
Transforming the Economy Sustaining Food, Water, Energy and Justice

Pork and Pollution: An Introduction to Research and Action on Industrial Hog Production

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Type of Presentation: Paper presentation

Biography: Dr. Robert K. Musil is president and CEO of the Rachel Carson Council, a legacy organization envisioned by Rachel Carson and founded in 1965. Dr. Musil is also a senior fellow and adjunct professor at the Center for Congressional and Presidential Studies at American University, where he teaches about climate change and environmental politics. Zoë Ackerman, the associate director for the RCC, conducts research on food and climate justice and directs a growing network of 25 colleges and universities.

Abstract: Livestock in the United States produce one million pounds of fecal matter every four seconds. On a daily basis, factory-farmed hogs in North Carolina alone turn out more waste than do people in six states, and most of it goes untreated and unregulated. The unseen effects of cheap barbecue and bacon wreak havoc on air, water, soil, and the health and well-being of workers and communities around the country. These will only worsen with extreme weather, rising temperatures, and sea level rise. “Pork and Pollution: An Introduction to Research and Action on Hog Farming” explores the connections between hog production, public policy, ecology, public health, social justice, and climate change. The report provides many entry points for civic engagement and is an ideal starting place for building coalitions between nonprofits, academic institutions, students, journalists, organizers, and anyone interested in reimagining our modern food system.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Alternative Visions for Leveraging the Food-Water Nexus for a Sustainability Transition: The Case of India

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Type of Presentation: Paper presentation

Biography: Dr. Aggarwal is an associate professor at the School of Sustainability at Arizona State University. She has a PhD in economics from Cornell University. Dr. Aggarwal's research and teaching interests lie at the interface between sustainability science and international development. She is currently engaged in research projects examining the impacts of globalization and climate change on agricultural and water governance, farm livelihoods, and food security in India, Nepal, Thailand, and Arizona.

Abstract: The National Food Security Bill enacted in India in 2013 has attracted a lot of international attention as it is the most ambitious plan worldwide to provide subsidized food grains to 67% of the 1.2 billion people of India. Currently around 40% of the population is provided subsidized grain through the Public Distribution System. The new bill would consolidate several previous government programs for food aid, extend their coverage, and introduce new measures. Given that India is home to around one third of the world's poor and one sixth of malnourished people, as well as being a major player in global food markets, understanding how this bill will affect the dynamic interaction of food and water systems across multiple spatial (state, regional, national, and global level) and temporal scales has become critical.

The issue of food and water interactions has become particularly salient in light of new findings from satellite data (and other sources) about the rapidly depleting groundwater reserves in semiarid regions of the country, where most of the population is concentrated and where groundwater is the major source of drinking and irrigation needs. There is also growing concern about how climate uncertainties would impact water availability and domestic food production and, consequently, the government's ability to continue to fulfill its obligation toward provision of subsidized food.

In our presentation we discuss how behind these trends, new—and contested—alternative visions are being articulated for the current and imagined future use of water, land, and energy resources. These alternative framings and visions reveal how access to and contestation over natural resources constitute a key political issue. Major decisions around food, water, and energy are highly political and take place within fragmented institutional spaces, which often do not align with the scientific understandings of the inherent linkages between these resources. Thus it is not surprising that despite the radical policy change at the higher level, the institutional and political rigidities hold back change at the grassroots level. However, it is also interesting that from within this chaos there are also several emerging examples of disruptive grassroots innovations that are leveraging the synergies across sectors to drive more sustainable solutions. These diverse outcomes provide some clues as to how decision making within individual sectors can be influenced through institutional and policy design to transition toward more sustainable pathways in a second-best world

Transforming the Economy Sustaining Food, Water, Energy and Justice

Unity in Diversity: Paths of Evolution in the Application of Ecological Economics in Latin America

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Type of Presentation: Full session

Biography: The proponents are presidents of the Latin American regional societies of the ISEE: SMEE (Mesoamerican and Caribbean Society of Ecological Economics), SAEE (Andean Society of Ecological Economics), ECOECO (Brazilian Society of Ecological Economics) and ASAUUE (Argentinean-Uruguayan Society for Ecological Economics). Together they are the coordinating team for REDIBEC (Iberoamerican Network of Ecological Economics).

Abstract: As a postnormal science, ecological economics has developed in Latin America, rather than a unifying theory, a constructivist approach to applied scientific work frequently using what Orlando Fals Borda called participatory action research. This approach is highly influenced by socioecological contexts and has evolved in fairly distinctive characteristics for each of the subregions in which the transdiscipline is applied: Mexico, Central America and the Caribbean, the Andean Region, Brazil, and the Rio de la Plata countries. This diversity is represented in the four existing regional societies: ASAUUE, ECOECO, SAEE, and SMEE. It is unified under the umbrella of the Iberoamerican Network of Ecological Economics (REDIBEC). Its journal, the *Revista Iberoamericana de Economía Ecológica*, shows this unified diversity in approaches.

Three of these regions show a stronger influence of political ecology and are studying distributive ecological conflicts. Some are combining these studies with social metabolism analyses to deconstruct the realities of their subregions, highlighting the contradictions of neoextractivism and the associated roles that these nations play in the new international division of labor. Other regional approaches show a stronger focus on the discussion of the appropriateness of policy instruments such as payments for ecosystem services and other green economy instruments.

Some authors in these regions have proposed typologies to distinguish between radical and nonradical approaches to ecological economics. The involvement of nonacademic institutions and civil society organizations in the construction and application of concepts such as ecological debt, food sovereignty, agroecological agriculture, biopiracy, buen vivir, and so on, is another important feature of these regional approaches. This makes Latin America one of the most dynamic and revolutionary regions in the ecological economics world community.

This survey brings important implications for ecological economics as an area of inquiry and for the ISEE as a professional organization. Should ecological economics strive for a unifying general theory? Is this unity in diversity in the nature of our transdiscipline? Should it be stimulated? Is the bottom-up construction of science an essential feature for the future of ecological economics? We will try to tackle these questions and more in this session.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Decoupling Natural Resource Use and Environmental Impacts: Evidence from Latin America

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Type of Presentation: Full session

Biography: The authors belong to diverse institutions in Latin America and Europe that are working on the issues of ecological conflictivity, social metabolism, and other aspects of ecological economics relevant to decoupling growth from natural resource use and environmental impacts.

Abstract: Decoupling human well-being from resource consumption is at the heart of the UN International Resource Panel's mandate and of UNEP's Green Economy Initiative. The conceptual framework for decoupling and understanding the instrumentalities for achieving the goals is said, according to UNEP-IRP publications, to be still at an infant stage. The underlying assumption for this concept is that it is possible to make progress toward a more sustainable economy, achieving an absolute reduction in resource use at a global level, while meeting human well-being demands, such that economic activities should expand and environmental impacts diminish.

This session examines evidence on the validity of this idea within the context of neoextractivism that currently characterizes Latin American realities. From this stance, the theoretical underpinnings and practical challenges of the concept are critically analyzed.

Commercial and physical trade deficits in South America are presented based on data for Argentina, Brazil, Colombia, Ecuador, and Peru. A case study approach is used to expose the violent consequences of unfair environmental space appropriation in extractivist ecological conflicts in the state of Pará, Brazil.

Further, the combined analysis of the social metabolism of national economies and the trends in distributive ecological conflicts are presented for Andean and Central American countries. It allows a more comprehensive understanding of the basis for economic development in these regions and its socioecological consequences. The complementary role of extractivist and service-based economies is discussed within the framework of the current international division of labor.

Overall, the session provides evidence that decoupling is not happening in Latin America. It suggests that active resistance may mean opposition to the structural characteristics of the development model, therefore indicating the nesting of the ecological conflicts within the general inequities resulting from it. The session highlights the need to adopt a postextractivist approach to development that may have less impact on and better results for the livelihoods of its inhabitants and its ecosystems.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Ecological Debt and Environmental Injustice in Semiurban Protected Areas—A Case Study

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Type of Presentation: Paper presentation

Biography: Environmental lawyer, ecological economist, and executive director of Fundación Neotrópica in Costa Rica. He is also an adjunct faculty member in environmental studies at Northern Arizona University, fellow at the Institute for Environmental Diplomacy and Security of the University of Vermont and the current president of the Mesoamerican Society for Ecological Economics. For more than two decades he has done academic and applied research work in ecological economics, political ecology, environmental law and Latin American studies.

Abstract: For many years conservation in Costa Rica has been led mostly by academic and scientific groups and has followed public vertical, traditional environmentalist NGO- or market-driven models. These perspectives have been insufficient for the conservation model known as the Protected Zone (ZP), which, especially in urban and semiurban areas, has not fully achieved its objectives. Nevertheless, it comprises 15% of the overall land under protection in the country and is especially important in its main watershed. As are other places in Latin America, Costa Rica is today showing traces of environmental situations that exemplify what political ecologists know as “environmentalism of the poor.”

This paper explores the usefulness of the concepts of this environmentalist trend to solve the problems of ZP. Specifically, it focuses on the case study of La Carpintera and documents the preliminary results of the work done today using concepts such as multidimensional ecological economic valuation and ecological debt to resolve the factors generating conflictivity that can result in the loss of environmental services generated by this important protected zone. The results of this analysis may be applicable to the Central American region and beyond as protected areas and the social problems of urban areas increasingly interact.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Can Interbasin Water Transfer for Stream Restoration Be Economically Justified? The Case of the Ayun Nature Reserve, Israel

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Type of Presentation: Paper presentation

Biography: Ariel Akron is a master's student at the Department of Zoology, Tel Aviv University, under the supervision of Prof. Tamar Dayan and Dr. Yaron Hershkovitz from Tel Aviv University and Dr. Andrea Ghermandi from Haifa University.

This research is part of a joint German-Israeli project (GIF agreement number G-1272-203.13/2014) to study the ecological status and ecosystem services of the Lake Kinneret watershed.

Abstract: Water diversion is a major cause of adverse ecological impacts on freshwater ecosystems, particularly in water-stressed areas such as the Mediterranean region. While the economic and ecological consequences of water abstraction and relocation have been widely studied, there are virtually no studies investigating the potential benefits of interbasin water reallocation for the restoration of flow and ecosystem services in the receiving basin.

The Ayun Stream Nature Reserve in Israel presents a unique case of interbasin water transfer aimed at restoring a continuous flow in an otherwise partially dried stream. For the past 50 years, the transboundary (Lebanon-Israel) Ayun River has been subjected to partial flow cessation from May to October, due to a water diversion at the Lebanese side. This has led to severe ecological and economic damage on the Israeli section of the river. Since August 2009, a total of ca. half a million m³ of freshwater have been transferred from the contiguous and much larger Dan River, with the purpose of rehabilitating the ecosystem and encouraging recreation at the Ayun stream.

The main goals of this study are (1) to examine the connection between water quantity in the Ayun Stream Nature Reserve and the provision of ecosystem services, mainly freshwater recreation, and (2) to perform a cost-benefit analysis of the water reallocation project.

We collected data on the monthly number of visitors and revenues generated by park entrance fees in the Ayun Nature Reserve between 2003 and 2014. First, we performed a time-series regression analysis of the number of visitors against a range of site-specific (i.e., water flow and infrastructure) and context-specific variables (e.g., demographic and socioeconomic characteristics of the visitors, presence of substitute sites, seasonality).

The best-fit model (Adj. R² = 0.542; n = 135) shows a highly statistically significant correlation between number of visitors and water flow (p < 0.001). A 10% increase in water flow increases the monthly number of visitors by 1.6%. We estimate that between 2009 and 2014, 32% of the visitation increment can be attributed to the water transfer project. This corresponds to 132,252 visitors and a 1.8 million NIS (ca. \$463,000) increase in park revenues.

Second, we performed a cost-benefit analysis of the water transfer project. We compared the investment, operation, and maintenance costs with the benefits that derive from increased recreational activities. To complement the information on market benefits from additional revenues, we performed an on-site survey of visitors to reveal the nonmarket benefits of recreation through a single-site, individual travel cost model.

Our results suggest that the Ayun water transfer project results in net economic benefits. Although profit making is not the goal of this state-managed nature reserve, it is nevertheless important to highlight the economic feasibility of such restoration projects alongside the obvious ecological benefits. We argue that the proposed approach can represent an additional instrument in the toolbox of decision makers aiming at more economically and ecologically sustainable river basin management in arid areas.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Monetary Valuation for Ecosystem Accounting: Experiences From a Pilot Project in San Martín, Peru

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Type of Presentation: Paper presentation

Biography: Dr. Alam is a research economist at Conservation International, leading research on economic valuation of ecosystem services in the context of ecosystem accounting. He earned his PhD in forest policy and economics from Ehime University, Japan. Prior to joining Conservation International he was a postdoctoral researcher at Université Laval, Quebec City, Canada.

Abstract: The ecosystem accounting approach addresses gaps in the current System of Environmental-Economic Accounting (SEEA) framework to describe interactions between the environment and the economy by linking the ecosystem service flows to different parts of the economy. Experimental approaches were piloted to trial ecosystem accounting in San Martín, Peru. The goal of this pilot was to field-test state-of-the-art theories and methods on quantification and monetary valuation of service flows in the accounting context. Within a larger set of accounts we used the “ecosystem services supply and use account” to record ecosystem services flows from the ecosystem (i.e., its supply) to beneficiaries (i.e., its use). In particular, we present results of monetary valuation of key ecosystem services in the region: provision of timber, water, firewood, bush meat, ecotourism, regulation of sediment, and climate (carbon stock). Consistent with national accounting frameworks, we employed a multitude of methods for monetary valuation depending on type of ecosystem services and type of beneficiary. We discuss how monetary accounts can be integrated in combination with biophysical accounts within the broader ecosystem accounting framework and what are the limitations, challenges, and opportunities for future research and development.

Transforming the Economy Sustaining Food, Water, Energy and Justice

The Economics of Ecosystem-Based Adaptation: Measurement, Valuation and Uncertainties

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Type of Presentation: Paper presentation

Biography: Dr. Alam is a research economist at Conservation International, leading research on economic valuation of ecosystem services in the context of ecosystem accounting. He earned his PhD in forest policy and economics from Ehime University, Japan. Prior to joining Conservation International he was a postdoctoral researcher at Université Laval, Quebec City, Canada.

Abstract: Ecosystem-based adaptation (EbA) is the application of biodiversity and ecosystem services as part of an overall adaptation strategy to help people adapt to the adverse effects of climate change. Due to the rapidly changing landscape of climate change and its impacts on life, livelihoods, and infrastructure, all countries, to a greater or lesser extent, are embarking on the design and implementation of climate change adaptation strategies. The conservation and restoration of ecosystems and biodiversity (EbA) requires financial and other resources, and allocation of these resources to achieve an adaptation goal means it has to compete for limited resources and political support with other development projects and processes or with other types of adaptation solutions. Policymakers often prioritize projects and programs that draw a higher return on investment. Therefore, a better understanding of the economics of EbA is key to promoting it as a viable, long term strategy among policy makers. Drawing on examples from a multicountry project, this paper presents how the cost-effectiveness of EbA investment options can be measured based on recent developments in theories and methods of measurements and valuation of environmental externalities.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Underestimating the Human Predicament

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Type of Presentation: Full session

Biography: Jack Alpert is director of Stanford Knowledge Integration Laboratory, originally at Stanford University in 1978. In 1992 the lab left Stanford and became a nonprofit research foundation. The research focused on how people gather and process information to understand dynamic systems. Over the years the lab has transitioned its focus to the relationship between human cognition and civilization viability. The current work is on discovering and implementing behavior that “changes our course” and creates a sustainable civilization.

Abstract: What if, on humanity’s present path, most of us die of starvation or conflict. This century, by some estimates**, 8–10 billion people perish if we lose our current energy supports and new technology can’t replace them.

These estimates are based on population, birthrate, inequity, resources, space, technology, environmental degradation, and other variables. Together they produce the difference between “required-support” for human activity and “actual-support.” The difference, in “overshoot” cases, indicates the number of annual deaths.

If this form of analysis is correct,

- a) our efforts to stop these deaths should be focused on measuring and zeroing out overshoot.
- b) a sustainable civilization has no overshoot and prevents its re-creation.
- c) “stopping growth” or “establishing a steady state economy,” which do little to reduce overshoot, will have little effect on the 8–10 billion deaths.

These concepts will be integrated into a short video I will present during the session and will post for public use. In preparation for viewing this video, take this

**Self Guided Tour of the Human Predicament and What to Do About It.

http://www.skil.org/position_papers_folder/TourlectureSKILconcepts.html

Transforming the Economy Sustaining Food, Water, Energy and Justice

Asset Prices, Growth, and Inequality

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Type of Presentation: Paper presentation

Biography: Joe Ament is a PhD student at the University of Vermont's Gund Institute for Ecological Economics. His research focus is ecological finance, specifically monetary systems for a finite planet. Joshua Farley is a professor of applied economics at the University of Vermont. His broad research interests focus on the design of an economy capable of balancing what is biophysically possible with what is socially, psychologically, and ethically desirable.

Abstract: This paper tests the hypothesis that much of the economic growth that has occurred since 1970 has been the result of asset price inflation rather than increased real production. Since asset price inflation redistributes wealth to the highly concentrated owners of those assets, increasing their claim to output without increasing output, we argue that the majority of the rise in income inequality can be explained by increasing asset prices. Essentially the new rentier class, the financial sector siphons real income from the economy and has stalled growth in productive capacity and services.

We argue that the United States has been dematerializing for forty-five years. That dematerialization, however, has not been the result of a collective decision to move toward a steady state but rather the result of a transfer of wealth to a concentrated group of asset owners. So while numerically we have dematerialized, ecologically we have not. Further, if inequality moves in tandem with dematerialization, the result is misery rather than prosperity. Thus, the dematerialization we have witnessed has been neither ecologically friendly, nor socially just.

We chose to study the forty-five year period from 1970 to 2015 for several reasons. First, this is when income inequality in the United States began to skyrocket. Gini coefficients rose from .385 to .467 during this time, ranking the United States 32nd out of 34 OECD countries. Second, per capita oil consumption dropped precipitously from more than 18 bbl/person/year in 1979 to less than 10 b/p/y in 2015, and energy plays a dominant role in real economic growth. Third, interest rates plunged from 20% in 1980 to .25% in 2015, while taxes (including corporate, income, and capital gains) also fell significantly during this time. Both of these factors have an enormous impact on asset prices. Lastly, the financial deregulation index has gone from -2.8 in 1970 to 1 in 2010, representing a huge shift to unregulated financial markets.

Taken together, we predict that these factors play a large role in explaining the increase of income inequality in the United States as well as the asset price inflation we see today. We propose a wedded monetary and fiscal financial system, including full-reserve or nationalized banking, compatible with a steady state economy, in which governments create money through spending on public goods such as ecological restoration and green technologies and destroy money by taxing environmental degradation, capital assets, land, and unearned income.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Financial Speculation, Asset Prices, and Inequality

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Type of Presentation: Paper presentation

Biography: Joe Ament is a PhD student at the University of Vermont's Gund Institute for Ecological Economics. His research focus is ecological finance, specifically monetary systems for a finite planet. Joshua Farley is a professor of applied economics at the University of Vermont. His broad research interests focus on the design of an economy capable of balancing what is biophysically possible with what is socially, psychologically, and ethically desirable.

Abstract: There is growing concern surrounding the immense wealth and income inequality in the United States and abroad. This paper tests the hypothesis that the current level of inequality is the result of financial speculation driven by monetary and fiscal policies. It focuses primarily on the hypothesis that lower interest rates, lower land taxes, and lower capital gains taxes increase asset prices. The expectation of increasing asset prices increases speculative demand, driving further price increases. Rising asset prices increase inequality, since ownership is highly concentrated and physical limits disrupt mathematical projections. The paper also examines the connection between an exponentially increasing money supply and increased inequality.

Conventional economists claim that asset prices are determined by the net present value of an asset's after-tax income stream. This paper argues that asset prices are determined by current monetary and fiscal policies that drive speculation and capitalization of revenue streams into new loans with the expectation of higher prices in the future. Further, conventional economists claim that money is loaned to firms that expect the rate of return to exceed the rate of interest. This suggests that the economy will be stable insofar as the growth rate of new physical output exceeds the growth rate of debt. As Picketty has pointed out, this condition rarely holds; in fact, as Farley, Daly, Soddy, and others have pointed out, this condition is impossible in the long run. The net result is a systematic growth in income inequality. Lastly, most loans are not invested in new physical output but are, rather, used to buy existing assets such as land, capital assets, and commodities with the expectation of future price increases. As asset prices increase, the share of wealth captured by their owners increases without creating any new wealth and creating the Minskyan conditions for economic collapse.

Since, under the current system, the vast majority of money is loaned into existence as interest-bearing debt, and the vast majority of that debt is speculative, we find ourselves with a monetary system that is systematically designed to concentrate wealth. The proposal focuses on a wedded monetary and fiscal financial system, including full-reserve or nationalized banking, compatible with a steady state economy, in which governments create money through spending on public goods such as ecological restoration and green technologies, and destroy money by taxing environmental degradation, capital assets, land, and unearned income.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Urban Water Services and Greenhouse Gas Emissions: Toward an Environmentally Sensitive Regulatory Approach

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Type of Presentation: Paper presentation

Biography: Jay Ananda is a senior lecturer in economics at Central Queensland University's Melbourne International Campus. His research interests focus on water policy making, climate change adaptation, efficiency and productivity analysis, and sustainability. He has contributed to many research projects dealing with urban water management and watershed development in Australia and South Asia. He has over seventy publications including journal articles in top-ranked journals and book chapters in authoritative volumes.

Abstract: Efforts to reduce greenhouse gas emissions (GHGs) in order to tackle climate change have put a spotlight on the environmental efficiency of utility industries including urban water operations. The urban water sector plays an important role in sustaining communities and economic growth. A substantial energy input is used in providing drinking water and sewage services, particularly water supply augmentation, water and sewage treatment, and pumping. In many countries, the traditional water supplies have been under pressure due to increased drought conditions and climate variability raising water security concerns. Climate-independent water supply options such as desalination have exacerbated the energy use in recent times. The majority of the sector's energy needs are met by electricity, resulting in GHGs.

Conventional economic regulation ignores the undesirable by-products of water and sewage services when setting water tariff structures, incentives and other revenue requirements for utilities. This paper presents an approach to internalize undesirable outputs, namely GHGs from urban water utilities when evaluating the performance of urban water utilities. The paper modifies the conventional efficiency and productivity indices. Using time-series data for the Australian urban water sector, the paper calculates the global Malmquist-Luenberger productivity index, which accounts for undesirable outputs. Findings indicate that the productivity growth of the sector has declined in cumulative terms. The water source, the level of wastewater treatment and production density showed a statistically significant influence on the relative environmental efficiency of urban water utilities. Incorporating undesirable outputs into performance evaluation frameworks helps to achieve more environmentally sustainable regulatory outcomes.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Resilience Toward Hurricanes in Coastal Communities in Oaxaca, Mexico

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Type of Presentation: Paper presentation

Biography: Full time reseracher at the Economics Resaerch Institute in UNAM, Mexico City.

PhD in environmental economics and management at York University, UK, and master's in tropical coastal management at University of Newcastle-upon-Tyne, UK.

Her main research interests are sustainable rural diversification, socioecological resilience, and environemntal policy instruments.

Abstract: Socioecological resilience is the system's ability to recover from a stress or shock, maintaining and arranging assets (capital) for securing sustainable livelihoods. Thus, the aim of this research is to create a resilience index for measuring the recovery of capital after a hurricane in rural coastal communities, as well as to assess the interaction between capital (social, natural, physical, financial, human) for recovering.

A total of 212 households were surveyed in January 2014, in four rural coastal communities in Oaxaca state in Mexico (Ventanilla, Vainilla, Escobilla, and Barra de Navidad) representing 73% of total households. For each capital, the perception of the degree of impact and recovery was asked, as well as the variables of each capital that had an influence on their recovery.

The resilience index assumes that households were in an initial state before the hurricane Carlota (2012). Three different indices were done, the first one assuming that if the household is much better or much worse, it has shifted to another state, but if the household is close to the original state it is resilient. The other index gradually measured the level of resilience, and the last one considered that only the worst households are not resilient.

Results show that natural and financial capital are among the most affected and the least recovered. Human and social capital were less affected, and human and financial capital are well recovered. There were no significant differences between indices results and an index of 0.79 resilience is obtained for the four communities; thus we can consider them resilient. Differences between communities are also interesting to note. Vainilla community was the most-affected one but also the one with highest level of recovery. However, the variables that are important for recovery for the majority of capital and households are community support (social cohesion), new agreements, income diversification, natural resources, capacitation, and external transferences.

In conclusion, the resilient index gives an inside look on the community's recovery and the variables that have an influence on it. Coastal rural household resilience toward hurricanes was measured using perception of capital recovery and their interactions.

Transforming the Economy Sustaining Food, Water, Energy and Justice

From Theory to Practice: Bringing Natural Capital Accounting to the Forefront of Economic Decision Making

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Type of Presentation: Full session

Biography: Wealth Accounting and the Valuation of Ecosystem Services (WAVES) is a global partnership that aims to promote sustainable development by ensuring that natural resources are mainstreamed in development planning and national economic accounts. This global partnership brings together a broad coalition of UN agencies, governments, international institutes, nongovernmental organizations, and academics to implement Natural Capital Accounting (NCA), where there are internationally agreed-on standards, and develop approaches for other ecosystem service accounts. <http://www.wavespartnership.org/>

Abstract: Natural capital accounting (NCA) is an extension of the international standard System of National Accounts (SNA), developed by the United Nations Statistics Division (UNSD) to account for the value of nature. NCA includes nature's contribution to items already included in GDP, the System of Environmental-Economic Accounts' Central Framework (SEEA-CF), and the extension to ecosystem service values external to GDP—the SEEA Experimental Ecosystem Accounts (SEEA-EEA). Groups such as the World Bank's Wealth Accounting and Valuation of Ecosystem Services (WAVES) program, the UNSD, and NGO and academic partners are working to advance the practice of NCA in countries' decision making. Major steps to mainstream NCA include to 1) pilot test the SEEA-CF and SEEA-EEA in a series of countries and train agencies within those governments in NCA, 2) institutionalize the use of NCA in government decision making and that of multilateral development institutions such as the World Bank, 3) contribute to the ongoing scientific development of the SEEA-EEA, and 4) build regional communities of practice where countries with more experience in NCA can train their peers within the region. In this session we will detail ongoing efforts to advance the underlying science of NCA and its use in policy.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Ecological Economics From Below

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Type of Presentation: Paper presentation

Biography: David Barkin is a distinguished professor at the Universidad Autónoma Metropolitana, Mexico City, emeritus researcher at the National Research Council, and vice president of the Mesoamerican Society for Ecological Economics. He was a founding member of the Ecodevelopment Center in Mexico in 1974. Presently Georg Forster Fellow, Humboldt University, Berlin. His work with students and communities involves collaboration with communities engaged in constructing “postcapitalist societies.” He is the author of numerous books and articles examining the relationship between society and ecosystems.

Abstract: If ecological economics (EE) is to inform the transition to societies capable of living within the bounds imposed by nature, it must assume the epistemological and ethical challenges that this involves. This requires a renewed commitment to explore alternative forms of social organization that remove themselves from the marketplace and the overwhelming influence of a single measure of value on all resources and activities. Indoamerican communities are directly engaged in a whole panoply of activities to protect the megadiversity of their ecosystems, strengthening their ability to manage collectively their territories by creating new spheres for social and political organization. These experiences offer a unique opportunity for us to apply EE to understand better the interaction of socioeconomic and biological dynamics, now encapsulated in the concept of “social metabolism.”

This paper explores the contributions that a number of these communities are making to effectively integrate the various dimensions of society and nature into a single process of “sustainable” socioecosystem management. The varied practices of the many communities engaged in these activities reflect an epistemic break with “normal science” to add new meaning to the contributions of postnormal and transdisciplinary analysis. The analysis examines the ways in which these new forms of organizing social activity transform metabolic processes from below, contributing to the conservation of the global commons while also improving the quality of life of people in these communities.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Toward an Epistemic Cognition Approach to Ecological Economics

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2nd Author: John Ruppert - Rutgers University and Saint Peter's University, NJ, USA

Type of Presentation: Paper presentation

Biography: Paul Bartlett's beginnings in ecological economics arose out of collaborations at the Barry Commoner Center for Health and the Environment (formerly Center for the Biology Natural Systems) at CUNY, working on the technological and economic feasibility of pollution prevention technology and policy. Paul assists contaminated communities (Great Lakes, Hudson River, 9/11, Mexico, the Arctic) and serves on international working groups and task forces. Paul began his career at the NYC Department of Planning.

Abstract: Investigations of epistemic cognition of ecological economics would be most helpful to understand how individuals and communities of practice think and act about ecological economics, whether they are aware of it or not.

An epistemic cognitive approach has the promise of revealing some of the differences between conventional economics and ecological economics as they are manifested in social interaction of actual communities of practice producing local situational knowledge. Communities of practice are "groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" (Lave & Wenger, 1991).

We report on an investigation of epistemic cognition of ecological economics from qualitative data generated by a case study of an urban coastal city in a postdisaster situation planning for resilience against future storm surge flooding (Ruppert, 2015), and ethnographic notes being collected on an ongoing basis as a new set of socioeconomic and political factors emerge and take on greater importance and conflicts over cost and justice issues arise.

Our qualitative data collection and analysis are guided by educational psychologists Chinn, Rinehart, and Buckland (2014) AIR model (Aims and value, epistemic Ideals, and Reliable processes for achieving epistemic aims) which allows us to investigate how competing aims, both epistemic and nonepistemic, as well as ideas about science evidence and processes, are used to construct evidence to track and characterize patterns of community engagement and identify factors that lead to these different patterns of engagement.

The challenge is to adapt this model developed by educational psychologists and philosophers to transdisciplinary ecological economics in a social-political setting where epistemic virtues and vices illuminate and obfuscate. This is an investigation of knowledge of ecological economics knowledge, hence a metastudy, an attempt to become more self-aware. The presentation is meant to provoke thought and discussion on new directions for ecological economics to develop, communicate, and educate.

Transforming the Economy Sustaining Food, Water, Energy and Justice

A Practical and Pedagogical Experience with Well-Being Analysis in Cincinnati, Ohio

Corresponding Author: Nancy Bertaux - Xavier University
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Type of Presentation: Speed talk

Biography: Nancy Bertaux, PhD, is professor of economics, as well as founder and director of the bachelor's degree programs in Economics, Sustainability and Society and Sustainability: Economics and Management at Xavier University in Cincinnati, Ohio, which have gone from zero to 40 majors in three years, with the first graduating class achieving 100% professional employment. She is also the faculty cochair of Xavier's Sustainability Committee. She is committed to the importance of integrating ecological economics into economics and interdisciplinary studies.

Abstract: Students in a senior-level capstone course in ecological economics and policy, primarily majors in two new programs at Xavier University—BA in Economics, Sustainability and Society and BSBA in Sustainability: Economics & Management—used an experiential learning methodology in the spring of 2016, whereby they assisted Cincinnati, Ohio, neighborhoods in assessing well-being, worked with Cincinnati's nonprofit Port Authority, and used a genuine well-being framework with assistance from ecological economist Mark Anielski. This paper/talk reports on the results of this pedagogical and practical exercise, considers how the theoretical concepts from ecological economics were used by students, and evaluates their value to both the educational experience and the "client" institution students worked with. It contributes to research in ecological economics education and communication and alternatives to GDP and improved measures of sustainability.

Transforming the Economy Sustaining Food, Water, Energy and Justice

The Role of Veterans in Agriculture and Food Security—Factors Influencing Long-Term Success in Farming

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Type of Presentation: Paper presentation

Biography: As professor and codirector of the Agroecology Program in the Earth and Environment Department at Florida International University, Miami, Florida, Dr. Bhat directs a USDA grant-funded program for training and transitioning veterans into agriculture. He comanages a program for training under-represented students in agriculture with a focus on agroecology, sustainable agriculture, and urban food systems.

Abstract: There is a growing emphasis on transitioning war veterans into U.S. agriculture. There are more than 19.6 million veterans in the country. A significant number of them either have service-related disabilities or are unemployed, homeless, or at risk of becoming homeless. Farming is found to have a beneficial impact on veterans by offering them both physical and mental health. Veterans tend to be younger than established farmers, and therefore their involvement in agriculture can help ease the problems of the aging farming population of the United States. However, veterans who are new to agriculture normally have to start with small operations that may not be viable for several years. They often face obstacles getting started, including high startup costs and limited land availability. The USDA has initiated training and financial assistance programs targeting veterans. Several nonprofit organizations have programs to help veterans make an easy transition into agriculture as well. The purpose of this study is to evaluate various factors that influence the success of veterans' farming. A survey of more than 30 veteran farming programs in the country is conducted. The managers or operators of those programs are asked to identify various training and financial assistance initiatives they had implemented in the last ten years and asked to identify various measures of success of their programs. They are asked to identify challenges they see their program participants face in transitioning into long-term farming. The preliminary results indicate that the veterans have the potential to contribute to food production. The biggest challenge they will face in the near term will be the high entry cost, technical know-how, and access markets, especially if their scale of production is small and supply is not steady throughout the year. Continued government assistance, help from technical and nontechnical organizations, and social and professional networking among veterans and with established farmers are critical to the veterans' success in future farming.

Transforming the Economy Sustaining Food, Water, Energy and Justice

The Role of Indigenous Cultures in Securing Sustainable Economic Development of Mineral and Energy Resources in Australasia and Europe

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2nd Author: Brian Dollery - University of New England, Australia

3rd Author: Dean Carson - University of Umeå, Sweden

Type of Presentation: Paper presentation

Biography: Boyd Blackwell is a principal research leader for the CRC for remote economic participation in Australia, undertaking research into enduring value from mining for remote communities. Brian Dollery is professor of applied economics and director of the UNE Centre for Local Government with interests in local government amalgamation and structural reform. Dean Carson is a professor of geography based in Sweden with interests in small-area demography and staff retention in rural and remote areas.

Abstract: Drawing on cases from Australia and Sweden, we compare the roles played by indigenous peoples in delivering sustainable development of mineral and energy resources in Europe and Australasia. The Sami people are the sole northernmost indigenous people of the European continent, and their role in resource development provides a rich contrast to that of the Aboriginal and Torres Strait Islanders of Australia. Contrast can be drawn culturally, socially, demographically, institutionally (recognition and realization of rights), environmentally (arctic versus desert/wet tropics), and economically (traditionally reindeer herders versus hunters and gatherers). Indigenous people in both locations have provided important impetus in ensuring that resource development is undertaken in a more sustainable way than would otherwise occur. This has ensured that there are economic and cultural benefits to local people, such as nourishment and the conservation of culture. Indigenous peoples have also helped to limit the environmental impact of resource development by holding fast to their rights over land and water. Indigenous peoples have also helped to guarantee that companies invest in employment and training programs as well as pay royalties to provide much-needed public services. Indeed, indigenous cultures make a valuable contribution to the sustainable development of resources in both regions.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Participatory Scenario Development to Explore the Future of the Agro-Forestry Systems in the Bolivian Amazon

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5th Author: Marisol Toledo - Instituto Boliviano de Investigación Forestal (IBIF), Santa Cruz, Bolivia

Type of Presentation: Paper presentation

Biography: Dr. Irene Blanco-Gutiérrez is assistant professor in the Department of Agricultural Economics at UPM and senior researcher at the CEIGRAM Research Center in Madrid, Spain. She has participated in numerous Spanish and European research projects dealing with integrated assessments of agricultural and environmental policies, water economics and management, climate change adaptation, and mitigation. Her work has primarily been in Europe, but she has also worked in the Mediterranean region and in Latin America.

Abstract: The expansion of agricultural land is responsible for most tropical deforestation. The Amazon basin is the region with the largest deforested area and where deforestation is causing the greatest impact on critical ecosystem services, resulting in biodiversity and biomass loss, carbon release and climate change, and soil and water degradation. Designing long-term strategies to preserve and restore tropical forests in Amazonia is thus crucial for balancing ecological and human needs. While this fact is uncontested, suitable approaches have to be found. One effective way to investigate potential different strategies is through the development of scenarios, which are plausible descriptions of how the future might evolve. This paper develops exploratory scenarios to examine the future of tropical agroforests in the Guarayos province in the southern margin of the Amazon basin (Department of Santa Cruz in Bolivia). This case illustrates the clash between ecosystem conservation and rural livelihoods in contexts of poverty, where agriculture, cattle ranching, and wood extraction are key activities that are threatening the rich ecosystems of the Amazon forest. Scenario development was done through a participatory process carried out in the EU project ROBIN (The Role of Biodiversity in Climate Change Mitigation), in which the global IPCC-guided socioeconomic scenarios were used as a framework for contextualizing and building down-scaled local scenarios. We applied fuzzy cognitive mapping (FCMs), a semiquantitative tool that models systems, taking into account direct and indirect feedback, to develop local stakeholder-based scenarios and assess their effects on rural livelihoods and the environment. Results show that stakeholders depict opposite future visions in terms of sustainability and economic developments. On the one hand, they envision a “good life” scenario (based on the shared socio-ecosystem pathway 1, SSP1), in which law enforcement, sustainable management of forests, increased environmental awareness, and increased technical capacity leads to a control of deforestation. On the other hand, they also see a possible “bad life” scenario (based on the shared socio-ecosystem pathway 4, SSP4) with social inequity and poverty, poor enforcement of laws, and high deforestation rates. Stakeholders concur that the necessary drivers to trigger sustainability and equity are those that provide alternatives to local economy through new infrastructures, access to credit, or technical capacities. Overall, the research evidences how the downscaling of aggregate socioeconomic scenarios to local realities is key to support policy development by identifying crucial elements and processes upon which policy makers and institutions can take action.

Key words: scenario development, stakeholders, fuzzy cognitive mapping, deforestation, rural livelihoods, interactions, Bolivian Amazon.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Being Sufficient—Being Happy?

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2nd Author: Martin Binder - Bard College Berlin

Type of Presentation: Paper presentation

Biography: Ann-Kathrin Blankenberg is a postdoc at the University of Goettingen. Her research interests are environmental economics, behavioral economics, and innovation.

Abstract: People ask themselves what kind of world they would like to leave for future generations, and most people would like to leave a green and liveable planet. But what does “most” mean, and how can most people, rather than all, make an impact? What are the required conditions that such a possible change can happen, and what motivates people? The problem of the tragedy of the commons is observable in the case of nature and our environment. Hardin (1968) argued that environmental degradation is due to population and that the freedom of the commons will destroy everything. Since the Rio Conference of 1992, a global blueprint for sustainable development has existed, pointing to the individual as the center of efforts for sustainable development. Sustainability, and respectively a sustainable society, requires different strategies to reach this goal, for example, a change in consumption patterns, leading to a sufficiency-based lifestyle. The Enquete Commission of the Lower House of German Parliament argues that sufficiency is one of four categories of action (along with regulation, consistency, and efficiency) to increase welfare and quality of life by simultaneously decreasing usage and consumption of resources. But being sufficient is not a reduction of lifestyle; rather, it is a conscious choice to adopt a certain type of lifestyle: improving life through the reduction of consumption, with the aim of reducing negative impact on the environment.

The literature indicates a link between mental state and consumption patterns. Happy people consume less, and sad people spend more. On the way to a sufficient society, there is still the problem that different institutions (rules, policy, markets, etc.) need to coevolve. Taking a closer look at the literature, combining public-choice analysis and behavioral economics, indicates that a certain willingness to cooperate for the greater good exists when other people also behave like this, with voting suggested as one possible way to reach sustainability. Although experiments are a strong simplification of the real world, they indicate a possible direction for further research. The impact of one single individual on society on the whole is rather small. Nevertheless, a lot of people follow this lifestyle. The determinants of subjective well-being are well-researched; it is shown in the literature that there is a link between the environment and subjective well-being. Why do people behave like this when the consequences for society and environment appear to be small? Is there a different benefit? Being happy because of being sufficient? Politicians as well as researchers indicate that sufficiency is one possible way to reach sustainability. Sufficiency is defined and described, but it is not operationalized yet; thus it is not possible to measure its effects or the reasons people should behave according to it. Our contribution is threefold. We try to operationalize sufficiency, examine the relationship between a sufficient lifestyle and SWB, and analyze the impact of environmental attitudes/environmental worries on a sufficiency-based lifestyle and analyze possible causality.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Toward Methodological Standardization of the European Alternative Measures of Economic Welfare

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4th Author: Dorothee Rodenhäuser - Institute of Interdisciplinary Research (FEST e.V.), and Alfred-Weber-Institute for Economics, University of Heidelberg

Type of Presentation: Paper presentation

Biography: The authors of this joint paper on alternative measures of economic welfare (AMEWs) have been working on this topic for many years. Brent Bleys is currently assistant professor at Ghent University, while his coauthors are working at the University of Heidelberg. Their collaboration on this paper is a second step toward methodological standardization of the European AMEWs, after the authors cochaired a session on this topic at the ESEE2015 conference in Leeds last summer.

Abstract: In Europe, the development of alternative measures of economic welfare (AMEWs) is gaining momentum. Most of the studies published over the last 10 years are, however, one-off academic efforts that do not seek to directly influence policy making. Two exceptions exist: both the Index of Sustainable Economic Welfare (ISEW) for Flanders and the National Welfare Index (NWI) for Germany are compiled on a regular basis following a specific demand from policy makers to develop such AMEWs. In Flanders the studies are carried out on behalf of the Flemish Environment Agency, while the German Ministry for the Environment and the Federal Environment Agency ordered the studies in Germany. Methodological differences between the studies imply that it is not possible to compare the levels of economic welfare between Flanders and Germany. Such differences are widely regarded as an important barrier to a broader use of AMEWs (e.g., Bagstad et al., 2014; Bleys and Whitby, 2015).

This paper investigates the methodological differences between the ISEW study for Flanders and the NWI study for Germany. It first looks at the different items included in both AMEWs and at the differences in the methodologies to monetarily value these items. We find that there is a certain overlap in the items included in both measures, while the valuation methods used differ substantially for a number of items (e.g., the welfare losses from income inequality, the depletion costs of natural resources, and the costs of climate change). Next, we identify the quantitatively most important components of the NWI for Germany in order to derive a “simplified” NWI that consists only of those items that make up more than 2.5% of the NWI total. This “simplified” NWI is then compiled for Flanders in order to explore the impact of the methodological differences between the NWI and the ISEW on the estimated levels of economic welfare. The impact is found to be substantial, as the NWI for Flanders reveals a much more positive trend over time of the estimated level of economic welfare for the region for the period 1990–2013. This is largely due to the different methodologies of the items concerning income inequalities and the costs of climate change. Finally, we identify ways to improve AMEW methodologies in general—ranging from avoiding double counting to using data on final energy use instead of primary energy consumption when estimating the depletion costs of nonrenewables—and argue that AMEWs would also benefit from having a well-defined theoretical foundation.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Brazilian Water Charging System: Does Decentralized Standard Setting Lead to a “Race to the Bottom”?

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Type of Presentation: Speed talk

Biography: Adriana Bocaiuva is a PhD student in public policies, development, and sustainability at the Economic Institute of Universidade Federal do Rio de Janeiro– UFRJ, with a master’s in environmental urban engineering (2012) from PUC-Rio and Technische Universitat Braunschweig and a specialization in environmental law (2005) from PUC Rio. She has professional experience in sustainability in the third and private sectors, she has worked on environmental projects in the north and northeast regions of Brazil, and has given legal advice to environmental agencies.

Abstract: The charge for bulk water use in Brazil is a control and planning instrument incorporated in the Water Resource Policy and set out in law n. 9.433/97. The environmental principles underpin the implementation of the charge by each basin committee independently. Empirical research focuses on related decentralized/public participation versus centralized/top-down modes of decision making for water-charging system implementation for environmental output quality. The study tries to understand whether the welfare-reducing race to the bottom does in fact exist and if the dominant approaches to federal environmental regulation—minimum environmental quality standards and uniform technology standards—are the most appropriate approaches to preventing a race to the bottom. Conceptual considerations and initial empirical findings are used to discuss causal factors that could explain the quality of environmental decisions under interstate competition.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Do Community Support Measures in Protected Areas Increase Household Welfare? A Case Study From the Brazilian Amazon

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3rd Author: Elías Cisneros - University of Bonn, Institute for Food and Resource Economics

Type of Presentation: Paper presentation

Biography: Jan Börner is an agricultural and environmental economist with applied research experience in Latin America, Africa, and Europe. He has spent seven years living and working in Brazil, where his research focused on the economic analysis and evaluation of tropical forest conservation policies. Since 2012, he has been Robert Bosch Junior Professor for Economics of Sustainable Natural Resource Use and Bioeconomy and has led the environmental policy research group at the Center for Development Research.

Abstract: Protected area managers often rely on community support measures, inspired by the model of integrated conservation and development programs, to safeguard the well-being of local communities dwelling in multiple-use reserves. In the Bolsa Floresta Program (Amazonas state in Brazil), community support is one of four intervention components that aim at reducing local pressure on forests while enhancing the livelihood of reserve dwellers. To evaluate the effect of community support as a component of the program's broader intervention strategy, we exploit a program irregularity that led to two neighboring reserves receiving differentiated treatment. One reserve has received all four program components since 2008, whereas the other was excluded from community support measures. Extensive household survey data was collected in 2013 from randomly selected households in both reserves. Our data covers multiple welfare dimensions and criteria potentially affecting self-selection into the program. Appropriate control households from the reserve without community support were identified using parametric and nonparametric matching techniques. Results including extensive sensitivity analyses suggest no significant effect of community support on household income and significant but not robust positive effects on asset wealth. Qualitative field evidence supports the conjecture that support measures are gaining traction in some communities but at a much slower pace than expected by the program implementers. Our final discussion centers on lessons for the design, monitoring, and evaluation of community support measures in tropical forest conservation initiatives.

Transforming the Economy Sustaining Food, Water, Energy and Justice

The Financial System as an Impediment to Steady State

Corresponding Author: Roger Boyd - Independent Researcher
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Type of Presentation: Paper presentation

Biography: Roger Boyd has 30 years of experience in the financial industry, with an MBA in finance and an MA in economics for transition. He is the author of *Energy and The Financial System*, published by Springer. He focuses on the barriers that the current financial system provides for the move to a sustainable economy, together with other societal impediments to such a transition.

Abstract: The financial system, as it is currently configured, is completely dependent on continued exponential economic growth. The high levels of debt in the advanced economies assume the continued growth required to provide the ability of individuals, companies, and governments to repay that debt. In addition, share prices assume the continued growth of company profits. Layered on top of this are the trillions of dollars of derivatives that are fundamentally leveraged bets on continued economic growth and the ongoing viability of the currently configured financial system.

If the assumption of future growth were removed, a major reset downward in asset prices would be the logical outcome. The effects of this would ripple throughout the economy and impact the insurance and retirement portfolios that society relies on to pay current and future insurance claims and retiree benefits. The end result may very well be immediate economic contraction, rather than a transition to a steady-state economy.

Without a fundamental reorganization and right-sizing of the financial system, it will prove a major obstacle to any orderly transition to a steady-state or degrowth economic regime.

Transforming the Economy Sustaining Food, Water, Energy and Justice

The Economics of Equity: Insights from the BDY Model

Corresponding Author: Garvin Boyle - Orrery Software (Retired)
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Type of Presentation: Paper presentation

Biography: Having worked as a computer programmer/analyst, as an IT project manager, and as a high school teacher of mathematics and science, in his retirement Garvin Boyle now studies sustainable economics. His personal goal is to understand the necessary and sufficient conditions for a fully modern society to become sustainable within the capabilities of the biosphere.

Abstract: In 1988 Benatti first described an extremely simple agent-based computer model demonstrating simple capital exchanges between economic actors. In a subsequent paper, Drăgulescu and Yakovenko elaborated the model and explored its behavior and implications. Now referred to as the BDY model, it is proving to be highly pertinent to the issue of income inequity, both within national economies and between nations. In this presentation I will briefly review the history of the BDY model, its simple construction, and its easily demonstrated behavior. I will show how the ubiquitous and widespread problem of extreme economic inequality is largely a direct result of fundamental mathematical and “natural” processes unrelated to skill, talent, or greed. Empirical studies from the econophysics literature and elsewhere will be referenced, supporting the interpretation of the model results. I will argue that this model demonstrates that economic processes are relentlessly subject to an entropy-like phenomenon independent of the significant economic role of thermodynamic entropy and that the theoretical foundations of ecological economics must encompass this phenomenon, in its various manifestations, if it is to maintain its stance as a science-based discipline. I will briefly address the philosophical question of whether such “natural” processes can be viewed as bad or good and should or should not be resisted. Finally, I will briefly outline the long-term local and global policy implications that must be addressed perpetually if the goal of a sustainable steady-state economy is to be achieved and maintained.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Sustainability and Social Justice: How Do We Make These Goals Compatible?

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Type of Presentation: Paper presentation

Biography: Having worked as a computer programmer/analyst, as an IT project manager, and as a high school teacher of mathematics and science, in his retirement Garvin Boyle now studies sustainable economics. His personal goal is to understand the necessary and sufficient conditions for a fully modern society to become sustainable within the capabilities of the biosphere.

Abstract: To be truly sustainable, any modern society, whether composed at the national or global level, must have some measure of social justice. It would seem clear that, if a large portion of society feels that it is being treated unjustly, then social unrest will grow and ultimately disrupt the society, making it unsustainable. Most activist organizations, it seems, that are established to halt the advancing degradation of the biosphere in which we live have these twin goals of sustainability and justice, and the ISEE is no exception. By examining several empirical global trends, this presentation will identify a few key macroscopic characteristics of any steady-state modern global society that might, optimistically, emerge. Based on the concept that form and function must work together, several unpleasant aspects of the quality of life of a typical citizen within such a society will be identified. Finally, in light of these probable characteristics of a modern sustainable society, two questions will be addressed. Can such a society be considered to be characterized by social justice? Under what policies or social contracts might the populace of such a sustainable modern society agree that social justice has also been achieved?

Transforming the Economy Sustaining Food, Water, Energy and Justice

How and Why Ecological Economics Must Change Its Tactics

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3rd Author: William Rees - University of British Columbia

Type of Presentation: Roundtable

Biography: Our group is organized by the Economics for the Anthropocene project at McGill University, York University, and the University of Vermont. It is composed of people who wish to advance the discipline of ecological economics and see its widespread adoption in the academy.

Abstract: How should ecological economics directly challenge neo-classical economics?

At least since the time of Georgescu-Roegen ecological economics has offered strong criticisms of mainstream thinking. And the work of Kenneth Boulding and Herman Daly have developed these critiques considerably and stated them with eloquence and force. As the critiques have improved the mainstream has paid little or no attention. The Castle is impervious to attack—its moat is flooded, its bridges are up. Some have argued that EE needs to seek rapprochement and have suggested that the pricing of nature will give EE “a seat at the table.” This suggestion has led to a burgeoning field of assigning monetary value to “ecosystem services” without noticing that the idea that nature is here to serve us is entangled in theological assumptions without any basis in current science. It is also likely that the idea of nature “a la carte” has hastened and legitimated the dismemberment of natural systems. At the same time there is another approach that might be called “quiet diplomacy” where the emphasis is placed on finding common ground and mutually reinforcing insights and theory development. Yet this more promising approach has not been able to overturn the hegemony of the “circular flow” approach that characterizes the economics education of hundreds of thousands of students in North America every year. The grounds for a challenge are simple—neoliberal or neoclassical economics contains no model whatsoever of biophysical systems or the temporal and spatial properties of the ecosystems within which the economy functions; it similarly omits most aspects of real social systems (community, family, loyalty to people and place, etc.), and it badly represents even individual human behavior. This session will focus on the duties of the profession of EE to find ways to mobilize resistance to what amounts to a collective misrepresentation that lays the foundation for the growing global tragedy now gathering accelerating momentum.

Transforming the Economy Sustaining Food, Water, Energy and Justice

An Integrated Framework for Linking the Ecosystem Services Valuation with the Freshwater Flow in the Florida Everglades

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4th Author: Ross Boucek - Florida International University, Earth and Environment Department, Miami, FL USA

5th Author: Jason Osborne - National Park Service, South Florida Natural Resource Center, Homestead, FL USA

Type of Presentation: Paper presentation

Biography: Christina Estela Brown is a PhD student in the Department of Earth and Environment at Florida International University with a concentration in natural resource science and management. She is interested in economic valuation of water resources.

Abstract: Sea level rise and certain anthropogenic factors are threatening the freshwater balance in coastal marsh ecosystems. The flow of freshwater through the coastal marshes serves to maintain low salinity conditions that are essential to maintaining good habitat for certain fish, wildlife, and plant populations. For instance, in the Florida Everglades and Florida Bay, a large recreational fishery industry is a direct beneficiary of improved and sustained fishery habitat. This flow is also essential to maintaining ecosystem conditions that contribute to carbon sequestration and storage. Both the recreational experience and carbon storage are therefore gaining attention from resource managers as two of the key ecosystem services (ES) of the hydroecological system of the Everglades. Economic valuation of these ES therefore serves as an important decision tool in the context of freshwater management, policies, and research.

This research develops a methodology to determine the economic value to stakeholders of recreational fishery and carbon storage ES in the Everglades and Florida Bay that could result from different water management scenarios. Historical data on recreational fish catch per effort, freshwater flow, salinity, rainfall, and temperature are used to estimate a biophysical model that links the fish productivity with freshwater flow. The recreational economic values are estimated using a discrete choice experiment, which is based on the utility-theoretic framework, while the carbon will be valued by building on existing data. The fishery and carbon economic values will then be linked with the biophysical model in order to develop seasonal and annual penalty-flow functions that directly relate the lost economic values or the social costs with the shortfalls in meeting certain historical freshwater flow targets. This paper hopes to present preliminary findings during the conference. The paper will also demonstrate how the economic values of the fisheries and carbon storage ES can be incorporated into the broader hydroeconomic model that is currently being developed for evaluating regional water management decisions in South Florida.

Transforming the Economy Sustaining Food, Water, Energy and Justice

The Climate Gamble—Implementation of Risk Into Integrated Assessment Models

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Type of Presentation: Paper presentation

Biography: Sebastian Brun graduated as an economist from the University of Bonn (Diplom Volkswirt) in 2011. Since 2012 he has been a research assistant and graduate student at the University of the Bundeswehr Munich in the department of sustainability and change.

Abstract: There is broad consensus among climate researchers that mankind faces high risks of permanent damage if global average surface temperature increases by more than 2°C compared to preindustrial times. However, given the high uncertainty of climate modeling, it is not entirely clear what amount of greenhouse gas emissions and subsequently what concentration of greenhouse gases in the atmosphere complies with this benchmark. In general, any emission path with an at least 50% chance of not overshooting the 2°C target is still acceptable. According to the IPCC this translates to future accumulated greenhouse gas emissions of about 225 GtCO_{2e}. This free amount of emissions is often referred to as carbon space.

The present study integrates this carbon space as a stock into an integrated assessment model (based on the DICE model). In so doing, the risk of irreversible damages and abrupt changes rises exponentially with additional emissions. Based on IPCC data the corresponding probabilities of occurrence then depend on the chosen mitigation path. However, accounting for risk also means noting that even unlikely scenarios could occur. Thus, abrupt changes could happen even under a very ambitious climate policy, and no major damage might occur despite following an undemanding mitigation path.

For this reason we apply a Monte Carlo simulation technique to produce probabilistic model results. This spans a corridor of potential outcome (e.g., discounted utility) for any chosen mitigation path, where the upper (lower) limit reflects good (bad) luck. First, this allows for a reassessment of existing climate policies. In this context we revisit two mitigation paths recently postulated by Nordhaus: the optimal mitigation path (without any temperature constraints) and the limit 2°C mitigation path (which only allows temperature increases of no more than 2°C compared to preindustrial levels). Second, the approach can be used to identify an optimal mitigation path based on a presupposed level of risk aversion. Before this background an optimal mitigation path for a risk-neutral and a risk-averse policy is identified.

First preliminary results suggest that the pursuit of the optimal mitigation path postulated by Nordhaus is associated with comparatively high risk for permanent damage and abrupt change not covered by the original model. In consequence the DICE model draws a rather optimistic and fortunate picture of the corresponding welfare close to the upper limit of the calculated corridor. In contrast, calculated welfare that comes along with the limit 2°C mitigation path seems to be more centered in the corresponding corridor. This is due to the fact that the probabilities of occurrence decrease with mitigation, which in turn reduces the importance of the random parameter.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Egalitarian Green Growth Program for India

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Type of Presentation: Paper presentation

Biography: Robert Pollin is distinguished professor of economics, Department of Economics, UMass Amherst, and codirector of the Political Economy Research Institute (PERI) at UMass Amherst. Pollin's research centers on macroeconomics, conditions for low-wage workers in the United States and globally, the analysis of financial markets, and the economics of building a clean-energy economy in the United States and worldwide. Shouvik Chakraborty is a research fellow at PERI, UMass Amherst. Shouvik's research focuses on agriculture, international trade, and energy-related issues.

Abstract: This paper explores the interrelationships in India among economic growth, expanding employment opportunities, and the imperative of dramatically reducing CO2 emissions. Specifically, it shows that within a framework of economic growth, the Indian economy can expand employment opportunities for workers, peasants, and the poor while also reducing CO2 emissions. The model assumes that India grows at an average annual rate of 6.0% over a 20-year period. Within this framework, it proposes that India increase its annual total of public and private investments in energy efficiency and clean renewable energy sources by 1.5% of gross domestic product. The paper finds that India will achieve dramatic CO2 emissions reductions and generate major gains in employment opportunities by undertaking these clean energy investments, as opposed to maintaining the economy's existing fossil-fuel based energy infrastructure. India could accomplish these goals while also eliminating entirely its reliance on nuclear power.

Our study shows that, on the basis of conservative assumptions as to costs of expanding capacity in clean renewable energy and increasing energy efficiency, India can stabilize emissions per capita relative to 2012 levels and reduce emissions by 52% relative to the IEA's current policies (that is business-as-usual) framework for 2035. This study finds that the clean energy investment project can also advance human well-being in India because it would generate an increase in millions of jobs relative to maintaining India's existing fossil-fuel energy infrastructure. The basis for this result is straightforward. As we show, building a clean-energy economy in India requires significantly more labor inputs per dollar (or rupee) of expenditure than maintaining India's existing fossil fuel infrastructure. Using the methodology of input-output analysis, we estimate that the total amount of direct plus indirect employment generated through the clean energy investment project at 1.5% of GDP would be about 12 million jobs. This is about 2.6% of the overall Indian labor force of 469 million people as of 2010.

We conclude that the clean energy project for India, scaled at about 1.5% of GDP per year, will generate, first, huge reductions in CO2 emissions while, concurrently, providing expanding employment opportunities throughout the country over the full 20-year investment cycle.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Green Returns to Education—Does Schooling Contribute to Proenvironmental Behaviors? Evidence from Thailand

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Type of Presentation: Paper presentation

Biography: Thanyaporn Chankrajang is a lecturer in the Faculty of Economics, Chulalongkorn University. Her first degrees were in economics from the LSE. She subsequently received a PhD in land economy from the University of Cambridge in 2012. Her primary research interests are in development and environmental economics. In particular, she seeks to understand the patterns and the evolution of (i) land rights and (ii) human capital accumulation and their impacts on economic development and the environment.

Abstract: This paper investigates whether there are green returns to education, where formal education encourages proenvironmental behaviors using nationally representative surveys on environmental issues in Thailand. It is crucial to consider emerging economies in the climate mitigation discourse since through the process of economic development, the corresponding CO₂ emissions in these countries are increasingly not negligible. In this paper, we focus on alternative principles in addressing the ecological and environmental challenge. Instead of advocating the usual economic devices such as taxation, emissions trading, and property right assignment, we seek to verify whether individual human capital accumulation through formal education can shape environmental attitudes and behaviors and lead to proenvironmental actions. Three levels of proenvironmental attitudes and behaviors are considered: (i) concern about global warming, (ii) private actions taken, and (iii) willingness to support further public action in the future. To establish the causal relationship between education and green behaviors, we exploit the instrumental variables strategy using the compulsory schooling reform and supply of schooling, which vary through time and across regions as the instruments, while controlling for cohort and income effects. While the choice and number of instruments enable us to strongly validate instrument relevance and exogeneity, we find that more years of schooling lead to a greater probability of being more environmentally friendly. In particular, a one-year increase in education raises the probability of concern about global warming a great deal, by 2.5%. There also exists statistically significant green returns to education for knowledge-based proenvironmental actions. More specifically, an increase in one year of education raises the probability of regular use of (i) cloth bags by 2.6%, (ii) energy-saving light bulbs by 2.7%, and (iii) energy-efficient appliances by 3.4%. Likewise, a one-year increase in education decreases the probability of never using (i) cloth bags by 4%, (ii) energy-saving light bulbs by 2.1%, and (iii) energy-efficient appliances by 1.5%. Nevertheless, we find that education has no statistically significant relationship with cost-saving proenvironmental actions such as turning off unused lights, turning off the tap while brushing teeth or taking a shower, and filling in a container when washing rather than washing under a running tap. This could be because environmentally friendly actions of this type could be motivated by other incentives such as living arrangement, household conditions, and desire to be economical that are not related to environmental and climate change concerns. In addition, individuals with more schooling express lower willingness to pay for future environmental tax. A one-year increase in education lowers the probability of agreeing with the future polluter-pay environmental tax by 1.4%, possibly due to the lower trust in public institutions and hence tax morale. The findings show that regarding this issue, there is little dissimilarity between developed and developing countries. They also strongly complement the literature that is dominated by evidence from developed countries.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Postnormal Speculation in Macro Design of a Wealth-Based Economy—Real Wealth as Measure of Ecological and General Health and Happiness

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Biography: Don Chisholm is a retired engineering technologist with a varied career in aviation systems, leading-edge digital data systems of the 1970s, automatic test equipment design and marketing, and finally federal aviation inspection for Transport Canada, which included oversight of aviation-related corporate quality assurance programs. After retirement he took a strong interest in global environmental issues and produced several journal articles.

His home page is <http://members.kos.net/donchism/index.htm>

Abstract: We live in times of extreme contrast and conflicting frames of reference that identify and define reality. In one reality we have state governments that follow the economic paradigm of everlasting growth in human activity; in contrast, scientific realities tell us the human footprint is already far larger than planet Earth's natural systems can sustain. Evidence of this conflict is brought home daily through media coverage of resource wars, population overflow, and troubling news of wide-ranging ecological decline: But on November 22, 2015, the *Wall Street Journal* carried this headline: "The developed world's workforce will start to decline next year, threatening future global growth." We have moved into a paradigm junction. The next paradigm remains undefined, leaving us with no viable goal while our reality conflict results in cognitive dissonance as the preferred alternative to outright despair.

This paper briefly examines why and how a few key elements of the existing economic/monetary paradigm have, over the past century, locked us into this cancer-like growth mode that is incapable of degrowth or even a steady-state economy. To change this trajectory we need to change the way we do a few things.

We discuss the usefulness of a postnormal approach in order to free ourselves to examine and assess the interactive elements of today's evolved approach to governance, economics, money creation, and human population issues—our paradigm. We will find that the vast majority of these "normalized" abstract concepts, the building blocks of our civilization, appear to serve us well.

But today's definition of wealth, coupled with bank-controlled debt-based monetary-generating protocols, remains a key driver of instability and growth in human activity. This must change.

We will suggest one possible framework for an integrated ecological macroeconomics and monetary control system that can become an influential regulator of human activity using feedback from real-time scientific measurement of the elements of real wealth, as defined in the title. It will be a dynamic system of governance with a clearly defined goal of reaching an ecological footprint compatible with our small blue planet.

A multidisciplinary group-developed shared vision of a viable future could be an essential tool to clear the fog of cognitive dissonance that prevents widespread acknowledgement of the dire need for change, and would provide a synergetic common goal for existing change initiatives.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Dynamic Regulation of Human Activity Through Socio/Biophysical Economics

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Type of Presentation: Paper presentation

Biography: Don Chisholm is a retired engineering technologist (Ryerson Institute of Technology Toronto 1958).

His working career included general aviation systems design and maintenance, the first wave of products using early integrated circuit devices, and digital computers, and finally aviation inspection for the federal government. He has spent the past 30 years researching, writing, and communicating about the human predicament.

Abstract: This paper is predicated on the understanding that the century-old, debt-based, bank-controlled money-creation system is incompatible with Earth's biophysical realities, and for a variety of reasons is likely to soon collapse. To avoid spiraling chaos and global resource wars prior to economic collapse it is urgent that we develop and begin to popularize its replacement.

Global human activity consists of individual humans, couples, families, communities, regions, states, and nations. Sociopsychology informs us that our individual behavior is influenced somewhat by all of these relationships; however, the level of influence drops rapidly as we move out from "self." This suggests that if we are to make a significant heading change of the global ship-of-state the best place to start would be to influence human activity of the individual human and close relationships, in an acceptable manner.

A significant factor in the level of an individual's resource throughput, "activity," is our relative affluence—our available money. Where women are educated, free-and-equal affluence also influences procreation choices, "human." Local peer pressure also has a significant effect. With this in mind we explore the merits and potential design of a science-based socio/biophysical economic system where we scientifically measure and assess the well-being of a large number of critical factors of our social and biophysical world's regions—accessible energy, biodiversity, and so on. Also measured are critical parameters of civilizations' infrastructure such as the stability of essential corporations and of human well-being and happiness within each region.

These socio/biophysical measurements form the input data for an interactive dynamic system with a goal of reducing the human ecological footprint toward a sustainable level. Transparent money creation and flow rates guided by input data provide dynamic feedback regulation of human activity at the individual and regional levels.

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Do Conservation Incentives Increase the Effectiveness of Protected Areas? A Spatial Matching Analysis of the Bolsa Floresta Program in the Brazilian Amazon

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Type of Presentation: Paper presentation

Biography: The lead author is a senior researcher and environmental economist in resource economics at the Institute for Food and Resource Economics. We specialize in our work on impact evaluation of tropical forest conservation combining different disciplines from economics, social science, geography, and biology.

Abstract: Incentive-based forest conservation programs, including under REDD+, are often piloted in protected areas. Separating the conservation impact of the protected area status from the incentive component thus represents a methodological challenge for impact evaluation. We employ a spatial matching approach to measure early conservation outcomes of the Bolsa Floresta Program (BFP), in the Brazilian state of Amazonas. Since 2007, the BFP offers community support measures coupled with payments for environmental services to inhabitants of 15 state-owned extractive reserves. The program depends on its ability to deter illegal invasion and increase local communities' compliance with environmental regulations of the reserves. In our theoretical framework the impact of payments for environmental services in protected areas is linked to economic pressures to clear forest arising from different sources inside and outside the reserves. We use a grid-based data structure, where potential control grid cells lie in extractive reserves not covered by the BFP. Selection bias is minimized by matching on spatially explicit covariates covering multiple preintervention years. Our findings confirm our theory of change, revealing heterogeneous conservation effects of the program across the targeted reserves. Deforestation significantly declines where deforestation pressures are low within reserves but high in the surrounding regions of reserves. In contrast, forest clearance increases in treated reserves in and around which deforestation was historically high. Due to the diverging effects across reserves the overall program effect averages zero. We discuss implications for the design and evaluation of forest conservation schemes that combine multiple policy instruments.

Transforming the Economy Sustaining Food, Water, Energy and Justice

A Dynamized Input-Output Economic Model Integrated Within a System Dynamics Ecological Model—Applying Feedback Loop Methodology to Fish Nursery Restoration

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Type of Presentation: Paper presentation

Biography: Takuro Uehara, Bertrand Hamaide, and Mateo Cordier met at Rio+20 at ISEE's international conference. Later Jeffrey Weih joined the team. He had met Takuro a few years before in the United-States.

Abstract: While environmentally extended input-output (I-O) models are commonly used for capturing interactions between ecological and economic systems, this kind of modeling cannot reflect interactions inside the ecosystem. Isard's (1968) model has been the only exception. He entered interactions occurring within the ecosystem into I-O. Nevertheless, given the linearity of I-O, he could only analyze environmental issues in a linear fashion.

We propose an alternative that reverses Isard's model types: the economic system is modeled within the ecosystem (not the contrary) as one of the ecosystem's components. To demonstrate its feasibility, we develop an ecological-economic model by integrating conventional economic I-O within system dynamics (SD), which captures nonlinear dynamics.

The originality of our model is that, first, there has thus far been no synchronization of an SD model with I-O; previous models translated I-O into SD, which is too laborious and inefficient. Second, SD-based I-O models in the literature have not incorporated ecosystem components. Third, our SD/I-O model incorporates five feedback loops between the ecosystem and the economic system.

After describing the methodological issues, we "test" the SD/I-O model on ecological and economic data by applying it to the restoration and destruction of the Seine Estuary, France, where common soles live. Our model brings insight into the consideration of feedback loops in the modeling of interactions between the ecosystem and the economic system. We believe such a tool may be of help to decision makers mixing economic and environmental issues like, in our application case, for example, fish habitat and economic harbor development.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Beyond Limits—Ecological Economics in an Age of Partial Abundance

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Type of Presentation: Paper presentation

Biography: David Courard-Hauri is the director of the Environmental Science and Policy Program at Drake University and has been a lead author on the annual Iowa Climate Statements since 2011.

Abstract: One of the key principles of ecological economics has been and remains the “full world” preanalytic vision. However, estimates of the timescale for resource depletion, most importantly in the “peak oil” and food scarcity debates, have not been predictive. Some authors have suggested that the full-world vision applies more to assimilative capacity of wastes than direct resource limits; indeed, the ecological footprint calculation is driven largely by considerations of carbon emissions and the potential rate of natural sequestration. The dangers of overwhelming ecological assimilative capacities present a more complex problem than avoiding direct resource limits because, without robust international mechanisms to address these types of issues, classic tragedy-of-the-commons analysis applies. However, emissions too are susceptible to technological solutions, and evidence suggests these may allow us to avoid yet another catastrophic limit where political solutions failed. Given the disparity between energy potentially available and energy required for human processes, it appears possible that in some ways Julian Simon was right to posit a future in which physical limits are often not binding. And yet, we face a world with a devastated biosphere, deeply unjust wealth inequality, increasingly dangerous and widely accessible tools of large-scale destruction, and the potential for advanced robotics and artificial intelligence to make significant groups of the global population unemployable and economically superfluous. Given this dangerous future, what does an ecological economics look like if freed from its “full world” roots?

Transforming the Economy Sustaining Food, Water, Energy and Justice

Critical Analysis of Bioeconomy as a New Way for a More Effective and Environmentally Friendly Energy Supply

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Type of Presentation: Paper presentation

Biography: Eva Cudlínová, associated professor, was educated at the University of Economics in Prague. She has been working as a lecturer in ecological and environmental economics at the university for more than 15 years. She has been a member of ISEE since the conference in Stockholm in 1993 and used to be coordinator of the Czech part of the EU Framework projects. The last was the EU project GILDED, which focused on a European Post-Carbon Society. She was also a member of EU Bioeconomic panel.

Abstract: Our paper focuses on a critical overview of the present situation of bio-based production of energy in EU from the position of sustainability. At the Rio+20 Summit in Johannesburg the concept of green economy was presented as a way to move from economic crisis to green economic growth with solutions for greenhouse gas pollution. The bioeconomy seems to be a very promising branch of the green economy concept. Bioeconomy is presented as an inherent part of green economy, which is based on the use of renewable resources from land and sea and the use of waste to make value-added products such as food, feed, bio-based products, and bioenergy and biofuels. Bioeconomy as a concept has officially been supported by EU policy from the beginning of 2012, and many EU countries have their own strategy for bioeconomy. In a simplistic way bioeconomy could be characterized as replacing the oil-based economy, which relies on oil refinery, with a bio-based economy with biorefinery. With biorefineries in their present form, many critics have also pointed out the negative effects of such a kind of energy production. The EU's target of 10% renewable energy in the transport sector by 2020 has been almost solely met with biofuels. Contrary to what many first envisioned, these have not been biofuels from residues or energy crops grown on marginal land. So far almost 90% of the target has been met with food crops such as rapeseed and soy grown on prime agricultural land inside and outside the EU. Europe urgently needs to rethink its bioenergy policies to account for their true impact on the climate, biodiversity, and food scarcity. The policy must ensure true GHG savings from bioenergy use and remove its automatic-zero carbon rating in EU energy policies. Further, it should also take into account the limited supply of biomass resources and land scarcity. This paper will compare the advantages and pitfalls of a new bio-based energy production as it could be found in research reports and political documents and find some new, reliable energy solution from a sustainable point of view.

Keywords: bioeconomy, biorefinery, bio-based energy

Transforming the Economy Sustaining Food, Water, Energy and Justice

Sustaining the Ski Industry: An Ecological Economic Perspective

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Type of Presentation: Paper presentation

Biography: Dr. Daley graduated in 1984 from the University of Maine, Orono, with a BS in chemical engineering. He earned a MA and PhD in economics from the Whittemore School, Durham, New Hampshire. His research interests include ecological economics and pedagogy of economics education. Dr. Daley was instrumental in creating and cochaired the UNE Environmental Council. He chaired the Paul D. Merrill Business Ethics Lecture Series. Dr. Daley served on the President's Climate Committee Action Team.

Abstract: Owners and management in the ski resort industry do not debate whether winters are warmer and shorter or if natural snow is scarcer than a few decades ago. This is evident in ski markets around the globe. Low- and high-altitude resorts alike can simply look at records showing increased reliance on snow-making activity to open on time, maintain adequate conditions, and avoid closing prematurely. Industry analysis indicates that a decrease in the number of ski operations in high-impact areas and a consolidation of ownership in low-impact have been underway for nearly three decades and only accelerated in the past decade. To date, efforts to cost-effectively combat a decreasing number of ski days with manufactured snow production, a struggle only complicated by a decreasing number of available snow-making days, have relied primarily on dramatic improvements in snow-making technology, which have lowered unit costs dramatically. However, the potential for reduced ski days resulting from global warming and reduced snowfall, in combination with a slowdown in snow-making efficiency, could spell serious trouble for an industry already facing steady pressure to maintain profitability and visitor demand. This paper presents a summary review of the ski resort industry's reliance on and relationship with manufactured snow as it has emerged over the past several decades. In contrast to the growth, efficiency, technology intensification model practiced by owners and management over this time frame, this paper argues that to be sustainable the ski industry must shift focus and treat snow as scarce manufactured capital. In shifting paradigms, the industry must clearly define their scale and scope of snow-making activity, cap snow-making production, and intensify efforts to preserve and conserve its manufactured capital.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Rice Intensive Cropping and Balanced Cropping in the Mekong Delta, Vietnam—Economic and Ecological Considerations

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Type of Presentation: Paper presentation

Biography: Tong Yen Dan has been a PhD candidate in environmental and ecological economics at the Center for Water Policy and Management, La Trobe Business School, La Trobe University, Australia, from March 2012 to the present and, since 2005, a lecturer in the Department of Agricultural Economics and Environmental Economics, School of Economics and Business Administration, Can Tho University, Vietnam.

Abstract: Rice intensification in Vietnam relies on the construction of high dykes in the Mekong Delta floodplain to prevent flood waters from entering fields during the flood season. This enables three rice crops to be grown annually instead of two. On the floodplain, two rice crops can be described as “balanced cropping,” since this integrates a natural fish harvest during the flood season as part of the rice field ecosystem. This study surveys agricultural practices among “three-crop” and “two-crop” farmers on the floodplain. It is argued that planting three crops (“intensive cropping”) cannot provide a sustainable alternative to balanced cropping, either from an economic or an ecological viewpoint. These findings suggest a case for limiting further dyke heightening as well as the need to recognize the societal value of balanced cropping systems for efficient and environmentally sound food production.

Transforming the Economy Sustaining Food, Water, Energy and Justice

New Developments in Fisheries Management—Moving Toward Sustainable Food Systems?

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Type of Presentation: Paper presentation

Biography: Ralf Doering is head of the economic analysis unit at the Institute of Sea Fisheries. He holds a master's in environmental and resource economics and a PhD in fisheries economics on the sustainable exploitation of fish stocks in the coastal waters of Rügen Island, Germany. He is a member of the Scientific, Technical and Economic Committee of the European Commission.

Abstract: Until the beginning of the 1970s marine ecosystems were seen as an endless source of food especially of fish as a very important worldwide protein source. In the meantime, however, the FAO concludes that approximately 25% of all commercially harvested fish stocks are overfished or in the status of recovery. Additionally, 50% are fished at the highest possible level. That means that only 25% are fished at a level where an increase in catches is possible. Additionally, many fisheries have high negative impacts on nontarget species, birds, marine mammals, and bottom habitats. Due to these reasons fisheries are often seen as a classical example of an unsustainable food system. Accordingly, the capacity of the oceans to provide food with fish is believed to be reaching its limits.

The fishing sector seems to risk its future for some short-term gains. On the other hand, over the last years in many countries new management instruments were introduced to improve the sustainable exploitation of fish stocks. This can be interpreted to be a result of the adoption of the concept of maximum sustainable yield (MSY) in the Johannesburg declaration, which now must be achieved by 2020 at the latest.

The adoption of MSY can be seen as a target, which from an economic point of view should be achieved with the lowest costs (cost-effectiveness approach). Over the last years bioeconomic models were developed to assess the economic impacts of management strategies. A lot of assessments came to the conclusion that short-term losses from reducing fishing efforts to rebuild the stocks are a good investment in the stocks as increasing stock levels allowed higher catches and, therefore, fishers were better off.

In the paper I will describe, first, the background of the MSY concept and its economic implications and, second, the achievements of the EU's Common Fisheries Policy toward achieving MSY. I will present some examples as to why such a policy can be seen to a certain extent as a success from the perspective of ecological economics, as it can reduce the impact on the overall ecosystem substantially. Third, I will show a few results from the impact assessments to give an indication that the rebuilding of fish stocks is a good strategy for securing long-term gains. Finally I will compare the EU model with the US approach recently implemented in the revised Magnuson-Stevenson Act.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Governing the Water-Energy Nexus Related to Hydropower on International Rivers—The Role for River Basin and Regional Energy Organizations?

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Type of Presentation: Paper presentation

Biography: Dr. Ines Dombrowsky heads the Environmental Policy Department at the German Development Institute / Deutsches Institut für Entwicklungspolitik (DIE) in Bonn, Germany, Dr. Waltina Scheumann is a senior researcher in the department. Both focus on water governance issues and have a long track record on conflict and cooperation on shared rivers and on environmental and social issues related to hydropower projects in developing countries and emerging economies.

Abstract: In international river basins, hydropower projects (HPPs) generate multiple cross-border and cross-sectoral interdependencies related to the water-energy-food-environment nexus. Governing them relies on voluntary negotiations between the water-, energy-, and environmental ministries or agencies of the countries involved, but private companies, civil society actors, and international donors may also play a role. It can be assumed that the actors involved have incentives to engage in international cooperation related to hydropower if cooperation increases net benefits compared to unilateral projects. It is argued that such negotiations may be facilitated by regional organizations, such as international river basin organizations (RBOs), which may reduce uncertainty and transaction costs by providing credibility, neutrality, information, and financial means. In particular, in the case of hydropower they may also seek to reduce negative environmental and social effects. However, it is less clear what clout international RBOs really have in dealing with HPP. Instead there are indications that regional energy organizations (REGs) may also play a role. The paper therefore explores the role of international RBOs and REGs respectively in managing water-energy-environment interlinkages related to HPP on shared rivers.

It does so by scrutinizing four cases in which either international RBOs or REGs play a role in ongoing negotiations on HPPs. These include a comprehensive literature review on the Xayaburi dam on the Mekong main stem in Laos and empirical investigations on the Rusumo Falls HPP by Burundi, Rwanda, and Tanzania on the Kagera River, the Ruzizi III HPP by Burundi, DR Congo, and Rwanda on the Ruzizi River, and on hydropower development on the Coruh River by Turkey and Georgia.

The paper finds that in the donor-supported Kagera case the Nile Basin Initiative (NBI) as an international RBO has been able to mediate the project and to foster the application of environmental and social safeguards, with substantial donor backing. In contrast, the Mekong River Commission (MRC) did not succeed in augmenting environmental and social standards related to the Xayaburi dam, developed without donor support. In the case of Ruzizi III, a REG, Energy of the Great Lakes (EGL), plays an important role in mediating ongoing negotiations and even initiated the setup of the international Lake Kivu RBO to protect the HPP from negative land use impacts; still donors insist on environmental and social safeguards. On the Coruh, an impasse in transboundary water negotiations was at least partly overcome by a bilateral deal of the Georgian and Turkish Energy Ministers setting up a bilateral committee for electricity trade; still it is unlikely that this arrangement will also address negative environmental effects. Hence, not only international RBOs but also REGs may play a role in fostering cooperation on HPPs on shared rivers and may in some cases even be more successful than RBOs. However, REGs might be less concerned with the environmental and social effects on such projects. Hence, international RBOs may still be important for bringing these issues on the agenda, as are international donors if they are involved.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Integrated Circular Economy Evaluation Method of Chinese Refinery Enterprises

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Type of Presentation: Paper presentation

Biography: Mr. Dong is a PhD candidate in energy at the China University of Petroleum, Beijing. Mr. Dong has had six papers accepted for publication, with five of them published to date. He focuses on energy systems modeling and energy economics.

Abstract: In facing the challenges and opportunities that arise as they enlarge their scope, upgrade their products' quality, enhance their energy/equipment price ratio, and respond to pressures to save energy, Chinese refinery enterprises are launching a new energy-saving retrofit. To do this, it is necessary for Chinese refinery enterprises to begin by developing a circular economy. This paper first presents a comprehensive and systematic investigation of the influencing factors of Chinese refinery enterprises' circular economy on the levels of economics, resource use, cleaner production and 3R, and environmental impact. This paper next constructs an evaluating index system of Chinese refinery enterprises' circular economy. Finally, this paper uses the DHGF method to empirically evaluate this evaluating index system. The empirical results indicate that this evaluating index system is significant in reflecting the level of circular economy objectively and accurately; therefore, it can be widely used to evaluate the level of Chinese refinery enterprises' circular economy.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Analysis of the Influencing Factors of Coal-Based Synthetic Natural Gas (SNG) Industry Development in China, Based on a Structural Equation Model

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2nd Author: Xiucheng Dong - College of Business Administration, China University of Petroleum (CUPB), Beijing

Type of Presentation: Paper presentation

Biography: Cong Dong is a PhD candidate at the College of Business Administration in China University of Petroleum (Beijing), majoring in energy strategy and policy systems.

Abstract: At present, the Chinese government takes the attitude toward the development of coal-based synthetic natural gas (SNG) industry that it should be neither standstill nor blisteringly developed. It is proposed by the National Energy Administration that the development of the coal-based SNG industry should be determined by China's national conditions as the realistic choice of China's energy structure adjustment so as to guarantee energy security and to meet the urgent needs of the natural gas supply. As of October 2014, there were 54 projects concerning coal-based synthetic natural gas at different stages.

Based on the actual situation of the coal-based SNG industry in China, resources, environment, market, technology, and policy are fully considered in the analysis of industry development. Meanwhile, 280 copies of questionnaires were distributed to scholars and practitioners in this field from related universities, institutions, and enterprises, 264 of which were returned, with a response rate of 94.3%. After scientific screening, 262 issues were selected as the effective ones. This paper first analyzes the survey data, including statistical analysis of sample distribution as well as the reliability and validity analysis of the questionnaire, and then builds the structural equation model of the factors that influence the development of the coal-based SNG industry. Results from empirical studies reveal the important factors affecting the development of the industry in China, the degree of influence, and the relationship between factors. First, the software SPSS17.0 is employed to statistically analyze the sample distribution as well as the reliability and validity of the questionnaire for 262 collected valid questionnaires. Then, the software AMOS 7.0 is used to do the confirmatory factor analysis for the data passing statistical tests so as to investigate the fitting degree of the survey data and the conceptual model as well as verify the model's scientificity and rationality. Furthermore, hypothesis tests are done according to the results of paths analysis of the structural equation model, further results of which are analyzed. It is illustrated in the structural equation model path diagram that the environment, technology, policy, and market directly or indirectly influence SNG industry development. In the end, suggestions are put forward.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Energy, Ecology and Equity in Quebec—The Second “Economics for the Anthropocene” Graduate Field Course

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Type of Presentation: Full session

Biography: This session is presented by the energy cohort of Economics for the Anthropocene (E4A). E4A is a diverse partnership of 25 academic, government, and NGO partners designed to improve how the social sciences connect to scientific realities about the human-Earth relationship. This is the second cohort of graduate students being trained in ecological economics concurrently at York University, McGill University, and the University of Vermont.

Abstract: Fossil fuel burning for energy is the greatest contributor to greenhouse gas emissions worldwide. On the other hand, worldwide, over 1.3 billion people lack access to electricity, and many more live in energy poverty that limits basic human needs. Expansion of renewable energy sources is critical for meeting the conflicting needs of energy and climate security. The Canadian province of Quebec is a world leader in renewable energy, producing 97% of electricity from renewable sources, nearly all from hydropower. This electricity also represents a substantial portion of the clean-energy portfolios of several other Canadian provinces and U.S. states.

This session presents the results of the second Economics for the Anthropocene (E4A) graduate field course, conducted May of 2016, focusing on Quebec’s role in the continental and global energy system. E4A is a diverse partnership of 25 academic, government, and NGO partners designed to improve how the social sciences connect to scientific realities about the human-Earth relationship. E4A is a first-of-its kind international collaboration in ecological economics, training PhD and master’s students at McGill University, York University, and the University of Vermont (UVM).

As global energy continues to change, Quebec stands at a crossroads as both a major exporter of clean energy and a shipping corridor for hydrocarbon fuels. Our research analyzes the current state of Quebec’s energy system and its possible future development from a tripartite view of ecological health, social equity, and economic sufficiency. Research areas will include historical impacts of hydropower infrastructure on First Nation peoples and aquatic ecosystems as well as analysis of plans for future energy infrastructure. These include expanded hydroelectricity infrastructure, wind energy development, and crude oil and natural gas transportation for export. Furthermore, the challenge of reducing nonelectricity fossil fuel use in heating and transportation—more than half of Quebec’s energy use—will be examined.

This course draws on UVM’s Gund Institute for Ecological Economics’s experience in organizing ecological economic field courses or *ateliers* for high impact research: previous ateliers have resulted in national or international conference sessions and special issues of the journal *Ecological Economics*.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Forest Restoration, Farmer Livelihoods, and Environmental Regularization—A PAR Approach to Ecosystem Services in the Atlantic Rainforest, Southern Brazil

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3rd Author: Alfredo Fantini - Federal University of Santa Catarina

4th Author: Joshua Farley - University of Vermont, Gund Institute for Ecological Economics

Type of Presentation: Paper presentation

Biography: The Redesigning Agroecosystems Research Group is an international initiative located at the Silvopastoral System Lab. (LASS) at the Federal University of Santa Catarina. It is dedicated to improving the livelihoods of small family farmers, protecting and restoring the Atlantic Forest's ecosystem services, and training a new generation of agroecologists. Drs. Schmitt-Filho and Farley are fellows at UVM's Gund Institute for Ecological Economics, where Benjamin Dube is doing his PhD.

Abstract: The Atlantic Forest (AF), one of the world's critically endangered biodiversity hotspots, is home to over 11,000 species and 100 million people. Some 15% of original forest cover remains. Forest loss likely contributes to catastrophic landslides, flooding, and the degradation of other critical ecosystem services ranging from water purification to pest control. Scientists have identified an ecological threshold at 30% forest cover, below which biodiversity and its associated ecosystem services likely plunge. The Brazilian forest code (BFC) mandates extensive restoration, which could avoid these outcomes, but many small family farmers rely on open pastures and croplands for their livelihoods. For 19 years the Redesigning Agroecosystem Research Group (UFSC and Gund IEE, UVM; former Voisin Grazing Group) has worked with dairy farmers in the Serra Geral of Santa Catarina to design and implement agroecological systems that improve pasture productivity while restoring ecosystem services. While farmers have expressed satisfaction with productivity gains from pasture-based dairy, restoring system resilience requires more extensive forest cover on individual farms and rapid dissemination of agroecological practices across the landscape. Here we present preliminary results from the next stage of the project. In this phase, 50 farms have volunteered to implement novel biodiverse Voisin silvopastoral systems and multifunction riparian forests in three micro-watersheds in Santa Rosa de Lima municipality. Both agroecological systems were developed by our Brazilian researchers partners using interdisciplinary, participatory action research. Farmers, students, local technicians, and researchers develop and implement these farm projects through a hands-on learning process. We are currently working with state and local governments to provide in-kind contributions and financial assistance to farmers, including compensation for opportunity costs, until tree crops begin producing. The project team, from both UVM and UFSC, will assist farmers during a spring field course, in preparing rural environmental registries of their properties, as mandated by the BFC, initiating the gathering of baseline economic and ecological data, and working with the municipal government and state agencies to develop a program of coinvestment in stewardship. Herein, we present a framework for protecting and expanding environmental services by combining enforcement of existing regulations, coinvestment in stewardship, and university research and extension. We contrast this model with the more common payments for ecosystem services schemes.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Region-Specific Drivers of and Barriers to Organic Farming in Germany

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2nd Author: Axel Schaffer - Bundeswehr University Munich

Type of Presentation: Paper presentation

Biography: Claudia Duevelmeyer currently works as a research assistant at the Department of Change and Sustainability at the Economic Faculty of the Bundeswehr University, Munich. She earned her bachelor's degree in international business administration at the European University Viadrina in 2009 and her master's degree in sustainable resource management at the Munich University of Technology in 2012.

Abstract: In 2002 the German federal government within its strategy for sustainable development set the aim to increase the share of organically farmed land to 20% of total agricultural land by 2010. Though shares have increased continuously, the target has not been reached yet. In order to fine-tune corresponding policy measures it is therefore of high interest to learn more about major determinants of organic farming. Following this line of thought, the current study identifies region-specific drivers of and barriers to organic farming in Germany by applying a spatial regression analysis to Germany's 295 rural counties. Due to the different agricultural structures in northern, southern, and eastern Germany, particularly concerning farm size and land use type, the analysis is conducted separately for each of those larger areas.

Preliminary results confirm the findings of earlier studies, according to which the share of organically farmed land positively and significantly relates to the regional share of meadows and pastures. It is further driven by the regional consumers' environmental awareness and thus attitude toward organic products (measured by votes for the Green Party in the last federal election). Both findings hold for northern, southern, and eastern Germany. In the south and the east, organic farming is also significantly determined by the adoption of renewable energy, albeit in different directions. While on-farm energy production seems to be in conflict with organic farming for southern regions, the results indicate a clearly positive correlation for eastern counties. The same holds for the regions' touristic orientation, which seems to have a (significantly) negative impact in the south but a (significantly) positive effect in the east. The farmers' professional status is only significant for northern counties, where organic farming increases with the share of farms run on a sideline basis. Finally, we identify spatial autocorrelation in the north and the south. In contrast, no neighborhood effects can be observed for eastern counties.

Policy implications focus on potential conflicts of organic farming with the adoption of renewable energy (particularly in the south), with ongoing professionalization and the continuous loss of meadows and pastures (in all larger areas).

Transforming the Economy Sustaining Food, Water, Energy and Justice

Leading National Energy Transitions One State at a Time: Carbon Pricing and Strategy at Subnational Scales

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Type of Presentation: Paper presentation

Biography: Professor Erickson has published widely on climate change policy, renewable energy economics, and environmental management; led international research and education programs as a Fulbright Scholar in Tanzania and visiting professor in the Dominican Republic, Iceland, and Slovakia; produced Emmy Award-winning documentary films on water, energy, and food system transitions; and founded and led numerous nonprofit organizations including the U.S. Society for Ecological Economics, Adirondack Research Consortium, Deportes para la Vida, and Bright Blue EcoMedia.

Abstract: It's widely argued that a large-scale energy transition requires significant taxation of fossil fuels, particularly in nations such as the United States with well-below-average energy taxes and above-average per capita energy use. Among OECD countries, the United States has the second-lowest energy taxes at EUR 0.3 per gigajoule, just above Mexico, and only 9% of the OECD average. In terms of an effective carbon tax rate, U.S. federal energy taxes sum to the equivalent of EUR 4.8 per ton CO₂, (in 2012) compared to an OECD average of EUR 52 per ton CO₂. While federal politics have been persistently against energy tax increases for over two decades, the recent U.S. Congress did see six different carbon pricing bills. However, progress on carbon pricing is coming from the states. The OECD analysis is limited to federal taxes, but including state fuel taxes brings some states closer to the OECD average. State gasoline taxes alone vary from \$0.124 per gallon in Alaska to \$0.485 per gallon in California, over 2.5 times the \$0.184 per gallon federal gas tax. While federal gasoline taxes haven't changed in over twenty years, over the last few years six states and Washington, DC, raised gas taxes, and another five raised taxes in 2015. While most of these tax increases have been earmarked for transportation infrastructure, a number of states have active carbon tax proposals, including Vermont, Massachusetts, Washington, and California. This paper will explore the economics, viability, and politics of subnational strategies to carbon pricing. I will highlight the current Vermont case, explore lessons learned from other subnational examples such as British Columbia, and analyze impacts from current state-led strategies to carbon emissions reductions.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Education for the Anthropocene

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Biography: Professor Erickson has published widely on climate change policy, renewable energy economics, and environmental management; led international research and education programs as a Fulbright Scholar in Tanzania and visiting professor in the Dominican Republic, Iceland, and Slovakia; produced Emmy Award-winning documentary films on water, energy, and food system transitions; and founded and led numerous nonprofit organizations including the U.S. Society for Ecological Economics, Adirondack Research Consortium, Deportes para la Vida, and Bright Blue EcoMedia.

Abstract: What if the natural sciences were seen as foundational to the social sciences and humanities, rather than a competing branch of knowledge? What if fields of study within the social sciences and humanities developed from a metaphysical view that embedded humanity within the Earth's biogeochemical systems, subject to the physical laws of the universe? What if normative fields such as economics, finance, governance, law, and ethics—fields that tell us what we ought to do—were informed by the more positive disciplines of physics, chemistry, and biology? Economics prescribes growth; finance how to manage personal, corporate, and public wealth; law the rights of property owners and the boundaries of legally allowable personal conduct; governance the legitimate powers of the state and other bodies; and ethics the privileges and duties of individual persons. Where does the “ought” of the normative conflict with the “is” of the positive?

Herein lie the necessary questions that open up a fresh and hopeful vision for the future. Today we have a better understanding of the cosmos than at any time in history. The scientific narrative that begins with the big bang and extends to the emergence of life on earth provides a new perspective from which to build the study of human economies and institutions, to guide public policy and governance, and to provide a new foundation and ethics that could help guide humanity through the planetary crises of climate change, mass extinction of species, and social conflict over growing human demands on dwindling planetary resources.

If the academy is to be relevant in addressing the ecological crises of our time, then research should purposefully consolidate worldviews between the natural sciences, social sciences, and humanities. This consolidation has some success in the more “positive” social science disciplines such as psychology and anthropology that have formed alliances with the natural sciences based on neuroscience and evolutionary biology. However, there is less discourse with the intellectual traditions of the more normative disciplines of the social sciences and humanities, a principal focus of this presentation. Ecological economics will be presented as one compelling example of building a study of the human economy that is (1) viewed as a complex social system and embedded in the biophysical universe, (2) grounded in the evidentiary standard of physical and biological sciences, and (3) framed in a problem-solving approach built on methodological pluralism that borrows broadly from many fields.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Water-Land Nexus Relationships in Socioeconomic Systems

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2nd Author: Bin Chen - Beijing Normal University

Type of Presentation: Speed talk

Biography: Delin Fang is an environmental scientist with a research focus on water resources management and modeling the interaction between human and environmental systems.

Abstract: The water and land are two essential and fundamental supporting resources for urban rapid development and environmental sustainability. The interaction between these two resources is complex, existing not only in natural systems, but also in human-dominated socioeconomic systems. Furthermore, as a result of growing water and land resource scarcity, the resources' related interconnectedness of the socioeconomic sectors has become more obvious. This research uses the concepts of virtual water and land footprint to interpret the water and land transaction networks in urban systems. Ecological network analysis is used to manifest the nexus relationships between water and land resources as well as the pair-wise control and utility relationships between economic sectors with a case study of Beijing.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Before Feeding 9 Billion...

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3rd Author: Joshua Farley - University of Vermont, Gund Institute for Ecological Economics

4th Author: Ernesto Mendez - University of Vermont, Plant and Soil Sciences

5th Author: Abdon Schmitt-Filho - Universidade Federal de Santa Catarina

Type of Presentation: Paper presentation

Biography: Juan Alvez comes from a pasture-based farm in Uruguay. He obtained his BS in agronomy in Brazil and his MS in plant and soil science and his PhD in natural resources at the University of Vermont. He has conducted interdisciplinary research in agroecology, ecosystems services, conservation policy, green markets, and ecological economics. His work addresses environmental, social, and productive aspects of farms with an emphasis on dairy management, ecosystems conservation, and sustainable livelihoods.

Abstract: In recent decades, population growth (especially in urban centers), coupled with higher living standards, has been demanding ever-increasing amounts of agricultural products. Meeting this demand has required intensification of the productive process, burdening already degraded ecosystems. Globally, around 38% of earth's land area is under some agricultural use, and within this context, livestock represents the single largest anthropogenic land use in the world, occupying between 25 to 45% of the area. Several studies have shown the negative consequences of conventional agricultural intensification on forests, biodiversity, habitat, soils, water, and rural livelihoods. Thereby, intensification of conventional agriculture is unsustainable due to the unprecedented and ever-increasing global loss of natural resources. Conventional agriculture relies on external inputs such as synthetic fertilizers, pesticides, and mechanization, which greatly depends on fossil fuels. In this sense, the Millennium Ecosystem Assessment has identified the decline of fifteen ecosystem functions, many of them related to conversion of natural land to agriculture, changes in agricultural practices, and changes from agriculture to urban uses. Evidence of climate change, coupled with these consequences, can cause further environmental degradation and economic losses.

Within this scenario, by 2050, farmers must satisfy food production for nine billion people, which represents an increase of over 50% from current production. The solution requires a broad discussion and bold policies considering intensification using agroecological principles because they may be the only suitable answer to restore ecosystem functions and services. Ecosystem services are vital to the benefits all species receive from healthy ecosystems. They are mostly public goods, and they cannot be easily marketed because of their nonrival and nonexcludability condition.

On the other hand, livestock—and the dairy sector in particular—are major providers of rural livelihoods, supporting over one billion people worldwide and generating almost \$1.5 trillion USD annually. The factor of livelihoods comprises the “different ways of making a living,” and considers development, equity, and environmental aspects in the process in which rural people create livelihoods for their households. Therefore, while healthy agroecosystems produce essential goods and services, the disservices of conventional agricultural practices alter the carrying capacity of the very ecosystems they depend on. The cost of agricultural disservices, from conventional agricultural practices, far exceeds the costs of transitioning to alternative agriculture. Therefore, achieving the balance between sound agricultural practices, sustainable livelihoods, and environmental protection has paramount relevance.

To restore the benefits of ecosystems, produce food for 9 billion people, and improve rural livelihoods on the same land, farmers must adapt their farming practices within agroecological practices. These practices provide a future path for reconciliation between production and conservation. By understanding farmers' needs and environmental constraints, it seems economically feasible to shift farm subsidies that support conventional agriculture toward farmers who adopt agroecological practices. Consequently, education, sound incentive mechanisms, and a strong academic and extension service must play a very important role in informing legislators to prioritize science-based agroecological practices that can address fair income to farmers and are suited to local food systems.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Walking Forward Together: Learning to Learn

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2nd Author: David Barkin - Universidad Autónoma Metropolitana, Xochimilco, Mexico City

Type of Presentation: Paper presentation

Biography: Katharine Farrell is a theorist of Ecological Political Economy, holding three honors degrees and one degree by research. Her work focuses on the political economy of knowledge concerning the environment, institutional aspects of ecosystems services valuation, ecological economics production theory, and environmental politics. Her current empirical work focuses on the role of science (and scientists) in sustainable development and the role of time and tradition in processes and principles of ecological economic production.

Abstract: A basic feature of 21st-century ecological economics is the presence of a consensus regarding the need to develop human understanding of human/human and human/nonhuman nature relationships in a context-aware, multidimensional, epistemologically complex manner. However, at the very same time that this consensus is being reached, the place-embedded, complex traditional knowledge of indigenous and local communities across the world is being destroyed by late-industrial globalized economic processes that are buttressed by modern scientific knowledge production. We understand this paradox to be a symptom of a stage in human history and wish to suggest here that the project of theorizing and operationalizing democratic methods for conducting what Funtowicz and Ravetz have called “extended peer review” is a moral duty of all ecological economists. We make a firm distinction between study of and study in collaboration with these communities, rejecting the former as an instrumentalization of these peoples and calling for practice of the latter as a moral duty. Based on references to a series of concrete examples of the kinds of context-aware knowledge systems that already exist in local and indigenous communities across the world, we explore the ways in which ecological economists can contribute to improving both the well-being of these communities and global social ecological sustainability by directly addressing the challenges of developing democratic transdisciplinary methodologies.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Study on the Relationship Between the Peak Demand of Fossil Fuels and Economic Growth

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Type of Presentation: Paper presentation

Biography: The authors are graduate students of the School of Business at China University of Petroleum (Beijing).

Abstract: Fossil fuel is closely related to economic development; data shows that fossil energy production and consumption always display very similar trends to the global GDP. However, interactions between the energy and economic system and their restricting mechanisms are not entirely explained. The production, consumption, and price of fossil fuels are closely related with economic development; the economic system influences fossil fuel production and consumption by demand. Based on the principle of feedback loops between these two systems, system dynamics are selected to achieve the modeling. The modeling includes two subsystems: energy and economic. The energy subsystem uses a Hubbert model to calculate the fossil fuels' production, and the economic system uses the CD production function to calculate the GDP and to estimate the modulus of elasticity. The result proves that the production and consumption of energy are determined by economic development; namely, a demand peak exists for fossil energy. Scenarios involving the increasing technological progress speed and a declining energy consumption elasticity coefficient are also considered, and the results show that the economic growth under both scenarios is better than that under a general scenario

Transforming the Economy Sustaining Food, Water, Energy and Justice

Global Income Inequality and Carbon Footprints

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Type of Presentation: Paper presentation

Biography: Dr. Feng is an associate research professor at the University of Maryland–College Park. His research focuses on energy, carbon, water, and land accounting at different spatial scales (local, national, and global). His expertise is in spatial ecological-economic modeling with regard to sustainable production and consumption, sustainable supply chain, and scenarios analysis. Dr. Feng also studies the energy-water nexus for different electricity generation technologies, such as coal, gas, nuclear, wind, and other renewables, by applying a hybrid life-cycle analysis approach.

Abstract: About 50% of the global population, more than 3 billion people, live on less than US\$3 a day. The top 10% earn more \$23 (PPP) per day. Clearly lifestyles, consumption patterns and associated per capita carbon footprints differ enormously between rich and poor. What is the difference in terms of carbon footprint? What is the contribution to total carbon emissions of the global middle class or the global elites? Do we see a convergence of consumption patterns and carbon footprints of the rich across countries? What are the carbon implications of moving hundreds of millions of people out of poverty as proposed in the Sustainable Development Goals? To answer these questions we present our compilation of consumption patterns for different income categories from consumer expenditure surveys for most countries of the world, representing some 90% of the global population. These have been linked to a global multiregional input-output model to calculate carbon footprints for different income categories, globally and specifically also for different income and lifestyle categories in the United States.

A general finding is that the higher the income, the higher the carbon footprint. There is no leveling off. Higher incomes generate higher carbon footprints. Thus it is not surprising that adding to the middle class by moving people out of poverty adds significantly to global carbon emissions and makes global targets for mitigating greenhouse gases more difficult to achieve given the slow pace of progress toward low carbon technologies and the degree of fossil fuel dependence, population growth, and the emulation of resource-intensive lifestyles in low-income countries and transition economies.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Beyond the Boomtown Effects: The Impact of Mining Activity on Adolescent Childbearing

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Type of Presentation: Paper presentation

Biography: David Fleming is a research economist at the Commonwealth Science and Industrial Research Organization (CSIRO) in Australia and obtained his PhD in applied economics from the Pennsylvania State University. His research has been published in different journals such as the *Australian Journal of Agricultural and Resource Economics*, *Food Policy* and the *Journal of Development Studies*.

Abstract: Literature on the impacts of mining on socioeconomic outcomes is extensive. While an increasing body of research has attempted to better understand the “resource” of resource extraction activity on local and national economies, a different body of knowledge has investigated boomtown effects, social conflicts, and other social issues related to mining activity. Thus, for communities and regions facing resource activity, besides all the potential economic benefits that mining brings to communities such as new paid employment and higher income in the area, negative externalities arising from environmental degradation to social disruptions such as increased crime, alcoholism, and other activities generally hit very hard towns that did not face resource activity in the past. One unintended consequence of this, as a product of all socioeconomic changes, is translated in the rate of young childbearing in the community. Thus, as a consequence of different socio and economic factors, higher pregnancy rates and youth motherhood are likely to be observed in areas where mining plays a role, in comparison to areas without resource activity.

To test our idea, we develop a data set that gauges the total number of people living in the 5-km radius of all mines in Australia, one of the largest mining countries in the world. With these data, we estimated mining influence in local areas by calculating the share of the total region population living surrounding mines. With this “mining influence” index, we then applied a set of different regression methods and different controls to analyze any correlation between adolescent childbearing and mining. Our results show a clear, statistically significant, and robust positive effect of mining on females reporting having babies at ages 15 to 19, 20 to 24, and 25 to 26 in the national census of 2011. Thus, women in mining regions are more likely to have kids at younger ages than those in other areas (in metropolitan areas or rural regions) of the country.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Interlinked Thinking as a Tool to Tackle Communication

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3rd Author: Garry McDonald - Market Economics

Type of Presentation: Paper presentation

Biography: Vicky is an ecological economist working at Ecological Economics Research New Zealand, based at Massey University, Palmerston North. Her research interests include the modeling of environment-economy interactions, analytical tools for progressing sustainability, sustainability theory and measurement, alternatives to GDP as a measure of progress, analysis of supply-chain responsibilities, sustainability assessments using life-cycle analysis, economic structures of regional economies and public participation in local government.

Abstract: The present-day world is a highly interconnected complex system characterised by uncertainty. Human minds struggle with complexity, and the tools available to assist us are limited. This leads to reductionism and a focus on the parts rather than the whole. Working with individual component parts ignores the dynamics that result from the interdependencies between components. It is these interactions that determine the behavior that we experience in real-world situations. Interlinked thinking is proposed as a way to help people work with, rather than ignore, complexity. It is a participatory process that allows people not familiar with systems analysis to have a structured dialogue on how components interrelate. Links between components are debated and decided on in a workshop session. These links are transcribed to a matrix and an algorithm is run to analyze the links in the system. This provides the following information as an output:

1. Feedback loops in the system and whether they are balancing or reinforcing.
2. Active components that have leverage in the system as they strongly influence other components, without the system having a strong influence on them.
3. Passive components that react strongly to changes in the system.
4. Critical components that have a forceful influence on the system and react strongly to change.
5. The strong links in the system, important for understanding behavior.

In addition, the output can be used to identify potential intervention points, and “what-if” implications can be considered by following links to see the chain of reaction from any potential intervention point.

The interlinked thinking methodology is a communicative tool to help people work with complexity. It aims to build understanding of feedback and systems in a way that does not require modeling skills. It has been tested with two case studies that linked well-being variables. Participants confirmed there was added value from linking indicators and understanding relationships. The methodology can be used to analyze relationships within any variable set.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Assessing Preferences Over Community Forest Concession Attributes and Forest Conservation Using Choice Experiments

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Type of Presentation: Paper presentation

Biography: Lea Fortmann is an assistant professor of economics at the University of Puget Sound.

Abstract: While the majority of forest concessions worldwide are industrial, there is a trend toward more collaborative efforts that promote both sustainable forest management and local community development (Bowler et al., 2009; Mollnar et al., 2011). One such example is the formation of community forest concessions in Guatemala's Maya Biosphere Reserve (MBR). While there is much potential for this kind of approach to community-based forestry, the success of this framework will largely depend on the incentives and benefits associated with concession membership. This paper uses choice experiment data from an in-person survey of 494 concession members and nonmembers in the MBR to assess which characteristics of community forest concessions are preferred by members, and what attributes increase the likelihood of nonmembers joining concession groups.

The MBR was created in 1990, and rather than the forests being turned over to private logging companies, a portion of the land was dedicated to community concessions, where local community groups formed associations and applied for property rights to a forest area after developing sustainable management plans for harvesting timber. From 1994 to 1997, 12 community concessions formed. While all the concessions were established under the same legal framework, they vary along a number of attributes such as the distribution of member benefits (in-kind or annual dividends) or whether the concession allocates land to members for personal use.

The results from the choice experiment, which are based on a fractional factorial design, indicate that preferences vary based on membership status, and the location of the community also influences which attributes of the concessions are preferred. For example, members who live inside the reserve are more likely to join a concession if they are allocated land and are allowed to engage in additional activities such as the collection of nontimber forest products (NTFPs). Members living outside the reserve, on the other hand, prefer ecotourism to NTFP collection and are less likely to join a concession that provides land to members for personal use. Surprisingly, both members and nonmembers have preferences for in-kind benefits, such as scholarships or community enhancements, over cash dividends paid out to members directly. The results of this research offer insight into the design of community forest concessions and which features of the concessions increase the likelihood of participation, providing direction for the development of future concessions on both a local and international scale.

Transforming the Economy Sustaining Food, Water, Energy and Justice

A Decision Tool Integrating Environment, Culture, and Economy

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Type of Presentation: Paper presentation

Biography: Michèle Friend is an associate professor in the philosophy department at George Washington University, and has worked there for the last 15 years. She teaches undergraduate and graduate courses in the philosophy of the environment, partly focusing on the differences between neoclassical economic thinking and ecological economic thinking. In her research she focuses on green practices in chemistry research, on multicriteria decision aides, and on second-order science.

Abstract: I present a new tool for helping with decisions: making them, accounting for them, and justifying them. Through an initially philosophical and later Bayesian process, one ends up with a statistically robust single arrow whose length and direction indicate an aggregation of indicators in different spheres: the natural environment, culture, and neoclassically measured economy. The tool can be applied to an institution, an ecosystem, an event, a country, or the whole planet.

The initial philosophical work consists in developing indicators in the three spheres. Using a little mathematics, they are aggregated to give one “compass direction.” Depending on the results, more indicators are developed, and there is a back-and-forth evolving process that ends when there is a robust (stable) compass reading.

The more-Bayesian work is then to make comparisons. We compare institutions, ecosystems, events, countries to each other or over time.

After displaying the compass and its workings, I then discuss how it can be used—intelligently or superficially—to make policy decisions, justify decisions, and be held accountable for decisions.

Last, I discuss what the tool is more philosophically. It is not a predictor, it is not a model, it is more of a “decision aide.”

Transforming the Economy Sustaining Food, Water, Energy and Justice

System of Accounts for Global Entropy-Production (SAGE-P)—The Accounts of the Low Entropy Fund (LEF) Available for Human Consumption in the Econosphere, Sociosphere, and Ecosphere

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Biography: Anthony Friend (economist), in collaboration with David Rapport (ecologist), developed at Statistics Canada the Stress-Response Environmental Statistical System (STRESS), the foundational framework for environmental indicators and State of Environment Reporting. He received his undergraduate degree from Sir George Williams, Montreal (1956–60), and his MA from Manchester University, United Kingdom (1961–63). He received a Commonwealth Scholarship (1963–66) from the Delhi School of Economics and an IDRC Research Award (1978–79) from the Science Policy Research Unit, University of Sussex, United Kingdom. He is the founder of the Institute for Research for Environment and Economy, University of Ottawa (1989), and was a member of the Editorial Board Ecological Economics (1989–2006).

Abstract: Income is reduced to a net-valued rate of entropy production per unit of consumption (i.e., enjoyment). Capital is reduced to a net-valued low entropy fund (LEF) available for human consumption (i.e., benefit/cost ratio). Thus, enabled are the stock-flow accounts of the economy (i.e., System of National Accounts [SNA]) governed by the second law of thermodynamics. Introduced is the concept of “pluralism in conserved values” unique to each of the following topological domain spaces (TDS): (a) econosphere (i.e., values conserved in exchange), sociosphere (i.e., values conserved in use), and ecosphere (i.e., values conserved in itself or existential). The end product is a set of quantitative/qualitative databases of physical/abstract objects (i.e., state conditions assessed at an instant in time) and functions (i.e., entropic processes assessed over a period of time). The end result is a set of balance sheets of the LEF assessed in terms of entropy efficiency of conserved values (i.e., (a) steady-state, (b) surplus-state, and (c) deficit-state). Applied are symmetric translations of I/O correspondence matrices: two-way mapping of the objects/functions of the econosphere \rightleftharpoons sociosphere \rightleftharpoons ecosphere. The accounts describe the algorithms of the entropic process where production is defined as negentropy, consumption is defined as entropy, and capital accumulation is defined as the LEF. The parameters of SAGE-P are defined by and compatible with the G-R flow-fund model. A unique feature of entropy production accounts for the distinction made between “physical” objects/functions that occupy space/time and are thus subject to the entropy law and “abstract” objects/functions that, while existing in time, have no physical manifestation in space. Another feature, possibly unique, is the set-theoretic hierarchical structure values in the form: existential (use-value (exchange-value)). The SAGE-P, while providing the conceptual framework for global entropy production, nonetheless enables the user to define the boundary conditions of the accounting objects and function to fit their special analytical frame.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Water-Energy-Food Nexus and Water Engineering Project in a Water-Scarce Region: The Jordan River Basin as a Case Study

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Biography: Ryuichi Fukuhara is currently a research fellow at the Center for the Creative Economy, Doshisha University, Japan. He served UNESCO and UNEP as Program Officer in implementing water and environmental management projects in the Middle East and participated in the United Nations' Reconstruction Programme for Iraq after the Iraq War in 2003. He holds a BSc and MSc in agriculture from Kyoto University in Iraq.

Abstract: Jordan is the most water-scarce country in the world and one of the typical countries that face the challenges of a water-energy-food nexus deprived by the chronic water shortage, disputes over transboundary waters, and sociopolitical instability in the region. Several water engineering options are proposed to meet increasing water demands as well as to mitigate further risk of water scarcity in Jordan. This paper conducts a case study examining whether water engineering options could sustainably address the water-energy-food dilemma based on footprint approaches.

The country has already overexploited its groundwater resources and imports about 80% of its food supply—which entails imports of virtual water while exporting agricultural crops with fewer economical benefits. Climate change in the long run is projected to further dry the region and to lead to more frequent droughts and increasing water and energy demands for irrigation. In addition, unlike other Arab countries, Jordan lacks significant fossil fuel reserves and has very little hydropower potential: on the contrary it depends on pumping surface and groundwater to the major demand sites over vertical gradients of more than 1000m. Accordingly, water supply accounts for about 25% of Jordan's total electricity demand.

Besides food trade and associated virtual water trade, the focus of Jordan's water strategy is on large-scale supply-side infrastructure projects. Given Jordan's already high water prices and the enormous costs and energy demands associated with new proposed projects, supply-side water management is reaching its limits while demand-side water management options seemingly have large untapped potential in Jordan.

Therefore many have already suggested that more attention should be paid to reducing water demand by changing the consumption patterns of the water-consuming sectors. Nevertheless, it is open to question that developing demand management options could fully address Jordan's challenges in the coming years; considering the slow effectiveness of positive impacts by demand-oriented management and contingent factors such as droughts or an influx of refugees from the neighboring countries, it remains unclear from the existing scenario analysis whether it is possible to meet the imminent water-energy-food challenges as well as to keep the drying Dead Sea from depleting in case of not implementing major water engineering options.

Historically water-engineering projects have been developed to increase water availability, with less attention to environmental aspects and to an appropriate balance among water-energy-food security. The advantages and disadvantages of possible responses to extreme water scarcity in Jordan are reviewed, with special attention to the Red Sea-Dead Sea Conveyance project, to identify the potentials and risks for the water-energy-food situation in the country and at the basin level.

Transforming the Economy Sustaining Food, Water, Energy and Justice

What Does “Sustainability Economics” Aim for and How Does It Differ From “Ecological Economics”?

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Abstract: Ecological economics was founded with the purpose to be about “the science and management of sustainability” (Costanza, 1991). Both issues have actually been at the core of ecological economics in its initial years. Concepts from weak to very strong sustainability (Turner, 1993) and the related debate about intra- and intergenerational justice (Martinez-Alier & O’Connor, 2001) have been discussed intensively alongside rules for a sustainable management of natural resources (Daly, 1990) and adjoining ideas like the revived safe minimum standard of Ciriacy-Wantrup (1952) or critical natural capital (Pearce & Atkinson, 1993). It can thus be rightfully claimed that ecological economics is a science of sustainability.

However, a decade after the initialization of ecological economics the new denomination of sustainability economics appeared (Walter, 2002). Following two papers by Baumgärtner and Quaas (2010a, 2010b) and subsequent responses (Bartelmus, 2010; van den Bergh, 2010) the discussion of its possible content and differences to ecological economics took some momentum. The debate continues, with increasing suggestions of how sustainability economics should be defined (Ballet et al., 2011; Binder & Witt, 2012) or if it is useful to have as an additional field at all (Remig, 2015; Söderbaum, 2015).

The current paper tries to approach this question from a different perspective. We look into the objectives and suggestions for sustainability economics and compare them with those of ecological as well as environmental economics. The purpose of the paper is to identify similarities and divergences between the approaches and to question whether there is a shared idea of what sustainability economics should be. Proposals encompass a broad range of ideas. Baumgärtner and Quaas aim to “reconcile the criteria of efficiency and of social justice” (2010a, p. 447). Van den Berg (2010) argues for particular investment (Hartwick, 1977) and compensation schemes (Howarth & Norgaard, 1995) to address the particular intertemporal focus of sustainability. Bartelmus (2010) suggests environmental accounting as an indicator of sustainability. Ballet et al. (2011) introduce the idea to found sustainability economics on Amartya Sen’s capability approach (1992), while Binder & Witt (2012) point out the need for an evolutionary foundation instead of this static concept.

The paper concludes that there are strong divergences between different concepts of sustainability economics, often more than between each of the propositions and ecological economics. This leads to the question whether we are actually faced with the development of a new science or with a debate about relevant issues for ecological economics.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Understanding and Valuing the Marine Ecosystem Services of the Northern Mozambique Channel

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Dr. Paulo A. L. D. Nunes is global manager and coordinator of the Project for Ecosystem Services at UNEP. Past positions include inter alia coordinator of the Policy and Experts Committee of the Wealth Accounting and Valuation of Ecosystems (WAVES), World Bank, and invited professor at the Johns Hopkins University, SAIS Bologna.

Abstract: The Northern Mozambique Channel (NMC) region is host to one of world's outstanding terrestrial and marine biodiversity areas. The coastal communities and economies of the region are intimately dependent on its marine and coastal resources, through fishing, tourism, and other economic activities, making its management and protection of key importance to the countries. The NMC region is currently at a crossroad regarding its future socioeconomic development and environmental status due to the concomitant presence of (1) rich natural assets, as yet only moderately impacted by human activities; (2) rapidly evolving socioeconomic drivers and pressures (e.g., demographic change, growth of tourism, and oil and gas sectors); and (3) a strong need to achieve sustainable livelihoods and poverty reduction.

This study deals with understanding and valuing the coastal and marine ecosystem services in the NMC region with the goals of (1) providing monetary estimates of the benefits provided by key coastal and marine ecosystem services, (2) identifying and prioritizing current knowledge gaps, and (3) providing guidance and recommendations to the local policy and decision makers on how ecosystem service values can help to sustainably manage the existing natural capital.

Six key coastal and marine ecosystem services are identified: coastal tourism, coastal recreation, fishery, mariculture, carbon sequestration, and coastal protection. A range of economic valuation techniques is implemented to provide spatially explicit monetary estimates of the current flow of ecosystem services values for each of the six ecosystem services as well as aggregated values at the province or Exclusive Economic Zone (EEZ) level for Madagascar, Mozambique, Tanzania, Comoros, Seychelles, and Mayotte.

Furthermore, we implement the Driver-Pressure-State-Impact-Response (DPSIR) conceptual framework in the investigation of a range of social, economic, environmental, and governance indicators, specifically at the province level for each of the NMC countries. We consider six categories of indicators: (1) biodiversity, (2) ecosystem service value flows, (3) multidimensional poverty, (4) institutional responses, (5) pressures, and (6) drivers. Each of the categories includes one or more subcategories and between three and 11 distinct indicators, for a total of 32 distinct indicators. The indicator values are standardized and aggregated in composite indices for each of the components of the DPSIR framework. The values of the composite indices for each of the countries or provinces in the Western Indian Ocean are analyzed with the help of spider diagrams.

In the face of competing actions and interests by different users and stakeholders, economic valuation of the benefits provided by coastal and marine ecosystems in the region can help increase the magnitude and level of integration of regional environmental policies, thus potentially helping to guide the NMC toward a sustainable growth path. Even if primary data is wanting, a more comprehensive understanding of the drivers of economic value change and how these interact with the range of provisioning, regulating and cultural NMC marine ecosystem services is a crucial step toward securing substantial and reliable ecosystem goods and services.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Unraveling the Role of Design Flaws in Incentive-Based Forest Conservation—Empirical Evidence From the Peruvian Amazon

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Biography: Renzo Giudice is a Peruvian ecologist and holds an MSc by research on environmental and natural resource economics and land-cover change modeling with applied research experience in Peru, Brazil, and Bolivia. His work experience and interest is to combine policy and applied quantitative and qualitative interdisciplinary research to support the design of effective and efficient forest management and conservation policies. He has over ten years of experience working in academia, NGOs, and government.

Abstract: The Peruvian National Program of Forests Conservation for Climate Change Mitigation (NPFC), inspired by the Ecuadorian Sociobosque Program, is the second incentive-based national forest conservation program in South America. Learning about how countries can cost-effectively reduce forest-based emissions will be fundamental in achieving the provisions in Article 5 of the Paris Agreement (COP 21, 2015). This paper presents results from the first counterfactual based evaluation of the NPFC. Between 2011 and 2012, the program enrolled 48 native communities in two Amazonian regions of Peru in its conditional cash-transfer scheme. In our theory of change we identify a series of program design flaws that lead us to expect relatively low or zero average impact of the NPFC on forest cover. These flaws include the targeting of regions with relatively low annual rates of forest loss and the fact that participating communities can define the amount and location of the forest land they enroll in the program. In some local economy contexts, however, we expect cash transfers to enable behavioral change to the benefit or at the cost of forest cover depending on available investment and market opportunities. Our empirical strategy is designed to identify such contexts using heterogeneous treatment effect analysis. The analysis relies on a combination of spatial matching and regression analysis using 13 years of remotely sensed annual deforestation estimates, a series of biogeophysical and socioeconomic covariates, and program expenditure accounts. Our findings indicate a relatively low cost-effectiveness of the NPFC during its early years and point to a series of potential design-based solutions with a high probability of enhancing overall program performance in the long run.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Examining the “Impact” of Local Food Systems and Government Intervention in Improving Local-Level Economic Outcomes

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Type of Presentation: Paper presentation

Biography: Sherrie Godette is a PhD candidate in the Department of Public Administration at North Carolina State University. Her broad research interests are in organizational and systems development and change, performance management, program and policy evaluation, agribusiness, and applied economics. She is currently completing her dissertation focused on studying the impacts of local food system development on local level social, health, and economic outcomes. Her recent work is published in the *Journal of Agriculture, Food Systems, and Community Development*.

Abstract: According to U.S. Agriculture Census data, the number of farms and farmland has steadily declined over the last 30 years, with small and mid-scale farms being most affected. A decline in farms and farmland creates several perverse situations for communities, such as reduced land resources toward food production, increased reliability of goods produced outside of the community, and loss of potential revenue to the community. Local food system development is a relatively recent and highly promoted development strategy viewed to be a viable approach toward supporting/developing infrastructure and creating sustainable economies at the local level. Organizations and agents at the local/community, state, and federal levels are contributing significant amounts of energy and resources through policy- and grants-making to support the efforts to develop local food systems (e.g., establishing farmers’ markets). While there is a great deal of advocacy and support for local food systems and their potentiality to enhance local economies, there is limited evidence to substantiate these claims. Integrating data from the U.S. Department of Agriculture (USDA) Economic Research Service Food Environment Atlas, and U.S. Census of Agriculture, this study uses robust regression analysis to examine county-level associations between the change in local food market availability (e.g., farmers’ markets per capita) and four county-level economic outcomes (e.g., change in the proportion of direct sales to total agriculture sales; total farm retention, small and mid-size farm retention; and total farmland retention). These models are adjusted for conventional food market availability (e.g., change in supermarket availability), socioeconomic, demographic, and geographic county features. Using grant data from the USDA’s Know Your Farmer Know Your Food database, this study also investigates whether government grants-making to support local food development moderates the relationship between farmers’ market availability and the stated economic outcomes. Preliminary findings suggest that the change in farmers’ market availability has a statistically significant effect on some economic outcomes; however, in some instances the effect is negative (e.g., negative association between percent change in farmers’ market availability and small and mid-scale farm retention). Further, findings also suggest that government grants have a statistically significant moderating effect on the relationship between farmers’ market availability and some local economic outcomes (i.e., the more grant funds awarded in a county the more positive the effect of the percent change in farmers’ market availability on the dependent variable) while having no significant influence on other economic outcomes.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Local Food Systems, Food Deserts, and Market Failure

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Biography: Sherrie Godette is a PhD candidate in the Department of Public Administration at North Carolina State University. Her broad research interests are in organizational and systems development and change, performance management, program and policy evaluation, agribusiness, and applied economics. She is currently completing her dissertation focused on studying the impacts of local food system development on local level social, health, and economic outcomes. Her recent work is published in the *Journal of Agriculture, Food Systems, and Community Development*.

Abstract: The existence of food deserts has emerged as a critical public issue as research increasingly supports links between food consumption and health outcomes (Larsen and Gilliland, 2009, p. 1158; Must et al., 1991; Segal et al., 1994; White, 2007). Local food system development has been promoted as a reasonable strategy toward increasing healthy food access, thereby mitigating the food desert problem. The existence of food deserts can be viewed as a manifestation of market failure. Market failures occur when free markets are “socially inefficient” (i.e., when social costs for a market or good outweigh the social benefits of the market/good) or when the full benefits for the use of social sources are not realized (Rocha, 2007, p. 14). Therefore, the insufficiency or limited availability of conventional food markets is marked by the conceptualization and existence of food deserts. Market failure is a commonly used justification for government intervention. Federal programs such as “Know Your Farmer, Know Your Food” are representative of government action in supporting local strategy to mitigate food desert and food accessibility issues. Despite optimism among policy makers, scholars, and advocates that local food systems aid in ameliorating social disparities, we know little about the extent to which local food systems either reduce or exacerbate food access and equity issues. In addition, while there is significant government action and public investment in supporting local food market development, there are few studies that examine the role or impact of government subsidization of local food market development as a means to achieve the aspired goals (e.g., increasing healthy food access). Integrating data from the U.S. Department of Agriculture (USDA) Economic Research Service Food Environment Atlas, U.S. Census of Agriculture, and the USDA’s Know Your Farmer Know Your Food databases, this study uses robust regression analysis to examine whether there is a significant difference in county-level local food-market availability (e.g., farmer’s market availability) in food deserts compared to nonfood deserts; adjusted for known demographic, socioeconomic, geographic, and food production capacity characteristics. In addition, this study investigates whether government intervention may contribute to greater local food market availability in food deserts compared to nonfood deserts. Models are stratified based on county metropolitan status (i.e., metropolitan/urban, metro-adjacent, and rural). Findings suggest that local food market development may not be contributing to the mitigation of the food desert problem; rather it may be contributing to the exacerbation of food access disparities in certain geographic contexts. Findings also suggest that government-supported grant-making efforts are statistically contributing to more local food-market availability, however, in nonfood deserts located in certain geographic contexts.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Does Ecosystem Services Valuation Help or Hurt Our Cause?

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Type of Presentation: Paper presentation

Biography: Sandra Goff, PhD, is an assistant professor of economics at Skidmore College. Her research focuses on the relationships between markets, moral reasoning, and prosocial attitudes and behaviors with an emphasis on sustainability issues. Timothy Waring, PhD, and Caroline Noblet, PhD, are assistant professors in the School of Economics at the University of Maine. Dr. Waring studies human culture and cooperation in relation to the environment. Dr. Noblet studies environmental behavior and economic psychology.

Abstract: Our planet's ecosystems provide a suite of services that benefit humans in important ways. Ecosystem services valuation attempts to determine the monetary value of the services provided by the natural world, estimated as the cost of providing such services through man-made technologies and infrastructure. Prior research has shown that making monetary value salient fosters self-interested behavior in experimental settings (Vohs et al., 2006) and reduces the intrinsic value ascribed to prosocial activities such as volunteering (Pfeffer & DeVoe, 2009). These findings raise concerns that ecosystem service valuation information might adversely impact individuals' proenvironmental behaviors. This study uses an experimental framework to determine whether ordinary citizens' exposure to valuation information, such as one might encounter in a news article or fundraising materials, might influence an individual's contribution to a natural resource conservation fund or willingness to be taxed for the preservation of public lands. Using the online worksite Amazon Mechanical Turk (mTurk), the study is implemented with 250 participants from across the United States. The control group reads a narrative description of the bountiful natural resources present on America's public lands and the benefits they provide. The treatment group is given a similar narrative supplemented by information regarding the monetary benefits and costs of replacement of the services provided by public lands. We find that participants receiving the treatment donate a statistically significant lower dollar amount of their experimental earnings on average than those in the control group (\$1.53 vs. \$2.20, $p = 0.05$). The effect differs in important ways for the three environmental organizations to which contributions could be given. We also find that the presence of the valuation information induces increases in reported financial stress suggesting self-interest activation (Pfeffer & DeVoe, 2009) as the likely source of the differences found between the treatment and control groups. Based upon this evidence, we conclude that the general public may be affected by ecosystem service valuation information in ways that could negatively impact the exact resources the information is meant to protect.

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Transforming the Economy Sustaining Food, Water, Energy and Justice

Environment Change and Migration: Empirical Evidence From Flood-Prone Communities in Indonesia

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Abstract: This paper aims to shed light on the complex relationship between environmental change and migration.

As recently as 1990, the Intergovernmental Panel on Climate Change (IPCC) warned that “the greatest single impact of climate change could be on human migration—with millions of people displaced by shoreline erosion, coastal flooding and severe drought” (Laczko & Aghazarm, 2009, p.13). There is little doubt that environmental degradation somehow impacts the decision to migrate; however, some researchers argue that the assumption of environmental change being the primary cause of migration is unsound. Migration is rather the result of a multicausal relationship. One of the best-known theories assumes that migration is caused by geographic differences, especially in economic measures. On the other hand, the “new economics of labor migration” theory states that migration should be seen as a household strategy. Still other theories focus on individual differences between migrants and nonmigrants. Consequently, in order to shed light on the complex relationship between the environment and migration we have to disentangle the impact of environmental factors from all the other potentially impacting factors.

Thus, we conducted quantitative microlevel studies in low-lying communities in two high-mobility countries, Ghana and Indonesia, which are particularly exposed to environmental hazards like coastal erosion, land subsidence, storm surges, and an increasing sea level, and thus are prone to flooding on a regular basis. In 20 communities households were randomly selected and interviewed. Reported migrants were interviewed over the phone. In the end, 309 Indonesian and 277 Ghanaian migrants and nonmigrants completed an extensive survey and participated in economic experiments with monetary payoffs in order to determine their risk and time preferences. Different measures of environmental change were collected, ranging from perceptions over expert opinions to the household’s distance to the coast. We analyze the relationship using logit regressions and controlling for other migration drivers. While variables like age, employment rates, and risk-taking behavior are significantly correlated with the decision to migrate, we cannot detect any statistically significant impact of floods, erosion, land subsidence, or the distance to the ocean on migration decisions. The only exception is the household head’s perception of storms in Ghana.

Our findings support the hypothesis that especially slow-onset environmental change is not a primary cause of migration but that other economic, household, and individual characteristics are more relevant. Nevertheless, in-depth interviews suggest that the environment can still indirectly influence the decision to migrate, especially through its impact on the economic situation in the sampled communities.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Migrants and Their Environmental Attitudes—Experimental Evidence

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Abstract: It is often argued that population growth increases pressure on ecosystems, especially on common pool resources. However, the most pressing demographic phenomenon might not be population growth but in-migration, since it not only puts additional pressure on resource extraction but might also diminish trust and cooperation and might change social relations and other critical institutions that limit free-rider problems associated with common property regimes (Curran & Agardy, 2002). Marine and coastal ecosystems tend to be particularly vulnerable to the disruptive effect of in-migration (Cassels et al., 2005). However, there has been little empirical research to examine how migration may affect coastal ecosystems. To shed some light on the complex relationship between migration and the coastal environment, we conducted quantitative microlevel studies in coastal communities in two high-mobility countries, Ghana and Indonesia. In 20 communities households were randomly selected and interviewed. In the end, 309 Indonesian and 277 Ghanaian migrants and nonmigrants completed an extensive survey and participated in some economic experiments. Due to the lack of data on the individual’s environmental behavior, we try to get an impression of the individual’s concern for the environment instead. Therefore, we collected information about their beliefs and perceptions about marine resources and built an environmental awareness index (as suggested by environmental psychology literature such as Wiseman & Bogner, 2003). Additionally, the respondents were asked to play a standard common pool resource (CPR) game with real monetary payoffs in which a group extracts jointly from a common fish pond. The individual extraction decision can be interpreted as an indicator of cooperation and environmental attitude. Using econometric methods, we find that migrants differ significantly from nonmigrants not only in their concern for coastal ecosystems but also in their extraction decision in the CPR game. These findings support the hypothesis that people who left their community and live in a new environment, are less cooperative within their new communities than those who stayed in their familiar environment. Nevertheless, this might also result from the fact that migrants’ livelihoods changed—making them less dependent on coastal ecosystems and resources. Thus, further research is necessary to examine whether these different environmental attitudes and the diminished willingness to cooperate are actually reflected in environmentally more destructive behavior.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Determinants of Land Conflict in Indigenous Lands in Southern Chile

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Type of Presentation: Paper presentation

Biography: Ricardo González is a Chilean environmental and resource economist and lecturer at the Department of Forest Science, University of La Frontera, Chile. Dr. González has experience in impact evaluation of forestry instruments in Chile using an econometric approach, valuation of environmental services from native forests in Chile, evaluation of marine and coastal resources in Fiji, and climate change issues in the Pacific. He also has research and teaching experience in the Pacific (University of the South Pacific, Fiji) and Australia (University of New England, NSW, Australia).

Abstract: In this paper we analyze the so-called Mapuche conflict, where a series of demands from indigenous Mapuche people against the Chilean State for land restitution, recognition of indigenous rights, the right for auto-determination and for better livelihood conditions have become rather violent. Authorities, on the other side, have referred to many of these Mapuche manifestations as terrorist behavior. I assembled panel data covering municipalities in the Araucanía region of southern Chile in the period 1990–2008 and fit a Poisson model with unobserved effects to explain the occurrence of violent events related to the land conflict, as explained by socioeconomic attributes and land afforested. Results show that part of the indigenous conflict may be explained by the expansion of forestry plantations and by socioeconomic attributes, where more forestry plantations and higher rates of unemployment aggravate the conflict while higher levels of literacy attenuate the conflict.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Fuel Poverty vs. Fuel Obesity—What Smart Meters Tell Us

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Type of Presentation: Paper presentation

Biography: João is a PhD student in the Climate Change and Sustainable Development Policies Program at the Universidade Nova de Lisboa and Universidade de Lisboa. He currently works on the assessment of electricity consumption profiles, drivers of electricity consumption, and fuel poverty identification in the residential sector by using smart meter data analytics combined with socioeconomic details and building and equipment characteristics from dedicated door-to-door surveys.

Abstract: Fuel poverty occurs when households are unable to afford adequate energy services in the home at reasonable cost. It includes all uses of energy and considers the thermal comfort levels needed and not what is effectively being consumed. The combination of low income, low performance dwellings with defective insulation (i.e. windows, walls, roofs), and older household members are enablers of fuel poverty.

As recognized by Thomson and Snell (2013), the knowledge on fuel poverty in the United Kingdom and Ireland is well established, with a strong focus on heating demand (Healy & Clinch, 2004) and on the impacts of fuel poverty on health (Healy & Clinch, 2002). Despite a growing body of literature covering other countries and acknowledged by Thomson and Snell (2013) and Wand (2013) as a potential serious problem for southern European member states, expected to suffer from summer average temperature increase, including heat waves, due to climate change, single evaluation of such countries has hitherto not been carried out. The increasing availability of power consumption data from smart meters makes easier the assessment of how energy is being used in the residential sector. By taking into account different socioeconomic drivers and building typologies, those data sets are valuable to highlight equity issues in energy use.

This paper contributes to fill the knowledge gap focusing on EU southern countries combining electricity smart meters registries (average 2011–2014 of 265 meters; EDP, 2015) with socioeconomic data collected from door-to-door surveys for the same houses to track fuel poverty and fuel “obesity,” using the Portuguese city of Évora as a case study.

The approach is anchored on the use of daily electricity consumption data evaluated by a cluster analysis, proving to be a powerful data nutshell for distinguishing groups of consumers. Our results unfold that one of the 10 electricity consumption clusters defined is under fuel poverty (21% of the sample) presenting the lowest electricity consumption levels (under 5kWh/day). The socioeconomic data from the survey (e.g., low incomes, occupants older than 65 years, houses built 1946 and 1990 with no insulation, low levels of ownership and use of heating equipment), combined with the annual consumption profile, portray the lack of fulfillment of thermal comfort levels inside households both in summer and winter. In contrast, two other clusters reached very high levels of daily consumption (40kWh/day), showing fuel “obesity” patterns, which are also backed up by their socioeconomic profiles. This knowledge is further combined with energy needs estimated from dedicated energy simulations of the cluster prevailing buildings typologies by using DesignBuilder and EnergyPlus. This allows confirmation if the levels of indoor thermal comfort for both heating and cooling are being effectively delivered.

We conclude that fuel poverty and fuel “obesity” regarding electricity consumption arise among households of the same city, explained by the socioeconomic details and indoor thermal comfort levels. Smart meters are shown to be powerful tools for supporting the assessment of equity on energy use that could serve to define targeted policy measures and incentives.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Articulating Ecosystem Services Values: A Participatory Framework to Support Decision Making

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2nd Author: Nuno Videira - CENSE - Center for Environmental and Sustainability Research, Universidade NOVA de Lisboa, Portugal

Type of Presentation: Paper presentation

Biography: Rita Lopes is a PhD student at the New University of Lisbon. Her research focuses on ecosystem services assessment and valuation and participatory approaches, developed in protected-areas contexts.

Nuno Videira is assistant professor at the New University of Lisbon and a member of the Ecological Economics and Environmental Management group of CENSE. His research focuses on participatory modeling approaches for stakeholder engagement in sustainability decisions.

Abstract: The concept of ecosystem services (ES), which calls for new approaches capable of integrating ES values in decision making, has been growing in dissemination and implementation both in research and policy agendas. Starting from the focal question, How to foster the integration and articulation of multiple values of ES to inform decision making?, we developed a three-step participatory framework, which is being tested in Arrábida Natural Park, a Portuguese coastal and marine protected area.

In the first step—setting the scene—we conducted a collaborative scoping process, which involved an institutional and stakeholder analysis that allowed us to identify key stakeholders, their interdependencies, and institutional rules governing the area. A first participatory workshop gathered 21 participants engaged in a process of ES identification, recognition of threats and links to human well-being, as well as a preliminary screening of the social, economic, and ecological importance of the identified ES. Results from this step were validated through an online survey.

For the second step—deepen understanding—we aimed to develop a participatory process to promote sharing and coproduction of knowledge regarding the structure underlying the provision of a sustainable flow of specific ES. A participatory systems mapping workshop was organized gathering 16 participants who jointly developed causal loop diagrams depicting four ES perceived as highly important for the natural park—ecotourism, food provision, climate regulation, and genetic diversity. These conceptual maps systematized knowledge on key indicators, leverage points, feedback loops, and interrelationships influencing conservation of ES.

The third step—articulating values—is currently being implemented with the collaboration of the park management team. We aim to develop and test a participatory approach to articulate the social, biophysical, and economic values elicited in the previous steps. A third workshop will be organized wherein the identified stakeholder groups will be asked to deliberate on the impacts of alternative policies for the protected area, assessed according to changes expected in multiple ES values.

The proposed framework intends to foster value articulation for decision-making support based on the integration of participatory methods and tools, implemented through a coherent and structured platform. By considering different value dimensions we acknowledge the need of considering, for example, the impacts on social welfare, equity, sustainability, ecological stewardship, and cultural and ethical values when dealing with variations on the ES flows. While these considerations may constraint or support specific policy decisions, the proposed deliberative approach creates the opportunity to accommodate scientific data together with plural stakeholder perceptions, thus supporting evidence and stakeholder-based assessments for management of ES.

Transforming the Economy Sustaining Food, Water, Energy and Justice

The Human Domination of the Biosphere—From Hunter-Gatherers to Industrial Agriculture

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Type of Presentation: Paper presentation

Biography: John M. Gowdy is professor of economics and of science and technology studies at Rensselaer Polytechnic Institute in Troy, New York. Gowdy is the author of over 170 published articles and 10 books. He has served as president of the U.S. Society for Ecological Economics and of the International Society for Ecological Economics. He is the recipient of the Herman Daly Award for contributions to ecological economics.

Abstract: A major driver of biodiversity degradation is the growth dynamic that came with the imperative of surplus accumulation after the widespread adoption of agriculture. The results of this growth dynamic can be seen in the staggering increase in the human presence on the planet. For about 95% of our existence as a species human biomass was a tiny fraction of total terrestrial vertebrate biomass. At the beginning of agriculture some 10,000 years ago the human/wild animal ratio was 1:1500 in favor of wild vertebrates. The current ratio of humans and their livestock compared to wild terrestrial vertebrates is over 60:1 in favor of humans (Smil, 2013). More alarmingly, the elimination of the nonhuman world has dramatically accelerated in recent decades. The World Wide Fund for Nature's Living Planet Index of populations of more than 10,000 vertebrate species declined by an astonishing 52% between 1970 and 2010 (WWF International). Insect populations are also crashing. A recently compiled index of invertebrate populations shows a global decline of about 45% over the past 40 years (Dirzo et al., 2014, p. 402). Human-induced climate change will likely accelerate the loss of wild nature.

The human domination of the earth biosphere came in two phases. The first phase was the appropriation of earth's productive capacity by redirecting the flow of solar energy, water, and soil fertility to produce the human food supply. By the year 1900 humans comprised over 80% of terrestrial vertebrate biomass, but the total biomass was about the same as it was before human agriculture. The second phase began with the fossil fuel revolution around the beginning of the last century. Today the earth's terrestrial biomass is about six times more than it was in 1900.

In this paper we will quantify the human appropriation of the earth's biomass by use of an input-output framework that will account for the main underlying processes behind the trend, namely the growth of total energy and natural resource use by human populations needed to maintain the current forms and magnitude of human food supply. These processes have allowed for the aforementioned growth in human dominance of the biosphere, but have dramatically transformed the land surface, altered the major biogeochemical cycles, and removed species and genetically distinct populations at unprecedented rates (Vitousek et al., 1997). The paper will also evaluate the likelihood of a future scenario where affordable supplies of modern forms of energy—fossil fuels in particular—and the availability of a wide range of nonenergy minerals might be compromised.

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Transforming the Economy Sustaining Food, Water, Energy and Justice

Ecosystem Service Approaches to Sustainably Manage Terrestrial Landscapes

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Type of Presentation: Paper presentation

Biography: Dr. Suzie Greenhalgh is a portfolio leader (supporting business and policy) at Landcare Research, New Zealand. She leads two large research programs: BEST (Building biodiversity into an ecosystem service-based approach for resource management) program and the Values, Monitoring and Outcomes for Freshwater Management program. Her work involves analysis, design, and implementation of environmental policy and policy processes (including collaborative processes), the development of market-based instruments for ecosystem services, and developing frameworks to incorporate ecosystem services into decision making.

Abstract: There has been an upsurge in use of ecosystem service concepts to assist decision making globally, particularly around the use and management of natural resources. Both public and private institutions are exploring how ecosystem service approaches can enhance the sustainability of their decisions. New Zealand, a country of abundant yet diminishing natural resources, is no different with business, local government, researchers, communities, and landowners seeing how this concept can be applied in practice. While challenges exist with integrating ecosystem services into decision making, evidence to date suggests the approach is compelling and provides a structured, transparent, and neutral mechanism to manage natural resources. A summary of the key challenges identified by these initiatives will be summarized covering the availability of knowledge, choice of indicators, how to include indigenous cultural values, language and communication, and use in decision making. To address a number of these identified challenges a framework, the Biodiversity and Ecosystem Services Assessment (BEST) framework, has been developed to facilitate the use of ecosystem services in decision making. This framework is based upon New Zealand's experiences with the use of collaborative governance processes for regulatory decisions to manage freshwater resources and also international experiences with ecosystem assessments. We will outline how the BEST framework is being used in a watershed context to explore future landscape decisions as well as highlighting some of the outstanding challenges yet to be resolved.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Eating More Sustainably by Trimming off the Excess—What About Discretionary Food?

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Type of Presentation: Paper presentation

Biography: Dr. Michalis Hadjikakou is a postdoctoral researcher at the University of New South Wales' Water Research Centre, in Sydney, Australia. Michalis is a member of the Sustainability Assessment Program team, specializing in environmental footprinting, with an emphasis on sustainable food consumption. He is currently the recipient of a grant from the Australian Academy of Science, which aims to compare and understand the health and environmental implications associated with dietary behavior in different socioeconomic groups.

Abstract: The notion of sustainable food consumption has acquired a broader definition in recent years: as the incidence of obesity and other diet-related chronic diseases rises, “sustainable” consumption has come to refer to not only planetary health but also human health. The food sustainability debate has thus far centered largely on reducing red meat consumption. However, this paper argues that we cannot seek to align health and environmental objectives without considering the role of discretionary food, defined as foods and drinks not necessary to provide the nutrients the body needs, such as soft drinks and sweets. These foods are typically highly processed and high in sodium, sugar, and saturated fat, and while their negative impacts on health are well documented, their broader environmental sustainability impacts deserve more attention. This is particularly true given that their affordability and palatability is a result of a food system that aggressively promotes the overconsumption of such products.

The paper combines unique nutrition and expenditure data from Australia, including a detailed classification of discretionary products, along with environmentally extended input-output analysis to estimate the life cycle environmental impacts of discretionary food consumption across diverse socioeconomic groups. The novelty of the approach lies first in a multi-indicator approach to measuring sustainability, simultaneously taking into account water use, energy use, carbon dioxide equivalent, and land use. Second, the approach accounts for equity considerations and distinguishes, on the basis of dietary intake, whether discretionary foods can be simply eliminated (excess consumption) or require substitution. The latter is typically the case for poorer socioeconomic groups who are currently malnourished because discretionary food has replaced core foods.

On average, discretionary foods account for a significant 30 to 40% of overall diet-related water use, energy use, carbon dioxide equivalent emissions, and land use, although these percentages vary depending on the types and quantities of foods consumed by each socioeconomic group. These results suggest that a reduction in the production and consumption of discretionary foods should be seen as an essential priority for a sustainable food system. We should continue to explore ways to encourage reduced discretionary food consumption, but more importantly, we should also consider proactively reducing production. A general call for divestment away from such food products, which are harmful to health and create an unnecessary burden on the environment, should be promoted as a more sustainable business model that prioritizes human well-being and environmental health.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Network Analysis of Distance From Rural Water Wells to Public Health Testing Laboratories in Alberta

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2nd Author: Abraham Munene - University of Calgary

Type of Presentation: Paper presentation

Biography: David Hall is a veterinarian with a PhD in agricultural economics and an associate professor in the Faculty of Veterinary Medicine, University of Calgary. His current research activities address animal health economics and policy, international development, ecohealth, and decision making. David has active research grants in Alberta, Vietnam, and China.

Abstract: More than 400,000 rural residents of Alberta use water from privately owned wells for domestic purposes. The responsibility for testing water and for well stewardship is predominantly left to the private owner. Water testing for well owners is conducted for no fee by the provincial public health laboratories, but despite that, very few rural residents (fewer than 5%) get their water tested. We hypothesize that distance to access points for provincial public health laboratories may be a factor in limiting a well owner's willingness and/or ability to submit water samples. Using network analysis, a vector-based tool in ArcGIS, we set up and solved rural home-owner routing problems to examine this question. More specifically, we used service area analysis to determine all accessible roads and the proportion of wells within four impedances (15, 30, 45, and 60 min of water sample drop off facilities and testing labs within the province). Our data were derived from the following: wells were identified using the Alberta Well Water Information Database and the Baseline Well Water Testing Program; the locations of 98 water testing facilities within the province were known and identified from Alberta Public Health Services; and hypothetical service areas around each public health facility were generated based on the four impedances. A large majority of rural water well (70–90%) were located within less than one hour of a public health testing laboratory. We concluded distance alone could not account for the extraordinarily low use of the Alberta well water testing program. Other factors that may have played a significant role included perception of very low risk of water being contaminated, lack of awareness of the program, inability to leave the home during daytime hours, and generally low priority for water testing compared to other maintenance chores in rural areas. Our model is in the early stages of development but has potential for improved prediction of travel time from home to water testing laboratories, prediction of who is least likely to submit based on demographics and perceptions, and analysis of improved placement and awareness of public health laboratories in Alberta.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Exploring Environmental Performance Through Innovation Practices: A Case Study Applied to a French Globalized Firm

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2nd Author: Virgile Chassagnon - Grenoble Alpes University - CREG Research Centre

Type of Presentation: Paper presentation

Biography: NACIBA HANED is the dean of faculty of ESDES Business School, Catholic University of Lyon, France, as well as associate professor. Her research interests are technological leadership, industrial dynamics, and organizational behavior. She has published several works on this topic in international journals, notably on innovative firms and their growth and persistence.

Abstract: The paper contributes to the environmental dimension of CSR (corporate social responsibility) debates in economics and management with a case study based on a multinational French firm in the energy sector. While social and environmental concerns within innovation processes and related firm performance implications have received considerable attention, little has been demonstrated about what drives these changes and how they are conducted within organizations. In many industrial manufacturing sectors, environmental strategies essentially depend on trading systems, standards, and legal constraints that are specific to firms' activity. Thus, regulation and market pressures constrained firms of different sizes to conduct environmental management tools but not necessarily to change their environmental strategies. In this context, environmental regulation creates opportunities for some firms and strong cost constraints and market entry barriers for others (see the case of French industrial firms, Chassagnon & Haned, 2015). This argument is consistent with the Porter and Van der Linde hypothesis asserting that environmental regulation and competitiveness can be positively related under favorable economic conditions.

The main goal of the paper is to analyze the process through which innovations and creative solutions for more sustainable activities are put together to enhance "value added" in the long term. We essentially contribute to the literature by focusing our attention on how firms conduct efficient innovation strategies that integrate environmental concerns.

The main pieces of our analytical framework are based on the literature that develops insights on corporate environmentalism (for instance Barnejee, 1998; Ndubisi & Nair, 2009), and the importance of innovation for organizational strategies integrating the environmental pillar of CSR (Wagner, 2012; Richomme-Huet & De Freyman, 2014).

Our previous works have shown that green innovation strategies generate an accumulation of specific knowledge; enabling firms to improve their innovation capacity and to seize market opportunities because it provides them with specific capabilities (Chassagnon & Haned, 2013). From this framework we develop a model that evaluates the capacity of firms to encourage a proactive environmental strategy. The analysis of organizational capabilities change and improvement is central to understanding the factors triggering practices that go beyond environmental regulations compliance.

The methodological tool that we use is based on the qualitative analysis of several interviews conducted by key heads of innovation, R&D, sustainable development, and BOP projects departments.

The main results of our study show that firm creative interorganizational community structures create strong incentives to implement proactive environmental strategies. In the studied firm, these characteristics are associated most of the time with explorative activities (March, 1991). Under these conditions, it enables the firm to develop new internal skills that create favorable conditions for innovation based on green creativity. We also find that technological and organizational positive benefits generated by green innovations offset compliance costs. We demonstrate through this case that regulatory and environmental concerns are a competitive advantage at the international level.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Engaging with Local Communities to Address Complex Coastal Management Issues—Cross-Cultural Collaborative Research in New Zealand

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Type of Presentation: Paper presentation

Biography: Derrylea Hardy is a research officer in the School of People, Environment and Planning at Massey University in Palmerston North, New Zealand. She has successfully managed interdisciplinary collaborative cross-cultural research for over 15 years. Her cross-disciplinary knowledge base includes management, ecological economics, integrative well-being, sustainable development, environmental restoration, cross-cultural research, and knowledge uptake. She is involved in various collaborative research projects in New Zealand and is undertaking a PhD on the uptake of integrative well-being.

Abstract: New Zealand must address the impacts of increasing coastal development and projected sea-level rise. Erosion of beaches and collapse of some coastal infrastructure during storms is already evident in many areas, along with increased flooding due to rise in groundwater over land less than 10m above the current sea level. The last IPCC report found that New Zealand's capital city, Wellington, has places where coastal flooding can become 1000 times more frequent by 2100 for a mid-range future climate scenario. Additionally, north of Wellington, extreme wave height during storm events is increasing nearly 10 times as much as sea level.

New Zealand's indigenous Māori communities collectively hold land as sources of "cultural identity and mana" (prestige), a worldview where private property values are not based on market monetary values. Preservation of such Māori values in the face of major coastal changes is a significant challenge.

To address such complex coastal challenges, adaptation strategies must deal with the inherent uncertainties and must take into account the differing ways that diverse stakeholder groups understand such "messy" problems. It is therefore critical that ecological economists find ways to effectively communicate and engage with local communities, to ensure culturally appropriate and effective adaptive actions are identified and implemented.

This paper examines two integrative cross-cultural collaborative research programs being conducted in New Zealand: "Oranga Taiao Oranga Tangata" (Healthy Environment, Healthy People), which aims to empower iwi/hapū (tribes and subtribes) to be strong partners in the comanagement of estuaries by providing improved knowledge, tools and processes; and "Adaptation Strategies to Address Climate Change Impacts on Coastal Māori Communities," which aims to develop a framework for building resilience in coastal Māori farming communities.

These participatory action research projects use a range of methods that bring together iwi and hapū, stakeholders and the research team, as an effective means of communicating with each other and coproducing new knowledge and capability to identify, respond, and adapt to coastal pressures. Both projects consider the interdependence among cultural, economic, and ecological issues and explore practical, culturally appropriate adaptive and diversified land use and coastal management practices that will build resilience within Māori coastal communities. Both projects are testing and developing new forms of holistic engagement with and within coastal societies.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Teaching Ecological Economics: Climate, Water, and Energy

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2nd Author: David Timmons - University of Massachusetts, Boston

3rd Author: Anne-Marie Codur - Tufts University, Global Development and Environment Institute

4th Author: Brian Roach - Tufts University, Global Development and Environment Institute

Type of Presentation: Full session

Biography: Jonathan M. Harris is senior research associate and director of the Theory and Education Program at the Tufts University Global Development and Environment Institute and president of the U.S. Society for Ecological Economics (USSEE). He is coauthor of *Environmental and Natural Resource Economics: A Contemporary Approach and of Principles of Economics in Context*.

Abstract: This complete session is organized by the Tufts University Global Development and Environment Institute. The institute has produced a series of teaching modules that seek to introduce ecological economics perspectives into the curriculum. These topical modules include the Economics of Renewable Energy, the Economics of Climate Change, and the Economics and Politics of Water. The modules cover ecological economics concepts but are also suitable for use in mainstream economics or environmental policy courses. Since they are made available for free at the website <http://ase.tufts.edu/gdae/> they have achieved wide usage throughout the world and are easily available in developing nations where textbook costs are often prohibitive. We hope these may provide something of a template for the further development of electronic and downloadable forms of ecological economics education. In this session, we will present material from three of the modules on crucial topics for ecological economics: climate, energy, and water systems.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Ecological Macroeconomics—Responding to Climate Change

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2nd Author: Heidi Garrett-Peltier - Political Economy Research Institute, University of Massachusetts at Amherst

3rd Author: Robert Pollin - Political Economy Research Institute, University of Massachusetts at Amherst

4th Author: James Heintz - Political Economy Research Institute, University of Massachusetts at Amherst

5th Author: Shouvik Chakraborty - Political Economy Research Institute, University of Massachusetts at Amherst

Type of Presentation: Full session

Biography: Jonathan M. Harris is senior research associate and director of the Theory and Education Program at the Tufts University Global Development and Environment Institute and president of the U.S. Society for Ecological Economics (USSEE).

Heidi Garrett-Peltier is an assistant research professor at the Political Economy Research Institute at the University of Massachusetts, Amherst. Her research focuses on the employment impacts of public and private investments, particularly those that support the transition to a low-carbon economy.

Abstract: This session will address the issue of how economies can be transformed to reduce carbon and other greenhouse gas emissions by 80% or more by 2050. This involves both technological issues of energy policy and macroeconomics issues of fiscal and monetary policy. Presenters Heidi Garrett-Peltier and coauthors will address potential economic benefits—rather than costs—associated with rapid carbon reduction. Jonathan Harris will address the macroeconomic issues in terms of a “Green Keynesian” analysis of future energy paths. A third presenter will also deal with macroeconomic and infrastructure issues involved in shifting to a “green” economy.

Heidi Garrett-Peltier et al.: Much of the literature on the economic impacts of climate change focuses on the costs of mitigation versus the costs of damages and relies on integrated assessment models (IAMs) to assess the economic impacts of various climate scenarios. Our approach contrasts dramatically with this literature by showing that reducing emissions can create economic benefits beyond damage avoidance. We find that investing about 1.5% of GDP is sufficient to meet IPCC emission-reduction targets while also expanding employment opportunities, even after accounting for job losses in fossil fuel industries.

Jonathan M. Harris: Economic crisis has led to a revival of the more radical interpretation of Keynesian theory, emphasizing inherent macroeconomic instability. Other theorists, explicitly building on ecological economic perspectives, have explored the possibilities of “prosperity without growth.” A combination of these two approaches suggests the possibility of a “Green Keynesian” macroeconomics promoting both employment and environmental sustainability. This presentation will explore aspects of a Green Keynesian synthesis in theory and policy, specifically as applied to a carbon-reducing energy transition.

Transforming the Economy Sustaining Food, Water, Energy and Justice

After Paris—Carbon Reduction Paths for Developed and Developing Nations

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2nd Author: William Moomaw - Tufts University, Global Development and Environment Institute

3rd Author: Paul Baer - Eco-Equity

4th Author: Anne-Marie Codur - Tufts University, Global Development and Environment Institute

Type of Presentation: Roundtable

Biography: Jonathan M. Harris is senior research associate at the Tufts University Global Development and Environment Institute and president of the U.S. Society for Ecological Economics.

William R. Moomaw is professor emeritus of International Environmental Policy, Fletcher School of Law and Diplomacy, Tufts University.

Paul Baer is the research director for EcoEquity and an internationally recognized expert on issues of equity and climate change.

Anne-Marie Codur is research fellow at the Tufts University Global Development and Environment Institute.

Abstract: Jonathan M. Harris: Chair

This session will address post-COP 21 climate policy at a global level. What are the prospects for serious carbon reduction in developed nations and low-carbon development paths in developing nations? What are appropriate responsibilities and how can they be achieved? We will review the outcomes of the Paris COP-21 conference and discuss national plans for greenhouse gas reduction and mitigation.

William Moomaw: Addressing climate change as a pollution problem misdiagnoses the issue by focusing on symptoms (emissions) and not on underlying causes (unsustainable development). A mutual-gains agreement should direct international cooperation toward promoting the provision of clean energy services for development and ensuring universal access to those services as part of an “early action” agenda that will complement efforts to use forests and reduce other GHGs from multiple sectors.

Paul Baer: The Greenhouse Development Rights Framework was designed to allocate the costs of climate policy between and within nations based on capability (ability to pay) and responsibility (contribution to the problem). As climate policy evolves, it has become clear that the cost of stranded assets is going to be a large part of the necessary solution, as fossil resources are a key input to development. In this talk, I address the logic of extending the GDR framework to address stranded assets as well as mitigation and adaptation and how it could help fund sustainable development.

Anne-Marie Codur: The COP-21 negotiations featured a wide range of NGO and civil society groups as well as official national delegations. The popular movement for action on climate change will play a critical role in determining how vigorously governments pursue the post-Paris agenda. Local action can both supplement and lead action on the national level, and a variety of groups are making major efforts to promote local strategies for greenhouse gas reduction and bring pressure on governments for national action. This presentation provides an overview of some of these efforts.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Using Adaptive Governance (AG) Thinking to Address National and Global Sustainability Challenges

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Type of Presentation: Paper presentation

Biography: Steve Hatfield-Dodds has worked for more than two decades at the intersection of research and public policy, with recognised expertise in adaptive governance, integrated modeling and assessment, ecological economics, and the science-policy nexus. His research focuses on developing worthwhile and attractive policy responses to sustainability challenges. Steve led the recent CSIRO Australian National Outlook and associated paper on the cover of *Nature* and leads a new initiative on “enhancing the value of science.”

Abstract: Adaptive governance (AG) is a concept that has emerged through the fusion of intuitional analysis of self-governance of common pool resources (following Ostrom) and the development of resilience-based approaches to the management of environmental assets and complex adaptive socioecological systems (following Holling, Folke, and the Resilience Alliance), with a focus at local and regional scales. This paper identifies key underlying assumptions and axioms of the AG literature, comments on its strengths and weaknesses relative to other approaches, and argues for an extension of AG thinking to a wider range of policy domains and socioeconomic scales. It suggests that applying AG more widely will require clarifying when changes in governance arrangements are (or are not) adaptive, which involves a normative judgement and so defines AG as “the evolution of rules and norms that better promote the satisfaction of underlying human needs and preferences of the community governed by these rules and norms, in the context of changes in understanding, objectives, and the social, economic, and environmental circumstances.” One implication is that policy recommendations and other proposed governance interventions should seek to be both worthwhile (analytically rigorous) and attractive (providing benefits of value to each relevant constituency).

Framed in this way, AG establishes a robust reference point for examining the dynamics of institutional change—akin to the concept of market failure within economics—and lays the groundwork for identifying impediments to the adoption of welfare-improving changes in governance across a wide variety of issues and scales.

The paper then examines how science could be more effective in informing societal responses to urgent sustainability challenges. It identifies five common impediments to AG at regional, national, and global scales and locates them within the overall AG framework. These impediments include that science-based knowledge and engagement (i) is not always relevant, integrated, and fit for purpose; (ii) fails to recognize and harness plural values and knowledge systems; (iii) fails to deserve and achieve social licence to operate; (iv) does not promote open-minded consideration of issues that are polarized along worldview divisions; and (v) rarely understands and manages science-policy engagement as an element of a wider complex system.

The paper concludes that AG provides a practical approach to understanding the effectiveness of urgently required national and global governance interventions, the attractiveness and adoptability of those interventions, and constructive responses to potential barriers that might otherwise block the adoption of welfare-enhancing changes.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Decoupling Social Aspirations and Economic Activity From Cumulative Ecological Impacts—Insights From the DPISR Accounting Framework

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Type of Presentation: Paper presentation

Biography: Steve Hatfield-Dodds has worked for more than two decades at the intersection of research and public policy, with recognised expertise in adaptive governance, integrated modeling and assessment, ecological economics, and the science-policy nexus.

Heinz Schandl is an international expert on natural resource use and resource efficiency including its history, the socioeconomic drivers, and its likely trajectory.

Steve and Heinz both contributed to the groundbreaking *Australian National Outlook* (www.csiro.au/nationaloutlook) and *Nature* paper (DOI 10.1038/nature16065).

Abstract: Adoption of the UN Sustainable Development Goals and Paris climate accord bring renewed attention to the need to reduce ecological pressures while also better meeting human needs and aspirations.

The associated discussion of decoupling environmental pressures from economic growth is often framed in terms of Ehrlich's I=PAT formulation (which defines impact as a function of population, affluence, and technology). Here we draw on an interpretation of the DPISR framework to identify key steps from underlying drivers (societal values, aspirations) through drivers (economic activity, population), pressures (energy, material extractions), and impacts (climate change, biodiversity loss) to states, which we interpret as cumulative impacts (damage and risks to earth systems and essential life support). This implies multiple potential contributions to decoupling, which can be expressed in terms of the relationships between underlying drives and drivers (reduced activities), drivers and pressures (reduced intensity), pressures and impacts (reduced pressure coefficients), and impacts and states (reduced damage, or repair of past damage). While in principle this approach can be applied to both ecological and societal impacts, we focus in this paper on ecological impacts.

We review available evidence on decoupling potentials, including changes in activities, intensities, and pressure coefficients. We find that substantial decoupling could be achieved through these multiple potential intervention points—offering the prospect of reducing cumulative impacts without any changes in societal values or aspirations. It is not clear, however, that available technical potential is sufficient to ensure future pressures and impacts remain within regional and global ecological limits or planetary boundaries. This implies that institutional changes, values activation, and values change all have valuable potential contributions, while recognising that some types of contributions (particularly changes in societal values) may be difficult to catalyze, take longer to achieve, or risk unintended consequences.

We conclude that examining decoupling potential through the DPISR framework has a number of advantages over the more commonly used I=PAT formulation.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Internalizing External Costs of Private Consumption—Socially Compatible or Not? An Income-Related Analysis for Germany

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Biography: Benjamin Held is a research associate at the Institute of Interdisciplinary Research (FEST e.V.) and at the Alfred-Weber-Institute for Economics of the University of Heidelberg. He is currently writing his doctoral thesis about the “Effects of the Internalization of External Costs of Private Consumption” at the University of Heidelberg.

Abstract: “Prices should tell the ecological truth.” This demand—put into a popular slogan—was stated emphatically by many over the last decades. Yet in many cases prices continue to “lie”: External costs are still not fully internalized into the prices of many goods and services. Others and/or future generations have to pay these costs. Therefore, the price mechanism, the most effective information and control instrument of a market economy, is distorted. Of course, solely internalizing external costs will not solve environmental problems, but at least people would have better information for their investment and purchasing decisions instead of being misled.

Why is it that external costs are still not fully internalized? An often stated argument against internalization concerns the question of its social compatibility: Poor households would be burdened much more heavily than rich ones (regressive tax burden). However, there are no reliable statistical analyses that prove or disprove this thesis for Germany in a comprehensive way. This contribution is based on a doctoral thesis that aims to close this gap.

In a first step, income-related data analyses of already existing data sets are conducted. They cover all areas of private consumption. The concept of net equivalent income is used to determine the economic capability of households. The members of the households are classified into deciles based on their net equivalent income. The used data sets are the scientific-use-files of the German Income and Consumption Survey 2008 and 2013 (about 44,000 households), the data set Mobility in Germany 2008 (about 50,000 households) and the Socio-Economic Panel of the DIW Berlin (SOEP v31; about 12,000 households).

In the second step environmental impacts are calculated by using emission factors, which are based on life cycle assessments (LCA; bottom-up; database: GEMIS). For consumption areas for which no LCA-data exist, an environmental extended input-output-analysis (EE-IOA; top-down) is used to calculate environmental impacts. Direct as well as indirect environmental impacts of consumption are included. The main focus is put on climate change impacts; where possible other environmental impacts such as acidification and eutrophication are also considered.

Finally, to calculate the external costs of private consumption, so called best-practice cost factors are used. These are published by the German Federal Environment Agency.

Based on these calculations the following research questions are addressed: How do consumption patterns and the external costs they cause differ between income groups? How much of the external costs are already internalized (e.g., by taxes or trading schemes)? How big—if there is one—is the internalization gap? What would be the consequences for different income groups if external costs were fully internalized?

The contribution will shortly explain the calculation methods, present interim results, and discuss their limitations and possible implications. Furthermore, possible instruments that are socially compatible for internalizing external costs (e.g., the so-called eco-bonus) will be discussed. As an outlook, the role the internalization of external costs can play en route to sustainable consumption will be assessed.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Alternative Economic Welfare Measurement in Germany—Results and Potential Role in National Sustainability Strategies Based on the National and Regional Welfare Index

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Dorothee Rodenhäuser is a research associate at the Institute of Interdisciplinary Research (FEST) and a PhD student/teaching assistant at the Alfred-Weber-Institute for Economics, University of Heidelberg.

Abstract: In recent years, the public discussion on welfare measurement beyond GDP has gained considerable momentum in Germany. Among other developments, a lasting political interest in the National Welfare Index (NWI) and its regional adaptation (Regional Welfare Index, RWI) points to the possibility of change. The NWI was created in 2009 with support from the Ministry of Environment to improve sustainability and welfare accounting in Germany at the federal level, by developing further the methodology of the ISEW. Answering a demand by political actors from green parties, it was adapted for the state level in 2011 and has since been calculated for seven German “Länder”: Schleswig-Holstein, Bavaria, Thuringia, Saxonia, Hamburg, Rhineland-Palatinate, and North Rhine-Westphalia.

The contribution focuses on three aspects: First, the latest results of the NWI and RWIs are presented and compared; major differences are identified and explained.

Second, the contribution will focus on one of the main problems that impede the widespread use of alternative welfare measures: the time lag. If the time lag of the publication is too large, it is difficult to compete with GDP. In Germany, GDP is published quarterly with a time lag of about one-and-a-half months. The current time lag of NWI amounts to—in the best case—22 months. In order to check for ways to reduce the time lag a project with the Macroeconomic Policy Institute (IMK) was started. Because of its high relevance, special emphasis is put on the component of income distribution and the potential use of prognostic instruments to estimate distributional changes. Interim results of this project will be presented and discussed.

A shorter time lag would also benefit the NWI’s chances of being considered for the German national sustainability strategy, which the German government is planning to refine. In this process the indicator set of the current strategy, the indicators proposed by the Enquête Commission “Growth, Prosperity and Quality of Life” and the results of a “Citizen Dialogue on Good Life in Germany” that had been organized by the federal government and hosted by Chancellor Merkel in 2015, are (re)considered. At the same time, the update shall take into account the Sustainable Development Goals (SDG). In the last step of the contribution, the refinement process of the German national sustainability strategy and the role the NWI has or could have in it is analyzed and discussed. Beyond the German context, it will also be discussed what role alternative welfare measures in general can play concerning the measurement and implementation of the SDG.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Land Control and the Social Reappropriation of Resources Under Recent Ecotourism Projects

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Type of Presentation: Paper presentation

Biography: Pablo Hernandez completed his PhD in economics at the University of Notre Dame. He has been at Hollins University since the fall of 2007, where he has taught introductory and upper-level undergraduate courses in economics, environmental studies, and international studies. His research interests lie in development, environmental economics, and ecological economics, and he has several publications and presentations in these areas.

Abstract: Indigenous dispossession, marginalization, colonization, and tenure/tenancy reforms are all common forms of land control and enclosure (Peluso & Lund, 2013). More recent forms of land control and dispossession include affirmation of land rights in the name of exclusionary resource conservation initiatives, such as the reorientation of labor use to produce carbon forestry products rather than the more traditional rich biotic and cultural crops (Osborne, 2013; Toledo & Barrera-Bassols, 2008). Land control also appears under the guise of new “territorialization” initiatives and ecotourism projects, both manifestations of primitive accumulation.

We identify recent forms of land control throughout various ecotourism projects in the eastern highlands of the state of Chiapas, Mexico. We identify patterns of exclusionary conservation initiatives gathered around recent ecotourism projects scattered throughout that region. This problem relates to the sustainable management of enclosed community livelihood where sustainability is understood from multidimensional perspectives. Historical roots of indigenous oppression in that region are underscored, as are contemporary attempts to alter labor relations as a social reappropriation of resources displaces the biological reproduction function of the same under earlier indigenous imaginaries. These latest land-control mechanisms have wrought further dispossession, particularly among indigenous smallholders.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Measuring the Costs and Benefits of Land Use Changes: An Holistic Ecosystem Services Valuation Approach

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Biography: Dr. Jesko Hirschfeld, economist, has 20 years of experience in economic modeling, ecological-economic valuation within interdisciplinary projects, and political decision support. As a senior researcher at the Institute for Ecological Economy Research in Berlin, Germany, he is responsible for the topic “water and land management.” He is experienced in river basin and coastal zone management, agri-environmental policies, environmental aspects of international trade and development, and the assessment of climate change mitigation and adaptation policies.

Abstract: Agriculture plays an important role for achieving greenhouse gas mitigation targets. But strategies focused solely on climate change could foster unintended negative consequences for other ecosystem services than the regulation of greenhouse gases. The project CC-LandStraD therefore analyzed the consequences of different strategies focusing on climate change mitigation, biomass production, and nature conservation. In order to provide effective decision support for a sustainable land management based on these strategies, a holistic perspective on their costs and benefits is required, materialized in an extended cost-benefit analysis. The valuation framework is based on the ecosystem services approach as a tool to categorize agricultural land use related costs and benefits into provisioning, regulating, and cultural ecosystem services. Provisioning ecosystem services relates to products that are traded at markets (e.g., the agricultural outputs) and valued with market-based methods. To approximate the effects in monetary units, we used results from the agricultural and environmental information model RAUMIS in terms of differences in profit margins to agricultural firms. Regulating (e.g., carbon sequestration and nutrient retention) and cultural ecosystem services (e.g., landscape scenery) require nonmarket valuation approaches like the assessment of abatement costs and elicitation of willingness to pay values. The values of cultural ecosystem services were determined through a stated preferences survey, conducted with nearly 10,000 randomly sampled respondents in Germany.

The results show that the highest net benefits could be achieved with a strategy that (besides the climate change mitigation goal that all strategies had in common) focused on extensification of agricultural production and on an enhancement of nature protection. The strategy focused on an increase in biomass production is the least effective one, which is mainly due to societal costs for the deterioration of landscape scenery and biodiversity.

As such analyses inherit a high degree of uncertainty, we also provide results of a sensitivity analysis, which revealed that the net benefits and thereby the ranking of strategies strongly depend on normative assumptions, e.g., on the costs of CO₂ emissions. In extreme cases, this can lead to a shift in the ranking of the respective strategies.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Environmental Justice Along Product Life Cycles: Importance, Renewable Energy Examples, and Policy Complexities

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Type of Presentation: Paper presentation

Biography: Professor Hoffman's 2010 book, *The Cooperation Challenge of the Economics of and Protection of the Water Supply*, explores the famous New York City collaboration as a limited experiment in sustainability. Her articles explore economic aspects of sustainability and environmental justice issues from varying perspectives including indicator construction, gender, criminal justice, social entrepreneurship, and product life cycles. She teaches courses in environmental economics and sustainability. She founded her college's Sustainability and Environmental Justice minor and program.

Abstract: Environmental justice is critical to our efforts to preserve the human habitat from the degradation of pollution and climate change because of the need for cooperation and due to our ignorance of how the intertwined effects of our actions in one locality affect the quality of life in other localities across the world. While environmental justice questions often focus on the location choices for specific activities that pollute, another important perspective is environmental justice over the life cycle of the production of products. Upon close examination renewable energies, critical alternatives to the fossil fuels that induce climate change, have environmental justice issues over their life cycles. Formal, statutory national law is not sufficient to address environmental justice problems along product life cycles in a world in which production is globalized and environmental effects pass beyond political borders. The responses to this challenge must draw on an interacting combination of information, custom, soft law such as international standards and certification, and formal national laws. Through an interesting complex of intertwined effects, this system has already advanced our capacity to address environmental justice problems along product life cycles. The magnitude of the challenge and the complexity of the system demands ongoing effort and further innovation. Also, the system is not well configured to address our burgeoning consumption, which continues to expand the burdens of future generations.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Water Transfers From Agriculture: Estimating the Impact of Foregone Production and Aquifer Decline in Northern California

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Type of Presentation: Speed talk

Biography: Dr. Houk is a Professor in the College of Agriculture and Science Director for the Center for Water and the Environment at California State University, Chico. Dr. Houk's research focuses on the economics of water allocation and water conservation. Specifically, he has examined the economic impacts of water transfers from agriculture, the economic effects of irrigation induced waterlogging and soil salinization, and the impact of water conservation efforts on residential water demand.

Abstract: The majority of California's fresh-water supply is located in the northern part of the state, while a majority of the water demand is in the central and southern parts. As such, large infrastructure projects were developed to transfer northern water supplies to southern water users. This ability to transfer water has placed pressure on northern California farmers to sell/lease their water and decrease agricultural production and/or increase groundwater pumping to offset these transfers. In addition to increasing water demands from the south, the current drought has placed even more pressure on these northern water supplies. Although water is already being transferred from northern California farms, the cost of these transfers on regional economies and aquifer levels are often poorly understood. The primary objectives of this study were to estimate (1) the economic impacts associated with land fallowing for surface water transfers and (2) the impact of additional groundwater pumping on aquifer levels. The direct impacts of land fallowing were estimated by identifying the forgone farm production and the indirect and induced (off-farm) effects were estimated using IMPLAN (Impact analysis for PLANning). Groundwater pumping scenarios were evaluated using the United States Geological Survey's (USGS) Central Valley Hydrologic Model (CVHM). The CVHM allowed us to predict the spatial and temporal effects of additional pumping on the groundwater levels. Changes in groundwater levels were used to estimate the additional groundwater pumping costs expected to occur throughout the region.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Measuring Economic and Social Impacts of UDC Farmer's Market

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Type of Presentation: Paper presentation

Biography: Xiaochu Hu is an economic evaluation specialist at UDC, where she teaches academic courses and conducts research on sustainable development. Prior to joining UDC, Xiaochu worked as a research assistant for the Center for Regional Analysis at George Mason University for five years. Xiaochu Hu received her PhD in public policy from George Mason University in 2014. She was also 2013 AEA-CSWEP Summer Economics Fellow and 2012 Philip Dearborn Fellow of the Economic Club of Washington, DC.

Abstract: Run by the Center for Sustainable Development (CSD), College of Agriculture, Urban Sustainability and Environmental Sciences (CAUSES) on every Saturday at the Van Ness Campus from May to late November since 2013, the UDC Farmers Market brings local, fresh, and sustainable produces to Ward 3 residents and beyond. This study's results are based on 250 surveys conducted at the market throughout the market season of 2015.

The economic impacts of the farmers' market goes far beyond the sales value because the local spending causes a larger multiplier effect throughout the economy that will stay local, compared to the spending that happens at grocery stores. Using the Sticky Economy Evaluation Device (SEED) methodology, it is estimated that the UDC Farmers Market in 2015 market season (mid-May to late-November) has an annual combined economic impact of \$423,450 on its vendors, host neighborhood, and surrounding region in the District of Columbia. Operating 26 days per year, the UDC Farmers Market is estimated to enjoy gross annual receipts of \$140,600. The CSD evaluation team also learned through its survey that the UDC Farmers Market attracts approximately 300 shoppers per market day, which results in an estimated annual attendance of 7,500 shoppers.

The social impact of this public market comes in three major ways: (a) an increase in fresh food access, (b) an increase in fresh food consumption, and (c) a decrease in food mileage (cost of transportation). In addition, core market statistics such as shopper frequency, geography, and other important demographic details are captured in our study.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Economic Benefits of Hydroponic and Aquaponic Systems

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Abstract: Hydroponic and aquaponic systems are both high-technology and bio-intensive agriculture systems that are relatively independent from the soil, water resources, and temperature of the local environment. Aquaponics, a unique type of hydroponics system, can use even fewer water resources than traditional hydroponics methods by converting fish waste to fertilizer for plants. Both hydroponic and aquaponic systems have great potential in mitigating risks and adapting agriculture to variations in climate, as well as acclimating agriculture in urban settings and other land- and resource-conscious environments. However, there has not been any comprehensive study quantifying the economic benefits of using hydroponic and aquaponic systems.

This study calibrates the economic benefits of hydroponic and aquaponic systems, respectively, compared to conventional field growing (baseline 1) and greenhouse growing (baseline 2) methods. Hydroponic growing methods' economic benefits come in the form of saving on land and water cost and in a possible increase in yield and faster crop rotation. Aquaponic systems' economic benefits, in addition to those of hydroponic, come in saving on fertilizer costs and fish production. In order to calibrate these benefits, empirical production data of the same crops under each condition are collected and then translated into a market value.

The results of this study will fill in the gap of the economic evaluation literature in high-technology agriculture research and will serve as substantial evidence in further popularizing these hydroponic and aquaponic methods.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Sustainability Transitions of Scientific Disciplines

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Biography: Janne I. Hukkinen is professor of environmental policy and director of the Environmental Policy Research Group at the Department of Social Research, University of Helsinki, Finland. Inge Røpke is professor at the Department of Development and Planning, University of Aalborg, Copenhagen, Denmark.

Abstract: The complexities of inter-, trans-, cross-, and multidisciplinary research have stimulated an intensive academic discussion in ecological economics over the definitions of and distinctions between different forms of hybridized knowledge production. However, the implications of hybridized knowledge production for the established disciplines from which the hybrids are shaped have received less attention. We argue that contemporary sustainability challenges require transitions not only in the practices of human-environment interaction but also in the scientific disciplines that constitute the knowledge base for such practices.

Recent discussions among ecological economists over hybridized forms of knowledge production can be divided in two groups. On one hand, cooperative efforts across disciplines have been characterized as metaphorical islands in an archipelago between two continents, with natural sciences and engineering on one side and social sciences and humanities on the other. The islands have different disciplinary roots and research foci but share some core axioms: first, they see social and natural systems as complex systems in their own right—the systems cannot be reduced to each other; second, social and natural systems interact and influence each other—causality goes in both directions; and third, the fields share an interest in finding more sustainable ways of interaction—they share a normative approach. On the other hand, there have been calls for a greater fusion between natural and social sciences. Established disciplines are from this perspective seen as too narrow to enable a crossdisciplinary understanding and may need to be partly replaced by interdisciplines that focus on novel hybrid analytical entities.

On the face of it, the idea of respecting natural and social systems as causally interactive systems in their own right and the idea of novel interdisciplinary analytical entities would appear incompatible. Is this so, or is it just a matter of short- versus long-term ambitions? And what should the ambitions of interdisciplines such as ecological economics be? We start by elaborating on the challenge of the mismatch between sustainability problems and the present knowledge structure of scientific disciplines. We then discuss to what extent this challenge can be addressed through crossdisciplinary cooperation. Since we find considerable problems in such cooperation, we argue that more radical steps are needed in the development of interdisciplines, and that this work ought to transform traditional disciplines and education.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Ecovillages—Ecological Economics in Practice?

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Type of Presentation: Paper presentation

Biography: The authors all work at the Centre for Ecological Economics at the University of Nordland. Prof. Dr. Ove Jakobsen has worked in the field of ecological economics since the early 1990s and has published several books and articles both nationally and internationally. Senior Lecturer Øystein Nystad works mainly in the field of environmental management; he has published books and articles nationally and internationally. Associate Professor Are Ingulfsvann (PhD) teaches in leadership and ethics and ecological economics.

Abstract: In this article we penetrate to what extent eco-villages represent relevant and illuminating models for ecological economics in practise.

Ecological economics is a transdisciplinary field of science studying the connection between economy, nature, and society, accepting that the Earth itself and all its living and nonliving components are a united community. Berry describes this interconnectedness in the following way: “There can be no sustained well-being of any part of the community that does not relate effectively to the well-being of the total community” (Fabel & St. John, 2007, p. 63). Ecological economics accepts that economic activities have to be in constructive interplay with their cultural and natural context.

In mainstream economics, competition has a central standing as regulating principle. Distinguished scholars in economics, from Adam Smith to Milton Friedman, have argued that competition is necessary to promote efficiency and wealth. They look at competition as a natural state of affairs in a hostile market environment, assuming aggressive individuals motivated by their self-interest.

In harmony with ecological economics, eco-villages offer a radically different example of how people and communities based on cooperation help in the transition to a more sustainable future. Eco-villages are an initiative looking for sustainable ways of living and promote innovative solutions in response to climate change, pollution, resource shortages, and social problems that people face. Eco-villages foster a culture of mutual respect, sharing, inclusiveness, positive intent, and fair energy exchange. Eco-villages are communities that integrate a healthy social environment with very resource-intensive lifestyles.

According to Ross Jackson, Global Eco-village Network (GEN), the best way to establish viable communities within the framework of sustainable nature and society is to initiate change in the direction of decentralized eco-villages. An eco-village is typically a society in miniature, situated in a small area, with not more than 50–400 people. Because of the size it is easier to provide viable solutions to problems than in modern western societies. Because all ideal eco-villages are different it is impossible to characterize the ideal eco-village. What do exist are thousands of partial solutions in myriad variants on the same general theme, in different cultures, under different climactic conditions, and under different kinds of societies (<http://www.ross-jackson.com/rj/21987/41762/>). A unifying characteristic of all resilient eco-villages is that they are in a process of development all the time.

We conclude that eco-villages based on life-enhancing cooperation have much in common with the main principles in ecological economics and are relevant as beacon lights for the development toward sustainable societies as a whole.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Friluftsliv as a Path Toward Nature-Friendly Lifestyle

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Type of Presentation: Paper presentation

Biography: Are Severin Ingulfsvann (PhD) is associate professor in ecological economics at University of Nordland, Norway. His PhD thesis was about value displacement in the Norwegian culture of Friluftsliv, examining how a frugal culture became commercialized. Are teaches in leadership and ethics and ecological economics.

Abstract: The Norwegian word for certain outdoor activities, “friluftsliv,” is often translated as outdoor life or outdoor recreation, but the word is value laden, and according to Naess and Rothenberg (1989) it should not be translated, since the English terms do not cover the value content toward free nature. Friluftsliv has a background in a counterculture against depression of free nature. In the 1970s, the eco-philosophical movement put it forward as the beginning of a change—where the focus should be on encouraging simpler lifestyles where people developed close connections to nature and decreased their consumption. Frugality and simplicity are important values in friluftsliv. These values represent attitudes breaking fundamentally with the attitudes pushed forward by modern marketing. The idea that one can increase quality of life through a reduction in consumption stands as an opposite to the main assumptions in the ideas that have led economic development since the 19th century. Jevons (1888) stated that human wants are insatiable and will never be satisfied—therefore consumption will increase. Ecological economics, taking a different turn, suggests that the economic system must be aimed at increasing quality of life without increasing consumption and that an aim for ecological economics is therefore to point out ways to increase quality of life and well-being without increasing consumption. We also see that fewer people grow up close to nature, and therefore nature, which is the foundation for living, becomes something strange and abstract, sometimes even considered hostile and dangerous. An argument in the philosophy behind friluftsliv is that when you know nature, you will also care about nature. Going into nature and staying there on nature’s premises helps people to reconnect with nature and become more aware of the problems caused by modern consumption culture.

The ideas and values in friluftsliv offer opportunities for both developing nature-friendly lifestyles and replacing leisure time based on consumption of goods with leisure time based on living within the natural environment.

This paper examines the history of the tradition and its weight on encouraging the love of nature and simple lifestyles as a path toward a strong, sustainable development, to establish an understanding for good lives based on reduced consumption.

Transforming the Economy Sustaining Food, Water, Energy and Justice

EU ETS and Innovation Activity

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Type of Presentation: Paper presentation

Biography: Dr. Emiko Inoue is a senior lecturer at the Graduate School of Economics, Kyoto University.

Abstract: Innovation is expected to play a more important role in overcoming difficult issues of climate change than ever. This study examines how corporate reactions toward the EU ETS influence innovation activity (R&D investments) of EU major corporations. Using firm-level panel data constructed based on the Carbon Disclosure Project, EU Industrial R&D Investment Scoreboard, and corporations' CSR reports, I estimate two dynamic panel models using a system GMM estimator. Endogeneity issue is addressed in these models. The results show that corporations that have a policy or a strategy to comply with the EU ETS or to react proactively before being regulated by the EU ETS are more likely to encourage R&D investment. The process of reacting toward the EU ETS may provide an opportunity for corporations to recognize the importance of R&D investment for their future strategy.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Why Less Bad Is No Good—A Required Shift From Green Economy to Ecological Economics

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Biography: Ove Jakobsen is professor in ecological economics and leader at the Center for Ecological Economics and Ethics at the Bodø Graduate School of Business/Nord University. Vivi Storsletten is a PhD research fellow, working on process quality in kindergartens in the context of ecological economics. Both perform transdisciplinary work, bringing together research on the economy, business administration and leadership, ecology, philosophy, and the social sciences.

Abstract: In the UN report entitled “Wake up before it is too late,” it is argued that “The world needs a paradigm shift in agricultural development: from a ‘green revolution’ to an ‘ecological intensification’ approach” and that “the required transformation is much more profound than simply tweaking the existing industrial agricultural system” (UNCTAD Report 2013). A shift to an ecological paradigm has several consequences for agriculture on both local and global levels. The UNCTAD report prescribes a fundamental systemic change.

In this article, we argue that the indispensable paradigmatic shift in agriculture gives a realistic idea of the massive and fundamental changes required in economics. This paradigmatic shift means that we have to change from green economy toward ecological economics. William Rees (2008) reasons that green economy has scarcely helped to solve the major environmental challenges; instead, it has contributed to concealing the real problems behind a veil of green concepts, e.g., green marketing and green growth. To delve deeper into the paradigmatic preconditions behind green economy and ecological economics, respectively, we focus specifically on contrasts on the ontological level.

On the one hand, solutions within green economy focus on how to reduce negative environmental and social symptoms using tools within the established neoliberalist economic paradigm. Since green economy focuses on reducing negative symptoms it (indirectly) contributes to protect the existing economic paradigm. On the other hand, contrary to green economy the focus in ecological economics is on bringing the economic and ecological crisis down to Earth by changing the system. Hence, ecological economics focuses on changes on both individual and systems level aiming to eliminate the causes behind the negative symptoms. To do this ecological economics revises the paradigmatic preconditions for economics and exceeds the established economic paradigm.

Ecological economics points to systemic failures connected to the mechanical and linear way of thinking to explain our limited success in reducing the negative and often unintended effects of the dominating economic system. In other words, ecological economics claims that the neoclassical economic paradigm based on a mechanical worldview is the problem and has to be substituted with a paradigm anchored in an organic worldview.

We conclude that green economy is well-suited to reduce many of the negative environmental and social consequences arising from the dominating economic paradigm. To establish harmonic interaction, however, between economy, nature, and society, it requires a shift to ecological economics.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Rethinking Agreement? Reflections on the Implications of Nudging Experiments in an Ongoing Regime Transformation Within Finnish Silviculture

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Type of Presentation: Paper presentation

Biography: Dr. Nina Janasik-Honkela works as a postdoctoral researcher in the Environmental Policy Research Group led by Prof. Janne I. Hukkinen at the University of Helsinki, Finland. Associate Prof. Ari Jokinen works as a senior researcher at the University of Tampere, Finland. Maria Åkerman works as a fixed-term professor in natural resources policy at the University of Eastern Finland.

Abstract: The Finnish forestry regime is currently undergoing a shift toward more open and diversified forestry management practices, as enabled especially by the new forestry legislation of 2014. In contrast to previous times, the legislation now, among other new liberties for forestry owners, allows for the application of the so-called Continuous Cover Forestry (CCF) way of practicing silviculture. As a set of forestry management practices designed to avoid the currently paradigmatic clear-cutting, CCF can be viewed as a long-suppressed niche technology that is trying to pave its way in Finnish forestry in explicit contrast to the calculations (in a broad sense) of natural scientists, forest economists, and other regime-bound actors alike. As a result of CCF being banned in Finland for 60 years, however, there is little knowledge of either the natural scientific, economic, or sociocultural ramifications of the newly liberated forestry management technology. As part of an attempt to clarify these issues, environmental social scientists have undertaken to conduct experiments based on nudging or the design of choice architecture. Although the explicit aim of the nudging experiments is pragmatic (to inquire into the most effective ways of framing policy instruments and management practices to different forestry stakeholder groups to facilitate quick adoption in the context of Finland's fragmented land ownership), conducting them in the context of participatory workshops raises interesting questions about the relationship between the more-often-than-not consensus-oriented mode of working within participatory structures and the potentially conflict-amplifying effects of nudging, especially in its explicitly linguistic forms. In this paper, we inquire into the implications of nudging, understood on the basis of our previous work as an experimental practice premised on the intentional and skillful use of cognitive dissonance, for the ongoing transformation within Finnish silviculture. Our preliminary hypothesis is that in addition to the specific—and potentially dramatic—contributions to the unfolding of the regime transformation in itself, linguistic nudging experiments also bring to the fore some of the implicit assumptions currently guiding efforts at participatory engagement.

Transforming the Economy Sustaining Food, Water, Energy and Justice

CO2 Emission Profiles for Mobility Behavior

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Type of Presentation: Paper presentation

Biography: Building on a background in economics, Julia Janke acquired experience in environmental economics as a researcher at the Institute for Advanced Studies (IHS) in Vienna. She currently works at TU Vienna at the Department of Spatial Planning, and her PhD research concentrates on the energy–welfare relationship. Stefan Schmelzer, mathematician, and Michael Miess, economist, work at the IHS in the field of ecological macroeconomics. In their PhD research, both concentrate on financialization and post-Keynesian macroeconomic modeling.

Abstract: Mobility needs in industrialized Western countries are mainly satisfied by fossil-fuelled transport choices that contribute significantly to the emission of CO₂, thereby driving anthropogenic climate change.

This paper aims to assess drivers of transport-related CO₂ emissions by setting up CO₂ emission profiles based on a household survey. This approach allows insights on spatial and structural determinants of mobility and CO₂ emission patterns. Our analysis is based on a representative household survey (1449 observations) in Austria from 2013. Three indicators were set up to provide CO₂ emission profiles for mobility behavior. The first indicator refers to CO₂ emissions generated by a typical trip that persons traveled most often. The second indicator reveals CO₂ emissions emerging from daily mobility behavior. Both indicators are based on trip distance and transport means (walking, car, motorcycle, bus, train, bicycle, underground, and tram). The third indicator considers distances and car-type ownership when relating to CO₂ emissions generated by annually driven kilometres by car.

Cross-sectional multivariate analyses allow insights on determinants of CO₂ emission level resulting from different mobility behaviors. Our results show that the size of a city, occupational status, and income are the most important factors in determining CO₂ emissions of persons. However, for some CO₂ emission indicators income becomes insignificant when age is included due to the correlation between income and age. Relating to daily driven kilometres, sex adds explanatory power since men drive more often and over larger distances. Also educational status becomes relevant as more highly educated people tend to travel by car more often. Persons living in rural areas have a higher CO₂ emission profile than people in urban areas because typical trips are longer. However, persons living in intermediately populated areas have even higher CO₂ emissions than rural areas, revealing interesting implications for spatial and regional planning. In general, persons living in larger cities tend to have lower CO₂ emissions because availability and actual use of low carbon transport modes (public transport, walking, cycling) become more common. Moreover, a positive environmental attitude does not directly affect CO₂ emissions generated by mobility in general.

These insights reveal that a combination of diverse factors creates characteristic CO₂ emission profiles. External and individual barriers as well as preferences play a crucial role for CO₂ emission patterns generated by mobility. A combined analysis of socioeconomic and spatial patterns informs urban and regional policies by providing insights on effective low-carbon mobility solutions.

Transforming the Economy Sustaining Food, Water, Energy and Justice

What Future Should We Count On? How System Futures Frame the Socioeconomic Assessment of Energy Investments

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Type of Presentation: Paper presentation

Biography: The authors are part of the interdisciplinary Centre for Design, Innovation and Sustainable Transition located at Aalborg University, Denmark. The center is committed to supporting sustainable transitions for economic and societal production systems.

Abstract: National planning and regulation of large-scale societal infrastructures in Denmark is increasingly influenced by socioeconomic analysis. Based on a survey of studies involving socioeconomic valuation of wind turbines in Denmark, we discuss whether socioeconomic analysis as an appraisal tool is likely to support a green transition of the energy system. We illustrate that socioeconomic valuation of wind turbines cannot be performed without assumptions regarding the future development of the overall energy system because the societal value of wind turbines is predicated on the ability of the future energy system to make good use of intermittent electricity. When planners calculate the socioeconomic effects of wind turbines, their choice of energy system future is thus critical for the outcome of the analysis.

The implication is that the choice of energy system future tends to generate self-fulfilling effects. Socioeconomic analyses that employ conservative energy system futures will favour path-dependent investments that fit into the present-day energy system. In contrast, socioeconomic analyses that assume that the energy system will undergo more radical changes over the coming decades tend to prioritize more transformative investments that do not necessarily fit well into the present-day energy system. In planning systems where socioeconomic analysis is an influential appraisal tool, the capability to construct and promote energy system futures is thus critical. Actors who support a transition agenda need to construct and promote energy system futures that make the socioeconomic effects of renewables appear positive. In order to promote democratic engagement, it is furthermore important to publicly illustrate and discuss which choice of “in-built“ energy system future that socioeconomic calculations of concrete investments draw upon.

Transforming the Economy Sustaining Food, Water, Energy and Justice

The Intrinsic Food Price—A New Metric for Global Food Policy

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Type of Presentation: Paper presentation

Biography: Lili Jia is a research associate in the Department of Engineering, University of Cambridge.

Abstract: Food price has played a central role in shaping food consumption behavior; however, neither sustainability nor health incentive of consumption behavior has been considered in food price. This paper will propose a new metric for global food policy by introducing intrinsic characteristics into food price. According to Lancaster (1966), any food item possesses more than one intrinsic characteristic, and these intrinsic characteristics can provide the satisfaction that a consumer requires, while the food item represents a combination of these intrinsic characteristics. An intrinsic food price is hence defined as the quantity of compensation paid by consumers for obtaining each unit of intrinsic food characteristic.

The intrinsic food price is directly linked to the incentives of food consumption behavior. As the intrinsic characteristics are the primary incentive of food consumption, intrinsic food prices can reveal the primary incentives of food consumption. Normally, consumers have more than one incentive in food consumption, and intrinsic food price can reveal the complex incentives from different dimensions. However, the incentives of food consumption are not static, and they will change with the economic, institutional, and environmental situations. The intrinsic food price can reveal these dynamic incentives of consumption behavior.

Further, we will demonstrate with the U.S. data between 1960 and 2012 that food price, without considering intrinsic characteristics, has been distorted in nutritional, environmental, and aesthetic dimensions, and these distortions prevent consumers from consuming food in a healthy and sustainable manner. It implies that food price policy targeting at reducing the intrinsic distortions will contribute to consumption behavior transitions from energy-dense to nutrient-dense and from resource-intensive to intelligent-intensive food systems.

To our knowledge, intrinsic food price has not been proposed so far, and this price has a novel feature of revealing food consumption behavior from intrinsic dimensions.

Reshaping human diets is a transdisciplinary task that requires a structural change across food system and cannot be fulfilled by any single discipline. Intrinsic food price serves a transdisciplinary and integrated metric for global food policy. The metric will allow researchers from various disciplines, such as economics, nutrition, and environmental science, to work together to facilitate dietary transitions from unhealthy to healthy and from resource-intensive to intelligent-intensive behavioral patterns.

Reference: Lancaster, K. J. (1966). A new approach to consumer theory. *Journal of Political Economy*, 74(2): 132–157.

Transforming the Economy Sustaining Food, Water, Energy and Justice

The UDC Urban Farm Project: Partnerships for Triple-Bottom-Line Transformation

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4th Author: Ian Leahy - American Forests

Type of Presentation: Roundtable

Biography: Dwane is the director of the Center for Sustainable Development, at which he implements research projects that integrate all programs of the College of Agriculture, Urban Sustainability and Environmental Sciences in an effort to produce and understand the implications and impacts of sustainable development. Dwane conducts research and teaches courses in urban sustainability, urban design, urban planning public policy and health, research and ethics, and low impact development. He holds degrees in urban planning, environmental planning, and urban design.

Abstract: This presentation will describe a uniquely collaborative process through which a large vacant parcel in southeast DC is being transformed into an urban farm, environmental research center, and community hub for recreation, art, and education. As part of the Urban Waters Federal Partnership, a team of representatives from the University of the District of Columbia, federal and city agencies, local nonprofit and resident groups, and design companies has worked together to identify ways to address environmental and public health issues in the Anacostia watershed. Members of the key partner groups will present the project from different perspectives, highlighting the major components of the process and its projected benefits.

Transforming the Economy Sustaining Food, Water, Energy and Justice

An Operational Safe-and-Just Space: Integrating Material Flows to Evaluate National Performance

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Type of Presentation: Paper presentation

Biography: Peter Sjøgaard Jørgensen is a biologist studying the macroecological consequences of anthropogenic global change and sustainable solutions that improve biological food, resource, health, and environmental systems in the 21st century. Peter's research focuses on unveiling recent macroecological trends in global natural resource use at the resolution of national economies. In particular, he seeks to integrate macroecological and social-ecological perspectives on the matter and to provide an integrated assessment of long-standing hypotheses originating from economics, natural resource studies, ecology, and other fields.

Abstract: The challenge of staying within environmentally safe planetary boundaries while reaching just goals of social development is one of the most wide-ranging and urgent challenges of the 21st century, recently conceptualized as the "safe and just operating space for humanity" (SJOSH) and the unifying theme of the Sustainable Development Goals (SDGs). The environmental and social goals of SJOSH are deeply interconnected through natural resources consumed to achieve social development, often the cause of environmental deterioration. Thus, improving the efficiency with which societies use increasingly scarce materials to achieve social justice goals is one of the most important metrics of progress toward SJOSH. The framework, however, currently does not reflect the material link between its two dimensions. Further, assessment of national progress is hampered by the lack of a consistent downscaling of the global framework. Here we introduce the notion of progress indicators and capitalize on recent progress in quantifying material flows in the global economy to operationalize the "safe-and-just space" for national economies. We characterize social and environmental change and their material efficiencies for more than 100 countries prior to the great recession (1990 to 2008). The analysis aims to shed new light on long-term debates about the relative role of trade in the export of environmental problems and in facilitating national progress toward an SJOSH, but possibly undermining global progress.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Reconsidering the Social Context of Critical Natural Capital

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Type of Presentation: Paper presentation

Biography: Kazuki Kagohashi is a permanent research fellow at the Institute for Social Ethics, Nanzan University, in Japan. He holds a PhD degree in global environmental studies from Kyoto University, Japan. He has written conceptual and empirical papers on water resources management. His research interests include drought adaptation, sustainable development, and the substitutability of natural capital.

Abstract: This paper investigates the discussion on the concept of critical natural capital (CNC) and shows how it can be interpreted in various ways depending on the theoretical foundations thereof. CNC as a concept has been advocated by the supporters of strong sustainability, which denies the substitutability between natural capital and man-made capital and argues that CNC should be evaluated through physical measures. However, little attention has been paid to the theoretical foundations of sustainability that the CNC concept relies on. Hence, we explore what kind of underlying theories could support the core idea of CNC (e.g., nonsubstitutability and essentiality).

To examine this, we take up four underlying theories of sustainable economic development, namely, (1) Solow-Hartwick's sustainability, (2) Daly's sustainability, (3) Pearce-Turner's sustainability, and (4) Ekins' sustainability, and analyze how each theory can interpret CNC in its framework.

Solow-Hartwick's sustainability and Daly's sustainability focus on the production process and recognize natural capital as a stock of resource input. Both theories can interpret CNC in their framework but they differ in that the former focuses on the flow aspect of natural capital while the latter focuses on the stock aspect. This brings about different interpretations of CNC, for example, rare metals or groundwater could be specified as CNC in Solow-Hartwick's sustainability, and farmland or fisheries as CNC in Daly's sustainability.

Pearce-Turner's sustainability, which basically inherits the same framework of Solow-Hartwick's sustainability but also recognizes the problem of Hartwick's rule that might disregard the distinctive features of natural capital such as irreversibility, multifunctionality. To resolve the problem, they proposed a "constant natural capital rule" that is applied to the natural capital the service from which should be consumed equitably beyond generations and the stock of it should be kept constant. This gives a theoretical basis to CNC in its framework, and CNC would be interpreted in the context of intergenerational equity.

Finally, Ekins' sustainability, which advocates the paradigm of strong sustainability and stresses the importance of the interrelationship of natural capital in its ecological system, identifies CNC as those assets whose loss could not be compensated and would lead to a collapse of environmental functions.

Our analysis implies, first, that the difference in the concept and interpretation of CNC comes from the differences in the theoretical framework among the four theories of sustainability. Second, it is relevant to look into the social conditions of natural capital for operationalizing the concept of CNC. Those social conditions include relevant technologies (in Solow-Hartwick's and Daly's sustainability), values and norms that people have in their cultural settings (in Pearce-Turner's sustainability), and the perception of the thresholds of the environmental functions (in Ekins' sustainability). We would discuss further in detail how these perspectives would be applied to the case of water management in Japan.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Limitation to the Privatization of Environmental Quality—The Case of Guanabara Bay in Rio de Janeiro State

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Type of Presentation: Paper presentation

Biography: James Kahn is the John Hendon Professor of Economics and director of the Environmental Studies Program at Washington and Lee University. He is also a professor in the Department of Fishery Sciences at the Federal University of Amazonas. The coauthors represent a set of Brazilian and U.S. researchers who have been addressing environmental problems in Brazil, using an interdisciplinary approach that encompasses ecological economics.

Abstract:

Despite the upcoming 2016 Olympic Games in Rio de Janeiro, little has been accomplished in terms of improving the water quality of Guanabara Bay, an important estuary and signature coastal feature of the City and State of Rio de Janeiro, and the site of the sailing and rowing events for the games. Obviously, nothing can be done to improve the water quality in time for the 2016 Olympic Games, but the governor of the state is about to announce a plan to greatly reduce sewage effluent in order to improve water quality. However, as the plan will be carried out by the private sector, it will be a project completely financed through sewage bills for the residences and businesses in the watershed. Given astronomical interest rates in Brazil (consumer loans at 45% APR, credit card interest at nearly 200%), it is likely that the move will impose undue hardship on the residents of the region, with many people without the monthly income to pay the charge and many people losing more than they benefit. Many people (including foreign tourists) who are not residents of the region will benefit from the increase in water quality. Nonresidents and residents with property near the bay are likely to receive net benefits, as are other residents with a lower level of welfare.

Our paper examines the efficiency, equity, and sustainability implications of this system in comparison with alternative methods of financing, including general tax revenue, payments for ecological services, property taxes, user fees from recreation, or a combination of these methods. A sensitivity analysis of interest rates is also conducted, along with a discussion of contradiction between the use of discount factors and sustainability. Finally, a choice modeling experiment will be conducted to estimate the willingness to pay among the different stake-holders who might value a restored Guanabara Bay. Based on the theoretical and empirical analysis, a set of recommendations are made for a plan to restore water quality and aquatic ecosystems in the bay.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Bulk Goods as an Imperfect Abstraction of the Physical World

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Type of Presentation: Paper presentation

Biography: Eric Kemp-Benedict is a senior researcher at SEI. Until March 2016 he was director of SEI's Asia Centre, and he earlier led SEI's Rethinking Development research theme. He carries out cross-disciplinary policy analysis for sustainable development strategies on diverse topics and using a range of methods at national, regional, and global levels. His research focus is the macroeconomics of a sustainability transition. Dr. Kemp-Benedict holds a PhD in theoretical physics from Boston University.

Abstract: Biophysical economics emphasizes the thermodynamic and ecological foundation of economic activity. Without material and energy resource flows there can be no economy, and like all such flows they are subject to the laws of thermodynamics. At present we mainly use geological deposits, including the fossilized remains of ancient ecosystems, for energy and materials, but we rely on existing ecosystems for food, some materials and energy, and waste processing, as well as for their cultural and aesthetic values.

One of the great achievements of the modern economy is that it hides its physical foundation through production, exchange, and financial activity. This activity interposes "abstraction layers," a term borrowed from software engineering, between the physical world and our systems of consumption and production. It is an achievement because, as with software development, abstraction layers allow for rapid and flexible invention and innovation, as the abstraction can substitute for the reality in both R&D and production. However, another contribution from software engineering is the "law" that all nontrivial abstractions are "leaky." When applied to the economy, the law helps clarify why the abstraction of the physical world presents one of the greatest challenges to sustainability.

Using the examples of steel, electricity, biofuels, and bulk chemicals, this presentation argues that bulk commodity production constitutes a particularly important abstraction layer. Bulk goods are the real building blocks as far as economic actors are concerned; they are what inventors, builders, engineers, and entrepreneurs take from the shelf, and they allow modern economies to operate smoothly as long as the abstraction holds. However, the law of leaky abstractions suggests that the abstraction will fail, and the underlying physical reality emerge, from time to time.

The presentation explores the implications of this view of bulk goods for a sustainability transition. To the extent that today's bulk goods can be produced reliably and in sufficient volumes from renewable resources a transition to a renewable and recyclable resource base will be much easier. Steel, as a material that can be efficiently recycled using low-carbon energy, is a good example. However, if new sources are not as reliable, as with intermittent renewable electricity sources, or annual production volumes are constrained, as with biofuels, or the bulk commodities may need to change, as with bio-based chemicals, then the transition is made more difficult.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Low-Carbon Transition in a Wage-Based Growth Regime

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Abstract: Post-Keynesian theory demonstrates that economies can be either profit-led, in which a rising profit share is expansionary, or wage-led, in which a rising wage share is expansionary. Recent work has shown that the global economy today is probably wage-led, as are most large economies. Smaller economies tend toward a profit-led regime because of the effects of trade. This is relevant to a low-carbon transition because there is evidence that the transition will initially result in more labor-intensive production. This is “job creating,” and if nominal wages are fixed—a reasonable assumption in the short run—it also shifts the distribution of income toward wages. In a wage-led regime this will be expansionary, thereby reducing unemployment or underemployment. However, if the slack is taken up an expansionary regime can drive either price inflation, through rising wages, or a financial bubble.

In the medium run the assumption of fixed nominal wages no longer holds. Two broad historical patterns are discernible and can be explained on the basis of changing capital productivity. Households deriving most of their income from wages and salaries want to maintain their real purchasing power, which means a stable wage share. In contrast, firms and investors want a stable profit rate, which is the product of capital productivity and the profit share. In some OECD countries, from the 1960s to the 1980s labor bargaining power contributed to a regime of comparatively stable wage shares, but from the 1970s capital productivity began to fall. Even with a stable profit share this meant a fall in the profit rate. Firms and supportive governments responded, giving an added push to a general trend toward declining union membership. By the mid-1980s a new regime of relatively stable profit rates was in place, backed by “target-return” pricing policies, in which falling capital productivity leads to a falling wage share. This is problematic for a low-carbon transition because many low-carbon investments, such as abatement technologies, are not directly productive while others, such as renewables, are currently less productive despite steeply falling cost curves. Low-carbon investments are therefore expected to lead to lower capital productivity, at least initially.

This presentation will explore potential short-term and medium-term macroeconomic responses to a low-carbon transition in a wage-led regime and under different pricing strategies. It will then discuss policy options for sustaining employment and investment.

Transforming the Economy Sustaining Food, Water, Energy and Justice

The Heart of Borneo: The Nexus of Bioregional Transition, Indigenous Environmental Ethics, and Environmental Sustainability

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Type of Presentation: Paper presentation

Biography: Choy received his master's in economics from Chuo University, Japan, majoring in development economics, and his PhD in economics from Keio University, Japan, majoring in international and environmental economics. He is currently teaching sustainable development and environmental ethics at the Graduate School of Economics, Kyoto University, Japan. His research interests range across a wide variety of topic areas in sustainable development studies. He has more than 10 years of field research experience on various policy-oriented development studies in Malaysia.

Abstract: The island of Borneo, shared by Indonesia, Malaysia, and Brunei Darussalam, is the third-largest island in the world covering an area of 74 million hectares. Its forest covers, which evolved between 100 and 150 million years ago, are among the most biologically diverse on Earth. The island is home to roughly four million indigenous people whose socioeconomic fabrics, cultures, and traditions are intimately associated with the earthly systems. Agriculture, mining, timber harvesting, tourism, and recently, heavy industries are important economic development activities.

The island has evolved a unique blend of natural, cultural, and economic values. However, today, this unique feature is under threat due to unrestrained exploitation of nature driven by the quest for economic growth. Since 2007, each country, recognizing the importance of restoring healthy relationships with nature on which humans depend for continued survival, has embarked on a bioregional transition toward greening its economy in a more balanced accord with environmental and cultural sustainability. This resulted in the mapping of a 22-million-hectare of natural landscape straddling the borders of each country known as the Heart of Borneo (HoB) for conservation management. This trinational and transboundary bioregion, which accounts for roughly 30% of Borneo's landmass, is inhabited by about one million indigenous people. It is home to 6% of the world's total biodiversity and a source for 14 of Borneo's 20 major river systems. A network of protected areas and biodiversity corridors has been created to conserve this intricate web of environmental and cultural values. A wide range of ecoefficiency tools, such as protected area management, help strengthen conservation efforts while providing opportunities for various economic activities in the region.

Despite this, however, an empirical assessment of the conservation progress in the HoB in general and the state of Sarawak in particular revealed that the bioregional transition process has failed to prioritize the promotion of environmental or cultural sustainability when optimizing the economic use of nature. This is mainly due to the regional leaders' overwhelming emphasis on achieving higher economic growth over environmental or cultural conservation. This may further be attributed to the lack of ethical considerations in resource use decision making or planning processes.

This article argues that the concept of bioregion as an ecologically designated space is imbued with ethical significance; ignoring this element in environmental planning and practice threatens to subvert the original holistic perspective. The article further explores the guiding principles of environmental ethics in environmental judgment and for bioregional planning based on lessons drawn from field studies conducted in Malaysia between 2007 and 2011, and in 2014 and 2015. The conclusion drawn from the field research, which evaluated the place-based environmental philosophy of the indigenous communities, is that environmental value judgments and environmental stewardship play an important role in shaping environmental decisions and hence successful bioregional transition.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Indicators for Sustainable Energy Development for Austria (ISED-AT)—Residential Buildings and Electricity and Heat Supply

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Biography: Claudia Kettner works as an environmental economist at the Austrian Institute of Economic Research (WIFO). She holds a master's in economics from University of Graz and a master's in renewable energies from Vienna University of Technology. Prior to her position at WIFO, she worked as a researcher at the Wegener Center for Climate and Global Change at the University of Graz. Her key areas of research include EU and Austrian climate and energy policy.

Abstract: A transformation of prevailing energy systems requires adequate measurement systems. In this paper we propose an energy-service-based indicator set and a composite index for monitoring sustainable energy development in the residential sector and electricity and heat supply in Austria. The system of Indicators for Sustainable Energy Development for Austria (ISED-AT) and the composite index focus on energy services instead of energy flows and are hence effective tools for monitoring and guiding the transition, as they allow assessing the whole range of technology options for providing a particular energy service. The analysis of household final energy demand and electricity and heat supply in Austria shows substantial progress in terms of ecological aspects, such as the share of renewable energy sources and CO₂ emissions. With respect to energy efficiency, in contrast, only little improvement can be observed. Efficiency of energy service provision is decreasing except for heating and air conditioning. Final energy demand is rising in all areas of household energy demand. The challenge lies in a substantial improvement of energy efficiency that will allow an absolute decoupling of energy service demand from final energy consumption.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Sectoral Allocation Patterns in the EU Emission Trading Scheme

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Biography: Claudia Kettner works as an environmental economist at the Austrian Institute of Economic Research (WIFO). She holds a master's in economics from University of Graz and a master's in renewable energies from Vienna University of Technology. Prior to her position at WIFO, she worked as a researcher at the Wegener Center for Climate and Global Change at the University of Graz. Her key areas of research include EU and Austrian climate and energy policy.

Abstract: The EU Emission Trading Scheme (EU ETS) is the most important climate policy instrument in the European Union. Implemented in 2005, the EU ETS was the first international trading system for greenhouse gas emissions, and it is still the largest carbon market worldwide: Currently the scheme covers more than 11,000 power stations and industrial plants in 31 countries responsible for more than 50% of the EU's greenhouse gas emissions.

In the first two trading phases, the performance of the EU ETS was, however, characterized by pronounced surplus allocation that translated into low carbon prices. Therefore, for the third trading phase (2013 to 2020) and beyond, a number of changes to the EU ETS were adopted in the EU's 2008 Climate and Energy Package that should help improve the credibility of the scheme, incentivising low carbon investment. One major modification referred to the change of allocation procedures, giving more weight to the auctioning of allowances as compared to previous trading phases.

Despite these fundamental changes, the third trading phase so far is still characterized by an oversupply of allowances. Based on a comprehensive empirical analysis of allocation and emissions on the installation level, this paper shows that the oversupply reflects the structural surplus of allowances banked from the second to the third trading phase as well as a persistent surplus allocation to sectors deemed to be exposed to carbon leakage.

This excess supply reflects the fact that sectoral production has been and still is below the levels anticipated when free allocation was determined. While this can be regarded as a means for alleviating the pressure of carbon prices on exposed sectors in times of an economic slowdown, it also hampers the long-term economic efficiency of the ETS, since the oversupply of allowances translates into a very weak price signal that is not sufficient for inducing low-carbon innovation.

Currently a revision of allocation mechanisms to increase the incentives for emission abatement generated by the EU ETS is discussed in the EU. The proposals by the European Commission include a more frequent alignment of free allocation to production levels as well as new criteria for sectors' eligibility for free allocation. If properly designed, these measures could contribute to reinforcing the carbon price signal in the post-2020 period.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Quantifying (Net) Energy and Complexity of the U.S. Economy

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Type of Presentation: Paper presentation

Biography: Dr. Carey King performs interdisciplinary research related to how energy systems interact within the economy and environment as well as how policy and social systems can make decisions and trade-offs among these often competing factors. The past performance of our energy systems is no guarantee of future returns, yet we must understand the development of past energy systems. Carey's research focuses on interpretations of the past to determine the most probable future energy pathways.

Abstract: Can we quantify “complexity” for modern economies, and does it relate to energy inputs? I will discuss calculations that describe the evolution of the structure of the United States economy since World War II and relate these to the consumption rate and cost of energy. This presentation is a combination of thoughts on net energy from physicists and ecologists (Robert Herendeen, Charles Hall), information theory applied to networks (Robert Ulanowicz), and societal structure and evolution from anthropologists (Joseph Tainter's energy-complexity spiral).

I use data (harmonized across all years) in the economic input-output tables from the Bureau of Economic Analysis to calculate information theory metrics (based on work of ecologist Robert Ulanowicz) that characterize the resilience (conditional entropy) and efficiency (mutual constraint) of the U.S. economy. The results show that when gross U.S. power consumption was increasing and the cost share of “energy and food” was decreasing, the economy grew in a way that distributed money more evenly across the various economic sectors. During times of relative energy constraints and increasing cost of food and energy (1970s, post-2000), the structure of the U.S. economy became more hierarchical, with the monetary flows more concentrated in the “energy and food” sectors.

The goal of this research is to foster discussion about how we can link different modeling approaches to understand world system dynamics and distributions of money and wealth in past states. This goal includes understanding how biophysical resources enable (or limit) society's ability to organize itself and grow economically and materially.

Transforming the Economy Sustaining Food, Water, Energy and Justice

A Comparison of Return on Investment for Energy: Power Versus Money

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Abstract: This presentation will discuss results from a recently published three-part series of papers entitled "Comparing World Economic and Net Energy Metrics." These papers focus on comparing energy and power return ratios, based on data with units of energy and power, to equivalent metrics based on data with units of money. The data originate from the International Energy Agency.

Specifically I focus on the need to understand the relationship between two particular metrics. The first metric is the net external power ratio (NEPR), which has often been termed "energy return on investment" but could more appropriately be termed "power return on power investment." My calculation of NEPR is the worldwide annual gross power supply (energy/yr) divided by the annual "own use" power consumption ("direct" energy/yr of energy carriers only) of the energy industry itself. The calculation NEPR declined from a value of 34 in 1980 to 17 in 1986 before staying in a range between 14 and 16 from 1991 to 2010.

The second metric is the net power ratio (NPR) of the world economy that is equal to the inverse of the energy cost share, or world monetary expenditures on energy divided by gross world product. For example, if world energy expenditures equal 5% of GDP, then the NPR is 20 ($= 1/0.05$). The calculations show that the NPR of the world economy was near 10 in 1979 and 1980, rose to over 30 in the late 1990s, and dropped to between 13 and 16 in the late 2000s.

It is useful to compare these metrics to each other as they are both conceptual ratios of power output over power input: one economic (NPR) and one biophysical (NEPR). I find that when the former divided by the latter is below unity, the world was in, or recovering from, a low-growth or recessionary state. The available data span only from 1980 to 2010, but there is a great need to understand this ratio in a more historical context.

This comparison of NPR (economic) to NEPR (biophysical) seeks to answer a very fundamental question: Over the long term, can the energy industry "leverage" money more than it can "leverage" power? That is to say, should the energy industry be about to foster more monetary output (GDP) relative to its own monetary input needs as compared to its net power output (total net primary energy supply) relative to its own power input needs? It is possible that the ratio of NPR (economic) to NEPR (biophysical) was significantly greater than one only during the brief period from 1985 to 2006 as indicated in my calculations. I conclude this presentation by hypothesizing that the world has spent the time since the start of the Industrial Revolution growing, interconnecting, consuming, and accumulating debt such that the NPR (economic) increased and the NEPR (biophysical) decreased until overshoot in the 1980s. The fact that the two ratios became equal at the end of the 2000s might represent a fundamental calibration to biophysical constraint on the economy.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Water Quality Management in the Lake Baikal Region of Russia

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Type of Presentation: Paper presentation

Biography: Sergey Kirillov graduated from the Faculty of Geography of Lomonosov Moscow State University in 1992. He is professor in the Department of Environmental Management. His research interests include the regulation of economic activity, protected areas, and tourism development.

Abstract: The Lake Baikal region is characterized by a difficult environmental, economic, and social situation associated with the protection of the Baikal Natural Territory and Lake Baikal as the World Natural Heritage Site.

A special regime of environmental management under federal law, "On Protection of Lake Baikal," causes damage and losses of profit for the region's economy. Charges for using water resources in Baikal basin exceed by 1.7 times the average rate for Russia. Charges for the negative impact on the environment are twice as high. Agriculture carries losses because of the requirements limiting the use of fertilizers and pesticides. All this creates difficulties for economic activities and people's living conditions.

An analysis of the current environmental situation within the Lake Baikal region and the forecast of its development in terms of increasing economic activity with the account of climate change showed that preservation of water quality in Baikal is impossible without the management system changing. The regulation of economic activity in the region requires the improvement of environmental legislation.

The main prospects for future development of the territory are connected with the creation of the Special economic zone of the tourist-and-recreational type "Baikal harbor" in the Republic of Buryatia and "Gates of Baikal" in the Irkutsk region. The creation of such clusters in the Lake Baikal Region will help to realize effective interaction among all stakeholders: public authorities, organizations, the tourism industry, academia, and civil society organizations.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Return in Good Condition—Essay on the Concept of Fair Bequest

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Biography: Bernd Klauer has been working at the Helmholtz Centre for Environmental Research–UFZ in Leipzig, first as a postdoctoral researcher and thereafter as a senior researcher and speaker of the Social Science Water Research working group. At the same time he is honorary professor for sustainability and water resources management at the University of Leipzig. His research focuses mainly on evaluation methods, decision support, governance, and sustainability, with applications in water resource management and nature protection.

Abstract: The UN Sustainable Development Summit September 25–27, 2015, in New York resulted in a final document “Transforming Our World: The 2030 Agenda for Sustainable Development.” The agenda contains 17 Sustainable Development Goals (SDGs) with 169 more or less concrete targets. It has been welcomed as a major step forward in operationalizing the general concept of sustainable development. Critics, however, argue that the large number of specific goals makes it difficult to attract sufficient public attention for pushing forward the issue of sustainability. The plea is for a concentration on a manageable number of sustainability topics. In contrast to this the essay asks how the holistic claim of sustainability can be met and what role the concept of “fair bequest” could play here. Can answering the question “What should the current generation bequeath to the subsequent one such that the latter receives a sufficient basis for a livable life?” lead to a better understanding of the tasks of a sustainability policy? Can the claim to live up to our responsibility for future generations be promoted by thinking in terms of “fair bequests”?

The essay will fathom the concept of “fair bequest” from two perspectives: In the first part an everyday example is used to illustrate the descriptive and normative aspects of the concept. Different ideas of sustainability—weak and strong sustainability as well as the world heritage—are analyzed with respect to their contribution to the concept of “fair bequest.” Here the concepts of capital (value for others), existence value, and intrinsic value come into play. It is worked out that the bequest has not only a material but also an immaterial, mental dimension, which is addressed by the notion “tradition”: The lore of moral concepts and values belongs to our bequest as well as the propagation of lifestyles and prejudices.

In the second part it is questioned who is responsible for our bequest. The structure of responsibilities within the modern economy is considered. This structure rules our handling of material bequests and at the same time can be seen as a mental bequest itself. The economy proves to be an autonomous structure of responsibilities whose dynamic is characterized by creative destruction. The economy’s structure of responsibilities makes the responsibilities for bequests anonymous and reaches its limits if existence values and intrinsic values are considered. After that, it is discussed whether the state needs to take a “guarantor responsibility” for world heritage. In the outlook the concern is expressed that humanity might be overburdened by its responsibility for all of our bequests.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Public Participation and State Responsibility in Environmental Politics

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Abstract: Environmental politics is an area that apparently calls for new ways for forming a political will, for decision making, and for implementation. This is because environmental politics—which in essence needs to be seen as sustainability politics—considers local and specific issues under global, holistic, and long-term perspective and vice versa. Environmental politics is inevitably intertwined with economic activities, namely production and consumption, and therefore requests the compliance of norms and rules by economic agents. In other words, it necessitates cooperation.

For this reason a widespread view is that the state should not make and implement decisions by “hierarchical power.” Hierarchical decision making needs to be supplemented or even replaced by new instruments that are discussed under the label of “governance.” The term governance generally describes a process where governmental and nongovernmental organizations come to collective decisions and coordinated actions. In its specific meaning the term puts governance in contrast to government in the sense of nonhierarchical decision making.

Within the more narrow meaning of governance as nonhierarchical decision making the issue of responsibility is particularly vivid: who finally makes the decision, implements it, and takes the responsibility. Taking responsibility includes compensating particularly for the unforeseen negative effects of a decision and answering for the consequences toward the parliament, the voters, and other instances or authorities.

One important and often-discussed form of New Environmental Governance in the field of environmental politics is public participation. Here the general public is integrated in one way or another in decision making processes. The EU Water Framework Directive (WFD) is a prime example for modern environmental politics where public participation explicitly plays a role (see Art. 14 WFD). The directive calls for a comprehensive informing of the general public about the current status of the European waters as well as about the planned measures to improve the waters. Moreover it demands an “active involvement of all interested parties” (Art. 14.1 WFD). This statement needs interpretation.

In the paper two different meanings of and perspectives on participation are considered: (i) the one of deliberative democracy (including its critique in the literature) and (ii) the one of systems theory. After discussing from a theoretical point of view the importance of participation in environmental politics, a more practical assessment of the achievements of participatory processes is made. For illustrative purposes and for empirical underpinning the results of a case study in the German federal state of Schleswig-Holstein are used.

The result of the theoretical as well as the practical assessment of participatory instruments is ambiguous. On the one hand, participation improves the acceptance of measures taken by the authorities by nongovernmental actors if the latter can take influence on the design of the measures. On the other hand, concerning the rationality of the outcomes of participatory processes for the general public the result is different. The participation of pressure groups involves the risk of an illegitimate compromise favoring the interests of individuals over the public interest.

Transforming the Economy Sustaining Food, Water, Energy and Justice

How Do We Like Our Waters to Be?

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Abstract: The densely populated landscapes in Germany and Central Europe can typically be characterized as cultural landscapes that have been intentionally altered and transformed for centuries. The usage of nature and substantial alterations of the landscape, intensive in many places, have indeed led to degradations and threats for a sustainable provision of ecosystem services. There is an urgent need for a scientifically informed debate on how to find an adequate compromise between the justified use of landscapes and natural resources for economic or—more generally speaking—human purposes on the one hand and the protection of nature on the other hand.

This difficult and rather fundamental debate on nature protection and economic interests can benefit from a very topical discussion in the more bounded but nevertheless reasonable complex field of water resources management: the implementation of the European Water Framework Directive (WFD) and its struggle for a good water status in all surface waters, coastal waters, and groundwater. The WFD takes pristine waters as a reference for the definition of its environmental objectives of a good water status. The high ambitions of the WFD's central environmental objective and the orientation toward a pristine status resulted in a massive use of the so-called exemptions that allow under certain circumstances for extensions of deadlines and for less stringent environmental objectives. Technical but in particular economic arguments can be put forward to justify exemptions. Their massive usage bears the danger of arbitrariness and of “watering down” the WFD's ambitions.

The enacting of the WFD has been widely considered a major alteration—a tipping point or regime shift—in the development of institutions governing the water resources as it brings with it several conceptual innovations, particularly by setting of objectives for the aquatic biocoenosis as receptor of multiple stresses. After decades of an emission-oriented, selective water management the WFD opens a window for opportunity for a (more) integrated water resources management. However, the considerable, realistic threat of a failure of the directive (which may take the appearance of an amendment—but is in fact a substantial depression of its objectives as well as its conceptual claims) may result in another backward shift in the institutional setting for water resources management with adverse feedback on the (aquatic) ecosystems as well as on the sustainable provision of its services to mankind.

Here, we propose a functional approach to water management. The idea is to assess the functionality of an ecosystem in consideration of use interests on the one hand and the requirements of near-natural conditions on the other hand. For this, main functions (e.g., biomass production, discharge, self-purification) have to be identified and parameterized and criteria for well-functioning have to be defined. Hence, they (i) could serve as intermediate objectives for selecting measures and (ii) might guide the definition of the “highest possible ecological status.” The paper presents a conceptual approach to assess the functionality of aquatic ecosystems and their usability in the implementation process of the WFD.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Opportunities for Incorporating Economy-Environment Interdependence in the Undergraduate Curriculum

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Type of Presentation: Paper presentation

Biography: Christie Klimas's research brings together ecology and economics, in urban and tropical settings, to address questions of sustainable resource use. Due to the economic drivers underlying resource use, economic knowledge is an essential component of sustainability. A commonality in her research interests is working toward ecologically sustainable resource management that recognizes the role of citizen stakeholders.

Abstract: For students of environmental science and studies (ENV), as well as students in sustainability programs, critical thinking about economy-environment interdependence is a key learning objective and a foundational part of the undergraduate curriculum. There are many courses that could provide initial exposure to economic theory. Not all are as adept at providing the necessary combination of critical thinking, relevance to important global issues, and economy-environment interdependence as ecological economics, but there are many opportunities to better incorporate the economy-environment interdependence across the ENV/sustainability curriculum.

This presentation highlights some such opportunities. To connect students personally to the interdependence between their purchases (economy) and the environment, I often use an assignment asking students to reflect on the environmental and social externalities of a recent purchase and then to propose economic solutions to incorporate these solutions more fully into the product's price. This assignment could be easily adapted for introductory-level courses in ENV or sustainability, industrial ecology, and political ecology, among others. Methods of better incorporating externalities (e.g., taxes, moral suasion) would need to be explained prior to giving the assignment.

The controversy surrounding valuation of the environment is important in economics, but it also connects with courses in philosophy, moral theology, and religious studies. Without extensive background in economics, students could read and debate about "The ethics of offsetting nature" using the recent publication by Ives and Bekessy (2015) in *Frontiers in Ecology and the Environment*.

Testing methods of changing consumer behavior could be incorporated into marketing courses. Business courses could focus on the economics associated with sustainability improvements, allowing students to examine the extent of current improvements and to explore systems-level thinking and how it has revolutionized production at Interface Carpet or other similar businesses. And while this is likely far from implementation, a chapter on ecological economics in macroeconomics textbooks would be a welcome addition to the undergraduate curriculum.

Because ecological economics is a transdisciplinary field, one opportunity to increase student understanding may include adding units on economy-environment interdependence throughout the curriculum. My presentation will highlight examples of courses that incorporate ecological economics (knowingly or not) as well as course modules or assignments that facilitate understanding of economy-environment interdependence.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Enhancing the Well-Being of EU Regions Through Innovative Governance Models—The Carbon Forestry CPR Regime

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Biography: CE SPECTRA and CETIP form a collaborative network (www.cetip.sk) that is tasked with introducing innovations from institutional ecological and behavioral economics into interdisciplinary research and education in the area of the human dimension of global change. This paper is the product of cooperation with the CzechGlobe research institute.

Abstract: Mountain landscapes face unique global change challenges but also offer opportunities for sustainable development; thus, such landscapes have represented a top policy agenda since the Rio Earth Summit in 1992. Climate regulation represents an important ecosystem service and a tool that contributes to meeting CO₂ mitigation objectives. Carbon sequestration is a natural process that significantly contributes to climate regulation by the capture and long-term storage of atmospheric carbon, the main greenhouse gas, in all ecosystem types. Temperate forests in European mountains are a significant world carbon stock, and therefore place mountain regions in a prominent position in climate change adaptation policies. Ecosystem services as public or common goods face the traditional social dilemma of individual versus collective interests often generating conflicts, overuse, and resource depletion. In this paper, we analyze carbon sequestration in mountain regions as an innovative forest management approach to addressing responses to global climate impacts. Furthermore, we analyze how resource regimes contribute to the effectiveness of management, in particular whether self-management and self-governance can increase innovation capacity, without external authority being needed to resolve the resource management problems. The potential of global climate regulation ecosystem services to improve the well-being of mountain regions will be demonstrated in European continental mountains, in particular in Slovenia and Slovakia. The paper demonstrates how carbon sequestration resource regimes contribute to the resilience and well-being of mountain regions and can be considered a governance innovation to scale down CO₂ objectives from global to local policy arenas.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Ecosystem Service Governance for Urban Sustainability

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Abstract:

Urban population has grown continuously from 34% of total world population living in cities in 1960 to 54% in 2014, as stated by the Global Health Observatory (2015). These trajectories leave significant pressure on urban ecosystems, resulting in degradation of their structure and functions. Considering that they are valuable resources for climatic, health, leisure, or nutrition benefits, current policies are failing to protect them from various land-use and economic interests. At one level, we speak of top-down instruments in the hands of state, regional, and municipal authorities, which would guide urbanization and spatial-functional transformation of urban areas to promote the provision of urban ecosystem services. At the second level, the need for policies defining the legislative and operative arena of bottom-up initiatives is emerging. Although carbon sequestration still represents an intensively debated contribution to climate change mitigation particularly at the scale of forest and mountain regions, in recent years the role of urban ecosystems as carbon sinks has starting to gain attention.

In this paper we determine the role of urban ecosystems in sequestering and storing carbon and link this potential spatial-ecological benefit to new management models. Following the research of Elinor Ostrom we argue that self-governance increases efficiency of semi-public spaces management and can create the conditions for CO₂ mitigation and adaptation under the global market. We are aiming to (i) map and quantify the capacity of specific local urban ecosystems to sequester above-ground carbon and (ii) measure the degree to which community-based bottom-up management affects this ecosystem service provision, depending on different institutional settings, such as ownership, rules, and management competences. The theoretical-empirical paper introduces common-pool resource regimes as possible solutions for self-governance of semipublic urban greenery. In accordance, benefits of a balanced network of well-managed green semipublic spaces are presented in the context of carbon mitigation. Finally, a case from a semipublic community garden in Bratislava empirically illustrates how a CPR regime may develop microclimatic qualities of a shared space.

Transforming the Economy Sustaining Food, Water, Energy and Justice

SMART Governance

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Type of Presentation: Full session

Biography: The SPECTRA Centre of Excellence has emerged as the product of successful collaboration under the project SPECTRA+ between the Slovak University of Technology and the Institute of Forest Ecology of the Slovak Academy of Sciences. The main objective is to concentrate on novel approaches to strategic decision making under the complexity and uncertainty in particular in global environmental changes and urban governance and on transdisciplinary research in the field of institutional, behavioral, and ecological economics.

Abstract: SMART Governance represents a concept for analysing and managing individual and group behavior for decision making under complexity. Purposeful behavioral change, considering institutional and ecological fit, is seen as an essential adaptation to building effective, resilient institutional arrangements. The main objective of this session is to model collective actions under controlled conditions to reduce uncertainty of information and complexity of social, technological, and biological factors. In particular the focus is on (i) testing novel policies and tools of decision making using experimental and participatory approaches, (ii) developing a mechanism for scaling down global issues and policy objectives such as climate change mitigation, land use abandonment, or urban sustainability. Communication, ecological dynamics of resources, local norms, power, and influence are key variables.

The session demonstrates the potential of experimental tools to model and test decision-making variables. We intent to present a novel decision-making support tool: role board games designed to simulate collective actions under controled conditions. Board games are interactive agent-based models that allow participants, coming from the most contrasting social backgrounds, to understand challenges and opportunities of decision-making processes at different scales, across multiple actors and interests. The role games represent two thematic backgrounds: energy innovations and ecosystem services.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Innovator's Profit at Risk—Findings from the Photovoltaic Industry Between 1954 and 2015

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Type of Presentation: Paper presentation

Biography: Yu-li is currently a job market candidate in ecological economics at Rensselaer Polytechnic Institute (RPI). Her main research area is an intersection of ecological economics and economics of technological change, and she mainly uses quantitative methods such as econometrics and computer simulations. For her thesis research, she empirically studies technological change in energy-related technologies such as photovoltaic and LED technology.

Abstract: Technological change in renewable energy is urgently needed to reduce climate change abatement cost. Photovoltaics, a representative renewable energy technology, currently supplies 1% of the global electricity market with worldwide government support for renewable energy. The International Energy Agency expects that photovoltaics can be the number one electricity source supplying 16% of total electricity market by 2050. To achieve this goal, R&D investment is needed, but innovator's profit for photovoltaics technology may be at risk due to the characteristics of "potentially disruptive technology." A mature market sometimes experiences technological disruption, allowing a new technology to take over the old. The new technology is radically different from the old and often initially uncompetitive. To achieve disruption, the new technology needs to overcome its initial uncompetitiveness through enhanced performance and lowered price by innovation. For innovators of potentially disruptive technology, most of the profit will be realized after the success of disruption, and this return structure may be unfavorable to early innovators. Resulting low profitability of R&D investment can deter technological change. The 60-year history of the photovoltaic industry is studied to investigate such appropriability. This paper answers how innovators' incentive has changed in this process. The study is conducted as quantitatively as possible with intensive data collection. The 60 years is divided into eras according to critical events and the appearance of new business opportunities, which coincide with period division in previous studies in the photovoltaic industry history and technical articles. Important technological changes are collected from historical documents and the previous studies. Firm names are collected from industry directories, magazines, patents, government and international organization reports, and other sources. The number of the patent is matched to the firm name. Innovative firms are identified with patent count and their contribution to historically important innovations. Market share is provided as much as possible even though there is no consistent market share data for all firms. Government policies are collected from government reports and international organizations' reports. Then how previous era's entrants and innovators behaved in the next era is studied to highlight the appropriability issue. Factors that may have influenced such appropriability are described in detail, along with their interactions. Findings consistently indicate low incentive for R&D and participation for firms and governments. Leaders, innovators, and early entrants in the previous era rarely had become major firms when new business opportunities appeared in the photovoltaic industry. Surprisingly, many of the innovative firms did not participate despite their technological capabilities. It implies firms' short-sightedness may be rational for potentially disruptive technologies. On the government side, policies have been reversed frequently although they are often critical to maintaining national industrial leadership. It may imply lack of incentive to aid technological change on governments' side. Driving forces that have impacted appropriability are identified. Findings support that radical, intensive, and globally coordinated policies are likely to be effective to propel potentially disruptive technology like photovoltaic technology.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Food Insecurity in the Time of Austerity—The Case of Greece

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Type of Presentation: Paper presentation

Biography: Charalampos Konstantinidis is assistant professor of economics at the University of Massachusetts–Boston. His primary research agenda concerns the political economy of food and agriculture with a focus on the European Union. He holds a PhD in economics from the University of Massachusetts Amherst.

Abstract: One of the most striking and often overlooked dimensions of the ongoing Greek crisis has been the sharp increase in hunger and food insecurity, the latter doubling over the last five years in Greece as measured by Eurostat’s Social Inclusion and Living Conditions dataset. I trace the central position of food and agriculture in Greece’s three structural adjustment (austerity) programs since 2010 and show how, through both internal devaluation and liberalization, the austerity programs reduced household incomes, the productive capacity of Greek agriculture, and access to food for large parts of the Greek population. Using Eurostat’s Social Inclusion and Living Conditions dataset for the period 2008–2014, I examine the determinants of food insecurity in Greece as well as the connection between food insecurity and other dimensions of material deprivation, such as household indebtedness and fuel and energy poverty. Moreover, I point to the significance of both formal and informal mechanisms, such as social transfers and family networks, respectively, in reducing food insecurity among Greek households. I conclude by discussing the emergence of new types of food systems in Greece during the crisis and argue that the concept of “food sovereignty” could offer a unifying theme for efforts to mitigate food insecurity and Greece’s ongoing humanitarian crisis, as well as to effect the productive reconstruction of the Greek economy.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Directed Evolution Approach to Environment and Development: The Case of the Sudd Wetland, South Sudan

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Type of Presentation: Paper presentation

Biography: Hannes Lang recently finished his PhD in ecological economics at the Rensselaer Polytechnic Institute under the guidance of Professor John Gowdy. After he finished his PhD he worked as a consultant for a project funded by UNEP on the evaluation of the economic, cultural, and ecosystem values of the Sudd, a large wetland in South Sudan. He is now doing my postdoctoral work at the TUM with Dr. Menapace, endowed professor of Governance of International Agribusiness.

Abstract: The Sudd wetland is one of the world's most unique and valuable ecosystems. It is threatened by a variety of development pressures, ranging from small-scale drainage and water diversion to a plan to almost completely drain the wetland for agriculture downstream. These pressures illustrate how economic and political drivers can lead to the destruction of a valuable and irreplaceable ecosystem and majorly disrupt the cultures that have thrived there for centuries. The case of the Sudd also illustrates the need for a broader and more refined approach to development and the environment. Both economic and environmental concerns can be addressed by understanding the importance of large ecosystems, pointing the way to more balanced, nuanced, long-term policies. In this paper, we explore some of the theoretical and practical issues involved in valuing the natural world in general and the Sudd wetland in particular. In our monetary estimates of the value of the Sudd, we focus on economic value, but we take a broad view by incorporating new developments in economic theory and policy. In particular, we use findings from behavioral economics, behavioral science, institutional economics, and new approaches from evolutionary economics and evolutionary biology to broaden the scope of "value" beyond market or quasi-market values. The Sudd wetland in South Sudan offers an excellent case study of the challenges and opportunities of ecosystem valuation. The Sudd is an area of immense biological, cultural, and economic importance. The conflicts there between different visions of valuation and, by implication, different visions of development could not be sharper; they starkly illuminate the consequences of policy decisions that are sometimes hard to see in more developed economies.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Women in Ecological Economics: Building Networks, Creating Action

Corresponding Author: Whitney Lash-Marshall - SUNY College of Environmental Science and Forestry and USSEE
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Type of Presentation: Roundtable

Biography: In 2013, the U.S. Society for Ecological Economics hosted the first gathering of women in the field to address persistent issues of inequality for women in society including work-life balance, discrepancy in salary, leadership models, and support networks. This meeting has grown into a network of women across the United States and Canada who are sharing strategies, leadership models, and resources for furthering our collective success in research, teaching, and life.

Abstract: At the past two USSEE conferences (2013 and 2015) we have hosted a gathering of Women in Ecological Economics to discuss persistent issues of inequality facing women in society and develop a network of experience, support, and action across the United States and Canada. Through the creation of this community we seek to promote continuing dialogue of issues including work-life balance, being a minority in a department or institution, empowering women leaders across and within our field, improving the visibility of women and women's issues, and how we can successfully walk through the world as women.

This session will begin with a brief introduction of the "Women in EE" group and the outcomes of our past meetings, including a list of action items developed at CANUSSEE in October 2015. We will then open it up to a roundtable style discussion to facilitate the sharing of stories and strategies from invited speakers who represent different ages, stages of their careers, disciplinary backgrounds, and regional societies. Speakers will share a short narrative and identify areas of opportunity for creating a new future. Through this dialogue we hope to (1) connect and develop nimble, inclusive, and equitable leaders in ecological economics to address our collective social and ecological problems; (2) implement a pilot project for undergraduate, graduate, and early-career women interested in ecological economics across ISEE to support and keep women in academic careers; (3) learn from the successes of leaders and mentors in the field of ecological economics, increasing their visibility; and (4) maintain a community that promotes dialogue on these and other issues related to the success of women.

Of particular interest is to address the maintenance and recruitment of women in our field—we see evidence of a demographic shift of more women entering environmental fields, but not yet in economics. As a transdisciplinary field that spans these and other disciplines, what has happened in ecological economics? What can we learn from each others experiences to facilitate and empower this shift in and through ecological economics?

Transforming the Economy Sustaining Food, Water, Energy and Justice

Creating a Culture of Collaboration: Operationalizing Interdisciplinary Research

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2nd Author: Paul Hirsch - SUNY College of Environmental Science and Forestry

Type of Presentation: Paper presentation

Biography: Whitney Lash-Marshall and Paul Hirsch represent part of a multi-institutional collaboration in the State University of New York (SUNY) Networks of Excellence system that has spent the past year applying a mixed-methods approach to identify, understand, and overcome barriers to collaborative interdisciplinary research, policy translation, and education in the SUNY system. Our overall goal is to enhance the ability of researchers to overcome these barriers to build more effective inter- and transdisciplinary research teams and outcomes that address global challenges.

Abstract: Responding to pressing social and environmental problems requires meaningful engagement across academic disciplines, as well as between researchers, policy makers, educators, and practitioners. Founded as an interdisciplinary field that crosses the traditional boundaries of ecology and economics, ecological economics provides support for interdisciplinary research and problem solving, but often these interdisciplinary research teams do not represent a collaborative model of research. In addition to the challenges associated with investigating highly complex problems, communicating across disciplines and boundaries requires navigating additional complexities in the research process: a set of epistemological, organizational, and teamwork challenges that may stand in the way of productivity and creativity. As part of a yearlong research initiative based in the State University of New York system, we have identified the barriers to authentic collaboration experienced by researchers when engaging in interdisciplinary research endeavors. Based on the results of an online survey and series of interviews and drawing from a diversity of disciplinary perspectives, we have begun to characterize authentic collaboration and identified strategies to overcome institutional, epistemological, and teamwork barriers. As we conclude the first phase of this work, we have identified promising pathways for overcoming each type of barrier: the cultivation of institutional opportunities and space, the promotion of intellectual openness and engagement, and training in facilitative leadership techniques and approaches. Traversing these pathways will require the cultivation of a particular set of skills and capacities of researchers working at and across the boundaries of disciplines and institutions, as well as between research and its application.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Regional Vulnerability in Conservation and Food Production in Costa Rica

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Type of Presentation: Paper presentation

Biography: Whitney Lash-Marshall is currently a visiting instructor and adjunct assistant professor at SUNY ESF and executive director of USSEE. A systems ecologist by training, her research and teaching strive to bridge disciplinary boundaries to develop more effective approaches to the study and management of complex social-ecological systems (SES). Her research focuses on conservation and natural resource management and developing strategies to overcome barriers to communication and collaboration in inter- and transdisciplinary research teams.

Abstract: Costa Rica, a Central American nation with over 26% of their national land area in protected areas, has adapted their institutional structure in response to the increasing complexity of the landscape by adopting regional conservation areas. Over time, their economic model has shifted from an agricultural to a more services-based economy dependent on tourism and export agriculture instead of subsistence agriculture. This shift represents a common trade-off facing developing countries between conservation and production, although Costa Rica is often upheld as a model for successful conservation strategies. Using the regional conservation areas as the unit of analysis, it is clear the geographic distribution of protected areas and the best agricultural lands are not represented equally across conservation regions, presenting management challenges and potential future vulnerabilities. Using a food security analysis and regional assessment of vulnerability, I investigate potential threats to the current system related to the economy and pathways to more resilient social-ecological systems.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Toward a Sustainability Theory of Value

Corresponding Author: Eli Lazarus - UC Berkeley
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Type of Presentation: Paper presentation

Biography: Eli Lazarus is an ecological economist currently in the Energy and Resources Group's (ERG) master's/PhD program at UC Berkeley. Eli was previously lead researcher at Global Footprint Network, calculating, developing, and applying the ecological footprint. His interest and research topic is in the development of nonfinancial metrics of welfare and sustainability. Eli holds an undergraduate degree in economics (summa cum laude) from San Francisco State University.

Abstract: Although it is not generally articulated as such, neoclassical economics centers on utility and markets in a way that could be called a utility theory of value. The failure of markets, including on the scale of global climate change, provokes a challenge to utility (in the way that it is formed essentially through markets) as a fundamental measure of value for humans, as the primary element to be maximized. A sustainability theory of value is proposed in the context of a human economy that is ultimately reliant on the continuation of the human species. This precept forms the theoretical foundation for sustainability economics, sustainability welfare, sustainability value, and ultimately, a system of sustainability valuation. A theoretical argument is presented and connected to historical economic schools that have also looked to sources of value more profound than the short-term desires of human individuals.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Mutualism and Competition in Economics

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Type of Presentation: Paper presentation

Biography: Eli Lazarus is an ecological economist currently in the Energy and Resources Group's (ERG) master's/PhD program at UC Berkeley. Eli was previously lead researcher at Global Footprint Network, calculating, developing, and applying the ecological footprint. His interest and research topic is in the development of nonfinancial metrics of welfare and sustainability. Eli holds an undergraduate degree in economics (summa cum laude) from San Francisco State University.

Abstract: Ecological insights provide models of natural system dynamics that can be useful for bringing novel perspectives to the analysis of the human economic system. We build on the foundation of an ecological insight discovered by Harte and Kinzig (Harte, 1993; Kinzig, 1998) on the coexistent competitive and mutualistic relationship between microorganisms and plants in the allocation of nitrogen. We map that interspecies dynamic as found in this ecological research to elements in the economy, investigating the applicability of this finding of combined mutualistic and competitive behavior as found in ecology to economic phenomena. Just as the element of mutualism was found to succeed within the constraints of geospatial subsectioning and not in the context of an open and mixed environment, we examine economic situations where market protection—both intentional and accidental—has allowed for mutualistic elements in the dynamics to survive.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Organizational Practices, Social Values, and Economic Measures in Community-Supported Agriculture: A Historical Overview

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Type of Presentation: Full session

Biography: We are a transdisciplinary research team who is interested in exploring new economic alternatives, sharing and promoting values like trust, cooperation, and ecological responsibility as a result of collective initiatives of people sharing the same thoughts, values, and motivations through their proposals of new ways of consuming, satisfying their needs and desires, organizing, and transforming social and collective life and societies at large. The concept of “community” stands as a founding principle of developing sustainable postgrowth economies.

Abstract: The dominant industrial economic model leads society into major ecological and social dead-ends. These short-sighted practices are largely diffused in agriculture, too, and the agricultural and food systems are currently subject to a convergence of crises. Innovative agricultural systems capable of rebalancing nature and mankind are required to overcome the impasse. The pioneering and inspiring role of agriculture justifies the focus on it. Agroecology is a well-established practice where production is simultaneously environmentally friendly, socially fair, and economically beneficial. Initiatives like community-supported agriculture (CSA) fully adopt agroecology.

The CSA concept was born in the 1980s in the United States and has been expanded throughout the world. CSA is a “concept describing a community-based organization of producers and consumers. The consumers agree to provide direct support to the local growers who will produce their food. The growers agree to do their best to provide a sufficient quantity and quality of food to meet the needs and expectations of the consumers” (Lamb, 1994). The concept translates into multiple forms: consumer-directed, farmer-directed, farmer-coordinated, farmer–consumer cooperatives (Polimeni, Iorgulescu, & Shirley, 2015).

We argue that CSA is a relevant grassroots initiative for a postgrowth economy. Food production is the fundamental requirement for life and sustainable human activities. Moreover, it is the necessary condition for the survival of human society. Besides being ecology-friendly, CSAs have organizational practices, social values, and economic measures departing from mainstream economic assumptions of self-interest, competition, and profit maximization. CSAs adopt a holistic perspective of producers and consumers, based on values like trust, cooperation, and ecological responsibility as a result of collective initiatives of people sharing the same thoughts, values, and motivations through their proposals for news ways of consuming, satisfying their needs and desires, organizing and transforming the social and collective life, and societies at large. The concept of “community” stands as a founding principle of developing sustainable postgrowth economies.

There is an abundant literature on CSAs, especially in the United States and in Europe. In the present paper, we focus on the main characteristics that make CSA organization a good candidate for economic, ecological, and social transition toward degrowth.

Our methodology is grounded in the institutional (Veblen), evolutionary, and ecological economics (Georgescu-Roegen). In this perspective, we chose the historical analysis of our subject.

In the first part, we present the CSA “model.” Unlike mainstream modeling methods, we define and look at CSAs through institutional, historical lenses. Our “model” is the mapping out of institutional features and their evolution through time. Then we discuss the limits of the model, and finally we attempt to analyze and theorize the organizational practices, social values, and economic measures underlying this model.

To attain these objectives, we proceed to an historical analysis of the literature on CSA. We analyze the legal status of the CSA, the business model, the investment policies, the risk sharing, the management style, the social values, the objectives, the measurement system for the financial, social, and ecological domains, and the agronomy put in place.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Frugal Innovations in Circular Economy—Exploring Possibilities and Challenges in Emerging Markets

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2nd Author: Sara Lindeman - Aalto University School of Business

Type of Presentation: Paper presentation

Biography: Jarkko Levänen, PhD, works as a postdoctoral researcher at the New Global project (newglobal.aalto.fi) at the Aalto University, Helsinki, Finland. His research focuses on social and cognitive aspects of innovation management in the circular economy.

Sara Lindeman, MSc, is a project manager of the New Global project and an expert on inclusive business. Her research focuses on market creation in low-income world majority contexts.

Abstract: Frugal innovation means an intelligent and affordable solution for a problem or a demand conditioned by resource constraints. Frugal innovation is important for further development of a circular economy in low-income contexts because it helps in thinking about and defining what circular economy can mean at the local level. In this paper we discuss the possibilities and challenges related to frugal innovation in fostering circular economy.

Circular economy does not mean only increased recycling. It can also mean, for example, reduction of material input in production, different reuse and reproduction opportunities, intelligent resource management (including energy resources), and changes in consumer behavior and business models. It is important to recognize that everything cannot be circulated, and the most promising opportunities for circulation differ from place to place. Thus those opportunities need to be identified locally, and that is where the concept of frugal innovation comes into play.

Frugal innovations are associated with sustainable development. To be truly frugal, a solution should be an outcome of a design process that manifests cradle-to-cradle thinking throughout the lifecycle of a solution. The discussion on frugal innovation also highlights the social and entrepreneurial aspects of innovation in the context of resource constraints also with respect to literacy and education. We argue that the identification of frugal solutions at the local level can leverage the impact of circular economy because one is forced to pay attention to local circumstances and opportunities.

Challenges with respect to frugal innovation and circular economy may arise if innovations are developed without taking the larger operating system into account. In this paper, we empirically study frugal innovations from water and energy sectors in East Africa. The cases are studied using action research and qualitative research methods. Examples show that optimal circulation can have very different forms in different places.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Whose Equity Matters? National to Local Equity Perceptions in Vietnam

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Type of Presentation: Paper presentation

Biography: Lasse Loft has been a postdoctoral researcher at the Senckenberg Biodiversity and Climate Research Centre, Frankfurt, Germany, from 2010 to 2015 and now holds a position as scientist at ZALF.

His research focuses on the governance of ecosystem services, with particular focus on incentive-based policy instruments, in particular payments for ecosystem services (PES) and reducing emissions from deforestation and degradation (REDD+), and normative aspects, in particular equity considerations of the distribution of rights and obligations of ecosystem services.

Abstract: This paper focuses on the integration of equity considerations in the distribution of payments under Vietnam's Payments for Forest Ecosystem Services scheme (PFES). Equity perceptions are powerful determinants of human behavior, and consequently, many environmental conflicts arise from contested visions of what constitutes "equitable" environmental management. Therefore, equity can play an instrumental role in shaping outcomes of PES schemes. Based on empirical work in Dien Bien province, this paper specifically analyzes local perceptions of equity and how these match equity considerations in the national PFES legislation. We conducted expert interviews on the national and provincial level, surveys with 52 village heads, 179 in-depth household interviews, and eight focus group discussions in four selected communes. Our results show that the prevailing perception of equitable benefit distribution corresponds to the egalitarian understanding of fairness. However, we find that this prevailing distributional equity principle is very much influenced by the degree of transparency in the process and information on payment distribution. Our findings at the local level reveal that there is wide support for a distribution of PFES based on input. This merit-based principle is in theory reflected in the underlying government rules for determining payment distribution according to one of the four K-coefficients. However, practical limitations in terms of financial, technical, and human capacity lead to suspending these official distribution rules on the ground, creating a mismatch between equity perceptions and actual implementation.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Shale Gas Development for a Low Carbon Economy in the United States? The Limitations We Have to Consider

Corresponding Author: Cristina Madrid Lopez - Yale University
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Type of Presentation: Paper presentation

Biography: Cristina Madrid-Lopez (BSc Environmental Sciences; MSc, PhD Ecological Economics) is a Marie Curie Fellow at the School of Forestry and Environmental Studies, Yale University, and the Institute for Environmental Science and Technology (ICTA), Autonomous University of Barcelona. She is interested in complex systems theory, bioeconomics, social metabolism, socio-ecohydrology, the water-food-energy nexus, and decision-making strategies. Currently she is working on a method that supports multilevel decision making about shale gas development taking into account socioeconomic, biophysical, and environmental aspects.

Abstract: Natural gas is considered a lower-polluting fossil fuel that can contribute to the transition to a low-carbon economy (LCE). However, a change in the energy mix toward a higher share of natural gas use requires increasing its production. Supporting horizontal hydraulic fracturing for shale gas extraction is one of the strategies considered by policy makers around the world to that end. The objective of this presentation is to show how useful shale gas development is for the objective of reaching a LCE.

In the United States, the production of natural gas has increased from 20 to 25 trillion cubic feet in only ten years due to the expansion of what it is now known as the “Shale Gas Factory.” One of the newest areas of drilling is located over the Marcellus Shale Play, in the northern and western regions of Pennsylvania. An extensive literature body exists that supports both the costs and benefits of the activity for the drilling areas. However, the question remains whether this strategy would help the state and the United States transition to a LCE.

In order to contribute an answer to this question, I examined the constraints that the maintenance of social and natural capabilities represent for the use of shale gas as a LCE strategy. Using a Multi-Scale Integrated Assessment of Societal and Ecosystem Metabolism (MuSIASEM) I evaluated the evolution of the shale gas sector in Pennsylvania in the period 2004–2014 and estimated a battery of metabolic indicators for the county, state, and federal levels.

Three scenarios are considered:

- a) Shale gas contributes the current share to the increase of natural gas production;
- b) Shale gas contributes all the increase of natural gas production;
- c) No shale gas is used for the increase of natural gas production.

The preliminary results show that shale gas development is not a particularly good LCE strategy at the federal level, and it could be used at the state and county level only under certain assumptions. In all levels, if natural gas is used instead of coal and oil to the point where carbon reduction targets are met, both the social and natural capabilities at each level will be affected. On the social side, it might be difficult to meet the social energy requirements and to maintain current levels of economic activity. On the natural side, water and land impacts do not compensate for the carbon reductions.

Transforming the Economy Sustaining Food, Water, Energy and Justice

On the Replacement Costs of the Aquifer System of Central Mexico

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Type of Presentation: Paper presentation

Biography: Carlos Lopez-Morales works currently as the coordinator of economic theory and public economics at UNAM's School of Economics, where he also teaches economic theory and valuation of ecosystem services. He has worked previously at the Watershed Management Office of Mexico's National Institute for Ecology. He has a PhD in ecological economics (RPI, 2010). His main research interests are water, agriculture, technology adoption, and ecosystem services.

Abstract: This paper reports research that estimates the costs of replacing the groundwater that the metropolitan areas of Mexico City, Toluca, and Cuernavaca, in Central Mexico, pump from 10 over-exploited aquifers with six supply alternatives of surface water. These aquifers provide about 70% of the water required by more than 28 million people (about 47 m³/second), and they have recharge zones in the so-called "Bosque de Agua" (Forest of Water, in Spanish), which is increasingly threatened by road construction, real estate development, and other economic activities. The six alternatives include five options for interbasin transfers from relatively nearby river systems and one option for artificial injection of treated water into the aquifer system. Replacement costs are estimated with 2012 data via a constrained optimization program that minimizes total costs (including investment and operation) subject to the transferring of the required volume.

Replacing the groundwater extraction involves the construction of all six alternatives at an estimated cost with the present value of 31 billion dollars (at the rate of US\$0.8/m³, using the official 6% discount rate) over a 26-year life cycle period. Given that 43% of water distributed to Mexico City is not used due to leaks in the system, the research tested through a scenario analysis the response of replacement costs to the implementation of several actions for leak control in the Federal District. Four scenarios are designed to combine control measures reducing leakage in a range between 3 m³/sec and 12 m³/sec, and a positive balance is found: every dollar invested in leak control reduces the cost of replacement by between \$1.13 and \$8. Further, centralized leakage attention by local government has the highest impact in reducing replacement costs, although the potential reduction is limited to 3 m³/sec. In contrast, every dollar invested in decentralized leak control has less impact on reducing replacement costs, but a higher potential for leakage reduction (up to 9 m³/S).

The replacement costs reported in this paper can warn local authorities about the economics of losing ecosystem services that are crucial to the sustaining of population and economic activity in the region of study. In this case, results confirm the economic sense of implementing leak control measures to reduce demand and, ultimately, extraction from over-exploited aquifers. Further, these results make clear the economic case of conservation measures: conserving the forest in the recharge zone involves costs that are only a fraction of the investment that would be required to replace the hydrologic services that would be lost if the forest is not conserved.

Transforming the Economy Sustaining Food, Water, Energy and Justice

The Role of Values in Framing Processes of Sustainability Meaning Construction

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Type of Presentation: Paper presentation

Biography: Tetyana Loskutova is a PhD candidate at the University of the Witwatersrand Business School. She has 18 years of work experience in the area of information systems. Her current interest is in human values and their role in understanding the current problems of sustainability. She approaches this topic from the cognitive and communicative lens in her thesis, titled "Towards a Value-Based Theory of Sustainability Problem Framing."

Abstract: Field-level framing is an interactive discursive process that results in the construction of the shared meaning of a new phenomenon. In the context of projects that claim to result in a more sustainable way of living for their stakeholders, the contextual meaning of sustainability is new and contestable. This meaning is communicated and perceived as a reduced frame relevant to this project. This frame of sustainability is constructed, evaluated, and negotiated in an interactive framing process between project owners and other stakeholders. This paper aims to explain the role of stakeholder values in the framing processes of sustainability meaning construction in the project context. Based on existing theories of value framing in political communication, a novel model is proposed for the analysis of value framing processes of the sustainability meaning construction in the project context. As independent variables, values shape the stakeholders' cognitive frames of sustainability. As dependent variables, values are influenced by the discourse of the sustainability meaning construction. The project scope provides space and time boundaries limiting the meaning of sustainability to the scope achievable within the boundaries. A case study of projects within the Solar Incentive Program in Los Angeles illustrates the model's application. The case study analyzes the discourse between the government, the media, and the public regarding the program's financial, social, and environmental sustainability. The study uses framing analysis to extract frames of sustainability constructed by various stakeholders and determine the values that influenced these frames. The study discusses the evidence of the contribution of the framing processes to the construction of the shared meaning of sustainability as the envisioned goal of the Solar Incentive projects. The paper concludes with the discussion of the limitations of the proposed model and suggestions for future research.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Investigating the Relationship Between Cancer and Economic Development

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Type of Presentation: Paper presentation

Biography: Tommaso Luzzati is associate professor in economics in the Department of Economics at the University of Pisa (Italy). His current research activity deals mainly with topics in ecological economics. He has written on composite indicators, on the links between growth and environment, the environmental Kuznets curve, the causes of environmental degradation and environmental policy, endogenous preferences (conformism), social norms, and rationality.

Abstract: Cancer is among the major causes of morbidity and mortality. Moreover, its burden is increasing (e.g., Stewart and Wild, 2014).

This piece of research aims at exploring the links between economic growth and cancer morbidity, an issue that is still rather unexplored (e.g., Beaulieu et al., 2009; Bray, 2012). We adopt a coarse-grained approach, that is, our purpose is assessing the overall role of economic development, similarly to the EKC literature, rather than zooming in on the very complicated figure concerning cancers and its determinants.

After presenting the main statistical facts, a brief literature review introduces the emerging etiological paradigms of cancer. This allows discussing the several factors that can affect the differences in cancer morbidity along the phases of economic development and setting a conceptual framework for the empirical analysis. On the one hand, the structural change involved in the initial phases of development (the shift toward industrial agriculture and manufacturing) is supposed to increase pollution and lower the quality of human environment. On the other hand, the improvement in material well-being involves both better sanitary conditions and changes in lifestyles, such as tobacco smoking, which is very relevant to cancers. To investigate the “true” net effect of GDP growth, however, one has to control for two factors that otherwise mix up evidence, that is, diagnostic capacity and life expectancy. Both of them increase with economic progress and involve higher cancer incidence. After controlling for them, we empirically investigate the shape of the relationship, if any, between cancer morbidity and per capita income. Obviously, since cancer takes many years to develop and appear, lagged values of income were used. Due to lack of data in some variables, in most of our analysis we restricted the lag to “only” 16 years. Data on cancers were taken from the database GLOBOCAN 2012, developed by a section of the World Health Organization. After selecting the countries for which data look reliable and excluding countries that are evident outliers, we ended up with a cross-section of 97 countries. We ran several econometric estimates, following what was suggested by the present state of the art. The analysis also includes a section on different types of cancers idiosyncratic to different stages of economic development. Preliminary results suggest that per capita health expenditure, the proxy for diagnostic capacity, plays a significant role in predicting the increase in morbidity. Moreover, lagged income seems to contribute first positively and then negatively to morbidity incidence, resulting in an inverted-U pattern.

Transforming the Economy Sustaining Food, Water, Energy and Justice

The Shifts of Scientific Interest in the Bio-Economy, Directing or Following Policy Interests?

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Type of Presentation: Paper presentation

Biography: Dries Maes gained professional experience in applied research and sustainable business strategies, specializing in bio-based technology and environmental sustainability. He was also a managing partner of a private sustainability consultancy in Brussels. His research during his PhD supplements this with evolutionary modeling and structural change in agriculture.

Abstract: The idea of a bio-based economy, or a bioeconomy, emerged at the end of the last century. The rapid growth of projects in genetic modification, new pharmaceuticals, and agriceuticals led to believe that a new economic structure was being built, based on biotechnological innovation. This concept has grown and became increasingly important following the industrial production of biofuels and biogas. Contrary to the production of high-value low-volume biotech products, renewable fuels and energy require high volumes of organic matter of various qualities. The quest for higher transformation efficiency of biomass streams led to research on biorefineries. The bioeconomy has now been adopted as a strategic element for research policy and industrial development by the European Commission and by several European member states.

The interest in this vision is in large part driven by pressing sustainability and scarcity concerns. Bio-based products can reduce the emission of greenhouse gasses significantly. But the entire impact on other environmental pressures is less predictable, and caution is needed to prevent unwanted effects such as increased eutrophication or water scarcity. The transition to a bio-based economy is also a complex development, with repercussions on several industrial sectors and on society. Large shifts in biomass use are also required, leading to important impacts on agriculture and on the environment. For instance the pharmaceutical, chemical, energy, biotech, and food processing sectors are involved in the emerging bio-based economy. An increasing collaboration between these sectors will lead to feedback loops, path-dependency or coevolution between previously unrelated sectors. This raises additional problems for policy makers. The correct design and implementation of policies will be as important to the emergence of the bio-based economy as the development of new technologies. This transition requires interdisciplinary research to analyze and guide this development to a more sustainable industrial structure.

This paper investigates the scientific efforts during this evolution. It analyzes the trends and the scientific focus of published research on the bio-based economy, starting from the emergence of this vision until the present day. The bibliometric analysis is visualized to show the shifts in scientific domains over the years. Differences in activity and understanding of the bio-based economy are demonstrated by comparing research in technological domains with research on environmental impact or social sciences. The evolution of scientific activity in this field is compared with the appearance of key policy documents from the European Commission and U.S. federal government. This shows that scientific effort is not always synchronized with the policy developments. Also the research on social and environmental consequences of the emerging bioeconomy are very limited in comparison with the technological research.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Behavior Diversity Limiting the Adaptation of Agriculture to the Growing Bio-Economy

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Type of Presentation: Paper presentation

Biography: Dries Maes gained professional experience in applied research and sustainable business strategies, specializing in biobased technology and environmental sustainability. He was also a managing partner of a private sustainability consultancy in Brussels. His research during his PhD supplements this with evolutionary modeling and structural change in agriculture.

Abstract: Structural change in agriculture is a highly complex process influenced by external drivers, diverse farm structures, and mixed adaptive capacities of individual farms. Moreover, farmers display different behavioral patterns during adaptation. This heterogeneity makes it hard to foresee the future evolution of the sector or to design successful adaptation strategies for farmers. Lately, the growing bio-based industry causes an increasing demand for biomass, bringing an additional driver for change.

This paper investigates the influence of an emerging bio-based industrial sector on structural change in agriculture. An agent-based model simulates future developments of agriculture coevolving with an emerging sector for innovative manure treatment. This simulation accounts for the heterogeneous behavior patterns and structural farm diversity. The evolution of agriculture is evaluated in two scenarios: (i) where bio-based industrial innovation is absent, and (ii) when several innovative technologies for manure treatment are being developed.

The results show that the behavioral patterns determine the overall evolution of the sector. During periods with low prices for agricultural products, the sector gradually becomes more rigid, and the overall adaptive capacity of the sector diminishes. This also has an effect on the emergence of new bio-based technologies. As this emergence requires a cooperation with farmers, a rigid sector hampers the deployment of bio-based innovations, while agriculture itself is hardly influenced by changing market conditions for biomass.

Transforming the Economy Sustaining Food, Water, Energy and Justice

CEA: Methods, Sustainability, and Economic Viability

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Type of Presentation: Paper presentation

Biography: Michael received a PhD in environmental science from the University of Maryland. He is currently an assistant professor of environment and sustainability (ES) at UMD. Michael directs the ES undergraduate degree program and the Center for Sustainable Community Development (CSCD). Michael's interest is in sustainable community development, with a focus on renewable energy and sustainable food systems. He currently directs a 9,000 ft² CEA production facility aimed at creating an economically viable model for cold-climate, year-round, sustainable food production.

Abstract: Controlled environmental agriculture (CEA) includes the indoor (greenhouse or building) hydroponic and/or aquaponic production of fish and produce. We report on three years of operations data from "Victus Farms," a 9,000 ft² CEA facility in Silver Bay, MN. "Victus Farms" was created to demonstrate a sustainable and economically viable method for year-round food production in cold climates. In addition, it serves as a research facility aimed at improving the environmental sustainability and economic viability of these CEA production processes. In this paper, we compare the environmental sustainability and economic viability of hydroponic and aquaponic floating raft production as well as vertical hydroponic production methods. We detail the production cost and sales revenues associated with each approach as well as the critical required inputs (space, water, energy, nutrients, herbicides, pesticides, and soil). Finally, we compare the environmental sustainability of these three CEA methods with conventional agricultural production.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Organic Economics

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Type of Presentation: Speed talk

Biography: Christos Makriyannis is a PhD Candidate (ABD) in economics at Clark University.

His research focuses directly on socioeconomic dimensions of the environment, particularly as they relate to coastal systems and climate change. He has presented his work at a number of national and international conferences.

Between 2008 and 2010 he served as senior advisor at KPMG in Cyprus, where he initiated and headed Sustainability Services.

Abstract: There is an overwhelming tendency within the economics discipline to model economies as mechanical and deterministic machines working according to given laws. This practice often leads to low evidence-theory ratios and strips the economics discipline of content and context in favor of abstract mathematical functions. Its critics trace back to a number of modern-day challenges including persistent poverty, increasing inequality, ecosystem loss, and climate change. Underlying this practice is the implicit assumption that economies' systems characteristics are limited to those of engineered machines. Yet there is little systematic research assessing whether economies are best characterized by the properties of complex engineered systems or those of biological organisms. This article draws from economics, systems theory, and biology to evaluate whether and how the mechanistic view of the economy influences the treatment of real-world challenges, compared to alternative views. Results show that economies share the characteristics of complex living systems. In contrast to the current mechanistic view, the biological model brings analytical clarity to (a) the problems of poverty and inequality, (b) the role of natural systems to economic well-being, (c) limits to growth, and (d) devising alternative measures of sustainability. These and other findings suggest that modern economists should not altogether dismiss alternative conceptualizations of economic systems and that a biological perspective on the economy may initiate novel and productive interdisciplinary research.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Conservation Reconsidered: Contingent Valuation With an Optimal Scale Constraint

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2nd Author: Herman Daly - University of Maryland

3rd Author: Joshua Farley - University of Vermont, Gund Institute for Ecological Economics

Type of Presentation: Paper presentation

Biography: Malghan, Daly, and Farley are ecological economists at the Indian Institute of Management Bangalore, University of Maryland, and University of Vermont respectively.

Abstract: We develop a new framework for contingent valuation of environmental public goods. Our framework is based on the representation of biophysical systems as a fund rather than a mere stock (Georgescu-Roegen, 1971). We modify the extant contingent valuation framework to “value” ecosystems considered as funds using optimal scale constraints. We use a combination of normative, political, economic, and ecological arguments to show why the framework developed here is superior to extant contingent valuation methods on all three primary outcomes of interest—justice, biophysical sustainability, and economic efficiency.

Nearly half a century after the publication of Krutilla’s seminal paper demonstrating the economic rationale for in situ conservation of nature helped lay the foundations of modern conservation economics, we argue that it is once again time to “reconsider” conservation. We have therefore brazenly plagiarized Krutilla’s memorable title as our own (Krutilla, 1967). Krutilla’s paper set in motion an “existence value revolution” fueled by the contingent valuation (CV) method. Contingent valuation is now the most widely used method to determine the exchange value of ecosystems, usually as part of a larger benefit-cost analysis (BCA). A comprehensive bibliography of contingent valuation compiled by a leading scholar lists more than “7500 CV studies and papers from over 130 countries” (Carson, 2012).

Even if policy is able to overcome missing or incomplete markets for environmental services, there is no theoretical reason why correcting for market failure would necessarily prevent the destruction of the “rare phenomenon of nature,” the original motivation for Krutilla’s “reconsideration.” The question of “irreversible diverse consequence” on natural systems is fundamentally a biophysical phenomenon that cannot be captured, even in principle, by the market allocation process—efficient or otherwise. In the contemporary lexicon, preventing “irreversible adverse consequences for rare phenomenon of nature” has become less rare and has been generalized in the concept of biophysical sustainability. We argue that an exclusive focus on correcting inefficient allocations resulting from externalities or missing markets for public goods limits the contribution that environmental economics can make to the sustainability discourse.

The biophysical environment, besides being a stock source of raw materials for the economy, is also the fund source of valuable services. Consider for example a paper mill that uses timber from the forest. The forest is not only a source of timber but also a source of valuable services like flood control and microclimate stabilization. The classic problem of environmental economics is that the market for timber does not take into account the impact of the logging industry on forest’s ability to provide flood prevention or microclimate stabilization services. Arguably, with technological progress, timber from the forest can be replaced by a wood substitute, but the microclimate stabilization services provided by the forest are indispensable. We develop a formal analytical model to distinguish between the stock and fund aspects of the ecosystem and use the framework to delineate a democratic method for aggregating sustainability preferences using an optimal scale constraint. Optimal-scale aggregates the stock-fund trade-off inherent in conservation policies.

Transforming the Economy Sustaining Food, Water, Energy and Justice

The UMass Amherst Urban Agriculture and Nutrition Program: Increasing Fresh Produce Production and Consumption in Urban Settings

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Type of Presentation: Paper presentation

Biography: The UMass Amherst Urban Agriculture and Nutrition Program and its extension are made of researchers in agriculture and nutrition who are working collaboratively to address adverse health issues among low-income communities in three large cities in Massachusetts with the goal of increasing fruit and vegetable consumption. A secondary goal is to work with farmers and gardeners, in urban and rural settings, to grow as much of this fresh produce as possible.

Abstract: Faculty and staff at the University of Massachusetts, Amherst, are working together to address adverse health issues among low-income communities in three cities in Massachusetts: Worcester, Springfield, and Lawrence. As is the case in a growing number of cities in our region and throughout the country, the immigrant and ethnic communities are rising in these urban setting. Non-Hispanic whites are now a minority in the public schools of these cities: 33.6% in Worcester, 12% in Springfield, and 5.2% in Lawrence, and Latinos are now the largest race/ethnicity in each public school: 39.6%, 63%, and 91.3%, respectively. Given the large Latino populations in these three cities, a focus of our activities has been proportionally to this group. Latinos have higher rates of diabetes, hypertension, and obesity than the general population and Puerto Ricans, the dominant Latino ethnicity in these three cities, have higher rates than most other Latino groups. We have developed nutritionally balanced, culturally appropriate recipes popular among Puerto Ricans and Dominicans that we have been promoting to these communities. One recipe, sofrito, is a mirepoix that is a staple in Puerto Rico and the Dominican Republic; we are promoting this healthier recipe, in Spanish, to these communities. In addition, we are working with urban, periurban, and rural growers in our state to grow the ingredients of this recipe; five of the six fresh ingredients of sofrito can be grown in Massachusetts. Research at UMass Amherst has developed sustainable production and marketing strategies for ají dulce, one of the staple ingredients of sofrito. We also developed a healthy, culturally appropriate recipe for sancocho, a hearty stew that is also a staple in these Latino locales. We will describe specific activities that led to the development of these recipes and how we are promoting them. We will also share the relationship between the use of the fresh ingredients of these recipes and growers, both urban and nonurban, in our state. We'll also talk about the growth in imports of fresh produce, especially those used by the large and growing immigrant populations, and how our farmers compete directly with these imports in the cities where we're working. Farmers in Massachusetts, paying an average wage of \$9.00/hour, are competing directly with farms in the Dominican Republic that export ají dulce year-round and where they pay farm workers \$2.67/day. We'll also talk about the importance of understanding the distribution system for fresh produce and how to take advantage of it.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Transforming Policy, Transforming the Landscape—Socioecological Land Use Scenarios for Native Forest Conservation in Chile

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2nd Author: Ricardo González - Department of Forest Sciences, Faculty of Agricultural and Forest Sciences, Universidad de la Frontera, Temuco, Chile.

Type of Presentation: Paper presentation

Biography: Daniela Manushevich, trained as biologist, is currently interested in land use change and socioecological systems. Ricardo González is interested in environmental economics.

Abstract: The landscape of south-central Chile, originally a mosaic of pristine native forests and prairies, has been converted into farms in the last 200 years. Farmlands and native forests have undergone a rapid conversion to fast-growing pine and eucalyptus plantations since the 1970s. Tree plantations expanded from 330,000 to nearly 2.3 million hectares in 2012, becoming the nation's largest renewable resource-based economic sector. This expansion occurred alongside the liberalization of the Chilean economy and the implementation of cost-sharing subsidies included in the Chilean afforestation program DL701 of 1974. Such measures have created a market that confers high land rent for tree plantations and does not provide any significant incentive for native forest conservation. In 2008 new legislation to protect native forests was implemented. Lax land use restrictions were left on the law and the bylaw, and a one-time payment for forest management aimed to promote forest conservation became the exclusive policy instrument in the new law. The payment, a cost-sharing subsidy of about 640 USD per hectare, has proven insufficient to affect the current land use trend.

We evaluate the expected impacts of the Native Forest Law by assessing different land-use policy scenarios, with different degrees of restrictions for forest conversion and higher levels of subsidies, compared against the business-as-usual scenario. First, we perform a cross-sectional logistic regression analysis that explains the probability of a land-parcel to be under native forest use as explained by a set of socioeconomic and biophysical variables. The regression analysis is expected to inform the relative importance of different determinants in explaining the presence of native forests. Second, we employ the land-use model "Dyna-CLUE" to convert each scenario into future land-use maps. For each land-use scenario we will evaluate the production of sediments and water quality by using an existing modeling package (InVEST). Both are critical outputs from native forests. The first one is inversely correlated with native forests area, and the second one is directly correlated with native forest area. Thus, they would indicate the negative impacts of human activities. We expect to find that a business-as-usual scenario will deliver significantly less ecosystem services than a conservation scenario.

Through the integration of policy-based scenarios, economics, and spatial modeling, this study seeks to inform how new policies may potentially transform landscape in south central Chile.

Transforming the Economy Sustaining Food, Water, Energy and Justice

The Cost of Population Growth in the United Kingdom

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Type of Presentation: Paper presentation

Biography: The principal author, Dr. Jane O'Sullivan of the University of Queensland and Sustainable Population Australia, is a professional economist. Roger Martin is a former British senior diplomat who resigned in midcareer as a deputy high commissioner to become an environmentalist. For 28 years, he has served as member or chairman of numerous NGO and government environmental bodies, regional and national. Recently he has concentrated on population as the multiplier of almost all sustainability problems.

Abstract: The cost of extending provision of infrastructure, equipment, and skilled service providers to additional population was estimated from U.K. historical expenditure accounts. It was found that each additional person requires £165,000 to be spent on housing, infrastructure, equipment, and training, to extend to them the services, living standard, and employment opportunities of current U.K. residents. This cost is borne by existing residents through a higher cost of living. At the current population growth rate, this corresponds to over £1,000 per person each year, or £2,300 per household. Between 1960 and 2010, maintenance of fixed capital (turnover) has cost 13.36% of U.K. GDP; its expansion has cost 6.89% of GDP per 1% population growth. Expanding infrastructure and equipment capacity at the current population growth rate of 0.7% p.a. consequently requires 4.8% of GDP per annum.

Applying these figures to Office of National Statistics projections from 2010 to 2050, the low population projection (0.24% population growth per annum) would cost 1.7% of GDP or £26 billion per annum; the principal (medium) projection (0.58% population growth per annum) would cost 4.0% of GDP or £67 billion per annum; and the high population projection (0.86% population growth per annum) would cost 5.9% of GDP or £106 billion per annum. The cumulative cost of U.K. population growth from 2010 to 2050 adds up to £1.1 trillion, £2.7 trillion and £4.2 trillion for the low, principal and high projection respectively, in 2011 values, assuming constant per capita GDP. To 2100, the cumulative cost would be £1.1 trillion, £5.5 trillion, and £11.6 trillion respectively. This expenditure is required simply to maintain, not improve, current standards. It is not offset by any improvement in demographic age structure, and does not include the extra cost of essential food and energy imports. Thus although these costs masquerade in the national accounts as "investment" (a current sacrifice for future gain), they are in fact only depreciation or maintenance costs, in that they create no additional benefit for any of those paying them.

According to the Global Footprint Network, the United Kingdom is already 240% ecologically overshoot, with a sustainable population of only 20.6 million; it is only 60% food self-sufficient; England is the most crowded country in Europe; and our polls show that 80% of U.K. residents would prefer a smaller population. Thus in addition to the economic cost, all U.K. population growth reduces quality of life for existing residents through increased congestion, reduced food and energy security, and so on.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Mapping and Analyzing Ecological Distribution Conflicts

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Type of Presentation: Full session

Biography: This paper is a product of the EJOLT project (www.ejolt.org) and the ACKnowl-EJ project at ICTA, Barcelona, a well-known institute researching ecological economics and political ecology. We are building an Atlas of Environmental Justice (www.ejatlas.org) with nearly two thousand cases of ecological distribution conflicts around the world, including the social actors involved (corporations, civil society organizations, indigenous groups, government), forms of mobilization, and outcomes (e.g., the cases of success for environmental justice).

Abstract: Ecological distribution conflicts are born from unequal access to the products and services of nature and from the unequal burdens of pollution. They often overlap with conflicts on social class, ethnicity, caste, or gender. Their description and analysis is part of ecological economics for two reasons. First, there appears to be an increasing number of such conflicts around the world, due to the increased metabolism of the economy (in terms of flows of energy and materials). Ecological economics together with industrial ecology has developed the methods for the study of the metabolism of the economy. The second link between ecological economics and the analysis of ecological distribution conflicts is that in such conflicts several “languages of valuation” are deployed by the social actors involved, from monetary compensation to environmental values, indigenous rights, or the sacredness of nature.

Even a nongrowing economy, if based on fossil fuels, would need to get “fresh” supplies from the commodity extraction frontiers because energy is not recycled (and materials are recycled only to a small extent). The industrial economy is not circular, it is entropic. It causes systematic cost-shifting, as explained by K.W. Kapp. Therefore there are many conflicts on resource extraction, transport, and waste disposal, and there are many local complaints, as shown in the Atlas of Environmental Justice (EJAtlas) (www.ejatlas.org) and other inventories. And not only complaints, there are also some successful examples of stopping extractive projects and developing alternatives, testifying to the existence of a rural and urban global movement for environmental justice.

This paper analyzes the results from a successful collective effort since 2012 to gather, describe, and classify two thousand ecological distribution conflicts around the world, doing comparative and statistical analyses of their main patterns in terms of social actors involved, forms of mobilization, and outcomes. The EJAtlas has been built through the cooperation of academics and activists, in the EJOLT project and, more recently, in the ACKnowl-EJ project.

Keywords: environmental justice, activist knowledge, EJAtlas, environmental racism, environmentalism of the poor, climate justice, statistical political ecology.

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An Analytical Model for Understanding the Relationship Between Renewable Energy and Metal Consumption—A Case Study on Copper

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Type of Presentation: Speed talk

Biography: Akiyuki Masuda received an ME degree from the University of Tokyo in systems innovation in 2015. His master's thesis is on simulating diffusion of recycling behavior. He is currently studying sustainable use of mineral resources at the postgraduate program of the University of Tokyo. He holds a BE degree in chemical engineering and has professional experience in the field.

Abstract: Global consumption of base metals has steadily been increasing while the ore grades are decreasing. Today, metal mining and production sectors show substantial presence in energy consumption. About 10% of total primary production in the world is estimated to be consumed by these industries (Fizaine & Court, 2015). However, gross energy requirement (GER) for metal production exponentially deteriorates as ore grades decline, and accordingly cumulative consumption of the primary resource increase. Thus, this tendency necessitates better understanding of the degree of the influence on future energy supply. Moreover, as renewable energy requires much more metal resources than fossil fuels do, energy consumption and metal consumption may dynamically interact with each other. From an analytical perspective, cumulative consumption is not nonlinear in its increase in total consumption due to the recycling rate at the time.

This report thus aims to present an analytical model of a dynamic relationship between renewable energy capacity and primary metal consumption. In this report, a numerical application is made as in wind-turbine and copper, based on various empirical studies. In this report, a modest assumption is made for annual increase of copper consumption. The global growth rate is set at 0.1%, which can still lead the current reserve base copper to depletion by 2045 without incremental recycling (Halada et al., 2008).

As a result, the ratio of GER with 0% and 100% recycling in 2045 to the current GER are estimated to be 3.94 and 1.44 respectively. Although 3.94 times more capacity may not be substantial for the entire energy consumption level, we note that this is rather an optimistic scenario. The results show that the ratio with 0% recycling is estimated to sharply rise after 2030 and even some 20% recycling drastically contains the increase. The analysis also reveals that the optimal recycling rate with regard to minimising energy capacity for metal production can be time-dependent. The current optimal rate for copper is calculated to be 38.2%, which is very similar to the actual rate (35%, International Copper Study Group, 2013). To uphold the optimal level, the recycling must rise to 64.8% in 2045. The feedback effect on mineral extraction from incremental energy capacity for the extraction is found to be negligible at ore grades of 0.1% order. Applying this approach to other metals to assess overall influence on energy capacity remains for future work.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Legal Institutions and Ecological Economics

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Type of Presentation: Full session

Biography: Dr. Volker Mauerhofer, MAS (Laws), MSc (Natural Sciences), Vienna MA (Ecological Economics, Leeds), is a lecturer at the University of Vienna, Austria. Currently he is also visiting professor (UNU IAS—United Nations University, Institute for the Advanced Study of Sustainability, Japan), visiting researcher (PRIMAFF—Policy Research Institute of the Ministry of Agriculture, Forestry and Fishery, Japan) and a designated visiting fellow (WTO research center of Aoyama Gakuin University, Japan). Furthermore, he does freelance research worldwide.

Abstract: This session aims to contribute to a better understanding of the relationship between legal institutions (LI) and ecological economics (EE). Therefore, it is intended to cover the complementarity and challenges of the general interplay between LI and EE, as well as the role of LIs in environmental protection and management such as the establishment of property rights and economic instruments. This interdisciplinary session will in particular deal with the challenges and regulatory responses related to the distribution and sustainable use of resources in the world of increasing resource scarcity and environmental degradation. Legal institutions are exclusively available to public authorities while they interrelate with economic instruments whether applied by public or private actors.

Legal institutions face challenges, too, for example due to their introduction on various geographical levels and the interplay among them. Furthermore, envisaged changes are often better addressed by other instruments or combined governance approaches, for example, in the sense of a mix of policy instruments. In summary, the goal of this session is to discuss key concepts, methods, and applications of legal institutions and ecological economics together. We will further map opportunities of and challenges for LI and EE as well as their interplay.

We will examine legal institutions and ecological economics with respect to their multilevel governance interplay and with regard to environmental, social, and/or economic sustainability; innovative local, national, regional, and international legal principles/approaches toward more sustainability including, for example, degrowth law, green economy law, public participation, soft law, and customary law; legal institutions and inter-/intragenerational justice on the pathway towards sustainable transitions; legislative, administrative, and judicial decision making and enforcement by law in terms of priority setting, ignorance, uncertainty, risk, conflicts of interest, and trade-offs; absolute and relative achievements by law; and the role of law for property rights, new commons, the Post2015 Agenda, and Sustainable Development Goals.

The session will consist of talks presenting full papers and a final panel discussion with floor participation. The papers are “How Do Ecosystem Services in Enforceable Law? Potentials and Pitfalls Within Regional and National Integration,” presented by Volker Mauerhofer and Iasmina Laza; “Putting ‘Bio’ in Bioeconomy: The Role of Law in Developing Sustainable Bioeconomy in the Finnish Forest Sector,” presented by Suvi Borgstrom; and “What to Pay For and Why? German Property Rights Regimes and Environmental Governance,” presented by Claas Meyer.

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Society and Ecosystem Service Trade-Offs on Behalf of Future Generations

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4th Author: Mark Borsuk - Dartmouth College

Type of Presentation: Speed talk

Biography: Georgia Mavrommati is a postdoctoral research associate in the environmental studies program, Dartmouth College. She collaborates with scientists from different disciplines (decision scientists, aquatic ecologists, forest ecologists, climate scientists) to characterize and value ecosystem services at the watershed level. Her research addresses some practical challenges of conventional valuation methods by the development and application of a novel framework based on a deliberative multicriteria method where sustainability considerations are incorporated and community engagement is ensured.

Abstract: Even though decisions taken today about managing ecosystem services are likely to have an effect on future generations' choices and human well-being, the current decision-making framework is based merely on current generations' values. Dealing with this uncertainty is inextricably linked to the way that sustainability is defined and perceived in the decision-making process. The school of weak sustainability asserts that trade-offs among ecosystem services across generations are acceptable as long as it is possible to find technological fixes for ecosystem services with limited supply, while the school of strong sustainability allows trade-offs among ecosystem services as long as ecosystems do not reach critical ecological thresholds. However, sustainability is an ethical value and a social goal. In this context, this paper explores ecosystem service trade-offs over time when preferences are socially constructed and social actors decide on behalf of future generations. We explored two different plausible scenarios with 11 panels of citizens. Our results suggest that when sustainability considerations are included in the valuation process, society as a whole is reluctant to make trade-offs on behalf of unborn individuals irrespective of the future state of the socioecological system. This finding has policy implications since it suggests that when preferences are socially constructed, ethical values pertaining to the decision making and the integration of ecosystem services trade-offs into environmental decisions become less important.

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Collective Forest Reserves in Agrarian Reform Settlements in the Brazilian Amazon: Opportunity to Prevent a Noncommons Tragedy?

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Type of Presentation: Paper presentation

Biography: The authors have been working together on sustainable rural settlements in the Amazon region for nearly two decades (May and Nunes) and more recently through the EU-supported POLICYMIX project, whose work in northwest Mato Grosso was coordinated by May with involvement by the remaining coauthors. Management of common forest resources as an instrument for building resilient community enterprises arose as a theme from an international workshop on public goods and common pool resources held in Rio de Janeiro.

Abstract: In the Brazilian Amazon, agrarian reform settlements (ARS) have recently been identified as a major regional focal point of deforestation. Collective forest reserves have been established in such settlements in the expectation they will act as a bulwark to detain further deforestation. In accordance with the precepts of common pool resource management, collective property rights and associated institutions can be effective in combating resource depletion. If land users instead seek to privatize their control over collective resources, a “noncommons” tragedy can arise in which resources designated for collective management are degraded due to incomplete definition of rights and responsibilities. Based on our research in two similar-sized settlements in neighboring municipalities in northwest Mato Grosso, collective forest reserves can only function sustainably if managed in combination with long-term efforts to assure synergies between common property rights and complementary land use and local development policies. In one ARS, despite the presence of a collective forest reserve and regional trends toward decline in deforestation rates, clearing continued at a rapid pace, and the reserve itself was the object of encroachment. In the other ARS, the reserve came under collective management for nontimber forest products and was protected despite external pressures to invade it for gold mining and timber extraction. This exemplary result occurred due to complementary measures including state legalization of sustainable land use, forest management certification, advance credit and supply chain contracts for added-value processing of Brazil nuts derived from the reserve, and neighboring properties where contractual use rights over extractive resources were negotiated. The study concludes that forest conservation and restoration required by the Brazilian Forest Code will be difficult to achieve in ARS given the widespread failure to institutionalize collective governance over remaining forests, as witnessed by their overall greater rate of land use change in comparison with neighboring lands. Solutions may arise through a focus on alternative livelihood opportunities afforded by local “policymixes” in combination with the effective establishment of property rights over remaining forests.

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A Policymix for Sustainable Use of Biodiversity and Ecological Services in Areas Surrounding the Iguaçu National Park in Paraná, Brazil

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Type of Presentation: Paper presentation

Biography: The authors, based in academic and consulting organizations, are engaged in an innovative study and pilot implementation of best land use practices in areas surrounding the Iguaçu National Park in Paraná, Brazil, in collaboration with the federal Chico Mendes Institute for Biodiversity Conservation (ICMbio) and stakeholders in 14 municipalities surrounding the park, part of the WWF-designated Paraná Biological Corridor that unites forest remnants in Brazil, Paraguay, and Argentina at the “trinational border” that meets in Foz de Iguaçu.

Abstract: The objective of this study is to identify targeted instruments and policies for conservation in the state of Paraná based on the Policymix approach. A survey was performed to assess how this mix of policies and instruments and their synergistic effects can assist in developing economic activities surrounding the Iguaçu National Park, based on the park’s ecosystem services. The Upper Paraná River and its tributaries constitute an ecoregion of 900,000 sq. km. With remarkably diverse fauna, including over 300 species of fish, in addition to diverse aquatic vertebrates and invertebrates, the Upper Paraná basin has a high degree of endemism of freshwater species that is likely the result of isolation by waterfalls. The vectors that bring pressure for biodiversity loss stem from various degrading economic activities that arose jointly with the formation of the PNI and its relationship with the surrounding communities. Studies have shown that negative pressures persist, especially on forest fragments surrounding the park, leading to serious consequences for connectivity and maintenance of ecosystem services. An important source of pressure is that of unsustainable farming practices throughout the surrounds of the PNI, as mechanized monoculture is the predominant economic activity in the 14 surrounding municipalities. We identified eight federal and state instruments that can contribute to the development of sustainable activities around the park. At the state level the Ecological Value Added (ICMS-e) instrument and the program of support to private nature reserves (RPPN) are worthy of particular attention. The state of Paraná created the ICMS-e in 1992, through which municipalities are benefited financially by the existence of protected areas in their territories. The RPPN measure established a series of incentives to owners possessing forest remnants on their land and declared these as protected areas in perpetuity. At the federal level, one of the main instruments identified was that of rural credit under differential conditions for family farmers (Pronaf), which has specific lines for agroecological production systems or forest restoration. Such lines have little uptake primarily due to their unfamiliarity to local farmers and bank managers. Also the revised Forest Code provisions are aimed at environmental regulation (Rural Environmental Registry-CAR) and for compensation of legal reserve surpluses conserved (Environmental Reserve Quota-CRA). Once development opportunities based on ecosystem services are identified, it is possible to identify how these policies can contribute to conservation effectiveness. Among opportunities discussed for prioritization with regional stakeholders, we identified the restoration of degraded legal reserves as synergetic with several other measures, including RPPN and ICMS-e, and income generation from local visitation, honey and artisanal products, and organic horticulture to serve the tourism industry in Foz de Iguaçu, as well as CO2 emissions neutralization from international events held in the region.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Direct Payments for Reduced Deforestation: The Social Benefits and Environmental Impact of the Bolsa Floresta Program in Amazonas, Brazil

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Type of Presentation: Paper presentation

Biography: The authors are engaged in a collaborative assessment of the social and environmental benefits of investments by the Bolsa Floresta Program (BFP) in Amazonas State in Brazil, financed by the Inter-American Development Bank. In existence since 2007, the BFP provides regular cash payments to nearly 10,000 households throughout Amazonas, residents of Sustainable Development Reserves. Interviews with institutional partners and beneficiaries are being undertaken to comprehend factors that influenced the program's relative success under different contexts in the region.

Abstract: Payments for environmental services (PES) consist of direct remuneration to “providers of environmental services,” conditioned on compliance with contractual agreements regarding adoption of recommended production practices or avoidance of land use change and degradation in threatened areas. PES schemes were devised to overcome problems in measuring the benefits generated by integrated conservation and development programs (ICDPs). These were often difficult to identify, being diluted among a wide range of often simultaneous socioeconomic interventions in the context of broader development policies and pressures. The results of the Bolsa Floresta Program (BFP) in Amazonas, Brazil—which we characterize as a hybrid between the PES and ICDP approaches—suggest several broad hypotheses to guide fieldwork among beneficiary communities in project areas lying within sustainable development reserves (RDS) in Amazonas state. Our hypotheses include (i) the relative significance of payments of the cash component (family-oriented) of the BFP toward deforestation decisions is reduced due to the small size of the payments in comparison with other sources of income (including governmental direct transfers), and by the fact that most beneficiaries are not in fact dependent for their livelihoods on deforestation related activities; (ii) cash payments under BFP are important to lead households to participate in noncash elements of the program, through which they are encouraged to pursue other livelihoods promoted by the implementing organization and partner institutions, which provide important long-term socioeconomic and institutional capacities; these in turn are expected to ensure greater resilience and stability to communities, and to have positive long-term repercussions for environmental quality and livelihoods; and (iii) measurement of environmental repercussions of the complex, sequential series of BFP interventions is affected by the considerable differences between field sites, in particular their relative distance to centers of economic activity and transport corridors, that bring competing economic interests in the areas surrounding protected areas. While remote sensing information provides some evidence that BFP family payment is a factor in encouraging protective land uses in and around target reserves, there is evidence from our field study that there is considerable differentiation in this respect between reserves and even between villages within specific reserves. These differences may be traced to different characteristics of drivers of deforestation as well as the environmental and socioeconomic context of various Amazon landscapes. The relative isolation of specific RDS, along with the transport and transactions costs associated with accessing cash payments, is an important factor in some reserves, overcome in the case of the BFP by allowing beneficiaries to accumulate their payments and make withdrawals at their convenience. External pressures and territorial disputes are another important factor, while the relative importance of investment in community production and social facilities is also perceived differently in accordance with the existence of other options and proximity to urban centers.

Transforming the Economy Sustaining Food, Water, Energy and Justice

A Conceptual Framework of Regional Socio-Economic Impacts Comparing Conventional and Unconventional Fossil Fuel Extraction

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Type of Presentation: Paper presentation

Biography: Tom Measham is a human geographer whose research focuses on how regional communities are affected by and engage with the social and economic challenges and opportunities that face them. He works in close collaboration with economists and sociologists on issues including environmental rehabilitation, mineral, and energy extraction and climate adaptation in diverse regional contexts. He holds a PhD from Australian National University, where he continues to serve as an adjunct associate professor.

Abstract: As global energy demand increases, the rapid expansion of the unconventional fossil fuel sector has triggered an urgent need for social, economic, and policy research to understand and predict how this sector affects host communities and how governance systems can respond to changes presented by this sector. In response to this need, this paper addresses three linked objectives. The first is to review the literature on regional impacts of energy extraction, presented in the form of a framework of hierarchical effects. The second is to consider how these are playing out differently in the context of conventional compared with unconventional fossil fuels. The third is to draw attention to the institutional avenues for addressing these impacts, including an overview of the lessons from existing research on the human and policy dimensions associated with conventional energy industries. In particular, we consider the importance of multistakeholder dialogue, which plays an important role in how regions respond to the challenges brought about through extractive industries. Overall, we demonstrate that experiences from conventional energy development provide a useful starting point for navigating the human and policy dimensions of unconventional energy for host communities and discuss how these experiences differ when unconventional energy seeks to coexist with other land uses such as agriculture. The paper draws attention to the dispersed nature of impacts (positive and negative) and how this may shape winners and losers from unconventional energy development, particularly in regions with preexisting land uses such as agriculture.

Transforming the Economy Sustaining Food, Water, Energy and Justice

The New Waste Economy: A Comparison Between Urban Solid Waste Management Systems Inside Two Favelas of Rio de Janeiro

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Type of Presentation: Paper presentation

Biography: Teresa Meira is a PhD candidate in economics and has a master's degree in environmental engineering. She has experience in international research and has been involved as coinvestigator in international and multidisciplinary projects. Her transdisciplinary academic background allows her to create synergies among knowledge generation, capacity building, and practice-oriented activities in the fields of environmental studies and ecological economics.

Abstract: Waste accumulation in the common areas of Rio de Janeiro's favelas is a persistent social dilemma. It can be addressed through modifications of the conventional collective action theory and/or by analyzing local environmental governance instruments able to induce a desirable local institutional change.

Under the premise of garbage as having the power to reorganize social life, the interactions among social agents are analyzed underlying the two different models of municipal solid waste management.

In Morro da Babilônia, a favela in the south area of Rio, there's a project called "Light Recicla," where the electricity company gives a discount on the electricity bill in return for the purchase of recyclable materials. Morro dos Prazeres, a favela located in the city center of Rio de Janeiro, meanwhile, constitutes a case of an ongoing community-based initiative related to a change in collective action toward waste disposal and management. The territory is characterized by a hilly topography, high density of poor housing settlements, high criminal violence rates and insufficient public services, especially sanitation, education, and health, among others, which makes waste-related activities even more challenging. For decades, an inefficient top-down waste management system and the absence of community-organized responses were prevalent. In addition, several factors (including attitudes and perceptions toward waste by local dwellers) interacting through negative feedback, reinforced the status quo, resulting in ineffective waste collection, a dirty environment, and a high incidence of health-related risks. However, at a given point in time, the system suffered a radical change toward a model dominated by much more effective community-based waste management. Such a shift (which took place in 2013) was triggered by the project called Reciclação ("recyclaction"). The project aims to introduce a different perspective on waste collection and destination, and to reduce the socioenvironmental risk caused by wrong waste-related behavior. The project follows the guidelines of the National Policy on Solid Waste, in which different sectors of society—the government, companies, and consumers—have shared responsibility toward waste disposal, aiming to reuse or recycle whenever possible. In one year of existence, this community-based waste management system managed to reduce by 50% the waste produced inside the community. Currently the project is collectively coordinated by a working group formed by different partners such as local institutions, the municipal urban sanitation company, a social investment institution, private companies, nongovernmental organizations, and the city hall. It has the goal of being the first favela that recycles 100% of the waste produced.

The results are discussed under seven analytical dimensions: waste production, recyclable materials production, disposal, obstacles and motivations, attitude-behavior gap, responsibility, and perceptions about system operation. The differences are discussed from the viewpoint of participatory governance structures involved, the inconsistency of attitude-behavior relationship toward waste disposal, and the desirability of increasing the level of cooperation and reducing environmental degradation. These responses found to contribute to the development of policies of shared responsibility among different levels of governance that are capable of attaining collective benefits.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Application of Systems Science Principles to Economics, With Examples From Biophysical and Ecological Economics

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Type of Presentation: Full session

Biography: George Mobus is an associate professor of computer science and engineering. He earned a PhD in computer science at the University of North Texas in 1994 and has worked in the embedded systems controls and instrumentation industry starting as a software engineer. He earned an MBA from San Diego State and eventually was promoted to CEO of Technetics, Inc. His undergraduate degree is in zoology. He is the lead author (with coauthor Michael Kalton) of *Principles of Systems Science* (New York: Springer, 2014).

Abstract: It is proposed that economics as a scientific study would be greatly strengthened by approaching empirical studies and experimental designs using the rigorous principles from systems science. In this workshop I will walk through how these principles (identified in my book with coauthor Michael Kalton, *Principles of Systems Science*) can be applied to the study of example systems in biophysical and ecological economics. Practicing economists in these fields are already using some or many of these principles when, for example, they do modeling. However the literature suggests that the “systems thinking” or “systems approach” is done from a more intuitive basis. In this workshop I will show how to make the systems approach more explicit and comprehensive (i.e., in consideration of all of the major principles). Grounding subject sciences in systems science has already proven beneficial in other areas.

The workshop will include explication of the principles and their relations with one another (the system of principles), and several exercises using the examples from BPE and EE are to be done in small working groups.

Examples of problems that can be used to examine systems principles in action are:

BPE: The boundary selection for EROI analysis;

EE: Analysis of sustainability criteria for complex adaptive and evolvable (CAES) systems—an economy for a human social system;

Cross-over (integrating areas): Role of money as an information carrier in a sustainable, steady-state economy—information regarding work already done and work that can yet be done.

Outcomes: Participants will learn how the major principles interoperate holistically in all systems and thus form a basis for more complete understanding of systems in real life. They will actively learn how to apply several principles to real example systems taken from the fields of BPE and EE. With some additional study on their parts they should be able to apply this understanding to their work.

Materials: I will supply participants with a workbook with descriptions of the principles and methods of application and with worksheets for the exercises. I will also supply some preconference reading material for their preparation via web links.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Environmental Justice and the Print Media During the Implementation of Superfund

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Type of Presentation: Paper presentation

Biography: Robert Mohr is associate professor at the University of New Hampshire. His research expertise is in the areas of environmental and labor economics. Shrawantee Saha is an assistant professor at the College of Saint Benedict–Saint John's University, and her research is in environmental and public economics. Marco Vincenzi is a lecturer of economics at the University of New Hampshire, and his research is in the areas of public policy and innovation.

Abstract: The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 authorized the establishment of a "Superfund" to cleanup the nation's most polluted sites. Approximately 1700 sites were since added to the National Priorities List for remediation. This study explores print media activity in response to Superfund designations. Our interest relates to environmental justice, the principle that environmental risks should be equitably distributed regardless of race or income. We ask if media attention correlates to the characteristics of the neighborhood adjoining a Superfund site. We study the degree to which racial composition and income associate with the number of newspaper articles written about a polluted site, controlling for the site's hazard score and geography. We identify how media attention correlates to the speed with which a site is remediated and removed from the National Priorities List.

We focus on the years 1982–1984. This period immediately follows Love Canal and is thus a time period when national attention was focused on environmental issues. The period was also one of rising racial resentment with diminished willingness to support policies with poor or minority beneficiaries. Superfund sites were disproportionately in poor or minority neighborhoods. Thus, the Superfund sites featured in the print media might have either reinforced the perception that pollution was a policy priority or the perception that government resources disproportionately benefited minorities. The first wave of the Superfund designations consisted of over 400 sites being added simultaneously to the National Priorities List, allowing us to contrast sites with and without media attention.

We use Lexis-Nexis to identify all articles in the *New York Times* and *Washington Post* from 1982 to 1984 that name a specific Superfund site; 259 sites received media attention. We compile information about site characteristics, location, hazard score, and the dates of key steps in the remediation process. We merge site characteristics data to Census data for geographic and socioeconomic variables including race and median income. Preliminary results show differences in the characteristics of sites that receive media attention from sites that do not. Sites with media attention, in particular those where newspaper articles highlighted neighborhood characteristics or interviewed local residents, were located in more white and less racially diverse areas than sites without media attention. A qualitative analysis of the five most-frequently mentioned Superfund sites shows that this pattern is even more pronounced; frequently mentioned sites in particular were in white, working-class communities.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Multifunctionality and Natural Resource Management Strategies: A Comparison of Two Social Forms of Land Tenure in Mexico

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Type of Presentation: Speed talk

Biography: Sofia Monroy is a PhD student in integrated ecosystems management at the Institute of Ecosystems and Sustainability Research; her thesis is called “Management Strategies and Economic Valuation of Natural Resources in Two Sites of the South Coast of Jalisco, Mexico.”

Abstract: In the Mexican agrarian context two forms of social land tenure exist: the ejido and the indigenous communities. These are two important institutional platforms related to natural resource management, since they legally own around two thirds of the Mexican forests. These institutions differ mainly in their origin (indigenous communities are pre-Hispanic) and their capacity to incorporate new members (indigenous communities can and ejidos cannot). At present these institutions combine private and common property rights that manifest individual and collective logics. As a result, the natural resource management strategy performed in ejidos and indigenous communities may differ. In this research we analyze the management strategies of one ejido and one indigenous community in the same region and with a very similar ecological context. These cases were chosen to observe the differences that reflect the land tenure and cultural origin of these two institutions. The household strategy can be understood as “the particular form in which every family recognizes, assigns, and organizes their productive resources, work and spending money with the goal of maintaining their material and nonmaterial conditions of existence.” This approximation seeks the understanding of heterogeneous responses that peasants manifest in particular contexts. Management strategies include economical and ecological exchanges, based on resource diversity and productive activities. The results show that both institutions are based on the multifunctionality principle that reflects the use and management of the landscape to obtain different goods and services. This multiple-use strategy has impacts on food security and resilience by reducing the risk associated with market and environment uncertainties. Although in the ejido peasants have oriented their strategy to market commodities specializing their productive activity to cattle raising, in the indigenous community the abandonment of traditional subsistence activities such as milpa agriculture has not been as radical as in the ejido. In relation to forest management (which has common property) both the ejido and the indigenous community recognized they have problems in the sharing of benefits, resulting in deficient management of their forest. The most important difference that we could identify is the sense of belonging by people who live in the ejido but cannot be recognized as a legal member and the effect in the social capital that weakens the collective strategy.

Transforming the Economy Sustaining Food, Water, Energy and Justice

The Natural Gas Boom—Impacts on Land Use and Ecosystem Function in the Deciduous Forest Biome of North America

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Type of Presentation: Paper presentation

Biography: Our research group has been investigating the land-use impacts resulting from the recent expansion of oil and gas development in the United States. Matthew Moran and Maureen McClung are faculty members in the Biology Department at Hendrix College who are both interested in ecology and conservation. The other coauthors are undergraduate students from the Biology Department.

Abstract: With the technological advancements of horizontal drilling and hydraulic fracturing, natural gas development has accelerated across much of the North American landscape. To date, tens of thousands of wells, along with their associated infrastructure, have been constructed in a series of shale basins located in the temperate deciduous forest biome of eastern North America. Industry estimates suggest that many more wells will be drilled in the coming decades. Most of these shale basins are in areas of high conservation value that had not seen extensive oil and gas development in the past. Within these gas fields, substantial increases in developed and fragmented land are affecting populations of organisms and ecosystem function. A case study of the Fayetteville Shale in Arkansas, located in an important biodiverse region, found substantial changes in land use throughout the gas field, with impacts being higher on private land compared to public land. However, some public lands were affected to a high degree, mostly due to differences in regulation and decision making by regulatory agencies. The extensive development of the natural gas industry in the last decade, although it provides short-term economic benefits to parts of the region, is likely to have long-lasting negative impacts on the ecosystem services that these landscapes provide.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Using Deliberative Monetary Valuation to Analyze Synergies and Trade-Offs Between Aquatic Ecosystem Services in an Irrigated Mediterranean Watershed

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Type of Presentation: Paper presentation

Biography: Sylvie Morardet is a senior researcher at Irstea, joint research unit G-eau. She is an agricultural engineer by training and holds a PhD in economics. She has 23 years of experience as an agricultural and environmental economist, in irrigation and water management in France and developing countries. Her current research focuses on economic valuation of aquatic ecosystem services, participatory approaches and system modeling to support stakeholder dialogue on natural resources management, and economic instruments for water management.

Abstract: Many catchments in southern France are facing imbalance between available water resources and demand (in particular for irrigation purposes). Furthermore, the implementation of the EU Water Framework Directive (WFD) has led to revise water abstraction authorizations in order to achieve good ecological status for all water bodies by 2015. These decisions are giving rise to conflicts among users and between users and water management authorities. In such a context it seems important to compare economic benefits related to irrigation (agricultural production, employment) with environmental costs due to excessive water abstractions, and more generally environmental impacts of irrigation.

The ecosystem services approach enables a holistic analysis of present and potential benefit derived from aquatic ecosystem functioning. It also helps to identify trade-offs and synergies among them as well as to improve the economic justification of water management incentives to implement the WFD. Environmental values are frequently assessed thanks to instrumental methods such as stated preferences approaches. However, these methods are increasingly criticized for assuming that monetarization can encompass the multiple dimensions of values that people actually support.

To overcome such limitations, the concepts of shared or social values have been recently advocated to designate nonutilitarian dimensions of ecosystem values that are articulated in the frame of social processes. This suggests that value elicitation can be channeled through not only quantitative methods but also qualitative methods. Deliberative monetary valuation (DMV) represents the various techniques that were recently developed to combine monetary valuation and participatory workshops in order to elicit the plurality of values that people hold for environmental goods.

In this framework, we adopted a mixed valuation method that combines choice experiment (CE) with participatory workshops. Our study focuses on deeply held values given by local population to water-related ecosystem services and attempts to determine whether and how deliberation influences their individual and/or shared values. This approach is applied to the Gardons River catchment (south east of France), confronted with quantitative and qualitative water management issues.

Our protocol comprises two major phases. The first phase consisted in designing the survey instrument and deliberation process and was based on interviews and a workshop with Gardons River stakeholders and experts. We identified 13 ES existing in the catchment and selected the four most relevant to design the CE survey. This phase also revealed the intricate linkages between cultural and socioeconomic dimensions of water uses in this catchment. Consequently, the final design includes three attributes representing the main provisioning and cultural ES (domestic water, tourism, traditional irrigation), and an ecological attribute at the basis of several regulating ES (the river good ecological status). The second phase consists in implementing the questionnaire and organizing deliberative workshops to discuss the principles that should guide water allocation decisions. This phase aims to elicit participants' values and their willingness to pay for identified benefits provided by the Gardons River ecosystems. It will be completed by early 2016.

Transforming the Economy Sustaining Food, Water, Energy and Justice

A Holistic View to Water Quality Trading Program in Jordan Lake, North Carolina

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Type of Presentation: Paper presentation

Biography: Marzieh Motallebi is an assistant professor at Clemson University, located at the Baruch Institute of Coastal Ecology and Forest Science. She earned her PhD in ecological economics from Colorado State University; her dissertation was on economic, ecological, behavioral, and hydrological aspects of water quality trading in Jordan Lake, North Carolina.

Abstract: Nutrient pollution is a crucial issue for Jordan Lake, North Carolina. A water quality trading (WQT) program was suggested addressing water quality issues in this rapidly urbanizing watershed. Although the WQT program is appealing in theory, its application feasibility has experienced a number of failures in the United States. Infeasibility of a WQT program is a multidimensional problem. This paper identifies and evaluates factors, called wedges, that diminish or eradicate the chance of a WQT program's success at Jordan Lake.

In the current paper, first, a unified economic model was designed to examine how economic and noneconomic wedges can undermine an ideal WQT market and in many cases make it unattainable. Then, we constructed a vertical ecosystem services stacking market to examine how designing an additional market can assist the success of a WQT program in Jordan Lake, North Carolina. We applied the Soil and Water Assessment Tool (SWAT 2012) model (Arnold et al., 1998) to the Jordan Lake watershed to predict the amount of total nitrogen (TN) and total phosphorus (TP) loads from agricultural fields in different scenarios. Also, Jordan Lake Nutrient Loading Accounting Tool (NCDENR, 2007) assisted us in extracting the urban developments' TN and TP load data.

Our model outcome shows that while the WQT program at the Jordan Lake watershed displays some potential, it does not appear to be applicable soon. However, designing a vertical ecosystem services stacking market can motivate WQT entities to participate in this program. Our comprehensive study emphasizes a holistic perspective of geographical, economic, and behavioral wedges required before implementing the emerging WQT program at Jordan Lake. Assessing all effective wedges in the WQT program will assist policy makers in evaluating the likely success or failure of this policy for Jordan Lake, NC.

Transforming the Economy Sustaining Food, Water, Energy and Justice

China-Nepal-India-Bangladesh in the Transboundary Water Issues: A Game Theoretic Analysis

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Type of Presentation: Paper presentation

Biography: Lekha Mukhopadhyay is an associate professor of economics at Jogamaya Devi College (Calcutta University), India, and has been World Bank postdoctoral fellow (2001–02) at UCR, USA; SANDEE (South Asian Network for Development of Environmental Economics, a World Bank wing of South Asian countries) research associate; and Fulbright fellow under the Fulbright–Nehru Environmental Leadership Program (2012–13) at the SEI’s (Stockholm Environment Institute) U.S. Center in Davis, CA.

Abstract: Transboundary water issues in the Ganges Brahmaputra Meghna (GBM) basin have been significant attributes of connectivity and conflict between the riparian nations: China, Nepal, India, and Bangladesh. Hydropolitics within the surrounding interbasin water transfer have led to a number of water treaties, contention, and defection from it. Ganges and Teesta water-sharing agreements (1977, 1996, 2011) between India and Bangladesh, the Indo-Nepal Mahakali river treaty (1996), and the Indo-China negotiation on the “Great Dam Rush” for northward rerouting of Brahmaputra (2013) in China exemplify this. By altering the hydrologic regime these countries are attempting to cater to the indigenous demand for hydroelectricity, river fishery, river irrigation, water for industry, and domestic consumption. These interbasin water diversions change patterns of the river’s volumetric flow, timing, and variability, affecting the distribution and abundance of species in the river ecosystem. This results in conflicts at varying scales due to the break in long-established balances of benefits to different stakeholders.

Even within the national boundary interstate water conflict and conflict between different production sectors within a state have been aggravated by this transnational water diversion. In the whole process of negotiation and settlement, both at the transnational and the nation levels, cooperative solutions are becoming difficult due to asymmetric bargaining power among the competing stakeholders. Asymmetry is rooted in the comparative geographical advantage (like upstream-downstream location; upstream user getting “prime mover’s” advantage), comparative technical efficiency (determining the water-use efficiency), and comparative endowment of other supportive natural resources.

Given this phenomenon as a backdrop, this paper attempts to capture the whole issue within a game theory framework. The main interbasin water transfer game comprises various subgames at two levels: level 1 covers the strategic interdependence of water diversion among the “players” at the transboundary international level, and level 2 covers the strategic choice among the competing water users (hydroelectricity, agriculture, and industry) within domestic boundaries, since the transboundary river is a matter of common property resources. In defining alternative strategic choices and thereby payoffs we have considered not only the water sharing but also sharing of rights upon the river and sharing the economic and ecological benefits. Finally we derived the conditions under which the “players” at the various subgame perfect equilibria will like to move to a cooperative solution with due consideration of ecological economic sustainability. All these issues are very much pertinent to the policy dynamics on the international and national hydropolitic agenda.

Key words: asymmetric game, Bangladesh, China, ecological and economic benefit, game theory, India, Ganges Brahmaputra Meghna basin, interbasin water transfer, Nepal, water conflicts

Transforming the Economy Sustaining Food, Water, Energy and Justice

Capitalism Without Growth or Degrowth Beyond Capitalism?

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Type of Presentation: Paper presentation

Biography: Barbara Muraca, Ph.D., is assistant professor in environmental and social philosophy at Oregon State University, Corvallis, OR, and codirector of the International Association of Environmental Philosophy (IAEP). From 2011 to 2014 she was senior scientist in the Postgrowth Societies Advanced Research Group at the Institute of Sociology of the University of Jena (Germany). Her dissertation research at the University of Greifswald (Germany) was on the process-philosophical foundations of sustainability.

Abstract: When talking about economic growth ecological economic literature has usually focused on the role and the relation between monetary growth (measured by GDP) and material growth (measured by biophysical indicators), while little attention has been dedicated to both its structural function for the dynamic stabilization of modern, industrialized societies and the cultural role that such a dynamic stabilization has played in form of acceleration (with respect to social and technological innovation, and to the pace of life) for the value setting and the “mental infrastructures” of modern societies. While the first dimension has been addressed by different theories of capitalism without reference to the degrowth literature, the second one has been at the center of the sociocultural critique of degrowth in its French fashion with little acknowledgment of structural analyses.

This paper aims at bridging the gap between these two approaches by presenting some recent results of a collaborative research project:

Modern industrialized societies are characterized by the capacity to dynamically stabilize themselves by means of economic growth. As long as growth can be maintained, stability is continuously yet dynamically restored. Currently, it is becoming increasingly clear that this dynamization logic is running up against its limits, triggering dysfunctional effects with regard to the socioeconomic, political, and cultural reproduction of society. Industrialized countries (and possibly also emerging economies) seem to have reached a threshold beyond which further growth exacerbates crises and enhances inequality rather than securing employment, social mobility, and welfare.

At the current juncture, it is unclear whether this will lead to a cyclical readjustment and the emergence of a new capitalist regime or whether it signals a more radical shift in systemic, social structures: Will the end of easy growth spell the end of the current capitalist regime or convey a transition toward a novel growth model based on the green economy? Are we rather entering a postgrowth-capitalism characterized by a dramatic increase in inequality and injustice in accordance to what some scholars have termed a “refeudalization” path? Or does this shift create a fruitful ground for the alternative path that proponents of degrowth are suggesting as a radical social-ecological transformation that avoids both the crises of growth and the imperatives of dynamic stabilization?

In the paper I present and discuss different scenarios (green growth, refeudalization, recession, degrowth) and their possible implications in terms of global environmental justice, social stabilization, democratic legitimation, and ecological impact.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Rethinking Ecosystem Services as Care Relations—A Feminist Ecological Economics Approach

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Type of Presentation: Paper presentation

Biography: Barbara Muraca, PhD, is assistant professor in environmental and social philosophy at Oregon State University, Corvallis, OR, and codirector of the International Association of Environmental Philosophy (IAEP). From 2011 to 2014 she was senior scientist in the Postgrowth Societies Advanced Research Group at the Institute of Sociology of the University of Jena (Germany). Her dissertation research at the University of Greifswald (Germany) was on the process-philosophical foundations of sustainability.

Abstract: The ecosystem services (ES) concept has become a powerful tool in an increasing number of policy and research contexts, ranging from ecosystem-functioning research to biodiversity protection through ecosystem accounting and sustainability policies.

Since its appearance it gained both enthusiastic attention and a sharp critique from different environmentalist groups. Critics claim that it reduces “nature” to a merely instrumental consideration and opens the floodgates to its ongoing commodification. Practitioners, on the other hand, have shown the successful implementation of some PES regimes and defend the concept of ES as a useful tool for nature conservation and sustainability.

While I agree that the ES concept is being dangerously used to pave the way to a sheer commodification of “nature,” I claim that by bringing to the fore the very idea of relational values, the ES concept can challenge any narrow consideration of “mere” instrumentality as the only way of framing relations to nonhumans (Jax et al., 2013). By focusing on the complex interconnection between ecosystem services and human well-being, the ES approach is essentially relational and might help, if not to overcome, at least to discontinue the obviousness in the Western tradition of environmentalism of the opposition between “nature” and culture/society.

However, such a paradigm shift in the understanding of the ES concept needs some critical reappropriation. One way that I explore in the paper is a reconsideration of the very concept of “services,” which has been mainstreamed by neoclassical-inspired economics in terms of sheer instrumentalization. According to ecological economics instead, services are flows that can be used without jeopardizing the qualitative regeneration of the so-called “funds” from which they stem (Georgescu-Roegen, 1971). Other than “stocks” that decumulate over time and whose flows are used up, services are used in a way that keeps them in good condition for being used again by others in the future. From the point of view of ecological economics, considering ecosystem functions as services implies entering a more complex relation that requires taking care of their conditions of regeneration.

Similarly, for feminist ecological economics, so-called reproductive services, delivered both by what we call “nature” and by other humans (mostly women and people from subaltern social groups), are those that support the reproduction of society materially, socially, and institutionally (Biesecker & Hofmeister, 2010). Rather than being mere instruments, (re)productive services belong to the category of fundamental relations that constitutes the very persons benefiting from them. Feminist ecological economics can thus liberate the concept of “services” from its mainstream-economic semantic of instrumentalization and resignifies them in terms of a care relation. Rethinking ecosystem services in terms of care relations not only stresses our care responsibilities toward them but also reframes our (human) condition as beings in need of care, dependent upon the incessant activity of living beings restoring the basic conditions for our flourishing.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Social Welfare in a Growth Model With Greenhouse Gases and Contemporaneous Externalities

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Type of Presentation: Paper presentation

Biography: Asjad received his PhD from the New School for Social Research in 2012 and is currently a postdoctoral researcher at the Institute for Ecological Economics, Department of Socioeconomics, WU. His research interests include ecological macroeconomics, climate change, inequality, migration, distributions, and stock-flow consistent models.

Abstract: Research literature in post-Keynesian ecological economics discusses the role of ecological limits by allowing either for a given ecological growth constraint or by modeling the feedback of ecological damage on production (either via depreciation or via investment) (e.g., Fontana and Sawyer 2015, Rezai 2010). However these models do not factor in a negative well-being impact (contemporaneous externalities), one that occurs outside the production economy. The existing literature on environmental economics often discusses GHG emission and air pollution (e.g., Nordhaus 2013). We follow the GUG literature in allowing a negative effect of the stock of GHG on output (with a substantial time delay). We introduce a social welfare function that depends positively on output, negatively on unemployment, and negatively on air pollution. We then derive a post-Keynesian and neoclassical closure of the growth model. Then we analyze a zero-growth and a stable-temperature policy strategy. For each of these we analyze the output path, air pollution, GHG pollution, and social welfare. The paper thus brings together three strands of literature: growth paths, emissions and damage functions, and well-being (or happiness) literature.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Shifting Technological Progress: A Stock-Flow Consistent Framework for Induced Resource-Saving Technological Change

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Type of Presentation: Paper presentation

Biography: Asjad received his PhD from the New School for Social Research in 2012 and is currently a postdoctoral researcher at the Institute for Ecological Economics, Department of Socioeconomics, WU. His research interests include ecological macroeconomics, climate change, inequality, migration, distributions, and stock-flow consistent models.

Abstract: The paper analysis the role of labor productivity, capital productivity, and natural resource productivity in a macroeconomic model. We are particularly interested in how, in such a model, government can redirect productivity growth toward resource-saving technological change. The paper contributes to literature by incorporating research and development expenditure and induced technological change through endogenous productivity growth in a stock-flow consistent (SFC) framework. A stylized fact of growth theory is that labor productivity is growing, but capital productivity and population growth are relatively stable. Presumably this is to a large extent because wages have increased, and capitalists thus had an incentive to rationalize labor productivity (Acemoglu, 1998). Similarly interest rate signals affect capital investment decisions, and resource costs affect resource productivity-related R&D expenditure. Firms as profit-maximizing institutes thus make R&D and investment decisions based on market signals. Assume that R&D is a fixed share of total investment. Investment is determined by a Kaldorian investment function. The R&D portfolio choice of investment across labor, capital, and resource-saving technologies is driven by market signals with the main motivation of maximizing profits. The type of market signal affects the R&D portfolio choice and subsequently the growth trajectories of the economy. Government as policy maker can incentivize the private sector to invest in a certain type of technology through various channels; rising environmental taxes directly transfer back to firms, following various forms of demand-led policies (increasing own expenditure, increasing demand of households) and enforcing green investment. In this paper we explore how different forms of government intervention affect the firm investment decision and what implications this has for different types of productivities and overall growth.

Transforming the Economy Sustaining Food, Water, Energy and Justice

International Trade in Environmental Technologies—The Participation of China and Brazil

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2nd Author: Luciana Togeiro de Almeida - Universidade Estadual Paulista Júlio de mesquita Filho (UNESP), Brazil

Type of Presentation: Paper presentation

Biography: Renata Muniz do Nascimento is a journalist and economist with a master's in economics from UNESP. She defended her dissertation in July 2015 on international trade in environmental technologies. It was supervised by teacher Luciana Togeiro de Almeida, whose master's and doctorate in economics are from Unicamp. She has experience in the field of economics and international economics of the environment, focusing on international trade and sustainable development. She was president and is currently a member of ECOECO as the vice-president of the regional section of ISEE.

Abstract: This study analyzes international trade in environmental technologies between the years 2002 and 2013 with four objectives: (1) to analyze the pattern of international trade to verify the hypothesis of the existence of a north-south pattern, in which the member countries of the OECD, represented by developed countries, lead exports, and non-OECD countries, represented by developing and least-developed countries, are practically limited to the status of importers of environmental technologies; (2) to analyze the insertion of Brazil into international trade of environmental technologies, in particular the performance of its trade balance in this segment; (3) in a similar manner and for purposes of comparison with Brazil, to analyze the inclusion of China in international trade in environmental technologies; and (4) to assess the level of tariff protection on imports of environmental goods in the OECD group compared to the group of non-OECD countries, especially the data for Brazil and China, in order to check whether there was a liberalization of trade in such goods. The results of this study show the maintenance, in aggregate, of a north-south pattern of international trade in environmental technologies, but the scenery begins to change in China's rise of reason and the U.S. share decline and Japan in this trade. But Brazil has deepened its trade deficit in environmental goods in this period. Regarding the degree of tariff protection, the developed countries have reduced average tariffs of import compared to those applied by developing countries. China keeps an average very similar to those import tariffs by developing countries. Brazil already applies much higher than average rates of import than those practiced by China, which may explain their lack of representation in the international trade of environmental technologies.

Transforming the Economy Sustaining Food, Water, Energy and Justice

The Value of Endangered Forest Elephants for Local Communities in a Transboundary Conservation Landscape

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4th Author: Denis Sonwa - Center for International Forestry Research (CIFOR)

Type of Presentation: Paper presentation

Biography: Jonas Ngouhouo holds a master's in environment and natural resource and is currently pursuing a PhD in forest economics.

Abstract: This paper seeks to determine and characterize the social and cultural preferences for endangered forest elephants' (EFE) conservation in the Congo Basin's Tridom Landscape. Using unique data from a 2014 stratified random face-to-face survey with 1035 households in 108 villages, we combined both double-bounded dichotomous choice (DBDC) and open-ended (OP) elicitation formats to better evaluate the willingness to pay (WTP) for EFE's conservation. We find that local households are willing to pay monthly CFA1139.4 (€1.74) to avoid EFE extinction. That's annually CFA753.9 million (€1.15 million) for the overall inhabitants. Indigenusness positively influences the WTP for EFE's conservation. Spatial data suggest that local communities prefer elephants to be far from their crops. The existence of human-elephant conflict has a neutral relationship to preferences for elephant conservation. Therefore, our study suggests that local communities would engage in biodiversity preservation when the public benefit from conservation comes with private benefits like human-elephant conflict avoidance

Transforming the Economy Sustaining Food, Water, Energy and Justice

Small-Scale Farming-Based Activities and Deforestation in the Tridom Transboundary Sentinel Landscape—Congo Basin

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Type of Presentation: Paper presentation

Biography: Jonas Ngouhouo holds a master's in environment and natural resource and is currently pursuing a PhD in forest economics.

Abstract: The purpose of this paper is to investigate the relation between livelihood production and deforestation in the Tridom Transboundary Sentinel Landscape (Tridom-TSL) using a unique georeference dataset. First, it evaluates the livelihood assets provided by small-scale farming and forest-based activities. Second, it assesses the factors driving small-scale deforestation, as well as the responsibility of agriculture and forest-based activities. It uses multidimensional statistics on cross-sectional data from our recent eight-month stratified and random survey with 1035 household heads in 108 villages of the landscape to evaluate and compare the livelihood provided by various activities. The drivers of deforestation as well as the livelihood effects are assessed using a multilevel spatial model. The variance component of the multilevel model shows that 14% of households' deforestation can be attributed to the villages' effect. The spatial Durbin model shows a significant spatial dependence between deforestation of each household and the average deforestation of neighboring households, suggesting that households tend to imitate their neighbors' deforestation decisions.

Direct effect parameters suggest that (1) an incremental change of the household's size, the head of the household's age, or the seniority in the village, which are the underlying drivers, increase households' deforestation by 0.15 ha; 0.017 ha, and 0.17ha respectively; and (2) households headed by women deforest in mean 0.33 ha less than households headed by men. Furthermore, increasing the number of households producing cocoa/rubber as a single activity, "cashcrop-forest," and "agriculture cashcrop-forest" approximately increases household deforestation by 4.7ha, 2.3ha, and 2.9 ha respectively. Indirect effects suggest that characteristics as well as households' livelihood strategies in terms of activities portfolios that drive deforestation from neighboring households have an impact on household deforestation. Instead, forest-based activities portfolios exert negative impact on household deforestation with a negative spillover effect on neighboring households' deforestation. Otherwise, agricultural-based activities portfolios as well as mixed portfolios have a positive spillover effect. For instance, an incremental change of the number of neighboring households whose portfolio is composed by subsistence agriculture, cocoa production, and bushmeat harvesting bring about 0.4 additional hectares deforestation to each household.

The results of the above multilevel mixed effect model suggest priority actions in subdivisions that have average deforestation above the overall mean with high ecological targets like Oveng, Mvangan subdivisions neighboring the Nkom National Parc, and the Mengame Gorilla Sanctuary with respective average deforestation of 8.8ha and 7.4ha, as well as Yokadouma and Salapoumbe subdivisions with 7.8 ha average deforestation. The direct and spillover effects suggest coaching households with agricultural- and cashcrop-based portfolio activities to adopt sustainable practices.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Energy, Trade, and Efficiency: Divergence and Convergence in Modern Growth

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Type of Presentation: Full session

Biography: The session consists of a number of international researchers based at three Swedish universities—Lund, Umeå, and Gothenburg. The scope of our research is primarily within the field of energy and environmental history, where the major aim is to give a more long-term historical perspective on numerous topics in today's field of ecological economics.

Abstract: The transition from organic energy carriers to fossil fuels has returned as a major theme in debates about the Industrial Revolution, global divergence, and responsibility for bearing the costs of climate change mitigation. A significant aspect of these issues is trade and to what degree developments in Britain and elsewhere related to the import of land-intensive goods and the export of energy-intensive goods and coal. Hitherto little data has been available on these flows, nor on how energy relates to industrial structure and trade. This session will provide data on energy embodied in trade and the structure and efficiency of energy consumption in different countries and will test Pomeranz's hypothesis that 19th-century Britain was a net importer of natural capital from the developing world.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Explaining Agricultural Technology Adoption Using Choice Experiments and System Dynamics

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4th Author: Jelili Adebisi - Michigan State University

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Type of Presentation: Paper presentation

Biography: The research group has worked together for two years to assess the potential for perennial grain technologies to improve farmer livelihoods and environmental outcomes in sub-Saharan Africa. This work was funded by the Bill and Melinda Gates Foundation.

Abstract: For decades, scientists and development practitioners have observed low rates of adoption of agricultural technologies with obvious environmental benefits in sub-Saharan Africa. Most studies that have sought explanations for these low adoption rates have not considered the dynamic nature of adoption trajectories, or how adoption criteria might interact in complex ways. In this presentation, we uniquely combine two methodologies—system dynamics modeling and behavioral choice experiments—to explore the case of perennial pigeonpea adoption in Malawi. Currently, most Malawian farmers who grow pigeonpeas cultivate it as an annual intercrop with maize. Perennial crops are considered “transformative” because they would require fundamentally different labor, input, and management practices from annual crops. Advocates of perennial grains cite their environmental benefits, such as enhanced soil carbon storage, higher biomass potential, improved soil water holding capacity and photosynthetic efficiency; reduced leaching, labor and input costs; and reduced soil erosion. We combined semistructured farmer interviews with choice experiments to assess the constraints, opportunities, and tradeoffs that perennial management of pigeonpea present to Malawian farmers. We then developed a system dynamics model to examine the possible trajectories of perennial pigeonpea adoption over time under varying conditions. Our results indicate that grain yield variability resulting from climatic conditions may be a critical factor in explaining low adoption rates. When farmers base their adoption decisions on the relative performance of the perennial crop compared to the annual crop observed in the previous year, a low yield advantage in a “bad” year suppresses adoption rates in a nonlinear manner due to the dynamics of trust and information spread around the technology. Understanding how these dynamics operate will be critical for the successful deployment of sustainable agricultural technologies in the future. These findings are particularly important in light of climate change, which is expected to increase variability of precipitation and yields in many regions of sub-Saharan Africa.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Using Ecosystem Service Valuations to Inform Management and Adaptation—A Case Study of the Velondriake Locally Managed Marine Area in Madagascar

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5th Author: Pieter van Beukering - Institute for Environmental Studies, Vrije Universiteit Amsterdam

Type of Presentation: Paper presentation

Biography: Dr. Oleson's research focuses on the reciprocal relationships between humans and the environment. Her current research integrates biophysical and economic modeling with decision science to inform management in tropical island systems.

Abstract: Understanding how people value ecosystem goods and services flowing from marine and coastal areas can provide important insight to guide environmental management decisions and adaptation strategies. Valuations in marine protected areas often focus on marketed goods and services, such as fisheries and tourism, and are helpful, for instance, to set user fees or calculate the added value of a sector. For many traditional fisherfolk, however, nonmarket ecosystem services, such as social capital, traditional medicine, coastal protection, and cultural heritage, are critically important for well-being. These nonmarket goods and services can reduce vulnerability to shocks, such as economic downturns, political unrest, and climate change. Moreover, in resource-dependent, coastal communities, social and environmental characteristics of the broader surrounding geographic area often play a critical role in sustaining well-being and conferring resilience. Despite the fact that coastal management's success is often predicated on an inclusive, holistic approach, very few valuation studies cover the full social-ecological system.

This study (i) conceptually and geographically maps the entire social-ecological system comprising a large-scale, locally managed marine area in southwest Madagascar; (ii) uncovers important social-environmental interactions driving key values; (iii) quantifies valuable nonmarket goods and services often neglected by traditional approaches that primarily focus on market goods and services; (iv) identifies potential trade-offs and win-wins from alternative management options; and (v) evaluates the role of nonmarket ecosystem goods and services in conferring social-ecological resilience to local communities.

We used conceptual mapping informed by interviews, focus groups, and direct observation to characterize the system. We then employed a variety of economic valuation methods to assess the total economic value (TEV) of ecosystem goods and services flowing from the system to local communities. The TEV includes provisioning (fisheries, wood, shells, freshwater, medicinal plants, research, and tourism), regulating (organic waste disposal, carbon sequestration, and storm protection), and cultural ecosystem services (social capital and cultural heritage, i.e., bequest value, education, recreation, and spiritual). We present values for all ecosystem services measured in the valuation, along with interpretations of differences between habitats, groups, and methods. We triangulate a number of the values using multiple methods, including market-based, ranking and rating, and Likert-scale summative rating. We reflect on what our results mean for community resilience and how they can inform alternative management approaches.

Our study uses valuation as a means to make better decisions. It sets the valuation within the broader social-ecological context. We argue that this approach can contribute toward improved decision making that aligns with local values, thereby increasing compliance and resulting in better social and ecological outcomes.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Why a Brazilian Cap-Trade Scheme?

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Type of Presentation: Paper presentation

Biography: Thais Oliveira is a PhD student in environmental economics at the Institute of Technology Sligo (Ireland) focusing on emissions trading mechanisms and policies. She holds a master's degree in economics (UNESP–Brazil, 2014), for which she investigated the impacts of international trade on Latin American countries and their environments; she has a bachelor's in economics as well (UNESP–Brazil, 2011). Her main area of research is ecological economics, focusing on international trade, climate change, and sustainability, and she is an associate researcher at the Center of Studies in International Economics, UNESP. She is ESEE's country contact in Ireland.

Abstract: Over the last years, Brazil has adopted a wide range of political measures to tackle the climate change problem, among them carbon markets initiatives. Since the Kyoto Protocol in 1997, this politico-economic tool has flourished. It has also gained global acceptance as the major mechanism to mitigate emissions, particularly by developed countries seeking to achieve their legally binding emissions target. For Newell and Paterson (2010), neoliberal environmentalism is creating a “climate capitalism,” in other words, a greener and more sustainable capitalism's paradigm that is oriented by the commitment of political and financial elites. The greatest and longest existing cap-and-trade scheme is the European Emissions Trade Scheme (EU ETS), operating since 2005. From this experience, some developing countries intend to follow the same model of “decarbonization.” In Brazil, there is a great discussion regarding the implementation of a cap-and-trade scheme similar to the EU ETS. However, the environmental and distributive impacts are generally less explored or simply nonexistent. It seems, therefore, that a Brazilian cap-and-trade scheme would emerge more as a new mode of accumulation of capital than as an ecological policy. Thus, the financialization of permits and commoditization of CO₂ would serve as a broader part of the “green economy” discourse and practice to facilitate the expansion of capitalist accumulation, as stated by Sullivan (2010) and Heartfield (2008). In this paper, our purpose is to develop a critical analysis, based on ecological economics principles and Marxist social theory, on why implementing a cap-and-trade scheme in Brazil is achieving greater importance and who exactly are its supporters. Some elite groups have an inherent interest in expanding carbon markets mainly due to “gains of trade.” Moreover, a cap-and-trade scheme in Brazil could subsidize destructive ecological activities while exacerbating preexisting inequalities. That being so, we argue that developing countries such as Brazil should pursue a different strategy to simultaneously achieve climate objectives and sustainable development. Our investigation elucidates that the Brazilian “climate capitalism” and its political ecology, supported by a cap-and-trade scheme, would negatively impact both the environment and the society.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Carbon Intensity of Brazilian and Irish Exports—A Sectoral Analysis

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Type of Presentation: Paper presentation

Biography: Thais Oliveira is a PhD student in environmental economics at the Institute of Technology Sligo (Ireland) focusing on emissions trading mechanisms and policies. She holds a master's degree in economics (UNESP–Brazil, 2014), for which she investigated the impacts of international trade on Latin American countries and their environments; she has a bachelor's in economics as well (UNESP–Brazil, 2011). Her main area of research is ecological economics, focusing on international trade, climate change, and sustainability, and she is an associate researcher at the Center of Studies in International Economics, UNESP. She is ESEE's country contact in Ireland.

Abstract: The climate change phenomenon is currently threatening the promotion of equitable and sustainable development in the world (IPCC, 2014). Several impacts over natural and human systems have been occurring as a consequence of the rise in greenhouse gas (GHG) accumulation in the atmosphere. In an attempt to avoid more severe risks associated with the global increase in GHG emissions, there has been a great effort from both developed and developing countries to map out policies and strategies to limit the impacts of climate change and to promote the transition to a low-carbon economy. Historically, developed countries were considered the largest GHG emitters and thereupon agreed to have more stringent and compulsory mitigation commitments under the Kyoto Protocol. However, currently there is a downward trend in emissions in developed countries. According to the literature, there was a stabilization of emissions from developed countries in the last decade, while the emissions of developing countries doubled. Some studies defend the idea that the exponential increase in emissions from developing countries results partly from the greater exports' contribution in total production by country. This means that increasing the flow of international trade has been associated with "transfers" of GHG emissions, in which developing countries are net exporters and developed countries net importers of emissions. A direct relation is observed, therefore, between the volume of GHG emissions and the volume of goods and services transacted via international trade. In this article we determine the carbon intensity embodied in international trade from Brazil and Ireland to evaluate comparatively the level of environmental pressure. We also evaluate climate change policies pursued by those countries, assuming that emissions embodied in trade may have a significant impact on their political choice. To quantify the emissions transfers via international trade, we propose a new approach for the carbon-intensity indicator, mapping the sectors of the Brazilian and Irish GHG emissions inventory into the sectors of Supply and Use Tables from 2000 to 2011. Carbon intensity embodied in international trade reveals the absolute volume of CO₂eq emissions generated proportionally among export sectors; that is, it expresses the potential physical impact of the exporting activity on the environment. The results show a reduction in carbon intensity embodied in Brazil's more than in Ireland's international trade over the decade. This fact indicated that both have reduced the environmental impact from exports in terms of GHG emissions. In fact, our results bring to light questions about viability of different policies and solutions for environmental pressure mitigation in exports-dependent developing versus developed countries. The most challenging issue will be to promote a feasible sustainable and low-carbon development sufficiently comprehensive for all countries while protecting the socioeconomic and environmental characteristics of each country.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Sociopolitical Dimensions and Stakeholders' Responses to Failed Chinese Hydropower Dam in Nigeria

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Type of Presentation: Paper presentation

Biography: Dr. Olorunfemi is a senior research fellow of the Nigerian Institute of Social and Economic Research and a research fellow of the Earth System Governance Project. His research interests are in the areas of climate change adaptation, disaster risk management, natural resource management, food security, and green economy.

Abstract: The rise of Chinese infrastructure investment in Africa has raised a set of questions about whose development agendas are being fulfilled by such projects, where the power lies in these negotiations, and how local communities are affected by the projects. Current assumptions see China as holding the power in these relations and that its state-backed TNCs unilaterally get their way. This paper examines the case of a “failed” Chinese project—the Zamfara Dam in Northern Nigeria—to question some of these assumptions and in doing so makes a case for the role of African political agency in brokering Chinese engagement. The dam project was initiated in 2008 between the Zamfara state government and the China Geo-engineering Company. After the initial assessment and community consultations that spanned three years, the project failed to take off. Primary data is used to understand the process of failure and shows that the dam was initiated based on political expediency rather than the actual drive for development. It was brokered among the elites of China, Nigeria, and Zamfara state and so failed to gain wider legitimacy and accountability. Also, in the drive to see the project initiated, statutory shortcuts were taken. Critically, consultation was not broad-based even among the state government officials and the communities. The initiation of the project did not follow the laid-down procedure of the Federal Ministry of Water Resources. Given that largely political factors played a significant role in the failure of the project, it is suggested that motivation for and implementation of development projects of this nature should transcend political whims and caprices of politicians and ensure more transparency and broad consultation.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Energy Transitions in Energy Primary Consumption in NAFTA: A Markov's Chains Analysis

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Type of Presentation: Paper presentation

Biography: Benjamin Lopez Ortiz is an economist and PhD student at ICTA, UAB, whose studies focus on applied economics, regulatory economics, and ecological economics and environmental management.

Abstract: The input-output tables of primary energy for the countries of NAFTA show energy used to produce energy available by primary source. In this analysis, the previous location of the consumption variable contains useful explanation of stochastic behavior in the period information. Through the analysis of Markov chains, it is found that the transition between primary energy sources provides information on the low substitutability that can translate into a slow energy transition scenario. That is, periods analyzed reveal low substitution to produce energy with solar, wind, biomass, and other sources. Transition to renewables on these oil-based economies should be reinforced with incentives and environmental policies in the energy sector in NAFTA countries.

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Transforming the Economy Sustaining Food, Water, Energy and Justice

Environmental Regulation in Energy Sector in NAFTA: Diminishing Emissions or Just a Market Instrument?

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Type of Presentation: Speed talk

Biography: Benjamin Lopez Ortiz is an economist and PhD student at ICTA, UAB, whose studies focus on applied economics, regulatory economics, and ecological economics and environmental management.

Abstract: This paper explores the environmental regulation impact on CO₂ emissions in the energy sector for Canada, the United States, and Mexico. The analysis is based on a panel data set and time series for the relationship between emissions and income, with regulation as an explanatory variable. Environmental regulation does not have null statistical effect; however, it needs reinforcement for a higher impact. Canadian and Mexican cases have a positive impact, but in the United States and NAFTA zone the results are not as expected. That is, when the whole zone has more regulatory instruments, it has more emissions. Liberalization incentivizes renewables, but energy production is still based on fossil sources and is growing. Maybe a change in direction in the environmental policy for the energy sector in NAFTA could change that trend.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Teaching Ecological Economics: From Principles to Practice

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Type of Presentation: Full session

Biography: Regina Ostergaard-Klem is associate professor of environmental science at Hawaii Pacific University; Christie Klimas is assistant professor, environmental sciences/studies at DePaul University; Kirsten Oleson is assistant professor of ecological economics at the University of Hawaii at Manoa.

Abstract: The objective of this session is to provide the space for others to share their pedagogy, philosophy, observations, and experiences about what does and doesn't work in the classroom as we endeavor to move ecological economics from theory to practice. If the end goal is to offer more than just an academic exercise, then questions arise such as, What competencies do our students need to acquire? How do we incorporate inter and transdisciplinarity into curriculum? How should students gain the knowledge and experience to effectively inform the policy process? How do we transfer lessons learned from academia to the practitioner and vice versa? Perhaps more importantly, how do we provide the skills to our students to do the same? These and other questions will facilitate information exchange and rich discussion about how we can make the jump from principle to practice in ecological economics.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Teaching the Trio: Using Examples From Hawaii to Incorporate the Water-Energy-Food Nexus Into Ecological Economics Curricula

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Type of Presentation: Paper presentation

Biography: Regina Ostergaard-Klem is an associate professor of environmental science at Hawaii Pacific University (HPU), where she teaches ecological economics and environmental policy and is director of the Global Leadership and Sustainable Development graduate program. She holds a PhD in systems analysis and economics for public decision making from the Johns Hopkins University. Her most recent research efforts focus on applications of the Genuine Progress Indicator (GPI) to Hawaii.

Abstract: Without a doubt, water, energy, and food are each fundamental to society. Look across the three collectively, and an intricate set of connections and dependencies appears: food to water, water to energy, energy to food. The intersection of the trio, or the water-energy-food (WEF) nexus, is a complex relationship with wider implications for the management of sustainable and resilient systems. Careful consideration of these interconnections helps to identify synergies, avoid conflicts, and assess trade-offs in a more comprehensive and holistic approach.

While conventional management of these resources takes a “silo” or isolated approach, the more-holistic nexus approach is now garnering increased attention, particularly in relation to climate change, sustainability, and resiliency. In light of this movement, our students need to master new and refined skills to address the WEF nexus. What theoretical understanding and practical learning are essential, and how best to incorporate these elements into the broader curriculum?

This presentation will use case studies from Hawaii to highlight methods to incorporate the WEF nexus into curricula. Islands face unique challenges in each of the water, energy, and food sectors due to factors such as remoteness, vulnerability, population pressures, and natural resource constraints. By extension, the nexus of these three factors in an island setting is also unique. We need to broaden the current conversation, leading to identification of pressures on and opportunities to address island resiliency across the intersection of water, energy, and food. The goal is to sharpen our students’ understanding of the WEF nexus, equipping them to work across sectors (both private and public), disciplines, and levels of policy making, and Hawaii provides excellent opportunities to enlighten that conversation.

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GPI Island Style—Moving the Genuine Progress Indicator From Theory to Practice in Hawaii

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2nd Author: Kirsten Oleson - University of Hawaii, Manoa

Type of Presentation: Paper presentation

Biography: Regina Ostergaard-Klem is associate professor of environmental science at Hawaii Pacific University; Kirsten Oleson is assistant professor of ecological economics at the University of Hawaii at Manoa.

Abstract: A series of technical reports prepared for the State of Hawaii Environmental Council and the Office of Environmental Quality Control starting in 2012 showcased the application of the Genuine Progress Indicator (GPI) within the state of Hawaii, resulting in “GPI Island Style.” Above all, the findings point to the many unique characteristics of our island setting. As a holistic measure of well-being, GPI is an accounting adjustment to Gross Domestic Product (GDP) and tracks a range of economic, environmental, and social factors and the corresponding adjustments in personal expenditures for either unrecorded costs or unrecognized benefits. Through our research, several subsets of value have come to light (such as coastal water quality, threats to the native environment by invasive species, and the strong sense of family), pointing to the potential for GPI to provide an adequate framework to capture the unique factors and core values within our state.

So what are the next steps for broader adoption or diffusion of GPI in our state? GPI is making its mark in several states in the United States, highlighting the need for alternative indicators to more inclusively track progress, leading to better-informed policy making. GPI Island Style is gaining visibility throughout Hawaii and dovetails nicely with other policy initiatives including Hawaii Green Growth and the Aloha Plus Challenge. This presentation will share our lessons learned, critical success factors, barriers, and recommendations as we continue the journey from theory to practice for GPI Island Style.

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Greening Regional Economy: Case of Buryatia Republic (Russia)

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Type of Presentation: Paper presentation

Biography: Alla A. Pakina was graduated from the Faculty of Geography of Lomonosov Moscow State University (MSU) in 1993 and earned her PhD in geo-ecology in 1997. Currently she holds the position of deputy head at the Department of Environmental Management at the Faculty of Geography, MSU. Her research activity ranges from evaluation of ecosystem services to general principles of ecological economics and sustainability. She is also a lecturer on environmental economics at the Faculty of Geography, MSU.

Abstract: Transition to a green economy is one of the priorities of Russian modernization; however, a contemporary national economy has a raw orientation. Dependence on extraction of nonrenewable resources, especially oil and natural gas, leads to an increase in environmental damage, reaching 4–6% of GDP annually. We have considered the case of the Republic of Buryatia (eastern Siberia) and the challenges it faces toward attaining a green economy. The area is characterized by extremely rich natural resources, a large territory, and harsh climatic conditions, as well as a very low population density and a weak infrastructure. The core of the area is Lake Baikal.

Preliminary economic analysis conducted for the Republic of Buryatia, shows that even the current low level of GRP is associated with high pressure on natural systems. In recent years, the GRP growth directly correlates with indicators of environmental degradation and depletion of resources. A transition to green growth in Buryatia will require significant time and additional resources, so currently the green development can be considered in regard to certain sectors of the regional economy. Economic activity that more or less meets the principles of green growth is planned to be carried out within the “Baikal haven” special economic zone (SEZ) on the Lake Baikal coastline. Being based on principles of a public-private partnership, the SEZ will provide conditions to build a transportation infrastructure, ski resorts, and a number of hotels with modern systems of water supply and sewage systems, with minimized impact on the natural landscape through energy saving and resource efficiency mechanisms. However, development of a touristic cluster will also cause a transformation of natural landscapes. Currently this area is covered with forests, and we may expect additional CO_a emissions of about ~1000 t/year due to deforestation of the area.

CO_a emission can be considered an indicator of the intensity of natural geosystems transformation. Among Russia’s regions, the largest carbon intensity of GRP is peculiar for the Siberian Federal district, including the Baikal region. Further research in the region included an assessment of environmental costs and benefits from different economic activities, and the priority to direct attention to the green economy in the Republic of Buryatia was proposed.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Integrated Assessment of Social-Environmental Factors of Transport System Development in Astana and Almaty Cities (Kazakhstan)

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2nd Author: Aksholpan Atalikhova - Lomonosov Moscow State University

Type of Presentation: Speed talk

Biography: Alla Pakina has a PhD in geography and has been the leading researcher at the Department of Environmental Management, Faculty of Geography, since 2013. She is a lecturer on environmental economics and an associate professor.

During the last 10 years she has participated in a number of projects on environmental assessment of economical activity in regions of Russia .

Abstract: Assessment of social and environmental factors' influence on urban transport systems were investigated during 2013–2015 in Astana and Almaty cities (Kazakhstan). Along with important social and infrastructure functions, urban transport is one of the main polluters of the cities' atmospheric air. Astana and Almaty are characterized by extremely different conditions due to their locations in steppe zone of northern Kazakhstan and in a mountain hollow of southern Kazakhstan, respectively. The results of the integrated assessment of socioenvironmental factors on the basis of the aggregate normalized index allows the identification of streets and areas of the city with the most favorable and stressful environmental conditions. These results form the basis for elaboration of recommendations to improve the efficiency of the urban transportation system taking into account both ecological and socioeconomic aspects.

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Measuring the Trade Effect of Wood Packaging Standards on African Exports—The Case of ISPM15

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Type of Presentation: Paper presentation

Biography: Dr. Elissaios Papyrakis is a senior lecturer in development economics (macroeconomics) at the Institute of Social Studies of the Erasmus University in the Netherlands. His research interests lie at the intersection of ecological and development economics.

Abstract: There has been increasing concern about the (often unintended) trade effects of international environmental standards. On the one hand, broad adherence to such standards is necessary to minimize environmental impacts associated with the production and transportation of exported commodities. On the other hand, such standards often act as nontariff barriers that decrease trade volumes and often place developing countries at a comparative disadvantage. The International Standard on Phytosanitary Measures (commonly referred to as ISPM 15) is such an environmental standard on the treatment of wood packaging materials (as a means against the spread of pests) and has been implemented by over 50 countries over the last decade. Surprisingly, given the widespread use of wood packaging in exports, very little is known about the trade effects of the ISPM 15 standard on trade volumes of implementing countries. While implementing countries might face higher export costs, nonimplementing countries may also face reduced access to international markets. It might also be the case that the standard leads to trade clustering, where ISPM-15 developed and developing countries increase their bilateral trade volumes, whereas noncompliant developing economies are forced to export to a small group of developed economies characterized by looser environmental regulations. We make use of a gravity model (using an extensive panel dataset) to estimate such bilateral trade volumes between 1990 and 2012 and the impact thereof of the ISPM15 standard (taking into account the adoption stage both for the importing and exporting country, distances, GDP size, colonial ties, language, institutional dimensions, etc.). We also disaggregate results according to the type of commodities exported to measure any sector-specific effects of the standard adoption.

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Degrowth, Banks and Ecological Constraints to Endogenous Money Theory

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Type of Presentation: Paper presentation

Biography: Corinne Pastoret is associate professor in the Economics Department and the School of the Environment at Laurentian University. She holds a PhD from the Université de Bourgogne on the role of banks in Post-Keynesian monetary theory. Her research also deals with finance for development, employment guarantee policy and complementarities between heterodox theories of money and banking and Ecological Economics.

Abstract: In Post-Keynesian theory, the money supply is endogenous, meaning that banks and the central bank could indefinitely accommodate the needs of a growing economy, with no ecological constraints to limit this process. In fact, endogenous money has made possible the transition from an “empty world” with rapid economic growth, overutilization of natural resources and increasing pollution to a “full world”, in which the economic system is getting close to the planetary boundaries (Goodland R. and Daly H., 1992).

Post-Keynesian theory and Ecological Economics seem irreconcilable, as they aim at reaching apparently incompatible objectives: economic growth and full employment versus degrowth and ecological constraints to economic growth and full employment.

Because money endogeneity has contributed to bringing our economic system closer to the planetary boundaries, ecological economists advocate 100% reserve requirements for banks. However, this solution might not have the expected results in an endogenous money framework, with unnecessary high costs in terms of employment and wellbeing.

This paper starts with Keynes’s refutation of the quantity theory of money, as he proposes to think in terms of flows of money and the motives for its creation and uses, while banks are not presented as creators of artificial money. It is then argued that ecological constraints can be integrated into the Post-Keynesian theory of endogenous money and banks. At the same time, Ecological Economics, and more specifically degrowth economists, might be interested in alternatives to the neoclassical commodity-based monetary and banking theories.

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Community Supported Agriculture and Sustainable Farm Livelihoods

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Type of Presentation: Speed talk

Biography: Mark Paul is a Ph.D. student in the Department of Economics at the University of Massachusetts Amherst and a research fellow for Economics for Equity & Environment where he works on the Future Economy Initiative. His research investigates the link between sustainable agricultural and equitable economic development. Mark's work has been supported by: the Institute for New Economic Thinking, E3 Network, Political Economy Research Institute, and the Graduate School at the University of Massachusetts Amherst.

Abstract: Originally, CSA set out to align the interests of members seeking fresh, sustainable, local food, with farmers seeking wanting to sustain themselves on a relatively small plot of land by engaging in high diversity land intensive production destined for their neighbors.

There have been few comprehensive efforts to analyze CSA across the United States, however this study provides an overview of the CSA and the resulting economic, social and environmental outcomes.

Using a mixed methods approach including interviews and a survey of CSA farmers, the results found and presented in this paper show significant variations in CSA farm structure. Farms generally failed to provide adequate income to farmers and workers; however the notion of livelihoods considers more than simple economic measures.

Results also suggested CSA greatly reduces the barriers to entry for young and new farmers through improving access to land, and improving farm viability on limited acreage. The explosive growth of CSA farms could indicate the values and variables that are often neglected in standard economic analysis of farm "efficiency".

Transforming the Economy Sustaining Food, Water, Energy and Justice

Food, Resources and Nexus under an Ecological Prebisch Approach: Social Metabolism and Neoextractivism from a Southern Perspective

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Type of Presentation: Full session

Biography: Walter Alberto Pengue, Agronomist and Dr. in Agroecology, is a founding member and former president of the Argentine/Uruguayan Association of Ecological Economics (ASAUEE), as well as of the Ibero- American Network of Ecological Economics (REDIBEE). He is a member of the Board of Directors of the International Society for Ecological Economics (ISEE). Dr. Pengue is also the director of the Postgraduate Specialization on Ecological Economics, and a member of Resource Panel, UNEP, IPBES and other international arenas.

Abstract: Land, soils, water and biodiversity are relevant natural resources that allocate Latin American potentialities among the “Big Players” of the global food system. Even though the connection between natural resources and food production is well known, the links with food security are issues that have not been tackled under a holistic perspective for Latin American people.

In a global context, the circulation of commodities, particularly of Agrifoods (cereals, grains, meat, milk, eggs) has been growing sharply in recent decades and is now an important part of the global flow of goods in the world economy.

While exporting countries are selling their products, they are not incorporating their intangibles values in terms of overexploitation (soils, water, biodiversity), and the cancellation of relevant environmental services (biogeochemical cycles, e.g.). There is a metabolism of materials that needs to be evaluated, particularly of those materials that are relevant for the stabilization of the food chain, such as the soils, particularly their nutrients, in terms of nutrient flows and balances (nutrient footprints).

The real flow of these agro-industrial products could be sustained as the result of not incorporating the externalities in terms of ecological and social costs. In each exported product, we send a part of relevant “environment” that developing countries are selling at a very low value.

If water means life, soils are the basket that contains it. Soils are and will be, at least during the coming fifty years, the support of food production and the main substrate that contains the life and nutrient cycles of ecosystems. Land degradation in the form of soil erosion, nutrient depletion, water scarcity, salinity and disruption of biological cycles is a fundamental and persistent problem. Latin America is losing its best soils in hands of the exportation of it with no an adequate management.

Ecological footprints and ecological rucksacks are well-known concepts that in a preliminary approach have not taken these implications into their estimations of the effects of the intensification in agriculture and trade.

The intensification of Latin American agriculture is related to the reduction of nutrients in the soil, changes in land use, water consumption and the deforestation process, all of which are causing relevant environmental and social costs for the region.

In this presentation, we will revise the original view of Raul Prebisch on the Latin American model, under the light of the new situation with industrial agriculture, the process of neo-extractivism and the degradation of the ecological and economic exchanges between importing and exporting countries.

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Water and Health: The Impact of Regional Development Growth on Water Pollution in Developing Economies: The Case of the Santiago Basin, Jalisco México.

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2nd Author: Manuel Guzman - University of Guadalajara

3rd Author: Martín Romero - University of Guadalajara

Type of Presentation: Paper presentation

Biography: Salvador Peniche received his PhD in social sciences at the Colegio de Michoacán and is an expert on ecological economics and rural development. The title of his doctoral thesis dissertation is: "Virtual Water Trade and Mexican Strawberry Exports". He is a senior researcher with the University of Guadalajara where his current research is focused on water management.

Abstract: The Santiago river basin is considered one of the most polluted in Mexico. The virtual death of the Santiago river is suspected to be caused by industrial, urban and agricultural discharges generated in the Guadalajara suburban area.

This paper criticizes the regional development model in Developing Economies and analyzes the effects on human health by relating the levels of pollution with different epidemiological vectors. The relevance of this research question relies on the fact that there is no recognition of this problem by water or health authorities, nor is there any public policy directed to alleviate the water pollution in the area.

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Food, Water and Energy Indicators as Proxies of Minimum Welfare in Mexico's Official Multidimensional Poverty Measurement

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3rd Author: Francisco Carrera - Research Centre on Sustainability (IIDSES) - Universidad Iberoamericana

Type of Presentation: Paper presentation

Biography: Dr. Pérez-Cirera coordinates the research agenda on economics and the environment at the recently created Research Centre on Sustainable Development at Universidad Iberoamericana. Previously, Vanessa worked for the World Wildlife Fund heading their Conservation and Climate and Energy Program in Mexico. Vanessa holds a BA in economics from Universidad Iberoamericana, Mexico City, an MSc in Development Policy and a PhD in environmental economics and policy, both from the University of York in the UK.

Abstract: Multidimensional poverty measurement has captured the attention of policy-makers and researchers during recent years. Mexico is one of the most advanced countries in the measurement of poverty beyond income indicators. However, the environmental dimension has been well under-represented.

Recent 2011 Constitutional changes establish the right to a healthy environment as a citizen prerogative, which has opened the door for CONEVAL, the National Commission for Social Policy Evaluation to consider the right to a healthy environment in the official poverty measurement methodology. Current official methodology includes 6 social shortcomings plus a welfare indicator based on income vis à vis the acquisition of two basic consumption bundles.

The paper proposes a way of incorporating the environmental dimension in Mexico's official poverty measurement methodology, and potentially elsewhere, based on core food, water and energy indicators of minimum welfare, in the framework of ecosystems' and human environmental health. Given the relevance of poverty eradication for global sustainable development, recognized in the Millenium Development Goals and the Post 2015 agenda, an integral, yet accurate and practical way of measuring poverty can go a long way in guiding long-term global sustainability.

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Building a Practical, Interdisciplinary Ecological Economics Pedagogy

Corresponding Author: Patricia Perkins - York University, Faculty of Environmental Studies
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Type of Presentation: Roundtable

Biography: The panel members are faculty, graduate students, community scholars, and partner organization representatives connected with the Economics for the Anthropocene (E4A) project, an innovative ecological economics education program linking York University, McGill University and the University of Vermont. Patricia Perkins, an ecological economist and professor at York University's Faculty of Environmental Studies who has taught ecological economics and currently teaches interdisciplinary research design and qualitative research methods, sits on the project's Steering Committee and will chair the panel.

Abstract: This panel will outline and discuss the Economics for the Anthropocene project's innovative pedagogical approach, which includes experiential education, field courses on special topics, inter-university distance education, internships, student involvement in curriculum development, and facilitated links between graduate students and partner organizations to address real-world problems. Graduate students, faculty members, community scholars, and partner organization representatives involved with the project (names still to be finalized) will share their perspectives on the project's pedagogy and how it has evolved, with suggestions for "best practices" in ecological economics teaching and research.

In an introductory presentation, Patricia Perkins will summarize theoretical challenges facing ecological economics as a discipline from the standpoint of pedagogy, and suggest some approaches to meet those challenges, outlining the objectives and rationale for the E4A project's design. The other panel members will contribute additional perspectives on how the pedagogy has developed over the two years since the first PhD students were accepted, and on which elements are more (and less) effective. The panel's concluding comments will share our preliminary conclusions regarding successful and appropriate pedagogical innovations for ecological economics.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Commons and Climate Injustice: Ecofeminist and Indigenous Traditions

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Type of Presentation: Paper presentation

Biography: Patricia E. Perkins is a professor in the Faculty of Environmental Studies, York University. Her research focuses on feminist ecological economics, climate justice, and participatory community as well as watershed-based environmental education for political engagement. She is the editor of *Water and Climate Change in Africa: Challenges and Community Initiatives* in Durban, Maputo and Nairobi (Routledge/Earthscan, 2013). She holds a PhD in economics from the University of Toronto.

Abstract: This paper brings together examples from the global South and North of traditional and new forms of commons which help to meet local subsistence needs and develop communities' social, political and economic resilience in the face of climate change.

Commons governance represents a dynamic means of risk-reduction, which addresses the shortcomings of both market and state-oriented governance and is likely to become increasingly relevant as climate change threatens human subsistence worldwide. Indigenous traditions and leadership are central to this (re-)emergent phenomenon.

Drawing on the literatures of ecological economics, political ecology, and ecofeminism as well as the work of Elinor Ostrom to situate these ideas, this paper sets out a framework for assessing communities' climate resilience from an equity standpoint, in terms of their commons-readiness. Some of the indicators involved in this framework include each community's openness/boundaries, historical experiences and aptitudes with commons, indigenous leaders and integration of indigenous culture, social networks and social learning, political and economic autonomy, income distribution, and women's empowerment.

Climate justice (improving the local and global equity of climate change impacts and procedures) advances in parallel with commons development; this paper also discusses scale issues related to local, regional, watershed-based, international and global commons and climate justice.

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The Natural Capital Protocol: Supporting a New Economic Paradigm: where Businesses Account Natural Capital and Manage Production Accordingly.

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2nd Author: Eva Zabey - World Business Council for Sustainable Development (WBCSD)

3rd Author: Holly Dublin - The B Team

4th Author: Mark Gough - The Natural Capital Coalition

Type of Presentation: Paper presentation

Biography: The Technical Group developing the Protocol includes: Eva Zabey of the World Business Council for Sustainable Development; Rosimeiry Portela, Conservation International; Holly Dublin, The B Team; James Spurgeon, Sustain Value Will Evison, PwC; Hannah Pitts, WBCSD; Josh Bishop, WWF; Quiller Brooke, PwC; Arturo Castillo, Imperial College; Ian Dickie, eftec; Mark Gough, Natural Capital Coalition; Stephanie Hime, Natural Capital Coalition (part time secondment from KPMG); Joël Houdet, ACTS, ISS and Synergiz; Johan Lammerant, Arcadis; Doug MacNair, ERM; Emily McKenzie, WWF and the Natural Capital Project; and Bianca Nijhof, Arcadis.

Abstract: Natural capital is defined as the stocks of natural resources that yield a flow of benefits, including goods and materials, hazard protection, water filtration, and climate regulation, on which our economy depends. Many of these benefits are, in a sense, hidden and largely unrecognized. Yet their losses have very serious negative consequences for business. As the links between business, natural capital and consumers become increasingly evident, a new economic paradigm is emerging that demands business to account for the value of natural capital, better understand the limits to nature's capacity to assimilate waste, and manage production accordingly.

This recognition is leading some of the most innovative companies to measure their impact and dependencies on nature, and use that information for risk management, investment consideration, and identification of potential new revenue streams. The development of the Natural Capital Protocol seeks to provide a standardized approach for business assessment of their impacts and dependencies on nature, in a robust, yet pragmatic and flexible way, intended to ultimately support companies on a range of applications, as deemed most relevant.

The Protocol, developed by the Technical Group on behalf of the Natural Capital Coalition, and accompanying Sector Guides for Food & Beverage and Apparel will provide a clear path to business on steps toward identification of key impact and dependencies, and on measurement approaches to estimate their magnitude for their identified application. Ultimately, the Protocol seeks to help business to identify the risks that may constrain business development or provide business opportunities for innovation, new markets, and better financing.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Eco-efficiency of The Metal Sector: An Application of Output Distance Approach in the Indian Context

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Type of Presentation: Paper presentation

Biography: Mousami Prasad is a doctoral student in Shailesh J. Mehta School of Management, IIT Bombay. Her interests lie in investigating and assessing corporate behaviour towards natural environment both in areas of disclosure and performance (process related and product related) and energy management.

Abstract: Companies are one of the important stakeholders (others being consumers and government) whose behaviour impacts the environment. Firms' activities create environmental pressure in form of climate change (due to emission of CO₂, CH₄, N₂O, CO), acidification (NO_x, SO₂), smog formation (HC), dispersion of particles (TPM) and noise (sound waves). This increase in emissions impacts physical, biological, human and managed systems. Globally, 78% of the increase in green house gases from 1970-2010, is due to CO₂ emissions from fossil fuel combustion and industrial processes.

Quantifiable impact of firms' activities on the environment is measured through eco-efficiency, which has been widely recognized as a measure of Corporate Environmental Sustainability (CES). Eco-efficiency has been defined as delivery of competitively priced goods/services while reducing environmental impacts and resource intensity, in line with earth's estimated capacity. The analysis involves assessment, based on both economic as well as ecological variables. As the research on CES is still evolving, the studies on eco-efficiency in developing nations are severely limited.

The present study therefore assesses eco-efficiency in a context of an emerging nation like India, drawing insights from productive efficiency literature. Eco-efficiency in the present study is measured using an output distance function approach and the results have been compared to traditional efficiency scores (without considering ecological variables). Ecological variable has been measured using carbon dioxide emissions, which is an undesirable output of the production process. An IPCC (Intergovernmental Panel on Climate Change) reference approach has been used to calculate CO₂, resulting from energy consumption. Firms from the metal sector have been selected as a study sample as the sector is high in terms of energy consumption and makes a relevant contribution to the economy's output. The sector consumes 28% of total industrial energy consumption and contributes 20% to industrial value added. The average CO₂ coefficient of solid fuels used in metal industry is 2.32 (ton CO₂/ton solid fuel), liquid fuel is 3.06 (ton CO₂/ton liquid fuel) and gas is 0.0021 (ton CO₂/cubic metre of natural gas).

An examination of efficiency for a cross-section of 106 firms for year 2006-07 and year 2011-12 showed that the CO₂ emission has increased on an average from 1.36 million tons in FY2006-07 to 2.05 million tons in FY2011-12. Further eco-efficiency stood at 47%, lower than economic efficiency at 52% for the financial year of 2011-12. The low level of efficiency shows that there is potential to improve output, and the waste per firm may be reduced, as such policy support in form of fiscal instruments may be required to improve efficiency of the sector and encourage firms to adopt cleaner technology and fuel switch in favour of renewable sources of energy.

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Carbon Pricing and Carbon Emissions Trading in China: How Effective Can They Be in Environmental Protection?

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3rd Author: Xin Chen - Xian International Studies University

Type of Presentation: Paper presentation

Biography: Prof. Elias Grivoyannis is an associate professor at Yeshiva University and, among others, editor of "The New Chinese Economy: Dynamic Transitions into the Future." Prof. Xin Chen is an assistant professor at Xian International Studies University in China. Her current research and interest focus on environmental economics. She is the author of, among others, "Financial support for ecological compensation in Northwest Resource Exploration." Prof. Nuria Quella is term assistant professor at Barnard College of Columbia University.

Abstract: Environmental protection has become a priority in China. Until recently, the Chinese government was the ultimate environmental protection agency, and the environmental protection toolbox was composed of command-and-control instruments and subsidies to local or regional governments to police their application. Currently China is experimenting with market-based policy instruments, in particular with carbon pricing and carbon emissions trading.

The use of financial market incentives is perceived as an answer to the conventional economic growth: environmental protection trade-off. It remains to be seen: first, whether China's institutional configuration and the distribution of incentives among regional and municipal governments is in alignment with the application of country-wide carbon trading, and second, whether China's financial markets and institutions are mature enough to make carbon trading and other environmental finance products efficient mechanisms for environmental protection. Our paper, still at its initial stage, aims to shed light on these issues as well as include empirical research by applying accepted models of carbon pricing to Chinese data.

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Policy Formulation for Transforming the Economy at State Level in India

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Type of Presentation: Paper presentation

Biography: K.V. Raju is the former economic advisor to the Chief Minister of Karnataka. Currently, he is the principal scientist at ICRISAT Development Center, (International Crop Research Institute for the Semi-Arid Tropics) in Patancheru, Telangana, India.

Abstract: A good policy does not necessarily lead to good development, unless it is implemented in its intended spirits. It also demands professional capabilities at the implementation and monitoring levels. While the policy formulation happens both at national and State level, actual development, in most development sectors, happens at the State level, to be implemented by the State agencies.

The national level steps of converting Planning Commissions to Policy Commissions may become a trendsetter at State level to reengineer their State Level Planning Boards to Policy Boards. With the advent of stronger and more professional bodies emerging outside the government arena in recent decades, which also marshal up quick analysis and policy briefs at sectoral and macro level, the planning boards are losing their sheen. For the same reason, many states are hiring professional agencies at a huge cost to prepare sectoral analytical reports at and Vision Documents or transformation exercises.

This directs us to understand the process of policy formulation at the state level and its critical dimensions. To a large extent, this is also true at the national level. The discussion in this paper is focused on State level scenario.

At the outset, the seeds for a new set of policies and programs are generally sown long before the election and the voting date of any particular party. Each political party would like to profess and argue for a new system of governance and development that they perceive to bring in, were they voted to power. The political parties are used to make promises before the voting date. This interesting process can be explained through flow charts.

At the outset, a political party copies the broader framework of their (if it is a national party) national agenda. It ranges from wide-scale welfare measures for the public to taking the country forward both in terms of economic and social developments in tune with the national agenda. This is why the national party prepares the manifesto at the national level with a set of promises and in some cases, specific numbers. Similarly, the state level party lists out both the general welfare measures and substantial portion of the state level manifesto also focused on site-specific issues.

These schemes are generally focused on a specific target group. Hence, the political parties compete with each other in pronouncing the target group specific promises both in terms of likely coverage and the quantum of assistance. The promises generally cover all sections of people. On the path of converting these promises into targeted policies, a political party considers a few definite steps. The SWOT analysis of this process indicates both internal and external factors in influencing this process. On one hand, good policy-making, as well as its effective functional design and execution, needs a stable government for a fixed term. Otherwise, in spite of good policies and its yeoman intentions, its intentions may remain on the paper due to poor execution. It is here that many subsidies are introduced together with revised or new policies.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Farm Size Heterogeneity, Access to Groundwater Resources and Its Use: Implications for Sustainable Groundwater Governance in India

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Type of Presentation: Paper presentation

Biography: Prof. N Chandrasekhara Rao is currently professor and head of the Agricultural Economic Research Unit at the Institute of Economic Growth in New Delhi, India.

Abstract: Over 60 per cent of the net irrigated area in India is sourced by groundwater and India is becoming increasingly dependent on these groundwater sources for irrigation. However, not only is access to groundwater attached to land rights, it is also variable temporally and spatially. The majority of the farms in India are small and marginal in nature, implying that farmers have smaller areas from where they can access groundwater. This paper specifically addresses the question whether small farmers with relatively small areas from where they can access groundwater extract relatively large (or larger) amounts of groundwater compared to farmers with larger access areas. If so, what are its policy implications?

The paper uses primary data collected from 825 farmers including both groundwater users and non-users from the upper, middle, and lower reaches of the Godavari river basin in India. Sample households have been selected following a stratified sampling procedure. Detailed statistical analysis of the cropping pattern and agricultural water use of the farmers have been carried out according to the size of their land holding.

Results show that farm size is a significant determinant of groundwater irrigated cropping patterns and groundwater application rates in the study area. The upper reaches, followed by lower reaches are more abundant in groundwater than middle reaches, which is also reflected in the cropping patterns of the respective regions. Across all reaches, small and marginal farmers, when assured of groundwater irrigation, seem to have an obvious preference for the cultivation of more water consuming food crop cereals, even over the cultivation of any other high value crop.

Using a simple model, the study shows that the pumping rates and per acre use of water for raising crops are much higher among small and marginal farmers compared to those of large farmers raising the same crop. The value of output and use of water per acre per crop is somewhat inversely related and has implications for efficient allocation of groundwater resources. Moreover, given the high initial investments needed, they are less likely to invest in water saving irrigation technologies.

It further shows that in the Indian context, where the average farm size is very small, the capacity of small farmers to generate income is also small but their marginal utility of income is very high. This raises their stakes in the trade-offs in allocating crops. They tend to perceive groundwater as a common property resource and tend to pump faster or extract more water. In the absence of proper regulation for groundwater withdrawal, this has serious consequences for the withdrawal of groundwater at the aggregate level as they do not have many incentives to internalize the externalities that they impose on others. Given the depleting groundwater resources and declining incomes of small and marginal farmers, improving groundwater efficiency becomes a priority both from the farmers' as well as from the society's point of view. It is crucial in sustaining the overall agricultural growth in the country. This study helps in highlighting how farm size influences groundwater efficiency under different resource availability conditions.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Can REDD+ Social Safeguards Reach the 'Right' People? Lessons from Madagascar

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Type of Presentation: Speed talk

Biography: Alexandra Rasoamanana is a social science researcher with an academic background in agriculture, forestry and rural development. Her experiences so far have been focused on bringing a better understanding of the effect of restriction and compensation to communities depending on protected forests. During her interventions, she got the chance to work closely with different stakeholders in the Forest conservation field (CI-Madagascar, PGME-GIZ,...).

Abstract: There is an extensive debate about the potential impact of the climate mechanism REDD+ on the welfare of forest-dwelling people. To provide emission reductions, REDD+ must slow the rate of deforestation and forest degradation: such a change will tend to result in a local opportunity cost to farmers at the forest frontier.

To mitigate negative impacts of REDD+, social safeguard processes are being developed by the World Bank. Madagascar has a number of REDD+ pilot projects with World Bank support including the Corridor Ankeniheny-Zahamena (CAZ). Nearly two thousand households around the corridor have been identified as 'project affected persons' (PAPs) and given compensation. There has been controversy as to how such people are identified.

We carried out intensive field work in one administrative unit, mapping the location of each household and selecting a random sample stratified by location for detailed household interviews. We compared the characteristics of households identified as eligible for compensation with those not identified as eligible. We found that households with more socio-political power locally, those with greater food security, and those that are easily accessible were more likely to be identified as eligible for compensation while many people likely to be negatively impacted by the REDD+ project did not receive compensation.

Given the fact that only poor information is available on location and access of communities is challenging, information does not reach remote households. Because of the unwillingness of people dependant on shifting agriculture to reveal this due to government sanctions, it is unsurprising that the official process faced challenges. We suggest that in cases where the majority of households are likely to bear costs, and identification of affected households is challenging, the optimal, and principled, strategy is likely to be blanket compensation offered to all the households in affected communities. Although potentially costly, this avoids dead weight costs of ineffective safeguard assessments.

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The Urgency of Updating Our Climate Accounting

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Type of Presentation: Paper presentation

Biography: Stanley Rhodes is CEO of SCS Global Services. He holds a PhD in chemistry from Purdue. In 1984, he founded SCS, a leader in third-party environmental and sustainability certification and standards development. Engaged for decades in international life-cycle assessment (LCA) methods development, he is now working with leading IPCC scientists to identify important new upgrades to climate accounting metrics, integrating the most up-to-date climate science. He is a US LCA Expert in the ongoing ISO TC 207 talks.

Abstract: Often overlooked, yet vital to discussions about climate change, are the accounting metrics used to assess climate change impacts and mitigation options. These metrics, embedded in the WRI/WBCSD GHG Protocol and ISO 14060-series standards, lie at the heart of climate treaty negotiations, including the recent treaty negotiated in Paris, as well as government policies, carbon registries, and corporate goal-setting, and are the basis for evaluating how billions of dollars are invested. The degree to which these metrics accurately reflect the global climate system will largely determine whether the Earth crosses projected near-term, irreversible climate “tipping points”.

Unfortunately, existing climate metrics, based on the state-of-the-science around the time of first IPCC report (1990s), are now seriously out of date. Climate science has advanced considerably since then. As a result, for the past several years, efforts have been underway to update these crucial metrics. The updated metrics, presented in New Delhi at the recent ISO meetings by the US delegation, accomplish the goal of integrating this science, using a Radiative Force Management (RFM) approach. RFM is based on the IPCC AR 5 core analytic framework. This approach now makes it possible not only to address the Kyoto GHGs, but also to: 1) address short-lived climate pollutants like black carbon and tropospheric ozone; 2) include the effects of coolants (i.e., negative forcers) like sulfate aerosols; 3) correctly account for methane; and 4) evaluate mitigation options for unintended consequences across the life cycle.

The upshot is that the RFM approach clarifies which mitigation strategies offer the best, most cost-effective opportunities to address climate change in the near-term and the long-term given finite investment dollars. Technically, RFM will support projects that maintain and even reduce global radiative forcing in the next critical 30 years to avoid the +2°C threshold. The market value of RFM projects would be set based on the scale of mitigation — i.e., the amount of direct reduction of the radiative forcing of the specific climate forcer plus its total avoided GHG emissions.

The audience for this presentation will learn about the assumptions upon which current climate accounting metrics are based, find out what updated climate science teaches us and how the metrics much change, and learn why the RFM framework is an important game-changer for how we tackle the climate crisis moving forward.

Transforming the Economy Sustaining Food, Water, Energy and Justice

The National Ecosystem Services Classification System as a Tool for Explaining Non-Market Connections Between Environments and Human Welfare

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Type of Presentation: Paper presentation

Biography: The Group consists of consultants and co-authors associated with the production of a recent US EPA report outlining a tool that may assist in moving cost-benefit analyses toward a more sustainably oriented inclusion of (unpriced) ecosystem services. All authors have PhDs in or closely related to environmental economics, with varying years of experience, averaging more than 8 years across the members of the group.

Abstract: In the search to improve tools that explain the value of healthy ecosystems to policymakers who may be narrowly focused on dollar values, the National Ecosystem Services Classification System (NESCS, EPA, 2015) offers the ability to link specific environments to the flows of (non-marketed, un-priced) ecosystem services from those environments that nonetheless affect human welfare, often in substantial ways.

Compared to ad-hoc approaches and ecosystem services classification systems rooted in the four groups of the Millennium Ecosystem Assessment (2005), NESCS offers dramatic improvement in the ability to identify flows of value, and to track marginal changes in flows of value, from ecosystems to particular classes of human uses and users. This capacity makes the NESCS appealing to economists and to national accountants, who have heretofore sometimes served as gatekeepers focused primarily on monetized benefits.

The capacity of the NESCS to serve as a modular component between land-use categorization and industrial classification was designed to assist US EPA in early stages of cost-benefit analysis work. Because the tool was designed with care and respect for the principles of classification and the needs of policymakers, developers eventually realized that the tool may be useful more widely, including for any level of government, for agencies or departments, or for "green accounting" that nations or the UN may conduct when accounting systems are fully developed. The NESCS tool may even appeal to NGOs and large firms interested in using the same standardized vocabulary and classification structures that appeal to governments, should such standardization emerge. The President's Council on Environmental Quality has charged US departments and agencies with developing plans to incorporate ecosystem services into decision making, so CEQ may seek some form of standardization.

If NESCS can serve as a hub for standardizing operational vocabulary within the ecosystem services perspective that is gaining appeal and user-ship across governmental and academic work, then building a library of case study and application results, with entries catalogued using NESCS's unique hierarchical coding system, would expand the range of what people consider to be services from nature when making policy, and may reduce the cost of estimating the economic value that classes of human users implicitly attach to certain environments.

Much of NESCS's flexibility stems from its "four-group structure," which is intended to categorize any flow of final ecosystem services by environment, ecological end product, (human) use, and (human) users. NESCS is intended to exhaustively and mutually exclusively categorize flows of final ecosystem services with minimal "double counting" of services, to be fairly easy and practical to use, to help in the selection of appropriate metrics, and may serve as an appropriate standard for use as a classification tool.

Interest in the new tool within the US EPA, in other US agencies and departments, at the experimental research arm within the UN's Statistics Division (working to build an international environmental accounting structure), and within the business accounting and other academic communities speaks to the flexibility of the tool as a potential resource.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Cooperative Agreements Between Farmers and Water Suppliers Addressing Diffuse Agricultural pollution: Bonn, Germany

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Type of Presentation: Paper presentation

Biography: Carmen Richerzhagen and Waltina Scheumann are senior researchers of the Department of Environmental Policy and Natural Resource Management at the German Development Institute (DIE).

Abstract: During the last decades, agricultural production has been increased and intensified to meet the growing food needs of the global population. This has been made possible through the use of nutrients (nitrogen, phosphorous), pesticides and the intensification of production systems by means of irrigation. The use of farm inputs has not always been efficient: pollutants are transported into surface and groundwater impairing water quality and aquatic life of the recipient water bodies (eutrophication). Although agriculture is not the only polluting source regarding nitrogen and phosphorus loads, its contribution is significant in restricting other uses, which rely on the good quality of water such as domestic water supply.

In order to avoid health hazards deriving from the poor quality of drinking water and to comply with national drinking water standards, advanced treatment technology (end of pipe) can be introduced but its investment and operation costs may be prohibitive and not effective. The application of economic instruments (pollution taxes, payment for ecosystem services, water quality trading schemes); environmental regulations which make farmers liable for water pollution; and information and other persuasive approaches may not be appropriate and their effects not straightforward due to institutional constraints (enforcement, monitoring) among other reasons. Therefore, especially in Germany, voluntary cooperative agreements concluded between farmers and water utilities have been developed as an outstanding, promising approach with the potential to successfully address water pollution from agriculture.

Based on a qualitative study this paper analyses the characteristics of such cooperative agreements and their advantages vis-à-vis other approaches. We identify the incentives for the relevant actors, the farmers and the water supply utilities, to engage in cooperative agreements and the conditions under which such agreements emerge. The cooperative agreement concluded between the water utility (i.e. the Wahnachtalsperrenverband (WTB)) and the farmers in the watershed in the Rhine-Sieg district in Germany aiming at reducing agricultural non-point source pollution will serve as a case study. The Wahnbach reservoir is the source of drinking water for the city of Bonn and large areas of the Rhine-Sieg district.

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Biodiversity, Ecosystem Services and Social-environmental Conflict in Colombia

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Type of Presentation: Paper presentation

Biography: Alexander Rincón-Ruiz is an economist, Master in Agricultural Economics and has a PhD in environmental sciences. He has worked as a technical secretary of the environmental satellite account in Colombia's National Administrative Department of Statistics (DANE), technical coordinator for the Latin American and Caribbean Initiative for Sustainable Development (ILAC – Colombia), and as a researcher for Colombia for the Millennium Ecosystem Assessment (MEA). Since 2012 he is coordinator of the research line in “Integral valuation of the biodiversity and the ecosystem services” at the Humboldt Institute in Colombia.

Abstract: The context that exists in Colombia is a particular one: It consists of a complex, heterogeneous, dynamic and conflict-stricken reality that could yet become very similar to those of other developing countries. During the last decade, there has been a considerable increase in demonstrations and socio-environmental conflicts that depend on the local context and in most cases this is reflected in decisions made on the use of territory.

The present study aims to show how policies that focus on solutions generated at a national level are of little use, whereas collective territorial building from the local level can be a better way of generating processes that are socially and environmentally sustainable over the long term, in addition to resilient territories. In this way, we show how decision making in this context must come from more than a political decision based largely on technical information.

Purely technical solutions can be exclusive and inappropriate for many cases in the developing world. For this reason, scenario analysis is proposed as one of the best ways of integrating values and positions in order to achieve a fairer building of territories; such scenarios have both participatory and technical components. In a world where socio-environmental conflict is increasing and the evidence for differences in values regarding the territory are becoming clearer and clearer, it is necessary to make decisions with more participatory tools that involve negotiation, albeit with the aid of technical support. In this order of ideas, concepts such as integrated valuation of biodiversity and ecosystem services developed by Rincon et al. 2014, can be considered as a tool of inclusion and evidence of multiple values to a collective construction of the territory.

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Ecosystem Services in the City - Protecting Human Health and Increasing Quality of Life

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Type of Presentation: Paper presentation

Biography: The author team at UFZ, Department of Economics, is coordinating the project "Natural Capital Germany - TEEB DE", the German follow up study of the international TEEB initiative on The Economics of Ecosystems and Biodiversity.

Abstract: Human well-being depends upon healthy ecosystems. They provide us with oxygen to breathe, clean water, food, natural medicinal substances, and raw materials for industrial goods; their many services include storing greenhouse gases and providing inspiration for technical solutions. They also provide a range of cultural services, which considerably enhance our quality of life. However, loss of biodiversity along with the depletion of natural resources and the resulting degradation of ecosystems are becoming ever more apparent. When ecosystem services and the benefits they provide are lost, it is difficult and often highly costly to society to offset this loss. Yet as numerous examples from around the world have shown, it is worthwhile, not least economically, to protect nature and ensure the sustainable use of biological diversity.

Compelling evidence for this has emerged from the international TEEB initiative on The Economics of Ecosystems and Biodiversity (2007 – 2010). "Natural Capital Germany – TEEB DE" is the German follow-up project and national implementation of TEEB and focuses on nature's services in Germany. The main task is to produce four topic-based reports presenting the economic case for nature conservation, as a complement to ethical and ecological arguments. After previously launched reports on "Natural capital and climate policies" and "Ecosystem services in rural areas", this contribution will provide key results for the third of these reports that focuses on ecosystem services in cities. Next to presenting ecological and economic findings on ecosystem services in German cities, this report especially emphasizes socially held values of nature, cultural ecosystem services and the relevance of urban nature for human health.

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Exploring The Gaps in the Gig Economy Using A Web-based Survey

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Type of Presentation: Paper presentation

Biography: We work in the Community Development and Consumer and Community Development Research units at the Federal Reserve Bank. Our focus is on the changing community ecosystems and sustainable economic development issues facing low-to-moderate income households, families, and communities.

Abstract: Given the ongoing changes to the alternative, informal and contingent work arrangements of many American workers (Schor, 2014; Friedman, 2014), the usual employment data sources such as the Current Population Survey (CPS-household survey, Census) and the Current Employment Survey (CES-establishment survey, BLS) are limited in measuring the new emergence of ‘gig’ and ‘supplemental’ work.

Employing a national internet panel of survey respondents aged 18 years and over (GfK-General Population Panel), we explore the drivers behind variation in work modes. These work modes cover: (1) full-time (with and without variable hours), (2) part-time (with and without variable hours), and (3) occasional work activity. Categories 1-3 occur while working (a) for someone else (employer-type work) or (b) for oneself (self-employed/small business/consultant and contractor/sole proprietor/partnership).

Some occasional work activity occurs online, other informal work occurs in mobile platforms (eg., food trucks, carts and kiosks). We measure selling goods (used and new) as well as services, (i.e., walking the dog, babysitting, personal errands and house cleaning, etc.) which can take place online and/or at specific locales (established flea markets, clienteles’ homes, etc.).

Our initial analysis of the ‘and’ component of the formal/informal workspace includes analyzing: (a) How big (volume-number of piece-meal jobs/work arrangements) and how common (frequent) are occasional or ‘gig’ work for typical Americans? (b) What are the demographics of those most involved in alternative work arrangements? (c) What are the connections between the ‘spatial’ and ‘digital’ occasional work arrangements? (d) What are the perceptions of those engaged in alternative work arrangements to their specific and particular activities? (e) Are the ‘survival – push factors’ versus the ‘preference – pull factors’ for contingent and ‘gig’ work driven by income, education, and other socio-demographic characteristics or mainly by region? The data are preliminary and provide both a weighted and unweighted snap-shot of 2,000 survey respondents.

Keywords: Web-based surveys, internet panel recruitment, low-income oversample, informal work, self-employment, 1099 economy and gig economy

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GPI In the Woods: How Can Vermont's Genuine Progress Indicator Reflect A More Accurate Value of Forests?

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Type of Presentation: Paper presentation

Biography: Eduardo is a doctoral candidate at the University of Vermont, and a graduate student fellow at the Gund Institute for Ecological Economics. His dissertation research focuses on ecosystem services trade-offs that result from alternative forest management strategies, and on improving the forest component of the Genuine Progress Indicator.

Abstract: A growing number of states throughout the U.S. are beginning to adopt the Genuine Progress Indicator (GPI) as a measurement of progress. This is a significant shift from decades of relying on Gross State Product (GSP), purely a measure of total economic production, to guide state policy. As GPI gains widespread use, ensuring the robustness of the economic, societal and environmental sub-indicators included in its accounting framework is critical for its reputation as a respected policy tool.

In Vermont, the forest component of GPI in its current form is a particularly coarse sub-indicator, as it considers every acre of forested land to be equally valuable. An acre of forested land in Vermont is assigned a value of \$318.50 for the services it provides, independent of differences in forest type, age or location.

Here we refine the calculation of the Vermont GPI forest sub-indicator by incorporating differences in forest characteristics throughout the state. We use a novel approach that incorporates maps of tree species basal area in order to quantify forest change in the Northern Forest over time. This methodology allows us to not only distinguish between forest types, but also to calculate carbon storage with much higher accuracy, resulting in a far more nuanced and robust estimate of the total ecosystem services provided by forests. Furthermore, recent developments in land cover products and spatially explicit modeling tools should allow for these calculations to be updated on an annual basis, and to be replicated in other U.S. states.

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Exploring Approaches To Assessing Natural Capital's Role in Environmental Decision Making: Insights from Stakeholder Engaged Case Studies in New England

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Type of Presentation: Paper presentation

Biography: Dr. Shannon Rogers is an assistant professor of environmental science & policy and ecological economist at Plymouth State University Her undergraduate degree is from Dartmouth College, she has graduate degrees from the University of NH, and post-doctoral experience with the U.S. Army Corps of Engineers. Chelsea Berg and Jonathan Loos were members of Rogers' research group at Plymouth and have successfully moved onto jobs at US EPA and American Rivers, respectively.

Abstract: Interest in ecosystem service and natural capital evaluation/valuation has exploded in recent years. There are numerous tools, models and methods available to researchers, but relatively few completed case studies that compare different approaches and methods, especially when it comes to stakeholder engagement and decision making.

We will present three completed case studies from New England that have all engaged various stakeholders (experts, resource managers, citizens) in different ways (survey input, workshop and focus group participation), utilized various tools (InVEST, multi criteria decision analysis (MCDA), value integration surveys, advanced ecological models, etc.) to understand, prioritize, and value the ecosystem services of nutrient removal, flood mitigation, and the actions of trail and milfoil management that facilitate many cultural ecosystem services in a lake watershed.

Beginning in a coastal watershed, we utilized tools from the Natural Capital Project and developed a stakeholder questionnaire process to drive alternative futures and quantify the benefits of increasing conservation land to support an impaired Estuary (Great Bay). In an inland watershed (the Upper Valley portion of the CT River Watershed in NH & VT) we utilized MCDA as a framework for engaging with local decision makers around flood adaptation alternatives. Finally, in the Squam Lakes Watershed, we utilized value integration surveys to help a membership organization prioritize their limited resources used to enhance cultural ecosystem services from recreation to aesthetics. Lessons learned throughout the process, such as the various time requirements of these tools and the challenges and benefits of collaborating with stakeholders, will be shared.

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Promoting A New Economics

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2nd Author: Timothy Foxon - University of Sussex

Type of Presentation: Roundtable

Biography: Inge Roepke is professor of ecological economics and Tim Foxon is professor of sustainability transitions.

Abstract: Whilst ecological economics has established itself as a coherent but pluralist approach, based on seeing the economy as a subsystem of the biosphere and recognizing agents as social beings, more work is needed to make a connection to other heterodox economics approaches which emphasize other challenges to mainstream economic thinking. As Edward Fullbrook, editor of *Real-World Economics Review*, has argued, there are many different ways to take issue with mainstream economics – or Old Paradigm Economics as he calls it – and economists have tended to create different “schools” defined on the basis of their particular difference with the orthodoxy. As long as each of the heterodoxies goes its own way instead of coming together to offer a new paradigm, there is no possibility of displacing the old paradigm, Fullbrook argues. He has compiled a number of substantive and methodological points that are shared across the spectrum of heterodox economics and contradict Old Paradigm Economics.

The purpose of this session is to discuss the basis for a New Paradigm Economics, based on Fullbrook’s points as well as other formulations of core ideas in a new economics, by asking:

- Is it possible to formulate core ideas in a coherent new economics?
- What should be included?
- How can a new economics be promoted?

The idea of combining ecological economics with other heterodox perspectives is not new (Jacobs 1996), but needs elaboration. Since the economic crisis has highlighted the failings of mainstream economic thinking, there is now a window of opportunity for combining various heterodox approaches to address the challenges and form the basis for a new economics (Foxon 2013). Mirowski (2009) has described how The Mont Pelerin Society was instrumental in developing the strength of the neoliberal paradigm. Maybe this story can inspire discussion on how to develop and promote an alternative.

The session will be organised as a discussion session, based on short contributions from invited scholars within and outside the ecological economics community, to explore the possibilities for either a common article or a special section on the topic based on short opinion pieces.

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Transforming the Economy Sustaining Food, Water, Energy and Justice

Social Justice In Carbon Market Design: Icing on the Cake or Condition Sine Qua Non? Theoretical Insights and Experiences in the EU, the United States, and Japan

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Type of Presentation: Paper presentation

Biography: Sven Rudolph is associate professor for contemporary economics at Kyoto University in Japan; Achim Lerch is professor at the Hessian University of Cooperative Education in Germany. Both authors hold a doctoral degree in economics from Kassel University, Germany. Their joint research has focused on sustainable carbon markets, international linking, and social justice issues. Together they have successfully engaged in government funded research projects and have published several peer-reviewed research articles on the respective topics.

Abstract: Besides effectiveness and efficiency, social justice plays a key role in sustainable climate policy. Social justice was a founding principle of sustainable development, recent empirical research has proven the appreciation people in different countries show for an equitable approach to climate policy, and continuous energy transformation debates have raised questions on a fair burden sharing in view of increasing energy and compliance costs. However, research so far has not adequately grasped the social justice dimension of economic climate policy instruments.

Still not the dominating force, economic instruments such as cap-and-trade will have to play an increasingly important role in any future climate regime. Despite of many problems in reality, carbon markets are capable of limiting overall emissions and achieving emissions reductions at comparatively low cost: they allow for linkages of domestic programs as a possible supplement to global climate regimes, and they have already been spreading globally on all government levels. However, major design differences exist and in view of many flaws of existing programs the question remains: Can carbon markets be designed in such a way that, in addition to environmental and economic requirements, they fulfill ambitious social justice criteria?

In our paper we answer this question by exploring into normative concepts of modern climate justice theory (intra- and inter-generational justice; national and international justice; procedural and result-based justice; justice in transfer and acquisition, justice within allocation, and redistributive justice; “why equality” and “equality of what” etc.), while also reviewing the respective positive literature. We then derive social justice criteria for carbon market design and evaluation. Using these criteria as a reference, we finally analyze current carbon markets in Europe, the United States, and Japan and evaluate their designs as well as their distributional effects.

We mainly argue that social justice is a key issue for sustainable and politically feasible market-based climate policy. In order to facilitate the compliance of carbon markets with social justice criteria, we newly provide a theoretically founded framework for designing socially just carbon markets and for evaluating existing programs on social justice grounds. We show that, while carbon markets in the EU, the United States, and Japan differ greatly in dealing with social justice issues, all programs can be significantly improved and that linking increases not only the efficiency, but also the fairness of international climate policy. Our solid framework can hence be immediately used in carbon market design (reforms) in the respective regions and beyond.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Environmental Federalism Featuring Local and Regional Carbon Markets: Insights from Theory and the Cases of Tokyo, California, and the U.S. Northeast

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Type of Presentation: Paper presentation

Biography: Sven Rudolph is associate professor for contemporary economics at Kyoto University in Japan; Toru Morotomi is professor for environmental economics at Kyoto University. Both authors hold a doctoral degree / PhD in economics, have (co) authored several books and a variety of research articles on climate and energy policy, and have been actively involved in carbon market design in Japan and Germany. Their joint research has focused on carbon pricing and environmental federalism.

Abstract: Despite of recent hopes for a new global climate regime after COP 21, there is certainly a need for bottom-up supplements such as regional or even local mitigation action. The same is true for ambitious carbon pricing schemes in major emitting countries such as Japan and the United States but also in other industrialized states such as Canada and Australia or in developing countries such as China and India, where so far national schemes have been politically deadlocked.

Carbon markets, despite some political failures on the national level in countries such as the United States or Australia and some design flaws in the EU scheme, have been spreading globally since the early 2000s, even reaching the regional and local level e.g. in the United States, China, and Japan. Carbon markets, if well designed, can still be considered a promising tool for limiting absolute carbon emissions at comparatively low costs, and in addition they allow for linking domestic schemes, as has been recently shown by the California-Québec linkage.

The environmental federalism debate focuses on the question whether and, if so, how government functions should be allocated across different government levels such as, national, regional, or local. While early contributions called for competition between local governments, later arguments warned of a “race to the bottom”. More recent papers, however, emphasize the positive aspects of environmental federalism again.

Against this theoretical and policy practice background, we ask: Do regional or local carbon markets represent a valuable supplement to global and national level market-based climate policy? We discuss this question by, first, reviewing the literature on environmental federalism. Second, we evaluate the economic and environmental performance of local carbon markets in Tokyo, California, and the U.S. Northeast, and test the hypotheses of environmental federalism on empirical grounds.

As a result, we provide an overview of major arguments in the modern environmental federalism debate and of respective empirical evidence on the performance and usefulness of regional and local carbon markets. We also offer a description and analysis of sub-national carbon markets in major emitting countries, where federal level carbon pricing has failed. We thus add new insights to the theoretical discussion on environmental federalism and provide policy lessons for the implementation of effective and efficient sub-national climate policy instruments.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Interdisciplinary Tools in Sustainability Education: Focus on Ecological Economics Modeling and Information Systems

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Type of Presentation: Paper presentation

Biography: Paul Safonov is co-founder and past president of the Russian Society of Ecological Economics and the (co) organizer of its biennial meetings since 1993. He has been professor in business school at St. Cloud State University, Minnesota since 2002. He has researched on computer modeling in ecological-economic systems at the Russian Academy of Sciences (Moscow). He has also been at the University of Versailles, the Free University of Brussels, the University of Campinas, the ZEW in Mannheim, holding guest presentations in over 40 universities worldwide. He has (co) authored over 100 publications, including "Modelling in Ecological Economics" (2004) with Edward Elgar.

Abstract: Gaining understanding of sustainability through the use of various information systems, including GIS and computer simulation systems is a main focus of this paper.

A literature survey about the experience of how these tools help in teaching the concepts of sustainable development is supported by the author's own educational findings through offering a series of post-graduate, graduate and undergraduate courses in ecological-economic modeling, decision support systems, information systems for sustainability and environmental engineering at universities in the United States, France, and Brazil.

Interdisciplinary skills that are mastered while using these tools require knowledge in business, economics, political and natural sciences, environmental studies, geography, mathematics and computer science, in different extent of depth.

The students noticeably improve their vision of the world as a holistic system by "playing the simulation game" of the interrelationships in multifaceted interface of human and nature. Models and information systems used in these educational examples embrace various aspects of energy, transportation, air and water pollution, population growth, bio-systems, spatial analysis, environmental accounting and people's participation.

To help create awareness of socio-ecological-economic problems and to help foster an understanding of ethical and cultural dimensions of sustainability, students were asked to work on group projects. Examples of topics they chose, to name a few, included: Spatial Distribution of Pollutants in Waterways, Great Pacific Garbage Patch, Oil Spills, Alternative Energy and Energy Conservation, Green Computing, E-Waste Management and Carbon Footprint of Media Distribution. An important aspect to mention is also that students from different international backgrounds brought an extra value into their project presentations and discussions by cross-educating peers on diversity of visions from different parts and cultures of the world.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Transforming the Indigenous Economy: Opportunities for Ecosystems-based Enterprises for Indigenous People in Northern Australia

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3rd Author: Robert Costanza - Australian National University

Type of Presentation: Paper presentation

Biography: Kamaljit Sangha is an ecological economist, mainly interested to link ecosystem services to the well-being of Indigenous communities in Australia. Her expertise lies in the field of plant ecology, including valuing ES, natural resource management, integrating indigenous perspectives of natural resource management with the scientific perspectives and applying capability approach to understand the role of ecosystems in human well-being.

Abstract: We provide an economic perspective of the role of Indigenous communities in managing the natural resources i.e. their duty of care for country, their use and value of these resources and related capabilities. This study addresses the main ecological, economic and social issues and the related challenges that currently exist in the northern Australian savannas.

We propose an ecosystem services (ES) framework based upon people's connections with their country, while applying Sen's capability approach. Currently, the role of many intangible ES from savannas and their importance, especially in indigenous well-being, is greatly underestimated and misunderstood e.g. in the recent Australian Government initiatives on Northern Development. This study suggests new perspectives for Northern Development based on Sen's capability approach and ES framework, to target ES-based enterprises.

It suggests opportunities for payments for ES (PES) that will enhance livelihoods of rural indigenous communities while providing them with culturally appropriate employment. This paper critically analyses the current Government-funded environmental programs that mostly relate to management of ecosystems, in comparison to the PES programs. Overall, it provides a holistic vision on the future of savanna economies targeting Indigenous people's well-being, their role in land and fire management, their capabilities, while suggesting the importance of PES programs in the region for developing long-term sustainable economies that provide culturally appropriate benefits for the Indigenous, locals as well as the wider Australian public.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Cost Effectiveness Analysis of Some Ecological Practices for Soil and Water Conservation on the Cantareira Water Supply System, São Paulo, Brazil

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Type of Presentation: Paper presentation

Biography: The first author has a PhD in economic development and environment by the State University of Campinas, São Paulo, Brazil. The past 5 years, his work has focused on applying ecological economics methodologies, trying to understand and plan more cost effectiveness strategies for water and soil conservation in the Cantareira Water Supply System, the most important human water supply system in Brazil.

Abstract: The Cantareira Water Supply System is one of the most important water supply systems for human consumption in the world. This system is currently passing through the biggest crisis of water supply capacity in its history. Experts are pointing out the largest dry season in decades as the main reason for this situation. In a context of climate change, as the international society has been indicating, the possibility of this critical situation still remaining for a long time and happening again in the near future is strong.

In this situation, environmental conservation programs directed to conserve ecosystem services related to the regulation and provision of water resources become a priority for this region. This research has the objective to identify the scenario in which practices involving the conservation of these ecosystem services into the Cantareira water supply system are more cost-effective. In this case, conservation practices are able to ensure water provision at the lowest cost possible.

To achieve this goal, the investigation uses one of the main hypotheses of ecological economics, which considers that the conservation of ecosystem services can be achieved by conserving ecological structures that support natural ecosystems and the agro-ecosystems managed by humans. The investigation proceeds with an analysis of the environmental impacts of current land occupation in the Cantareira region and proposing conservation practices that enhance the ecological resilience of watersheds that make up this System and at the same time are in line with the socio-economic reality of the region.

The analysis of the private cost for environmental conservation in the region and the results obtained from some ecological indicators analyzed by this investigation showed that the more cost-effective scenario can be achieved by improving the ground cover in areas currently occupied with pastures. Livestock grazing occupies 40% of all land in the region. Thus the ecological effects expected from economic incentives directed to improve pastures have the potential to reduce 30% of the sediments that are annually deposited in rivers, streams, springs and reservoirs that sustain the Cantareira System and to contribute to water provision security in this region.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Income and Environmental Performance across Indian States and Union Territories: A Regression Analysis

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Type of Presentation: Paper presentation

Biography: Dr. Rakesh Saxena is a professor in economics area at the Institute of Rural Management, Anand (Gujarat) in India. He is engaged in teaching, training and his research relates to economic, social and environmental development.

Abstract: India is a lower middle-income country with low environmental performance. There is, however, a large divergence in income and environmental performance across its 36 States and Union Territories (UTs). This study explores a statistical relationship between income and environmental performance using cross section data across these States and UTs during 2011-2013. The per capita Net State Domestic Product at constant prices has been used to represent income while the recently initiated Environmental Performance Index by the Planning Commission of India (PC-EPI) has been used to represent environmental performance. The PC-EPI is based on (1) air quality, (2) water quality, (3) forests, (4) waste management and (5) climate change. Two associated dimensions, namely inequity, as measured by the Gini coefficient, and the poverty ratio measured by the percentage of people living below poverty line, have also been analysed with respect to change in income.

The third degree polynomial equation is found to be the best fitting equation to indicate the relationship between income and environmental performance. With a wave-like shape, the environmental performance shows three phases with respect to ascending per capita incomes across different States and UTs. Close to 60 percent of the States and UTs located at the lower end of per capita incomes show improvement in environmental performance with a rise in per capita income from one State/ UT to another. Next, 34 per cent of the States and UTs located in the middle with respect to per capita incomes show lower environmental performance for higher per capita incomes. The remaining six per cent of States and UTs with the highest levels of per capita incomes again indicate higher environmental performance for higher per capita incomes. The performance of the individual sub-indicators of EPI with respect to income is best represented by log-quadratic and transcendental equations showing inverted U-shaped curves. For any given State or UT, the highest performance is shown by the air quality followed by water quality, waste management, forests and climate change in descending order. The Gini coefficient and the poverty ratio show an inverse relationship with income through the best fitting log-linear and log-quadratic equations, respectively.

The paper shows that there is still a good scope for improving both income and environmental performance, as well as reducing inequity and poverty (promoting inclusive growth) in India with a selective approach.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Comparing Individual and Group Based Valuation Methods in a Developing Country Context

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Type of Presentation: Paper presentation

Biography: Marije Schaafsma is an economist interested in decisions concerning ecosystem management and human development. She specialises in the application of economic methods to inform such decisions and trade-offs. Her research focuses on the comparison of different valuation methods and the use of ecosystem service values in trade-offs between forest conservation and agricultural development. Marije's experience includes ecosystem services assessments and different methodologies for monetary valuation of ecosystem services.

Abstract: This paper presents the results of a comparison between two valuation methods, choice experiments (CEs) and multi-criteria analysis (MCA), conducted in two different settings: individual interviews and group sessions. It examines their respective contributions to understanding public preferences for ecosystem services, using a case study on sustainable agricultural projects with largely private benefits among small-scale farmers in Malawi.

The use of environmental economics methods to measure individual well-being derived from ecosystem services to inform decision making, where all features of an environmental good and money are assumed to be commensurable, has been heavily debated. Some ecological economists argue that alternative methods, such as deliberative-analytical monetary or non-monetary valuation methods, are equally relevant or more suitable, because inter alia they can accommodate non-compensatory decisions and shared, rather than only individual, values. However, the use of non-market and non-monetary valuation methods is still relatively novel in the field of ecosystem services assessment, especially in developing countries. Therefore, this paper argues that there is a strong need for tests of the methodological reliability and validity of all valuation methods to better understand which valuation methods are suitable in which context, for which purpose, and for which goods and services.

In a case study in Malawi, where food insecurity and ecosystem degradation are immediate challenges to sustainable livelihoods, farmers in four villages responded to a series of questions about different cropping techniques and tree planting options to improve soil fertility and climate change resilience. A combination of financial and non-financial incentives was proposed to increase adoption and success rates and cover upfront investment costs. The options had no immediate spill-overs to neighbouring farms.

Results suggest that the two methods lead to different rankings of alternatives in the group exercises and minor differences in the individual exercises (using simple additive rules in the MCA). Groups preferred a cash crop in the CE, but a food crop with more credit in the MCA. Although post-exercise evaluations suggest that respondents find CEs easier, the MCA provides broader insight into the well-being aspects that farmers anticipated upon adoption of the proposed options. Respondents selected not only basic needs and income as important evaluation criteria, but also criteria related to social capital, non-material well-being, and resilience.

Group rankings differ from individual rankings in both methods, with changes in choices, evaluation criteria and scores. The group discussions provided more opportunities for sharing knowledge, perceptions and learning. Respondents reported to better understand the valuation scenarios and MCA criteria, and gave significantly more consideration to the choice attributes time delay, leading to changes in MCA rankings and 30% of individual choices. At the same time, group pressure seemed to affect those respondents already struggling with the scoring exercise, and participants that were perceived to be more articulate or experienced tended to dominate. Lack of trust among community members limited the perceived benefits of options that required cooperation to profit.

The incongruent results of the valuation methods and elicitation processes raise important validity questions for private and public good value assessments.

Transforming the Economy Sustaining Food, Water, Energy and Justice

The Land Footprint: How Can It Contribute to Sustainable Development?

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Type of Presentation: Paper presentation

Biography: Liesbeth de Schutter (MSc in zootechnology and in business economics) works as research associate at WU Vienna and is enrolled in the PhD program in economic and social sciences (“Transformative pathways towards a sustainable EU bio-economy”). Liesbeth has a long track record in food and agribusiness research at a business, sector and financial services level. Her research focus is on environmental issues related to the EU and global bio-economy, with a particular interest in sustainable resource use from a production and a consumption perspective.

Abstract: The Land Footprint is increasingly used in environmental studies to relate the consumption pattern of a country to its original land use in the countries of production. Both economic, physical and hybrid approaches all point in the same direction: affluent countries appropriate significant land areas in foreign countries and, most importantly, show that food and non-food consumption patterns require growing land areas in tropical countries with vulnerable ecosystems.

This also brings the issue of equitable land use on the table: how much land can we actually use in order not to impact food safety and development in other countries? This paper explores and assesses the Land Footprint as an environmental indicator in policy making, both in the ecological and the social field: what is feasible, what not and which actions are required to implement the Land Footprint for such purposes? The paper shows that the Land Footprint is an efficient monitoring tool supporting the transformation towards more sustainable pathways in a national and, hence, global bio-economy and land system.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Fossil Energy in Economic Growth: A Study of the Energy Direction of Technical Change, 1950-2012

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Type of Presentation: Paper presentation

Biography: Gregor Semieniuk is a research fellow at the Science Policy Research Unit at the University of Sussex, where he studies finance for renewable energy investment and the role of energy in economic growth. He holds a PhD in economics from the New School for Social Research.

Abstract: The imperative to mitigate climate change challenges national economies to grow in productivity while reducing fossil energy consumption. Yet no consensus has been reached in how far recent economic history proves these two goals to be compatible. This paper investigates the correlation between the rates of change in labor productivity and the fossil energy- labor ratio in order to determine the direction of technical change with regard to fossil energy.

A dataset of output, employment and energy use is constructed for the years 1950-2012, which incorporates more than 95% of gross world product and goes beyond existing studies in terms of time and geographical coverage. Visual analysis shows that national growth rates of labor productivity and fossil energy-labour ratio are positively correlated, with only three exceptions: the aftermath of the 1979 oil crisis, the transition of formerly socialist countries and the 1997 Asian crisis. Linear and local polynomial regressions reveal that in multi year cross-sections of the non-exceptional periods, the elasticity of the energy-labor ratio with respect to labor productivity is close to one. Hence, labor productivity growth has historically been achieved by almost proportionate increase in the energy use per unit of labor.

Additional analysis shows that countries that decrease the share of fossil energy in their energy mix tend to also have low labor productivity growth rates. Countries that increase the share in economic output contributed by industrial production tend to have fast labor productivity growth rates. The findings suggest that faster productivity growth has depended on energy becoming a more important factor in production, a version of the Kaldor-Verdoorn effect. As long as fossil energy constitutes the dominant energy source for industrial production, there is a trade-off between fast economic growth and a fast decarbonisation.

Transforming the Economy Sustaining Food, Water, Energy and Justice

The Gender Implications of Forest Degradation in the Poor Households

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Type of Presentation: Paper presentation

Biography: Dr. Alok Sen is professor in the Department of Economics of Assam University in Silchar, India. He is a life member of the ISEE. He has supervised five PhD works, and has published 25 nos. research papers and one book. In addition, he has participated and presented research papers at the biennial conference of International Society for Ecological Society (ISEE), 2014 at the University of Iceland, Iceland and at the 32nd conference of NABET, 2009, at State College P.A., Pennsylvania, United States.

Abstract: This present paper is a modest attempt to examine the ramification of forest degradation on the gender equity among the rural poor in India. This investigation has been made through a case study of a forest region named Tinsukia district of the northeastern region of India. The major objectives set in this paper are:

- To investigate the effects of environmental degradation on women's time allocation decisions.
- To examine the fortune of children: gender wise, due to change in the time required for environmental resource collection by the female members in a family.
- To examine the impact on time devoted by women for the family due to the male members getting engaged in various public employment generating schemes.
- To assess women's participation in environmental resource management activities in the society.

Hypotheses

To fulfill the above objectives the following null hypotheses have been tested:

1. There has been no significant change in total time required for environmental resource collection in the households during the period 2005-2010.
2. Resource availability in the forest does not affect time allocation decision of the households.
3. There is gender equity in the family in sharing the additional time required for resource collection.

Methodology

This study is based on 472 randomly collected samples, which make up 10% of the total population. The period of study extends from 2005 to 2010.

Due to non-availability of data on forest degradation in the study area we have taken change in distance covered and time spent to collect forest resources as proxies for forest degradation. To assess the impact of deforestation on women or gender equity we used the variables like burden of extra time for resource collection on women, ratio of drop out of girls from school and the inability of women to participate in environment self-management programmes. The basic econometric tools used are: paired Z-test for objective no.1 and hypotheses no.1, 3; Multiple Regression Analysis for objective no.2, 4 and hypothesis no.2; The Logit model was used for objective no.4.

The major findings of this study are that due to forest degradation, women's and girl children's time spent in fuel and fodder collection have significantly increased; women's time allocation for other necessary domestic activities including leisure time has been reduced and drop-out of girls from school has increased.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Coping with Climate change and Human Development: An Exploration on Bihar India

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Type of Presentation: Paper presentation

Biography: The author is a life member of the Indian Society for Ecological Economics (INSEE) and has participated at the earlier conference of ISEE held in Reykjavik at the University of ICELAND. He has completed his doctorate degree in environmental economics and worked on issues like climate change and fishing communities in India. Currently He is serving as assistant professor at Chandragupt Institute of management in Patna, India. His areas of research interest are climate change, vulnerabilities, adaptation livelihood, and urban and coastal ecosystems.

Abstract: In the case of a developing country like India, the two most important challenges are human development and climate change. Looking at the current progress India has made in technology, there is an urgent financial need that we must jointly address both the issues of climate change and development in a single forum. As mitigation and dealing with GHG emissions and energy uses, but the simultaneous adaptation of the environmental challenges are equally important, developing integrated policies at a micro level is very much necessary.

Keeping this in mind, this paper highlights the issues and challenges people are experiencing in Bihar, India. Bihar is the poorest and most underdeveloped state in India. However, it is also vulnerable to climate change and on the development front the indicators point towards the state. Agriculture and related activities support livelihoods for the majority of the population in Bihar, which is getting affected by climate change due to severe changes in rainfall patterns, temperatures and floods. There is rampant migration from rural to urban areas, which is further causing problems and posing challenges for sustainable urban management. Many of the health indicators are showing worried results, such as increasing diseases like malaria and dengue.

Therefore, a district-wise vulnerability index has been developed and analysed. Here, climate change indicators are divided into sensitivity, exposure and adaptive capacity as provided by IPCC and other literature. Adaptive capacity includes human development indicators in order to derive more combined results for vulnerability and to provide policy suggestions to the local government. This study is mainly based on secondary data analysis and it will be extended to primary analysis and vulnerability will be derived at a household level in the next phase.

Transforming the Economy Sustaining Food, Water, Energy and Justice

SWAMPED: Mapping and Measuring Food Access in Cleveland

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Type of Presentation: Paper presentation

Biography: Md Rumi Shammin, associate professor and chair of environmental studies at Oberlin College, has ongoing research on food access, food justice and triple-bottom-line analysis of urban agriculture in NE Ohio. This paper involves collaboration with Paul Boehnlein of Western Reserve Land Conservancy on designing a spatial analysis model to map food access in Cleveland. Data on food sources were compiled by Isabella McKnight (OC '15) and Mimi Stern (OC '16). Mimi also conducted GIS mapping and preliminary analysis.

Abstract: In order to design more just and sustainable urban food programs, it is important to study the landscape of food access to better understand how access to healthy food varies based on income and racial composition of neighborhoods. A new alternative to the food desert, the 'food swamp' represents proximity, affordability, and prevalence of unhealthy foods inundating more desirable food options.

Using spatial analysis, we compared the overabundance of undesirable food sources (fast food, liquor stores, drug stores, etc.) relative to the presence of desirable sources (supermarkets, grocery stores, etc.) within walking distance from each residential parcel in Cleveland. We identified neighborhoods that are in food swamps and categorized the severity of inundation of unhealthy sources. We found that racial minorities are over-represented in areas classified as extreme and high food swamps, while white populations are underrepresented.

We recommend that spatially informed policy efforts to improve access to healthy food in areas overburdened with undesirable food sources on a neighborhood scale are needed to reduce negative health impacts and food injustice in urban areas. Inclusion of such social goals of food justice and food access in policy endeavors for swamped neighborhoods have the potential to add value to urban agriculture and food justice initiatives and contribute towards justifying their overall economic viability.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Contested Value - Alternative Discourses of Payments for Ecosystem Services in Mexico

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Type of Presentation: Paper presentation

Biography: Dr. Shapiro-Garza is currently an assistant professor of the practice of environmental policy & management at the Nicholas School of the Environment at Duke University. She is a human geographer whose research concerns market-based environmental policies and programs in Latin America. She conducts multi-scale analyses of these systems in the context of: community level socioeconomic, institutional and ecological dynamics; political, policy and market drivers; environmental state and non-state governance.

Abstract: Payments for ecosystem services (PES) approaches have been widely employed in Mexico since the mid-1990s, primarily as a market-based mechanism for forest conservation, by both government entities and NGOs and at multiple scales. These initiatives were originally promoted under the guise of the neoclassical economic discourse of PES that conceptualizes ecosystems as factories whose various outputs can be quantified and their benefits assigned an economic value and converted to commodities.

More radical discourses of PES have since largely dominated, which, while incorporating the premise that ecosystem services hold value, claim that the right to decide the calculation and distribution of those values should lie not within the market, but with those who produce them. These alternative discourses reimagine payments as compensation for the sustainable stewardship and related labor of rural communities and as a means to counteract the systematic and structural inequities between rural and urban areas as well as the Global North and South.

This paper examines the production and influence of this alternative discourse and is based on participant observation in sites of contestation from 2005-2015 and interviews during the summer of 2015 with members of four of the civil society organizations in Mexico who have been among the primary drivers of its development and dissemination and who have operationalized it in the implementation of their own PES mechanisms. It analyzes: 1) the common conceptual threads in these discourses, but also the variances; 2) the ways in which the fundamental elements of each discourse influence the specific design and implementation of PES projects; and 3) how these grounded discourses have influenced the larger dialogue in Mexico on PES, including REDD++ strategies, and the pathways and mechanisms by which their promoters exert influence, from violent street protests to joining the ranks of the bureaucrats implementing these programs.

Transforming the Economy Sustaining Food, Water, Energy and Justice

The Multidimensional Assessment of Sustainability: Harmony versus the Turning Point

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Type of Presentation: Paper presentation

Biography: Dr. Stanislav Shmelev is an ecological economist specializing in ecological-economic modelling, multidimensional assessment of progress, sustainable urban development, ecosystems in biodiversity and environmental policy. He is an author of "Ecological Economics: Sustainability Analysis" (Springer, 2012), co-editor and co-author "Sustainability Analysis: an Interdisciplinary Approach" (Palgrave, 2012), editor and co-author of "Green Economy Reader: Lectures in Ecological Economics and Sustainability" (Springer, 2016). Dr. Shmelev has been a senior researcher at Oxford University and a visiting professor at the Universities of Geneva, Paris, Versailles etc.

Abstract: Multidimensional assessment of sustainability is a way to reconcile the need for the simultaneous consideration of various indicators of progress beyond GDP growth with a policy-focused visualization of multi-dimensional trends in clear and transparent manner. The various composite measures used for sustainability assessment often hide the trade-offs between economic, social and environmental dimensions of sustainability.

This chapter discusses indicators used for sustainability analysis at the macro scale and offers a multi-criteria sustainability assessment framework. It discusses results that were obtained in sustainability assessments for the United States, Brazil, China, France, Germany, Britain and Russia. The Multicriteria Decision Aid tool, Aggregated Preference Index System (APIS) is used for the assessment with the following three headline indicators: GDP per capita; CO2 emissions and Life Expectancy at birth. The indicators represent economic, environmental and social dimensions respectively. The multidimensional assessment is designed with two different policy priorities: priority of economic over environmental and social dimension versus priority of environmental and social dimensions over economic. Results help to identify countries where economic development has happened at the expense of the environmental and social dimensions and lead to policy conclusions.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Multidimensional Sustainability Benchmarking for Megacities

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Biography: Dr. Stanislav Shmelev is an ecological economist specializing in ecological-economic modelling, multidimensional assessment of progress, sustainable urban development, ecosystems in biodiversity and environmental policy. He is an author of "Ecological Economics: Sustainability Analysis" (Springer, 2012), co-editor and co-author "Sustainability Analysis: an Interdisciplinary Approach" (Palgrave, 2012), editor and co-author of "Green Economy Reader: Lectures in Ecological Economics and Sustainability" (Springer, 2016). Dr. Shmelev has been a senior researcher at Oxford University and a visiting professor at the Universities of Geneva, Paris, Versailles etc.

Abstract: Urban sustainability assessment is required for the purpose of establishing strategic directions for 'greening' our cities to reduce the environmental impact of their performance and to improve employment and economic viability and enhance the quality of life.

This paper considers large world cities: London, New York, Hong Kong, Los Angeles, Sao Paulo, Rio de Janeiro, Paris, Berlin, Singapore, Shanghai, Sydney and Tokyo. The progress towards urban sustainability is defined as a multidimensional improvement. To assess urban sustainability performance, the paper applied Principal Component Analysis and Multi-Criteria Decision Aid tools to compare the cities on the range of multiple dimensions: economic (Gross Regional Product, GRP), social (unemployment, Gini index) and environmental (carbon dioxide emissions, emissions of particulate matter, PM10), etc. The multi-criteria methods chosen for this assessment are ELECTRE III, NAIADE and APIS.

The results have shown that Singapore dominates the sustainability rankings in most multi-criteria applications, showing particular strength in economic and environmental dimensions and a slightly less strong performance in the social dimension according to the APIS results. The paper explores the reasons why Singapore has achieved such success, namely innovative sustainability strategies and new governance structures. Shanghai and Rio de Janeiro have been identified as cities with the lowest level of sustainability achievement and therefore the highest potential for the development of a green economy.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Conflict and Consensus: The Limits of Transdisciplinary Research and Participation

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Type of Presentation: Paper presentation

Biography: Bernd Siebenhüner is professor for ecological economics at Carl von Ossietzky University of Oldenburg, Germany. He is coordinator of the Master's programme Sustainability Economics and Management and holds a PhD in economics and Master's degrees in economics and political science. He has headed numerous research undertakings in the fields of international organizations, global environmental governance, social learning, corporate sustainability strategies, climate adaptation and biodiversity governance, and the role of science in global environmental governance.

Abstract: Numerous recent studies, in particular in the field of climate change and sustainable development at large, call for participatory approaches granting access for various societal groups in socio-ecological transformation on local levels such as cities, regions, or local communities. Transdisciplinary research has been proposed as an approach to bring scientists and societal stakeholders together to learn and to develop solutions towards socio-ecological transformation. In these concepts, granting access is intended to promote knowledge integration, consensus and activate local actors to initiate and advance learning and change processes. In doing so, however, participatory processes enter societal battlegrounds and meet conflicting interest and knowledge claims. They thus are essentially about conflict resolution and overcoming resistance and blockages and, in many cases, less about consensus formation and mutual agreement.

Building on the discussion on transdisciplinarity and participatory research, this paper analyses a project on regional adaptation approaches to climate change. It studies processes and outcomes with regard to the societal impact of the project and discusses explanatory factors with a focus on success factors and key barriers for socio-ecological transformations. In doing so, it identifies central lessons for future conflictive transdisciplinary processes.

Transforming the Economy Sustaining Food, Water, Energy and Justice

From Transdisciplinarity to Transformation

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Abstract: The debate about transdisciplinary research calls for solution-oriented action research with a strong collaboration of non-scientific actors on equal footing with scientists. It seeks to develop socially robust knowledge to advance sustainable development in particular in local contexts. While there is growing experience with this kind of research also pursuing similar approaches such as co-production of knowledge, co-design and co-dissemination or concepts of action research, there is little experience with society-wide truly transformative processes and the role of the different actors therein.

Therefore, this paper contrasts transdisciplinary research with transformative research that targets at larger society-wide change processes towards sustainability goals. Thus far, that is the central hypothesis of the paper, there is little knowledge about whether and how large-scale processes take place and how they relate to or aggregate from small-scale processes of socio-ecological change or social learning. The paper develops central categories for the analysis of transformative research processes and about the roles of different actors therein including scientists and civil society actors. It continues to identify different patterns of scaling up change to a society-wide level and provides examples for such processes. Finally, it draws conclusions about how to promote transformations and about the role of research and scientific actors.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Measuring the Willingness to Pay for Carbon Emissions of Fee Paying Commuters

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Biography: Dr. Philip Sirianni is an assistant professor of economics at SUNY Oneonta. In his research, he uses econometric methods and climate-economy modeling to examine the efficacy of policies for reducing greenhouse gas emissions from economic and environmental perspectives. Dr. Sirianni teaches courses in microeconomics and environmental economics.

Abstract: We have conducted a survey of commuters to a midsize public college campus to elicit their willingness to pay for the carbon emissions associated with their commutes. We presented each respondent with a dollar estimate of his/her environmental damages over the academic year. We then asked whether the respondent would be willing to pay for these damages in the form of a higher parking fee, given that the funds collected above and beyond the normal parking fee would be used to offset some or all of their emissions via the purchase of carbon offsets.

Logit and probit regressions shed light on the factors correlating with willingness to pay. We also demonstrate how to extrapolate the survey results to the greater campus community in order to estimate the total emissions of commuters – a component of Scope 3 emissions which many institutions have a difficult time estimating. Currently, the institution surveyed is considering setting up an actual carbon offset fund for commuters. Once this occurs, we will be able to compare actual contribution rates with the survey responses. These results will be presented at the conference.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Optimal Pollution Taxes when Pollution Damages are Non-Separable

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Type of Presentation: Paper presentation

Biography: Philip Sirianni is an assistant professor of economics at the State University of New York at Oneonta, where he researches and teaches courses in environmental economics.

Abstract: In the presence of a negative externality such as pollution, a divide exists between the private cost of production, which is incurred by polluting firms, and the true cost of production, which is incurred by the society as a whole. As a result, the market outcome is inefficient, and deadweight social loss is a result of an overproduction of the dirty good, its price being too low.

A particular policy instrument called a Pigovian tax raises the private cost of production so that it is in line with social costs, thus incentivizing firms to reduce pollution. A key issue is at what rate to set the tax. In this paper, we derive the optimal (Pigovian) tax rates for a particular class of pollutants that have non-separable environmental damages.

To this end, we formulate a simple model with two pollutants so that both pollutants have their own detriments in that they each contribute to environmental degradation in their own way; however, the innovation in this paper is that the marginal effect of one pollutant decreases with increases in the other. This characterizes the problem of carbon and sulfur emissions in that carbon has a warming effect while sulfur has a cooling effect, yet at the same time, sulfur causes additional damages in the form of acid deposition. Thus, increases in sulfur emissions will increase acid deposition but diminish the effect of additional carbon in the atmosphere.

We link the social planner's problem with the polluting firm's problem to derive the optimal tax rates. The results show that the optimal tax on each pollutant increases with increases in that pollutant; however, it decreases with increases in the other pollutant. The key takeaway message is this: If the goal is to implement tax rates that are truly optimal in the Pigovian sense, then the regulator must take into account the levels of all pollutants which have non-separable damages such as this. The result has implications for tax policy in that the levels of both pollutants cannot be evaluated independently, as the regulator needs to consider the optimal "mix" of tax rates. Otherwise, distortions (deadweight social loss) will still exist, and pollution control objectives will be neither cost effective nor achieved.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Resources and Impact Decoupling - Evidence from Brazil

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Abstract: Some developed countries have shown decoupling of economic growth from natural resource consumption and environmental impacts, building a trajectory towards a green economy. However, a portion of this resource decoupling may be related to environmental pressure in developing countries, such as Latin American and Caribbean countries, whose economic development model is intensive in natural resources and based on exports of low value-added products. Brazil is one of the world biggest natural resources and agricultural products exporters.

This article aims to investigate the long-term relationship between economic growth and the environment in Brazil based on resource and impact decoupling indicators. To this end, indicators of resource use according to Material Flow Accounting method (MFA) are measured for all categories of materials (biomass, fossil fuels carriers, non-metallic minerals and metallic minerals) from 1970 to 2013. In addition, indicators of impacts related to different environmental aspects (air, land, water, biodiversity, sanitation) are used in the course of this analysis.

The results show that there was no resource decoupling in Brazil in the 44 years of this study, due to the increase in resource per capita consumption of 7.76 tons in 1970 to 23.59 tons in 2013. Furthermore, there was an increase of 26% in material intensity (DMC/GDP). Brazil has a Physical Trade Balance deficit especially caused by exports of biomass (soybean, sugarcane) and metal ores (iron), while it is still dependent on imports of fossil fuels and chemical minerals (fertilizer). On the other hand, there were improvements in impact indicators, particularly a reduction of GHG emissions between 1990 and 2012, as a result of the decrease in deforestation rates in the Legal Amazon. Summing up, empirical evidences of decoupling in Brazil are contradictory; some improvement in impact decoupling contrasting to a dramatic increase in the consumption of natural resources as a consequence of the resource intensive economic development model guided by exports of primary products.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Analytical Framework for Ecological Macroeconomics

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Type of Presentation: Paper presentation

Biography: Ranulfo Sobrinho has devoted his efforts to solving socio-ecological issues since 1994. His multidisciplinary background (Bachelor of ecology, Master in civil engineering and a PhD in economics) allow him to analyze these problems considering multiple methodologies, such as use of technology block-chains to create crypto-currencies aimed to promote sustainable development; multi-criteria evaluation and dynamic systems. The author is co-founder of Sustainability.School and a collaborative researcher at the Institute of Economics (UNICAMP) as well as being a member of SMEE (Sociedad Mesoamericana de Ecologia Ecologica).

Abstract: We present a qualitative analytical framework that aims to analyze the influence of the international financial flow on the dynamics of economic growth in countries situated in the post Bretton Woods Agreement. This framework emerged from the analysis of important contributions made by several authors, which analyzed isolated parts of a phenomenon that has become more frequent since the 1970s. This is the credit expansion in the economy, in such levels that it could result in economic growth, followed by formation and subsequent bursting of economic bubbles. As will be shown, this process occurs mainly due to entry of international financial resources into the economy of a country.

The increased flow of international financial resources causes both positive and negative effects. The negative consequences of this international flow have the potential to overcome its positive impacts. Accordingly, it is crucial to really understand the phenomenon, as well as having the ability to measure it. Once having assessed the potential damage of these flows, it becomes possible to think in macroeconomic ecological policies to avoid it.

This analytical framework has two main objectives: 1) to show some important relationships between the main parties that have influenced economic growth in the countries since the 1970s; 2) to provide elements to build a new macroeconomic framework which will enable economic development without sacrificing natural resources, but rather enabling increased employment and development of economic activities that are both eco-efficient, and especially resilient.

Regarding the first objective, this structure consists of the following elements: 1) high interconnectedness of financial institutions through SWIFT (Society for Worldwide Interbank Financial Telecommunication), which enables the international flow of funds in amounts and speeds never witnessed in human history; 2) high connectivity of financial institutions known as "primary dealers" who play an important role in the money creation process together with governments and central banks; 3) change in the composition of reserve assets after the breakup of the Bretton Woods Agreement; 4) mutual credit expansion process between countries with current account surpluses and those with deficits (with some exceptions due to the high level of indebtedness).

Regarding the second objective, the elements that can support an ecological macroeconomic framework come from the knowledge about the sustainability of complex flow systems. These findings show the need to insert resilience into a system in order for it to be sustainable. In this case, it involves the insertion of new institutions that can create money and credit differently than it has been carried out by central banks and other financial institutions. This new kind of money and credit would be created to finance actions aimed to promote sustainable development.

Transforming the Economy Sustaining Food, Water, Energy and Justice

What Features Should Have a Crypto-currency to Promote Sustainable Development?

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Abstract: The emergence of block-chain technology opens up opportunities to create a specific crypto-currency to promote sustainable development and solving socio-ecological problems on both a local and global scale.

It is a good time to think about the design of this crypto-currency because, as pointed out by the Club of Rome report ""Money and Sustainability: the missing link"", the type of money and credit created by central banks and other financial institutions have effects that are detrimental to sustainability. These effects are:

1. The pro-cyclical character of the money creation process, which amplifies both the upturns and downturns of the business cycle
2. The systematic encouragement of short-termism because the interest feature of the money system programs 'rational' investors to discount the future
3. Compulsory growth due to the mechanism of compound interest
4. Concentration of wealth
5. A devaluation of social capital

We can create a transformative crypto-currency distinct of the main ones available today, like Bitcoin and other alts developed as adaptations of the Bitcoin source code. These crypto-currencies are based on the notion of scarcity, since they have a limited currency supply. This is problematic, because as more people demand the crypto-currency, the cost to obtain it can become higher and its function as a medium of exchange could shift to a speculative one. Also, due its design, only miners can benefit from the crypto-currency creation process as it has been applied until today.

Some ideas to take into account in the design of a new crypto-currency to promote sustainable development include:

- 1). Adopting the idea of abundance.

Consider oxygen. The supply of this essential chemical element is renewed depending on the lifetime of the living beings that generate it (micro algae, cyanobacteria, and other plant species). Just as oxygen is essential for the life of human beings, money is essential for carrying out business transactions in an economy. As oxygen is abundant, we can create a crypto-currency that is also abundant over certain period of time.

- 2). Adding Periodicity.

The currency can have an expiration date, which means that it can automatically self-destruct after a period and self-renew in different quantities than in the previous period. Abundance over a period of time could encourage people to act faster in order to solve as best as possible the challenges selected by them for a year. Although the problem has not been solved during the first year, the knowledge gained by analyzing the problems can be shared with people facing similar problems for the years to come.

- 3). Creating the crypto-currency based on environmentally and socially beneficial actions

Not just miners can benefit from a currency creation process; we can create a currency that is backed on environmentally and socially beneficial actions. The currency is created when someone makes a difference.

- 2) Incorporating knowledge from 'social physics'

Ideas such as peer pressure promote the adoption of some practices/behaviors. We believe it can help accelerate behavioral change and improve collective performance, which can boost the adoption of actions to solve our socio-ecological problems.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Green Amenities, Local Food, and Economic Justice in a Large U.S. City

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Biography: John A. Sorrentino is associate professor of economics at Temple University. He was a co-founder of Temple University's Environmental Studies Program, and was honored by the University with a Lindback Award for Distinguished Teaching. His research work has appeared in journals such as the AER, JEEM, Environmental Management, and Landscape & Urban Planning. John received his B.B.A. from Baruch College of the City University of New York and M.S. and PhD degrees from Purdue University.

Abstract: Ensuring a decent quality of life for those less fortunate by redistributing some of the wealth generated in the United States is meeting significant resistance. As with action on climate change, the impetus for a transition from the status quo is coming from local governments, businesses, non-governmental organizations and individual citizens. An example of such a movement is Greenworks Philadelphia.

Greenworks Philadelphia "...describes a city in which residents and businesses benefit from lower energy costs, cleaner air, greener neighborhoods, better transit and new jobs." (Sustainability Working Group, 2009) The program is inspired by the Triple Bottom Line of Economy, Environment and Equity, but also explicitly includes Energy and Engagement. Among the initiatives in the program are: (i) increased tree coverage citywide to 30% by year 2025; (ii) local food within 10 minutes walking time of 100% of city residents by 2015; (iii) park and recreation resources within 10 minutes walking time of 100% of city residents by 2025.

These initiatives are singled out because they present the potential for in-kind improvements of well-being and equity among Philadelphia's less fortunate citizens. The present work will examine the achievements of the Greenworks Philadelphia implementation period, and assess how such achievements impact measures of inequality in the quest for "just sustainability." Combining theoretical work on the provision of in-kind goods and services with data provided by the City of Philadelphia on street trees, green spaces and healthy food locations, this analysis involves computing changes in the estimates of popular economic inequality measures. These changes are used as a basis for policy recommendations in the domain of urban sustainability and justice.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Ecosystem Services As If People Mattered

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Biography: Joachim H. Spangenberg works on ecosystem services and their generation as a co-production of biosphere and anthroposphere. As an economist with earlier education in biology and ecology, he integrates social, economic and cultural aspects with bio-geo-genic factors in his analyses. His work is transdisciplinary, emphasising stakeholder participation. Currently a senior scientist at the German UFZ, he has been working for SERI Germany, the University of Versailles, the Wuppertal Institute and the Institute for European Environment Policy

Abstract: The complexity and diversity of meanings attributed to nature by human societies and cultures is all too easily brushed aside by the techno-bureaucratic rationality of monetisation. Individual preferences are taken into account (albeit in methodologically dubious ways), but social decision processes are ignored. External experts decide which service is valuable to whom.

The paper provides an alternative by focusing on how agents take decisions, in particular in dilemma situations when they have to decide between private benefit and the public good. Resource managers, decision makers and researchers are the key addressees of the paper.

Decision makers should take this into account to avoid decisions that are in clear contradiction to peoples' will and values. Researchers should recognise that bottom-up approaches, stakeholder involvement and local preferences have to be the basis of ecosystem valuation, and that the economic calculus is bound to fail.

The theoretical framework of the paper integrates the ESS cascade approach of Spangenberg et al. 2014a;b, von Haaren 2014, and the social-ecological system framework SES developed by E. Ostrom and collaborators to highlight the role of agents' decisions in ecosystem service provision and system management.

We show that an analysis based on the SES framework, although in contradiction to the logic of monetisation, can be integrated into the ecosystem service cascade model. However, significant problems in harmonising the terminology of two independent bodies of investigation have to be solved for a fruitful cross-fertilisation.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Law and Governance for Justice and Sustainability: The Current State and Movement Forward

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Biography: The authors are affiliated with the Economics for the Anthropocene project (www.e4a-net.org), led by McGill University, University of Vermont, and York University. These institutions and their many partners aim to articulate, teach and apply a new understanding of Human-Earth relationships grounded in and informed by the insights of contemporary science. Here, the authors present the results of a self-taught seminar on Law and Governance in the Anthropocene during the fall 2015 semester.

Abstract: Many of the most pressing problems for law and governance currently lie at the intersection of social and ecological justice: climate change, property law, indigenous rights, and, broadly, societal vulnerability and resilience. Ecological economics has long acknowledged that social systems require fundamental transformations to shift toward a mutually enhancing human-nature relationship, yet current social systems continue to approach these complex issues through laws that blindly promote development without regard for nature. Rarely do institutions of law and governance ask how planetary and political boundaries can be reconciled with respect to rights of nature and social justice. To shift toward a more balanced system of law and governance, these fields must move beyond the singular focus of human economic growth to legal systems that are reflective of the complex social and ecological systems they govern.

A transition to a more sustainable and just legal and political system must address planetary boundaries, the rights of nature, ecosystems services, the time frame for which laws apply, and many other factors. Here, we ground law and governance practices in the perspective that social systems could shift toward a sustainable and just human-environment relationship through six themes: 1) global environmental governance in the Anthropocene, 2) ecological law, 3) rights and rules, 4) property-rights systems, 5) human actor and groups, and 6) institutional and network structures.

We build from the understanding of humans and society existing within a larger ecosphere to critically examine existing and potential systems of law and governance in the Anthropocene and the extent to which systems reflect or negate this human-earth relationship. Drawing from various perspectives and proposals for achieving a fundamental transformation of law and governance, we identify critical gaps in understanding and research. Existing mechanisms for change, including deliberative democracy and participatory governance will be considered with respect to their potential to address critical issues in current systems. Additionally, we will address the current state, challenges, and opportunities for interdisciplinary research on law and governance for justice and sustainability.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Analysis and Valuation of the Health and Environmental Co-benefits of Dietary Change

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Type of Presentation: Paper presentation

Biography: Dr. Marco Springmann is a post-doctoral researcher and James Martin Fellow at the Oxford Martin Programme on the Future of Food at the University of Oxford, UK. He is working on a multi-disciplinary global modelling project with the aim to systematically assess the impacts of climate change, economic development, and changing dietary habits on the global food system, and to analyse the effects of current and future policy approaches.

Abstract: What we eat greatly influences our personal health and the environment we all share. Recent analyses have highlighted the likely dual health and environmental benefits of reducing the fraction of animal-sourced foods in our diets. Here we couple for the first time a region-specific global health model based on dietary and weight-related risk factors with emissions accounting and economic valuation modules to quantify the linked health and environmental consequences of dietary changes.

We find that the impacts of dietary changes towards less meat and more plant-based diets vary greatly amongst regions. The largest absolute environmental and health benefits result from diet shifts in developing countries while Western high-income and middle-income countries gain most in per-capita terms. Transitioning towards the more plant-based diets that are in line with standard dietary guidelines could reduce global mortality by 6-10% and food-related greenhouse gas emissions by 29-70% compared to a reference scenario in 2050.

We find that the monetised value of the improvements in health would be comparable to, or exceed, the value of the environmental benefits, though the exact valuation method used considerably affects the estimated amounts. Overall, we estimate the economic benefits of improving diets to be USD 1-31 trillion which is equivalent to 0.4-13% of global GDP in 2050. However, significant changes in the global food system would be necessary for regional diets to match the dietary patterns studied here.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Preferences over Improvements in Wetland Attributes: A Choice Experiment Study of Loktak Lake in India

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Abstract: Wetlands are an important resource for the sustenance of societal livelihoods. They provide diverse goods and services, which are of an immense social, cultural and above all economic value. However, these precious resources often get ignored in the conventional policy framework, mainly due to the intangible nature of the services rendered by the same. Further, the majority of the goods and services that wetlands generate are non-marketed in nature, hence they do not have readily available market prices to represent their economic significance.

The consequent negligence on the part of the stakeholders as well as unsustainable use lead to the depletion and degradation of the wetlands. Loktak Lake in India is an example for such a case. Loktak Lake is considered as the lifeline of the State of Manipur due to its importance to the socioeconomic and cultural life of the people. It is the largest natural freshwater lake in the north-eastern region of India and plays an important role in the ecological and economic security of the region. A large population living in and around the lake depends purely upon the lake resources for their sustenance.

Keibul Lamjao National Park, the World's only floating national park, is a part of Loktak Lake, which is the natural habitat of the endangered Manipur brow antlered deer 'Sangai'. The Lake is also an important Bird Area and Ramsar site, considered as a potential breeding site for waterfowl. Moreover, the Lake attracts numerous migratory birds during winter season. The Lake is currently threatened with several conservation issues leading to its degradation, like siltation, eutrophication, pollution, and excessive proliferation of Phumdis, etc.

In the present study, we employ discrete choice experiments to estimate the economic values of changes in select attributes of Loktak Lake as perceived by its stakeholders. Random parameter logit model with socioeconomic interactions is used to estimate the stakeholders' preferences for the improvement of the Lake. The results reveal that heterogeneity exists on a significant scale across stakeholder preferences. On average, however, they hold positive and significant values for the improved conservation and management of Loktak Lake.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Groundwater Irrigation and Sustainable Intensification of Agricultural Production Systems: A Study with Special Reference to Spatial Variability in Groundwater Availability at a River Basin Level in India

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Type of Presentation: Paper presentation

Biography: Dr. Jeena Thathamath Srinivasan is associate professor at the Centre for Economic and Social Studies, Hyderabad, India.

Abstract: The massive expansion of groundwater irrigation that has been taking place over the past several decades and the resulting overexploitation which has started showing up in several regions in the recent years poses serious challenges to sustainable intensification of overall agricultural and specifically to food production systems and poverty reduction in India. Against this background, this paper attempts to understand the critical links between groundwater irrigation, agricultural development and poverty across regions with varying groundwater resource availability and identifies some of the major challenges and opportunities for sustainable intensification of agricultural and food production systems in India.

We have used primary data collected from over 800 farmers comprising of both groundwater users and non-users in the Godavari river basin in India, which has spatial variability in groundwater availability. Since it also covers some of the most agriculturally important states in the country, where considerably higher levels of poverty exist in some areas, it provided an ideal setting to explore the above relationship. We selected sample farmers from the upper, middle and lower reaches of the basin representing different scenarios with respect to groundwater availability and its use in agriculture. Agricultural development has been assessed in terms of types of crops grown (both irrigated and non-irrigated) and incomes derived from crop production. Crop incomes have been estimated from the input/output details collected for each crop grown by the farmer in the agricultural year 2011-12. For poverty estimation, both agricultural and non-agricultural incomes of the households have been taken into account. Using this, we computed Foster, Greer, Thorbecke measures of poverty, such as, the head count ratio, poverty gap and squared poverty gap. We also estimated a logit model to find out the determinants of poverty by controlling other socio-economic characteristics of the households apart from whether they are users or non-users of groundwater.

The study observed that access to groundwater irrigation differed according to the size of holding and social status of the farmers. The upper reaches, which had better availability of groundwater resources, are characterised by a more diverse cropping pattern dominated mostly by high value food crops. On the other hand, middle reaches, which faced more scarcity of ground water, are less diverse in terms of cropping pattern, and a major portion of them is occupied by cotton, the remainder with food grains. Lower reaches, which have a somewhat better availability but less physical access to groundwater, are more diverse in cropping pattern than the middle reaches, and cultivate more food grains and less other high value food crops.

The study observes that the share of agricultural income is higher for those farmers who had access to groundwater as compared to others and this differed from upper reaches to lower reaches. Inequalities in incomes were observed to be higher where groundwater availability was better. This was throwing up both challenges, as well as opportunities for sustainable intensification of agricultural and food production in India.

Transforming the Economy Sustaining Food, Water, Energy and Justice

What Ecological Economists can learn from Karl Polanyi

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Type of Presentation: Paper presentation

Biography: With her first PhD in ecological economics, and 15 years of research experience, Sigrid Stagl is also Professor of Environmental Economics and Policy at the Department of Socioeconomics at the Vienna University of Economics and Business. She is currently head of the Institute for Ecological Economics in Vienna.

Abstract: What is it about free-market ideas that give them this tremendous staying power in the face of failures such as persistent unemployment, widening inequality, environmental problems and financial instability that have stressed Western economies over the past forty years? Polanyi (1944) argues that the free market championed by market liberals never actually existed. While markets are essential for enabling individual choice, they cannot be self-regulating; they require regulation. By themselves they cannot provide the necessities of social existence. Subjecting more and more elements of social life to market principles threatens social life and risks major crises. Despite these theoretical flaws, market principles are powerful and attractive as they promise to diminish the role of politics in social life. Politics entails coercion and unsatisfying compromises among groups with deep conflicts, the wish to narrow its scope is understandable. Yet, the ideology that free markets can replace government is utopian and dangerous (Block and Somers 2014).

Markets are a form of regulating social life (Pirker 2004). Markets are sets of institutions (Hodgson 1988) and thus always regulated. Depending on the regulation, markets deliver socially desirable outcomes or not. This paper develops an ecological economic critique of market fundamentalism and in doing so, draws primarily on Karl Polanyi's work. Two case studies from green finance and labor markets illustrate these points.

Polanyi (1944) argues for a paradigm shift in how freedom is understood. The idea of freedom in Anglo-American countries is highly individualistic - a Robinson Crusoe version of freedom. Polanyi questions the suitability of this conceptualisation of freedom for a society characterised by a rather complicated division of labour. The freedom to do as you like is in conflict with the freedom from intrusion by others. Since the liberal notion of freedom is not suitable for a complex society, where we are interdependent with other people, Polanyi argues for a paradigm shift. In his view, freedom is the capacity to live an ethical life. The freedom to be ethical under the conditions of industrial society could mean to have the space to develop one's capacities in connection with other people and Polanyi thought that the way to develop this was by strengthening democracy and ultimately subordinating the economy to democratic politics.

It is widely acknowledged in ecological economics that addressing real-world problems normally requires interdisciplinary research. The political-economic thinking of Karl Polanyi was never properly absorbed into "mainstream economics". However, Polanyi's ideas help to understand real-world economic processes and serve as an example of the need for interdisciplinary analysis.

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Transforming the Economy Sustaining Food, Water, Energy and Justice

Ghettos in Slovakia: The Environmental Exclusion of the Roma Minority

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2nd Author: Richard Filcak - Institute for Forecasting Studies, Slovak academy of Sciences

Type of Presentation: Paper presentation

Biography: Tamara Steger, PhD and Richard Filcak, PhD are founders of the Environmental Justice Program at Central European University in Budapest, Hungary. As a research team, they have explored the contours and potentialities of environmental justice in Central and Eastern Europe (CEE) and mapped the role of discrimination in access to basic living necessities, particularly among the Roma communities in CEE.

Abstract: More than half of the Roma population in Slovakia lives in spaces that are segregated or separated from dominant non-Roma communities. The socio-spatial marginalization of Roma is both generated and reinforced through open and discrete social processes and measures largely orchestrated by local governments, enabled by an ineffective state and reinforced by the general socio-economic policy framework.

This article builds on extensive held research on predominantly Roma-occupied spaces (i.e., 'settlements') in Slovakia and focuses on the nature and function of Roma segregation and separation in Slovakia from an ecological socio-political, and economic standpoint. Based on Loïc Wacquant's work on ethno-racial segregation and the concept of environmental justice, we discuss social and environmental discrimination as one of the constituent elements in understanding Roma socio-spatial marginalization and its functions, and employ the neologism, 'hyper-osada' as a tool to conceptually and analytically investigate the new impetus and recent trajectory of Roma segregation and separation.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Assessing the Value of the Ecosystem Services by Quantifying their Contribution to Well-being: What Have We Learned and What Knowledge Gaps Remain?

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Type of Presentation: Paper presentation

Biography: Natalie is a professor of economics at James Cook University (JCU). She has a BEc from the Australian National University (ANU), a MEc from JCU and a PhD from ANU. She is particularly interested in environmental and distributional issues associated with economic growth in rural areas. She has an established record of multi and trans-disciplinary research and extensive experience with a wide range of non-market valuation methods.

Abstract: Economists have been thinking about the multitude of ways in which the environment contributes to 'utility' for well over 70 years and they have developed numerous different methods for estimating the monetary equivalent of that contribution (using, for example, the travel cost method, hedonic pricing, contingent valuation and choice modelling). But it was, arguably, not until the Millennium Ecosystem Assessment (MEA) changed the discourse and encouraged people to think about the contribution which ecosystem services (ES) make to well-being, that methods of valuing the environment (or different ES) started to gain broad support from non-economists. Some of this newfound support simply increased the number, profile and complexity of 'traditional' valuation studies. Broader interest has also facilitated the incorporation of social science perspectives into the literature. Most relevant to this paper is the notion that well-being, or 'life satisfaction' (for which psychologists have developed reliable measurement scales) can be used as a workable (and cardinally measurable) proxy for utility.

This opened up a new avenue of research in the valuation field; one that allows people to directly examine the relationship between utility, income and various indicators of ES (instead of needing to exclusively rely on methods that draw inferences about 'value' using indirect utility (or expenditure) functions). Direct-utility valuation methods are as yet far from perfect, but they show much promise. This presentation collates insights and findings from life-satisfaction studies that have been undertaken in numerous different managerial and geographical contexts around the world (including, Australia, the Philippines, China and Costa Rica), noting key lessons learned, problems encountered, and issues in need of further research.

Transforming the Economy Sustaining Food, Water, Energy and Justice

The Feasibility of Shifting Diets towards Just Food Systems and Global Sustainability: A Review of Influence Factors

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2nd Author: Uta Schmidt - University of Greifswald

Type of Presentation: Paper presentation

Biography: Susanne Stoll-Kleemann is professor and Chair of Sustainability Science and Applied Geography at the University of Greifswald, Germany, with previous positions at the Humboldt University of Berlin, the Potsdam Institute for Climate Impact Research, and at the Swiss Federal Institute of Technology (ETH) in Zurich with research on biodiversity conservation, climate change mitigation and sustainable consumption and land management.

Abstract: Shifting diets to reduce high levels of meat consumption predominately in high-consumption areas such as the USA and Europe is a key leverage point for tackling food justice and overall global sustainability. The research reviewed here is directed towards the feasibility of reducing meat consumption. If more crops were grown for direct human consumption, instead of grown for livestock feed, there would be less need to intensify agriculture. Meat consumption is steadily increasing in developed countries on an already high level, and rapidly expanding in more prosperous, populous countries such as China. The consequences of this are manifold: (1) biodiversity is being degraded and lost to a considerable degree, with 70% of the world's deforestation a result of stripping for animal husbandry; (2) about 14.5% of the world's anthropogenic greenhouse gas emissions are the result of livestock activities; (3) food security is challenged by poverty, displacement of former smallholders, and the destruction of local markets in developing countries.

This contribution reviews barriers, opportunities and steps that need to be taken in order to encourage the consumption of less meat based on an interdisciplinary and multifactor approach. The evidence is gathered from a systematic meta-analysis of 154 studies analysing factors (including personal, sociocultural and external factors) that influence individual meat-eating behaviour. Among the 11 influence factors identified for a resistant high level of meat consumption in developed countries 'values and attitudes' (72) and 'social norms, roles and relationships' (64) are mentioned most often. However, this does not mean that these factors are more important than, e.g. 'emotions and cognitive dissonance', the 'food context' or other personal and social factors, but it may provide an insight into what researchers regard as important factors to examine with regard to meat consumption.

In our qualitative assessment, the most relevant influences on behaviour appear to be emotions and cognitive dissonance and, again, sociocultural factors (as a whole). The latter are important because meat still has an important social status for many people as an essential part of a meal and its consumption or avoidance can be regarded as a choice that is part of the lifestyle decisions people make in late modernity. For different factors and groups of people, different strategies are appropriate. For example, for men and older people deploying the health argument or arguing for it, flexitarianism (reduced meat consumption) may prove the most promising approach, while providing emotional messages or promoting new social norms is recommended in order to address barriers such as cognitive dissonance.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Teaching Institutional Decarbonization Economics

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Type of Presentation: Paper presentation

Biography: Assistant professor David Timmons holds an MS in community development and applied economics from the University of Vermont with graduate certificate in ecological economics (2006), and a PhD in resource economics from the University of Massachusetts Amherst (2010). At the University of Massachusetts Boston, Timmons teaches environmental, resource, and ecological economics. Timmons currently studies decarbonization of world, national, and local economies, and has also studied biomass energy, urbanization environmental impacts, and local food systems.

Abstract: Given the problem of climate change, the world economy must be decarbonized. Many U.S. and world colleges and universities have made commitments to reduce their carbon emissions. For example, signatories to the American College and University Presidents' Climate Commitment (ACUPCC) have pledged to reduce their greenhouse gas emissions by 40% in the year 2020 and by 80% in 2050. A review of filed ACUPCC plans indicates that few institutions have publicly identified specific actions that will result in achieving these goals, or the costs of such actions. Planning for such institutional decarbonization presents an opportunity to introduce students to climate change science, to the economics of renewable energy and energy conservation, and to analytical tools useful in decarbonization planning for businesses, institutions, cities, and countries.

This presentation reports on a spring 2016 special-topics economics course at the University of Massachusetts Boston, a course based on the Tufts GDAE modules "The Economics of Climate Change" and "The Economics of Renewable Energy". The course reviews climate change science from the first module, and then uses economic tools described in the second module to develop a cost minimization method combining energy conservation, renewable energy production, and renewable energy purchasing. The cost of conserved energy (CCE) is expressed in the same units as an energy cost (\$/kWh). Marginal CCE is ultimately rising, as is marginal cost of producing renewable energy on campus. From an institutional perspective, the cost of purchasing renewable energy from the grid is likely constant but uncertain. To minimize decarbonization costs, the marginal costs of conserved, produced, and purchased energy must be equal. From this condition, optimum quantities of institutional energy conservation and renewable energy production can be identified, with the cost of grid-purchased renewable electricity providing an upper bound on costs of both produced renewable energy and energy conservation. The course also considers issues around central heating plants, uncertainty about conservation performance, and building replacement rather than retrofit.

In addition to providing an overview of the spring 2016 course and the educational module applications, we describe experience with student research on campus decarbonization. While most students are neither professional engineers nor economists, they can play valuable roles in conducting preliminary research, in describing broad outlines of institutional decarbonization plans, and in raising the profile of campus decarbonization planning. At the same time, students can add to their own sets of skills and job-relevant experiences.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Towards Improving Ecosystem Service Valuation: Microeconomic, Dynamic, and Macroeconomic Considerations.

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Type of Presentation: Paper presentation

Biography: Assistant professor David Timmons holds an MS in community development and applied economics from the University of Vermont with graduate certificate in ecological economics (2006), and a PhD in resource economics from the University of Massachusetts Amherst (2010). At the University of Massachusetts Boston, Timmons teaches environmental, resource, and ecological economics. Timmons currently studies decarbonization of world, national, and local economies, and has also studied biomass energy, urbanization environmental impacts, and local food systems.

Abstract: The 1997 “Value of the World’s Ecosystem Services and Natural Capital” by Costanza et al. created a storm of controversy around whether and how to value global ecosystem services. After 19 years, the theoretical underpinnings of ecosystem service values are still not completely resolved, while the original valuation motivation remains: without reliable estimates of values, ecological considerations may be omitted from public policy decisions. In this paper we propose microeconomic, dynamic, and macroeconomic components of ecosystem service valuation.

At the microeconomic level, ecosystem service valuation studies should consider marginal values and their spatial variation. In a typical ecosystem service marginal benefit function, marginal values are low when available quantities are high, or when ecosystem services are amply provided. Since abundant ecosystem service provision is associated with unspoiled natural environments, we should not be dismayed by low or even near-zero marginal values for ecosystem services. Rather, the opposite is cause for concern, with high marginal values indicating ecosystem service scarcity. Values may rise exponentially near critical ecological thresholds, and high marginal values may signal significant environmental damage. If critical ecosystem services become unavailable, society will forego much other consumption to obtain these services.

A related principle is that for policy relevance, valuation studies should consider ecosystem service price dynamics. Static valuation studies are of limited use, with the precise value of any ecosystem service perhaps being less important than its price path over time. Falling, constant, and rising ecosystem service values signal different underlying environmental dynamics, and policy makers must thus have such estimates of ecosystem service value time trends.

If value is defined as opportunity cost, the value of anything cannot be greater than what can be given up to obtain it. At the macroeconomic level, national income equals GDP and is an upper bound on all value including ecosystem service value, though national income might be broadly defined. This income constraint need not be problematic for ecosystem service valuation—indeed it represents information, which can be incorporated in valuation studies, improving their accuracy. Valuation results that are in excess of some portion of GDP can be appropriately scaled to stay within the bounds of total value. This avoids errors possible from aggregating individual ecosystem service values in the absence of any upper bound.

Together these three approaches should make ecosystem valuation studies more reliable, more policy relevant, and more consistent with economic theory.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Nutrient Load Impacts on the Growth of Perch Population at the East Coast of Sweden

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Type of Presentation: Paper presentation

Biography: Wondmagegn Tafesse is a PhD student at the Department of Economics of the Swedish University of Agricultural Sciences (SLU), specialised in environmental economics. Wondmagegn is primarily interested in research topics related to energy and resource economics. Currently, his research work focuses on examining the dynamics of fishery, ecosystem services and sustainable economic development in Sweden. Some of his areas of interest include development economics, international agricultural trade and policy, applied econometrics and CGE modeling.

Abstract: Degradation of marine ecosystems due to overexploitation and eutrophication has been a major concern of sustainable fishery management along the east coast of Sweden. In this aspect, previous studies in fishery economics are specifically bounded in investigating the partial effects of overexploitation on fish population rather than paying attention to the role of other anthropogenic factors.

This suggests the importance of examining fishery dynamics from a broader perspective. Hence, this paper attempts to estimate the effects of commercial and recreational fishery and nutrient loads on perch population relying on a development of the Gordon-Schaefer model. To this end, we use yearly-based data ranging between 1970 and 2014 from the east coast of Sweden. Results from the Fully Modified Ordinary Least Square (FMOLS) regression indicated that fishing intensity and nitrogen load in the Baltic Proper are statistically significant in affecting perch growth rate at a 95% and 90% confidence interval, respectively. Besides, the lagged variables for nitrogen and phosphorus show high levels of statistical significance suggesting the existence reaction from past nutrient load in a dynamic manner.

Without any external pressures, perch population can grow on an average factor of 0.27 per annum, which is also statically significant at a 90% confidence interval. Notably, the simulated result indicated that perch population size will increase as nutrient loads and the combined relative harvest rates are decreased. This indicated the requirement of shorter time periods to reach steady a state population level. Therefore, measures to reduce nutrient loads will increase the population of perch, which, in turn, create societal benefits in terms of, among others, commercial and recreational fishery.

Transforming the Economy Sustaining Food, Water, Energy and Justice

The Value of Improving Biodiversity in the Rocky Habitats Ecosystem by Removing ALDFG

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Type of Presentation: Paper presentation

Biography: Stefania Tonin is an economist. She is an associated professor at the Department of Design and Planning in Complex Environments, University IUAV in Venice. She has wide experiences in environmental economic valuation and economics of sustainability.

Abstract: Halting biodiversity loss in either the coastal or the marine environment represents a fundamental objective for EU. The EU Integrated Maritime Policy recognizes the necessity of reducing anthropogenic pressures in an integrated ecosystem-based approach and suggests the development of sustainable sea-related activities.

The aim of this paper is to provide an estimate of people's willingness to pay for an improvement of biodiversity change thanks to detecting and removing the abandoned, lost or discarded fishing gear (ALDFG) in the North Adriatic Sea, in Italy.

The ALDFG causes considerable damage to the natural environment, including the destruction of nursery areas and the accidental entanglement of marine protected species. In general, the main threats recognized in this ecosystem area are the degradation due to waste water, the damage caused by destructive fishing methods, the negative impact of divers' activities, the effects of the invasion of alien species, non-sustainable tourist practices, water turbidity and alluvial sediments.

The paper presents some preliminary findings of a contingent valuation survey administered to a sample of 4000 Italian residents randomly selected and controlled by socio-demographic representative quotas with the help of a specialized firm in Computer Aided Web Interviewing (CAWI). We estimated the value of marine biodiversity improvement using different contingent valuation scenarios with various biodiversity improvement indexes and randomly assigned payments. We also asked respondents to provide the willingness to pay for supporting the issuing of a new regional regulation aiming to prevent further biodiversity losses and monitoring the ecosystem areas in order to avoid damaging behaviours.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Improving Social and Economic Justice for At-risk Youth through Urban Agriculture in Washington, D.C.

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3rd Author: Mchezaji Axum - University of the District of Columbia

Type of Presentation: Paper presentation

Biography: Harris Trobman and Kamran Zendehtdel are working in the Center for Sustainable Development focusing on urban agriculture and Green Infrastructure in context of sustainable development. Mchezaji Axum leads research and development in urban agriculture at the UDC Muirkirk Research Farm as the director of the Center for Urban Agriculture.

Abstract: Washington, D.C. high school graduation rates continue to lag behind other cities nationally. High school completion has far-reaching consequences and affects individuals' life trajectories both socially and economically. Individual benefits include better health and greater opportunities for the next generation. Furthermore, high school education is not only important to individuals; the societal consequences of a well-educated citizenry include increased productivity, lower crime rates, and increased community service (Sokatch, 2006). Lack of training and reduced opportunities for advanced education in these regions mean that there are few jobs for unemployed populations (DC Fiscal Policy Institute, 2011). At the same time, food security is a vital question facing Washington D.C.'s residents, where 8 census tracts are food insecure (DOH, 2014).

One way to address this socioeconomic concern is by providing youth entrepreneurial opportunities through UDC food hubs across Washington DC. This paper presents the efforts of faculty, staff, and students at the University of the District of Columbia (UDC)-College of Agriculture Urban Sustainability and Environmental Sustainability (CAUSES) and their initiative of engaging at-risk youth (17-22 years old) in a three-acre urban farm project in Ward 7.

The purpose of the project is to use various components of urban food hub food production, food preparation, food distribution, and waste reduction/reuse as a tool to train a group of at-risk youth to think about their future, how they can be part of the community and learn new skills and it enables them to find employment and working opportunities. At the heart of the CAUSES Urban Food Hubs project lie high efficiency food production sites that utilize bio-intensive, aquaponic, and hydroponic production methods. Engaging the youth in these activities creates economic opportunities for the youth while providing healthy, socially, and economically accessible food sources for the local residents of ward 7.

The UDC youth-centered urban agriculture project offers job-training programs and puts youth on a path toward education and full-time employment. In this way, they can learn about a wide range of food-related topics and sustainability. The project serves as a gateway to employment opportunities in a positive, friendly, and productive atmosphere. The UDC Urban Food Hub project in Ward 7 started in September 2015 and seeks to identify how local schools can be involved into the training programs to encourage an active youth participation and involvement.

The project unites youth of diverse backgrounds and uses food production and marketing as vehicles for developing leadership skills in the context of sustainable development. Our program not only provides technical skills to at-risk youth, it also provides communication and soft skills that the youth needs to present themselves in the market and find employment.

Transforming the Economy Sustaining Food, Water, Energy and Justice

How Low Impact Development Approaches are Guiding Campus Designs: Lessons from University of District of Columbia and University of Maryland

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4th Author: Victoria Chanse - University of Maryland

5th Author: Lea Johnson - University of Maryland

Type of Presentation: Full session

Biography: The panel is composed of different drivers of sustainability at UMD and UDC: Harris Trobman, Green Infrastructure Specialist Center for Sustainable Development, UDC; Kamran Zendehtel, Assistant Director Center for Sustainable Development, UDC; Kathy Denise Dixon, Associate Professor of Architecture, UDC; Victoria Chanse, Assistant Professor, Department of Plant Science & Landscape Architecture, UMD; Lea Johnson, Assistant Professor, Department of Plant Science & Landscape Architecture, UMD; Mark Stewart, Campus Sustainability Director, UMD

Abstract:

Universities, like many other institutions, are using the 21st century environmental challenges as an opportunity to make new investments, develop new courses and attract more students. Sustainable solutions for urban challenges like water and air quality, food and resources scarcity, climate change and urban development have attracted tremendous attention among researchers, policy makers and communities all around the world. In the D.C. Metro area, universities are including sustainability courses in their curriculum and using green infrastructure projects as living laboratories in their campus. This has enabled the universities to solve many environmental, social, and economic sustainability challenges and to provide their students as well as the public with new educational opportunities. Two landgrant Universities in the D.C. Metro area have been exploring the above sustainability approaches on their campuses.

The University of the District of Columbia (UDC) has been developing urban food hubs (UFH) and green infrastructure (GI) approaches on its campus including a 20,000 square-foot food producing rooftop and aquaponics systems to help promote sustainability and food security in Washington, D.C. In contrast, in Maryland's College Park campus, initiatives around campus resiliency and carbon reduction that have resulted in storm-water and biodiversity projects including a campus canopy and arboretum initiatives. Panelists from both campuses will highlight the innovative green infrastructure and low impact development techniques used on campus and how these approaches enhance sustainability benefits and shape education for the students and a broader community.

The integrated learning laboratories have led to strong innovation and participation in sustainability. The panelists will share a range of experiences from different roles of creators of sustainability projects. The EPA's Campus Rain Works Challenge, a design competition that promotes innovative applications of green infrastructure on campus landscapes as a tool for sustainability education, is one program that helps promote all facilities to link their curricula to the sustainability projects. A team of students from the Landscape Architecture and Engineering Studio at the University of Maryland and a team of architecture students from the University of the District of Columbia College of Agriculture Sustainability and Environmental Science (CAUSES) each submitted projects to the competition. UDC and UMD are both involved in the "business of sustainability," and seek to maximize their return in investment on projects and improving the lives of people and wildlife alike on campus.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Has Rising Income in Brazil Lead to More Energy-intensive Consumption?

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Type of Presentation: Paper presentation

Biography: Luis Gustavo Tudeschini is currently a second year PhD candidate at the Research Group on Bioenergy, Institute of Energy and Environment, University of São Paulo. He is a team member of the French-Brazilian research project entitled “Evolution of consumption patterns, economic convergence and carbon footprint of development: A comparison Brazil - France”. His PhD research focuses on regional economics, consumption patterns among income classes and their impact on energy consumption and related carbon footprint.

Abstract: In the first decade of the 21st century, Brazil experienced an important distributional change with almost nine million households ascending to middle and affluent income classes. In this context, the study’s main objective is to evaluate the distribution and patterns of Brazilian household expenditure, and the related total (direct and indirect) energy use.

The results confirm the conventional wisdom that, although higher income groups consume more energy, they also tend to consume less energy intensive market baskets as they rely more on services. A surprising finding is that over the period analyzed, most industries improved in their energy efficiency, except the electricity and fuel sectors, which represent almost 50% of the energy required in 2009, and whose energy intensity increased by 30%.

Transforming the Economy Sustaining Food, Water, Energy and Justice

The Connection between Fossil Fuel EROI, Human Energy EROI, and Debt

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Type of Presentation: Full session

Biography: Gail Tverberg is researcher at OurFiniteWorld.com, on topics related to energy and the economy. She is fellow of the Casualty Actuarial Society and has an MS in mathematics from the University of Illinois, Chicago. She is the author of academic papers, including "Oil Supply Limits and the Continuing Financial Crisis," published by Energy in 2012. She is director of the Energy Economics for Space Solar Power Institute, and has taught at the China University of Petroleum, Beijing.

Abstract: Joseph Tainter in "The Collapse of Complex Societies" talks about increasing complexity being necessary to overcome problems of diminishing returns, as human population outgrows its resource base. Suppose we define complexity as the increased concentration of energy use, through such approaches as the creation of capital goods, the fielding of larger armies, and the use of more hierarchical relationships within work groups, allowing some workers to receive an increasingly large share of the output of the system. The use of increased complexity has the possibility of gaining higher total return on human labor, for the group of workers as a whole, at least until diminishing returns reduces the total energy return for the group. The major problems with a system dependent on increasing energy concentrations are (1) debt needs to keep rising, to increasingly pay for these energy aggregations in advance of the time that the benefit of these aggregations of energy are actually realized, and (2) unless total net energy of the system is rising rapidly, wages of non-elite workers tend to fall too low, because too large a share of the output of the system is needed for the high-level energy aggregations of the system.

One corollary of this view of how we reach limits of a finite world is that alternative energy products should perhaps be considered from two perspectives: (1) the traditional Energy Return on Fossil Fuel Investment, and (2) the extent to which the use of alternative energy adds costs that will need to be paid in the future through future obligations (debt with interest, higher taxes, or future dividends).

Another corollary of this view is that the return on human labor (measured by after-tax wages), and the dispersion of this return on human labor, needs to be a concern. If the total return of the system is too low, the danger is that the return on the wages of non-elite workers will fall too low. If this happens, these non-elite workers will increasingly be unable to buy goods that require energy accumulations, such as vehicles, homes, and appliances for the home. This lack of affordability of big-ticket items can lead to a drop in commodity prices such as we are now experiencing, and ultimately lead to a collapse of the system.

Transforming the Economy Sustaining Food, Water, Energy and Justice

An Operational and Theoretically Sound Sustainability Assessment Framework for Integrated Coastal Zone Management

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Type of Presentation: Paper presentation

Biography: The research was funded by the Ministry of the Environment Government of Japan. The authors conducted research on Satoumi, a Japanese concept of socio-ecological production landscapes, in order to restore, attain, and sustain Satoumi. Information about Satoumi is available at https://www.env.go.jp/water/heisa/satoumi/en/index_e.html

Abstract: This study proposes a novel regional sustainability assessment framework for integrated coastal zone management (ICZM). The framework is systematic, not ad hoc, and transdisciplinary; it integrates three distinct approaches: Satoumi (a Japanese concept of socio-ecological production landscapes, SEPLs), ecosystem services (ES) approach, and inclusive wealth (IW) index. The three approaches complement each other and their combined integration makes the framework credible and operational. It is operational in that it provides practical guidance for its implementation and inputs into ICZM to attain or sustain a desired coastal zone. The framework was tested in Seto inland sea, Japan, along with in-depth analysis. The paper discusses its implications for ICZM and future research topics to further develop the framework.

IW is a stock-based sustainability assessment framework grounded in rigorous neoclassical growth theory and has been adopted mostly at national scale (UNU-IHDP and UNEP, 2012 and 2014). However, it faces theoretical and practical challenges in its application to a regional open subsystem and eliciting practical management implications. The original IW defines a sustainable development path as $dV(t)/dt \geq 0$ where $V(t)$ is a net present value of social welfare obtained from stocks at t . We extended the condition in two ways in order to make IW fit into our purpose: a strong sustainability condition and a desired social welfare condition. They require value judgment and need a consensus among stakeholders for which the original IW does not provide a clear guidance. Its implementation will be complemented by the Satoumi and ES approaches.

Satoumi, a Japanese SEPL, has been shaped through long-term harmonious interactions between humans and nature in a manner that fosters well-being while maintaining biodiversity and ecosystem services (Gu and Subramanian, 2012). Alternatively, Satoumi is the state of the coastal sea that a local community desires (Matsuda, 2011).

The ES approach bridges IW and Satoumi; while IW requires a specific list of stocks and their shadow prices, Satoumi describes what people want to benefit from coastal zones. The ES approach links ecosystem structure, processes, intermediate services, final services, and goods and benefits associated with human well-being/welfare (UKNEA, 2014). The human well-being can be measured in monetary value such as willingness to pay. ES approach also helps people understand what they receive and want from SEPLs since people are often not aware of what they want or are receiving (Costanza, 2015).

The framework was tested in Seto inland sea, through which we demonstrate how we can build IW (e.g. how to identify stocks) and what management implications we can obtain. The $dV(t)$ for Seto inland sea results show a 34% decline over the past five decades. In order to attain a desired Satoumi (i.e., to improve $dV(t)$), ICZM can influence the three components of $V(t)$: shadow prices, stocks, and external factors. An improvement of a stock's quality may raise the shadow price (which can be measured by WTP). Building or restoring a stock will directly result in a larger quantity of a stock. External factors such as NGOs/NPOs from outside the region (Matsuda, 2012) may also improve $V(t)$.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Valuation of Wetland Ecosystem Services: The Case of the Usumacinta Delta, Mexico

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5th Author: Vladimir Erives - El Colegio de la Frontera Sur

Type of Presentation: Speed talk

Biography: Vera Camacho Valdez is a CONACYT research fellow at El Colegio de la Frontera Sur-San Cristobal de las Casas, Chiapas (2015-ongoing). Her areas of research interest include environmental and resources economics with emphasis on assessing ecosystem services, spatial analysis (GIS and remote sensing) and coastal management. She received her B.S. in Oceanography from Baja California Autonomous University (Mexico), and her M.S in Marine Resources Management from Interdisciplinary Centre of Marine Science (Mexico).

Abstract: Usumacinta Delta wetlands are among the most productive ecosystems in Mexico, supporting diverse natural functions and providing important services to human societies. However, wetlands are under anthropogenic pressure, particularly due to land use changes, because they have traditionally been treated as areas of low economic value. This lack of awareness of the value of wetland conservation has resulted in the destruction or heavy alteration of these environments, generating substantial social and environmental costs.

The main objective of this study was to estimate the economic value of the ecosystem services provided by the wetlands distributed in the Usumacinta Delta. Therefore, it combines remote sensing and SIG to estimate the land use/land covers together with a value transfer approach to generate baseline estimates of the value of wetland ecosystem services.

The results reveal that palustrine wetlands are important not only in terms of coverage (591,989 ha) but due to the high economic value representing their ecosystem services, contributing significantly to the total value (80%), estimated at 16,000 million dollars per year. The map representing the aggregate values of the ecosystem services highlights the west region of the study area as the highest concentration of value zone, where the palustrine and river wetlands are some of the wetlands with greater presence. In accordance to the above and the overall results obtained in this research, we can argue that the conservation of these environments should be a priority in the design of future management plans.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Monetary Valuation of Natural Predators for Biological Pest Control in Pear Production

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Type of Presentation: Paper presentation

Biography: Steven Van Passel is associate professor of environmental economics at the Departement of Engineering Management of the University of Antwerp (80%) and at Centre for Environmental Sciences of Hasselt University (20%). As an ecological and environmental economist, he is interested in conceptual and methodological aspects of assessing sustainability, clean technologies and climate change. He has different peer-reviewed journal publications (50 SSI). The Centre for Environmental Sciences of Hasselt University is a multidisciplinary research centre.

Abstract: This paper values the biological pest control provided by three natural predators of pear psylla (*Cacopsylla pyri* L.) (Homoptera: Psyllidae) in low-strain organic pear production in Flanders (Belgium). Three research objectives are being addressed: (i) the quantification of the relationship between natural predator densities and the degree of pest suppression associated through development of an ecological simulation model, (ii) the estimation of the effect of a reduction in species richness of natural predators on marketable agricultural production and farm revenues through the use of production functions, and (iii) the introduction of an alternative valuation method for natural predators based on their ecological function in the ecosystem. This approach results in a monetary value for marginal changes of biodiversity losses (here: reduced number of natural predators) whereby the functional role of the species in the ecosystem (here: pest control) is the key mechanism for affecting the provisioning of a marketable good (here: agricultural production).

With the use of STELLA 10.0.6 (Costanza and Gottlieb, 1998; Costanza and Voinov, 2001), the bio-demographics of the pest insect *Cacopsylla pyri* (Pp) and the interaction with (i) *Anthocoris nemoralis* (An), (ii) *Allothrombidium fuliginosum* (Af) and (iii) *Heterotoma planicornis* (Hp) (Erler, 2004) are simulated over a period of one year. The economic model assesses the costs of a loss in species diversity by analyzing the effects on yield quality decreases at farm scale, calculating the impact on gross revenue and net income.

Linking biological pest control losses, which result from the ecological simulation model, with the economic model is established by identifying a damage threshold function. Irrespective of gross or farm income and irrespective of the generalist or specialist nature of the species under investigation, the indirect use values which can be assigned to the ecological functions performed by natural predators range between 1255 €/ha-1 and 5832 €/ha-1 for one natural predator and between 5084 €/ha-1 and 10093 €/ha-1 for two predators. Effective valuation of biodiversity can include both intrinsic as well as economic arguments. In order to take into account the effect of biodiversity losses in economic arguments, it is imperative that the ecological function is taken into account. This implies some challenges. Modeling real systems is rarely simple and the reality shows a great variability both in ecological as well as in economic parameters. The analysis provided here is therefore a conservative indication of the effect of the loss of entire species on the provisioning of biological pest control and on the decrease of quality.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Integrated Sustainability Assessment of Agro-ecological Systems: The Case Study of the “Alta Murgia” National Park in Italy

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Type of Presentation: Paper presentation

Biography: Steven Van Passel is associate professor of environmental economics at the Departement of Engineering Management of the University of Antwerp (80%) and at Centre for Environmental Sciences of Hasselt University (20%). As an ecological and environmental economist, he is interested in conceptual and methodological aspects of assessing sustainability, clean technologies and climate change. He has different peer-reviewed journal publications (50 SSI). The Centre for Environmental Sciences of Hasselt University is a multidisciplinary research centre.

Abstract: Several indicators and methods are already applied for sustainability assessment in agriculture. The links between sustainability indicators, agricultural management and policies are not well explained. The aim of this study is to combine biophysical and monetary sustainability assessment tools to support agriculture policy decision making.

Four methodological steps are considered: i) the environmental impacts of farms are assessed using terrestrial acidification, freshwater eutrophication, soil and freshwater eco-toxicity as well as natural land transformation; ii) the most relevant indicators of agriculture damages on ecosystems are aggregated into an index; iii) the farms index scores are integrated with farm assets, land and labor, into the Sustainable Value approach (SVA), as indicator of natural resources used by farms; and iv) the return to cost ratio and different resource productivities are assessed.

As a case study, the methodology was applied to arable farms with and without animal husbandry of the "Alta Murgia" National Park. The crops farms, in our sample, have a higher sustainable value using their economic and environmental resources. Mixed farms need to improve their resources use efficiency. Although crop farms have lower land-use efficiency compared to mixed farms, our results suggest supporting, by means of policy options, the specialized crops farms that, on average, perform better in terms of biodiversity preservation. Finally, we find that Life Cycle Assessment (LCA) to soundly measure the environmental impacts clearly enriches the SVA.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Identifying Policy Options for Achieving Sustainability in Social-ecological Systems of Amazonian Regions

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Type of Presentation: Paper presentation

Biography: Prof. Dr. Consuelo Varela-Ortega is a full professor of agricultural economics at the Universidad Politécnica de Madrid (UPM), Spain, specializing in agricultural and water economics and climate and policy interactions of social and natural systems. She has directed more than 25 research projects, taken part in advisory panels of international institutions (IFPRI, CGIAR, CIRAD, FAO), and has been panel expert of research projects and programs with the EU Commission and a member of the advisory group in DGRTD for Environment

Abstract: In recent decades, the Amazon Basin has been subject to extensive deforestation, being responsible of most of greenhouse gas emissions on Earth. The causes behind such deforestation are complex, but can be attributed mostly to agricultural expansion, infrastructure development and timber extraction. Numerous strategies and initiatives have been designed to preserve and restore tropical forests. However, the success of such strategies is determined by the context of countries in which they are developed, the causes of deforestation in those countries and the responses at local level.

This paper studies the future of social-ecological systems in two case studies of the Amazonian region, the Bolivia lowlands of Guarayos and the Brazil Tapajos National forest. Social-ecological systems are linked complex systems that pose substantial challenges for modeling. In this regard, Fuzzy Cognitive Maps (FCMs) have proven to be a useful method for capturing the functioning of this type of systems and for simulating the effects of changes in the system, such as policy interventions. The research is carried out in the context of the EU project ROBIN (The Role of Biodiversity in Climate Change Mitigation) and it is based in the carrying out of a series of stakeholder workshops to develop locally perceived future scenarios on the evolution of the ecological and human systems using FCMs.

To capture the local stakeholder visions, we started by using the general IPCC-Shared Socio-Economic Pathways (SSP), which were downscaled using FCMs. We used complex networks concepts, such as the adjacency matrix and centrality properties to calibrate the FCMs. In the two case studies, the downscaled SSP1 scenario represented the stakeholders' sustainable future, where control of deforestation, improved people livelihoods and sustainable agriculture were the most important goals.

Main policy actions to attain these goals differed across case studies. In Bolivia, key actions include alternatives to local economy through new infrastructures, access to credit or technical capacities. In Brazil, social and political actions, such as enhanced social participation, greater social awareness and improved institutional settings were predominant.

In order to prioritize the policies that would achieve sustainability in the two Amazonian case studies, we developed a DSS using the Analytic Network Process (ANP). This multi-criteria assessment tool can assist in considering real world decision problems represented as a network of interconnected elements such as those included in the FCMs. Stakeholders in Bolivia prioritized the following three options: technical training, programs to assist subsistence farmers and improving the implementation of land use zoning; whereas in Brazil, governmental coordination, investment in health and education and programs to aid integration of agricultural and forestry activities were preferred. These options were generally found to have considerably high social acceptance, with high levels of associated implementation costs and widespread compatibility with present legislation.

With respect to the methodology, this study shows that a coupled application of FCMs and ANP highlights some mutual benefits of both approaches, with FCM facilitating problem-structuring and supporting scenario building, whereas ANP supports multi-criteria evaluation and capturing and prioritizing stakeholder preferences.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Longterm Perspectives on Water Use, Climate Change and Human Development in the Mediterranean

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Type of Presentation: Paper presentation

Biography: Prof. Dr. Consuelo Varela-Ortega is a full professor of agricultural economics at the Universidad Politécnica de Madrid (UPM), Spain, specializing in agricultural and water economics and climate and policy interactions of social and natural systems. She has directed more than 25 research projects, taken part in advisory panels of international institutions (IFPRI, CGIAR, CIRAD, FAO), and has been panel expert of research projects and programs with the EU Commission and a member of the advisory group in DGRTD for Environment

Abstract: The Mediterranean region is one of the world's most water-scarce regions and climate change hotspots. Social and political developments as well as future climate projections envisage dramatic implications for the water and agricultural sectors that will endanger economic development and lead to natural resources degradation and social instability. This study aims to assess the long-term socio-economic and environmental effects of different societal and human development scenarios and trends in the effect of climate change on future water use in the water-scarce southeastern Mediterranean rim countries (MED11: Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Occupied Palestinian Territory, Syria, Tunisia and Turkey).

The scenarios are defined in the EU project MEDPRO (Perspectives for the Mediterranean region) considering two dimensions: (i) sustainability and (ii) cooperation between the two shores of the Mediterranean (EU and MED11 countries). To address these complex interactions of the human and water systems we have carried out a panel-data based econometric analysis on water use trends and long-term scenario-based future projections across sub-regions and individual countries.

To cope with water resources variability and a changing socioeconomic environment, different modes of water resources management and adaptation measures have been analyzed for each country and scenario. Results show that climate, as well as socio-economic projections in the different scenarios, may have clear differential effects on water withdrawals across the MED11 countries over time.

The analysis illustrates that the most sustainable scenarios that entail Euro-Mediterranean cooperation mitigate water withdrawal in all countries in spite of the increase in water demand due to changes in population, GDP and trade. This is due to the installment of more efficient water technologies as well as the adoption of demand-side water saving management policies. However, in all scenarios and for all countries, to close the gap between water demand and supply would require a combination of additional measures and water investments.

The effectiveness of adaptation measures differs across countries and scenarios, being more acute in the most water-scarce countries where the cost of overcoming the lack of water and climate change effects will be highest. The study also points out that the scenarios where factors such as effective water management, governance and structural change are predominant, water resources and social stability are more secured. In general, the study concludes that for supporting efficient water policies an integrated vision is required. Technical and agronomic drivers will not be sufficient, and economic, social and institutional factors have to be considered. The study shows that, envisaging a future of stronger Euro-Mediterranean alliance, the MED11 region can benefit from more integrated agricultural and water policies. This type of scenario-based analysis can support policy integration and improve preparedness to climate and societal changes in water-scarce countries.

Key words: Water management, econometric analysis, socio-economic scenarios, adaptation, climate change, Mediterranean region

Transforming the Economy Sustaining Food, Water, Energy and Justice

The Role of Public Private Partnerships in International Food Security

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Type of Presentation: Paper presentation

Biography: Madhavi Venkatesan is a faculty member in the Department of Economics at Bridgewater State University. Prior to re-entering academics, Madhavi held senior level positions in investor relations for three Fortune 250 companies. Madhavi started her financial services career after completing her post-doctoral fellowship at Washington University in St. Louis. She earned a PhD, MA, and BA in economics from Vanderbilt University and a Masters in sustainability and environmental management from Harvard University.

Abstract: Chronic food security issues in Africa have spurred an increase in public–private partnerships (PPPs), as governments across the continent seek to stimulate agricultural productivity. Through multiple international channels, PPPs are implementing programs within the agricultural sector with the stated intent to promote both nutrition and food security. However, the success of agricultural PPPs is yet to be proven. Further and related, concerns exist among stakeholders that the humanitarian objective of PPPs may be obscured in lieu of investor returns.

This paper evaluates one PPP, the Global Agriculture and Food Security Program (GAFSP). Using a single country example, Malawi, findings of the GAFSP activities validate concerns related to PPP objectives and outcomes. Additionally, the assessment surfaces the need for proper governance and oversight of PPP activities to ensure internal alignment between public and private initiatives. The paper concludes with recommendations for PPP deployment.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Evaluating Nuclear Energy from the Viewpoints of Social Costs, Social Capital, and Social Justice and Impacts to the Communities in the Navajo Nation and Fukushima, Japan

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Type of Presentation: Paper presentation

Biography: Yoshihiko Wada is a professor at the Faculty of Economics, Doshisha University, Kyoto, Japan. He graduated from the School of Community and Regional Planning at the University of British Columbia, Vancouver, BC, Canada and obtained his PhD in 1999. He was a visiting scholar at the Gund Institute in 2008/2009. He has taught issues on the topic of the environment and natural resources and ecological economics. His research focuses include the Ecological Footprint, environmental and social impacts of uranium, rare earth mining and nuclear energy.

Abstract: Nuclear energy is often held up as a realistic and cost-effective way of addressing energy shortage and global warming simultaneously. However, this technology exhibits profound defects, which threaten democratic, harmonious and sustainable features of society. Examples of these defects include degradation and destruction of social capital in communities as well as increased social costs and inappropriate discriminatory treatment of workers. Health impacts to the workers and residents who live in the surrounding communities of nuclear facilities are not insignificant. Another example of social costs are the prolonged impact management (PIM) costs of spent fuels and decommissioned nuclear reactors (highly radioactive toxic materials) inherited by future generations for more than one hundred thousand years. These negative aspects of this high-tech energy source are often concealed and whitewashed in systematic efforts, both internationally and nationally, which are orchestrated by the powerful international nuclear lobby groups.

This paper critically examines whether this high technology and the supporting systems have provided net benefits to humanity in the last several decades in terms of social costs, social capital, and social justice. It also examines how and why this seemingly anti-democratic and repressive energy regime has survived in the democratic world over the last several decades. Data and information collected through literature reviews is used in addition to historical and scientific studies conducted by the members and adherents of the Society for Studies on Entropy (sometimes considered the equivalent of the Ecological Economics Society in Japan. A past honorary president was Nicholas Georgescu-Roegen) as well as information collected through field visits to communities in the Navajo Nation and Japan.

I first look into the long-term social costs of nuclear energy use. These include various costs from the upstream to the back-end stages, for example, health impacts to the workers in the uranium mine sites and refineries in Navajo communities as well as to the workers who are engaged in periodic inspections and repairs of nuclear reactors in Japan.

Second, I examine the negative impacts to social capital after nuclear power plants have been in place in Fukushima and other communities in Japan. One of the typical impacts is the division of communities into pro- and anti-nuclear groups. The stakes at risk in having a nuclear project on site are so high and long-term that the tension and distrust between the two groups of a community are often much more divisive and extensive compared with other types of public projects such as construction of highways and waste incinerators. After the 2011 nuclear disaster in Fukushima, communities and sometimes families were divided into three groups, 1) a voluntary evacuation group, which distrusts official announcements on safety, 2) those who distrust the government but could not evacuate because of various reasons, and 3) an anti-evacuation group, which trusts what the government says.

Finally, I critically examine the further dependency on nuclear energy which may be enhanced by the use of the liner motor trains and electric and fuel cell vehicles which are generally believed to be cleaner and environmentally friendly modes of transportation.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Studies on Teaching Content System for Ecological Economics

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Type of Presentation: Paper presentation

Biography: Shuyu Wang, PhD, was born in 1964 and graduated in Shanxi Agricultural University for plant protection with a Bachelor's degree in 1985. She obtained a botanic Master's degree in 1997 from Lanzhou University. In 2006, she obtained her doctorate in ecology from Nanjing Agricultural University. Now, she is associate professor and vice president in the College of Environmental Economics at the Shanxi University of Finance and Economics. She is mainly engaged in ecological economy assessment and regional planning.

Abstract: Ecological economics is the scientific study of integration systems of ecological economics, in an effort to solve the ecological economic contradictions for sustainable development of eco-economic system. The subject is less than 50 years old, and has been taught at universities for only 20 years. Currently, the teaching content system of ecological economics is far from perfect.

Looking at ecological economics textbooks in Chinese, differences are obvious in contents. It is mainly reflected in: (1) Different content selection – although these textbooks substantially have the same arrangement in the context system, the choice of the specific content is emphasised differently. Some focus on industrial upgrading and technological practice of eco-economy, while the others focus on eco-economic accounting and analysis, evaluation methods, specific to the population, economic growth, consumption, technology, trade, and distribution; (2) Lack of a sound logical framework – The choice of the logical framework is not handled with enough attention, resulting in many textbooks being confusing and incomplete in content.

The theoretical study in ecological economics abroad developed from the classical period of some well-known economists, thinking about the relationship between economy and nature, while criticizing the traditional economic theory. However, most of them essentially do not discuss population issues and few analyse technical problems of the eco-economic system. It does not involve the eco-industries.

A perfect teaching content system usually has a clear logical starting point, as a good foundation to construct the system, which will expand the chapters following a clear and logical order. Logical starting points are often the main ideas of a textbook, a logical clue is its framework, with and it selects its content. With such a clear structure, ordering of textbooks would not be such a random phenomenon.

The sustainability assessment equation ImPACTS can be used to construct a logical framework for a teaching content system in ecological economics. ImPACTS was derived from IPAT by the demographer Paul R. Ehrlich, and was proposed in 1971 to represent relationships between the environmental impact and its factors. IPAT expressed human environmental impacts (I) as factors driving for population (P), affluence (A) and technology (T). Waggoner and Ausubel (2002) developed the IPAT equation as IMPACT, of which (C) stands for consumption. Xu Zhongmin (2005) considers the ability to mitigate environmental impact after social development, turning the equation IPAT to IMPACTS, giving meaning to the management of (M).

According ImPACTS logical idea, the teaching content system of ecological economics is composed of five parts: (1) Integration or introduction (I): subjects on the characteristics and discipline of ecological economics; the structure, functions and succession of eco-economic systems; the law of the inherent contradiction in complex system. (2) Production, Consumption, Technology (PCT): introducing ecological industries, eco-agriculture, eco-industry, eco-service, eco-consumption and eco-market. (3) Assessment (A): analyzing value, efficiency, and accounting methods of ecological economics. (4) Management (M): ecological economic management, mainly on ecological economic planning and Regional. (5) Social (S): introducing eco-economic systems and eco-economic policy.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Using a Virtual Portrayal of Depleting and Polluting to Deter Earning and Spending

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Type of Presentation: Speed talk

Biography: I am a practitioner of ecomedicine. My patient is the ecosphere.

Abstract: This study uses a model of depleting and polluting to deter earning and spending. Can such a model be used effectively? Previous models have generally focused on specific instances of depleting and polluting; this model addresses depleting and polluting in general.

The model uses US BEA input-output data to construct a virtual money subunit (USD 0.01) that displays on one side the current pattern of depleting (associated with earning and producing), and on the other side the current pattern of polluting (associated with spending and consuming). Such virtual money subunits are made available to study participants for their use in representing both their actual and potential instances of earning and spending, with the participants recording both their general and specific reactions to their use as indicators of depleting and polluting. Any reduction of earning and spending as a result of using the virtual money subunits would imply a potential ecologic and economic benefit from using them on a wider basis.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Ecological Economics in Latin American Public Policies: Food, Resources and Justice

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3rd Author: Alberto Lopez Calderón - Litoral National University, Argentina

4th Author: Mario Pérez-Rincón - University del Valle, Columbia, and Andean Ecological Economics Society

5th Author: Maria Amélia Enríquez - Federal University of Pará, Brazil

Type of Presentation: Full session

Biography: A group of ecological economists with leadership roles in the Latin American ecological economics societies got together to organize this panel: Walter Pengue, General Sarmiento National University and Alberto Lopez Calderon, National University of the Litoral, both from Argentina; Mario Perez of the University del Valle, Colombia; Maria Amélia Enríquez, Federal University of Pará and Joseph S. Weiss, University of Brasília, Brazil, corresponding authors.

Abstract: The Latin American ecological economics societies propose to organize a session on Ecological Economics in Latin American Public Policies: Food, Resources and Justice, as part of the topic Public Policy for Local and Global Sustainability, with a special concern for institutions, governance, politics and economics. The session is the result of interaction among the four societies of ecological economics in the region: Brazilian, Argentine-Uruguayan, Middle American and Andean.

The session will deal with the ecological economic and political elements of national public policies in Latin America, the use of natural resources, the reversion to Prebischian conditions of the 1970s and its relevance to food, natural resources, biodiversity and water, as well as the region's relations with global environmental justice. It presents views and analyses consistent with wide-held thought among Latin American intellectuals shared by many others in the South. Many of the articles merge updated ideas of the 20th Century's UN Economic Commission with ecological economics, taking into account the developments at UNEP, at the societies' recent meetings, at the UN environment conferences and many other recent events and literature.

The paper covers the following topics:

1. Policies relevant to food and natural resource issues
2. Ecological political economics and resource metabolism seen from the South, by Walter Pengue,
3. Socio-ecological impacts of re-primarization in Latin American economies, by Alberto Lopez Calderon.
4. International trade from a physical ecological Prebischian perspective, by Mario Perez
5. Mining in Latin America – from super-cycle to new normal – economic and socio-environmental implications by Maria Amélia Enríquez

6. Policies relevant to biodiversity and water resources: The Search for Anthropocenic Ecological Justice: Conflict within the United Nations Political System on the Role of Nation-States, by Joseph S. Weiss.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Preparing a Latin American Position Paper

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3rd Author: Alberto Lopez Calderón - Argentine-Uruguayan Ecological Economics Association

4th Author: Mario Pérez-Rincón - University del Valle, Columbia, and Andean Ecological Economics Society

Type of Presentation: Roundtable

Biography: Joseph S. Weiss is a collaborating researcher at the Center for Sustainable Development of the University of Brasilia. He is an ecological economist who obtained his PhD at Cornell University in 1971. He has dedicated his career to analyzing public policy and the processes by which they are developed and implemented, devoting special effort to environmental policy, especially in the Brazilian Amazon. His recent research has been on stakeholders and social movements.

Abstract: In 2009, The Brazilian Society of Ecological Economics produced the Cuiabá Letter at its 8th biennial meeting, stating its concerns for the challenges of Brazil's environment. In 2012, at the Rio ISEE meeting, regional societies organized a "South" panel to develop the position of the emerging countries, with representatives from Brazil, Russia, India, China, Argentina and Nigeria.

Following up on these steps, the Brazilian Society of Ecological Economics (ECOECO) prepared the Araraquara Consensus at its XI National meeting, held in that city of state of São Paulo, jointly with the VII Iberoamerican of Development and Environment Congress, on September 8-11, 2015. It outlined 10 ECOECO objectives following the topic of these meetings: applications of ecological economics to Latin American public policy, authorized by the ECOECO General Assembly in consultation with the three other regional societies of the International Society of Ecological Economics. Within the context of ecological justice, the 10 topics selected were well-being indicators, decoupling, innovations, agriculture, ecosystem services, water resources, cities, large works, awareness and governance.

These ISEE regional societies propose a special session at the ISEE2016 meeting in Washington to discuss the objectives with the ISEE members present at the time. After distributing the latest version of the document in advance, in English, Spanish, Portuguese and possibly other languages, a representative of the regional societies would present it and the presidents of the four societies (or their representatives) would then debate with the audience about the ecological justice issues laid out therein. Other debaters will be invited, from other regional societies and from outside the ISEE.

One possible outcome would be a new ECOECO Washington Consensus, agreed to by these members. It also could be considered by ISEE as a whole, if the Board so requests. In this case, other topics dealt with at other ISEE2016 sessions would have to be included. The procedures for a democratic discussion and outcome remain to be defined.

In considering the inclusion of this session in the ISEE2016 Program, I submit the attached draft English translation of the Araraquara Consensus. Given that this was completed on the final submission deadline, we request that, in the review of this session proposal, adjustments be considered, taking into account later suggestions by the regional societies and ISEE.

Transforming the Economy Sustaining Food, Water, Energy and Justice

UN Environmental Policy: Actors, Trends and the Regulatory Role of the State

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3rd Author: Maria Amélia Enríquez - Federal University of Pará, Brazil

4th Author: Peter May - Federal Rural University of Rio de Janeiro (UFRRJ)

5th Author: Stanislav Shmelev - University of Oxford, and Environment Europe Ltd

Type of Presentation: Paper presentation

Biography: The corresponding author of this paper is Joseph S. Weiss, collaborating researcher at the Center for Sustainable Development of the University of Brasilia. He is an ecological economist who obtained his PhD at Cornell University in 1971. He has dedicated his career to analyzing public policy and the processes by which they are developed and implemented, devoting special effort to environmental policy, especially in the Brazilian Amazon. His recent research has been on stakeholders and social movements.

Abstract: The authors seek to bridge the research gap identified by the Earth System Governance Project on the influence of UN non-state actors (civil society and corporate organizations) on the role of the nation-state in emissions reduction policy, its impact upon environmental justice and the prospects for a desirable future and ideological transition in the Anthropocene. To this end, they conceive the UN political system stakeholders as consisting of four heterogeneous networks, two state (“north” and “south”) and two non-state, civil society organizations and transnational corporations.

The paper reviews changes in UN architecture and agency. A timeline shows that UN architecture gradually shifted from favoring civil society to corporations. Regarding agency, peak corporate organizations, with green economy objectives, increased their access to nation-States and UN agencies more than civil society organizations seeking sustainable development. The corporate green economy frame influenced UN documents, shifting world debate towards a voluntary corporate orientation, while reducing the regulatory and enforcement roles of the State.

For market incentives to reduce environmental degradation, stronger nation-states are needed to enforce regulations and implement related policies, enhanced by business and civil society initiatives. Better dialogue among governments, corporate and civil society organizations is important to make progress towards the UN sustainable development goals.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Food Security: Inconvenient Questions

Corresponding Author: Richard White - Smith College
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Type of Presentation: Paper presentation

Biography: Richard White is Professor Emeritus of Astronomy at Smith College (Northampton, MA). While at Smith, he affiliated with the Environmental Science and Policy Program and taught a course on the science and policy of climate change. Since taking early retirement in 2002, he has been a community sustainability and climate protection advocate. He is the author of three book chapters on global food security, and also serves on the Durango, CO, City Council.

Abstract: Noted historian of science George Sarton once wrote: ""In science immense progress is made whenever the right question is asked, the asking in proper form is almost half of the solution, but we can hardly expect these right questions to be discovered at the beginning."" Although global food security has dimensions beyond science, his observation suggests asking: what are the "right" questions that would enable successful responses to the daunting challenge of global food security?

Discussions of food security tend to focus narrowly on the food system, typically on the already challenging question "Can we feed the world?" Including the temporal dimension of Food Security, meeting everyone's nutritional needs at all times, expands the scope of inquiry. This entails attention to the environmental impacts of agriculture and to systemic linkages to broader sustainability issues, especially climate change. System dynamic models, following the pioneering initiative of Limits to Growth, reveal the unsustainability of indefinite economic growth and imply its insufficiency to produce global food security. Ecological economists espouse a steady state economy as a means to a sustainable and desirable future, which necessarily would incorporate food security. Unfortunately, awareness of this alternative paradigm scarcely exists in global policy circles. Whether or not global food security is even possible then becomes an inconvenient question that challenges efforts around this crucial topic. This presentation examines the following questions:

- Can we feed the world?
- How does food security link to other global challenges?
- What do system dynamic models say about interlinked global challenges?
- How do we create a sustainable, desirable, and food-secure future?
- Is global food security even possible?
- What can ecological economists do to enhance the possibility?

Transforming the Economy Sustaining Food, Water, Energy and Justice

Managing the Scale and Distribution of Nonpoint Source Pollution: Lessons from Agriculture

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3rd Author: Mindy Selman - USDA

4th Author: Suzie Greenhalgh - Landcare Research, New Zealand

5th Author: Laura DiPietro - State of Vermont Agency of Agriculture, Food, and Markets

Type of Presentation: Full session

Biography: Our session is the work of a diverse, multi-national team comprising researchers and policymakers representing: the Gund Institute for Ecological Economics at the University of Vermont; the State of Vermont Agency of Agriculture, Food, and Markets; the Landcare Research New Zealand, the United States Department of Agriculture; and the World Resources Institute.

Abstract: For many decades, policymakers have struggled with the challenge of managing nonpoint source pollution. The challenge is particularly acute in food systems, where a productivist paradigm has led to farm and market consolidation, intensification, and regional specialization, amplifying the impacts of nonpoint source nutrient pollution.

In this session, we will explore different approaches to managing nutrient pollution at the farm, watershed, state, and national scales, drawing upon examples from the United States and New Zealand. In this context, we focus on the challenges inherent to nutrient pollution management given landscape heterogeneity and the complex economic, social, and political factors that shape food systems at multiple scales. Presenters will assess regulatory and non-regulatory strategies in light of their effectiveness in addressing competing management priorities and engaging key stakeholders, including the agricultural community.

Management of nonpoint source nutrient pollution is a challenge that lies at the heart of ecological economics. In examining different efforts to solve this “wicked” problem, we hope to draw lessons that can be applied to similar policy challenges featuring multiple competing goals and finite resources in complex realities.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Contingent Valuation and Deliberative Valuation: Examining Divergence in WTP Values Generated

Corresponding Author: Brian Witt - SOAS, University of London
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Type of Presentation: Speed talk

Biography: Brian Witt is a master's student in environmental economics at SOAS, University of London. Prior to this, he worked as an analyst for the United States Congress and as a public policy consultant. His research focuses on environmental valuation, particularly contingent and deliberative valuation, and experimental economics, particularly the dynamics of group decision making.

Abstract: Contingent valuation (CV) has emerged over the last two decades as one of the most commonly used environmental valuation techniques. One of the most important reasons for this increasing popularity is its theoretical ability to capture both the use, and non-use, values of a particular environmental good. However, concerns about the validity of values generated by CV has lead quite a few economists to favor combining CV surveys with more participatory and deliberative methods.

The author conducted a CV study of small-scale agricultural water users in central Mexico, examining the willingness of residents in the Valleys of Teotihuacan and Tlaxcala to pay higher water prices, through a gradual subsidy withdrawal. After the completion of this survey, the author also conducted a deliberative valuation study with the same participants, in order to compare the WTP value generated by the two techniques, given the same respondents and environmental good.

The results generated by the two techniques suggest that there may be considerable divergence in WTP values generated, even with identical groups of respondents and identical environmental goods being valued. The results also indicate that degree of this divergence may vary considerable depending on the cultural and institutional factors present in the particular valuation study.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Is Context and Complexity a Bridge Too Far? Metaphors for Infusing Multi-Level Governance in Policy Debate

Corresponding Author: Timothy Wojan - Economic Research Service
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Type of Presentation: Paper presentation

Biography: Tim Wojan is a regional economist at the Economic Research Service. His current research focuses on rural innovation, location and impact of the "rural creative class," the impacts of globalization on rural development, improving the information gleaned from econometric analysis for policy decisions, and assessing place-based alternatives to rural and agricultural development policy. During a two-year appointment to the OECD (2000 - 2002), Tim coordinated reviews of regional development policy in member countries.

Abstract: Despite a rich literature on the importance of governance and local context in finding sustainable solutions to vexing problems, these critical issues are often glossed over or disregarded in policy debates. The disciplinary hegemony of economics takes the blame for this sad state of affairs, which raises the uncomfortable question for non-economists: why does the arithmomorphic transformation of complex problems prove to be more compelling for non-specialist policymakers and journalists than arguments that fully address issues of context and governance?

The facile answer that simplistic arguments are more persuasive succeeds in both dismissing the target audience and dismissing the possibility of any improvement. A more productive answer examined in this paper is that economics has found ways to tap into more natural ways of knowing about phenomena through metaphor that are accessible to non-specialists. In this sense, metaphor can bring two separate domains into cognitive and emotional relation by using language directly appropriate to the one as a lens for seeing the other.

The metaphors used by economics are based in Newtonian physics that are able to tap into our common hardwiring to solve problems of motion and conservation of energy required by the First Law of Thermodynamics. For example, the metaphor of "cities as engines" of growth has been hugely successful in naturalizing the paradigm of new economic geography. In contrast, metaphors based on order and decay in open systems might be able to tap into our hard-wiring for solving problems associated with the Second Law of Thermodynamics, thus naturalizing many paradigmatic arguments regarding context and multi-level governance.

The specific metaphor to be explored is that of multi-level governance as tending a garden. Two uses of the metaphor will be demonstrated: 1) naturalizing the importance of context and complexity in policy problems, and 2) identifying problems of oversimplification by attempting to tend the garden using the economic paradigm.

Transforming the Economy Sustaining Food, Water, Energy and Justice

The Case for NNP or Inclusive Wealth-linked Bonds

Corresponding Author: Rintaro Yamaguchi - Kyoto University, Graduate School of Economics
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Type of Presentation: Paper presentation

Biography: Rintaro Yamaguchi's research interest lies in the theoretical and empirical study of inclusive wealth accounting, shadow prices of natural capital, discounting in climate change, demography and development, and other resource and developmental issues. He has publications in Economics Letters, the Scottish Journal of Political Economy and the Social Indicators Research, among others.

Abstract: We propose that national governments issue bonds whose interest payments link to green net national product (NNP) or, almost equivalently, link to inclusive wealth. The main intention of the paper is to create an incentive for investors and the national government to divert money into investment into human and natural capital, whose corresponding financial assets currently do not exist. As the concept of wealth expands, the corresponding asset side in the balance sheet of nations should, too. Whereas the argument for GNP-linked bonds is focused on trimming public debts toward fiscal sustainability, our NNP- or wealth-linked bonds are meant for ensuring long-term sustainability of an economy. Moreover, a welfare economic theoretical link is more plausible for our proposed bond.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Ecological Economics and Urban Sustainability

Corresponding Author: Ernest Yanarella - University of Kentucky

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2nd Author: Richard Levine - CSC Design Studio, LLC

Type of Presentation: Paper presentation

Biography: These bio-sketches have already been submitted. I am writing to substitute the third paper abstract for an early draft of one of the proposed papers, which I inadvertently attached to the session proposal

Abstract: The quest to retain a strong and robust understanding of sustainability has had to fend off assaults from the green movement that swept business and governmental domains in the nineties and the resilience “turn” in the early 21st century. The former promoted milquetoast renderings of sustainability that typically emphasized only one leg of the sustainability tripod and undercut the equity leg entirely. The latter, driven by a covert despair of the possibility of strong sustainability, drew upon the idea of resilience in an effort to fortify human communities at various scales against palpable threats to their integrity and for the most part putting in place programs and policies that would allow cities, nations or the globe to rebound from expected calamities, such as weather and other disasters, social, military or even health-related threats.

The purpose of this paper is to hone in on two tools for fortifying sustainability theory and practice in the face of these putative alternatives and to advance a sustainability agenda that promises to give stronger substance and deeper grounding to sustainability in reaction to sustainability skeptics in general, even those sustainability thinkers who have lost their way and become witting or unwitting allies to the sustainability counter-revolution.

The paper begins with a critique of the literature on “best practices” in order to retrieve from its allure and shortcomings a more valuable kindred and largely concealed concept—that of multiple scenario-building. From there, the paper develops a species of multiple scenario-building growing out the authors’ Sustainable City Game—namely, the multiple scenario-building process. The paper concludes with a demonstration how alternative or multiple scenario-building as a best process offers a means to take strong sustainable strategies to the next level through a step-level jump in democratic theory and policy sophistication and, in the process, overcome some of the conundrums facing the sub-discipline of ecological economics.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Estimating Averting Behaviors on Food Choices of Japanese Consumers after the Nuclear Power Plant Accident

Corresponding Author: Kentaro Yoshida - Nagasaki University
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Type of Presentation: Speed talk

Biography: Kentaro Yoshida received his PhD from Hokkaido University in 1997. From 1993-2003 he was a senior researcher at the Policy Research Institute of the Ministry of Agriculture, Forestry and Fisheries. From 2003-2009, he was associate professor at the University of Tsukuba. From 2009-2015, he was professor of ecological economics at Nagasaki University.

Abstract: This study aims at an econometric modeling of averting behaviors on food choices affected by radioactive contamination. Great earthquakes and tsunami in 2011 triggered the explosion of nuclear power plants in Fukushima, Japan. It led to the large-scale diffusion of radioactive residuals and the contamination of agricultural products. Direct damages to farmers were the restraint of planting and shipment. Indirect damages to farmers were the decrease in sales due to consumers' averting behavior on food with radioactive residuals regardless of their actual impacts. Consumers were likely to avoid the food produced near Fukushima even if the residuals level were below safety standards. Indirect damages were rather serious because it directly led to the decrease in farmers' income but it had not been fully compensated by the polluter or government, which were liable to severe damages.

In this study, the effects of radioactive contamination on consumers' averting behaviors on food choices were analyzed. Web-based questionnaire surveys were conducted all over Japan at three different timings. The first web survey was conducted in January 2012, 10 months after the nuclear accidents. The second survey was conducted in late December 2012, and the third survey in January 2014.

Surveys showed that consumers' averting behavior on agricultural and fishery products from the areas of which people were not convinced they were safe were not statistically different among three survey results. More than 60% of consumers avoided agricultural and fishery products from Fukushima and areas within 100 km concentric circle from ground zero. In order to compare with consumers' averting behaviors, a choice set of 47 prefectures and three foreign countries for country/region-of-origin labeling was presented. For food produced in Fukushima, people showed the highest averting behavior. About 20% of consumers responded: "do not want to buy" for the Fukushima-origin products. The rate of "do not want to buy" had not changed significantly between January 2012 and January 2014. Averting behavior still existed three years after the nuclear accident. On the other hand, about 80% of consumers responded: "want to buy" for products of Australian and U.S. origin compared with the products from Fukushima and the surrounding areas.

These consumers' responses to Fukushima and Australian products were analyzed by ordered probit model. A dependent variable with five Likert scales was the purchasing behavior towards products of each origin. Independent variables were: attitude toward radioactive contamination, health damage, economic damage, cancer risk, and knowledge of safety standards for radionuclides in food, residential areas, and age. The estimated results demonstrated that younger consumers were likely to avoid products of Fukushima-origin. Respondents who had children preferred Australian-origin food. Respondents who live near Fukushima did not avoid products of Fukushima-origin. This study revealed that the severe accidents of Fukushima Daiichi Nuclear Plant had a huge impact on Japanese consumers' behavior on food choices in terms of country/region-of-origin labeling. It led to a preference shift and has not rebounded to the pre-accident level.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Accounting Wealth in a Socio-Ecological Production Landscape: Regional application of the Inclusive Wealth Index in Japan

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4th Author: Shunsuke Managi - Kyushu University
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Type of Presentation: Paper presentation

Biography: Yuki will present findings of an ongoing project to operationalize the Inclusive Wealth Index and to capture the nonmonetary wealth of underappreciated socio-ecological production landscapes. She is a doctoral student at the Graduate Program in Sustainability Science Global Leadership Initiative (GPSS-GLI) at the Graduate School of Frontier Sciences, University of Tokyo with a BA from Middlebury College and MS from the University of Illinois at Urbana-Champaign.

Abstract: The present research adapts the Inclusive Wealth Index at the regional level in order to capture the social value of socio-ecological production landscapes in Japan. The research site is a rural island representing the harmonious coexistence of humans and nature and the bundles of ecosystem services such landscapes provide for human well-being. Given the limited ability of conventional measures of economic performance to capture the social welfare and human well-being of such landscapes, this application was conducted to better understand and document previously unrecognized benefits and challenges and their implications for sustainability. Moreover, an island society with a relatively transparent material cycle offers unique insights into the function and sustainability of socio-ecological production landscapes.

The current paradigm for understanding a society's performance focuses narrowly on economic growth and fails to capture the full range of factors that determine human well-being. While more comprehensive measures of social welfare and human well-being have been proposed, most are temporally limited and ill-fit as indicators of the potential social welfare and human well-being of future generations. The Inclusive Wealth Index improves upon those many existing measures by measuring the stock, rather than flow of capital. It also begins to address the interrelationship amongst the different capitals, taking into account not only manufactured capital, but also natural and human capitals. This study addresses the need for further applications and developments of the Index to increase the validity and reliability of the methodological approach.

Available longitudinal data were used in order to capture both the diversity and interrelatedness of the capitals including those easily missed in conventional economic indicators, as well as changes in these productive bases over time. Findings on the manifestation of aging and depopulation during the nation's rapid economic growth in the post-war era provide novel insights into the ability of the Inclusive Wealth Index to capture the dynamics of the capitals and their implications for sustainability.

As one of few longitudinal applications of this Index at the regional level, the study paves the way for future applications at other sub-national municipalities for monitoring and for decision making. It also raises questions regarding the instrument's limitations in capturing the essence of socio-ecological production landscapes. The presentation will elucidate upon continued work to more comprehensively capture the wealth of such landscapes through the addition of social capital, as well as efforts to empirically verify the results of this study.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Educating Youth in Urban Agriculture and Sustainability in Washington, D.C.

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2nd Author: Lorraine Clarke - University of the District of Columbia

3rd Author: Xiaochu Hu - University of the District of Columbia

4th Author: Richard Hess - University of the District of Columbia

Type of Presentation: Paper presentation

Biography: Zendehtdel (Ph.D.), Xiaochu Hu (Ph.D.), Lorraine Clarke (Ph.D), Richard Hess (M.A.) are working in the College of Agriculture, Urban Sustainability and Environmental Sciences (CAUSES) in the University of the District of Columbia (UDC). They are part of landgrant and academic programs which promote urban sustainability and green infrastructure projects. Their program goals are focused on improving the quality of life and economic opportunity of people and communities in the District of Columbia and beyond.

Abstract: In Washington, D.C., lack of access to affordable, nutritious food is a growing problem. From small grocery stores and cheap fast food restaurants to steady increase in heart disease, obesity, and diabetes, the evidence of food insecurity and food deserts is shocking. Food insecurity disrupts the stability that is vital to children's healthy development into adolescence and adulthood.

In spring and summer 2015, the College of Agriculture, Urban Sustainability and Environmental Sciences (CAUSES) started a youth urban agriculture workshop for middle and high schools students from underserved areas in Washington, D.C. During each workshop, between 25-40 students from one or multiple schools in D.C. joined a small team of professionals from CAUSES for two hours to learn and practice urban agriculture, soil health, farming in practice, diet and health and food tasting. The purpose of the workshop was to enhance student's knowledge on urban agriculture and change their behavior toward a healthier diet.

An outcome-based survey was developed from the youth urban agriculture program logic model, which contained both demographic and evaluation variables. The demographic variables were gender, race, and residence area (ward). The evaluation variables corresponded to program outcomes, like student's knowledge and behavior. These outcome variables were scored on a five-point Likert scale ranging from "strongly disagree" to "strongly agree". We look at the relationships between gender/race and self-reported learning outcomes using statistical tests and Ordinary Least Squares (OLS) regression.

T-test and OLS regression results show that female students have about half-grade (0.43-0.63 points) higher self-reported scores for both knowledge and behavioral change. T-test and OLS regression results also show that black students have about half a grade (.45) higher self-reported scores for knowledge but their self-reported behavior scores are not significantly different from non-black students'. Our results indicate that demographics that are at higher risk for food security issues (black and female students) have a larger increase in knowledge, indicating a greater value on knowledge or a larger increase in knowledge.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Residents' Welfare Evaluation for the Ecological Restoration of Landscape River in Suzhou, China

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2nd Author: Sheng Li - Department of Agricultural Economics, Auburn University

3rd Author: Manhong Shen - Nibo University

Type of Presentation: Paper presentation

Biography: Yifei Zhang is a full professor and researcher in ecological economics and environmental policy at Shanghai University of International Business and Economics.

Abstract: Numerous urban rivers have gotten ecologically restored by the central and local governments in China in the past several years. Residents' welfare can be improved by owing to the river restoration and this is essential for the input-output analysis of governmental spending. Compared with WTP (willingness to pay), WTA is a better index to reveal the improved welfare in a hypothetical market for ecosystem degradation, especially in a developing country.

WTA for Pingjiang river degradation was investigated in Suzhou based on the sample of 426 residents. Results indicate 48.4% respondents denied to accept any money compensating for the river degradation or landfill. The mean value of samples that are willing to accept compensation is 39,607 RMB, and the median value is 25,000 RMB. The result by an econometric model showed residents who had donated for an environmental issue before, were more satisfied with river, were in contact with the river more frequently, were employed, and owned a house were more likely to deny the WTA.

Moreover, results also indicated residents that who had lived by the river for a long time, who were much younger, who were nearer the river, and who had larger families, who had never donated for environmental issue and were unsatisfied with the green belt around the river were willing to accept more money.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Adaptive Management of Critical Transitions in Social Ecological Systems: Governing Alternate Stable States in Lake Champlain Basin

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4th Author: Andrew Schroth - University of Vermont

5th Author: Brian Beckage - University of Vermont

Type of Presentation: Paper presentation

Biography: Dr. Asim Zia is currently serving as an associate professor of public policy and decision analysis in the Department of Community Development and Applied Economics, with a secondary appointment in the Department of Computer Science, at the University of Vermont. He is also fellow at Gund Institute of Ecological Economics. All authors on this paper are part of NSF-EPS 1101317 project “Research on Adaptation to Climate Change: New Understanding through Complex Systems”.

Abstract: When exposed to exogenous shocks or endogenous surprises, recent complexity science-informed research on social ecological systems has demonstrated that these systems do not necessarily go through gradual change. Indeed, rather abrupt shifts between alternate stable states can suddenly take place. It is typically hypothesized that a loss of resilience usually triggers such critical transitions in the social ecological system’s state variable. Such stochastic fluctuations may often be driven externally; however, they can also result from internal system dynamics. How will social ecological systems undergo abrupt shifts into alternate stable states? Further, if social ecological modeling approaches could be used to generate an early warning or foresight about the tipping points in a complex system, will human actors within the system use the early warning to adapt and adjust their behaviors to avoid the worst case scenarios?

We examine these questions and hypothesis in the light of the social ecological system governing water quality in Lake Champlain. The multi-jurisdictional Lake Champlain Basin (LCB), situated in USA (New York & Vermont) and Canada (Quebec) and covers approximately 21,326 square kilometers. Anthropogenic climate change could induce abrupt alternate stable states in the Lake Champlain from more frequent and more intense flooding events in LCB to reduced ice cover internally in the lake system.

In this study we are modeling a suite of scenarios of human induced climatic change, increasing agricultural land usage and rapid urbanization in the Lake Champlain Basin, to determine if and under what conditions the Lake segments could abruptly switch to a eutrophic state. Furthermore, our integrated models examine the effect of proactive adaptive management strategies on prevention of further eutrophication of portions of the Lake under climate change.

We present a social ecological model using system dynamics approaches to simulate baseline and alternate adaptive management scenarios and, in particular, to generate foresight about the timing and incidence likelihood of critical transitions in two segments of the Lake Champlain. In this context, we demonstrate the potential of computer simulation models in visualizing alternate stable states for the Lake Champlain Basin under different management and governance scenarios and differential thresholds of risk and uncertainty about the tipping points and critical transitions. We draw broad theoretical implications for adaptive management of critical transitions in social ecological systems, with an emphasis on generating foresight/early warning for critical transitions, adapting social system behavior in response to the foresight and (social) learning through policy experimentation.

Transforming the Economy Sustaining Food, Water, Energy and Justice

Spatial Scale and Political Ideology Confound Climate Risk Communication

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Type of Presentation: Paper presentation

Biography: Dr. Asim Zia is currently serving as an associate professor of public policy and decision analysis in the Department of Community Development and Applied Economics, with a secondary appointment in the Department of Computer Science, at the University of Vermont. He is also a fellow at the Gund Institute for Ecological Economics.

Abstract: The communication of risk associated with adverse climate change impacts suffers from errors in translation from numerical (e.g. “35%”) to verbal (e.g. “unlikely”) expressions and vice versa. The numerical value that people associate with a verbally expressed risk varies greatly among individuals: a discrepancy that can potentially contribute to ineffective climate policy.

Here, we analyze experimental survey data from a random sample of Vermont residents taken in 2010 and repeated in 2012 (following Tropical Storm Irene in 2011) to identify confounding variables, and we show evidence through population-weighted regression models that political ideology, gender, education, and distance scale of the perceived climate change impact significantly influence the interpretation of risk. Moreover, we use pre- and post-Tropical Storm Irene data to explore the role of direct experience of flooding as a confounding variable in risk interpretation.

Contrary to our expectations, we find that people who directly experienced flooding from the storm in their community did not display a significantly improved risk perception, nor did they systematically overestimate interpreted risk as a result of the storm. An “anchoring and adjustment” heuristic, according to which people start with an implicitly suggested reference point (the “anchor”) to assess probabilities of future events and make “adjustments” to it to reach their risk estimates, could potentially explain this counter-intuitive finding, because we find that flood-prone communities have significantly higher baseline risk perceptions compared to the control groups.

Transforming the Economy Sustaining Food, Water, Energy and Justice

How Equitable are CO₂ Emission Entitlements in the Paris Agreement? Evaluation of “Intended Nationally Determined Contributions” Versus CO₂ Per Capita for a 2C Global Carbon Budget and Global Carbon Trading Mechanism

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Type of Presentation: Paper presentation

Biography: Dr. Asim Zia is currently serving as an associate professor of public policy and decision analysis in the Department of Community Development and Applied Economics, with a secondary appointment in the Department of Computer Science, at the University of Vermont. He is a fellow at the Gund Institute of Ecological Economics and the director of the Institute for Environmental Diplomacy and Security (IEDS).

Abstract: While the landmark Paris agreement negotiated by 195 countries under the auspices of UNFCCC COP21 meeting provides a bottom-up voluntary framework for nation-states to commit to reduce Green House Gas (GHG) emissions through so-called “Intended Nationally Determined Contributions” (INDCs), these commitments do not necessarily appear to be equitable in terms of allocation of CO₂ emission entitlements in the global atmospheric commons.

Although Paris Agreement stipulates measurable, reportable and verifiable nationally appropriate mitigation commitments on a “common but differentiated” basis, the INDCs submitted by the nation states are symptomatic of “grandfathering” decision heuristic, i.e. high emitters like US and oil producing countries will gain a substantially large allocation in the global carbon budget determined through running 2C above pre-industrial policy target in Global Circulation Models.

The equity implications of Paris Agreement can be determined by comparing the nationally reported INDCs versus a CO₂ per capita principle to allocate carbon emission allowances across the nation states. This study undertakes a comparative analysis of CO₂ emission allowances that will be available to each country of the world under Paris agreement negotiated “grandfathered” INDCs and CO₂ per capita decision heuristic for assessing the equity implications of the emerging international climate policy under the Paris agreement.

A new global carbon trading mechanism will be proposed to “equitably” share the global atmospheric common by enabling a UNFCCC mandated transfer of carbon credits from the countries that claim more than their fair share of GHG entitlements to the countries that can avoid GHG emissions by purchasing these carbon credits. The \$100 billion/year floor for financial transfers from industrialized to developing countries, established under the green climate fund and adaptation fund mechanisms of Paris Agreement, will be compared with the “equitable” share of financial transfers under a 2C global carbon budget allocation on CO₂ per capita basis.