The Ecological Society of America

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Member-at-Large: Margaret A. Palmer, Department of Entomology, University of Maryland, College Park, MD 20742-0001

AIMS

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

MEMBERSHIP

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

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

PUBLICATIONS

The Society publishes a bulletin, three 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. Ecological Archives is published on the Internet at http://esa.sdsc.edu/Archive and contains supplemental material to ESA journal articles and data papers.

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

Subscriptions for 2004 are available to ESA members as follows:

<table>
<thead>
<tr>
<th>Publication</th>
<th>Regular</th>
<th>Student</th>
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<tr>
<td>Ecology</td>
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<td>Ecological Monographs</td>
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<th>Publication</th>
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<th>Society of America</th>
<th>Free</th>
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<tr>
<td>Bulletin of the Ecological Society of America</td>
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<tr>
<td>Ecological Archives</td>
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Application blanks for membership may be obtained from the Ecological Society of America, Member and Subscriber Services, 1707 H Street, NW, Suite 400, Washington, DC 20006, to which all correspondence concerning membership should be addressed. Checks accompanying membership applications should be made payable to the Ecological Society of America.

Cover Photo: Seastars (*Pisaster ochraceus*) foraging on mussels and barnacles in the low intertidal region at Strawberry Hill, Oregon, a wave-exposed habitat. Prey (mussels) recruitment and growth were higher at exposed than at sheltered locations, and higher at Strawberry Hill than at Boiler Bay, 80 km north. Field experiments indicated the resulting annual pulses of abundant food, visible as a black zone of mussels (*Mytilus trossulus*) between the seastars and the permanent *M. californianus* zone (top), attract seastars, leading to higher predation intensity than observed at the other sites. Prey production may therefore underlie variation in the strength of keystone predation. These or similar sites will be the focus of an overnight preconference field trip during the 2004 ESA meeting, when tides will be very low. Photo by Bruce Menge, Department of Zoology, Oregon State University, Corvallis OR 97331.
MEETINGS
65 Meeting Calendar
65 • ESA Annual Meeting, 1–6 August 2004, Portland, Oregon
72 • 2004 North American Forest Biology Workshop: Houghton, Michigan
72 • 2004 International Symposium on Plant Responses to Air Pollution and Global Changes: Tsukuba, Japan
73 • Second Biennial Conference of the International Biogeography Society: Shepherdstown, West Virginia

CONTRIBUTIONS
74 Commentary
79 • An Ecological Purpose for Life: Responsibility to Earth. J. S. Rowe
81 • Things That Can Go Wrong With PowerPoint Presentations. M. Köchy
83 • Deviations and Errors: Standards in Statistics. A. G. Hart
ESA 2004 Election Results

The winners of the 2004 elections are:


Nancy Grimm
Department of Biology
Arizona State University

Vice President for Science (2004–2007)

Gus Shaver
The Ecosystems Center, Marine Biological Laboratory,
Wood’s Hole, Massachusetts

Secretary (2004–2007)

David Inouye
Department of Biology
University of Maryland

Member-at-Large (2-year term, 2004–2006)

Dee Boersma
Department of Zoology
University of Washington

Shahid Naeem
Department of Biology
Columbia University

Board of Professional Certification (3-year term, January 2004–December 2006)

Jeff Klopatek
School of Life Sciences
Arizona State University

David Breshears
Environmental Dynamics and Spatial Analysis Group
Los Alamos National Laboratory

Diane Wickland
Terrestrial Ecology Program
NASA Headquarters
REQUEST FOR STUDENT AWARD JUDGES

Murray F. Buell Award
E. Lucy Braun Award

Judges are needed to evaluate candidates for the Murray F. Buell Award for the outstanding oral presentation by a student and the E. Lucy Braun Award for the outstanding poster presentation by a student at the Annual ESA Meeting at Portland, Oregon in 2004. We need to provide each candidate with at least four judges competent in the specific subject of the presentation. Each judge is asked to evaluate 3–5 papers and/or posters. Current graduate students are not eligible to judge. This is a great way to become involved in an important ESA activity. We desperately need your help!

Please complete and send this form by mail, fax, or e-mail to the Chair of the Student Awards Subcommittee: Christopher F. Sacchi, Department of Biology, Kutztown University, Kutztown, PA 19530 USA. Call (610) 683-4314; FAX: (610) 683-4854 or e-mail: sacchi@kutztown.edu

If you have judged in the past several years, this information is on file. If you do not have to update your information, simply send me an e-mail message, “Yes, I can judge this year.”

Name______________________________________________________________
Current mailing address _______________________________________________
June/July mailing address_______________________________________________
Current telephone __________________ Summer telephone ____________________
E-mail __________________________ Fax ________________________________
Year M.S. received __________________________ Year Ph.D received _____________

Areas of expertise (check all that apply):

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<th>Discipline</th>
<th>Research approach (please rank)</th>
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<td>Population ecology</td>
<td>Vertebrates</td>
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<tr>
<td>Zoology</td>
<td>Community ecology</td>
<td>Invertebrates</td>
</tr>
<tr>
<td>Microbiology</td>
<td>Ecosystem ecology</td>
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<tr>
<td>Applied ecology</td>
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<th>Habitat</th>
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<th>Plants</th>
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<tr>
<td>Soil</td>
<td>Behavioral ecology</td>
<td>Fungi</td>
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<tr>
<td>Terrestrial</td>
<td>Paleocology</td>
<td>Types: ________</td>
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<tr>
<td>Freshwater</td>
<td>Theoretical ecology</td>
<td>Microbes</td>
</tr>
<tr>
<td>Marine</td>
<td>Evolutionary ecology</td>
<td>Types: ________</td>
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</tbody>
</table>

Provide a few key words or phrases that describe your interests and expertise: ____________________________
International Collaborations: Robert H. Whittaker Fellowship

One to two awards annually of $750–1500 are available to promote active collaboration and exchange of ideas between foreign and U.S. ecologists. Awards are given to foreign scientists to help defray the cost of travel to the United States for research collaboration with colleagues. Requirements: the foreign ecologist must possess an earned doctorate, reside in a foreign country, and not be a U.S. citizen. Application for the fellowship may be made directly by the foreign ecologist or by a U.S. scientist on behalf of a foreign scientist. Either the foreign scientist or the U.S. ecologist must belong to the ESA. Applicants should submit a proposal describing the purpose of the travel, the nature of the research, travel itinerary, and costs. Proposals should not exceed four double-spaced pages for these materials. The foreign ecologist’s CV and a one-page letter of support from the United States collaborator should be appended; these items are not included in the page limit.

Desert Ecology: Forrest Shreve Student Research Award

One to two awards annually of $1000–2000 are available to support research in the hot deserts of North America: Sonora, Mohave, Chihuahua, and Vizcaino. Projects should be clearly ecological and should increase our understanding of the patterns and processes of deserts and/or desert organisms. Proposals should not exceed 5 double-spaced pages for all material and should include objectives, importance, background, methods, literature cited, and justified budget. Proposals will be ranked based on the importance of the project to understanding desert ecology, feasibility, experimental design, and innovation.

The postmark deadline for both the Whittaker and Shreve Awards is 30 April 2004. Send six printed copies of the proposal to:

Wendy B. Anderson  
Department of Biology  
Drury University  
900 N. Benton  
Springfield, MO 65802  
(417) 873-7445  
E-mail: wanderso@drury.edu
Call for Nominations for Section officers for 2004–2006

The Applied Ecology Section is seeking candidates for the offices of Chair, Vice-Chair, and Secretary. Applied Ecology Section Officers serve a 2-year term. Final nominees will be selected by the Nominating Committee by 15 June, and the election will be held by e-mail in July. Responsibilities of the Officers are described in the Section Bylaws, which are reprinted below.

Article 5. OFFICERS. The officers of the Section shall be a Chair, Vice-Chair, and Secretary. The Officers shall comprise the Section Executive Committee and may act on behalf of the Section during intervals between annual meetings. Voting for Officers shall be by either mail or by email ballot distributed to members in odd numbered years. Officers shall serve for a term of two years and not be eligible for re-election. The Chair and Secretary assume office in the year the election is held, and the Vice-Chair assumes office the following year.

Article 6. CHAIR. The Chair shall preside at the business meetings of the Section, authorize expenditures of Section funds, and shall promote in every practical way the interests of the Section. The Chair shall appoint a Nominating Committee, which shall prepare a slate of candidates for each office.

Article 7. VICE-CHAIR. The Vice-Chair shall be responsible for arranging the scientific program for all meetings of the Section, and shall assume the duties of the chair whenever that person is unable to act.

Article 8. SECRETARY. The Secretary shall keep the records of the Section and an up-to-date membership and mailing list, and shall perform such other duties as may be assigned by the Chair.

Duties that may be assigned by the Chair can include: submits information to ESA Bulletin by deadline for publication in the next ESA Bulletin; takes minutes at the annual meetings; maintains and updates the web page; assists the Chair and Vice Chair with distributing information and other tasks as deemed by the Chair; assists with organizing and tallying votes for the Student Travel Award; counts ballots for elections.

Please send nominations, including a one-paragraph biosketch that describes your vision as an Officer of the Applied Ecology Section, by 15 May 2004 to the Applied Section Chair:

Paulette Ford, Research Ecologist
Rocky Mountain Research Station
333 Broadway SE, Suite 115
Albuquerque, NM 87102-3497 USA
(505) 766-1044
Fax: (505) 766-1046
E-mail: plford@fs.fed.us
SOUTHEASTERN CHAPTER NEWSLETTER
Issue 2004–1

Chapter Officers

Vice-Chair: Joan Walker (2003-2005) joanwalker@fs.fed.us
Secretary/Treasurer: Yetta Jager (2002-2004) jagerhi@ornl.gov
Web-Master: Mark Mackenzie mackenzi@forestry.auburn.edu
Chapter home page: http://www.auburn.edu/seesa/

Spring 2004 Chapter Meeting in Memphis

Please attend our business meeting and luncheon on Friday, 16 April at noon (FEC room 217) at the meeting of the Association of Southeastern Biologists (ASB) in Memphis, Tennessee. This will be our opportunity to vote on the poster award and to elect the chair and secretary/treasurer for the term beginning August 2004. Scott Franklin, an ESA-SE member from the University of Memphis, will be one of our hosts. Dan Simberloff will give the ASB keynote address the evening of Wednesday, 14 April, and a social will be held at the Gibson guitar factory on 15 April. The ESA Southeastern Chapter will co-host with the TN Exotic Pest Plant Council a symposium, “Invasive Plant Awareness and Research: Priority Status.” The symposium, coordinated by Pat Parr and Jack Ranney, will be held Thursday morning, 15 April. Visit http://www.people.memphis.edu/~biology/asb/

Membership Renewal and Odum Award

Please remember to renew your membership in the SE chapter when you renew your ESA membership. Your donations to the Eugene P. Odum Fund support the 2004 Best Student Paper Award. We are within $1250 of our goal of $10,000, which is the amount needed to make the Odum Fund sustainable.

A proposed bylaws amendment to establish the QUARTERMAN-KEEVER poster award for the best student poster was published in the January 2004 ESA Bulletin. The amendment will be voted on at our April 2004 meeting.

Southern Appalachian Man and the Biosphere Cooperative and Foundation

SAMAB has the goal of “promoting environmental health, stewardship, and sustainable development of natural, economic, and cultural resources in the Southern Appalachians.” Learn more at http://samab.org. SE Chapter members may also be interested in data available at the Southern Appalachian Information Node, National Biological Information Infrastructure, see http://sain.nbii.gov.

Farm Bill Funding for Conservation

The USDA Continuous Conservation Reserve Program is available to assist private landowners with water and land conservation. CP-22-Riparian Forest Buffers offers significant incentives to farmers to restore trees to riparian areas to benefit stream banks and improve water quality in streams. For more information, see http://www.nrcs.usda.gov/
Upcoming Meetings and Symposia

ESA 2004 Meeting

The ESA Annual Meeting will be in Portland, Oregon, on 1–6 August. The Chapter will have a brown bag lunch meeting on Tuesday, 3 August. Check the program for time and place. We will discuss symposium ideas or other Chapter-sponsored activities for the 2005 ASB and ESA meetings.

ASB 2005 Meeting

ASB will meet on 13–16 April 2005 in northern Alabama. Proposals for symposia at this meeting will be due in early September 2004.

ESA 2005 Meeting

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

SEAFWA 2004

The South Carolina Department of Natural Resources invites you to the 58th Annual Southeastern Association of Fish and Wildlife Agencies Conference, Hilton Head, South Carolina, 30 October–3 November 2004. [www.sednr.state.sc.us/seafwa](http://www.sednr.state.sc.us/seafwa)

Keeping in Touch

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

Respectfully,
Yetta Jager
Newsletter Editor

Other Notices

Manual On Coastal Habitat Restoration Monitoring Available

Coastal resource managers, practitioners, and the public now have a consolidated set of science-based tools available for planning and conducting monitoring associated with restoration projects in habitats throughout U.S. coastal waters.

for developing and carrying out monitoring of coastal restoration efforts. While designed to support the monitoring of projects funded under the Estuary Restoration Act, the framework and tools presented in this document have broad applicability.

“Given the broad diversity and geographic scope of our nation’s coasts, there clearly is no one-size-fits-all, cookie-cutter approach to science-based restoration monitoring,” said lead author Gordon Thayer, of NOAA’s National Centers for Coastal Ocean Science/Center for Fisheries and Habitat Research, in Beaufort, North Carolina. “Individual coastal managers, working with their public and private-sector partners, can use this document to determine the individual strategies best suited to a specific restoration effort or region.” Thayer emphasized that the newly released NOAA report includes consistent principles and approaches likely to be applicable to a wide range of coastal restoration efforts, including those undertaken without federal funding support.

Along with providing a framework for structuring monitoring efforts, the newly available manual provides an introduction to restoration monitoring related to specific coastal habitats: water column, rock bottom, coral reefs, oyster reefs, soft bottom, kelp and other macroalgae, rocky shoreline, soft shoreline, submerged aquatic vegetation, marshes, mangrove swamps, deepwater swamps, and riverine forests.

A companion volume, “Science-Based Restoration Monitoring of Coastal Habitats, Volume Two: Tools for Monitoring Coastal Habitats,” is due for release later this calendar year. This document will delve deeper into monitoring approaches for the selected coastal habitats, providing techniques for monitoring them. Additionally, volume two provides tools such as a searchable database of restoration monitoring programs nationwide, a guide to selecting reference sites, and a discussion of the monitoring of social and economic aspects of coastal restoration.

The NOAA report is expected to be useful to scientists, managers, and citizens involved in planning and conducting restoration monitoring efforts, including individuals in academia, industry, government interests at all levels, nongovernmental organizations, and the media. Copies of the report, Science-Based Restoration Monitoring of Coastal Habitats, Volume One: A Framework for Monitoring Plans Under the Estuaries and Clean Waters Act of 2000 (Public Law 160-457) can be downloaded as a PDF file by visiting ‹http://coastalscience.noaa.gov/ecosystems/estuaries/restoration_monitoring.html›.

Additional information and printed copies of the report are also available by contacting: ‹restoration.monitoring@noaa.gov› or:

Teresa A. McTigue, Ph.D
National Centers for Coastal Ocean Science (N/SCI)
1305 East-West Highway, Room 8128
Silver Spring, MD 20910
(301) 713-3020 x 186
Fax: (301) 713-4353

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**ESA Publications News**

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

No more paper copies or diskettes will be required!

Submit manuscripts and reviews to *Ecology, Ecological Applications* and *Ecological Monographs* journals online.

For details: ‹esapubs.org/esapubs›.
Resolution of Respect

Frank A. Pitelka

1916–2003

Frank Alois Pitelka, Professor Emeritus of Zoology at the University of California at Berkeley, died on 10 October 2003 at his daughter’s home in Altadena, California. His death, at age 87, was caused by complications from prostate cancer. Frank was a prominent player in the early discussions of concepts that underpin much of modern ecology. The scope of empirical studies conducted by Frank and his students was enormous and addressed such diverse topics as speciation, population regulation, bioenergetic constraints, territoriality, the niche concept, Arctic ecology, and the evolution of breeding systems. Frank was also a demanding, but supportive, mentor to the 37 Ph.Ds and 8 postdocs whom he trained at Berkeley.

Frank was born on 27 March 1916 and raised in Berwyn near Chicago. Both of his parents were born in Czechoslovakia, although they first met in Chicago. As a result, Frank learned to speak Czech at home and continued to do so at every opportunity throughout his life. Frank’s father was a building contractor, and at his insistence, Frank studied the business curriculum at Morton High School and Junior College in Cicero, a neighboring suburb of Chicago. (Frank’s business training was reflected in the amazing speed of his typing and shorthand. His letters were swiftly drafted and, as a consequence, they retained the vividness of the original observations that prompted him to write.) In 1936, following his graduation from Junior College, Frank took a position as the secretary to one of the managers of the Electromotive Corporation, a subsidiary of General Electric. During this time, Frank studied on his own and passed the courses required for admission to the University of Illinois, where he majored in Chemistry and Zoology and graduated summa cum laude in 1939.

Frank started on the naturalist’s path at an early age. In sixth grade one of his teachers, Miss Luckness, took the class on bird walks. He was so taken by this experience that he started watching birds on his own. In 1933, as his interests in the natural history of birds broadened, Frank learned of the Prairie
Club (a Midwestern version of the Sierra Club). He asked his teachers how he might attend club meetings. They arranged a meeting with Mrs. Nellie J. Baroody, a cultured woman who was active in circles devoted to natural history and conservation. She took a strong interest in Frank and invited him to participate in family activities. He accompanied her to public lectures and concerts as well as on field trips to prairies and the Lake Michigan dunes. It was through Mrs. Baroody that Frank was introduced to biologists at the Field Museum and the University of Chicago. Frank was always deeply grateful for Mrs. Baroody’s sponsorship; she opened up a whole new world beyond his ethnic neighborhood, and introduced him to the music and cultivated lifestyle that he enjoyed throughout his life. Frank honored Mrs. Baroody by donating a student award in her name to the American Ornithologists’ Union.

Frank started to develop his editorial skills at an early age by assisting Rudyard Boulton at the Field Museum with *Bird Lore*. He began publishing his observations on birds in 1935. He entered the University of Illinois in 1937, even though General Electric made him attractive offers to remain with the company. He was somewhat older, with more developed interests than the average undergraduate, and the ecologists on the faculty, S. Charles Kendeigh and Victor E. Shelford, treated him like a graduate student. He shared an office with two other noteworthy students of Kendeigh, Eugene Odum and Frank Bellrose. Frank had access to Kendeigh’s library and read extensively on his own. He had a vivid memory of running across Charles Elton’s 1927 book on animal ecology. He put everything aside and read into the night until he had finished. Elton had a profound influence on Frank’s thinking—an influence that Frank put into context in 1957 and 1958 when he had an NSF senior fellowship to work with Elton’s group at Oxford University.

Kendeigh and Shelford, who both received the Eminent Ecologist award, stimulated new interests in Frank and broadened his perspective. Shelford spent much of the 1920s and 1930s documenting the composition of North American biotic communities, including soft-bottom marine invertebrates, and with Frederic E. Clements, developed the biome concept. Kendeigh, who hired Frank as his research assistant, emphasized studies of the distribution and abundance of birds, and had students in his ecology class draw maps of the distributions of biomes. No doubt as a result of these influences, some of Frank’s early work included a review of the distribution of birds in relation to major biotic communities, including a map of North American biomes cited in textbooks, and the mapping of soft-bottom invertebrate communities in Tamales Bay, California. The biome map was Frank’s senior thesis and brought an earlier map, by Shantz and Zon, up to date. Frank’s map differed from the others in acknowledging that there are extensive regions that are best treated as “ecotones.”

Frank moved to Berkeley, California, in 1940 with the intention of working on a Ph.D under Joseph Grinnell’s direction. Grinnell died suddenly, however, of a heart attack just before Frank arrived. There followed an interlude during which Frank worked on a variety of topics, including studies on the rocky intertidal communities at Friday Harbor, Washington. Unfortunately, this work was never published.

It was at Berkeley that his romance with a fellow graduate student, Dorothy Riggs, blossomed and eventually led to a happy marriage with three children. Dorothy became a noted electron microscopist and held a research position in the Cancer Research Genetics Laboratory and an appointment as Adjunct Professor of Zoology until her retirement in 1984. She died 10 years later, but two sons, Louis and Vince, and a daughter, Kazi, have survived their parents, as have five grandchildren and two great-grandchildren.

As a student of Alden Miller, Frank was based in the Museum of Vertebrate Zoology where the Grinnellian tradition remained strong. During the 1940s and 1950s much emphasis at the Museum was focused on building collections for the study of geographic variation. Frank’s doctoral research, for which he was awarded a Ph.D in 1946, took the form of a careful analysis of what can, and cannot, be learned from such data. In two monographs, one on shorebirds (dowitchers in the genus *Limnodromus*) and the other on the American jays (*Aphelocoma*), Frank developed hypotheses about how speciation may have proceeded within each of these two groups of closely related species. These monographs set new standards, broadened the conceptual scope of museum-based studies, and
continue to figure importantly in the analyses of biogeographic patterns, largely because of the extensive and carefully gathered data that they contain.

Frank also was an important pioneer in behavioral ecology. By producing superb papers that served as exemplars, he played an important role in defining the major questions and lines of approach in this discipline. Starting with his early work on territoriality and courtship in hummingbirds, he consistently placed behavior in an ecological context long before this was fashionable. Frank’s extensive research on shorebirds (on both their breeding and wintering grounds) laid the groundwork for comparative analysis of behavior. This work was rich in details about foraging behavior, predator avoidance, interspecific interactions, and the timing of activities in a highly variable environment.

In the late 1970s Frank started to collaborate with some of his graduate students on a long-term study of the Acorn Woodpecker at the Hastings Reservation in the Carmel Valley of California. This investigation, which continues, has yielded some of our earliest and most convincing demonstrations of cooperative breeding and kin selection.

In addition to his impact on avian ecology and ornithology in general, Frank made major contributions in other areas. Indeed, in some circles he is best known for his work on the interactions of small mammals with their food supply and predators. In the 1950s, in collaboration with Arnold Schultz, a plant ecologist and colleague at Berkeley, he developed the nutrient recovery hypothesis to explain population cycles of brown lemmings in the arctic tundra near Barrow, Alaska. Although subsequent work has not supported the details of this well-known hypothesis, particularly its emphasis on changes in quality of forage, it did inspire later research that documented the impact of small mammals on tundra and grassland vegetation. Furthermore, the interaction of lemmings with the quantity of available forage remains a favored explanation for lemming cycles. The studies by Frank and his students on the territorial and breeding responses of avian predators to fluctuations in lemming densities are still regularly cited. Concurrent studies in the Arctic included those of breeding populations of shorebirds, which began in the 1950s and blossomed in the 1970s, and studies of the demography of long-spurs. Frank was clearly in his element during these 25 years of active field work in the Arctic, as anyone who had the good fortune to hear his enthusiastic daily reports of the latest discoveries can testify.

Because of his interest in population dynamics, Frank was an ardent participant in the debates that sprang up after 1954 about the regulation of populations. Frank was a champion of Lack’s view that populations are most often held in check by density-dependent biotic factors. He was a speaker at the famous symposium at Cold Spring Harbor in 1957, which attracted leading ecologists from all over the world (e.g., H.G. Andrewartha, L. C. Birch, G. E. Hutchinson, and A. J. Nicholson) to weigh the relative importance of density-dependent and density-independent factors in limiting populations.

Frank’s breadth of interests in systematics and evolution, in behavioral ecology, and in population and community ecology stemmed from his love of natural history and making first-hand observations in the field. He listened attentively to reports of new discoveries and immediately began musing about their significance for the grand scheme of evolutionary and ecological theory. His conversation and writing reflected his broad views, sometimes with considerable elaboration as he made eclectic references to relevant information, and always helped provide a more synthetic approach to the problem. It came as no surprise that after his retirement in 1985 he continued to contribute to the intellectual life of the Museum of Vertebrate Zoology and the Department of Integrative Biology. He was a regular attendee at the weekly meetings of the Behavioral Ecology Seminar, and the Museum Lunch. Ecolunch, which he founded in the 1960s, became a model for informal lunchtime meetings, a tradition that his former students spread throughout North America. In addition, he was often consulted for his historical perspective on the rise of ecology and evolutionary studies in the 20th century.

Frank’s legacy to ecology lives on in his many graduate students and postdocs (listed below). His style of training research students was simple and highly effective; he continually asked questions that drew out significant insights. These cross-examinations took place in a variety of settings: hallway encounters where he stopped students to discuss a re-
cent journal article or a new bit of data, seminars and brown-bag lunches, where reasoning was expected to be more polished, and private lunches in one of Frank’s favorite restaurants, where he reported his candid observations on personal issues that were holding back the work. Most of Frank’s students developed a deep fondness for him because he cared about them as individuals, and his concern for them went far beyond that expected of graduate advisors. The closeness between Frank and his students was evident at his 70th and 80th birthdays, when many returned to Berkeley and helped him celebrate with all-day symposia (dubbed Pitelkafests). Frank’s students also honored him by establishing the Frank A. Pitelka Award for Excellence in Research, which is awarded by the International Society for Behavioral Ecology.

Frank’s extraordinary breadth of professional interests was also reflected in the variety of his personal interests. A social conversation with Frank likely would range from music (chamber music and opera were his passions), to art (he had an extraordinary collection of objets d’art), cuisine (he was known by sight at the best restaurants in the Bay Area), and gardening (he was an avid gardener, both in his yard and as a supporter of the University of California Botanical Garden in Strawberry Canyon).

Frank taught introductory and advanced ecology courses throughout his career. He also served in a variety of other capacities. For the University of California at Berkeley, he was Curator of Birds in the Museum of Vertebrate Zoology (1958–1963), Chairman of Zoology (1963–1966, 1969–1971), and Associate Director of the MVZ in charge of the Hastings Natural History Reservation (1985–1997). In addition, he edited three journals, Ecology/Ecological Monographs, Condor, and Systematic Zoology, and served on advisory panels for the National Science Foundation, the Atomic Energy Commission, the National Academy of Sciences, and the National Commission for UNESCO. Finally, he was the first Director of the Tundra Biome, a large-scale ecosystem research program in the early 1970s, supported by the National Science Foundation as a United States contribution to the International Biological Program.

Frank received many honors during his lifetime, including the Mercer Award and the Eminent Ecologist Award of the Ecological Society of America, and the Brewster Medal of the American Ornithologists’ Union. He was an elected fellow of the Arctic Institute of North America, the American Ornithologists’ Union, the American Association for the Advancement of Science, the Animal Behavior Society, and the California Academy of Sciences, as well as an honorary member of the Cooper Ornithological Society. Because of his background, one of his proudest moments occurred in 1997 when he received an honorary doctorate in biological sciences from Masaryk University in Brno in the Czech Republic. In spite of all these honors for his scientific achievements, the one that he may have valued most was the Distinguished Teaching Award that he received from UC Berkeley in 1984. That award reflected the special relationships that he established with his students.

Finally, we would be remiss if we did not try to convey the ebullient personality that has led to Frank being described as “larger than life.” Frank was prone to impatience, a trait that made driving with him an adventure. His imposing physiognomy and conversational style commanded attention at any gathering. This led some people to conclude that Frank was egotistical (or even imperious), when actually he was expressing his natural enthusiasm and playfulness. Frank’s rich voice, hearty laugh, adept choice of words, and Darwinian enthusiasm for any new bit of information all contributed to his charm. He was generous with praise and took as much delight in the accomplishments of others as in his own. We shall miss him. Fortunately, he has left a legacy that will not soon be forgotten.

Acknowledgments

We thank Peter Connors, Harry Greene, Richard T. Holmes, Walter D. Koenig, Ronald L. Mumme, Louis F. Pitelka, and David W. Winkler, who answered our questions about what was going on during the periods when they were working closely with Frank.

Doctoral students and postdoctoral research associates of Frank A. Pitelka*
Ph.D students


Postdoctoral research associates

Tom J. Cade, Guy N. Cameron, Peter G. Connors, Janis L. Dickinson, Susan J. Hannon, Charles J. Krebs, Paul W. Sherman, Jeffrey R. Walters

In addition Frank was an important mentor to many ecologists who were never officially his students. We regret that we cannot include these people because the variety of connections makes it impossible to fairly say who was among them.

*This list was compiled from the names found in Pitelka 1993a (in the bibliography below) and in a newsletter of the International Society for Behavioral Ecology. The newsletter, dated May 1996, may be traced by contacting:

Wendy King
ISBE Archivist
Department de Biologie
Universite de Sherbrooke
Sherbrooke, Quebec
Canada J1K 2R1

Selected bibliography of the ecological publications of Frank A. Pitelka

This selection was drawn from a total of 129 papers in Frank's curriculum vitae. The list, which is in chronological order, was selected to illustrate how Frank's interests evolved and to record the breadth of his contributions.


Richard B. Root
Ecology and Evolutionary Biology
Corson Laboratory
Cornell University
Ithaca, NY 14853

George O. Batzli
Shelford Vivarium
606 E. Healey St.
University of Illinois
Champaign, IL 61820
SOCIETY ACTIONS

Highlights of the 21–22 November 2003 Governing Board Meeting

- Accepted the audit for the year ending 30 June 2003.
- Met with ESA-sponsored AAAS Congressional Fellow Evan Notman.
- Received a status report on the Ecological Visions Project and provided reactions and recommendations to the Visions Committee for consideration as they finalize their report.
- Discussed plans for a planning retreat in February 2004.
- Agreed to award the Sustainability Science Award at the Awards Ceremony held during the ESA Annual Meeting.
- Supported prescreening of applicants for the Buell and Braun awards prior to the Annual Meeting.
- Adopted a Corporate Grants and Sponsorship Policy.
- Reviewed a petition and proposed bylaws for a Canada Chapter and voted to recommend approval of the Chapter to the ESA Council in August.
- Adopted public policy priorities for the coming year
- Approved criteria recommended by the Publications Committee for the review of ESA Editor-in-Chiefs and of the Publications Program.
- Appointed Kiyoko Miyanishi as Program Chair for the Memphis, 2006 Annual Meeting.
- Appointed Catherine Potvin, McGill University, and Christian Messier, University of Quebec–Montreal, as the local co-hosts for the Montreal, 2005 Annual Meeting.
- Reviewed a planning time line for a themed meeting in Mexico in late 2005 or early 2006, and suggested the theme “Ecological Consequences of Trade” for the event.

Minutes of the ESA Governing Board Meeting
21–22 November 2003

The 21–22 November meeting of the ESA Governing Board was attended by Bill Schlesinger (President), Ann Bartuska (Past President), Jerry Melillo (President-Elect), Jill Baron (Secretary), Jim Clark (Vice President for Science), Norm Christensen (Vice President for Finance), Carol Brewer (Vice President for Education and Human Resources), Sunny Power (Vice President for Public Affairs), Margaret Palmer, Ed Johnson, and Oswaldo Sala (Members-at-Large). Also attending were Katherine McCarter (Executive Director), Elizabeth Biggs (Finance Director), Jason Taylor (Education Director), Clifford Duke (Science Director), Sue Silver (Editor-in-Chief for Frontiers), David Baldwin (Managing Editor), and PAO representative Maggie Smith. The meeting was called to order by President Schlesinger at 7:00 pm on Friday, 21 November 2003, and adjourned at 5:00 pm on Saturday, 22 November 2003.
I. ROLL CALL

A. The GB unanimously adopted the agenda.
B. The minutes from the August 2003 meeting were approved with two amendments related to wording of the 2–3 August IID, Ecological Visions Committee.

II. REPORTS

A. Meeting with ESA Auditor

Terri Marrs, an auditor with Gelman, Rosenberg, and Friedman, presented the results of their independent audit of the ESA finances for the fiscal year July 2002–June 2003. She reported a clean opinion and stated that it was a very positive year for ESA. Both she and the Governing Board noted that much of the credit belongs to Finance Director Elizabeth Biggs, who is thorough, careful, and well prepared. The financial report was approved unanimously.

B. Meeting with Congressional Fellow

Dr. Evan Notman, the Congressional Fellow sponsored by ESA for 2003–2004, introduced himself to the GB. He is one of 45 Congressional Fellows sponsored by scientific societies this year, and will be on the staff of the Senate Agriculture Committee, working with Senator Tom Harkin of Iowa. He will be working on issues of farm conservation, specifically pesticide regulations. The GB requested that Notman reflect on his year as a Fellow at the ESA Annual Meeting in Portland.

C. Report of the President

President Schlesinger reported on Capitol Hill activities, including letters about the ruling regarding observance of the Endangered Species Act on military bases, fire policy, revisions to the Endangered Species Act, briefings to Senators on the carbon cycle, and an Inter-American Institute letter to Rita Colwell, Director of the National Science Foundation. President Schlesinger noted that Maggie Smith in the Public Affairs Office deserves credit for much of this work, and the GB thanks her. President Schlesinger also noted that enacting the recommendations of the Visions Committee will be a big agenda item in 2004.

D. Report of the Executive Director and Staff

1) Executive Director McCarter noted that ESA staff have been devoting time to redesigning the web site, building *Frontiers* subscriptions, the Federation of the Americas, manuscript tracking, and education programs. Membership and subscription numbers look good, and the Savannah annual meeting was successful.

2) Education. President-elect Melillo and Education Director Taylor will go to NSF BIO directorate to promote increased funding for SEEDS students to come to ESA meetings, and generally strengthen the links with NSF.

3) Finance Biggs noted that there are 8116 ESA members.

4) Journals. *Frontiers* Editor-in-Chief Silver reported that there are 83 days from submission to acceptance for *Frontiers in Ecology and the Environment*, and the journal has a 53% rejection rate. The journal is
not yet indexed by ISI or BioSys, but *Frontiers* is under consideration by both. President-elect Melillo noted that advertising still needs to improve in order to cover more of the costs of producing the journal. Managing Editor Baldwin announced the imminent inauguration of manuscript tracking for ESA journals.

5) Science. Science Director Duke noted the significant help provided by Rhonda Kranz to the Visions Committee and to the Science Program overall in 2003. The Weed Science meeting was a success, and credit is due to Lori Hidinger. Duke is preparing a proposal to develop a common statement across many societies regarding data archiving.

**E. Reports from Committees**

A written report from the Annual Meeting chairman was submitted.

**F. Financial Updates**

Vice President for Finances Christensen and Executive Director McCarter reported that ESA had a solid first quarter. In stocks, ESA mutual funds are holding steady, while those in the equities fund are slightly higher than they were in January 2003.

**G. Federation of the Americas**

1) A motion was made, seconded, and unanimously approved to add $600 to the funds Member-at-Large Sala now has to increase the print run of three Spanish-version *Issues in Ecology* from 450 to 1000.

2) Discussion regarding the possibility that the 450 ESA overseas members receive a hard copy of *Frontiers* ended with the suggestion that funding for mailing could be an introductory request to a small foundation interested in building international cooperation. Finance Director Biggs will e-mail GB members with the costs of mailing *Frontiers*.

3) As a result of a suggestion from the Meeting of the Americas in August, a letter of support for the InterAmerican Institute for Global Change Research was sent to NSF.

4) Member-at-Large Sala reported on meetings ESA has had with potential funding organizations to support the activities of the Federation of the Americas. The Organization of American States (OAS) Sustainability in the Environment sections, USAID, and NSF International Programs are all interested with varying levels of available support. President-elect Melillo suggests ESA meet with DEB, GEO, and International Programs in February to inform a greater funding base at NSD.

5) ESA staff are exploring the possibility of holding a theme meeting in Mexico in 2005–2006.

**III. DISCUSSION ITEMS**

**A. Ecological Visions Committee Update**

Member-at-Large and Visions Committee Chair Palmer presented a draft report of the Visions Committee, which the GB reviewed and commented on. Among the questions raised during discussion were whether the Visions Report would lead to a sea-change within ESA, what is and what is not part of the role of ESA in implementing the plan, how should ESA bring in partners (national and international), since the vision is larger than ESA alone? Other professional societies named to include early as partners included AIBS, AGU, ASLO, the Agronomy Society, and education societies.
B. A special meeting of the ESA GB will be held February 20 to begin to revise the ESA strategic plan around the recommendations from the Visions Committee.

C. Trends in ESA Revenues, Expenses, And Subscriptions

There was an anticipated decline in individual member journal subscription trends between 1999 and 2003, but institutional subscriptions remained fairly constant. VP Brewer suggested ESA explore the idea of a State University System pricing (“Tier 4”) for multiple universities that share site licenses and subscriptions. It was also suggested that ESA look again into bundling the journals, since students at universities that do not subscribe to one or more ESA journals (such as Duke University) are not exposed to those journals. A discussion of the PLOS initiative noted that there is lots of opposition to the idea of pay-per-view fees for individual manuscripts. Member-at-Large Sala requested to see the trends of Impact Factors for ESA journals in comparison with other society and for-profit journals over time. Other trends observed were increases in both total income and total expenses, with income slightly higher than expenses. The Board asked to see the trends for the Annual Meeting displayed as net revenue per participant. Funding for the Public Affairs Office has not changed since 1999, while other offices within the Headquarters Office have increased. The GB greatly appreciated the information provided by trend lines, and requested similar summaries once a year.

D. Awards Issues

1) Odum Award. Linda Wallace, Chair of the Odum Award, and Carol Brewer, VP for Education and Human Resources, request more recognition for the recipient of the Odum Award, such as presentation of a lecture and/or paper in Frontiers. The GB responded with the idea that the committee consider additional creative activities, such as sponsoring a symposium or a workshop.

2) Buell/Braun Awards. There is a perennial problem of getting enough people to judge Buell and Braun student paper and poster presentations. The GB recommends a pre-screening process and suggests that Sections and Chapters be involved; Secretary Baron will urge Sections and Chapters to support these awards by volunteering judges. VP Brewer will explore student award guidelines from other societies, such as NABS. The Buell/Braun award committee is urged to change the wording of the announcement for submissions to suggest that participation should present the capstone of a student’s career.

3) Sustainability Award. The GB unanimously agreed that presentation of the new Sustainability Science Award be included in the ESA annual award ceremony.

4) Awards Ceremony. The GB agreed that the awards ceremony in the Opening Plenary Session at the Annual Meeting was effective.

E. Canada Chapter

The Board reviewed a petition by 20 Canadian ecologists as well as draft Chapter by-laws and unanimously approved recommending establishment of a Canada Chapter to the ESA Council in August.

F. Corporate Grants Policy

The Board adopted a Corporate Grants Policy for ESA to guide the solicitation and receipt of corporate grants and sponsorships. GB recommended that corporate prospecti and awards are to be approved by the GB prior to solicitation or receipt, and a time limit will be established for how long a sponsor can use the ESA logo.
G. Public Policy Priorities

The PAO proposes that Forest Fire Management, Air Pollution, Endangered Species Act, Marine Issues, Genetically Modified Organisms, and Invasive Species become the topics of focus for 2004. The first four issues are on the legislative agenda, and the last two have pending position papers. Maggie Smith recognized these issues are not exclusive of others that may arise. GB recommended there should be a list of 8–10 experts identified for each of the issues, and will send names of experts to Smith. GB also recommended that a list of the upcoming year’s PAO activities be prepared yearly and brought to the GB in August before the fall legislative session. The list should be reviewed again each May.

H. Editor-in-Chief/Publications Program Review Criteria

The Publications Committee presented review criteria for Editors-in-Chief and for the entire Publications Program to the GB. The GB approves the broad criteria for evaluations. For all EiC evaluations except Frontiers these are: (1) quality and breadth of editorial board; (2) interaction with editorial board and authors; (3) interaction with society membership; and (4) interaction with Managing Editor. For the entire Publications Program, including Frontiers, the criteria are: (1) scientific quality of journals; (2) service to ESA members; (3) scope and breadth of publications; and (4) efficiency and quality of journal production and publication. Details under these broad criteria need not be spelled out explicitly, but the Governing Board requested that the evaluations presented to them reflect how each criterion was specifically reviewed. Review committees for EiC and the Publications Program should be recommended by the Publication Committee to the Governing Board.

I. Meeting Issues

1) Montreal 2005 symposia. The GB voted unanimously to cap the number of symposia at 24 for the joint meeting of ESA with INTECOL, but to encourage all symposia to reflect the international flavor of the meeting. The GB strongly suggests ESA and INTECOL work as partners to develop themes for the symposia.

2) Program Chairs

a) There was approval of Kiyoko Miyanishi as the Program Chair for the 2006 meeting in Memphis, Tennessee, with Ed Johnson abstaining.

b) Names were suggested as possible Program Chairs for 2007 and 2008 and will be forwarded to the Meetings Committee for consideration. The Board looks forward to the Meetings Committee returning with recommendations.


4) Mexico Meeting

Discussion centered on possible themes and program chairs for a meeting in Mexico to be held in the winter of 2005. The GB felt that the theme of the meeting should be decided before appointing program chairs, and possible topics (partnerships for the planet, ecological consequences of trade, GMOs, and bioprospecting) were added to the list already developed by the Meetings Committee. Theme possibilities should be cycled back to the Federation of the Americas leaders. The Mexico Chapter should be involved in planning the meeting.
J. Position Paper Updates

The GB wonders if the Invasive Species paper under construction by Lodge et al. could be produced in time for the March 2004 AIBS invasive species theme meeting. VP for Science Clark will ask for a ~ 5-page distillation of the Biodiversity paper, which is currently being considered for publication in *Ecological Applications* or *Ecological Monographs*. Secretary Baron will check on guidelines for the role of the Governing Board on position papers.

K. New Business. There was no new business.

Respectfully submitted,

Jill Baron, Secretary
Ecology 101

Note: Dr. Harold Ornes is the editor of Ecology 101. Anyone wishing to contribute articles or reviews to this section should contact him at the Office of the Dean, College of Science, Southern Utah University, Cedar City, UT 84720; (435) 586-7921; fax (435) 865-8550; email: ornes@suu.edu

The recruitment of new faculty members is an important function of any university academic department. Once hired, the new recruit is often faced with a significant portion of their time devoted to teaching. Of course, another significant portion of time is devoted to research, and another significant portion of time is devoted to service.

I think the following article by Karen Wilson, University of Toronto, and Stephanie Hampton, University of Washington, will be useful for both rookie and the veteran professors. Whether you are at a R-1 university or private undergraduate campus, the emphasis on quality classroom instruction begins with your first semester and continues through posttenure review. If you can document that you are effectively using most of these methods and strategies suggested by Wilson and Hampton, your students will benefit and the teaching portion of your promotion and tenure application will be applauded.

Harold Ornes

Ecology Teaching Tips for First-year Professors

The first term of teaching undergraduate and graduate courses as a new faculty member is an especially challenging new duty for those who have no previous teaching experience, but also can be unexpectedly difficult for those who thought they were prepared by graduate teaching assistantships. Teaching assistantships introduce us to many fundamental educational concepts, increase our comfort with teaching, and may have even taught us to prepare a lecture or two, but creating and delivering an entire course—or several different courses in the same semester—is often beyond the training graduate students receive. The tips in this article emerged during the fifth DIALOG Dissertations Initiative for the Advancement of Limnology and Oceanography Symposium <http://aslo.org/phd.html> for new Ph.Ds in Limnology and Oceanography as we shared our experiences in the 1-year sabbatical replacement positions we each took prior to our postdoctoral research positions. We both feel we had excellent training as graduate teaching assistants, but were still somewhat overwhelmed when we faced numerous unanticipated questions and challenges in our first year of faculty-level instruction. In these jobs, all our time and energy was consumed by teaching, and we learned to teach in proverbial trials by fire. We have organized the tips into four categories: (1) getting started with a course, (2) teaching style and resources, (3) methods of teaching other than lectures, and (4) course evaluations. Our primary goal in compiling these hints is to deliver some information that would have greatly reduced the first-term panic we felt, and the amount of time we spent in self-instruction. Additionally, we have included many tips for making the experience more enriching for both you and the students. In the busy life of a new professor, incorporating all of these suggestions into your teaching
at once would be overwhelming. Start slowly, and allow your teaching to build over time.

1) Getting Started

- When preparing a new class (or revamping an old one), ask for syllabi, notes, slides, etc. from your advisor, mentors, and fellow new professors (or whomever you are replacing while they are on sabbatical). Don’t worry about using other people’s work; you’ll find yourself modifying other’s lectures to meet your own specific needs and character. You can return your colleague’s generosity by giving your benefactor your version of the notes when you have finished your class, scanning your advisor’s slide collection into digital form in return, or passing your notes on to the next sabbatical replacement in line.
- Get to know lab coordinators, IT personnel, secretaries, grant coordinators, and housekeeping staff quickly and treat them well. These people are essential.
- Order your “free” examination copy of textbooks from the publisher at least 6 months before your class will occur. You may need a letter from your Department Chair confirming the name of your course and enrollment, but most publishers will send things for free, or charge only for shipping. Find the publisher’s web page for information on how to order. Be aware that once you are in their database, publisher representatives may e-mail and call you indefinitely.
- Make a syllabus:
  - Put some thought into your syllabus as far in advance as possible (i.e., not the night before the first class).
  - Your first syllabus may closely resemble the syllabus of a senior colleague, but not necessarily. Take ownership of your course.
  - Realize that it is initially very rare to have the order of lectures, and even content, remain the same over the term. Don’t worry about changing the order of your syllabus as you go along, but do give students fair warning. However, it is unfair to increase your students’ workload as the term progresses or change the dates of major exams or projects.
  - Syllabus should state clearly your course objectives, your expectations for students, and how you will grade the students. Be very specific with regard to class policies. See below for some topics to cover on grading.
  - Think through the timing of your assignments, exams, long labs, and field trips. Ask other professors when students are usually bogged down in midterm exams, and try to have large assignments due at other times. If your students commonly take a set of courses together, work with their other professors to set nonoverlapping exam days.
  - Scan the Web for examples of syllabi from other courses to give you an idea on how others have organized the information.
- Set up a course web page. Course web pages are a great way to keep in contact with students and quickly disseminate information. Support staff are generally available to help with setting up course pages, but even simple, functional web pages can be created using commonly available programs such as the Composer page in Netscape.
  - A course web page can be a place to:
    - Post handouts for students to download before or after class; this system eliminates an enormous amount of paper waste from students who miss class. If you have students download their own handouts to bring to lecture, you must post them several days in advance of the class.
    - Post take-home exams or homework assignments
    - Post instructions for term projects or research papers, course expectations, or links to other information.
    - Post your updated syllabus and reading list (very useful for the first time you teach a course when the order of lectures and assignments is often in flux).
    - Share articles/readings (in pdf format)—note that because of copyright restrictions, you may need to limit this part of your web site to your students only (password-protected).
- Share data files.
- Before the term begins, familiarize yourself with your institution’s policies and resources for:
  - Accommodation of learning disabilities
  - Failing students
  - Dishonesty issues (e.g., cheating on exams, plagiarism)
  - Student mental or physical health
  - Know who to call or where to send students if issues arise (they will, unfortunately)

2) Teaching

- Preparing lectures. For those of you who came of age in a big-school environment, realize that lectures aren’t the only way to teach, and, in many cases, may not be the best or most enjoyable technique!! See Part 3 for some other ideas.
  - Time management is critical
    - Limit the time you spend researching and preparing each lecture – some can do it in 2 hours per 1 hour lecture, but others (like us) need 6–8 hours per lecture, at least the first time through. If you are starting from scratch, you’ll need at least 6 hours per lecture the first time through (and possibly twice that).
    - If you have a chance to prepare some but not all lectures for a new course before the term begins, prepare lectures for the first week or so and do a good job outlining your main points for each lecture for the rest of the term. Then complete lectures that you can spread out across many weeks so that for the remaining weeks in the term, you only have to complete two instead of three new lectures a week. Having a break one day a week will make your first term bearable.
    - Always have a big-picture general-interest lecture or two in your back pocket just in case things get crazy and you cannot complete a scheduled lecture. In a Limnology course, we have used topics with which we are very familiar, such as eutrophication, food webs, and biomanipulation as “safety” lectures because they often fit just as well interspersed throughout the course or at the end.
    - See Fig. 1 for suggestions on how to manage your time. It is helpful to have a copy hanging above your desk.
  - Lecture Style
    - The key point to remember is that students need to be able to listen to you at the same time that they write notes. Some instructors try to eliminate note writing by giving extremely thorough handouts to students, but we have had students tell us that they frequently stop paying attention if they don’t have to write notes. At the other extreme, instructors may not provide a handout at all, which forces students to watch them and write everything. If you use the latter tactic, honestly evaluate whether your lecture style allows students to write everything down while listening. We have found that an intermediate approach, with handouts that function as an outline of the lecture and include copies of key figures, can be very effective.
    - PowerPoint lectures are a great way to organize information and present (and archive) photos, figures, and notes in one medium.
      - HOWEVER students often dislike PowerPoint lectures because it is so easy to make them impossible for the student to follow:
        - No student can copy notes as quickly as you can flip through slides.
        - Students will copy EVERYTHING on your slide, regardless of its relative importance, and ignore what you are saying while they write.
        - If you post your complete PowerPoint lectures on your website, you may find that students will not attend class.
### Ways to improve PowerPoint presentations:
- Use SIMPLE animation (like “appear”) to bring in one point at a time when you are actually talking about it (not before).
- Do not use full sentences on your slide; write everything shorthand, as you’d expect your student’s notes to read.
- Never put a slide up (photo, graphs, or words) that you are not ready to talk about. If using a photo as a transitional slide, at least tell the students what it is before launching into a preamble. This prevents them from wondering, “What is that?” as you talk to them.
- Make sure your font is simple (sans serif) and at least 20 pt. For instance, Arial is easier to read from a distance than Times New Roman.
- Use the board in conjunction with PowerPoint:

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**Fig. 1.** At times it helps to be reminded what is really important and urgent, and what is not. Redrawn from *Seven Habits Of Highly Effective People* by Stephen R. Covey (1990).
For example, show vocabulary words in PowerPoint, but write the actual definition on the board.

For life cycles and other diagrams, work through the details of life cycles on the board, using simplified, easily copied drawings. Then use PowerPoint to present a final, full-color version.

Remember, when you write (or draw) on the board, most students can keep up with the pace of your writing. This virtually eliminates the dreaded and disruptive, “Can you go back to the last slide?” question.

- Be animated! Enthusiasm is ok! You are on stage!
- Students love photos. Photos of organisms and places make a big difference in increasing student enthusiasm. See below for some tips on resources.
- Get feedback on your teaching effectiveness as you teach:
  - Ask your department chair to watch you teach and give you feedback. This is especially important if you’ll be applying for jobs and need a reference for your teaching.
  - Some schools offer a service in which specially trained students sit in on the class and give you feedback on your lecturing. Teaching assistants can also give you invaluable information on your lecture style and the corresponding comprehension of your students.

- Watch your colleagues teach (especially the ones that are well liked).

### Teaching Tools

- The best lecture is a good, captivating story, with a clear message. It is always a good idea to outline exactly what you want students to get from a lecture in the beginning of your lecture, even if the lecture is one long story from start to finish.

Adobe Acrobat (the program you pay for, not download free) allows you to copy figures/photographs out of pdf files (i.e., new, exciting full-color research from *Science* or *Nature*). A small golden key symbol indicates the document is locked and you may not be able to copy figures (or text), but some files allow you to turn this security feature off. Be sure to indicate the source for each figure on your slides as an example of proper citation format and policy.

- Always keep track of the references you used to construct a lecture, either at the end of the PowerPoint presentation, or in a “notes” file. You’ll be happy you did when you revise or review the lecture later.

- You can reduce paper waste by saving teaching materials in electronic format: pdfs of source articles, lecture notes with relevant references, photos, etc. We suggest archiving your files on a CD after each term is finished.

### Distill your messages!

- Beware that it is really, really tempting to dump a huge amount of information on the students (because you know there is so much to learn!) but you must resist! Use a message box (Fig. 2) to figure out your main points and stick with them. Don’t be afraid to drop a lecture or two and use the time for good discussions or active learning instead (see below).

- A “question of the day” presented at the end of lecture is a useful method to challenge students to use what they learned in lecture that day. You can have them turn in the question the next lecture for credit (also a way to monitor who is showing up in class) or use a few of the questions as exam materials. In either case, you can start the next lecture by bringing up the question and working with the class to figure out the (an) answer—a good informal way to start lectures that gets everyone thinking and involved and provides a bridge between class periods.
Fig. 2. The message box is an excellent method for pinpointing your take-home message in lectures, or in research. Begin by succinctly stating the issue or topic of your lecture. Then consider what the problems are related to this issue, and why students should care. What are the solutions to this issue? How can we benefit from understanding this issue? Be specific and logical. Adapted from materials from SeaWeb.

- Be approachable!
  - If you don’t know the answer immediately, tell the student that it’s a great question, but you don’t know at the moment, and that you would be happy to find out. But ask the student to contact you for more information, so you don’t have to remember to get back to that student along with everything else you have to do.
  - Encourage questions in class. Ask colleagues for advice on soliciting student participation in class; they have a wealth of experience and a diversity of solutions! For example, you can stage a series of your own innocuous questions for students just so they can hear their own voices in class, such as “Has anyone ever seen >insert interesting phenomenon or organism<?”
  - Set specific times for office hours: students know when they can definitely find you, and you protect the uninterrupted time necessary to concentrate on other responsibilities. Requiring students to come to your office hours in the beginning of the term (to discuss a term project or receive their first exam) will break the ice and make it easier for them to return on their own later in the term.

- Information sources:
  - Use Google.com/Images to search for photos to use in lectures. It is not clear what the legality is behind this, but cite the web page and photographer (if available) and only use the images for educational purposes. To download the photo, right-click on the photo on the web page you want, and select “Save as.” Create a digital photo library classified by subject.
  - Build a good personal library of texts, compelling articles, and your own digital photos for quick
reference when making lectures. The more photos and stories you use, the better the students will remember your main points. Your school may have personal development funds you can use for purchasing texts and specialized subject books that your library may not have. Having multiple textbooks allows you to judge which to use in class, and you can introduce figures and examples not used in the students’ text. Other texts provide a fast way for you to find multiple examples of the same phenomenon to show your students, when a primary literature search is not possible.

- Creating handouts
  - Pass out lecture outlines that follow your PowerPoint lectures. To easily outline a PowerPoint lecture, put PowerPoint into outline view, copy the text, and paste into a word-processing program. Paste into your document as unformatted text or the default. Then copy graphs and figures directly out of PowerPoint and into the document. In Microsoft Word, paste PowerPoint figures in as a picture using paste special (not as a PowerPoint object). Be sure to format the resulting “picture” as “in front of text” (Go to format/picture/layout/”In front of text”) so it is easy to reposition the figure.
  - Use the handout to outline the lecture, highlight main points, and provide places for students to fill in extra notes, write out definitions, and draw on figures. Do not put as much wording on your handout as you have in your slides. They must WRITE for themselves.

3) Learning situations other than lectures (often much more enjoyable and memorable for all involved)

- Discussions
  - Ways to make discussions successful:
    - **A good discussion requires as much preparation as a lecture;** don’t use a discussion when you don’t have time to put a lecture together.
    - Break your class into small groups (you may want to pre-assign these groups to speed the process). Mix the groups up from discussion to discussion.
    - Have the students prepare for the discussion by reading materials or doing research before class. Insure the preparation is done by requiring students to turn in a written summary that includes their opinions on the topic.
    - Use good topics such as current or controversial issues, or issues to which the students can easily relate. Issues that affect their family or hometown are often useful. You might also ask the students to suggest topics.
    - Another form of discussion is to have students take sides, but again, the more work your do organizing before the discussion, the better it will go. Do your homework.
    - Be prepared to devote your entire class period to the discussion if possible. Good discussions take time.

- Student teachers: Another way to give yourself a little breathing room is to allow students in your course to do some of the teaching. However, you’ll need to work with the students to make sure things go well and the class period is worth everyone’s time, so you should dedicate some time to working with the students before they present. I’d suggest an initial meeting to discuss their topic, and a final meeting to check for glaring mistakes, etc. Be sure to give the students a good model of what will be expected of them. Student teaching gives students ownership of the course and helps with public speaking and confidence building.

- Guest speakers: still another way to break up the monotony of the lecture course is to bring in new and exciting guest speakers. Old friends from graduate school are a great asset, as are mature, well-advanced graduate students. Encourage your guest speakers to talk about their own work, show interesting photos, movie clips, and lots of enthusiasm.

- Case studies: As another approach to learning, many teachers use case studies to get the point across in a nonlecture way. Be sure you are clear on the take-home message. Check out these web sites for some examples:
Field trips: Include a handout with questions students will need to turn in to keep the students focused. Give them other ways to report back (photos, poster session, etc). In our opinion, the best field trips incorporate inquiry-based learning (see below) or generate data that can be used later for writing scientific papers.

Inquiry-based learning: It works the students through the scientific process from discovery (observation and accident) to inquiry, during which the student designs experiments to test hypotheses that arise from the discovery phase. Many teachers are using this approach for labs (and classrooms) rather than the “canned” labs of old. Inquiry-based learning is something to look into if you don’t already do it. Lots of information on the web.

Poster sessions: A great way to show off your student’s work and let the department know what your class has been doing. Rather than having students sit at their posters while you walk around and interview each group, assign each person a set of posters that they must visit and evaluate over the course of the poster session. Leave it to the student groups to be sure they have a representative present at their poster at all times. Pre-made evaluation forms, plus preassigned posters, are a must. This scheme makes 2 hours go by very quickly. Food and drink also help tremendously.

Service learning: This is a great twist on the old term-paper standby. In this case, the idea is that each student, or group of students, does research or some other activity that also functions to help an organization or cause. The end goal is to have a product that can be shared with others. In an environmental studies course K.A.W. taught, students interviewed potential users of a proposed light rail project and wrote to the congressman and local newspapers with their findings; another student created a web site for a caving group interested in preserving a group of caves; another group of students investigated food waste in local eateries, and still another group wrote an environmentally based kids story and then read it to preschoolers. A poster session at the end of the term allowed students to share their work with classmates and faculty and friends. This is a great way to do outreach with the help of your students and gives them a purpose to their learning. Once again, the more preparation on your part (such as making initial contact with local nongovernmental organizations), the better things go.

Always encourage the use of primary literature (not just web sites!!).

4) Evaluations

Of your students:

Grading: you must articulate a grading policy when you make your syllabus. How are points allocated to each assignment and exam? Students will challenge you if you deviate from this policy. Several questions to ask yourself about your grading policy before students ask you in class:

- What are the cut-off percentages for “A,” “B,” and “C,” and do they change from exam to exam?
- Do you offer any means for students to “make up” exams or assignments, and what are the rules to do so?
- Do you offer “extra credit” and how?

Above and beyond the final exam, consider using a simple quiz during the first lecture to evaluate the level of basic understanding that your students have before you proceed. Or use the quiz to
demonstrate what the students probably do not know, then give them the quiz at the end of the term to see what they’ve learned.

- Of your teaching:
  - Conduct informal **mid-term evaluations** with your students, so you can improve your teaching before it’s too late. This is also a chance to ask your own evaluation questions, like: “Of the two different assignment types, which do you learn the most from?” or “Is the speed of the lectures good for you?” or “What has been your favorite lecture thus far and why?” and so on. Be sure to ask you students to offer constructive criticism, and keep in mind the limitations of the situation. These evaluations really help. If nothing else, the students feel as though they’ve had a chance to contribute to the direction of the class.
  - Add your own questions onto your department’s end-of-term evaluations, especially if you’ve tried a new technique or format for your course.
  - Evaluating the dreaded student evaluations: keep in mind that it is very difficult to please everyone and it’s difficult not to take evaluations personally. A good course evaluation might mean that 90 percent of the students love you, and 10 percent dislike you. If it’s more like 50:50, or 20:80, you probably need to improve your teaching style or effort.

**Other resources:** We suggest perusing journals such as the *Journal for College Science Teaching* for some more details of many of the subjects we’ve raised in this article. For instance, Druger (2000) presents more thoughts on exams and grading; Yuretich (2003) discusses ways to encourage critical thinking through modifications of lecture style and content. The web may also provide good guidance; for instance, the web site [http://www.unl.edu/gradstud/GSAP/101things.html](http://www.unl.edu/gradstud/GSAP/101things.html) contains a great list of things to do in the first few weeks of class.

**Finally, a comment on sustenance.** Get to know other new professors or sabbatical replacement professors early and keep in touch even when things get absolutely crazy. Get a beer, coffee, or cookie even if you have only a half hour before you have to go back to work. You’ll need the opportunity to discuss successes, and failures, with someone in the same position as you. Venting to your department chair, especially if you’ll need a recommendation in the future, may be politically unwise.

Good luck and enjoy!

**Acknowledgments**

Many thanks to participants in the fifth DIALOG symposium for their inspiration and interest in Teaching Hints for First-Year Professors, and DIALOG organizers Susan Weiler and William (Monty) Graham. We also thank our colleagues and students at Carleton College (Northfield, Minnesota) and the University of Nevada (Reno, Nevada) for their gracious guidance during our tenures as Visiting Assistant Professors. Thanks to Phil Camill, who provided an excellent teaching role model at Carleton College, even while on sabbatical. Finally, our interest in teaching ecology can be largely attributed to the fine examples set by our mentors in graduate school: John Magnuson, John Gilbert, and Carol Folt.

**Literature cited**


Karen A. Wilson
Department of Zoology
University of Toronto
25 Harbord Street
Toronto, Ontario M5S 3G5 Canada
(416) 946-7232
E-mail: k.wilson@utoronto.ca

Stephanie E. Hampton
School of Aquatic and Fishery Sciences
University of Washington
Seattle, WA 98195
(206) 543-7546
E-mail: shampton@u.washington.edu
M E E T I N G S

Calendar

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

All scientific sessions to be held under one roof at the beautiful new Oregon Convention Center (OCC), boasting award-winning sustainable design and offering spacious meeting rooms, affordable wireless Internet access, and on-site Starbucks, Kinko’s, and micro-brew outlets

Program to include 24 Symposia, 45 Workshops and Evening Sessions, 26 Scientific Field Trips and Tours, and over 100 oral and poster presentations, as well as business meetings and mixers, brown bag lunch discussions, and ticketed social events

Program Highlights

- Sunday, 1 August–Opening Ceremony featuring Grande Ronde dancers and Public Plenary with Dr. Patricia Limerick, historian and author; All-Society Welcome Mixer–”Pacific Northwest Sampler”

- Monday, 2 August–Awards, Opening Plenary, and Keynote Address by Dr. Daniel B. Botkin, noted Lewis and Clark scholar; presentation of the ESA Scientific Visions report

- Tuesday, 3 August–Evening Session with Pacific Northwest Authors and Poets David James Duncan, Craig Lesley, Kathy Moore, and Liz Woody followed by book signing

- Wednesday, 4 August–Federal Leadership in Ecological Research Plenary with the Directors of the USGS, U.S. Forest Service, and NOAA

- Thursday, 5 August–ESA Social at the World Forestry Institute and Discovery
- Friday, 6 August–Annual Meeting Summary Breakfast with panelists Jerry Melillo, Peter Vitousek, Kay Gross, Jayne Belnap, Jerry Franklin; Newsworthy and Late-breaking Poster Sessions

- Dedicated exhibit/poster presentation hours during Poster Pubs with sponsored snacks and cash bars Monday through Thursday and during Posters and Pastries session on Friday

The 2004 Scientific Program Includes 24 Symposia

<table>
<thead>
<tr>
<th>Title</th>
<th>Organizers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biological Invasions: Species Exchanges Between Eastern Asia and North America</td>
<td>Young Choi, Richard Mack, Shili Maio, Harbin Li</td>
</tr>
<tr>
<td>Complex Interactions Between Human Population and the Environment: Integrating Demographic, Socioeconomic, and Ecological Perspectives</td>
<td>Jianguo (Jack) Liu, Rebecca Clark</td>
</tr>
<tr>
<td>Cultural and Environmental Controls on Past Fire Regimes in Inhabited Woodlands</td>
<td>Bryan Shuman, Emily Heyerdahl</td>
</tr>
<tr>
<td>Digging deeper or scratching the surface? Exploring ecological theories in urban soils</td>
<td>Mitchell Pavao-Zuckerman, Loren Byrne</td>
</tr>
<tr>
<td>Disease Ecology and Declining Populations: Analyzing and Predicting Disease in Sensitive Populations</td>
<td>Liz Harp, Jeffrey Lake</td>
</tr>
<tr>
<td>Echoes from the Past: Remote Sensing of Land-use Legacies and their impact on Ecosystem Function</td>
<td>Steven Hamburg, John Mustard</td>
</tr>
<tr>
<td>Ecohydrology: Towards an Ecologically Meaningful Water Budget.</td>
<td>David Breshears, Osvaldo Sala</td>
</tr>
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<td>Title</td>
<td>Authors</td>
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<tr>
<td>Ecological Implications of Fuel Reduction Treatments to Reduce Fire Hazard in Forested Landscapes.</td>
<td>Eric Knapp, Jon Keeley, James McIver</td>
</tr>
<tr>
<td>Ecological Implications of Phenotypic Plasticity.</td>
<td>Benjamin Miner, James Vonesh, Mike McCoy</td>
</tr>
<tr>
<td>Ecological Recovery After the 1980 Eruptions of Mount St. Helens.</td>
<td>Virginia Dale, Frederick Swanson, Charles Crisafulli</td>
</tr>
<tr>
<td>Ecological Theory and Rangeland Sustainability: Local Strategies, Global Solutions</td>
<td>Elizabeth King, Jeffrey Herrick, Jacoby Carter</td>
</tr>
<tr>
<td>Exotic species: a source of insight into ecology, evolution, and biogeography</td>
<td>Dov Sax, John Stachowicz</td>
</tr>
<tr>
<td>Family Dynamics.</td>
<td>Michael Neubert, Joan Roughgarden</td>
</tr>
<tr>
<td>Fighting the odds: the challenge to save the sagebrush biome.</td>
<td>Clifford Duke, Steven Knick</td>
</tr>
<tr>
<td>Frontiers in the Biogeosciences: Ecology and the Earth Sciences.</td>
<td>Alan Townsend, Jason Neff</td>
</tr>
<tr>
<td>Functional significance of mountain biodiversity.</td>
<td>William Bowman</td>
</tr>
<tr>
<td>Geographical Ecology: Variation in and Control of Species Interaction Intensity Over Regional and Global Scales</td>
<td>Bruce Menge, Sergio Navarrete.</td>
</tr>
<tr>
<td>In the Footsteps of Lewis and Clark: Rediscovering Earth from land to sea—a Biogeoscience perspective</td>
<td>Pallaoor Sundareshwar, Connie Crandall, James Elser</td>
</tr>
<tr>
<td>Is Microbial Ecology Fundamentally Different? New Insights into Patterns and Controls of Microbial Diversity</td>
<td>M. Claire Horner-Devine, Brendan Bohannan</td>
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<tr>
<td>Title</td>
<td>Organizers</td>
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<tr>
<td>Resistance, Resilience, and Multiple Stable States: Defining Endpoints</td>
<td>Daniel Sarr, Paul Hosten</td>
</tr>
<tr>
<td>and Recovery Pathways for Damaged Ecosystems.</td>
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<tr>
<td>The Evolution of Ecology in Mexico: Research Challenges and the Role</td>
<td>Marisa Martinez, Robert Manson, Patricia Balvanera</td>
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<td>of Mexico–U.S. Collaboration</td>
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<tr>
<td>Un-Plowing the Land: Restoring Agroecosystem Health and Function.</td>
<td>Lisa Schulte, Heidi Asbjornsen, Matt Liebman, David Andow, Tom Crow, Alison Power</td>
</tr>
</tbody>
</table>

**Contributed Oral Paper Sessions and Poster Sessions, Special Sessions, Workshops (Sunday, Lunchtime and Evening), Discussions and Unique Evening Sessions**

And, New This Year, 36 Organized Oral Sessions

<table>
<thead>
<tr>
<th>Title</th>
<th>Organizers</th>
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</thead>
<tbody>
<tr>
<td>Anthropogenic Disturbances to Western Alpine Lakes: Past, Present,</td>
<td>Jasmine Saros, Craig Williamson</td>
</tr>
<tr>
<td>and Future</td>
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</tr>
<tr>
<td>Biocomplexity Scaling: An Ecological Perspective</td>
<td>Madhur Anand, Frederic Guichard</td>
</tr>
<tr>
<td>Biological invasions: model systems for studying rapid evolution</td>
<td>Heather Davis, Michael Blum</td>
</tr>
<tr>
<td>Coarse Woody Debris: Lessons Learned, Current Knowledge and Future</td>
<td>Kristine Metzger, Daniel Tinker, Monica Turner</td>
</tr>
<tr>
<td>Directions.</td>
<td></td>
</tr>
<tr>
<td>Community Stewardship Organizations: Potential Laboratories for</td>
<td>Fred Bosselman, William Shaw, John Shepard</td>
</tr>
<tr>
<td>Ecological Research</td>
<td></td>
</tr>
<tr>
<td>Ecological Implications of Phenotypic Plasticity</td>
<td>Michael McCoy, James Vonesh, Benjamin Miner</td>
</tr>
<tr>
<td>Ecological insights from long-term studies in environmental biology</td>
<td>Saran Twombly, Michael Bowers</td>
</tr>
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<td>Authors</td>
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<td>----------------------------------------------------------------------</td>
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<tr>
<td>Emerging approaches for the analysis of stochastic ecological data: dealing with multiple error sources, hidden states, complex non-linearities, and uncertainty.</td>
<td>Eli Holmes</td>
</tr>
<tr>
<td>Estimating carbon dynamics in forested and deforested landscapes of Costa Rica</td>
<td>Flint Hughes, Boone Kauffman, Alex Pfaff</td>
</tr>
<tr>
<td>Exotic species invasion dynamics: Who, what, when, where, and why?</td>
<td>Susan Beatty</td>
</tr>
<tr>
<td>Exploring an Invasion From Molecules to Landscapes: Nonindigenous Cordgrass in Pacific Estuaries</td>
<td>Debra Ayres, Sally Hacker</td>
</tr>
<tr>
<td>Forest Canopies as Participants in Ecosystem and Landscape Ecology</td>
<td>Nalini Nadkarni, David Shaw</td>
</tr>
<tr>
<td>From Idea to Reality: Applied Science and Ecological Problem Solving in the National Forest System</td>
<td>Hugh Safford, Tom DeMeo, Richard Holthusen,</td>
</tr>
<tr>
<td>Genetic Explorations of the Seascapes: Using Molecules and Experiments to Understand Marine Biodiversity</td>
<td>Erik Sotka, Robert Thacker</td>
</tr>
<tr>
<td>Human Ecosystems: Trajectories, Information, and Organization</td>
<td>John Stepp, David Casagrande</td>
</tr>
<tr>
<td>Impacts of Urbanization on Plants and Animals</td>
<td>Roarke Donnelly, Matthias Leu</td>
</tr>
<tr>
<td>Indicators for Monitoring the Health of USA Forests</td>
<td>Susan Will-Wolf, Christopher Woodall</td>
</tr>
<tr>
<td>Integrating Approaches to Connectivity: Landscapes, Patches &amp; Networks</td>
<td>Christopher Brooks, Nick Haddad</td>
</tr>
<tr>
<td>Interannual Climate Variability: How temporal signatures can drive ecosystem processes</td>
<td>Linda Wallace, Jay Arnone</td>
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<tr>
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<td>Authors</td>
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<tr>
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<tr>
<td>Invasive Ecosystem Engineers in the West: Effects on Community Function</td>
<td>Elizabeth Brusati, John Lambrinos</td>
</tr>
<tr>
<td>Lewis and Clark’s Encounters With Wildlife and Native Americans—A GIS Analysis</td>
<td>Andrea Laliberte, William Ripple</td>
</tr>
<tr>
<td>Linking Species-Level Processes to Ecosystem Level Change: Climate Change and Insect Pest Disturbance</td>
<td>Dennis Ojima, Jesse Logan</td>
</tr>
<tr>
<td>Natural Enemy Escape as a Mode of Exotic Species Invasions: Theory, Evidence, and Implications</td>
<td>Steven Franks, Paul Pratt</td>
</tr>
<tr>
<td>Education: Environmental Justice</td>
<td>Leanne Jablonski, Charles Nilon</td>
</tr>
<tr>
<td>Organic N Cycling in Terrestrial Ecosystems: A Synthesis of Current Knowledge with Implications for Future Research</td>
<td>Adrien Finzi</td>
</tr>
<tr>
<td>Organisms as Ecosystem Engineers: Conceptual Progress, Limits and Challenges</td>
<td>Justin Wright, Clive Jones</td>
</tr>
<tr>
<td>Parasites and host social organization</td>
<td>Sonia Altizer, Charles Nunn</td>
</tr>
<tr>
<td>Partners in Diversity—Mycorrhizas and Oaks</td>
<td>Caroline Bledsoe, Ian Dickie</td>
</tr>
<tr>
<td>Recovery of Rare Species and Communities in Pacific Northwest Prairies and Oak Woodlands</td>
<td>Peter Dunwiddie, Scott Pearson, Tom Kaye</td>
</tr>
<tr>
<td>Restoration effects of fire and thinning treatments on mixed-conifer ecosystems</td>
<td>Malcolm North, Jim Innes</td>
</tr>
<tr>
<td>Field Trip and Tour Offerings Include (but are not limited to):</td>
<td></td>
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<tr>
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</tbody>
</table>

### Overnight Trips prior to the Meeting
- Klamath Basin
- Semi-arid Oregon
- Olympic National Park
- Oregon Coastal Science and Education

### Oregon Dunes

#### Day Trips on Sunday, 1 August
- Andrews LTER
- Forest Management in the Western Cascades
- Mt St Helens Pre Meeting, East Side
- Spotted Owl Habitat
- Tillamook Estuary
- Columbia River Gorge Fish and Bonneville
- Old Growth Ecology and Policy
- Lichens
- Portland Gardens (included in a Workshop)
- Portland Urban Ecology

#### Midweek Trips
- Canopy Crane Trip (three days in the early morning)

<table>
<thead>
<tr>
<th>The Mechanics of Integrating Ecological Science and Public Policy</th>
<th>Kathleen Weathers, Tanya Rios, Kathy Fallon-Lambert</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valuation of Ecological Resources: Integration of Ecology and Socio-economics to Inform Environmental Decisions</td>
<td>Lawrence Kapustka, Ralph Stahl</td>
</tr>
<tr>
<td>Incorporating Ecological Science in the Northwest Forest Plan: Evolution, Application, and Effectiveness of the Plan</td>
<td>Jerry Franklin</td>
</tr>
<tr>
<td>Human Dominated Ecosystems: Opportunities and Challenges for Ecology</td>
<td>Marina Alberti, Jeff Hepinstall</td>
</tr>
</tbody>
</table>

### Wednesday Scientific Field Trip
- Columbia River: Then and Now

### Post Meeting Trips
- Mt St Helens Post Meeting Forests and Fish
- Columbia River Estuary -- Birds
- Willamette Valley and Cascades Wildfires

### Special Tours
- Wine Tasting at McMenamin’s (Portland Pub and Winery)
- Pub Crawling in Portland’s Micro Breweries
- Chinese Gardens Docent Tour and Dutch Treat Lunch at the Tea House
Register Early and Save

Registration will open in early May. Register by the Early Bird deadline, 5 pm Eastern Daylight Time on Thursday, 17 June 2004, to take advantage of lowest fees offered:

- $225 - Regular ESA Member
- $310 - Regular Nonmember
- $115 - Student ESA Member
- $145 - Student Nonmember
- $145 – K-12/Pre College Educator

More Ways to Save:

Save money on lodging: book through the ESA Housing Bureau (opening in May). Conference rates range from $89–$127 per night plus tax at downtown economy, full service, and boutique hotels (all within walking distance of the OCC) OR $30-$55 per night (including shuttle transportation to the OCC) for single or double dormitory rooms and residence halls with kitchen facilities.

Discounts on airfare and car rentals will be also available through the official ESA travel agency. In addition, Portland is served by the MAX LINE light rail system that provides convenient and inexpensive service between the airport and downtown and free service within the downtown area.

Additional information about meeting schedule and amenities as well as related forms will appear in the Preliminary Program.

Check the Meeting web site [http://www.esa.org/portland](http://www.esa.org/portland) for more information and registration in May.

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2004 North American Forest Biology Workshop

The 18th North American Forest Biology Workshop, sponsored by the Physiology and Genetics Working Groups of the Society of American Foresters, will be hosted by the School of Forest Resources and Environmental Science, Michigan Technological University, 11–15 July 2004. The Workshop theme will be “Managing Forest Resources in the 21st Century: An Integrated Approach.” The meeting will focus on the state of the North American forest resource featuring the expansive forests of the Upper Midwest, current environmental challenges, and how to preserve ecological function while providing for an increasing diversity of demands from society. The vast aquatic and forest ecosystems, and rich history, make Michigan’s beautiful Upper Peninsula an ideal venue for this year’s meeting. Daily flights from Minneapolis-St. Paul International Airport make travel to Houghton convenient and a great place to vacation before or after the meeting. For more information on the meeting program, travel, housing, and vacation opportunities visit the meeting web site at [www.forestbiology.org](http://www.forestbiology.org).

2004 International Symposium on Plant Responses to Air Pollution and Global Changes

The Sixth International Symposium on Plant Responses to Air Pollution and Global Changes will be hosted in Tsukuba, Japan on 19–22 October 2004. The Symposium brings together scientists from various disciplines who are actively involved in research on the effects of air pollutants and global change on plant function and
growth, from molecular to ecosystem scales. Sessions will cover molecular, biochemical, physiological, and ecological responses of plants to O₃, CO₂, S, N, as well as multiple pollutants. They will also address related research in remote sensing, forest decline, volatile organic compound emissions from vegetation, ecological modeling, and current Asian environmental problems. Nonstop daily flights from the United States to Tokyo Narita International Airport link to direct bus service, making travel to Tsukuba convenient, and a great place for the meeting. For more information on the meeting program, travel and housing, and vacation opportunities visit the symposium website at [http://apgc2004.en.a.u-tokyo.ac.jp/](http://apgc2004.en.a.u-tokyo.ac.jp/) or contact Dr. Kenji Omasa at aura@mail.ecc.u-tokyo.ac.jp.

Second Biennial Conference of the International Biogeography Society (TIBS)

Biogeography is an interdisciplinary and integrative field. It forms the conceptual framework within which holistic studies of the evolving earth and its biota are melded, and insights from biogeographic studies promote and sustain biodiversity conservation on a global scale. In this spirit, The International Biogeography Society (TIBS [www.biogeography.org](http://www.biogeography.org)) was founded in 2000 to foster communication and collaboration among biogeographers, to transmit their contributions to other scientists and the lay public, and to promote biogeographic training and education. To advance this mission, TIBS has embarked on a variety of important initiatives, including the publication of a new book, *The Foundations of Biogeography* ([http://www.biogeography.org/Foundations.htm](http://www.biogeography.org/Foundations.htm)), the launching of a new book series, *The Frontiers of Biogeography* ([http://www.biogeography.org/Frontiers.htm](http://www.biogeography.org/Frontiers.htm)), and the organization of biennial meetings. The inaugural meeting of TIBS ([http://www.biogeography.org/inaugural.htm](http://www.biogeography.org/inaugural.htm)) attracted over 200 attendees from more than a dozen countries.

In recognition of the geographic scope exhibited by many environmental threats, and the fact that a biogeographic perspective is invaluable for setting conservation priorities, the theme “Conservation Biogeography” was established for the second conference. It will be held 5–9 January 2005 at the U.S. National Conservation Training Center (<http://training.fws.gov/> in West Virginia, and will again be organized around poster presentations and five symposia: Biogeography of Parasites and Infectious Diseases; Biogeography of Exotic Species; Biogeography of Extinctions; Biogeography of *Homo sapiens*: from Prehistory to the Future; and Biogeographic Responses to Global Change. Oral/poster presentations will be held on 6–8 January, with pre-meeting workshops on 5 January and an optional 9 January (behind the scenes) field trip to the Smithsonian Institution (Washington, D.C.).

**Confirmed plenary speakers include:** Dan Brooks, Jim Brown, Gerardo Ceballos, Rob Channell, Sharon Collinge, Jack Cully, John Gittleman, Jean Francois Guegan, Sandy Harcourt, Eric Hoberg, Uriel Kitron, Mark V. Lomolino, Paul S. Martin, Stuart Pimm, Dov Sax, Felisa Smith, David Steadman, John Terrell, and Harmut Walter.

We ask that you check the IBS web site ([www.biogeography.org](http://www.biogeography.org)) for updates, details, and registration information. Contact person:

Dr. Michael Douglas  
Department of Fishery and Wildlife Biology  
Colorado State University  
Ft. Collins CO 80523-1474  
(970) 491-7265  
E-mail: Michael.douglas@colostate.edu
Scientific Writing And Publishing—A Guide For Students

Publication is central to the advancement of science—peer-reviewed journals provide access to information that researchers and decision makers can put to use. However, little attention is devoted to instructing students and other early-career writers on strategies for writing and publishing their research. Many authors have provided valuable insights into writing style and the effective communication of ideas (e.g., Mack 1986, Woodford 1986, Day 1998). Rather than revisiting these topics in detail, we focus on the nuts and bolts of organizing, writing, and publishing hard-earned scientific results with the goal of achieving maximum scientific impact. We provide this advice from the combined perspectives of a recent Ph.D recipient (Harley), a current associate editor of Ecology and Ecological Monographs (Hixon), and a past associate editor of Limnology and Oceanography and current contributing editor for Marine Ecology Progress Series (Levin). We present this information in the sequence in which a writer would typically proceed, from the identification of main ideas through the final submission of a revised manuscript. Please note, however, that every writer is different and journal guidelines are idiosyncratic, so our advice may not be suitable for everyone and every situation.

Before writing

Several issues should be addressed before any actual writing occurs. Most importantly, the author must establish one or at most two main points that he or she would like to convey in the paper. Any more than this, and the main message is likely to be lost, or worse yet, the paper may become so convoluted that it is never read. At this stage, authors may also be faced with a decision of how much data to include. The SLOSS (single large or several small) debate familiar to reserve designers comes into play in the scientific publication process as well. Given a large body of data, a researcher must decide whether to include a lot of information in a single paper, or divide the data into several smaller contributions. There are advantages and disadvantages to each approach. Ideally, a manuscript should contain enough information that the story is complete, but not such a variety of detail that the main focus is lost. To be avoided is the LPU (Least Publishable Unit) approach that unnecessarily clutters scientific literature.

Once the general content of the manuscript has been established, the identity and sequence of authors can be determined. The first author is assumed to have done most of the writing and to have had the primary intellectual contribution. Although there is variability among and within disciplines as to how many additional authors are included on a paper, secondary authorship typically encompasses individuals who have contributed to the planning and execution of the research, the analysis and interpretation of the data, and/or the writing itself. Galindo-Leal (1996) provides a summary of authorship issues and the degree of contribution that should be expected of an author.

A final piece of the puzzle that must fall into place before serious writing begins is the selection of the desired audience and the appropriate journal to reach that audience. This decision will determine the overall approach taken to introduce the ideas under study and to discuss the implications of the research. It will also affect the length and format of the manuscript, the number and nature of the figures and tables, etc.
Knowing these details in advance makes the writing process much more efficient. Other considerations in the choice of a particular journal are its readership (general vs. specialized), the extent of its distribution, the length of papers considered, the time to publication, and likelihood that a manuscript will be accepted (an issue to which we will return below).

The first draft

It is a surprise to some first-time writers that the components of scientific papers are not most easily written in the order in which they appear in print (e.g., Title, Abstract, Introduction, Methods, Results, Discussion). The organization of the printed text reflects the scientific method, whereby hypotheses are formulated, observations and experiments are conducted, data are generated, and results are interpreted. However, when writing a manuscript, the author already has “the answer” or main idea(s) in hand and must decide how best to convey this information to the reader. Therefore, rather than writing the sections of the manuscript in the order in which they will eventually be presented, it is helpful to write the sections in order of increasing constraints. The manuscript as a whole is largely guided by the available data; it is therefore useful to articulate the objectives of the paper as primary questions or hypotheses, and then organize figures and tables around these at the outset. The Results section then follows fairly directly from the presentation of the data in the figures and tables. Once the Results have been written, it will become clear what information needs to be included in the materials and methods. The information included in the Results also constrains the interpretations presented in the discussion as well as the background information that is pertinent to the Introduction. Only when the main body of the text has been written will the true nature of the paper be revealed; thus, the abstract and title should be written last. Below, we flesh out some of the details of writing the various sections of a scientific paper.

Figures, tables, and the Results section

Figures and tables are used to support the main point(s) of the manuscript. Having them organized from the beginning will guide the writing of the text. Needless to say, the figures should be as clear and illustrative as possible (Selby 1976, Tufte 1983). Furthermore, because many readers will only take the time to skim an abstract and glance at the figures and tables, these illustrative tools should be self-contained, with all relevant information included in the captions or footnotes. The text of the results follows directly from the data presented, and does not include finer points of interpretation. However, when certain tests or experiments yield nonsignificant results, it may be convenient to limit the presentation of these to text without supporting figures, unless negative results provide a major conclusion (in which case the power of the statistical analyses becomes an important issue). Note that some journals provide for supplemental data and related information to be published online (e.g., Ecological Archives for ESA journals).

Materials and methods section

The content of this section refers to, and is therefore determined by, the information presented in the Results, figures, and tables. There should be sufficient detail, both methodologically and statistically, for others to repeat the work. The Methods section also allows the reader to put the work into its environmental context. Thus information on the location of field sites, the time at which samples were collected, and environmental parameters for laboratory experiments all merit inclusion. However, the temptation to include too much information (e.g., overly detailed descriptions of the study site or study organisms) should be avoided.

Discussion section

The Discussion section is a return to the original objectives and hypotheses. Rather than reiterating the results, the Discussion serves to interpret the results and place them in a broader context by citing and discussing related studies. The discussion also provides an opportunity to present some of the implications of the work (e.g., direct applications, implications for other fields). Although new hypotheses suggested by the data may be presented, the discussion should not include extensive speculation that is unsupported by
the data or the literature.

**Introduction section**

The Introduction serves to highlight previous advances on similar topics and therefore to set the rest of the paper in its scientific context. Once the Results and Discussion have been written (i.e., once the data have been presented and interpreted), it is easier to determine what background information will improve the reader’s understanding of the scientific context of the reported research.

**Abstract, keywords, and title**

Although these components appear at the beginning of the paper, they are most appropriately written last. The abstract is the most important section of the paper because many people limit most of their reading to abstracts, saving in-depth reading for specific projects. This trend is increasing, thanks to online computer searches, which readily provide abstracts, though full copies of the papers may not be available. Thus, it is crucial that the Abstract both summarize the key findings of the paper and clearly articulate what is novel and important about the work. The key words should be chosen carefully, because electronic database keyword searches are one of the primary ways people search for information. The title should be concise, informative, and as brief as possible.

**Acknowledgments section**

The Acknowledgments can be written at any time, and this section often provides a welcome break from the writing of more labor-intensive parts of the manuscript. Obvious candidates for acknowledgments are granting agencies and those individuals who substantially improved the research at any stage (from providing access to equipment or field sites to revising the manuscript). There are often individuals outside of science that merit an acknowledgment (e.g., beleaguered spouses, search-and-rescue personnel, bail bondsmen, or pets). Although this section should be concise, it never hurts to make the acknowledgments as generous as possible.

**For those who get stuck**

Writing can be a frustrating process, particularly for novice authors. Many graduate students suffer considerably as they attempt to write their thesis work. We offer two lines of advice to ease the pain of writing. First, it is quite helpful to work from an outline. If the outline is sufficiently detailed, the writing process consists of expanding each bullet point into a paragraph. This makes the manuscript seem like a much more manageable animal. Second, many people have trouble writing from an outline, or even writing the outline itself. To them, we relay the sage advice of an anonymous neuroscientist/musician: (1) write drunk, and (2) edit sober. Although this strategy was developed for writing rock and roll lyrics, the basic philosophy holds for science writing as well (with or without the consumption of alcohol). If the author is willing to write wildly, knowing full well that most of the material is of poor quality, the production of a draft of any quality whatsoever is often the turning point in the writing process.

**The second through final drafts**

Once the first draft has been assembled into a readable form, it is extremely important to seek outside critique. Generally speaking, it is very useful for authors to think like a peer referee throughout the writing process, and anticipate the questions that reviewers may raise. (Kuyper [1991] provides a superb list of such important questions.) However, authors are often so involved in the work itself that they may not recognize important gaps in the manuscript. Comments from an advisor and from others both inside and outside of the author’s home department can vastly improve a manuscript.

This leads to the issue of how many drafts a paper should go through before it is submitted. One of the most difficult things for a first-time writer to accept is that a paper can always be a little bit better. Nevertheless, it is important to be willing to submit a paper even though it is not 100% perfect (especially given that perfection is unattainable). The reasons for this are illustrated in Fig. 1. At a certain stage, authors’ efforts will reach a point of diminishing returns. Thus, in the time it would take to improve a manuscript from 98% perfect to 99% perfect, the author(s) could write
a second 98% perfect manuscript in its entirety. In our example, if 95% perfect is the cut-off for submission, then the authors could write and submit three papers in the time it would take to write a single 99% perfect manuscript. The sacrifice of perfection has obvious limits; if submitted papers are of insufficient quality, they will not be accepted. However, the “perfect paper” does not exist, and all papers (even those thought to be very nearly perfect) will need to be revised to some extent following the review process.

Submission

Before submission, authors must check the journal format carefully. Failure to follow the journal’s guidelines can lead to rejection without review. It is also important that the lead author ensures that all authors have had a chance to read and comment on the final version of the manuscript. Student authors who are still in school should also give their advisor and committee members an opportunity to read the manuscript.

Manuscript submissions are accompanied by a cover letter to the editor. This letter briefly describes the manuscript’s topic and its importance. Often, journals will request the names of potential reviewers and their contact information. This is a valuable opportunity to steer the review process toward reviewers who are well qualified to review the paper and are likely to be receptive to the manuscript (e.g., those that are cited in a favorable light). Journals often offer guidelines regarding the content of submission letters. Use them.

The editorial decision

At this stage, it is important for authors to be able to set aside their egos. Manuscripts will be returned with a wide variety of criticisms, all of which (one hopes) are designed to improve the quality of the contribution. Everyone gets hammered by reviewers every now and then, so early career writers should neither despair nor explode when, for example, a reviewer states that the paper “does not provide compelling evidence of anything” (as quoted from a review recently received by one of us).

Fig. 1. Manuscript quality through time. (A) Even after 12 months of writing, the paper is only 99% perfect and still improving by small increments. (B) If manuscripts are submitted when 98% perfect, two writing projects can be completed (solid lines) in the time it would take to reach 99% perfection on a single manuscript (dashed line). (C) As above, only 95% perfection is now the cutoff for submission, and three manuscripts are completed. Note that these curves are asymptotic; 100% perfection is never attained.

No papers are published exactly as they are submitted. Comments from reviewers and editors typically range from accepted pending minor revisions to rejected without an invitation for resubmission. If the paper is accepted, the authors should carefully follow any instructions provided by the editor. If revisions have been suggested, these should be incorporated unless the author has very good reasons for not doing so (e.g., the suggested change was based on a misinterpretation of the results). When the manuscript is returned to the editor, it should be accompanied by a
letter that describes and justifies any changes (or lack thereof) made to the manuscript.

If a paper is rejected, authors should first allow the emotional shock of the rejection to subside before taking any action. Then they must decide where (and whether) to resubmit the paper. Often, a paper can be resubmitted to the same journal, provided that substantial revisions have been made and the authors can make a compelling (and polite) argument that the initial rejection was unwarranted. More typically, the rejected paper is revised and sent elsewhere. Because these revisions consume time and effort, it is not in the best interests of the author to have a paper rejected from several journals. This is why the choice of journal is such an important one. On the one hand, scientists who never submit to Science or Nature will never publish a paper in these high-impact journals. On the other hand, authors who submit everything to top-tier journals regardless of the quality or scope of the manuscript will waste much of their time revising and resubmitting their work—time which could be spent more productively, for example, by writing additional manuscripts (see Fig. 1). It is advisable to have a priority list of journals in mind. If an early-career author is unsure which journals will likely consider his or her work, more senior colleagues can aid in this decision process.

Conclusions

Scientific publication is very important. Publication is often necessary for advancement within the sciences. More significantly, publication is necessary for the research to make an impact. Only when scientists have a document upon which they can elaborate, and decision makers have a document to which they can refer, does the science actually “count.” From the standpoint of both the advancement and the application of science, unpublished data effectively do not exist.

Given that writing and publishing are important aspects of the scientific process, we stress that authors should seek to maximize their total impact. For example, the willingness to submit a paper even though it could be a tiny bit better will allow a researcher to devote the time saved to additional research or writing projects. Likewise, not all data should be published. If the importance of the main idea or the quality of the dataset is low, it may be more productive to abandon a project (even if considerable effort has already been invested) and use the time saved to embark on a new project. If the ultimate goal of a scientist is to make an impact on his or her field or on society as a whole, then the intelligent organization and publication of his or her results and ideas can greatly improve the magnitude of that impact.

Acknowledgments

The ideas presented here emerged from a student-sponsored workshop at the 2003 annual meeting of the Western Society of Naturalists. We sincerely thank the graduate student committee, Bonnie Becker, Aimee Bullard, Brian Kinlan, Chris Krenz, Amber Mace, and Michael O’Donnell, for organizing the workshop and inviting us to participate.

Literature cited


Christopher D.G. Harley
Bodega Marine Laboratory
Bodega Bay, CA 94923
1Corresponding author. E-mail: cdharley@ucdavis.edu

Mark A. Hixon
Department of Zoology
Oregon State University
Corvallis, OR 97331-2914

Lisa A. Levin
Integrative Oceanography Division
Scripps Institution of Oceanography
La Jolla, CA 92093-0218
An Ecological Purpose for Life: Responsibility to Earth

The word “purpose” has two important meanings, the most common one having to do with the progress of some thing in time, answering the question: What is its goal (purpose)? The second, less common meaning, has to do with the fitting of a part to a whole, answering the question: What is its function (purpose)? My thesis is that we will never satisfactorily answer the first question of purpose-as-goal in our lives until we reach a consensus on the second: What are our human roles as purposive, functional parts of Earth?

For most of our history the only purposeful question has been about progress, about goal-seeking in time. Why are we here and where are we headed? These questions have puzzled humanity ever since the first well-fed hominid sat down under a banyan tree and pondered the miraculous fact of her being. Later, when men figured out how to get women doing the work of feeding them well, so that they could sit under the banyan trees and ponder, the miraculous fact of her being. Everyone’s purpose in life, the sages of the Western world declared, is to praise the Creator and follow His laws which, fortunately, we have found engraved on tablets of stone in the Middle East and, relatively recently, on tablets of gold as befits more prosperous North America.

Thoroughly religious societies are dogmatic about purpose in human life. They have their pat answers. In secular societies purpose-in-life is an open question, particularly since the advent of Darwin’s explanation of evolution by the lottery of natural selection. If organic life-forms evolve by producing unpredictable progeny from which our unpredictably changing environment selects the most fit, then blind chance seems to be in charge. If evolution is neither purposeful, progressive, nor cumulative, where is the goal? If all organic life-forms, including the human, are randomly determined by rolls of the dice, where is the purpose? Darwin’s theory of natural selection posits no trend nor intent; it does not reveal any direction of organic evolution. Exemplifying “good science,” it only seeks to answer the question of “how” species change through the ages, not “why” they change and to what end.

Today the lines are drawn between those who cling to tradition, believing that all Nature exhibits design-in-process-of-development toward a better future in which Heaven plays a prominent part, and those who reject the idea of any preordained goals for people and the Nature that surrounds them. Both opposing views are statements of faith; there is no bridging the gap between them because science, as consensual knowledge, has nothing to say on such matters. The reason is that both the “purposeful world” view and its “purposeless world” counterpart (whose corollary is the purposelessness of human life) hinge on the definition of “purpose” as the end of a causal sequence in time. Both are attempts to read trends from past to future, whereas only the present is truly known.

Because we cannot comprehend the future and know little of the past, the question of humanity’s larger purpose, in the sense of a path toward fulfillment of a goal, is moot and always will be. Whatever the long-term trends on Earth, whether goal-seeking or random and blind, we can never know them with certainty.

Despite the logic that denies humans the ability to detect cosmic purpose in Nature, we do find within ourselves the capacity to conceive purposes, to set goals and make plans to achieve them. Whether or not the wide world is purposeless or purposeful, we feel ourselves to be purposeful. To some extent we can determine what tomorrow will bring—which raises again the important question: What purposes ought we to pursue; what are tomorrow’s worthy goals? Answers can be found in ecological reality that invokes the second meaning of purpose: the functional fitting of parts to wholes.

Rather than questing for trends in time, functional purpose seeks relationships. Simple examples with reference to our bodies are such questions as: What is the purpose of legs? To give motility to the whole body of which the legs are parts. What is the purpose of eyes? To prevent the body in which they are embedded from bumping into trees or getting too close to saber-toothed cats. Broader questions of the same character can be asked about the purposes of all organic things in Nature. Ecological terms for the functioning of organisms (as parts) in their enveloping ecosystems (the wholes) are “niche” and “role”—two names for “purpose” that avoid the goal-seeking meaning called “teleology,” a word that makes scientists shudder.

The role/purpose of plants is to fix sunlight energy in support of the variety and creativity of all
other life-forms in their geographic ecosystems. The niche/purpose of snails in an aquarium is to keep the algae in check; otherwise the little glass-enclosed ecosystem would soon turn soupy-green and putrid. The role/purpose of fungi in the soil is to decompose the plant leaf mat and thus maintain the cycling of minerals for new growth in the forest ecosystem. In every case the part’s essential purpose is to maintain the integrity/wholeness/health of the whole ecosystem.

Purpose-as-function/niche/role operates in the here-and-now as the relationship of compliant part-to-whole. It asks no questions about final ends, leaving eschatology—beliefs about the destiny of humankind and the world—to the theologians. In the functional sense the improbable living Earth is filled with purpose, and all Earth’s parts must contribute in one way or another to the continuation of that improbability.

While purpose-as-end, as time-seeking goal, is difficult to decipher in Nature apart from the goals we ourselves set, purpose-as-function is clearly evident in the organic parts of healthy productive ecosystems such as unpolluted rivers, lakes, grasslands, and forestlands. In these natural examples we can to some extent learn the meaning of “purpose” by observing the appropriate functions of organic things in the context of the ecosystems of which they are parts. As we too are animals, living in and supported by regional ecosystems, such understanding ought to suggest worthy human goals.

What functional purpose do humans serve? The question requires prior identification of the whole in which the human species participates. Homo sapiens is obviously one of the innumerable components of the Planet’s varied ecosystems, as affirmed by the chemistry and physiology of our bodies. Each person, composed of Earth materials, is clearly related in cellular composition to all other creatures since the beginning of time. Like other animals, though far more numerous than those of the same size and hungrier than most, humanity fits in the category “heterotroph” (literally, “other feeder”), a species dependent on other organisms, unable to manufacture its own food from water, carbon dioxide, soil minerals, and sunlight, as plants do. Without plants, no animals; without animals no plants. Earth runs on cyclic phenomena, symbolized by the serpent with its tail-tip in its mouth: a Mandala with no beginning nor a foreseeable end.

The ecological niche of animals in general seems to be coexistence in multispecies ecosystems. All animals use other organisms as needed, but rarely if ever to the extent of driving them to extinction. Only the human animal has the non-sense to exterminate. Coexistence of innumerable species of organisms in their matrix of air, water, and soil, is the normally fluctuating, slow-changing pattern that suggests a compliant role for the most intelligent of the primates. From the larger perspective, humanity’s functional purpose is revealed as contributing to maintenance of the health, beauty, and permanence of Earth and its land-and-water ecosystems. When these three qualities of the Ecosphere are safeguarded, quantitative productivity will look after itself.

To know one’s larger purpose/responsibility/function on Earth is not to deny individuals and societies their just degrees of freedom. As members of society and of regional ecosystems, people are semi-autonomous “parts.” They are entitled to develop their talents/abilities and justified in pursuing their particular interests to the limits set by the one overarching responsibility: to maintain, not destroy nor weaken, the probity of the Ecosphere. Responsibility to the integrity and health of the Earth is the primary constraint on human freedom.

The essential Earth Rule—Be responsible to Earth and treat kindly its ecosystems and their contents—takes precedence over the admirable Golden Rule that advises responsibility and kindliness to one another. The two provide worthy leading goals and purposes for education. If what we learn in schools and colleges does not make us more benevolent, more considerate of the Earth and of each other, what is the point of it all?

J. Stan Rowe
Professor emeritus, University of Saskatchewan (ecology)
Box 11, New Denver, British Columbia, Canada V0G 1S0
E-mail: stanrowe@netidea.com
Things That Can Go Wrong with Powerpoint Presentations

Computer-based projection of slides for scientific presentations has displaced conventional slides and transparencies within the last few years. This, however, also means that most users of LCD projectors have little experience with this tool. To spare users the hiccups associated with learning from their own mishaps, I have compiled a list of problems and precautions (Table 1). The list is based on observations at two international conferences 2003 (Annual Meeting of ESA in Savannah, Georgia, and Annual Meeting of GÖ—Ecological Society of Germany, Austria, and Switzerland in Halle, Germany), comments of colleagues, and personal experience.

Computer-based presentations involve many components that must collaborate: storage device, computer, projector, and presentation program. Although these components are supposed to be compatible, they are not as compatible as their manufacturers would like us to believe.

Storage devices and computer: CDs are the most frequently used storage medium. CDs, however, can be defective and some computers may refuse to read the data. Floppy disks get out of use because presentations often make use of pictures whose resolution is unnecessarily high. The resulting files are too large to fit on a high-density disk. Some newer computers do not have floppy drives, but it may still be a good idea to have the presentation on a floppy disk as a backup.

The role of floppy disks has been taken over by USB memory sticks. They require special drivers on a computer. If the driver has not been preinstalled, the memory stick won’t work. Older computers, that may still be in use at universities, do not have a USB socket or the sockets may not be accessible (i.e., at the back side) when the computer is permanently installed in a lecture hall.

Projector: The resolution of newer projectors is good and the projectors adapt to the resolution sent by the computer. Older projectors are set to one resolution and image scan frequency. Other resolutions fed by the computer will result in poor quality with unreadable text and missing lines. Other frequencies will cause “running” images. Most computers have a key combination (hardware dependent) for feeding the image signal to the projector. A restart is usually not necessary.

System software: Windows (Microsoft) is the dominant system, but Macintosh (Apple) should be kept in mind. The Macintosh system is more widely used in academic institutions in Switzerland, Sweden, and North America than in other regions.

Presentation program: PowerPoint by Microsoft is the most commonly used program, but it is not universal. Acrobat Reader also has a built-in presentation module, which means that most programs can be used to prepare presentations. PowerPoint comes in different versions that are not completely backward compatible and whose properties and abilities depend on program version, system software version, and certain helper programs installed on the computer. It is a common problem that characters from special fonts (e.g., mathematical symbols, bullets, icons, superscripts) used in the presentation are not available on the conference computer. They are replaced by others that can cause missing symbols, changed line breaks, and other unaesthetic and confusing changes. Graphics not stored within the presentation file rely on import filters that must be present on the conference computer. Animation of objects may also be affected by incompatibility among versions and, consequently, may fail. Another problem is that the layering of objects can become reversed. Thus, background objects can cover other objects. Finally, colors may also change when settings differ among computers.

Most problems can be avoided by following these simple suggestions (see Table 1):

- prepare the presentation for the computer environment offered for the lecture,
- use your own computer for the presentation (at the risk of incompatibility with the projector),
- store the presentation on different media (including transparencies) and in several formats (the original, an older version of the presentation program, and as PDF),
- finally, check the presentation ahead of time on the computer that will be used.

Martin Köchy • Department of Biochemistry and Biology • University of Potsdam
Maulbeerallee 2 • 14469 Potsdam, Germany
+49 (331) 977-1974
E-mail: martin.koechy@gmx.net
Table 1. List of common problems and suggested solutions regarding computer-based presentations.

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<tr>
<th><strong>Cause</strong></th>
<th><strong>Problem</strong></th>
<th><strong>Solution</strong></th>
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<tr>
<td><strong>Storage medium</strong></td>
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<td>diskette</td>
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<td>copy of presentation file on different media</td>
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<td>memory stick</td>
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<td>CD-ROM</td>
<td>CD not readable (write error or incompatible CD format)</td>
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<td><strong>System software and environment</strong></td>
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<td></td>
<td>no communication between computer and projector</td>
<td>use your own computer</td>
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<td></td>
<td>presentation program incompatible with system software</td>
<td>use the computer provided by the organizer</td>
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<td>missing fonts and symbols</td>
<td>don’t use rare fonts or symbols, use the PDF format with included fonts</td>
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<td>missing import filter for pictures or sounds</td>
<td>store graphics and sounds inside the presentation file</td>
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<td></td>
<td>reduced color space</td>
<td>use standard 256 colours</td>
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<td><strong>Projector</strong></td>
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<td>low resolution: lines disappear, text is hard to read</td>
<td>use sans-serif fonts like Helvetica or Arial, use bold text, avoid thin lines (in plots, tables, etc.), set the computer to the lowest resolution</td>
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<td><strong>Presentation program</strong></td>
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<td>animations don’t work</td>
<td>test your presentation on several computers with different versions of the system software and the presentation program</td>
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<td>layering of objects mixed up</td>
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Deviations and Errors: Standards in Statistics

Introduction

Clear and concise data presentation in text and figures are essential to avoid both ambiguity and wasting readers’ time. A common way to present summarized data in text is to use means and standard deviations (SD) (“mean ± SD”). On figures it is commonplace to see “error bars,” usually one SD in length, perched above and hanging below data points or bars. However, it is also routine for data to be summarized using means and standard errors (SE). Although the standard deviation (SD) and the standard error of the mean (SE) are related by a simple formula, they are not, strictly speaking, interchangeable. The use and misuse of these different “standards” has been the subject of a current and longstanding debate in the medical literature. Here, I examine that debate, consider the differences between the SD and the SE, and discuss whether the debate has any general lessons for ecologists.

The debate over “standards” in medical science

In 1985 the editor of the American Journal of Psychiatry announced in an editorial article that “beginning in January 1986, the Journal will require authors to report the statistical standard deviation (SD) rather than the standard error of the mean (SE) of data” (Bartko 1985). This rule is still in place, and similar editorial discouragement of the SE has been adopted by other journals, including The Lancet. The decision to sideline SE in reporting clinical studies had been foreshadowed. Brown (1982) stated that “we are advised to describe clinical data using means and the SD…and to eschew use of the SE,” a statement supported by noted statistical authorities (Feinstein 1977, Glantz 1981). Brown (1982) also voiced concern about undefined summary data (i.e., “36 (mean) ± 2.4,” without the “2.4” being defined as SD or SE), a problem he found common in his informal survey of leading medical journals. In addition, Brown’s survey highlighted the practice of freely interchanging SD and SE in the same work without reason, using error bars without defining them and using SD to describe highly skewed data where ranges or percentiles would be more suitable. A month later, Horan (1982) asserted that “On most occasions when variability is being described it is the standard deviation which should be quoted [rather than SE].” Other authors weighed in, literally begging journal editors to “banish” misuse of the SE (Herxheimer 1988), supporting the widespread use of the SD rather than the SE (Malagon 1996) and recommending that journals no longer report the SE at all (Mokkink 2002). Several authors have used literature surveys to support the assertion that SE is frequently misused in clinical studies (Nagele 2001, Zaugg 2003). Nagele (2001) suggested that as the SE is always smaller than the SD, use of the SE misleads the reader into underestimating the variability between individuals within a study sample. Zaugg (2003) went further and stated that some authors perhaps use the SE precisely because it is smaller than the SD, thereby potentially misleading readers either deliberately or through ignorance. However, the SE has had its supporters, those who object to a blanket ban on certain statistical practices, for example, Thompson (1987), defended its use in reporting data from large surveys that use complex sampling. More balanced views on the use of SD and SE have emerged from the debate (Webster and Merry 1997), with at least two authors (Streiner 1996, Davies 1998) taking an educational approach to assist clinicians and medical scientists in appropriate statistical reporting.

Use of the SD and the SE has, it seems, become problematic in the medical literature, with suggestions being made of statistical underhandedness and journal editorial policies being influenced. Correctly, the SD and the SE describe different things and are appropriate in different situations, but why are medical researchers so concerned about misuse, does “misuse” actually matter, and should ecological researchers be concerned?

Standard deviation vs. standard error

The mean is a useful summary of data, but on its own it conveys no information on inter-individual variation. One measure of variability is the SD, which is “an index of how closely the individual data points cluster around the mean” (Streiner 1996; my...
emphasis). (Details of how to calculate the SD, and the SE, can be found in most statistics books.) If data are highly variable and many data points are greatly different from the mean, then the SD will be large. Conversely, the smaller the SD, the less variable data are. The mean and the SD together provide a useful and well-known rule-of-thumb for “eyeballing” data. If the data are normally distributed, then roughly two-thirds (68.2%) of a given sample will lie in the interval “mean ± SD,” and around 95% (actually 95.4%) will lie in the interval “mean ± two SDs.” Therefore, the SD gives us a clear impression of the data and its distribution around the mean. In short, the SD describes data.

Unlike the SD, the SE is not a description of the data at hand but an inferential statistic applicable to a wider group. To practically calculate the mean value of some variable in a large group of individuals, we must usually take a random sample of individuals and consider the mean of the sample as an indication of the true mean of the wider group. However, if we take different samples (even of the same size), we will obtain different values of the mean. The SE is the standard deviation of these different means. In fact, we do not need to take many repeated samples and calculate the SD of all the means thereby obtained to obtain the SE. Instead the SE can be calculated by dividing the SD of a sample by the square root of the number of data points in the sample. The SE describes data and SE estimates population parameters using the data (Davies 1998).

Discussion

It is perhaps surprising that there is a longstanding and continuing debate in the medical literature over the use of SD and SE. Why are clinicians and medical scientists so concerned about whether to use SD or SE, and should ecologists be likewise concerned?

With good reasons, medical scientists are concerned about representation and misrepresentation, since lives and budgets may be compromised by poor decisions based on misrepresented data. In medical science, some journals have effectively banned the SE altogether to prevent confusion between SD and SE and misrepresentation. However, in many fields, including ecology, we are frequently more interested in the precision of the estimates of population means or in the inferences that can be drawn from our data about population parameters than a measure of within-sample variability. Used correctly, both SE and SD have their place in statistical reporting.

What, if anything, can ecologists learn from the above debate? I suggest that while we neither need, nor want, extensive instruction and editorial policies on the use of SD and SE, the debate provides a useful general lesson. The lesson is that we cannot and should not assume that everyone in science is equal in their statistical knowledge, and we must be aware of how statistics are understood and misunderstood by others. This becomes particularly important as interdisciplinary research reaches across traditional disciplinary boundaries and scientists from different fields and knowledge-bases seek to work together. Statistics are an essential tool, and we should be ever vigilant for ways to both deepen our understanding and improve our usage of them.

Literature cited

Malagon, I. 1996. Standard error of the mean or


Adam G. Hart
Department of Animal and Plant Sciences
The University of Sheffield
Western Bank, Sheffield
S10 2TN, UK
Telephone: 44 114 2220144
E-mail: a.hart@sheffield.ac.uk
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<tbody>
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<td>15 November</td>
</tr>
<tr>
<td>April (No. 2)</td>
<td>15 February</td>
</tr>
<tr>
<td>July (No. 3)</td>
<td>15 May</td>
</tr>
<tr>
<td>October (No. 4)</td>
<td>15 August</td>
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The following advisory items are provided to help focus your review.

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

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

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

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

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

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

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

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