

VITA

Richard L. Bernknopf  
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Title: Research Professor

Education: B.A., George Washington University, 1970  
Ph.D., George Washington University, 1980

**Professional Experience:**

Research Professor, 2011 – present, Economics Department, University of New Mexico  
Visiting Fellow, 2017 – present, Resources for the Future, Washington, DC  
Fellow, 2010 – present, Institute for Urban Research, University of Pennsylvania  
Economist, 1973 - 2011, US Geological Survey  
Associate Editor, 2005 – 2008, Professional Geographer, Association of American Geographers  
Co-director, 2005 – 2011, Spatial Integration Laboratory for Urban Systems, Institute for Urban Research, University of Pennsylvania  
Co-director, Center for Earth Science Information Research, 1995 - 2001, Stanford University  
Consulting Professor, 1994 - 2001, Stanford University  
Research Fellow, 1989 - 1993, Stanford-USGS Institute for Earthquake and Seismology Research  
Adjunct Assistant Professor of Economics, 1980 - 1981, George Washington University

**Award:**

US Department of Interior Meritorious Service Award, 2010

**Committees to Render Scientific Judgment:**

Advisor, Coordination Group for Meteorological Satellites Socioeconomic Benefits Tiger Team, NOAA, Silver Spring, MD, 2015

Review panel member, USGS Fall Energy and Minerals Research Grade Panel, Reston, VA, 2014

Collaborator, Panel on Risk, Vulnerability, and True Costs of Coastal Hazards, The H. John Heinz III Center for Science, Economics, and the Environment, Washington, DC, 2000

Policy Advisor to the California Seismic Safety Commission, Sacramento, CA, 1996 - 2001

Economics Advisor to the Instituto Geologica y Minero de Espana, Madrid, Spain, 2003

Advisor to the Geological Survey of Canada and Natural Resources Canada, Ottawa, Canada, 1998 - 2008

Economics Advisor to the Climate Change Science Program for Decision Support Systems and Risks of Abrupt Climate Change, Washington, D.C., 2004 - 2006

Advisor to the NSF and USGS on A Resiliency and Vulnerability Observatory Network: RAVON, 2008

**USGS and US Department of Interior Committees:**

USGS Science Advisory Council for Climate Change, 2007 – 2011; Member Science Subcommittee of the US Department of Interior Climate Change Committee, 2007; Member, USGS Interdisciplinary Carbon Committee of Scientists and Managers, 2008 – 2010; Member, Steering Committee for the John Wesley Powell Institute for Energy and Mineral Resources, 2008-2009

**In press manuscripts**

Estimating the impact of drought on farm income using the US Drought Monitor, 2018, *American Journal of Agricultural Economics*, (Kuwayama, Y., R. Bernknopf, B. Zaitchik, A. Thompson, and P. Vail), in press.

Societal Benefits: Methods and Examples for Estimating the Value of Remote Sensing Information, in Morain, S., M. Renslow, and A. Budge, ed., 2018, *Manual of Remote Sensing 4<sup>th</sup> edition*, American Society for Photogrammetry and Remote Sensing, Bethesda, Maryland, (Bernknopf, R., D. Brookshire, M. Macauley, G. Jakeman, Y. Kuwayama, H. Miller, L. Richardson, and A. Smart), in press.

**Refereed Journal Articles**

The Value of Remotely Sensed Information: The Case of GRACE-Enhanced Drought Severity Index, 2018, *Weather, Climate and Society*, v.10, p.187-203, DOI: 10.1175/WCAS-D-16-0044.1, (Bernknopf, R, D. Brookshire, Y. Kuwayama, M. Macauley, M. Rodell, A. Thompson, P. Vail, and B. Zaitchik).

A Conceptual Market Framework for Water-bound Nitrate Pollution, 2017, *International Journal of water Resources Development*, v.34, p.1-16, <http://dx.doi.org/10.1080/07900627.2017.1296349>, (Broadbent, C., R. Bernknopf, and D. Brookshire).

Economic Assessment of the Use Value of Geospatial Information, 2015, *International Journal of Geographic Information*, v.4, p.1142-1165; doi: 10.3390/ijgi4031142 (Bernknopf, R., and C. Shapiro).

Measuring Earthquake Risk Concentration for Hazard Mitigation, 2014, *Natural Hazards*, v. 74, p.2163-2192, (Bernknopf, R., and P. Amos).

An integrated multi-criteria scenario evaluation web tool for participatory land-use planning in urbanized areas: The Ecosystem Portfolio Model, 2013, *Environmental Modelling & Software*, v. 41, p. 210-222, (W. Labiosa, W. Forney, A.-M. Esnard, D. Mitsova-Boneva, R. Bernknopf, P. Hearn, and D. Hogan, L. Pearlstine, D. Strong, H. Gladwin, and E. Swain).

Estimating the Cumulative Ecological Effect of Local Scale Landscape Changes in South Florida, 2011, *Environmental Management*, v. 49, p. 502-515, 2011, DOI 10.1007/s00267-011-9771-8, (Hogan, D., W. Labiosa, L. Pearlstine, D. Hallac, D. Strong, P. Hearn, and R. Bernknopf).

Recovering from the ShakeOut Earthquake, 2011, *Earthquake Spectra*, v. 27, p. 521-538, (Wein, A., L. Johnson, and R. Bernknopf).

The influence of hazard models on GIS-based regional risk assessments and mitigation policies, 2006, *International Journal of Risk Assessment and Management*, v.6, nos. 4/5/6, p. 369-387, (Bernknopf, R., S. Rabinovici, L. Dinitz, and N. Wood).

Geospatial decision support systems for societal decision making, 2005, *Boletín Geológico y Minero*, v.116, no.4, p. 325-330, (Bernknopf, R.).

The economic and health risk trade-offs of swim closures at a Lake Michigan beach, 2004, *Environmental Science and Technology*, v.38, no.10, p. 2737-2745, (Rabinovici, S., R. Bernknopf, A. Wein, D. Coursey, R. Whitman).

A portfolio approach to evaluating natural hazard mitigation policies: an application to lateral-spread ground failure in coastal California, 2001, *International Geology Review*, v.43, p.424-440, (Bernknopf, R., L. Dinitz, S. Rabinovici, and A. Evans).

Thoughts on the application of science to decision making, 1998, *Water Resources Update*, no. 113, p.14-20, (Bernknopf, R., and H. Karl).

Estimating the social value of geologic map information: a regulatory application, 1997, *Journal of Environmental Economics and Management*, p.204-217, (Bernknopf, R., D. Brookshire, M. McKee, and D. Soller).

The southern California uplift and associated earthquakes, 1996, *Geophysical Research Letters*, v. 23, p.3011-3014, (Castle, R., and R. Bernknopf).

Uncertainty of groundwater vulnerability assessments for agricultural regions in Hawaii: Review, 1996, *Journal of Environmental Quality*, v. 25, p.475-490, (Loague, K., R. Bernknopf, R. Green, and T. Giambelluca).

Earthquake and volcano alerts: an economic evaluation of risk perception changes, 1990, *Journal of Environmental Economics and Management*, v. 18, p.35-49, (Bernknopf, R., D. Brookshire, and M. Thayer).

An economic and geographic appraisal of a spatial natural hazard risk: a study of landslide mitigation rules, 1988, *Environment and Planning A*, v. 20, p.621-631, (Bernknopf, R., D. Brookshire, R. Campbell, and C. Shapiro).

A probabilistic approach to landslide mapping in Cincinnati, Ohio, with applications for economic evaluation, 1988, *Bulletin of the Association of Engineering Geologists*, v. 25, p.39-56, (Bernknopf, R., R. Campbell, D. Brookshire, and C. Shapiro).

Economic analysis of the maximum economic recovery of federal coal, 1984, *The Energy Journal*, v. 5, (Bernknopf, R., and W. Watson).

Costs of geologic information in the exploration for minerals: a case study of porphyry copper, 1984, *Journal of Resource Management and Technology*, v.13, (Watson, W., C. Shapiro, and R. Bernknopf).

### **Books and Book Chapters**

Measuring the Socioeconomic Value of Data and Information Products Derived from Earth Observation and Other Geospatial Data, 2018, in J. Kruse, J. Crompvoets and F. Pearlman (eds.), *GEOValue: The Socioeconomic Value of Geospatial Information*, CRC Press, p.9-26, (Gallo, J., R. Bernknopf, and S. Lev).

A Review of Socioeconomic Evaluation Methods and Techniques, 2018, in J. Kruse, J. Crompvoets and F. Pearlman (eds.), *GEOValue: The Socioeconomic Value of Geospatial Information*, CRC Press, p. 149-194, (Alan Smart, A., A. Coote, B. Miller, and R. Bernknopf).

Agricultural Case Studies for Measuring the Value of Information of Earth Observation and Other Geospatial Information for Decisions, 2018, in J. Kruse, J. Crompvoets and F. Pearlman (eds.), *GEOValue: The Socioeconomic Value of Geospatial Information*, CRC Press, p.243-263, (Bernknopf, R.).

Impacts of geospatial information for decision making, 2013, in J. Drake, Y. Kontar, and G. Rife (eds.), *New Trends in Earth-Science Outreach and Engagement, Advances in Natural and Technological Hazards Research, Volume 38*, p. 137-152 (Pearlman, F, R. Bernknopf, M. Stewart, and J. Pearlman).

Estimating the Benefits of Land Imagery in Environmental Applications: A Case Study in Nonpoint Source Pollution of Groundwater, 2012, in Laxminarayan, R., and M. Macauley, ed., *The Value of Information: Methodological Frontiers and New Applications in Environment and Health*, Springer Dordrecht, p. 257-300 (Bernknopf, R., W. Forney, R. Raunikar, and S. Mishra).

Using econometrics and geographic information systems for property valuation: a spatial hedonic pricing model, 2010, in M. Linne (ed.), *Visual Valuation: Implementing Valuation Modeling and Geographic Information Systems*, The Appraisal Institute, Chicago, p.265-300, (Bernknopf, R., K. Gillen, S. Wachter, and A. Wein).

The social cascade: preserving communities after a disaster, 2008, in Koshalek and M. Amatuillo, (eds.), *The L. A. Earthquake Sourcebook*, Art Center College of Design, Los Angeles, CA, p. 246-253, (Lewis, J., R. Bernknopf, M. Ghilarducci, and A. Wein).

Improving the Homeland Security Advisory System: an experimental analysis of threat communication for national security, 2005, in Richardson, H., P. Gordon, and J. Moore II, ed., *The Economic Impacts of Terrorist Attacks*, Edward Elgar, Cheltenham, p. 133-151, (Ganderton, P., D. Brookshire, and R. Bernknopf).

Earthquake and Volcano Hazard Notices: An Economic Evaluation of Changes in Risk Perceptions, 2004, in H. Kunreuther and A. Z. Rose, ed., *The Economics of Natural Hazards*, Edward Elgar, Cheltenham, UK, p. 141-155, (Bernknopf, R., D. Brookshire, and M. Thayer).

The hidden cost of coastal hazards: Implications for risk assessment and mitigation, 1999, *The John Heinz Center for Science, Economics, and Environmental Policy*, Island Press, 220p, (Kunreuther, H., R. Platt, S. Baruch, R. Bernknopf, M. Buckley, V. Burkett, D. Conrad, T. Davison, K. Deutsch, D. Geis, J. Good, M. Jannereth, A. Knap, H. Lane, G. Ljung, M. Macauley, D. Mileti, T. Miller, B. Morrow, J. Myers, R. Pielke, A. Pratt, and J. Tripp).

Estimating a societal value of earth science information in the assessment of nonpoint source pollutants, 1999, in Corwin, D., K. Loague, and T. Ellsworth, (eds.), *AGU Special Publication: Application of GIS, Remote Sensing, Geostatistics, and Solute Transport Modeling to the Assessment of Nonpoint Source Pollution in the Vadose Zone*, p.291-308, (Bernknopf, R., K. Lenkeit, L. Dinitz, and K. Loague).

Evaluation of landslide hazards: an economic synthesis of geologic information, 1989, in P.M. Sadler, P., and D. Morton, (ed.), *Landslides in a semi-arid environment: studies from inland valleys of southern California*, Inland Geological Society (Bernknopf, R., D. Brookshire, and R. Campbell).

Domestic coal distribution: an interregional programming model of the U.S. coal industry, 1986, JAI Press, 230p, (Bernknopf, R.).

### **USGS Publications**

Assessing the Socioeconomic Impact and Value of Open Geospatial Information: U.S. Geological Survey Open-File Report 2016-1036, 2016, , 36 p., <http://dx.doi.org/10.3133/ofr20161036>, (Pearlman, F., J. Pearlman, R. Bernknopf, A. Coote, M. Craglia, L. Friedl, J. Gallo, H. Hertzfeld, C. Jolly, M. Macauley, C. Shapiro, and A. Smart).

An economic value of remote-sensing information – Application to agricultural production and maintaining groundwater quality, 2012, U.S. Geological Survey Professional Paper 1796, 60 p. (Forney, W., R. Raunika, R. Bernknopf, and S. Mishra).

A method for assessing carbon stocks, carbon sequestration, and greenhouse-gas fluxes in ecosystems of the United States under present conditions and future scenarios, 2010, *U.S. Geological Survey Scientific Investigations Report 2010-5233*, 190 p. (Zhu, Z., ed., B. Bergamaschi, R. Bernknopf, D. Clow, D. Dye, S. Faulkner, W. Forney, R. Gleason, T. Hawbaker, J. Liu, S. Liu, S. Prisley, B. Reed, M. Reeves, M. Rollins, B. Sleeter, T. Sohl, S. Stackpole, S. Stehman, R. Striegl, A. Wein, and Z. Zhu)

Application of the Land Use Portfolio Model for the Analysis of Long-term Earthquake Hazard Mitigation Policy in the City of Memphis, and Shelby County, TN., in Witt, E.C., III, ed., 2010, *Proceedings of preparing for a significant Central United States earthquake – Science needs of the response and recovery community: U.S. Geological Survey Scientific Investigations Report 2010-5173*, Reston, VA, 76 p, (Hearn, P., R. Bernknopf, D. Strong, N. Luco, and E. Karaca).

The South Florida Ecosystem Portfolio Model – A Map-Based Multicriteria Ecological, Economic, and Community Land-Use Planning Tool, 2009, *U.S. Geological Survey Scientific Investigations Report 2009-5181*, Reston, VA, 41p, (Labiosa, W., R. Bernknopf, P. Hearn, D. Hogan, D. Strong, L. Pearlstine, A. Mathie, A. Wein, K. Gillen, and S. Wachter).

The ShakeOut Earthquake Scenario – A Story That Southern Californians Are Writing, 2008, *U.S. Geological Survey Circular 1324*, USGS, Reston, VA, <http://pubs.usgs.gov/circ/1324/>, 24 p, (Perry, S., D. Cox, L. Jones, R. Bernknopf, J. Goltz, K. Hudnut, D. Mileti, D. Ponti, K. Porter, M. Reichle, H. Seligson, K. Shoaf, J. Treiman, and A. Wein).

Analysis of Improved Government Geological Map Information to Mineral Exploration: Incorporating Efficiency, Effectiveness and Risk Considerations, 2007, *USGS Professional Paper 1721 - Geological Survey of Canada Bulletin 593*, 45p (Bernknopf, R., A. Wein, S. Lucas, and M. St-Onge).

A cost-benefit analysis of the National Map, 2004, *USGS Circular 1271*, 40p (Halsing, D., K. Theissen, and R. Bernknopf).

The role of geo-science information in reducing catastrophic loss using a web-based economics experiment, 2003, *USGS Professional Paper 1683*, 28p, (Bernknopf, R., D. Brookshire, and P. Ganderton).

An Interdisciplinary assessment of regional-scale nonpoint source groundwater vulnerability: theory and application, 2001, *USGS Professional Paper 1645*, 21p, (Bernknopf, R., L. Dinitz, and K. Loague).

Mapping time-dependent changes in soil-slip-debris-flow probability, 1998, *USGS Miscellaneous Investigations Series Map I-2586*, (Campbell, R., R. Bernknopf, and D. Soller).

The societal value of geologic maps, 1993, *USGS Circular 1111*, 53p, (Bernknopf, R., D. Brookshire, D. Soller, M. McKee, J. Sutter, J. Matti, and R. Campbell).

Economic effects of western Federal land use restrictions on U.S. coal markets, 1990, *USGS Circular 1042*, (Watson, W., A. Medlin, K. Krohn, D. Brookshire, and R. Bernknopf).

Regional availability and economics of coal, in National energy issues: geologic perspective and the role of geologic information, 1988, T.W. Offield, ed., *USGS Bulletin 1850*, (Bernknopf, R. L., and W. Watson).

### **USGS Open-file Reports**

Assessing the Socio-economic Impacts and Value of "Open" Geospatial Information, 2016, *USGS Open-File Report 2016-1036*, USGS, Reston, VA, 36p., <http://dx.doi.org/10.3133/ofr20161036>, (Pearlman, F., J. Pearlman, R. Bernknopf, A. Coote, M. Craglia, L. Friedl, J. Gallo, H. Hertzfeld, C. Jolly, M. Macauley, C. Shapiro, and A. Smart).

The ShakeOut Scenario, 2008, *USGS Open File Report 2008-1150*, USGS, Reston, VA, <http://pubs.usgs.gov/of/2008/1150/>, 308p, (Jones, L., R. Bernknopf, D. Cox, J. Goltz, K. Hudnut, D. Mileti, S. Perry, D. Ponti, K. Porter, M. Reichle, H. Seligson, K. Shoaf, J. Treiman, and A. Wein).

A Roundtable on a National Framework for Natural Hazard Risk Reduction and Management: Developing a Research Agenda, 2007, *USGS Open-File Report 2007-1106*, 21 p, (Shapiro, C. D., R. L. Bernknopf, and S. M. Wachter).

An Adapative Management Approach Using Offsets for Reducing Mercury Loadings to the Sacramento River Watershed, 2004, *USGS Open-File Report 2004-1408*, 75 p, (Wood, A., W. Labiosa, R. Bernknopf, J. Rytuba, R. Champion, D. Singer, and R. Kapla).

Preliminary Preview for a Geographic and Monitoring Program Project: A Review of Point Source - Nonpoint Source Effluent Trading/Offset Systems in Watersheds, 2003, *U.S. Geological Survey Open-File Report 03-079*, 25 p, (Wood, A., and R. Bernknopf).  
Mapping time-dependent changes in soil slip-debris flow probability, 1994, *USGS Open-file report 94-699* (Campbell, R., R. Bernknopf, and D. Soller).

Hazard of earthquake-induced lateral-spread ground failure on the central California coast modeled from earth-science map data in a geographic information system, 1994, *USGS Open-file report 94-662*, (Pike, R., R. Bernknopf, J. Tinsley, III, and R. Mark).

Earthquake hazard mitigation: using science for decisions, 1994, *USGS Open-file report 94-172* (Bernknopf, R., and D. Soller).

Public policy issues of earthquake and landslide hazards reduction," in Workshop on earthquake risk: information needs of the insurance industry, ed., W.W Hays, 1988, *USGS Open-file report 88-669*, (Bernknopf, R.).

### **Other Publications**

Spatial Data and Modeling for a Resilient and Sustainable Urban Future, 2016, Penn Institute for Urban Research Special Report, University of Pennsylvania (Wachter, S., R. Bernknopf, and A. Tuluc).



A spatial modeling framework for analyzing potential earthquake damage: an application to Memphis, 2011, SILUS Working Paper, University of Pennsylvania (Smith, T, R. Bernknopf, and A. Wein).

The Effect of Scientific and Socioeconomic Uncertainty on a Natural Hazards Policy Choice, Modeling and Simulation 2007, 2007, Christ Church, New Zealand, 7p, (Bernknopf, R., P. Hearn, A. Wein, and D. Strong).

Interdisciplinary Approaches to Regional Risk Reduction Decision-making, Modeling and Simulation 2007, 2007, Christ Church, New Zealand, 7p, (Wein, A., and R. Bernknopf).

Scenario-based Risk Analysis within an Analytic-deliberative Framework for Regional Risk Reduction Planning, Modeling and Simulation 2007, 2007, Christ Church, New Zealand, 7p, (Wein, A., M. Journey, and R. Bernknopf).

The Societal Value of Geologic Maps, 2006, in Ogasawara, M., and K. Ooi, (eds.), Societal Value of Geologic Maps - Japanese Translation of USGS Circular 1111 and Reviews of Studies on the Economic Evaluation of Geologic Maps in the United States, GSJ Interim Report No. 37, Geological Survey of Japan, AIST, p. 5-58, (Bernknopf, R. L., D. S. Brookshire, D. R. Soller, M. J. McKee, J. F. Sutter, J. C. Matti, and R. H. Campbell).

Debris-flow hazard map units from gridded probabilities, 1997, Hydraulic Engineering, ASCE, p.1902-1907, (Campbell, R., and R. Bernknopf).

Time-dependent landslide probability mapping, 1993, Proceedings of the American Society of Civil Engineers, 1993 National Conference on Hydraulic Engineering, San Francisco, CA, (Campbell, R., and R. Bernknopf).

Time-dependent earthquake-induced landslide hazard mitigation, 1991, Proceedings, Fourth International Conference on Seismic Zonation, V.III (Bernknopf, R., P. Gori, R. Campbell, S. Nishenko, and D. Soller).

Estimating the cost of wetland restoration in a prairie pothole region, 1992, Proceedings of the 19th annual conference on wetlands restoration and creation, Institute of Florida Studies, Hillsborough Community College, Tampa, FL, (Bernknopf, R., C. Shapiro, D. Soller, and W. Moy).

The marginal cost of conforming to sulfur emission standards in the distribution of coal, 1979, Environmental Protection Agency monograph, (Bernknopf, R.).

Practical applications of space systems, report of the Panel on Costs and Benefits to the Space Applications Board of the Assembly of Engineering of the National Research Council, 1976, National Academy of Engineering monograph (Bernknopf, R.).

### **Funded Research Reports**

Net Resource Assessment (NetRA): An Approach to Estimation of the Tradeoff of Natural Resource Development and Ecosystem Services Conservation, Sponsor # G14AS00001 and # G15AS00001, (Bernknopf, R., C. Broadbent, D. R. Adhikari, V. Tidwell, C. Babis, D. Brookshire, and E. Pindilli), January 2017.

Net Resource Assessment (NetRA): A Collaborative Effort between the USGS Science and Decisions Center, the Science Impact Laboratory for Policy and Economics (University of New Mexico) and Sandia National Laboratories Final Report, Sponsor # G14AS00001 and # G15AS00001, (Brookshire, D., R. Bernknopf, D. R. Adhikari, C. Babis, C. Broadbent, V. Tidwell), August 2016.

The Value of Information from a GRACE-Enhanced Drought Severity Index, Final Report to the Applied Sciences Program, NASA, Sponsor # NNX13AQ58G, (Bernknopf, R., D. Brookshire, Y. Kuwayama, M. Macauley, M. Rodell, B. Zaitchik, A. Thompson, and P. Vail), August 2015.

A Conceptual Framework and Market for Nitrate Loading in the Tensas River Basin in the Lower Mississippi Valley, Sponsor #: G10AC00303, (Bridge, B., D. Brookshire, C. Broadbent, R. Bernknopf, S. Pesko), Submitted to USGS Science and Decision Center, Reston VA, and Aquatic Ecology Laboratory, Leetown Science Center, through a cooperative agreement: "A Collaborative Agreement between USGS & SILPE: A Focus on Ecosystems & Institutional Frameworks," December 2014.

A Conceptual Framework for a Multidisciplinary Resource Assessment: The Net Resources Assessment Tool (NetRA), (Bernknopf, R., B. Bridge, C. Broadbent, S. Faulkner), Submitted to the USGS Science and Decision Center through cooperative agreements: "A Focus on Natural Resource Economics & Value of Information," Sponsor # G13AC00076, "A Collaborative Agreement between USGS & SILPE: A Focus on Ecosystems & Institutional Frameworks," Sponsor # G10AC00303, June 2014.

### **Selected Presentations**

The impact and societal benefits of using earth observation for ground water policies in the agricultural sector, 2017, European Geosciences Union General Assembly 2017, (Pearlman, F., R. Bernknopf, J. Pearlman, and M. Rigby).

A Use Case for implementing Earth observation (EO) to avoid regional groundwater contamination in the Midwest US, 2016, American Geophysical Union, San Francisco, CA, (Bernknopf, R., and J. Pearlman; invited).

NetRA: Assessing the Trade-off Between Economic Development and Conservation of Ecosystem Services, 2016, A Community on Ecosystem Services Conference, Jacksonville, FL, (Bernknopf, R., C. Broadbent, D. Brookshire, D.R. Adhikari, C. Babis, and V. Tidwell).

Urban Expansion and the Impacts on Ecosystem Services: Analysis of Regional Scale Land Use in South Florida, 2016, Spatial Data and Modeling for a Resilient and Sustainable Future Symposium, University of Pennsylvania, (Bernknopf, R., and D. Hogan; invited).

Societal Benefits Analysis of Earth Observation, 2016, Group on Earth Observations, Geneva, Switzerland, (invited).

The Value of Geospatial Information and Tutorial Case Study: Baffin Island, Nunavut, 2016, Workshop on the Societal Benefits of Geospatial Information, The Organization for Economic Co-operation and Development (OECD), Paris, France (invited).

NetRA Resources Assessment (NetRA), 2015, American Geophysical Union, San Francisco, CA, (Bernknopf, R., D. Brookshire, C. Broadbent, V. Tidwell, D.R. Adhikari, and C. Babis; invited).

Use Case and Case Study for the systematic application of geospatial information to public and private sector decisions, 2015, American Geophysical Union, San Francisco, CA, (Bernknopf, R., and J. Pearlman; invited).

Global Mapping and Remote Sensing for Sustainable Urbanization, 2015, Penn Earth Day Event 2015, University of Pennsylvania, Philadelphia, PA (invited).

NetRA: The Net Resources Assessment, 2015, Workshop on Landscape Approaches and Multi-Resource Analysis for Sustainable Natural Resource Management, The National Academies of Sciences, Washington, DC, (Bernknopf, R., D. Brookshire, C. Broadbent, D.R. Adhikari, C. Babis, V. Tidwell, E. Pindilli, P. Pierce, D. Semmens, D. Soller; invited).

Measuring the Value of Earth Observation Information with the Gravity Research and Climate Experiment (GRACE) Satellite, 2014, American Geophysical Union, San Francisco, CA, (Bernknopf, R., Y. Kuwayama, D. Brookshire, M. Macauley, B. Zaitchik, S. Pesko, P. Vail, and A. Thompson).

A Regional Multi-permit Market for Ecosystem Services, 2014, American Geophysical Union, San Francisco, CA (Bernknopf, R., E. Zhang, P. Amos, invited).

An Emerging Approach to Economic Assessment: Demonstrating Value in Use of Geospatial Information, Assessing the Socioeconomic Impacts and Value of “Open” Geospatial Information, 2014, The George Washington University, Washington, DC (Bernknopf, R., and C. Shapiro).

Economic Analysis of Disaster Prediction with Earth Observations, 2014, Business Recovery Managers Association, San Jose, CA (invited).

Earth observation for regional scale environmental and natural resources management, GEO-X Ministerial Summit, Geneva, Switzerland, 2014, and American Geophysical Union, San Francisco, CA, 2013, poster (Bernknopf, R., D. Brookshire, B. Bridge, C. Broadbent, S. Faulkner, and B. Chivoiu, invited).

The Value of Information from a GRACE-Enhanced Drought Severity Index, 2013, American Geophysical Union, San Francisco, CA, (Kwayama, Y, R. Bernknopf, D. Brookshire, B. Zaitchik, M. Macauley, and M. Rodell; invited).

Approaching methodologies and case studies, 2012 Socioeconomic benefits workshop: defining, measuring, and communicating the socioeconomic benefits of geospatial information, NCAR, Boulder, CO (invited).

Estimating the value of earth observation information for monitoring agricultural land use activities and the geographically variable impacts of nitrates on groundwater quality, 2012, IEEE Global Humanitarian Technology Conference, Seattle, WA (invited).

The complexity of earth observation valuation: modeling the patterns and processes of agricultural production and groundwater quality to construct a production possibilities frontier, 2012, (with Will Forney, USGS), American Geophysical Union, San Francisco, CA.

Estimating the Costs, Capacity and Tradeoffs of Ecosystem Services in a Net Resource Assessment in the 21<sup>st</sup> Century, 2012, A Conference on Ecosystem Services, Ft. Lauderdale, FL.

Economic management of multiple ecosystem services: a portfolio approach, 2012, A Conference on Ecosystem Services, Ft. Lauderdale, FL.

Estimating the Annualized Costs and Capacity (Supply) of Ecosystem Services in a Regional Resource Assessment, Developing Capacity to Use Ecosystem Services Tools to Support Land Use planning in the Galveston Bay Watershed, 2011, Lone Star Community College, The Woodlands, TX (invited).

Evaluating the use of publicly funded scientific data for decisions: VOI component analysis, 2011, Benefits from the use of earth observations workshop, Ispra, Italy (invited).

Offsets: Their Roles, Their Challenges, The Next Round of Climate Economics & Policy Research, 2011, Stanford Institute for Economic Policy Research and Resources for the Future Conference, Washington, D.C (invited).

Estimating the Annualized Costs and Capacity (Supply) of Ecosystem Services in a Resource Assessment, 2011, Fourth National Conference on Ecosystem Restoration, Baltimore, MD.

Evaluating the use of publicly funded scientific data for decision-making, 2010, National Research Council, Washington (invited).

Informing decisions with scientific information through benefit / cost analysis and the value of information, 2010, NASA Headquarters, Washington (invited).

A general framework for estimating the benefits of moderate resolution land imagery in environmental applications: a case study in nonpoint source pollution of groundwater resources, 2010, Resources for the Future, Washington (invited).

Application of Landsat for international verification of carbon offsets and accounting of carbon sequestration benefits, 2009, Resources for the Future, Washington (invited).

An integrated assessment framework of crop production and its pollution, 2008, A Conference on Ecosystem Services, Naples, FL.

A spatial hedonic pricing model for Miami-Dade, Florida: using econometrics and geographic information systems for property valuation, 2008, Greater Everglades Ecosystem Restoration Conference, Naples, FL.

Using science in regional risk assessment of natural hazards, 2007, AAAS, San Francisco, CA.

The Effect of Spatially Correlated Failures on Natural Hazard Damage Assessments: Natural Disaster Scenarios: Accuracy, Relevance and Effectiveness, 2006, AGU, San Francisco, CA (invited).

The Land Use Portfolio Model: A Multi-Disciplinary Approach for Risk Analysis, 2006, World Planners Conference, Vancouver, BC (invited).

Applying Science to Increase Resiliency and to Reduce Risk from Natural Hazards, 2006, Association of American Geographers, Chicago, IL.

Applying Science to Increase Resiliency and to Reduce Risk from Natural Hazards, 2006, Association of American Geographers, Chicago, IL (invited).

The impact of spatial dependency on earthquake risk analysis, and A GIS-based decision support system for earthquake risk mitigation in the city of Memphis and Shelby County, TN, 2006, European Geosciences Union General Assembly, Vienna, Austria, (invited).

The risk in risk reduction, 2005, European Geosciences Union General Assembly, Vienna, Austria.

Geospatial systems for decision making, 2003, Magna de Mapa Geologico de España, Madrid, Spain (invited).

### **Research Contracts**

“A Focus on Natural Resource Economics and Value of Information”, USGS, PI, 2012 - 2017, \$284,000.

“The Value of Information from a GRACE-Enhanced Drought Severity Index”, NASA, Co-PI, 2013 - 2015, Total Grant \$347,000, UNM \$161,000.