Friday, 20 April	
08:00-09:00	**Conference Registration Desk Open**
09:00-09:30	**Conference Opening**
09:30-10:05	**Plenary Session - Jonathan Berkey, International Sustainable Developemnt, Middlebury Institute of International Studies, Monterey, USA**
	"Renewable Energy Power Shift"
10:05-10:35	**Garden Conversation & Coffee Break**
10:35-11:20	**Talking Circles**
	Room 1 - Scientific Evidence **Room 2 - Assessing Impacts in Divergent Ecosystems** **Room 3 - Human Impacts and Impacts on Humans** **Room 4 - Technical, Political, and Social Responses** **Room 5 - 2018 Special Focus: 'Engaging with Policy on Climate Change'**
11:20-11:30	**Transition**
11:30-12:45	**PARALLEL SESSIONS**

Room 1

Waterways and Water Resources

Water Temperature Change and Morphology of Coastal River-deltas

Prof. Ashish Mehta, University of Florida, Gainesville, Florida, United States
Dr. Earl Hayter, United States Army Corps of Engineers, Washington, D.C., United States
Dr. Andrew Manning, University of Plymouth, Plymouth, UK

The transport of water-borne suspended sediment, particularly flocculated cohesive clay particles, is known to depend on water temperature, which influences the viscosity of the suspension and, more importantly, electrochemical inter-particle bonds governing floc properties including size and density, hence the settling velocity. Increasing temperature decreases the settling flux as the bonds holding the flocs together become weaker and cause floc size to decrease and floc structure to become more open. This would mean that the location, morphological evolution and the size of muddy coastal river-deltas would be altered. To date, in fine sediment transport research limited attention has been focused on the role of fluid temperature, as most areas of engineering concern have been in the mid-latitudes. As a result only rudimentary anecdotal information is available on the differences in the morphodynamics of the more studied deltas and those in the cold regions. On the other hand, some experimental information has been compiled in the literature on the effect of temperature on the settling velocities of suspended flocs and their erosion at the bed. In the present paper we have summarized this information, which is then used to demonstrate likely scenarios on the effect of long-term water temperature change on delta morphology. We show that due to the high sensitivity of the floc properties on temperature, significant morphologic changes may ensue depending on the temperature anomaly. Increasing the temperature would form the delta further seaward (where it could be more susceptible to dissipation by wave action) and its rate of growth would slow down. In turn the role of the delta as a feature protecting the shoreline from erosion could diminish. *Scientific Evidence*

Evaluation of Water Availability in Climate Change Scenarios

Leonel Sousa, Federal University of Rio Grande do Norte, Natal, Brazil

As a result of the continuous climate change in many environmental system, rainwater harvesting system(RWHS) has received notable attention as an alternative way of decrease water vulnerability. In general, the design and performance of a RWHS is determined by using historical rainfall data without the impacts of climate change on rainfall. The objective is to investigate the effects of climate change in a domestic rainwater harvesting system based on different combinations of roof-surface, rainwater-tank sizes and water demands. The water balance in the tank will be simulated applying yield-after-spillage criteria, located in the northeast Brazil. It is expected that the findings help water authorities and policy makers to select appropriate rainwater tank size in the context of climate change. Principal component analyses will be used to group the water-saving efficiency into a select set of variables.
Human Impacts and Impacts on Humans

Contamination of Drinking Water Sources in Gilgit Baltistan and Its Economic Consequences: Climate Change Impacts on Drinking Water Sources

Ijlal Hussain, Government of Gilgit Baltistan, Gilgit-Baltistan, Pakistan

The Gilgit Baltistan (GB), Pakistan serves as the principal water catchment for the Indus River, upon which a majority of Pakistan's irrigation and hydroelectricity depends. The Karakoram Highway provides an all-weather land link to the GB with the rest of the country. The region supports some 0.870 million people (1998 Census) living in approximately 1000 villages which are administratively divided into 105 union councils falls under 20 tehsils and 10 districts.This study is based on survey conducted by Local Government & Rural Development Department on the water borne diseases and availability of improved drinking water and sanitation services, with a particular focus on diarrhea as a major water borne disease. Using a combination of qualitative and quantitative data, the study's main objectives are to determine economic factors and access to improved sources of water and sanitation in Gilgit Baltistan is a big challenge to face ahead.
Human Impacts and Impacts on Humans

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Friday, 20 April	
11:30-12:45	**PARALLEL SESSIONS**
Room 2	**Wildfire Conditions**

Prevention of Wildfire in a Climate Change Reality

Janet Stanley, University of Melbourne, Melbourne, Australia

The incidence of large wildfires is increasing internationally, along with the risk of a wildfire becoming catastrophic, where its spread is difficult to predict and it is all but impossible to extinguish without a natural suppressant such as heavy rain. At the same time, our knowledge of prevention of wildfire is narrow, limited, and at times incorrect, with a heavy reliance on environmental modification. Given that about 85% of fires are human initiated it is urgent that we gain better understanding of the role of humans and how to prevent these fires being lit. This paper will present outcomes from current research based on an extensive 20 year data base from an Australian Arson Squad and Crime Stoppers on how to better identify the features of who is at greater risk of committing arson, thus initiate improved prevention responses, such as surveillance and putting protective initiatives in place. Findings will also be presented on a longitudinal study (6 waves over 8 years) on the propensity of the community to understand and report fire-lighting activity. These world first studies will be presented in an international context of prevention of wildfires

Technical, Political, and Social Responses

Wildfire: Getting What You Pay For

Prof. Michael Mann, George Washington University, Washington, D.C., United States

Stemming from our research on effects of human settlement in wildfire prone areas, under conditions of climate uncertainty, we present data and a scenario that challenges us to view wildfire in a new light. In particular, we explore the compounding effects of climate change, land use change, and poor management, which leave our communities vulnerable to risk.

Human Impacts and Impacts on Humans

Room 3 — **Climate Governance**

Governments in Australia and Climate Change Responses: How Knowledge Uptake Can Influence Policy

Tayanah O'Donnell, University of Canberra, Canberra, Australia

The potential for individuals and societies to adapt to climate change is framed by how governments can develop and implement effective strategies that cut across spatial, sectoral, and temporal challenges and opportunities (Adger, 2011). Each of the three tiers of government in Australia responsible for various regulation and policy can influence, either positively or negatively, adaptation priorities and agendas. The centrality of governments, as drivers of governance, to break down barriers to climate adaptation remains critical. This paper will discuss key policy changes in Australia, along with focus group findings. It concludes that the role of government for climate change responses remains critical, and that the research community can contribute a sound evidence base for these responses.

Technical, Political, and Social Responses

Local Climate Governance in Germany

Dr. Denise Keele, Western Michigan University, Kalamazoo, Michigan, United States

Cities are vulnerable and face unique climate change challenges; however, cities also have distinctive powers and resources within multilevel governance systems to address both mitigation and adaptation to global climate change. The European Union and specifically Germany are recognized as climate leaders, and most previous scholarship has focused on national and international policy adoption. Based on over sixty interviews with local government officials, this research describes the policy responses, challenges and opportunities of the thirty-four urban districts (city level administrative units) located in two Länder (e.g. States) of Germany, Bavaria and Baden-Württemberg. Emphasis will be placed on the role of the city within federalist systems with contrast and comparisons to the United States.

Technical, Political, and Social Responses, 2018 Special Focus: Engaging with Policy on Climate Change

Climate Change Secretariat Initiatives to Achieve the National Climate Change Policy in Sri Lanka

Vindya Hewawasam, University of Tsukuba, Tsukuba, Japan

Kenichi Matsui, University of Tsukuba, Tsukuba, Japan

In order to build a climate resilient nation, the government of Sri Lanka established the Climate Change Secretariat (CCS) within the Ministry of Environment. It became the National Focal Point (NFP) to the United Nations Framework Convention on Climate Change (UNFCCC) in 2008. Accordingly, the CCS adopted the National Climate Change Policy (NCCP) in 2012 with an aim to minimize adverse consequences. The CCS coordinates and implements climate change related activities, including NCCP. This study examines CCS's adaptation initiatives by using an analytical framework. This framework consists of six criteria: namely, feasibility, effectiveness, acceptability, equity, impacts and implementation. The analysis mainly focuses on CCS's adaptation activities from 2010 to 2017. Further this study provides a comparative analysis of the climate change policy and initiatives taken by Bangladesh and Japan to identify positive trends, gaps, present and future needs of the NCCP. Finally, this study makes recommendations that may improve the NCCP.

Human Impacts and Impacts on Humans

Room 4 — **The Science of Change**

High Resolution Remote Sensing for Tropical Cyclones Energetics and Forecasting Models

Prof. Virendra Goswami, Indian Institute of International Studies, New Delhi, India

The values of characteristics, such as lifetime, distribution, trajectories, size and three dimensional structure would be computed in order to develop a Medium Range Forecasting Model for South East Atlantic Hurricanes with the detailed analysis of morphological, dynamical properties cum structure and energetics of mainly three Hurricanes. The possibility is considered of computing the optimum values of cluster characteristics, kinematic and thermodynamic structural parameters to develop a medium range forecasting model.

Scientific Evidence

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Friday, 20 April	
11:30-12:45	**PARALLEL SESSIONS**
	Dynamo Speed Control and Tectonics: Modeling Earth as a Shunt Wound DC Machine Greg Poole, Industrial Tests, Inc., Rocklin, California, United States The Sun's slow periodic flux transfer to the Earth, the low frequency of Schumann Resonance, and the fixed DC voltage of the capacitor direct us toward direct current (DC) machines for electrical modeling purposes. The Earth exhibits dual characteristics of a motor generator set by motoring the mechanical Earth around its axis, while at the same time generating energy for its spherical capacitor. It follows that electrical and mechanical output of the Earth are powered by the magnitude of the flux transfer events, the constant DC voltage supply and any potential nuclear contribution within the core. Like an induction furnace, powerful magnetic flux from the Sun partially melts the outer iron core of the Earth and magnetizes the inner solid iron core. The solid inner magnetic core acts as a rotating armature similar to a DC machine. All electrical machines experience no load and full load power loss while in operation. Speed control of large rotating DC machines is well understood and has been applied in industry for over a century. Speed can be changed either by varying the field resistance and/or the armature resistance. The characteristic of a constant speed DC machine is such that a change in field resistance will cause a compensatory change in armature resistance to maintain velocity. In the case of the earth, a decrease in armature resistance results in an increase in volume of the iron core, which may result in greater seismic and volcanic activity. Climate change may be the direct result of changes in soil and sea water resistance, which we lump together as field resistance. *Scientific Evidence* **Is Fracking Kosher?: The Role of Climate Change in the Jewish Response to the Unconventional Extraction of Fossil Fuels** David Krantz, Arizona State University, Tempe, Arizona, United States As hydraulic fracturing, AKA fracking, has increased in both use and prominence over the last decade around the world, religious communities have taken notice. How has the Jewish community responded? This paper/presentation will compare the response to fracking among Jewish organizations in the United States and Israel. How does the prospect of climate change affected their decision making? To what extent have Jewish groups in both countries worked together? What are the similarities and the differences to the approaches taken by Jewish activists in both countries? What do Jewish groups see as their religious obligations to either support or oppose fracking? Other questions that will be addressed include: Why did Jewish organizations take the stances that they did? What new organizations have sprung up in response to fracking? What inspired their leaders to fight for or against fracking? How have these organizations worked with both secular groups as well as within an interfaith context? And to what extent have Jewish individuals involved in the fracking debate within secular organizations been informed and inspired by Jewish values in pursuing their work on fracking? While many of the larger Jewish organizations merely issued policy statements on fracking, what may come as some surprise is the variety of activities among smaller Jewish groups and individuals — including fracking wells being dug at Jewish summer camps, a Jewish photography exhibit on fracking, and even rabbis being arrested at fracking protests. *Technical, Political, and Social Responses*
Room 5	**Health and Wellness** **Temperature and Emergency Room Visits from Mental Health-Related Outcomes** Rupa Basu, California Environmental Protection Agency, Oakland, California, United States Temperature and morbidity has been explored previously. However, the association between temperature and mental health-related outcomes, including violence and self-harm, remains relatively unexamined. We obtained daily counts of mental health-related emergency room visits involving injuries with external cause from the California Office of Statewide Health Planning and Development from 16 California climate zones from 2005 to 2013, and combined them with data on mean apparent temperature, a combination of temperature and humidity. Using Poisson regression models, we estimated climate zone-level associations, then used random-effects meta-analyses to produce overall estimates. Analyses were stratified by season (warm: May-October; cold: November-April), race/ethnicity, and age. A 10-degree Fahrenheit increase in same-day mean apparent temperature was associated with a 4.8% (95% confidence interval, 3.6-6.0%), 5.8% (4.5-7.1%), and 7.9% (7.3-8.4%) increase in visits for mental health disorders, self-injury/suicide, and intentional injury/homicide, respectively, during the warm season. High temperatures during the cold season were also positively associated with these outcomes. Variations were observed by race/ethnicity, age group, and sex, with Hispanics, Whites, 6-18 year olds, and females at greatest risk for most outcomes. Increasing mean apparent temperature was found to have acute associations with mental health outcomes and intentional injuries, and warrants further studies in other locations. *Human Impacts and Impacts on Humans*

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Friday, 20 April	
11:30-12:45	**PARALLEL SESSIONS**
	Temperature and Term Birth Weight in California Rupa Basu, California Environmental Protection Agency, Oakland, California, United States Reina Rau, University of California, Berkeley, Berkeley, United States Dharshani Pearson, California Environmental Protection Agency, Oakland, California, United States Brian Malig, California Office of Environmental Health Hazard Assessment, Oakland, California, United States Few epidemiologic investigations have explored adverse birth outcomes from ambient temperature exposure. In a retrospective cohort study conducted in California from 1999 to 2009, we examined apparent temperature, a combination of temperature and relative humidity, and term low birth weight (LBW) among 43,629 full-term LBW infants and 2,032,601 normal weight infants. We relied on birth certificate data provided by the California Office of Vital Statistics and meteorologic data from the California Irrigation Management Information System, the US EPA, and the National Climatic Data Center. After considering several exposure apparent temperature metrics, we found that full gestational (13.0%; 95% confidence interval: 4.1, 22.7% per 10 degrees Fahrenheit (°F) increase in apparent temperature) and third trimester exposure (15.8%; 5.0, 27.6%) had the greatest associations for term LBW above 55°F and 60°F, respectively. First month of exposure exhibited no significant risk, while first trimester had a significantly negative association, and second trimester, last month and last two weeks had slightly increased risks. Mothers who were Black, older, delivered male infants, or gave birth during the warm season conferred highest risk. Our findings provide further evidence for risk of adverse birth outcomes from high temperatures for pregnant women, particularly for vulnerable subgroups. *Human Impacts and Impacts on Humans* **Climate Action Co-benefits and Community Planning: Uncovering the Synergies and Trade-offs** Robert Newell, University of Victoria, Victoria, Canada Engaging in climate action through integrated sustainability strategies can yield benefits for communities in a more effective way than through compartmentalized approaches. Such strategies can result in co-benefits, that is, community benefits that occur from acting on climate change that extend beyond mitigation and adaptation. For example, creating more walkable cities can be a strategy for reducing greenhouse gases, but can also lead to healthier communities with lower rates of obesity and hypertension. Climate strategies with co-benefits can result in 'win-win' situations, and thus comprise best practices for community planning. However, this planning approach also presents challenges, as it requires understanding complex relationships between community development practices and identifying synergies. In addition, some co-benefit strategies might also have associated trade-offs that should be taken into consideration when exploring a particular development path. This research examines climate action co-benefits and trade-offs in order to develop a comprehensive picture of the relationships and potential effects of implementing certain plans and strategies. The research consisted of collecting data on climate action efforts occurring in 11 BC (Canada) communities and coding it to identify climate strategies, co-benefits and trade-offs. Relationships between codes were then identified through a coding matrix, which subsequently were used to build a conceptual model of the multitude of co-benefits and trade-offs that stem from community adaptation and mitigation. Such a model can be used to gain a holistic impression of the advantages and disadvantages associated with different plans and strategies, which in turn can inform integrated community planning and decision-making. *Technical, Political, and Social Responses*
12:45-13:45	**Lunch**
13:45-15:25	**PARALLEL SESSIONS**
Room 1	**Global Implications** **Environment Protection via Optimal Global Economic Restructuring: Stochastic Data Envelopment Analysis Approach** Prof. Alexander Vaninsky, Hostos Community College, New York, New York, United States This paper introduces an approach to environment protection based on proper economic restructuring of global economy. It is suggested that countries and regions voluntarily made changes in their economic structures so that the amounts of greenhouse gases decrease together with energy consumption, while the gross domestic product (GDP) per capita and the use of renewable energy – increase. A model is suggested that allows to evaluate the level of success in achieving this goal. Stochastic Data Envelopment Analysis with a Perfect Object is used as a mathematical tool. We use the indicators of GDP per capita and the share of renewable energy as inputs, and energy intensity of the GDP and energy carbonation as inputs, with all measured as the shares of global total. We estimate the current efficiency index and compute its gradient. Finally, we derive a system of differential - algebraic equations that guide the global economic restructuring in locally optimal way. A case study of the global economy 2015 is analyzed based on the information of the U.S. Energy Information Administration. *Technical, Political, and Social Responses*

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Friday, 20 April	
13:45-15:25	**PARALLEL SESSIONS**
	Energy Ships for the Transition to an Emission-free Global Economy by 2050 Max Platzer, University of California Davis, Davis, California, United States Nesrin Sarigul-Klijn, University of California Davis, Davis, California, United States Land-based and off-shore based renewable power generation encounters significant resource and political constraints. In contrast, the wind power available in many ocean areas far exceeds the global power needs. Therefore, in 2009 we proposed to convert the ocean wind power into propulsive sailing ship power which, in turn, makes it possible to convert the relative water flow power between the moving ship and the stationary water into electric power by means of ship-mounted hydro turbines. The electric power delivered from the hydro turbines is then used to split the seawater into hydrogen by means of electrolysis, the hydrogen is compressed and stored in tanks and transported to shore. We will present the major results of the techno-economic and socio-political aspects of the "energy ship concept" studies which we conducted since 2009 and we will show that fleets of hydrofoil-borne autonomously operating sailing ship convoys enable the large-scale production of hydrogen, the large-scale energy storage in the form of hydrogen or of electro-fuels made from hydrogen, the production of potable water as a byproduct of converting hydrogen into electricity, and the extraction of carbon-dioxide from the sea water. *Technical, Political, and Social Responses* **Global Warming: How to Better Sell the Cause** Marc Duncan, Eastern Oregon University, La Grande, Oregon, United States Most scientists agree that global warming, aka climate change, is a reality. However, the debate on whether or not there is a direct and significant relationship between concentrations of carbon in the atmosphere and increases in global surface temperatures remains heated, and recent political decisions around the Paris Climate Agreement will continue to make the debate even hotter. Much research has been focused around computer models that predict both rises in sea levels and temperatures over the next 100-200 years, related social and environmental impacts of what these changes might bring, preventative and mitigation measures that could/should be taken, and means by which we can frame the dialog so that populations will more likely embrace the required social changes many believe necessary to avoid predicted calamities. This paper looks at this latter item, framing strategies, and encourages redirecting the present global warming frame and its long term, moral focus to more immediate and very real concerns for developed and developing countries, including depletion of oil supplies over the next 30-40 years and its impact to our national security, the consequential impact of such depletion on world economies and society at large, and job creation from renewable technologies, to name a few. Necessary politically induced social behaviors via alternatively framed promotional messaging are needed to better and more actively induce current consumer consumption changes as well as their support for alternative energy and transportation technologies, all of which will have ancillary benefits for those fearing global warming. *Technical, Political, and Social Responses* **Cities as Vanguards of Global Climate Change Policy** Avi Gottlieb, Tel Aviv University, Tel Aviv, Israel The world's cities are currently the most effective drivers of climate change policy and governance, and due to the ongoing massive urbanization process, their importance will only grow in the course of this century. This paper focuses on the policies and measures that cities worldwide have already taken to mitigate their GHG emissions. It is based on a meta-analysis of published research on the mitigation policies and actions in cities around the world, and on their progress toward realizing their GHG reduction targets. We find that, remarkably, many cities have set emission targets that are pointedly higher than those of their national governments, and many have already put these commitments into action. The findings indicate that cities around the world deploy several key strategies to mitigate their GHG emissions, though priorities and specific policy measures are context-dependent. The findings also point to the strategic role of economic benefits in formulating and implementing urban climate policies (saving money, creating jobs, health and quality of life), and to the importance of investments and cost-effective technologies in supporting these policies. *2018 Special Focus: Engaging with Policy on Climate Change*
Room 2	**A Focus on Carbon Emissions** **Carbon Emission as Cause of Climate Change: The Metro Manila Transport Example** Olusegun Kayode Bello, University of Ibadan, Ibadan, Nigeria Mustapha Olawuni, University of Ibadan, Ibadan, Nigeria Peter Chukwuma Obutte, University of Ibadan, Ibadan, Nigeria The Metro Manila, Philippines, is known to be one of the most populated and polluted cities in the world with incidence of carbon emissions from motor vehicles. The Philippines is ranked 48th in terms of carbon emission in the transportation sector. Air Pollution in Metro Manila is dangerously high, and according to study, 65 percent of the pollution comes from vehicle emissions, thereby contributing to a degraded and unhealthy environment. It is estimated that carbon dioxide emission is increasing in the Philippines by 1.4 percent on average, every year since 2006, based on the World Bank data, using linear trending. This Paper portrays the various actions, responses and agitations towards climate change adaptation and mitigation, while using the Metro Manila in the Philippines as an illustration and particularly the constant pollution from the motor vehicles. Review of relevant literature on the subject, climate change is undertaken. *Human Impacts and Impacts on Humans*

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Friday, 20 April	
13:45-15:25	**PARALLEL SESSIONS**
	Comparing International Views on Climate Change Issues and Climate Change Policy Eric Jamelske, University of Wisconsin-Eau Claire, Eau Claire, Wisconsin, United States James Boulter, University of Wisconsin-Eau Claire, Eau Claire, Wisconsin, United States Climate change is the most important environmental/societal issue facing our world today. Because of the global causes/consequences of climate change, international cooperation is essential in developing, implementing and financing successful mitigation policy action. Moreover, public support for action around the world will likely be a significant determining factor regarding if/when climate change mitigation policies will be enacted. In particular, China and the United States are of great interest given that they are the largest greenhouse gas polluters and the largest economies. Vietnam is also of interest because they represent a smaller/poorer country with significantly lower GHG emissions. We will present comparisons from data collected in 2015 and 2017 from surveys conducted in these three respective countries. Ultimately, we will focus on support for an international climate treaty and willingness to pay for the costs of addressing climate change. Overall, we find more skepticism and denial and varying views in the United States compared to China and Vietnam. We also find more support for an international treaty and higher willingness to pay in China and Vietnam compared to the United States. *Technical, Political, and Social Responses, 2018 Special Focus: Engaging with Policy on Climate Change* **Comparative Analysis of Energy and Emissions for Sustainability Rating: A Case Study** Mehran Dadkhah, California State University, Fresno, Fresno, California, United States Fariborz M. Tehrani, California State University, Fresno, Fresno, California, United States This paper presents the results of a case study to compare various performance measures of a sample project in relation to sustainability. The presented case is the construction of an undercrossing bridge designed to reduce traffic congestion and enhance safety at the existing at-grade intersection of a major ring road. Results include input energy and carbon dioxide emissions during construction based on actual data obtained from the site as reported by the contractor. In addition, an analysis of cost breakdown, including materials, equipment, and labor, for major construction activities, such as earthmoving, is provided. Application of sustainability rating using ISI (Institute for Sustainable Infrastructure) ENVISION is presented to allow a comparative analysis on various performance measures, including resource allocation and impacts on natural world. Conclusions of this paper enable project managers and sustainability professionals to identify and evaluate challenges and opportunities of similar projects in respect to sustainable development. *Human Impacts and Impacts on Humans, Technical, Political, and Social Responses* **Climate Change Mitigation Policy and Electric Vehicles: The Relationship between the Percentage of Renewable Energy and the Lifecycle Carbon Dioxide Emissions** Ryan Cornell, Colorado Technical University, Colorado Springs, Colorado, United States This project quantifies the carbon dioxide emissions produced by electric vehicles (EVs), as a function of renewable energy. These values are compared to the emissions for internal combustion engines (ICE) of varying efficiencies. Many studies quantify carbon dioxide emissions based on a static grid, but this fails to accurately measure the long-term potential of electric vehicles. My model disaggregates grid-based and non-grid-based emissions, which allows production-based emissions to accurately reflect the percentage of renewable energy that is entered into the model. I employ Argonne National Laboratory's GREET Model and a variety of meta-analyses to determine the emissions per kWh and per gallon. The model also allows for the manipulation of a variety of variables other than the percentage of renewable energy, including: EV efficiency, miles per gallon, and battery-based emissions. The lifecycle EV carbon emissions for a vehicle powered by the 2016 US grid is 30.82 metric tons, while the emissions for an EV powered by 100% renewable energy is 6.3 metric tons. An average internal combustion engine vehicle (25.4 miles per gallon) is responsible for 68.38 metric tons of carbon dioxide over its lifetime, while an ICE vehicle with a utopian efficiency of 80 miles per gallon accounts for 25.5 metric tons of carbon dioxide. *Technical, Political, and Social Responses*
Room 3	**Reciprocal Reliance** **Agriculture's Role as a Terrestrial Carbon Sink** Neal Samuel Eash, University of Tennessee, Knoxville, Tennessee, United States Bruce Hicks, University of Tennessee, Knoxville, Tennessee, United States Joel Oetting, University of Tennessee, Knoxville, Tennessee, United States Deb O'Dell, University of Tennessee, Knoxville, Tennessee, United States With the 1985 Farm Bill and its conservation compliance mandate, US agriculture leaped forward in ways that reduced erosion and improved soil structure...for at least a few years. Alas, recent trends in the past few decades have seen a tillage relapse/rebirth and with it the loss of the recently sequestered C acquired through conservation compliance's minimal tillage practices. While there are many arguments for why more tillage is being used today, one important factor is that rainfall patterns have changed since my early days on the farm necessitating the perceived need for tillage to dry the soil for planting. Using 120 years of local rainfall data we will show how the farmer's climate has changed, how the farmer has reacted to these changes, and why it is imperative that soil management be addressed and included in policy in climate change mitigation. Micrometeorology/eddy covariance data from Tennessee, Ohio, as well as southern Africa (Lesotho and Zimbabwe) Africa, will provide evidence that soil can be an important sink for carbon dioxide. Soil can play a very important and passive role in climate change mitigation if policies help provide action. *2018 Special Focus: Engaging with Policy on Climate Change*

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Friday, 20 April	
13:45-15:25	**PARALLEL SESSIONS**
	Role of Livestock in Driving Climate Change: Dietary Change is Essential to Meet the Paris Agreement's Targets Peter Stevenson, Compassion in World Farming, Surrey, UK A review of the literature shows that technical mitigation measures and increased productivity will be insufficient to prevent an increase in the GHG emissions produced by the livestock sector. Research shows that on a business-as-usual basis our diets alone could by 2050 take us over the Paris Climate Agreement's targets. Studies establish that the Paris targets cannot be met without a shift to healthier diets with reduced meat and dairy consumption. Transitioning toward diets that are in line with standard dietary guidelines could reduce global food-related emissions by 29–70%. This would also produce environmental, nutritional and animal welfare co-benefits. Focus group research in the USA, China, Brazil and the UK demonstrate a general belief that it is the role of governments to encourage and incentivise efforts to reduce unsustainable levels of meat consumption. Measures to encourage dietary change could include: awareness raising, nutrition education, sustainable dietary guidelines, initiatives by retailers and chain restaurants to promote less emissions-intensive diets, public procurement policies that provide meals with reduced emissions, economic incentives and taxation measures that encourage farmers and consumers to decrease the proportion of meat and dairy produced and consumed. *Technical, Political, and Social Responses* **Perceptions of Fishers to Climate Change in Puerto Rico's Coastal Communities** Karin Jakubowski, University of New Haven, West Haven, Connecticut, United States Tarsila Seara, University of New Haven, West Haven, Connecticut, United States Coral reefs provide important resources to Puerto Rico's commercial fishers, recreational anglers, and ornamental collectors and exporters. However, the degradation of coral reefs and the decline in fishery resources that live in and depend upon these ecosystems have serious consequences of both ecological and socioeconomic nature. Climate change is also considered a major aspect affecting the well-being of coastal communities worldwide including fishing resource dependent communities. For these reasons, there is a strong need to understand what factors influence the perceptions and behaviors of fishers around the reef. Factors that can affect perceptions of the environment and behaviors towards that environment include education, fishing experience, knowledge about environmental issues, and local ecological knowledge. This study investigated the perceptions of fishers and other stakeholders within coastal communities in Puerto Rico by interview and survey. Such findings can inform and engage resource users and the public as well as inform management decisions tightly linked to ecosystem goods and services to address climate change and other important pressures on coral reef fishing systems, while focusing on supporting community resilience at a local scale. *Human Impacts and Impacts on Humans* **Perceptions and Response Actions of Smallholder Coffee Farmers to Climate Variability in Montane Ecosystems** Dr. Frank Mugagga, Makerere University, Uganda Data was collected from 157 proportionately sampled households, using Open Data Kit (ODK) Software installed on handheld Samsung Galaxy Note7 Tablets and analysed using the SPSS (version18) software to derive descriptive statistics, notably, frequencies and percentages as well chi square tests to establish relationships between variables. A severity scale (1-5) was used to establish farmers' perceptions about variations in selected weather elements (specifically rainfall, temperature, wind and droughts) over the last ten years; with responses triangulated with meteorological data from Buginyanya Zonal Agricultural Research and Development Institute. Farmers generally perceive rainfall and temperature to have moderately increased, while, winds and droughts were noted to have significantly increased over the ten years. Available meteorological data (2007 – 2012) depicted decreasing trends in annual rainfall receipts while temperature minimally varied. Such variations significantly affected coffee production ($p=0.003$) with early rainfall onsets perceived to cause early ripening of coffee berries, while short rainy seasons resulted into reduced yields. Longer dry seasons led to drying of coffee berries and ultimately reduced crop yield. The common response actions included agronomic practises such as, planting shade trees, pruning, replacement, planting drought-resistant varieties and application of organic fertilizers. Several socio-economic factors influence response actions with the most significant being access to climate change information ($p= 0.029$), level of education ($p= 0.029$), access to credit ($p= 0.019$). The study recommends enhancement of adaptive capacity of the coffee farmers through provision of timely and accurate weather forecasts. Smallholder coffee farmers also need to organise themselves into farmer groups/cooperatives that will uplift their marketing and negotiation power to access credit. However, this will require concerted and collective effort by all stakeholders including the technical personnel, local political leadership as well as the farmers themselves. *Technical, Political, and Social Responses*
Room 4	**Insecurities at Sea Level** **Flood, Rebuild, Repeat: How Flood Insurance Can Trap Homeowners** Rob Moore, Natural Resources Defense Council, New York, New York, United States In the U.S., flood insurance is usually the only timely assistance owners of repeatedly flooded homes can access easily, but it generally pays to repeatedly rebuild in the same vulnerable location. For homeowners who want to move, assistance is hard to find. The U.S. spends relatively little purchasing flood-prone properties, even though it is often cheaper than rebuilding. When assistance is offered, it can take years of waiting. More than 30,000 "severe repetitive loss properties" have flooded an average of five times and the U.S. spent $5.5 billion to repeatedly rebuild these homes. NRDC estimates that sea level rise will put 0.82-2.57 million homes in an identical situation by century's end, costing the U.S. $143b-$447b. NRDC has developed a proposal to pre-approve interested low-income homeowners and guarantee them a future buyout, eliminating the years long waiting and uncertainty common to current efforts. *2018 Special Focus: Engaging with Policy on Climate Change*

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Friday, 20 April	
13:45-15:25	**PARALLEL SESSIONS**
	Greenhouse Gas Emitting Activities at Sea: Sources and Solutions John Duff, University of Massachusets, Boston, Massachusetts, United States The oceans of the world serve as the setting within which substantial climate change driving activities reside. This presentation highlights two major sea-borne greenhouse gas emitting activities: international shipping and offshore energy production. It outlines governance authorities and mechanisms that currently apply, and the prospects for new or evolving approaches to reducing such emissions. Part One outlines the history and status of international shipping as well as the governance authorities and mechanisms that currently apply to those seaborne activities. It reflects upon the prospects for new or evolving approaches to monitoring, measuring and managing those activities in an effort to reduce such emissions. Part Two employs a similar approach with regard to GHG emissions associated with offshore hydrocarbon development. Part Three considers the factors that distinguish the very different approaches employed to identify, evaluate and manage GHG emissions from the two types of offshore activity reviewed. Part Four examines recent/ongoing efforts to develop and implement legal/regulatory approaches to reducing GHGs from each of these ocean use sectors. *Technical, Political, and Social Responses* **Climate Change Adaptation in Coastal Cities of Developing Countries** Tu Dam Ngoc Le, University at Buffalo, Buffalo, New York, United States Coastal cities in developing countries are increasingly susceptible to the adverse impacts of climate change due to the combination of climatic and non-climatic factors. In responding to this global climate issue, cities can make a significant contribution to local efforts. For nearly two decades with the international assistance, many coastal cities in developing and least-developed countries have made significant progress in shaping their climate action plans to adapt to climate change. A systematic analysis of these local efforts, however, is understudied. This study aims to explore the adaptation planning practices in coastal cities of developing countries regarding planning methodology and the formulation of adaptation strategies. It utilizes a content analysis of 37 documents of vulnerability assessment and climate adaptation plans in 27 coastal small and medium-sized cities in developing and least developed countries. The study shows a prevailing community-based approach in adaptation planning in these local contexts, in which local knowledge is an important input for the planning process. The finding illustrates a strong linkage between vulnerability assessment and the formulation of adaptation strategies. Spatial vulnerability assessment offers a great opportunity for the identification of vulnerable places, while non-spatial assessment explores the root causes of vulnerability. The two methods complement each other to inform adaptation options and policies. The spatial visualization, however, is hindered in many cities due to data availability. A framework for the combination of these two methods and ways to overcome the limitation are recommended. *Technical, Political, and Social Responses* **Spatial Heterogeneity and Household Preferences for Sea Level Rise Adaptation Plan in Florida** Dr. Sisi Meng, University of Colorado, Denver, Colorado, United States Accumulating evidence indicates that global sea levels have been rising at an accelerating rate. This trend, linked with global warming, is posing a great risk to the communities living in the low elevation coastal areas. Florida is particularly vulnerable to the effects of sea level rise (SLR) due to its low topography, porous geology, subtropical climate, and densely populated coastal counties. This study aims to understand public preferences and produce estimates of economic value for sea level rise adaptation projects. Specifically, a series of choice experiments embedded in a household survey of Florida's selected communities were used to: examine the determinants of households' preferences for short term adaption plans and long term adaptation plans; identify the spatially heterogeneous preferences in household choices, by incorporating detailed spatial information generated by Geographical Information Systems (GIS) into the survey data; investigate the differences and similarities in perceptions and preferences among Florida's yearlong and seasonal residents. The empirical results can provide important inputs to the design of optimal adaptation plans and mitigation policies to avoid risks posed by climate change-induced sea level rise. *Human Impacts and Impacts on Humans, 2018 Special Focus: Engaging with Policy on Climate Change*
Room 5	**Administration and Management** **Auditing Climate Change Responses in Canada** Kimberley Leach, Auditor General of Canada, Ottawa, Canada Katie Olthuis, Auditor General of B.C., Victoria, Canada Amy Hart, Auditor General of B.C., Victoria, Canada Carol Bellringer, Auditor General of B.C., Victoria, Canada Kristin Lutes, Auditor General of Canada, Ottawa, Canada The audit offices of all provinces and territories in Canada, collaborated together and with the Office of the Auditor General of Canada (OAGC) to conduct their own independent audit work to determine the extent to which Canadian governments met commitments to reduce GHG emissions and adapt to climate impacts. This paper will discuss the overall project and an adaptation case study from the Office of the Auditor General of British Columbia (OAGBC). Audit offices designed a conceptual approach based on accepted adaptation processes found through literature review and measured government action against this framework (risk assessment, adaptation plan or strategy, implementation of plan, monitoring and reporting). To complete this work OAGC and OAGBC followed accepted performance audit methodology which largely involves qualitative research techniques (document review and key informant interviews) and consultation with subject matter experts in the field. Results from the OAGBC audit highlight strengths and weaknesses of the provincial approach to adaptation, and led to recommendations for government on how to move adaptation forward in the province. The audit identified key climate-related risk areas in the province and highlighted challenges faced by government in addressing these risks. *2018 Special Focus: Engaging with Policy on Climate Change*

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Friday, 20 April	
13:45-15:25	**PARALLEL SESSIONS**
	A Nexus of Sustainability and Resilience Planning: Observations of Emerging Practices and Policies Dr. Haris Alibašić, University of West Florida, Pensacola, Florida, United States Local governments' approach to climate action planning varies based on the type of municipal leadership, financial resources available to resilience planning, and a community level commitment to addressing the threats of climate change. Several cities deployed climate change plans in their operations. While using different approaches, the intended outcomes of climate change plans in cities are similar. The paper reviews programs and policies for implementing climate resilience measures, and how cities approach climate change indirectly, by specific targets embedded in sustainability planning or directly through funding climate action planning in city's operations. The key outcomes related to climate change action and resilience planning are transparency, accountability, measurements, reporting requirements, annual review, and progress report-related adjustments. *2018 Special Focus: Engaging with Policy on Climate Change*
	Assessing the Impact of the Western Climate Initiative on Quebec Industrial facilities David Talbot, École nationale d'administration publiquek, Quebec City, Canada Julien Hanoteau, Euromed, Marseille, France Since 2013, Quebec (Canada) has implemented a greenhouse gas emissions trading system (ETS) as part of the Western Climate Initiative. This carbon monetization has aroused strong reactions particularly in the industrial sector where companies feared a loss of competitiveness on world markets. The objective of this article is to assess the impact of this regulation on Quebec industrial plants. In order to do so, we compared the performance of regulated facilities in Quebec with other Canadian facilities of the same NAICS sectors but from different provinces, thus evolving in other regulatory contexts (tax or no regulation) on a period of 5 years. Conditional difference in differences OLS regressions results show that regulated plants in Quebec have reduced their GHG emissions about 10 percent faster than non-regulated plants in the rest of Canada. They have also reduced employment about 7 percent faster. However, the implementation of the Quebec carbon ETS had no significant impact on the efficiency of production with respect to GHG emissions. These results suggest that during the period 2013-2015, regulated facilities in Quebec did not adapt to the program through a change in their production process or technology that would affect carbon intensity. They responded mainly by adjusting production scale and employment. This contrasts with the results of previous studies on the early stage effects of the European carbon ETS on French and German facilities and firms. European industry adapted through changes in GHG intensity of production, not scale. This raises question about the efficiency of the Quebec ETS to induce innovation in industrial facilities. Other studies on the early stage effects of the British Columbia (Canada) carbon tax scheme reveal that facilities adapted to it by cutting employment, but that effect has been mitigated thanks to the positive effect of a green fiscal reform that accompanied the carbon tax. This challenges the initial allocation scheme of the carbon permits in the Western Carbon Initiative, underlying the importance of recycling appropriately the carbon rent. *Technical, Political, and Social Responses*
	Promoting Dialogue on Campus and within Community Colleen Bye, Utah Valley University, Orem, Utah, United States Diana May, Utah Valley University, Orem, Utah, United States Bryan Lacerda, Utah Valley University, Orem, Utah, United States Michelle Li Szhen Teh, Utah Valley University, Orem, Utah, United States James Brandt, Utah Valley University, Orem, Utah, United States Erin Call, Utah Valley University, Orem, Utah, United States The study includes a comparison to national data using the New Ecological Paradigm (NEP) scale. Additionally, they will discuss methods of creating opportunities for discussion on campus and beyond. They will describe an event at their college, Sustainability Day, that was created to provide current research and factual information and, more importantly, to promote civil discourse. Issues of sustainability have become highly politicized; for example, research shows that the largest factor concerning one's beliefs toward climate change is one's political affiliation, which is mainly due to an increase in the use of social media as a primary news source. Consequently, many have formed confirmation biases that have led to highly polarized nation. UVU is a very conservative campus with 80% of its reporting to be Ladder Day Saints. This event hosted a question and answer session on climate change, a round table discussion concerning energy, and speakers presenting on a variety of sustainability topics. Representatives from over 24 local and national organizations provided service opportunities and pertinent data and research. Finally, they will describe their efforts to gain a commitment towards sustainability from their college president and establish a strategic plan for growth. *Human Impacts and Impacts on Humans*
15:25-15:40	**Transition**

Please see the announcement board by the conference registration desk for any changes or additions to the above schedule.

Friday, 20 April

15:40-16:55 **PARALLEL SESSIONS**

Room 1

Problematic Heat Stressors

Assessing the Vulnerability and Perception of Adaptability to High Temperature in Buildings among the Residents of Lagos State

Kehinde Aina, University of Northampton, Northampton, UK

Heat waves is the occurrence of temperatures greater than 35°C for several days,several days of stagnant air masses, and consecutive nights of higher than usual minimum temperature (Astrom et al, 2011). Extreme heat event related mortality is characterized by temperature and humidity substantially greater than the mean for a specific time of year (Luber, 2008). Relative humidity is a critical factor in the impact of heat on human health, because of its effect on the body's ability to keep cool by evaporation (Luber, 2008). Household level heat exposure includes air conditioner usage, housing characteristics and the way houses are built. Building materials with high thermal mass such as brick, poorly ventilated houses and closed windows have been associated with a high risk of illness and mortality during heat waves (Sakka et al, 2012). The way air conditioning and other heat preventive gadgets are used has been shown to act as a preventive means during heat waves by reducing the effect of heat stress, Although, those that do not have access to this heat preventive gadgets are exposed to higher temperature than those who do have access to them (Sakka et al, 2012). Residential buildings in Nigeria especially in Lagos are typically neither equipped with an air conditioning system, nor with any other active cooling systems to reduce the indoor air temperature in hot periods. Therefore the building itself must provide sufficient protection against high temperature. Moreover, from an environmental point of view, it is undesirable to apply air conditioning system and other active cooling system on a large scale in these residential buildings, since this will lead to a higher energy consumption and thus to higher emission level of greenhouse gasses, which will intensify climate change and global warming even more (Nasrallah et al,2004). To protect building occupants from the effects of climate change without increasing the energy use, one should therefore rely on sustainable solutions to prevent indoor overheating in residential buildings.

Human Impacts and Impacts on Humans

Social Impacts of Climate Change-related Occupational Heat Stress and Adaptation Strategies of Workers

Victor Fannam Nunfam, Edith Cowan University, Perth, Australia
Kwadwo Adusei-Asante, Edith Cowan University, Perth, Australia
Eddie Van Etten, Edith Cowan University, Perth, Australia
Kwasi Frimpong, Edith Cowan University, Perth, Australia
Jacques Oothuizen, Edith Cowan University, Perth, Australia

Adverse effects of occupational heat stress due to climate change on working populations are subtle but considerably harmful. Yet trajectories of social dimensions and impacts of climate change-related occupational heat stress to safety and health, productivity, and social well-being concerns of workers are often overlooked and relegated as minor issues in social impact analyses of occupational heat stress due to climate change. This paper offers a conceptual framework based on a review and synthesis of the literature from 2007 to 2017 on social impacts of climate change-related occupational heat exposure on workers' safety and health, productivity, and social well-being in the context of sustainable development. A sustained global, national, institutional, and individual collaborative involvement and financial support for research, improved social protection and adaptation strategies can reduce exposure and boost the resilience and adaptive capacity of workers to facilitate the sustainable development goals.

Human Impacts and Impacts on Humans

Managing the Heatwave Phenomena

Natalie Batshon, Macquarie University, Sydney, Australia
Stephen Smith, Macquarie University, Sydney, Australia
Vincent Pang, University of New South Wales, Kensington, Australia

Heatwaves is a phenomena that has been faced around the world for decades and its impact and occurrence is increasing at an increasing rate. However research towards Heatwaves, particularly within Green IS has been limited. As a result, this paper addresses this research gap by conducting and presenting an exploratory study on Heatwaves. The paper conducts primary and secondary studies to understand the Heatwave phenomena and explains the importance of using information systems to develop systems, methods and policies that help manage Heatwaves and their impacts. Primary research undertaken includes conducting a focus group and numerous interviews. Members who attended the focus group were directly impacted by the multiple severe Heatwaves that struck New South Wales (NSW) Australia during its December 2016 to February 2017 summer. The research undertaken is significant as it aims to increase understanding of Heatwaves among all those who are impacted by them. Additionally, the paper argues the importance of having a unified global definition of Heatwaves and the importance of developing systems, methods and policies that aim to directly manage Heatwaves.

Technical, Political, and Social Responses

Room 2

Compromises in Air Quality

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Friday, 20 April	
15:40-16:55	**PARALLEL SESSIONS**
	"Right to Clean Air" but What Went Wrong?: A Case Study on Opportunities and Obstacles to Communicating Climate Change on Social Media in Thailand Teerada Chongkolrattanaporn, Chulalongkorn University, Bangkok, Thailand Climate change campaigns in Thailand have faded in the past few years due to a change in government policy. Thus, non-governmental organizations have to be more active in conducting campaigns to raise awareness and encourage Thai citizens to change their behavior to mitigate climate change. Greenpeace (Thailand) is one the major campaigners who energetically promotes this issue. "Right to Clean Air" is a recent campaign designed to tackle air pollution problem and to educate about climate change. Greenpeace does not only use online platforms to disseminate information, but also to gain more supporters. In 2016, Greenpeace members wore black t-shirts when they ran in a marathon organized to celebrate Her Majesty the Queen's birthday. This led to outrage on social media such as Facebook and Twitter. Thus, this research investigates Greenpeace's Facebook fanpage to examine the trend of people's responses to the campaign. Results showed that negative comments outweighed positive ones. Framing analysis was conducted to determine the most prominent frames presented in the Facebook platform. The "climate change" frame was hardly mentioned by the public, while the "attack on NGO" frame was mentioned the most. *Technical, Political, and Social Responses* **Economic and Health Impacts of Climate Change: Air Pollution in Ethiopia** Aemade Mistru Terefe, University of Bologna, Bologna, Italy Despite many years of environmental regulation, significant levels of air pollution are generated by the provision of goods and services and such Economic and domestic activities have been causing a profound deterioration of air quality in developed and developing countries. Air pollution mainly refers to human activities or the natural processes that cause a certain substance to continuously enter the atmosphere at a sufficient concentration that disturb the dynamic equilibrium in the atmosphere and thereby affect the health of human being. The main purpose this research work is to present a descriptive documentation on the nature of air pollution in the case study area and to estimate the willingness to pay for morbidity reduction due to air pollution. The study used health production function model which is used for estimating the household's willingness to pay for reduced morbidity, a detailed description of how the environmental variables are related to different socioeconomic characteristics of sample households in the study area and finally try to deal with the estimation of willingness to pay using Health production Function. This paper tries to point out the policy implications for the healthcare service and willingness to pay for improved air quality. *Human Impacts and Impacts on Humans* **Electric Vehicles on the Rise while Decarbonizing the Grid** Nilmini Silva-Send, University of San Diego, San Diego, California, United States California though not a country is well placed to transition to a low carbon economy in the electricity and transportation sectors. 50% of Zero Emission Vehicle (ZEV) sales in the US in 2015 were in California, where ZEVs enjoy consistent policy support. The latest goal is for 1.5 million ZEVs on the road by 2025 and incentives are provided by federal, state, regional and many local entities. More ZEVs will increase electricity loads and GHG emissions. However, California law mandates 50% renewable electricity by 2030, and some cities are implementing a 100% renewable electricity mandate pushing this limit higher in some places. Therefore, transportation electrification is not expected to increase GHG emissions and less gasoline on roads means immediate local co-benefits from reduced N2O, SO2 and particulates. Using the example of San Diego county, this presentation will show how policies to increase transportation electrification simultaneously with increased renewables in grid electricity intersect to the point at which electrification of transportation reduces overall GHG. These are policies which can be adapted for developing countries and smoggy cities to further clean energy and its benefits to air and the climate. *Technical, Political, and Social Responses*
Room 3	**Eco-development** **Eco-Innovation: Perspectives from a Theoretical Approach and Policy Analysis** Natasha Hazarika, City University of Hong Kong, Hong Kong Xiaoling Zhao, Northern Arizona University, Flagstaff, Arizona, United States Limiting the impacts of climate change and building a resilient world is one of the biggest policy challenges today. It has been widely recognized that for controlling the costs of climate change adaptation and mitigation in the long run, environmentally sound technologies or eco-innovations need to be developed and adopted which would help curb the climate issues in future. Eco-innovation is defined as production, assimilation or exploitation of a product, process, service or business method which, in any stage of its life cycle, would result in reduction of environmental risk, pollution and other negative impacts as compared to conventional technologies or approaches. However, unlike regular innovations, eco-innovations are not self-enforcing and are associated with the double externality problem. Therefore, it is emphasized that eco-innovations need govt. intervention in the form of supportive policy instruments on priority. Off late, factors like consumer demand, plans and programs as well as the competitiveness of the firms have been considered as equally important. However, the interaction among these driving forces has not been fully traced out. Also, the theory on eco-innovation is found to be at a nascent stage which does not resonate with its dynamics as it is traditionally studied under the neo-classical economics theory. *Technical, Political, and Social Responses*

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Friday, 20 April	
15:40-16:55	**PARALLEL SESSIONS**
	Labor Leading on Climate: Using Climate Mitigation Policy to Create Family-sustaining Jobs Mijin Cha, Occidental College, Los Angeles, California, United States Lara Skinner, Cornell University, Ithaca, New York, United States This paper details an initiative in New York State that developed climate policy in coordination with the labor movement. By placing the labor movement at the center of climate policy development, two sometimes disparate movements are brought together and the economic realities of climate mitigation and adaptation are given appropriate attention. Moreover, given the economic and personal sacrifice fossil fuel workers have given to provide the fuel that powered the growth of the American economy, there is a moral obligation and duty to ensure a just transition to a clean energy economy. The purpose of this work is to highlight the need for climate mitigation and adaptation policies to expand their focus beyond just the environment and include the economic realities of climate change mitigation and its impact on workers and communities. *Technical, Political, and Social Responses, 2018 Special Focus: Engaging with Policy on Climate Change* **Is "Being Green" Rewarded in the Market?: An Empirical Investigation of Decarbonization Risk and Stock Returns** Soh Young In, Stanford University, Stanford, California, United States While investors are increasingly prioritizing climate finance and looking for investment opportunities of "yield with impact," they seem still reluctant. It is mainly because they need more clear understanding on the return-risk relationship related to investing for a clean energy economy. To shed more light on the market evaluation of decarbonization, this study empirically investigates the relationship among firm-level decarbonization, financial characteristics, and stock returns by analyzing 75,638 observations of 739 U.S. firms during the period of January 2005 to December 2015. The main research questions include: what types of firms are more likely to take decarbonization actions; whether carbon-efficient firms' stocks are likely to outperform carbon-intensive firms' stocks; and if so, whether these excess returns on decarbonization are from a pure alpha or market compensation from bearing additional risk. We define firm-level carbon intensity as the actual amount of greenhouse gas (GHG) divided by company revenue, construct EMI ("efficient-minus-inefficient") portfolio based on carbon intensity, and find that EMI portfolio exhibits a large positive cumulative return from 2009. By applying multi-factor asset pricing models using factor-mimicking portfolios of market, size, value, operating profitability, investment, and momentum, we find that those well-known risk factors cannot fully explain EMI portfolio return and the estimated positive alphas of EMI portfolio amount to 7.7~8.9 percent of abnormal returns per year. In addition, estimating factor loadings on industry portfolios, we also find that EMI portfolio has explanatory power that is independent from well-known risk factors. We discuss how carbon intensity is related to other firm-level characteristics concerning corporate governance and financial performance, along with implications for climate finance in the viewpoints of investors, firms and policymakers. *Assessing Impacts in Divergent Ecosystems, Technical, Political, and Social Responses, 2018 Special Focus: Engaging with Policy on Climate Change*
Room 4	**Revising Policy** **Ocean Acidification Post-Paris: Gauging Law and Policy Responses in Light of Emerging Scientific Projections** David VanderZwaag, Dalhousie University, Halifax, Canada M. Cecilia Engler, Dalhousie University, Halifax, Canada Katja Fennel, Dalhousie University, Halifax, Canada Scientific knowledge on the impacts of increased atmospheric CO2 on the ocean's biogeochemistry, marine species, and marine ecosystems has grown exponentially in the last decade. The emerging evidence and projections makes a strong case for precautionary and preventative mitigation and adaptation responses to ocean acidification (OA) at multiple levels, including substantive and urgent reductions in CO2 emissions. Although policy and legal responses to OA at the national, regional and international level have lagged behind, there is growing momentum for a robust response to "the other CO2 problem". The paper addresses the opportunities and challenges of incorporating the threat of OA in mitigation and adaptation actions under the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement. For that purpose, it: briefly describes the international legal and policy instruments relevant for OA, and justifies the focus on the global climate regime; provides a critical assessment of the role of OA in the climate negotiations leading to the Paris Agreement; assesses the implications of the Paris Agreement and its implementation mechanisms for OA, including scientific and legal challenges; and suggests possible avenues for strengthening the international legal response to OA in the post-Paris context. *Technical, Political, and Social Responses, 2018 Special Focus: Engaging with Policy on Climate Change* **Integrating Carbon Pricing into Renewable Energy Regulatory Reform** Ross Astoria, University of Wisconsin, Kensoah, Wisconsin, United States New York state is leading the nation is reconfiguring its state policy around the technological characteristics of renewable energy resources. In particular, the New York Public Service Commission is undertaking a complete revision of the regulatory framework for the electrical power sector. Called "Reforming the Energy Vision" the Commission initiative is transitioning the regulatory framework away from one which presupposes centralized, fossil generation to one configured around decentralized, renewable technologies. In re-aligning the regulatory framework away from incumbent fossil infrastructure and to renewable technologies, carbon pricing plays an ambiguous role. There are presently three different carbon prices in New York, that generated by the RGGI cap-and-trade, the social cost of carbon, and that built into the Value of Distributed Energy Resources. The Commission has, therefore, commenced harmonizing the integration of the carbon pricing into the REV proceeding. This paper will trace the coursing of a carbon price through the regulated system with the purpose of assessing the relative importance of carbon pricing versus other reforms meant to align the regulatory framework with renewable technologies. Lessons learned from New York's reforms will inform mitigation and pricing efforts in other jurisdictions. *2018 Special Focus: Engaging with Policy on Climate Change*

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Friday, 20 April

15:40-16:55 **PARALLEL SESSIONS**

Climate Change Effects: Responsibility without Accountability

Christa Isabelle Stünzi, University of Bern, Bern, Switzerland

The legal response to addressing the consequences for the climate change phenomenon is based on the legislation on environmental protection. While it is praiseworthy and necessary that climate change issues are addressed on a global rather than a regional or national level, creating new concepts, agreements and guidelines will not effectively lead to improved climate conditions. One fatal legal flaw remains: No responsibility without accountability! In my paper, I argue that sufficient legal tools exist for governing the environment and the negative consequences of climate change. What we need, however, is to rethink the system in which these rules are put in action. In both international and domestic law, accountability is always at the very center of each responsibly claim. It is fundamental not to look at environmental burdens as criminal lawyers would do (the polluter pays) but through the lens of a risk manager. By doing so the international legislator needs to be understood from the top down, as a common problem with a solidarity responsibility. This approach is not new. Implementing a concept by which a common responsibility exists would mean that natural resource must be shared and exploited in the interest of mankind with regard to the inter-generational equity. With this we would establish a legal concept of responsibility without accountability enabling better responses to climate change. So we don't need more international agreements but we need to act on the ones we have.

Technical, Political, and Social Responses

Room 5

Responding to Change

Alarming Climatic Tendencies at the Critically Endangered Brazilian Midwest Savannas

Leandro Oliveira Salles, Federal University of Rio de Janeiro , Rio de Janeiro, Brazil

As the most threatened savanna biome in the world, the Cerrado Hotspot faces a critical moment demanding urgent conservation actions before it gets too late to revert the damages produced by vectors of frontier development that have already jeopardized more than 80% of its native vegetation. Thousands of springs drain from the Cerrado, crucially contributing to the maintenance of eight of the twelve main Brazilian Drainage Basins. The savanna vegetation remain somewhat green nearly all year long essentially due to its extended roots that can often reach the water table and also to an excess of Amazonian humidity that is driven towards the region by high atmospheric winds sustaining a stable rainy season. Despite of these conditions, data sets amassed by our research group (encompassing the last 50 years) strongly support tendencies of aridification at multiple scales including that of the entire Cerrado. This drought-stress tendency has been also corroborated by our recent years of intense fieldwork at a key region of the Cerrado (the Serra Geral range) that stands out by its contrasting scenarios, where regions of high endemism rate and Protected Areas are located almost adjacent to one of the most recent and important agribusiness frontiers in the country. The alarming forecast for this central region of the South American continent could be synthesized by a tendency of progressive increase in maximum and minimum temperatures as well as a mild reduction trend of absolute humidity apparently due to the rapid expansion of the agribusiness coupled with the excessive destruction of the vegetation cover.

Assessing Impacts in Divergent Ecosystems

State-level factors in Metropolitan Climate Activism

Carl Hand, Valdosta State University, Valdosta, Georgia, United States

Dana Williams, Valdosta State University, Valdosta, Georgia, United States

As nation states equivocate over meaningful climate change agreements, hundreds of cities worldwide and in the US have joined to promote climate change policies and actions. Many US cities have taken a leadership role in promoting ameliorative public policy and best practices, overcoming significant disincentives for doing so, particularly low levels of public salience and unreliable federal support and resources. Several of these evolving networks are now in existence, including the United States Conference of Mayors Climate Protection Agreement. The US Conference of Mayors plays a significant role in facilitating best practices as well as recognizing cities on the vanguard of climate leadership. Research to date has examined the factors explaining metropolitan climate activism, including potential climate risk, the influence of carbon intensive industries at the local level, and the role of community environmental capital. Less understood is the role that state-level energy policy and socio-political factors play influencing metropolitan climate activism. This research underscores the significance of political partisanship, both in terms of state environmental politics and statewide Democratic voting record, for understanding metropolitan climate activism.

Technical, Political, and Social Responses

Climate Impacts on African Diaspora: Expanding the Articulation of Climate Justice

Samuel Mr, Lead Consultant, The Public Policy Project, Saint Paul, Minnesota, United States

This paper will present data on climate impacts on the African diaspora using a complex environmental justice analysis. It is argued that the complexity of climate impacts on the African diaspora require a more comprehensive and locally nuanced framework for climate justice in order to nourish both local climate residence and substantive global agreements that do not extend the harms of 600 years of colonialism now with its extension through carbon colonialism. A study is currently being conducted on the ten nations in the diaspora with the largest Africana population and the climate justice analysis done indicates need for expanding our sensibilities and approaches to the realization of deep climate justice. A set of recommendations are made, based on analysis, about what such an expanding definition, platform and approach might entail.

Human Impacts and Impacts on Humans

16:55-17:00 **End of Sessions**

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Saturday, 21 April	
08:30-09:00	**Conference Registration Desk Open**
09:00-09:15	**Daily Update**
09:15-09:50	**Plenary Session - Michel Gueldry, International Relations and Sustainability Studies, Middlebury Institute of International Studies, Monterey, USA**
	"Approaches and Strategies for Engaging Climate Change Skeptics - and Their Limits"
09:50-10:20	**Garden Conversation & Coffee Break**
10:20-12:00	**PARALLEL SESSIONS**

Room 1

Innovation Showcase

The Energy Net: The Free Enterprise Solution to Solve Global Climate Change

Tim Kaelin, Impact Analytics, West Palm Beach, Florida, United States

Free enterprise has proven to be the most powerful force on Earth. America, the most powerful nation was built on free enterprise. Whenever invoked, free enterprise asserts its will, be it industrial revolution (1760-1840), the tech boom of the 1990's. If you can guide it toward a goal, it will surpass your most optimistic expectations. The Energy Net is a solution based in free enterprise. It strives to emulate the 1990's Tech Boom in a number ways, allowing 100's of thousands of Americans to innovate, invest and contribute to the American ideal, dramatically improving our economy and creating jobs, stemming the tide of Radical Islam, and solving Climate Change completely.

2018 Special Focus: Engaging with Policy on Climate Change

Room 2

Responsive Policy for Stakeholders

Climate Change, Migration and Conflict: The Chittagong Hill Tracts in Bangladesh

Rafiqul Islam, Dhaka University, Dhaka, Bangladesh

Climate change and conflict is a much-talked topic with the increasing of climate change events and its impacts on human livelihood and security. This presentation will highlight this human concerning issue of how the climate events, e.g. floods, sea-level rise, drought and disasters are impacting on human displacement; and consequently generating conflict when the displaced people migrate to another place. The case of this presentation is Bangladesh. As one of the most climate affected countries, Bangladesh has already suffered from mass displacement and social and political violence. In Bangladesh, many people affected by the environment and climate have migrated and settled in the urban centres and the Chittagong Hill Tracts (CHT) in Bangladesh. The CHT is a conflict-prone hilly area inhabited by the ethnic minority people. The influx of migrated people to this region has complicated the socio-economic condition of the CHT, which has consequently complicated the conflict and peace-building efforts. This paper will explore how climate change-indued displaced people have migrated and settled in the CHT and complicated the socio-economic conditions, which have resulted in a long-standing social conflict in the region. This paper will also propose some policy recommendations to manage conflicts and build peace.

Human Impacts and Impacts on Humans

Transformative Scenario Planning Workshops in Namibia and India

Teresa Perez, University of Cape Town, Cape Town, South Africa

Transformative Scenario Planning (TSP) has been successful in bringing about change in issues characterised by conflict, but has yet to be applied to climate change topics. The Adaptation at Scale in Semi Arid Regions (ASSAR) project experimented with TSP as a way to bring together scientists, policy makers, and community members, to tackle adversity exacerbated by climate variability. I observed TSP workshops held in Namibia and India that focused on water problems. Based on transcripts from semi-structured interviews I report on the different ways that influential stakeholders spoke about their agency: specifically, the contribution that the TSP methodology had made to their past routines, present decision-making and future planning. My findings showed that the value of the process lay not necessarily with helping identify new ideas about climate adaptation. Rather, activities encouraged participants to cling less rigidly to habitual ways of thinking and to working in silos. Consequently people across the social system were able to think creatively, in the long-term and appreciate the opportunities that working collaboratively might bring. The implication is that setting aside time for powerful stakeholders to be self-reflective, could be an important precursor to formulating and implementing climate change policies.

Technical, Political, and Social Responses

Heritage Monitoring Scouts across Florida: Archaeologists and Citizen Scientists Respond to Climate Change

Sarah Miller, Florida Public Archaeology Network, Pensacola, Florida, United States

Laura Clark, Florida Public Archaeology Network, Pensacola, Florida, United States

The Florida Public Archaeology Network (FPAN) launched the citizen science-based Heritage Monitoring Scout (HMS Florida) program statewide during the fall of 2016 in part to assist Florida's Division of Historical Resources, which currently does not have the budget or policy permissions in place for climate change concerned initiatives. Fortunately, the program was in place a month before Hurricane Matthew and helped stewards document conditions and threats to sites in northeast Florida. During the first year, 233 volunteers signed up and submitted over 312 monitoring forms from across the state. This paper will discuss the challenges of developing a program that addresses impacts of climate change in a denial state, education and awareness for managing cultural resources given global climate change obstacles, and assessing the value of the community education component of the program. Impacts on cultural resources reported by the community from Hurricane Irma will also be discussed.

Technical, Political, and Social Responses

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Saturday, 21 April	
10:20-12:00	**PARALLEL SESSIONS**
	Climate Change, Global Interdependence and Bargaining Leverage: A Neoclassical Realist Critique of Why South Korea Adopted a Carbon Cap and Trade System Benedict DeDominicis, Catholic University of Korea, Seoul, South Korea South Korean diplomatic bargaining leverage is enhanced through South Korea acquiring global leadership positions in promoting sustainable development. Global governance trends in addressing the greenhouse gas emission causes of climate change create opportunities for South Korea to benefit in terms of its power capabilities. They include diplomatic bargaining leverage deriving from South Korean representatives' high profile in supporting global multilateral treaty initiatives and their implementation organizations. South Korea benefits diplomatically from increasing global awareness of political economic interdependence for national sustainable development. Competition for influence by the United States and China in the post-Cold War international environment had included vying for leadership in global sustainable development initiatives. South Korea's geographic and institutional location at a nexus where US and Chinese focus their competition creates greater opportunities as well as dangers. South Korea aims to direct their competition into global sustainable development promotion with South Korea a leading proponent of these initiatives. As a lesser power, South Korea must accommodate this competition, while seeking to mitigate it to avoid regional and global interdependence from being undermined. Korean nationalism is the primary factor motivating Seoul's green international development promotion policy. Korea's experience of foreign domination since the turn of the last century has critically shaped prevailing expectations regarding American foreign policy towards northeast Asia. The US Trump administration's decision to withdraw from the 2015 Paris Agreement and the Trans Pacific Partnership disturbs these established Korean attitudes regarding US commitments to globalization. *Technical, Political, and Social Responses*
Room 3	**Implications for Agriculture** **Impact of Climate Change on the Overwinter Boundary of Amyworm** Xi-Jie Li, Nanjing Agricultural Univeristy, Nanjing, China Winter temperature warming is one of the most important characters in global change. Distribution boundary of some species in winter were reported shifted. The distribution of armyworm (Mythimna separate), an important phytophagous insect whose host can be various, was also limited by low temperature. In order to analyze the impact of winter temperature on overwinter boundary of armyworm, isotherm developing trend in decades and annual fluctuation of potential overwinter area derived from daily measured data were applied to display the change of armyworm's overwinter boundary during 1951 to 2014 in eastern China continent. We found that in the context of global warming, which was caused by the increased "warm-winter" frequency, the overwinter boundary shifted northward by different latitudinal distances among years. Comparing with cold winter, the northern limitation shifted northward for 0.5 - 1.5° (latitude) in warm-winter. Our results also suggested that the north overwinter limit had northward shift and the available overwintering area for armyworm extended. Furthermore, it could be concluded that winter temperature warming has been a possible threaten for crop production in China. *Assessing Impacts in Divergent Ecosystems* **Influence of 2015-2016 El Niño on the Occurrence of Rice Planthoppers in China** Bao-Ping Zhai, Nanjing Agricultural Univeristy, Nanjing, China The objective of this research is to determine the influence of El Niño on the occurrence of rice planthoppers in China, so as to illustrate the occurrence regularity of rice planthoppers under extreme weather. The northward migration processes of rice planthoppers in the next year (2016) after an event of El Niño were analyzed based on the data of the weather over the East Asia migration field and population sizes of rice planthoppers monitored by light traps. The light trap catches of rice planthoppers in nine provinces of southeast China in the latest decade were statistically analyzed. The 2015-2016 El Niño was one of the strongest events since 1980s. This event resulted in significant influences on the weather of East and Southeast Asia. It caused the unprecedented worst drought in Indo-China peninsula, and heavy rain and floods in the south and east of China. That suppressed the rice planthopper from population development. It was found that the impacts of this El Niño on rice planthoppers are not only related to the own property of this extreme meteorological event, and some certain short-term weather events during the El Niño also might be crucial for the population development of rice planthoppers. *Assessing Impacts in Divergent Ecosystems*

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Saturday, 21 April	
10:20-12:00	**PARALLEL SESSIONS**
	Impact of Irrigation and Organic Supplements on N2O Emissions from Fruit Orchards and Vegetable Farms in Australia and Vietnam, and Policy Options for Mitigation Phi Hung Nguyen, Northern Mountainous Agriculture and Forestry Science Institute, Phu Tho, Viet Nam Gordon Rogers, University of Sydney, Sydney, Australia Kelvin Montagu, Western Sydney University, Penrith, Australia Peter Ampt, University of Sydney, Sydney, Australia Agriculture is a major contributor to greenhouse gas emissions, and these are likely to be affected by the cropping practices on different crop systems. This study measured seasonal and annual emissions of N2O from the typical fruit and vegetable farms in NSW Australia (cherry, apple, babyleaf spinach, processing tomato and sweet corn) and intensive vegetable production farms in Vietnam (mustard, cabbage and choysom). The studies provided baseline N2O emissions and in Australia, evaluated the impact of organic mulches, compost and well managed sub-surface irrigation on emissions. In Australia, the apple and cherry orchards, and the baby spinach and processing tomatoes the baseline N2O fluxes were low, with both orchards averaging about 6g N2O-N ha-1 day-1, on babyleaf spinach about 20g N2O-N ha-1 day-1 and for processing tomatoes on sub-surface drip irrigation emitting 3.1g N2O-N ha-1 day-1. In contrast, sweet corn emissions averaged 137g N2O-N ha-1 day-1, and this was attributed to higher nitrogen fertilizer applications and frequent overhead irrigation. Adding compost or organic mulch around the apple or cherry trees increased N2O emissions by about 2.7 and 3.8 times greater than the site controls, respectively. In Vietnam, N2O emissions from four vegetable farms were related to management practices including tillage, fertilizer and irrigation. Peak emissions ranged from 54g to 179g N2O-N ha-1 day-1 immediately after tillage and top dressing fertilizer. *Human Impacts and Impacts on Humans* **Predicting High Loss, Low Frequency Agricultural Drought Events: An Example Using Machine Learning for Cereal Crops in Ethiopia** Michael Mann, George Washington University, Washington, D.C., United States James Warner, International Food Policy Research Institute, WAshington, D.C., United States The ability to monitor and predict crop yields in developing countries is critical to the successful adaptation to changes in our climate. Increased temperatures and variability has already been linked to losses in maize and wheat yields (-3.8 and -5.5% respectively) and affected crop prices globally. Although much effort has been placed on modeling the spatial distribution of these shifts, less effort has been placed on how yields vary across space and time, particularly under conditions of drought. Advances in remote sensing provide new avenues to monitor agricultural crop health at high spatial and temporal resolution. However, our ability to monitor changes in plant productivity is still limited in more complex environments common to many developing countries. Here we integrate a variety of data sources (agricultural field surveys, GIS data and remote sensing products) and apply novel econometric techniques to highly disaggregated (sub-kebele) data on crop yields for all major growing regions of Ethiopia. Importantly, this training data covers the 2010-2016 period which includes a major regional drought event. Results indicate localized impacts on predominately rain-fed agriculture and potential coping mechanisms. Similar efforts in India have been able to achieve R2 values exceeding 85% at the district level. *2018 Special Focus: Engaging with Policy on Climate Change*
Room 4	**Impacts on Humans** **Impacts of Climate Change to Tourism Development in the Mekong Delta Region of Vietnam** Van Da Huynh, Can Tho University, Can Tho, Viet Nam Awais Piracha, Western Sydney University, Penrith, Australia Mekong Delta Region of Vietnam is forecasted to have one of world's most severe impacts from climate change. There is a big knowledge gap in research on climate change impacts on tourism in this area. While climate change's impacts on agriculture and fisheries have received much attention from authorities and researchers, impacts on tourism have largely been ignored. Tourism modes that are predominant in the Delta such as ecotourism, islet tourism, national parks tourism and mangrove forests tourism are highly vulnerable to climate change. This paper presents findings from a field study the authors conducted to fill the research gap on climate change's impact on tourism in Mekong River Delta. The study based on questionnaires and interviews of local tourism leaders, tourism businesses and tourists discovered that climate change is a real challenge for region's tourism businesses and there are significant gaps in climate change awareness among key tourism stakeholders. The study also unearthed that in climate change adaptation for tourism resources and infrastructure, local authorities and tourism businesses are not heeding global climate change scenarios. Tourism relies on agricultural, fisheries and other sectors of economy. Most of these related sectors can be successfully adapted to climate change. Although it has become an interdisciplinary issues climate change is adaptable in tourism sector. The resilience and adaptation process for tourism in Mekong River Delta will be effective if there is strategic planning based on bottom up approach is considered during tourism planning in the region. Increasing the awareness and readiness of the stakeholders is also very important elements to tackling climate change. Moreover, vulnerable tourism businesses in low and flat delta such as Mekong needs more attention and practical actions from international organizations and local entities in the era of climate change threats. *Human Impacts and Impacts on Humans*

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Saturday, 21 April	
10:20-12:00	**PARALLEL SESSIONS**
	Economic Determinants of Land Use Change in Mexico David Ricardo Heres, Centro de Investigación y Docencia Económicas, Mexico City, Mexico Griselda Priscila Mortera, Centro de Investigación y Docencia Económicas, Mexico City, Mexico Mexico's territory contains a wide range of ecosystems that host a high degree of biodiversity and forests represent a third of the total area of the country. During the last century, however, the forest cover in Mexico has been reduced to half its original size. Importantly, as part of the global efforts to mitigate climate change, Mexico has committed to conserve forests that contain and are capable of sequester large amounts of carbon. As major drivers of deforestation are still present in the country, for these policies to be effective it is necessary to identify the determinants of land use changes. The objective of the study is to explain land-use transitions between 2002 and 2011 based on economic returns in different uses. Our econometric estimations are based on a sample of almost 200,000 polygons that cover the whole country and for which we have information on land use, economic returns in competing uses, land type, access to roads, and socio economic conditions. As expected, our preliminary results indicate that agricultural returns are the main driver of deforestation and that the required compensation for conserving forests can be substantial in areas with high productivity in competing uses. Based on the results from this model, further research will be conducted to estimate the carbon sequestration supply curve in Mexico. *Technical, Political, and Social Responses, 2018 Special Focus: Engaging with Policy on Climate Change* **New Fascism: The Retrofit of Karl Marx in the Quest for the Fully Capitalized Planet in the Age of the Climate Change Apocalypse** Wendy Lynne Lee, Bloomsburg University of Pennsylvania, Bloomsburg, Pennsylvania, United States Indeed, it is precisely because climate change presents a potentially irrecoverable environmental crisis that the disregard of mounting evidence demands an equally potent pretext. Marx, I'll argue, provides just that pretext. Weaponized as the enemy of free markets or deified as the hero the worker's state, "Marxism" provides the ideological pretext for maintaining the myth of inexhaustible resources. Whether cast as the foe of "Making America Great, Again!" job creation in the manufacturing or mining sectors of the U.S. economy, or as the champion of Xi Jinping's "Chinese Dream," whether as foil or inspiration, a suitably retrofitted Marxism has been deployed by both leaders to legitimate unsustainable economic policies. However otherwise different, Donald Trump and Xi Jinping personify what I will call the new fascism: confronted with an existential threat the magnitude of climate change, both will reach for the most effective, ideologically reliable tool at their disposal to help dispel the growing recognition that the conquest of capital is responsible for climate change: "Marx." This paper traces how the potential impacts of climate change are mediated via the essentially nationalist commitments of two otherwise very different leaders. That the machinations of capital accumulation are responsible for greenhouse gas emissions is well-established, but the ways in which our response to--or denial of--climate change is ideologically disposed--that deserves greater exploration. The impacts of climate change, after all, are not only environmental, but social, economic, and geopolitical, particularly for developing world countries or regions like rural China which I discuss at some length. My argument is that Marx--if not always in name--plays an important role as spoiler (for Trump) or as hero (Xi) in what amounts to achieving the same ends: the preservation of multinational capitalist venture regardless the clear warnings about its role in global warming. *Human Impacts and Impacts on Humans, Technical, Political, and Social Responses* **Tourist Responses to Potential Climate Change Impacts in Florida: The Filter of Social Representations** Roberta Atzori, California State University, Monterey Bay, Seaside, California, United States Alan Fyall, University of Central Florida, Orlando, Florida, USA Florida, one of the most visited tourist destinations in the world, holds one of the most "unenviable" positions in terms of its vulnerability to climate change with the effects already visible, particularly on its coastal areas. Beside the physical impacts of climate change, society's perception of climate change, and the response to it at various decision-making levels, have become critical issues. This paper presents the perspective of tourists who have previously visited Florida, in a hypothetical scenario of changed climatic conditions. The main purpose of this study was to understand whether, with the implementation of adaptation strategies directed to limit negative impacts of climate change, the likelihood of tourists to return to Florida would improve in comparison with a future in which no action is taken at the state level to address climate change. In this scenario, the filter of social representations in shaping tourists' perspectives was used as a system of explanation of different tourist responses. The results of this study show that predicting shifts in tourism demand based on stated visitation intentions requires caution. These can encourage future researchers to pursue a more critical way of exploring the meaning behind tourists' stated responses, which could lead to expanding our current understanding of how climate change will transform tourism demand across different destinations. *Technical, Political, and Social Responses*
Room 5	**Imperatives for Change** **Fracking: An Often Overlooked Cause of Climate Change** John Ray, University of Montana, Butte, Montana, United States Hydraulic fracking, whereby sand, water and chemicals are injected at very high pressure to fracture shale oil rock in order to release natural gas, negatively affects climate change directly by releasing methane gas during the fracking process and indirectly by increasing our dependence on fossil fuels. Methane gas is much more potent as a greenhouse gas than is CO2. Some studies have found that methane gas leakage from fracking produces more potent greenhouse gas emissions than does coal. Fracking also contributes to climate change because by making natural gas cheaper and more plentiful, fracking encourages the greatly increased use of natural gas, thereby increasing greenhouse gas emissions. While burning natural gas per unit is less harmful to our climate than coal, by increasing the use of natural gas fracking contributes to global warming. In addition, natural gas processing and compressing plants significantly contribute to CO2 emissions. Shale oil from fracking also has led to a significant increase in refining petroleum, which also contributes directly to global warming. This paper discusses in depth the direct and indirect effects of fracking on climate change. Fracking and the use of the natural gas that it produces is not the benign alternative to coal. *Assessing Impacts in Divergent Ecosystems*

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Saturday, 21 April	
10:20-12:00	**PARALLEL SESSIONS**
	Climate Change and Its Effect on the Global Economy and Security Oluwaseyi Adebayo, University of Manitoba, Winnipeg, Canada Olufemi Olaoye, University of Manitoba, Winnipeg, Canada Climate change unleashes negative impact on human water supplies, agriculture, migration patterns, infrastructure, financial flows, disease prevalence, and economic activity. These impacts, in turn, lead to national or international security problems stemming from the aggravation of internal conflicts, increased poverty and inequality, exacerbation of existing international conflicts, diversion of national and international resources from international security programs, contribution to global economic decline or collapse, or international realignments based on climate change mitigation policies. Hence, this study seeks to beam searchlight on the danger that climate change poses to human existence, environment, development, global economy and security. Although, the United Nations through its legal frameworks as set out in the Paris Agreement and Kyoto Protocol has put in place climate finance for mitigation and adaptation mechanism to curtail the effects of climate change. But the big question is how effective and realistic will the actualization of this mechanism be in the advent of inadequate climate finance or funding and prevalent corrupt practices in most of the developing (vulnerable) country parties? Hence, a call for more robust climate finance, prevention of climate finance against misappropriation or corrupt spending and review of the provisions of Articles 9 (1), (3), (4) of the Paris Agreement and 12 (8) of Kyoto Protocol to United Nations Framework Convention on Climate Change. *2018 Special Focus: Engaging with Policy on Climate Change* **Resilient Infrastructure and Climate-Related Disasters : Building Climate Disaster Resilience, and Reducing post-disaster Recovery Time** Francesca O'Hanlon, Founder & Director, Blue Tap, Cambridge, UK To achieve the Sustainable Development Goals set by the United Nations in 2015, improving resilience to climate-related disasters is essential. Certainly, under the umbrella of international development, disaster resilience is viewed as an increasingly essential element of poverty reduction. A person living in a developing country is 150 times more likely to be affected by disaster than a person living in wealthier nations. As a percentage of GDP, economic losses in the face of a disaster can be 20 times greater in developing countries than high-income countries. This is, in part, caused by the higher risks associated with the geophysical location of developing nations, but also because many cities in low GDP countries suffer from a lack of resilient infrastructure to provide for, and protect populations. Infrastructure services often go unnoticed by society when functioning at full capacity. It is only when they fail that society's dependence on these services is made fully clear, and in these cases, the consequences can be devastating. This is particularly true for vulnerable populations. Service disruption or failure can lead to economic and societal consequence that significantly delay the length of recovery after a disaster. This paper examines historic events where the failure of two critical infrastructure services, electricity and water has significantly inhibited the disaster recovery process in low and medium income countries. The paper states that in order to build resilient communities, infrastructure systems must be designed and managed to deal with the increased hydrometeorological threats that populations face in the 21st century. The paper argues that critical infrastructure should be viewed as a socio-technical system, and to protect against extreme weather events, should be designed not only with a reduced probability of failure in mind, but also with the aim to reduce negative consequences when failure does occur. Several recent cases of disruption in water and electricity services in the wake of climate disasters are assessed to analyse what the consequences of critical infrastructure failure are on the recovery time after a natural disaster. Case studies of the recent extreme weather events that impacted Puerto Rico, Dominica and Barbuda are used to study the impact of critical infrastructure failure on society. The disaster and recovery process is described and a new set of indicators that defines a successful post-disaster recovery are developed. A comparison is made between the consequences of critical infrastructure failure in high-income countries and the consequences of critical infrastructure failure in lower income nations. Finally, the role of building resilience into infrastructure services is discussed to see how, in the wake of failure of these services, societies can continue to re-build after a catastrophic climate-related disaster. The paper concludes that failure of critical infrastructure services plays a key role in prolonging the emergency phase after a weather-related disaster, and the failure of these services significantly impacts the nature of the recovery process. *Technical, Political, and Social Responses* **Providing Awareness and Outreach on Climate Change to Consumers: Data from Local Governmental and Advocacy Efforts in California Illustrating Roadblocks and Success Stories** Sri Lekha, University of Nebraska, Lincoln, Nebraska, United States Climate change is a global problem affecting everyone, yet a there is a significant shortfall in consumer awareness on ways to positively impact the environment. This presentation will discuss data from interviews with governmental, utility, advocacy and outreach organizations on the measures taken by these entities to promote consumer awareness on climate change, and the successes and failures, of such measures. The session will also discuss the various cultural, demographic and geographical roadblocks that exist in creating consumer awareness among different cultures and demographics and highlight efforts that were successful in overcoming the obstacles. The session is aimed at creating a dialogue on effective practices in creating grassroots consumer awareness on personal practices to mitigate climate change that can propel research, innovation, policy and advocacy work in this cause. *Human Impacts and Impacts on Humans*
12:00-13:00	**Lunch**
13:00-13:45	**PARALLEL SESSIONS**

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13:00-13:45 **PARALLEL SESSIONS**

Hallway **Posters**

Impacts of Climate Change on Agriculture Water Use in the Central Valley, California

Lisbeth DaBramo, Lawrence Berkeley National Laboratory, Berkeley, California, United States
Helcio Blum, Lawrence Berkeley National Laboratory, Berkeley, California, United States
Raghavendra Suribhatla, INTERA, Austin, Texas, United States

The Central Valley in California accounts for approximately 10% of the total U.S. farm production and 94% of the irrigation water used in the state. The agricultural water demand is sustained by a combination of local and imported surface water and local groundwater supplies. Projections of climate change indicate reduction in snowpack volumes in the northern Sierra Nevada and surface water flows, and a consequent shift towards increased supply from local groundwater. The recently-passed Sustainable Groundwater Management Act (SGMA), on the other hand, might restrict groundwater pumping to reduce overdraft and prevent other undesirable results. This study examines the impact of projected changes in precipitation and temperature on crops water demand, surface water supply, and on groundwater use under alternative policy constraint scenarios. We rely on downscaled precipitation and temperature datasets and projections of surface water deliveries. We use an integrated surface water-groundwater model of the Central Valley to estimate groundwater pumping and simulate groundwater levels for alternative climate trajectories. The latter will eventually indicate the likelihood that groundwater pumping will be maintained at historical levels with no impacts on agriculture water supply. It will also inform future research on agriculture climate adaptation strategies and their energy impacts.

Human Impacts and Impacts on Humans

The Social Influence of Graphic Design on Climate Change: Presenting Climate Change in a Visually Compelling Way

Jong Yoon Kim, Plymouth State University, Plymouth, New Hampshire, United States

Graphic Design, also known as communication design, is the art and practice of planning and projecting ideas and experiences with visual and textual content. We, graphic designers, are professionally trained to inform audiences in visually effective way, such as innovative logo designs, engaging web designs, and creative packaging designs. But there's another avenue of design that does well when sourced to the crowd that can have significant impacts outside of profit margins: socially influential design. Today, we are facing on severe climate change threatening humans. Climate is changing. During the 20th Century Earth's average temperature rose 0.6° Celsius (1.1°F). While climate has changed throughout Earth's history, this is the first time that humans are the main cause. As a graphic designer and an educator, I have come up with several questions based on scientific information to ask ourselves and to inform audiences; How do we know climate change is real? Why is climate change happening? What are the effects of climate changing? What is the effective ways of presenting climate change to solve the problems? I am convinced that the quality of design plays a bigger role in our lives than ever before. Designers are not only good at designing functionalities but also good at solving problems, and especially in recognizing problems that people didn't previously consider to be problems at all. This poster/exhibition session will feature various possibilities of graphic design tools and methods connecting scientific information to visual communication.

Technical, Political, and Social Responses

Climate Change, Agricultural Pesticide Use, and Establishing Exposure Risks for Agricultural Communities

Katie Fellows, University of Washington, Seattle, Washington, United States

Climate change is expected to influence agricultural pest dynamics and pesticide application timing and rate, but to date no research has quantified this relationship. This project assesses the association between climate change and agricultural pesticide use, utilizing a combination of climate science, agricultural assessment, and public health methods to further understand the spatial and temporal impact of climate change underlying the relationship between pesticide exposure and human health by testing whether climate is historically associated with insect pest populations and pest management strategies such as pesticide use, and whether climate change will result in increased pest populations and insecticide use under future climate projections. The project investigates insecticide use on almonds grown in the Central Valley, utilizing the states Pesticide Use Reporting database. Historical and future climate data comes from ten statistically downscaled global climate models. The historical association between climate and pesticide use is then modeled and applied to future climate projections to project pesticide use in 2050. Changing pesticide application impacts risk of human exposure to these chemicals, and the corresponding adverse health outcomes. A geospatial risk assessment of future exposure in California maps potential exposure risk, identifying areas with the greatest human health hazard.

Human Impacts and Impacts on Humans

The Shadow System for the Adaptive Capacity to Climate Change: The case of Santos, Brazil

Fabiano de Araujo Moreira, State University of Campinas, Campinas, Brazil

As part of the comprehensive Project Metropole (Belmont Forum), this research aims to analyse the shadow system – understood as the informal interactions between communities and networks at different scales inside the organisations structures that do not count as official, but may be effective due to their greater agility – and its importance for the local adaptive capacity given the advent of climate change in the highly strategic and dynamic municipality of Santos, Brazil. For the analysis were considered the results of Adaptive Capacity Index (ACI), developed by researchers from King's College London, applied to 24 local agents that have the responsibility to create the rules of the city from the government, civil and private sector. The ACI determine the adaptive capacity of Santos through analysing the factors that affect the planning of necessary adaptation measures and policy changes within the social context of the region, but the focus for this presentation will be the considerations regarding the shadow system: the interviewees in Santos strongly emphasised these informal relationships as a way to circumvent the limitations caused by regular restructuring and modification of job descriptions and responsibilities within government agencies. With this study it was possible to observe that the shadow system is partly responsible for a significant change in the organisational and governmental capacity of Santos, enabling the organisations to overcome barriers such as periodic government overhaul, which causes policy discontinuity, and that shows the importance of considering these informal relations to strengthen the adaptive capacity of the municipalities.

Technical, Political, and Social Responses

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13:00-13:45 **PARALLEL SESSIONS**

Biomass Burning Impact on Aerosol Characteristics and Radiative Forcing over Middle Indo-Gangetic Plain

Nandita Singh, Banaras Hindu University, Varanasi, India

Indo-Gangetic plain is one of the most densely populated regions of the world encompassing the northern and eastern India, Pakistan, and virtually all Bangladesh. Every year extensive post-harvest agricultural residue burning occurs during October-November (Rice) and April-May (Wheat) over the North-West Indo-Gangetic Plain (IGP). The emissions from the prime burning locations transported over thousands of kilometers downwind, covering the IGP from west to east and central Himalayan region. The biomass burning (BB) emissions potentially influence Earth's radiation budget, atmospheric chemistry, impacting air quality and risks to human health. In 2016 and 2017, BB has played a noticeable role in unexpected severe smog and haze episodes over Delhi that overlapped with the stable atmospheric condition. Present submission focuses the impact of BB on aerosol characteristics, its radiative properties, and long-range transport over middle-IGP during the October-November, 2016 by analyzing ground-based and satellite-retrieved observations. The average aerosol loading was found high (362±211 μgm-3) with the maximum of 734 μgm-3 and AOD550 (0.55±0.22) raised to a maximum of 1.92. The average black carbon (8.6±3.1 μgm-3) was found high and positive delta C values (2.4±1.0). The estimated shortwave atmospheric radiative forcing was found positive with higher values (95±65 Wm-2) with an average heat rate of 3 Kday-1. The current findings were found higher than the other reported in IGP during previous years which suggests that there is an increase in atmospheric warming over middle IGP. It may lead to change in regional climate such as increase in temperature, alteration in precipitation cycle and drought.

Scientific Evidence

Climatic Change Tendency in Yellow River Delta during 1961-2013

Mei Han, Shan Dong Normal University, Jinan, China

The Results showed that the temperature presents an increasing trend over the last 53 years, the temperature tendency rate is 0.3℃/10a. Precipitation, evaporation, wind speed and relative humidity are all decreasing, and the climate tendency rate is -12.6 mm/10a, -69.4 mm/10a , (-0.26 m/s) /10a and -0.58%/10a, respectively. The precipitation and relative humidity of the annual variation showed obvious fluctuation. While the evaporation and wind speed of the annual variation presented a continued downward trend. Besides, the temperature in the four seasons appears a rising trend; the average seasonal precipitation showed an increasing trend in the spring, and the others showed a downward trend. The average evaporation, the average wind speed and the average relative humidity, all has a decreasing trend of each season. Moreover, the annual temperature range in the YRD area is large. The temperature reached the highest in July, which is 26.62℃ , while the minimum temperature is -2.98℃ in January. Distribution of the precipitation in the YRD region is uneven, and each month varies greatly, which concentrated in January to August. The evaporation of each month has some significant differences, which the maximum was in June and the minimum was in January. The average wind speed in each month was in the form of saddle shaped, and the maximum was in April. The relative humidity change in maximum was in August and the minimum was in April. From June to August the YRD region has the characteristic of high temperature, rich precipitation, strong evaporation, high relative humidity and less wind speed.

Scientific Evidence

Using Complex Network Analysis to Evaluate a Changing Electrical Landscape

Vanessa Wolf, CLT, ACLT, SLT, Set Lighting, Freelance, Los Angeles, California, United States

The distribution of electricity through the power grid is of fundamental importance to the functioning of society, yet remains an infrastructure-level contributor to greenhouse gas emissions. At present the grid is mostly centralized. However, diversified energy production, as a way to reduce fossil fuel usage and mitigate climate change, may radically change its topology. Increases in small-scale renewable generation sources, such as from solar panels and wind turbines, have already begun to impart a more distributed character to power generation compared to the power-station model which has until now dominated the electrical landscape. Additionally, the implementation of microgrids in future infrastructure may introduce new topologies with unique characteristics. We model the electric grid as a complex network and perform a statistical Complex Network Analysis. In particular we investigate the topological properties of a model of a single neighborhood (or microgrid) with the grid radiating from a single substation, as distributed generation from secondary sources increases over time.

Technical, Political, and Social Responses

Relatively Stable Response of Fruiting Stage to Warming and Cooling Relative to Other Phenological Events

Shiping Wang, Chinese Academy of Scienced, Beijing, China
Lili Jiang, Chinese Academy of Sciences, Beijing, China
Yaoming Li, PostDoc., Institute of Tibetan plateau, Chinese Academy of Sciences

Plant phenology is the recurrence of life history events. Impacts of climate change and human activity on phenology were significant in the Qinghai-Tibetan Plateau, and warming and optimal grazing advanced the timings of green-up and flowering but delayed the end date of senescence. However, fruiting time kept relative stable compared with other phenophases. Warming prolonged the duration of plant activity period which was mainly derived from prolonged flowering duration as well as other reproductive phenophases. These changes mainly attributed to changes of temperature, moisture and grazing. Warming and wet, moderate grazing contributed to advance and lengthen phenophases, whereas warming and drought led to delay and shorten phenophases. Changes of phenophases had significant influences on structure and function of populations, community, ecosystem and productions and lives of pastoral and tourism.

Assessing Impacts in Divergent Ecosystems

Please see the announcement board by the conference registration desk for any changes or additions to the above schedule.

Saturday, 21 April	
13:00-13:45	**PARALLEL SESSIONS**
	Mobile Apps that Fight the Challenges of Climate Change Nanhee Kim, California State University, Chico, Chico, California, United States Climate change is no longer a new term to us. From drought to global warming, climate change affects our lives in critical ways. Climate change not only affects our environment; it will eventually affect the livability of our eco-system. Many factors influence Earth's climate but the evidence indicates that a large part of climate change is caused by human activities. These are factors that we can and should address. Due to the seriousness of this issue, climate conscious groups have acted to raise awareness of the climate change and how people can reduce the negative effects of climate change. Design has played an important role in raising social awareness and has served to solve some of society's substantial issues. The growth of technology and the evolution of mobile app usage suggest that mobile apps have a role to play in raising awareness of relevant social issues. Engaging mobile apps could capture these new social media audiences and produce greater social awareness of sensitive topics. This study evaluates mobile apps that aim to advance user awareness of climate change and help to develop a healthier eco-system. These are mobile apps intended to impact the effects and causes of climate change on the environment. This research discusses the limitations and strengths of the mobile apps in addressing the social and economic aspects of climate change. *Human Impacts and Impacts on Humans*
Plenary Room	**Focused Discussions** **How a Physics Professor Saved Italy from Big Oil** Maria D'Orsogna, California State University, Northridge, Los Angeles, California, United States What is the role of non-elected scientists in environmental decision making? We review Italy's recent offshore drilling ban, an example of science-activism and community engagement through technology and social media. Can science and social media work together to raise awareness and help set environmental policies? What responsibilities do professional scientists studying climate change have in communicating with the general public and calling for action? Should scientists engage with adversarial policy makers and push for environmentally conscious decisions? What are the proper avenues for action outside academia? What is the emotional cost of full-fledged activism? As a case study, we will review Italy's recent 12-mile ban on offshore drilling. Establishment of the ban was influenced by a scientist-turned-activist who used social media, town-hall meeting lectures and public debates to create awareness among the general public, expose corruption, coordinate letter writings, raise awareness and spur action. We discuss how, by engaging with the community and pushing boundaries, scientists and educators can truly make a difference. *Technical, Political, and Social Responses*
Room 1	**Workshop** **Picturing Climate Change in Thunder Bay: Reflections on a Photovoice Project** Lindsay Paige Galway, Lakehead University, Thunder Bay, Canada Climate change is a wicked problem characterized by uncertainty, complexity, and the need for multi-level action. Although climate change is a global phenomenon, it is experienced locally and community level awareness and adaptation are imperative. Against this backdrop, a community photovoice project was developed and conducted by researchers from Lakehead University and The City of Thunder Bay. The objectives of the project were: to document and explore ideas about building resilience to climate change in Thunder Bay; to use photographs to raise community awareness about climate change; and to build momentum for climate change adaptation. Photovoice participants included members of the Thunder Bay Adaptation Working Group. Three workshops were held between July and September 2016. The introductory workshop provided an overview of the photovoice process and an opportunity for the group to finalize objectives and guiding questions. The second workshop focused on sorting, describing, and synthesizing photographs taken by participants. In the final workshop, emergent themes were identified, a community message was crafted, and those photographs that best represented the emergent themes and community message were selected. The final outputs from this project included a community photo exhibit entitled "Picturing Climate Change in Thunder Bay: Urgency, Hope and Action" and a project website. *Technical, Political, and Social Responses* **Preservation of Human Rights in Iran's Climate Change Policy** Ali Kiani Neyestanaki, University of Tehran, Tehran, Iran Borna Bateni, University of Tehran, Tehran, Iran Adverse impacts of climate change on the human right to benefit from adequate conditions of life, in an environment of a quality that permits a life of dignity and well-being, have necessitated the role of States to apply a human rights-based approach to their climate change policies; meaning an assessment on to which extent, climate change will impede improvements of human well-being, and prevention of unjust and discriminatory climate change strategies. Iran, signatory to the 1992 Rio de Janeiro Earth Summit, 2005 Kyoto Protocol and 2015 Paris agreement, has shown to be trying to act in compliance with international integration about the climate change matter. Mitigation policy of Iran is also reflected in Iran's Sixth Five-Year National Development Plan (2017), the 2025 Vision of Iran, the National Communications of Iran to UNFCCC and numerous environmental legislation. In this paper, after providing a survey of interrelationship between human rights and climate change, we scrutinize the effect of the human rights-based approach on Iran's climate change policy, by examining Iran's treaty obligations, regulations and governmental decrees. *2018 Special Focus: Engaging with Policy on Climate Change*

Please see the announcement board by the conference registration desk for any changes or additions to the above schedule.

Saturday, 21 April	
13:00-13:45	**PARALLEL SESSIONS**
	Environmentalism and the Machine: Questioning the Human/nature Dualism for a Sustainable Future Melusine Martin, James Cook University, Cairns, Australia The conventional connotation of the term "ecology" implies seeing everything as connected, as constituting a whole that is greater than the sum of its parts. Yet the human/nature dualism is still predominant in environmental thinking. It is an aspect of Western culture and of Western discourses on nature protection that defines humans and nature as opposite. As scientists identify further support for the biophilia hypothesis while researching the effects of nature on brains, the notion of wilderness as "unspoiled" nature is slowly evolving to encompass human beings, and human beings are evolving to consider themselves part of nature. This conference paper, made following a literature based research methodology, offers a critical analysis of studies questioning the human/nature dualism in green thought. I argue that some aspects of environmentalism (deep ecology among others) are still a practice determined by Western culture in a postindustrial context, and that they are an expression of the human/nature dualism. I call on individuals to rethink human-nature disconnectedness by digging deeper to the problem's cultural roots. New social and cultural approaches to climate change come from changing our beliefs about nature and our ideas about our place in nature. *Technical, Political, and Social Responses*
Room 2	**Virtual Posters** **Economic Impact of Climate Change on Asian Developing Economies** Xiaobing Zhao, Northern Arizona University, Flagstaff, Arizona, United States Developing Asia accounts for 30% of world GDP and 40% of global CO2 emissions, and thus is important for global climate change. Previous studies have used national-level data to demonstrate that higher annual temperatures negatively affect economic output and growth in Asia (e.g., Dell, Jones and Olken, 2012; Burke, Hsiang, and Miguel, 2015; Lee et al., 2017). Yet, annual temperatures and productivity often vary greatly across space within countries. If the true effect of temperature on economic growth is nonlinear, then the spatial aggregation inherent in national data may bias estimators for the temperature-growth relationship. With this in mind, we revisit the international within-country relationship between temperature and growth in developing Asia using subnational 1-degree longitude by 1-degree latitude grid cell data at five-year intervals, originally developed by Nordhaus (2006). Increasing spatial resolution to the grid cell level improves statistical precision, makes temperature measures more meaningful, and tightens the spatial link between temperature and economic growth. Using long-horizon data measured at five-year intervals may also better capture the long-run impact of temperature on growth and reduce the sensitivity of estimates to spurious idiosyncratic shocks. Furthermore, we follow recent research (e.g., Deryugina and Hsiang, 2014; Graff Zivin and Neidell, 2014), and estimate the impact of temperature on economic growth in developing Asia with a linear splines model. Empirically, we find strong evidence of a nonlinear relationship between temperature and growth in developing Asia, which has significant policy implications. *Human Impacts and Impacts on Humans* **Plant Organic N Uptake Drives Plant Dominance under Warming** Lili Jiang, Chinese Academy of Sciences, Beijing, China Shiping Wang, Chinese Academy of Sciences, Beijing, China There is ample experimental evidence for shifts in community composition under climate warming. However, so far, the underlying mechanisms of these compositional shifts remain poorly known. The amount and forms of nitrogen available to plants are among the primary factors limiting productivity and plant species coexistence in terrestrial ecosystems. We conducted a short-term 15N tracer experiments in an alpine grassland to investigate the effects of warming and grazing on plant uptake of NO3−-N, NH4+-N, and glycine-N. Four dominant plant species (Kobresia humilis, Potentilla anseria, Elymus nutans, Poa annua) were selected for the study. We found that 10-years warming decreased soil inorganic N content? And the rate of uptake of inorganic N by plant. In contrast, warming increased plant organic N uptake rate in K. humilis, P. anseria, and E. nutans but not in P. annua. Warming did not affect the uptake rate of plant species total available N and plant relative biomass, except for warming decreased it in P. annua. There were no grazing × warming interactions on uptake rates of plant available N. We conclude that plant can keep its dominance when it increased organic N uptake under long-term warming. *Scientific Evidence*
Room 3	**Workshop** **Visualizing Science: Using Artistic Experiences to Communicate Climate Change** Sally Graves Machlis, University of Idaho, Moscow, Idaho, United States Delphine Keim, University of Idaho, Moscow, Idaho, United States Scientists seek to understand the vexing problems facing humankind including public health, the environment, and natural and manmade disasters. It is often difficult to explain the vastness of their research or the problems they seek to answer to the general public. Some of the issues we face such as climate change are so complicated and frightening that much of the population chooses to not even look at the science. Facts, maps, and charts often serve those who are already concerned with our unsustainable trajectory. Art can be a compelling avenue for communication. It can help us understand what it means to be human. It can connect us to our feelings and emotions. While scientists seek to convey knowledge through research and data, artists seek to change culture through their unique vision. In this workshop the authors will share the recent collaboration between artists and scientists at the University of Idaho visualizing scientific research. Participants will be led through a structured exercise to visualize an aspect of their research similar to the process used at UI. They will be guided with a series of prompts to uncover an early scientific fascination. What is the earliest experience of their research focus? Modeling the artistic creative process, participants will have the opportunity to create a visual/emotional interpretation of a specific aspect of their scientific research using 3-D media (plastic clay) and/or a 2-D media (colored pencils and oil pastels). Materials provided. *Human Impacts and Impacts on Humans*
13:45-14:00	**Transition**

Please see the announcement board by the conference registration desk for any changes or additions to the above schedule.

14:00-15:40 **PARALLEL SESSIONS**

Room 1

Vulnerabilities

Vulnerability Assessment of Critical Oil/Gas Infrastructure to Climate Change Impact in the Niger Delta

Justin Udie, De Montfort University, Leicester, Leicestershire, United Kingdom
Subhes Bhattacharyya, De Montfort University, Leicester, Leicestershire, United Kingdom
Leticia Ozawa-Meida, De Montfort University, Leicester, Leicestershire, United Kingdom

The Niger Delta is the energy hub of West Africa. Critical energy infrastructure built around this coastal area are under severe threat of climate change impacts. This provoked the need for a crucial investigation of the vulnerability of these infrastructure with the view to suggesting possible adaptation strategies for sustainable energy exploration in the region. We used Analytic Hierarchy Process (AHP) of Multicriteria Decision making Analysis (MCDA) to illuminate vulnerable oil/gas infrastructure after randomly selecting seven (7) assets upon an intensive exploratory survey. In addition, adequate scoping and review of literature revealed seven (7) AHP criteria that were used to engage stakeholders in the industry for focus group interviews. Analysis of result revealed a high vulnerability of critical oil/gas infrastructure due to; proximity between climate threat windows and location of infrastructure; exposure of these assets to direct sunlight upon the rising ambient temperature is causing rapid corrosion of carbon-steel infrastructure. The investigation further revealed that assets located in inundated areas (4.5 m asl) with weak adaptive capacities due to age and obsolescence are more vulnerable to flood, storms and rising Atlantic tides. We proposed infrastructure upgrade, decommissioning and substitution of carbon steel systems with glass reinforcement epoxy made systems.

Assessing Impacts in Divergent Ecosystems

Climate Change and Its Impact on Humans' Lives : A Human Rights Perspective

Marlene Payva Almomte, University of Liverpool, Liverpool, UK

The rise of sea-levels, floods, droughts, water scarcity, heavy precipitations are vividly evidencing the tremendous impact of climate change on people' lives worldwide, particularly, in the least developed areas, giving a sense of urgency of measures to address the problem through collective climate action whereby human rights should be an essential component. In the last years the role of human rights has slowly and gradually been accepted in different fields of the climate change debate and literature. The scope and potential of this role remains to be seen. A few decades ago, it would have been unthinkable to consider human rights and its mechanisms as having a space in the climate change debate, which was almost regarded as scientific and technical. Today, there is no doubt that human rights have a role to play in addressing the major global challenge of climate change. The harmful effects of climate change on a range of human rights has widely been recognized in a number of documents and scientific reports including the Human Rights Council resolutions, reports of the United Nations Special Rapporteur on Human Rights and the Environment, scientific reports of the Intergovernmental Panel on Climate Change, among others. The Paris agreement consolidates the universal recognition of the importance of human rights in addressing the challenges that climate change poses to humankind.

Human Impacts and Impacts on Humans

Disasters, Displacement, and Dysfunction: The Capacity of Emergency Housing Policies to Assist "Climate Refugees" in Natural Disasters

Matthew Moore, California State University, Easy Bay, Hayward, California, United States
Chandrakala Ganesh, California State University, Easy Bay, Hayward, California, United States

In 2005, Hurricane Katrina displaced approximately a quarter of a million people in New Orleans, Louisiana, over half the city's population. 12 years later there remain serious and persistent concerns about the policies, programs, and procedures in place to mitigate housing displacement caused by natural disasters associated with climate change. The Federal Emergency Management Agency (FEMA) estimates that it can provide short-term shelter for up to 50,000 individuals, a fraction of the number displaced in such a disaster. Most communities rely instead on state and local emergency programs; frequently, these plans are simply to use schools and public buildings as temporary shelters, with no long-term solutions. Compounding the problem, homelessness has exploded as economic inequality has increased, with tent encampments becoming ubiquitous on city streets and in parks. Existing programs already struggle to serve these populations. In a future displacement event, existing emergency housing programs would likely be overwhelmed. Our paper will conduct a systematic policy analysis of current emergency-housing programs at the federal, state, and local levels, evaluate the likely ability of these programs to affectively mitigate significant displacement caused by climate-change related natural disasters, and suggest policy solutions to sustainably improve the capacity of these programs.

Technical, Political, and Social Responses

Climate Change and Internal Migration in Brazil

Claire Brunel, American University, Washington, D.C., United States
Yuanyuan Maggie Liu, Georgetown University, Washington, D.C., United States

Global warming affects productivity in climate-sensitive sectors thereby creating income shocks, especially for rural households in poor countries. Internal migration represents an important channel through which households can cope with these shocks. Recent empirical work suggests that high migration costs could be a significant impediment to relocation for poor households. Using the state of road infrastructure as a proxy for migration costs, we exploit exogenous variation in temperatures and precipitation rates across 137 mesoregions in Brazil and examine the response of long-run bilateral migration flows between 1980 and 2010. The empirical evidence is based notably on a novel road dataset we constructed by digitizing historical maps of the road networks, combined with geospatial data on climate factors and bilateral migration data from decennial censuses. Our results suggest that migration costs act as a significant deterrent of climate-driven relocation.

Human Impacts and Impacts on Humans

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14:00-15:40 **PARALLEL SESSIONS**

Room 2

Economic Challenges

Economic Evaluation of Large Weather Events Due to Climate Change: Floods in Atlantic Canada

Yuri Yevdokimov, University of New Brunswick, Fredericton, Canada

Yuliya Burina, University of New Brunswick, Fredericton, Canada

Stanislav Hetalo, University of New Brunswick, Fredericton, Canada

Historically Atlantic Canada is vulnerable to flooding. Destructive consequences of these events have been seen in the past and are expected to occur in the future specifically due to climate change. The goal of this study is to establish a relationship between socio-economic, climate change as well as direct flood factors and economic loss from floods. The study attempts to assess economic consequences of floods as the most frequent, damage-causing extreme weather event in Atlantic Canada. Evaluation of the above mentioned relationship is done on the basis of statistical analysis based on data collected from Canadian Disaster Database, database of Environment Departments and Local Governments of Maritime Provinces. The study concludes that economic impact from floods in Atlantic Canada is negative and statistically significant, and it depends on climate change. Expected economic loss from floods evaluated in this study represents the upper bound for potential investment into mitigation measures.

Assessing Impacts in Divergent Ecosystems

British Columbia's Carbon Tax to Combat Climate Change: Lessons for Taiwan

Tsung-Sheng Liao, National Chung Cheng University, Chiayi, Taiwan, Taiwan

Among instruments to reduce greenhouse gases, the carbon tax tool represents a promising but politically controversial approach. British Columbia, Canada, introduced a broad and consumption-based carbon tax in 2008. The carbon tax rate was $10 per ton of carbon dioxide equivalent (CO2e) emissions initially, increased to $30 per ton in 2012, and covers 70 percent of British Columbia's greenhouse gas emissions. The introduction of the tax had faced immense challenges, but turns out to be a successful innovation in climate action. This article explores background and context of British Columbia's use of the carbon tax to reduce greenhouse gas emissions. The author examines and focuses on challenges involved and solutions for them. Then, by comparing background facts and circumstances of British Columbia and Taiwan, this article lays out what challenges Taiwanese Government may confront with and what solutions the Government can employ if the carbon tax tool becomes necessary to deal with greenhouse gas emissions in Taiwan.

Technical, Political, and Social Responses

Role of TTIP on the Environment

Dhimitri Qirjo, State University of New York at Plattsburgh, Plattsburgh, New York, United States

Razvan Pascalau, State University of New York at Plattsburgh, Plattsburgh, New York, United States

This paper empirically investigates how the implementation of TTIP (Transatlantic Trade and Investment Partnership) affects per capita emissions of GHGs and CO2. We show that the implementation of TTIP could help in the fight against global warming. We find that one percent increase in bilateral trade as a share of GDP between the US and a typical EU member reduces per capita emissions of CO2 and GHGs by about 2.7 and 2.4 percent respectively. These results stand because the pollution haven motive based on national income differences is dominated by the factor endowment argument and the pollution haven hypothesis based on population density variations.

Technical, Political, and Social Responses

Disbursement Process of Climate Funding in Adaptation Fund, Least Developed Countries Fund and Green Climate Fund: How Far Aligned with the Adaptation-Needs of LDCs

Badiul Alam, Macquarie University, Sydney, Australia

Least Developed Countries (LDCs) are the most vulnerable countries to the adverse impacts of climate change because of their less resilient power and poor economic condition. The UNFCCC, Kyoto Protocol and the recent Paris Agreement, all international treaties on climate change have acknowledged the vulnerability of these LDCs and have given responsibility to the developed countries to supply financial resources for the implementation of adaptation activities in these countries. But the LDCs have complaint about disbursement process and the funding mechanism of these international Climate Funds. In the Adaptation-finance architecture, a central challenge is to design institutions that can channel funds effectively for the implementation of adaptation activities in the fund-receiving countries. The question as to how far these Climate Funds are meeting the adaptation-needs of the LDCs and promoting the country-ownership has become central in the climate change and adaptation-finance nexus. In that context, this paper will investigate into the challenges of decision-making, disbursement process and overall management of some selective international Climate Funds such as AF, GCF and LDCF from the adaptation-perspective of the Least Developed Countries. As outcome, this paper will contribute in legal and policy reforms in the overall management-arena of international climate change adaptation finance.

2018 Special Focus: Engaging with Policy on Climate Change

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14:00-15:40 **PARALLEL SESSIONS**

Room 3

Adaptation and Mitigation

Adapting to Climate Change in Tennessee: University of Tennessee Extension Approaches to Adapting to More Droughts and More Floods

Forbes Walker, Univeristy of Tennessee, Knoxville, Tennessee, United States

It is anticipated that Tennessee will experience more floods and more droughts in the future. This will affect agriculture in the state in different ways. University of Tennessee (UT) Extension personnel are working closely with landowners and producers to provide practical and cost-effective strategies for managing and coping with changes in climate patterns especially during periods of rainfall deficient and droughts. This paper will summarize the on-going applied research and extension efforts of UT Extension to provide livestock with adequate forages during the summer months, as well as extend the grazing season and improve irrigation efficiency for row-crop and nursery crop agriculture. This work is in part supported by a USDA NIFA Water for Agriculture grant awarded to the University of Tennessee in collaboration with Tennessee Technological University, University of Memphis, Middle Tennessee State University and the University of Tennessee at Martin to study the effects that climate change may have on agricultural production in the Tennessee and Cumberland River Basins in the coming decades.

Technical, Political, and Social Responses

Adaptation of Asia-Pacific Forests to Climate Change

Guangyu Wang, University of British Columbia, Vancouver, Canada
John Innes, University of British Columbia, Vancouver, Canada

Climate change is an immense threat to the stability and productivity of forest ecosystems in the Asia-Pacific region. Potential changes to or loss of forests will have drastic environmental impacts on biodiversity, ecosystem function and resilience, as well as immense socio-economic impacts on people and economies dependent on forest resources and ecosystem services. Despite their importance, there is a lack of information and tools focused on Asia-Pacific ecosystems and economies, which are necessary to understand the potential effects of climate change and develop regionally-specific adaptation and mitigation strategies. The project Adaptation of Asia-Pacific Forests to Climate Change aims to address this lack of knowledge and tools and to increase the adaptive capacity of Asia-Pacific forest ecosystems. This objective has been achieved through: development of a high-resolution climate model, ClimateAP, applicable to any location in the region; development of ecological models to project how climate change will affect suitable climatic conditions, regeneration, and productivity of forest tree species; development of tools to assess the most effective local management strategy based on management objectives and projected impacts of climate change; evaluation of models to assess forest fire risk and the relationship between forest fire and climate change; assessment of ecosystem carbon storage using LiDAR; and evaluation of how vegetation dynamics respond to climate change using remote sensing technology. All project outputs were developed with ease of communication in mind, as to ensure that information can be clearly disseminated and easily understood. This is necessary to allow for project findings to be used in the development of effective policy and sustainable forest management strategies related to adaptation and mitigation of forests to climate change.

Assessing Impacts in Divergent Ecosystems

Communities Led Drought Mitigation in the Thar Desert, India

Prakash Tyagi, GRAVIS, Jodhpur, India

Thar Desert of India is severely drought prone region with severe food and water insecurity and deep rooted poverty. While perennial droughts have always been an issue in Thar, Climate change has manifested in the unpredictability and shifts in rainy reasons in recent years. Overall precipitation has been higher recently but rains were neither spread out as per traditional rainy seasons, nor did it come when most useful for agricultural needs. In the absence of structures that could store water for household use and agriculture, and with existing agricultural seasons and practices, farmers are not able to make use of this water for agriculture or household purposes. GRAVIS has been addressing drought mitigation in Thar for over 3 decades. Over last few years, looking at above aspects, GRAVIS has taken up a Communities led Drought Mitigation Program focusing on climate resilience. The program has three main components – innovating/ improving designs of rainwater harvesting structures maximizing storage capacity, innovations around crops and introducing new agro-horticultural practices suiting new rainfall patterns, and capacity building on climate change. The program is reaching covering over 100,000 farming households. In last 5 years, farmers have registered 50 to 60% increase in crops cultivated and water stored. GRAVIS envisions to scale-up the program.

Technical, Political, and Social Responses

Transforming Saskatchewan Power Grid: Policies and Potentials

Jane Akpan, University of Regina, Regina, Canada

Global warming caused by the emission of Greenhouse Gas (GHG) represents a potential threat to human and the ecosystem. To this effect, Canada pledged to reduce GHG emission in 2030 by 30% below the 2005 emissions level, beginning from the electricity sector. Most provinces responded to this call; Ontario phased out coal electricity with the aid of incentive mechanisms that boost investments in clean electricity generation. Quebec has a cap-and-trade scheme in place, the province of British Columbia has a carbon tax scheme. However, Saskatchewan is yet to adopt a policy framework, though it emits the highest per capita GHG (67.1tonnes per person) in Canada. More so, 75% of electricity generated in Saskatchewan comes from fossil fuel-based power plants, which suggests that transforming the electricity generations towards cleaner alternatives may help the province in its efforts to reducing GHG emission.

Technical, Political, and Social Responses

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Saturday, 21 April	
14:00-15:40	**PARALLEL SESSIONS**
Room 4	**Divergent Impacts**

Effects of Experimental Warming on Invasive Rhamnus Catharica as Compared to Native Temperate and Boreal Tree Species

Kerrie Sendall, Georgia Southern University, Statesboro, Georgia, United States
Peter Reich, University of Minnesota, St. Paul, Minnesota, United States
Rebecca Montgomery, University of Minnesota, St. Paul, Minnesota, United States
Artur Stefanski, University of Minnesota, St. Paul, Minnesota, United States

Our manipulative open-air experiment in northern Minnesota addresses the potential for climate warming to alter tree function and species composition at the boreal-temperate forest ecotone through effects on juvenile phenology, physiology, and growth. The goal of this study was to compare plant functional traits of tree species from three groups (invasive temperate, native temperate, and native boreal) grown under two temperature regimes (ambient and warmed 3.4 °C belowground and aboveground) to determine whether an aggressive invasive species is differentially sensitive to climate warming than common native species. We found significant effects of warming on growth that differed among species. Native boreal species showed a decline in growth under the warming treatment, while native temperate and the invasive temperate (Rhamnus cathartica) species generally responded positively to warming. However, the invasive R. cathartica showed the largest increase in growth. This growth response to warming by the invasive species does not appear to be driven by differences in growing season length, as all species extended their growing season in the warmed plots. Percent leaf nitrogen was also not a driver of growth per se, as this trait was largely unaffected by the warming treatment. However, while specific leaf area (SLA) of both native groups did not vary among treatments, SLA of R. cathartica declined significantly in the warming treatment, causing increased area-based leaf nitrogen concentrations. Area-based photosynthetic rates followed a similar pattern, increasing in the warming treatment for R. cathartica, but remaining stable or declining in the two native groups. Our growth and leaf trait results suggest that invasive R. cathartica may outgrow and outcompete the native species in northern Minnesota under climate change.

Assessing Impacts in Divergent Ecosystems

Degree of Households Vulnerability to Climate Variability in Nigeria

Abiodun Emmanuel Awoyemi, Pennsylvania State University, Centre County, United States
Oluwafunmiso Adeola Olajide, University of Ibadan, Ibadan, Nigeria

The broad objective of the study will be to examine the degree of vulnerability of households to climate variability in Nigeria. The specific objectives are to determine; the socio-economic characteristics of the households in the study area, the relationship between crop production and rainfall pattern, the vulnerability of households to climate variability in the study area and the effect of climate variability on agricultural productivity. The methods of analysis that will be used in this study includes; descriptive analysis, correlation analysis, principal component analysis (PCA) Household Vulnerability Index (HVI) and multiple regression (Hausman Test). Households Vulnerability Index (HVI) will be used to measure the vulnerability of households to climate variability in Nigeria using the integrated vulnerability approach. The findings of this study will help the stakeholders to know the relationship between climate variables and their productivity. The vulnerability study will help them to know how sensitive and how exposed they are to climate change. Therefore, it is envisioned that the outcome of this research will contribute in the design programme through an elaborate of the degree of household's vulnerability to climate variability which will enable the policy makers to formulate policies that will be beneficial to all.

Assessing Impacts in Divergent Ecosystems

Assessing Climate Change Impacts on Cultural Ecosystem Services: A Case of Riverine Ecosystem of Ujjain City, India

Rama Pandey, School of Planning and Architecture, Bhopal, Bhopal, India
Parikshit Mehta, Panchayat & Rural Development Department, Government of Madhya Pradesh, India

In India, rivers are venerated as spiritual and heavenly entities and this belief results in multifarious rituals and customs being practised along their banks. Cultural Services that are ordained by riverine ecosystems in India in the form of religious rituals and pilgrimages happen to be more than any other country in the world. Therefore in India, Cultural Ecosystem Services (CES) play an important role in the well being of people as they provide the necessary mental succour and is an integral part of their religious and spiritual practices. The fast pace of urbanization, development activities and spiritual tourism is leading to extensive degradation of riverine ecosystem. This along with drastic impacts of climate change in the form of extreme events along rivers and adjoining areas are affecting the provision of CES. The city of Ujjain, an ancient riverine settlement, is considered as cultural and spiritual capital of central India. The riverine ecosystem of Ujjain has already suffered degradation due to over-exploitation of CES and now facing new threat of climate change. In this study, components of the ecosystem such as river, lakes, ponds and urban green have been tracked over a period of time and assessed for its degradation. Perception survey of stakeholders is conducted to ascertain the difference in level of CES and to find possible interventions to mitigate climate change impacts on riverine ecosystem that leads to sustainable use of CES for human well-being.

Assessing Impacts in Divergent Ecosystems

Please see the announcement board by the conference registration desk for any changes or additions to the above schedule.

Saturday, 21 April	
14:00-15:40	**PARALLEL SESSIONS**
	Salmon Punks Collaborative: An Educational Strategy for Inculcating Sustainability Proactivism Jennifer Woodcock-Medicine Horse, Montana State University, Bozeman, Montana, United States The Salmon Punks Collaborative (SPC) is a culminative proposal based on 104 in-person qualitative interviews conducted at ten major museums in the United States, funded by NSF-EPSCoR and a Smithsonian Research Fellowship. SPC is designed to be a collaborative, interdisciplinary, cross-institutional Citizen Science and Citizen Art program, educating and inspiring Indigenous and non-Indigenous youth about climate change and proactivism. SPC will empower children to create social and technical solutions to global climate change by educating, mentoring, and supporting their environmental scholarship and communicative abilities. The SPC could reside at either a university or a museum, inviting collaboration with their local school district, tribal communities and senior citizens. The pilot program will be a scalable Citizen Science project focused on the pollinators - bees, bats, butterflies, birds - which are critically import to our food supply, sensitive to climate disruption, found in many localities, and familiar to children. SPC will create K-12 pollinator data collection exercises, teaching increasingly complex academic skills. Students will be mentored by environmentally knowledgeable seniors; First Nations/Tribal youth will be supported in appropriately sharing traditional ecological knowledge. SPC will bring Citizen Science and Citizen Artist students together with faculty and museum staff to conceptualize and create scientifically sound, emotionally evocative exhibits and programs to meaningfully convey their scientific findings. Following a successful pilot phase, SPC could expand to include sister communities, and to interconnect globally with similar programs. *Technical, Political, and Social Responses*
Room 5	**Late Additions** **India's Response to Global Climate Change** Samsher Singh, Central University of Gujarat, Gandhinagar, India Natural environment plays a distinctive role in the life of large section of the Indian population. The Intergovernmental Panel on Climate Change's definition of climate change as "long term changes in temperature, humidity, clouds and rainfall and not to day to day variations (IPCC 2007). This research examines the concept of climate change and how the emergence of climate change as a global phenomenon raise challenges for India. India is among the most vulnerable country when it comes to thee impacts of changing climate. And despite of several international multilateral negotiations, how India change its position in the global climate change scenario. This research addresses the ultimate global environmental governance challenge: climate change. It explores three key questions: Who is responsible for climate change? Who is affected by its consequences? Who should act in response? Climate change requires a global response, encompassing the North and the South, local and Global communities, and the public and private sectors. As environmental issues have traditionally played a secondary role in the India's policy formulation; the emergence of climate change as a global phenomenon has raised challenges for India. The fourth IPCC assessment report lists multi-sectoral impacts of climate change (IPCC, 2007). Some of the major sectors that will be adversely affected are coastal ecosystem, agriculture, water resources, natural habitat and biodiversity including the possibility of large scale displacement of communities. *2018 Special Focus: Engaging with Policy on Climate Change*
15:40-15:55	**Transition**
15:55-17:10	**PARALLEL SESSIONS**
Room 1	**Impacts and Responses** **Geophysiological Treatment of an Ailing Earth from Space: Self-Replication Technology is Essential** Alex Ellery, Carleton University, Ottawa, Canada Current approaches to climate mitigation are insufficient to solve the problem of climate change. In analogy to medical practice, we submit that baseload clean energy source are required (antibiotic) together with geoengineering (analgesic). We have highlighted space technology as offering these solutions - solar power satellites in geostationary orbit around Earth and space-based solar shields at the L1 Sun-Earth Lagrange point. The chief hurdle is the high cost of launch assets into space. We propose to eliminate this cost barrier by implementing self-replication technology based on 3D printing techniques applied to material resources on the Moon. This eliminates the launch cost problem. We have been making progress in developing the underlying capabilities that will realise self-replication technology. The ability to 3D print electric motors and electronics is key to the construction of robotic machines from lunar material. This work will be described. If self-replication technology can be implemented even in a simple way it opens the possibility of exponential growth in productive capacity on the Moon. Constellations of both solar power satellites and solar shield modules - our treatment of choice - become feasible at very low cost. *Technical, Political, and Social Responses* **Climate Change Adaptation Policy Actions in the Coastal Areas of Bangladesh** Sujay Chowdhury, Planning Commission of Bangladesh, Dhaka, Bagladesh Kenichi Matsui, University of Tsukuba, Tsukuba, Japan Bangladesh is one of the most vulnerable countries to climate change in the world. The coastal area of Bangladesh is more susceptible to disaster. However, there is limited information on policy initiatives to reduce the vulnerability of its coastal community. This paper attempts to identify climate change adaptation actions taken by the Bangladesh government in the coastal areas, especially the Bangladesh Climate Change Strategy and Action Plan (BCCSAP). These two main policy actions were formulated in 2009 as the key operational document on climate change. To implement the BCCSAP, three major operational climate change funds have been in place to deliver climate sensitive actions. The study reveals that 44% of projects have been implemented in the coastal area from 2009 to 2016. The findings of this study identify the disparity between urban and coastal areas. *2018 Special Focus: Engaging with Policy on Climate Change*

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15:55-17:10 **PARALLEL SESSIONS**

Role of Leadership in Adoption of Waste-to-Energy in Nigeria

Jahan Moghadam, Georgia State University, Atlanta, Georgia, United States
Karen D. Loch, Georgia State University, Atlanta, Georgia, United States

The use of Renewable Energy (RE) has considerably increased in the last several years. Innovative forms of sustainable alternative energy production, such as solar and wind, have now become a recognized energy sources. Following suit, this paper has reviewed Waste-to-Energy (WtE), an innovative and evolving form of RE, and its possible adoption in Nigeria, a developing country, to address both the energy crisis and the pollution problem, both contributors to climate change. The theoretical framework of this paper utilizes the genesis of Fishbein and Ajzen's theory of reasoned action (TRA), expanding on renewable energy studies using TRA and the leadership-led change framework in order to explain leaders' behavior to adopt WtE in Nigeria. A survey of 184 leaders affirmed that Nigeria's energy crisis is a major contributor to serious air, water and land pollution. The extent to which these leaders acknowledge the need for change, believe they possess the ability and authority to affect this change predicts the likelihood of the adoption of WtE.

Technical, Political, and Social Responses

Room 2

Adaptive Strategies

Resilient Spaces that Mitigate Adverse Effects of Climate Change and Enhance Human Health and Wellbeing

Omar Youssef, University of Arizona, Tucson, Tucson, Arizon, United States

The southwest has witnessed unprecedented transformation and its cities are becoming centers for urban growth. The goal of this research is to develop resilient spaces that demonstrate adaptation techniques; mitigating the adverse effects of climate change and promote healthy living. The impact of environmental attributes was measured, objectively, and non-obtrusively. Transitional Spaces were assessed by, the analysis of the climatic and microclimatic forces, the built and human environment forces; a survey on occupants that frequently visit pre-selected sites; and test 3 indoor and outdoor locations where people spend at least 30-45 minutes in a transition space to allow for metabolic adaptation, sweat regulator vasomotor, dilation and adjustment of the pupil, and the regulation of skin temperature. Combining spatial design with health parameters, architects are able to make decisions that will reduce energy consumption, decrease the impact on climate change; ultimately protect the natural world and support future life.

Technical, Political, and Social Responses

Teaching Science of Climate Change to Primary and Secondary Teachers in Spanish

Camilo Ruiz, University of Salamanca, Salamanca, Spain

Education, capacity building and awareness have been identified as effective tools to build Climate Change resilience, mitigation and adaptation. In order to mobilize the society we need well informed citizens that can answer what is Climate Change, what are its causes and consequences. Only then we will be able to produce the changes needed to reach the goals of the Paris Agreement. But the resources to educate about this important issue are scarce. We have identified an important lack of high quality, evidence based educational resources about this topic in Spanish, a language with 477 million native speakers. Massive Online Open Courses (MOOC) are a valuable tool that can help us to fix this situation. In this paper, we describe the design and the making of a MOOC on the Science of Climate Change for primary and secondary teachers in Spanish. This MOOC is designed around the principles of evidence based facts, scientific rigor and actuality. We have analyzed the public school curricula in Spain and use these contents to build the structure of our course. The course is aligned with the consensus emanated from the IPPC and its reports. The focus is to bring scientific data and consensus to the reach of Spanish speaking teachers. The MOOC contains high quality videos, figures, graphs and other didactic resources which could be used by the teachers on their own lessons. The course will be offer by MiríadaX web portal on the summer of 2018 (https://miriadax.net/home) users from all over the world will be able to use it. In the discussion forums of the MOOC we will highlight the global aspects of the problem and encourage the discussion between Spanish speaking teachers all over the globe. Also, for the first time we will use Big Data to create a diagnostic tool to evaluate the level of engagement and establish a good estimation of the impact of our project. By preparing teachers, the schools and communities will be better equipped to face natural hazards and reduce disaster risk. This project will help to mobilize the society through education, and to create a new positive narrative around young climate leaders that convey urgency and hope, away from pessimist and into imperative action.

Technical, Political, and Social Responses

Anthropogenic Activities and Climate Change: Impacts on Rural Dwellers

Geraldine Ibe, Michael Okpara University of Agriculture, Umudike, Nigeria

Excessive anthropogenic activities lead to environmental consequences, vulnerability on Non-Timber Forest Products and climate change shocks. Human contributions to climate change; its result on NTFPs and livelihood was assessed. Data was obtained using stratified-simple random method from 9 villages out of 26 villages in Ohafia. 216 households were interviewed using a well structured questionnaire. Frequency findings show that 87.5%, 53.2% and 35.7% engage in bush burning, fertilizer usage and deforestation. 59.7% use motorcycle for transportation; 55.6% use firewood to cook. Over 30% use insecticides and generator sets, 88% practice indiscriminate waste burning that emits gases which contributes to acid rain, deteriorate plant life, damage soil fertility and increase river acidity. There is an indication of desertification, 52.8% lack knowledge on the contribution of their daily activities to climate change, while 17.1% were certain. Bush burning is a central theme and its effects on human settlement and the ecosystem are increasingly damaging. 72.2% and 64.4% stated that increased temperature and heavy rainfall have decreased NTFPs yield in the last four years. Over 35% said climate change has decreased plant species and biodiversity due to massive deforestation. 54.2% have no access to safe drinking water, 29.6% have faced starvation and health challenges. The people were vulnerable due to lack of campaign on environmental management and alternative plans. Vulnerabilities could be reduced through campaign on embracing climate change plans, funding through government and foreign countries' collaboration, re-training extension workers. Local policies should be formulated through a consolidated effort using modern approaches and techniques.

Human Impacts and Impacts on Humans

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Saturday, 21 April

15:55-17:10 **PARALLEL SESSIONS**

Room 3

Public Welfare

Indicators for Vulnerability Assessment of Human Health to Climate Variability

Meena Sehgal, The Energy and Resources Institute, New Delhi, India

Populations in emerging economies such as India, depend on natural resources and on weather patterns for food and water security, putting them at higher risks from climate change. We have created an index of nutrition to determine vulnerability of the population. This nutrition index has been created to rank nutritional status at small area (district) level in developing countries such as India. This nutrition index includes parameters such as underweight, wasting, stunting, and anaemia, for children under five years and, mothers. The index has been computed using log values of parameters and weights assigned based on Principal Component Analyses. The data for related health variables was obtained from the most recent national survey, National Family Health Survey (NFHS-4). The NFHS is a large-scale, multi-round survey and is based on representative state level sample of households throughout India. Using an existing agricultural vulnerability index to climate change for the districts of India we have identified the districts presenting both- extremely poor nutrition rank and high agricultural vulnerability to climate change. This approach would help identify and provide targeted interventions.

Human Impacts and Impacts on Humans

Climate Change and Ecopedagogy: What Role for the University in Global Environmnetal Change?

David Humphreys, The Open University, UK

Climate change is the greatest public welfare problem of our age. It calls for a public education endeavour in its broadest sense, one involving not just the academy and students but the global public. Ecopedagogy offers the prospect of a new curriculum, a radical approach to education that opposes those political and economic structures that generate environmental problems while working with social movements to generate an alternative politics. It challenges those engaged in environmental education to rethink how they teach agency to students and what the role of the educator should be in teaching citizens to think through how they should respond to environmental degradation. This paper examines the relevance of ecopedagogy as a teaching model at the Open University in the United Kingdom. It presents some examples of teaching on agency and environmental issues from OU environment modules that encourage students to evaluate what their role should be in responding to climate change and global environmental degradation.

Technical, Political, and Social Responses

The Impact of Hurricane Maria in Puerto Rico : Rapid Assessment of the Damage and the Massive Environmentally Driven Displacement

Nuria Del Alamo Gomez, University of Salamanca, Salamanca, Salamanca, Spain

Camilo Ruiz, University of Salamanca, Salamanca, Salamanca, Spain

Puerto Rico was devastated in September of 2017 by the Hurricane Maria. The island suffered catastrophic damage, including almost total destruction of its deteriorated electrical grid. For weeks in Maria's wake, most of the island's population suffered from flooding and lack of resources, compounded by the slow relief process. In this paper we discuss about the exodus that started as a consequence of the hurricane within the socio political status of Puerto Rico. We start by discussing the degree of destruction after the hurricane using a rapid assessment of the night time lights and comparing it to the population density. This method provides an accurate description of the impact of the Hurricane Maria and the slow pace of recovery, which explain to some extent the large migration that followed the hurricane. We also discuss the impossibility to call these migrants climate refugees. First, because a direct causal relation between Climate Change and this environmental displacement is hard to establish, although it is clear that it influences the process. On the other hand, these migrants can not be called refugees as they do not cross an international frontier and their migration is not due to one of the reasons included in international treaties. The situation of Puerto Rico is an important case to understand the effects of Climate Change on migrations and how it can amplify, accelerate and enhance social and political crisis to produce profound and grievous changes in our societies.

Human Impacts and Impacts on Humans

Room 4

Development Outcomes

Impacts of Climate Change on Livelihood and Mangrove Resources in Bangladesh

Momen Majumdar Mohammad Sayed, Government of Bangladesh, Dhaka, Bangladesh

Sundarbans is the largest mangrove forest with a trend of declination due to climate change which results from coastal aquaculture. The objective of this study is to find the impacts of climate change on livelihood and natural resources as well. A structured questionnaire survey to randomly selected 150 houses was conducted in 2017. This study reveals that climate change is a result of both natural and anthropogenic activities. Huge patches of agriculture land had already been converted into shrimp pond, meanwhile the main input like shrimp fry were collected from wild. On the other hand, cyclone Aila in 2007 changed the livelihood. At present, from sample households, 55% engaged in coastal aquaculture, while 52% were engaged in shrimp culture. The average shrimp pond area was 0.18 ha, three times higher than paddy field. Most alarmingly, 86% shrimp pond owners depends on shrimp fry from forest, whether fully or partially. Climate change also impact on homegardens. Homegardens were decreasing significantly and in many case replaced by mangrove species. 95% forest dependent households collect fuelwood while they enter forest for collection of resources. Livestock decreased significantly as a result of climate change. Finally this study draws a clear picture that, climate change results over extraction of forest resources due to change in livelihood in Sundarbans adjacent villages.

Human Impacts and Impacts on Humans

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Saturday, 21 April	
15:55-17:10	**PARALLEL SESSIONS**
	From Confrontation to Long-term Cooperation: A Case Study of Russia and Western Arctic Nations Fazolat Nasretdinova, UNESCO, Paris, France This research addresses prospects for long-term cooperation between Arctic nations in the Arctic region. The Arctic was chosen due to the increased global interest in the region, which can be attributed to its geopolitical implications and natural resources. Current relations between Western Arctic nations and Russia may be characterized as tense and non-cooperative. No single structure for cooperation has been created which might unify their interests in light of the political, economic, and security considerations at play. Due to the recent political events and disagreements regarding Russian foreign policy, the Western Arctic nations boycott Russia and prevent cooperation, a policy which renders equal interaction in developing and exploring the region.In order to address the state of conflict, this thesis analyzes three options: focus on cooperation, isolate Russia, and do nothing. The positive and negative implications for the region's development, as well as for cooperation among the Arctic nations, will be addressed. Through the application of game theory as a methodological tool, I classify each of the options mentioned above as win-win, win-lose, and lose-lose scenarios, respectively, and illustrate their outcomes and consequences. Through this policy analysis, I focus on cooperation is chosen as the preferred option, as it best resolves current confrontations and issues between the Arctic nations. Research's conclusions provide us with answers to the research questions: Is cooperation between the West and Russia desirable in the Arctic region? Is cooperation possible among the Arctic nations, in the short-term and/or long-term? *Technical, Political, and Social Responses* **Working Equids' Contributions to Climate Change Adaptation** Angela Varnum, Colorado State University, Fort Collins, Colorado, United States The global contributions of working equids (horses, donkeys, and mules) include transporting products and tourists, laboring in agriculture, and generating household income. Their use endures despite industrialization. The purpose of this study was to describe working equids' contributions to climate change resilience and human livelihoods in an area of Peru which is rated at significant risk for climate vulnerability.Ethnographic interviews were conducted with fifteen working equid owners and community members working in tourism and agriculture in the mountainous region surrounding Cusco, Peru. Recent climate variability and decreased harvest means agriculturally-dependent individuals have adapted by engaging in tourism activities which are strengthened by equids. Working equid power enables livelihood diversification and protection against climate impacts, supporting household well-being. Working equid use is not without significant environmental challenges, specifically the availability of grazing sources in the face of a shortened growing season. Working equids labor at the balancing point between traditional livelihoods and entrepreneurship, softening the climate factors which lead to human vulnerability. A more detailed understanding of the ways in which working equids absorb impacts of climate change and affect the environment can inform wider policies for their use in this and other tourism-dependent areas. *Assessing Impacts in Divergent Ecosystems*
17:10-18:40	**Closing Ceremony & Reception**

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