

Poster Session

Monday, April 26, 2010 | 4:30 - 6:30 p.m.
Big Ten B

Presenters and poster descriptions

MSU Residential and Hospitality Services sustainability initiatives

Diane Barker, assistant director of sustainability, Residential and Hospitality Services, MSU

Display will showcase initiatives that Residential and Hospitality Services is involved with regarding sustainable initiatives. These include facilities, dining, and purchasing initiatives.

Climatically resilient hybrid poplar clones for woody biomass feedstock development

Sophan Chinn, Forestry, MSU

Woody biomass is a renewable resource that can serve as a feedstock to produce electricity and heat (bioenergy), as well as liquid fuels such as ethanol (biofuels) which in turn helps displace fossil fuel use. Sustainable woody biofeedstock production systems require a reliable supply of woody biomass. To be economically feasible, growth and yield of hybrid poplars needs to be accurately accounted for, and possible perturbations in biomass supply due to changes in climate must be accounted for to minimize risk in economic investments. However, there is limited understanding of the climatic sensitivity of short rotation woody crops such as hybrid poplars. The general objectives of this study is to identify climatically resilient hybrid poplar clones for woody biomass feedstock development. Specifically, tree-ring analysis methods (dendrochronology) were used to quantify the influence of climate on stem growth rates of hybrid poplars by measuring year-to-year changes in tree-ring width from different cultivars of hybrid poplar and relating annual growth patterns with past instrumental climate records (i.e., temperature and precipitation). Tree-ring analysis was conducted on a full-sib progeny plantation of different cultivars of hybrid poplars (*Populus x smithii* derived from different geographical variants of aspen parents: trembling aspen (*Populus tremuloides*) and bigtooth aspen (*Populus grandidentata*) located on Michigan State University property in the Sandhill Research Area. Climatic sensitivities that were identified in the hybrid poplar cultivars included: the degree of summer moisture stress, the timing of the start of the growing season, the timing of the end of the growing season, and the degree of winter harshness. The results also indicated that increased growth vigor appears to be associated increased climatic resiliency. Tree-ring analysis can thus contribute to retrospective screening of the sensitivity of hybrid poplar cultivars to climatic stressors.

Risk society and social capital: Implications for trust in social institutions to address global climate change

John Clements, Sociology and Environmental Science and Policy Program

Risk society theory and the concept of social capital have implications for trust in social institutions to solve environmental problems. I use data from the 2006 General Social Survey to test risk society theory and its supposition that reflexivity and individualization lead to a lack of trust in traditional institutions to address global climate change. I also test whether the presence of social capital predicts trust in social institutions, even in a risk society. Results support the notion that there is a lack of trust in business and government to address global warming, while science is overwhelmingly trusted to address this issue. In addition, social capital measures – especially helpfulness as a measure of reciprocity, and concern about environmental problems – predict trust in science, government and business to address global warming.

Climate change in a Great Lakes state: A qualitative review of a climate change conference in Indiana

Alexandre Ferreira da Silva, Northern Illinois University and Calumet College of St. Joseph

In Indiana, environmental groups are attempting to warn the public about the impending ecological, social and economic ills that will befall Hoosiers if measures are not taken to reverse the effects of climate change. The debate surrounding climate change in Indiana has made many people doubt the scientific claims supporting climate change made by environmentalists when compared against scientific claims that disparage the existence of climate change. Environmentalists in Indiana joined forces to inform the public of how climate change will harm all Hoosiers. According to environmentalists, Indiana will be irreversibly harmed by climate change. Action must be taken immediately or this Great Lakes state will experience permanent climactic, ecological and economic changes from the Ohio River in the south, up through the central agricultural heartland, all the way north to Lake Michigan. In an effort to inform the public about the harms of climate change, environmental groups in Indiana mounted a state wide education campaign. Earth Summit 2008 was organized by the Indiana chapter of the Sierra Club. Earth Summit was a state wide event held on the same day in various locations. The goal was to canvas the state with consistent information. To accomplish this, a one-hour video was developed and distributed across the state to inform the public about the impact of climate change in Indiana. In an effort to provide validity to their one-hour video, Sierra Club interviewed six experts. The experts represented various regions of Indiana and were specialists in the discipline they represented. The author attempts to determine how expert represented the possible effects of climate change on Indiana to Hoosiers. The author performed a quantitative analysis on the presentations given by the six experts. The goal of this study was to clarify the intent of each expert and how these tasks were accomplished. The results of this analysis demonstrate that the experts did use their specialized knowledge to influence the public. The analysis also shows that the themes selected by the experts were not consistent with one another. The desire to motivate people to act requires the use of consistent themes. The speakers did address the general topic of climate change but did not specify how climate change is/ has or will affect Indiana. The experts helped support the environmentalists' position on climate change but were unable to demonstrate that climate change is an immediate problem that requires immediate action.

The Kyoto Protocol: A preliminary assessment of compliance and enforcement issues

Jessica Fry, Criminal Justice and Environmental Science and Policy Program, MSU

The Kyoto Protocol represents an international attempt to curb global greenhouse gas emissions through the establishment of a cap-and-trade system for carbon dioxide emission credits. The creation of a global carbon market raises issues of monitoring, compliance, and enforcement that are not well understood. In the current paper, we offer a preliminary assessment of criminal activities and enforcement problems that have arisen in carbon markets around the world with a particular focus on the European Union Emissions Trading System. Our analysis is based on extant academic and news literature and original interviews with environmental and financial enforcement experts. Implications for shaping future efforts will be discussed.

The implementation of the European Union Emissions Trading Scheme and its impact on industrial competitiveness

Jong Duk Kim, Economics, MSU

Heavy anthropogenic carbon emission is pointed as the main culprit of climate change. So-called 'Cap-and-Trade' is nowadays the most favored market-based method to curb carbon emission in many regions of the world. Besides many benefits from emission trading scheme, one of the most intriguing questions and controversial debates related to emission trading scheme is whether the implementation of emission trading actually hurts the competitiveness of industries.

There are two most relevant yet opposite hypotheses about the impact of environmental regulation on industrial competitiveness; 'pollution haven hypothesis' and 'Porter hypothesis'. The former states

that the implementation of emission trading scheme raises cost burdens of the firms or industries regulated so that harms their 'competitiveness' against firms or industries from other regions that have less or no environmental regulations and some firms or industries may leave to those regions with less severe environmental regulations. On the other hand, the latter, asserted by Porter (1991) states that environmental regulations such as emission trading scheme spur the innovation of firms, increase productivity and so eventually benefit firms.

What we want to understand from this project using the data of the EU Emission Trading Scheme (EU ETS), the world's first significant Cap-and-Trade system for CO₂ reduction, are how the whole system has worked and whether the implementation of the EU ETS actually hurts or improves the competitiveness of firms in the participating industries.

Modeling: A tool for addressing the challenges of climate change

Arika Ligmann-Zielinska (Geography and Environmental Science and Policy Program, MSU), Sandra Marquart-Pyatt (Sociology and Environmental Science and Policy Program, MSU), Laura Schmitt Olabisi (Community, Agriculture, and Resources Studies and Environmental Science and Policy Program, MSU)

Understanding and responding to complex global environmental changes is one of the major challenges facing policy makers in this century. Modeling has emerged as a useful tool to effectively study coupled human and natural systems, addressing a variety of problems including climate change, water shortages, soil erosion, and deforestation at various spatial and temporal scales. At the same time concerns have been raised over the failures of highly constrained and deterministic traditional modeling approaches to address these issues, which are believed to poorly incorporate long term dynamics, constantly evolving human behavior, adaptive natural resource management, robust decision making, collaborative and interactive problem solving, and varying scales of interaction. To effectively address these challenges, we are proposing, as part of MSU's Environmental Science and Policy Program graduate curriculum, a new educational cluster around modeling techniques for addressing socio-environmental issues in complex systems. This module of courses would expose students to cutting-edge modeling methodologies, including agent-based modeling, system dynamics modeling, participatory model-building, and hierarchical linear and structural equation modeling. Our objective is to build a thorough foundation of the theory of models and complex systems, and provide hands-on experience with model design, development, and evaluation geared toward specific research topics including climate change. The coursework will culminate in an interdisciplinary team-taught capstone seminar on case-based group research, which will address a selected practical policy problem. Students will work with practitioners to develop an applied project that will utilize a wide ensemble of modeling tools in order to perform a systemic analysis and a transdisciplinary synthesis of multiple proposed courses of action. Projects related to the local community, including non-governmental organizations, community groups, agencies and policy-makers in mid-Michigan are particularly encouraged.

Minnesota GHG mitigation strategy modeling and application to Michigan

Laura Schmitt Olabisi, Community, Agriculture, and Resources Studies and Environmental Science and Policy Program, MSU

In 2009, the United States House of Representatives passed a bill calling for an 83% reduction in U.S. greenhouse gas emissions below 2005 levels by 2050. If this ambitious goal is to be achieved, state and regional efforts to cut emissions will be critical. We projected GHG mitigation strategies for the state of Minnesota, which has adopted a strategic goal similar to the House bill of 80% emissions reduction by 2050. A portfolio of conservation strategies, including electricity conservation, increased vehicle fleet fuel efficiency, and reduced vehicle miles traveled, is likely the most cost-effective option for Minnesota and could reduce emissions by 18% below 2005 levels. An 80% GHG reduction in

Minnesota would require complete de-carbonization of the electricity and transportation sectors, combined with carbon capture and sequestration at power plants, or deep cuts in other relatively more intransigent GHG emitting sectors. I will discuss the implications of the Minnesota analysis for Michigan's similar GHG reduction targets, and how potential GHG reduction strategies could unfold regionally in the Midwest.

Carbon emission offsets from urban forests at MSU

Lisa Parker, Forestry, MSU

Michigan State University holds voluntary membership in the Chicago Climate Exchange (CCX), North America's cap and trade registry for green house gases (GHG). This has necessitated a detailed analysis of the university's carbon footprint and the potential for reduction of carbon emissions. With this poster I present research that contributes to this effort through quantification of carbon sequestered in MSU-owned lands and forests. Two phases of the project are discussed: The first phase of research was the expansion of the annual carbon sequestration formulas to include the vast diversity of woody plant species found on the campus. Currently the CCX's urban tree carbon offset protocols provide for only 100 common tree species, while the MSU campus contains over 400 within more than 80 Genera. This highlights a general problem in plant carbon sequestration estimation: many more species are sequestering carbon than have been studied. The second phase of inquiry involved calculation of the potential magnitude of annual offsets to MSU's Simon power plant emissions from urban trees and urban forests, a formerly undefined component. Specific consideration of the CCX's eligibility requirements and carbon offset accounting rules dictated a proposed expansion of the CCX's species growth rate database and adaptation of the Urban Tree protocol, based upon the research undertaken. This venture culminated in the acceptance by the CCX of MSU's proposed protocol revisions titled "Carbon Emission Offsets from Urban Forests at MSU", thus establishing MSU as "the first CCX urban forestry project to be validated." (CCX Offsets Report Vol 1 #5 2009)

Plausible climate change adaptations for crop production in the Upper Great Lakes Region of the United States

Perdian, Geography and Environmental Science and Policy Program, MSU

The Upper Great Lakes Region (UGLR), which includes Michigan, Wisconsin and Minnesota, is an important agricultural production area in the United States. Climate change is expected to have substantial impacts on the regional crop production. This study explores the possible impacts of climate change and its plausible adaptations for two major crops in the region, corn and soybeans.

Empirical yield models for corn and soybeans were developed using a quadratic form of a crop production function. The dependent variable was annual yield by county and independent variables included a time trend as a proxy for agricultural technology improvements, growing season averages of maximum and minimum temperature and precipitation, and atmospheric CO₂ concentration. The likely impacts of climate change based on future climate scenarios for 2025-2035 were assessed by constructing probability distributions of changes in simulated corn and soybean yields between the future period and a baseline period defined as 1991-2008. The probability distributions were obtained by applying Monte Carlo random sampling assuming uniform distribution for the independent variables.

Potential climate change adaptation (CCA) options for the two crops were identified from previous literature for the UGLR and the other regions with a similar climate. The plausibility of the potential adaptation options was evaluated based on UGLR farmers' experience with advanced farming management and technology (AFMT), drawn from literature review and responses to surveys conducted from 1996-2005 by the Agricultural Research and Management Survey (ARMS) within the

Economic Research Services (ERS) of the United State Department of Agriculture (USDA).

The probability distributions of future yield suggest a relatively high chance of higher corn and soybean yields by 2025-2035 relative to the baseline, although a small possibility exists of lower yields. Climate change adaptations could boost potential benefits gained from climate change and limit negative impacts. Potential CCA options for corn and soybean production in the UGLR include new seed varieties, changes to the rate and time of application of fertilizer and irrigation, crop rotation, earlier planting times, changes in soil management strategies, and pest and disease management. Except for irrigation, these options can be considered as “plausible” based on the experience of UGLR farmers.

Further research should be directed at assessing different combinations of production inputs, such as seed varieties, fertilizer and irrigation applications, and planting time shifts, under future climate change scenarios. This type of assessment is a critical step to assist decision makers to formulate a suite of strategies to adapt to future climate change.

Greenhouse-gas emissions associated with conversion of open lands to short-rotation woody biomass plantations.

David E. Rothstein (Forestry, MSU), Paligwende Nikiema (Forestry, MSU), and Raymond Miller (Forest Biomass Innovation Center, Michigan Agricultural Experiment Station)

The conversion of open lands to short-rotation woody-biomass crop (SRWC) plantations is gaining increased interest as a way to supply feedstock to several new bioenergy plants in development across the northern Michigan and Wisconsin. Open lands most likely to be converted include abandoned agricultural lands and economically-marginal pastures and hay fields. Soil C loss, emissions of N₂O and fossil fuel combustion associated with SWRC establishment and production all have the potential to undermine the net greenhouse gas (GHG) reductions associated with substituting biomass fuels for fossil fuels. This is of particular concern for old pasture lands and hayfields in the northern Lake States where soil organic matter (SOM) levels can be extremely high, suggesting that conversion to SWRC may incur a significant GHG debt due to oxidation of soil C and emissions of N₂O resulting from increased rates of nitrification and denitrification. We have begun to study GHG emissions associated with conversion to SWRC across a range of sites in northern Michigan and Wisconsin. Initial results from two pasturelands with high levels of SOM and restricted drainage show very large releases of N₂O associated with conversion. Specifically, we have found that impacts of conversion on direct N₂O emissions alone have resulted in a GHG debt equivalent to 10-20 Mg CO₂ ha⁻¹ during the first year of establishment. These data suggest that selection of suitable sites and development of no-till methods of plantation establishment will be critical to the development of a sustainable SWRC industry in this region. We are expanding our work to include four new sites in 2010 that encompass a wider variety of initial site conditions, and will use long term monitoring to assess impacts of conversion on soil C stocks.

Climate change impact assessments: Moving from the local to the global

Julie Winkler (MSU), Suzanne Thornsbury (MSU), Pang-Ning Tan (MSU), Jeffrey Andresen (MSU), J. Roy Black (MSU), Scott Loveridge (MSU), Shiyuan Zhong (MSU), Jinhua Zhao (MSU), Amy Iezzoni (MSU), Nikki Rothwell (MSU), Géza Bujdosó (Research Institute for Fruit Growing and Ornamentals, Hungary), Frank-M. Chmielewski (Humboldt University, Germany), Peter Hilsendegen (DLR Rheinpfalz, Germany), Dieter Kirschke (Humboldt University, Germany), Robert Kurlus (University of Poznan, Poland), Malgorzata Liszewska (Institute of Meteorology and Water Management, Poland), Tadeusz Niedzwiedz (University of Silesia, Poland), Denys Nizalov (Kyiv School of Economics, Ukraine), Zbigniew Ustrnul (Jagiellonian University), Harald von Witzke (Humboldt University, Germany), Costanza Zavalloni (University of Udine, Italy), Marco Artavia (Humboldt University,

Germany), Sangjun Lee (MSU), Mollie Woods (MSU)

The vast majority of climate change impact assessments evaluate how local or regional systems and processes may be affected by a future climate. Alternative strategies that extend beyond the local or regional scale are needed when assessing the potential impacts of climate change on international market systems. These industries have multiple production regions that are distributed worldwide and are likely to be differentially impacted by climate change. Furthermore, for many industries and market systems, especially those with long-term climate-dependent investments, temporal dynamics need to be incorporated into the assessment process, including changing patterns of international trade, consumption and production along with evolving adaptation strategies by industry stakeholder groups. A framework for conducting climate change assessments for international market systems, and initial steps for applying the framework to the tart cherry industry, are outlined.

Impacts of carbon sequestration projects on management of and access to forest resources in Malawi

Heather Yocum, Anthropology, MSU

Environmental and social policies which seek to mitigate or manage the effects of climate change are leading to the reimagining of ecological landscapes in ways which may reinvigorate or reshape struggles over the management, control, and access to these natural resources. As nations across the globe attempt to respond to the realities of climate change, two key questions have emerged: how will poor nations adapt socially and financially to the environmental change?; and how will wealthy nations reduce their emissions? In response, carbon sequestration projects (CSPs) projects which provide compensation for the carbon stored in the biomass of trees, plants, and soil are being introduced as a way to help mitigate the effects of climate change, generate income to finance community development projects, enhance community resilience, and conserve natural resources. However, very little is known about the social and environmental impacts of CSPs on the management of and access to forest resources. This presentation will outline the changes that have resulted in environmental governing structures in preparation for the implementation of a pilot CSP in Malawi, a country in southern Africa.

Can GMOs play a role in adapting Uganda's agriculture to climate change?

Barbara Zawedde, Horticulture and Environmental Science and Policy Program, MSU

Uganda is one of the countries most vulnerable to climate change. A major cause of its vulnerability is low adaptive capacity due to high dependence on natural resources for livelihoods. The majority of the labor force (80%) depends on agriculture, which is extremely vulnerable to climate change. Addressing Uganda's vulnerability requires understanding the impacts of climate change on agriculture and identifying relevant adaptation strategies. Ongoing studies of climate change and agriculture have recommended adoption of stress-resistant crop varieties as a feasible strategy. Genetic engineering provides tools that can be used to develop stress-resistant crop varieties known as genetically modified organisms (GMOs). However, for Uganda to adopt GMOs as an adaptation strategy, a number of concerns must be addressed and strategies implemented. These include investing in research and development, putting in place mechanisms for risk assessment and effective governance, managing intellectual property rights (IPR), and addressing trade issues. This paper seeks to foster policy discourse on challenges Uganda's agriculture is likely to face due to climate change, and considerations to take into account before adoption of GMOs as an adaptation strategy.