriented conference theme is being developed. It will likely address the New Jersey Pine Barrens as a unit for study. Announcements will be made to chapter members in the Fall, and we encourage all ESA members who are in this region to join and be active! If you are not a chapter member and wish to be placed on this year's mailing list, please contact the new Chair at ‹vanderkleid@mail.montclair.edu›.

Submitted by:
Dean Cocking, Secretary/Treasurer

ROCKY MOUNTAIN CHAPTER

The Rocky Mountain Chapter continues work to revitalize and diversify our activities. The objectives of the Chapter are to encourage education and research and to sponsor meetings for the communication of ecological education and research activities of special interest to ecologists in the Rocky Mountain Region of North America. To that end, the Chapter continues to sponsor the Annual Front Range Student Ecology Symposium at Colorado State University. The 11th Symposium was held 5–6 April 2005, and our chapter provided $500 of support. The theme for this year's symposium was: "How Does Global Change Influence the Way We Do Science?" A full description and schedule of events can be found at: ‹http://lamar.colostate.edu/~ecosym/_Home.html›

This year, six colleges and universities from Colorado and one Colorado high school resulted in 28 oral presentations and 30 posters. Student, faculty, and Federal scientist members of ESA participate each year and are thus on hand to "recruit" and to learn from our next generation of leaders in the field.

On that note, all leadership positions of the chapter will be open this year, and we will organize elections at our Annual Meeting on Thursday, 11 August 2005, 7:00–8:00 am. Continental breakfast will be served, and we will devote most of the meeting to the Rocky Mt. Ecological Observatory (ROMEO) and our development of a strategy to be part of the National Environmental Observation Network (NEON). That discussion will be led by Dr. Jill Baron, U.S. Geological Survey and the Natural Resource Ecology Laboratory, Colorado State University.

Submitted by:
Geneva Chong, Chair

SOUTHEASTERN CHAPTER

The Southeastern Chapter held an informal brown bag lunch meeting at the ESA Annual Meeting in Portland, Oregon. Discussion at this meeting focused primarily on administration of two student awards: the Odum Award and the Quarterman-Keever Award. Committees for administering these awards were assigned. Joan Walker presented a plan that we hope will fund the Quarterman-Keever Award in the future. Various ideas for symposia to be developed for the 2006 ASB and ESA meetings were discussed.

The Southeastern Chapter held its annual meeting with the ASB in April in Florence, Alabama. At the business meeting Neil Billington (Troy University) was elected Vice Chair, and outgoing Chair Paul Schmalzer was thanked for his efforts during the last 3 years. Various ideas for symposia were again discussed. Due to recent changes in land use throughout the Southeast, it was decided to determine how a symposium might be organized around this issue.

The Quarterman-Keever Award was given for the first time at the 2005 ASB meeting. The recipients were Joy Hester, Davidson College for "Effects of relocation on movements and home ranges of eastern box turtles (*Terrapene carolina*)," co-authored by Steven J. Price and Michael E. Dorcas, and Melinda D. Roberts, Appalachian State University for "The influence of water relations on the response of cutleaf coneflow-

er to ozone," co-authored by Howard Neufeld, Alan Davidson, and Arthur Chappelka. Recipients of the 2005 Odum Award were Chrissie McKenney, University of Southern Mississippi for "Nest site selection by gopher tortoises in south Mississippi," co-authored by Carl Qualls, and Sarah Johnson, East Carolina University, for "The effects of competition on the threatened dune annual, *Amaranthus pumilus* Raf. (Amaranthaceae)," co-authored by Claudia Jolls.

Chapter newsletters have been published on the Chapter's web site ‹http://www.auburn.edu/seesa/› and in the *ESA Bulletin*.

Submitted by:
James Luken, Chair

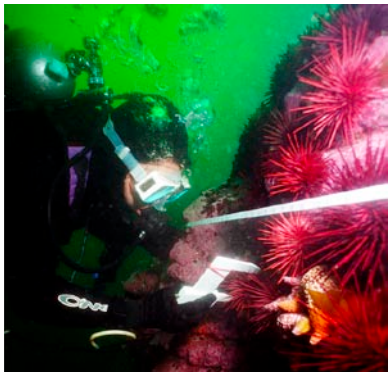


Photo Gallery

ELK PREFER GRASSLAND MEADOWS

Photo © John Winnie, Jr.

These photographs show elk (*Cervus elaphus*) in the grassland meadows, which they preferred in the absence of wolves, but avoided in the presence of wolves. The article analyzes data from elk carrying GPS collars to ask if their movements and habitat selection were affected by the presence of wolves.

Photo © John Winnie, Jr.

Wolves regularly moved into and out of the four drainages on our study site in the Yellowstone ecosystem. Investigators took advantage of the movements to ask whether elk used the landscape differently on days that wolves were present and when they were absent. Because the analysis considers the behavior of the same elk, in the same location, in the same year, when wolves are present and absent, it circumvents confounding variables that have complicated prior studies. In the presence of wolves, elk were more likely to use coniferous woodlands that provided protective cover, and less likely to use open meadows that were their preferred foraging habitat in the absence of wolves. These results have implications for the hypothesis that predation risk can drive trophic cascades, and for discussions of the relative importance of direct and indirect effects of predation on prey.

These photos were taken in association with the article, "Elk alter habitat selection as an antipredator response to wolves," by Scott Creel, John Winnie, Jr., Bruce Maxwell, Ken Hamlin, and Michael Creel, to be published in *Ecology* **86**(12), December 2005.

MEASURING ABALONE AND SEA URCHINS

Photo © Shannon Fitzgerald

Life history traits such as reproduction, growth, and survival in many marine species are based on animal size. For many marine invertebrates and fishes, larger animals have greater reproductive output, higher survival, and may continue growing slowly as they age. Size-specific life history data are needed to construct structured population models. Here Jennifer Stephenson collects size-specific data on red abalone in the cold waters off northern California.

Photo © Laura Rogers-Bennett

Large red abalone are susceptible to multiple sources of mortality, including fishing, predation, disease, wave dislodgement, and boring clams and sponges that compromise the integrity of the shell.

Photo © Shannon Fitzgerald

Photo © Laura Rogers-Bennett

Red abalone in shallow eelgrass beds in Horseshoe Cove, Bodega State Marine Reserve in northern California. This reserve is the oldest reserve in northern California where organisms are protected from fishing. There is an active recreational fishery for red abalone in northern California where shore pickers and free-divers collect abalone from shallow intertidal and subtidal habitats.

Tag and recapture studies are used to estimate growth and mortality rates. Data from a large-scale tagging program conducted by the California Department of Fish and Game was used to estimate growth and mortality for red abalone. Tags are made of stainless wire twisted through the open respiratory pores in the shell to hold numbered stainless washers. Abalone are tagged by Peter Haaker, California Department of Fish and Game, at Van Damme State Park in northern California.

Photo © Shannon Fitzgerald

Individuals tagged with stainless tags can be identified for years in the field. Tagged red abalone in the Bodega State Marine Reserve.

Photo © Shannon Fitzgerald

Red abalone inhabit coralline algae in the shallow nearshore communities.

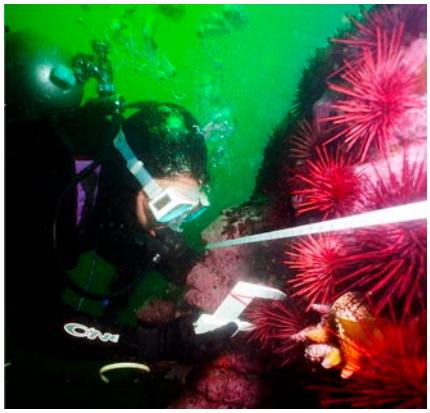
Red abalone are dominant herbivores in subtidal rocky communities in northern California.

Look for the article by L. Rogers-Bennett and R. T. Leaf, "Elasticity analyses of size-based red and white abalone matrix models: Management and conservation in California," to be published in *Ecological Applications* **16**(1), February 2006

KELP OF VARYING SIZES

Size differences among individuals of the annual kelp *Alaria nana* develop rapidly among even-aged cohorts due to persistent differences in growth among individuals that is independent of size. Catherine A. Pfister and Mei Wang present a matrix model and loop analysis approach to modeling populations where growth history is an important state variable. These kelp are abundant at the study site on Tatoosh Island off the coast of Washington state where the picture was taken.

Look for the article by Catherine A. Pfister and Mei Wang, "Beyond size: matrix projection models for populations where size is an incomplete descriptor," in *Ecology* **86**(10):2673–2683, October 2005.



CONTRIBUTIONS

Commentary

Interpreting the Results from Multiple Regression and Structural Equation Models

The coefficients that are associated with pathways in multiple regression, as well as more advanced methods based on regression, such as structural equation models, are central to the interpretations made by researchers. The complex of factors that influence these coefficients make interpretations tricky and nonintuitive at times. Very often, inappropriate inferences are made for a variety of reasons. In this paper we discuss several important issues that relate to the interpretation of regression and path coefficients. We begin with a consideration of multiple regression. Here we discuss the different types of coefficients that can be obtained and their interpretations, with our focus on the contrast between unstandardized and standardized coefficients. Structural equation modeling is used to show how models that better match the theoretical relations among variables can enhance interpretability and lead to quite different conclusions. Here we again emphasize often-ignored aspects of the use of standardized coefficients. An alternative means of standardization based on the "relevant ranges" of variables is discussed as a means of standardization that can enhance interpretability.

Biologists have long used multiple regression in its various forms to examine relationships among explanatory and response variables. Over the past decade and a half, there has been a steady increase in the use of path analysis by biologists to serve the same purpose, but in the context of a more interpretive structure. Most recently, there has developed a considerable amount of interest in the more comprehensive capabilities of structural equation modeling (SEM) for understanding natural systems, again with the purpose of enhancing our interpretation of results. These methodologies have in common that they are based on the fundamental principles of regression and share many of the same issues when it comes to interpretation.

Researchers may not be aware that there has been a long history of discussion among quantitative social scientists and statisticians about the interpretation of results from both multiple regression and path analysis applications. The topic is sufficiently subtle and important that the central theme of Pedhazur's (1997) book on regression is the pitfalls of interpreting results. Among the many things he concludes is that results are frequently misinterpreted, particularly as they relate to the meaning of path coefficients. Many of these same issues apply to SEM. This discussion has involved a consideration of many topics, including the types of coefficients that can be calculated, the kinds of interpretations that can be supported using different coefficient types, and the importance of theory to interpretation. Here we illustrate some of these issues and discuss problems with the use of standardized coefficients, as well as a possible remedy.

An illustrative example

To illustrate the points being made in this paper we consider an example dealing with the response of shrublands to wildfire in Southern California (J. B. Grace and J. E. Keeley, *unpublished manuscript*). The data presented here represent a small subset of the variables in the complete study. In addition, the relationships among variables have been modified somewhat to meet the needs of the current paper. In this example, 90 sites were located in areas burned by a series of fires that occurred during a 2-week period in the fall of 1993 (Keeley et al., *in press*). Plots were established in all 90 sites and sampling began in spring of the first postfire year and continued for 4 more years, though only the data from the first sampling following fire are discussed here. At each site, the variables included (1) herbaceous cover (as a percentage of ground surface), (2) fire severity (based on skeletal remains of shrubs, specifically the average diameter of the smallest twigs remaining), (3) prefire stand age (in years), estimated from ring counts of stem samples, and (4) the elevation above sea level of the site. The data used in this analysis are summarized in Table 1. Again, the data presented are a subset of the original, and some relations in the data have been modified to make the example more applicable to our purposes.

Issues related to multiple regression

A multiple regression represents a particular model of relationships in which all potential explanatory variables (predictors) are treated as coequal and their interrelations are unanalyzed. As we shall see, the ability to obtain interpretable results from such models depends on the degree to which their structure matches the true relations among variables. Fig. 1 presents diagrammatic representations of a multiple regression model in which fire severity, stand age, and elevation are related to vegetation cover. Parameter estimates were obtained using the software Mplus (Muthén and Muthén 2005) under maximum likelihood estimation. Several types of coefficients were obtained from the analyses and are presented in Fig. 1, with each subfigure presenting a different view of the relations among variables.

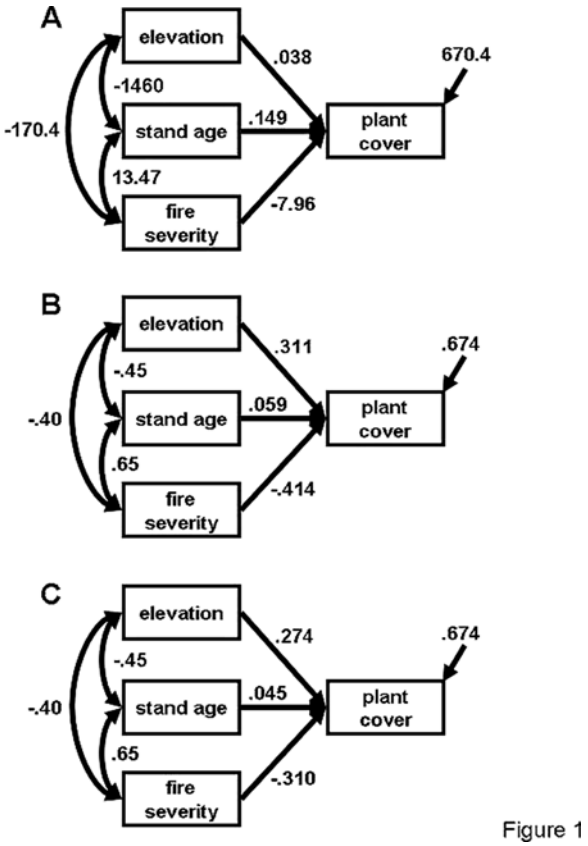


Figure 1

Fig. 1. Multiple regression results based on analysis of the data in Table 1. (A) Unstandardized parameters. (B) Standardized parameters. (C) Semipartial coefficients for the directional pathways.

Unstandardized coefficients

Fig. 1A presents the unstandardized path coefficients associated with the regression of plant cover on elevation, stand age, and fire severity. While the unstandardized coefficients are the most primary parameters obtained from a multiple regression, often they are not presented by investigators. In fact, typically the significance tests associated with regression are tests of the unstandardized parameters, and the standardized parameters are simply derived from the unstandardized coefficients and not directly tested. Characteristic of unstandardized parameters, they are expressed in the original units of the explanatory and

dependent variables. With reference to a simple linear regression, unstandardized coefficients associated with directed paths represent the slope of the relationship. The same is true in multiple regression, although the slope is in *n*-dimensional space.

As we begin to interpret the results in Fig. 1A, note that the undirected relationships (double-headed arrows) represent the covariances among exogenous variables (predictors) in a model. In contrast, the coefficients associated with directed paths are partial regression coefficients. It is important for the discussion that follows to understand when the principles of partial regression apply. Simply put, partial regression represents a method of statistical control that removes the effect of correlated influences. Pathways that involve partial regression can be recognized by the following: (1) they involve a directed relationship (single-headed arrow), (2) the response variable (variable receiving the arrow) also receives other arrows, and (3) the multiple predictors affecting the response variable are correlated. As we can see from these criteria, all directed paths in multiple regression will involve partial regression as long as there are significant correlations among predictors. The question then is how are we to interpret such coefficients.

The literal definition of a partial regression coefficient is *the expected change in the dependent variable associated with a unit change in a given predictor while controlling for the correlated effects of other predictors*. There are actually several different ways we can look at partial regression coefficients. The most direct is to view them as parameters of an equation such as

$$\text{cover} = 0.038(\text{elevation}) + 0.149(\text{age}) - 7.96(\text{severity}) \quad (1)$$

when variables are in their raw units. If we were able to plot a four-dimensional graph of cover against elevation, age, and severity, the unstandardized regression coefficients would be the slopes of the relationship in the plot. From this perspective, it should be clear that the coefficients estimate the mean influences of predictors on the response variable and the variation around the mean is ignored. Deviations from the mean in this case relate to the estimation of the probabilities that coefficients' values are zero. Thus, one interpretation of the unstandardized coefficients is that they are prediction coefficients. They also are descriptive coefficients in that they describe the association between cover and a one-unit change in the other variables. Hypothetically, these coefficients might also be viewed as explanatory. However, for such an interpretation to be valid, we must depend on the structure of the model to match the true dependencies among the predictors. As Pedhazur (1997:8) states, "Explanation implies, first and foremost, a theoretical formulation about the nature of the relationships among the variables under study." This point will be illustrated later in the paper when we discuss the structural equation model results for these data.

Referring back to our example, if we were to keep elevation constant for a set of plots, and the stands being burned were of a fixed age, a one-unit difference in the fire severity is associated with an average difference in cover of –7.96 cover units (i.e., the cover of the postfire community would differ by 7.96%). Similarly, if we were able to apply a fire of fixed severity while also holding stand age constant, a difference in elevation of 1000 m is associated with an expected difference of 38% in the postfire cover.

Standardized coefficients

Looking at Fig. 1A, we see that it is difficult to compare unstandardized coefficients among different pathways because the raw units are various. Cover varies in percentage points, elevation varies in meters, age varies in years, and fire severity varies in the units of an index based on the diameter of remaining twigs following fire. So, is a value of 0.038 (the coefficient for elevation effects on cover) large or small relative to the effect of another factor? The standardization of the coefficients based on the standard deviations of the variables is the approach typically used to make coefficients comparable. In essence, this puts variables in standard deviation units, and in that sense the expected

impact of a standard deviation difference in one variable (say elevation) can be compared to a standard deviation difference in another variable (say fire severity). Though a convenient transformation, standardized regression coefficients are frequently misinterpreted, for reasons we will discuss next.

The most common misinterpretation of standardized coefficients is to interpret them as if they represent a partitioning of explained variance in the model. The fact that standardized coefficients are in standard deviation units contributes to the tendency to make this mistake. For example, the formula for standardized partial regression coefficients can be expressed in terms of the correlations among variables. In the case of two predictors, x_1 and x_2, and one response, y_1, this formula is

$$\gamma_{11} = \frac{r_{x1y1} - r_{x1x2} \times r_{x2y1}}{1 - r^2_{x1x2}} \quad (2)$$

where γ_{11} refers to the standardized partial regression coefficient representing the response of y_1 to x_1, and the r values represent the bivariate correlations among variables. This formula can be readily extrapolated to the case of more than two predictor variables (Pedhazur 1997).

Another relationship that applies to standardized coefficients is that the sum of all simple and compound associations between two variables equals the bivariate correlation between those two variables. For example, the bivariate correlation between elevation and cover is 0.45 (Table 1). With reference to Fig. 1B where standardized coefficients are presented, we find that the coefficients are those that satisfy the formula (allowing cover to be y_1, and elevation, stand age, and severity being $x_1 - x_3$)

$$r_{x1y1} = \gamma_{11} + r_{x1x2} \cdot \gamma_{12} + r_{x1x3} \cdot \gamma_{13}, \quad (3)$$

where γ_{11} is the response of y_1 to x_1, γ_{12} is the response of y_1 to x_2, γ_{13} is the response of y_1 to x_3, and r's refer to correlations.

A third property of standardized coefficients is that they can be related to the explained variance in our response variable using the equation

$$R^2 = r_{x1y1} \cdot \gamma_{11} + r_{x2y1} \cdot \gamma_{12} + r_{x3y1} \cdot \gamma_{12} \quad (4)$$

Pedhazur (1997). For our example presented in Fig. 1B, we find that the expression in Eq. 4 yields an R^2 of 0.326 (note the standardized error variance shown in Fig. 1B equals 1 minus the R^2).

Now, the properties of standardized coefficients give the impression that they solve a number of problems. Most obviously, they put all the coefficients in what seem to be the same units. However, they are only the "same" if we are willing to say that a standard deviation for one variable in one metric is *interpretationally equivalent* to a standard deviation of another variable that was measured in a different metric. This is an implicit assumption of using standardized coefficients and it is not obvious that this assumption is suitable other than in the fact that each is a standard deviation.

More seductive than that, however, is that standardized coefficients are expressed in terms of correlations, *which represent the variation associated with the relationships.* In the case of simple regression (involving one predictor variable), we know that the unstandardized coefficient represents the slope, while the standardized coefficient represents the square root of the variance explained in the response variable. Eq. 4 may give the false impression that this relationship between standardized coefficients and variance explained can be generalized to the case of multiple correlated predictors. However, it cannot be so generalized. To see why more readily, we now turn to the concept of semipartial coefficients and unique variance explanation.

Semipartial coefficients and the concept of shared variance explanation

The semipartial coefficient, when expressed in standardized form, represents a measure of the *unique ability of a predictor variable to explain variation in a response variable that cannot be explained by any other predictor variable in the model.* We can under-

stand this in contrast to stepwise regression, which measures the sequential abilities of variables to explain residual variance. In sequential variance explanation, there is a pervading influence on the results by the logic used to determine the order of variables included. Here, the semipartials represent a measure of the minimum effect of a variable regardless of logical order. In the example in Fig. 1C, the coefficients associated with directed paths are semipartial coefficients, while the coefficients associated with undirected paths remain correlations. The unique variance explanation abilities of our three predictors (elevation, age, and severity) are 0.075, 0.002, and 0.096, the squares of the semipartial coefficients. Collectively, the three variables provide unique variance explanation of 0.173. Since the total variance explained by the full model is 0.326, we must conclude that 0.153 (roughly half) of the explained variance is shared among predictors.

The concept of *shared variance explanation* makes sense when we have predictor variables that are correlated for some unknown or unspecified reason. How are we to apportion the correlated explanatory power among predictors in a multiple regression? Since our relations among predictors are unanalyzed or not understood, we have no means to accomplish this. The implications of these relations can be seen if we compare the coefficients in Figs. 1B and C. It is to be expected that the partial regression coefficients are greater than the semipartial coefficients, with the degree of difference directly related to the strength of the correlations among predictors. It should be clear from the above discussion that as predictors become more highly correlated, their unique variance explanation ability decreases. It should also be clear from our presentation that the standardized partial regression coefficients (Fig. 1B) do NOT represent measures of variance explanation ability. Rather, *the standardized partial regression coefficients represent expected changes in* y *as a result of manipulations in* x *in standard deviation units while controlling for the correlated effects of other predictors.* The reason these coefficients cannot be used to represent variance explanation is simple; it is because we cannot guess how to apportion the variance explanation shared among predictors. In sum, the total variance explained in a multiple regression can only be attributed to the collection of predictors. The truth of this is most evident in nonlinear regression where individual predictors (e.g., x and x^2) may explain no variance by themselves, yet together they can explain substantial variance in some y.

Conclusions about the interpretability of multiple regression

While investigators commonly ask, "What is the relative importance of a set of causes controlling some observed phenomenon?" we must conclude that when predictor variables are correlated for unknown reasons, standardized partial regression coefficients do not provide an answer to this question. It is true that when correlations are not excessive, path coefficients can provide important insights. Multiple regression, which is inherently designed to ignore the causes behind the correlations among a set of predictors, makes for a particularly poor approach to understanding, however. This fundamental problem has been long recognized and is the central theme in Pedhazur's (1997) book on multiple regression. While Pedhazur discusses the problem from many different angles, his main conclusion is that without a theory to guide the analysis, a meaningful answer to the question of relative importance of factors is usually precluded in a multiple regression analysis. As we have seen, standardized regression coefficients do not equate to variance explanation. At the same time, measures of unique and shared variance explanation, which can be obtained using semipartial analysis, really don't address explanatory questions either, but instead, relate more to their unique roles as predictor variables.

Structural equation modeling

Since the interpretability of multiple regression results is typically limited by an insufficiently developed theoretical framework, we should consider what problems are solved using a theory-oriented method such as SEM. For those not familiar with SEM, it involves the use of a generalized multiequation framework that enables the analyst to represent a broad range of mul-

tivariate hypotheses about interdependencies (Bollen 1989). Path analysis, which is now familiar to most ecologists, is best known in analyses that only consider relations among observed variables. Modern SEM allows for the inclusion of unmeasured (latent) effects, as well as the specification of a wide range of model types. Importantly, SEM allows for evaluations of model fit that serve to permit overall testing of the model as a hypothesis. While SEM is most commonly based on maximum likelihood estimation, many model types can be solved using various least squares procedures. While we do not present latent variable examples in this paper, the issues discussed apply equally to such models.

We should begin by stating that SEM does not solve all problems associated with interpreting multivariate relations. Both inadequate data and insufficient theory can block substantial progress. Additionally, while SEM permits the implications of a causally structured theory to be expressed, the analysis itself does not contribute to the establishment of causality. This must come from other information. Nonetheless, the use of theory to guide our analysis within an SEM framework has the potential to remove many obstacles to interpretation. The example presented here is meant to illustrate that potential, but not to imply that the application of SEM automatically leads to a superior analysis.

Returning to the example of fire response by California shrublands, we now ask, "What do we know of the relations among our explanatory variables?" In this case, the authors of the original study felt they knew some important things, but we were unable to incorporate this information into the multiple regression performed in the previous section. First, substantial experience (Keeley 1991) indicates that postfire recovery by the plant community may be affected by fire severity because of impacts on seed survival. It is also possible that impacts to soil properties could contribute as well (Davis et al. 1989). The point is that fire severity is reasonably modeled as having a direct impact on plant cover. Stand age can be expected to have an effect on fire severity because older stands tend to have more fuel. A simple thought experiment illustrates the point. If we were to vary stand age (say, allow a stand to get older and accumulate more fuel), we might reasonably expect that it would burn hotter (though this would not be guaranteed). However, if we were to manipulate fire severity in a plot, that would certainly not affect the age of the stand. This logic and the experience upon which it is based encourages us to represent the relationship between stand age and fire severity as a directional one rather than a simple correlation. By a similar logic, we can see that the relationship between elevation and stand age should be represented as directional. If shrub stands tend to be younger as we go higher in elevation, which the data indicate, (e.g., if there were a reduced incidence of fire suppression at higher elevations), then picking a spot lower on the mountain will likely result in finding an older stand. On the other hand, if we were to allow a stand of shrubs to get older, we would not find that there was an associated change in elevation. Again, the use of thought experiments, which tap into our body of prior knowledge, suggest directional relationships among variables.

Some researchers may be uncomfortable with the logic used above to indicate directional relationships in causal models. This subject is beyond the scope of our discussion in this paper and we refer the reader to more in-depth treatments of the subject (e.g., Bollen 1989, Pearl 2000, Shipley 2000). For now, we accept such a procedure as reasonable and illustrate its consequences in Fig. 2. The path model represented in Fig. 2 illustrates the logic of the dependencies described above. In addition, it represents the possibility that there may be influences of elevation on cover that are unrelated to associated variations in stand age and fire severity. Because this model is not saturated (i.e., not all paths are specified), our model represents a testable hypothesis. Inherent in SEM practice is the evaluation of fit between model expectations and observed relations in the data. Our point here is not to elaborate on this point, but only to note this feature of SEM practice and then continue with our discussion of interpretation. The patterns of covariances specified in Table 1 in fact fit the model presented in Fig. 2 reasonably

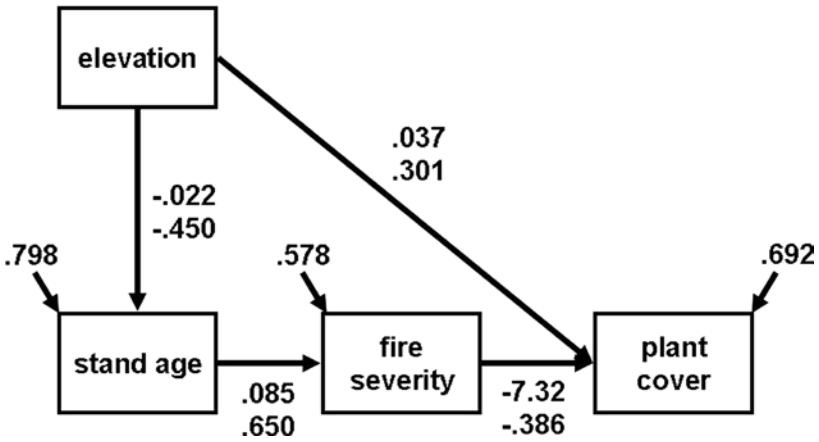


Fig. 2. Path model results based on analysis of data in Table 1. For path coefficients, upper numbers are the unstandardized coefficients, while lower numbers are standardized path coefficients. Error variables are standardized values. Model chi-square = 2.535 with 2 df, $P = 0.278$.

well (chi-square = 2.535 with 2 df and $P = 0.278$; note that a nonsignificant P value indicates the absence of significance deviations between data and model). This does not, of course, prove that the model is the correct one, only that it is consistent with the data.

The first thing we should do when interpreting the results in Fig. 2 is to consider which of our paths involve partial regression and which involve simple regression. Recall that response variables receiving two or more directed arrows will involve partial regression if the predictors involved are correlated. As stand age and fire severity only receive single directed arrows, their incoming pathways represent simple regression relations. We can see in fact that the correlations in Table 1 match the standardized path coefficients in Fig. 2 for these two pathways. Cover, on the other hand, has multiple influences and thus, the coefficients from elevation to cover and fire severity to cover are partial coefficients. What this means is that when we examine the relationship between elevation and stand age or between age and severity, there are no influences from other variables in the model to control for. On the other hand, the relationship between severity and cover is controlled for the covarying effects of elevation on cover. Similarly, the direct path from elevation to cover represents the effect once the influence of severity is removed.

Considering the unstandardized path coefficients in Fig. 2, we can see that the covariance between elevation and stand age can be understood as an expectation that age will decline on average by 2.2 years with an increase of 100 m. The covariance observed between stand age and fire severity can be understood as an expectation that severity will increase by 0.085 units with each year older a stand gets. Thus, we can understand the covariance between elevation and fire severity as the product of these two described relationships. Further, there is no indication of any other effect of elevation on fire severity except that mediated by stand age (because there is no direct path from elevation to severity to indicate some other effect).

The interpretation of unstandardized coefficients connecting severity and elevation to cover is somewhat different from those associated with a simple regression coefficient. We would draw the interpretation from Fig. 2 that increasing fire severity by one unit while holding all other conditions constant would cause a decrease in cover of 7.32%. The effect of elevation on cover is somewhat more interesting because of the presence of both direct and indirect effects on cover implied by the model. The direct path from elevation to cover predicts that if one were to choose a site 100 m higher than the mean and yet have an average severity fire, postfire cover would be 3.7% higher

Table 1. Covariances and correlations† among four variables relating vegetation regrowth in response to wildfire and the standard deviations of each variable (n = 90).‡ Matrix diagonals are the variances for the four variables.

Variables	Vegetation cover (% cover)	Fire severity (index values)	Prefire stand age (yr)	Elevation (m)
Cover	1,006.2	–26.2	–139.4	3686.3
Severity	–0.50	2.722	13.47	–170.4
Age	–0.35	0.65	157.8	–1459.6
Elevation	0.45	–0.40	–0.45	66,693
Standard deviations	31.72	1.65	12.56	258.25

†Note that the variance/covariance matrix can be reconstituted from the correlations and standard deviations presented. All analyses presented are based on the analysis of covariances.

‡The correlations among variables have been modified from the original to make the example more useful for the purposes of this paper. However, the standard deviations are as found by Keeley and Grace (submitted), thus the original scales for variables are preserved.

than the mean. On the other hand, the total effect of elevation on cover is 0.050, which indicates that if one moved upslope 100 m and allowed stand age and severity to vary as it naturally would (i.e., we are not holding them constant), there would be a net increase in cover of 5.0%. For the total effect of varying elevation, part of the increase in cover (1.3%) would result from the fact that stands would be younger (on average), 100 m higher, and associated fires would be expected to be less severe.

Consideration of standardized coefficients (Fig. 2) provides for an understanding of relationships expressed in terms of standard deviations. Such coefficients are both more easily compared (assuming different standard deviations can be thought of as equivalent) and somewhat more abstract. In these units, we see that if severity were increased by one standard deviation while elevation was held constant, cover would be expected to decrease by 0.386 standard deviations. On the other hand, if elevation was increased by one standard deviation, while holding severity constant, cover would increase by 0.301 standard deviations. Based on an estimated total effect of elevation on cover of 0.414, we can see that if elevation was increased one standard deviation without holding age and severity constant, then cover would increase 0.414 standard deviations. Thus, in terms of standardized units, the direct effect of elevation on cover is less (sign ignored) than the effect of severity (0.301 vs. 0.386), though the total effect of elevation on cover is greater (0.414).

So, how does all this relate to the question of the relative importance of different factors in affecting cover? If we accept standardization in terms of standard deviations as a reasonable basis for comparing coefficients (which is questioned below), it can be seen that the total influence of elevation on cover is greater than that of fire severity, with the total effect of stand age (–0.251) being least. The question we must now address is what it means to say that a pathway

represents expected change in terms of standard deviation units.

Criticisms of standardization

While the above discussion appears to provide a suitable resolution of the question of how we may evaluate the importance of explanatory variables, we were forced to accept the caveat that standardization based on standard deviations was reasonable. Many metricians actually recommend that researchers avoid using standardized coefficients and focus on the unstandardized coefficients when seeking to draw conclusions from regression models (Darlington 1990, Luskin 1991). The reason for this is tied to the substantive meaning of unstandardized coefficients and the conditional nature of standardized coefficients. If we presume that our sample is fairly representative of some larger world, our unstandardized estimates represent the slopes of the relationships (i.e., the mean responses). When we use standardized coefficients, we interject additional variables into the problem, that of the sample variances. As Pedhazur (1997:319) so eloquently put it, "The size of a [standardized coefficient] reflects not only the presumed effect of the variable with which it is associated but also the variances and the covariances of the variables in the model (including the dependent variable), as well as the variances of the variables not in the model and subsumed under the error term. In contrast, [the unstandardized coefficient] remains fairly stable despite differences in the variances and the covariances of the variables in different settings or populations."

These criticisms of standardization appear rather powerful. In many ecological studies, we know that our samples often represent a tiny fraction of the total samples possible. Also, restrictions on randomization, for example because of accessibility problems or other sampling limitations, mean that sampling is often neither purely random nor fully representative; thus, variances can easily vary from sample to sample. Additionally, comparisons among populations based on standardized coefficients depend on the variances being constant across populations, which may frequently not be the case. Unstandardized coefficients are generally much more readily estimated with accuracy and less sensitive to differences in the variances of the variables across samples. Comparisons across populations (or between paths) in unstandardized coefficients do not depend on equal sample variances, and as a result, are more generalizable parameters than are those based on standardization. Altogether, there are assumptions that go into the interpretation of standardized coefficients and these are typically ignored, representing unknown influences.

A possible resolution using an alternative standardization procedure

Despite the criticisms of standardization, researchers generally would prefer a means of expressing coefficients in a way that would permit direct comparisons across paths. The debate over this issue goes back to Wright (1921), who originally developed path analysis using standardized variables. It was Tukey (1954) and Turner and Stevens (1959) who first criticized the interpretability of standardized values in regression and path models, and many others have since joined in that criticism. However, Wright (1960) argued in defense of standardized coefficients, saying that they provide an alternative method of interpretation that can yield a deeper understanding of the phenomena studied. Later, Hargens (1976) argued that when the theoretical basis for evaluating variables is based on their relative degrees of variation, standardized coefficients are appropriate bases for inference. Therefore, there are circumstances where standardized coefficients would be desirable. As Pedhazur's recent assessment of this problem concludes, ". . . the ultimate solution lies in the development of measures that have meaningful units so that the unstandardized coefficients . . . can be meaningfully interpreted."

So, how might we standardize using measures that have meaningful units? We must start by considering what it means to say that if x is varied by one standard deviation, y will respond by some fraction of a standard deviation? For normally distributed variables, there is a proportionality between the standard deviation and the range such that six standard deviations are expected to include 99% of the range of values.

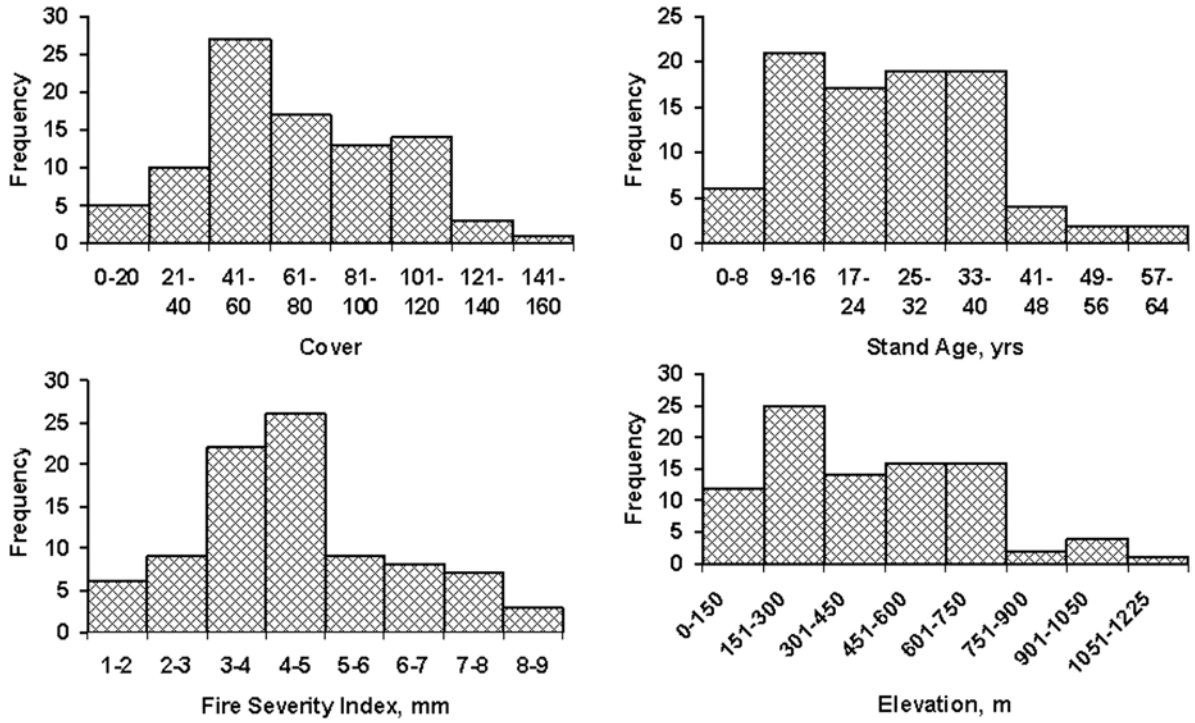


Fig. 3. Frequency diagrams for cover, stand age, fire severity, and elevation.

As discussed earlier, this may seem reasonable if (1) we have a large enough sample to estimate a consistent sample variance, (2) our variables are normally distributed, and (3) variances are equal across any samples we wish to compare. The reason why many metricians oppose standardized coefficients is because these three necessary conditions are not likely to hold generally. Of equal importance, rarely are these requirements explicitly considered in research publications and so we usually don't know how large violations of these requirements might be.

Fig. 3 presents frequency distributions for the four variables considered in our example. In the absence of further sampling, the repeatability of our sample variance estimate is unknown. This contributes to some uncertainty about the interpretability of coefficients standardized by the standard deviations. As for approximating a normal distribution, three of the four variables are truncated on the lower end of values. Cover can never be <0%, elevation likewise has a lower limit of expression relevant to terrestrial communities in this landscape, and stand age is also limited to a minimum value of between 0 and 1 year. None of these deviations are substantial enough to cause major problems with hypothesis tests (i.e., these variables are not wildly nonnormal); however, the deviations from idealized normality may very well impact the relationships between standard deviations and ranges. The observed range for cover was from 5% to 153% (overlapping canopies allow cover to exceed 100%), while six times the standard deviation yields an estimated range of 190%. The observed range for elevation was from 60 to 1225 m, while six times the standard deviation equals 1550 m. Stand age ranged from 3 to 60 years old, with six times the standard deviation equaling 75 years. Finally, fire severity index values ranged from 1.2 to 8.2 mm, while six times the standard deviation equals 9.9 mm. Thus, observed ranges are consistently less than would be estimated based

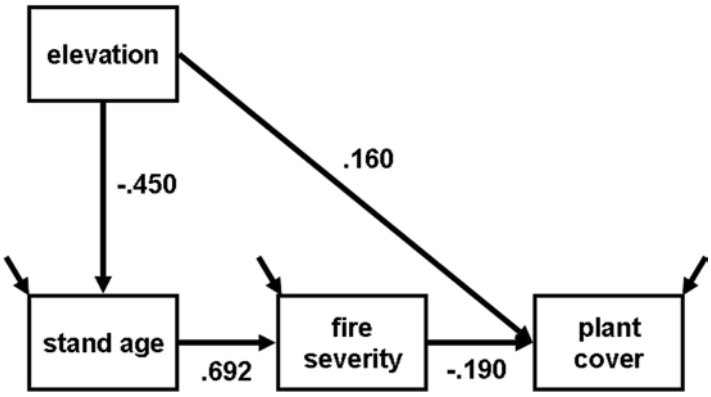


Fig. 4. Path analysis result showing coefficients standardized by the relevant ranges.

on standard deviations and the degree to which this is the case is slightly inconsistent (ratios of observed to predicted ranges for cover, elevation, age, and severity equal 0.78, 0.75, 0.76, and 0.71).

It is possible that in some cases information about the ranges of values likely to be encountered or of conceptual interest can provide a more meaningful basis for standardizing coefficients than can the sample standard deviations. We refer to such a range as the "relevant range." For example, if we have a variable whose values are constrained to fall between 0 and 100, it would not seem reasonable for the relevant range chosen by the researcher to exceed this value regardless of what six times the standard deviation equals. On the other hand, it may be that the researcher has no basis other than the observed data for selecting a relevant range. Even in such a case, we can choose to standardize samples that we wish to compare by some common range so as to clarify meaning across those samples. Whatever the basis for standardization, researchers should report both the unstandardized coefficients and the metrics used for standardization.

For the variables in our example, we specify the relevant range for cover to be from 0% to 270%. Obviously values cannot fall below 0%, but why chose an upper limit of 270%? Examination of cover values for all plots across the five years of the study show that values this high were observed in years 2 and 4 of the study. By using a relevant range of from 0% to 270%, we permit comparisons across years standardized on a common basis. Of course, this implies that the slopes measured will extrapolate to that full range, which is an assumption that should be evaluated closely. For elevation, the relevant range we choose is the observed range, from 60 to 1225 m. This span of 1165 m is chosen because we do not wish to extrapolate to lower or higher elevations, in case relationships to other variables are not robust at those elevations. For stand age, we specify the relevant range to be 60 years for basically the same reason. Finally, the fire index range chosen was also the observed range, which was 7.0 mm. It is clear that values could be obtained beyond this range in another fire. It is not known, however, whether the relationship between remaining twig diameter and herbaceous cover would remain linear outside the observed range.

Based on these determinations, we can generate path coefficients standardized on the relevant ranges. These coefficients are shown in Fig. 4. The biggest numeric differences between these values and those standardized using standard deviations (Fig. 2) is that the absolute values of the coefficients leading to cover are lower because of the large relevant range for this variable. The coefficient for the effect of age on severity is slightly higher, while that for the effect of elevation on age is unchanged. Using these coefficients now allows us to describe the importance of variables us-

ing their relevant ranges as the explicit context. These interpretations are *only* valid for relative comparisons within the *n*-dimensional parameter space defined by the relevant ranges. As fire severity increases across its relevant range, cover would be expected to decline by 19% of its relevant range. As elevation increases across its relevant range, the total change in cover from both direct and indirect causes would be an increase of 21.9% (the total effect). We now conclude from this analysis that the sensitivities of cover to fire severity and elevation (19% vs. 21.9%) are roughly equivalent in this study, though of opposing sign. It is possible to test whether these two estimates are reliable differences, which in this case, they are not.

Conclusions

It is important to recognize that the analysis of data has both an analytical element and a research element. By analytical element, we refer to the purely mathematical and statistical properties of the analytical methods. By research element, we refer to the fine art of applying analysis methods in the most meaningful ways. Formal training in statistics often emphasizes the analytical element and provides limited prescriptions for research applications that do not include a great deal of subjective judgment. What experienced statisticians have long known, however, is that for the application of statistical methods to be successful, strong guidance from the research perspective is required. Structural equation modeling is powerful specifically because it allows researchers to incorporate their accumulated knowledge into the analysis. Our advice regarding the interpretation of path coefficients is in that same vein. Rather than automatically allow sample standard deviations to represent the authoritative basis for standardizing coefficients, it is possible to insert our knowledge of the subject into the standardization process by explicitly considering the relevant ranges over which variables are to be considered. This procedure of standardizing based on substantive considerations acts to facilitate comparisons while avoiding problems associated with the sample-specific nature of standard deviations.

As with many new approaches, initial gains from defining and using the relevant range for standardization may be modest. Often the sample range will provide the best estimate available. However, as we accumulate additional information and focus on the ranges that are relevant to the inferences we wish to draw, much can be gained. Again, we recommend that unstandardized coefficients always be presented, regardless of the use of standardized coefficients of any sort. By also including either the sample standard deviations or the relevant ranges, which provide the bases for standardization, researchers can begin to compare both standardized and unstandardized values across studies. At present, there is a widespread and careless misapplication of standardized coefficients by researchers, both in the use of multiple regression and in the use of SEM/path analysis. Alternative means of comparing standardized coefficients may prove useful in drawing meaningful conclusions from analyses.

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Commentary

An Ecologist's Perspective of Ecohydrology

When my hydrological colleagues first brought up the term "ecohydrology" several years ago, I was simultaneously enthused, wary, and territorial. I still am. Enthused because the interface between ecology and hydrology still seems largely unmined, despite its key importance in ecosystems ecology—particularly in the water-limited systems that have been the focus of most of my work. Wary because although this interface does seem simultaneously unmined and important, the first response tends to be, "Well it's not news to ecologists that water is important in driving ecological processes and dynamics, and it is certainly not news to hydrologists that vegetation influences the water budget." And territorial because after feeling awash and striving to get my groundings in the ever-growing field of ecology, I was uneasy labeling any new collaborative endeavor—and particularly labeling myself—with a term ending in something other than "-ecology" or "-ecologist." A few years later, these points merit reflection and updating given the rapid growth in this area, which has affected me personally, as well as, I believe, a growing number of ecologists and hydrologists.

Most researchers have been cautious about labeling ecohydrology as a new field (Baird 1999, Bond 2002, Van Dijk 2004, Wilcox and Newman 2005). Rather, it is often referred to with respect to an increase in the interaction between ecology and hydrology. The terms "ecohydrology" and "hydroecology" have both been tossed around and have not been used consistently (Hannah et al. 2004). In general, "hydroecology" seems to be used more in association with aquatic ecology and riparian systems, whereas ecohydrology seems to be used more in association with terrestrial ecology, particularly for drylands. Most generally, there seems to be agreement that ecohydrology focuses on the interactions and interrelationships between hydrological processes and the pattern and dynamics of vegetation.

Debate remains about the relative newness and importance of ecohydrology (Hannah et al. 2004). Most colleagues I have spoken with who come from a hydrological background are particularly enthused about this growing area (see also Rodríguez-Iturbe 2000). Ecohydrology seems to have captured the interest of a subset of ecologists as well, although I have the sense there is not as much widespread enthusiasm as there appears to be in hydrology (see also Bond 2003). Many ecologists see it as just the next step in developing a new interface in ecology, similar to previous advances in plant ecophysiology or biogeochemistry. Some in natural resources believe that a wheel is being reinvented that is ignoring previous interdisciplinary contributions of watershed science and management. Although the latter perspective merits weight, I do believe that recent efforts in ecohydrology indeed represent a new level of interdisciplinary integration between current ecology and hydrology. Both fields have had substantial intellectual and membership growth over the past several decades since watershed resource management became established in an academic context. Some of the difference in perspective and level of enthusiasm for ecohydrology between the ecological and hydrological communities may reflect differences in their roots. Hydrologists have more direct roots in engineering relative to ecologists (see also Baird 1999), who like to view ourselves as being fundamentally rooted in multidisciplinary science. (It should be noted, however, that hydrologists often seem to be able to run circles around ecologists when it come to predicting relevant properties from the two respective disciplines.) Hence, ecologists and hydrologists may be viewing ecohydrology from different perspectives along the engineering–science continuum. I personally see the most evidence of the impor-

tance of greater integration between ecology and hydrology in a recent set of papers published in *Ecology* that resulted from an American Geophysical Union Chapman Conference on "Ecohydrology of Semi-arid Landscapes" (Wilcox and Newman 2005). This was one of the most exciting and stimulating workshops I have participated in, and the resulting papers (disclosure no. 1: I am a coauthor on two of the resulting papers) represent what I believe are novel syntheses that would be extremely unlikely to have been developed from either the ecological or hydrological communities alone.

Disclosure no. 2: I am still a bit uneasy with labeling myself as an "ecohydrologist," because it sounds like a specialty or "sub"-discipline in hydrology. But a close ecology colleague and friend pointed out, "Hey, Dave, you are an ecohydrologist—almost everything you study is related very tightly to the water budget, plant water use, and vegetation patterns and dynamics." I now use the term when it seems appropriate, but I also try to clarify that I am an ecologist, not a hydrologist, and I often refer to the area as "ecohydrology and vegetation dynamics." My active involvement at this interface was a major factor associated with my recent move to the University of Arizona, where I am working to build strong ties among related programs spread across three colleges: Hydrology and Water Resources in the College of Engineering; Ecology and Evolutionary Biology in the College of Science; and the Watershed Program within the School of Natural Resources in the College of Agriculture and Life Sciences. These academic units comprise a representative microcosm of much of the ecohydrology community at large. We now have a training grant in ecohydrology from the USDA and this fall I will teach a new course on "Dryland Ecohydrology and Vegetation Dynamics," so my near-future fate is somewhat coupled with upcoming development in ecohydrology. Developing this ecohydrology interface remains challenging, as does any interdisciplinary endeavor, but there currently is a great deal of interest and enthusiasm about it.

So what are these important, unmined areas in ecohydrology? Most generally, there is an important shift in emphasis between ecohydrology and the traditional focus of either ecology or hydrology. Ecohydrology, as noted above, focuses on the interactions and interrelationships between hydrological processes and vegetation pattern and dynamics. Traditionally, hydrology has focused in large part on issues of water yield and, as I perceive it (as a perhaps somewhat ignorant outsider), has invested much less effort in processes that are of particular interest in understanding ecological dynamics and the associated feedbacks between hydrology and vegetation dynamics. Most notably, I believe that a major challenge in ecohydrology is to develop much more predictive and well-tested relationships for the partitioning among the subcomponents of evapotranspiration (Loik et al. 2004, Huxman et al. 2005). Evapotranspiration represents the vast majority of the water budget—more than 95% of the total in most arid and semiarid ecosystems (Wilcox et al. 2003*b*). There is great ecological relevance in how this vast majority of the water budget is partitioned among major components, which include at least three: intercepted water that is assumed to evaporate back to the atmosphere, soil evaporation, and plant transpiration. Many models generate predictions about the partitioning among these three components, yet few field studies have rigorously estimated the various components, at least for arid and semiarid ecosystems (Reynolds et al. 2000, Huxman et al. 2005). Those few studies vary in ecosystem type, methods applied, and in time scale of measurements. Hence, we need to improve our ability to predict these components of the water budget and how they vary with vegetation patterns and dynamics. Indeed, some of the most important differences between nondegraded and degraded dryland ecosystems may be evident in the ratio of transpiration to total evapotranspiration (Huxman et al. 2005).

Ecologists have not done much better than hydrologists in tackling the evapotranspiration partitioning (but see Yepa et al. 2003 as an example exception). But perhaps the most important shift for ecologists in moving toward an ecohydrological emphasis is moving away from use of precipitation alone and toward a more comprehensive understanding of the water budget (Loik et al. 2004). In particular, we would like to have a more comprehensive understanding and quanti-

tative ability to predict the amount of "plant-available water" at a site. (This is, of course, interrelated with partitioning components of evapotranspiration.) Precipitation has served as a powerful predictor of plant productivity and other ecological attributes in many systems. When coupled with other climatic variables, it also serves as the underlying driver for biogeography and biogeochemistry models. Yet vegetation dynamics might arguably be much more tightly related to soil moisture, and soil moisture dynamics can differ markedly from patterns of precipitation alone. There are many data sets that have one, two, or even three years of soil moisture data (the old familiar correlation with grant length), and there are several emerging data sets that are five-or-so years in length, thanks to advances in automated data collection for soil moisture and longer term studies such as those associated with the Long Term Ecological Research Network, but there remain few data sets spanning up to a decade or more (e.g., Scott et al. 2000). Arid and semiarid systems characteristically exhibit great interannual variability in precipitation input. We are learning more about how longer climate patterns can persist, and this insight highlights how critical it is to obtain longer-term soil moisture time series. Soil moisture may be much more heterogeneous than we have previously appreciated, varying substantially under trees and shrubs vs. between them, or at a smaller scale, with respect to the presence or absence of biological soil crusts (Loik et al. 2004). Similarly, soil water potential gradients may be affected by vegetation type, and can, surprisingly, draw upward as well as downward (Seyfried et al. 2005). Recent insights about hydraulic lift of water by plants add whole new levels of complexity to understanding ecohydrological processes (e.g., Zou et al. 2005). These factors all require a more detailed and ecologically relevant reassessment of the water budget at a site. As one colleague frequently reminds me, data collection is usually a humbling process.

Unraveling the feedbacks between ecology and hydrology remains challenging and will surely require both modeling and field-based approaches. Continued integration is needed between these two general approaches to avoid the "Do they ever even go out in the field?" vs. "Could they even model their way out of a paper bag?" schism, which is an ongoing challenge in most areas of environmental science. Progress in modeling feedbacks is highlighted in two recent books on ecohydrology: Eagelson's (2002) *Ecohydrology* and Rodríguez-Iturbe and Poporato's (2004) *Ecohydrology of Water-controlled Ecosystems* (2004). These texts both articulate the importance of vegetation in hydrology and the role of feedbacks, with the latter particularly emphasizing the importance of soil moisture. Their strength lies in their attempts to build toward generality, an approach that I applaud. Modeling approaches such as these will be critical to improving our understanding of feedbacks between components of the water budget and vegetation dynamics. It remains critical, however, for such approaches to remain well grounded in ecological processes. Eagelson's seminal papers of the 1970s and 1980s (see Eagelson 2002 and references therein), which laid the groundwork for his recent book, intrigued me when I first read them and continue to stimulate my thinking. Yet Kerkhoff et al. (2004), in a recent publication stemming from the senior author's dissertation (disclosure no. 3: I served on his graduate committee) documents how three fundamental assumptions in the proposed framework are all ecologically flawed. (The three are related to canopy stress minimization, successional stress minimization, and maximum soil productivity.) This example simply highlights one of many areas where further collaboration among ecology and hydrology and further integration of modeling and field-based approaches seems warranted.

Perhaps the clearest success story to date for ecohydrology is the unraveling of the dynamics of ecosystems with banded vegetation, in which the redistribution of runoff alters the spatial distribution of soil moisture and drives vegetation change, which in turn feeds back to runoff patterns (Ludwig et al. 1997, Tongway et al. 2001). In this case, the effects of vegetation on runoff have been clearly documented, as has been the response of vegetation to soil water inputs from runon. Hence the feedback mechanism in this case is nicely demonstrated. Importantly, a clear plan for improving land management has been developed as a result of the new insights for these systems (Lud-

wig et al. 1997). Similar processes appear to be relevant not only for systems with banded vegetation, but also to some degree for a diverse set of arid and semiarid ecosystems (Wilcox et al. 2003*a*, Ludwig et al. 2005). We need to tackle other areas of ecohydrology with a similar approach, capturing the vegetation effect on hydrological processes, the hydrological effect on vegetation, the resultant feedback dynamics, and the implications and applications for management.

Where is ecohydrology headed? Well, certainly there is a need to fully partition the water budget and to better quantify feedbacks, as discussed above. Other recent interdisciplinary endeavors in ecology such as plant physiological ecology have helped dramatically to reveal underlying mechanisms and to increase predictive capability. Recent progress in ecohydrology offers similar promise. In addition, ecologists are making great progress in explicitly clarifying the ways in which ecosystems provide goods and services to society, something that the hydrologists have had down since the inception of hydrology as a discipline. (You've got to have water.) This is perhaps most clearly highlighted in the new Millenium Ecosystem Assessment (2005). There are many ecohydrological challenges imbedded within the issues raised by the Millenium Ecosystem Assessment, with desertification being among the prominent issues raised. So in addition to improving our ability to partition the water budget and quantify feedbacks, another major issue for ecohydrology is to improve our understanding and ability to predict and manage how ecosystem dynamics affect ecosystem goods and services. I look forward to the challenges ahead with both my ecology and hydrology colleagues, and will enthusiastically embrace the emerging "ecohydrology" emphasis in the hope that we will be able to improve science and serve society through this framework.

Acknowledgments

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Commentary

A History of the Ecological Sciences, Part 18: John Ray and His Associates Francis Willughby and William Derham

John Ray (1623–1705) was the greatest naturalist and natural theologian of his time. He was assisted early in his career by patron, student, and zoologist Francis Willughby (1635–1672), and late in his career by cleric, natural philosopher, and natural theologian William Derham (1657–1735), who became his literary executor. Ray had a number of other associates who also contributed to his work, especially Martin Lister, Tancred Robinson, and Hans Sloane, all of whose roles are described in Charles E. Raven's encyclopedic biography of Ray (1942). Ray was the first naturalist to emphasize that natural history must be founded on an ability to identify plant and animal species, yet systematics was never the goal of his studies. His interest in natural theology encouraged his investigation into how nature works. Although his adult life was something of a struggle, he was nevertheless a constantly productive naturalist who produced numerous publications (Keynes 1951). The cumulative impact of his work was a major contribution to the Scientific Revolution during the 1600s (Levine 1983).

Ray (spelled Wray until 1670) came from modest circumstances: his father was a blacksmith and his mother a herbal healer. He absorbed her love of plants and religion. Little is known of his childhood, but if he had not been an excellent student, he would never have been admitted to Cambridge University. Arriving in 1664, he prepared for the ministry but showed a strong interest in botany and zoology. Since there were no courses offered in natural history, he joined a group of scholars who dissected animals to study comparative anatomy of vertebrates, and he published the first county flora in England, using as a model Gaspard Bauhin's flora of Basle, Switzerland. Raven (1942:81) described Ray's *Catalogus plantarum circa Cantabrigiam nascentium* (1660) as

> *a small octavo volume suitable for the pocket, is certainly an unpretentious . . . work. Few books of such compass have contained so great a store of information and learning or exerted so great an influence upon the future; no book has so evidently initiated a new era in British botany.*

Fig. 1. John Ray (Ray 1717).

Ray studied Cambridgeshire plants for 6 years before beginning work on the book and then took 3 years to complete it. In deference to the assistance of three friends (named in Ray [1975:24] including Willughby; a letter in Thompson [1974:112] illustrates that assistance), he did not even put his name on the title page. In an age still burdened with polynomials, correlating Cambridgeshire plants with those described in books on British and Continental plants was a demanding task, yet he found and identified 558 species, listed alphabetically, only one of which, a sedge, is of uncertain identity today. Fortunately, Ray's herbarium survives and is in Britain's Natural History Museum (Walters 1981:6–14).

Ray's *Catalogus* is directly relevant to ecology in his accurate recording of places where each species are found—bogs, woods, meadows, riverbanks. More important, he includes biological observations and conclusions. Under ash tree (*Fraxinus excelsior*) he explained the correlation between growth rings seen in a tree stump and the age of the tree, a study at the interface between ecology and physiology (Ray 1660:55; translated by Ewen and Prime, Ray 1975: 64–65):

> *The rings which are seen in the trunks and boughs of trees when cut crossways show more openly in the wood of this tree than in others. These rings in trees growing in the tropics are equidistant all round and have the heart of the tree in the true centre as Gassendus* tom 2. *P.178. observed in the wood of the Brazilian acanthus. In other regions situated either to the south or to the north they are expanded towards the equator and are contracted in the regions facing the pole so that the hearts are always found to be eccentric . . . .*
>
> *1. The age of a tree or branch is disclosed by the number of rings, unless the tree has stopped growing, the number of rings equals the number of years. 2. Normally the inner rings are closer together owing to pressure, probably in trees of great girth and growing old, the outside rings may be narrower through lack of vigour. 3. The pith is compressed as the tree ages; this is evident in the Elder. 4. The wood is harder and darker in the inner rings than in the outer, certainly never lighter . . . . 5. The tops of the trees have fewer rings and the inner rings of the trunk can be seen drawing to a point as they rise; the pattern thus formed is called in English* [he wrote in Latin] *the "grain of the tree". 6…my opinion is that so long as the tree is alive, it adds a new ring, even if it is a narrow one, every year; the age of a tree cannot be determined because its inside decays and the external rings become too narrow to count.*

Ray wrote this 5 years before Hooke announced his discovery of plant cells in *Micrographia*, and since Ray clearly did not examine tree rings under a microscope, he could not explain exactly how the rings grew. Under hops (*Humulus lupulus*) he observed (Ray 1660: 91, translated by Ewen and Prime, Ray 1975:81) that "The hop and probably other twining plants follow the course of the sun, that is they twist from east through south to the west never in the reverse direction. . . ." Under elm tree (*Ulmus procera*) he recorded how the growth of trees in the open isinfluenced by prevailing winds (Ray 1660:180; translated by Ewen and Prime, Ray 1975:126):

> *From the shape of a tall tree growing in the open air it is possible to say from what quarter of the heavens the stronger and more prevalent winds are accustomed to blow in any particular locality. Thus trees growing near the sea point to the east because those parts of the country are particularly exposed to frequent gales.*

He also explained some animal uses of various species. Under hemlock (*Conium maculatum*) he reported (Ray 1660:34; translated by Ewen and Prime, Ray 1975:54) that he had dissected the crop of a bustard (*Otis tarda*) and "found it stuffed with hemlock seeds;

there were only four or five grains of corn mixed with them. So even at harvest the bird leaves corn for hemlock." If Ray hoped this observation on food preference might help save bustards from farmers' ire, it seems unsuccessful—the last bustard was killed in Britain in 1835. Under deadly nightshade (*Atropa belladonna*) he commented (Ray 1660:157–158; translated by Ewen and Prime, Ray 1975:114) that snails and slugs commonly eat it despite its poison. (He added that these animals are hermaphroditic.)

His longest note under any plant is not about the plant itself but about its habitual insect pest. The discussion is under rape (*Brassica rapa*) and wild turnip (*B. napus*), where he reported (Ray 1660:134; translated by Ewen and Prime, Ray 1975:102) that "Caterpillars born on brassica have taught us that a close relationship exists between these stocks as the leaves of rape are eaten no less greedily that those of brassica although they scorn many other plants that we have offered them as food." He raised 10 or so of these caterpillars in a wooden box at the end of August 1658 and inadvertently discovered insect parasitism, but without fully understanding it (Ray 1660:134–138; translated by Ewen and Prime, Ray 1975:103):

> *Seven of them proved to be viviparous or vermiparous; from their backs and sides very many, from thirty to sixty apiece wormlike animalcules broke out; they were white, glabrous, footless and under the microscope [perhaps only a magnifying glass] transparent. As soon as they were born, they began to spin silken cocoons, finished them in a couple of hours, and in early October came out as flies, black all over with reddish legs and long antennae, and about the size of a small ant. The three or four caterpillars which did not produce maggots changed into angular and humped chrysalids which came out in April as white butterflies.*

He also described a case of parasitism of *Rosa canina* by the rose bedeguar (*Rhodites rosae*), and commented on previous authors' observations on the subject (Ray 1660:139–140; translated by Ewen and Prime, Ray 1975:105):

> *Sometimes a smooth hairy lump grows on the stalks of...*[Rosa canina]. *If you cut open this gall, you will find it packed with small white maggots; this is on the evidence of* Bacon nat. hist. cent.6 exp.562. Spigel isag. lib. 1, cap.10. Moufet. Theat insect. lib.2, cap.20. . . . *Spiegel, Moufet and Aristotle* (Arist. Lib.5. hist. cap.19) *say that beetles are borne from these maggots*....[but] *the maggots which lie hidden in the gall during the winter come out in the month of May the following year in the form of flies; their shape and proportion are like those of winged ants; their size is a little smaller . . . . Some of these flies are armed with a sting or spike protruding from the tail but others altogether lack this, so this probably makes a distinction between the sexes.*

Raven (1942:102–103) points out that some of Ray's observations on insects published in this first book were extended in his last book, *Historia insectorum* (1710); for example, he expanded his observations on insect galls in it on pages 259–260.

After sending his catalogue of Cambridgeshire plants to the printers (in Cambridge and London), Ray and Willughby took their first extended field trip, to northern England and the Isle of Man, which is equidistant between northern England and northern Ireland. The friends decided to compile natural histories of British plants and animals, and since Willughby's stronger interest was in animals, he would do them and Ray would do the plants. Before returning to Cambridge, Ray visited Thomas Brown at Norwich in August and they botanized along the Norfolk coast. Ray and Willughby's collaboration was very productive, though Willughby never got beyond the note-taking stage before his death at age 37 in 1672. In 1658, 1661, and 1662 Ray went on field trips without Willughby into other parts of Britain.

Fig. 2. Francis Willughby (Allen 1951).

Ray had trained for the ministry and was ordained, and he had intended natural history to be only an avocation. However, in 1662, after the Restoration, a Royalist Parliament passed a law requiring all ministers to sign a loyalty oath, and Ray, a Puritan, felt it violated his religious belief. His refusal to sign ended his clerical career, and his avocation became his life's work. In 1663 he and Willughby left on a 3-year trip to Western Europe to collect observations, specimens, and illustrations and to visit professors at several universities and a few unaffiliated naturalists (Ray 1673, Raven 1942:112–140, Allen 1951:419–422). This experience enabled the partners to broaden the scope of their studies beyond Britain, first to western Europe and later to the rest of the world known to Europeans.

In 1660, the 25-year-old Willughby had become a founding Fellow of the Royal Society of London—which happened at that young age only because he came from the nobility. In 1667 Ray was elected a Fellow, and in 1669 Willughby and he sent in "Experiments concerning the Motion of Sap in Trees, Made this Spring by Mr. Willughby and Mr. Wray," which the Society published in its *Philosophical Transactions*. Willughby had returned from the Continental trip before Ray and had begun these experiments himself (Welch 1972:76). Their experiments were exploratory, without a hypothesis, in a Baconian manner. Although Raven (1942:188) admitted that they made no fundamental discovery, he thought that this was "the first systematic attempt to study the physiology of a living plant and thus opened up a new field of research and gave a new direction to botany." In claiming such priority for Ray, however, Raven failed to consider the studies before 1669, discussed in Part 14 (Egerton 2004:210), though Raven may be right about these experiments stimulating studies by others. Botanist and historian Agnes Arber (1943) cited other examples in which Raven slighted other botanists while praising Ray. More recently, however, Morton (1981:210) followed Raven's example in claiming Ray as "the founder of plant physiology, even though his original contributions were modest." He based his judgment largely on the discussion of plant physiology in Volume 1 of Ray's *Historia Plantarum* (three volumes, 1686–1704); this is generally considered Ray's greatest scientific treatise. Ray was the first naturalist to pay special attention to the distinction between species, and he wrote his first essay on the subject in 1672 (published in 1757 and reprinted in Ray 1928:77–83). His later expression of his species concept in *Historia Plantarum* was long standing (Ray 1686:Volume I; translation by E. Silk, in Mayr 1982:256–257):

> *After a long and considerable investigation, no surer criterion for determining species has occurred to me than the distinguishing features that perpetuate themselves in propagation from seed. Thus, no matter what varia-*

tions occur in the individuals or the species, if they spring from the seed of one and the same plant, they are accidental variations and not such as to distinguish a species . . . . Animals likewise that differ specifically preserve their distinct species permanently: one species never springs from the seed of another nor vice versa.

In a different context, Ray explained, "I reckon all Dogs to be of one Species, they mingling together in Generation, and the Breed of such Mixtures being prolifick" (Ray 1717:21). Ray made important contributions to the classification of plants (Stevenson 1947, Sloan 1972, Morton 1981:201–203, 228–229, Stearn 1985–1986:113–117), including drawing a distinction between herbaceous Monocotyledons and Dicotyledons in his Methodus Plantarum (1682). Ray is often credited with being first to make this distinction (Raven 1942:195, Morton 1981:203, 228–229), but Mayr (1982:163) cites four predecessors. Although Ray was able to obtain funds to publish illustrations in the treatises on ornithology (from Emma, Willughby's widow) and ichthyology (from the Royal Society), both of which carried Willughby's name as author, he was unable to obtain funds for plates of the different species for his own books on plants (Henrey 1975:127–134, 266–269).

Soon after Willughby's death in 1672, Ray turned to producing Willughby's *Ornithology*, which was a memorial to his patron and became the beginning of modern ornithology. Although he placed Willughby's name alone on the title page as author, Ray's contribution to the book was as much or more than Willughby's careful notes and collected illustrations (many from their European tour). This point is seen in an extract from Ray's letter on various birds to Martin Lister, 1 October 1667 (Ray 1928:113–115 [in Latin], Raven translation 1942:315):

Your observation of the Green Woodpecker corresponds with my own of the Black and both the Spotted Woodpeckers and the Wryneck. I once got out of the crops of these birds on dissection larvae as big as my small finger. The muscles and tendons by which they shoot out and retract their tongues deserve curious study.

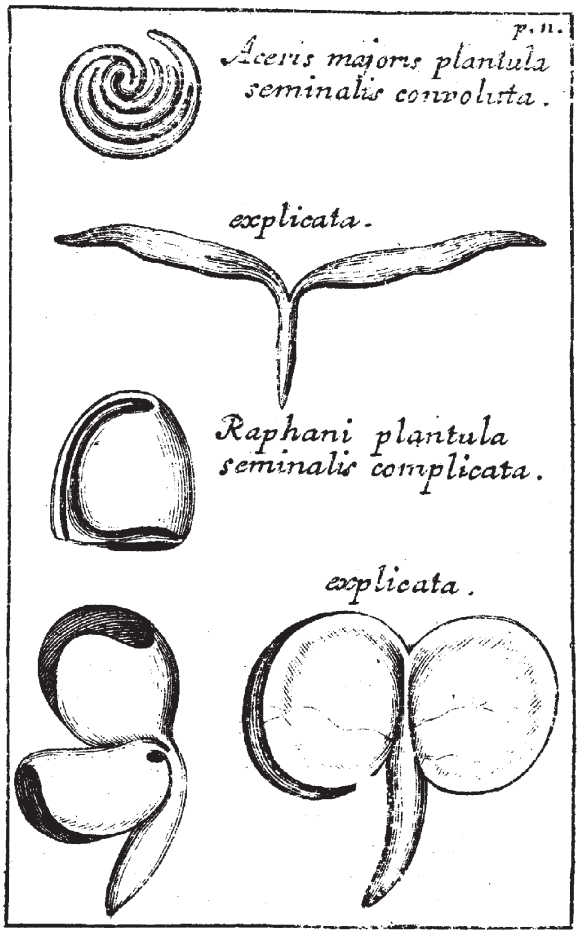

Fig. 3. This drawing of sycamore and radish seeds from Malpighi's *Anatomy of Plants* (1675) is reprinted in Ray's *Methodus Plantarum* (1682) and *Historia Plantarum* (1686).

Although Ray initially published the *Ornithology* in Latin (1676), 2 years later he published an enlarged English version. Two modern histories of ornithology (Stresemann 1975:43–45, Walters 2003:38–40)

stress the importance of these authors' new classification of birds, and Ray performed the same service in 1693 for quadrupeds (Petit and Théodoridès 1962:317–320). Raven (1942:308–338) provides the most details on the *Ornithology*'s production and contents; Hall (1951:18–30) quotes the classification, human bird-hunting techniques, and the dodo; and Miall (1912:103–111) presents a briefer overview than Raven and more natural history extracts than Hall.

In the *Ornithology*, Chapter 3, "Of the generation of birds," our authors disagreed with William Harvey's belief (1651, exercise 29) that some hen eggs only come into existence after copulation. They thought (Willughby [and Ray] 1678:10–16) that hens are born with all the eggs in their ovaries that they ever lay. They cited five cases of longevity that seemed credible to them: a goose and a pelican had each been kept for 80 years; a pigeon had lived 22 years and had bred until its last 6 months; a linnet lived 14 years, and a goldfinch 23 years. When pigeons raise two young, Willughby wondered whether they were of opposite sexes; Ray replied that they usually are but sometimes are not.

Aristotle's *Historia Animalium* (600a15) claimed that swallows do not migrate in winter as other birds do, but hibernate, and naturalists revived this belief from the 1500s to the 1700s. Willughby and Ray (1678:212, quoted in Raven 1942:328) doubted this: "To us it seems more probable that they fly away into hot countries, viz. Egypt, Aethiopia etc." Their many natural history observations of ecological interest are illustrated in these six examples:

Lapwing (*Vanellus vanellus*) (Willughby [and Ray] 1678:308, quoted in Miall 1912:109–110):

> *It builds its nest on the ground, in the middle of some field or heath, open and exposed to view, laying only some few straws or bents under the eggs, that the nest be not seen. The eggs being so like in colour to the ground on which they lie, it is not easy to find them though they lie so open. The young, so soon as they are hatcht, instantly forsake the nest, running away, as the common tradition is, with the shell upon their heads, for they are covered with a thick down, and follow the old ones like chickens. They say that a lapwing, the further you are from her nest, the more clamorous she is, and the greater coil she keeps; the nearer you are to it, the quieter she is, and less concerned she seems, that she may draw you away from the true place, and induce you to think it is where it is not.*

Fig. 4. Plate from Willughby [and Ray] (1678).

Blackbird (*Turdus merula*) (Willughby [and Ray] 1678:191, quoted in Miall 1912:111):

The blackbird builds her nest very artificially with outside of moss, slender twigs, bents and fibers of roots, cemented and joined together with clay instead of glue, daubing it also all over withinside with clay. Yet doth she not lay her eggs upon the bare clay, like the mavis, but lines it with a covering of small straws, bents, hair, or other soft matter, upon which she lays her eggs, both that they might be more secure and in less danger of breaking, and also that her young might lie softer and warmer.

Honey-Buzzard (*Pernis apivorus*) (Willughby [and Ray] 1678:72, quoted in Raven 1942:327):

It builds its nest of small twigs, laying upon them wool and upon the wool its eggs. We saw one that made use of an old Kite's nest to breed in, and that fed its young with the nymphae of wasps: for in the nest we found the combs of wasps' nests and in the stomachs of the young the limbs and fragments of wasp-maggots. There were in the nest only two young ones, covered with a white down, spotted with black. Their feet were of a pale yellow, their bills between the nostrils and the head white. Their craws large, in which were Lizards, Frogs etc….This bird runs very swiftly like a Hen. The female as in the rest of the Rapacious kind is in all dimensions greater than the male.

Dipper (*Cinclus cinclus*) (Willughby [and Ray] 1678:149, quoted in Raven 1942:327–328):

It frequents stony rivers and water-courses in the mountainous parts of Wales, Northumberland, Yorkshire etc. That I (J.R.) described was shot beside the river Rivelin near Sheffield in Yorkshire: that Mr Willughby described near Pentambeth in Denbighshire in North Wales. It is common in the Alps in Switzerland, where they call it Wasser-Anzeil. It feeds upon fish, yet refuseth not insects. Sitting on the banks of rivers it now and then flirts up its tail. Although it be not web-footed, yet will it sometimes dive or dart itself quite under water. It is a solitary bird, companying only with its mate in breeding time.

Cormorant (*Phalacrocorax carbo*) (Willughby [and Ray] 1678:330, quoted in Raven 1942:328):

. . . on the rocks of Prestholm Island near Bearmaris we saw a Cormorant's nest, and on the high trees near Sevenhays in Holland abundance . . . . besides this we have not known or heard of any whole-footed bird that is wont to sit upon trees, much less build its nest upon them.

Puffin (*Puffinus puffinus*) on the Isle of Man (Willughby and Ray 1678:333, quoted in Raven 1942:328):

The old ones early in the morning, at break of day, leave their nests and young and the island itself and spend the whole day in fishing in the sea…so that all day the island is so quiet and still from all noise as if there were not a bird about it. Whatever fish or other food they have gotten and swallowed in the day-time, by the innate heat or proper ferment of the stomach is (as they say) changed into a certain oily substance (or rather chyle) a good part whereof in the night-time they vomit up into the mouths of their young, which being therewith nourished grow extraordinarily fat.

The story of Willughby [and Ray]'s *Historia Piscum* (1686) is similar to that of the *Ornithology*: it was a joint effort, with editor Ray contributing more than Willughby. The latter had left fewer notes on fish than on birds, and Ray supplemented them by soliciting information from his naturalist colleagues (Raven 1942:339–370). The resulting volume contained many fewer natural history observations of ecological

interest than the bird volume, no doubt because fish behavior is more difficult to observe than bird behavior. Miall (1912:112) pointed out that the fish volume depended heavily upon previous books by Rondelelt, Belon, Salviani, Gesner, and Marcgraf, and therefore "It cannot be said that this is a very important contribution to natural history." Even the observation from *Historia Piscium* that Miall mentioned, about sharks having the mouth on their bottom side as a provision of nature to ensure safety of other fish and to prevent sharks from dying from gluttony, is actually repeated from Aristotle's *De Partibus Animalium* (696b24–33, quoted in Egerton 1973:328–329). Nevertheless, two historians of ichthyology thought highly of this work. Cuvier in 1828 wrote (Simpson translation 1995:71):

> *Ray and Willughby had the honor of being the first to write an ichthyology in which the fishes were clearly described according to nature and classified based on characteristics drawn only from their structure, and in which their natural history was finally rid of all passages from ancient writings…*

More recently, Jordan wrote (1905:390) that "The basis of classification was first fairly recognized by" Ray and Willughby in *Historia Piscium*, which brought "order out of the confusion left by their predecessors." Their treatise described 180 species directly from nature and described 240 more from other authors' works. There was no later English edition.

In 1690 when Ray, age 63, began work on his *Historia Insectorum*, his health was already in decline. However, we saw above in notes to his Cambridgeshire catalogue of plants (1660) that he had an early interest in insects, the persistence of which is illustrated in this extract from his letter to Lister on 17 July 1670 (Ray 1718:69, quoted from Salmon 2000:252):

> *This summer we found here the same horned* Eruca [caterpillar], *which you observed about Montpelier, feeding on* Foeniculum [Seseli] tortuosum. *Here it was found on common Fennel: It has already undergone the first change into a* Chrysalis*, and we hope it will come out a* Butterfly *before winter.*

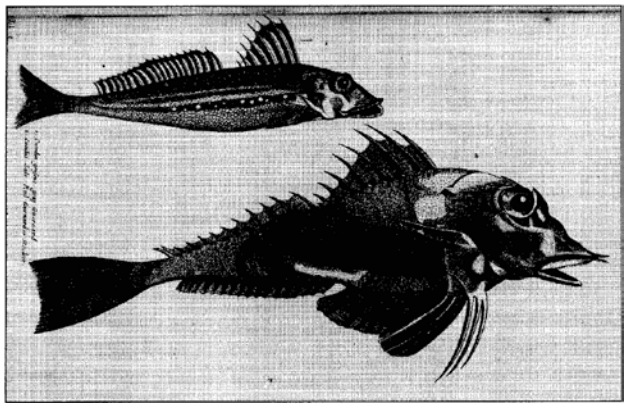

Fig. 5. Top: Flying gurnard (*Cephalacanthus volitans*); bottom: sea-robin (*Prionotus evolans*). Willughby [and Ray] 1686: Plate 13.

Ray also published a note on ants in 1671. Willughby's notes available to Ray were not limited to insects, but included worms and other invertebrates. As usual, Ray solicited and received help from other naturalists, and he used Lister's observations on spiders and beetles. For this project he was also aided by his wife, Margaret, and their four daughters—Margaret, Mary, Catharine, and Jane—who collected insects around their Black Notley home. In gratitude, he named several newly discovered butterflies and moths after his daughters. On 29 May 1693 his wife made an important discovery concerning a moth which Raven thinks was probably *Pachys betularia* (Ray 1710:177, Raven translation 1942:395):

> *It emerged out of a stick-shaped geometer caterpillar: it was a female and came out from its chrysalis shut up in my cage: the windows were open in the room or closet*

where it was kept, and two male moths flying round were caught by my wife who by a lucky chance were into the room in the night: they were attracted, as it seems to me, by the scent of the female and came in from outside.

Raven suggests that this was probably the first record of insect pheromones (though Raven did not use that term).

James Petiver (1663–1718) was Ray's only significant predecessor in naming British insects. He was a London apothecary (pharmacist) and nature collector who published on insects from 1695 until 1717 (Allen 2004, Stearns 1952, Salmon 2000:103). He and Ray were friends, not competitors, and he provided valuable assistance. In 1660 when Ray reported caterpillars producing flies instead of butterflies when chrysalises opened in the spring, he had been unsure how to interpret his observations. By the time he wrote *Historia Insectorum*, however, he understood (Ray 1710:114, translated by Raven 1942:104):

I think that the ichneumon wasps prick these caterpillars with the hollow tube of their ovipositor and insert eggs into their bodies: the maggots are hatched by the warmth of them, and feed there until they are full grown: then they gnaw through the skin, come out, and spin their cocoons.

There was no English edition of *Historia Insectorum* either. However, Bodenheimer (1928–1929:I, 486–494; II, 412–427) provided a German translation of extracts and also modern identifications of insects Ray discussed.

In addition to the ecological observations scattered through Ray's numerous natural histories, he also emphasized interactions among plants and animals in a more coherent way in his very influential book on natural theology, *The Wisdom of God Manifested in the Works of the Creation* (1691). The idea that one can learn about God by studying his creation arose among the ancient Greeks, and there were two basic arguments: (1) that the lives of plants and animals are designed to intertwine in ways to preserve the balance of nature, and (2) that the structure and function of the organs of the human body are designed to enable humans to flourish. The most famous discussion from antiquity of the former argument is in *De Natura Deorum* by Cicero, a first century BC Roman (Glacken 1967:54–61, Egerton 1973:30). Discussion of the latter argument is in several writings by the Greek physician Galen, in the 100s AD. In a very comprehensive survey of the history of natural theology, Neal C. Gillespie (1987) argues that there were few original contributions to the subject since Cicero and Galen until Ray, and that Ray made the most important contributions down to the time when the whole subject was challenged by Darwin's *Origin of Species* (1859). Glacken (1967:415–442), Raven (1942:452–478), and Zeitz (1994) essentially agree. Although I think Matthew Hale's *Primitive Origination of Mankind* (1677) was a more substantial contribution to the subject than Gillespie recognized (Egerton 2005), there is no doubt about the overwhelming importance of Ray's book on natural theology.

Ray had expressed his strong skepticism of spontaneous generation of animals in a note published in 1671, and that skepticism remained in his later writings. Arguments that he accumulated over the years were explained in *The Wisdom of God* (cited from the seventh edition, 1717:298–326, 1977). Another of Ray's concerns was the possible extinction of species. Since antiquity, it had been argued that all species are endowed with effective means of preservation (Egerton 1973). If any species actually became extinct, it could reflect against God's omnipotence or creative wisdom. Particularly worrisome were large fossil ammonites. Only the much smaller chambered nautilus had ever been found alive. Ray (1692:19–124) did not take a dogmatic stand, but pointed out that much of the world remained unexplored by European naturalists. In a posthumous essay, "Mr. Ray of the Number of Plants," (in Derham 1718:344–351), he also argued against the origin of new species or the extinction of

previously existing species. Although he could not prove that species do not become extinct, he could emphasize their means of survival. This was another theme that went back to antiquity (Egerton 1973), and Ray (1717:110–146, 1977) marshaled the usual evidence along with a few new examples, including Lister's observation that swallows, like chickens, will continue laying eggs if previous eggs are removed from the nest daily (until 19 were laid), and Ray's own observation about woodpeckers' tongues being designed to extract insects from the trunks of trees or limbs.

A somewhat newer question, or at least newly answered (Ray 1717:368–373, 1977), was why there are multitudes of noxious insects. First, because it displays the riches of the power and wisdom of God. Second, because insects are eaten by other animals, many individuals are needed to prevent their extinction. Third, because insects are important food for birds, fishes, and various quadrupeds. Among his examples is an implicit food chain. Derham had, using a microscope, studied "those vastly small animalcula" (zooplankton), and found that they were food for small insects, which Ray had just said were eaten by fish, and of course he knew that people ate fish. Fourth, God can use noxious insects when he wishes to punish wicked persons or nations. Since it was known that insect pests are much worse in some places than in others, one may wonder why Ray did not conclude from his fourth point that wicked people are attracted to areas with many insect pests and virtuous people are not. That thought was "beyond the radar" of natural theologians, including Ray.

William Derham was a clergyman in Upminster, a town near London, which occupation left him with ample time to pursue his scientific studies (Atkinson 1952, Knight 1971, Smolenaars 2004). He became a Fellow of the Royal Society in 1702 and published 46 articles in its *Philosophical Transactions*, 1698–1735, many of them concerning the weather at Upminster. His justification for a clergyman engaging in scientific studies was that they provided material for his own two books on natural theology, *Physico-Theology* (1713) and *Astro-Theology* (1715), both of which were very popular and went through many editions and translations into other languages. Derham was bound to cover some of the same ground as Ray, but Derham also had new information and new perspectives (Glacken 1967:421–424). He provided a new synthesis of animal and human demography (Egerton 1967:135–144), and he had a larger store of knowledge of them than had Matthew Hale 36 years earlier (Egerton 2005). Derham seems to have first actually used the word "balance" in a discussion of the balance of nature (Derham 1716:171, 1977): "Thus the Balance of the Animal World is, throughout all Ages, kept even, and by a curious Harmony, and just Proportion between the increase of all Animals, and the length of their Lives, the world is through all Ages well, but not overstored." In discussing human demography, he drew upon the studies by John Graunt and later authors. He saw (1716:177, 1977) the tendency of births to be more numerous than deaths as

> *an admirable Provision for the extraordinary Emergencies and Occasions of the World; to supply unhealthful Places, where Death out-runs Life; to make up the Ravages of great Plagues, and Diseases, and the Depredations of War and the Seas; and to afford a sufficient number for Colonies in the unpeopled Parts of the Earth.*

He suggested that some of these calamities might be punishment for wickedness and also "wise Means to keep the Balance of Mankind ['s population] even. . . .

Ray had defended the wisdom of having mountains as providing a variety of abodes for a variety of species of plants and animals. Derham generalized this argument to explain that the diversity of soils and climates of the earth provide the needs for the large variety of existing species. In his chapter, "Of the Food of Animals," he further observed (1716:180–215, 1977) that animal species have special kinds of food, and

also special anatomical features that enable them to obtain it, such as the long bills of woodcocks, snipes, and curlews, which they use to extract worms from the soil. It would have been difficult to make his argument for what we call ecological diversity had Derham chosen omnivorous species as examples; that is one limitation to his argument, and his neglect of competition between species is another. Perhaps a focus on the wisdom of creation diverted attention from these aspects of species interactions.

Thus, natural theology had limitations as a paradigm for understanding the living world. However, as a motivator for natural history studies, it played an important role in the thinking of European and American naturalists from the 1600s into the 1800s. John Ray and his associates, Francis Willughby and William Derham, provided the guidance and inspiration for many of these studies.

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Acknowledgments

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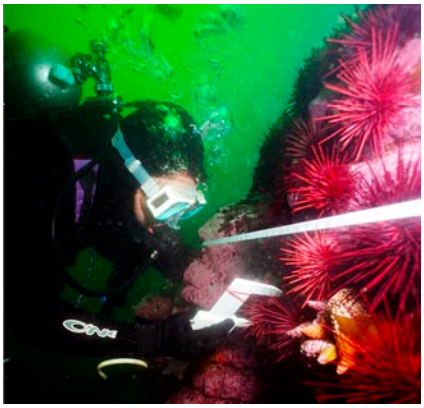

DEPARTMENTS

Ecology 101

Statistics Without Math

Magnusson, W. E., and G. Mourão. 2004.
Statistics without math.
Sinauer Associates, Londrina, Brasil.

"Statistics without Math" sounds like an oxymoron, but it is actually an innovative text that empowers ecology students with a simple, clear conceptual understanding of deductive/inferential statistics. In the new millennium, students rarely encounter maths, as it is generally contained within the computer programs that perform their statistical analyses. Unlike most statistics books that leave the reader confused and bamboozled with mathematical jargon, this book focuses on providing the conceptual basis for inferential statistical analyses, ranging from the basic chi-square and *t* test and ANOVA through to multivariate statistics and path analysis. These explanations allow students to understand how the computer has processed their data (without the algorithms).

There is little dispute that most undergraduate students in biology fear and loathe statistics. Overcoming "stats phobia" is a constant challenge for teachers and students alike. This book also forms the basis for an innovative course in Experimental Design and Statistics. It has been taught extensively, as a 2-week intensive course, at universities in Brazil, North America, Australia, and Fiji. The course is equally valuable for all students in the early stages of their research careers (honors, M.Sc. and Ph.D students), but is also valuable for managers and state agencies, providing them with a basis for understanding the statistics used in scientific reporting. Tips for teachers (Chapter 14) are available online at: ‹www.sinauer.com/swm›

The book is relatively small (130 pages) making it an easy read for students, who readily consume it from cover to cover. While brief, it provides students with an understanding of statistics that leaves them with a thirst for more knowledge—and the confidence to face their demons, and tackle the stats books with the mathematics.

In summary, this book provides a novel format for learning statistics. It also provides the foundations for an elementary course for teaching statistics. As such it is an excellent tool, and an essential asset, for all students, teachers, and practitioners in biological sciences.

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Ecological Education: K–12

Ecology Education in Schools

Taste and smell are undervalued and underused in our school classrooms as teaching strategies. Tom Lauer presents here an innovative way of using taste to memorably demonstrate an ecological concept. Whilst his experiences are described at the college level, this activity can easily be applied to high school classes. Indeed, if you are looking for an extension activity for more able students, it provides an ideal motivating context. Have fun, but do remember to check school policy on providing food items, and of course allergies to peanuts, dairy, etc.

Please send contributions to this column to either Susan Barker or Charles (Andy) Anderson.

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Eating Your Way Through Ecology Class: It's a Realistic Way to Learn.

Introduction

While attending graduation, I ask one of my students what was the most significant classroom experience she had while attending our university. Much to my astonishment, she indicated a day 2 1/2 years prior in my ecology class, when I had students eating Hershey Kisses to demonstrate an ecological concept. As educators, we often use sight and sound in the classroom, but ignore other senses that can be used for learning. With the exception of culinary schools, taste is generally ignored as a pedagogy tool. Why? I suspect that the additional effort to have safe, acceptable, low-cost foods available to students is one contributing factor. Another, and more likely deterrent, is understanding how to incorporate taste into the classroom experience, even for motivated instructors.

The concept of taste is closely associated with predation and can be used as a teaching tool (Lauer 2000). We know that taste will discourage consumption and is a defense mechanism for some organisms (Molles 2002). We also know that if a prey item is available (Forrester and Steele 2004, Graeb et al. 2004), acceptable to the taste (Stanger-Hall 2001, Massei et al. 2003, Darmaillacq et al. 2004), and can be physically consumed (Truemper and Lauer 2005), it is more likely to be eaten. In addition, students (like many predators) are usually hungry and can be counted on to eat most anytime. Lastly, the National Science Education Standards (National Research Council 1996) suggest that active learning provides a lasting effect to the student in contrast to passive classroom activities. Applying and combining these concepts in the educational setting serves several purposes: (1) taste can be used as a learning tool, (2) taste can teach ecological princi-

Table 1. Mock data set and calculations showing how to conduct the analysis.

Trial/student	No. of kisses in population (abundance)	Search time (s)	Handling time (s)	Total time, TT (s)	Rate of kiss consumption (1)/TT × 1000
1	2	35	9	44	23
1	5	24	8	32	31
1	10	10	12	22	46
1	20	7	11	18	55
1	50	3	13	16	62
2	2	26	12	38	26
2	5	23	11	34	29
2	10	11	9	20	50
2	20	4	8	12	62
2	50	3	12	15	67

ples, and (3) taste can enhance the student experience.

Moving from concept to application in the classroom is not always obvious to instructors. An approach I often use is to generate data as they relate to the concept at hand. For example, I often try and replicate existing data sets (typically from the textbook) to validate or dispute findings. This methodology provides an opportunity for students to critically evaluate scientific findings that is often lacking in a "lecture only" setting. An example of this teaching application involving taste is delineated below, and involves a specific ecological predator/prey principle.

Teaching objective: predator–prey interactions

To have students understand two components of predation, search time and handling time, and how they interact with varying abundance of prey. The specific concept has also been termed "Type II Functional Response" (Holling 1959).

Methods

1) Prior to class, obtain a bag of Hershey's Kisses, and ~100 –200 other similar-sized candies wrapped in paper, foil, etc.

2) During class ask for volunteers to participate in the exercise. If you think getting volunteers during class will be problematic, you can ask selected students to participate before class begins. Two students are required to time activities, while one or more are needed to act as predators.

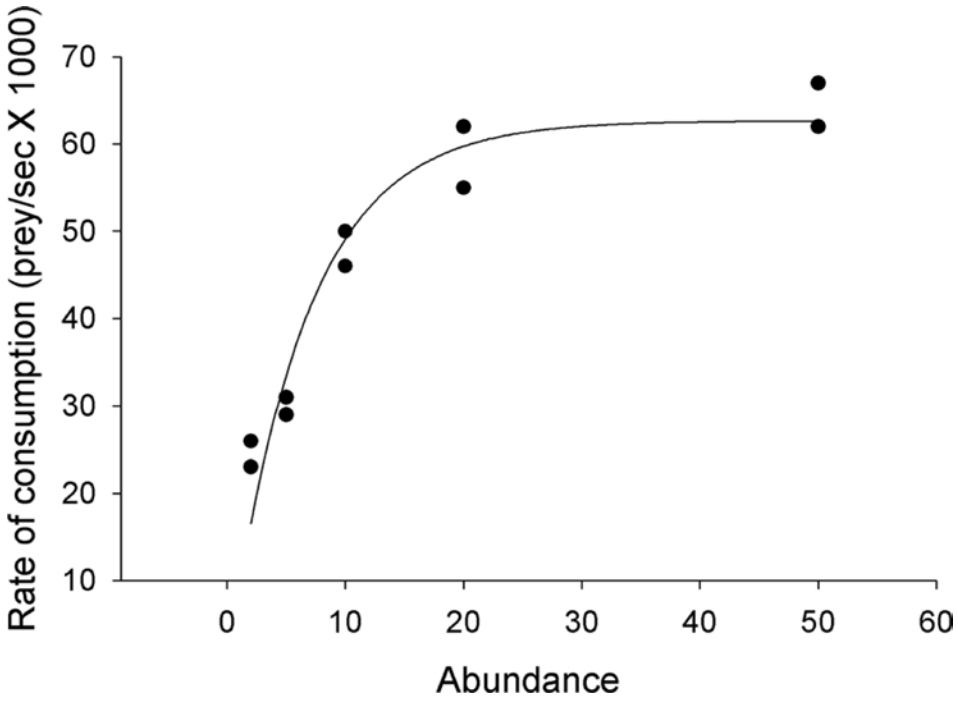

FIG. 1. Mock data set points plotted with a curvilinear best fit line demonstrating a Type II functional response, after Holling (1959).

3) Spread out the similar-sized candies on a large desk or the floor. Do not put any kisses with them at this time.

4) Show the predator the candies that are spread out. Explain that you will be putting some Hershey's Kisses in with the other candies, and indicate that the kisses are the only are the kind of food they can eat. Their task is to locate a kiss, unwrap, and eat it when they are given the signal to do so. When the kiss is completely swallowed, the student needs to indicate he/she is done.

5) Blindfold the student.

6) Place two kisses among the other candies.

7) Give the "Go" signal to the student to begin the search.

8) The time required to locate the kiss should be recorded by one timer. The time required to unwrap and eat should be recorded by the other timer.

9) After the first kiss has been eaten, have the student do the procedure four more times. However, with successive trials, increase the number of kisses in the candy community to 5, 10, 20, and finally 50, but only have the student eat (and time) the first kiss found. Record the data for the class to see (e.g., on a chalkboard, see Table 1). By having multiple students participate (separately) in the five trials, several things will occur. First, more students are involved in the learning process. Second, some measure of variability or increased number of data points will improve the quality of the data, and third, the number of students participating can vary depending on the time available.

10) After the data have been collected, plot the results on a graph. The *X* axis should be prey abundance (1, 5, 10, 20, and 50), while the *Y* axis should be

the rate of consumption expressed as kiss (1)/second consumed, using total consumption time (searching and handling). The theoretical relationship is shown in Fig. 1.

Concept application

Ask the students in the class to explain the graph. Include in the questioning any changes in both search time and handling time as the abundance increased. Theoretically, search time is reduced, while handling time remains the same. The ecological concept suggests that as prey increases from low levels, the number of prey consumed increases rapidly. However, as prey density reaches higher levels, further increases in the rate of prey consumed is slowed asymptotically by the amount of time needed to "handle" (kill and eat) the prey. Next, have students speculate whether this concept applies to other predators, such as bears eating salmon, birds eating worms, wolves eating moose, and deer eating plants. Lastly, have the students come up with other predator–prey examples that may fit the concept, including searching the Internet for pertinent sites (key words: ecology; functional response; numerical response; population ecology; quantitative ecology; predator–prey functional response).

Term introduction

After the discussion, I usually give the "lecture" on the three types of functional response curves (Fig. 2). When the introduction of terms follows the understanding of the concept (i.e., nonverbal awareness [Hendrix 1960]), students are less likely to be exposed to "jargon fright," and assimilate the concept more easily.

Conclusion

The teaching of the three types of functional response has merit in the ecology classroom, particularly when the students are actively involved in the learning process. However, the greater importance of this activity may be in identifying a pedagogical technique that links an ecological concept to student learning. Although we don't usually think of students as predators while giving instruction, employing them in this role has merit (Lauer 2000, 2003), and can be used as a template for parallel learning experiences.

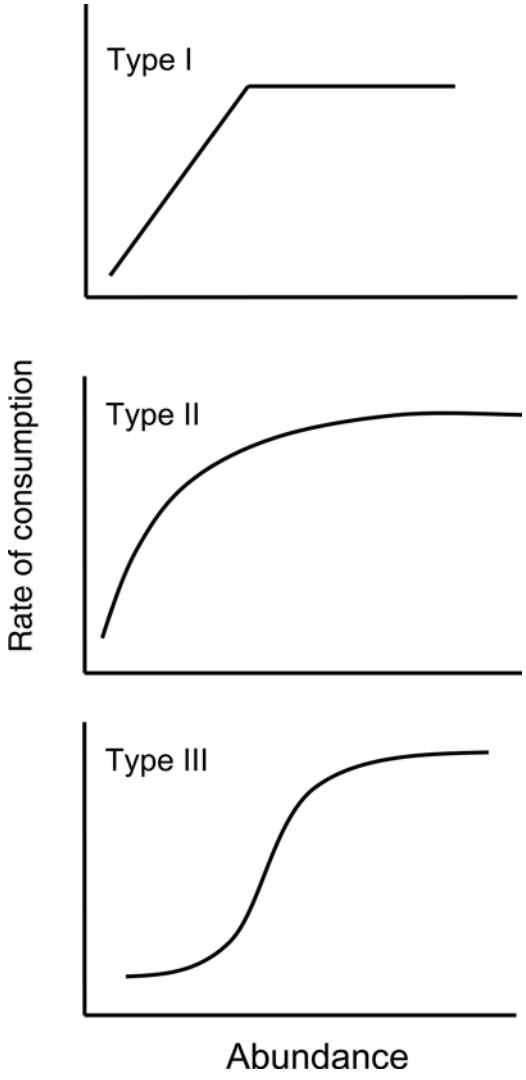

FIG. 2. Theoretical Types I, II, and III functional response relationships patterned after Holling (1959). Type I response: As prey increases the number of prey consumed increases proportionally until predators are satiated. Type II response: As prey increases from low levels, the number of prey consumed increases rapidly. However, as prey density reaches higher levels, further increases in the number of prey consumed is slowed by the amount of time needed to "handle" (kill and eat) the prey. Type III response: As a previously rare or unknown prey species increases, predators slowly increase their consumption of that prey at first, then rapidly increase their consumption with prey density, until limited by predator satiation or prey handling time.

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Public Affairs Perspective

Congressional Visits Day

Three ESA members participated in the May 2005 Congressional Visits Day (CVD) in Washington, D.C. CVD is a multi-society, multi-discipline, 2-day annual event that brings scientists, engineers, researchers, and educators to Washington to raise visibility and support for science.

David Bowne, Adjunct Professor of Biology at Franklin and Marshall College, Gera Jochum, a graduate student at West Virginia University, and Anika McKessey, a doctoral student at Drexel University, all traveled to the nation's capitol to meet with their congressional delegations and learn more about the legislative process.

Hill Scare

McKessey, Jochum, and Bowne on Capitol Steps

Nadine Lymn, the Society's Public Affairs Director, and Laura Lipps, ESA Policy Analyst, helped manage this year's CVD, which featured briefings from high-ranking administration and congressional staff and more than 200 scientists and educators from across the United States.

Jochum, Lipps, McKessey, and Bowne swap stories

ESA members and staff met with six congressional offices to emphasize the importance of funding research across scientific disciplines. To add to the excitement, McKessey, Bowne, and Jochum experienced more than they bargained for when they were evacuated from Capitol Hill during the security scare caused by a small plane that had crossed into the restricted airspace.

During their meetings with congressional offices, Bowne, McKessey, and Jochum were able to highlight their research and the vital connection between federal support of agencies such as the National Science Foundation, the Department of Energy's Savannah River Ecology Laboratory, and the Department of Agriculture's National Research Initiative.

Society Section and Chapter News

Plant Population Ecology Section Newsletter

Minutes from the Section meeting, August 2005, Montreal

The Section meeting at the ESA Montreal was a great opportunity for us to mix, socialize, and do Section business. It was wonderful to see so many of you there.

Here is a summary of some of our activities during the business meeting. As an aside, all of my past communications have been sent through the Section's directory/listserv. Recently I realized that the directory is not updated to reflect the official ESA enrollment, so that most of our communication has gone to only a fraction of the membership. My apologies; all Section business will now go to all those registered with ESA, beginning with this message.

Below are the minutes. Items listed there include:

- New Section chair installed
- NOMINEES REQUESTED for Section chair
- Student travel grants awarded
- Successful silent auction
- Section website update
- ONLINE DISCUSSION FORUM inaugurated

Details are below.

1) Chris Ivey was installed as new Section chair. Chris will be taking over those duties starting this fall and will preside over the Memphis meeting. My last action as Chair will be the (potential) endorsement of a Symposium Proposal, and then I will hand the reins over to Chris.

2) We need nominees to serve as the Vice Chair for the Section in the upcoming year. The Vice Chair will become the Chair next year. There will be an e-mail call for nominations soon.

3) Student travel grants

a) We announced the recipients of the Section's graduate student travel awards (Kristin Anton of Portland State University; Richard Lankau of UC Davis; Lori Spindler of University of Pennsylvania).

b) We then discussed whether the Section's travel awards should be restricted to only graduate students, or whether undergraduates are also eligible. Given that an accepted abstract is a requirement for the applications, the Section strongly supported the eligibility of undergraduates.

4) Thanks to all those who donated items and bid on them at the Silent Auction. We made several hundred dollars through their generosity. The money from the auction will help support student travel awards to the 2006 ESA meetings.

5) The deadline for SYMPOSIUM PROPOSALS for the 2006 ESA meetings in Memphis, Tennessee, will be 15 September. The theme of the meeting is: "Icons and Upstarts in Ecology." Our Section is allowed to endorse one symposium proposal. No one has suggested any proposal topics yet, but if you have any such ideas and would like the Section's approval, you should contact me soon with a proposal topic. If we have several proposals, we will send the topics out to the membership for a vote.

6) Gordon Fox has done a major upgrade to the Section's web site ‹http://pltecol.cas.usf.edu/index.pl/home›, and was thanked for his very productive efforts. This is a good time to remind you to be sure to look at your contact information on the Section web site and make sure it is up to date.

7) Gordon Fox and Jonathon Silvertown introduced the Section's new web discussion board for current ideas in Ecology: ‹http://pltecol.cas.usf.edu/index.pl/discussions›

The main motivation for this initiative is that many journals now include a "new ideas section," but the discussion that such ideas spark can be limited because of spatial, temporal, and other limits. The new forum is intended to overcome these limits. By hosting the discussion on the Section's web server through a browser interface we can provide real-time interaction across the globe among any interested scientists. The current plan is to foster a free and open discussion of new ideas, but to limit the discussion to published papers. The forum will be open to all, regardless of whether or not they are members of the Plant Population Ecology Section of ESA. This forum is for debate and discussion of scientific issues. Other sorts of communication (e.g., requests for data, advice on technique) should be achieved through the Section listserver, or the Discussion board on the web site; they are not appropriate for this forum.

To inaugurate the series, we put up for discussion a recent provocative paper by one of the moderators of the forum:

Silvertown, J. 2004. Plant coexistence and the niche. Trends in Ecology and Evolution 19:605–611.

More details about the forum are on our web site. Log in and take a look!

See you in Memphis!

Randy Mitchell
Section Chair 2004–2005

Canada Chapter Newsletter

ESA had a well-attended and successful meeting in Montreal. The Chapter business meeting and mixer were held on Monday, 8 August, with more than 50 people passing through.

The chapter is doing well and represents the largest membership of Canadian professional ecologists. The symposium topic supported by the Canada Chapter last year was approved and it was well attended. Thank you to Ed Johnson (Calgary), Kiyoko Miyanishi (Guelph), and Kathreen Ruckstuhl (Calgary) for organizing "The boreal forest and global change." This year we supported the symposium proposal from Marc Johnson (Toronto) and Randall Hughes (UC Davis) on "The ecological consequences of genetic diversity."

Ed Johnson and I met with ESA public affairs staff and Thomas Balint, senior policy advisor from the Office of the Ambassador to the Environment for the Government of Canada. This was a useful meeting, introducing them to ESA and what the Canada Chapter can provide in terms of expertise and opinion on environmental and policy issues. Unfortunately, the environment minister and the chief policy advisor were busy with the train oil-spill in Alberta. We will continue with efforts to meet regularly with federal government policy staff. The Chapter will be seeking an ESA "long-range planning grant" to provide a professional web site with links to ecology-related resources intended for government, media, and educational sectors as a resource. We are going to coordinate provincial "rapid response teams" to match those in the United States. The aim is to provide input in policy development and on environmental issues as they arise. This will be coordinated through ESA Headquarters through the Public Affairs office. There was some interest in holding a Chapter meeting within Canada in the near future. The date of Spring 2007 seemed practical. Sina Adl is willing to host a Chapter meeting in Halifax, in the first week of May 2007. There will be further announcements regarding

this. Two student prizes were drawn from a hat. The lucky winners were Danielle Way and Patrick Vogan, who will each be receiving their $50 cheques.

The new officers were elected for a period of 2 years, as follows:

Chair: Kenneth Lertzman, School of Resource and Environmental Management, Simon Fraser University, Burnaby, BC V5A 1S6, E-mail: lertzman@sfu.ca

Vice-Chair: Karen Yee, University of Calgary, 2500 University Drive NW, BioSciences Room 356, Calgary, AB T2N 1N4, E-mail: yeeka@ucalgary.ca

Secretary: Beatrix Beisner, Departement des Sciences Biologiques, Case Postale 8888, Succ. Centre-Ville, Montreal, QC H3C 3P8, E-mail: beisner.beatrix@uqam.ca

Sina Adl
Past Chair and Acting Secretary
Dalhousie UIniversity
Halifax, NS
Canada

Southeastern Chapter Newsletter

News from SE Chapter Brown Bag Lunch at ESA

On 9 August 2005 our Chapter held its traditional Brown Bag Lunch at the Ecological Society of America Meeting in Montreal, Canada. Several members attended and we encourage more to do so at future meetings.

ASB and ESA symposia

Discussion centered on symposia ideas for the 2006 meetings of the Association of Southeastern Biologists (ASB), in Gatlinburg, Tennessee, and the Ecological Society of America, in Memphis, Tennessee. The deadline for submitting symposia proposals is 15 September 2005 for both meetings, and more information is available on their respective web sites.

Elsie Quarterman-Catherine Keever Award

Formal fundraising for the Quarterman-Keever Award will begin this fall, and members are encouraged to support this award given at the ASB Annual Meeting for the best student poster dealing with an ecological topic.

2006 Association of Southeastern Biologists Meeting, Gatlinburg, Tennessee

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he University of Tennessee will host the 67th ASB Annual Meeting in Gatlinburg, Tennessee, 29 March–1 April 2006.

Abstract deadline

Titles and abstracts of papers and posters are due to the Program Committee by 18 November 2005. Details of the abstract format and submission instructions are available at ‹http://www.asb.appstate.edu/› and in the September 2005 issue of *Southeastern Biology*, the Bulletin of the Association.

Applications for Elsie Quarterman-Catherine Keever Award

Undergraduate and graduate students who want to be considered for the 2006 Quarterman-Keever Award should (1) be the sole or senior author on a poster presentation clearly dealing with an ecological topic and representing a completed research project, and (2) submit a copy of their abstract to both the 2006 ASB Program Chair, Dr. Jake Weltzin, University of Tennessee (jweltzin@utk.edu) and the Quarterman-Keever Committee Chair, Dr. Frank Gilliam ‹gilliam@marshall.edu›, Marshall University, by 18 November 2005.

Eugene P. Odum Award

Undergraduate and graduate students are eligible for the Odum Award; the student must be the sole or senior author on a paper presentation clearly dealing with an ecological topic and representing a completed research project. Students who wish to be considered for the 2006 Odum Award must submit a copy of their abstract to both the 2006 ASB Program Chair, Dr. Jake Weltzin, University of Tennessee ‹jweltzin@utk.edu› and the Odum Committee Chair, Dr. Nicole Turrill Welch ‹nwelch@mtsu.edu›, Middle Tennessee State University, by 18 November 2005.

Keeping in touch

Check the Chapter Home page:
‹http://www.auburn.edu/seesa/›
for updates and additional information. To join the Southeastern Chapter of ESA 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: ‹nwelch@mtsu.edu› for inclusion in the next quarterly newsletter.

Chapter officers

Chair: James Luken (2004–2006) ‹JoLuken@coastal.edu›

Vice-Chair: Neil Billington (2005–2007) ‹askdrb@troy.edu›

Secretary/Treasurer: Nicole Turrill Welch (2004–2006) ‹nwelch@mtsu.edu›

Web-Master: Mark Mackenzie ‹mackenzi@forestry.auburn.edu›

Chapter Home page: ‹http://www.auburn.edu/seesa/›

Respectfully submitted,

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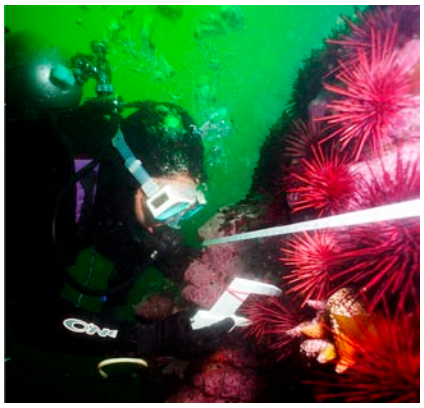

MEETINGS

Meeting Review

Ecological Models and Satellite Imagery

"Ecological Models and Satellite Imagery: from Observations to Forecasts," an Ecological Modeling for NASA Applied Sciences Workshop held at the Asilomar Conference Center, Pacific Grove, California, 29 March–1 April 2005.

An unprecedented number of satellites currently orbit the Earth, measuring terrestrial, atmospheric, and marine variables ranging from land cover, to precipitation, to sea surface temperature and chlorophyll concentrations. As a result, we are awash in environmental data to a degree unique in history. How to make sense of this potential Babel? If these rich data sets are to foster progress in ecology (indeed, in any of the Earth sciences), we must improve our ability to integrate data from diverse sources, whether satellite based or in situ. To address this challenge, many researchers and resource managers are turning to ecological models as integration tools. These models are a key component of our developing capability to generate ecological forecasts (Clark et al. 2001). To explore how investigators use models to bring together satellite and in situ data sets for improved understanding and decision support, the U.S. National Aeronautics and Space Administration (NASA) hosted a workshop focusing on modeling developments within three areas of its Applied Sciences Program—public health, invasive species, and ecological forecasting.

The workshop format consisted of plenary presentations by researchers, with evening sessions and the morning of 1 April reserved for synthesis discussions. Habitat suitability and niche modeling constituted a common thread across the three program areas, while research and applied talks each took up roughly half of the program.

Geoffrey Henebry (University of Nebraska–Lincoln, Nebraska) started things off with a call for a synoptic ecology built upon the remote sensing of ecological change. To determine the "plots" of ecological systems, one needs to identify spatiotemporal baselines concerning phenomena such as land surface phenology, outbreaks and spread of invasive species, succession in ecological communities, and the growth of urban areas—topics that lend themselves to recurrent observations. Over time, these observations allow for the detection of anomalies and unique events. It is in the detection, quantification, assessment, and attribution of the unusual that we build the understanding necessary for making ecological predictions as well as estimates of the uncertainties associated with them.

Andrew Hansen (Montana State University, Bozeman, Montana) presented results from two case studies. The first modeled the distribution of bird species richness in the Pacific Northwest of the United States, using statistical regression and geographic models to relate energy, as proxied by net primary productivity and climate data of vapor pressure deficit, and bird

species richness from Breeding Bird Survey data. His team found higher levels of species richness associated with intermediate levels of energy. Another study by Hansen and collaborators ran models to simulate different scenarios of exurban development in the Greater Yellowstone Ecosystem to the year 2020 and assess the concomitant impacts on lands important to biodiversity. The means of assessing these impacts was a biodiversity index generated from measures of irreplacability, migration corridors, and bird hot spots, among others. This work found that a growth management scenario could significantly limit the impacts of new homes on places important to biodiversity in the Greater Yellowstone Ecosystem.

Inside out and outside in

In research characterized as going from the "inside out," or from the organism to the broader ecosystem, David Spencer (U.S. Department of Agriculture Agricultural Research Service, Davis, California) used individual-based models to simulate virtual invasive plants in the United States (the giant reed *Arundo donax*), their increase in biomass over time, and the degree of light reduction under *A. donax* canopies. In addition to canopy shading characteristics, the model provided estimates of the timing of greatest shoot and biomass production, as well as the morphological patterns for rhizome and shoot growth. These are vital parameters for ascertaining what types of biocontrol might be effective, and the invasive plant's impact on native vegetation. Combining individually modeled plants into stands should allow this work to be scaled to levels detectable via remote sensing. Edward Wiley (University of Kansas, Lawrence, Kansas) approached the challenge of invasive marine fishes from the "outside in," going from the environment to the organism. His team employed the genetic algorithm GARP to model ecological niches for invasive fishes using environmental coverages derived from both satellite sources (e.g., sea surface temperature, chlorophyll *a*, and suspended solid concentrations from the NASA Moderate-Resolution Imaging Spectroradiometer (MODIS) sensor) and in situ sources (e.g., bathymetry and silicate, phosphate, and nitrate concentrations). In a companion freshwater example, Wiley demonstrated the ability of GARP to generate statistically significant "postdictions" of the spread of the invasive largemouth bass (*Micropterus salmoides*) in Japan.

Simon Ferrier (Department of Environment and Conservation, Armidale, New South Wales, Australia) and his team modeled a community-level property of biodiversity (i.e., compositional turnover or beta diversity) by means of generalized dissimilarity modeling (GDM). GDM models dissimilarity in species composition between biological survey sites, or collection localities, as a function of environmental differences between these sites. Satellite data provide the source for several of the environmental variables used. GDM provides a powerful means of analyzing data from lesser known, yet highly diverse taxa, such as insects. Current applications of the approach include assessments of the representativeness of the world's protected area system (Ferrier et al. 2004).

Different types of data and models

In the public health arena, Uriel Kitron (University of Illinois, Urbana-Champaign, Illinois) presented work in which high spatial resolution remote sensing from the commercial IKONOS satellite system allowed the assembly of spatially explicit transmission models for schistosomiasis in coastal Kenya. Researchers studied changing human demographics via households, and performed spatial statistical analyses of snail distribution and human infection on the household level as it clustered around water contact sites (Clennon et al. 2004, Kariuki et al. 2004). In subsequent work, the IKONOS imagery are augmented by Landsat imagery and data from the Shuttle Radar Topography Mission and MODIS to document the connectivity of water bodies and demonstrate how local hydrological patterns sustain snails, and thus the disease, during times of drought. Other presentations demonstrated the application of remote sensing

data within epidemiological models to derive public health tools for decision makers. Durland Fish (Yale School of Medicine, New Haven, Connecticut) and his colleagues have developed landscape-based epidemiologic models that incorporate Landsat data to forecast Lyme disease risk at spatial scales ranging from county to individual residential property. Disease risk maps enable public health agencies to improve the effectiveness of disease prevention methods by targeting high-risk populations. A similar approach was used to estimate West Nile virus risk in New York City during the 1999 outbreak (Brownstein et al. 2003). Human cases peaked in census tracts with intermediate levels of vegetation as determined by Landsat Thematic Mapper measures of NDVI (Normalized Difference Vegetation Index), which also had a higher frequency of mosquitoes infected with the virus. Ecological models using satellite-derived data for rapid assessment of disease risk have important applications with emerging diseases and threats from bioterrorism.

Coupling different types of models is a challenge. To improve fisheries management, Richard Barber (Duke University, Durham, North Carolina) and his team seek to improve our understanding of the relationship between changes in climate, at ocean basin and regional scales, and marine food webs. Seasonal to interannual changes in climate, such as El Niño Southern Oscillation (ENSO) or Pacific Decadal Oscillation (PDO) events, dramatically affect fisheries. Barber et al. have coupled a Pacific Ocean simulation model with regional ocean models of the California coastal waters. Satellites provide key environmental data sets such as sea surface temperature, ocean chlorophyll, sea surface height, and ocean winds, while supercomputers enable the simulation of the surface of the entire Pacific Ocean basin at 12.5-km spatial resolution. Coupling basin models with higher resolution, a three-dimensional physical-ecosystem regional ocean model brings the user to the scale of the upwelling zone. Fishery population models take the information from this point to project the impact of climate changes on populations of species of concern. Modeling the impacts of climate events on fisheries offers a common approach that could potentially lend itself to terrestrial modeling applications, such as the impacts of ENSO and/or PDO on disease outbreaks and the spread of invasive species.

Ecological models and observations for decision support

Several presentations highlighted decision support tools that combine Earth observation data and models for use by resource managers and public health officials. John Schnase and Jeff Morisette (NASA Goddard Space Flight Center, Greenbelt, Maryland) introduced the Invasive Species Forecasting System (ISFS), a joint initiative by the U.S. Geological Survey and NASA. ISFS uses geostatistical models that incorporate environmental coverages (both from satellite sensors, such as MODIS and Landsat ETM+, and in situ STATSGO soils data, etc.) and species location information from the U.S. National Biological Information Infrastructure (NBII) and other sources. These models generate maps, with associated estimates of uncertainty, of areas likely to support a given invasive species. The near-daily access to MODIS imagery allows detection of reflectance differences related to phenological changes, useful in the location of certain invasive plants. ISFS ‹http://invasivespecies.gsfc.nasa.gov/› currently focuses on several plant species in the western United States, but plans are for it to become a national system predicting the locations and possible spread of invasives of all taxa.

Danny Hardin (University of Alabama at Huntsville, Alabama) discussed the implementation of the SERVIR decision support system in Central America. SERVIR brings together imagery from multiple satellites, regional climate models, and GIS layers with ecological and socioeconomic information, and visualization software to monitor and provide visualizations of environmental changes in the seven countries of Central America. This integrated regional system ‹http://servir.nsstc.nasa.gov/› has already demonstrat-

ed its effectiveness by producing data products on fire, red tide, and severe weather events for decision makers in Guatemala, El Salvador, Costa Rica, and Panama. A decision support tool briefed by Chris Potter (NASA Ames Research Center, Moffett Field, California) uses the CASA biosphere–atmosphere exchange model as the basis for an internet-based terrestrial carbon accounting tool known as CQUEST ‹http://geo.arc.nasa.gov/website/cquestwebsite/index.html›. Like ISFS and SERVIR, CQUEST integrates satellite and in situ data into models for decision support.

Common threads

Workshop participants emphasized the importance of maintaining the continuity of data sets for ecological research in order to detect anomalies that deepen our understanding of ecosystems under study and enhance our predictive abilities. Long-term data sets are also the only means to detect natural cycles that might be incorrectly attributed to other drivers.

A recurring issue was the degree of spatial resolution required for accurate modeling of phenomena of interest. David Stockwell (University of California at San Diego, California) noted that the accuracies of ecological niche forecasts from GARP models do not necessarily improve with the application of higher spatial resolution environmental data sets, e.g., 1-km imagery may yield accuracies equal to those derived from 30-m imagery (Stockwell, *in press*).

Seeking consensus among different model results is important in that it contributes to the robustness of these results. While the integration of many data sets was a constant theme for this workshop, there was also an appreciation of the need for parsimony in ecological modeling—the challenge of isolating those environmental inputs having the biggest impact on results. These inputs would presumably be the parameters around which we should focus future monitoring efforts, whether satellite or in situ.

A clear goal for ecological models is the generation of "if–then" scenarios that will allow resource managers and policy makers to discern the impacts of their decisions on the ecosystem goods and services upon which all depend. James Smith (NASA Goddard Space Flight Center, Greenbelt, Maryland) challenged participants to consider combining "inside out" approaches examining organismal energy balances with "outside in" efforts to detect ecological niche spaces of organisms from climate and other environmental data sets. The ultimate goal is to use this combined modeling approach to simulate migration events and other movements across the landscape. The relevance of such an approach to forecasting changes in the component parts of ecosystems during an era of potentially rapid climate change is obvious.

Finally, although NASA hosted the workshop, all participants would agree that satellite data alone are insufficient for significant progress in ecological prediction through modeling. Most, if not all, presentations made use of data collected in situ. A principal recommendation coming out of the workshop is the need to link satellite-based efforts with ground-based activities such as the U.S. National Science Foundation's Long Term Ecological Research (LTER) Network, as well as its proposed National Ecological Observatory Network (NEON). Collecting remote sensing and in situ data at common sites for collaborative work is essential. In fact, if there were one overriding challenge to come out of this workshop, it would be the challenge of integration: integration across data sets captured at different scales for different disciplines for use in different models. While difficult, examples of this type of integration are increasing. Ecological models are frequently the tool of choice for making this happen. The future of ecological forecasts and their ability to inform resource management practices rely upon the continued integration of often disparate information through ecological models, and the distillation of model outputs and their uncertainties into decision support frameworks.

Copies of some presentations as well as more information about this workshop are available at ‹http://

geo.arc.nasa.gov/sge/health/ecoworkshop/›

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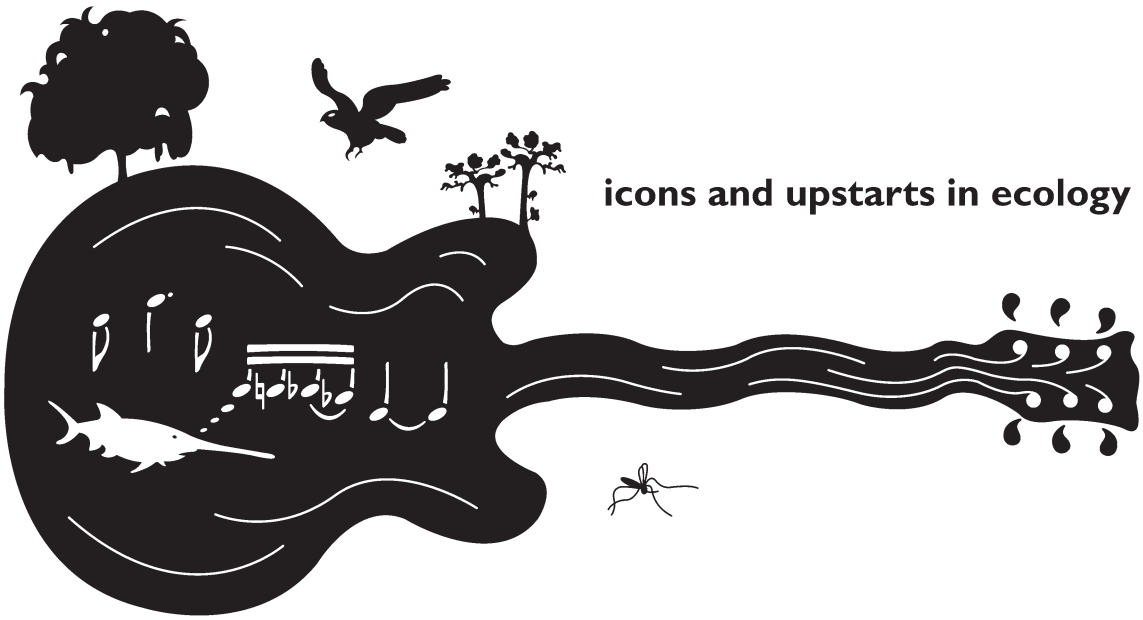

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d) What new was discussed? What previously weak hypotheses were strengthened, confirmed or supported? Were any breakthroughs, or new or innovative hypotheses presented, that forced participants to rethink current concepts?

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