

Linking the Social and Natural Sciences
(*Linking across Scale*)

Presenter: Noelle Selin

Author(s): *Noelle Selin*

Earth System Governance: Linking Natural and Social Sciences to Reduce Mercury Risks

Despite over a century of scientific research and policy actions to control mercury, exposure to toxic methylmercury continues to pose risks to humans and the environment. This paper analyzes linkages between scientific advancements and mercury reduction policies, focusing on the challenges that mercury poses as an issue that crosses natural and political scales. Most research and policy activity to date has focused on the mercury problem at a single level of scale, with local science-policy action being most well-connected and developed. The paper introduces three case studies of science-policy interactions at local, national, and international scale, respectively. Efforts at local scale have focused on monitoring levels in fish and addressing local contamination issues; national-scale assessments have addressed emissions from particular sources; and global-scale reports have integrated long-range transport of emissions and commercial trade concerns. It is argued that while policy-relevant scientific understanding would be improved by a focus on cross-scale interactions and long-term global biogeochemical cycling, such research does not have a clear policy audience. This poses methodological challenges for better integrating natural science insights with social science work on architectures of earth system governance across multiple scales. The paper concludes by drawing lessons from the three case studies about how to better link science and policy making in addressing cross-scale issues for improved earth system governance.

Linking the Social and Natural Sciences
(*Linking Research to Practice*)

Presenter: David Stainforth

Author(s): *David Stainforth, Samuel Fankhauser*

Seeking and Extracting Relevant Information: Linking Natural Science, Social Science and Policy

Responding to climate change is a challenge which, at its heart, is about how global society utilises knowledge and understanding. The identification and extraction of actionable, robust information from the natural and social sciences is critical for the generation of appropriate policy responses. Yet the scale and complexity of the scientific questions are immense so it is unsurprising that the focus is often on those questions most amenable to analysis. Unfortunately these are not necessarily the same as those for which answers are sought by the policy communities. There is a need to define and characterise policy relevant applied and foundational climate research and in doing so identify and trace the assumptions underpinning research output so as to evaluate its relevance and potential robustness for policy decisions.

Typically information flows from the natural sciences to the social sciences and policy. We argue that social science must move from being simply a recipient of information on climate change from the natural sciences to a driver of climate research. However, the price of this is threefold. First, is increased awareness and study of the assumptions which underpin statements about future climate, particularly at smaller spatial scales. Second is an awareness that social science guidance must often be derived from natural science understanding rather than quantified predictions. Third is a requirement to define the parameters and mechanisms of social science and policy assessments as a means to enable natural climate science to evaluate the robustness and value of different lines of enquiry.

Linking the Social and Natural Sciences
(Linking the 5As)

Presenter: Geoffrey Nwaka

Author(s): *Geoffrey Nwaka*

Indigenous Knowledge as Local Response to Globalization and Climate Change in Nigeria/Africa

Globalization is now widely perceived in Africa as a new version of earlier forms of external domination and exploitation. But Marshall Sahlins has rightly emphasized the need for all peoples “to indigenize the forces of global modernity, and turn them to their own ends”, as the real impact of globalization depends largely on the responses developed at the local level. How can Africa engage profitably with globalization, and cope effectively with the effects of climate change? The current global economic and ecological crises have exposed flaws in the Western neo-liberal model of development which is largely to blame for these problems, and for widening inequalities within and between nations. There is now renewed interest in an alternative approach to development which emphasizes the cultural dimension of development, and the overlooked potential of indigenous knowledge as “the single largest knowledge resource not yet mobilized in the development enterprise”. This paper considers how indigenous knowledge and practice can be used to support good governance, agriculture and natural resource management, poverty alleviation, and the mitigation and adaptation to climate change. The indigenous knowledge movement has great potential for the mitigation and adaptation to climate change. Development agents, researchers and donors have a lot to learn from indigenous knowledge about locally appropriate ways of forecasting weather systems, traditional techniques of soil management, pest and disease control, adopting suitable crop and animal varieties, etc. By building on the indigenous we can make development more participatory and sustainable, and also promote intercultural dialogue in African development.

Linking the Social and Natural Sciences
(*Linking Research to Practice*)

Presenter: Tom Herbstein

Author(s): *Tom Herbstein, Lorena Pasquini, Clifford Shearing*

Socio-Ecological Landscapes and the Insurance Industry: A South African case study

Insurance plays a dominant societal role, not only through its risk spreading capacity, but also as a central pillar of modern economies. It plays three roles: as risk carrier, risk manager and, in representing 11% (US\$17 trillion) of global assets, as investor. Through these mechanisms the industry seeks to minimize its risk exposure, yet remains vulnerable, threatened by large unpredictable events, historically associated with natural hazards like storms, fires and flooding).

As environmental change increases the occurrence and magnitude of these events, so insurance is increasingly burdened with rising claims, threatening its own resilience. While adaptive, most innovations for dealing with contemporary risks are largely confined to its risk-carrying (e.g. managing levels of exposure) and investor (e.g. use of derivatives to spread risk) roles.

There are examples of insurance engaging in 'risk management' in other areas of its business (e.g. private security and vehicle safety). However, little progress has been made to promote climate change adaptation and mitigation at community levels, particularly in the global South, an area especially vulnerable.

Drawing from an empirical case study in South Africa's Eden District, this paper explores the capacity of insurance to engage communities as a risk manager in climate change adaptation and mitigation. The focus will be on the crucial interface between insurance and local government. This paper examines how the industry must start to re-imagine itself, within the context of changing socio-economic landscapes, and through doing so, strengthen its resilience by managing that of the communities in which it operates.

Linking the Social and Natural Sciences
(*Linking across Scale*)

Presenter: Hilda Blanco

Author(s): *Daniel Mazmanian, Hilda Blanco*

On the convergence of two global trends – urbanization and climate change – and the governance challenges they pose

Today over half of the world's population has become urban, and demographers estimates the urban population will grow to 65% by 2050. Meanwhile, climate scientists are projecting emissions of greenhouse gases by sector, not by urban areas, yet most of these sectors – energy, industry, transport, residential and commercial buildings and waste and wastewater – are located primarily in urban areas. Moreover, it is at the urban level that most of these issues will be addressed. Thus, urban governance will be critical both in addressing the largest human migration ever experienced and the causes, and even more so the effects of climate change.

This paper focuses on the dual challenges that human migration and climate change pose to urban governance: managing emerging mega urban patterns of growth within the context of the challenges and uncertainties associated with climate change. On the one hand, adequate planning and governance architectures to meet the challenge will need to address the mismatch between political jurisdictions and the varying scales of environmental systems. On the other, new patterns of urbanization are already outpacing governing capacity and jurisdictions. Thus, emerging megacities and mega-city-regions face a vexing mismatch between their political jurisdictions and larger functional responsibilities. Compounding this is the uncertainty associated with climate change impacts, especially at local and regional scales. This paper will explore the principles for governance architectures to address the spatial/political mismatch and uncertainties at the interface of these two global trends.

Linking the Social and Natural Sciences
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Presenter: Sushil Kumar

Author(s): *Sushil Kumar*

Innovative Management of Traditional Water Resources in Mountain Himalayan Areas: Indigenous Models of Inclusive Growth and Sustainable Development through Community Participation

The state of Himachal Pradesh in Indian Himalayan region represents unique agro-ecological setting with dominating traditional systems of indigenous resource management. The generational experience over the years has resulted in development of traditional community based modules of water harnessing and use. These models are inclusive in their growth with potential of sustainability. The local livelihoods of the people were largely determined by the successful implementation of these traditional water management strategies. Due to rising resource pressure, these have started rupturing. Thus there is need to conserve the water through the maintenance of age old models of community based initiatives of water harvesting.

A systematic effort is being attempted through implementation of watershed development project with the involvement of local community and village level institutions, Panchayats. I am closely associated with this project and implementing it in 16 watersheds draining in national river Yamuna. The traditional community managed water reservoirs are successfully intervened and rejuvenated through reconciliation of local community initiatives and external technical inputs. The traditional wisdom and ethos of the stakeholders are effectively reflected in the village micro plans which are implemented in field through community participation.

The paper begins with an attempt to understand the evolution of policies on watershed management and its linkage with community and its impact on water management based livelihood issues. It explores the community models as inclusive growth initiatives. It also examines the possibilities of strengthening local institutions through appropriate policy interventions.

Linking the Social and Natural Sciences
(*Linking Research to Practice*)

Presenter: Sarah Freed

Author(s): *Sarah Freed, Veronica Dujon, Elise Granek*

Investigating social and ecological outcomes of governance using a mixed methods approach

Governance systems are rarely studied using mixed methods approaches, but this type of approach can provide the greatest understanding of the system and measurement of its social–ecological success. We used methods from the natural and social sciences to investigate the management of coral reefs and reef–impacting activities in the Comoros Islands. The goal of the study was to determine the effects of traditional management and co–management on ecological and social outcomes, in particular, live coral cover, fish abundance and diversity, prevalence of reef–impacting activities, and local perspectives on reef health and non–extractive reef value. When comparing social–ecological success of different governance strategies, we were able to ascertain the relative importance of governance strategy versus the social, political, and environmental context within which the strategy was carried out. We found that indeed, social, political, and environmental factors influence the management of coral reefs and their resources as well as management outcomes. This study illustrates how natural and social science methods can be applied to gain a comprehensive understanding of a governance system and its outcomes within its social and ecological context.

Linking the Social and Natural Sciences
(*Linking across Scale*)

Presenter: Anna Pechan

Author(s): *Anna Pechan, Rebecca Stecker, Micha Steinhäuser, Maja Rotter, Gerd Scholl, Klaus Eisenack*

Why are Utilities Reluctant to Adapt to Climate Change?

Although the infrastructure in the transport and energy sectors is highly relevant for society and economy and although top-down estimates show very high adaptation costs, the question of how utilities should adapt to climate change has not been deeply investigated so far. Adapting infrastructure requires anticipatory action, as large parts of infrastructure are designed for long periods. To understand how utilities can adapt, it is necessary to know what is already done in this respect, and if not, whether there are good or problematic reasons to do so. The study analyses already taken efforts, future potentials and current problems of adaptation of utilities with a multi-method research design. This consists of a survey of German utilities, a series of stakeholder workshops with selected corporation, a qualitative analysis of the policy arena and a scientific impact assessment. The first objective is to identify how far utilities already start to adapt, and whether current activities are in an adequate range. Second, hypotheses about potential barriers to adaptation are evaluated. We come to the conclusion that there is some adaptation, although only at the first stages. The issue is further rising on agenda of public administration and companies. The analysis reveals potential barriers that may hinder further progress – if not addressed by adaptation policy. Thus, there is a role of the public in adapting utilities to climate change, but the process of adaptation is far from being understood sufficiently.

Linking the Social and Natural Sciences
(*Linking across Scale*)

Presenter: Siri Hettige

Author(s): *Siri Hettige*

Transcending Boundaries, Harmonizing Scales

The symbiotic relationship between social and ecological processes is an empirically verifiable fact. These processes can be tracked along temporal and spatial scales. Additionally, social processes correspond to different levels of social organization ranging from individual families to global social networks and institutions.

Social processes unfolding along different scales are guided by economic, political and demographic processes. For instance, the economic policy shifts, political upheavals and demographic transitions influence daily decisions that millions of individuals and families make. As is well known, recent liberal economic reforms have led to massive social transformations in many countries, changing the way millions of people work and live. The ecological impact of this social transformation can be explored empirically in terms of increased energy use, environmental pollution, deforestation, urban congestion, etc. Environmental change on the other hand, influences social behavior in predictable ways, mediated by such factors as governance and economic circumstances. People often leave poorly governed and vulnerable environments in favor of those with better environmental governance, to avoid risks to their lives.

This paper develops an integrated conceptual framework that can facilitate empirical investigation of the interplay between social and ecological processes along temporal, spatial and social scales. It is argued that persisting inconsistencies both within and across the above scales, in spite of increasing recognition of the need for coherence, pose the biggest challenge to global and local environmental governance. The need of the hour is to develop strategies, economic, social and political, to harmonize environmental governance across different scales.

Linking the Social and Natural Sciences
(*Linking Research to Practice*)

Presenter: Klaus Hubacek

Author(s): *Klaus Hubacek, Mark Reed*

Lessons learned from a computer-assisted participatory planning and management process in UK's uplands

In order to support stakeholders in adapting to socio-economic, environmental and policy pressures a group of researchers and key stakeholders joined forces to develop an iterative social learning process supported by computer models designed in a participatory modeling process. This paper details the genesis, development and operation of this approach to enabling adaptive co-management in a complex socio-ecological landscape situated in UK uplands. Instead of experimenting with new management activities and learning from the results of these actions, we used formal computer models to tell the stakeholders what the implications of their actions might be in terms of their own livelihoods and impacts on a range of ecosystem services. Including stakeholders in all stages of the process increases acceptance of the work and allows the inclusions of relevant multiple views and can enhance shared understanding. Participatory scenario modelling was found to be very useful as it enables surprises and changes in emphasis to be incorporated in the process. Selection and inclusion of the 'right' selection of stakeholders matching the spatially diverse ranges of different ecosystem services is a key ingredient to a successful process. We experienced with a number of different participatory approaches and communication tools such as films outlining the key scenarios to reach also non-traditional stakeholder groups. To have a chance for the learning and adaptive management process to survive beyond the project duration a certain set of attitudes and organisational cultures are required that can facilitate processes where goals are negotiated and outcomes are necessarily uncertain.

Linking the Social and Natural Sciences
(*Linking across Scale*)

Presenter: David Mutekanga

Author(s): *David Mutekanga*

THE COMPLEXITY OF THE EARTH SYSTEM GOVERNANCE: THE USANGU WETLAND CASE STUDY IN TANZANIA

This paper examines and reveals the complexity of the Earth System Governance using a local situation where pastoral communities were evicted from a wetland to enable the wetland serve “other” ecosystem services. The decision to evict these pastoralists is an Earth System Governance issue.

The paper first identifies the various social, economic, political and ecological variables affecting decision making hence governance issues involved in this case. Despite the original argument that this was an environment verses development issue, the socio-economic and political variables show that this was a local illustration of how complex decision making is especially in a rural African developing country context and that making decisions concerning the earth is in reality much more complex than it had been earlier thought.

The linkages between social, economic, political and ecological factors are identified and discussed using the trade off approach attributes of composition, structure and function.

The results show that the situation on the ground in decision making is not merely a “win-win” situation as being argued among some conservationists today but a complex trade off among all the actual and potential players; where to some extent all lose in one way or another and all gain in one way or another albeit in different percentages / degrees.

Finally the paper argues that the Earth System Governance is a very unique way of starting to examine and re-examining former decisions which have been taken concerning environment and those being considered now. Recommendations are made for similar cases in developing countries.

Linking the Social and Natural Sciences
(*Linking across Scale*)

Presenter: Geoffrey Garver

Author(s): *Geoffrey Garver*

A Framework for Novel and Adaptive Governance Approaches Based on Planetary Boundaries

Johan Rockström and colleagues (Nature 2009) put forth nine proposed “planetary boundaries” that together delimit “safe operating space” for humanity. The authors suggest that these boundaries – based on climate change, biodiversity, global nutrient cycles, toxic chemical pollution, atmospheric aerosols, stratospheric ozone, freshwater use and land use change – might provide the basis for “novel and adaptive” forms of governance at global, regional and local levels. How might these new forms of governance develop? First, the objectives for framing normative limits on human use of the ecosphere must be considered: what is meant by “safe operating space” and what objectives flow from it? Second, metrics must be established for tracking progress toward meeting those objectives. The proposed planetary boundaries and related metrics such as ecological footprint and human appropriation of net primary productivity provide a starting point. Third, an adaptive methodology is needed for transposing those metrics into regulatory and policy regimes, taking into account scientific uncertainty, political obstacles (such as seemingly intractable commitment to economic growth) and challenges in devising fair ways to distribute or allocate regionally and locally the responsibility to respect global limits. Some features that, taken together, will make these forms of governance “novel” are that they must be radically re-focused on reduction of material and energy throughput; global, but distributed; supranational, with rights for non-state actors; constrained by ecological considerations, not economic growth; re-oriented to the common good; dependent on greatly expanded research and monitoring; and comprehensively cautious about crossing planetary boundaries.

Linking the Social and Natural Sciences
(*Linking Research to Practice*)

Presenter: Ashley Cobb

Author(s): *Ashley Cobb*

Incorporating Multiple Knowledge Systems into Climate Change Management

Climate change has created an opportunity for the exploration of Western scientists' knowledge assumptions regarding the relationship between society, nature, and environmental management. Drawing from a variety of literature sources and my own personal experiences working with the Oglala Sioux Tribe on the Pine Ridge Reservation and the National Park Service I will explore how knowledge is disseminated, reified, and adapted within Western science and in the cultural traditions of Native Americans. Badlands National Park and the Oglala Sioux are currently negotiating joint management of the South Unit of Badlands National Park, an opportunity which provides the groundwork for the integration of scientific and traditional knowledge.

Berkes (2009) argues that the single most serious limitation of the application of traditional ecological knowledge (TEK) to climate monitoring and management initiatives is the difficulty in translating indigenous knowledge and science into forms that are mutually intelligible, in ways that make it accessible to decision makers. In light of the collaboration between the Oglala Sioux and the National Park Service I will attempt to distinguish and explore the relative strengths and weaknesses of both Western science and TEK as they relate to climate change and natural resource management. I will also explore barriers to effective collaboration between these two groups and their knowledge systems. By identifying barriers to collaboration scientists, managers, and tribes may be able to move forward to integrate TEK into western environmental management processes allowing indigenous peoples to move up the spectrum of management from monitors to managers.

Linking the Social and Natural Sciences
(*Linking the 5As*)

Presenter: Gregory White

Author(s): *Gregory White*

Security and Governance: Climate-Induced Migration in a Warming World

“Environmental refugees” has often been framed as a security issue. This tendency has only deepened in recent years, as a specific kind of displacement—namely climate-induced migration (CIM)—has been cast as a security threat to North Atlantic countries. Security officials have emphasized that rising sea levels, warming temperatures, and changing precipitation patterns are likely to spur future CIM. In the words of one Washington report, “large-scale migrations” of “potentially hundreds of millions” of people are likely to “trigger major security concerns.” European officials proffer similar conclusions. Such securitized discourse not only capitalizes on popular fears of impending climate change, but may detract from efforts to pursue mitigation and adaptation efforts.

This paper examines the challenges for global governance frameworks to counteract the securitization of CIM. It does so by first examining the natural science evidence with respect to a specific case: Sahelian and sub-Saharan Africa. There, contrary to alarmed expectations, the evidence is mixed that climate change will spur future waves of migration north toward the Mediterranean; most migration will remain sub-regional. Second, it examines the emergent normative architecture concerning CIM. It applauds efforts to craft global frameworks for recognizing and resettling future “climate refugees.” Here, an emphasis on accountability is surely necessary. Nonetheless, the paper cautions against ignoring the natural science evidence. And it argues further that there is an ironic tendency for global governance approaches to use securitized language and accept the inevitability of worst-case scenarios.

The paper is based on research conducted at Columbia University’s Earth Institute.

Linking the Social and Natural Sciences
(*Linking Research to Practice*)

Presenter: Shaju Thomas

Author(s): *Shaju Thomas*

Linking Natural and Social Sciences for Earth System governance – A Case Study from the Western Ghats, India

The abiotic and biotic elements of the earth constitute a complex entity and exhibit the synergy of the components, hence poses a big challenge to understand, interpret and manage. A mini-scale attempt to understand the biodiversity, resource utilization, extinction threats and ecological history of a village at the foot hills of the Western Ghats, one of the global hotspots of biodiversity in India, was carried out over a five year period. It was an attempt to understand the interactions and interdependence of the various components, including Man in the geographical system. The site selected was a Local Self Government Institutional Area (LSGIA), which is the basic unit of governance in India. Conventional ecological field methods, modern tools like GIS and approaches like oral history have been employed.

The study resulted in documenting not only the biotic richness of the area but also the perception of the stakeholders in resource utilization, conservation and management. The 35.46 sq.km area is composed of 11 major landscape element types (LSEs), and harbors more than 863 species of plants. The fauna is rich and several animals are endemic and endangered. An “ecological brain mapping” (EBM), was also carried out to understand the impact of human activity on the ecosystem, and the ecological history and conservation attitude of the people. Based on the study an environment friendly sustainable development plan was evolved. It was found that an interdisciplinary and integrated approach linking natural and social sciences is essential to evolve better management and governance strategies.

Presenter: Elina Andersson

Author(s): *Elina Andersson, Sara Brogaard, Lennart Olsson, Anne Jerneck*

Critical realism for bridging social and natural dimensions of land degradation

It is a challenge in Earth System Governance research to bridge knowledge across the social and natural science divide and to integrate social and natural dimensions of sustainability. A critical realist approach, we argue, can facilitate a shared understanding across disciplinary boundaries by addressing many of the ontological and epistemological problems involved. In this paper this reasoning is illustrated by global land degradation seen as a sustainability challenge belonging to a contested scientific field.

Land degradation can be described as a long-term loss of ecosystem functions and services, caused by disturbances from which the system cannot recover unaided. According to most definitions, land degradation is manifested in problems such as: loss of nutrients and organic matter; reduction in plant-available water capacity; reduced depth of topsoil due to erosion; reduction in micro-faunal and micro-floral populations; increasing acidity and soil degradation causing increased bulk density, surface crusting and other physical effects. From a critical realist approach many of the biophysical aspects mentioned here can be observed and assessed in measureable and objective terms. However, the underlying mechanisms, consequences and remedies require in-depth qualitative studies tracing processes and causal relationships in the multilayered social context of structures, institutions and relations wherein land degradation occur. We take examples from sub-Saharan Africa and Northern China to illustrate the use of critical realism in integrating natural and social dimensions and for showing how this may lead to indepth understandings and improved policy making.

Linking the Social and Natural Sciences
(*Linking across Scale*)

Presenter: Suzanne Kent

Author(s): *Suzanne Kent*

The Transnational Production of Consumers--A Fundamental Challenge to Managing Natural Resources

A concern with natural resources demands that we understand not just the pressures on ecosystems, but also the processes that cause these pressures. A fundamental threat to the earth system is an economic framework which (1) requires ongoing economic growth; (2) in its current application, demands continual increases in production as the dominant method of achieving that growth; (3) is therefore dependent on increasing consumption; and (4) is structured in sophisticated and powerful ways at a global scale to produce consumers. In order for measurable change to occur, these structures must be understood and addressed. In this presentation I will discuss the mechanisms that function to produce consumers, two of the most powerful being marketing and media. I will outline theories regarding the impacts of these on consumption-related beliefs and behaviors and I will present evidence that these mechanisms have an increasingly global reach and impact. Earth system governance researchers must understand the ideas, practices, and rhetoric of economists, policy makers, and marketers, as well as both the financial sector and business arena in order to better position themselves to encourage change.

Linking the Social and Natural Sciences
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Presenter: Tanzim Afroz

Author(s): *Tanzim Afroz*

Coastal Adaptation to Climate Change: Challenges and Responses in Bangladesh

The coastal area of Bangladesh comprises the second largest delta of the world. The total area of the coastal belt is about 47,201 sqkm which is around 32% of the country's total area. This coastal area comprises distinctive development opportunities which can be instrumental in reducing poverty and can contribute significantly to the development of Bangladesh as a whole. However, because of the warming of global climate, the coastal areas of Bangladesh are being identified as more vulnerable areas than ever before. The accelerated sea-level rise and frequent and severe storm events, which are expected to accompany the global warming, will cause potential stresses on these areas. But the vulnerability will differ from region to region, from developed to developing countries. Climate change will pose a daunting challenge on the developing countries like Bangladesh whose economy is highly stressed and fragile. In fact, the impacts of climate change have already started exacerbating the existing environmental pressures on its coastal areas and inflicting a disproportionate cost impact than the developed countries. Moreover, unplanned and disorganized coastal adaptation programmes and absence of climate change considerations in the coastal planning are deteriorating the whole scenario.

In this context, this paper provides an assessment of impacts of climate change in the coastal zones of Bangladesh. It also examines the existing adaptation strategies and policies of the government. Then it outlines the necessity for new adaptation strategies and policies with a special focus on various challenges posed by global climate change to coastal management.

Linking the Social and Natural Sciences
(*Linking the 5As*)

Presenter: Tanzim Afroz

Author(s): *Tanzim Afroz*

Implications of Climate Change for Water Resources Management in Bangladesh: Challenges of Legal and Institutional Reforms

Changing climate will have significant impacts on the availability of water, as well as the quality and quantity of water that is available and accessible. The predicted changes in quantity, quality and accessibility to water will have important consequences for human populations, through impacts to agriculture and food security, health, economic activity, and conflict over water resources. The proposed study provides an overview of the potential implications of climate change for water sector with identification of potential adaptation strategies to mitigate the impacts of climate change. The study also aims to examine legal regime of water resources management in Bangladesh. Then the study proceeds to examine problems of implementation of IWRM in Bangladesh and identifies gap between existing practice and rhetoric of IWRM and finally puts forward suggestions on how to make better integration in water resources management in Bangladesh.

Linking the Social and Natural Sciences
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Presenter: Tanzim Afroz

Author(s): *Tanzim Afroz, Mostafa Naser*

**Community Based Adaptation Strategies in Coastal Areas in Bangladesh:
Challenges and Responses**

The geographical location, low and almost flat topography, very high population density, etc. have made Bangladesh one of the most vulnerable countries of the world to be affected by the climate change. This is more so for the coastal area of the country. In order to safeguard the country against such a disaster, it is imperative to know the disaster and its impending dangers beforehand and innovative approaches to social protection, adaptation and Disaster Risk Reduction (DRR) will be needed to bolster local resilience, support livelihood diversification strategies and reinforce people's coping strategies. Community-based adaptation or CBA emerged out of a growing recognition in the developing community that those most vulnerable to climate change are the poorest people in the world's poorest regions. So rather than implementing highly technical, expensive and outsider-led interventions that are often untried in field conditions, priority should be given to using and modifying traditional coping mechanisms developed in the communities in Bangladesh. With these ends in view, the paper will discuss the vulnerability of coastal regions in Bangladesh to climate change and identify some adaptation options. This paper will also investigate simplified 'bundles' of archetypal livelihoods at household and community level and examine the risks these livelihoods and households face under conditions of climate change. Then it will assess the potential for various adaptation strategies at community level for coastal areas and evaluate whether these can be supported through policy.

Linking the Social and Natural Sciences
(*Linking Research to Practice*)

Presenter: Natalie Beckman

Author(s): *Natalie Beckman, Theresa Jedd, Ellen Wohl*

Local management, global impact: How land management affects wood loads and carbon cycles in rivers of the Colorado Front Range.

Historical documents and recent field studies suggest that resource use within the Colorado Rockies during the past two centuries has reduced the wood loads and frequency of wood jams along most forested streams. Recent research has also shown that streams play a significant role in the sequestration and transport of organic carbon, meaning that instream wood, which tends to slow the transport of carbon and encourage its uptake in the riverine environment, may have effects which extend beyond streams and into the global carbon cycle. The paper aims to quantify the effects of past and present resource management on instream wood loads and logjam frequency along Colorado's Front Range. We have developed a database that includes wood loads and jam locations for channel reaches within national park, national forest, and state park jurisdictions. Wood loads and jam frequency are compared based on stream characteristics, past and present fire management, flow alteration, recreational access and logging history. Information collected in a GIS database is analyzed to quantify the degree of human impact. We hypothesize that more highly impacted reaches (as measured by recent fire, logging, easy access and high flow regulation) will demonstrate lower wood loads, and by implication higher carbon flux and lower return of carbon and nutrients to the surrounding ecosystem. Quantified effects of human impacts can be used to influence future management decisions. Ultimately, the paper aims to increase our knowledge of how governance architecture directly impacts ecological systems.

Linking the Social and Natural Sciences
(*Linking Research to Practice*)

Presenter: Simon Niemeyer

Author(s): *Simon Niemeyer, Kersty Hobson*

Distilling Climate Change for Consumption: The Respective Roles of Scenarios and Deliberation

This paper discusses findings from ‘Climate Change and the Public Sphere’: a multi-disciplinary project that developed a series of climate change scenarios of the Australian Capital Region for use in individual interviews with over 100 local participants, to explore potential reactions to possible climate futures. It examines the impact these scenarios had on participants’ perceptions of, for example, feasible pathways to collective and individual adaptation, notions of responsibility, and social and ecological ‘tipping points’. These results suggest governing climate change impacts is dependent on successful communication of the nature of risks involved, and not just the science of climate change. Failure to do so may result in maladaptive responses to attempts at adaptive governance.

In addition, a sub-set of participants was selected to continue on to a 3-day deliberative process, where climate change research and possible adaptive actions were discussed in greater detail. The outcomes of this process suggest that deliberative approaches are potentially valuable mechanisms for promoting adaptive action. Yet, such mechanisms are only as promising as the quality of inputs from an epistemic community often not well equipped to engage with the public. The overall results have clear implications for adaptive governance and the need to bring epistemic communities and the public ever closer together: a move in which the use of public oriented scenarios could provide an important facilitative role.

Linking the Social and Natural Sciences
(Linking the 5As)

Presenter: Rajeev MM

Author(s): *Rajeev MM, Sandrine Bonin*

Environmental Risk and Public Opinion – A Case Study on the tsunami affected communities in India Rajeev MM and Sandrine Bonin

The Indian Ocean Tsunami that hit the southern coast of India on December 26, 2004 left hundreds of thousands of people dead, causing enormous destruction to properties, and left millions stranded without food, shelter, and safe drinking water. In India, though the relief, rescue, and rehabilitation activities of the government, non-governmental organizations, and other actors were timely and appropriate, a closer analysis of these operations reveal several lacunae. One serious issue was that the disaster recovery operations seldom appreciated the crucial linkages between environmental risk and the livelihood of the coastal community. It is in this context, Mata Amritanandamayi Math (MAM), a global organization working in the development sector decided to create public opinion on the different kinds of environmental risks that coastal communities face, and accordingly developed community-based alternatives to environmental and livelihood uncertainties. This paper describes the dynamics and challenges faced by MAM in generating public opinion towards environmental risks and in sustaining such processes. It also explains the strategies and approaches adopted in strengthening community based initiatives towards coastal and environmental management. This paper is actually a case study, which is qualitative in nature. The villages that are described here are the Alappad village in Kollam district of Kerala, and the Andaman islands respectively. The arguments presented in the paper show that local culture, social capital, and other contextual factors such as technology used for livelihood, state policies and market are crucial components that shape and sustain community participation in sustainably managing the natural resources.

Linking the Social and Natural Sciences
(*Linking across Scale*)

Presenter: Manohar Rathore

Author(s): *Manohar Rathore*

Society and Nature: Adaptation to Climate Change

The Third Assessment Report of Working Group II of the Intergovernmental Panel on Climate Change (IPCC) predicted that climate change would impose significant stress on resources throughout Asia. The Asian region is home to more than 60% of the world's population; natural resources are already under stress, and the resilience of most sectors to climate change is poor. Many Least Developed Countries (LDCs), which are already struggling to tackle issues of poverty, health and education, are expected to be among the most vulnerable to climate change and extreme events because of their lack of economic strength, low level of institutional capabilities and greater dependence on climate sensitive resources. It is vital that realistic measures for adapting to climate change are developed for these vulnerable countries and integrated into their wider development agenda. Recognizing that climate change phenomena will seriously affect and alter the distribution, type and quality of natural resources of the country and the associated livelihoods of the people attempt was made to look at micro level the impact of climate change and how people cope or adapt it in a small area of Rajasthan, India.

Most NGO's interventions/actions were mostly addressing the climate variability issues affecting the livelihood of rural population. The paper will be an ex post analysis of a NGO's interventions to know that whether the interventions addressed the issues of adaptation or mitigation of the impact of climate change.

Linking the Social and Natural Sciences
(*Linking Research to Practice*)

Presenter: Benjamin Preston

Author(s): *Benjamin Preston, Chiara Danese, Emma Yuen*

Embedding Climate Change Risk Assessment within a Governance Context

Climate change adaptation is increasingly being framed in the context of climate risk management. This has contributed to the proliferation of climate change vulnerability and/or risk assessments as means of supporting institutional decision-making regarding adaptation policies and measures. To date, however, little consideration has been given to how such assessment projects and programs interact with governance systems to facilitate or hinder the implementation of adaptive responses. An examination of recent case studies involving Australian local governments reveals two key linkages between risk assessment and the governance of adaptation. First, governance systems influence how risk assessment processes are conducted, by whom they are conducted, and whom they are meant to inform. Australia's governance system emphasizes 'evidence-based' decision-making that reinforces a 'knowledge deficit' model of decision support. Assessments are often carried out by external 'experts' on behalf of local government, with limited participation by relevant stakeholders and/or civil society. Second, governance systems influence the extent to which the outputs from risk assessment activities are translated into adaptive responses and outcomes. Technical information regarding risk is often stranded by institutional barriers to adaptation including poor uptake of information, competition on the policy agenda, and lack of sufficient entitlements. Yet, risk assessments can assist in bringing such barriers to the surface, where they can be debated and resolved. In fact, well-designed risk assessments can contribute to 'multi-loop' learning by institutions, and that reflexive problem orientation may be one of the more valuable benefits of assessment.

Linking the Social and Natural Sciences
(*Linking Research to Practice*)

Presenter: Shafiqur Rahman

Author(s): *Shafiqur Rahman*

Climate Change Governance and CSR (Corporate Social Responsibility): A Case Study of Telecom Sector in Bangladesh

The Role of Bangladesh Telecom Sector in Climate Change Mitigation is significant. Major Telecom Players operating in Bangladesh are making considerable contributions in CSR activities. Climate Change Mitigation and other environmental issues are on the top of their CSR agendas. This paper explores the contribution in Climate Change Mitigation by the telecom industry as a part of their CSR initiatives.

The author applies the secondary data to analyse the CSR performance of telecom companies in relations to climate change mitigation through a comparative method. It is reported that among the five major telephone companies, Grameenphone spends the highest amount of money in social activities including in climate change mitigation as well as social awareness, education and healthcare. However, Banglalink, another telecom company, has created a momentum in the society to change the perception of social contribution (they call it Din Bodol). The study reveals that in terms of CSR performance in environmental protection and Climate Change Mitigation, the telecom companies are playing very vital role. This exploratory study makes a contribution to the relatively new area on CSR in Bangladesh, especially in the telecom sector, who are considering Climate Change Mitigation as their top CSR agenda.

Linking the Social and Natural Sciences
(*Linking across Scale*)

Presenter: R. Patrick Bixler

Author(s): *R. Patrick Bixler*

The "Radical Middle-Ground": the Role of Boundary Organizations in Natural Resource Collaboration

The need to build conservation partnerships that straddle public-private boundaries is an enduring problem in earth system governance. The goal of this paper is to evaluate the role of "boundary organizations" in the context of collaborative natural resource management. Boundary organizations are institutions that straddle the shifting divide between politics and science and can adapt to the needs and wants of multiple actor networks. With the increasing interest in community-based conservation, questions about appropriate governance architecture arise. These organizations can play an important role. Using ethnographic research methods, I explore the extent to which the Blackfoot Challenge transforms contestation into collaboration across social, natural, and scalar boundaries. The Blackfoot Challenge, a land-owner driven non-profit, coordinates conservation efforts from "ridge-top to ridge-top" in the Blackfoot watershed in Northwest Montana. In this region, stakeholders' conflicting cultural and material interests relative to conservation, development, and livelihoods often result in land and natural resource management disagreements often so polarized that finding middle ground becomes "radical." The recognition and pursuit of mutual goals is noteworthy. I suggest that groups using natural resource management techniques which convene landowners, recreationists, environmentalists, public officials and others at the boundary between conservation science and practice offer a promising opportunity to link social and ecological knowledge and learning. However, organizations working at the boundary face many challenges such as effective inclusivity and maintaining trust and flexibility. The conclusions have implications for our understanding of the factors that facilitate and constrain effective communication, interaction, and collective-action capability across boundaries.

Linking the Social and Natural Sciences
(*Linking Research to Practice*)

Presenter: Ashley Massey

Author(s): *Ashley Massey, Shonil Bhagwat, Josh Fisher*

Do Dragons Prevent Deforestation? Indigenous Belief and Conservation in a Social–Ecological System in Kiang West, the Gambia

Over twelve percent of the Earth's land surface is currently categorized as 'protected.' However, this classification does not include areas customarily conserved by indigenous beliefs and practices such as taboos, spirits and juju. The international conservation community has recently begun to recognize the contribution of customarily conserved areas to biodiversity conservation including the provision of ecosystem services inter alia pollination, watershed protection and serving as refugia for wildlife in the landscape. This research employs a case study approach to consider the conservation implications of the belief in mythical ninkananko, or dragons, in Kiang West, the Gambia. The Normalized Difference Vegetation Index (NDVI) of the ninkananko areas, a national park and forest parks is compared in Landsat images from 1984, 1988, 1991 and 2006. Thus this study considers the efficacy of formal and informal institutions in a social–ecological system over a 22–year time scale. Analysis of interview and social survey data identifies demographic factors correlated with whether respondents profess belief in the ninkananko and describes the current cultural resonance of the belief.

Linking the Social and Natural Sciences

(Linking the 5As)

Presenter: Josie Plaut

Author(s): *Brian Dunbar, Josie Plaut, April Wackerman***LENSES: A framework for integrating natural, social, and economic systems in sustainable development**

The design, construction, and operations of buildings and grounds account for nearly 50% of global greenhouse gas emissions, over 40% of raw materials use and almost 20% of fresh water consumption. The green building and sustainable development efforts are helping to reduce negative impacts associated with the built environment; however, current global environmental challenges require society to move beyond incremental improvements toward a transformative model that seeks to develop truly healthy ecosystems, communities, and local economies worldwide. People working in development need input and direction from social and natural sciences in order to create places with multiple benefits to community and neighboring natural systems. Only by encouraging a shared and transformative vision can we change our approach to the challenges, opportunities, and desired outcomes for society and our built environments.

LENSES (Living Environments in Natural, Social, and Economic Systems) is a process and metrics guide created to help communities and project teams create places where natural, social, and economic systems can mutually thrive. LENSES is adaptable and is designed to explore and enhance relationships and interconnections. LENSES strength lies in its ability to help groups consider elements and concepts often missing in other frameworks such as inclusivity, financial sourcing, cultural resources, regional context, education, shared authority and governance, and on-going prosperity. LENSES provides a clear path for building trust, addressing complexity and moving toward regenerative, place-based solutions.

Linking the Social and Natural Sciences
(*Linking across Scale*)

Presenter: Debora Drucker

Author(s): *Debora Drucker, Carlos Joly, Leila Ferreira*

**The Need to Quantify Uncertainty and to Understand Processes Interactions
Across Scales in Earth System Science**

Earth System Science deals with complexity that is traditionally divided into closed disciplinary boxes. The present study aims to contribute to the discussion of how to associate the knowledge on natural and social processes to better understand Earth System Complexity. I analyze DIVERSITAS and IHDP Science Plans in order to detect common and diverging conceptual and methodological tools and discuss ways of connecting them. The importance of understanding how patterns and processes differ according to geographic and temporal scale is highlighted at both documents, as well as the relevance of the choices that are made when the boundaries are defined. Detailed information on a well bounded defined system is usually not able to be directly generalized to broader scales. IHDP document also discuss another dimension of scale, the institutional one. Another fruitful issue for debate registered in the Science Plans is the necessity of considering the uncertainty intrinsically related to the nature scientific inquiry, with new information continually shaping our understanding of socio-ecological systems. I discuss how scientists deal with uncertainty and its relation to policy making. Although we can increase the ability to predict processes and how they interact across scales, there is a component of uncertainty that is not predictable. The incorporation of uncertainty as a source of information appears as an alternative to bridge the science-policy gap.

Linking the Social and Natural Sciences
(*Linking Research to Practice*)

Presenter: Israel Dunmade

Author(s): *Israel Dunmade*

Sustainability Issues in Innovative Waste Reduction Technology Adoption

Increasing number of innovative waste reduction technologies are being developed across various industrial sectors. Adoption of proven waste reduction technologies can lead to significant resource savings, cost reductions, protection of biodiversity, and environmental conservation. However, transfer and adoption of technologies either across industrial sectors or geographical jurisdictions may pose enormous challenges to the adopters. In this study, the author identified issues involved in successfully transferring waste reduction technologies from developed countries to developing countries. The author also examined difficulties involved in deploying waste reduction technology from one industrial sector in another industrial sector. It was discovered that the sustainability of waste reduction technology adopted depends on the fitness of the technology to the overall corporate success strategy, its compatibility with the national/corporate culture, availability of enabling operational infrastructure, sustained socio-political interest, and lifecycle cost of the technology.

Linking the Social and Natural Sciences
(*Linking Research to Practice*)

Presenter: Thomas Princen

Author(s): *Thomas Princen*

Social Organizing Principles: From the Biophysical to the Social

Policy responses to environmental change take place in the context of multilevel governance structures. The political relationships between levels of governance, or scale politics, can have significant consequences for policy outcomes and effectiveness. Scale politics are the strategic interactions among social actors that produce and reproduce scalar configurations of governance to serve their interests. This paper develops and tests a framework that allows for a comparative analysis of how scale politics affect policy outcomes and effectiveness. The policy area for comparison is the development of recycled water for cities. Recycled water helps to reduce the amount of freshwater resources needed by cities, but it can be perceived as a public health risk by water users if the water is inadequately treated or inappropriately used. The cases of California and Australia provide a useful comparison of the effects of scale politics on urban recycled water development as they have similar biophysical systems but different urban governance structures. In addition, both California and Australia have been leaders in developing recycled water in response to increased water scarcity, making explicit commitments to prioritize recycled water for the sustainability of their respective regions. The findings reveal that while Australia's centralized system of governance is often more effective at developing recycled water for cities, when faced with resource scarcity and local resistance the scale politics in Australia are highly conflictual. In California, the decentralized governance structure often undermines state and federal level efforts to support the development of recycled water, but cities in California are forming coalitions and partnerships of their own to overcome costs and meet shared goals. The findings reinforce the value of a multi-scalar approach to understanding response to environmental change, and provide one way of gaining further insight into the multi-scalar dynamics involved in governing social-ecological systems.