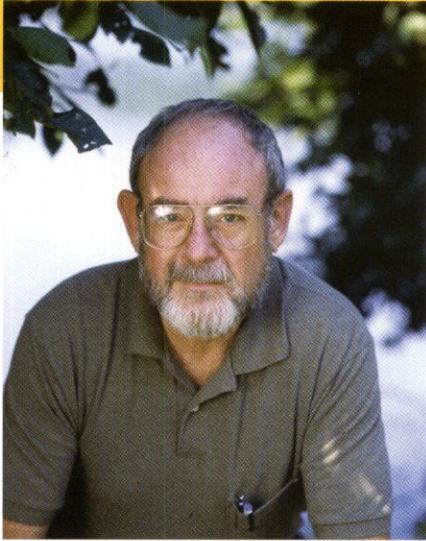


Finding Answers to Global Questions

From the Chair



Jay Ziemann, Chair

Department of Environmental Sciences

This department was founded in 1969 on what was at the time a unique premise: that by bringing the fields of ecology, geosciences, hydrology, and atmospheric sciences under a single roof, we would develop a richer, more full-featured, and ultimately more accurate appreciation of the forces that shape the evolution of our planet and that create the baseline conditions for life.

Given the complexity and severity of the environmental challenges we face today, this decision proved farsighted. The collaborative pursuit of knowledge, now the norm at research centers around the world, has dramatically enlarged our understanding of fundamental environmental processes. In doing so, it has set the stage for the next generation of inquiry—finding the connections that join the local and the global, that link the present moment to the millennia, and that enable us to understand environmental systems in their full temporal and geographic dimensions.

Taking the Measure of the Global Ecosystem

This work is taking members of this department around the world. A few examples will suffice. **Jim Galloway**, as chair of the International Nitrogen Initiative, has worked tirelessly to create a global network of centers that enable people in each region of the world to focus on minimizing the negative effects of nitrogen on human health and the environment while optimizing its beneficial role in sustainable food production. Joint activities conducted by researchers affiliated with these centers are producing a global picture of the way nitrogen moves through the environment.

The catastrophic hurricane season we endured this year only underscores the importance of understanding the evolution of these destructive storms from their genesis in West Africa. **José Fuentes** will be applying expertise gained studying convective and stratiform storms in Brazil to NASA's African Monsoon Multi-disciplinary Activities project. One goal of the project is to make connections between regional variations in rainfall over West Africa and decadal variations in Atlantic hurricane activity. This investigation will provide benefits for people on both continents, strengthening our ability to provide more accurate forecasts of precipitation in drought-stricken West Africa as well as more accurate forecasts of hurricane activity in the Caribbean and eastern United States.

José is also known for the quality of the connections he makes in the classroom. In addition to being awarded the Cavaliers' Distinguished Teaching Professorship, which recognizes an eminent scholar for outstanding and enduring excellence in the teaching of undergraduates, he was one of 15 faculty members statewide to receive an Outstanding Faculty Award from the State Council of Higher Education for Virginia. This is the Commonwealth's highest award for college and university faculty.

In the United States, **Karen McGlathery**, as director of the Virginia Coast Reserve Long-Term Ecological Research (LTER) program, is focusing work at the

reserve on how processes scale across the landscape over time. Scientists there are extending their site-based work to understand how the VCR is representative of the entire mid-Atlantic region and then put the mid-Atlantic region in the context of the national network of coastal LTER sites. They also want to see how parts of the landscape link together to cause changes across the marshes, lagoons, and barrier islands. Understanding the dynamic processes within these ecosystems requires understanding episodic events that occur on time scales of minutes to decades.

Another faculty member, **Howie Epstein**, has embarked on a regional-scale project with a team of scientists from South America. Their goal is to understand the impact of land-use change on ecosystems and societies in the Río de la Plata basin. The Río de la Plata basin is the second largest on the continent and accounts for 70 percent of the gross national product of Brazil, Uruguay, Argentina, Paraguay, and Bolivia.

Deborah Lawrence is also studying the effects of land use. In tropical forests in Indonesia and Central America, she has examined the impact of shifting cultivation on tree diversity, soil nutrient dynamics, and biomass accumulation. In particular, she has found that after four cultivation cycles, these forests become less productive and much less diverse. The implications are dire, not just for local inhabitants. As biomass accumulation drops, the carbon-sequestration value of tropical forests diminishes.

At the Intersection of People and the Environment

These efforts and others under way around the department are groundbreaking, not simply because of the scope of our research agenda, but because this research agenda, in many instances, has been enlarged to focus explicitly on the intersection of people and the environment. This is particularly true of our Center for Regional Environmental Studies, which investigates global change in order to better inform policy and development. Members of our faculty associated with the center have been deeply involved in studying ecosystem dynamics in southern Africa for almost two decades. We are now applying that knowledge to the study of conservation ecology.

Ultimately, the importance of our international activities is the impact they have on our students. In locations around the world, graduate and undergraduate students from this department are working side by side with our faculty. If they are to take on the critical challenge of understanding environmental systems on a global scale, they must be ready to cross borders and work collaboratively with scientists and citizens from around the world.

In focusing on the accomplishments of our students as well as our faculty, this report reflects the department's long-term strategy to tackle some of the most pressing issues of our time.



***Our challenge
is to find the
connections
linking the local
with the global.***

2004–2005 Awards & Appointments

Undergraduate Students

Daniel J. Smith was selected for the College of Arts & Sciences Distinguished Majors Program in 2005.

The department recognizes outstanding fourth-year students in each of the environmental sciences. This year, the Mahlon G. Kelly Prize in ecology went to **Emily G. Grossgold**, the Wilbur A. Nelson Award in geology was given to **Mark T. Gross**, the Michael Garstang Atmospheric Sciences Award went to **Addison L. Sears-Collins**, and the Hydrology Award was presented to **Laura E. Erban**.

Lindsay A. Hawks won the Departmental Interdisciplinary Award.

The Bloomer Scholarship provides a \$1,500 award to a rising fourth-year undergraduate majoring in the department with a focus on geology. This year's winner was **Melissa A. Rodriguez**.

The honors for producing the best undergraduate poster at this year's Environmental Sciences Research Symposium went to **David M. Hondula**. **David Knight** gave the best presentation by an undergraduate.

Elizabeth M. Dubovsky received the Trout Unlimited Award, which was established by the Thomas Jefferson Chapter of Trout Unlimited for "significant contributions to research concerning cold-water fisheries or related ecosystems."

This year's Wallace-Poole Prize for the fourth-year student majoring in environmental sciences judged to be the most outstanding student in the class went to **Lynn M. Rubin**.

Amy E. Grady was this year's recipient of the Richard Scott Mitchell Scholarship, which provides \$1,500 to a rising fourth-year student who is focusing on geology and who has taken petrology or mineralogy.

Rachel K. Gittman and **Chad A. Logan** won coveted Harrison Undergraduate Research Awards to fund research projects. Forty Harrison Awards of up to \$3,000 each are distributed by the Faculty Senate to the most promising undergraduate research projects at the University.

The Double Hoo Research Grant is an innovative University-wide initiative that pairs graduate and undergraduate students on a research project. This year eight grants were awarded, including one to undergraduate **Katherine C. Hamel** and graduate student **Lorelei J. Hartman**.

Graduate Students

Established by Dr. F. Gordon Tice in 1992, the Maury Environmental Sciences Prize is the premier department award. This year's winner was **Jordan G. Barr**.

Amanda L. Floyd was honored for producing the best poster by a master's student at this year's Environmental Sciences Research Symposium, while **Benjamin I. Cook** created the best poster in the doctoral student category. **Thomas J. Mozdzer** was singled out for producing the best graduate presentation by a master's student, and **Junran Li** gave the best presentation by a doctoral student.

The department offers a series of awards honoring outstanding graduate students in each specialty in environmental sciences. This year **Lorelei J. Hartman** earned the Graduate Award in Ecology, **Samuel A. Flewelling** won the Graduate Award in Hydrology, **E. Daniel Carre** won the Graduate Award in Atmospheric Sciences, and **Sharon A. Wilson** won the Arthur A. Pegau Award in Geology. **Junran Li** received the Robert Ellison Award for Interdisciplinary Studies.

Meredith Ferdie was the recipient of a STAR Fellowship from the EPA.

Erin B. Potter won the department's Fred Holmsley Moore Teaching Award. She also received the University Teaching Resource Center departmental GTA Award.

Three graduate students took prizes in the physical sciences and mathematics category at the 2004 Robert J. Huskey Graduate Research Exhibition at the University of Virginia. They were **Thomas O'Halloran** (first place), **Sarah Lawson** (second place), and **Pie-Jen Lee** (third place).

The Michael Garstang Award supports graduate student research in interdisciplinary atmospheric sciences. This year, **Erin B. Potter** and **E. Daniel Carre** shared this award.

E. Daniel Carre received an Excellence Award from the department's Environmental Sciences Organization.

Temilola E. Fatoyinbo was a recipient of a Hearst Minority Fellowship.

This year, **Benjamin I. Cook** and **Alexia M. Kelley** won Moore Research Awards. The award is based on merit and was initiated to help sponsor the dissertation and thesis work of environmental sciences graduate students. **Lindsey Bowser**, **E. Daniel Carre**, and **Erin B. Potter** won Departmental Research Awards, while **Jenica M. Ansanitis**, **Dane A. Barr**, **Teferi D. Dejene**, **Marcia S. DeLonge**, **Anna B. Estes**, **Stephanie A. Harbeson**, **Lorelei J. Hartman**, **Quinn S. McFrederick**, **Thomas J. Mozdzer**, **Thomas L. O'Halloran**, **Jin Wang**, and **Lixin Wang** received Exploratory Research Awards.

Sarah M. Walker was the recipient of an Earth System Science Fellowship from NASA.

William P. Gilhooly was awarded a Graduate School of Arts & Sciences Dissertation Year Fellowship.

Faculty & Staff

Thomas H. Biggs received a certificate of appreciation from the department's Environmental Sciences Organization.

Robert E. Davis served a term as chair of the University of Virginia Faculty Senate. He also edited *Climate Research: Interactions of Climate with Organisms, Ecosystems, and Human Societies*. One of his essays was cited as the Climate Science 2003 Paper of the Year by the Climate Science Group of the Association of American Geographers.

Paolo D'Odorico was associate editor of *Water Resources Research*.

Robert Dolan was on the editorial board of *Journal of Coastal Research*.

Howard Epstein sat on the Committee of Visitors to evaluate the National Science Foundation's Office of Polar Programs.

Michael Erwin was the recipient of a U.S. Geological Survey STAR Award for Achievement.

José D. Fuentes was made editor of the *Journal of Geophysical Research—Atmospheres* and served on the International Science Committee for the Global Precipitation Mission. He was awarded the Cavaliers' Distinguished Teaching Professorship.

James N. Galloway served as associate editor of *Environmental Chemistry* and as a member of the international editorial board of *Journal of Environmental Sciences*. He also received an Excellence Award from the department's Environmental Sciences Organization.

Bruce Hayden successfully led a team that won the award for the National Environmental Observatory Network.

Janet S. Herman was associate editor of *Water Resources Research*. She was also chair of the Hydrogeology Division of the Geological Society of America.

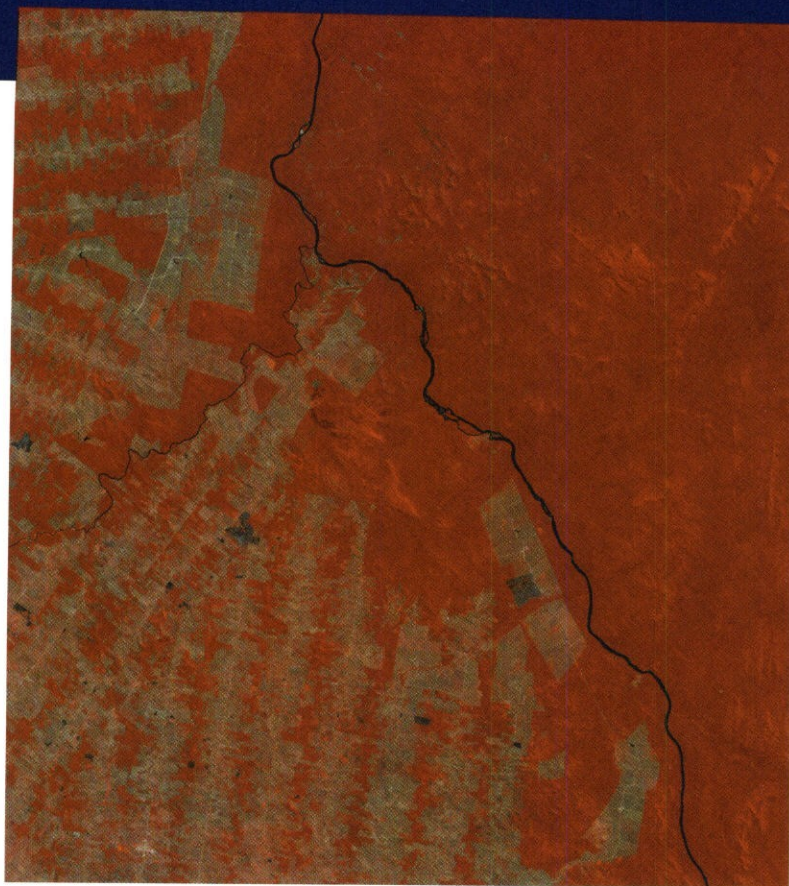
George M. Hornberger was president-elect of the Hydrology Section of the American Geophysical Union. He was also a presidential appointee to the Nuclear Waste Technical Review Board and a member of the National Research Council Committee on Hydrologic Sciences.

William Keene was a member of the board of directors of the Canadian Surface Ocean—Lower Atmosphere Study of the International Geosphere-Biosphere Program.

Ann Kidd received the department's Graduate Student Association Award, which recognizes members of the department who have been particularly helpful to the graduate student body.

Stephen A. Macko is on the editorial boards of a number of journals. He served as associate editor of *Amino Acids*, *The Scientific World: Isotopes in the Environment*, and *Science of the Total Environment*. He was the plenary speaker at the Goldschmidt Conference and elected as a fellow of the Joint European Association of Geochemistry and the Geochemical Society.

Michael E. Mann was a member of the National Academy of Sciences/National Research Council Committee on Radiative Forcing Effects on Climate.



DEFORESTATION IN BRAZIL

Image courtesy of NASA/GSFC/METI/ERSDAC/JAROS, and U.S./Japan ASTER Science Team.

Karen J. McGlathery was associate editor of the *Journal of Phycology*. She also serves on the LTER executive and coordinating committees.

Aaron L. Mills served on the editorial boards of *Microbial Ecology* and *Geobiology*.

G. Carleton Ray was a member of the editorial board of *Aquatic Conservation*.

Papers by **William F. Ruddiman** were the most frequently downloaded in *Quaternary Science Reviews* and *Climatic Change*.

Herman H. Shugart served on the editorial boards of *Global Change Biology*, the *Australian Journal of Botany*, and the *Eurasian Journal of Forest Research*. He was named a fellow of the World Innovation Foundation.

David E. Smith won the department's Chair's Award in recognition of his extraordinary service to the department and his interdisciplinary approach to both teaching and research.

Robert J. Swap served as guest editor of the *International Journal of Remote Sensing* and represented the University of Virginia at the Second Science Conference

of the Large-Scale Biosphere-Atmosphere Study in Brazil.

Patricia Wiberg served as associate editor of the *Journal of Sedimentary Research* and the *Journal of Geophysical Research*. She was also coeditor of *Continental-Margin Sedimentation: Transport to Sequence*.

A number of faculty members were named as "highly cited researchers" by the Institute of Scientific Information, placing them among the top 250 researchers in a particular field. **Jack Crosby** was listed in ecology/environmental science, **James N. Galloway** was cited in three areas—ecology/environmental science, geosciences, and engineering, **George N. Hornberger** was named in ecology/environmental science and engineering, and **Herman H. Shugart** was named in ecology/environmental science. According to ISI, highly cited researchers comprise less than one-half of one percent of all publishing researchers.

2004–2005 Publications

Aherne, J., T. Larssen, P. J. Dillon, and **B. J. Cosby**. 2004. Effects of climate events on elemental fluxes from forested catchments in Ontario, Canada: Modelling drought-induced redox processes. *Water, Air, & Soil Pollution: Focus* 4 (2–3): 37–48.

Andronova, N. G., M. E. Schlesinger, and **M. E. Mann**. 2004. Are reconstructed pre-instrumental hemispheric temperatures consistent with instrumental hemispheric temperatures? *Geophysical Research Letters* 31, L12202, doi:10.1029/2004GL019658.

Aranibar, J. N., L. Otter, **S. A. Macko**, C. J. W. Feral, **H. E. Epstein**, P. R. Dowty, F. Eckardt, **H. H. Shugart**, and **R. J. Swap**. 2004. Nitrogen cycling in the soil-plant system along a precipitation gradient in the Kalahari sands. The SAFARI 2000–Kalahari Transect Wet Season Campaign of Year 2000 Thematic Issue. *Global Change Biology* 10 (3): 359–73.

Bailey, L. L., W. L. Kendall, D. R. Church, and **H. M. Wilbur**. 2004. Estimating survival and breeding probability for pond-breeding amphibians: A modified robust design. *Ecology* 85 (9): 2456–66.

Baldocchi, D. D., T. A. Black, P. S. Curtis, E. Falge, **J. D. Fuentes**, A. Granier, L. Gu, A. Knohl, K. Pilegaard, H. P. Schmid, R. Valentini, K. Wilson, S. Wofsy, L. Xu, and S. Yamamoto. 2005. Predicting the onset of net carbon uptake by deciduous forests with soil temperature and climate data: A synthesis of FLUXNET data. *International Journal of Biometeorology* 49 (6): 377–87, doi:10.1007/s00484-005-0256-4.

Betts, R. A., and **H. H. Shugart**. 2005. Dynamic ecosystem and earth system models. Pp. 232–51 in *Climate Change and Biodiversity*, ed. T. Lovejoy and L. Hannah. New Haven, CT: Yale University Press.

Blum, L. K., and R. R. Christian. 2004. Belowground production and decompo-

sition along a tidal gradient in a Virginia salt marsh. Pp. 47–75 in *Ecogeomorphology of Tidal Marshes*, ed. S. Fagherazzi, M. Marani, and L. K. Blum. Coastal and Estuarine Studies, vol. 59. Washington, DC: American Geophysical Union.

Blum, L. K., M. S. Roberts, J. L. Garland, and **A. L. Mills**. 2004. Distribution of microbial communities associated with the dominant high marsh plants and sediments of the United States East Coast. *Microbial Ecology* 48 (3): 375–88.

Borum, J., O. Pedersen, T. M. Greve, T. A. Frankovich, **J. C. Zieman**, J. W. Fourqurean, and C. J. Madden. 2005. The potential role of plant oxygen and sulphide dynamics in die-off events of the tropical seagrass, *Thalassia testudinum*. *Journal of Ecology* 93 (1): 148–58.

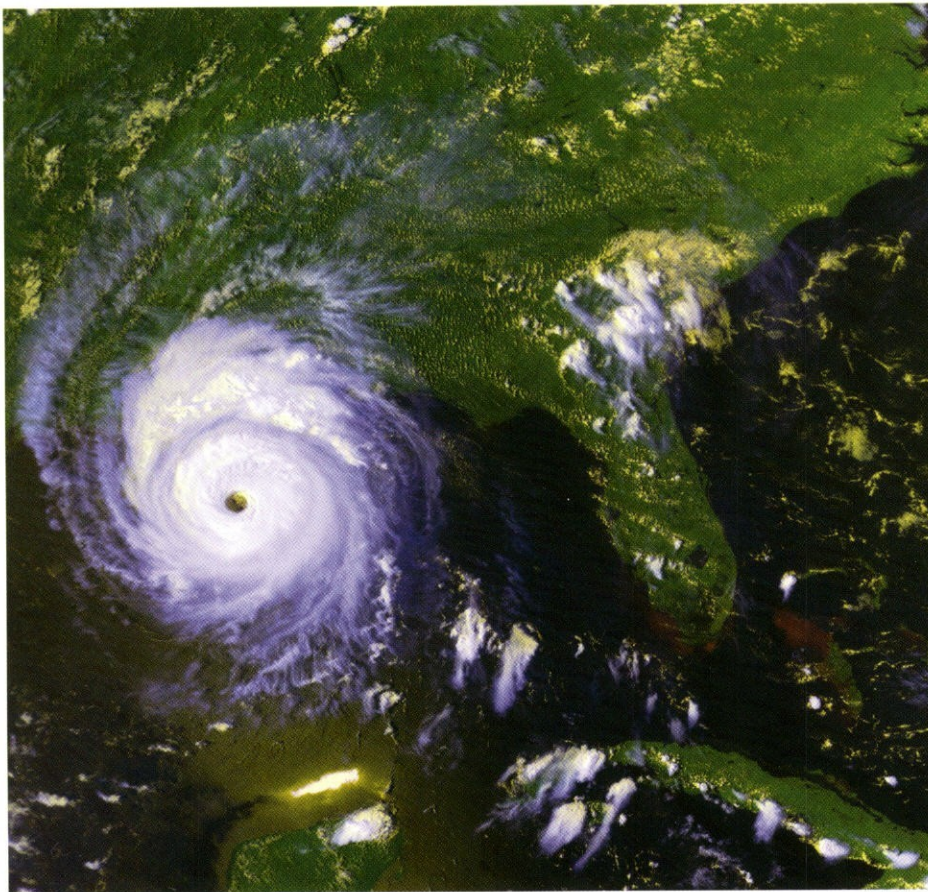
Burke, I. C., P. B. Hook, D. G. Milchunas, J. E. Barrett, M. A. Vinton, R. L. McCulley, J. P. Kaye, R. A. Gill, **H. E. Epstein**, R. H. Kelly, W. J. Parton, A. R. Mosier, C. M. Yonker, and P. Lowe. 2005. Soil organic matter and nutrient dynamics of shortgrass steppe ecosystems. In *Ecology of the Shortgrass Steppe: Perspectives from Long-Term Research*, ed. W. K. Lauenroth and I. C. Burke. Oxford: Oxford University Press.

Caylor, K. K., P. R. Dowty, **H. H. Shugart**, and S. Ringrose. 2004. Relationship between small-scale structural variability and simulated vegetation productivity across a regional moisture gradient in southern Africa. The SAFARI 2000–Kalahari Transect Wet Season Campaign of Year 2000 Thematic Issue. *Global Change Biology* 10 (3): 374–82.

Caylor, K. K., **T. M. Scanlon**, and I. Rodriguez-Iturbe. 2004. Feasible optimality of vegetation patterns in river basins. *Geophysical Research Letters* 31, L13502, doi:10.1029/2004GL020260.

Caylor, K. K., and **H. H. Shugart**. 2004. Simulated productivity of heterogeneous patches in southern African savanna landscapes using a canopy productivity model. *Landscape Ecology* 19 (4): 401–15.

Caylor, K. K., **H. H. Shugart**, and I. Rodriguez-Iturbe. 2005. Tree canopy effects on simulated water stress in southern African savannas. *Ecosystems* 8 (1): 17–32.



HURRICANE ANDREW

Image courtesy of the NASA GSFC Visualization Analysis Laboratory.

- Clair, T. A., I. F. Dennis, P. G. Amiro, and **B. J. Cosby**. 2004. Past and future chemistry changes in acidified Nova Scotian Atlantic salmon (*Salmo salar*) rivers: A dynamic modeling approach. *Canadian Journal of Fisheries and Aquatic Sciences* 61 (10): 1965–75.
- Cook, B. I., **M. E. Mann**, **P. D'Odorico**, and **T. M. Smith**. 2004. Statistical simulation of the influence of the NAO on European winter surface temperatures: Applications to phenological modeling. *Journal of Geophysical Research* 109, D16106, doi:10.1029/2003JD004305.
- Cooper, O. R., C. Forster, D. Parrish, M. Trainer, E. Dunlea, T. Ryerson, G. Hübler, F. Fehsenfeld, D. Nicks, J. Holloway, J. de Gouw, C. Warneke, J. M. Roberts, F. Flocke, and **J. Moody**. 2004. A case study of trans-Pacific warm conveyor belt transport: Influence of merging airstreams on trace gas import to North America. *Journal of Geophysical Research* 109, D23S08, doi:10.1029/2003JD003624.
- Dattagupta, S., D. C. Bergquist, E. B. Szalai, **S. A. Macko**, and C. R. Fisher. 2004. Tissue carbon, nitrogen, and sulfur stable isotope turnover in transplanted *Bathymodiolus childressi* mussels: Relation to growth and physiological condition. *Limnology and Oceanography* 49 (4): 1144–51.
- Davis, R. E.**, P. C. Knappenberger, **P. J. Michaels**, and W. M. Novicoff. 2004. Seasonality of climate-human mortality relationships in U.S. cities and impacts of climate change. *Climate Research* 26 (1): 61–76.
- D'Odorico, P.**, S. Fagherazzi, and R. Rigon. 2005. Potential for landsliding: Dependence on hyetograph characteristics. *Journal of Geophysical Research—Earth Surface* 110, F01007, doi:10.1029/2004JF000127.
- D'Odorico, P.**, and A. Porporato. 2004. Preferential states in soil moisture and climate dynamics. *Proceedings of the National Academy of Sciences* 101 (24): 8848–51, doi:10.1073/pnas.0401428101.
- D'Odorico, P.**, A. Porporato, F. Laio, L. Ridolfi, and I. Rodriguez-Iturbe. 2004. Probabilistic modeling of nitrogen and carbon dynamics in water-limited ecosystems. *Ecological Modelling* 179 (2): 205–19.
- Douglass, D. H., B. D. Pearson, S. F. Singer, P. C. Knappenberger, and **P. J. Michaels**. 2004. Disparity of tropospheric and surface temperature trends: New evidence. *Geophysical Research Letters* 31, doi:10.1029/2004GL020212.
- Druckenbrod, D. L., and **H. H. Shugart**. 2004. Forest history of James Madison's Montpelier Plantation. *Journal of the Torrey Botanical Society* 131 (3): 204–19.
- Dudash, M. R., C. J. Murren, and **D. E. Carr**. 2005. Using *Mimulus* as a model system to understand the role of inbreeding in conservation: Genetic and ecological approaches. *Annals of the Missouri Botanical Garden* 92 (1): 36–51.
- Elberling, B., B. H. Jakobsen, **P. Berg**, J. Søndergaard, and C. Sigsgaard. 2004. Influence of vegetation, temperature, and water content on soil carbon distribution and mineralization in four high Arctic soils. *Arctic, Antarctic, and Alpine Research* 36 (4): 528–38.
- Engel, M. H., V. E. Andrus, and **S. A. Macko**. 2004. Amino acids in carbonaceous meteorites: Biotic or abiotic? *Proceedings of the International Society for Optical Engineering* 5163:1–6.
- Epstein, H. E.**, J. Beringer, W. A. Gould, A. H. Lloyd, C. O. Thompson, F. S. Chapin III, G. J. Michaelson, C. L. Ping, T. S. Rupp, and D. A. Walker. 2004. The nature of spatial transitions in the Arctic. *Journal of Biogeography* 31 (12): 1917–33.
- Epstein, H. E.**, M. P. Calef, M. D. Walker, F. S. Chapin III, and A. M. Starfield. 2004. Detecting changes in arctic plant communities in response to warming over decadal time scales. *Global Change Biology* 10 (8): 1325–34.
- Epstein, H. E.**, J. M. Paruelo, G. Piñeiro, I. C. Burke, W. K. Lauenroth, and J. E. Barrett. 2005. Interactions of water and nitrogen on primary productivity across spatial and temporal scales in grassland and shrubland ecosystems. In *Dryland Ecohydrology*, ed. **P. D'Odorico** and A. Porporato. Berlin: Springer-Verlag.
- Erwin, R. M.**, G. M. Sanders, and D. J. Prosser. 2004. Lagoonal marsh morphology at selected northeastern Atlantic coast sites of significance to migratory waterbirds. *Wetlands* 24 (4): 891–903.
- Fagherazzi, S., **A. D. Howard**, and **P. L. Wiberg**. 2004. Modeling fluvial erosion and deposition on continental shelves during sea level cycles. *Journal of Geophysical Research* 109, F03010, doi:10.1029/2003JF000091.
- Ferdie, M.**, and J. W. Fourqurean. 2004. Responses of seagrass communities to fertilization along a gradient of relative availability of nitrogen and phosphorus in a carbonate environment. *Limnology and Oceanography* 49 (6): 2082–94.
- Ferrier S., G. V. N. Powell, K. S. Richardson, G. Manion, J. M. Overton, T. F. Allnut, S. E. Cameron, K. Mantle, N. D. Burgess, D. P. Faith, **J. F. Lamoreux**, G. Kier, R. J. Hijmans, V. A. Funk, G. A. Cassis, B. L. Fisher, P. Flemons, D. Lees, J. C. Lovett, and R. S. A. R. van Rompaey. 2004. Mapping more of terrestrial biodiversity for global conservation assessment. *BioScience* 54 (12): 1101–9.
- Fischer, E. V., R. W. Talbot, J. E. Dibb, **J. L. Moody**, and G. L. Murray. 2004. Summertime ozone on Mount Washington: Meteorological controls at the highest peak in the Northeast. *Journal of Geophysical Research* 109, D24303, doi:10.1029/2004JD004841.
- Forsberg-Taylor, N. K., **A. D. Howard**, and R. A. Craddock. 2004. Crater degradation in the Martian highlands: Morphometric analysis of the Sinus Sabaeus region and simulation modeling suggest fluvial processes. *Journal of Geophysical Research—Planets* 109, E05002, doi:10.1029/2004JE002242.
- Frankovich, T. A., and **J. C. Zieman**. 2005. A temporal investigation of grazer dynamics, nutrients, seagrass leaf productivity, and epiphyte standing stock. *Estuaries* 28 (1): 41–52.
- Galloway, J. N.**, F. J. Dentener, D. G. Capone, E. W. Boyer, R. W. Howarth, S. P. Seitzinger, G. P. Asner, C. C. Cleveland, P. A. Green, E. A. Holland, D. M. Karl, A. F. Michaels, **J. H. Porter**, A. R. Townsend, and C. J. Vörösmarty. 2004. Nitrogen cycles: Past, present and future. *Biogeochemistry* 70 (2): 153–226.
- Garstang, M.** 2004. Long-distance, low-frequency elephant communication. *Journal of Comparative Physiology A* 190 (10): 791–805.

Publications

- Green, P. A., C. J. Vörösmarty, M. Meybeck, **J. N. Galloway**, B. J. Peterson, and E. W. Boyer. 2004. Pre-industrial and contemporary fluxes of nitrogen through rivers: A global assessment based on typology. *Biogeochemistry* 68 (1): 71–105.
- Herman, J. S.** 2004. Water chemistry in caves. Pp. 609–14 in *Encyclopedia of Caves*, ed. D. C. Culver and W. B. White. San Diego, CA: Elsevier Science/Academic Press.
- Howard, A. D.**, and J. M. Moore. 2004. Scarp-bounded benches in Gorgonum Chaos, Mars: Formed beneath an ice-covered lake? *Geophysical Research Letters* 31, L01702, doi:10.1029/2003GL018925.
- Irwin, R. P., III, **A. D. Howard**, and T. A. Maxwell. 2004. Geomorphology of Ma'adim Vallis, Mars, and associated paleolake basins. *Journal of Geophysical Research* 109, E12009, doi:10.1029/2004JE002287.
- Irwin, R. P., III, T. R. Watters, **A. D. Howard**, and J. R. Zimbelman. 2004. Sedimentary resurfacing and fretted terrain development along the crustal dichotomy boundary, Aeolis Mensae, Mars. *Journal of Geophysical Research* 109, E09011, doi:10.1029/2004JE002248.
- Ivey, C. T., **D. E. Carr**, and M. D. Eubanks. 2004. Effects of inbreeding in *Mimulus guttatus* on tolerance to herbivory in natural environments. *Ecology* 85 (2): 567–74.
- James-Pirri, M. J., **R. M. Erwin**, D. J. Prosser, and J. Taylor. 2004. Monitoring salt marsh responses to Open Marsh Water Management. *Ecological Restoration* 22 (1): 55–56.
- Jia, G. J., **H. E. Epstein**, and D. A. Walker. 2004. Controls over intraseasonal patterns of AVHRR-NDVI for the Arctic tundra in northern Alaska. *International Journal of Remote Sensing* 25 (9): 1547–64.
- Jones, P. D., and **M. E. Mann**. 2004. Climate over past millennia. *Reviews of Geophysics* 42, RG2002, doi:10.1029/2003RG000143.
- Kang, S., and **A. L. Mills**. 2004. Soil bacterial community structure changes following disturbance in the overlying plant community. *Soil Science* 169 (1): 55–65.
- Keene, W. C.**, and A. A. P. Pszeny. 2004. Technical comment on “Reactions at interfaces as a source of sulfate formation in sea-salt particles” by A. Laskin, D. J. Gaspar, W. Wang, S. W. Hunt, J. P. Cowin, S. D. Colson, and B. J. Finlayson-Pitts. *Science* 303 (5658): 628.
- Keene, W. C.**, A. A. P. Pszeny, **J. R. Maben**, E. Stevenson, and A. Wall. 2004. Closure evaluation of size-resolved aerosol pH in the New England coastal atmosphere during summer. *Journal of Geophysical Research* 109, D23307, doi:10.1029/2004JD004801.
- Kelley, A. M., **H. E. Epstein**, and D. A. Walker. 2004. Role of vegetation and climate in permafrost active layer depth in arctic tundra of northern Alaska and Canada. *Journal of Glaciology and Geocryology* 26 (suppl.): 269–74.
- Krankina, O. N., K. M. Bergen, G. Sun, **H. H. Shugart**, V. Kharuk, E. Kasischke, K. M. Bergen, J. G. Masek, W. B. Cohen, D. R. Oetter, and M. V. Duane. 2004. Northern Eurasia: Remote sensing of boreal forests in selected regions. Pp. 123–38 in *Land Change Science: Observing, Monitoring, and Understanding Trajectories of Change on the Earth's Surface*, ed. G. Gutman, A. C. Janetos, C. O. Justice, E. F. Moran, J. F. Mustard, R. R. Rindfuss, D. Skole, B. L. Turner II, and M. A. Cochrane. Norwell, MA: Kluwer Academic Publishers.
- Kruse, J. A., R. G. White, **H. E. Epstein**, B. Archie, M. Berman, S. R. Braund, F. S. Chapin III, J. Charlie Sr., J. Eamer, N. Flanders, B. Griffith, S. Haley, L. Huskey, B. Joseph, D. R. Klein, G. P. Kofinas, S. M. Martin, S. M. Murphy, W. Nebesky, C. Nicolson, K. Peter, D. E. Russell, J. Tetlich, A. Tussing, M. D. Walker, and O. R. Young. 2004. Modeling sustainability of arctic communities: An interdisciplinary collaboration of researchers and local knowledge holders. *Ecosystems* 7 (8): 815–28.
- Lamoureux, J.** 2004. Stygobites are more wide-ranging than troglobites. *Journal of Cave and Karst Studies* 66 (1): 18–19.
- Larssen, T., **B. J. Cosby**, and T. Høggåsen. 2004. Uncertainties in predictions of surface water acidity using the MAGIC model. *Water, Air, & Soil Pollution: Focus* 4 (2–3): 125–37.
- Lauenroth, W. K., **H. E. Epstein**, J. M. Paruelo, I. C. Burke, M. R. Aguiar, and O. E. Sala. 2004. Potential effects of climate change on the temperate zones of North and South America. *Revista Chilena de Historia Natural* 77 (3): 439–53.
- Lawrence, D.** 2005. Biomass accumulation after 10–200 years of shifting cultivation in Bornean rain forest. *Ecology* 86 (1): 26–33.
- Lawrence, D.** 2004. Erosion of tree diversity during 200 years of shifting cultivation in Bornean rain forest. *Ecological Applications* 14 (6): 1855–69.
- Lawrence, D.** 2004. Land-use change, biodiversity and ecosystem functioning in West Kalimantan. Pp. 253–68 in *Land Use, Nature Conservation and the Stability of Rainforest Margins in Southeast Asia*, ed. G. Gerold, M. Fremerey, and E. Guhardja. Berlin: Springer-Verlag.
- Lawrence, D.**, and D. R. Foster. 2004. Recovery of nutrient cycling and ecosystem properties following swidden cultivation: Regional and stand-level constraints. Pp. 81–104 in *Integrated Land-Change Science and Tropical Deforestation in the Southern Yucatán: Final Frontiers*, ed. B. L. Turner II, J. Geoghegan, and D. R. Foster. Oxford: Oxford University Press.
- Lawrence, D.**, H. F. M. Vester, D. Pérez-Saliciup, J. R. Eastman, B. L. Turner II, and J. Geoghegan. 2004. Integrated analysis of ecosystem interactions with land-use change: The Southern Yucatán peninsular region. Pp. 277–92 in *Ecosystems and Land Use Change*, ed. G. Asner, R. Defries, and R. Houghton. Washington, DC: American Geophysical Union.
- Leahy, P., G. Kiely, and **T. M. Scanlon**. 2004. Managed grasslands: A greenhouse gas sink or source? *Geophysical Research Letters* 31, L20507, doi:10.1029/2004GL021161.
- L'Heureux, M. L., **M. E. Mann**, B. I. Cook, B. E. Gleason, and R. S. Vose. 2004. Atmospheric circulation influences on seasonal precipitation patterns in Alaska during the latter 20th century. *Journal of Geophysical Research* 109, D06106, doi:10.1029/2003JD003845.
- Macko, S. A.**, T. Szuba, **R. Swap**, H. Annegarn, B. Marjanovic, F. Vieira, and

R. Brito. 2004. Real-time interactive environmental teleducation between southern Africa and the United States. *South African Journal of Science* 100:5–8.

Mann, M. E. 2004. On smoothing potentially non-stationary climate time series. *Geophysical Research Letters* 31, L07214, doi:10.1029/2004GL019569.

Mann, M. E., M. A. Cane, S. E. Zebiak, and A. Clement. 2005. Volcanic and solar forcing of the tropical Pacific over the past 1000 Years. *Journal of Climate* 18 (3): 447–56.

Manzoni, S., A. Porporato, **P. D'Odorico,** F. Laio, and I. Rodriguez-Iturbe. 2004. Soil nutrient cycles as a nonlinear dynamical system. *Nonlinear Processes in Geophysics* 11 (5/6): 589–98.

McGlathery, K. J., K. Sundbäck, and I. C. Anderson. 2004. The importance of primary producers for benthic nitrogen and phosphorus cycling. Pp. 232–63 in *Estuarine Nutrient Cycling: The Influence of Primary Producers*, ed. S. L. Nielsen, G. T. Banta, and M. F. Pedersen. Norwell, MA: Kluwer Academic Publishers.

McKittrick, R., and **P. J. Michaels.** 2004. A test of corrections for extraneous signals in gridded surface temperature data. *Climate Research* 26 (2): 159–73.

Michaels, P. J. 2004. *Meltdown: The Predictable Distortion of Global Warming by Scientists, Politicians, and the Media.* Washington, DC: Cato Books. 272 pp. + illustrations.

Michaels, P. J., P. C. Knappenberger, O. W. Frauenfeld, and **R. E. Davis.** 2004. Trends in precipitation on the wettest days of the year across the contiguous USA. *International Journal of Climatology* 24 (15): 1873–82.

Midgley, G. F., J. N. Aranibar, K. B. Mantlana, and **S. A. Macko.** 2004. Photosynthetic and gas exchange characteristics of dominant woody plants on a moisture gradient in an African savanna. *Global Change Biology* 10 (3): 309–17.

Mittermeier R. A., P. Robles Gil, M. Hoffman, J. Pilgrim, T. Brooks, C. G. Mittermeier, **J. Lamoreux,** and G. A. B. da Fonseca. 2004. *Hotspots Revisited: Earth's Biologically Richest and Most Endangered Terrestrial Ecoregions.* Mexico City: CEMEX.

Moldan, F., V. Kronnäs, A. Wilander, E. Karlun, and **B. J. Cosby.** 2004. Modelling acidification and recovery of Swedish lakes. *Water, Air, & Soil Pollution: Focus* 4 (2–3): 139–60.

Moore, J. M., and **A. D. Howard.** 2005. Large alluvial fans on Mars. *Journal of Geophysical Research* 110, E04005, doi:10.1029/2004JE002352.

Okin, G. S., and T. H. Painter. 2004. Effect of grain size on remotely sensed spectral reflectance of sandy desert surfaces. *Remote Sensing of Environment* 89 (3): 272–80.

Overton, M. F., J. S. Fisher, and **R. Dolan.** 2004. Predicting shoreline change on a manipulated shoreline. Pp. 2462–70 in *Coastal Engineering 2004: Proceedings of the 29th International Conference*, vol. 3. Hackensack, NJ: World Scientific Publishing Co.

Palm, C. A., P. L. O. A. Machado, T. Mahmood, J. Melillo, S. T. Murrell, J. Nyamangara, M. Scholes, E. Sisworo, J. E. Olesen, J. Pender, J. Stewart, and **J. N. Galloway.** 2004. Societal responses for addressing nitrogen fertilizer needs: Balancing food production and environmental concerns. Pp. 71–93 in *Agriculture and the Nitrogen Cycle: Assessing the Impacts of Fertilizer Use on Food Production and the Environment*, ed. A. R. Mosier, J. K. Syers, and J. R. Freney. Washington, DC: Island Press.

Peterson, B. V., M. Hummerick, M. S. Roberts, V. Krumins, A. L. Kish, J. L. Garland, S. Maxwell, and **A. L. Mills.** 2004. Characterization of microbial and chemical composition of shuttle wet waste with permanent gas and volatile organic compound analyses. *Advances in Space Research* 34 (7): 1470–76.

Porporato A., and **P. D'Odorico.** 2004. Phase transitions driven by state-dependent Poisson noise. *Physical Review Letters* 92 (11): 110601.

Pszenny, A. A. P., J. Moldanová, **W. C. Keene,** R. Sander, **J. R. Maben,** M. Martinez, P. J. Crutzen, D. Perner, and R. G. Prinn.



DUST ALONG THE AFRICAN COAST (STREAMERS OF DUST)

Image courtesy of SeaWiFS Project, NASA/Goddard Space Flight Center, and ORBIMAGE.

2004. Halogen cycling and aerosol pH in the Hawaiian marine boundary layer. *Atmospheric Chemistry and Physics* 4 (1): 147–68.

Raulfs, E. C., **S. A. Macko,** and C. L. Van Dover. 2004. Tissue and symbiont condition of mussels (*Bathymodiolus thermophilus*) exposed to varying levels of hydrothermal activity. *Journal of the Marine Biological Association of the UK* 84 (1): 229–34.

Ravi, S., **P. D'Odorico,** T. M. Over, and T. M. Zobeck. 2004. On the effect of air humidity on soil susceptibility to wind erosion: The case of air-dry soils. *Geophysical Research Letters* 31, L09501, doi:10.1029/2004GL019485.

Ray, G. C. 2004. Reconsidering “dangerous targets” for marine protected areas. *Aquatic Conservation: Marine and Freshwater Ecosystems* 14 (2): 211–15.

Rice, K. C., J. G. Chanut, **G. M. Hornberger,** and **J. R. Webb.** 2004. Interpretation of concentration-discharge patterns in acid-neutralizing capacity during storm flow in three small, forested catchments in Shenandoah National Park, Virginia. *Water Resources Research* 40, W05301, doi:10.1029/2003WR002709.

Publications

- Riedel, S. M., **H. E. Epstein**, D. A. Walker, D. L. Richardson, M. P. Calef, E. J. Edwards, and A. Moody. 2005. Spatial and temporal heterogeneity of vegetation properties among four tundra plant communities at Ivotuk, Alaska, U.S.A. *Arctic, Antarctic, and Alpine Research* 37 (1): 25–33.
- Rissler, L. R., **H. M. Wilbur**, and D. R. Taylor. 2004. The influence of ecology and genetics on behavioral variation in salamander populations across the Eastern Continental Divide. *American Naturalist* 164 (2): 201–13.
- Roberts, M. S., J. L. Garland, and **A. L. Mills**. 2004. Microbial astronauts: Assembling microbial communities for Advanced Life Support Systems. *Microbial Ecology* 47 (2): 137–49.
- Ross, K. M., C. R. Hupp, and **A. D. Howard**. 2004. Sedimentation in floodplains of selected tributaries of Chesapeake Bay. Pp. 187–208 in *Riparian Vegetation and Fluvial Geomorphology*, ed. S. J. Bennett and A. Simon. Water Science and Application Series, vol. 8. Washington, DC: American Geophysical Union.
- Rounds, R. A., **R. M. Erwin**, and **J. H. Porter**. 2004. Nest-site selection and hatching success of waterbirds in coastal Virginia: Some results of habitat manipulation. *Journal of Field Ornithology* 75 (4): 317–29.
- Ruddiman, W. F.** 2004. Early anthropogenic overprints on Holocene climate. *PAGES News* 12 (1): 18–19.
- Ruddiman, W. F.** 2004. The role of greenhouse gases in orbital-scale climatic changes. *EOS* 85:1–7.
- Scanlon, T. M.**, and J. D. Albertson. 2004. Canopy scale measurements of CO₂ and water vapor exchange along a precipitation gradient in southern Africa. The SAFARI 2000–Kalahari Transect Wet Season Campaign of Year 2000 Thematic Issue. *Global Change Biology* 10 (3): 329–41.
- Scanlon, T. M.**, K. K. Caylor, S. Manfreda, S. A. Levin, and I. Rodriguez-Iturbe. 2005. Dynamic response of grass cover to rainfall variability: Implications for the function and persistence of savanna ecosystems. *Advances in Water Resources* 28 (3): 291–302.
- Scanlon, T. M.**, G. Kiely, and Q. Zie. 2004. A nested catchment approach for defining the hydrological controls on phosphorus transport. *Journal of Hydrology* 291 (3–4): 218–31.
- Schmidt, G. A., and **M. E. Mann**. 2004. Reply to comment on “Ground vs. surface air temperature trends: Implications for borehole surface temperature reconstructions” by D. Chapman et al. *Geophysical Research Letters* 31, L07206, doi:10.1029/2003GL019144.
- Schmidt, G. A., D. T. Shindell, R. L. Miller, **M. E. Mann**, and D. Rind. 2004. General circulation modelling of Holocene climate variability. *Quaternary Science Reviews* 23 (20–22): 2167–81.
- Shindell, D. T., G. A. Schmidt, **M. E. Mann**, and G. Faluvegi. 2004. Dynamic winter climate response to large tropical volcanic eruptions since 1600. *Journal of Geophysical Research* 109, D05104, doi:10.1029/2003JD004151.
- Shugart, H. H.** 2004. *How the Earthquake Bird Got Its Name and Other Tales of an Unbalanced Nature*. New Haven, CT: Yale University Press. 240 pp.
- Shugart, H. H.**, and **S. A. Macko**. 2004. Verification of dynamic global vegetation models using Kalahari Transect/SAFARI 2000 wet season data. Special Issue. *Global Change Biology* 10:273–392.
- Shugart, H. H.**, **S. A. Macko**, P. Lesolle, T. Szuba, M. M. Mukelabai, P. Dowty, and **R. J. Swap**. 2004. The SAFARI 2000–Kalahari Transect wet season campaign of year 2000. The SAFARI 2000–Kalahari Transect Wet Season Campaign of Year 2000 Thematic Issue. *Global Change Biology* 10 (3): 273–80.
- Smith, T. M.**, and R. L. Smith. 2005. *Elements of Ecology*. 6th ed. Menlo Park, CA: Benjamin Cummings.
- Soja, A. J., W. R. Cofer, **H. H. Shugart**, A. I. Sukhinin, P. W. Stackhouse Jr., D. J. McRae, and S. G. Conard. 2004. Estimating fire emissions and disparities in boreal Siberia (1998–2002). *Journal of Geophysical Research* 109, D14S06, doi:10.1029/2004JD004570.
- Soja, A. J., A. I. Sukhinin, D. R. Cahoon Jr., **H. H. Shugart**, and P. W. Stackhouse Jr. 2004. AVHRR-derived fire frequency, distribution and area burned in Siberia. *International Journal of Remote Sensing* 25 (10): 1939–60.
- Stow, D. A., A. Hope, D. McGuire, D. Verbyla, J. Gamon, F. Huemmrich, S. Houston, C. Racine, M. Sturm, K. Tape, L. Hinzman, K. Yoshikawa, C. Tweedie, B. Noyle, C. Silapaswan, D. Douglas, B. Griffith, G. Jia, **H. Epstein**, D. Walker, S. Daeschner, A. Petersen, L. Zhou, and R. Myneni. 2004. Remote sensing of vegetation and land-cover change in Arctic Tundra Ecosystems. *Remote Sensing of Environment* 89 (3): 281–308.
- Strong, C., and **R. E. Davis**. 2005. The surface of maximum wind as an alternative to the isobaric surface for wind climatology. *Geophysical Research Letters* 32, L04813, doi:10.1029/2004GL022039.
- Strong, C., **J. D. Fuentes**, and D. Baldocchi. 2004. Reactive hydrocarbon flux footprints during canopy senescence. *Agricultural and Forest Meteorology* 127 (3–4): 159–73.
- Sullivan, T. J., **B. J. Cosby**, A. T. Herlihy, **J. R. Webb**, **A. J. Bulger**, K. U. Snyder, P. Brewer, E. H. Gilbert, and D. L. Moore. 2004. Regional model projections of future effects of sulfur and nitrogen deposition on streams in the Southern Appalachian Mountains. *Water Resources Research* 40, W02101, doi:10.1029/2003WR001998.
- Sundback, K., and **K. J. McGlathery**. 2005. Interactions between benthic macroalgal and microalgal mats. In *Interactions Between Macro- and Microorganisms in Marine Sediments*, ed. E. Kristensen, R. R. Haese, and J. E. Kostka. Coastal and Estuarine Studies, vol. 60. Washington, DC: American Geophysical Union.
- Swap, R. J.**, J. N. Aranibar, P. R. Dowty, W. P. Gilhooly III, and **S. A. Macko**. 2004. Natural abundance of ¹³C and ¹⁵N in C₃ and C₄ vegetation of southern Africa: Patterns and implications. The SAFARI 2000–Kalahari Transect Wet Season Campaign of Year 2000 Thematic Issue. *Global Change Biology* 10 (3): 350–58.
- Thomsen, M. S., and **K. J. McGlathery**. 2005. Facilitation of macroalgae by the sedimentary tube forming polychaete *Diopatra cuprea*. *Estuarine, Coastal and Shelf Science* 62 (1–2): 63–73.

Townsend, M. A., D. P. Young, and **S. A. Macko**. 2004. Kansas case study applications of nitrogen-15 natural abundance method for identification of nitrate sources. *Journal of Hazardous Substance Research* 4:1–22.

Vutchkov, M., G. Lalor, and **S. A. Macko**. 2004. Inorganic and organic geochemistry techniques. In *Essentials of Medical Geology: Impacts of the Natural Environment on Public Health*, ed. O. Selinus. San Diego, CA: Elsevier Science/Academic Press.

Walker, D. A., **H. E. Epstein**, W. A. Gould, A. Kade, A. Kelley, J. A. Knudson, W. B. Krantz, R. A. Peterson, C. L. Ping, M. K. Reynolds, and V. E. Romanovsky. 2004. Frost-boil ecosystems: Complex interactions between landforms, soils, vegetation and climate. *Permafrost and Periglacial Processes* 15 (2): 171–88.

Walker, S. M., and **P. V. Desanker**. 2004. The impact of land use on soil carbon in Miombo Woodlands of Malawi. *Forest Ecology and Management* 203 (1–3): 345–60.

Webb, J. R., B. J. Cosby, F. A. Deviney Jr., J. N. Galloway, S. W. Maben, and A. J. Bulger. 2004. Are brook trout streams in western Virginia and Shenandoah National Park recovering from acidification? *Environmental Science & Technology* 38 (15): 4091–96.

Welsch, D. L., and **G. M. Hornberger**. 2004. Spatial and temporal simulation of soil CO₂ concentrations in a small forested catchment in Virginia. *Biogeochemistry* 71 (3): 413–34.

Whitehead, P. G., **B. J. Cosby**, and H. Prior. 2005. The Wheal Jane wetlands model for bioremediation of acid mine drainage.

Science of the Total Environment 338 (1–2): 125–35.

Wilson, S. A., and J. R. Zimelman. 2004. Latitude-dependent nature and physical characteristics of transverse aeolian ridges on Mars. *Journal of Geophysical Research* 109, E10003, doi:10.1029/2004JE002247.

Wimmers, A. J., and **J. L. Moody**. 2004. Tropopause folding at satellite-observed spatial gradients: 1. Verification of an empirical relationship. *Journal of Geophysical Research* 109, D19306, doi:10.1029/2003JD004145.

Wimmers, A. J., and **J. L. Moody**. 2004. Tropopause folding at satellite-observed spatial gradients: 2. Development of an empirical model. *Journal of Geophysical Research* 109, D19307, doi:10.1029/2003JD004146.

Wright, R. F., and **B. J. Cosby**. 2004. Recovery of acidified mountain lakes in Norway as predicted by the MAGIC model. *Journal of Limnology* 63 (1): 101–10.

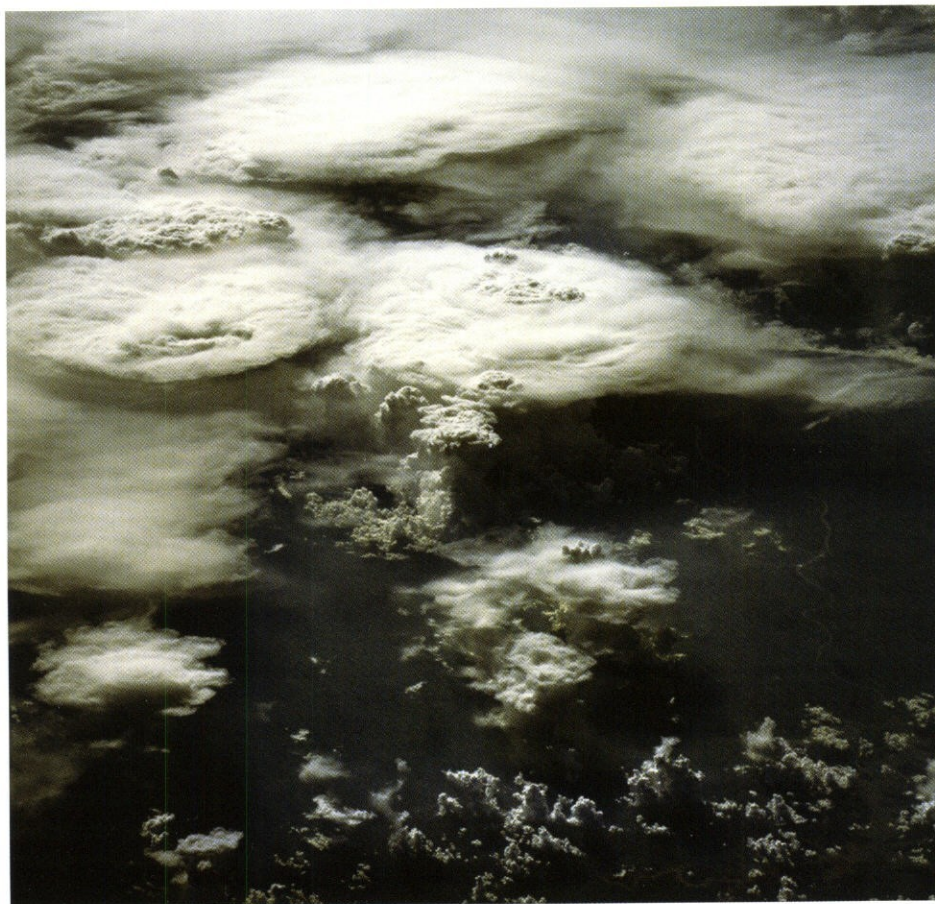
Yu, M., J. E. Ellis, and **H. E. Epstein**. 2004. Regional analysis of climate, primary production, and livestock density in Inner Mongolia. *Journal of Environmental Quality* 33:1675–81.

Yurewicz, K. L., and **H. M. Wilbur**. 2004. Resource availability and costs of reproduction in the salamander *Plethodon cinereus*. *Copeia* 2004 (1): 28–36.

Zhang, Z., and **Mann, M. E.** 2005. Coupled patterns of spatiotemporal variability in Northern Hemisphere sea level pressure and conterminous U.S. drought. *Journal of Geophysical Research* 110, D03108, doi:10.1029/2004JD004896.

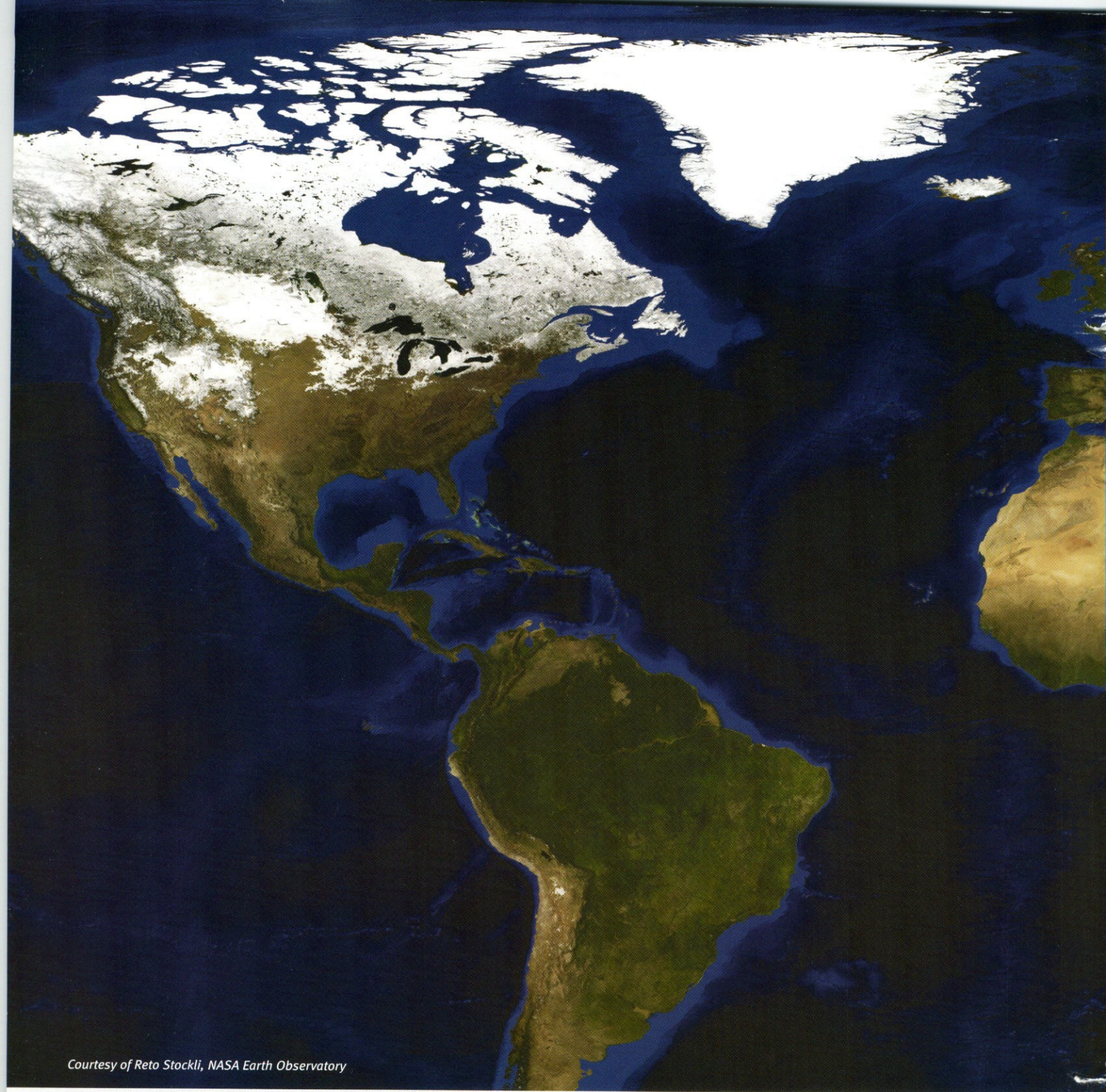
Zhang, Z., **M. E. Mann**, and E. R. Cook. 2004. Alternative methods of proxy-based climate field reconstruction: Application to the reconstruction of summer drought over the conterminous United States back to 1700 from drought-sensitive tree ring data. *Holocene* 14:502–16.

Zieman, J. C., J. W. Fourqurean, and T. A. Frankovich. 2004. Reply to B. E. Lapointe and P. J. Barile's comment on our paper "Seagrass dieoff in Florida Bay: Long-term trends in abundance and growth of turtle grass, *Thalassia testudinum*." *Estuaries* 27 (1): 165–72.



THUNDERSTORMS OVER BRAZIL

Image courtesy of the Earth Sciences and Image Analysis Laboratory at Johnson Space Center.



Courtesy of Reto Stockli, NASA Earth Observatory



Department of Environmental Sciences
University of Virginia
291 McCormick Road
P.O. Box 400123
Charlottesville, VA 22904-4123

Nonprofit Organization
U.S. Postage
PAID
Permit No. 164
Charlottesville, VA