

Second Biennial Conference  
of the  
United States Society for  
Ecological Economics

May 22-24, 2003

Prime Hotel and Conference Center  
Saratoga Springs, New York

co-sponsored by

Gund Institute for Ecological Economics  
Rensselaer Polytechnic Institute Dept. of Economics  
Santa-Barbara Family Foundation  
University of Vermont School of Natural Resources

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# SECOND BIENNIAL CONFERENCE OF THE UNITED STATES SOCIETY FOR ECOLOGICAL ECONOMICS

## CONFERENCE SUMMARY

### Thursday, May 22

#### *Morning*

|       |                      |
|-------|----------------------|
| 9:00  | Registration Opens   |
| 11:30 | Concurrent Session 1 |

#### *Afternoon*

|      |                                   |
|------|-----------------------------------|
| 1:00 | Refreshments                      |
| 1:30 | Concurrent Session 2              |
| 3:00 | Refreshments                      |
| 3:30 | Concurrent Session 3              |
| 5:00 | Reception in Honor of Herman Daly |
| 6:00 | Conference Dinner & Keynote       |

### Friday, May 23

#### *Morning*

|       |                      |
|-------|----------------------|
| 8:00  | Registration Opens   |
| 8:30  | Concurrent Session 4 |
| 10:00 | Refreshments         |
| 10:30 | Concurrent Session 5 |

#### *Afternoon*

|       |                            |
|-------|----------------------------|
| 12:00 | Conference Lunch & Keynote |
| 1:30  | Poster Session             |
| 2:30  | Concurrent Session 6       |
| 4:30  | Plenary Session 1          |
| 6:00  | Free Time                  |
| 8:00  | Performance Night          |

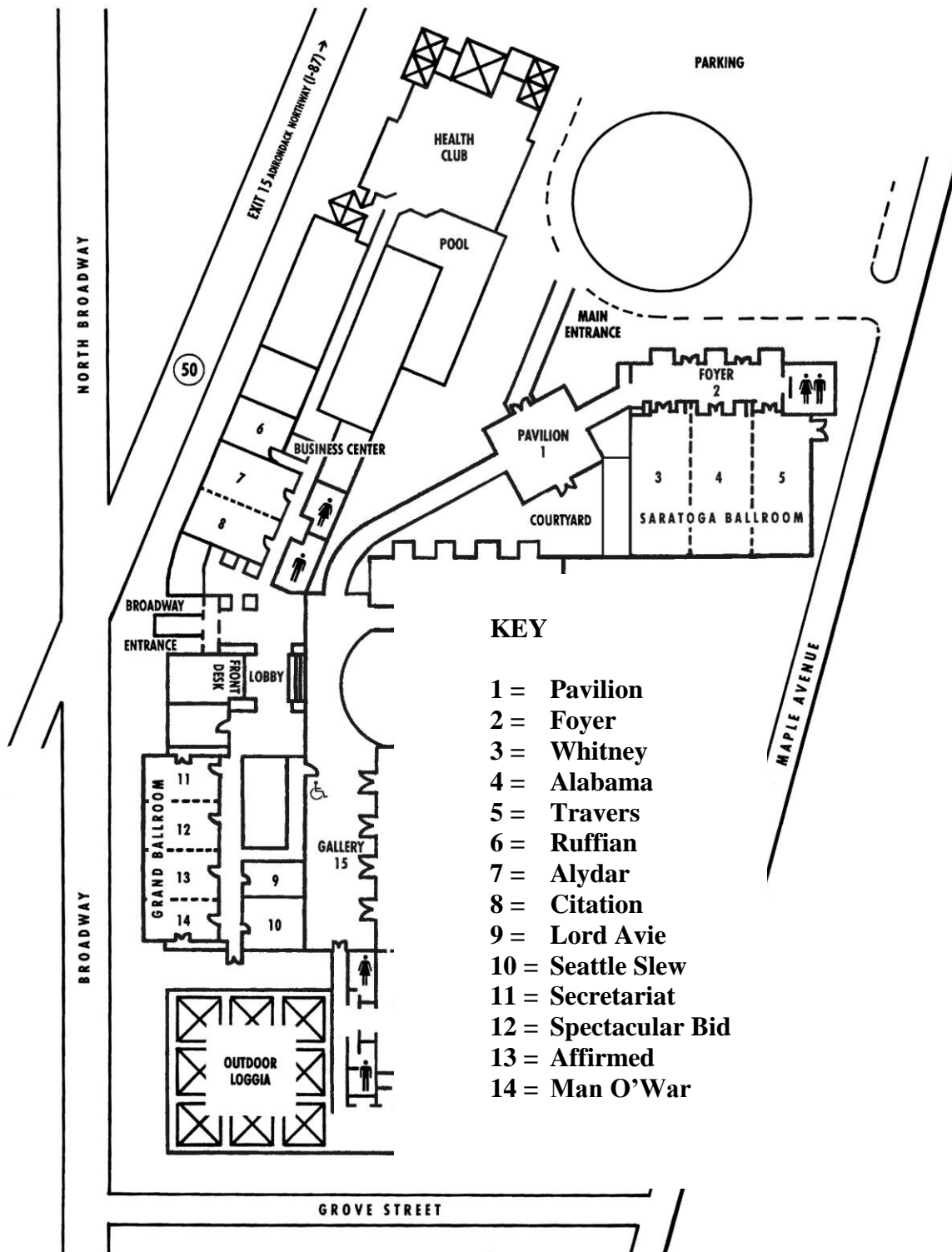
### Saturday, May 24

#### *Morning*

|       |                      |
|-------|----------------------|
| 8:00  | Registration Opens   |
| 8:30  | Concurrent Session 7 |
| 10:00 | Refreshments         |
| 10:30 | Plenary Session 2    |

#### *Afternoon*

|       |                           |
|-------|---------------------------|
| 12:00 | Free Time; Board Meetings |
| 1:30  | Concurrent Session 8      |
| 3:00  | USSEE Business Meeting    |
| 4:00  | Conference Adjourns       |



# THURSDAY, MAY 22 – PRESENTATIONS

| #         | Chair     | Presenters  | Presentation Titles  |
|-----------|-----------|---|--|
| <b>1A</b> | Farley    | Christensen<br>Czech<br>Farley                                  | The Industrial Juggernaut versus Nature's Robust but Fragile Systems<br>Technological Progress, Economic Carrying Capacity, and Biodiversity Conservation<br>Ecological Macroeconomics   |
| <b>1B</b> | Cox       | Cox, Phillips,<br>Lorenzo, Wilson                               | Northern Forest Panel Discussion   |
| <b>1C</b> | Gowdy     | Vadineanu & Costel<br>Iorgulescu<br>Batabyal & Beladi           | Constraints and Opportunities for Transition of the Romanian Socio-Economic System: An Ecological Economic Perspective<br>Gender, Institutions, and Development in Two Nigerian Villages<br>Renewable Resource Management in Developing Countries: How Long Until Crisis?  |
| <b>1D</b> | Luzadis   | Norton<br>Pritchard<br>Boumans et al.                           | In Search of Method: Evaluation in Ecological Economics<br>Is Natural Resource Modeling a Hindrance to Understanding?<br>Simulating ecosystem services within the context of the Global Unified Meta Model of the Biosphere  |
| <b>1E</b> | Kane      | Kraft<br>Voinov<br>Sunder                                       | Legitimacy and Watershed Planning Process--Implications for Ecosystem Services<br>Defining Parameters Affecting the Landscape Transition: Comparison Between Urban and Rural Watersheds<br>Water Scarcity, its Management and Conflicts in India   |
| <b>2A</b> | White     | Tyagi<br><br>Waaub &<br>Vaillancourt<br>Adger                   | Designing the claims: A Fair and Efficient Framework for Limiting Greenhouse Gas Emissions with Developing Country Commitments<br>Equity and Efficiency in International Greenhouse Gas Abatement Scenarios: a Multicriteria Approach<br>Environmental Justice and Sustainability at Diverse Scales: A Discussion on Climate Change  |
| <b>2B</b> | Cleveland | Cleveland<br>Cleveland & Najam<br>Ahlen                         | Energy Quality, Net Energy and the Coming Energy Transition<br>Energy and Sustainable Development at Global Environmental Summits: An Evolving Agenda<br>Energy and the Human Development Index  |
| <b>2C</b> | Frank     | Carlisle-Frank et al.<br>Mallia<br>Frank et al.                 | Are Rental Properties Markets that Allow Companion Animals Efficient?<br>An Overview of the Benefits and Costs of Using Animal Assisted Therapy in Nursing Homes<br>The Place of Animals in Ecological Economics: Have animal issues been overlooked?  |
| <b>2D</b> | Troy      | Voinov & Seppelt<br>Kraft et al.<br>Polimeni                    | Applications of Landscape Optimization Techniques to Define Restoration Priorities and Ecosystem Values<br>Trade-offs among Ecosystem Services or Environmental Benefits and Agricultural Production--Implications for Watersheds<br>Application of a Spatial Simulation of Residential Development to Evaluate Land Value Taxation in the Hudson River Valley, New York State |
| <b>2E</b> | Walton    | Ash and Fetter<br><br>Khanna &<br>Plassmann<br>Vidovic & Khanna | Who Lives on the Wrong Side of the Environmental Tracks? Evidence from the EPA's Risk-Screening Environmental Indicators Model<br>Exposure to Ozone: Counting Pollution Where it Matters<br>Participation in Voluntary Pollution Prev. Programs and the Role of Community Characteristics: Evidence from the 33/50 Program   |

## THURSDAY continued . . .

| #  | Chair    | Presenters                     | Presentation Titles  |
|----|----------|--------------------------------|--|
| 3A | Erickson | Davis, Bergen, & Geurts        | Information Asymmetry And Externalities With Respect To Scarce Water Resources: A Cross-County Comparison In The Hudson Valley             |
|    |          | Kane & Erickson                | Examining Urban-Rural Interdependence: A New Perspective on Questions of Urban Water Supply  |
|    |          | Sorrentino                     | Willingness to Pay to Preserve the Raytharn Farm: A Retrospective View   |
| 3B | Drennen  | Kaufmann                       | Identifying the mechanisms for AEEI : a cointegration analysis of the US Energy/GDP ratio  |
|    |          | Richmond & Kaufmann            | Is there an Environmental Kuznets Curve for Carbon Emissions?  |
|    |          | Khanna & Chapman               | World Oil Resources, Pricing, and Security   |
| 3C | Hermans  | Hermans & Erickson             | Multicriteria Decision Aides in Land-Use Planning  |
|    |          | Cox & Erickson                 | Evaluating Sustainable Forest Management Alternatives Using Multicriteria Decision Analysis  |
|    |          | Strager                        | An Application of Spatial Multicriteria Analysis in Prioritizing Lands for Protection  |
| 3D | Batabyal | Gallagher                      | Economic Integration, Environment, and Development: Lessons from Mexico  |
|    |          | Wise                           | Is the United States a Pollution Haven? NAFTA, Corn and the Environment  |
|    |          | Aguilar                        | Complexity and the Political Ecology of US-Mexican Border Twin Cities: a Few Reflections   |
| 3E | White    | Hecht                          | Operationalizing Sustainability: Implementing Sustainability Indicators at the State Level   |
|    |          | Basoli & Davidsdottir          | Indicators for sustainable energy development: the development of a three-dimensional index  |
|    |          | Jollands, Patterson, & Lermitt | The Holy Grail of Sustainable Development Indicators: an Approach to Aggregating Indicators with an Application to Eco-Efficiency          |
| 3F | Chilson  | Hajkowicz                      | Investing in nature: Approaches for choosing priority projects and regions   |
|    |          | Swallow & Philo                | Impact Fees for Conversion of Open Space to Developed Land Uses: Examples using Contingent Valuation for Land Conservation in Rhode Island |
|    |          | Glennon & Porter               | Effects of land use management on biotic integrity in the Adirondack Park, New York  |

## FRIDAY, MAY 23 – PRESENTATIONS

| #  | Chair       | Presenters                                   | Presentation Titles  |
|----|-------------|--|--|
| 4A | Richard-son | Hudspeth                                     | Ecotourism Initiatives to Achieve Sustainability in Belize, Costa Rica, Brazil, and Honduras   |
|    |             | Casey et al.<br>Batker & Carr                | The Potential for Nature-Based Tourism in Southern Quintana Roo, Mexico<br>Ecological Economics Applied in Campaign to Expand Mount Rainier National Park  |
| 4B | Gutman      | Müller<br>Flomenhoft<br>Tyagi                | The Position of Ecological Economics and Mainstream Economics on the Issues of Distributive Justice<br>The Triumph of Pareto (Does Equity Matter?)<br>Sustainability as Justice  |
| 4C | Costanza    | Stainbrook &<br>Limburg                      | Assessing Ecosystem Health in Dutchess County, NY: Multiple Metrics to Evaluate Watershed Condition  |
|    |             | Fisher et al.                                | Biodiversity and Ecosystem Services: An Empirical Study of the Contribution of Species Richness to Net Primary Production and Nitrogen Cycling   |
|    |             | Mackay et al.                                | Accounting for the Ecosystem-Service Requirements of Dairying: Waikato Region, New Zealand   |
| 4D | Devkota     | Gorga<br>Harris & Goodwin<br>Torras          | Ecological Economics in the Context of Concordian Economics<br>Reorienting Macroeconomic Theory to Take Account of Environmental Constraints<br>Some Remarks on the Feasibility and Desirability of Sustained GDP Growth |
| 4E | Khanna      | Choi & Luzadis<br>Pasinella<br>Davis         | Investigation of the Validity of Environmental Kuznets Curve Hypothesis for Carbon Dioxide Emissions<br>Dematerialization Indicators in US Metal Consumption<br>State Water Quality Standards - Who Calls the Shots?     |
| 5A | Farley      | O'Hara<br>Harris                             | Ecological Economics and Education: Linking Theory and Practice<br>Mainstreaming Ecological Economics: Using a New Text  |
| 5B | Cleveland   | Drennen et al.<br>Gallagher                  | Hydrogen Futures Dynamic Simulation Model<br>Development of Cleaner Vehicle Technology? Foreign Direct Investment and Technology Transfer from the United States to China  |
|    |             | Falkena et al.                               | Energy Requirements of Household Consumption in European Cities  |
| 5C | Voinov      | England<br>Troy & Grove<br>Gustafson & Lynne | Property Taxation, Land Use Zoning and Metropolitan Sprawl in New England<br>Ecological Economic Framework for Characterization of Social & Economic Patches<br>An Ecological (Meta)Economics Look at Land Urbanization  |

|           |        |  |   |
|-----------|--------|--|---|
| <b>5D</b> | Fisher | Lui, Costanza, &<br>Boumans<br>Stephenson et al.<br>Seaton | A Dynamic Model of the Value of Biodiversity in Providing Ecosystem Services in Global Grasslands<br><br>Ecosystem Valuation in Dam Removal Decisions: The Case of the Elwha<br>Valuing Natural Systems : Bank of Nature, Inc.                  |
| <b>5E</b> | Batt   | Batt<br>Smith<br>Hartzok                                   | The Compatibility of Georgist Economics and Ecological Economics<br>Geonomics and the Double Dividend<br>Green Tax Policy   |
| <b>5F</b> | Vail   | Kahn<br>Wolf<br>Roach & Wade                               | Rethinking Forest Economics: An Ecological Economics Approach<br>Forest and Agricultural Eco-Certification as a Process of Innovation in Extended Networks<br>Policy Evaluation Of Natural Resource Injuries Using Habitat Equivalency Analysis |

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## FRIDAY continued . . .

| #                     | Chair        | Presenters                                    | Presentation Titles   |
|-----------------------|--------------|---|---|
| <b>Poster Session</b> |              | Baer  | A Simple Model for Estimating Ecological Debt   |
|                       |              | Batker  | Steps to Implement Ecological Economics   |
|                       |              | Herendeen                                     | Personal Energy Impact of Attending this Meeting  |
|                       |              | Illge & Schwarze                              | Sustainable Development and Economics. A Survey Project on the Contribution of Economics to Sustainability Research |
|                       |              | Loik & Haddad                                 | PrecipNet: An International Network for Precipitation and Ecosystem Change Interdisciplinary Research               |
|                       |              | McDaniel & Bystroff                           | A Simple Model for Consumption-Web Stability Under Various Rates of Change  |
|                       |              | Nordman, Wagner, & Whaley                     | The Effect of Export-Led Economic Growth Policies on the Provision of Forest Ecosystem Services in Chile            |
|                       |              | Parrish                                       | Navigating Progress: Managing for Sustainable Outcomes with an Integrated Management Model                          |
|                       |              | Santa-Barbara                                 | The Scale Project   |
|                       |              | Tyagi   | Economic Growth and Carbon Di-oxide Emissions   |
|                       |              | White   | ZERI: Sustainable Development through Biologically-based Systems  |
| <b>6A</b>             | van den Belt | Farley  | Applied Problem-Solving Approaches to Education in Ecological Economics   |
|                       |              | Batker & Barclay                              | Implementing Ecological Economics through Training, Capacity Building & Action                                      |
|                       |              | Illge & Schaefer                              | Sustainability and the Wealth of Regions. Investigating Citizens' Conceptions of Wealth Using Q Methodology         |
| <b>6B</b>             | McDaniel     | Goodstein                                     | The Costs of Climate Change: A Regional Analysis  |
|                       |              | Howarth                                       | Tax Shifting and Double Dividends in the Economics of Climate Change  |
|                       |              | Richardson                                    | A Contingent Behavior Analysis of the Effects of Climate Change on National Park Visitation                         |
| <b>6C</b>             | Gowdy        | Gowdy, Gutman, Lenox, Vollick, Edmonson, Shaw | Undergraduate Education for Ecological Economics  |
| <b>6D</b>             | Kane         | Smith   | Natural Designs in a Sustainable Economy  |
|                       |              | Herendeen                                     | The Matter of Size in Planning  |
|                       |              | van den Bergh                                 | Limits to World Population Revisited: a Meta-Analysis   |
| <b>6E</b>             | Luzadis      | Womersley                                     | A Peculiarly American Green: Religion and Environmental Policy in the United States                                 |
|                       |              | Davis   | Perceiving Ecologically, The Role of the Visual Arts  |
|                       |              | Anderson                                      | Adult Object Permanence and the Neglected Power of Observation  |
| <b>6F</b>             | Ackerman     | Ackerman                                      | Death, Fishing, and Cost-Benefit Analysis: The Limits of Externality Valuation                                      |
|                       |              | Heinzerling                                   | OMB's Legal Problems  |
|                       |              | Warren  | Flunking the Cost-Benefit Test: The OMB Revolution in the Regulatory Review Process                                 |

## SATURDAY, MAY 24 – PRESENTATIONS

| #  | Chair      | Presenters  | Presentation Titles   |
|----|------------|---|---|
| 7A | Howarth    | Doering et al.<br>Haddad<br>Dóñez                                   | Integrating Economic and Biophysical Assessments of Adaptation to Climate Change<br>Ranking Climate Change Adaptive Capacity when Socio-political Goals are Explicit<br>Adaptive Environmental Management: A Tool for Climate Change Adaptation?  |
| 7B | Boumans    | Spash<br>Batabyal & Beladi<br>Buckley & Haddad                      | Genetically Modified Organisms in Agricultural Crops: The European Debate<br>Swidden Agriculture in Developing Countries<br>Restorationist-Farmer Interactions: a Game Theoretic Analysis   |
| 7C | Hudspeth   | Patterson<br>Vail and Herrera<br>Ghosh                              | Effects of Tourism on Net Social Benefits: A Case Study from Tuscany, Italy<br>Promoting Tourism in Maine's Forest and Fishing Communities<br>Public Intervention to Promote an Eco-friendly Tech.: Biofertilizers in Indian Agric.   |
| 7D | Hecht      | Salmi<br>Davidsdottir<br><br>Seager, Grimes, &<br>Theis             | Shaping the Past and Future Paths of Industrial Ecology: The Case of the Murmansk Region of North-Western Russia<br>Pulp Non-Fiction: Incorporating Dynamic Feedback Relationships between Material and Energy Flows and Vintage Effects in the US Pulp and Paper Industry<br>Applying a Game Theory Framework to Assess Cooperative Product Responsibility Policies: The Case of Toner Bottles |
| 7E | Richardson | Casey, Kahn, &<br>Rivas<br>Solomon, Corey, &<br>Halvorsen<br>Baxter | Willingness-to-Pay for Safe, Reliable Drinking Water in Manaus, Amazonas, Brazil<br>Safe Minimum Standard Analysis of the Florida Manatee: A Case Study in Citrus County<br>Sustainability of Surface Water Transport of Goods: An Ecological Economic Investigation of Systems and Policy Implications   |
| 7F | Piasecki   | Managi et al.<br>Hodge & Canham<br>Santos et al.                    | Environmental Regulations & Tech. Change: Rethinking the Porter Hypothesis<br>Environmental and Financial Performance Connection: The Win-Wins of Strategic Environmental Management<br>Integrated Incentive Schemes to Promote Sustainability in Agro Industries   |
| 8A | Solomon    | Lange et al.<br>Batker & Barclay<br>Batabyal & Beladi               | Trade and the Environment in Southern Africa: The Water Content of Trade<br>An Update on Current Issues in Trade Policy from an Applied Ecol. Econ. Perspective<br>A Differential Game Theoretic Analysis of Inter'l Trade in Renewable Resources   |
| 8B | Patterson  | Batker &<br>Mormorunni<br>Voinov & Seppelt<br>Collados              | Ecological Economics in Practice: The North American Spot Prawn Fishery<br>Understanding and Communicating Sustainability: Global vs. Regional Perspectives<br>Environmental Policy and the Economic System   |
| 8C | Gowdy      | Good & Reuveny<br>Devkota<br>Schlör                                 | Easter Island. What Could Foresight Have Done?<br>Strong Sustainability: an Example from Nepal<br>The Asymmetry of Sustainability and their Consequences  |

|           |      |                    |   |
|-----------|------|--------------------|---|
| <b>8D</b> | Wood | Smargon            | The Theory and Practice of Green Purchasing: An Experiment in Private Educational Procurement and Sustainability      |
|           |      | Belling            | An Analysis of Biodiesel Conversion for University Bus Fleets   |
|           |      | Crone              | Global Seminar: Multicampus Teaching in Environmental Sustainability  |
| <b>8E</b> | Cox  | Clukey et al.      | How Visible Is My Community? The Economics of Identity in the Digital Age   |
|           |      | Holmes             | An e-Commerce Development Program for Very Small Manufacturers in the Adirondack Park Area of Northern New York State |
|           |      | Höller & Paulesich | Can Venture Capital Boost Sustainability?   |

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## CONCURRENT SESSION 1 – THURSDAY – 8:30 to 10:00 AM

### SESSION 1A – ECOLOGICAL MACROECONOMICS

**Chair: Josh Farley, University of Vermont, Burlington, VT, USA**

**Room: Alydar**

**Christensen, Paul P.**

Hofstra University, USA

#### *The Industrial Juggernaut Versus Nature's Robust but Fragile Systems*

The theoretical core of neoclassical economics is constructed on assumptions of rational behavior, unlimited wants, with scarcity, substitutability, and diminishing returns applied to all goods and resources. The result, based on the equilibrium theories of analytical mechanics, is a model where excessive resource use and depletion will be checked by rising costs and prices, assuming basic political parameters are properly set. Yet any constraints on individual resources will be countered by technical change and market forces. We can have our cake and eat it too! Meanwhile, nature's vast but finite "renewable" production systems continue to fragment and weaken under the assault of an increasingly powerful and global system of production and consumption driven by increasingly rapid technological change, an ever expanding array of products and the consumption of high-quality fossil fuels and geologically vast reserves of materials. This is a world of increasing not diminishing returns and endogenous not exogenous change. Although limits on the resource side may eventually constrain this incredible growth machine, this will not happen before the living systems of the planet are deeply damaged. We are launched on a developmental path that will not be easily redirected. The behavioral assumptions of neoclassical theory lack any correspondence with the findings of modern psychology and neuroscience just as its physical assumptions violate the physical principles governing material and energy use. In terms of environmental work, a central requirement of any theory must be that it address the central physical connections between existing human economies and nature's systems and principles of production. A long investigation of the early evolution of economic theory reveals a hidden theory of economic production set out from the principles that were being formulated in the natural sciences. ... This paper will provide the "missing chapter" of classical production theory and its potential for a physical and "ecological" theory of industrial production linked to nature's productive systems and resources.

**Czech, Brian**

Virginia Polytechnic Institute and State University, Falls Church, VA, USA

#### *Technological Progress, Economic Carrying Capacity, and Biodiversity Conservation*

The human economy generally grows at the competitive exclusion of nonhuman biodiversity. However, many expect technological progress to reconcile the conflict between economic growth and biodiversity conservation. Others expect technological progress to result in the liquidation of more natural capital and therefore biodiversity. The argument has focused largely on the types of technological progress available. A closer analysis of the sources of economic growth and technological progress reveals another challenge to biodiversity conservation, especially in the current political economy of corporate globalization. Most technological progress derives from corporate research and development, which is funded as a function of profit. Profit required for research and development derives largely from economies of scale. This suggests that economic growth is required for technological progress, engaging the principle of competitive exclusion, and that biodiversity conservation via technological progress is no better than a zero-sum game.

**Farley, Joshua**

Gund Institute for Ecological Economics/CDAE, University of Vermont, Burlington, VT, USA

#### *Ecological Macroeconomics*

Mainstream macroeconomists and mainstream policy makers generally apply macroeconomic policy levers towards the pursuit of continuous economic growth, where the economy is narrowly defined to include only human made goods. Distribution is a nominal concern, but growth is expected to solve that problem as well. Ecological economists also believe that growth is a central issue, but from an entirely different perspective, and strive to keep the economic system from growing beyond the capacity of the global ecosystem to sustain it. If growth cannot continue indefinitely, then it cannot be the solution to problems of distribution. Ecological economists are also deeply concerned with the non-market goods and services provided by global ecosystems. The question is, how can we use the macroeconomic fiscal and monetary policy levers to achieve a desirable scale and just distribution, and to

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‘efficiently’ allocate scarce resources among market and non-market goods and services? This paper suggests how we can use the policy levers of government expenditure, taxation, money supply and interest rates to achieve ecological economic goals. Fiscal policy is a flexible tool that can be used to address the ‘macro-allocation’ of resources between market goods and ecosystem services, and can also improve distribution. The distribution of resources earned from the sweat-of-the-brow is contentious, and more acceptable policies should focus primarily on the capture of and redistribution of wealth created by nature and society, and not by the individual. Traditional monetary policy primarily affects market goods, and therefore is a far blunter instrument from the ecological economic perspective. However, increasing bank reserve requirements would return the right of seignorage to the government, creating numerous opportunities for investing in non-market natural capital and for improving distribution.

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### **SESSION 1B – Northern Forest Panel Discussion**

**Chair and Session Organizer: Graham Cox, Audubon New York, Albany, NY, USA**

**Participants: Spencer Phillips, The Wilderness Society, Vermont**

**Mark Lorenzo, National Wildlife Federation, Vermont**

**Michael Wilson, Northern Forest Center, Maine**

#### **Room: Citation**

The City of Saratoga Springs, the site for the 2003 USSEE second conference, is a gateway community to a 26-million acre region covering the 30 most northern counties of four states -- New York, Vermont, New Hampshire and Maine. It is a forested and mountainous region rich in rivers and lakes that stretches from the Tug Hill Plateau, east of Lake Ontario, in the west, to the most northern communities along the Allagash River of Maine and to the Downeast communities along the Maine coast. This panel discussion will introduce conference participants to the economy and the geography of this spectacular region, where for much of two centuries the mainstays of the economy have been forestry and the forest products industry, and tourism and recreation. However, rapid and fundamental change has come to the region. Timber companies are divesting themselves of huge acreages of forest land. Second home development is eating into the fringes of the region. Employment patterns are changing; quality of life is rated highly, but unemployment remains high and wages relatively low. Panel members will discuss the changes in the regional economy and describe the opportunities for building a sustainable life style and sustainable communities based on three strategies: fostering appropriate amenity-based development, encouraging value-added forest products manufacturing, and fostering recreation and tourism based on the region's cultural, heritage and ecological values. These strategies are in turn based on conservation and on a reinvigorated, rejuvenating forest. Panel members represent four organizations active in the economic and ecological planning for the region. Discussion will include the construction of a Northern Forest Wealth Index, spearheaded by the Northern Forest Center. It will also include a discussion of research opportunities for practitioners in the nuts and bolts of translating the ideas of ecological economics into practical community action. Publications prepared by the Northern Forest Alliance, an alliance of 43 member conservation organizations, as well as the Northern Forest Center will be available for conference participants.

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### **SESSION 1C – Ecological Economic Perspectives from Developing Countries**

**Chair: John Gowdy, Rensselaer Polytechnic Institute, Troy, NY, USA**

**Room: Secretariat**

**Vadineanu, Radu<sup>1</sup>, Costel Negrei<sup>2</sup> and Angheluta Vadineanu<sup>1</sup>**

1-Department of Systems Ecology and Sustainability, University of Bucharest, Romania

2-Department of Environmental Economics, Academy of Economical Sciences, Romania

*Constraints and Opportunities for the Transition of the Romanian Socio-Economic System: An Ecological Economic Perspective*

Since 1990, Romania has been recognized as one of the country with “economy in transition” from CEE region. The established target for this complex and expensive process was to replace the former political, social and economic system (dictatorial, centralized and state owned economy) with a new one based on democracy, de-

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centralized and free market economy. Unfortunately the process was designed at inappropriate time and space scale and has neglected totally the structure and metabolism of the inherited economic system. Under these circumstances it is not surprising that the result till now shows that even the ownership is changing there's a marked tendency to preserve the structure and metabolism of the former economic system and consequently its capacity for deterioration of the domestic natural capital and human health. In order to prove and explain, on one hand this trend and its dangerous consequences at the medium and long term and on the other hand the need to re-design the attractor and the process of transition, we analyze in the paper the preliminary results derived from the assessment of: i) the structure and metabolism of the reference socio-economic system from 1989; ii) the Ecological Footprint required by the reference socio-economic system, and; iii) the ecological infrastructure and the respective domestic natural capital. The results are showing that fundamental constraints for the transition are linked to the structure and metabolism of the reference SES (e.g. built mostly on processing raw materials and relying in less than 50% on the domestic natural capital) which tend to be preserved during the economic reform and, the opportunities consists in the richness of the domestic natural capital (both as the diversity of biophysical structures and high productive and carrying capacity) and in the high ethno-cultural diversity and quality of human capital. Taking into consideration such findings there's an attempt to argue that is a need for focusing the transition on the structural and functional adaptation of the romanian SES to the structure, productivity and carrying capacity of the domestic natural capital. At the end we are suggesting a reduction to less than 30% of total dependence of the metabolism of SES by the external Natural Capital.

### **Iorgulescu, Raluca Ioana**

Rensselaer Polytechnic Institute, Troy, NY, USA

#### *Gender, Institutions, and Development in Two Nigerian Villages*

The paper presents some of the results of research done in two Nigerian villages-Umuluwe and Obigbo-together with Professors Steve Onyeiwu and John M. Gowdy in May 2001. Umuluwe is representative of remote, still traditional Igbo villages, while Obigbo can be seen as representing more modern sub-urban villages. Obigbo being a satellite village of Umuluwe, the two of them are studied together. Increased participation in the global economy has weakened traditional institutions making it more difficult to raise the bulk of the population above the poverty line. Our findings support the idea that the new rules and behaviors imposed by development do not always improve the condition of ordinary people, particularly women. Through the 2001 survey, we track an increasing gender discrimination of a type that was not present in traditional Igbo society. The traditional Igbo society of Umuluwe was in many ways more democratic than the more "modern" society of Obigbo. On the other hand there appear to be more educational and economic opportunities for women in Obigbo.

### **Batabyal, Amitrajeet A.<sup>1</sup> and Hamid Beladi<sup>2</sup>**

1-Rochester Institute of Technology, Rochester, NY, USA

2-University of Dayton, Dayton, Ohio, USA

#### *Renewable Resource Management in Developing Countries: How Long Until Crisis?*

A key goal of renewable resource managers in developing countries is to take actions to ensure that the resource being managed stays away from irreversible or crisis states in which it provides neither consumptive nor non-consumptive services to humans. However, despite a manager's best efforts, the resource may still hit a crisis state. Therefore, given a particular management regime, it is useful to know how long it takes until the resource hits a crisis state. In this paper, we provide a theoretical analysis of this hitherto unstudied question. We first probabilistically delineate two management regimes. Next, we compute the expected time until crisis for both these regimes. Finally, we provide a numerical example to illustrate the working of our model and then we discuss the implications of our findings for renewable resource management in developing countries.

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## CONCURRENT SESSION 1 – THURSDAY – 8:30 to 10:00 AM

### SESSION 1D – Methods, Models, and Reason

**Chair:** Valerie Luzadis, SUNY College of Environmental Science & Forestry, Syracuse, NY, USA

**Room:** Spectacular Bid

**Norton, Bryan G.**

School of Public Policy, Georgia Institute of Technology, Atlanta, Georgia, USA

*In Search Of Method: Evaluation in Ecological Economics*

Ecological Economics will not be established as an independent entity until it develops its own, distinctive method for evaluating environmental change. Following Andrew Stirling, a "justificatory" approach to decision analysis is defined as any approach that has as its goal to turn "large areas of policy making into a 'normal science'," and it will be argued that these approaches cannot be effective in particular, contextual, and dynamic decision making such as is necessary in adaptive management contexts. These justificatory approaches, which mostly try to evaluate changes in terms of a single currency, cannot by themselves provide guidance to improve environmental policy decisions. An alternative approach is proposed: embed evaluation of environmental change into an adaptive management process, using a two-phase evaluation method. In the Action Phase, chosen criteria are applied to particular management decisions; in the Reflective Phase, communities-as part of an ongoing, iterative process-discuss how to weight these multiple criteria. Ecological Economics should thus be pluralistic, employing different approaches to evaluating change in different situations. Pluralism, however, requires development of "meta-criteria" to determine which evaluative tool is appropriate in various situations. The need for pluralism can be illustrated if one recognizes the difficulty of evaluating losses of biodiversity, a case study that shows how concentration on putting dollar values on "biological resources" can divert decision makers from the over-riding value of "sources of biological resources," defined by Paul Wood as "the sum total of differences among biological entities." Evaluating changes in biodiversity, surely an important task in ecological economics, cannot be accomplished with justificatory methods; use of a pluralistic, two-phase approach to evaluation of environmental change can provide useful heuristics for decision makers.

**Boumans, Roelof M, Robert Costanza, Matthew Wilson and Joshua Farley**

Gund Institute for Ecological Economics, University of Vermont, VT, USA

*Simulating Ecosystem Services Within The Context Of The Global Unified Meta Model Of The Biosphere*

A Global Unified Metamodel of the BiOsphere (GUMBO) was developed to simulate the integrated earth system. It is a "metamodel" in that it represents a synthesis and a simplification of several existing dynamic global models in both the natural and social sciences at an intermediate level of complexity. GUMBO is the first global model to include the dynamic feedbacks among human technology, economic production and welfare, and ecosystem goods and services within the dynamic earth system. GUMBO includes modules to simulate carbon, water, and nutrient fluxes through the Atmosphere, Lithosphere, Hydrosphere, and Biosphere of the global system. Social and economic dynamics are simulated within the Anthroposphere. GUMBO links these five spheres across eleven biomes, which together encompass the entire surface of the planet. The interaction among the human system and biome changes are simulated and evaluated. Historical calibrations from 1900 to 2000 and a range of future scenarios representing different assumptions about technological change, investment strategies and other factors have been simulated. A "base case" condition follows historical trends over the last one-hundred years, with no changes made in the model parameters or assumptions. Four alternative scenarios labeled: "Star Trek" (ST), "Mad Max" (MM), "Big Government" (BG) and "EcoTopia" (ET) were developed under contrasting assumptions about technology, the resilience of the global environmental system and the ability of economic production to cope with future changes in sinks and sources of natural capital. Overall, the model reproduces historical behavior extremely well and shows the different impacts of alternative choices and policies within the dynamic earth system.

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## CONCURRENT SESSION 1 – THURSDAY – 8:30 to 10:00 AM

### SESSION 1E – Watershed Management and Modeling

**Chair: Mindy Kane, Rensselaer Polytechnic Institute, Troy, NY, USA**

**Room: Affirmed**

**Kraft, S.<sup>1</sup>, J. Adams<sup>1</sup>, C. Lant<sup>1</sup>, T. Loftus<sup>2</sup>, L. Duram<sup>1</sup>, J. Ruhl<sup>3</sup>, and J. Klauser<sup>1</sup>**

1-Southern Illinois University, Carbondale, IL, USA

2-Heidelberg College

3-Florida State University, USA

#### *Legitimacy And Watershed Planning Process--Implications For Ecosystem Services*

Driven by ongoing problems of non-point source pollution, the 1990's witnessed a rapid development of watershed-scale planning initiatives. Various called "place-based," "community-led," "locally-led," "integrated watershed management," or other similar terms, these initiatives now number over 1000 and are growing rapidly throughout the nation. These initiatives face numerous obstacles, more social than hydrologic, in achieving improved water quality and other natural resource goals. In particular, water resources and land-use planning in multiple-owner, largely private watersheds has been fragmented and subject to a variety of forces originating both within and outside the watershed. Watersheds do not normally constitute formal, organized political jurisdictions; hence resource planning groups face the challenge of acquiring political legitimacy and legal authority. While much has been written about the use of locally-led watershed planning activities, the discussion of the legitimacy of the planning process and the resulting plans has been minimal. Given a watershed, there might well be competing perspectives on the legitimacy of the planning process and the resulting plans, e.g., farmers actively using the landscape versus nonfarm rural and village residents. The literature on policy implementation and compliance suggests that the perceived legitimacy of the process producing the policy and accompanying rules/laws as well as the perceived legitimacy of the rules themselves have a large impact on the extent to which the rules are complied with. Using the emerging literature on the legitimacy of resource plans and planning processes as well as survey research in a watershed that has experienced a resource planning process, the authors address the central issues related to watershed planning, plan implementation, and implications for other planning activities dealing with ecosystem services.

**Voinov, Helena**

Gund Institute for Ecological Economics, University of Vermont, Burlington, VT, USA

#### *Defining Parameters Affecting The Landscape Transition: Comparison Between Urban And Rural Watersheds*

Understanding driving forces that lead to landscape transition is crucial for developing effective ecosystem management plans and for targeting ecological research to areas that define scarce ecosystem services. Multiple studies show that land use at various stages of development is significantly influenced by site-specific and institutional factors and, accordingly, that land-use patterns are largely determined by the physical structure of landscapes and socioeconomic conditions of a region. The amplitude of the impact of various factors varies significantly between different stages of the landscape development and spatial mosaics. We have analyzed formalized the influence of physical factors (e.g. slope, different kind of proximities to highways, secondary roads, employment centers, etc.), socio-demographic factors (e.g. population densities, education, income), and landscape mosaics. We came up with hypotheses regarding the effect of various site and locational features for spatially explicit dynamic landscape modeling. Two watersheds have been chosen to represent structural differences of a landscape. The Gwynns Falls (MD) watershed has been chosen as a heavily urbanized region of Baltimore Metropolitan area, while the Hunting Creek watershed in the Patuxent River basin is a mostly agricultural region in Southern Maryland. Both watersheds are parts of a Chesapeake Bay basin. This work is part of a larger project connecting the land use transition with a process-based spatially explicit ecological model in order to explore the sensitivity of ecological processes and functions to changes on the landscape.

## CONCURRENT SESSION 1 – THURSDAY – 8:30 to 10:00 AM

**Sunder, Shyam**

National Institute of Rural Development, Rajendranagar, India

*Water Scarcity, Its Management and Conflicts in India*

It is tried to examine the estimate of the water requirement in India for the period from 1990 to 2025 based on projected population and economic growth trends and compares it against an estimate of future water supplies. According to the estimate, the gap between demand and supplies of water would be 26.20m ham by the year 2025, with widespread scarcity, and growing competition and conflicts over the use of water between and within sectors as major fall-outs. The author argues that solution to the growing water crisis lies in demand management to prevent the financial and environmental risks associated with creating new supplies. The scope of demand management interventions in each sector is analysed and it is argued that they can be affected only through institutional changes. The institutional changes suggested are establishment of tradable private/cooperative property right regimes, and incentive systems such as economic pricing of water for irrigation and urban supplies, rational pricing of electricity for groundwater pumping and pollution tax. The author, however, emphasizes that improving the quality of irrigation and water delivery to farmers. Effective monitoring of their use and recovery of service charges will be crucial to ensuring the effectiveness of fiscal instruments in promotion of efficient use of canal water and electricity along with improving the financial performance of irrigation and power sector. Establishment of tradable property rights will promote water markets and thus can create incentive among farmers, the largest users of water, for transfer of resources to economically efficient uses in times of water shortages. The new breed of institutions that need to be created for other changes are: (1) multi-tier hierarchy of organization for irrigation management in confrontation with the structure of irrigation system; (2) village level and system level organization for managing regional water supply scheme and (3) creation of village electricity co-operatives for power distribution in the farm sector and private-sector involvement for power supply. The major policy change suggested is the adoption of river basin as the unit for planning water development and management projects; and river basin organization as institutional model for resolving conflicts over water allocation and use. Policy changes are required to encourage inter-sect oral and intra-sect oral co-ordination, to facilitate a paradigm shift from designing strategies to alter the natural system for increasing supplies to alter the socio-economic system for managing the demand of water, and to enable development of new set of techno-social and techno-institutional database for managing water in the context of river basins. Changes are also needed in the existing legal framework to enable establishment and protection of private property in water; and establishment of river basin organizations that can be made possible for water resources management and allocation of water within and across sectors.

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## CONCURRENT SESSION 2 – THURSDAY – 10:30 AM to 12 NOON

### SESSION 2A – EQUITY, EFFICIENCY, AND SCALE IN GREENHOUSE GAS ABATEMENT

**Chair:** Tom White, Assumption College

**Room:** Alydar

**Tyagi, Anupam**

Tucker, GA, USA

*Designing the Claims: A Fair and Efficient Framework for Limiting Greenhouse Gas Emissions with Developing Country Commitments*

An important question in the climate change negotiations is: What commitment to limit climate change and Greenhouse Gas (GHG) emissions should be required from the currently exempted developing countries? The answer to this lies in separating commitments to GHG levels from commitment to fair principles and criteria that assign GHG levels to different countries. All countries, including the currently exempt countries, are expected to commit to a fair set of principles and criteria, such as the one proposed in this paper. The commitments to the specific levels of GHG that derive from fair principles is a more robust approach for the long-term success of the climate change treaties than temporarily negotiated outcomes based on the political and economic power of countries and of lobby groups within them. Evidence presented in this paper documents large inequities in the use of global emissions capacity among countries. Contributions from different sources to overall emissions varies significantly. These contributions have changed over time---liquid and solid fuels are more important. Contributions have shifted from solid to liquid and to gas fuels over time. Inequalities between income groups and regions contribute more to overall inequality than the inequality within them. The results on inequality decompositions of carbon dioxide emissions are surprising. It remarkable to note that regions are much more homogeneous in terms of carbon emissions than income groups. This suggests that a regional focus in the climate change debate and mechanisms is as important as a focus on income groups. The framework for allocation of emissions developed in this paper identifies goals that can be sequentially achieved in stages to meet the overall aim of limiting climate change. The groups of countries that can be sequentially assigned increasing responsibility for limiting carbon emissions are identified. Emissions trading and prices are addressed.

**Waaub, Jean-Philippe<sup>1</sup> and Kathleen Vaillancourt<sup>2</sup>**

1-Université du Québec à Montréal, Canada

2-Research Center in Decision Analysis, GERAD and Département de Géographie

*Equity And Efficiency In International Greenhouse Gas Abatement Scenarios: A Multicriteria Approach*

The climate change problem involves long term global efforts through sustainable development. The international burden sharing of greenhouse gases abatement constitutes a controversial debate. Equity is an important issue to be considered in the mitigation policies to insure the participation of as many developing countries as possible. The main purpose of this research is to allocate equitable international greenhouse gases emission entitlements using several criteria. There are many equity definitions and some are conflicting. A dynamic multicriterion method is proposed to compare various alternatives and to find a compromise solution. If the decision-making process can take into account interests and preoccupations of every country, significant progress could be made to achieve a world consensus. Several burden sharing schemes are proposed. Then, modeling abatement scenarios using the MARKAL world energy model allows to determine the cost-effectiveness opportunities. Permit trading systems allow to reach a global reduction target with the overall minimal cost, but the different allocation schemes lead to different trading patterns and total costs for each country. Then, burden sharing issues are analyzed in accordance with the different equity principles.

**Adger, W. Neil**

University of East Anglia, Norwich, UK

*Environmental Justice and Sustainability at Diverse Scales: A Discussion On Climate Change*

All environmental decision-making presents dilemmas of justice at diverse scales from local to global. The paper outlines a framework a framework for analysing justice issues and examine justice implications of international environmental law, national policy planning and local practice in the case of climate change. The

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arguments concerning equity and justice in mitigation of climate change are well known, but the paper demonstrates that these are also central to debates on impacts of climate change and, importantly, to adaptation policies and strategies. Justice involves both distributive and procedural elements in a pluralist framework; the former focusing on the incidence of consequences of responses and the latter on how decisions are made. Moreover, both consequentialist and deontological concerns must be recognised in the two areas of justice. Adaptation to climate change is examined in detail. It is comprised of inaction and proactive and reactive responses at the international, national, local and individual levels. Inaction at higher levels delegates the responsibility for adaptation to lower levels, and higher-level responses influence alternatives that are available at lower levels. Justice is thus always implicit in the choice of adaptive responses. International law on adaptation expresses a commitment to assist developing countries but does not provide a clear foundation for it and does not resolve how the burden of funding ought to be shared and how the adaptation funds ought to be distributed. The Marrakech Accords of the Framework Convention on Climate Change have increased the emphasis on procedural justice, such as the role of developing countries in decisions on adaptation. While creating ways to acknowledge and hear developing country and local voices, the recent legal changes do not create full rights to participation in decision-making on adaptive responses.

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### SESSION 2B – ENERGY AND ECOLOGICAL ECONOMICS

**Chair and Session Organizer: Cutler Cleveland, Boston University, Boston, MA, USA**

**Room: Citation**

#### **Cleveland, Cutler J.**

Center for Energy and Environmental Studies and Department of Geography and Environment,  
Boston University, Boston, MA, USA

#### *Energy Quality, Net Energy and the Coming Energy Transition*

Global oil production will peak in the coming decades, followed by natural gas and coal. These turning points constitute an unprecedented watershed in human history. This paper focuses on some of the critical challenges we face in the transition from conventional fossil fuels to alternative sources, particularly solar energy. Conventional wisdom holds that technical improvements in the efficiency of energy end use and the shift towards a dot-com economy will de-couple energy use and economic well-being. But the relationship is much more complex than this simple formulation. Most analyses underestimate the important quality differences between fossil fuels and solar energy and their economic implications. Quality in this case is measured by the amount of output generated per unit of energy input. The lower quality nature of solar energy is reflected in part by its energy density, and its lower energy return on investment, the amount of energy delivered by a system compared to the energy used in the delivery process. When quality differences are accounted for, the relationship between energy use and economic activity remains quite strong. Countervailing forces are rising affluence and the rebound effect. Rising demand due to population growth and rising incomes, especially in developing nations, can increase consumption faster than efficiency gains reduce it. This will be extremely important in the coming decades as developing nations continue to rapidly industrialize and adopt consumption habits similar to industrial nations. The rebound effect applied to energy is this: energy efficiency gains look to the consumer a lot like price reductions, spurring increased demand for energy either directly through price elasticity effects (e.g., people buying more gasoline when its price drops), or indirectly through released purchasing power redirected to energy-using goods and services. The cost and ease of transition to a non-carbon energy system will hinge on effective response to these challenges.

#### **Najam, Adil<sup>1,3</sup> and Cutler J. Cleveland<sup>2,3</sup>**

1-Department of International Relations, Boston University, USA

2-Department of Geography, Boston University, USA

3-Center for Energy and Environmental Studies, Fredrick S. Pardee Center for the Study of the  
Longer-Range Future, Boston University, USA

#### *Energy and Sustainable Development at Global Environmental Summits: An Evolving Agenda*

This paper presents a framework for understanding energy issues in the context of sustainable development. It posits that there are three important ways in which energy is related to sustainable development: a) energy as a source of environmental stress, b) energy as a principal motor of macroeconomic growth, and c) energy as a

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prerequisite for meeting basic human needs. These three dimensions correspond to the three dimensions of the often-used triangle of sustainable development: environmental, economic, and social. Using this framework, the paper traces how successive environmental summits at Stockholm (1972), Rio de Janeiro (1992) and Johannesburg (2002) have dealt with energy issues. It identifies a slow, surprising, and important evolution of how energy issues have been treated at these global discussions. Energy has received increasing prominence at these meetings and become more firmly rooted in the framework of sustainable development. Stockholm was primarily concerned with the environmental dimension, Rio de Janeiro focused on both the environmental and economic dimensions, and the major headway made at Johannesburg was the meaningful addition of the social dimension and the linking of energy issues to the United Nations' Millennium Development Goals.

**Ahlen, Jenny**

Center for Energy and Environmental Studies, Boston University, Boston, MA, USA

*Energy and the Human Development Index*

Energy is central to any discussion of sustainable development because it is central to economic growth, social change, and environmental quality. In terms of the economic dimension of sustainable development, energy is clearly an important motor of macroeconomic growth. In terms of the environmental dimension, conventional energy sources are major sources of environmental stress at global as well as local levels. In terms of the social dimension, energy is a prerequisite for the fulfillment of many basic human needs and services, and inequities in energy provision and quality often manifest themselves as issues of social justice. This paper examines the quantitative relationship between commercial energy use and human development. Specifically, it presents an econometric model of energy use and the Human Development Index (HDI) for 120 nations. A panel data set is used to test various hypotheses about the relation between energy uses and the level of development as measured by the HDI.

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### SESSION 2C – THE PLACE OF ANIMALS IN ECOLOGICAL ECONOMICS

**Chair and Session Organizer: Josh Frank, FIREPAW, Albany, NY, USA**

**Room: Secretariat**

**Carlisle-Frank, Pamela, Joshua Frank and Lindsey Nielson**

Foundation for Interdisciplinary Research and Education Promoting Animal Welfare  
(FIREPAW), Albany, NY, USA

*Are Rental Properties Markets that Allow Companion Animals Efficient?*

Inability to obtain housing has been found in several studies to be one of the leading causes of companion animal surrender and often death in U.S. shelters. Anecdotal evidence suggests there may be a mismatch between the supply and demand of rental properties that allow companion animals in many markets. More specifically, some potential renters report an inability to obtain housing that allows animals at any price, or that there is a mismatch between the premium charged for companion animals and the actual risks to property owners from those animals. The presentation will argue that these markets may actually suffer from irrationality and bias as well as high information costs that lead to inefficient outcomes. It will be argued that landlord inexperience and factors that work against natural selection forces in these markets help to perpetuate this inefficiency. Preliminary results from a study currently in progress will be presented. This study analyzes data from selected markets nationwide to determine the existence of a rental premium for companion animals. The study also surveys both landlords and renters to determine what are the average costs and risks that are associated with renting to tenants with companion animals and how these average costs/risks compare to perceived costs to landlords. The survey also examines whether there is a mismatch between the quantity supplied and the quantity demanded for properties that allow companion animals.

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**Mallia, Mary Ellen**

Siena College, Loudonville, NY, USA

*An Overview of the Benefits and Costs of Using Animal Assisted Therapy in Nursing Homes*

Animal assisted therapy is beginning to gain popularity in the United States as recent studies have found a direct link between the use of AAT and improved health and quality of life. This paper examines the application of this method in nursing homes. The first part reviews the variety of benefits and costs associated with AAT. There exists a multitude of direct benefits for the patient including: physical improvements, emotional support, improvement in mental health and greater socialization opportunities. Additionally, there exists indirect benefits on the family and society. A brief discussion on valuing the quality of life is also provided. The direct costs of such a program would involve the fee for the animal trainer and any additional operating costs of the facility. Indirect costs include the valuation of volunteer's time plus any psychological costs due to fear and perceived lack of hygiene of the animals. Finally, an overview of the types of economic evaluation methods are studied. These techniques are analyzed for their appropriate application to AAT programs based on a facilities' objective.

**Frank, Joshua and Pamela Carlisle-Frank**

Foundation for Interdisciplinary Research and Education Promoting Animal Welfare (FIREPAW), Albany, NY, USA

*The Place of Animals in Ecological Economics: Have animal issues been overlooked?*

Ecological Economics has played an important role in providing both an alternative theoretical framework to neoclassical economics and in giving greater coverage to important issues regarding the environment, natural resource use, and poverty/inequality. Animals have received some consideration in terms of species extinction and in terms of ecosystem balance. Yet issues addressing the welfare of animals as *individuals* with the capacity to experience pain and suffering or utility and disutility have been largely overlooked. This is particularly surprising since Ecological Economics has often focused attention on human beings who are underrepresented in market-based resource allocation decisions (e.g. the poor and future generations). This presentation will do the following: (1) Discuss whether sentient non-humans should receive some form of consideration in resource allocation decisions, incorporate the philosophical literature, and how such consideration might be achieved; (2) Discuss whether indirect consideration through the utility of sympathetic humans is sufficient to account for animal interests, how information costs may hinder indirect consideration, and some potentially perverse implications; and (3) Briefly summarize a few of the major areas in which economics has much to contribute and has been noticeably absent from the discussion regarding animal issues including: (a) Animal experimentation involves trade-offs of animal versus human interests. Rarely if ever is a serious economic analysis of the costs and benefits undertaken, and market decisions do not provide such an analysis due to externalities; (b) The market for animal food products raises many important issues. In this area in particular the evolution of cruelty-free markets may be hindered by institutional considerations; (c) Companion animals is one of the few areas where the public clearly exhibits a high willingness to pay to improve animal welfare. This area raises many important economic issues such as financial incentives to spay/neuter animals and the substitutability of pure-bred versus adopted animals.

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### SESSION 2D – SPATIAL ANALYSIS OF LANDSCAPE CHANGE

**Chair: Austin Troy, School of Natural Resources, University of Vermont, Burlington, VT, USA**

**Room: Spectacular Bid**

**Voinov, Alexey<sup>1</sup> and Ralf Seppelt<sup>2</sup>**

1-Gund Institute for Ecological Economics, University of Vermont, VT, USA

2-Institute of Geoecology, Technical University Braunschweig, Germany

*Applications Of Landscape Optimization Techniques To Define Restoration Priorities And Ecosystem Values*

Spatial landscape modeling has been recognized as an important tool to link change in landscape pattern and organization with the ecological conditions in the rivers and estuaries. We have built a spatially explicit landscape model to estimate the impact of economic growth on environmental conditions in Hunting Creek

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watershed, a small subwatershed in the Chesapeake Bay catchment area. The model takes into account information about economic indicators (such as land use patterns, amount of nutrient pollution from various sources, etc.), physical characteristics of the area (elevation, soil types, etc.), and biological characteristics (habitat types, vegetation types, etc.). We focused on nitrogen as an indicator of environmental quality and were comparing the concentration of nitrogen in the estuary zone of Hunting Creek under a variety of scenarios. The model was further used to find optimal strategies of fertilizer application and crop allocation within the watershed. It was shown that spatial distribution of the development is an important factor for water quality in the estuary. The river buffers came out as the areas that have the most effect on the water quality. By setting various goal functions the optimization algorithms can be used to identify the most efficient spatial patterns for land use and restoration projects. Moreover assuming that the existing landscape patterns are optimal in a certain sense, we can compare the "optimal" patterns that result from optimization with existing landuse coverages to understand how people value their landscapes.

**Kraft, S.<sup>2</sup>, D. Bennett<sup>1</sup>, J. Beaulieu<sup>2</sup>, J. Nicklow<sup>2</sup>, C. Lant<sup>2</sup>, and T. Loftus<sup>3</sup>**

1-University of Iowa, USA

2-Southern Illinois University, Carbondale, IL, USA

3-Heidelberg College

*Trade-Offs Among Ecosystem Services or Environmental Benefits and Agricultural Production: Implications For Watersheds*

Using a Spatial Decision Support System (SDSS) and the theoretical concepts related to a Productions Possibilities Frontier (PPF): trade-offs along the frontier as well as increases in efficiency as one moves from the interior of the feasible space toward the frontier, policy alternatives for landscape use within watersheds are explored. The resulting SDSS and PPF are useful tools in helping watershed planners, residents, and landscape professionals visualize alternative mixes of land uses for the same region. The implications of these alternative land uses for environmental benefits are discussed and related to the current policy debate based on the 2002 farm bill and other watershed planning initiatives.

**Polimeni, John M.**

Department of Economics, Rensselaer Polytechnic Institute, Troy, NY, USA

*Application Of A Spatial Simulation Of Residential Development To Evaluate Land Value Taxation In The Hudson River Valley, New York State*

This paper projects residential development in the Wappinger Creek Watershed within Dutchess County, New York State using an integrated modeling framework consisting of a spatial econometric model, and a geographic information system (GIS). The spatial econometric model is used to project residential development at the tributary watershed level, sub-watershed level, and census block level. The GIS is employed to extract socio-economic and county-level tax parcel data to be used in conjunction with bio-geophysical attributes, such as slope, soil, and location attributes, to calculate and project growth trends on a residential level for undeveloped land parcels. The focus of the paper will be on detailed case studies, consisting of several related scenarios that will be used to present stakeholders the economic, social, and environmental implications of possible courses of action. The scenario analyses will indicate where new development will likely occur in the Watershed under current property taxation methods as compared to land value taxation. The scenarios will demonstrate how land value taxation can be used by policy-makers to prevent decentralized development, thus protecting the Wappinger Creek Watershed ecosystem.

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### SESSION 2E – ENVIRONMENTAL JUSTICE

**Chair:** Marsha Walton, Department of Economics, Rensselaer Polytechnic Institute, Troy, NY, USA

**Room:** Affirmed

**Ash, Michael<sup>1</sup> and T. Robert Fetter<sup>2</sup>**

1-University of Massachusetts, Amherst, MA, USA

2-Science Applications International Corporation

*Who Lives on the Wrong Side of the Environmental Tracks? Evidence from the EPA's Risk-Screening Environmental Indicators Model*

This study analyzes the social and economic correlates of air pollution exposure in U.S. cities using a unique dataset created as a by-product of the EPA's Risk-Screening Environmental Indicators model and find evidence of disproportionate exposure to environmental hazards in communities with higher concentrations of lower-income people and people of color. We improve on previous studies of environmental inequality in three ways. First, where previous studies focus on the proximity to point sources and the total mass of pollutants released, our measure of toxic exposure reflects atmospheric dispersion and chemical toxicity. Second, we analyze the data at a fine level of geographic resolution. Third, we control for substantial regional variations in pollution, allowing us to identify exposure differences both within cities and between cities. We combine 1998 data on toxicity-adjusted exposure to air pollution with 1990 Census block group data for urbanized areas. We find that blacks tend to live both in more polluted cities in the U.S. and in more polluted neighborhoods within cities. Hispanics live in less polluted cities on average, but they live in more polluted areas within cities. We find an extremely consistent income-pollution gradient, with lower income people significantly more exposed. Our findings highlight the importance of controlling for inter-regional variation in pollution levels in studies of the demographic correlates of pollution.

**Khanna, Neha and Florenz Plassmann**

Department of Economics, Binghamton University, Binghamton, NY, USA

*Exposure To Ozone: Counting Pollution Where It Matters*

In this paper we use a multivariate regression analysis to examine the exposure of racial minorities to ozone pollution in the United States in 1990. We use two very different ways of measuring exposure to ozone. In the first method we use the ambient concentrations of ozone measured at various locations across the US. In the second method we use the number of days in 1990 when ambient ozone concentrations exceeded the national ambient air quality standards (NAAQS) for ozone as a measure of exposure to harmful levels of ozone pollution at various locations. We find that even after controlling for the influence of various economic factors such as income, poverty, education, employment status, housing tenure, and degree of political participation, racial minorities are, indeed, exposed to higher ambient concentrations of ozone. However, it appears that this exposure is at levels of ozone that are not harmful to human health. When exposure to pollution is measured by the number of days on which ozone concentrations exceeded their NAAQS, the regression coefficient on the percentage of minority population is not statistically significant. We speculate that this difference could be due to the fact that ozone is regulated under the US Clean Air Act and its Amendments (CAAA). Earlier literature had argued that minorities were more exposed to ozone pollution using data from the 1970s and early 1980s. Our data examines pollution in 1990. It is possible that the CAAA has successfully reduced pollution by the greatest degree in the most polluted areas, that is areas with a significant minority population.

**Vidovic, Martina<sup>1</sup> and Neha Khanna<sup>2</sup>**

1-Bloomsburg University, Bloomsburg, PA, USA

2-Binghamton University, Binghamton, NY, USA

*Participation In Voluntary Pollution Prevention Programs And The Role Of Community Characteristics: Evidence From The 33/50 Program*

In this paper, we evaluate the success of the 33/50 program and provide policy recommendations with respect to future program design and questions of environmental justice.

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We extend into two areas of research; the literature on firm participation in voluntary pollution prevention programs, and the literature on distribution of toxic pollution. We examine the factors that influence firm participation in the 33/50 program, as well as the influence of community characteristics including race, income, education, and political action on the participation decision of the facility, after controlling for firm participation in the program and facility specific releases. The measure of toxic emissions also incorporates the differences in chemical toxicity based on the Threshold Limit Values published by the American Conference of Governmental Industrial Hygienists. We use data on 330 firms that were eligible to participate in the Program over its entire lifetime, and over 1,100 facilities that belonged to participating firms. We employ a two stage estimation method to get consistent estimates of the parameters. In the first stage we estimate a probabilistic choice model for the firm level participation in the 33/50 program using firm level emissions, firm specific factors and factors measuring influence of mandatory environmental regulation. In the second stage we model facility level participation decision for the sample of facilities belonging to participating firms. The second stage explanatory variables include zip code level demographic, political and socio-economic variables, as well as facility specific level of emissions. We also control for the sample selection bias by including the inverse Mill's ratio among the right hand side variables. The inverse Mill's ratio comes from the first stage estimation. We analyze the firm and facility level participation decision using a pooled cross section time series data, and also carry the analysis out separately for each year to check for structural changes over the life of the Program. ...

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## CONCURRENT SESSION 3 – THURSDAY – 3:30 to 5:00 PM

### SESSION 3A – URBAN-RURAL LANDSCAPES AND INTERDEPENDENCE

**Chair:** Jon Erickson, School of Natural Resources, University of Vermont, Burlington, VT, USA

**Room:** Alydar

Davis, Ann, Scott Bergen and Tom G. Geurts

Marist College, School of Management, Bureau of Economic Research, Poughkeepsie, NY, USA  
*Information Asymmetry and Externalities With Respect to Scarce Water Resources: A Cross-County Comparison in the Hudson Valley*

In the economics literature, there are several dimensions regarding potential market imperfections. Two examples include the work of Joseph Stiglitz and Coase, on the problems of information asymmetry and externalities. This paper will explore the nature of information asymmetry problems regarding the externalities with respect to scarce water resources in a local real estate market. There are different strategies for dealing with information regarding access to water resources in the counties in the Mid-Hudson Valley. Some counties provide comprehensive information regarding public and private water systems on publicly accessible websites. Other counties actively suppress this information, making it very difficult to obtain, or this information is not collected, consolidated, or routinely reviewed by policy officials. In the absence of uniform regulations regarding the collection and dissemination of this information at the state level, or consensus behavior by market participants, the market value of real estate in the public information access market may be lower, because the public is more aware of potential resource constraints during the life of the asset. In a county in which this data are not readily available, there is no such awareness, and prices may be too high as a result, since the negative externality is not internalized through a market pricing mechanism. Comparisons will be made regarding the functioning of the market mechanism in the respective “disclose” and “don’t disclose” real estate markets, using a model for residential real estate prices. The initial hypothesis to be tested is that the availability of water resource information will have a significant effect on housing prices. This study hopes to shed light on the social costs and benefits of information provision regarding scarce water resources.

**Kane, Melinda<sup>1</sup> and Jon Erickson<sup>2</sup>**

1-Department of Economics, Rensselaer Polytechnic Institute, Troy, NY, USA

2-School of Natural Resources, University of Vermont, Burlington, VT, USA

*Examining Urban-Rural Interdependence: A New Perspective on Questions of Urban Water Supply*

Increasing pressures on fresh water supplies at all scales on the one hand and population shifts from rural to urbanized areas on the other have led many researchers to ponder the critical question of how cities will supply clean water for their inhabitants in the future. This study focuses on the case of New York City and its evolving policies which attempt to ensure sufficient water quality in the face of pressures stemming from economic changes in its supplying watershed, increasing water quality standards, and a potential multi-billion dollar price tag for new water treatment facilities. Like many large urban centers, New York City draws its drinking water from relatively pristine rural watersheds outside its political boundaries. New York City's relationship with its supplying watershed has played a central role in the debate over how best to proceed. Relationships between urban and rural regions have been postulated in economic terms by central place theory. Research on urban metabolism has attempted to quantify the flows of resources through urban systems, thereby providing a basis for the study of how urban and rural regions are linked in resource or ecological terms. Independently, neither of these approaches can help adequately inform the debate on how best to approach the problem of water provision for urban areas while facing up to the economic constraints placed on the rural region in its designation as a “service” area for the urban core. This study uses an interregional input-output model with land accounts to examine the connectedness between the New York City economy and the watershed region's economy. The land accounts in the input-output framework serve as a rough proxy for ecosystem functions provided by the watershed. Various measures of connectivity used in the input-output literature as well as other issues in model estimation are discussed. Implications for the design of water supply policies will be drawn from the results.

## CONCURRENT SESSION 3 – THURSDAY – 3:30 to 5:00 PM

### **Sorrentino, John A.**

Department of Economics, School of Business & Management, Temple University Ambler, USA  
*Willingness To Pay To Preserve The Raytharn Farm: A Retrospective View*

The aim of this work is to examine the willingness to pay (WTP) of private individuals who actually donated amounts of money to preserve the Raytharn Farm in southeastern Montgomery County, Pennsylvania. One hundred and sixty acres of farmland were being considered by the owners for development into as many as 200 building lots. The land is adjacent to the Pennypack Ecological Restoration Trust (PERT), which was already the steward of hundreds of acres of preserved suburban land. A combination of things happened to make preservation of the farm possible: the land-trust owners reduced the \$10.5 million asking price to \$5.5 million, the county and state provided nearly \$3.5 million, and private donors contributed over \$2 million. A mail survey of 500 of the 630 private donors has been developed & sent out / posted on the web, the survey responses are in, & the analysis will begin shortly. Several of the research questions to be answered are: How does expressed WTP compare to what they donated?; How do the donors break down their motives into use, option, existence & bequeath value?; What characteristics of the Farm as open space do donors who use it value most?; What are comparable market prices for private places that yield the same experience as a visit to the Farm?; Is it likely that the model of preservation displayed in this case become a generic method to preserve open space & prevent suburban sprawl?

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### **SESSION 3B – THE FUTURE OF ENERGY, OIL, AND CARBON**

**Chair: Tom Drennen, Hobart and William Smith Colleges, Geneva, NY, USA**

**Room: Citation**

### **Kaufmann, Robert K.**

Center for Energy & Environmental Studies, Boston University, Boston, MA, USA

*Identifying the Mechanisms for AEEI: A Cointegration Analysis of the US Energy/GDP Ratio*

Many forecasts for energy use and carbon emissions assume that energy intensity will decline over time for reasons unrelated to energy prices, which is termed the autonomous energy efficiency increases (AEEI). A cointegration analysis of a vector error correction model indicates that the types of fuels consumed, personal consumption expenditures spent on energy, and energy prices account for changes in the ratio of energy use to economic activity in the US between 1929 and 1999. Cointegration indicates that AEEI is associated with technical and/or structural changes which allow consumers to substitute oil, natural gas, and/or primary electricity for coal, and that shift energy use from final demand to intermediate sectors. Identifying the factors responsible for AEEI allow me to (1) show that econometric efforts to measure technical change using a deterministic trend are inconsistent with economic theory and cannot be interpreted reliably; (2) show that modeling technical change with a deterministic trend may generate forecasts that overstate reductions in energy use and carbon emissions; and (3) test the observational record for the presence of price-induced technical change and its effect on economic growth. Together, the results indicate that current estimates for AEEI may overstate future reductions in energy use and that the economic impacts of policies to reduce energy use and slow emissions may have a greater effect on economic growth than anticipated currently.

### **Richmond, Amy K. and Robert K. Kaufmann**

Center for Energy and Environmental Studies, Boston University, Boston, MA, USA

*Is There an Environmental Kuznets Curve for Carbon Emissions*

This study analyzes the effect of omitted variable bias and model specification on conclusions about the relation between economic activity and energy use and/or carbon emissions. We attempt to answer the question of whether an Environmental Kuznets Curve (EKC) exists for carbon dioxide emissions. The EKC hypothesizes that the relation between economic activity and the use of natural resources and/or the emission of wastes has an inverted U-shape. According to this specification, use of natural resources and/or the emission of wastes increases with income at relatively low levels of income. However, beyond some turning point the use of the natural resources and/or emission of waste declines with income. We estimate the relation between energy use and economic activity and/or carbon emissions from a panel of international data. The panel includes observations from thirty six nations between 1973 and 1997. These nations include twenty one developed nations and fifteen developing nations. Together these nations account for 93 percent of global energy demand in 1990. Our results indicate that fuel mix

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has a statistically measurable effect on energy use and carbon emissions. Consequently, regression results reported by previous studies are biased by omitted variables. This bias affects conclusions about the ability of an EKC to describe the relation between economic activity and energy use and/or carbon emissions. Our results suggest that the relation between economic activity and energy use or carbon emissions can be described more accurately by a model that specifies diminishing returns than an EKC and that the types of energy consumed is an important determinant of both energy use and carbon emissions. These results suggest that economic growth alone will not eliminate concerns about energy use and carbon emissions.

**Khanna, Neha<sup>1</sup> and Duane Chapman<sup>2</sup>**

1-Department of Economics, Binghamton University, Binghamton, NY, USA

2-Department of Applied Economics and Management, Cornell University, Ithaca, NY, USA

*World Oil Resources, Pricing, And Security*

Three new probabilistic assessments of oil resources by the United States Geological Survey and the United States Minerals Management Service result in an expansion of global remaining conventional world oil resource estimates. The new value used here is 3.3 trillion barrels; the comparable earlier 1991 assessment was 2.1 trillion barrels. Using optimal control depletion theory, a global monopoly has theoretical net present value economic rent of \$22 trillion, with supply-demand quantity equilibria peaking in about 85 years, then declining to exhaustion in 25-30 years. However, actual global markets (as distinct from theoretical markets) operate in a game theoretic-framework. The Persian Gulf-OPEC team of exporters (accompanied by Norway and Mexico) faces the United States- Organization for Economic Co-operation and Development team of importers. The acceptable price range was \$23 - \$30 per barrel for the period up to the beginning of 2003. The Persian Gulf continues to be the major locus of world oil resources, and has production costs (including return on capital and a risk allowance) at \$5 per barrel or less. The political and military security system that provided stability for this production and pricing system is increasingly unstable, and new international systems should be considered.

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### SESSION 3C – SPATIAL MULTICRITERIA DECISION AIDES IN FOREST AND LAND MANAGEMENT

**Chair: Caroline Hermans, School of Natural Resources, University of Vermont, Burlington, VT, USA**

**Room: Secretariat**

**Hermans, Caroline and Jon Erickson**

School of Natural Resources, University of Vermont, Burlington, VT, USA

*Multicriteria Decision Aides in Land-Use Planning*

This paper presents the use of decision analysis to frame an integrated spatial watershed land-use model to aid stakeholders in selecting development policies in the Wappinger's Creek watershed in Dutchess County, New York. This research is a part of a Hudson River Foundation grant, the goal of which is to better identify and define the complex processes that shape the decline of ecosystem health in the area. The increasing rate of suburbanization of rural areas in the Hudson River Valley is causing severe watershed degradation. and a primary objective of this effort is to help stakeholders/decision makers (DMs) understand these complex processes and to project paths of development that arrest further degradation. A multicriteria decision-making (MCDM) approach using the PROMETHEE method of outranking is employed. The land-use model is comprised of environmental, socio-economic, and spatial components and serves to provide data on the performance of the objectives in an evaluation matrix. Stakeholder/decision maker (DM) involvement exists at every step of the decision process: definition of the decision problem, selection of possible solutions, identification of decisive factors and their corresponding weights, characterization of DM preferences, revision of the decision process based on newly acquired knowledge/decreased uncertainty/imprecision. This paper presents 1) the structure of the integrated land-use model data within the PROMETHEE framework and 2) describes the actual process of MCDM used with stakeholders in the Wappinger's Creek Watershed.

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**Cox, Graham<sup>1</sup> and Jon Erickson<sup>2</sup>**

1-Audubon New York, Albany, NY, USA

2-School of Natural Resources, University of Vermont, Burlington, VT, USA

### *Evaluating Sustainable Forest Management Alternatives Using Multi-Criteria Decision Analysis*

This paper explores the application of MCDA to participatory planning for sustainable management of the State Forest of New York. Applying the **P**reference **R**anking **O**rganization **M**ETHod of **E**nrichment **E**valuation (PROMETHEE) procedure, this paper analyses the planning process for two reforestation and multiple use (RMU) State Forest units with the aim of improving the process and the quality of unit management plans (UMPs). The methodology included the following elements. First, goals and alternative forest management options were identified, based on the State Department of Environmental Conservation (DEC) draft Master Plan for State Forests. Second, sustainable forestry criteria and indicators (C&I) were adapted from the Montreal Process, an international agreement between twelve nations containing ninety percent of the world's temperate and boreal forests. Third, alternative management scenarios were developed from selected stakeholders representing interests in the UMP process. Results include partial and complete ranking of management alternatives, Graphical Analysis for Interactive Assistance (GAIA) planes for conflict resolution, and full sensitivity analysis of scenario profiles, criteria and stakeholder weights, and stability intervals of rankings. Results from one forest unit demonstrate that active timber management can support the dual goals of conservation and passive recreation. This is preferred over the current UMP. In the second forest unit, where planning had just begun, MCDA helped clarify stakeholder positions. The resulting profiles and preference rankings demonstrate likely management conflicts between passive and active recreational demands and protection of biodiversity. In both cases, the Montreal Process C&I need significant refinement to be relevant to broader planning goals, including recreation.

**Strager, Michael P. and Randall S. Rosenberger**

West Virginia University, WV, USA

### *An Application of Spatial Multicriteria Analysis in Prioritizing Lands for Protection*

This paper presents the integration of stakeholder preference measures with spatial data in a spatial multicriteria analysis framework for the purpose of prioritizing lands for protection in the Cacapon River Watershed of West Virginia. The framework enables local decision makers to be more proactive in targeting lands for protection using conservation easements. This research was undertaken to combat the development pressure from the metropolitan Washington DC, which is becoming a major threat to the rural character and natural beauty of the watershed. A local land trust is interested in identifying high priority lands based on social and ecological characteristics, including agricultural viability, water quality, forest quality, and rural heritage. These four categories are characterized by biological, social, and economic measures that should be considered in combination for holistic land management. A challenge in developing a decision support system is the integration of preference data and spatial, ecological data. A spatial multicriteria analysis methodology is adopted that integrates preference data measured using the Analytical Hierarchy Process and spatial data in a geographical information system (GIS). Two important issues were determined early in the analysis: (1) local stakeholders' priorities differ from outside experts' priorities on several of the criteria; and (2) many of the criteria identified by the participants were not amenable to GIS data development (e.g., expressions of 'meanings of place' that are weakly associated with physical attributes of a location). This paper presents the framework developed and data collection methods and discusses the tradeoffs and applications of integrating these data to aid decision making. It is anticipated that many of the techniques and insight provided will benefit others performing similar studies.

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### SESSION 3D – TRADE AND THE ENVIRONMENT

**Chair: Amit Batabyal, Rochester Institute of Technology, Rochester, NY, USA**

**Room: Spectacular Bid**

#### **Gallagher, Kevin P.**

Global Development and Environment Institute, Tufts University, Medford, MA, USA

*Economic Integration, Environment, and Development: Lessons From Mexico*

This paper will examine the extent to which economic integration has affected levels of environmental degradation in Mexico between 1985 and 1999. Two economic theories are empirically tested: the environmental Kuznets Curve (EKC) and the pollution haven hypotheses. Consistent with the broader literature on such theories, this paper finds limited evidence for each of them for the case of Mexico. Despite incomes in Mexico above the estimated “turning point” for the EKC, many environmental trends continue to worsen significantly. Interestingly, it is also found that such trends are not occurring because Mexico is serving as a pollution haven for dirty U.S. firms—the marginal costs of pollution abatement in the U.S. are relatively small. Environmental conditions in Mexico are found to be worsening for two reasons: first, “scale” effects are outweighing slight “composition” effects in the Mexican economy, and second, because Mexico has failed to erect effective environmental programs to counter the degradation caused by trade-led growth.

#### **Wise, Timothy A.**

Global Development and Environment Institute, Tufts University, Medford, MA, USA

*Is the United States a Pollution Haven? NAFTA, Corn and the Environment*

The tariff reductions under the North American Free Trade Area (NAFTA) have produced a significant shift in corn trade between the United States and Mexico, with U.S. corn exports to Mexico more than doubling since the treaty took effect in 1994. The resulting price drops in Mexico have placed significant pressure on traditional corn farmers, threatening to displace many. This paper will examine the net environmental impacts of this production shift for the continent, with the United States serving as a “pollution haven” for unsustainable practices. The author will detail the significant negative environmental externalities of increasing corn production in the United States, including unsustainable use of chemical fertilizer, pesticides, and water, as well as the rising use of genetically modified corn. The paper will draw on collaborative work with Mexican economist Alejandro Nadal to present the positive environmental externalities associated with traditional corn farming in Mexico, most notably the maintenance of agro-biodiversity in the world’s center of origin for corn. The author will discuss the ways in which NAFTA has served to magnify these impacts by linking the two cases of market failure. The paper will conclude with an analysis of this phenomenon of the “globalization of market failure,” discussing policy options to address the problem.

#### **Aguilar-González, Bernardo**

Cultural and Regional Studies, Prescott College, Prescott, AZ, USA

*Complexity and the Political Ecology of US-Mexican Border Twin Cities: A Few Reflections*

The serious economic crisis in economies like the Mexican has been accompanied by deterioration in social indicators and a raised awareness on the effects of decades of environmental neglect. Economic policies have searched for a solution in the application of neoclassical recipes: privatization, foreign investment attraction and emphasis on export products. Growth and affluence expected to take care of social and environmental problems. Among the main poles of application for this model have been the US-Mexico border's twin cities, which are true multicultural Diasporas. The neoliberal economic discourse sustains that, in the aggregate, the gains from the changes brought about by free trade ideologies have benefited Mexico in general and specifically the border region cities. Sustainability indicators, including multicultural diversity and an examination of 'Gramscian' spaces such as the prevalence of informal economies may contradict this diagnosis. Yet, it is not until the researcher experiences "la frontera" that s/he realizes the complexity of the problem. It becomes obvious that the reductionist model of postindustrial growth may enter in conflict with the assumptions of multicultural globalization. Regardless of their interdependence, border cities show levels of social and environmental degradation correlative to economic growth and a clear inequality between the American and Mexican sides. We propose a re-examination of the roots of U.S.-Mexican border city capitalism through a political-ecology approach. This approach seeks to overcome the boundaries of human systems in order to understand the ongoing interplay between political and economic forces

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and local cultural, demographic, and ecological factors. In this sense, traditional historical analysis is supplemented by understanding the limits that, through time, the natural world has set on what people can do. It is also expanded to understand the connections that those ecological imperatives have with events occurring beyond the strict geographical area of study. As it is also an exercise in critical economic analysis that goes back to the ethical roots of development problems, it is a political economic perspective. Further, the analysis is enriched with qualitative evidence gathered from field trips along the US-Mexican border. Specific cities included are: San Diego-Tijuana, San Luis Río Colorado-Yuma, Nogales Arizona/Sonora, Agua Prieta-Douglas and Ciudad Juárez-El Paso.

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### SESSION 3E – SUSTAINABILITY INDICATORS

**Chair: Tom White, Assumption College**

**Room: Affirmed**

**Hecht, Joy E.**

New Jersey Sustainable State Institute, New Brunswick, NJ, USA

*Operationalizing Sustainability: Implementing Sustainability Indicators at the State Level*

The New Jersey Sustainable State Institute (NJSSI) was created in June 2002 as a non-political, non-advocacy home for a set of indicators tracking sustainability at the state level. The Institute is taking an innovative approach to operationalizing sustainability indicators, in that it is not housed in a government agency, is not an offshoot of a data-supplying statistical agency, is not political, and is not the creature of an advocacy organization espousing a particular view of how to achieve sustainability. Rather, it was created to take a neutral and analytical view of both public and private progress towards sustainability goals. For this reason it has been viewed as a model for how to institutionalize the development and use of indicators, and is being watched with interest by others working in this field. The Institute will be one year old by the time of the USSEE conference, so it will be time to begin assessing the effectiveness of this approach. The talk will consider a range of issues, among them: (1) how to establish the credibility of a set of indicators from the vantage point of an independent institute without strong ties to government, (2) distinguishing sustainability indicators from discrete indicators of the environment, the economy, and the society, (3) how to set indicator targets, particularly targets that might actually be sustainable, rather than merely feasible, (4) how key players in the state (government, businesses, large institutions, consumers) are - or are not - using the indicators and the targets, and (5) how indicators and targets could be useful in furthering sustainability, or at least some of the elements that contribute to sustainability, at the state level.

**Basoli, Dan and Brynhildur Davidsdottir**

Center for Energy and Environmental Studies, Boston University, Boston, MA, USA

*Indicators for Sustainable Energy Development: The Development of a Three-Dimensional Index*

Agenda 21, the Rio Declaration on Environment and Development adopted in 1992, presents the features of sustainable development in four dimensions: social, economic, environmental and institutional. To embark on a path towards increased sustainability, regions need to achieve certain objectives within each dimension, preferably simultaneously. Since in essence any economic activity requires the use of energy, energy clearly is one of the main components of economic growth as well as economic development and of course sustainable development. Thus, sustainable energy development is a central theme to sustainable development. Agenda 21 described sustainable energy development as follows “the provision of adequate energy services at affordable cost in a secure and environmentally benign manner, in conformity with social and economic developmental needs”. Numerous one-dimensional energy sustainability indicators exist such as energy intensity, energy consumption per capita, energy consumption per GDP, share of total energy consumption supplied by renewable energy and fraction of households without electricity. Despite the multitude of one-dimensional energy sustainability indicators, a multi-dimensional energy sustainability indicator does not yet exist. The research presented in this paper describes the development of an indicator, which integrates the three dimensions of sustainable energy development, the social, economic and the environmental dimension, as defined by the IAEA. Each dimension includes the estimation of several separate indexes, somewhat based on the development of the Human Development Index (HDI), which then are aggregated, and weighted to give a score on the scale 0-1. The final score for each state or a region is then given as a (non)-weighted mean of the three scores from each dimension.

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**Jollands, Nigel, Murray Patterson and Jonathan Lermitt**

AgResearch Ltd and Massey University, New Zealand

*The Holy Grail of Sustainable Development Indicators: An Approach to Aggregating Indicators with an Application to Eco-Efficiency*

The search for aggregate indices could be regarded as the Holy Grail of contemporary sustainable development indicators work. Decision-makers in business and government require succinct information. Therefore, the challenge for the analyst is to transform detailed base data into aggregate indices. Little work has been done on appropriate methods for developing aggregate indices. What is needed is a generic approach to aggregating indicators. This paper presents such an approach that provides guidance on the selection of an appropriate aggregation function and choice of weights. Specifically, the approach provides a method of assessing the mathematical accuracy of an aggregation function in the context of both increasing and decreasing-scale indicators. This framework is applied to a matrix of 263 eco-efficiency indicators across 48 sectors of New Zealand. Together with the use of a Principal Components Analysis as a weighted linear-sum aggregation function, the results show that 5 aggregate indices (water pollutants, energy and energy-related emissions, mineral inputs and land and nitrate pollutants) explain 90 percent of all variation in the eco-efficiency indicator matrix. These results demonstrate that this aggregation approach can reduce redundancy in the eco-efficiency indicator matrix and provide decision-makers with high-quality aggregate indices needed to direct development towards an ecologically sustainable future.

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### SESSION 3F – OPEN SPACE: INVESTMENT, VALUES, AND LANDSCAPE INTEGRITY

**Chair: Gary Chilson, Paul Smiths College, Paul Smiths, NY, USA**

**Room: Man O'War**

**Hajkowicz, Stefan**

CSIRO Land and Water, Policy and Economic Research Unit, Australia

*Investing in Nature: Approaches for Choosing Priority Projects and Regions*

Public funds allocated to environmental programs are rarely sufficient to cover all regions and all problems. Typically funding needs to be targeted at a subset of high priority issues, with an objective of maximising returns on investment. This introduces a requirement for some type of priority setting exercise. Policy analysts charged with setting priorities will often be faced with political pressures, conflicting stakeholder priorities, incomplete information and tight time frames. With these conditions, developing an objective and transparent priority-setting framework is extremely difficult. This paper presents an approach to regional priority setting in the State of Queensland (Australia) based on the use of multiple criteria decision procedures. Through this process data relevant to prioritisation decisions were compiled for around 13 natural resource management regions. These data, which effectively became priority-setting criteria, related to biodiversity, water use, agricultural profits, demographics and water quality. The data were assembled into a multiple criteria analysis framework that allows community/government decision making panels to weight criteria and review alternative regional priorities. The process is currently being used to help inform Queensland Government decision makers responsible for allocating environmental funds across competing regions and projects.

**Swallow, Stephen K. and Lisa DeProspero Philo**

Department of Environmental & Natural Resource Economics, University of Rhode Island, USA

*Impact Fees for Conversion of Open Space to Developed Land Uses: Examples Using Contingent Valuation for Land Conservation in Rhode Island*

Urban sprawl and rural-residential development is widely viewed as a critical issue in efforts to conserve ecosystem integrity. While states and municipalities have approved billions of dollars for land conservation, in many areas the rapid pace of development threatens to prevent the administrators of bond monies from conserving the highest priority undeveloped lands. Market incentives may complement existing efforts to purchase land for conservation and serve as a means to encourage developers to consider the relative value of lost open space in their

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planning. This paper considers information from contingent valuation of land conservation as a foundation for environmental impact fees. Impact fees are already established in many municipalities where development leads to increases in school or infrastructure costs. The environmental impact fee concept could be linked by contingent valuation to the value of lost open space as additional development alters a community's rural or ecological character. A community's plans for an open space green-way or ecological reserve might establish a public facility contributing to residents' quality of life. These features may be sufficient to pass judicial scrutiny under the U.S. Constitution's clauses concerning "takings" of private property for public value. The presentation reviews contingent valuation (choice experiment) studies of land conservation in Rhode Island. The validity of contingent valuation (hypothetical bias) will be considered based on results involving real monetary contributions for conservation easements on wooded lands. Hypothetical bias may be absent from marginal calculations. Alternative methods of developing impact fees will be discussed. The obvious method derives from neo-classical willingness to pay. An alternative method involves in-kind compensation where public access to conservation land plays a key role in compensating for the open space services lost from privately owned land. The paper also illustrates implications of conservation biology, favoring spatial connections between conservation lands, as impact fee revenues might be expended over time.

**Glennon, Michale J.<sup>1</sup> and William F. Porter<sup>2</sup>**

1-Wildlife Conservation Society, Saranac Lake, NY, USA

2-SUNY College of Environmental Science and Forestry, Syracuse, NY, USA

*Effects of Land Use Management on Biotic Integrity in the Adirondack Park, New York*

The Adirondack Park has been described both as a model for people living in wild areas and as an experiment in sustainable development, because of the unique combination of public and private lands which characterize the area. The public lands in the Adirondacks are well protected under the State constitution as "forever wild" forest. However, more than half of the Park is in private ownership and characterized by varying levels of use and impact on the natural character of the land. We examined patterns in the organization and structure of bird communities as they relate to land use management in this region. We explored the response of bird communities to a gradient of human impact, by testing the relationship of land use types to an Index of Biotic Integrity across the Adirondack landscape. We found significant differences in total, functional, compositional, and structural integrity on 5 land use types ranging from hamlet to wilderness. In all cases, integrity was lowest in hamlet areas and increased along the gradient to its highest level in wilderness areas. We found that bird community integrity was strongly related to roadlessness and that birds responded primarily to the distinction between developed and undeveloped land types. We examined the effects of increased development on biotic integrity by modeling 3 scenarios of potential patterns of residential development across the Adirondack Park. Our results showed that biotic integrity declines most rapidly when development is channeled to areas of the Park that are currently characterized by open space uses.

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## CONCURRENT SESSION 4 – FRIDAY – 8:30 to 10:00 AM

### SESSION 4A – ECO-TOURISM

**Chair: Robby Richardson, School of Natural Resources, University of Vermont, Burlington, VT, USA**

**Room: Alydar**

**Hudspeth, Thomas R.**

School of Natural Resources, University of Vermont, Burlington, VT, USA

*Ecotourism Initiatives to Achieve Sustainability in Belize, Costa Rica, Brazil, and Honduras*

A brief overview of sustainability is followed by consideration of approaches to make sustainability more concrete and make it come alive. At the University of Vermont (UVM), we have been using such approaches to teach students about sustainability first-hand via 3 different travel-study courses: (1) Two weeks to Honduras or Brazil in early January over winter intersession; (2) Ten days (extended Spring Break) to Belize in mid-March; and (3) Three weeks to Costa Rica in late May through mid-June. In all of these travel-study courses, ecotourism is viewed as one means of attempting to achieve sustainability. Ecotourism is travel to fragile, pristine, and usually protected areas that strives to be low impact and (usually) small scale; it helps educate the traveler, provides funds for conservation, directly benefits the economic development and political empowerment of local communities, and fosters respect for different cultures and for human rights. The United Nations declared 2002 as the International Year of Ecotourism, recognizing ecotourism's great potential for both economic development--especially in remote areas where few other possibilities exist--and for conservation of the natural environment and human cultures if it is properly planned, developed, and managed. And while all these courses provide students with first-hand knowledge about tropical forest ecosystems (and coral reef ecosystems, also, in the case of Belize), what distinguishes them most from other university travel-study courses to Latin America is their emphasis on community-based conservation/protection of biodiversity--a sharp contrast with the North American tradition of setting aside tracts of land as parks or other protected areas. Members of the community cooperate in protecting the biodiversity of their natural communities and offer ecotourism efforts from which they benefit financially far more than they would if they cut down the forests and engaged in slash-and-burn agriculture or ranching, killed the wildlife, etc.

**Casey, James F.<sup>1</sup>, Alejandra Bereskyj<sup>1</sup>, Susanne Kissman<sup>2</sup> and Francisco Rosado May<sup>2</sup>**

1-Washington and Lee University, Lexington, VA, USA

2-University of Quintana Roo, Mexico

*The Potential for Nature-Based Tourism in Southern Quintana Roo, Mexico*

The state of Quintana Roo is the fastest growing state in Mexico in terms of population and GDP per capita. But, the state is really, at least, two states; Northern Quintana Roo with Cancun at its epicenter and Southern Quintana Roo with Chetumal as its primary center for economic and political activity. The city of Chetumal acts as the southern gateway to the Mexican Caribbean. Although it is the capital city of Quintana Roo, it is not nearly as famous as its northern cousin Cancun, Chetumal has the potential to fill a niche in the tourism boom occurring in the Mexican Caribbean. Chetumal is located on The Bay of Chetumal, a National Manatee Reserve and lies between the Banco Chinchorro National Park to the east and the Calakmul Biosphere Reserve to the west. It is the jumping-off point for visits to Mayan ruins, tropical forest exploration, flat water fishing, cave and open-sea diving and much more. The undisturbed beauty of Southern Quintana Roo is its comparative advantage. With Chetumal at its center, Southern Quintana Roo has the potential to develop a truly sustainable Nature-Based tourism industry, but will anyone come? The initial results of this paper suggest they will and they already are. But where are they coming from? How much are they willing to spend on services and what sorts of services do they want? And most importantly, are they willing to pay (WTP) for Nature-Based tourism activities? Initial analysis of results from an intercept survey conducted by The University of Quintana Roo at the Chetumal bus station show visitors coming from 30 different countries, most of whom want to visit archeological ruins and the Laguna Bacalar. Additionally, in response to a contingent valuation type question median WTP is \$23.00 for a two hour guided hike on trail through a tropical forest. Further analysis will include a Travel Cost Model using airfare to estimate the consumer surplus associated with visitation to Southern Quintana Roo.

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### **Batker, David and Liz Carr**

Asia Pacific Environmental Exchange Center for Applied Ecological Economics

#### *Ecological Economics Applied in Campaign to Expand Mount Rainier National Park*

The APEX Center for Applied Ecological Economics is implementing a campaign to expand Mount Rainier National Park, change forest management in a buffer area around the Park to 140 year rotations, and capture critical habitat in preservation status. This campaign provides a concrete example of the application of ecological economics and ecosystem health to a single watershed, the Carbon River Valley, and helps to demonstrate how economic health and environmental sustainability can be mutually reinforcing. Over a century ago, Mount Rainier was designated as the United States' fifth national park. The Park's boundaries were drawn straight across a vast wilderness. Today, these boundaries do not reflect the natural ecosystems and processes needed to maintain the health of the Park. Logging along its borders, urbanization, and population growth have left the Park an ecological island. The National Park Service is seeking a three-mile boundary extension at the Carbon River entrance. APEX is leading a campaign to ensure this extension becomes reality but also to complement it with additional key acquisitions and easements. This plan is based on ecological economics and ecosystem health science and will preserve critical open space down the corridor of the Carbon River to its confluence with the Puyallup River, protecting important habitat for federally-listed threatened and endangered species, including chinook and sockeye salmon, steelhead, bull trout, northern goshawk, northern spotted owl, marbled murrelet, and Van Dyke's salamander. The campaign is also focused on increasing economic opportunities in the local, traditionally extraction-dependent communities of Wilkeson, Carbonado, Upper Fairfax, Burnett, and South Prairie through ecological restoration, tourism, and sustainable timber practices. Participants include ten environmental groups, Federal, State and local governments and the Puyallup Indian Tribe. We raise critical questions regarding the application of ecological economics and ecosystem health to the full range of ecological services provided by this watershed ecosystem as well as the complications of applying ecological economics to a landscape with intricate political, historical and land ownership qualities.

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### **SESSION 4B – DISTRIBUTIVE JUSTICE**

**Chair: Julie Gutman, Rensselaer Polytechnic Institute, Troy, NY, USA**

**Room: Citation**

### **Müller, Frank G.**

Department of Economics, Concordia University, Montreal, Quebec, Canada

#### *The Position of Ecological Economics and Mainstream Economics on the Issues of Distributive Justice*

International environmental agreements, such as the Convention on Biological Diversity, as building blocks of the overall long run and global goal of sustainable development, force the international community to address and re-visit the “distributive question”. Their addressing of these issues appears to many mainstream economists and decision makers as a return to mediaeval thinking about the ‘pretium iustum’. The on-going debate on sustainable development is not focusing on the distribution problem *per se*, but rather on the thorny distributive issues such as fair and equitable income and wealth distribution between industrialised and developing countries, between present and future generations, and the scale of global economic system with respect to the global ecosystem. Thus, the thesis of this article, which here can only be discussed quite sketchy and incomplete, is that: (1) Neo-classical economics, despite its focus on issues of allocation, seems to provide some ‘answers’ - at least implicitly - on distributive issues in intra- and intergenerational context; while (2) Ecological Economics has not yet developed a comprehensive theory of distribution, but in the political discussion Ecological Economics has taken on these issues on ethical grounds and criticises the presently existing realities of intra- and intergenerational distribution of income and wealth. The article intends to provide an analysis of the different theoretical backgrounds and concepts of these two different economic schools on these issues.

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**Flomenhoft, Gary**

Gund Institute for Ecological Economics, University of Vermont, Burlington, VT, USA

*The Triumph of Pareto*

One of the goals of ecological economics is to make a transition to an economy based on qualitative development instead of quantitative growth. In order to achieve this it is important to understand current factors driving the economy to growth. These factors include: Theological belief in growth, fixation on GDP, bank interest, discounting, interest charged on money creation, to provide jobs for labor displaced by productivity improvements, welfare economics being defined by consumption, profit motive, materialism, and Pareto optimality. All of these factors, their origin, values behind them, and their current usage should be explored in order to devise alternatives to the growth economy. In this paper I will explore the ethical values of Vilfredo Pareto including Pareto Optimality, and their effect on recent economic conditions, especially the distribution of wealth and income in a growing economy. This will allow us to evaluate the oft cited neo-classical argument that the way to solve poverty is for the economy to grow.

**Tyagi, Anupam**

Tucker, GA, USA

*Sustainability as Justice*

This paper addresses three issues about philosophical basis of sustainability, starting with Rawls' idea of justice. Intergenerational justice and sustainability has received only a passing thought in Rawls' work, and in philosophy. The issues addressed are as follows: (i) Why should there be sustainability? This is an inquiry into motivation and justification for sustainability. The main proposition is: an unsustainable society is unjust, and avoidance of injustice sufficiently motivates sustainability. A general framework of situations in which injustice can be claimed by future generations is proposed. (ii) What is to be sustained (intergenerationally distributed)? What are the implications of different proposals, including utility, wellbeing, resources, primary goods and productive abilities? General characteristics of this 'something' that should be the focus of sustainability are outlined, based on ideas of agency, merit and egalitarianism. It is proposed that conditions of sustainability require maintenance of productive abilities of future groups, without putting an unjust burden on earlier groups or individuals. Implications of technological change are considered. (iii) What is the relation between inter-generational and intra-generational distributive justice? A Principle of Minimum Egalitarianism is proposed as a minimum condition for consistency between the two kinds distributive justice.

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### SESSION 4C – ECOSYSTEM HEALTH AND SERVICES

**Chair: Robert Costanza, Gund Institute for Ecological Economics, University of Vermont, Burlington, VT, USA**

**Room: Secretariat**

**Stainbrook, Karen M. and Karin E. Limburg**

SUNY College of Environmental Science and Forestry, Syracuse, NY, USA

*Assessing Ecosystem Health in Dutchess County, NY: Multiple Metrics to Evaluate Watershed Condition*

Land use, which is decided by economic activity and social policies, is a key determinant of ecological structure and function, a fact increasingly recognized by economists and ecologists alike. The Hudson River watershed supports a variety of land uses, but the current trend in a large portion of the basin is rapid transformation of forest, pasture, and agricultural lands into suburban and urban uses. An integrated study of land use change and its impacts is underway for two Hudson tributaries, the Wappingers and Fishkill Creek watersheds in Dutchess County, NY. We report here on multiple means to assess the status ("health") of the stream ecosystems draining the watersheds. Thirty-two sites were sampled synoptically to assess physical, chemical, and biotic properties of the systems. Results are integrated into a geographic database and can be related to socioeconomic and geographic variables and analyses. Our chemical and biological metrics, when compared to historical data, show an erosion of water quality as reflected in fish and macroinvertebrate community structure, with Fishkill Creek (the most

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developed watershed) showing the largest change. Fish and macroinvertebrate Indexes of Biotic Integrity (IBI) are different and reflect physical and chemical stresses, respectively. The next step is to link our results into an integrated model of (1) how economic activities influence land use tenure and change, (2) how these activities influence key ecological properties of the system, and (3) how ecosystem value contributes to broader social goals.

**Fisher, Brendan, Robert Costanza, Shuang Liu, Brian S. Barker, Simon C. Bird, Roelof M. J. Boumans, Erica J. G. Brown, Marta Ceroni, Cheryl E. Frank, Jennifer C. Jenkins, Michelle Johnson, Mark Keffer, Justin Kenney, Barton E. Kirk, Serguei Krivov, Caitrin E. Noel, Ferdinando Villa, Tim C. White, and Matthew Wilson**

Gund Institute for Ecological Economics, University of Vermont, Burlington, VT, USA

*Biodiversity and Ecosystem Services: An Empirical Study of the Contribution of Species Richness to Net Primary Production and Nitrogen Cycling*

Studies of the relationship between biodiversity and ecosystem functions in microcosms (Naeem et al. 1996) and field mesocosms (Tilman et al. 1995) have indicated positive relationships between species richness, primary production and nutrient cycling. But these small scale experimental studies have not been verified by large scale field data. This paper fills this gap by assembling data on species richness, nutrient cycling, net primary productivity (NPP), years since disturbance, temperature, precipitation, and soil organic matter content for a range of sites. Multiple regression models with NPP and nutrient cycling as the independent variables showed positive relationships with species richness, when the other variables were also included. Species richness explained 10% of the variation in NPP and xx% of the variation in nutrient cycling across sites in models that explained xx% and xx% of the total variation in these variables, respectively. NPP and nutrient cycling represent two major ecosystem services that together have been estimated to be worth \$19 Trillion/yr (Costanza et al. 1997) out of a total of \$33 Trillion/yr for all ecosystem services globally. Using the percentages of the variation in these services attributable to species richness estimated using the multiple regression models, we estimated the value of biodiversity via its contribution to these services as \$1.9 Trillion/yr. Adding this to the direct value of genetic resources estimated by Costanza et al. (\$0.8 Trillion/yr) yields a total of \$2.7 Trillion/yr. If one assumes that species richness explains roughly the same percentage of the value of the other 13 ecosystem services estimated in Costanza et al., the total direct and indirect global value of biodiversity is estimated to be \$4 Trillion/yr. This is very close to the estimate of \$3 Trillion/yr by Pimental et al. (1997) for the global value of biodiversity.

**Mackay, Sarah<sup>1</sup>, Stewart Ledgard<sup>1</sup>, Liz Wedderburn<sup>1</sup>, John Finlayson<sup>1</sup>, Han Eerens<sup>1</sup>, and Murray Patterson<sup>2</sup>**

1-AgResearch Ltd, Hamilton, New Zealand

2-Massey University, Palmerston North, New Zealand

*Accounting for the Ecosystem-Service Requirements of Dairying: Waikato Region, New Zealand*

AgResearch has prepared environmental accounts for the dairy industry in the Waikato Region of New Zealand. This case study aims to assess the total environmental impact of the industry, and to provide us with the framework to determine "hot spots"; evaluate potential benefits from new technologies; and determine the most effective environmental mitigation practices. The study has highlighted the large variation between dairy factories in both their resource use and pollutant outputs. The Waikato Region is the heartland of New Zealand's dairy industry. There are about 6000 dairy farms (40% of NZ total) and nine processing factories. The accounts use a whole system approach to assess total resource use, emissions and economics for dairy farms and dairy processing factories. The accounts were created using standardised farm budgets; resource use data available from consents and monitoring by Councils for factories; factory product inputs and outputs; and data on environmental effects of farming and emissions of factories. The accounts can be used to estimate eco-efficiencies, for example GJ/\$; water use/product; kg CO<sub>2</sub>/\$. To increase the usability of results, some emissions were combined into single indices eg greenhouse gases and eutrophication (nutrients to water). The accounts can be used to assess the likely impacts of best management practices, and to compare factories, farms or regions to evaluate new technologies in terms of direct and embodied resource demand and direct and embodied emissions. International comparisons can also be made of resource or environmental advantage from dairying in the Waikato. This is important as food miles are considered more in international trade. This paper outlines AgResearch's findings from the accounts, and manipulations of the accounts to identify key best management practices and their relative effectiveness.

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### SESSION 4D – FRONTIERS IN ECONOMIC THOUGHT

**Chair: Surendra Devkota, Department of Economics, Rensselaer Polytechnic Institute, Troy, NY, USA**

**Room: Spectacular Bid**

**Gorga, Carmine**

Polis-tics, Inc., MA, USA

#### *Ecological Economics in the Context of Concordian Economics*

Ecologists study stocks of natural resources; economists study flows of funds. This disparity of scope gives rise to a noticeable tension between the two schools of thought. The tension does not turn to the benefit of any one group in particular. A convergence of views is essential to the welfare of the community as a whole. The proposed paper attempts to demonstrate that it is possible to create a common framework of analysis for economists and ecologists. This new framework might be called Concordian economics. Concordian economics takes the lead from a change in the second equation of Keynes' model of the economic system and offers the integration of a series of models of flows and stocks of real as well as monetary wealth. A referee of the Journal of Economic Theory has referred to this new framework as a "new analytic engine." The purpose of the paper is to work toward a convergence of views held by economists and ecologists. It is hoped that working within a common framework of analysis economists and ecologists will collaborate in the creation of sustainable and equitable economic policies. These policies are aimed to benefit, although in varying degrees, all members of society.

**Harris, Jonathan M. and Neva R. Goodwin**

Global Development and Environment Institute, Tufts University, Medford, MA, USA

#### *Reorienting Macroeconomic Theory to Take Account of Environmental Constraints*

Macroeconomic theory to date has taken little account of environmental constraints. Despite calls by Daly and others for an environmental macroeconomics, mainstream macroeconomic theory and policy are still oriented towards unlimited growth. Keynesian and neoclassical perspectives, as well as their many current variants, all accept growth as the goal, while differing over the best means to achieve that goal. It is important for ecological economics to advance alternative approaches to thinking about the macroeconomy. The first essential area for reorientation of macroeconomic thinking is with respect to the goal of increasing consumption. Growth of consumption in developing nations must be viewed differently from growth of consumption in the developed world. For the developed countries, a good case can be made that current material consumption is sufficient (or perhaps excessive). For the developing world, increased material consumption is essential, but a distinction needs to be drawn between consumption of basic needs, health services, and education, and a broad range of consumer products such as the automobile. On the production side, standard macroeconomics assumes an aggregate production function based on supplies of labor and capital, with output determined by total factor productivity. These supply factors determine the basic pattern of economic growth, while demand fluctuations explain deviations from the long-term trend. In contrast, an ecological perspective implies that there is no inevitable long-term growth trend; the choice of path and the issue of economic fluctuations around the path are both issues of macroeconomic policy. Introduction of an ecological perspective makes for a much richer, and less abstracted, view of macroeconomics. The ecological critique can be fruitfully combined with other critiques concerning distributional equity and social goals to provide the elements of a macroeconomics of sustainability.

**Torras, Mariano**

Adelphi University, Garden City, NY, USA

#### *Some Remarks on the Feasibility and Desirability of Sustained GDP Growth*

Sustainable development is often mistakenly identified with sustainable GDP growth, which many reject as either physically infeasible or socially undesirable. An integration of ecological and institutional economics suggests that a proper definition of sustainable development is in conflict with continued GDP growth. Regarding the question of its feasibility (the ecological dimension), uncertainty persists absent reliable projections on technological innovations or future gains in throughput efficiency. It is a scientific question for which the science remains uncertain. Yet the undesirability of sustained GDP growth (institutional dimension) is increasingly apparent. And

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while an enlightened 'post-industrial' policy shift away from GDP growth does not appear imminent, such a change is more politically palatable than accepting the physical impossibility of sustained GDP growth. Infeasibility implies a pessimistic perspective on the ability of humans to overcome the resource limits that they encounter, while undesirability implies a rather optimistic transcendence of GDP growth as a requirement for well-being improvement. While GDP growth may not be physically sustainable in the long run, there is no reason to expect the same for well-being improvements under a 'post-industrial' regime. The implications for long run sustainable development are therefore not unfavorable.

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### SESSION 4E – ENVIRONMENTAL KUZNETS CURVES

**Chair: Neha Khanna, Department of Economics, Binghamton University, Binghamton, NY, USA**

**Room: Affirmed**

**Choi, Jaewon and Valerie A. Luzadis**

SUNY College of Environmental Science and Forestry, Syracuse, NY, USA

*Investigation of the Validity of Environmental Kuznets Curve Hypothesis for Carbon Dioxide Emissions*

This study is intended to investigate the validity of the inverted-U hypothesis between per capita income level and atmospheric air pollution, which is known as 'environmental Kuznets curve (EKC)'. The theory is that during the period when an economy develops into an industrializing society from pre-industrialized society, environmental conditions get worse until it reaches a turning point and then gets better as the society develops further into an advanced one. Some empirical researches have claimed environmental Kuznets relationship exists for certain pollutants. Incautious policy inference can be derived from this claim. That is, economic growth itself can be regarded as a remedy to environmental problems. Previous EKC studies have relied on technological advancement, increasing demand for quality environment, and stricter regulations in developed countries for the theoretical explanation of the phenomenon. Based on the notion of physical limitations to material production process, I oppose the generalization of the EKC hypothesis. My hypothesis is that emission of pollutant monotonically increases as income increases, as opposed to the inverted U-shape relationship between income and pollution. I use a panel dataset consisted of 85 countries from 5 continents from 1971 to 1996 period. Variables include per capita CO<sub>2</sub> emissions, real GDP, energy consumption, population growth, export and import data. The initial finding with the fixed effect estimator is that the relationship between CO<sub>2</sub> emissions and economic growth is better captured by using the model with linear relationship between the two variables than by using the model which assumes inverted-U shaped relationship between the two variables. Along with the multiple regression techniques, multivariate statistical methods, such as cluster analysis and discrimination analysis techniques are used to see if there exist any distinctive groups of countries in terms of CO<sub>2</sub> emissions.

**Pasinella, Brett N.**

Department of Geography and Environment, Boston University, Boston, MA, USA

*Dematerialization Indicators in U.S. Metal Consumption*

Previous studies of the relationship between materials flow and economic process have focused on the topic of dematerialization (Larson, Ross et al. 1986; Bernardini and Galli 1993; Wernick, Herman et al. 1996; de Bruyn and Opschoor 1997). Dematerialization is the absolute or relative reduction in the quantity of materials used in the production of a unit of economic output (Cleveland and Ruth 1999). The intensity of material use (IU) is a commonly used indicator of dematerialization. A steady stream of research suggests that the US economy has dematerialized. Many attribute this to the maturation of economies and/or rising incomes (Tilton 1990; Rogich 1993). These changes drive efficiency improvements, recycling, re-manufacturing, miniaturization, and many other activities on the production side. Household consumption may also contain more services (financial, entertainment, recreation) that are assumed to be less material intensive. However, recent studies raise several issues, with the assumptions, methodologies, and policy implications of earlier studies that may require a reexamination of previous research (Adriaanse, Bringezu et al. 1997; Cleveland and Ruth 1999; Matthews, Amann et al. 2000). By studying dematerialization in light of these critiques, my research will contribute to a better understanding of links between materials use and the economy. It will include an econometric analysis to determine the statistical relationship, if

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any, between rising income and declining IU, and will also attempt to determine which variables (changes in household consumption, sectoral shifts in the economy, etc.) has the greatest influence on dematerialization.

### **Davis, Mary**

Department of Economics, University of Florida, Gainesville, FL, USA

#### *Who Calls the Shots? State Water Quality Standards*

The Clean Water Act is one of the largest federal programs ever to delegate primary standard-setting responsibility to states. Therefore, an analysis of the variation that exists among states in chosen water quality standards is of interest. The factors that influence the decision of a state to enact strict or relaxed standards have important policy implications for environmental reforms on both the state and federal levels. This paper performs an empirical analysis of a newly compiled dataset of state water quality standards that identifies key variables in this environmental policy decision. Empirical analysis is based on an adaptation of Peltzman's general model on legislator vote-maximization. Specifically, this paper establishes the agriculture industry as a motivator for weak state water quality standards, while heavy industry does not play an integral role in the process. Certain state-specific environmental characteristics also prove significant, as they reflect the added costs of implementing stricter standards. Evidence of an inverted-U shaped curve linking state environmental standards and income is also revealed in this paper.

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## CONCURRENT SESSION 5 – FRIDAY – 10:30 AM to 12 NOON

### SESSION 5A – ECOLOGICAL ECONOMICS AND EDUCATION

**Chair:** Josh Farley, Gund Institute for Ecological Economics, University of Vermont, Burlington, VT, USA

**Room:** Alydar

**O'Hara, Sabine U.**

Concordia College, Moorhead, MN, USA

#### *Ecological Economics and Education: Linking Theory and Practice*

Education plays a critical role for a new and evolving field like Ecological Economics. Content definitions, relevant topics, methodological approaches and even the term itself may need clarification and imply different things to different observers and participants. Since Ecological Economics is an interdisciplinary field with a strong focus on the larger environmental and socio-cultural context of economic activity, it must bring this contextual understanding to the fore through dialogue within and outside the traditional academic channels of education. This implies disseminating information about Ecological Economics within formal institutions of learning, between educational institutions and public and private sector parties, and learning from within and outside the academy. This paper gives an example of educational efforts that stress the context view of ecological economics and that advance the educational dialogue between academics and practitioners.

**Harris, Jonathan M.**

Global Development and Environment Institute, Tufts University, Medford, MA, USA

#### *Mainstreaming Ecological Economics: Using a New Text*

The text *Environmental and Natural Resource Economics: A Contemporary Approach* (Houghton Mifflin, 2002) attempts to bridge the gap between standard and ecological approaches to resource and environmental analysis. Initial use of the text during the academic year 2002-2003 has given some insight into the presentation of ecological economics concepts to an undergraduate or first-year graduate audience. There is often confusion between 'environmental economics' and 'ecological economics', and indeed there is no hard-and-fast boundary between the two. However, there is a clear difference between the standard economic approach to environmental issues, which essentially applies microeconomic theory to the environment, and the ecological economics perspective, which seeks to place the economic system in the context of broader biophysical systems. It is beneficial for students to be aware of both approaches, and to explore the strengths and limitations of each. This text presents the two perspectives clearly and early, then uses a combination of perspectives to focus on specific resource and environmental issues. Students need to have a good grasp of standard economic techniques for environmental valuation, as well as the theory of externalities, resource allocation, and common property resources. But in addition to these they can be introduced to concepts such as natural capital, environmental and resource accounting, macroeconomic scale, and long-term sustainability. In examining specific topics such as population, agriculture, energy, renewable and non-renewable resources, and pollution management, both theoretical paradigms prove useful. Topics such as trade and the environment, industrial ecology, and global climate change are especially appropriate for introducing a broader perspective. Pedagogical exposition of environmental and resource issues is facilitated by extensive use of specific examples, practical exercises, and web research links. Flexibility in approach is also important, since each instructor has different priorities, and instructional time is limited. Classroom feedback will be important in improving the presentation of ecological economics to a broad audience.

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### SESSION 5B – ENERGY: CONSTRAINTS AND OPPORTUNITIES

**Chair:** Cutler Cleveland, Center for Energy and Environmental Studies, Boston University, Boston, MA, USA

**Room:** Citation

**Drennen, Thomas<sup>1</sup>, Arnold Baker<sup>2</sup>, and William Kamery<sup>1</sup>**

1-Hobart and William Smith Colleges, Geneva, NY, USA

2-Sandia National Laboratories, Albuquerque, NM, USA

#### *Hydrogen Futures Dynamic Simulation Model*

Fuel cells offer the hope for a carbon free energy future. What that future will include, however, is far from certain. While hydrogen could be produced from electrolysis, it could also come from coal gasification, or onboard reformation of gasoline or methanol. The Hydrogen Futures Simulation Model (HyFuSim) is a high-level dynamic simulation model that analyzes the various options for a hydrogen future, including hydrogen production, transmission, distribution, storage, and end use utilization. Key outputs include delivered hydrogen costs (\$/gallon gas equivalent), key environmental effluents (carbon), and end user costs (\$/vehicle mile driven). The model allows the user to compare alternative hydrogen enterprise scenarios to assess a broad range of policy and investment issues, such as: (1) What are the cost and other trade-offs associated with generating hydrogen from water with nuclear or renewable electricity, or by stripping it from fossil fuels? (2) What are the costs and trade-offs of direct combustion of hydrogen compared to its use in fuel cells? (3) What are the tradeoffs associated with onboard conversion of fossil fuel to hydrogen versus centralized hydrogen generation and transportation/storage to refueling stations? (4) How will alternative hydrogen scenarios affect carbon and other environmental effluents, and US oil import requirements? This policy tool provides policy, corporate and R&D decision-makers a much better understanding of the options for the hydrogen enterprise and the implications of alternative configurations. HyFuSim will help policy makers develop a strategic understanding of where R&D investment might have the greatest impact on making the hydrogen enterprise successful.

**Gallagher, Kelly Sims**

John F. Kennedy School of Government, Harvard University, Cambridge, MA, USA

#### *Deployment of Cleaner Vehicle Technology? Foreign Direct Investment and Technology Transfer from the United States to China*

The number of passenger cars being produced in China is growing by 12-15 percent each year. This will result in a doubling of the total number of cars every six years. Currently, there are no fuel efficiency standards in China and Chinese air pollution emission standards are far behind U.S. levels. China became a net importer of oil in 1993 and will increasingly compete for world oil supplies. In fact, if there were as many cars per person in China as there are in the U.S., 650 million cars would congest China's roads. Even if those cars met U.S. levels of pollution control and energy efficiency, China's oil consumption could soar to 22 million barrels per day (twice the amount of current U.S. imports), urban air pollution would dramatically worsen, and greenhouse gas emissions would rise sharply. Already, up to 70 percent of urban air pollution comes from motor vehicles in China. The Chinese leadership has indicated it wants to avoid a heavy dependence on foreign oil and more air pollution from automobiles. This will require considerable technological advances since China's domestic capacity for clean vehicle production is almost entirely dependent on foreign technology transfer. The U.S. Big Three automakers have all formed joint ventures in China and are in the process of transferring technology to their Chinese partners. Is their foreign direct investment (FDI) helping China to modernize its auto industry? Is knowledge and being transferred that will enable China catch up to world levels? What are the energy and environmental consequences of technologies currently being transferred? Could the U.S. auto companies help China to leapfrog over conventional internal combustion engines? This paper will provide three in-depth case studies of Beijing Jeep, Shanghai GM, and Ford China based on dozens of interviews in the U.S. and China. Findings will be presented.

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**Falkena, H.J., R. Kok, and H.C. Moll**

Centre for Energy and Environmental Studies, University of Groningen, Germany

*Energy Requirements of Household Consumption in European Cities*

Households are responsible for a large part of the environmental pressure of human society on the natural environment. Households have a direct impact on the environment when driving cars, using electricity, generating waste, etc. There is also an indirect impact. By means of their consumption patterns households greatly influence the production by industry and, therefore, the environmental pressure by the industrial sector. Our research has been done to gain insight in the consumption patterns of households and the environmental load resulting from household consumption. We used the total (direct and indirect) energy requirements of households as a proxy for environmental pressure related to household consumption. The direct energy demand refers to the energy that is literally consumed by households. The indirect energy demand refers to the energy embodied in consumer goods and services. Accounting for the indirect energy demand brings in the production and distribution activities in the economy. We have investigated different type of households in a number of European cities. Our findings show that large differences exist in the consumption patterns of households with different incomes, sizes and housing situations. Also, there are some large differences between the average consumption patterns in the different cities. As a result, we found significant differences in both the total value as well as the composition of household energy requirements. The results of our research can be used to more effectively develop strategies to reduce the environmental load by household consumption. We bring up multiple change options for more sustainable consumption patterns. We do not have a ready-made recipe for any household or any city, however. Different change options apply to different types of households and to different cities.

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### SESSION 5C – URBANIZATION, HOUSING MARKETS, AND HUMAN NATURE

**Chair: Alexey Voinov, Gund Institute for Ecological Economics, University of Vermont, Burlington, VT, USA**

**Room: Secretariat**

**England, Richard W.**

Center for Business and Economic Research, University of New Hampshire, Durham, NH, USA

*Property Taxation, Land Use Zoning and Metropolitan Sprawl in New England*

This paper reports on recent trends in land use change in New England and proposes several fiscal reforms at the state and local level that might help to prevent metropolitan sprawl and preserve open space. Research suggests that heavy reliance on local property taxation and low-density zoning by municipal governments contribute to sprawl. Shifting to land value taxation in cities and providing state grants for municipal infrastructure investments could foster compact development within the region.

**Troy, Austin<sup>1</sup> and J. Morgan Grove<sup>2</sup>**

1-School of Natural Resources, University of Vermont, Burlington, VT, USA

2-USDA Forest Service, Burlington, VT, USA

*An Ecological Economic Framework for Characterization of Social and Economic Patches*

While considerable literature in landscape ecology has addressed the issue of ecological patches, only recently has attention been given to characterizing socio-economic homogeneity and heterogeneity across space. Social scientists have traditionally analyzed relationships in a spatially aggregated manner. This is frequently inappropriate because of the spatial non-stationarity of many social processes (Fotheringham et al 2002). Simpson's paradox (Simpson 1951), when applied spatially, shows that a spatially aggregated analysis of the relationship between two factors may yield the opposite result of two spatially stratified analyses of that same relationship. Increasingly, social scientists have tried to disaggregate factors across space to capture this spatial variation, but the problem of how to disaggregate space so as to best capture these relationships has been poorly addressed. This paper will propose a framework for characterizing and analyzing socio-economic patches in space and time, and for finding the appropriate patch scale and extent for characterizing socio-economic relationships. As an illustrative example, we will look at the question of defining housing markets in space and time. While various econometric studies have attempted to deal with this empirically in the past, the theory on how housing markets, as social

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entities, are defined and develop in space and over time is still nascent. We propose the development of an integrated framework that addresses the complex and interacting series of social, economic, environmental and locational factors that influence the “patchiness” of housing markets. This framework will look at many variables that have been traditionally ignored in the assessment of housing markets, including the level and type of natural and social capital, and the spatial arrangement of and access to those types of capital. In particular, we are interested in how the natural environment interacts with and defines housing markets. Among the theoretical questions we will address are to what extent housing markets have defined boundaries versus gradients, what factors determine how fast those boundaries/gradients can shift and can a nested hierarchy of market patches be developed? We will test this framework using empirical methods in conjunction with existing longitudinal and cross sectional data from the Baltimore Ecosystem Study, including extensive household survey data and property transaction data.

**Gustafson, Christopher and Gary D. Lynne**

Department of Agricultural Economics and School of Natural Resource Science, University of  
Nebraska, Lincoln, NE, USA

### *An Ecological (Meta) Economics Look at Land Urbanization*

Acreages—residences constructed on land at least one acre in size—and large lot suburban homes have become especially popular in recent years. The resulting rambling developments present not only a challenge to municipalities and counties, but also bring into focus the arguably less efficient use of land, defined in an ecological economic sense to include all the on-going work of nature. The metaeconomic theory and approach used here represents a different kind of integration of ideas in evolutionary biology, behavioral and social science about human nature. It is a pluralist theory, admitting the real possibility that humans are dually motivated multiple-selves (likely inherent in our biology) in the two domains of egoism/self-interest and empathy-altruism/other-interest. A third, symbiotic balancing part within the human brain resolves the conflict between the two interests not only within the individual but at higher scales in the decision process. This theory is tested for a case of urbanization in a county experiencing pressure from rapid growth in both Omaha and Lincoln, Nebraska, each on a side of a historically agricultural county. A contingent valuation method modified to represent the new behavioral theory led to rejection of the null hypothesis of “no other-interest.” This also suggests we need to reject standard neoclassical economics as not telling the whole story about urbanization. The empirical results point to purchasing development rights as a viable way to address the land-use efficiency problem if individuals are given ways to express their other-interest. The conversion will only be stemmed if individuals can see to balance their interests, and not have to pursue only their self-interest like neoclassical economics suggests or only their other-interest (generally regulated, coerced) like ecological economics suggests. Metaeconomics points to the fallacies in both, and suggests a viable new theory and approach.

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## SESSION 5D – ECOSYSTEM VALUATION

**Chair: Brendan Fisher, Gund Institute for Ecological Economics, University of Vermont,  
Burlington, VT, USA**

**Room: Spectacular Bid**

**Liu, Shuang, Robert Costanza, and Roelof Boumans**

Gund Institute for Ecological Economics, University of Vermont, Burlington, VT, USA

### *A Dynamic Model of the Value of Biodiversity in Providing Ecosystem Services in Global Grasslands*

This paper presents a dynamic systems model of species diversity’s indirect use value in terms of providing ecosystem services in global grassland. By adding a biodiversity dynamics sub-model and a sub-model of biodiversity’s effect on ecosystem functioning, this model illustrates the interactions between biodiversity dynamics, ecosystem functions, and their services to human society. The result shows that, though a larger number of species could increase the value of ecosystem services in general, it is not necessarily the case. In addition, the value of ecosystem services increased as diversity increased by 10%, varying widely from year to year, ranging from 0.4% in 1950 to 29.2% in 2010.

## CONCURRENT SESSION 5 – FRIDAY – 10:30 AM to 12 NOON

**Stephenson, Kurt<sup>1</sup>, Charles Gowan<sup>2</sup>, and Leonard Shabman<sup>3</sup>**

1-Department of Applied Economics, Virginia Tech, Blacksburg, Virginia, USA

2-Department of Biology, Virginia Tech, Blacksburg, Virginia, USA

3-Resources for the Future, Washington, DC

### *Ecosystem Valuation In Dam Removal Decisions: The Case Of The Elwha*

From a policy perspective, ecological economics is concerned about ensuring that ecosystem services are integrated and valued in public policy decision-making. Some ecological economists assert that monetization of ecosystem services is an effective means to account for these ecosystem services in policy making. The frequently stated premise of this literature is that "because ecosystem services are not fully 'captured' in commercial markets or adequately quantified in terms comparable with economics services and manufactured capital, they are often given too little weight in policy decisions (Costanza et al 1997, *Nature*, 1997, p. 243)." Yet, the premise of this research program in ecological economics - that monetization of ecosystem services will generate more weight in policy decisions - is rarely questioned and subject to systematic inquiry. This paper will examine the role and contribution of economic analysis, and specifically ecosystem valuation, in a precedent setting dam removal case. The issue of removing operating hydropower dams for the purpose of ecosystem restoration (as opposed for safety reasons) is rapidly gaining national attention and interest. As little as twenty years ago, however, the suggestion of removing a dam against the wishes of the owner was considered heretical. One of the first cases to set in motion this radical transformation in public perceptions of dam removal involved two dams on the Elwha River in the state of Washington. The Elwha case became so highly contentious and visible that it eventually drew the attention of Congress, who ultimately decided to remove the dams. In this paper we identify what technical analysis was produced and how such analysis contributed to the dam removal decision (with a specific focus on economic and ecosystem valuation studies). A detailed case analysis is presented that describes how knowledge of, and values for ecosystem services were discovered and reflected in a landmark case.

**Seaton, Robert**

Brinkman & Associates Reforestation Ltd

### *Valuing Natural Systems: Bank of Nature Inc.*

Although the term "Natural Capital" is widely used, most current valuation methodologies for natural systems focus on valuing natural capital as a commodity/service or series of commodities/services, such as recreational value, biodiversity value, water filtration service, etc. rather than as pure capital. These approaches use market valuation approaches derived from commodity economics. An alternative approach which may be of significant value arises from assessing natural capital as pure capital, rather than as commodities and services. Natural capital then has the attributes of being capable of paying dividends, based on inherent growth, and of being borrowed at an interest rate determined by the risk associated with the loan and the availability of capital willing to take that risk versus the demand for that type of capital. The methods used to value natural capital under this model are based on the principles underlying venture capital markets and on actuarial methods. Thus for instance an old growth forest in a heavily logged area may represent a very scarce capital form with high demand, and a very long repayment period, and have a consequently high value. Although the resulting valuation methodology is not a complete solution to the valuation problem, it may more accurately reflect the ecological impacts of human interventions in natural ecosystems. As well, it may allow the integration of the impact of management and ecological restoration activities into the valuation process, and give a more accurate estimate of the relative value of human and natural capital for future generations.

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## CONCURRENT SESSION 5 – FRIDAY – 10:30 AM to 12 NOON

### SESSION 5E – ECOLOGICAL ECONOMICS AND GEORGIST ECONOMICS

**Chair and Organizer: Bill Batt, Central Research Group, Albany, NY, USA**

**Room: Affirmed**

**Batt, Bill**

Central Research Group, Albany, NY, USA

*The Compatibility of Georgist Economics and Ecological Economics*

Two candidates for a new economics are emerging following the disintegration of neoclassical economics and Marxism. One is Georgism, a venerable tradition a century. The other is Ecological Economics, largely an integration of physical and biological sciences with what economics is salvageable. This paper finds good reasons for compatibility and integration between them.

**Smith, Jeffrey**

Geonomy Society

*Geonomics and the Double Dividend*

Environmentalists who would shift taxes have lately embraced a shift of the property tax (PTS) from buildings to land. While the “green tax” movement initially followed the principle of “polluter pays”, this PTS leads them to a deeper principle: “pay for what you take, not for what you make”. On this virtue, cutting-edge ecologists have erected an alternative economic ideology that is neither left nor right but organic, herein called “geonomics”. Its spear point is the collection of Rent, which the PTS effects. Compared to the original Environmental Tax Shift (ETS), this PTS promises a \_double\_ “double dividend” – more efficient land use and a growing social surplus, plus local empowerment and greater ethical awareness. All four benefits contribute to our sustaining ourselves within our ecosystem.

**Hartzok, Alanna**

Earthrights Institute

*Green Tax Policy*

How Green Tax Policy combined with an holistic progressive agenda can provide an aggressive stimulus for strong sustainability. This presentation will address several perspectives and concerns expressed by Carl McDaniel and John Gowdy in their book *Paradise for Sale*.

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### SESSION 5F – ECONOMICS, INSTITUTIONS, AND RESOURCE VALUE

**Chair: David Vail, Department of Economics, Bowdoin College, ME, USA**

**Room: Man O’War**

**Kahn, James R.**

Environmental Studies Program, Washington and Lee University, Lexington, VA, USA

*Rethinking Forest Economics: An Ecological Economics Approach*

The entire literature in forestry economics focuses on developing an optimal rotation, based on maximizing the present value of the stream of income from the forest. As other social benefits of the forest have been appreciated, researchers have attempted to incorporate these values into a model of optimal rotation. This, however, makes no sense as ecosystem services and the recoverability of a forest (especially a tropical rainforest) are more related to the way in which the forest is cut, not how often it is cut. The paper develops an alternative management paradigm, based on developing a sustainable stream of income, minimizing ecological impact while promoting the continuous flow of ecological services, and improving the quality of life of forest communities. The paper suggests a reformulation of lease structure and development of additional economic incentives to achieve ecosystem management, a cutting regime that leaves the forest intact, and in a position to recover very quickly. These principals are illustrated with examples from the author's ongoing research in sustainable forestry policies in Amazonas, Brazil. The paper will also discuss how to use this method to incorporate fire management issues in temperate forests.

## CONCURRENT SESSION 5 – FRIDAY – 10:30 AM to 12 NOON

**Wolf, Steven**

Department of Natural Resources, Cornell University, Ithaca, NY, USA

*Forest and Agricultural Eco-Certification as a Process of Innovation in Extended Networks*

We present an institutional analysis of agricultural and forest eco-certification based on consideration of contemporary innovation dynamics. Innovation is conceptualized as a process of creating and growing networks through new knowledge creation. Central to our analysis is the notion that this new knowledge includes differently formatted knowledge. On the one hand, we observe demands for circulation of objective data to satisfy public standards of accountability; for example, standing volume of timber, rotation age, width of stream buffers. On the other hand, cognitive processes associated with consumption leads to a need to mobilize symbols as referents to transcendent dimensions of quality; for example commitments to biodiversity conservation, human rights, and rural development. The cases of group certification of non-industrial private forestland in the Northeastern U.S. and bananas in Ecuador are introduced to illustrate the general arguments. Our analytic framework offers a means to interpret observed strategies of actors engaged in eco-certification and the new competencies required to elaborate a system of certification in global networks capable of mobilizing diverse consumers' social commitments. Attention to the need for diverse knowledge production capacities may usefully advance efforts to institutionalize eco-certification.

**Roach, Brian<sup>1</sup> and William Wade<sup>2</sup>**

1-Global Development and Environment Institute, Tufts University, Medford, MA, USA

2-Energy and Water Economics, Columbia, TN, USA

*Policy Evaluation of Natural Resource Injuries Using Habitat Equivalency Analysis*

The natural resources managed by government agencies are commonly subject to injuries from accidental events. The management plans adopted by these agencies can affect the probability and magnitude of natural resource injuries. In order for agencies to evaluate alternative management plans, economic cost estimates are required of the natural resource injuries under alternative scenarios. However, accurate damage estimates are often difficult to obtain because of a lack of data on the ex ante economic costs of natural resource injuries. The economic costs of natural resource injuries are often estimated ex post, typically as part of legal proceedings by public trustees. In recent years, trustees have increasingly used habitat equivalency analysis (HEA) to scale compensation for natural resource injuries. Unlike traditional economic analysis, which bases damage estimates on losses to human use (and sometimes non-use) values, HEA estimates the ecological service loss of the injury and then scales restorative ecological compensation to offset these losses. Thus, HEA aims to maintain a baseline level of ecological functioning rather than a baseline level of human welfare. This paper describes the first attempt to use the HEA approach as an ex ante policy evaluation tool. The specific policy application is the offshore oil development managed by the U.S. Minerals Management Service. Oil development poses a risk of natural resource injuries from accidental releases of petroleum products into the environment. The paper describes the reasons HEA was deemed the appropriate methodology and the procedures used to estimate the potential natural resource injuries, derive suitable ecological compensation in a HEA framework, and convert restorative ecological compensation into economic damage estimates. The validity of the economic estimates is explored by comparison to existing data, with encouraging results. The paper concludes that HEA offers a viable alternative to traditional economic analysis when potential injuries to ecological habitats are being evaluated.

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## POSTER SESSION – FRIDAY – 1:30 to 2:30 PM

### **Baer, Paul**

Energy and Resources Group, University of California, Berkeley, CA, USA

#### *A Simple Model of Ecological Debt*

In the context of climate change, the basic concept of “ecological debt” is straightforward. By using the atmospheric sink to a greater degree than is sustainable, the historic overusers have avoided costs that they would otherwise have incurred, and have accordingly become wealthier; the share of the atmospheric sink that was used unsustainably will not be available to future generations in regions which have not accumulated this wealth, and thus they will be poorer. The moral and legal status of this debt is of course debatable on a number of grounds. In political terms, however, this debt is significant, as it has direct bearing on the question of who should pay for mitigation, adaptation, and compensation for climate damages. There are a variety of economic tools for quantifying this ecological debt. In particular, there has been extensive work on optimal growth with renewable and non-renewable resources and with pollution that bears directly on the climate change problem. I draw on this work to develop a simple growth model with two-regions (one “rich” and one “poor”) with renewable and non-renewable common resources, in which the allocation of rights to the common resource can be treated by simple parameterization. I then use this model to show that the transition from an open access to a regulated regime with a global cap, at a time when use in one region has exceeded sustainable levels, generates a permanent wealth advantage for the overusing region that can be conceptualized as an ecological debt. I then use plausible parameterizations to provide very rough estimates the size of this debt in the climate context. Finally, I discuss further elaborations on the model (e.g., changes in technology over time) that will be necessary to make the calculation of debt more robust and believable.

### **Batker, David**

APEX Center for Applied Ecological Economics

#### *Steps to Implement Ecological Economics*

Ecological economic ideas are tremendously powerful but have, for the most part, not yet been implemented in our society. The APEX Center for Applied Ecological Economics, based in Seattle, Washington, is working to translate ecological economics into application in two key ways. The first is through trainings called “skillshares” in which environmental groups, government officials, or others are trained in ecological economics. The second is through three case studies each focused on applying ecological economics to bring about sustainable resource management in particular contexts - the spot prawn fishery, the Carbon River Valley adjoining Mount Rainier, and in Washington state trade policy.

### **Herendeen, Robert A.**

Illinois Natural History Survey, Champaign, IL, USA

#### *Personal Energy Impact of Attending this Meeting*

Mainly because of the magnitude of transportation energy, the energy impact of meetings is often not negligible. At two recent meetings I have canvassed the attendees about their travel (mode, distance) and expenditures, and then converted these to their direct and indirect energy requirements. This poster will repeat the exercise here. Besides presenting some representative numbers, I will canvass all attendees (with a onepage questionnaire on day 1) and present tabulated results a day or so later. For reference, the previous results for average per capita impact are:

- USSEE meeting, Duluth, MN, July, 2001: Round trip distance = 2050 km, energy = 1.6 barrels oil equivalent.
- Workshop "Reconsidering the Importance of Energy", Porto Venere, Italy, May 2002: Round trip distance = 6100 km, energy = 2.9 barrels oil equivalent.

For comparison, average global annual per capita energy use is 12 barrels oil equivalent.

## POSTER SESSION – FRIDAY – 1:30 to 2:30 PM

### **Illge, Lydia and Raimund Schwarze**

German Institute for Economic Research (DIW), Berlin, Germany

*Sustainable Development And Economics. A Survey Project On The Contribution Of Economics To Sustainability Research.*

Concepts of sustainability have been emerging within various disciplines both in the natural sciences and humanities. The central question of this project is about the role that Economics could play in relation to sustainability research. We start from the hypothesis that up to today, the new scientific paradigms evolving under the label of 'sustainable development' have not been integrated into the main streams of Economics. This missing integration is particularly evident for the dominating Neoclassical theory of Economics. For instance, most Neoclassical answers to today's environmental problems are still based on the traditional ideas of market failure and (nation) state regulation. Most economic theories of sustainability have been and still are evolving in an institutional, terminological and methodological framework separated from the mainstream. Under the label of Ecological Economics, largely heterogeneous approaches have gathered, represented by Rawlsians, entropy theorists, socio-biologists, eco-centrists and many others. However, what is unifying them is their opposition to Neoclassical economic theory. The separate developments described above can be clearly observed within the German branch(es) of Economics related to associations, journals, professorships and in the field of policy advice. As a result, valuable and - in view of today's ecological problems - much needed synergies within Economics may remain unused. The separation may also inhibit the process of theory building through integration and differentiation - both in Ecological Economics and Neoclassical Economics. In the project, we are investigating the variety of sustainability concepts within Economics and related disciplines in order to identify promising approaches, lacks and needs for further research. The guiding questions are: What are the challenges resulting from the sustainability concept for the development of theories and methods in Economics? What contributions can Economics make for further developing sustainability research both conceptually and methodologically? For this purpose, an extensive literature review as well as expert interviews and workshops will be carried out. At the USSEE conference, we would like to discuss our project approach and invite US proponents of the Ecological Economics movement to help us in 'catalyzing' the discussion in Germany and Europe. Project results are expected for Spring 2004.

### **Loik, Michael E. and Brent M. Haddad**

Department of Environmental Studies, University of California, Santa Cruz, CA, USA

*Precipnet: An International Network for Precipitation and Ecosystem Change Interdisciplinary Research*

Ecologists from various terrestrial ecosystem study sites, along with climate modelers and social scientists, have formed PrecipNet: An International Network for Precipitation and Ecosystem Change Interdisciplinary Research. The purpose of this network is to encourage communications and collaborations across research groups with common interests regarding the impacts of future precipitation patterns on ecosystem processes and the human enterprise. Twenty five ecological study sites in the US, and 15 sites in nine other countries, participate in PrecipNet. The primary objective of this research coordination network is to encourage an integrated effort that promotes studies of the effects of altered timing and magnitude of rain and snowfall across ecosystems, and the impacts on human society. A related goal is to develop common experimental, modeling, scaling, and integration approaches for the study of future precipitation patterns. We encourage interactions with other research coordination networks, such as AmeriFlux, BASIN, FLUXNET, and TERACC, as well as the participation of individual scholars. An unique aspect of this network is the promotion of interdisciplinary research between natural and social scientists regarding the impacts of climate change on natural ecosystems and with human systems. PrecipNet activities include workshops to explore the latest climate model predictions, develop strategies for comparing methods, synthesize research, conduct meta-analyses, and test models of climate-ecosystem-societal relationships. We plan to begin a series of coordinated exchanges of graduate and postdoctoral students between research groups to enhance skills development, use of common methods, and technology transfer. We extend an invitation to USSEE members to participate in PrecipNet.

## POSTER SESSION – FRIDAY – 1:30 to 2:30 PM

### **McDaniel, Carl and Christopher Bystroff**

Department of Biology, Rensselaer, Troy, NY, USA

#### *A Simple Model for Consumption-Web Stability Under Various Rates of Change*

We have created havoc in the biosphere by altering long standing patterns of evolutionary and ecological processes. Individual ecosystems form the functional units of the biological landscape. In ecosystems, stasis is a transient property revealed in minuscule units of time and space while dynamic equilibrium is a property of larger blocks of time and space. Ecological and evolutionary processes evolved under this agenda of extended periods of minimal change to create quasi-stable ecosystems. When humans became behaviorally modern, probably with the acquisition of complex language some fifty to one hundred thousand years ago, they gained the capacity to innovate and adapt on a time scale orders of magnitude faster than the rate of ecosystem equilibration. Slowly, in patches at first and then globally, humans replaced stasis and dynamic equilibrium with change. To demonstrate the effects of rapid change on a slowly-equilibrating ecosystem, we have constructed a simple computational model for an changing consumption web using Markov chains. A node in the chain represents a species (resource) and each directed edge represents consumption. Each simulation cycle yields new populations that depend on the old population and the availability of resources. Without change, the populations equilibrate after several cycles. Change is introduced by adding a new species or by "innovation," the acquired ability for one species to consume a new resource. Rapid innovation results in the loss of species. In our simulations, consumption webs are stable and robust if the rate of change is much lower than the rate of equilibration, whereas high rates of innovation cause the collapse of consumption webs. Under a regime of constant change, renewal of quasi-stable biological relations on any temporal or spatial scale meaningful to humans appears not possible, only biological impoverishment is experienced.

### **Nordman, Erik, John Wagner and Ross Whaley**

SUNY College of Environmental Science and Forestry, Syracuse, NY, USA

#### *The Effect of Export-Led Economic Growth Policies on the Provision of Forest Ecosystem Services in Chile*

Ecosystems and their component species provide the essential conditions and processes that sustain all life, including human life. Sustainable development demands that human activities do not compromise ecosystems' capabilities of carrying out these processes, known as ecosystem services. My objectives are 1) to quantify the value of select ecosystem services provided by three land-cover types: native forests, plantation forests and abandoned agricultural land in the Los Lagos region of Chile; 2) to examine how national-level economic policies have affected the shift from one land-cover type to another; and 3) to demonstrate why it is critical to incorporate the value of ecosystem services when drafting economic policies that are compatible with "sustainable development". I will use remotely-sensed imagery to determine present land-cover types in Los Lagos as well as detect changes in the extent of these land-cover types over time. I will employ ecological economic methods for determining value of ecosystem services provided by the different land-cover types in Los Lagos. I will use archival research of government forest planting initiatives in the Los Lagos region to determine which economic policies have influenced changes in land-cover type. Finally, I will use impact analysis to determine the effect of these policies on ecosystem services. I expect to find that economic policies that encourage export-led economic growth lead to changes in the mix of land-cover types. I also expect to find that different ecosystems and land-cover types provide suites of ecosystem services that differ in value and composition. These ecosystem services are critical for sustainable development. Economic policies that do not consider the provision of ecosystem services are likely to disrupt those services. Policies that promote economic growth at the expense of life-sustaining ecosystem service do not meet the criteria for sustainable development.

## POSTER SESSION – FRIDAY – 1:30 to 2:30 PM

### **Parrish, Bradley**

SUNY College of Environmental Science and Forestry, Syracuse, NY, USA

#### *Navigating Progress: Managing For Sustainable Outcomes With An Integrated Management Model*

This study will address the role management plays in moving society toward sustainability. The objective is to improve the ability of managers operating in complex systems to manage their activities in a manner that improves societal wellbeing. Sustainable development theory will be used as the basis to develop a management tool that integrates the systemic economic, ecological, and social dimensions of organizational activity. The tool will assist managers in developing strategic action plans that enable the realization of organizational and societal goals. The presentation will include the conceptual framework and developed tool, which will later be field tested.

### **Santa-Barbara, Jack**

The Santa-Barbara Family Foundation, Lynden, Ontario, Canada

#### *The Scale Project*

The Mission of The Scale Project is to influence relevant intergovernmental bodies to integrate the scale concept into their policy decisions, and to assist them implement those decisions in an effective manner. It is noted that many environmental groups and international agreements on environmental and related issues almost never address the scale issue. Yet an understanding of the scale issue is often critical to dealing effectively with the issues they address. The purpose of The Scale Project is to bring together the relevant knowledge, data and arguments regarding the importance of scale in a single resource, and making that resource and related support services widely available through a website and training and consulting services. It is the intent of The Scale Project to initially focus on those ENGOs who deal with environmental issues related to scale, but who are not explicitly addressing the scale aspects of the issues they are targeting. The Project will seek to identify those ENGOs that could benefit most from integrating a scale perspective in their work, and approaching them to work together to examine the implications of scale for their success. The idea is to use the limited resources of The Scale Project to leverage the contacts, resources and networks of existing ENGOs to advance the scale issue in various public education and NGO- Governmental forums, at the same time assisting those NGOs in achieving their targeted goals. The presentation will identify the various scale issues of interest, discuss the project's workplan and tactics, and solicit feedback and suggestions. (Recruitment of staff is also an objective)

### **Tyagi, Anupam**

Unaffiliated

#### *Economic Growth And Carbon Dioxide Emissions*

This paper provides probably the first within sample evidence for both the short-run and the long-run relationships between economic growth and carbon dioxide emissions, in aggregate and for individual sources---solid, liquid and gas fuels, and cement manufacturing. An international panel with 147 countries over the period 1950--1996 is used with flexible piecewise linear spline functions, and fixed time and country effects. A partial adjustment process captures the adjustment lags in the dynamic model. The results for total emissions in the static model are consistent with earlier finding of a negative income elasticity of emissions at the upper income levels. The long term relationships revealed by the dynamic model, and individual emissions sources, sometimes substantially differ from the static model and earlier research, particularly for cement, coal and gas. For sources other than coal, the evidence for a long-run decline in emissions with economic growth is weak even at high incomes. These results are driven mainly by the cross-sectional aspects of the panel, casting doubt over the usefulness of similar estimates used by some studies for forecasting future emissions. Therefore, mechanisms other than economic growth, like the Clean Development Mechanism and Activities Implemented Jointly of the Kyoto Protocol, are important for limiting carbon emissions. This is especially so for the low-income and middle-income countries that have high income elasticities of emissions, and therefore a high potential for future growth in emissions.

## POSTER SESSION – FRIDAY – 1:30 to 2:30 PM

### **White, Richard E.**

Environmental Science and Policy Program, Smith College, Northampton, MA, USA

#### *ZERI: Sustainable Development Through Biologically-Based Systems*

ZERI is an acronym for Zero Emissions Research and Initiatives, a foundation established in Switzerland in 1996 and led by Belgian economist Gunter Pauli. "Zero Emissions" implies eliminating the very concept of waste. "Research" embraces the use of science to discover novel ways of using presently wasted material to meet critical human needs for water, food, health care, shelter, energy, and jobs, without destroying the ecosystem. "Initiatives" includes the crucial application of these ideas in real-world projects. A ZERI project focuses on meeting human needs starting with local resources and focusing on systems rather than single products. A central business, such as a coffee farm or a brewery, provides a primary waste stream. Then ZERI identifies a system of collateral enterprises that use successive waste products as input for value-added activities, such as mushroom growing, compost generation, and animal husbandry. The ultimate goal is a system that generates economic value-added while eliminating waste -- emulating the natural world where the waste of every organism is food for an organism in a different biological kingdom. By expanding the scope of operation beyond the core business, ZERI systems employ more people, not fewer, unlike conventional businesses that reduce labor costs in the interest of narrowly-defined economic efficiency and export environmental and social costs. Furthermore, ZERI systems adopt a decentralized management system modeled after the biological immune system. This empowers workers to achieve continual improvements, while rendering the system robust against external disruptions. In economic terms alone, the whole ZERI system is greater than the sum of its parts. In addition, ZERI fosters truly sustainable development by harmonizing human economic activities with the environment and by fostering community development through job creation that respects local culture and tradition. ZERI projects now exist on five continents. The presentation will include both agricultural and industrial examples.

## CONCURRENT SESSION 6 – FRIDAY – 2:30 to 4:00 PM

### SESSION 6A – PROBLEM-SOLVING AND ECOLOGICAL ECONOMICS

**Chair:** Marjan van den Belt, Mediated Modeling, LLC, Burlington, VT, USA

**Room:** Alydar

#### **Farley, Joshua**

Gund Institute for Ecological Economics, University of Vermont, Burlington, VT, USA

#### *Applied Problem-Solving Approaches to Education in Ecological Economics*

Ecological economics is a transdiscipline directed towards the understanding and resolution of serious problems at the interface of the human system and the global ecosystem that sustains it. Such problems are exceedingly complex, and a university education cannot possibly provide all the theoretical and methodological training required to resolve them. Instead, advanced training in ecological economics should emphasize problem solving skills through applied work in which the problems themselves determines the methodologies and theories required to resolve them. This paper describes experiments with scientific ‘ateliers’—transdisciplinary workshop/field-courses carried out in close collaboration with community sponsors and stakeholders to address specific problems. Background material, including training in systems thinking and the basic concepts of ecological economics, is presented through web-based courses prior to the field portion of the course. Once in the field, students work with institutional partners (e.g. NGOs, local government, cooperatives) to address particular problems. Applying theories to real life problems reinforces the understanding of the theories and provides a framework that facilitates analysis of the problems. It provides a motivational context, a meaningful story with emotional connection to the real world, and a well-structured knowledge base. Equally important, practical applications teach students to examine theories critically and improve on their weaknesses--particularly important for new and developing fields such as ecological economics. While ideally the ateliers can contribute to the resolution of an actual problem, too much focus on pragmatic problem solving is likely to lead to a reductionist approach, in which the consequences of a problem are addressed with a technological fix, distracting students from understanding the root causes of the problem. Ultimately, we must take a systems approach to problem solving, using the specific problem being studied as a ‘theme-generator’ that provides a context through which to understand the system in which the problem occurs.

#### **Batker, David and Elizabeth Barclay**

Asia Pacific Environmental Exchange (APEX) Center for Applied Ecological Economics

#### *Implementing Ecological Economics Through Training, Capacity Building & Action*

Ecological economic concepts are crucial to the future of the Earth, yet are largely unknown to the public and policy-makers. A key agent for publicizing and helping implement policies based on ecological economics could be the environmental community. Non-profit environmental groups are skilled in capturing and directing media attention, pressuring decisionmakers, and carrying out effective public education campaigns. Unfortunately, however, most environmentalists are still largely unaware of ecological economic theory. At the same time, many academics would benefit from learning about the issues from the perspective of environmental activists and the tools activists employ. To close this gap, the APEX Center for Applied Ecological Economics is carrying out ecological economics trainings, or "skillshares," for the environmental and academic communities. Each skillshare explains the key concepts of ecological economics and then focuses on particular applications of ecological economic concepts to issues, campaigns, or concerns identified by the environmental activist participants. Skillshares can range in length from an hour to a day to as long as a few weeks. Resources and references distributed enable interested trainees to learn more about ecological economic concepts. Increasingly, APEX is also working to follow up on this skillshare training by linking environmental groups with ecological economists when appropriate. As a result, advocates facing environmental problems on the ground can benefit from consulting advice or analysis from a graduate student or academic ecological economist. In the past two years, APEX has organized major skillshare trainings for non-profit groups in Geneva, Qatar, Seattle, Hong Kong, the Philippines, Thailand, Washington, DC, and San Francisco and has conducted over 50 individualized skillshare trainings for environmental groups in the U.S. and beyond. These skillshares have helped advocates more effectively counter conventional economic arguments and design more convincing and robust alternatives. It has also generated a tremendous demand for further ecological economics capacity building and campaign work. Additional work to ensure the ecological economic fluency of the environmental community will likely pay dividends in speeding crucially-needed implementation of ecological economic concepts.

## CONCURRENT SESSION 6 – FRIDAY – 2:30 to 4:00 PM

**Illge, Lydia<sup>1</sup> and Martina Schaefer<sup>2</sup>**

1-German Institute for Economic Research, Berlin, Germany

2-Center for Technology and Society, Technical University of Berlin, Germany

*Sustainability and the Wealth of Regions: Investigating Citizens' Conceptions of Wealth Using Q Methodology*

In economics, creating wealth is generally presented as being the ultimate goal of economic activities. Thus, the question arises about what makes up wealth. The concept of sustainable development calls for considering economic, environmental and social aspects of life jointly and for understanding their interrelations, especially in the long run. Furthermore, sustainable development strategies of a region need to be based on the specific conditions in that region as well as on the needs of the citizens and the problems seen by them. Thus, sustainable development requires a holistic concept of wealth that also takes specific regional conditions into consideration. The main question to be answered by this paper is about what peoples' concepts of wealth are and how these concepts 'match' with the holistic and long-term oriented picture required by the sustainability approach. For this purpose, an empirical analysis is carried out identifying citizens' conceptualizations of wealth in the Berlin-Brandenburg region, Germany. The analysis is carried out by using Q methodology, a statistical method for discourse analysis. Its evaluation will provide answers on whether and in what way the identified regional wealth concepts reflect economic, environmental and social aspects of life and a long-term view. In the analysis, a distinction is made between individual and regional wealth. The study results will be used - as an element of a larger project - for finding out about where to start developing sustainable development goals and strategies in the region and how to communicate them. The results will also be used for integrating the principles of sustainable development in decision making processes on the development of Berlin-Brandenburg.

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### SESSION 6B – CLIMATE CHANGE ECONOMICS

**Chair: Carl McDaniel, Department of Biology, Rensselaer Polytechnic Institute, Troy, NY, USA**

**Room: Citation**

**Goodstein, Eban**

Department of Economics, Lewis and Clark College, Portland, OR, USA

*The Costs Of Climate Change: A Regional Analysis*

Over the last decade, economists have focused significant attention on estimating the costs of controlling the greenhouse gas emissions that cause global warming. Dozens, if not hundreds of detailed regional, sectoral and technological analyses have been completed. Far fewer studies have addressed in any detail the benefits of controlling emissions, or alternatively, the costs of climate change, under business-as-usual emission scenarios. To date, most benefit-cost analyses of proposed climate policy have been based on very gross measures of damage from global warming, concluding that the costs of unregulated climate change will be large but contained-typically, less than 2% of GDP for developed countries. However, the macro scale of these cost estimates means that adjustment costs have not been adequately addressed, and particular regional impacts have been overlooked. In the Pacific Northwest, the major impact of global warming will very likely be a dramatic loss of a particular form of natural capital: snowpack. With substantially more precipitation falling as rain and not snow, the hydrology of the entire region will be fundamentally altered, with substantially increased flows and flood risks in the spring, and significant flow reductions in the summer. As a first attempt to estimate the costs of climate change in the Pacific Northwest, this project will develop a very simple model valuing mid-range loss estimates for snowpack, based on current shadow price estimates for Columbia River summer water. This value estimate will be adjusted to reflect higher populations and incomes across the next century. The project will then evaluate the robustness of this estimate by developing more concrete scenarios for water use relating to endangered species, agriculture, hydropower, and urban consumption; sea level rise; and forestry. The impact of uncertainty on the costs of infrastructure investment and adaptation in these arenas will also be evaluated.

## CONCURRENT SESSION 6 – FRIDAY – 2:30 to 4:00 PM

### **Howarth, Richard B.**

Environmental Studies Program, Dartmouth College, Hanover, New Hampshire, USA

#### *Tax Shifting and Double Dividends in the Economics of Climate Change*

In 1991, David Pearce argued that greenhouse gas emissions taxes should yield "double dividends," defined in terms of simultaneous improvements in environmental quality and reductions in the cost of financing public expenditures. Subsequent work by Bovenberg and Goulder (1996), however, found that environmental taxes can interact with pre-existing taxes in ways that actually exacerbate the social costs of taxation. This study examines the double dividend debate in the context of a numerically calibrated model of climate change and the world economy, extending Coleman's (2000) analysis of optimal taxation to account for the costs and benefits of greenhouse gas emissions control. Under "first-best" conditions, the greenhouse gas emissions tax would be set equal to the discounted marginal cost that present emissions impose on the future economy. This decision rule yields a tax that rises from \$25 to \$183 per metric ton of carbon equivalent over the next one hundred years. When emissions tax revenues are used to reduce distortionary taxes on capital and labor, however, the optimal (second-best) emissions tax rises from \$84 to \$283 per metric ton over this same period, yielding additional net benefits of \$11 trillion beyond those captured in the "first-best" scenario. While this model is highly simplified, it captures key stylized facts from the literatures on climate change and public finance. In this analysis, environmental taxes can yield strong double dividends if they are properly coordinated with other policy instruments.

### **Richardson, Robert**

School of Natural Resources, University of Vermont, Burlington, VT, USA

#### *A Contingent Behavior Analysis of the Effects of Climate Change on National Park Visitation*

Potential changes in the global climate pose challenges for public land managers concerned with future land uses. Changes in climate, resulting from higher levels of greenhouse gas (GHG) concentration, impact the planning process in several ways. Climate affects the wildlife, vegetation, and other resources that the National Park Service is charged with preserving, and it also affects visitation levels (both directly, through the visitor experience, and indirectly, through changes in park resources). The impacts of natural resource changes on a visitor's recreation experience may affect decisions about the frequency and duration of future visits to a national park, ultimately affecting local economic activity in the park's gateway community. The purpose of this study is to estimate the role of climate variables and their effects on national park visitation using stated-preference methods. Contingent behavior analysis is employed using a visitor survey to test for the significance of direct and indirect climate scenario variables on visitation at Rocky Mountain National Park in Colorado. A visitor survey included descriptions of hypothetical climate scenarios (depicting both weather- and resource-related variables) and questions about how respondents' visitation behavior would change contingent upon the scenarios. Univariate and multivariate hypothesis tests are used to estimate the impact of climate change on park visitation and to assess the relative significance among scenarios. Both direct (weather-related) and indirect (resource-related) climate scenario variables are found to be statistically significant determinants of contingent behavioral changes. The results indicate that the effects of changes in certain climate variables would have a positive impact on visitation levels. Temperature was found to be a positive and significant determinant of visitation behavior. An increase in visitation of 9-13% was estimated under climate scenarios predicted for the year 2020.

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## CONCURRENT SESSION 6 – FRIDAY – 2:30 to 4:00 PM

### SESSION 6C – UNDERGRADUATE EDUCATION FOR ECOLOGICAL ECONOMICS

**Chair and Organizer: John Gowdy and Julie Gutman, Rensselaer Polytechnic Institute, Troy, NY, USA**

**Participants: Pam Lenox, Jesse Vollick, Jake Edmonson, Shawn Shaw**

**Room: Secretariat**

This panel will explore, from a student perspective, the essential components of undergraduate training in ecological economics. The Chair of the panel is graduate student in the Ecological economics Ph.D. Program at Rensselaer Polytechnic Institute. The panel speakers are undergraduate students at RPI who participated in a first-year studies course called “Nature, Society and the Global Economy.” These students will participate in a Seminar in the Spring 2003 Semester, led by Professors John Gowdy and Julie Gutmann, dedicated to preparing the papers for this conference. Each participant will focus in depth on a topic relevant to ecological economics education. These topics are: Scientific Methodology for Ecological Economics, Biodiversity Science and Policy, Climate Change Science and Policy, and Income Distribution in an Unstable World. We will work throughout the Spring Semester to develop and integrate these crucial topics relevant to environmental and social stability. Students support for the conference will be provided by the School of Humanities and Social Science, at RPI.

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### SESSION 6D – SCALE MATTERS

**Chair: Mindy Kane, Department of Economics, Rensselaer Polytechnic Institute, Troy, NY, USA**

**Room: Spectacular Bid**

**Smith, Jeffrey**

Geonomy Society

*Natural Designs in a Sustainable Economy*

The important thing you’re doing right now is not reading this paper but breathing. Yet you don’t breathe, beat your heart, or digest your food willfully. The most important things you do, you relegate to your autonomic nervous system, freeing your brain to engage in higher pursuits: to read this, or better yet daydream, paint murals on ceilings, perfect nuclear weapons, or play video games (tastes vary). Just as evolution liberated the brain to pursue its interests, so has it created an autonomous system for society - the economy - to let us pursue our loftier interests. The most recent advance: inventors and investors joined forces and delivered us the microchip, the internet, and a new way to live our lives. What was enjoyed by the “wired” could be enjoyed even by the millions left behind, if we let the economy run more autonomously. However, we don’t; we distort the economy’s natural patterns - primarily its feedback loops, both negative and positive. We distort price, the economic signal most laden with information. Out of social habit, we let private parties externalize their costs and expropriate social values; conversely, we let public bodies tax goods and subsidize bads. Once distorted, price reshapes output, the business cycle, and our evaluation of nature. We could quit these bad habits and instead collect and disburse public revenue more organically. To various degrees, some jurisdictions have; these localities and nations decreased taxes and subsidies and instead increased the sharing of the commonwealth. By sparing and rewarding exertion, they let their economies self-regulate to a greater degree, enabling their citizens to both prosper and converse. Seeing economies as autonomous as the rest of the ecosystem provides us with a different paradigm. Patterns like the Law of Supply and Demand become a negative feedback loop, and Ricardo’s Law of Rent a positive feedback loop; the flow of rent - the economic values of locations and privileges - tugs other economic indicators along in its wake. This ecological economics is different enough from conventional economics to launch a new field: “geonomics”.

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**Herendeen, Robert A.<sup>1</sup> and Md. Rumi Shammin<sup>2</sup>**

1-Illinois Natural History Survey, Champaign, IL, USA

2-Department of Natural Resources and Environmental Sciences, U. of Illinois, Urbana, IL, USA

### *The Matter Of Size In Planning*

Most of us are familiar with I = PAT and the interplay of efficiency and overall scale in environmental loading. The rosy view is that being smart (i.e., efficient) removes the concern over overall growth. The dark view is that size matters and that we cannot grow to sustainability. To address this dissonance we will present refined calculations on the resource impacts of smart growth vs. normal growth. We will also describe progress on a project to incorporate off-site (beyond-boundary) impacts into planning in the twin cities of Urbana-Champaign, IL.

**Van den Bergh, Jeroen C.J.M. and Piet Rietveld**

Department of Spatial Economics, Free University, Amsterdam, The Netherlands

### *Limits to World Population Revisited: A Meta-Analysis*

Based on seventy past studies that have assessed a limit to the world population, a meta-analysis is performed. The range of estimates is 0.5 to 1E21 billion people. A meta-analysis allows to see what overall picture emerges when different methods, assumptions and parameters, limiting factors, levels of aggregation and data are taken into account. Limiting factors include availability of land, food, water, energy, carbon, forest products, nonrenewable resources, heat removal and photosynthesis capacity. Methods include spatial extrapolation, 'multiple regions', temporal extrapolation, 'actual supply', hypothetical modelling, dynamic systems modelling and 'categorical assertion'. Potentially important parameters (assumptions) are the level of technology, energy intake per person and available arable land. The meta-analysis makes use of both descriptive statistics and regression analysis.

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## SESSION 6E – OBSERVATION, PERCEPTION, AND ENVIRONMENTAL CHANGE

**Chair: Valerie Luzadis, SUNY College of Environmental Science and Forestry, Syracuse, NY, USA**

**Room: Affirmed**

**Womersley, Mick**

Division of Liberal Studies, Unity College, Unity, ME, USA

### *A Peculiarly American Green: Religion and Environmental Policy in the United States*

A movement of religious environmental groups began forming in the United States around 1990 to forward advocacy in the area of sustainable development. This study asked if this movement had recognizable antecedents, if it developed along philosophically or culturally distinct paths, if it changed mainstream American religions, if it affected normative policy analysis as practiced by academic and governmental elites, and if it has or will change domestic American and global environmental politics. Original historical documents were collected, analyzed, and interpreted using standard methods. Leaders of the movement and lay members of church and temple congregations were interviewed and resultant data analyzed ethnographically. The study found that the religious environmental movement was partly original but also had instructive antecedents. It has become large, widespread, and officially approved by mainstream Christian and Jewish denominations and has affected the concepts of religious identity and environmental stewardship taught by them. However, it has affected normative policy analysis ambiguously if at all and has provoked marked theological, philosophical, and political opposition. Though it may subtly have affected global-change policy in the Clinton presidential administration, the movement has fallen short of most of its goals.

**Davis, Cami**

Art Department and Environmental Program, University of Vermont, Burlington, VT, USA

### *Perceiving Ecologically: The Role of the Visual Arts*

We are in the midst of a critically significant opportunity to evolve as a species. Can we respond as respectful, responsible, reverential, and brilliantly collaborative participants within this exquisite living system Earth? It makes deep sense to align all understanding, behaviors and disciplines, from this practical, ethical and

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spiritual perspective. As we perceive and proceed ecologically, how might we assign value to that alignment? What role do the arts play within this system? In 1999 a small group of artists came together to discuss the state of the world. Out of that questioning arose The Temenos Books, Images for Global Healing, Peace and Gratitude created by painters Cami Davis and Sally Linder. This community arts project utilized the creation of images as an introduction to the international document The Earth Charter, which outlines principles for building a just, sustainable and peaceful global society. Over 5000 students and citizens participated in this project exhibiting throughout Vermont and beyond. On Sept 9, 2001 the event For Love of Earth, A Celebration of the Earth Charter, was held at Shelburne Farms, in Shelburne, Vermont. Paintings, music and dance brought the abstractions of this international document into the participant's hearts and understanding. Speakers Jane Goodall, Satish Kumar, Dr. Steven C. Rockefeller, Stephanie Kaza, John Todd and Nancy Jack Todd, and music by Paul Winter, inspired us. The nearly 2,000 participants created Temenos Books images and placed them in The Ark of Hope, a sculptural vessel, designed by Linder. Two days later, in response to the September 11th tragedy, the remarkable decision was made to walk The Ark of Hope and The Temenos Books to the United Nations, sharing the Earth Charter en route. The project journeyed to The World Summit on Sustainable Development in Johannesburg, South Africa and continues to travel world wide.

### **Anderson, David A.**

Department of Economics, Centre College, Danville KY, USA

#### *Adult Object Permanence and the Neglected Power of Observation*

The literature on child psychology discusses object permanence in regard to infants, who neglect the continuing existence of objects no longer in sight. This paper discusses the likelihood of a carryover of this phenomenon to adults, some of whom may dismiss or discount the relevance of items (refuse, emissions, brownfields) they no longer see, almost as if these items did not exist. The paper then describes how the neglected power of sight could be exploited in modern policy and educational efforts. The cleanest areas in our environment are those we see the most-our literal and figurative front yards. In contrast, we face mounting problems with municipal solid waste, which conveniently disappears on pick-up day. Production externalities may be neglected in part because they occur overseas and out of sight. The most commonly accepted forms of pollution are invisible, as are many of their effects in the short run. And we labor to protect the most visible people and wildlife species, while heavily discounting the lives of those we do not see. The influence of sight is supported by research in other fields. Obesity studies find that it is relatively difficult for dieters to resist food that is within view. Studies on risk and uncertainty indicate that individuals overestimate risks associated with visible threats like lightning, and underestimate the risks of unseen but known threats like cancer. Criminologists find an increased likelihood of infanticide when an infant is found face down because it is harder to take a child's life when the child's face can be seen. Despite the clichés-out of sight, out of mind; seeing is believing; a picture is worth 1000 words-the importance of personal observation may be undervalued in environmental efforts. We are seldom shown images of the sources of manufactured goods. Formal policy debates over the fate of the national parks and the ANWR go on with a blind eye to that which is at stake. Even environmental economics textbooks use few pictures to convey their messages. And neoclassical adherence to rational cost-benefit analysis notwithstanding, consumers do not look the environment in the face before deciding its destiny.

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### SESSION 6F – THE LIMITS OF COST-BENEFIT ANALYSIS

**Chair and Organizer: Frank Ackerman, Global Development and Environment Institute, Tufts University, MA, USA**

**Room: Man O'War**

#### **Ackerman, Frank**

Global Development and Environment Institute, Tufts University, Boston, MA, USA

##### *Death, Fishing, and Cost-Benefit Analysis: The Limits of Externality Valuation*

Economists have assumed, at least since Pigou, that externalities could and should be monetized and internalized into the market economy. Today the rapidly growing use of cost-benefit analysis in policymaking appears to put the theory into practice. However, fundamental obstacles prevent meaningful valuation of some of the most important aspects of externalities. Thus cost-benefit analysis is intrinsically biased toward understating the true benefits of health and environmental protection. Two examples, drawn from recent regulatory debates, illustrate the problem. First, avoided deaths are among the key benefits of many laws and regulations, including the Clean Air Act and the standard for arsenic in drinking water. How much is an avoided death worth? \$6.1 million (1999 dollars), according to EPA, which has relied heavily on wage-risk studies done more than 20 years ago, simply updating the results for inflation. While this approach is theoretically incoherent and ethically troubling, the leading alternatives, proposed by OMB and conservative economists today, are even worse. Second, power plants kill huge numbers of fish as they extract cooling water from rivers, lakes, estuaries, and oceans. How much should they be expected to spend to avoid killing fish? OMB has insisted that EPA use a cost-benefit analysis to justify its regulatory proposals, and has set detailed (and stingy) standards for the valuation of fish. Technical judgments have been made in favor of the power plants in numerous details - and the crucial category of existence value has been all but eliminated by administrative fiat. Neither the value of human life nor the existence value of nature is meaningfully expressed in monetary terms. The dilemmas of valuation are inescapable, and require an approach to public decision-making that does not depend on monetization of everything we care about.

#### **Heinzerling, Lisa**

Georgetown University Law Center, Washington DC, USA

##### *OMB's Legal Problems*

U.S. Presidents since Ronald Reagan have required federal agencies to conduct cost-benefit analyses concerning their major rules and have asked the Office of Information and Regulatory Affairs (OIRA), within the Office of Management and Budget (OMB), to review these rules and analyses. This regulatory oversight from the White House has always created some tension between OIRA and the agencies, especially where agencies' statutory mandates either forbid or do not require cost-benefit analysis in developing rules. In the Bush Administration, OIRA's aggressive oversight of agency rules has created not only political stress but also potential legal problems. OIRA has begun to intervene in agency rulemakings very early in the process, so that its influence on agency decisions is sometimes hard to discern; it has apparently begun to become involved in deciding how laws under which authority is delegated to other agencies ought to be interpreted; and it has asserted a broad-ranging power to return rules to agencies on a wide variety of grounds. These developments are of enormous political and practical importance and, what is more, of dubious legality.

#### **Warren, Wesley P.**

Natural Resource Defense Council, Washington, DC, USA

##### *Flunking the Cost-Benefit Test: The OMB Revolution in the Regulatory Review Process*

As part of the President's economic team, the Office of Management and Budget (OMB) gives oversight to federal agencies. In particular, OMB's Office of Information and Regulatory Affairs (OIRA) acts as a gatekeeper for regulations to be considered by the White House. OIRA establishes general procedures for agencies to follow in developing regulations and leads the review of individual rules requiring White House attention. Every year OMB produces a report on the costs and benefits of government regulation. The Bush administration has used this report to advance certain innovations in policymaking, including the way economic analysis is used in developing regulations. Unfortunately, many of the administration's innovations can be misused to twist the decision making process and weaken environmental protections. Chief among these OMB innovations in its 2001 report is to change the basis for decision making for environmental rules by superseding health-based or technology-based standards

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with a cost-benefit test. OMB then slants the way in which cost-benefit analysis is conducted by requiring agencies to use techniques that lower the value of life by excessively discounting future health benefits and depreciating effects on older Americans through the use of Quality Adjusted Life-Years. Yet, in these innovations OMB neglects to correct for the anti-environmental bias of cost-benefit analysis through its tendency to overstate costs and undervalue qualitative or unquantified benefits. Another OMB innovation in its cost-benefit report was to invite the public to suggest existing rules to change. In the final report OMB selected 13 major environmental rules for review, based mainly on suggestions from industry representatives. Recently, the administration has announced several actions on rules from this “watch list,” which has included decisions to weaken protections governing snowmobiles in national parks, modifying sources of air pollution under the Clean Air Act, and harvesting timber in national forests. The OMB’s new approach to economic analysis often plays a key role in justifying these decisions.

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### SESSION 7A – ADAPTING TO CLIMATE CHANGE

**Chair:** Richard Howarth, Dartmouth College, Hanover, NH, USA

**Room:** Alydar

**Doering III, Otto C.<sup>1</sup>, J.C. Randolph<sup>2</sup>, Jane Southworth<sup>3</sup>, Rebecca A. Pfeifer<sup>4</sup> and Leah Moore<sup>5</sup>**

1-Purdue University, USA

2-Indiana University, USA

3-University of Florida, USA

4-Private Consultant, USA

5-Natural Resources Conservation Service, USDA, USA

#### *Integrating Economic and Biophysical Assessments of Adaptation to Climate Change*

Many sectors are or will be influenced by climate change and climate variability that result in increasing global temperatures, changing precipitation patterns, and increased frequency of unusual weather events. Agriculture is particularly vulnerable to such climate change. Ten distinct ecological zones that are agricultural areas in the Upper Midwest Region (the heart of the U.S. Corn Belt) were subjected to climate change and changing climate variability through simulations of future climate scenarios based on results from general circulation models. Crop-specific crop growth models, calibrated to the study sites were used to simulate yields under varying climate conditions. Farm level production and economic analyses were performed to determine what adaptation strategies might be best utilized to maintain productivity and profitability for producers under such conditions. Analysis was also performed assessing the impact of allowing for changing risk parameters at the farm level. The robust systems methodology for assessing impacts and adaptation opportunities in different ecological zones was designed to allow appropriate micro- economic analysis to take place. The requirements of the production economic analysis were met only through utilization of more detailed and robust biophysical approaches than have been used heretofore. The lesson is that economic analysis of phenomena like global climate change will likely require linkage to more detailed and robust climate and biophysical approaches to be useful. In addition, such results can provide valuable insights into potential paths for adaptation strategies that maintain economic viability. Such adaptation analysis is most useful at the firm level where adaptation will have to take place.

#### **Haddad, Brent**

Department of Environmental Studies, University of California, Santa Cruz, California, USA

#### *Ranking Climate Change Adaptive Capacity when Socio-Political Goals are Explicit*

The IPCC and other analysts agree that industrialized nations possess superior adaptive capacity to deal with challenges posed by greenhouse-gas-related climate change. This paper first reviews the literature related to adaptation to climate change, focusing on fresh water resources. It then attempts to expand the adaptation discussion by arguing that the prior question of a nation's socio-political goals should frame adaptation discussions. Rankings of national adaptive capacity are then presented in map form for normative goals of nations based on utilitarianism, contractarian liberalism, religious/political dictatorship, technocracy, and Nash utilitarianism. Nations are shown to have different rankings based on alternative normative goals, rankings that do not always align with the typical industrialized/emerging market/developing nation categories.

#### **Dóñez, Francisco**

Energy and Resources Group, University of California, Berkeley, CA, USA

#### *Adaptive Environmental Management: A Tool for Climate Change Adaptation?*

This research examines how the emergent theory and practice of adaptive environmental management might prove a useful tool for climate change adaptation. Both climate change adaptation (the problem) and adaptive management (the analytical and policy instrument) originate from traditions of natural and physical science, at least in their dominant formulations. The scientific and policy communities have defined (separately) this problem and this policy instrument in reductionist, technocratic, scientifically optimistic terms. Scholars and practitioners in more activist traditions have also succeeded in weaving threads of morality, justice, and community participation into the discourse on these subjects. As a result, both "adaptive management" and "climate change adaptation" exist more as continuing discussions rather than cohesive, well-defined methods or subjects of inquiry. However, this

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environmental problem and this policy instrument may prove less than compatible even in narrow technical terms. The usefulness of adaptive management for facilitating climate change adaptation depends crucially on the instrument and the problem working at commensurate scales. In spatial terms, adaptive management uses ecosystems as its main unit of analysis, while the primary units for climate change adaptation are political jurisdictions, some of which may encompass entire ecosystems, but many of which do not; for example, the Columbia River watershed reaches across numerous large states in the northwestern U.S. In temporal terms, the situation is reversed. Adaptive management, as a tool for management and scientific experimentation, deals with time scales on the order of years to decades. On the other hand, the impacts and vulnerabilities associated with climate change may occur over decades to century scales-or may occur quickly and catastrophically. This research project attempts to illuminate these points of incommensurability, with the hope that the powerful concept of adaptive management might help communities address the urgent problem of climate change adaptation.

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### SESSION 7B – THE CHANGING FACE OF AGRICULTURE

**Chair: Roel Boumans, Gund Institute for Ecological Economics, University of Vermont, Burlington, VT, USA**

**Room: Citation**

**Spash, Clive L.**

Macaulay Institute and University of Aberdeen, UK

*Genetically Modified Organisms in Agricultural Crops: The European Debate*

The scientific techniques termed ‘genetic modification’, and in particular the new food products that have resulted from their use, have been widely interpreted in European public debate as representing a radically new direction for global food production systems, and even for society as a whole. Whether this is seen as beneficial or threatening depends in part upon the extent to which something being genetically modified (GM) is seen as a departure from the past. Such techniques can be debated in terms of their own scientific reference base (genetic manipulation vs. traditional breeding techniques) or within a broader frame of technological development in modern society (e.g. economic growth vs. the environment). Many of the issues of public concern in Europe have also been expressed in relation to other recent technological innovations, such as computers and telecommunications, which were likewise perceived as revolutionary. While the technical debates may be important in their own right, they are often far removed from the drivers of public concern. Public disquiet over technological innovation is intrinsic to the type of modern economy in which we live, and similar concerns are expressed across a range of problems facing society from biodiversity loss and global climate change to nuclear power. The overarching issues include the institutional framework for managing risk and uncertainty, the role of both science and markets within society, understanding of human-environment interactions, and the distribution of power and wealth. Thus new technologies can bring into focus fundamental conflicts in our society relating to the institutional and economic framework which regulates the development and marketing of new technologies. The tensions that emerge through public debates on genetically modified organisms (GMOs) concern the relationships between the wider public and scientists who develop new technologies, corporations that bring them to market, and regulators expected to place controls on their development and commercialisation. These issues are explored in light of on-going developments in Europe concerning the commercial release of GMOs into the environment.

**Batabyal, Amitrajeet A. and Hamid Beladi**

1-Rochester Institute of Technology, Rochester, NY, USA

2-University of Dayton, Dayton, OH, USA

*Swidden Agriculture in Developing Countries*

Small farmers in many tropical developing countries practice swidden agriculture. A key aspect of swidden agriculture is the time period during which the land is left fallow. This paper uses a new ecological-economic approach to study the fallow period and to determine the optimal length of this period in swidden agriculture. We first construct a theoretical model of a parcel of forest land that has been cleared for swidden agriculture. We then show how the dynamic and the stochastic properties of this cleared land can be used to derive two objective functions for a small farmer that are ecologically meaningful. Finally, using these two objectives, we discuss a probabilistic approach to the determination of the optimal length of the fallow period. In this approach, the focus of

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the small farmer is on maintaining the ecological and the economic sustainability of swidden agriculture on the cleared parcel of forest land (CPFL).

### **Buckley, Mark and Brent Haddad**

Environmental Studies Department, University of California, Santa Cruz, CA, USA

*Restorationist-Farmer Interactions: A Game Theoretic Analysis of Restoration of the Sacramento River*

Restoration of natural areas involves the conversion of developed lands and waters back to functional ecosystems. Agricultural areas provide opportunities for restoration because they retain natural characteristics that can support ecosystems. Conversion of agricultural areas to natural areas necessitates removal of lands from production and movement of edges of restored areas nearer to other landowners. Establishment and expansion of natural areas near agricultural lands can have positive or negative effects on production via pollination, weed-dispersal, endangered species migration, and for riparian areas, flooding. Farmers have taken a variety of roles, positions, and actions in reaction to restoration activities. Strategic behavior by restorationists and farmers occurs in direct negotiations over land sales and use, as well as land-management decisions that have effects beyond property boundaries. We have constructed games where farmers' moves consist of selling their land, contracting for restoration-consistent land management, and land management defensive against possible negative effects from adjacent or upstream restoration. Restorationists choose among buying farmland, contracting for restoration-consistent land management, and various methods for restoring their lands. Our analysis of cooperative and non-cooperative scenarios reveals a framework for decisions, identifies feedbacks, and recommends optimal restoration strategies for given scenarios.

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## **SESSION 7C – TOURISM, TECHNOLOGY, AND SOCIETY**

**Chair: Tom Hudspeth, School of Natural Resources and Environmental Program,  
University of Vermont, Burlington, VT, USA**

**Room: Secretariat**

### **Patterson, Trista M.**

University of Maryland, Bethesda, MD, USA

*Effects of Tourism on Net Social Benefits: A Case Study from Tuscany, Italy*

The word 'ecotourism' frequently brings to mind positive connotations of tropical destinations, lesser developed countries, and biodiversity hotspots. But what of the rest of the world? As the world's largest and most rapidly growing industry, will tourism expansion increase net social benefit in the world? In the past, answers to this question have relied on tourism's fantastic ability to generate employment and profit margins literally overnight. The lure of the tourism industry's "fail-safe" method to achieve economic growth has been increasingly shadowed by a growing awareness of the ecological, social, and cultural costs paid in exchange. Furthermore, tourism literature demonstrates an active political ecology, which orients host community concerns differently between industrialized and lesser developed countries. Those issues which have been under-examined in industrialized countries, are highlighted in this case study of cultural and agricultural tourism from Tuscany, Italy. We have much to learn about the impacts of our visits and visitors, yet rigorous analytical study of the tourism industry has lagged far behind in intellectual and academic forums. Given the complexity of tradeoffs and consequences, the Province of Siena, Italy, is currently unable to fully perceive, appraise, or manage consequences of tourism development. This situation illustrates Siena's central challenge to sustainability, that an inability to monitor, predict, or control impacts resulting from economic growth will eventually threaten the social and natural foundations which support quality of life for residents- and which attract visitors in the first place. This paper first outlines a comprehensive conceptual model, against which host communities can weigh the relative costs and benefits of tourism expansion. Second, it presents a theoretically rigorous and quantitative approach to defining optimal scale for Siena's tourism industry.

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### **Vail, David and Guillermo Herrera**

Department of Economics, Bowdoin College, ME, USA

#### *Promoting Tourism in Maine's Forest and Fishing Communities: Conflicts and Complementarities*

Tourism growth is widely viewed as a key to sustainable economic revitalization in distressed regions along Maine's 3000-mile coastline and in its vast north woods. Tourism's boosters stress the untapped economic opportunities inherent in Maine's location, within a day's drive of 70 million potential whale watchers, lobster eaters, snowmobilers, and autumn leaf peepers. The two regions' historically dominant resource extraction and processing industries are "mature" or in decline. The capacity of fishing to sustain yeoman livelihoods and working waterfronts has been diminished by decades of groundfish depletion and labor saving technological change. Likewise, forest employment and mill town vitality have gradually been undermined by a mix of excess spruce-fir harvesting and "stump to mill" mechanization. The essay explores the potential for sustainable multiple-use management of marine and forest ecosystems and of the built environments (gateway communities) adjacent to them. It assesses the extent to which traditional resource extraction and a range of consumptive and non-consumptive tourism activities are compatible, competing, or mutually exclusive, particularly under pressure of growing tourist numbers. Conflict and complementarity among activities are interpreted both in terms of bio-physical limits and of subjective human responses.

### **Ghosh, Nilabja**

Institute of Economic Growth, University Enclave, Delhi, India

#### *Public Intervention to Promote an Eco-Friendly Technology: Biofertilizers in Indian Agriculture*

The green revolution brought impressive gains in food production but with profound damage to the ecology. Environmentalists also caution that trade liberalisation will bring further damages by raising level of economic activity. The Indian government has been trying to promote an improved practice involving new inputs, the biofertilizers along with chemical fertilizers. Chemical fertilizers, based on fossil fuels are intrinsically exhaustible and in India are imported and backed by subsidies. But the increasing gap between nutrient uptake/loss and replenishment is bringing down soil quality while a significant part is lost to atmosphere or leaching out threatening to pollute water and air. Biofertilizers such as *Rhizobium* are cultures of micro-organisms that help to make nutrients abundant in nature usable for plants. They also improve soil health and are cheap and light for use and transport. The Government promotes the new technology by demonstration, subsidies and financial grants to investors in the industry and direct production in public sector. However, data available indicate only limited success till now. The growth rate of distribution is stagnating, there has been no spatial diffusion and despite entry of small private firms in market, the role of the private sector hardly signifies commercial success. A regression analysis further indicates that the spatial concentration is not explained by any intrinsic advantage and the private unit distributes relatively less under similar conditions. The paper however argues there is ample ground for state intervention in the market but there is a need to refocus the strategy. Biofertilizers involve social gains not appropriated by farmers and the time lag taken by positive soil impact to show up may not warrant the risk and learning cost undertaken by farmers, often working in bounded rationality. The new entrant unit too risks failure but provides important information to others through their success. Moreover, inter-fertilizer price distortions from fertilizer subsidies can be discouraging. The government's emphasis should be more to encourage farm-level use by research on suitable varieties, risk coverage, information and subsidies if considered necessary. At the industry end, access to bank finance and appropriate distribution networking with feedback mechanism can supplement the demand side actions to generate commercial viability.

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## CONCURRENT SESSION 7 – SATURDAY – 8:30 to 10:00 AM

### SESSION 7D – INDUSTRIAL ECOLOGY

**Chair: Joy Hecht, New Jersey Sustainable State Institute, NJ, USA**

**Room: Spectacular Bid**

**Salmi, Olli**

Laboratory of Environmental Protection, Helsinki University of Technology, Finland

*Shaping The Past And Future Paths Of Industrial Ecology: The Case Of The Murmansk Region Of North-Western Russia*

With some well-known exceptions the core literature of industrial ecology has omitted the importance of historical path dependencies, conditions upon which the institutional and the resulting technical solutions of industrial ecosystems are built. This paper aims to bring forth the discussion of such conditions through a case study of the resource intensive industrial systems in the Murmansk region in North-Western Russia. Since the late 1920's the planners of the Murmansk region industrial economy have advocated for closed-loop processing of natural resources. Yet this case study and historical data from two of the region's mining communities, Apatity and Kirovsk, reveal that the state level and regional decision making systems have constrained the implementation of the plans throughout the industrial history of the area. The novel institutions of the Russian transition economy seem to continue on the same track. Some of the results of this history can be clearly seen in the pollution devastated landscape around the industrial communities of Monchegorsk and Nikel. In spite of the unfortunate previous attempts of establishing an industrial ecosystem, the idea of closed-loop production still has strong support in the minds of some of the local experts. Others express concerns of the novel environmental risks such a complex system introduces. So why have the attempts of creating an industrial ecosystem in the Murmansk area failed and still do so? If such a system were created, what would be the consequences to the condition of local ecosystems and human life? Or could there be a need for a fundamental change in the design of industrial practices and institutions of natural resource and environmental management? To be able to respond to these questions I take a look at the historical events in the local ecosystems and on the different levels of natural resource management of Apatity and Kirovsk. ...

**Davidsdottir, Brynhildur**

Center for Energy and Environmental Studies, Boston University, Boston, MA, USA

*Pulp Non-Fiction: Incorporating Dynamic Feedback Relationships between Material and Energy Flows and Vintage Effects in the U.S. Pulp and Paper Industry*

As a necessary part of each production process, industrial systems process large amounts of energy and materials, both of which have important implications for the environment. To design public policies that aim at altering energy and material flows, one needs to understand what influences the dynamics of material and energy flows, i.e. investment behavior, substitution possibilities, technological change and vintage structure. In addition, since energy and material flows are often closely interlinked, such as in the pulp and paper industry, both need to be analyzed simultaneously when analyzing the potential industrial response to e.g. climate change policies. This paper describes the development of a regional vintage based model of the US paper industry which aims at capturing simultaneously investment decisions, material and energy flows, as well as the vintage structure of the capital stock – capturing the impact of capital inertia. A perpetual inventory model quantifies changes in the capital stock. Each vintage or age-class of installed capital is specified by age-specific retirement rates, fiber, and energy intensities. Two types of technical change are incorporated: change embodied in the capital stock of newly installed capacity and change occurring after installation. Carbon emissions from fuel use and methane emissions (using the EMCON methane generation model) from wastepaper discarded in landfills are calculated. The model is used to simulate carbon and methane emissions between 2000 and 2020 under various assumptions regarding the regulatory environment. The results demonstrate that carbon emissions vary considerably between regions within the US and the response to e.g. a carbon driven increase in fuel prices will influence the industry very differently in e.g. Mid Atlantic versus the South. Those results have important implications for the management of greenhouse gases, which are discussed.

## CONCURRENT SESSION 7 – SATURDAY – 8:30 to 10:00 AM

**Seager, Thomas P.<sup>1</sup>, Hilary G. Grimes<sup>2</sup> and Thomas L. Theis<sup>3</sup>**

1-Environmental Research Group, University of New Hampshire, Durham, NH, USA

2-Environmental Manufacturing and Management, Clarkson University, Canton, NY, USA

3-Institute for Environmental Science and Policy, University of Illinois, Chicago, IL, USA

*Applying A Game Theory Framework To Assess Cooperative Product Responsibility Policies: The Case Of Toner Bottles*

One of the principal motivations behind industrial ecology research is what may be termed the *systems hypothesis*: that if all the components in a system may be optimized in concert, rather than individually, industrial systems would function more profitably, sustainably, and greater environmental efficiency. However, life cycle assessment -- the principal tool by which industrial ecology investigates this hypothesis -- has yet to effectively incorporate economic theory to reveal the incentive structures that drive life cycle inventories. That is, while LCA quantifies life cycle impacts, it has yet to provide the economic tools to describe *why* any particular option (and concomitant inventory profile) should be employed by any particular agent along the product life cycle. Because product life cycles involve several economic agents including raw materials suppliers, manufacturers, distributors, consumers, waste collectors, and recyclers, it is unlikely that decisions made at one stage of the product life cycle (e.g., raw material selection) are optimized (i.e., for maximum profits) with downstream economic and environmental implications in mind (e.g., disposal). This research employs a game theory framework to create a combined economic and life cycle assessment, using the example of a toner bottle, to investigate whether life cycle players could design a toner bottle life cycle cooperatively, rather than competitively. The game theory model is used to predict life cycle player strategies under different policy or contractual constraints, such as bottle deposits, disposal fees, or raw materials taxes; the life cycle framework is used to characterize the environmental implications of those strategies. The results suggest that the cost of transporting empty bottles is a significant barrier to successful post-consumer bottle reuse, and that any life cycle cost savings must accrue disproportionately to consumers and bottle collectors to create sufficient incentives to motivate them to fully participate in bottle return programs.

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### SESSION 7E – USE AND VALUES IN AQUATIC SYSTEMS

**Chair: Robby Richardson, School of Natural Resources, University of Vermont, Burlington, VT, USA**

**Room: Affirmed**

**Casey, James F.<sup>1</sup>, James R. Kahn<sup>1</sup> and Alexandre Rivas<sup>2</sup>**

1-Washington and Lee University, Lexington, VA, USA

2-Universidade de Amazonas

*Willingness-To-Pay for Safe, Reliable Drinking Water in Manaus, Amazonas, Brazil*

The 1.5 million residents of the city of Manaus form the epicenter for economic activity and development in the Amazon Basin. The current water treatment facilities were built when there were a mere 100,000 people living here. The fifteen-fold increase in population has made access to safe drinking water a major public health concern. Families that can afford to buy bottled water do, and those that can't are susceptible to water-borne disease and illness at an ever increasing rate. In order to determine how much citizens are willing to pay for universal access to safe drinking water, the University of Amazonas, Center for Environmental Sciences has conducted a survey of over 1,500 residents, collecting information on current water needs, health concerns, household socioeconomic characteristics, and, from a contingent valuation (CV) experiment, how much they would pay for access to clean, safe drinking water. Four separate elicitation formats were used with slightly less than 400 respondents in each sub group. An open-ended, open-ended with a "pre-qualifying" statement, a descending bid and an ascending bid question will allow for more robust estimates and comparisons of elicitation formats for CV. Initial results from non-parametric estimates suggest a WTP of R\$12.81 per month per household with a minimum of R\$0.00 and a maximum of R\$80.00.

## CONCURRENT SESSION 7 – SATURDAY – 8:30 to 10:00 AM

**Solomon, Barry D.<sup>1</sup>, Cristi M. Corey<sup>2</sup> and Kathleen E. Halvorsen<sup>3</sup>**

1-University of California, Santa Cruz, CA, USA

2-U.S. Forest Service, Rhinelander, WI, USA

3-Michigan Technological University, USA

*Safe Minimum Standard Analysis of the Florida Manatee: A Case Study in Citrus County*

A safe minimum standard (SMS) analysis was conducted for the Florida manatee (*Trichechus manatus latirostris*). The SMS equation includes: net benefits of development, measurable benefits of species preservation, and more difficult to measure benefits of species preservation. The objective was to determine if preservation benefits at the target population for species recovery exceeded the development benefits foregone. The manatee is a long-term endangered marine mammal that has brought millions of dollars to many coastal Florida communities. While its population has increased in recent years, motor boat collisions occur frequently yet continued protection is controversial. Measurable protection benefits include local economic development, as coastal Florida depends upon both recreational boating activity and manatee-related tourism, and ecological services performed by manatees through consumption of hydra in waterways, which otherwise would be dredged. To account for the more difficult to measure preservation benefits, a contingent valuation method (CVM) survey was sent to a random sample of Citrus County, Florida residents who live near the mammal's winter habitat. The CVM described a hypothetical market to measure household willingness to pay to protect manatees. The survey included a brief description of the species and its plight, and the form and frequency of potential payment for protection, i.e. donation into a dedicated trust fund, or more expensive boating tags and titles. Statistical analysis was performed on the determinants of the value of manatee preservation. Net development benefits foregone were proxied based on the cost of law enforcement of boating speed limits, since the land values of local manatee refuges are irrelevant because they would be in the public domain irrespective of the existence of manatees. The study found that the benefit of manatee protection in Citrus County greatly exceeded the develop benefits foregone, supporting a SMS at current protection levels if not higher.

**Baxter, Brian J.**

University of New England, Armidale, NSW, Australia

*Sustainability of Surface Water Transport of Goods: An Ecological Economic Investigation of Systems and Policy Implications*

This paper describes a research effort concerned with the central role of dredging operations in the development and expansion of trade in containerized freight at the Port of New York/New Jersey over the past quarter century; and, discovery of policy implications revealed through exercise of an ecological economic model capturing dynamic spatial-temporal change to this extended port system. Dredging practices are recognized as essential to service the operational requirement of access for ocean-going vessels to interior parts of the Ports' navigational network, specifically, terminals handling break-bulk, neobulk, and containerized freight; dredged sediment thus produced is treated as a time series that is at once and the same an outcome of economic growth and a driver of succession dynamics of selected immobile benthic species resident at the federally designated sediment disposal site known as the Mud Dump Site. Spatial-temporal dynamics of terminal status (expansion, modification, closure) is addressed in an economic sub-model dealing with freight, containers, and associated export/import values; a linked and temporally synchronized sub-model describing changes in benthic biomass is handled as an ecological sub-model. The dredged sediment time series is interrogated using spectral methods, analytic results are matched with interpretive data and key event about world, USA, NY/NJ trade economics and ecological abundance data for the New York Bight.

## CONCURRENT SESSION 7 – SATURDAY – 8:30 to 10:00 AM

### SESSION 7F – FRONTIERS IN ENVIRONMENTAL POLICY AND MANAGEMENT

**Chair: Bruce Piasecki, AHC Group, Saratoga Springs, NY, USA**

**Room: Man O'War**

**Managi, Shunsuke<sup>1</sup>, James J. Opaluch<sup>2</sup>, Di Jin<sup>2</sup> and Thomas A. Grigalunas<sup>3</sup>**

1-South Carolina State University, SC, USA

2-University of Rhode Island, RI, USA

3-Woods Hole Oceanographic Institution, MA, USA

#### *Environmental Regulations and Technological Change: Rethinking the Porter Hypothesis*

Society faces important tradeoffs between economic production and environmental quality in the design and implementation of environmental controls. In carrying out this task on behalf of the public, government agencies must evaluate the technical feasibility, economic viability and, in a broad sense, the social desirability of new regulations which define implicit or explicit tradeoffs between environmental quality and production. Technological progress can play a key role in the resolving environmental problems while maintaining a high standard of living. However, the extent of its contribution depends on how well environmental policies are designed and implemented. Successful environmental policies can encourage technological innovation, while poorly designed regulations can constrain and discourage innovation. This paper tests the so-called Porter hypothesis, which states that environmental regulations may spur technological change, potentially leading to long run increases in productivity and profitability. To do so, we apply Data Envelopment Analysis (DEA) to a unique field-level data set for offshore oil and gas production in the Gulf of Mexico, and we apply Almon lag models and Granger causality tests to identify lagged relationships among the stringency of environmental regulations and various components of productivity change. We find no support for the standard version of the Porter hypothesis, but we find support for a re-cast version which measures joint productivity of market and environmental outputs. We also find that the rate of technological change in environmental outputs lag far behind that for market outputs. We speculate that this may be due to the fact that the command-and-control structure of environmental regulations provides little flexibility for innovation. We also find a causal link from technological change of market outputs to environmental stringency, but not for joint production of market and environmental output. This finding is more consistent with the environmental Kuznets curve than with technology-based standards.

**Hodge, Jennifer C.<sup>1</sup> and Hugh O. Canham<sup>2</sup>**

1-Industrial Economics, Inc., MA, USA

2-SUNY College of Environmental Science and Forestry, Syracuse, NY, USA

#### *Environmental and Financial Performance Connection: The Win-Wins of Strategic Environmental Management*

Research has shown that a company who observes and reports environmentally responsible behavior experiences enhanced financial performance. Numerous studies indicate that stock prices are higher for environmentally responsible companies. Yet, many companies and institutional investors are not incorporating comprehensive environmental management strategies into their decision-making agenda. These claim that the studies are ambiguous and do not offer the proper information for incorporating such ideas into their decision making models. It is clear that there is a communication gap between corporate, investment and environmental communities. Those who investigate the connection between corporate environmental and financial performance, should offer the proper data to bridge this information gap. This report models the Capital Asset Pricing Model data inputs, risk and return, and asset management, using financial accounting metrics derived from annual financial accounting statements of corporations. Investors and corporations use these statements to make their investment and strategy building decisions. Using a model that is so widely accepted and well established as a decision making tool in the investment community will build a useful the connection between environmental and financial performance to help investors, corporations and environmental organizations communicate effectively with one another. This will help all of these communities make more effective decisions with their respective organization objectives. Running the model using financial metrics to represent risk, return and asset management, for two populations of public corporations - environmentally responsible and less so - metrics were found that were significantly enhanced for environmentally responsible companies. This information will aid investors and companies to integrate strategically effective environmental actions made by corporations into their currently established strategy building mechanism, and will bridge the information gap that currently exists. Such information will support investors, companies, and

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environmental advocates to make the most value-added and environmentally responsible decisions, aligning the needs of all stakeholders for a more sustainable world.

**Santos, Rui, Paula Antunes, Luís Jordão, Gualter Baptista, and Luísa Madruga**

Faculty of Sciences and Technology, New University of Lisbon, Portugal

*Integrated Incentive Schemes to Promote Sustainability in Agro Industries*

Pig farming is the major polluting sector in Montemor-o-Novo (Portugal), originating several environmental problems. Furthermore, many farms are located on environmentally sensitive areas or near urban zones. As the pig market grows, request for changing the existing capacity arise, through adaptations of farms, closing or re-opening of existing farms, or the built up of new farms. In such a context, authorities need to adapt their management processes, to turn these requests into opportunities for environmental improvement. It is nowadays acknowledged that new tools and policy instruments are required to handle environmental management issues in agriculture and rural industries. The new agenda stresses the potential of industry to develop its own solutions. The adoption of mixed approaches, combining government-led regulation with economic incentives and voluntary schemes, is seen as a promising route, likely to result in the best environmental, marketplace and social outcomes (Mech and Young, 2001). Having this in mind, the local authorities initiated a research project with the collaboration of the Ecological Economics and Management Centre to develop a set of tools to support the integration of environmental concerns on land use planning and operations management for the pig farming sector. The first stage in this process is the development of a local regulation, establishing the basic rules for the licensing of pig farms. A set of economic incentive schemes, applying the tradable development rights concept is being developed to address the location problems, namely to promote the progressive reduction of installed capacity near urban and sensitive areas. The scheme encourages the relocation of farms, and the installation of new farms, to areas with higher environmental suitability. The adoption of best environmental management practices is being promoted through product certification. An eco-labelling scheme to be awarded to the meat products from farms meeting environmental, social and economic performance requirements is being implemented. Environmental improvement will be attained and pig-farmers will gain a competitive advantage in the market. The implementation of the project has been following a participatory approach, to guarantee the consideration of the farmers' viewpoints in the design of the scheme, thus fostering its chances of success, including in the partnership a group of pig farmers and the National Federation of Pig Farmers Associations.

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## CONCURRENT SESSION 8 – SATURDAY – 1:30 to 3:00 PM

### SESSION 8A – CURRENT ISSUES IN TRADE POLICY

**Chair:** Barry Solomon, University of California, Santa Cruz, CA, USA

**Room:** Alydar

**Lange, Glenn-Marie<sup>1</sup>, Rashid Hassan<sup>2</sup>, and Jaap Arntzen<sup>3</sup>**

1-Institute for Economic Analysis, New York University, New York, NY, USA

2-Centre for Economic and Environment Policy Analysis, University of Pretoria

3-Centre for Applied Research

#### *Trade and the Environment in Southern Africa: The Water Content of Trade*

Botswana, Namibia and South Africa have designed strategies for economic development based in part on economic growth, diversification, and trade promotion. As in many developing countries, the structure of exports in these countries is heavily weighted toward primary commodities and processing of these commodities, which is often water-intensive. Water is a scarce resource in southern Africa that needs to be carefully managed to ensure its availability and quality to support economic growth and to meet the basic needs of households in the future. These three countries, which utilize shared international water sources, have identified water as a primary constraint to development and South Africa has already been categorized as a water-stressed country. However, until very recently they have emphasized conventional supply side solutions to water scarcity and have set water tariffs below actual cost, which has encouraged inefficient use of water including promotion of exports that are highly water intensive. Major policy revisions are underway in Namibia and South Africa to implement the 'user pays' principle for natural resources, particularly water. Under this principle, water pricing would be based on three components: full financial cost, environmental damage, and a water conservation charge. As part of an environmental accounting program, these three countries have constructed accounts for water (as well as other resources). The water accounts are linked to an input-output (IO) table for Namibia, and Social Accounting Matrices (SAMs) for Botswana and South Africa. This paper uses the water accounts and the IO/SAMs of each country to assess the comparative water-dependence of their exports and the amount of water 'imported' embodied in imports. The paper discusses the likely impact of changes in water pricing policy on trade in the future.

**Batker, David and Elizabeth Barclay**

Asia Pacific Environmental Exchange Center for Applied Ecological Economics

#### *An Update on Current Issues in Trade Policy from an Applied Ecological Economic Perspective*

The APEX Center for Applied Ecological Economics is actively involved in monitoring trade policy at a state, national and international level. At the state level, APEX is conducting an extensive review of Washington State's publicly-financed trade promotion activity. The investigation provides a vivid example of the contradictions of U.S. trade policy. While Washington State promotes "free trade," many of its policies are protectionist in practice. Washington State has developed a vast network of state departments, positions, institutions, subsidies, tax exemptions, regional and international relationships assistance programs, university programs and dubious public/private trade promotion alliances. In general, there is no coherent policy at all, only a massive jumble of hand-outs for exporting companies with effective lobbyists. In actuality, implementation of free trade would likely be devastating to many of the State's primary export industries. Moving beyond the state level, significant contradictions also exist in trade policy at the federal and international level. Negotiations to expand the provisions of the World Trade Organization (WTO) agreements and the Free Trade Area of the Americas Agreement (FTAA) are examined from the perspective of scale, just distribution, economic efficiency and democracy. Three trade cases are examined in particular depth, including: 1) the case for banning the trade in toxic waste; 2) the case for stiff trade regulation in the trade of aquaculture shrimp; and 3) the case for greater trade in the area of medicinal drugs where patent monopolies restrict trade and benefits. In each case, current trade institutions are shown to be wholly lacking in the ability to deliver public benefits through the lenses of scale, distribution, efficiency and democracy. Ecological economics, in contrast, points the way to development of a more coherent state, national and international trade policy in accordance with these principles.

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**Batabyal, Amitrajeet A.<sup>1</sup> and Hamid Beladi<sup>2</sup>**

1-Department of Economics, Rochester Institute of Technology, Rochester, NY, USA

2-University of Dayton, Dayton, OH, USA

*A Differential Game Theoretic Analysis of International Trade in Renewable Resources*

We use a Stackelberg differential game to model international trade in renewable resources between a monopsonistic buyer and a monopolistic seller. The buyer uses unit and ad valorem tariffs to indirectly encourage conservation of the renewable resource under study. First, we show that the efficacy of these trade policy instruments in furthering conservation depends essentially on whether harvesting costs are stock dependent or independent. When harvesting costs are stock independent, the optimal open loop tariffs are time consistent. In contrast, when harvesting costs are stock dependent, the optimal open loop tariffs are time inconsistent. Second, we point out that because the simultaneous use of both tariffs does not render one tariff extraneous, it makes sense for the buyer to use both tariffs concurrently. Third, we show that when the buyer uses both tariffs simultaneously, she can force the monopolistic seller to behave competitively. Finally, we discuss the implications of these and other findings for renewable resource conservation in general.

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### SESSION 8B – ECOLOGICAL ECONOMICS IN PRACTICE

**Chair: Trista Patterson, University of Maryland, College Park, MD, USA**

**Room: Citation**

**Batker, David and Cristina Mormorunni**

Asia Pacific Environmental Exchange Center for Applied Ecological Economics

*Ecological Economics in Practice: The North American Spot Prawn Fishery*

To assist in popularizing and refining ecological economic concepts, APEX is working on several applied ecological economic projects. One of these applications is on the spot prawn fishery. Shrimp, harvested in the wild or produced via aquaculture, are one of the most unsustainable seafoods, involving vast amounts of bycatch, habitat destruction, mangrove deforestation, and dislocation of coastal communities. Moving shrimp fisheries toward sustainability is important to marine conservation and sustainable seafood goals. The spot prawn fishery, which extends from Dutch Harbor, Alaska to San Diego, California, has the potential to be a model of such sustainable management. Based on the principles of ecological economics and ecosystem health, a precautionary sustainable management plan for the fishery is being developed. Among other elements, the plan includes provisions to: 1) strengthen management capacity and political will so that existing policies and systems move toward a model of spot prawn management that reduces the ecological footprint of the fishery; 2) design and create a network of spot prawn marine reserves; 3) utilize the Marine Stewardship Council (MSC) Certification process to create incentives for sustainable spot prawn management; 4) build management and industry support for spot prawn certification to boost the value of the fishery to keep returns to fishers high despite reductions imposed in catch; and 5) provide a high-quality, high-value seafood product to influence practices in other U.S. shrimp fisheries. The project is in year 2 of a multiyear campaign. Thus far, the response of fisheries managers and the industry to the proposed management concepts has been extremely positive. We raise critical questions we have encountered in the application of ecological economics and ecosystem health science to a politically, socially and ecologically complicated system.

**Voinov, Alexey<sup>1</sup> and Ralf Seppelt<sup>2</sup>**

1-Gund Institute for Ecological Economics, University of Vermont, Burlington, VT, USA

2-Institute of Geoecology, Technical University Braunschweig, Germany

*Understanding And Communicating Sustainability: Global Versus Regional Perspectives*

Sustainability in its present connotation is a Western concept that has emerged in the West and largely represents the attitudes of the developed world. Systems in the developing countries are in transition that is further promoted by globalization. They are foreign to sustainability because by definition they are apt to change rather than maintenance, they are either in the release or renewal stages that hardly anybody wishes to sustain, or have just entered the growth stage. Sustainability is enticing for the developed economic systems, which have reached the

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conservation phase, and would rather endure this stage. In communicating the knowledge of sustainability it is essential to adapt to the local specifics and redefine sustainability accordingly. Local sustainability can be ensured only by borrowing energy, resources and adaptive potential from outside of the system, or by decreasing the sustainability of the global system. Sustainability of a subsystem is achieved at the expense of the supersystem or other subsystems. Therefore institutions that are to maintain life support systems on this planet need to emphasize global priorities and test policies and strategies against the sustainability of the biosphere, rather than regional or local sustainability. We illustrate these ideas with our findings in the Kola Peninsula (Russia) and in the Mekong watershed.

**Collados, Cecilia**

Independent Researcher

*Environmental Policy And The Economic System*

This paper provides an overview of the interaction of environmental policies and the economic system. It identifies the points at which these policies could counteract the environmental damages produced by the economic system by introducing changes in the production, consumption, waste management, and conservation processes. The objective of these changes is to improve the regional quality of life. Under this framework, the paper analyzes how, because of various historical reasons, the U.S. has generated an eclectic set of environmental policies that diminish or increase the flows of certain services and waste at some points in the economic process, but lack the coordination and effectiveness that would be provided by a systemic view of policy making.

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### SESSION 8C – ACHIEVING SUSTAINABILITY

**Chair: John Gowdy, Department of Economics, Rensselaer Polytechnic Institute, Troy, NY, USA**

**Room: Secretariat**

**Good, David and Rafael Reuveny**

School of Public and Environmental Affairs, Indiana University, USA

*Easter Island: What Could Foresight Have Done?*

Many scholars argue that renewable resources such as fresh water, forests, rangelands, fisheries, and the atmosphere are imposing growing limits on contemporary economic development. This view was first stated formally by Malthus (1798) who argued that population growth would eventually lead to environmental and economic decline, starvation, wars, and a fall in population – so called, the Malthusian trap. In this context, Easter Island is an interesting place to study since it remained isolated for nearly 1400 years. By the time Europeans arrived in the eighteenth century, its once thriving civilization had all but disappeared, the island experienced a total depletion of what was once a lush forest, and it had periods of brutal tribal warfare and cannibalism. For a long time, scholars have been puzzled by what caused the Easter Island collapse. Recently, Brander and Taylor (1998) applied formal economic and biological modeling to the problem by characterizing the island as a Predator-Prey system: the human population, dependent on the island's resources, over-exploited them, which led to a rapid population decline. Brander and Taylor assume that agents are myopic. We modify Brander and Taylor's assumption that agents are myopic in order to examine what difference modern institutional arrangements would have had on the island's history. We then address the relevance of our work to contemporary societies. Many have suggested that the appropriate solution to the Malthusian Trap is institutional through the assignment of property rights. Standard economic growth models approach the mathematics of institutions by assuming that agents have an infinite time horizon. Agents are assumed to solve an optimal control problem in order to maximize the sum of their appropriated discounted utilities over time and optimal harvesting rules are developed, which must then be enforced by property right institutions through incentives or sanctions on the members of society. ...

## CONCURRENT SESSION 8 – SATURDAY – 1:30 to 3:00 PM

**Devkota, Surendra R.**

Department of Economics, Rensselaer Polytechnic Institute, Troy, NY, USA

*Strong Sustainability: An Example From Nepal*

This paper explores the ways that people in different parts of the globe are working at local level toward sustainable development. A general debate on strong and weak sustainability is reviewed, and argued for the strong sustainability. Forest management at the local level in Nepal is example of strong sustainability, where people in forest user's group try to avoid "the tragedy of commons". The objective of such user's groups is to obtain forest products like fuel wood, fodder, and timber by sustainably managing local forests. Further, user's groups are not only taking the forest products, but they are to increasing the forest stock, which is an act of natural capital enhancement. In addition, people realize indirect benefits of forest protection such as further control of landslides, and improvement of local watershed and microclimate. This provides evidence that local communities are not only satisfying their demand for natural resources, but are also determined to increase their resource potential for future. More than 11 thousands FUGs are managing about nine hundred thousands of forests. Therefore, FUG, which has a successful integration and cooperation of the society, economy and ecology, exemplifies a model of strong sustainability with both political and economic equity as well as efficiency.

**Schlör, Holger, and J.F. Hake**

Research Centre Jülich, Jülich, Germany

*The Asymmetry of Sustainability and their Consequences*

The thesis of the paper is that sustainability is defined by asymmetrical restrictions. At the one hand, we have to deal with intergenerational issues of justice and on the other hand, we have to deal with the limitations of the substitutability between natural capital and man-made capital both in production and consumption. In the intergenerational context, we are confronted by the fact, that the politics of the present generation does undoubtedly have consequences for the next generation but the politics of the future generations will have no consequences for the current one. This fact leads us to the question: Why should we care about future generations? One possible answer is that the current generation is connected by their children to the next generation and the fact that the transition to the next generation is not a discrete but a continuous one. Normative answers were given by Immanuel Kant in his categorical imperative and by John Rawls in his Theory of Justice. This analysis will lead us to the ethical and economical basis of the strong and weak sustainability concept. The main difference between both concepts is the issue of substitutability between natural capital and man-made capital. The paper will show, that also in this topic, we have to deal with asymmetric problems in the sense that if perfect substitutability is achieved in the production sector it will not necessarily occur in the consumption sector especially when the consumers do not accept new products (i.e. genfood). Finally the currently discussed sustainable indicator concepts will be analysed if they take into account the above mentioned asymmetric restrictions of sustainability and if they enable us to define a sustainable development pathway.

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### SESSION 8D – GREENING EDUCATION INSTITUTIONS

**Chair: Roy Wood, Kodak, Inc., Rochester, NY, USA**

**Room: Spectacular Bid**

**Smargon, Adam Joshua**

Bryant & Stratton College, USA

*The Theory and Practice of Green Purchasing: An Experiment in Private Educational Procurement and Sustainability*

Most purchasing departments evaluate suppliers on the four competitive dimensions of value: quality, dependability, flexibility, and cost. Now suppliers are being evaluated on another dimension: environmental responsibility, usually known as green purchasing. At Rensselaer Polytechnic Institute (RPI) in Troy, New York, I was a graduate student in Environmental Management. I was hired in 1999 as the school's Green Purchasing Coordinator. This experimental position lasted for seven months and illustrated the difference between the "ivory-tower" theories of green purchasing, and the roadblocks I found in the practice of this position. Over the years, purchasing has evolved into new responsibilities; the duties have expanded from the acquisition of materials and

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inputs to being responsible for inbound logistics, quality management, continuous improvement, as well as being integral in marketing and management decisions. Green purchasing's motivation comes from concerns about how environmental issues relate to the quality and future of people's lives. At the administrative level, however, it comes from a need to increase efficiency: reducing operational expenses, reducing demand for natural resources, and lessening environmental impact. The goals are conserving energy, minimizing pollution and packaging, eliminating negative disposal impacts, and encouraging reduction and reuse. Because purchasing departments are required to negotiate and award all contracts, they can screen the environmental impact of incoming commodities, and the possibilities for waste quantities. An environmentally sensitive contract should place an obligation, through the competitive bidding process, for environmental preservation and sustainability with the contractor. This encourages those manufacturers that produce with minimal environmental impact, and discourages those manufacturers that produce without regard to environmental impact. Tremendous change can be made with the change in purchase of paper and office supplies; computers, appliances, and other electronics; architecture, construction, and building materials; bathrooms, kitchens; and other high-use locations of water and plumbing; furnishings; chemistry classes; and other categories.

### **Belling, Doug**

School of Public Affairs, University of Maryland, College Park, MD, USA

#### *An Analysis of Biodiesel Conversion for University Bus Fleets*

The paper examines the feasibility of conversion of some or all university bus vehicles, at the University of Maryland, to biodiesel fuel. The paper examines potential for use of waste vegetable oil as a feedstock, and the economics of producing fuel from waste oil in an institutional setting. Results include analysis of petroleum-based versus biodiesel for cost, fuel efficiency, advantages and disadvantages. The paper suggests next steps and applications for other institutional settings.

### **Crone, Wilson**

Hudson Valley Community College, Troy, NY, USA

#### *Global Seminar: Multicampus Teaching In Environmental Sustainability*

Global Seminar (<http://www.globalseminar.org>) is an effort, spearheaded by Cornell University, to explore issues in environmental sustainability with interdisciplinary case studies. Students at different campuses interact via course management software and videoconferences as they work on both local presentations and semester-long group projects. My experience with community college students in Global Seminar indicates that they work to make the connections among the many facets of environmental issues. The Global Seminar concept may not be limited to those students directly enrolled in the course. Depending on events of this upcoming spring semester, I hope to be able to report on cross-linking Global Seminar with a general economics course on our campus as well. The flexibility of a course built on case studies may be key to fields that cut across disciplines such as ecological economics.

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## SESSION 8E – NEW BUSINESS MODELS

**Chair: Graham Cox, New York Audubon, Albany, NY, USA**

**Room: Affirmed**

### **Clukey, Tim, Elizabeth Bernat, and Jonathan Slater**

Department of Communication, Plattsburgh State University, NY, USA

#### *How Visible is my Community? The Economics of Identity in the Digital Age*

The Internet has shifted the phenomenon of community visibility into the virtual realm. Geographic communities that once relied on conventional mass media and even word-of-mouth to extend their visibility beyond local limits will be obligated to have a presence on the World Wide Web if they are to remain sustainable in this century. Community identity--the product of interactions among a system of community stakeholders, agents, participants and observers--is already showing signs of stress induced by a communication medium that allows global, 24-hour-a-day access to information about communities. For many communities, their identities held in the physical world are not adequately present, visible, or re-presented in the virtual world. With users increasing their

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reliance on the web for travel, relocation and business information, an ecological approach to the study of whole communities' visibility is imperative. The Community Web Visibility Project team--now in its third year of a long-term research study--has been systematically monitoring the on-line visibility of 50 communities in New York's North Country. Additionally, the research team has analyzed trends in visibility, providing insight into how successfully these communities have transitioned to a virtual identity and what the implications are for their survival.

### **Holmes, Timothy P.**

Holmes & Associates, Saranac Lake, NY, USA

#### *An e-Commerce Development Program for Very Small Manufacturers in the Adirondack Park Area of Northern New York State*

AdirondackWood.com, established in May 1999, now features an online, up-to-date directory of over 700 wood-based businesses in the Adirondack North Country region of upstate New York. AdirondackCraft.com, strictly an online store for Adirondack North Country-made gifts and home décor items, has grown to almost 60 small manufacturers and 250 products since its launch in December 2001. It now attracts online customers throughout the United States who on average place an \$82 order for two items. AdirondackCraft.com is one of only a handful of regional craft websites around the country that are successfully marketing locally-made products to a national audience for small manufacturers based in rural areas. A majority of the products displayed fall into one of the special forest products categories, including: aromatics, berries and wild fruit, decorative wood, forest botanicals, greenery, syrup, and speciality wood products. All products are made by residents of the predominately forested Adirondack region in Upstate New York. The websites and related research carried out by Holmes & Associates have resulted in research findings of interest to rural development organizations exploring use of the Internet as a rural economic development tool. "Putting a face" on a region's craft and wood industry is one way to think about applying this program in other areas. Local hands-on experience with a regional e-commerce program contributes to the goal of creating locally directed and relevant "learning economies" within rural regions that are based on the active acquisition and maintenance of knowledge, the cornerstone of any sustainable economy. Thanks to ANCA's encouragement, a regional e-commerce development program centered around AdirondackCraft.com and AdirondackWood.com is now moving on a three-year path towards sustainability. While income from commissions on sales covers a portion of the program's expenses, sponsorship by local, regional, and state small business development organizations appears crucial in the short-term. A number of organizations are interested in effective public-private partnerships that can support the continuation of regional e-commerce services that now seem essential to any successful business assistance activity that targets the interests of small manufacturing firms.

### **Höller, Barbara and Reinhard Paulesich**

Department of Environmental Economics and Management, University of Economics, Vienna,  
Austria

#### *Can Venture Capital boost Sustainability?*

Answering the question if sustainability can be boosted with venture capital is part of our research-strategy 'sustainability and the capital market'. Since the discussion on whether sustainability and venture capital go together has started only recently we attempt to structure this newly created research-field. This task shall be illustrated by the case study 'the Green Bio Refinery', a sustainable technology for cracking grass from extensive land cultivation for the production of a variety of goods (bulk and fine chemicals, energy, insulation material). The following aspects are to be examined and assessed according to the EASEY-Model: (1) The Process of sustainable technology development: from the idea to breaking even; (2) Phases of VC investment from entrance to exit; (3) Venturers and Investors - a special species of financiers (Decisive factors why venture capitalists invest; Screening, assessment and evaluation of promising venture entrepreneurs; Main reasons why entrepreneurs are refused by venture capitalists); and (4) Other stakeholders involved in the process. Additionally to our empirical findings we will discuss the different positions we've found in the relevant literature. Existing gaps will be pointed out and as far as possible filled. Following the outcomes of our research we want to draw conclusions whether and if yes, which sustainable pristine businesses are suitable for venture capital financing.