
International Symposium on Sustainability Science:
The Emerging Paradigm and the Urban Environment
Keynote Speakers

Robert W. Kates
Independent Scholar

Dr. Robert W. Kates' research focuses on long-term trends in environment, development, and population, and he is particularly known for his work on natural hazards mitigation, driven by a Quaker belief in relevance to human society. Kates defines his central question as "What is and ought to be the human use of the Earth?" This has led him to address the human use of natural resources and human response to hazards. His approach is to set up "natural" experiments, and then to develop a set of comparative observations or analogs. This led to several studies of natural and technological hazards, rural resource and water development, and methodologies for studying people's perception of the environment, the assessment of risk, and the impacts of climate on society. Since retiring from Brown University he has continued to work on: the sustainability transition; long-term population dynamics; global environmental change; and the prevalence and persistence of hunger.

Following the devastation of New Orleans after Hurricane Katrina, he returned to his earlier work on hazards and published a research perspective on the reconstruction of New Orleans. Professor Kates helped to establish the international Initiative for Science and Technology for Sustainability, was Executive Editor of *Environment* magazine for many years, and is still a Senior Associate at Harvard University. In previous years, he worked in Africa with Clark University colleagues, and also developed and directed a resource assessment centre at the University of Dar El Salaam. At Clark University he founded CENTED (the Centre for Technology, Environment, and Development), now part of the Marsh Institute, where he remains a Distinguished Scientist.

Among several honors, he is a recipient of the 1991 National Medal of Science, is a MacArthur Fellow (1981–85). He is also a Member of the National Academy of Sciences, the American Academy of Arts and Sciences, a Fellow of the American Association for the Advancement of Science and the Academia Europaea. He was awarded an honorary DSc from Clark University for his many contributions to hazards research.

John D. Sterman
Massachusetts Institute of Technology

Dr. John D. Sterman is the Jay W. Forrester Professor of Management at the MIT Sloan School of Management and Director of MIT's System Dynamics Group. His research includes systems thinking and organizational learning, computer simulation of complex systems, climate change, and sustainability. He is the author of many scholarly and popular articles on the challenges and opportunities facing organizations today, including the book *Modeling for Organizational Learning*, and the award-winning textbook *Business Dynamics*.

Sterman's research centers on improving managerial decision making in complex systems. He has pioneered the development of "management flight simulators" of

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complex human systems. These flight simulators are now used by corporations and universities around the world. His recent research ranges from the dynamics of organizational change and the implementation of sustainable improvement programs to global climate change and sustainability.

Professor Sterman has twice been awarded the Jay W. Forrester Prize for the best published work in system dynamics, won a 2005 IBM Faculty Award, won the 2001 Accenture Award for the best paper of the year published in the *California Management Review* (with Nelson Repenning), has seven times won awards for teaching excellence from the students of the Sloan School, and was named one of the Sloan School's "Outstanding Faculty" by the 2001 *Business Week Guide to the Best Business Schools*. He has been featured in a wide range of print, broadcast, and web media for his work on management flight simulators, climate change, and sustainability.

Simon Asher Levin Princeton University

Dr. Simon A. Levin received his B.A. from Johns Hopkins University and his Ph.D. in mathematics from the University of Maryland. At Cornell University (1965-1992), he was Chair of the Section of Ecology and Systematics, and then Director of the Ecosystems Research Center, the Center for Environmental Research and the Program on Theoretical and Computational Biology, as well as Charles A. Alexander Professor of Biological Sciences (1985-1992). Since 1992, he has been at Princeton University where he is currently George M. Moffett Professor of Biology and Director of the Center for BioComplexity. His research interests are in understanding how macroscopic patterns and processes are maintained at the level of ecosystems and the biosphere, in terms of ecological and evolutionary mechanisms that operate primarily at the level of organisms, in infectious diseases, and in the interface between basic and applied ecology. Levin is a Fellow of the American Academy of Arts and Sciences and the American Association for the Advancement of Science, a Member of the National Academy of Sciences and the American Philosophical Society, and a Foreign Member of the Istituto Veneto. He is a University Fellow of Resources for the Future, a Fellow of the Beijer Institute of Ecological Economics, and a Fellow of the Society for Industrial and Applied Mathematics. He Chaired the Governing Council for IIASA for more than five years and is currently Vice-Chair, and co-chairs the Science Board of the Santa Fe Institute. He is also Vice-Chair for Mathematics of the Committee of Concerned Scientists. Levin is a former President of the Ecological Society of America and the Society for Mathematical Biology, and a past Chair of the Board of the Beijer Institute of Ecological Economics. He won the MacArthur Award (1988) and the Distinguished Service Citation (1998) of the Ecological Society of America, the Okubo Award of the Society for Mathematical Biology and the Japanese Society for Theoretical Biology, and the Distinguished Scientist Award of the American Institute for Biological Sciences. He was honored with the Dr. A.H. Heineken Prize for Environmental Sciences by the Royal Netherlands Academy of Arts and Sciences (2004) and the Kyoto Prize in Basic Sciences (2005) by the Inamori Foundation. Levin has mentored more than 100 graduate students and postdoctoral fellows, and has published widely.

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James Aronson

Center for Functional and Evolutionary Ecology, CNRS, Montpellier, Fr

Dr. James Aronson is a researcher at the Center for Functional and Evolutionary Ecology, of the government research network (CNRS), in Montpellier, France, and at the Missouri Botanical Garden, USA. He has worked on projects and programs related to the restoration and rehabilitation of degraded ecosystems for over 25 years. He is editor of the book series *Science and Practice of Ecological Restoration*, published jointly by the Society for Ecological Restoration International (SER) and Island Press. His own most recent books include:

- Aronson, J. S.J. Milton & J. Blignaut (eds.) 2007. *Restoring Natural Capital: Science, Business and Practice*. Island Press, Washington, D.C.
- Aronson, J. et al. (eds.) 2009. *Cork Oak Woodlands on the Edge: Ecology, Biogeography, and Restoration of an Ancient Mediterranean Ecosystem*. Island Press, Washington, D.C.
- Blondel, J.J., J. Aronson, J.-Y. Bodiou & G. Boeuf. 2010. *The Mediterranean Basin - biological diversity in space and time*. Oxford University Press, Oxford.

With South African economist Prof. James Blignaut, and Andre Clewell, president emeritus of SER, he founded the RNC Alliance (www.rncalliance.org) to advance RNC thinking. With Blignaut and Dr. Martin de Wit, he is also a director of the not-for-profit organization, ASSETResearch based in Pretoria, www.assetresearch.org.za. ASSET, an interdisciplinary research and capacity building program, focusing on the economy/environment interface in sub-Saharan Africa.

Ronald C. Baird

University of North Carolina – Wilmington

Dr. Ronald C. Baird is Research Professor at the University of North Carolina Wilmington's Center for Marine Science. He previously served as director of the National Sea Grant College Program and associate director for Ocean Research in the National Oceanic and Atmospheric Administration's principal line office for research.

Dr. Baird holds a Ph.D. in biology from Harvard University, an M.A. in zoology from the University of Texas at Austin, and a B.S. in zoology from Yale University. He served as vice president of university relations and director of corporate relations at Worcester Polytechnic Institute (WPI), the nation's third oldest engineering college. He was appointed by the Secretary of Commerce to the National Sea Grant Review Panel and served as its chair from 1992-1994. Dr. Baird was president and a director of Schuster Corporation, an investment holding company and also served as director of research at Geo-Marine, Inc., an engineering and environmental consulting firm in Dallas, Texas.

Dr. Baird spent nine years as a professor of marine science at the University of South Florida in St. Petersburg. His published works include contributions to the biology of deep-sea fishes, encounter theory and marine policy and management. He is a lifetime

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member of Sigma Xi and a fellow of the American Institute of Fisheries Research Biologists. In 2000, he received the Presidential Rank Award for helping position the U.S. as a world leader in marine research and the sustainable development of coastal resources. In 2006 he received his second Presidential Rank Award for his management innovations in the National Sea Grant Program.

Richard Burroughs **Rhode Island and Yale Universities**

Dr. Richard Burroughs is Professor of Marine Affairs at the University of Rhode Island and Adjunct Professor of Coastal Science and Policy at Yale University. His research focuses on the mechanisms that societies use to shape their coastal and marine activities, and the means by which natural science and technology influence those governance solutions. This approach is applied in *Coastal Governance* (Island Press, 2011) through assessing the origins and implementation challenges of sector-based, spatial, and ecosystem-based means of managing coastal systems. At the University of Rhode Island his teaching has included coastal ecosystem governance, marine pollution policy, marine science and policy analysis, ocean uses and marine science, coastal margin management, polar resources and policy, and a marine affairs seminar. Articles by Professor Burroughs have appeared in *Science*, *Coastal Management*, *Maritime Policy and Management*, *Ocean Management*, *Marine Policy*, *Environmental Management*, *Society and Natural Resources*, *Local Environment*, *Journal of Maritime Law and Commerce*, *Journal of Urban Technology*, and *Marine Geology*.

Robert Costanza **University of Vermont**

Dr. Robert Costanza is the Gordon and Lulie Gund Professor of Ecological Economics and director of the Gund Institute for Ecological Economics at the University of Vermont. He is also a Distinguished Research Fellow at the New Zealand Center for Ecological Economics, Massey University, Palmerston North, New Zealand, and a Senior Fellow at the Stockholm Resilience Center, Stockholm, Sweden.

Dr. Costanza's transdisciplinary research integrates the study of humans and the rest of nature to address research, policy and management issues at multiple time and space scales, from small watersheds to the global system. Dr. Costanza is co-founder and past-president of the International Society for Ecological Economics, and was chief editor of the society's journal, *Ecological Economics* from its inception in 1989 until 2002. He currently serves on the editorial board of eight other international academic journals. He is founding editor in chief of *Solutions*, a new hybrid academic/popular journal.

His awards include a Kellogg National Fellowship, the Society for Conservation Biology Distinguished Achievement Award, a Pew Scholarship in Conservation and the Environment, the Kenneth Boulding Memorial Award for Outstanding Contributions in

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Ecological Economics, and an honorary doctorate in natural sciences from Stockholm University.

Dr. Costanza is the author or co-author of over 400 scientific papers and 20 books. His work has been cited in more than 5,000 scientific articles and he has been named as one of ISI's Highly Cited Researchers. More than 200 interviews and reports on his work have appeared in various popular media. His article on "The value of the world's ecosystem services and natural capital", published in *Nature* 387:253-260 (1997) is the second most highly cited article in ecology/environment in the last decade. More information on Costanza and the Gund Institute is online at www.uvm.edu/giee/.

Rudolf de Groot **Wageningen University, The Netherlands**

Dr. Rudolf de Groot is Associate Professor in Integrated Ecosystem Assessment and Management with the Environmental Systems Analysis Group of Wageningen University, the Netherlands. He is a Landscape Ecologist by training and has worked for over 20 years on ecological-economic analysis of impact of land use and climate change on ecosystem services as a tool for sustainable planning and management. De Groot published over 100 scientific papers, including 2 books, and was involved as Coordinating Lead author in the UN-supported Millennium Ecosystem Assessment (2001-2005) www.maweb.org and is currently Coordinating Lead author of two chapters of a follow-up study on "The Economics of Ecosystems & Biodiversity" (TEEB 2008-2010) www.teebweb.org. He is Global Theme leader on Ecosystem Services of the IUCN Commission on Ecosystem Management (CEM) and a member of the Editorial Board of several Journals, including "Conservation Letters" and "Regional Environmental Change" and Editor-in-Chief of the International Journal on "Biodiversity Science, Ecosystem Services and Management".

Faye Duchin **Rensselaer Polytechnic University**

Dr. Faye Duchin is a Professor of Economics whose research analyzes scenarios for sustainable development that involve changes in demographics and consumption, resource availability, technological changes, and policy initiatives. She developed a model of the world economy, the World Trade Model, which is especially suited for cross-disciplinary analysis and is used by researchers at several institutions. One of her current studies is a multidisciplinary, EU-funded project for compiling a large, publicly available environmentally extended database of the world economy, to which the WTM is being applied to analyze scenarios about changes in diets and in farming methods in different parts of the world. Several of her doctoral students have used the model for other kinds of studies.

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Professor Duchin was previously director of the Institute for Economic Analysis at New York University. She came to Rensselaer in 1996 as dean of the School of Humanities and Social Sciences, resigning that position in 2002 to return full-time to research and teaching. She has served as president of the International Input-Output Association and vice president of the International Society for Ecological Economics and has been actively involved with the International Society for Industrial Ecology since its beginning. She was an early advocate for integrating that field's focus on technological options with input-output economics. She has published numerous journal articles and four books, including *Structural Economics: Measuring Change in Technology, Lifestyles and the Environment* and, with G. Lange, *The Future of the Environment: Ecological Economics and Technological Change*.

Stephen M. Gardiner **University of Washington**

Dr. Stephen M. Gardiner, Associate Professor in the Department of Philosophy and the Program on Values in Society, has written and taught about a number of issues in environmental ethics and policy. He is currently finishing work on his forthcoming book on the moral challenge posed by climate change. Much of his research and published work has concentrated in this area especially its intergenerational dimensions. But he has also written on the precautionary principle, world population, nuclear protection and geo-engineering. Dr. Gardiner specializes in ethics, political philosophy and environmental ethics. He is the editor of *Virtue Ethics, Old and New* (Cornell, 2005), and the coordinating co-editor (with Dale Jamieson, Simon Caney and Henry Shue) of *Climate Ethics* (Oxford, forthcoming). In *The Real Tragedy of the Commons* he offers a critical analysis of Garrett Hardin's application of the Tragedy of the Commons metaphor to world population, and (rejecting it) suggests that the more relevant tragedy is intergenerational and emerges most clearly in the climate change problem. His manuscript, *A Perfect Moral Storm: Climate Change, Intergenerational Ethics and the Global Environmental Tragedy* is also currently under contract at Oxford. In 2007, he organized the interdisciplinary conference Ethics and Climate Change at the University of Washington.

Alan D. Hecht **U.S. Environmental Protection Agency (EPA)**

Dr. Alan D. Hecht is Director for Sustainable Development in the Office of Research and Development, at the U.S. Environmental Protection Agency (EPA). In this role he leads planning and implementation of EPA science and technology research for sustainable development and bio-energy. On detail to the White House, from 2001 to 2003 he was Associate Director for Sustainable Development at the Council on Environmental Quality (2002–2003) and Director of International Environmental Affairs for the National Security Council (2001–2002) where he served as White House lead on issues related to environment and sustainable development and coordinator for preparations for the

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World Summit on Sustainable Development. At the EPA, he served as the Deputy Assistant Administrator for International Activities from 1989 to 2001 and Acting Assistant Administrator for International Activities from 1992 to 1994. Before joining the EPA, Dr. Hecht was Director of the National Climate Program at the National Oceanic and Atmospheric Administration (1981–1989) and Director of the Climate Dynamics Program at the National Science Foundation (1976–1981).

Dr Hecht has a PhD in Geology from Case Western Reserve University. His most recent publications are: “EPA at 40: Bringing Environmental Protection into the 21st Century” *ES&T*, 209, 43, 8716-8720. (With Joseph Fiksel, Thomas Graedel, David Rejeski, Gary Saylor, Peter Senge, Deborah Swackhamer and Thomas Theis.); “Government Perspective on Sustainability” *Chemical Engineering Progress*, January 2009, 41-46, and “The Next Level of Environmental Protection: Business Strategies and Government Policies Converging on Sustainability” *Sustainable Development Law and Policy*, Fall 2007, 19-25.

Eric Stowe Higgs **University of Victoria, Canada**

Dr. Eric S. Higgs, Professor and Director of the School of Environmental Studies, focuses his scholarly and civic work on ecological restoration, and more generally on how we relate to nature in a technological culture. His work spans conceptual issues in restoration (e.g., his book, *Nature by Design: People, Natural Process, and Ecological Restoration*, 2003), field studies in historical ecology (e.g., the Mountain Legacy Project <mountainlegacy.ca>), and restoration policy (e.g., chair of the Society for Ecological Restoration International, 2001-03). He is a professor in the School of Environmental Studies at the University of Victoria (Canada), and served as director of the School from 2001-2010.

His honors and awards include: Excellence in Leadership Award, Society for Ecological Restoration International 2003; Computerworld Laureate, Jasper Photo Project 2002; Golden Trowel Award, Society for Ecological Restoration 2000; and Conservation Award, Jasper National Park 1996.

Christopher Kennedy **University of Toronto**

Dr. Christopher Kennedy is a Professor in the Department of Civil Engineering at the University of Toronto, where he teaches courses in Engineering Ecology, Infrastructure Economics, and the Design of Infrastructure for Sustainable Cities. His work involves applying principles of Industrial Ecology to the design of urban infrastructure systems, including buildings, water systems, and urban transportation. Amongst his publications are studies of urban metabolism, greenhouse gas emissions from global cities and processes for developing sustainable urban transportation systems. His wider work includes

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contributions to probability theory, regional economics, contaminant transport and engineering education. His book *The Evolution of Great World Cities: Urban Wealth and Economic Growth* will be published by University of Toronto Press in early 2011.

Kennedy has worked and studied in Europe and North America. He holds degrees in Civil Engineering from Imperial College, London (B.Eng.) and the University of Waterloo, Canada (M.A.Sc., Ph.D.), as well as a diploma in Economics from the University of Warwick, U.K. and an MBA from the University of Toronto. His previous employers include the UFZ Centre for Environmental Research, Leipzig, and engineering firms in the UK. In 2004/05, Kennedy was a visiting professor at Oxford University and ETH Zürich. He has been a consultant on infrastructure economics for the Martin Prosperity Institute, Infrastructure Canada and the Ontario Ministry of Finance. He has also conducted professional and voluntary work for the Canadian Society for Civil Engineering, Environment Canada, the National Research Council, the US National Science Foundation, UN-HABITAT and the World Bank. Kennedy is Treasurer of the International Society for Industrial Ecology and an Associate Editor of the *Journal of Industrial Ecology*.

Judith Layzer **Massachusetts Institute of Technology**

Dr. Judith Layzer is Associate Professor of environmental policy in the Department of Urban Studies and Planning at MIT. Trained as a political scientist, she focuses on the role of science and values in environmental policymaking; the extent to which innovative approaches to environmental problem solving yield environmentally beneficial results; and the obstacles to environmentally sustainable behavior by individuals, firms, organizations, and governments. In *Natural Experiments* (MIT Press 2008), she investigates the extent to which ambitious experiments in ecosystem-based management yield genuine environmental improvements. A more recent book, *Freedom, Efficiency, and Environmental Protection* (MIT Press, forthcoming) examines the impact of political conservatives on environmental politics and policy in the U.S. A current research project explores the efficacy of sustainability policies adopted by U.S. cities.

Robin M. Leichenko **Rutgers University – New Brunswick**

Dr. Robin M. Leichenko is an Associate Professor in the Department of Geography at Rutgers University. Her research program emphasizes the connections between climate change and globalization, focusing on how these processes jointly affect regions, sectors, and social groups. Her current research projects explore social and economic vulnerability and adaptation to climate change in New York and New Jersey. Leichenko serves as a member of the New York City Mayor's Panel on Climate Change, and she is an Associate of the International Human Dimensions Programme on Global Environmental Change and Human Security. Her recent book, *Environmental Change and Globalization: Double Exposures* (New York: Oxford University Press, 2008), co-

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authored with Karen O'Brien of the University of Oslo, received the 2009 Meridian Book Award for Outstanding Scholarly Contribution in Geography from the Association of American Geographers.

Bonnie J. McCay **Rutgers University – New Brunswick**

Dr. Bonnie J. McCay, is Board of Governors Distinguished Service Professor at Rutgers University, New Brunswick, where she chairs the Department of Human Ecology. Her graduate training was in the ecological anthropology program within the anthropology department at Columbia University (PhD 1976), and her research and teaching have focused on challenges and policies for managing common pool resources, particularly fisheries. McCay has done field research in Newfoundland and Nova Scotia, Canada; in New Jersey; and in Baja California, Mexico, with funding from the National Science Foundation, the New Jersey Sea Grant College Program, and the New Jersey Agricultural Experiment Station. Her books include *The Question of the Commons, Community, Market and State on the North Atlantic Rim: Challenges to Modernity in the Fisheries, Oyster Wars and the Public Trust*, and *Enclosing the Commons*. McCay is currently the lead PI on a “coupled human and natural systems” project studying the consequences of climate change for the socio-ecological system that is focused on surfclams, a dominant benthic organism in Mid-Atlantic and Southern New England waters. She is also researching the roles of fishermen’s cooperatives in managing local fisheries as well as sustaining local communities in Mexico; the cumulative personal, social, and economic effects of regulatory and other changes in the marine fisheries of New Jersey; and collaborative processes in the creation of knowledge for decision-making about marine fisheries management in the northeast region of the United States.

McCay’s grants, honors, and awards include: National Associate, National Research Council, National Academy of Sciences, 2003 (lifetime) Award for Overall Excellence in Teaching, Research, and Outreach, Cook College, Rutgers University, 2002; Board of Governors Distinguished Service Professorship, Rutgers University, 2000-; The Norwegian Marshall Fund Award, Norge-Amerika Foreningen, for Research in Marine Conservation.

Sandra Passchier **Montclair State University**

Dr. Sandra Passchier is an Associate Professor in the Earth and Environmental Studies department and her primary research interests are in the sustainability of the cryosphere and its role in global climate change as it can be extracted from sediment cores on high latitude continental margins. She was an invited scientist in five international drilling programs in Antarctica and published more than 20 peer-reviewed articles in journals such as *Nature*, *Sedimentology*, *Journal of Geophysical Research*, and *Palaeogeography - Palaeoclimatology - Palaeoecology*. Dr. Passchier has received over

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\$500,000 in external funding from NSF and the Joint Oceanographic Institutions. She is a member of the international steering committee for Antarctic Climate Evolution, one of the five flagship research programs of the Scientific Committee of Antarctic Research.

Michael Redclift **Kings College, London, UK**

Dr. Michael Redclift is Professor of International Environmental Policy at King's College, London. His research interests include sustainable development, global environmental change, environmental security and sustainable consumption. Between 1973 and 1997 he was at Imperial College (Wye Campus), ultimately as Professor of Environmental Sociology. In 1987 his book, *Sustainable Development: Exploring the Contradictions*, was published by Routledge to considerable critical success, and was subsequently translated into several languages. He was the first Director of the Global Environmental Change programme of the ESRC between 1990 and 1995, and has coordinated research grants for the European Commission (FM IV and V), and for the TERM programme of the European Science Foundation. He has also held grants from the ESRC/AHRC (2003-2005) and, in 2007, began research on a three year study for the ESRC (with Mark Pelling and David Manuel) of coastal urbanization, local governance and adaptation to environmental risks in the Mexican Caribbean. In 2006, he was the first recipient of the 'Frederick Buttell Award', from the International Sociological Association (RC 24). Recent books include: *Chewing Gum: The Fortunes of Taste*, (2004, Taylor and Francis, New York) and, in 2006, a major comparative study published by MIT Press: *Frontiers: Histories of Civil Societies and Nature*. He is also the editor, with Graham Woodgate, of a completely new edition of the *International Handbook of Environmental Sociology*, to be published in 2010. His current research is in post-carbon society and the ideas of sufficiency and natural limits.

William E. Rees **University of British Columbia, Canada**

Dr. William E. Rees is a human ecologist, ecological economist, Professor and former director of the University of British Columbia's School of Community and Regional Planning (SCARP) in Vancouver, Canada. His research and teaching focus is on the biophysical prerequisites for sustainable societies in an era of accelerating global ecological change. Within this 'envelope', he has a special interest in the vulnerability of cities and policy for urban sustainability. Rees is a founding member and past President of the Canadian Society for Ecological Economics and founding Director of the OneEarth Initiative. He is perhaps best known in ecological economics as the originator and co-developer of "ecological footprint analysis." His book on eco-footprinting, with then PhD student Dr. Mathis Wackernagel, has been translated into eight languages including Chinese. He has also authored over 125 peer reviewed papers and book chapters and numerous popular articles on humanity's (un)sustainability conundrum. The influence of Dr Rees' work is widely

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recognized and awarded. He has lectured by invitation in 25 countries around the world; the *Vancouver Sun* named Prof Rees one of British Columbia's top public intellectuals in 2000; in 2006 he was elected to the Royal Society of Canada and in 2007 he was awarded a prestigious Trudeau Foundation Fellowship.

Bob Reiss **Sokol Lecturer**

Bob Reiss is a bestselling New York based author and journalist, a former *Chicago Tribune* reporter and former correspondent for *Outside Magazine*. His work has also appeared in *The Washington Post Magazine*, *Smithsonian*, *Parade*, *Rolling Stone*, and other national publications. His most recent novel, (March 2007) *Black Monday*, chronicles the collapse of the world as we know it when a genetically engineered microbe destroys the world's oil supply system. The book has been optioned by Paramount, and is being developed for a major motion picture. He has published 13 additional novels including the Washington Post best-seller, *The Last Spy* and *The Side Effect*. His three non-fiction books include *The Coming Storm*, about global warming, and *The Road to Extrema*, about the state and fate of the Amazon rainforest. Writing as Ethan Black, he is the author of the acclaimed Conrad Voort series, five novels about a New York City detective whose ancestors have worked law enforcement in the city since Colonial times, under Dutch rule. Reiss travels widely around the world to research his books, and draws on his experience as a journalist for fiction material. His novels tend to be political or police thrillers, and his non-fiction work covers environmental issues. Mr. Reiss graduated from Northwestern University with a Bachelors degree in Journalism, and from the University of Oregon with an MFA. His first novel, *Summer Fires*, was published by Simon & Schuster, in 1980. He speaks regularly at colleges and universities on global warming, subject of his recent non-fiction book, *The Coming Storm*.

Tom Rudel **Rutgers University - New Brunswick**

Dr. Tom Rudel is a Professor in the Departments of Human Ecology and Sociology at Rutgers University. His research focuses on two landscape transformations, the loss of tropical forests in the global South and the outward expansion of metropolitan areas in the global North. His early work included both detailed, village level studies, in the Ecuadorian Amazon and quantitative analyses at the global scale. More recently, he has investigated forest regrowth - a historical generalization about a 'forest transition' in which forest cover first declined and then increased in response to industrialization and urbanization - that promised to explain, with one idea, both forest destruction in the tropics and forest recovery in temperate places. This interest led to several investigations of the situations that encourage turnarounds in forest cover, from deforestation to forestation, and an intensive case study of forestation. This research led to the publication of two books, *Tropical Deforestation: Small Farmers and Land Clearing in the Ecuadorian Amazon* and *Tropical Forests: Regional Patterns of Destruction and*

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Regeneration in the late 20th Century (both with Columbia University Press). *Tropical Forests* won the 2008 Outstanding Publication Award from the Environmental Sociology section of the American Sociological Association.

In addition he has had long-term interest in land use planning in suburban regions of the United States. Land use planning processes, at least in theory, try to incorporate and accommodate two seemingly contradictory goals, economic development and environmental preservation, into a single political process. In this respect, processes of land use planning provide a laboratory for understanding the ways in which humans integrate contradictory concerns into the construction of communities. This line of research is summarized in *Situation and Strategies in American Land Use Planning* (Cambridge University Press). Currently, he is studying efforts by suburban residents to slow down or stop further real estate development through the designation of ecologically sensitive parcels of land as open space and the creation of zones of land use that require large minimum lot areas for the construction of a single home. Both changes promised to reduce real estate development, albeit in very different ways, in suburban places. In a related line of research, he has developed an interest in the social contexts that promote green decision-making among real estate developers.

For this body of research Dr. Rudel won the 1995 Distinguished Contribution to Environmental Sociology Award and the 2009 Merit Award from the Rural Sociological Society. In 2000, he was elected a fellow of the American Association for the Advancement of Science.

Daniel Simberloff **University of Tennessee**

Dr. Daniel Simberloff is the Nancy Gore Hunger Professor of Environmental Studies at the University of Tennessee. He received his A.B. (1964) and Ph.D. (1968) from Harvard University and was a faculty member at Florida State University from 1968 through 1997, when he joined the Department of Ecology and Evolutionary Biology at the University of Tennessee. His publications number ca. 500 and center on ecology, biogeography, evolution, and conservation biology; much of his research focuses on causes and consequences of biological invasions. His research projects are on insects, plants, fungi, birds, and mammals. At the University of Tennessee he directs the Institute for Biological Invasions (<http://invasions.bio.utk.edu/resources/index.html>). He is editor-in-chief of *Biological Invasions*, associate editor of the *Annual Review of Ecology, Evolution, and Systematics*, and serves on the editorial boards of several other journals. He served on the United States National Science Board 2000-2006. In 2006 he was named Eminent Ecologist by the Ecological Society of America.

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Robert Winston Taylor
Montclair State University

Dr. Robert W. Taylor is a professor of urban environmental management at Montclair State University who recently returned from a Fulbright Award to the Philippines where he collaborated on a sustainability management plan for the City of Manila. He was previously a Fulbright to Nigeria which resulted in the edited book, *Urban Development in Nigeria: Planning, Housing and Land Policy* (Avebury/Ashgate). Dr. Taylor has written widely in the areas of urban planning and development, and is currently specializing in sustainability management planning as it relates to developing countries. His teaching specialties are in organizational environmental management and communications. His technical specialties are in brownfields redevelopment and zoning and master plans for sustainable cities. He has delivered over 100 international presentations in the following countries: Nigeria; United Kingdom; Sweden; United States; China; South Korea; Japan; Canada; Poland; Israel; Russia; Malaysia; Hong Kong; and the Philippines. Conference sponsors range from the Association of American Geographers; American Planning Association; International Planning History; Regional Science Association; Urban Affairs Association; Fulbright/ CULCOM, etc. He has also administered grants dealing with photovoltaic solar systems and building energy conservation.

R. Eugene Turner
Louisiana State University

Dr. R. Eugene Turner is a chaired Professor and Distinguished Research Master at Louisiana State University, who is sometimes an oceanographer crawling up the watershed to affect water quality. At other times he is a wetland ecologist. Recent efforts are focused on the scientific aspects of coastal environmental management, including the low oxygen zone off the Mississippi River (the 'DEAD ZONE'), and the conservation and restoration of the Mississippi River deltaic coast. He is Chair, INTECOL Wetlands Working Group, Executive Board Member of INTECOL, serves on several national scientific committees and editorial boards, and maintains an active field research program. He was the recipient of the National Wetland Award and, with Nancy Rabalais, the Blasker Award for Science and Engineering.

Michael P. Weinstein
Montclair State University

Dr. Michael P. Weinstein is the Director, PSE&G Institute for Sustainability Studies (ISS) at Montclair State University located in Montclair, New Jersey. He is the former President & CEO, New Jersey Marine Sciences Consortium where he also served as the New Jersey Sea Grant College Program Director. Dr. Weinstein conducts extensive research in the areas of coastal ecology, sustainability science, fisheries science, wetland ecology, and restoration ecology, primarily in salt marshes, sea grass meadows, and mangrove habitats. The recipient of many awards, he has served on numerous

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National Research Council Committees, an International Working Group on Sustainability, an NCEAS Working Group, the US-Japan CEST Panel, SDWA Audit Panel, and the US-China Initiative in Sustainable Development. He was also a member of the National Working Group for preparing the Nationwide Strategy for Coastal Habitat Restoration. He has authored more than 100 peer-reviewed journal articles, books, chapters, and monographs. His most recent text, *Concepts and Controversies in Tidal Marsh Ecology* has had international impact on the direction of tidal marsh research and restoration science.

His honors and awards include: Educator of the Year, Research & Development Council of New Jersey 2008; the Governor's 2006 Environmental Excellence Award; an Efrogmson Fellowship; Spirit Award, Coastal America 2005; Governor's Tourism Award, Coast Day NJ, 2004; Environmental Quality Award, USEPA, Region II, 2000; Nomination, Best Paper Award, 2000, Transactions of the American Fisheries Society Summit on Sustainable Development.

Jianguo “Jingle” Wu Arizona State University

Dr. Jianguo “Jingle” Wu is Dean's Distinguished Professor of Sustainability Science, Advisor to the President's Office on China Projects, Arizona State University, Tempe, Arizona. He holds a B.S. in biology from Inner Mongolia University in 1982 and Ph.D. in ecology from Miami University, Oxford, Ohio in 1991 and was a National Science Foundation (NSF) postdoctoral fellow at Cornell University and Princeton University from 1991 to 1993. His current research areas include landscape ecology, sustainability science, urban ecology, and the relationship between biodiversity and ecosystem functioning/services. Wu is the author of seven books and more than 150 journal articles and book chapters. He has served as Editor-in-Chief of *Landscape Ecology*; and editorial board member for several other international journals. He was Chair of Asian Ecology Section of Ecological Society of America (1999-2000); Program Chair of the US Association for Landscape Ecology (US-IALE) in 2001; Councilor-at-Large of US-IALE (2001-2003); Ecological Research Subcommittee member, and a member of the Board of Scientific Counselors for the US Environmental Protection Agency (2005-2006).

Wu is Founding Director of the Sino-US Center of Conservation, Energy and Sustainability Science (SUCCESS) and is a Guest Professor at Beijing University, Beijing Normal University, East China Normal University, and Graduate University of the Chinese Academy of Sciences, Inner Mongolia University, Inner Mongolia Agricultural University, Institute of Botany of the Chinese Academy of Sciences, and Zhejiang University.

He is the recipient of the 2006 American Association for the Advancement of Science (AAAS) Award for International Scientific Cooperation; elected AAAS Fellow in 2007; named a Leopold Leadership Fellow in 2009; and recipient of the 2010 Distinguished Landscape Ecologist Award, US Association of Landscape Ecology (US-IALE).

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Selected Books include:

Wu, J. and R. Hobbs (Eds). 2007. *Key Topics in Landscape Ecology*. Cambridge University Press, Cambridge.

Wu, J., B. Jones, H. Li, and O. L. Loucks (Eds). 2006. *Scaling and Uncertainty Analysis in Ecology*.

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From the Unity of Nature to Sustainability Science: Ideas and Practice

Robert Kates, Bangor, ME

The ideas of sustainability science are two centuries old; the practice a decade. Humboldt's dream, Malthus' limits, Marsh's *Man and Nature*, Pasteur's use-inspired research, Vernadsky's biosphere and noosphere, Carson's *Silent Spring*, Forrester's, Meadow's, Herrera's systems, and Holling's resilience—all provided essential elements of the science to come. In the 1980s, concerns about the environment and human development begin to come together, first by the International Union for the Conservation of Nature, then the Bruntland report of the World Commission on Environment and Development, and most recently by the Earth Science Community. But Sustainable Development, a political success, loses most of its science connection.

The U.S. National Academy of Sciences (1999) and the World Academies (2000) reconnect with sustainable development. Sustainability science and technology supports a transition that meets human needs, preserves the life support systems of the planet, and reduces hunger and poverty. Thus it is needs-directed, place-based, integrative science similar to such fields as the agricultural or health sciences.

Explicated in *Science* in 2001, it is now a decade old with an active solution-oriented research agenda, a theoretical perspective in coupled human environment systems, a large published library of new work, dedicated centers and institutes in many parts of the world (E.U., Japan, S. Africa, U.S.), and a growing number of degree programs at every level. Its research questions are now better defined, but of the original core set major progress has been made in some, limited progress in others. Needed competencies for students have been discussed, but common sets have not yet emerged. Joint undertakings with practitioners from local communities, industry, government, and civil society are common, but with fewer examples of solutions offered or problems solved. Creating better knowledge and moving it into action is the task of the next decade.

The Challenge of Sustainability: Lessons from an Evolutionary Perspective

Simon A. Levin, Princeton University

The continual increase in the human population, magnified by increasing per capita demands on Earth's limited resources, raise the urgent mandate of understanding the degree to which these patterns are sustainable. The scientific challenges posed by this simply stated goal are enormous, and cross disciplines. What measures of human welfare should be at the core of definitions of sustainability, and how do we discount the future and deal with problems of intra-generational and inter-generational equity? How do environmental and socioeconomic systems become organized as complex adaptive systems, and what are the implications for dealing with public goods at scales from the local to the global? How does the increasing interconnectedness of coupled natural and human systems affect the robustness of aspects of importance to us, and what are the implications for management. What is the role of social norms, and how do we achieve

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cooperation at the global level? All of these issues have parallels in evolutionary biology, and this lecture will explore what lessons can be learned from ecology and evolutionary theory for addressing the problems posed by achieving a sustainable future.

Sustaining Sustainability: Creating Systems Science in a Fragmented Academy and Polarized World

John Sterman, Massachusetts Institute of Technology

Creating a sustainable world is the quintessential “systems” challenge. We’ve long been told that the unsustainability of our society arises because “everything is connected to everything else” while we act in narrow, parochial, short-sighted ways, externalizing social and environmental damage at the expense of the less powerful and future generations. Many advocate that overcoming these problems requires the development of systems thinking. If people had a holistic worldview, it is argued, they would then act in consonance with our collective long-term best interests and transform our society. The challenge is in moving from slogans to specific tools and processes that help us understand complexity, design better policies, facilitate individual and organizational learning, and catalyze the technical, economic, social, political, and personal changes we need to create a sustainable society. Here I outline a design for a systems science of sustainability that rises to this challenge. Where the dynamics of complex systems are conditioned by multiple feedbacks, time delays, accumulations and nonlinearities, our mental models generally ignore these elements of dynamic complexity; where the consequences of our actions spill out across time and space, across disciplinary and organizational boundaries, our universities, corporations, and governments are organized in silos that focus on the short term and fragment knowledge. I describe how sustainability research, teaching, and engagement with the policy process can be organized to provide scientifically grounded, reliable knowledge crosses disciplinary boundaries that engages multiple stakeholders, that grapples with the unavoidable issues of purpose, values, and ethics, and that leads to action.

Sustainability of Biodiversity under Global Changes, with Particular Reference to Biological Invasions

Daniel Simberloff, University of Tennessee

Four major interacting global changes heavily influence the distribution and abundance of biodiversity: (1) biological invasions, as well as changes in (2) climate, (3) biogeochemical cycles, and (4) land use. The resulting impacts on biodiversity transform virtually all human uses of biodiversity, rendering many unsustainable. Further, they indirectly affect biodiversity patterns by their effects on invasions and biogeochemical cycles. Less attention has been paid to how biological invasions and changed biogeochemical cycles directly affect distribution and abundance of biodiversity, as opposed to indirectly affecting biodiversity by modifying land use. The direct, large-scale impacts of invasions and changed biogeochemical cycles on distributions and abundances of important species suggest that invasions and altered biogeochemical

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cycles warrant expanded research efforts. Although we have been slow to develop policies and management strategies, great improvements in preventing or minimizing the impacts of invasions are attainable; e.g., risk assessment procedures for planned introductions and for invasion pathways are continually being improved and can be modified to account for predicted climate and biogeochemical changes. Early warning systems, an underused tool in invasive species management, can also be expanded and tied to effective rapid response procedures. Many approaches to managing invasions once they have established substantial populations have produced successful control, but these successes tend to result from projects highly tailored to particular species rather than from “silver bullets” that target multiple invaders simultaneously. Such successes will be possible even as other global changes proceed, so long as we remain committed to the effort.

Post-sustainability: the Emergence of the Social Sciences as the Handmaidens of Policy

Michael Redclift, Kings College, UK

The genius of ‘sustainable development’ was that almost everyone could sign up to it. The mechanisms that were subsequently unleashed via deregulation and the neoliberal ascendancy became the favoured instruments of policy in seeking to achieve ‘sustainable development’ in a) attempts to internalise environmental externalities in products and services; and b) the development of carbon markets, both within industries and, more importantly, between countries. The former mechanism was viewed by the European Union as a means to gain a competitive advantage over the United States and any developing rivals by reducing energy and material throughput, and consequently offsetting environmental damage. The latter mechanism represented a challenge for entrepreneurship, new market opportunities, and required very little government action. Carbon markets were thus popular among devotees of free-market economics and environmentalism, unlike other interventions such as carbon taxes. But what might happen when the market price of carbon dropped significantly? What are the wider implications of trading in a ‘bad’ (pollution) rather than a ‘good’ situation, in institutionalising the idea of carbon dependency? This latent opposition to carbon trading as a solution remained largely inchoate in the rush to endorse it. The conjunction of newly ‘liberated’ markets and environmental concern can with hindsight be seen as a ‘managed senescence’, if we continue with the biological metaphors of ‘development’. A more mainstream view, however, would be that they addressed system failures, and could even lead to a rejuvenated, if scarcely recognisable, type of materials ‘light’ capitalist development.

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The Value of Social Capital in Our Current Full World and in a Sustainable and Desirable Future

Robert Costanza, University of Vermont

Ecosystem services are the benefits people obtain from ecosystems. These include provisioning services, such as food and water; regulating services, such as regulation of floods, drought, and disease; supporting services, such as soil formation and nutrient cycling; and cultural services, such as recreational, spiritual, and other nonmaterial benefits. These benefits may or may not be fully perceived by people. Most are outside the market exchange system and are best thought of and managed as public goods (the commons). Ecosystems are experiencing serious degradation in regard to their capability of providing services. At the same time, the demand for ecosystem services is rapidly increasing as populations and standards of living increase.

As the world has moved from one relatively empty of humans and their artifacts to one increasingly full of humans and their artifacts, the value of our natural and social capital assets (the commons) has become significantly more important to sustaining human happiness and well-being than marketed goods and services (as measured by GDP). In this world we must better assess, model, and value our natural and social capital assets. A sustainable and desirable future is one that respects biophysical boundaries, distributes resources and responsibilities fairly, and adequately values and balances built, human, social and, natural capital assets.

Steps Towards Sustainability through Restoring Natural Capital. Examples From the Mediterranean Basin

James Aronson, CEFE/CNRS, France, and Missouri Botanical Garden, USA

There are at least three “divides” that must be bridged if we are to achieve a globally sustainable society. These are the ideological divide between fundamentalist economists and ‘deep’ ecologists; an economic development divide between the wealthy and the poor, both within and among nations; and an information divide, with regards to “the economy” and the feedback information that the economy should be responding to from “the environment”. The proven potential of ‘restoring natural capital’ (RNC) through various means can help revise outmoded economic models, and improve communication and collaboration among natural and social scientists, public opinion, and policy-makers. RNC also refers to activities undertaken and investments made to reduce waste, erosion, and pollution within production systems and exploitation processes, as well as, in and around cities. It also refers to educational programs centered on the importance of natural capital to human economies and wellbeing. As a result of gradually mainstreaming ‘RNC thinking’ in policy, business, education, media, and law, significant steps towards sustainability could be achieved. Examples from coastal, urban areas in the Mediterranean basin and elsewhere will help illustrate how we can in fact augment renewable natural capital and cultivate or revive social capital in the process, through investment in the restoration and rehabilitation of ecosystems and landscapes that nourish human society. These are excellent investments which provide

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durable flows of “interest”, i.e., the ecosystem goods and service upon which we depend. Existing and emerging mechanisms for the appropriate valuation and finance of RNC will be mentioned, as well as promising incentives and synergies to be explored and cultivated in the future.

Investing in Natural Capital Pays

Rudolf de Groot, Wageningen University, The Netherlands

Human well-being depends upon the free services provided by Natural Capital in many ways: wetlands purify the water, forests clean the air and regulate our climate, bees pollinate our crops, mangroves support our fisheries and protect our coasts and coral reefs store our future medicines. Unfortunately, these are predominantly public goods and services that have no proper market and, thus no price and their benefits are not or only partially taken into account in our current economic system. Yet scientific studies are increasingly demonstrating that, in addition to the dependence of the livelihoods and health of millions of people, the contribution of Natural Capital to the economy is immense. Likewise the loss of biodiversity leads to enormous societal costs: current losses (in terms of damage and repair costs) are estimated between 3-5% of GDP and with no policy-change this will increase to at least 14 trillion US\$/year in 2050 (or 7% of the projected global GDP). The evidence is also mounting that, when all services of our Natural Capital are properly accounted for, the benefits of money spent on conservation and restoration by far outweigh the costs: depending on the type of ecosystem and socio-economic conditions the benefit-cost ratio of ecosystem restoration ranges between a factor 3 to 75. Similar benefit-cost ratios apply to “green and blue” space in urban ecosystems. The author of this paper is involved in The Economics of Ecosystems and Biodiversity (TEEB) assessment to analyze the global economic benefits of biological diversity, the costs of the loss of biodiversity and the failure to take protective measures versus the costs of effective conservation and sustainable use and will present the major findings of this study. Ways to turn the value of our Natural Capital into real money to invest in Natural Capital conservation and restoration will also be discussed.

Economics for a Transition to Global Sustainability

Faye Duchin, Rensselaer Polytechnic Institute

Besides living within our environmental means, sustainability also requires a development transition to eliminate poverty and safeguards against global financial crisis. An economics for sustainability must be issue-driven, concretely rooted in the natural world, and accommodate a variety of personal and collective motivations and behaviors. Growth of consumption and production — to keep up with growth of the human population, affluent Western lifestyles, and sharply increasing affluence in some developing countries — impose increasingly unsustainable pressures on air, land, water, minerals and ecosystems. An economics for sustainability must serve two distinct purposes. The first is to identify key variables and indicators, such as the ecological

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footprint, for monitoring and reporting on the historical progression. This paper focuses on a second purpose: to analyze the feasibility and desirability of scenarios about the future. Achieving this purpose requires a theoretical framework, model-building, and scenarios that can: distinguish the impacts of relevant lifestyle choices, such as plant-based vs. meat-based diets, and of technological alternatives, such as reliance on primary resources or recycled materials; and impose physical constraints on the maximum amounts of resources, like fresh water or arable land, that are sustainably available for use. These features represent significant departures from mainstream economic theory and methods. They involve working at a mesoeconomic, rather than a micro- or macroeconomic, level; allowing for multiple objectives, not exclusively economic growth; expanding the kinds of behaviors considered “rational” beyond only self-interested ones; and supplementing the role of money prices in determining and evaluating outcomes with a role for key variables measured in other than monetary units. The paper describes an emerging economic framework incorporating these and other desirable features and reports results of empirical studies, both completed and in progress.

Sustainability Trajectories for Urban Waters

Richard Burroughs, University of Rhode Island

Improving the sustainability trajectories for urban waters requires enhancing the effectiveness of U.S. nitrogen control programs for watersheds, cities, and ocean waters. As a limiting nutrient in most marine waters, nitrogen in excess contributes to algal blooms, declining levels of dissolved oxygen, and changes in biodiversity among other factors. Left unchecked excess nitrogen results in a regional trajectory away from biological sustainability, and its impacts have been observed on local, national, and global scales. Important factors in mapping a regional trajectory include the state of sustainability science, political will, the means utilized for changing nitrogen flow, and the results obtained. Point or pipe discharges of nitrogen to ocean waters and to estuarine waters adjacent to cities can be governed effectively but raise issues concerning cost and equity. Watersheds where nonpoint or diffuse sources dominate lack effective governance mechanisms, which results in impoverished biological systems downstream. Selected elements of ecosystem-based management hold promise to reverse negative sustainability trajectories where nonpoint sources dominate.

The Purpose and Politics of Ecosystem-based Management

Judy Layzer, Massachusetts Institute of Technology

Ecosystem based management (EBM) is a prescription that grew out of dissatisfaction with natural resource policymaking predicated upon a disjointed mix of local and national regulations that treat complex, diffuse phenomena as if they are separable into problems that are well bounded, clearly defined, and linear with respect to cause and effect. EBM, on the other hand, entails purposefully bringing stakeholders together at a regional scale to craft a single, holistic plan that is tailed to particular conditions. Unlike the conventional approach—which critics describe as rigid and hierarchical—EBM is