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***Principal Positions:***

April 2009 – present	Manager, Environment and Energy Team, Development Research Group, World Bank (DECEE)
September 2008 – present	Lead Economist on Climate Change, Development Research Group, World Bank
April 2006 – September 2008	Senior Economist and Director, Environment, Energy and Economic Development Program, RAND Corporation
January 2003 – April 2006	Senior Economist, Environment Division, Sustainable Development Department, Inter-American Development Bank
September 1994 – February 1996	Senior Staff Economist (environment), White House Council of Economic Advisers
September 1981 – January 2003	Resources for the Future (RFF), Washington DC: Fellow (1981-89), Senior Fellow (1989-2003), and Director (1997-2002), Energy and Natural Resources Division

***Other Professional Activities:***

1984 – 2012	Adjunct faculty, Nitze School of Advanced International Studies, Johns Hopkins University
2000 – 2010	Adjunct faculty, Bren School of the Environment, University of California, Santa Barbara
Fall 1993 and 1994	Visiting Lecturer, Department of Economics, University of Maryland at College Park
April – May 1987	Visiting Economist, Office of Economic Policy, Federal Energy Regulatory Commission

***Education:***

Ph.D. Economics, University of Rochester, 1982  
M.A. Economics, University of Rochester, 1981  
M.Sc. Applied Mathematics, Brown University, 1977  
B.A. With Highest Honors, Economics and Mathematics, Indiana University, 1976 (Phi Beta Kappa)

Member, Association of Environmental and Resource Economists, European Association of Environmental and Resource Economists

### **Publications: Refereed Articles and Books**

"Understanding Nonrenewable Resource Supply Behavior" (Douglas R. Bohi, co-author), *Science*, 25 February 1983.

*Analyzing Nonrenewable Resource Supply* (Douglas R. Bohi, co-author), Resources for the Future, 1984.

"Optimal Control With an Unbounded Horizon," *Journal of Economic Dynamics and Control*, November 1985.

"International Cooperation in Stockpiles and Tariffs for Coping with Oil Supply Disruptions" (Frederic H. Murphy and Howard J. Weiss, co-authors), *Journal of Policy Modeling*, Winter 1985.

"Oil Supply Disruptions and the Role of the International Energy Agency" (Douglas R. Bohi, co-author), *The Energy Journal*, April 1986.

"Non-Price Provisions in Long-Term Natural Gas Contracts" (Harry G. Broadman, co-author), *Land Economics*, May 1986.

"Risk Aversion and the Insurance Value of Strategic Oil Stockpiling" (Molly K. Macauley, co-author), *Resources and Energy*, June 1986.

"An Integrated Analysis of U.S. Oil Security Policies" (Frederic H. Murphy and Howard J. Weiss, co-authors), *The Energy Journal*, July 1986.

"Existence and Transversality Conditions for a General Infinite-Horizon Model of the Mining Firm," *Journal of Economic Dynamics and Control*, September 1986.

" 'Depletion Effects' and Nonrenewable Resource Supply: A Diagrammatic Exposition," *Land Economics*, November 1986.

"International Cooperation for Energy Security" (Douglas R. Bohi, co-author), *Annual Review of Energy*, December 1986.

"Common Property Resource Externalities and Free Entry," *Resources and Energy*, December 1986.

"Games for Studying Strategic Petroleum Reserve Issues" (Frederic H. Murphy and Howard J.; Weiss, co-authors), in B. Lev et al, eds., *Strategic Planning in Energy and Natural Resources* (Studies in Management Science and Systems, Volume 15), North-Holland, 1987.

"Existence and Optimality of Dynamic Competitive Equilibria With a Nonrenewable Resource," *Resources and Energy*, March 1987.

"Futures Trading and Oil Market Conditions" (Douglas R. Bohi, co-author), *Journal of Futures Markets*, April 1987.

"A Stochastic Dynamic Nash Game Analysis of Policies for Managing the Strategic Petroleum Reserves of Consuming Nations" (Frederic H. Murphy and Howard J. Weiss, co-authors), *Management Science*, April 1987.

"Restructuring the IEA Crisis Management Program to Serve Members' Interests Better" (Douglas R. Bohi, co-author), in George Horwich and David L. Weimer, eds., *Responding to International Oil Crises*, American Enterprise Institute, 1988.

"Auctioning Pipeline Capacity: a New Regulatory Tool," in H. M. Trebing and P. C. Mann, eds., *Alternatives to Traditional Regulation: Options for Reform*, Institute for Public Utilities/Michigan State University Press, 1988.

"No Free Launch: Efficient Space Transportation Pricing" (Molly K. Macauley, co-author), *Land Economics*, May 1989.

"A Dynamic Nash Game Model of Oil Market Disruptions and Strategic Stockpiling" (Frederic H. Murphy and Howard J. Weiss, co-authors), *Operations Research*, November-December 1989.

"Market-Based Regulation of Natural Gas Pipelines" (Dan Alger, co-author), *Journal of Regulatory Economics*, September 1990.

"The Implications of Market Changes for Technology Choice in Electricity Generation (Hadi Dowlatabadi, co-author), *Resources and Energy*, September 1990.

*Changes in Electricity Markets and Implications for Generation Technologies* (Hadi Dowlatabadi, co-author), Resources for the Future, 1991.

"Providing Earth Observation Data From Space: Economics and Institutions" (Molly K. Macauley, co-author), *American Economic Review* (Papers and Proceedings), May 1991.

"Prospects for a Global Greenhouse Gas Accord: Lessons from Other Agreements" (Peter Morrisette, Joel Darmstadter, and Andrew Plantinga, co-authors), *Global Environmental Change*, June 1991.

"Designing Price Caps for Gas Distribution Systems" (Thomas P. Lyon, co-author), *Journal of Regulatory Economics*, June 1991.

"Supplying Earth Observation from Space" (Molly K. Macauley, co-author), *Space Policy*, February 1992.

"Equity and International Agreements for CO<sub>2</sub> Containment" (Dallas Burtraw, co-author), *Journal of Energy Engineering*, August 1992.

*Power Plant Fuel Supply Contracts: The Changing Nature of Long-Term Relationships* (Karen Palmer, Peter Fox-Penner, and David Simpson, co-authors), Public Utility Reports, 1992.

"The Economics of Energy Security: Theory, Evidence, Policy," in Allen V. Kneese and James L. Sweeney, eds., *Handbook of Natural Resource and Energy Economics, vol. 3: Economics of Energy and Minerals*, North-Holland, 1993.

"Electricity Fuel Contracting: Relationships With Coal and Gas Suppliers" (Karen Palmer, Peter Fox-Penner, and David Simpson, co-authors), *Energy Policy*, October 1993.

"Energy Security: Externalities and Policies" (Douglas Bohi, co-author), *Energy Policy*, November 1993.

*Assessing Surprises and Nonlinearities in Greenhouse Warming* (Joel Darmstadter, co-editor), Resources for the Future, 1993.

"Defining an Economics of Sustainable Forestry: General Concepts," in Nels Johnson, Jeff Olson, and V. Alaric Sample, eds., *Defining Sustainable Forestry*, Island Press, 1993.

"Economics, Ecology, and Sustainability," in Dennis Le Master and Roger Sedjo, eds., *Modeling Sustainable Forest Ecosystems*, American Forests, 1993.

"Economics and Sustainable Development" (Pierre Crosson, co-author), in Braden Allenby and Deanna Richards, eds., *The Greening of Industrial Ecosystems*, National Academy Press, 1994.

*Pollution Abatement Strategies in Central and Eastern Europe* (editor and contributor), Resources for the Future, 1994.

*Alternative Policies for the Control of Air Pollution in Poland* (Robin Bates and Janusz Cofala, co-authors), World Bank Environment Paper #7, 1994.

"Alternative Standards and Instruments for Air Pollution Control in Poland" (Janusz Cofala and Robin Bates, co-authors), *Environmental and Resource Economics*, October 1994.

"Economics and 'Sustainability': Balancing Tradeoffs and Imperatives," *Land Economics*, November 1994.

"Neoclassical Economic Growth Theory and Sustainability" (Jeffrey Krautkraemer and John Pezzey, co-authors), in Daniel Bromley, ed., *Handbook of Environmental Economics*, Basil Blackwell, 1995.

"Nonrenewable Resource Supply: Theory and Practice" (Margaret Walls, co-author), in Daniel Bromley, ed., *Handbook of Environmental Economics*, Basil Blackwell, 1995.

*The Economics of Energy Security* (Douglas R. Bohi, co-author), Kluwer, 1996.

"The Value of Health Benefits from Ambient Air Quality Improvements In Central and Eastern Europe: An Exercise in Benefits Transfer" (Alan Krupnick, Kenneth Harrison, and Eric Nickell, co-authors), *Environmental and Resource Economics*, June 1996.

"Sustainable Forest Ecosystems and Management: A Review Article" (Mark Ashton, co-author), *Forest Science*, August 1996.

"An Overview of Adaptation to Climate Change" (Rosina Bierbaum, co-author), in Joel Smith et al, eds., *Adapting to Climate Change: An International Perspective*, Springer-Verlag, 1996.

"Ecosystem Valuation: An Overview of Issues and Uncertainties," in Norman L. Christensen, Jr., and R. David Simpson, eds., *Human Activity and Ecosystem Function*, Chapman and Hall, 1997.

"How Should An Accumulative Toxic Substance Be Banned?" (Karen Palmer, co-author), *Environmental and Resource Economics*, January 1997.

"Managing Foreign Participation in Government-Funded Applied Space Research and Product Development" (Molly Macauley, David Austin, and David Simpson, co-authors), *Space Policy*, August 1997.

"Sustainability: Ecological and Economic Perspectives" (Bryan Norton, co-author), *Land Economics*, November 1997.

"Cost-Benefit Analysis and Regulatory Reform" (Alan Krupnick and Ray Kopp, co-authors), *Human and Ecological Risk Assessment*, November 1997.

"Research Frontiers in the Economics of Climate Change," *Environmental and Resource Economics*, April/June 1998.

"Using Emissions Trading to Regulate US Greenhouse Gas Emissions: An Overview of Policy Design and Implementation Issues" (Carolyn Fischer and Suzi Kerr, co-authors), *National Tax Journal*, September 1998.

“Why Not to Calculate ‘The Value of the World’s Ecosystem Services and Natural Capital’” (short comment), *Ecological Economics*, April 1998.

“Sustainable Decision Making: The State of the Art,” in Martin O’Connor and Clive Spash, eds., *Valuation and the Environment: Principles and Practices*, Edward Elgar, 1999.

“Using Cost-Benefit Analysis to Improve Environmental Regulations” (Scott Farrow, co-author), *Environment* magazine, March 1999.

“Assessing Sustainability: Some Conceptual and Empirical Challenges” (Ronald Lile and Dennis King, co-authors), *International Journal of Environment and Pollution*, November 1999.

“The Economics of ‘When’ Flexibility in the Design of Greenhouse Gas Abatement Policies” (Richard Morgenstern and John Anderson, co-authors), *Annual Review of Energy and Environment*, 1999.

“Climate Change Policy” (Jason Shogren, co-author), in *Public Policies for Environmental Protection*, 2nd ed. (Paul Portney and Robert Stavins, eds.), 2000.

“Environmental Policy in a Transitional Economy: Problems and Prospects in Russia” (David Simpson, co-author), *Georgetown Public Policy Review*, June 2000.

"Accumulative Pollution, ‘Clean Technology,’ and Policy Design" (Cees Withagen, co-author), *Resource and Energy Economics*, October 2000.

"Early Emission Reduction Programs: An Application to CO<sub>2</sub> Policy" (Ian Parry, co-author), *Energy Journal*, 2002.

"International Oil Security: Problems and Policies," *Brookings Review*, Spring 2002.

"Progress and Problems in the Economics of Sustainability" (John Pezzey, co-author), in Tom Tietenberg and Henk Folmer, eds., *International Yearbook of Environmental and Resource Economics 2002/2003*, Elgar, 2003.

“Ancillary Benefits of Reduced Air Pollution in the U.S. from Moderate Greenhouse Gas Mitigation Policies in the Electricity Sector (Dallas Burtraw, Alan Krupnick, Karen Palmer, Anthony Paul, and Cary Bloyd, co-authors), *Journal of Environmental Economics and Management*, June 2003.

“Energy and Economic Development: An Assessment of the State of Knowledge (Barbora Jemelkova, co-author), *Energy Journal*, 2003.

"Optimal Investment in Clean Production Capacity" (Carolyn Fischer and Cees Withagen, co-authors), *Environment and Resource Economics*, 2004.

*India and Global Climate Change: Perspectives on Economics and Policy from a Developing Country* (Ujjayant Chakravorty and Shreekanth Gupta, co-eds.), RFF Press, 2004.

“Economic Analysis and the Formulation of U.S. Climate Policy,” in *Painting the White House Green* (Randall Lutter and Jason Shogren, co-eds.), RFF Press, 2004.

“Fundamental Economics of Depletable Energy Supply” (Jeffrey Krautkraemer, co-author), in *Encyclopedia of Energy* (Cutler Cleveland, ed.), 2004.

*Scarcity and Growth Revisited: Natural Resources and the Environment in the New Millennium* (David Simpson and Robert Ayres, co-editors), RFF Press, 2005.

Sustainability and its Economic Interpretations (John C.V. Pezzey, co-author), in *Scarcity and Growth Revisited*.

“The Economics of Climate Policy,” (Charles Kolstad, co-author), in *Handbook of Environmental Economics*, (Karl-Goran Maler and Jeff Vincent, eds.), North-Holland, 2005.

“The Roles of the Environment and Natural Resources in Economic Growth Analysis,” in *Economic Development and Environmental Sustainability: New Options* (Ramón López, co-editor), Oxford University Press, 2006.

“Energy, Equity and International Development” (Douglas Barnes, co-author), in *New Options for Sustainable Development*.

“Climate Change: Passing Through the Eye of the Needle?,” in *Perspectives on Climate Change: Science, Economics, Politics, Ethics* (Walter Sinnott-Armstrong and Richard B. Howarth, eds.), Elsevier, 2006 (Advances in the Economics of Environmental Resources, vol. 5).

“Values in the Economics of Climate Change,” *Environmental Values* August 2006.

*Impacts on U.S. Energy Expenditures and Greenhouse-Gas Emissions of Increasing Renewable-Energy Use* (James Griffin and Robert Lempert, co-authors), Technical Report TR-384-1-EFC, RAND, 2008.

*Unconventional Fossil-Based Fuels: Economic and Environmental Tradeoffs* (Aimee Curtright, David Ortiz, Joel Darmstadter, Brian Shannon, co-authors), Technical Report TR-580-NCEP, RAND, 2008.

*Strengthening U.S. International Energy Assistance to Reduce Greenhouse Gas Emissions and Improve Energy Security* (Scott Hassell and other, co-authors), Occasional Paper OP-251-RC, RAND, 2009.

*Imported Oil and U.S. National Security* (Keith Crane and others, co-authors), Monograph MG838-USCC, RAND, 2009.

*Evaluating Options for U.S. Greenhouse-Gas Mitigation Using Multiple Criteria* (Nicholas Burger, Liisa Ecola, and Thomas Light, co-authors), Occasional Paper OP-252-RC, RAND, 2009.

“Contrasting Future Paths for an Evolving Global Climate Regime” (Scott Barrett, co-author), *Global Policy* 1(1), January 2010. (Also appeared as World Bank Policy Research Working Paper 5164.)

*China’s Technological Catch-Up Strategy for Industrial Development: Impact on Energy Efficiency and CO<sub>2</sub> Emissions* (Michael T. Rock, co-author), Oxford University Press, forthcoming.

**Publications: Collected Papers Volumes, Short Articles, Working Papers, Others**

"Common Property Resource Externalities and Entry Deterrence," in Richard L. Itteilag, ed., *Government and Energy Policy*, International Association of Energy Economics, 1983.

"The Outlook for 'Spot' Trade in Natural Gas," *Public Utilities Fortnightly*, 10 July 1986.

"Space Transportation Policy: Commercial Policies and International Competition (Molly K. Macauley, co-author), in Molly K. Macauley, ed., *Economics and Technology in Space Policy*, Resources for the Future 1987.

"The Difficulty in Defining Sustainability," in Joel Darmstadter, ed., *Global Development and the Environment: Perspectives on Sustainability*, Resources for the Future, 1992; reprinted in *A Survey of Ecological Economics*, Rajoram Krishnan, Jonathan M Harris, and Neva R. Goodwin, eds., Island Press, 1995.

"Development, Scale, and Resource Valuation" (short comment), *Environment and Development Economics*, February 1996.

"Analyzing the Environmental Impacts of Subsidies: Issues and Research Directions," in *Subsidies and the Environment: Exploring the Linkages*, OECD, 1996.

"Environmental and Economic Reforms in the Central and Eastern European Transitional Economies," in Peter Kaderjak and John Powell, eds., *Economics for Environmental Policy in Transition Economies*, Edward Elgar, 1997.

*Climate Economics and Policy*, special issue of *Resource and Energy Economics* (guest editor and author of introductory essay), August 1999.

"Estimating the Ancillary Benefits of Greenhouse Gas Mitigation Policies in the US" (Dallas Burtraw, co-author), in *The Ancillary Benefits and Costs of Greenhouse Gas Mitigation*, OECD/RFF/WRI/CI, Paris, 2000.

*Climate Change Economics and Policy: An RFF Anthology* (editor and author), Resources for the Future, 2001.

*The Economics of Sustainability: A Review of Journal Articles* (John Pezzey, co-editor and co-author of introductory essay), Ashgate, 2002.

"Climate Change and Economic Development," Barbora Jemelkova and Joel Darmstadter, co-authors), RFF Issue Brief 02-23 (August 2002).

"'Greening' Economic Development Activities For Greenhouse Gas Mitigation," RFF Issue Brief 03-02 (December 2003).

*Climate Change* (Brent Sohngen, co-editor and co-author of introductory essay), Ashgate, 2004.

"Urban Air Quality and Human Health in Latin America and the Caribbean" (Luis Cifuentes, Alan Krupnick, Raul O'Ryan, coauthors), IDB working paper, 2005.

"In Search of Effective and Viable Policies to Reduce Greenhouse Gases" (Nicholas Burger, Liisa Ecola, and Thomas Light, co-authors), *Environment*, May-June 2009.

“Responding to Threats of Climate Change Mega-Catastrophes (Carolyn Kousky, Olga Rostapshova, and Richard Zeckhauser, co-authors), Policy Research Working Paper 5127, World Bank, November 2009.

“ ‘Green Stimulus,’ Economic Recovery, and Long-Term Sustainable Development” (Jon Strand, co-author), Policy Research Working Paper 5163, World Bank, January 2010.

“Infrastructure and Sustainable Development” (Marianne Fay, co-author), in Shahrokh Fardoust, Yongbeom Kim, and Claudia Paz Sepúlveda (eds.), *Post-Crisis Growth and Development: A Development Agenda for the G-20*, World Bank, November 2010.

“Green Growth – Opportunities and Challenges for South Africa” (Milan Brahmbhatt, co-author), *South Africa Economic Update Issue 2*, World Bank, November 2011.

“ ‘Green Growth:’ An Exploratory Review,” Policy Research Working Paper 6067, World Bank, May 2012.

“Technological learning, energy efficiency, and CO2 emissions in China's energy intensive industries” (Michael T. Rock, Yuanshang Cui, Kejun Jiang, Yun Song, and Yanjia Wang, co-authors), Policy Research Working Paper 6492, World Bank, June 2013.

“Factors influencing energy intensity in four Chinese industries” (Karen Fisher-Vanden, Yong Hu, Gary Jefferson, and Michael T. Rock, co-authors), Policy Research Working Paper 6551, World Bank, June 2013.