

# 1999 OPEN MEETING OF THE HUMAN DIMENSIONS OF GLOBAL ENVIRONMENTAL CHANGE RESEARCH COMMUNITY

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Shonan Village, Japan  
24-26 June 1999

## ABSTRACTS



HUMAN DIMENSIONS OF GLOBAL ENVIRONMENTAL CHANGE RESEARCH COMMUNITY

International Scientific Planning Committee of 1999 Open Meeting  
Hosted by IGES

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## **ABSTRACTS**

Shonan Village, Japan  
24-26 June 1999

### **Organised by**

International Scientific Planning Committee of 1999 Open Meeting

### **Co-Sponsors**

Institute for Global Environmental Strategies (IGES)

Environment Agency of Japan

Asia-Pacific Network for Global Change Research(APN)

### **Other Sponsors**

International Human Dimensions Programme on Global Environmental Change (IHDP)

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## **Objective**

An Increasing number of researchers are interested in the human causes and impacts of global environmental change, as well as recognizing that local and regional scales are critical for their studies. In response to the interest, the International Scientific Planning Committee (ISPC) has organized an international Open Meeting in the Shonan Village of Japan in June 1999. The Meeting follows the successful international meetings of members of the research community held at Duke University in 1995 and at IIASA in 1997. The 1999 Open Meeting aims to promote exchanges of information on current research and teaching and to encourage networking and community building in this emerging field.

## **Major Topics**

- ☐ Conflict and the Environment- the interaction between conflict prevention and resolution and environmental issues
- ☐ Decision-making Processes in Response to Global Environmental Change- in particular the linkages between the international, national and local scales and the obstacles to the transfer of policy instruments and norms from one region to another
- ☐ Land Use and Land Cover Change- the social dimensions of changing land use, human settlements and land cover patterns
- ☐ Valuation of Ecosystem Services- current thinking on the values that can be attributed to services such as climate regulation, water supply and recreation
- ☐ Demographic Change and the Environment- the relationships between population growth and other demographic factors, for example migration, and environmental change

## **Further topics include**

- ☐ Industrial Transformation
- ☐ Vulnerability and Impact Assessment
- ☐ Resource, Security and Adaptation
- ☐ Climate Change and Risk Management
- ☐ Ecopolicy Linkage
- ☐ Public Perception/Attitude/Behavior
- ☐ Sustainable Development
- ☐ Urbanization
- ☐ Integrated Assessment
- ☐ Institutionalizing Science in Global Environmental Policy
- ☐ El Niño
- ☐ Carbon Management Post-Kyoto
- ☐ Innovative Social Sciences in Coastal Zone
- ☐ Environmental Management and Audit
- ☐ Business and Trade
- ☐ Health

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## Time Table of the Meeting

Day 1		24-Jun
9:00	Opening Ceremony	L-Dazai-Hall
<b>Session1</b>		
9:30	Plenary Talk Land Use and Land Cover Change	L-Dazai-Hall
10:45	Parallel Sessions	
	1.1 Industrial Transformation: Indicators and Corporate Practices	S-Conference Room 2
	1.2 Decision-making processes: International Approaches	L-Isshiki
	1.3 Resources, Security and Adaptation	L-Sengen
	1.4 Climate Change and Risk Management	S-Conference Room 5
	1.5 Land Use and Land Cover Change: Multiscale Approaches	S-Auditorium
	1.6 Public Perceptions of Global Environmental Change: Cross-national Comparisons	L-Dazai-Hall
	1.7 Sustainable Development	S-Conference Room 1
	1.8 Integrated Assessment/Integrated Regional Assessment	S-Conference Room 6
12:30	Lunch	
<b>Session2</b>		
14:30	Plenary Talk Demographic Change and the Environment	L-Dazai-Hall
15:45	Parallel Sessions	
	2.1 Industrial Transformation: The Energy Sector	S-Conference Room 1
	2.2 Decision-making processes: Participatory Approaches	S-Conference Room 2
	2.3 Institutionalizing Science in Global Environmental Policy	S-Conference Room 5
	2.4 El Niño	S-Conference Room 6
	2.5 Land Use and Land Cover Change: Rapid Urbanization	L-Sengen
	2.6 Land Use in Temperate East Asia	S-Auditorium
	2.7 Integrated Assessment for Environmental Security in the Asian Region	L-Isshiki
	2.8 Demographic Processes and the Environment	L-Dazai-Hall
18:30	Welcome Party	

There might be some change in the programme.

**Day 2**

**25-Jun**

### **Session3**

- 9:00 Plenary Talk**  
Decision-making Processes and Global  
Environmental Change  
L-Dazai-Hall
- 10:15 Parallel Sessions**
- |  |                     |
|--|---------------------|
| 3.1 Industrial Transformation: Trade,<br>Transport and Transitions | S-Conference Room 1 |
| 3.2 Institutional Interplay: The Vertical Dimension                | L-Dazai-Hall        |
| 3.3 Eco-policy linkage   | S-Auditorium        |
| 3.4 Vulnerability and Impact Assessment                            | S-Conference Room 2 |
| 3.5 Land Use and Land Cover Change:<br>Innovations in Modeling     | S-Conference Room 5 |
| 3.6 Carbon Management Post-Kyoto                                   | S-Conference Room 6 |
| 3.7 Attitudes and Behavior: European Perspectives                  | L-Isshiki           |
| 3.8 Sustainable Urbanization in East<br>and Southeast Asia         | L-Sengen            |

**12:00 Lunch**

### **Session4**

- 14:00 Poster Session**  
**Demonstration**  
S-Conference Lobby  
(Basement)
- 15:15 Parallel Sessions**
- |  |                     |
|--|---------------------|
| 4.1 Industrial Transformation  | L-Dazai-Hall        |
| 4.2 Environmental Conflict Management                                | S-Conference Room 5 |
| 4.3 Decision-making Processes  | S-Conference Room 2 |
| 4.4 Urbanization   | S-Conference Room 1 |
| 4.5 New Data Acquisition and Integration Methods<br>for LUCC Studies | S-Conference Room 6 |
| 4.6 Land Use and Land Cover Change:<br>Subsistence Agroecosystems    | L-Sengen            |
| 4.7 Attitudes and Behaviour: Climate Change                          | S-Auditorium        |
| 4.8 Innovative Social Sciences in the Coast Zone                     | L-Isshiki           |
- 19:30 Evening Meetings on Programs and Networks**

There might be some change in the programme.

**Day 3****26-Jun****Session5****9:00 Plenary Talk**

Conflict and the Environment

L-Dazai-Hall

**10:15 Parallel Sessions**5.1 Study of the Environmental Management  
and Audit

S-Conference Room 6

5.2 Conflict and the Environment: Conflict Resolution

S-Auditorium

5.3 Global Change Science and Decision-making

L-Isshiki

5.4 Business and Trade

S-Conference Room 1

5.5 Health

S-Conference Room 2

5.6 Qualitative Approaches to Integrated

Assessments of Land Use and Land Cover Change

L-Dazai-Hall

5.7 Land Use and Land Cover Change: Case Studies

L-Sengen

5.8 Attitudes and behaviour: Citizens

S-Conference Room 5

**12:00 Lunch****Session6****14:00 Plenary Talk**

Valuation of Ecosystem Services

L-Dazai-Hall

**15:15 Parallel Sessions**

6.1 Human-Environment Interactions

S-Conference Room 6

6.2 Resources, Security and Adaptation II

S-Auditorium

6.3 Towards the critical evaluation of global  
environmental assessments

L-Isshiki

6.4 Population and Land Use in China, India  
and the United States: Results of the  
Tri-Academy Project

L-Sengen

6.5 Land Use and Land cover Change:  
Climate Feedbacks

S-Conference Room 1

6.6 Valuation of ecosystem services

S-Conference Room 2

6.7 Regional Environmental Risks and  
Risk Perception in Asia

S-Conference Room 5

**17:30 Closing Session**

L-Dazai-Hall

**19:00 Farewell Party**

There might be some change in the programme.

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# Plenary Talks

## Land Use and Land Cover Change

*Diana Liverman*

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As the world approaches the millennium the rate and intensity of land use and land cover change remains high in many regions. These land use and land cover changes have significant impacts on global and regional environmental conditions and on local livelihoods and ecologies and have prompted scholars in the human dimensions of global change community to develop coordinated programs to monitor, understand and model land use and land cover dynamics. The last decade has seen considerable progress in research including:

- \* placing land use and land cover change at the core of the overall global change research agenda including an accepted role for the social sciences
- \* taking advantage of new technologies of remote sensing and geographic information systems
- \* the development of innovative conceptual frameworks based on the analysis of institutions and political ecology
- \* more nuanced analysis of demographic variables and the relative roles of population, consumption and technology (beyond IPAT)
- \* the emergence of new sources of funding
- \* the organization of international collaborative and comparative projects

One such program - the LUCC initiative - is convened by the International Human Dimensions Programme together with IGBP, and is now a fully-fledged project with science and implementation plans, core project offices, and dozens of affiliated projects in different regions of the world.

The IHDP/IGBP LUCC programs, as well as other social science studies of land use and land cover, face some formidable challenges as we move into the next decade of research. The main objective of my paper is to examine some of these challenges and research opportunities and to illustrate them using examples from my own research in Mexico.

As a geographer I believe that one of the great challenges of land use and land cover change studies is the question of scale. Scale challenges us at every stage of our research, in deciding on the units of analysis for original data collection or in identifying the scale constraints of existing data, in linking global processes to regional policies and to community, household and individual responses and decisions, as well as demanding flexibility from GIS and other systems when scale changes or has fuzzy boundaries.

A second challenge is to capture and understand the role of spatial and temporal variability in land use and land cover change. There has been a tendency in the search for general conclusions and predictability to focus on larger scale regional trends rather than on the heterogeneity of local land uses and processes or the seasonal and interannual fluctuations in land use and cover. Extreme climate events, such as those associated with El Niño, and rapid shifts in economic policy associated with trade shifts and currency collapse can produce dramatic shifts in land, such as the

recent loss of forests in Mexico and Central America associated with fires and hurricanes. Similarly the tremendous variations in physical and cultural conditions across countries such as Mexico produce highly varied patterns of land use, even when the major driving forces for change are larger scale economic forces or national land tenure or market institutions.

A third challenge is to use new technologies such as remote sensing and GIS in appropriate and efficient ways. Some of us end up spending too much project time, resources and person power on the analysis of satellite images and development of a multi-layered multi-temporal geographic information system without a clear set of questions or processes to model, a method of linking the data to less quantifiable processes at both local and global scales or a strategy for transferring the technologies to local decision makers. This challenge will grow as new satellite platforms provide even more detailed, multivariate and frequent data and as the millennial censuses appear in digital forms.

The fourth challenge is to link our study of global environmental change to the vigorous field of globalization studies in the social sciences. Whilst there is still some debate over the definition and extent of globalization, it is clear that major changes in international trade and markets, the establishment of global institutions such as the World Trade Organization, and the implementation of economic restructuring through national policies such as neoliberalism has important implications for land use and land cover. In Mexico, for example, the simultaneous implementation of NAFTA, land reform, privatization of water and primary resource industries, withdrawal of state subsidies, and economic instability associated with new global financial and commodity markets has produced rapid and rather unpredictable land use and land cover changes. At the same time, political democratization, the decentralization of regulation, changes in consumption and the rise of social movements have further complicated the local impacts of and responses to globalization.

The final challenge discussed in the paper is that of implementing truly collaborative and carefully comparative research programs. Comparative studies need to develop rigorous frameworks for comparison, generalization and for the identification of singular local conditions including both quantitative and qualitative components and common protocols for data collection and analysis. Collaborative projects must find ways to fund, develop human resources and take advantage of local knowledge in different regions, and to involve stakeholders and enable research partners to influence local and international policies.

## Demographic Change and the Environment

Wolfgang Lutz  
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Throughout human history demographic changes have been intimately interwoven with the natural environment. The *human condition* has been facilitated by certain climate conditions, land, water and food availability that have formed the complex network of human life support systems. While in the past demographic changes, such as the ups and downs in the death rate and interregional migration patterns, tended to respond to the exogenous changes in the natural environment, more recently the attention has focused on the human population as an agent of environmental change. Hence any comprehensive analysis of population-environment interactions needs to look at both directions of causation: population impacts on the environment and possible feedbacks from a changing environment on population. The picture is further complicated by the fact that the critical issues and the mechanisms of these interactions tend to vary significantly by the regional scale of analysis. Global climate change is very different from local soil erosion and biodiversity concerns are different from those about local ground water pollution. Yet most of these issues relate to demographic changes in one way or the other.

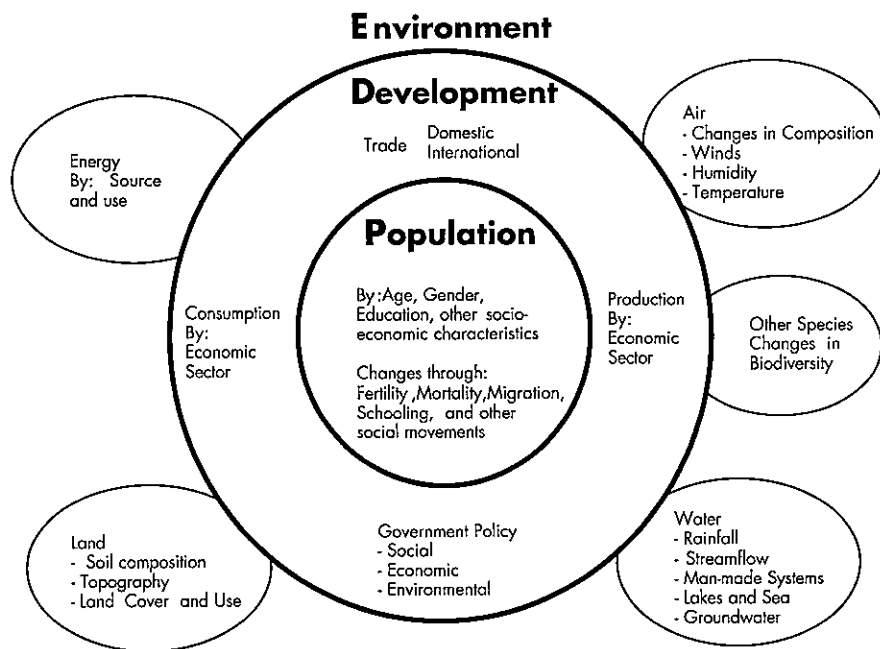
Recent years have seen a rapid increase in specific population-environment studies. In a recent attempt of a survey I managed to look at more than 200 such studies. In doing so I learned tremendously interesting facts about specific conditions in specific places around the world. After the exercise, however, I had to draw the sobering conclusion that it is very hard to come up with any generalizable finding about the very nature of these complex population-environment interactions. Yet it is clear that such a relationship exists. Common sense tells us that demographic change somehow must be related to environmental change, yet scientists seem to have a hard time in coming up with the appropriate research paradigms. One thing that we have clearly learned in the meantime is which approaches are **not** useful for a scientifically sound in-depth analysis of the phenomenon. In the paper I will quickly go through some of them, including the still popular Ehrlich/Holdren I=PAT identity.

In searching for a more comprehensive approach that at the same time should be structured enough to facilitate comparative analysis across different ecosystems, cultures and stages of economic development we will start with the very broad framework depicted in Figure 1. I will argue that one has to focus on certain segments, such as population and biodiversity or population and water, or, if one wants to maintain the holistic approach, this can only meaningfully be done for a specific homogeneous setting. I will bring examples for both kinds of approaches from recent work on population and CO<sub>2</sub> emissions and a holistic case study on the island of Mauritius. In both cases it is not just population size but structural changes in the population that impact on the environment (mediated through economic variables and consumption patterns).

What direction should future research in this field take? What is the most promising avenue for finally improving our understanding about these complex interrelationships? One way to go is clearly to apply more methodological rigor, to try to use at least comparable variables measured in a comparable way in a series of isomorphic studies in different settings. This strategy, however, requires a certain degree of coordination between research groups in the field and a basic agreement

about some of the methods and paradigms used. An easier and much more popular (although less efficient) strategy is to "let all flowers bloom." This is actually what has been happening in the field over the last decade. It will be argued here that in order to become useful in increasing our general understanding about population-environment dynamics, we need to find some better means of communication between the different groups working in the field. Only such increased communication can help to avoid the regrettable situation in which everybody tries to invent the wheel again from scratch. It may help to facilitate an increasing self-organization of a still poorly structured but highly relevant field.

Figure 1. General framework for PDE (population-development-environment) analysis.



## Decision-making Processes and Global Environmental Change

*Akio Morishima*

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While the effects of global environmental issues, by their definition, reach beyond national boundaries, policies to cope with the issues are ultimately formulated and implemented at the national level. There has not been an international government and sovereign power is still in the hands of each national government. No international environmental policy can be made without the consent of national governments, even at an international forum, such as the United Nations.

When environmental policies are formulated at national and/or local levels, decision-making processes are somewhat different from those for other issues. Causes of environmental disruptions are usually not clearly identified and, even if identified, mechanisms of causal linkages are scientifically unclear. Apart from these problems, the sources of environmental disruptions are so numerous and diverse that it is often desperately difficult to find measures to effectively control them. In short, environmental issues are characterized by uncertainty.

With these characteristics, there is much room for policy makers to have different opinions on how to address an environmental problem. The evaluation of risks varies among policy makers. A consensus may not be reached with regard to the assessment of effectiveness of policy alternatives and controlling technologies. There is no way to decide which opinion is better in substance than others, not to mention which is right and which is wrong.

The most difficult obstacle to reaching a policy decision in an environmental issue is a value choice. An environmental value often conflicts with economic values. Investment in environmental protection is usually considered by the business sector a burden on economic development. Environmental policy makers are frequently forced to make compromises for business interests.

Environmental policy making in international settings is no better than in national ones. As pointed out previously, an international policy making process cannot escape from the influences of the sovereign power of relevant nations. The negotiation processes of UNFCCC and COPs are a good example of how national interests have hindered consensus building for GHG reduction policy.

To cope with these difficulties, transparency in policy making or negotiation processes and public participation has been widely adopted at the national level, as well as the international level. In Japan the Central Council of the Environment, an environmental policy-making advisory committee for the government, has opened its discussions and data and materials for discussion with the public since 1995. It also receives public comments and holds public hearings before finalizing its policy proposals.

The role of NGOs, particularly in international negotiation, is very important. NGOs provide information and views from a neutral viewpoint. In the last ten years NGOs have been given

increased status to allow representation at major UN conferences. Since they are not influenced by national interests, they can form a coalition internationally and pressure national governments and industries.

To provide the basis for the activities of NGOs and facilitate unbiased discussions for policy-making, it is necessary for science communities to provide objective scientific data on the environment and policy alternatives.



## Conflict and the Environment

Michael Redclift  
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We might begin by taking a fresh look at what we mean by "security" within an international perspective today. The end of the Cold War has not served to increase security, and it is bringing even more serious consequences for the environment. Global military expenditure outside the United States and Russia has increased dramatically since 1989. The developing countries now account for a much higher percentage of global military expenditure. In 1960 it stood at only about eight per cent. Today countries in the South with per capita incomes averaging under \$2000 p.a. spend two and a half times as much on the military as they receive from development aid, and more than their health and education expenditures budgets combined. At the same time almost thirteen million children under five years of age die annually, largely from the consequences of poor sanitation and diet. The challenge of the so-called 'peace dividend' is to redirect our efforts towards addressing the *insecurities* that most people experience in their daily lives, beginning with the environment. Building environmental security implies considering the effects of the environment on peoples' livelihoods, and of peoples' livelihoods on the environment, starting from both international, and local, conflicts.

Environmental changes come about as the result of *competition* over the environment, rather than simply as a series of 'naturally occurring' processes. This competition takes various forms: the globalisation of economic relations, and the development of global markets, has served to create ideological uniformity in terms of uniform economic goals. But it has also created more competition between different economic and political interests to secure these goals. The environment - at both global and local levels - has become a heavily contested domain, in which different discourses co-exist, notably about what constitutes acceptable, and 'sustainable', development. The effect of globalisation, especially in the aftermath of the Cold War, has been to transform the environment into a new kind of 'battlefield', in which responsibility for environmental processes becomes the business of transnational actors - corporations, local communities and Non Governmental Organisations - as well as national governments.

In considering the relationship between conflict and the environment, and the need to create sustainability, we need to distinguish the spheres in which competition for the environment, and natural resources, is played out. These include:

- \* the spheres of 'production' in which most people spend their working lives;
- \* the sphere of consumption in which their everyday practices, and consumer choices, are expressed;
- \* the sphere of social capital, which supports economic activity, the "supply side" of the environmental equation;
- \* the sphere of 'nature', in which we relate to other species, and to the wider systems represented by the countryside and wilderness;
- \* and, last, but not least, the sphere of physical sustainability, the climate systems and ecological systems linked to climate and biodiversity: coastlines, watershed forests, drylands etc.

To achieve greater environmental security we need to focus on the conflicts over the environment

between different groups of people, which demonstrate the value they place on different environmental functions and services. We will need - in effect - to build new "securities" from the building blocks of everyday life, in the developing world as much as in the developed countries. Finally, from the standpoint of participatory, democratic politics, we also need to consider how people are brought into the policy debates about the environment. By examining the various spheres of environmental conflict and risk we can broaden the compass of debate about "environmental management", making it more reflexive, and facilitating further the 'ownership' of the environmental debate. By exploring the sources of environmental conflict, we can take the first steps towards understanding environmental citizenship.

## **Valuation of Ecosystem Services: The Human dimensions of climate change in developing countries context**

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Man's expanding activities have reached a level at which their effects are global in nature. Increased economic activities have resulted in the increase in traces of natural gases on the atmosphere, thus disturbing the natural ecosystems i.e. the atmosphere, land, sea as well as life on this planet. It is also clear that the major natural terrestrial biomes are changing and that there has been increased deforestation in the tropical forested area.

While it is being universally accepted that ecosystems are essential to human existence, it is also being argued that the ecosystem services have not been correctly valued. This is because ecosystem services are not fully captured in commercial markets nor adequately quantified in terms comparable with economic services and manufactured capital. As a result the importance of maintaining the balance of the ecosystem is not reflected in the policy decisions and the day to day economic activities.

There have been many attempts in the past few decades to estimate the value of a wide variety of ecosystem services. This paper will briefly explain the various methods that have been used to value the ecosystem and try and study them in the context of the developing countries. Further this paper will concentrate on the argument that the issues/assumptions that are central to valuation of ecosystems in the developing countries are entirely different when compared to the issues that are central to the valuation of ecosystems in the developed countries. Therefore the tools and techniques of valuation of ecosystem services in the developing countries should focus on being more socio-ecological, that is not only must the biophysical bases of economic activity be understood, but so must the socio-ecological and political (Jacobs, 1996). (Though it can be argued that the same holds true for all countries). The central theme of this paper- valuation of ecosystem: human dimension to climate change in the context of developing countries- will be centred on the following arguments:

\* The conventional supply (marginal cost) and demand (marginal benefits) curve for a typical marketed goods or services used to find out the total economic value of the ecosystem will not apply in the developing countries context. In the valuation literature the consumer surplus is assumed to reflect the willingness to pay for the services of the ecosystem, which is assumed to reflect the value of the non-marketed services of ecosystem. The total economic value of the ecosystem is then assumed to be equal to the marketed (like market value of timber) and the non-marketed (like the aesthetic value of the forests) value. This paper argues that rather than depicting the supply function by a curve that rises throughout, the supply curve should initially lie along the horizontal axis from the origin until the function gets threatened (this would be the effect of climate change, deforestation etc), then it will rise gradually with demand, until it hits a vertical straight line representing saturation. Also the demand curves will shift upwards as per the growth

in economic activity. Even then, in the case of the developing countries the technique of using the consumers rent as the willingness to pay (used to capture the nonmarketed value of ecosystems) may not be as representative as in the case of the developed countries. As in many cases, the WTP values are derived based on the current WTP of individuals for ecosystem services assuming they are well informed and environmentally conscious individuals. In the developing countries to assume such socially fair society would be a blunder as people are unaware, ill-informed and least conscious of the environmental impacts in the face of continuous challenge of destitution. Moreover the WTP method may not correctly reflect the true value of the ecosystem as other factors like income level do have considerable impacts on the WTP. Thus while valuing the ecosystem in the context of developing countries- factors like identification of social structure, culture, income level, etc will have to be covered to determine the individual economic behavior.

\* In terms of the discounting factor-in the developing countries, owing to the heavy dependence on the ecosystem services for subsistence need, the discounting factor would be quite high compared to the case in the developed countries, which may imply that the supply curve having reached the vertical line status far quicker than compared to the case in the developing countries. The demand in this case approaches infinity as fast as the quantity available approaches zero, and the consumer surplus (as well as the total economic value) approaches infinity. Does this imply some kind of weighted preference to be given to the variable WTP in developing countries so as to capture the importance of the high discount factor to enable comparison or aggregation of value at the world ecosystem level? This may require further research on its implications if any in the valuation technique per-se and the concept in general.

\* There can arise the case of misinterpretation in the developing countries particularly due to lack of alternatives, choice, and technology. For e.g. in the developing countries- a persons WTP to pay for access to water may be different than the same in the developed countries. As in the later, it is the inherent assumption of clean water, which may be different when viewed in the context of developing countries, where WTP for access to water may not mean access to clean water due but merely access to water only, due to differences in the infrastructural facilities.

\* In the developed countries, the availability of alternatives- both in terms of choice/solutions and technology can offer solution so as to adopt the measures for balanced ecosystem. Compared to this, in the developing countries, lack of choice, high cost technology and such other related factors, make solutions to balance ecosystem quite difficult.

\* Lastly it has to be borne in mind that the Value as perceived by the poor will be quite different to the value as perceived by the rich. For e.g., the value of forest to the rich will also include the aesthetic values, however the value of forests to the poor may just reflect the sustenance needs. Though the impact of environment changes is global in nature, yet local and regional scale studies are critical. Thus while valuing the world ecosystem, adjustment of local factors at the regional level is essential to reflect the true value of the ecosystem.



## **Parallel Sessions**

## **ACCOUNTING FOR CORPORATE SUSTAINABILITY Applying Theories of Macroeconomic Sustainability and Life Cycle Analysis with Economic Evaluation**

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There are a great many studies and reports on 'sustainability indicators' for corporations, nations and even the world. Unfortunately, with few exceptions, they are not grounded in any theory of sustainability. It is not too extreme to characterise most of the exercises as 'data in search of a meaning', i.e. the measures are data-driven rather than asking what sustainability means and then looking for the data (or creating the data) to measure the concept. In an attempt to address this shortcoming, the approach put forth here sets out a concept of *corporate sustainability* that builds on the theory of *macroeconomic sustainability*, i.e. the sustainability of whole nations. The challenge is to see if sustainability has a sectoral meaning and whether it is meaningful for a corporation. It turns out that, while one might think of a nation's economy as a giant corporation, there is at least one important difference in the approach to sustainability of a corporation. This refers to the issue of savings. We present here an approach for defining the savings of a business and then show how a *genuine savings rule*, which has been applied to nations, can be applied to the life cycle data of a company's products to come up with an indicator of corporate sustainability. This is based on the economic value of life cycle impacts and life cycle savings. We then go one step further and demonstrate how this data may be incorporated into the traditional corporate accounts, drawing from the system of *satellite accounting* used at the national level.

## ENVIRONMENTALLY SIGNIFICANT CONSUMPTION: ANALYSIS OF COMPANY BEHAVIOR IN JAPAN

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### Keywords

Environmental Consumption, Organizations, Japan

This paper analyzes environmentally relevant consumption activity by Japanese companies using an organizational perspective. This is an exploratory study in which we ask two questions. First what are main categories of consumption relevant activity undertaken by companies? Second, what are the factors that influence corporate decisions to undertake the different types of consumption related activity? In general, we hypothesize that organizational objectives, motivations and reactions are different depending upon the type of consumption related activity considered. As a result, which factors contribute to company adoption of consumption oriented activity depends upon the type of activity considered.

This paper first identifies different categories of organizational activity (based on LCA and other research methods) that potentially affect environmentally significant consumption. Then, drawing from the organization literatures, we develop an analytical framework that seeks to explain why firms adopt environmental consumption activity. Hypotheses are generated and tested. The primary data source is a 1996 survey of environmental consumption practices of 5000 Japanese companies conducted by the National Institute for Environmental Studies in Japan. The model is applied to all firms together and to each of four industrial sectors - manufacturing, service, agriculture, and retail/wholesale.

Preliminary analysis indicates that categorically discernable environmentally significant consumption activities by organizations are driven by different factors.



## Physical Dimensions of Modernization: Beyond Metabolism

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### Keywords

Industrial Transformation, Theory of society-nature interaction, Societies Metabolism, Colonization, Breeding, Biotechnology

We approach an understanding of industrial transformation by examining the long term dynamics and driving forces that triggered industrial modernization. This paper (1) proposes a theoretical framework to analyze industrial modernization in terms of society-nature interactions; (2) shows how this framework can discipline empirical studies; and (3) asks what lessons can be drawn for developing strategies of sustainability.

The theoretical model focuses on the mutual dependences of symbolic/cultural and biophysical processes that are relevant for societal dynamics, thus linking social and economic development to environmental change. The model comprises two complementary concepts, "society's metabolism" and "colonization of natural processes", to describe the physical interactions between societies and their natural environments. Society's metabolism refers to flows of materials and energy between society and nature. Colonization of natural processes refers to the deliberate and sustained transformation of natural processes using various forms of intervention e.g. planting, application of agrochemicals, consolidation of farmland, changes of water regimes, breeding or genetic engineering.

Society's metabolism, can be operationalized using various methods of material flow accounting and by relating these data to social and economic parameters. In these terms industrial modernization can be described as a process that originates with a fundamental change in the metabolic profile (the transition from a solar based society to a society based on fossil fuels) and is accompanied by an exponentially growing use of energy and material. The key question, then, is how this physical dynamic is linked to economic growth and human welfare and how delinking processes can be introduced. We already have considerable knowledge of these processes.

Considerably less is known about the interdependences between industrial modernization and the development of colonization strategies. The second part of our presentation will focus on methods to identify the influence of different colonization strategies on natural and social processes. Agrarian breeding techniques will serve as a case study.

The development of agrarian breeding techniques has a different profile than the dynamic of industrial metabolism. It can be characterized by a time lag, compared to industrial metabolism, and by a rapid increase of the intensity of colonization during the past several decades. The mutual dependencies between modernization and colonization, fostered by this development, will be described. The case study aims at developing an integrated view on problems, which are usually discussed separately like genetic engineering, limits of biomass metabolism, pressures on landscapes, exploitation of genetic resources, risk assessment and consequences for sustainability. The development of such an integrated view can better inform sustainability strategies.

## **MEASURING BUSINESS SUSTAINABILITY: TOWARD AN INTEGRATED FRAMEWORK OF SOCIAL, ENVIRONMENTAL, AND ECONOMIC INDICATORS**

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### **Keywords**

environmental metrics, sustainable development indicators, corporate environmental performance, and green investment.

Ever since the World Commission on Environment and Development (Bruntland Commission) called for the development of new ways to measure and assess progress toward global sustainability, developing a well-defined set of sustainable indicators has become one of the important goals of the global environmental research community. The primary objective of this paper is to discuss the development and the application of sustainable development indicators (SDIs) in the business sector.

In the past couple of years, a number of initiatives have been launched trying to improve the methodology of assessing the social and environmental performance of corporations, including the US National Academy of Engineering ("Industrial Environmental Performance Metrics"), the Canadian National Round Table on the Environment and the Economy ("Eco-efficiency Taskforce"), and the World Business Council for Sustainable Development ("Corporate Social Responsibility Project").

The tremendous interest in this issue can be seen in the results of a recent survey of corporate sustainability indicators, which identified nearly 50 social, environmental, and sustainability assessment initiatives that are currently operating around the world.

This paper is not trying to determine if there is *one* correct methodology to measure business sustainability. But rather, it seeks to evaluate the progress the global environmental research community has made so far in the area of business sustainability measures and what analytical gaps if any need to be filled. Some of the questions that will be addressed in the paper include: What are the driving forces behind the business sustainability measures movement?; What lessons if any can be learned from the experiences of the investment research community?; How can (or should) social and ethical concerns be integrated with environmental objectives?

## **INSTITUTIONS, CLIMATE CHANGE AND CULTURAL THEORY: TOWARDS A COMMON ANALYTICAL FRAMEWORK**

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### **Keywords**

Institutions, cultural theory, new institutionalism, climate change

Institutions are the multitude of means for holding society together, for giving it a sense of purpose and for enabling it to adapt. Institutions help to define climate change both as a problem and a context, through such socialised devices as the use of scientific knowledge, culturally defined interpretation of scientific findings, and politically tolerable adaptation strategies. This paper briefly reviews the origins and current status of the 'new' institutional theories that have recently developed within the social sciences. The conclusion is that they are based on such contradictory interpretations of human behaviour that, although appealing, a complete synthesis will never be possible. In effect, there is a fundamental institutional 'failure' over the interpretation and resolution of climate change. Cultural theory helps to explain why this is the case by throwing light on the inherent contradictions that beset us all when confronted with global warming.

## BRAZIL AND THE INTERNATIONAL POLITICS OF CLIMATE CHANGE

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### **Keywords**

climate, regime, Brazil, Politics, International

The paper has four parts. In the first one the paper analyzes the Brazilian reality on the main parameters related to the formation of the International regime on Climate Change: general greenhouse gases emissions, energy matrix, industrial/transportation/agricultural performance, and deforestation. The paper analyzes also the socioeconomic interest linked to the status quo of the greenhouse emissions (inefficient industrial sectors, traditional agriculture, and car industry complex) and to the reduction of emissions (efficient industries, renewable energy corporations, and modern agribusiness and timber industry).

In the second part the paper analyze how Brazil moves away from the anti-Environment position (prevailing in the 1980's) during the preparation of the Rio Conference (1990-92): accepting some restrictions on the Amazonian sovereignty, assuming common/differentiated responsibility in coping with the global climate, promoting global environmental governance institutions and support for carbon tax.

In the third part the paper analyzes the Brazilian arena and agenda of domestic policies on issues related to climate change (1992-98): globalization of macroeconomic parameters, privatization of the energy corporations, reduction of ethanol subsidies, lack of consistent control of Amazonian deforestation, absence of proposal of tax reform oriented toward sustainability, etc.

In the fourth part the paper analyze several dimensions of the Brazilian position during the Conference of the Parts (Berlin 1995, Geneva 1996, Kyoto 1997 and Buenos Aires 1998): ambivalent participation in the G77/China coalition, supporting quantitative emissions targets and timetables only for developed and former planned economies, promotion of emergent countries influence in the Global Environment Facility decision making, opposition to joint implementation; opposition to emergent countries voluntary commitments, confrontation with the USA in relation to emissions trading; promoting compensation for tropical forests as global carbon sinkers, proposal of the clean development fund, confrontation with Argentina and lack of leadership on Mercosur.

## COMPARATIVE STUDY OF THE ENVIRONMENTAL POLICIES IN EAST ASIAN COUNTRIES

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### Keywords

Environmental Policy, East Asia, Economic Growth, Comparative Study

With regards to global environmental issues, international institutions strongly interact with domestic ones. Therefore, when we discuss how we can deal with global environmental change, it is quite important to pay attention to environmental policies not only at the global level but also the national level.

Rapid economic growth in the East Asian region has immensely influenced global environmental change. Quite recently many countries in this region witnessed a financial collapse with severe implications for the economic and social situation in Asia.

The purpose of this study is to examine comparatively the development processes of environmental policy in the East Asian countries of China, Korea, and Japan in relation to the countries' economic growth, using quantitative economic indicators. This study will contribute to overcoming obstacles in order to build up effective linkages between global and national policies.

The comparison in this study shows that, except for a certain time lag, institutional aspects of environmental policy in the East Asian countries have been converging in the long run and that the environmental policy development processes in the East Asian countries are closely related to economic growth. However, when compared to Japan, the tempo of environmental policy development in China and Korea has been faster than that of their economic growth. Major differences identified in these processes were due to several factors: the role of local government, information disclosure, influence of international pressure, latecomer status, the market mechanism, and environmental issues in the policy agenda.

This study suggests that developed countries, through multilevel cooperation - national government, local governments, companies, and citizens - should appeal to developing countries to make use of their experiences regarding environmental policy so that developing countries can adapt those policies to the tempo of their own country's economic growth.

**Targets and Strategies: The Role of Economic Assessments in  
European Climate Policy  
ENRP Discussion Paper E-98-14, Kennedy School of Government,  
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**Keywords**

economic assessments, climate policy, interactions between science and policy

Economic assessments play an important role in climate policy. The forms of economic assessments used range from simple energy forecasts, to cost assessments, economic impact assessments, cost-benefit analyses, and integrated assessments. This paper illuminates the role that economic assessments play in the determination of greenhouse gas reduction goals and the formulation of climate policies and measures. The focus is on the ministerial level in different European countries, namely Germany, the Netherlands, and the United Kingdom as well as the decision-making bodies of the European Union. Except for the United Kingdom, where privatization of the energy sector led to a decline in greenhouse gas emissions at virtually no costs, cost assessments are the most important assessment form.

Economic assessments are very sensitive to their basic assumptions, the analytical method employed, and their political function, which offers the opportunity to influence the assessment results in one or another direction. For this reason, policy-makers largely rely on commissioned research rather than studies from industry or environmental groups because they are familiar with the critical assumptions and the methodological approach used. Non-commissioned research, however, is insofar influential as policy-makers use it to become an idea of the upper and lower bound of reduction costs. By determining what assumptions have to be made and which modeling method employed, policy-makers can also influence the assessment results and use them to further own interests rather than provide objective information. Such a 'strategic' use of economic assessments is often seen by the Ministry for Economic Affairs. While the Ministry of the Environment takes the lead in setting the national CO<sub>2</sub> reduction target, the Ministry of Economic Affairs has a more passive role in the target setting process and tries to lower the target afterwards by pointing to the expected unacceptably high mitigation costs. The majority of economic assessments are, nevertheless, used as an informative tool for deciding about cost-effective reduction strategies. A pre-condition is the existence of an interdepartmental working group which serves as a consensus generating forum for the critical assumptions and parameters that are fed into economic analyses.

## AGRICULTURAL ADAPTATION TO CLIMATIC CHANGE: A COMPARATIVE ASSESSMENT OF THREE TYPES OF FARMING IN CENTRAL CANADA

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### Keywords

adaptation, climatic change, agriculture, central Canada

The focus of agriculture - climatic change research has begun to shift from modeling the direct impacts of alternative climatic change scenarios on specific attributes of agricultural systems (e.g. frost-free season length, crop yield) to studies which seek to understand how farmers perceive and respond to climatic and other changes. This shift has re-focused the research scale, places greater emphasis on working directly with farm communities than earlier studies, and integrates conventional models of agricultural systems with emerging social science techniques.

This paper summarizes conventional approaches to assessing regional impacts of climatic change on agriculture and reviews findings from these studies for central Canada. It then considers alternative approaches for investigating responses to climatic change at the farm-level and summarizes the differential potential of three farming systems in central Canada to adapt to changing conditions, including future climatic change. The farming systems include (a) grass-based cow-calf operations in a predominantly rural area north of Ottawa, Ontario (b) highly capitalized livestock operations in the rural-urban fringe around Ottawa, and (c) market (vegetable) gardening south of Montreal, Quebec. The paper concludes with a commentary on how to advance agriculture - climatic change research, and its potential contributions to agriculture and climate policies.

## ACTUAL AND POTENTIAL IMPACTS OF ENVIRONMENTAL DEGRADATION ON THE WORLD'S GROWING CITIES

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### **Keywords**

urbanization, climate, water, food, vulnerability, policy

For the first time in human history, the majority of the population lives in cities. The negative environmental impacts of cities are already large, and as they continue to grow and become more prosperous, those impacts are likely to increase. Cities themselves are affected by these environmental impacts, including by rising levels of air and water pollution in much of the developing world. If the environment further changes and degrades, the impacts on cities will probably be considerable.

This article considers the environmental and economic situations faced by many cities today, particularly in the developing world, beginning with high absolute rates of growth. It then turns to consider environmental changes occurring at global, continental, regional, and local scales. The production and consumption systems that sustain life in cities are largely responsible for many of these changes.

Climate change is probably the largest long term concern of cities, but many of them face an immediate problem of shortages of water that is fit to drink. Climate change interacts with the hydrological cycle, threatening to exacerbate this problem. Other possible consequences of climate change, including more severe storms and flooding, and degradation of food supplies and distribution, are discussed.

Development policies that might mitigate or avert some of these problems are suggested. It is pointed out that a high quality of life need not mean high levels of consumption, and that, all else equal, the earth can better support a smaller population than it can a larger one.



## THE ATMOSPHERE AND HUMAN SECURITY: REFLECTIONS ON THE EMERGENT INTERNATIONAL CLIMATE CHANGE REGIME

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### Keywords

climate change, global warming, mitigation, adaptation, collective goods, emission trading, joint implementation, flexibility mechanisms, environmental security, threats, vulnerability

The Framework Convention on Climate Change (1992) and the Kyoto Protocol (1997) are designed to "stabilize" greenhouse gas emissions at levels that would avert "dangerous anthropogenic interference with the climate system." Thus, the international response to global climate change could be described as being almost exclusively oriented toward severely limiting the amount of global warming that takes place.

Questions arise, however, whether such a goal is even remotely realistic, even assuming a much greater willingness of states to substantially reduce GHG emissions than they have exhibited thus far in negotiating the FCCC and Kyoto Protocol. If significant climate changes and associated impacts are likely, or indeed inevitable, greater attention will presumably be given to adaptive strategies. The proposed paper will analyze and critique the existing climate change regime and speculate on the whether adaptation is a realistic alternative or supplement to a preventive approach. While there is a growing literature on how states could adapt to climate change, little attention has been given to the international implications of a shift toward such a strategy.

## Conflict and Shared Rivers

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### Keywords

water, conflict, Correlates of War, environment and conflict.

'The previous war was about oil, the next war will be about water'. Such predictions have been made regularly, and particularly with reference to the possibility of upstream-downstream conflicts in major rivers which cross interstate boundaries. There are more than 200 such river systems, and many of them run between countries with a history of conflict and where water plays an important part in the economic life of the country. This study is built on a newly generated dataset that adds information on boundary-crossing rivers to the Correlates of War contiguity dataset. Preliminary results indicate that over the period of the Correlates of War project, a joint river does increase the probability of militarized disputes and armed conflict over and beyond mere contiguity. However, this risk factor is much smaller than the effect of contiguity itself.

## RISKS FROM SEA LEVEL RISE IN COASTAL CALIFORNIA AND MAINE

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### Keywords

sea level rise, coastal land use, stakeholders, risk perception, decision making processes

Sea level rise (including storm surges, erosion, and shoreline recession) is a global phenomenon with local effects. The United States, with more than 19,000 km of coastline, contains many locations where low-lying coastal environments are at risk from even small rises in sea level.

Anthropogenic factors appear to affect climate patterns leading to an intensification of oceanic storm surges, shoreline recession and erosion. Sea level rise phenomena are expected to exacerbate the instability of coastline ecology and decrease available coastline land at a time when coastal population and demand for coastal development are increasing.

Current failures of governments to act globally to stabilize climate accentuate the importance of local community actions to mitigate climate change and sea level rise. Responses to risks of sea level rise include actions by local stakeholders and by state and national organizations, but such responses are often ineffective without local research and action blueprints.

We are developing response protocols for use in local risk assessment and sea level rise impact models. Our activities include the following tasks: (1) Develop protocols for assessing risks and impacts of sea level rise; (2) Develop "no regrets" cost effective response strategies to mitigate impacts; (3) Provide local stakeholders with risk and impact assessment tools.

Risk perceptions of local stakeholders influence coastal land-use decisions to mitigate impacts of sea level rise. Stakeholders, including elected and appointed officials, environmental activists, recreational users, real estate developers, and area residents were interviewed in coastal Ventura County, California and coastal Maine. Stakeholders assessed potential risk to coastal areas of sea level rise and expressed their views regarding coastal development and casualty insurance.

Our findings are as follows: (1) The overriding determinant of sea level rise impacts is coastal urbanization. Continued urbanization will increase the frequency and intensity of impacts. (2) Storm surges are cutting-edge impacts of sea level rise. (3) Adaptations of stakeholders to perceived risks from sea level rise can be expressed in terms of cost/benefit analysis. Stakeholders represent different economic interests, but share a common fate from sea level rise, which may be a basis for response strategies. (4) "No regrets" local response strategies are a promising way to mitigate sea level rise impacts. Analyses of sea level rise impacts in Maine indicate that it is less costly to allow development to occur, and then remove structures and infrastructures which would be affected over the next 100 years, than to continue costly annual beach renourishment and bulkheading. (5) The time spans over which sea level rise impacts occur decrease as shoreline development increases. Not building near the shoreline appears to be the most effective local mitigation measure.

## **A TRANSFRONTIER RISK PROFILE AND MULTILATERAL RISK MANAGEMENT STRATEGY IN THE NORTHEAST ASIA**

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### **Keywords**

transfrontier risk, North-East Asia, Chemical Oxygen Demand (COD), environmental load, marine pollution

The progress in economic globalization in the Northeast Asia has given a substantial rise to the risk issues of transfrontier environmental problems: the increase of environmental pollutions or risks crossing national and regional boundaries. The multilateral or inter-regional management of air, water and marine pollutions, and preservation of water and marine resources has become one of the urgent policy issues in the Northeast Asia.

The Northeast Asia consists of China, Japan, Far East area of Russia, Korea (South and North) and some parts of Mongolia. This area has three major marginal seas: Japan Sea, Bohai Bay, Yellow Sea. All are semi-closed coastal seas and flow into the outer oceans through several straits such as the Bohai Strait, the Korea Strait, La Perouse (Soya) Strait, the Tsugaru Strait and etc. The potential environmental risks in these marginal seas depend not only on the degree of global climatic change, but also the economic development and the environmental protection strategy in this region as a whole.

In this paper, we discuss whether the water or marine resources of the marginal seas would be vulnerable or resilient in the future due to a possible economic globalization and development strategies under global climate change. Although the data and the information to determine the degree of ecological and economic vulnerability are not enough, the risk profile of the environmental impacts will be assessed based on the existing statistical data and the models of environmental loads in terms of industrial outputs and household consumption.

Estimated result shows that the environmental loads in the Northeast Asia increased unevenly since 1990. The total amount of COD increased from 7.39 million tons in 1990 to 8.64 million tons in 1994 as a whole. However, while China and South Korea increased substantially, Japan and Russia decreased during that period by the different reasons, respectively. We introduced a Response Index (RI) model which explains the rate of the change in environmental load for each country. The RI model illustrates a response of each driving force such as economic growth, population increase and technological progress of environmental management to prevent an increase of the environmental load.

Finally, some policy implications of the estimated risk profile are discussed for the precautionary risk management of the water and marine resources in the Northeast Asia. It is extremely important to share the common knowledge or understanding on environmental risks existed in these marginal seas in order to set up various multilateral mechanisms for the precautionary risk management strategy.

## **AN INVESTIGATION OF THE EFFECTS OF PROPERTY RIGHTS ON COASTAL ZONES AND SOCIO-ECONOMIC ACTIVITIES IN THE WESTERN REGION OF FIJI**

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The impact of the patterns of ownership and usufruct rights for natural resources including the coastal zones is an important determinant of the way in which resources are used in the Fiji Islands. This paper investigates the impact of the patterns of ownership and usufruct rights on coastal resource use and how it affects the social and economic activities. Fiji's western region is the main economic backbone of the country and has major resource endowments. The major coastal zone activities are tourism development, fishing and subsistence activities of the inhabitants. In the past there have been major conflicts about the use rights and the claim of ownership of fishing rights, land rights and the use of other coastal resources. In this paper we investigate the competing claims of ownership and changes in the coastal environmental indicators on socio-economic issues. The nature of property rights appears to be one of the key factors that determine the nature of coastal resource use.

## The Impacts of Climate Variability on Near-Term Policy Choices and the Value of Information

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### Keywords

stochastic systems, signal detection, adaptive decision-making

Variability is one of the most salient features of the earth's climate, yet quantitative policy studies have generally ignored the impact of variability on society's best choice of climate-change policy. This omission is troubling because an adaptive emissions-reduction strategy, one that adjusts abatement rates over time based on observations of damages and abatement costs, should perform much better against extreme uncertainty than static, best-estimate policies. However, climate variability can strongly affect the success of adaptive-abatement strategies by masking adverse trends or fooling society into taking too strong an action. This study compares the performance of a wide variety of adaptive greenhouse-gas-abatement strategies against a broad range of plausible future climate-change scenarios. We find that: i) adaptive strategies remain preferable to static, best-estimate policies even with very large levels of climate variability; ii) the most robust strategies are innovation sensitive, that is, adjust future emissions-reduction rates on the basis of small changes in observed abatement costs but only for large changes in observed damages; and iii) information about the size of the variability is about a third to an eighth as valuable as information determining the value of the key parameters that represent the long-term, future climate-change state-of-the-world.

## INTEGRATED MODELLING OF LAND USE AND LAND COVER CHANGE WITH THE CLUE MODELLING FRAMEWORK: APPLICATIONS IN ASIA

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### Keywords

Land Use and Cover Change, driving factors; model, multi-scale

The CLUE modelling framework (The Conversion of Land Use and its Effects) is a dynamic, multi-scale, land use change model. The aim of the model is to analyse and quantify relations between Land Use and Land Cover Change (LUCC) and its (candidate) driving factors and the exploration of realistic, near future developments of the land use pattern.

Land use changes are clearly driven by human activities. However, the actual location where land use changes take place is determined by biophysical conditions as well. Many studies at detailed scales have been undertaken which offer detailed insights into specific cases that unfortunately cannot be generalised. Causal relations between actors and land use change, as identified on detailed scales, can often not be used at coarser scales. This is due to lack of detailed data and scale dependency of relations. Hence, the CLUE methodology is developed to obtain insights in LUCC at the regional level in an integrated, scale-sensitive and comparable way.

Within the CLUE modelling framework a number of comparable case studies is made in different regions of the world (China, Indonesia, Philippines, Costa Rica, Honduras and Ecuador). The studies were made for the country as a whole or for large regions within the country. Spatially explicit data on land use and candidate driving factors or their proxies were used to quantify the relations between these factors and land use allocation. The results indicate that, although regional differences are large, the land use pattern can only be described by taking biophysical as well as human factors into account. The scale of study, i.e. the resolution and extent of analysis, influences the relative importance of the determining factors. A multi-scale approach is needed to obtain a more complete and realistic description of the land use pattern.

The relations found are used in a dynamic model to explore changes in the land use pattern under near future conditions of demand for agricultural production and other land utilisation. Within the modelling procedure explicit attention is given to competition between different land use types and top-down and bottom-up interactions.

Competition between land use types is especially important for the case-studies in Asia (China and Java). In these areas the frontier of agricultural expansion has been reached. Urbanisation has caused a decrease in agricultural area while intensification of land use has led to degradation of land resources. The application of the model is illustrated with examples from these case-studies in which simulations are used to identify potential 'hot-spots' of land use change. The model results are also essential to assess the possible consequences of land use and land cover change for biogeochemical cycles.

## LAND USE DRIVERS AND SPATIAL SCALE DEPENDENCE IN PONDICHERRY REGION, INDIA

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Interpretations of how land use/cover driving forces act and interact is still controversial, especially with respect to the assessment of the relative importance of the different forces and factors underlying land use decisions in specific cases (Turner et al., 1994). An illustrative case study (Skole & Tucker, 1993) demonstrated that land use changes are tied to numerous human factors and operate across many spatial and temporal scales. An attempt has been made in this case study to divide the causal factors of land use change into bio-physical and socio-economic drivers. Each set of drivers are then analyzed at different spatial and temporal scales. The importance of certain kinds of drivers over others, has been identified and linked across scales with the latest tools in application, remote sensing and geographic information systems. Demographic factors are the main drivers of land use change at all scales, whereas the biophysical conditions merely act as constraints to where and what changes take place. At the village level, land degradation (land use change) is highly related to the percentage of population living under poverty line. On the other hand, land tenure system and per capita loan availability appears to be the major drivers at the farm level. As a part of this research study (funded by the Department of Science and Technology, Govt. of India), the consequences of these scale dependent land use changes - especially erosion, fertility reduction, and sea water incursion - have been studied elaborately. Land use planning under the premises of "Living with Global Change", is suggested as a policy measure to achieve landscape configurations which don't compromise the short and long term futures of Pondicherry Region.

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## **TOWARDS A MULTI-SCALE ANALYSIS OF AGRICULTURAL LAND-USE CHANGE**

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### **Keywords**

land-use change, linking spatial scales, U.S. Great Plains

The process of agricultural land-use change is determined by biophysical, economic and sociocultural influences that operate on a hierarchically-ordered set of spatial scales. These scales range in areal extent from the individual farm to the global food market. Because these influences are often related to phenomena at other scales, it is imperative that the historical, cross-scale relationships be identified for forward-looking modeling efforts to be calibrated correctly. To date the hierarchical relationships among land-use change determinants have not been adequately articulated. This research proposes a methodology for a historical multi-scale assessment called multi-level modeling, presented in the context of a project examining the determinants of land-use change in the US Great Plains. A multi-level application is discussed using interviews of farmers and ranchers (micro-scale information) alongside census data (macro-scale information). This approach represents a first step in the process of identifying the hierarchical relationships among determinants of agricultural land-use change.

## **A Framework for Understanding the Role of Global-to-Local Linkages in Environmental Change.**

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### **Keywords**

global-to-local linkages, environmental change, South Florida/Everglades.

The primary objective of this paper is the analysis of the impacts of global-to-local linkages on local environmental change. Local landscapes are increasingly being transformed by a variety of forces operating at state, national, and international levels. Shifts in the flow and movement of capital, information, and resources can accelerate or slow existing ecological trends and patterns. This phenomenon of environmental change has been broadly recognized by social scientists, but it remains undertheorized, and very few detailed empirical analyses have been conducted. In this regard, this paper focuses on the following central questions: To what extent and in what way do non-local forces influence the nature and rate of environmental change within locales? How do non-local actors and institutions, either separately or in concert with local actors and institutions, influence the character and rate of environmental degradation and restoration in particular places?

The first section of the paper focuses on a theoretical treatment of the nature and character of global-to-local relations and the resulting conceptual framework through which to analyze how these processes can be manifest. The empirical component of the research, a case study of the South Florida/Everglades region, composes the second section of the paper. Data were gathered on the physical indicators of environmental change (e.g. land use/land cover data, water use/water quality data, biodiversity data). Other information was gathered through the collection of archival data (e.g. meeting transcripts, agency reports and surveys), and interviews with selected key players (e.g. government officials, environmental activists, resource and land development interests).

Much of the native ecological condition in South Florida has been changed through land modification and conversion practices. The paper presents four specific conditions in which global-to-local linkages and their evolution impacted the environmental change process of a region. These include core-periphery interactions, glocalization, intra-regional competition, and periods of local political-ecological transformation. Evidence of the environmental change impacts of these global-to-local linkage shifts is developed in the region by examining the socio-economic conditions and environmental changes in South Florida from 1900 to 1996. The analysis indicates that there are specific periods of transition (circa 1930; and circa 1970), and that within the eras 1900 to 1930, 1930 to 1970, and 1970 to present different types of global-to-local linkages took place. Extensive examination is made of the 1970 transition period and the present period (1970-1996).

Although the role non-local actors and institutions in the environmental change process grew in influence over time, several important caveats are put forward. For example, the development of local coalitions and interests groups played a significant role in mediating the impact of non-local forces. These local groups' structure and focus were found to be highly dynamic, and flexible in the face of changing societal and environmental conditions. Spatial scale linkages proved to be an important mechanism through which coalitions' form and function changed.

## AMERICAN PUBLIC OPINION ON GLOBAL WARMING: THE IMPACT OF THE FALL 1997 DEBATE

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### Keywords

public opinion, global warming, environmental attitudes, policy debates, partisanship

During the Fall of 1997, the American public witnessed a remarkable national debate about global warming. Kicked off on October 6, 1997 by the White House Conference on Global Climate Change, hundreds of stories on global warming appeared in television, radio, newspaper, and magazine news stories. The debate was further expanded by advertisements, paid for by business and other advocacy groups, as well as radio talk shows and numerous web sites. The media turned away from global warming and attended to other issues after December 11 when the Kyoto Treaty was signed.

Did the public debate about global warming have any impact on Americans' opinions on the matter? We investigated this by conducting national telephone surveys both before and after the debate. We found that the debate did indeed reach people, leading them to think more about the issue than they had before, and crystallizing attitudes as a result. Opinions became increasingly polarized along political party lines, with Democrats moving toward the White House's position and Republicans moving away FROM IT. These findings and others from our work shed light on the causes, consequences, and strength of Americans' beliefs about global warming.

## GLOBAL ENVIRONMENTAL ATTITUDES: A COMPARISON OF RESULTS FROM THE NETHERLANDS AND JAPAN

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### **Keywords**

GOES, the Netherlands, values, environmental attitudes, environmental behaviors

This paper will report and compare the results of the Dutch and Japanese portions of the Global Environmental Survey (or GOES), an international project intended to obtain data from a wide range of countries (including USA, Brazil, Mexico, Germany, United Kingdom, Japan, China, Canada, Austria and Norway) on public perceptions, attitudes, values and behaviors regarding environmental issues in general and global environmental change in particular.

The main purpose of GOES is to provide cross-national comparisons on citizens' perceptions, preferences and behaviors related to such issues. For this purpose a joint questionnaire has been developed which has been fielded (or is in the process of being field) in the above-noted nations. Two of the first nations in which the GOES questionnaire was administered are the Netherlands and Japan, and this paper will analyze and compare the results of the Dutch and Japanese surveys.

This is an especially interesting and important comparison because both Japan and the Netherlands are highly industrialized, economically developed countries that are also among the leading countries in the environmental policy arena. Yet, they are vastly different in histories, religions, political and societal cultures, and also in terms of their most pressing environmental problems. Do these similarities and dissimilarities produce a noticeable effect on citizens' environmental values, attitudes and behaviors? And if so, how?

In this paper the findings from the GOES surveys in the Netherlands and Japan are analyzed and compared. In total about 1,000 citizens in the Netherlands and 2100 citizens in Japan have been interviewed. The leading questions are: are citizens concerned about global environmental change and other environmental problems, and is this concern related to underlying social, cultural, and environmental values, how are these concerns and values.

## GLOBAL ENVIRONMENTAL SURVEY: BRAZILIAN RESULTS

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### **Keywords**

GOES, Brazil, value system, environmental attitudes, environmentally friendly actions

This paper will report the preliminary results of the Brazilian GOES survey. Brazil is the one of the key developing countries and a crucial actor in global environmental policy-making. It has large forests, population, and it is under strong pressure for economic development. Using almost same questionnaires as other countries (including the Netherlands and Japan which will be presented before), we explore citizens' concern about environmental problems in general and global environmental change in particular, and relate this concern to underlying social, cultural, and environmental values. Special attention will be given to the fact that people in developing countries like Brazil are aware of environmental issues but this awareness is couched in unique cultural expression that are not internationally used. This is a very important point to keep in mind when conducting public opinion surveys in developing countries; otherwise, the high awareness of people in developing countries might be missed.

## GLOBAL ENVIRONMENTAL SURVEY: EAST ASIAN RESULTS

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### **Keywords**

GOES, China, Thailand, value system, environmental attitudes and behavior.

This paper will report the results from surveys conducted in China (Beijing area), Thailand (Bangkok area) and possibly Philippines (Manila area), in which many of the GOES questions were used. We also report results from another comparative study between Japan and Thailand about the relationship between peoples' value systems and their environmental attitudes. Since East Asian nations have different religious and cultural systems as well as histories than do Western countries, we hypothesize that there will be significant differences in value systems, attitudes and behavior toward the environment between East Asians and Westerners. We also expect to find differences in environmental orientations among the East Asian nations surveyed, since they are at different levels of economic development. Research by Schwartz, et al. (1982) has already highlighted differences between the value systems of Asians and Westerners, and our study will enable us to probe how these differences produce varying orientations toward environmental issues.

## **Travel patterns and environmental effects now and in the future Implications of differences in energy consumption among socio-economic groups**

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### **Keywords**

travel patterns, energy consumption, income, gender, age, sustainability, future.

Travel patterns among different socio-economic groups in Sweden are investigated. It is shown that elderly persons, persons with low incomes and women in general do not travel extensively. Middle-aged persons, persons with high incomes and men travel much farther. Cars are the dominant transportation mode for all population groups. Aeroplanes are used mostly by high income earners and men, while public transportation is mostly used by young people and women. Energy consumption for the different travel patterns differs substantially. Men with high incomes consume the most energy, with 94 000 MJ during one year, while elderly women consume 12 000 MJ. When compared to a calculated sustainable level of energy consumption for travel, most population groups are in excess. The level for sustainable energy consumption is calculated based on an assumed global potential for renewable energy of 360 EJ per year, divided equally among the global population. A certain share of this energy potential is supposed to be used for travelling. A scenario for 2020 is presented in which vehicle energy efficiency has increased and travel patterns have changed from what they are today. Sustainability can only be reached when both travel patterns and vehicle technology have changed radically. Differences in energy consumption for travel due to age and gender are likely to remain in the future. Scientific knowledge from the social domains seems to be important for devising efficient strategies for a sustainable society. Current focus on policy measures has been mainly on technical issues.

## The Environmental Issues with Industrialization, Urbanization and Energy Consumption in Taiwan

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### Keywords

environmental issue, industrialization, urbanization, energy consumption

Since the early 1980's, the rapidly economic development of Asia NIEs (Newly Industrializing Economies) have gathered hearty attention from the world. And as a member of Asia NIEs, Taiwan has gained a rapidly increasing nation income as well as splendid performance in industrialization.

Then many other developing countries (ex. ASEAN) have imitated the industrializing processes of "Taiwan Model" in order to catch up with the economic growth of the world, and they also have had a brilliant result since the late 1980's. Generally we define such processes of industrialization in short term as a "compressed industrialization" to tell the difference between the European and American industrialized countries.

But as same as the European and American industrialized countries during the Industrial Revolution and Japan during 1960's, Taiwan's industrial policies took precedence over all others and neglected the living foundation during take-off period, had made environmental issue of different kinds become obviously and seriously at the same time. And there are many studies try to make clear and analyze the primary factors, processes and performances of Taiwan's economic and industrial development, but most of the conclusions are attached to evaluate the results of the economic growth, the environmental issues which are caused by the thoughtless economic and industrial policies are often ignored, and many tasks are still left. So continued study and analyze from different sides to reconsider the evaluation and meaning of "Taiwan Model" is therefore necessary.

This paper tries to make a brief description and review of Taiwan's industrializing and urbanizing processes, and focuses on the energy policy to discuss the shift of energy supply, demand and consumption in Taiwan. Then pointing out the environmental issues which are caused by rapidly industrializing and urbanizing with inefficient energy consumption, and such inefficient energy consumption is due to the low energy price policy during two times "Oil Shock" in 1970's. This paper also shows the different result of the different energy policy in comparison with Japan and Taiwan.

There are three purposes in this paper. First, as a study case of policy science in development economics, "Taiwan Model" sets a significant example. That is to say not only high performances in economic growth but economic and social warp occurs in Taiwan as the same time. Therefore, it is more effective to recognize the environmental issues of the compressed industrialization. Second, as a different opinion of neoclassical economic theory in development economics, the author tries to show the unique approaches.

That is to say industrial policy of different kinds play a essential factor in the processes of development, but industrial policy is not always valid. Third, it is necessary to reconsider the pattern of development in developing countries after "Financial Crisis in Asia", and this paper tried to make a proposal to the government of Taiwan and other developing countries.



## PROBLEM STRUCTURING AND POLICY MATRIXES-LAYERS OF INSTITUTIONAL APPROACHES TO PESTICIDE USE IN THE SOUTH

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### Keywords

policy, local-global complexity, institutions, pesticides

The increasing number of environmental issues which demonstrate local-global linkages in both their driving forces and effects, and where policy responses are initiated in institutions at both local, national and global level, create challenges in handling the complexity and local-global heterogeneity of the policy issue. This situation gives rise to a number of methodological research challenges studying such complex policy matrixes from the local to the global level.

The study compares problem structuring by stakeholders, and factors that influence some central elements of policies aimed at reducing risks of the use of pesticides in the South. The effects of pesticide use in developing countries may be manifested from the individual farmer in Kenya to the biota in the lakes of Canada and northern Europe, a fact which in 1998 elicited international negotiations to ban the use of certain persistent pesticides globally. The study attempts to show how such a problem with manifested effects across the globe is structured and approached in institutional settings at different levels. By employing the case of pesticide use in the South as a probe into problem structuring and policy formulation at local, national and global levels the study highlights the knowledge, uncertainty and values that influence whose problem is actually addressed in institutions' policies.

Semi-structured qualitative interviews with representatives of stakeholder groups at each level—with Kenya as a case for the national and local level—was used as the primary methodological approach, complemented by studying policy relevant documents of each institution. Representatives from more than ten UN offices in UNEP, WHO, FAO, ILO and WTO etc. were interviewed, as well as representatives from a global industry association and international NGOs. In Kenya over 30 representatives of stakeholders at national level (government ministries, NGOs, industry and university researchers have been interviewed) and more than 65 local stakeholders including farmers, local government officials and pesticide retailers were interviewed.

Problem structuring varied from a trade and health focus at global level in IGOs, to a production focus in national government in Kenya with health and trade issues looming in the background, to primarily an economic issue locally among Kenyan coffee farmers. Pesticide technology was at one extreme constructed as infallible, with only the circumstances and the appliers of that technology being seen as "human" who thus could fail to use it properly, and at the other as a technology which was impossible ever to use "safely". The common denominator across levels was the virtual absence of concern for the local environment in developing countries partly due to the absence of data. Developing countries experience a bias in the level of uncertainty of the effects of pesticide use both on health and the environment in their own regions. Further, the efforts of international institutions to harmonise risk assessment for pesticides across the globe are complicated by the spatial complexity and diversity of local natural and social-economic systems.

For policy makers facing uncertain effects and driving forces on different levels, choosing different strategies for addressing such a complex policy situation becomes the crucial issue.

## **Intergenerational Social Choice and Discount Rate In Environmental Resource Use: From the viewpoint of Justice and Individual Decision**

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### **Keywords**

intergenerational cooperation, social choice, intergenerational justice, individual decision.

In academic discussions for "Sustainable Development", present generation's duty to ensure future generations' rights to access natural resources and environment is regarded as an ethical requirement. In this paper, we will examine the meanings of future generations' rights and reasons to secure future generations' rights. We will describe the relation between present and future generations as partners to cooperate, then we analyze the importance of present generation's responsibilities and institutions to enforce it.

## Uncertainty at Risk: Learning from the Dutch Environmental Assessments

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### Keywords

Integrated Assessment, uncertainty, risk, perspectives, complexity

Integrated Assessment (IA) aims to facilitate decision-making processes on complex issues. IA can be described as a structured process using knowledge from various scientific disciplines and/or stakeholders, such that integrated insights are made available to decision-makers. Dealing with uncertainty and risk is principally at the core of Integrated Assessment. IA practitioners realise that. However, approaches currently available for uncertainty and risk analysis in Integrated Assessment suffer from either one or two of the following disadvantages:

- \* the methods do not allow to address the most salient uncertainties and risks
- \* the associated uncertainty and risk measures are not understandable to non-scientists in general and decision-makers in particular.

Both disadvantages are undermining the key ambitions of Integrated Assessment: to analyse and interpret complex issues, and to communicate integrated insights to society and decision-makers in particular.

Within ICIS the research project "Perspectives on uncertainty and risk" is carried out, with the aim to develop new IA methods for uncertainty and risk analysis. The first step is a theoretical investigation into the topics uncertainty and risk in order to outline the contours of an integrated approach to uncertainty and risk. Building on the literature analysis, we concluded that central to the new uncertainty and risk approach is the concept of different perspectives. As a first step this idea is applied in Integrated Assessment modelling in the form of perspective-based multiple model routes. In the current project we build upon these experiences to develop an integrated framework for uncertainty and risk analysis that can be applied in quantitative and qualitative assessment efforts.

Part of the project is an empirical analysis of earlier assessment efforts in order to demonstrate why uncertainty and risk are really problematic issues in IA and to illustrate what the above integrated approach has to offer. To that end a case-study on the Dutch environmental assessments (1988, 1991, 1993 and 1997) performed by the National Institute of Public Health and the Environment (RIVM) is carried out. In the first phase, we will analyse how uncertainty and risk are managed in each environmental assessment and whether, and if so how, this approach to uncertainty and risk has changed over time.

In the next step the proposed method for integrated uncertainty and risk analysis is applied to the Dutch environmental assessments. This approach has two clear advantages:

- \* it prevents the method of perspective-based uncertainty and risk analysis from becoming a theoretical artefact that won't be of any use for IA practise, and
- \* such a constructive assessment goes beyond superficial criticism.

The proposed paper will summarise the new method for risk and uncertainty analysis in IA and the main conclusions of the case-study.

## **AN INTEGRATED ASSESSMENT: CLIMATE CHANGE, LAND USE, AND REGIONAL SUSTAINABILITY IN THE YANGTZE RIVER DELTA OF CHINA**

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### **Keywords**

integrated assessment, global climate change, land use, and sustainable development

Current research direction suggests that in order to explore ways to bring climate change (CC) study and sustainable development (SD) research together, it is necessary to develop more heuristic tools that can involve users or stakeholders. In this respect, this paper focuses on methodological development in research to address the relations between climate change, land use, and sustainable regional development (SRD).

The paper starts with an introduction of a conceptual structure for identifying important attributes of SRD and salient properties of climate and land use change to guide research on integrated assessment and environmental policy evaluation. This is followed by a brief review of some methods and approaches which have been used for integrated assessment and policy evaluation. The paper then presents a research approach for integrated environmental assessment and SRD evaluation.

A case study in the Yangtze Delta of China provides some articulation on how the integrated approach can be applied in a region to show implications of climate and land use change for sustainable regional development. In this respect, the paper focuses on applying the integrated assessment approach to assess climate change impacts and to evaluate alternative options. The study identifies and evaluates a number of response options to deal with potential global warming and future land use change. The study provides information to help decision making in the Yangtze Delta. The research will improve scientific understanding of the interactions between sustainable development, land use, and climate change.

## A FRAMEWORK FOR INTEGRATED REGIONAL ASSESSMENT OF GLOBAL CLIMATE CHANGE

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### Keywords

integrated assessment, regional assessment, climate change

Regional dimensions of climate change impacts and mitigation are receiving increasing attention. Set within the broad framework of integrated assessment of global climate change, integrated regional assessment is both a process and product of the study of climate change impacts at national, river basin, sub-national, or local scale--scales compatible with many of the models developed in the social and environmental sciences. Integrated regional assessment uses a systems approach to regional analysis that examines the contributions of regions to global change and traces the impacts of global change at the regional level. This includes, for example, the contribution of local activities to greenhouse gases, and on the other hand, downscaling from global climatic models to local climate changes and their implications. As a process, integrated regional assessment involves scientific researchers interacting with the community of stakeholders and decision-makers. As a product, an integrated regional assessment presents the impacts of anticipated climate change, the impacts of greenhouse-gas mitigation strategies, and the potential impacts of climate change should global mitigation not occur. A framework developed at the Center for Integrated Regional Assessment provides one heuristic for addressing this important dimension of climate change impact studies.

Our framework for integrated regional assessment of global climate change is based on the concept of using scientific modeling approaches to understanding how the future of a region would be perturbed by climate change. Such effects could emerge from climate change impacts in the region itself, from changes in other regions providing challenges or opportunities for the region in question, or from the impacts of attempts to alter the contribution of the region to climate forcing factors such as greenhouse gas emissions and changes in radiative forcing from changes in land use and land cover. We have diagrammed our proposed process to reflect the general flow of scientific investigation, keeping in mind that the process is not just within the scientific community but also in dialogue with the policy community. The basic framework is a continuous loop from causes to climate changes, thence to consequences of these changes and human responses to the consequences, which then alter human activities which generate the climate change. Linking these four general concepts--causes, changes, consequences and responses--are the climate forcing factors resulting from human activity (such as greenhouse gas emissions), the ecological and physical impacts of the changes, the opportunities and vulnerabilities identified after examination of the consequences, the adaptation and mitigation strategies that alter consequences, and changes in the driving forces of human activities which generate climate forcing. In greater detail, the framework recognizes the way in which each region is embedded in a matrix of contiguous regions of similar resolution as well as larger spatial units through hierarchical relations.

## A New Approach in Computer Modeling for Participatory Integrated Assessment: A Case Study of Climate Change in Alpine Regions

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### Keywords

integrated assessment, regional climate change, participatory methods, interactive information tools, uncertainty

Current approaches to integrated assessment (IA), such as IA models (e.g. those built to assess anthropogenic climate change) and multidisciplinary expert panels (e.g. the IPCC), are directed towards integrating scientific knowledge to obtain new insights for use by decision-makers.

In addition to scientific 'facts' and their associated uncertainties, other factors - such as decision-makers' perceptions, values, attitudes toward risk and decision-making procedures - are vital in making an IA of climate change. There is also a growing recognition of the importance of stakeholder participation. In the emerging field of participatory IA methods, non-scientists, like policy-makers and stakeholders, are actively involved in the assessment process.

Participatory methods emphasize the crucial importance of making scientific insights accessible to and utilizable by the participants. Current IA models and scientific reports are produced for scientists or professional international policy-makers; however, many climate-related decisions depend on the individual choices of millions of citizens. Citizens are important because their lifestyle choices and their acceptance or rejection of climate-related policy options can influence policy-making at all levels.

We have developed a participatory methodology in which citizens assess anthropogenic climate change in moderated discussion groups (focus groups) which use '**Interactive Citizens' Information Tools**' (ICITs) to obtain relevant information on complex policy issues. ICITs, developed by scientists and sociologists in close collaboration, provide direct interactive access to credible scientific information tailored to the participants' specific needs. They combine qualitative information with quantitative models to produce comprehensive scenarios. To foster the uptake of information and stimulate discussion, ICITs are based on entertaining multimedia information blocks embedded in a clear hierarchical information structure.

In contrast to most IA models, ICITs do not provide an IA based on normative methods. Instead, the information they provide to the focus group participants is incorporated into the group discussions that lead to the citizens' assessment. The IA is then based on the citizens' assessment combined with an evaluation of the whole focus group process.

We have developed three ICITs for citizens' focus groups. '**IMPACTS**' provides information about the causes and impacts of regional climate change, concentrating on European Alpine regions and emphasizing the uncertainties involved. With the '**Personal CO<sub>2</sub> Calculator**', citizens can estimate their individual CO<sub>2</sub> account interactively, based on their own lifestyles. Finally, '**OPTIONS**' provides information about regional policy measures and about the option of a low-energy society.

Within the context of a transdisciplinary research program, several focus group processes were conducted in Switzerland. Preliminary results show that citizens are able to work with the ICITs on their own. The quality of their discussions on scientific issues improved after using the information tools. The citizens themselves judged the tools as being user-friendly and informative, and most preferred ICITs to passive information sources like written reports.

The experience gained here suggests that ICITs are valuable tools for providing a broad audience with information on scientific insights in order to foster a process of mutual learning between science and society.

## **Deregulation of Energy Markets and Diffusion of Efficient Technologies: UK Engine Cogeneration**

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### **Keywords**

uncertainty, expectations, satisficing, technology diffusion

Adoption of decentralized energy technologies will be crucial in the evolving structure of energy markets and the magnitude of future greenhouse gas emissions. This detailed analysis of the adoption of engine cogeneration gives insights into organizational decision making regarding the diffusion of a cost effective decentralized energy technology. Detailed site information on over 600 UK cogeneration installations was collected and analyzed for the six year period during which the energy market was deregulated. We postulate that the observed decline in adoption of cogeneration was due to decision makers satisficing on comparable savings available from conventional supply cost reductions following deregulation. An alternative explanation is that adopters learnt from previous poor investments in engine cogeneration. This decline in adoption resulted in the loss of potential savings of 375,000 tonnes of CO<sub>2</sub> and 7,300 tonnes of SO<sub>2</sub>. A detailed examination using standard investment criteria of the cogeneration schemes indicated that over 70% of investments were of questionable economic value to adopters. This was because these installations were below our calculated minimum economic size threshold. A key determinant of this size threshold was the fixed costs of maintenance. An analysis of the financing of installations revealed that the largest fraction of poor investments occurred in energy services agreements between suppliers and adopters. The policy implications for decentralized energy technologies of a minimum size threshold and poor investment decisions by early adopters are discussed.

## FOREIGN-AFFILIATED FIRMS AND ENVIRONMENTAL PROBLEMS IN CHINA: ENVIRONMENTAL IMPLICATIONS OF FOREIGN DIRECT INVESTMENT

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### Keywords

foreign direct investment, foreign-affiliated firms, industrial relocation, energy consumption, China

Extensive industrial relocation is taking place in Asia due to various factors such as labor costs, changes in the exchange rate, and the quest for new markets. In particular, Japanese manufacturers have largely shifted their production facilities to other countries in Asia. The transfer of industry from Japan to other countries, from different point of view, is the transfer of production equipment and its accompanying environmental load to other Asian countries. For the industrializing countries which receive this transferred technology, it means taking over production of goods with large environmental loading on behalf of the industrialized countries, and achieving economic growth by exporting the products to those industrialized countries. The industrializing countries receive production facilities and equipment from the industrialized countries, acquiring advanced technology and the opportunity to shift to cleaner production technology with lower environmental loading. This change in the international location of industry is directly related to industrial restructuring in both Japan and received countries, and also to the structural change of trade. Moreover, countries with extensive land area, such as China, may end up with disparate levels of development between different internal regions due to differences in technology transfer from other countries. To achieve a balanced economic development throughout East Asia and to resolve environmental problems, it is a big issue what international division of labor and industrial location are desirable in the region.

This paper discusses the environmental implications of the increased presence of Japanese-affiliated firms in China, which is the second largest recipient of Japanese foreign investment next to the US. The number of foreign-affiliated firms has increased gradually in China since the 1980s: in 1994, the share of foreign-affiliated firms in its industrial gross output value amounted to 13.6%, it was as large as 38% in Guangdong Province. Foreign-affiliated firms usually employ the same technology as they have used in their home countries, and this greatly contributes to the modernization of the industrial technology of the recipient country in terms of emissions and primary resource consumption per unit of production.

It is estimated that the contribution of foreign-affiliated firms to the total energy consumption in China was about 2% while they contributed to a reduction in energy intensity per unit of production (energy consumption per GDP) in China by 26.5% from 1982 to 1994. In Guangdong Province, where the share of production value by foreign-affiliated firms is a large 38%, foreign-affiliated firms accounted for 14% of energy consumption and 47% of energy intensity reduction since 1982. The same analysis was performed for the industry sector for all of China, with essentially identical results.

The effects of industrial relocation between Japan and China was analyzed for four industries (iron/steel, textiles, chemicals and paper/pulp). It was found that less than 1% of total Chinese energy consumption was due to Japanese-affiliated firms, and that the energy intensity reduction was especially large in the chemical industry.



## **A Study on Structural Changes of Manufacturing Sector in Korea: The Measurement of Real Energy Intensity and CO<sub>2</sub> Emission**

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### **Keywords**

structural change, real energy intensity, CO<sub>2</sub> Intensity

It is well known that economic development and the expansion of manufacturing sector has strong relationship. Economic development strategies of most of countries are to expand manufacturing sector, at the early economic development stage, which is the main engine of its economic growth. Obviously, Korea was a typical example of such countries. However, it is also known that the energy intensity of manufacturing sector is higher than any other sector. Especially, in Korea, the energy intensity of manufacturing sector rebounded from late 1980's. In this study, we closely examine the structural composition of manufacturing sector in Korea from 1981 to 1996 and its energy intensity and its implications to CO<sub>2</sub> emission by introducing the measurement of real energy intensity.

The conventional index of energy intensity is not proper for the aggregate industries. Since the aggregation of industries (manufacturing sector) includes the structural changes in it, it is better to separate this effect. Hence, in this study, we derive the method of real energy intensity. In each industry, the energy intensity is also a mixed measurement of pure energy efficiency improvement and fuel substitution. We also calculate real energy intensity in each industry level. Based on our analysis, we derive CO<sub>2</sub> intensity and analyze the factors to affect CO<sub>2</sub> emission in this sector.

Major findings are followings. First, during 1988 - 1993, the energy intensity of manufacturing sector in Korea was deteriorated. If we sort out the effect of structural changes, the real energy intensity in this sector was even worse during this period. The main reason for this phenomenon was that during this period, the share of energy intensive industries, such as steel, cement and petro-chemical industries was increased. Second, however, during the same period, the natural gas was rapidly penetrated in this sector, so that the CO<sub>2</sub> intensity was improved. We find that the harmonization of economic development strategies and environmental consideration is crucial for sustainable development. Based on our study, we derived some policy implications. Integration of industrial policies and energy efficiency improving programs is quite important, as well as the acceleration of fuel substitution to less carbon intensive ones. Policy integration of local and global environmental policies also plays important role for mitigating CO<sub>2</sub> emission.

## Industrial Transformation and Energy: An Asian Perspective

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The energy needs of the developing countries are two folds - (a) large scale energy requirements to fuel the growth of the economies with specific emphasis on rapid industrialization and urbanization and (b) to meet the energy requirements of the rural population. This is further complicated by the fact that investments in infrastructure is very huge and require substantial involvement from the multilateral agencies and the private sector.

Often the decision making process is difficult due to various pressures and a wide range choices. The conflict is between large centralized energy supply systems or small decentralized energy supply which may be based on the local resources and requirements. The other conflicts are between renewable energy and fossil fuel, Imported fossil fuel versus indigenous fuel. At the planning and the administrative level the conflict is in the allocation of scarce resources for education, health and other social programs or for large scale infrastructure for exploitation and transportation of energy.

Often these choices have significant regional and global impacts. These impacts are not only environmental in nature but also economic. Like the choice of fuel for power generation on the West coast of India is not easy to make purely on the basis of economics. As coal (indigenous and imported) is equally competitive with LNG.

World over energy scenario is changing rapidly. The entire energy sector is undergoing significant transformation especially in the power and the coal sectors. Even in most Asian countries the entire energy sector is being restructured. The emphasis is on privatization and significant investments to meet the challenges of the next millenium. The large centralized planning for energy needs of a country is on its way out. The primary objective behind this is to improve efficiency at all levels and to provide cost effective energy to all segments of the society.

The environmental pressures from local and international bodies have forced many Governments and organizations to evaluate the plans for energy developments.

This paper uses some of the tools in Industrial Transformation in trying to address selected issues related to energy exploitation and use especially in the Asian sub-continent. The list below provides an overview of the different aspects that will be covered in the paper:

- Environmental aspects related to energy exploitation use
- Analysis of energy requirement and future needs
- Critical analysis of the existing energy policies
- Socio-economic aspects of energy use in the Asian sub-continent
- Ongoing reforms in the energy sector and its impact on energy usage and environment
- Policies of the government on local and global environmental aspects
- Programs and policies of the government for promotion of renewable energy
- Technologies for large scale power generation and energy use in large industries
- Identification of the policies and instruments for promotion of technologies that suit the development of the energy sector as per the criteria set by tools of Industrial Transformation.

## A new criterion to evaluate environmental policy measures in the international context to limit global environmental risks: the "cooperative push"

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### Keywords

environmental policy instruments, traditional judgement criteria: efficiency and ecological accuracy, the global alliance of risk, risk welfare, a new criterion: the *cooperative push*

**Abstract:** Global environmental change requires a critical assessment of environmental policy instruments with regard to their ability to solve international problems of "open access", like global warming. In a national context the advantages and disadvantages of each instrument have been sufficiently discussed in the literature according to different criteria. Economists have given close attention to the *efficiency* criterion indicating whether a given instrument is able to attain a pre-determined target level with minimum cost. Another criterion is *ecological accuracy* focusing on the degree of exactness with which the instrument is able to reach the target. Comparing emission taxes and emission quotas, generally, the former approach is more efficient than the latter. However, with respect to ecological accuracy the opposite is true: quotas are more accurate than taxes. Since these two criteria evaluate different dimensions it is hard to decide which instrument is most favourable overall. Moreover, the traditional criteria are not readily applied to evaluate the aptitude of instruments to initiate and enforce international environmental agreements for the protection of *global* public goods. Therefore, the paper focuses on the following topics:

- 1) It is shown that the introduction of a risk welfare function opens the road to simultaneously analyse environmental instruments according to the traditional criteria: *efficiency* and *ecological accuracy*, by merging them into a one dimensional indicator, the risk-welfare.
- 2) A further judgement criterion is introduced: the "*cooperative push*". This criterion provides a link between local and global concerns to place traditional criteria into a wider context to support a sustainable reduction of *global* environmental risks. It emphasizes the fact that even high levels of efficiency or ecological accuracy may not be sufficient for global risk reduction. It points out that a sustainable risk limitation is only to be expected if criteria-specific advantages of instruments enhance the possibility of international cooperation.

It will turn out, first: the type of policy instrument most suitable to fight global environmental problems is very sensitive to the form of a countries' risk preferences. And second: the performance of an instrument regarding efficiency and accuracy is among the factors determining how it fares according to the new criterion of cooperative push. According to this new point of view, national policy measures of global risk management can be designed as a catalyst of international cooperation for mastering the global commons.

The analysis also shows that the "*balance*" of the criteria-specific advantages and disadvantages with respect to risk welfare is crucial for the *internal* cooperative push of instrumental choice. And moreover, that the global alliance of risk offers a chance to push other countries into cooperation by national instrumental choice. The aptitude of instruments to enhance the neighbour country's willingness to cooperate - i.e. the instrument's *external* cooperative push - may lead to the counterintuitive result that a "cautious" nation "acts against its nature" choosing an instrument which leaves a relatively high residual risk. The reason for this "paradoxical" behaviour is that the choice of this kind of instrument increases the other country's propensity to cooperate.

## THE RESPONSE OF COMMUNITY WATER SYSTEMS MANAGERS TO CLIMATE VARIATION AND CHANGE: A CASE STUDY IN PENNSYLVANIA'S SUSQUEHANNA RIVER BASIN.

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### Keywords

decision-making and uncertainty, community water systems, vulnerability, climate variation and change.

Community water systems (CWS) are sensitive to weather and climate. For this reason, we would expect that CWS managers (1) plan their responses to contemporary weather extremes and climate variation and therefore (2) will be amenable to planning their responses to future climate change. In contrast, the literature indicates that utility managers are unlikely to expend resources planning for scenarios that are beyond a five-year planning cycle and uncertain. Our interaction with CWS managers supports the view that many managers do not plan adequately for contemporary weather extremes and climate variation and have little interest in planning for climate change.

We hypothesized that several factors, such as system size, the number and types of sources, and the regulatory environment, may be associated with the way that CWS managers respond to contemporary climate variation and perceive climate change. To test this hypothesis, we conducted case studies and focus groups of small, medium, and large CWS. We also surveyed approximately 461 CWS managers in the Susquehanna River Basin of Pennsylvania.

The case studies demonstrated that small, less affluent systems with part-time or volunteer managers do little planning for problems caused by weather and climate. These CWS often rely on one water source. They have difficulty complying with state and federal water-quality regulations. This combination of factors makes them vulnerable to extreme weather and climate events. In contrast, larger, more affluent CWS have full-time managers. An important component of their job is to plan for difficulties that arise from weather and climate extremes. These systems typically have many sources of water and comply with state and federal water quality regulations, thus we expected them to be less vulnerable to weather and climate perturbations.

The survey suggested that CWS managers are ambivalent about climate change, but their systems are vulnerable to climate variability. While systems based primarily on surface water showed more vulnerability to droughts and floods, as was suggested by the case studies, not all survey results matched our expectations. Despite our expectation that smaller systems would be more vulnerable, the survey suggested that larger systems are more vulnerable to droughts and floods. The larger systems reported significantly more frequent disruptions in supply and more increases in demand due to drought, and reported more frequent problems with water quality as a result of floods. This finding suggests that larger systems tend to be more complex, thus increasing their vulnerability. Alternatively, this finding may be the result of smaller CWS managers being less attentive to the impacts of climate on their systems. Further research is required to explore this issue.

There are at least two policy implications from this research. First, it is important to help CWS managers learn the value of incorporating weather and climate planning even for their current operations and to facilitate that planning. Second, the reasons and strategies for planning in the face of uncertainty must be communicated to all CWS managers to reduce vulnerability.

## **The vision of a low energy society as guide for a polycentric climate change policy**

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### **Keywords**

low-energy society, integrated assessment, climate change policy

The current perception of the climate change decision problem is large based on justifying costs of reducing carbon dioxide emissions by the benefits of preventing a climate catastrophe. Decision making is viewed as top-down process with a few or even a single utility maximizing decision maker. The advantage of such approaches is that they can be formalized. The interface between natural and social sciences can be clearly structured. Natural sciences provide scenarios for possible impacts, economists quantify the costs of potential damage and the costs for options to prevent such damage.

However, many decisions will be made by the individual choices of millions of organizations and citizens, and these will be driven by local interests and conditions. One cannot talk of a shared perception of "the" climate change decision problem. This argues for an approach where climate change is viewed as being part of an unstructured problem situation embedded in a wider range of societal concerns.

Carbon dioxide emissions can only be stabilized by non-marginal improvements in energy efficiency. Such changes cannot be brought about by conventional policy measures but require collective decision making processes based on procedural rationality. Changes in procedures and rules can only be the result of collective action. The paper argues for a novel approach to climate policy with an emphasis on process guided by the vision of a low energy society. The vision of a low energy society (reduce per capita energy consumption to about 30% of today's value) is of fundamental difference from a specific goal (e.g. reduce carbon dioxide emissions by 5%). A vision is remote enough from the current state that discussions are not focused on the operationalization of quantitative goals. A vision is comprehensive. It addresses underlying values, beliefs about desirable and undesirable futures. However, the power of the vision of a low energy society depends also on the existence of a plausible transition path. It is argued here that costs will depend on the transition path chosen. Policies to realize a vision of a low energy society require thus institutional change with learning environments for society. The role of integrated assessment is to structure the debate, to present scientific facts and uncertainties, risks and options.

The presentation will discuss conceptual issues, a methodology of integrated assessment combining interactive model platforms with a participatory approach, experience with regional integrated assessment of climate change in Switzerland and arguments for and against the existence of an attractive development path to a low energy society.

## **Institutionalizing Science in Global Environmental Policy Between North and South-Does Access Matter?**

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### **Keywords**

science in international institutions, environmental assessment, North-South relations

This paper addresses the question of access to scientific advisory bodies within international environmental regimes. It will be argued that asymmetries in participation in such bodies help to explain variance in the content, legitimacy, credibility, and influence of the information that is generated. In particular, the paper analyzes asymmetries in the actual access of industrialized and developing countries to scientific advisory bodies. For example, developing countries have consistently sought to increase the participation of their own scientists in the Intergovernmental Panel on Climate Change (IPCC), claiming that without sufficient representation by developing countries in the IPCC process, its very legitimacy would be jeopardized. This research will thus be of major significance for improving the design of the work of such bodies.

Although the theoretical argument and some empirical evidence applies to most countries, the main empirical work addresses the role of South Asian countries in scientific advisory bodies within international environmental regimes, and the role these bodies play in the formulation of South Asian environmental policy. Empirically, the paper examines participation in scientific advisory bodies within the regimes on the protection of the ozone layer, the prevention of climate change, and the preservation of biological diversity.

The paper will focus on three different effects of the participation of developing countries in scientific advisory bodies: First, it examines how variation in access to information-generation leads to variation in its outcome, that is, the specific knowledge generated. Is there a relationship between the participation of a country in a scientific assessment process and the framing of the content of this assessment? Here, the information in itself is being addressed, asking in particular 'Who benefits more from certain assessment outcomes?'

Second, the paper analyzes whether variation in access to information-generation leads to variation in access to this very information. Does more participation of one nation's scientists, or of scientists of developing countries in general, entail more knowledge within this nation about the environmental problem in question?

Third, the paper shows how variation in access to information-generation leads to variation in the perceived legitimacy of the information by actors. It appears that the more citizens of one state participate in a given scientific environmental assessment process, the more this assessment is considered as 'legitimate information' that could be used for decision-making in this state. The paper questions here the perception of the information, asking in particular 'Who accepts which claims of truth as legitimate and will use them for decision-making?'

Finally, it will be outlined how a country's access to information-generation, access to the information itself, as well as the perceived legitimacy of that information, effect this country's policy toward the environmental problem in question.

## **'Prior Informed Consent' in Managing Transboundary Environmental Risks-An Institutionalized Global Procedure Versus Decentralized Information Generation**

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### **Keywords**

transboundary risk, informed consent, decentralized information generation

In this paper, I undertake an in-depth examination of "prior informed consent" as an emerging global-level tool by which to mitigate transboundary transfers of environmental risk. Following a brief exploration of "prior informed consent" within the 1989 Basle Convention on the Control of Transboundary Movements of Hazardous Waste and Their Disposal, and the 1998 Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, I explore its relevance for one of the newer issues on the global environmental agenda- "biosafety" or safety with regard to trade in the products of genetic engineering.

The Biosafety Protocol, currently being negotiated under the Convention on Biological Diversity, relies upon prior informed consent (or "advanced informed agreement") as its primary risk mitigation strategy. The Protocol can be viewed as a global-level effort to institutionalize and standardize procedures for the generation and dissemination of information about the risks posed by use of genetically engineered organisms in differing national contexts. The assessment of risk remains, however, a decentralized endeavor, to be undertaken by relevant institutions within exporting and importing countries. The main task of my paper will be to critically evaluate the assumptions underlying a workable "informed consent" procedure within such an institutional context. The assumptions I will evaluate include, first, that information about the novel risks posed by use of genetically engineered organisms can be produced; second, that this information can be generated according to standardized procedures, and through reliance upon quantitative risk assessments; and third, that such assessments can have relevance for the vastly differing socio-economic and ecological contexts within which they will be deployed. In exploring the validity of these assumptions, I focus on three key questions: Which discourses about risks posed by genetically engineered organisms are included, and which are excluded, from standardized quantitative risk assessments? Who is generating the decentralized information about risk, and in what institutional contexts? Finally, who is authorized (at what levels of decision-making, on whose behalf) to give informed consent?

In addressing these questions, I draw upon the emerging literature within science and technology studies, as well as within international relations theory, on questions of participation and agency in information generation and dissemination in environmental decision-making. I will also draw upon key debates within the trade and environment literature on harmonization, at the global level, of differing national environmental health and safety standards. The significance of this research will be to (a) explore the relationship between standardized global procedures for information generation, and decentralized production and dissemination of such information in a new issue-area; and (b) to critically assess the effectiveness of reliance upon a risk communication strategy such as "informed consent" in dealing with transboundary transfers of novel forms of environmental risks.

## The Science-Policy Interface in International Environmental Regimes- Lessons from Comparative Analysis

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### Keywords

international environmental regimes, advisory processes, institutional effectiveness,  
institutional change, institutional learning

Decision-making on global environmental issues has to deal with high degrees of uncertainty about causes and impacts (of action and non-action). Therefore, advisory processes aimed at the reduction of uncertainty about the problem and about possible solutions are important for facilitating cooperation among states. They are often a built-in feature of international environmental regimes, and established to help moving these regimes from general norms (e.g., as in framework conventions) towards binding and verifiable rules (e.g., as in protocols to framework conventions).

The paper presents a comparative analysis of institutionalized processes that are aimed at the production of policy-relevant knowledge within international environmental regimes. The formation and operation of these processes will be explored in three issue areas: long-range transboundary air pollution, protection of the ozone layer, and climate change. The analysis seeks to shed light on the bi-directional nature of science-policy interactions: On the one hand, in recognizing that knowledge-production is a social process, it examines the forces that (re)shape the parameters of the advisory process and its informational outputs. On the other hand, the analysis explores which features of the advisory process increase the chance that it influences the policy process.

As regards the effectiveness of advisory processes, the paper suggests credibility, usability, and the targeted communication of the produced knowledge as endogenous meta-criteria. Trade-offs between the first two criteria-credibility and utility-seems particularly important to manage in many cases: For example, broader participation in the advisory process helps to make results more credible to more actors, but may have adverse effects on the quality and timeliness of information outputs. Conversely, including policy analysis or policy recommendations in assessment reports could make them more relevant for the negotiating process, but at the same time threaten the credibility of the institution as a "scientific" body. The importance of the communication-criterion increases with the politicization of an issue and the resulting variety of competing knowledge claims. In this situation, effective communication channels to national audiences and transnational issue networks can improve the "competitiveness" of international advisory processes.

In a dynamic perspective, adaptability-or the capacity for institutional learning-becomes an additional source of effectiveness. This includes, among others, the inclusion of new sources of knowledge when the information needs of the policy-making process change along the issue-cycle. The effectiveness of the IPCC, for example, depends on its capacity to integrate local knowledge in treating the issue of impacts of climate change, as well as the social sciences when examining the socio-economic dimensions of climate change. The comparison of three processes that have undergone a considerable amount of institutional changes seeks to find out if there is convergence a) in the sources and patterns of change, and b) in the way these changes influence the suggested criteria for effectiveness.



## THE USE OF CLIMATE FORECAST IN POLICYMAKING: LESSONS FROM NE BRAZIL

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### Keywords

seasonal climate forecast, policymaking, drought, NE Brazil

This paper addresses the human dimensions of natural climate variability in the state of Ceara in Northeast Brazil. The Northeastern Region of Brazil is subject to severe periodic droughts that can be devastating, especially for the poor, rural population. The severest droughts appear to be associated with the warm phases of the El Niño-Southern Oscillation (ENSO). In recent years, the state of Ceará has issued seasonal climate forecast based on global climate models that include ENSO data. Based on these models, the government of Ceara has implemented public policy, especially in the areas of agriculture and drought relief.

This paper examines the social and policy implications of the use of climate forecast to mitigate the impacts of drought, focusing on the ability of state policymakers to effectively use climate data in policy implementation. In addition, it reports on current research that is designed to determine (1) to what extent are farmers in Ceará aware of the official climate forecasts, (2) to what extent do they use the forecast in their farming decisions, and (3) if the availability of climate forecasts has improved their ability to cope with drought conditions.

The climate forecasting literature often depicts data application as an "expected" follow-up to data production without closely examining how the process of data dissemination and policy implementation actually works. However, forecast data dissemination and use in policymaking are more complex than climate forecasters assume (Kingdon 1985, Feldman 1989). First, forecasts often have high degrees of uncertainty that complicate the processes of policy and decisionmaking. Second, forecast data timing and inaccuracy may preclude their use in policymaking. Third, there is evidence that what scientists understand by supporting policymaking can be significantly different from what policymakers expect from science (Offutt 1993, J.C. Bernabo et al. 1993). Moreover, clients lack of trust in science and/or in the government data use may affect their decision to use the data. Finally, user preference for traditional forecast methods and their limited range of choice in responding to public policy also affect their ability to use the data. Thus, in order to improve the level of data applicability, it is critical to understand the mechanisms of scientific data dissemination, access, and use by both policymakers and end-users in the field. In turn, climate data use in policymaking can be significantly complicated by the involvement of different kinds of institutions from different countries. How to integrate distinct levels of data production, dissemination, and use becomes paramount for data application success.

The feedback from applications and social science to the modeling community is essential to a fully integrated and policy-relevant effort in climate prediction and global change research. In this sense, this research may have a direct effect on social and economic planning for the mitigation of negative global climate phenomena with real benefit for vulnerable groups and societies all over the world. Moreover, by illuminating the process of scientific data dissemination and use, this paper seeks to benefit other areas of applied sciences searching for improved communication between scientists and potential users of scientific information.

## THE HUMAN DIMENSION OF CLIMATE CHANGE: THE TRADE CONVERGENCE CLIMATE COMPLEX (TC3)

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### **keywords**

humid tropics, climate variability, human dimension, agriculture, aquaculture

El Niño/Southern Oscillation (ENSO) events in the 1990s (warm and cold events) have once again underscored the vulnerability of societies in the American Tropics to climate variability and climate change. The need for sustained climate research and improved forecasting is accompanied by the necessity of developing adequate methodologies and mechanisms to assess and mitigate the effects of climate variability in climate-sensitive economic sectors.

In response to this need the TC<sup>3</sup> network began in 1994 assembling a regional team of experts not only in climate research and forecasting, but also on the socioeconomic impacts of climate fluctuations, researchers in agriculture, human health, energy and water resources sectors along with planners and decision makers, both of the private and governmental sectors. The TC<sup>3</sup> domain extends from South Florida (U.S.) and Southern Mexico through Central America and the Caribbean to the northern portion of South America from the Guyana to northern Ecuador. TC<sup>3</sup> is a regional Research Network (<http://www2.usma.ac.pa/~cathalac/etccc.htm>) based on the concept that TC<sup>3</sup> region is linked by climate processes shared in common by the countries of the region and that the impacts of climate variations also tend to be of similar nature.

The economy of the region is heavily dependent on activities that are largely influenced by climate variability such as agriculture, aquaculture and fisheries, tourism, among others and therefore are easily affected by climatic events. This dependence has been evident during the last 20 years when extreme climatic events such as ENSO have disrupted TC<sup>3</sup> countries economy. For example, economic losses in Ecuador during the 1982-83 ENSO event were up to 400 million dollars and during the 1997-98 event over 3000 million dollars due to changes in land use, increased in the population but mostly because we have not been able to make information accessible and understandable to everyone for disaster prevention and impact mitigation. This does not mean that we have neither augmented our scientific knowledge nor improve forecasting. It really means that we have to translate the scientific knowledge into usable and understandable science and to be more effective in transferring the information to the economic sectors impacted by climate events, governmental levels and decision-makers.

The Human Dimension (HD) component of TC<sup>3</sup> is working initially in four socioeconomic sectors: human health, agriculture, aquaculture and fisheries, and water/energy resources. TC<sup>3</sup> research projects are not only focussed on the empirical relationships among climatic variables but also on the empirical relationships that exist between socioeconomic activities and climate variability and how we should apply the research results to improve the knowledge of the impact of climate variability in each sector; to develop useful tools for decision-makers; and to promote rational responses to predicted variability in the socioeconomic sectors most affected, so as to mitigate adverse impacts and redistribute resources for optimal benefits and to improve our region economy and environmental sustainability. Some pilot applications have been developed in agriculture and aquaculture. The responses of these sectors to information provided about the 1997-98 ENSO event by TC<sup>3</sup> HD group will be shown.

## **EL NIÑO EFFECTS IN THE NORTHERN BORDER OF MEXICO. URBAN AND NATURAL PROCESSES IN SIX BORDER COUNTIES**

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### **Keywords**

El Niño-ENSO, environmental vulnerability, border cities, disaster, and Mexico.

We analyzed the social and environmental vulnerability caused by El Niño-ENSO in six urban areas. The focus is on the potential risk induced by pluvial precipitation effects like floods and landslides at cities located in the northern of Sonora, Mexico (Agua Prieta, Sonoyta, Nogales, Caborca, Puerto Peñasco and San Luis Río Colorado). The main goal was to identify the vulnerability areas of major susceptibility to extraordinary precipitation, specifically in the 1998 cycle of El Niño-ENSO. We used the spatial approach for this study; the analysis based both the natural landscape and the socioeconomic features in each city. Both elements are very important to propose recommendations according for the prevention of urban disasters and to avoid human losers.

Social and economic processes magnify the effects caused by environmental phenomena. The recent events of El Niño-ENSO have damaged and altered the economic and social structures in many cities located near the coast of the Pacific Ocean, like Tijuana in the northern border.

The Mexican border cities in Sonora did not have tragic effects in 1998; nevertheless it may be possible that next cycles of El Niño-ENSO may cause certain effects that now are unpredictable. This is due in part to deficient infrastructure of those cities and low public capabilities to planning policies for confront environmental contingencies, and because the population growth is higher than the amount granted of urban equipment in all this cities. In relation to social organization it was found that United States (U.S.A.) nearness is relevant to continue binational cooperation between leadership groups of the border to prevent disasters and help to reduce their consequences in the future.

## THE SOCIAL AND ENVIRONMENTAL DIMENSIONS OF CHANGING LAND-COVER PATTERNS IN A HILLY INDIGENOUS AFRICAN CITY

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### **Keywords**

urbanization, deforestation, legislation, human settlement and urban planning

By a combination of many factors, Ibadan has been characterized and variously called the "Black Metropolis" or the most remarkable city in Nigeria. Established in 1821, Ibadan sprawls, like Rome, over a range of hills which runs across its center from south to the north. Most of the wards in the city take their names from these hills. From a population of 70,000 in 1856 and 459,196 in 1952, the city has transcended its initial seven hills to other adjoining eight hills with a population of 3,000,000 people in 1996 spread over 11 local governments and 50 sq. kilometers of land. It is the consequences of this increasing population and intensity of human interaction which has wrought great changes in the land cover pattern of the Ibadan city region. This is the concern and focus of this paper which draws its results from a year-long study of land-use pattern in Ibadan.

All the hills on which Ibadan now situates were initially forested and protected by law. Ownership of these forests were vested in the Ibadan Native authority (and latter council). All these protected forests became forest reserves in 1916 and although the sole aim of of the reserves was to provide firewood for the city of Ibadan, it became protection for the watersheds of the numerous water bodies, streams and rivers in the valleys of these many hills. According to our research findings, permission were sparingly given to residents to farm and or build within these reserves.

Today, only about one-tenth of these forests exists because of the various human intervention which has adversely affected the land cover pattern in the city region. For example and by virtue of the history of the town, the early settlement were on the hills for defensive purposes. Overtime and as the city expands, the hill solpes became inhabited and various land uses, notably, residential and commercial became common place such that today, Ibadan is a mixture of the old and the new, the rural and the urban. The initials forests have given way to residential, commercial and industrial buildings, very many churches and mosques, recreation centers and stadia, research and educational institutions and a host of other uses.

The environmental/ecological consequences of these changes in land-cover pattern have been costly in both human and material terms. For example, the city have witnessed annual floods arising from encroachment on flood plains, the worst being in 1980 with a mild one in 1998; loss of biodiversity and endangering of indigenous plants and animal species; general environmental degradation etc.

The proposed paper will document all the causes, consequences and remedies for the changing land cover pattern in Ibadan city region with a view to making recommendations which will make the city region environmentally sustainable and environment friendly in the 21st century.

## **SOCIO-ECONOMIC DIMENSIONS OF URBAN DEVELOPMENT, LAND USE / COVER CHANGE AND RESPONSES TO ENVIRONMENTAL CHANGE IN METROPOLITAN FRINGE OF DELHI**

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### **Keywords**

urban development, metropolitan fringe, land use/cover change, socio-economic consequences, environmental assessment, governance, policy development

Globally, people are moving to cities in search of higher incomes, improved services, and access to various amenities. It has been said that 21st century will be the world's first urban century.

Much of the urbanisation in the world is taking place in developing countries, and is accompanied with major changes in the social, economic and technological arenas. Many of these global trends are also apparent in India, a country that is being transformed by rapid economic growth and social change. Delhi Metropolitan region has faced even more rapid rate of urbanisation and environmental change than the average for India. This accelerated urbanisation trend has had environmental costs. This includes air and water quality problems: waste removal and disposal have depleted; and the metropolis and the development corridor in which it is located have an impact on the surrounding country side through the depletion of resources such as food, potable water, and aggregated building materials. This is causing immense change in land use patterns as well as human responses from the surrounding rural areas. The land use change is primarily from agriculture to residential/industry or brick kilns. In this process the region faces severe problems of land degradation.

The present paper deals with urban development and its environmental and socio-economic consequences in a metropolitan fringe in Delhi with a view to developing practices and policies towards sustainability. The main objective of the paper is to provide an information base with which to address inter-linked issues relevant to sustainability; basic human needs for environmental quality; infrastructure development through policy and regulatory approaches; and good governance through public participation in decision making. Practical applications of the results will contribute to developing local capacity to deal with urban environmental problems; institution building through the involvement of local NGOs; engendering local ownership of the development process; and the building of partnerships among government agencies, donor agencies, NGOs and the local people. The paper incorporates waste management, environmental assessment, aggregate extraction and hazards management analysing information base related to archival and historical information, government policy, land use time-series data analysis using Remote Sensing and GIS in order to promote policy development towards sustainable urban development. The strategy suggests that an urgent need for government to take appropriate steps and if possible legislation for land encroachment to prevent shrinkage of prime agricultural land.

The best way to check these problems is through economic development of the regions experiencing maximum out-migration. Policy guidelines for rural development (i) stop villages from degrading into slums (ii) finding ways of enforcing land use plans and building by-laws (iii) checking transport network, sewage and drainage (iv) finding ways of providing safe transmission of energy, irrigation and communication. The development rationale of the study found in focus areas of Agenda 21 of the UN Conference on Environment and Development. Such study based on Delhi experience will contribute to promote environmentally sound development through Sustainable Urban Development and Environmental Impact Analysis.

## ANALYZING THE RELATIONSHIPS BETWEEN LAND USES, SOCIO-ECONOMIC AND PHYSIOGRAPHIC FACTORS IN JAPAN

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### Keywords

land use change, Japan, GIS, canonical correlation analysis

Land uses are determined by many and complicated conditions. Socio-economic and physiographic conditions especially have great influence on the change of land use. Socio-economic activities that use and change land attributes are considered as the proximate sources of land use change. And land use changes are constrained by physiographic factors. The purpose of this study is to clarify the static relationships between land uses, socio-economic and physiographic factors in the whole Japan by canonical correlation analysis. Then spatial distributions of land uses and land use changes are investigated using the GIS.

This study is based on the land use data of 1975 and 1990. Land use types were classified into four main categories (Farmland, Urban land, Forestland and Other land). In 1990, farmland was about 20% of total area, urban land was about 4% and forestland was about 74%. Municipality was selected as the unit of analyses. Japan is composed of 3245 municipalities in 1990. The distribution of each land use was expressed by the percentage of total area. On the other hand, most of factors were standardized by dividing by area of the municipality and expressed as proportions because of difference in municipal area. Socio economic factors indicate (1) demographic condition, (2) agricultural condition, (3) secondary and tertiary industry conditions. Physiographic factors show (4) slope condition, (5) elevation condition, (6) topography condition.

Findings of the analyses are described as follows,

#### 1) Spatial distribution of land uses and land use changes

The areas, which have high percentage of urban land in 1975, were located in Tokyo, Osaka, Nagoya and their environs and some regional hub cities. Between 1975 and 1990, land use changes have mainly occurred in the big cities and their environs. The increase of urban land roughly corresponded to the decrease of farmland between 1975 and 1990.

#### 2) Static relationships between land uses and factors

Static relationships are analyzed by the canonical loadings. In the result of analysis of 1975 data, farmland was positively correlated to gross farm product per farmland, gross farm product per farm household and percentage of full-time farm household. Urban land had direct relation to population density, number of shop per unit total area, number of business firm per unit total area, industrial product per unit total area and percentage of tertiary industry employees. And farmland and urban land are located in gentle slope and low elevation and lowland area. These land uses, therefore, compete for location. Urban-rural mixed areas have yielded due to urban land use extension in the urban fringe area. On the other hand, forestland is located in mountain area, steep slope and high elevation relatively. The result of analysis of 1990 data was similar to that of 1975 data. Accordingly we can indicate that the relationships between land uses and factors remained unchanged between 1975 and 1990.

We conclude that land use changes have mainly occurred in the big city and their environs, and that the relationships between land uses and factors are clarified.

## STUDY ON THE REGIONAL DEVELOPMENT, LAND USE IN CHINA: CASE STUDY IN SHENZHEN CITY

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### Keywords

land use change, simulation, CA model, remote sensing, GIS, China

The coastal region in East Asia comprising the coastal areas of China, South Korea and Japan have undergone a rapid urbanization and changes in land use and environmental conditions associated with rapid economic development of the region in the last few decades. The changes are further ongoing in a larger scale in China, especially in some specific areas such as those in Guangdong province and Yangze river delta area.

Study of land-use and land cover change is crucial not only for detecting the global environmental changes but also for formulating sustainable development strategies in local areas. At descriptive level, Remote Sensing (RS) and GIS can capture the pattern of land-use change. Dynamical modeling and prediction, however, require further studies beyond the capabilities of GIS and RS. This study adopts the cellular automata model (CA) to provide a framework for modeling the spatial dynamics of regional economic development, urbanization, and land use changes. By using a constrained, stochastic CA-based model, a reproduction of the past trend and the prediction of future changes are made with respect to the land-use change, while integrating GIS, CA and RS.

The general analytical scheme is applied to Shenzhen City, and studies are conducted to simulate their significant land-use change in the process of rapid urbanization. The case studies were conducted in the following way:

- 1) The land-use changes have been detected based on the post-classification comparison technique in combination with the maximum likelihood classifier and probabilistic-relaxation method, using the LANDSAT MSS and TM data for the years of 1980, 1988 and 1994.
- 2) A constrained, stochastic CA-based model has been designed specifically to represent relevant characteristics of land-use change, which involve a larger number of cell states, in order to represent a variety of types of land-use. The transition rules were defined taking into account the inherent suitability of the cell for each of the active land uses and the aggregate effect of the various land-uses within a neighborhood of the cell, in addition, the effect of stochastic perturbation also included. The parameters of model have been calibrated by Monte-Carlo method based on the history of land-use change in Shenzhen City from 1980 to 1994. The simulation result in the period of 1980-1994 shown that coincidence index could attain about 0.7 to 0.8.
- 3) The calibrated model have been used to predict the future land-use of the cities under the study in the years of 2000, 2005 and 2010 by assuming that the transition rules are not changed in the future.

## INTEGRATED ANALYSIS OF CLIMATE CHANGE IMPACTS ON LAND USE IN TEMPERATE EAST ASIA (LUTEA): INTEGRATION OF ECOSYSTEM AND ECONOMIC FACTORS DETERMINING LAND USE UNDER CLIMATE CHANGE

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### Keywords

LUTEA, Integrated Land Use Analysis

The impact of climate change on temperate ecosystems (such as croplands, grasslands, and forests) affects physical, ecological and socio-economic processes. Changes in these processes affects the soil fertility, soil moisture, and soil organic matter resulting in further regional land use and climate changes. These changes in land use and climate at the regional scale are often quite different from national or continental scale changes, so that regional differences are expected with in land use decisions relative to climate change. Integrated assessments (IA) are needed to more completely model whole human-environment systems. IA efforts are under way that provide spatial and sectoral detail necessary to achieve reliable estimates of land use and ecological changes at county to regional scales.

The objectives here are: (1) to explore the development of an information linkage between the CENTURY terrestrial ecosystem model and social economic data; (2) to describe the analytical framework to assess the importance of the critical human and environmental factors controlling land use decisions at local and regional scales. This presentation provides insight to the interactions of climate, ecosystem, economic and socio-cultural interactions controlling land use change at local to regional scales. The ability to analyze the integrated effects of the factors controlling ecosystem and socio-economic integrity relative to changes in climate and land use management of the these ecosystems is a complicated task. A framework to simplify the complex interactions within and between various subsystems is provided using a modelling approach that includes all the major components and links them together in an integrated fashion. Development of this framework for assessing changes and incorporation of information to integrate factors controlling ecosystem and social-economic dynamics.

Technological advances in remote sensing (RS), geographic information systems (GIS) and ecological simulation modeling have increased our ability to link information across a broad array of disciplines. This ability has allowed us to begin to answer a variety of complex issues related to changing patterns of environmental and socio-political drivers in the Temperate East Asia. Since land use change is a dynamic process, the integration of GIS with simulation techniques provides a way to examine their spatial and temporal characteristics and identify forces contributing to land use change. The utility and information content of GIS and RS data depends on our knowledge of the socio-political, economic, and ecosystem structure and function. Thus, a way to increase the utility of RS and GIS data for interpreting land use-ecosystem process has been to combine RS and GIS with socio-economic and ecosystem modeling technologies.

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## A New Concept for Land Use Change Simulation Model Projections for China: Simulation of Spatial Expansion of a City by Diffusion Process

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### Keywords

urban expansion, diffusion, and simulation

Enlargement of a city will lead to a loss of highly productive arable land, which is a big issue on sustainable development in China. Although spatial growth of a city is an integrated outcome of interaction of society, economy, policy, and natural conditions, we assume that such growth can be dealt with in the similar process to the flow of heat, or water to some degree. Basing on this, we assume that cities expand dependently on density of some kind of substance.

According to the mathematical theory of diffusion, we have a two-dimensional diffusion equation to be expressed as:  $\partial m / \partial t = \rho x (\partial^2 m / \partial x^2 + \partial^2 m / \partial y^2)$  by supposing that the parameter  $\rho$  is independent from the space coordinate  $(x, y)$ . In practice, we have a numerical solution:  $m_{ij}(t + \Delta t) = m_{ij}(t) + \rho x \Delta^2 m_{ij}(t)$  to this equation by replacing differential with difference.

Generally, the aspects influencing the flow of substance can be divided into two kinds: endogenous one, and exogenous one. The endogenous aspect reflects the internal attribute of substance whereas the exogenous one reflects the difference of external media along which the substance flows. We used the following two elements in this equation to describe those two aspects.

1. Internal element--density,  $m$ , represents different substances. Three of socio-economic factors were considered to contribute to the value  $m$ . They are the size of population, physical structure of a city, and average income of the city.

2. External element--the parameter,  $\rho$ , was used for representing related geographical factors for expansion of a city. The value of  $\rho$  reflects the conductivity of the external media. In general, the road is an example to contribute to  $\rho$ .

Sample data derived from RS data were used to examine the model. Here we focused the model on the aspect of simulating the future expansion by imitating the past expanding trend. In the process, we first extracted urban area of a given city from TM data of two different years through supervised classification method, then, the expansion trend was derived from the difference between the two data sets by the calculation of  $\rho$  and  $m$  at corresponding locations, and finally, we estimated a potential expansion by applying this model with the calculated values of  $\rho$  and  $m$ .

## LAND USE CHANGE ON THE MONGOLIAN STEPPES

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### Keywords

land use, Mongolian steppe

Grasslands of the Mongolian Steppe are a critical resource for meat, milk, leather, wool, and cereal grains that provide subsistence for millions of people. We have characterized the factors controlling long-term ecosystem dynamics (soil C and fertility, plant production, water flux and etc.) and sustainable land use alternatives relative to changes in climate and land use management of the Mongolian steppe. The scope of the presentation includes analyses of existing information of recent historical patterns of plant productivity, grazing intensity, land use practices, human and livestock demographic patterns, economic growth and economic policies that determined local and regional land use systems. The analysis implements an interactive ecosystem-human socioeconomic system modeling framework. We are using this analytical framework to determine various strategies of sustainable land use in this region.

Historically, low population densities of nomadic pastoralists have used the rich grassland region to graze their mixed herds of cattle, sheep, goats, horses and camels. Grazing patterns were dictated more by intra- and interannual climate variability than political or economic factors. However, with changes in governments and in political controls on livestock demographic patterns, dramatic changes in land use have occurred. During the last 40 years, socialistic practices replaced many aspects of the traditional nomadic culture. The herdsman were commonly organized into collectives and were allowed only a small number of animals for private ownership. The herdsman moved less frequently, but for longer distances. In addition, human population levels in the region have risen dramatically during the past several decades. This has led to increased grazing intensity and rates of cropland conversion. Stocking rates around villages and water sources have increased. The most fertile land areas in the central part of Mongolia have been converted to croplands, and grazing has been shifted to fewer productive lands. This practice has intensified grazing on the remaining areas and has often reduced ecosystem productivity.

Since 1990, Mongolia has been converting from a socialistic centralized economy to a free market economy. These changes have affected the livestock sector in a number of ways. A private ownership of animals increased to 94% and a total number of livestock increased from 25.8 million in 1990 to 31.3 million in 1997. Goat numbers increased from 5.1 million to 10.3 million at the same period because of the market value of cashmere. The number of the herders families increased from 75,000 to 184,000, with the largest growth of herders families - almost doubling occurred during privatization of livestock in 1991-1992. The number of herdsman nearly tripled for 1990-1997, reaching 410 thousands.

Land use changes in Mongolian grasslands modify biological constraints (plant nutrients and grazing) and will affect sustainability of the grazing system in the Mongolian Plateau. The traditional management of the rangelands sustained for centuries, but changes in land use during the last several decades are apparently increasing rangeland degradation.

## DEVELOPMENT OF AN INTEGRATED ASSESSMENT FRAMEWORK FOR ENVIRONMENTAL SECURITY IN THE ASIAN REGION

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### Keywords

environmental security, sustainable development, Asian region

The rapid growth of the population and economic activities in the Asian region have destroyed and deteriorated the environment. Traditionally, natural resources such as water resources, forest/timber, land have been used wisely for daily life of local residents and for the primary industry like agriculture. However, rapid economic development disrupted the traditional system, and as a result, human induced environmental change has affected the socio-economic situation and human daily life significantly. This relationship is called vicious cycle. To cut off this negative feedback relationship, it is essential to identify the critical factors forming this vicious cycle based on the past research and the field survey, and to integrate them into a human activity - environmental change - economic growth model in a comprehensive manner for future prediction of the environment and the society and for establishment of the better response strategy. The aim of this session is 1) to identify the critical factors forming this vicious cycle in the Asian region, 2) to predict future conditions regarding water resource, food security, and land use using an integrated assessment model which was developed to explain this cause-effect relationship and to predict future change assuming several socio-economic scenarios, and finally 3) to propose possible countermeasures for the sustainable development in this region. The study area is basically the Asian region, but the research findings can be applied to other regions.

Prior to the subsequent three papers, as an introduction of this session, this paper demonstrates the current research project concerning the development of an integrated assessment model for environmental security and sustainable development in the Asian region briefly. The key items to be explained are as follows.

- 1) Background and purpose of the research project and a framework of an integrated assessment model on the interaction between the regional environmental change, human activity including socio-economic aspects along with the research team composition and international collaboration.
- 2) The most remarkable problems identified in the Asian developing countries, i.e. food security, water resource scarcity, and land use; the current situation identified from literature and field survey conducted in the research.
- 3) Summary of the research findings, and future development of this research project.

## IMPACTS OF ENVIRONMENTAL CHANGE ON FOOD SECURITY IN THE ASIAN REGION

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### Keywords

agricultural productivity, food security, Asian region, climate change impact

Impacts of environmental change including climate change on crop production in the Asian region may be one of the most serious problems in the next century. In order to evaluate this problem quantitatively, a modeling framework to estimate an economic impact caused by climate change was developed. The framework comprised two main models, a GIS-based potential crop productivity model and a 30-region international trade model. The former model simulates the physical process of crop growth using the monthly climate data such as temperature and precipitation, as well as the physical and chemical soil data. The latter is the computable general equilibrium model which simulates the domestic supply-demand balance and the international trade.

Without considering the direct impact of atmospheric CO<sub>2</sub> concentration increase, the potential crop productivity of winter wheat decrease by 45% in India and decrease by more than 50% in Bangladesh by the end of the next century, while that of rice and maize will not decrease so seriously in any regions. Taking these regional changes of potential productivity as technical changes in production function of the international trade model, the social welfare in India will decrease considerably, 4.89%, while that in Japan will increase 0.02%. Globally, the social welfare will decrease 0.046%.

The result shows that the economic impact caused by the changed crop productivity is not so severe if it is averaged globally because of the market adjustment through global trade. However, the considerable negative economic impact is estimated in the region where the productivity will decrease and the share of agricultural products in the total private expenditure is high. In the Asian region, impacts of climate change along with other environmental factor degradation directly will affect agricultural production, and then cause significant negative impacts on regional and international food supply and demand relationship. The research also considers how to deal with such future food shortage problems in consideration with autonomous and social adaptation.

## RISK ANALYSIS OF WATER RESOURCE SCARCITY IN CHINA

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### Keywords

water resource, water supply and demand, China

In China, water resource scarcity has been one of major concerns for sustainable economic development. To analyze the current situation of water resources problems and to predict future risk of water scarcity in China, a physical factor-based river water runoff model (hydrological model) was developed in cooperation with the National Institute for Environmental Studies, Japan as a part of an integrated assessment model for environmental security.

There are growing concerns that climate change will have significant impacts on the hydrologic cycle and water resources in many regions of the world. Thus the hydrologic cycle is identified as the highest scientific priority for global change research. So far, available water resources has been investigated based on river flow models including possible climate variations. However, it is pointed out that, different formulae of physical processes as well as different conceptualizations of hydrologic components will likely respond differently under climate change scenarios. In development of water resources model, it is essential to consider regional characteristics of hydrologic cycle, especially evapo-transpiration (PET). Several methods of PET calculation were examined for better fits between observed and predicted river water flows.

In addition to the hydrological model, a water supply/demand model has been developed for agricultural, industrial, and urban water uses. Linking these two models, future risk of water resources scarcity was evaluated. In conclusion, water supply and demand in China will be unbalanced, and risk of water deficit will be increased significantly. To mitigate this predicted water deficit, strict water saving activity should be incorporated into the development plan. Water resources is one of fundamental resources for future sound development of the country, so the research outcomes would be applied to other regions in the Asia.

## LAND USE CHANGES AND THEIR GHG EMISSIONS DERIVED FROM BIOMASS ENERGY SUPPLY AND FOOD CONSUMPTION PATTERN

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### Keywords

land use change, greenhouse gas emission, economic growth scenario

It is important to investigate how to use the land resources in the future from the viewpoint of competition of land use and the greenhouse gas emission from land use changes. The population increase and the food consumption pattern changes cause the land use competition among cropland, pasture and forest. Moreover the increase in biomass energy demand for reduction of greenhouse gas emission makes the field for biomass energy plant increase. And the deforestation leads increase in the greenhouse gas emission such as CO<sub>2</sub>. In this study, GTAP model, which is a general equilibrium model with 10 sectors and 17 countries and regions in the world, is modified in order to analyze the competition of land use among agriculture, livestock, forest, and biomass energy plant supplies. The global land use changes are simulated based on the various scenarios on the economic growth, the energy demand, and the population growth derived from Special Report on Emissions Scenario of IPCC. From this study, the future land use patterns will be changed in each scenario. But it is found that in almost all will keep high until the beginning of 21st century, and after that, the forest area will serve as a sink for CO<sub>2</sub>. And the pasture for livestock will increase until 2100 due to the growth in demand for meat accompanying economic progress. Especially, in the scenario with the low growth rate of land productivity, this expansion of the pasture will be rapid. In the scenario, which needs the very huge biomass energy supply, the area for biomass energy supply will increase very rapidly. As a result, the price of the land will increase about twice compared with the scenario without so much biomass energy supply.

## SENEGALESE GHOST CITIES IN THE CONTEXT OF SEA-LEVEL RISE IN WEST AFRICA

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### keywords

sea level rise, population displacement, assessment, modelling, coastal zones, environmental information and protection

With examples of abandoned cities or cities partly affected by population displacement in the Senegalese coastal zone we try to show that active erosion appears as the sign of non linear sea level rise manifestation. This coastal process is particularly expressive of a reality, which should be integrated within the context of global environmental change research and policy at the sub-regional scale of the West African coastal zone.

The local coastal line, as elsewhere in Africa, has attracted population by its richness in natural resources (fisheries) and its development opportunities (industries and particularly tourism services). In the south coastal part of Sénégal, the Petite Cote, one can notice the highest human concentration (Fadiout an island is a very particular area with 3000 inhabitants per hectare ! and a rate of demographic growth which is also one of the highest in the country (2.5-3%).

With multisource data (iconic, demographic, etc.,) encompassing a temporal scale of about one hundred years, we try to show habitat change for some representative sites. We insist on risks which populations have to face when they settle on low area sites near the main level sea. These sites are lagoons borders or spits. These populations are totally or partly affected by displacement and they often move towards sites which are not more safe.

In doing correlation with demographic data and dynamic erosion we develop a model which based on help, from results, to assess coastal vulnerability (populations, habitats, infrastructures, etc.), which consequences are :

- the probable disappearance of some islands and spits sites;
- the possible displacement of some infrastructures and 1/4 of total population living in coastal zone in less than 25 years.

This estimation shows the need or necessity for environmental policies to emphasize on assessment, diagnosis and modelling.

Based on this review, suggestions are made concerning the need to develop more awareness and information dissemination activities in order to promote the development of longer-term prevention strategies and mitigation policies as well as improved preparedness programmes to enhance environmental and socio-economic protection and preparedness in emergencies -both of which are aimed at decreasing vulnerability in coastal areas. The fast development of prevention with information and environmental protection is an emergency.

## RUSSIA BETWEEN EAST AND WEST: NEW MIGRATION SPACE

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### Keywords

international migration, geopolitical changes, Russia, illegal migration

International migration appears to be one of the most important processes accompanying geopolitical changes over the world. Collapse of the Soviet political system and territorial integrity of the USSR, liberalization and integration of Russia into the international economic developments and labor market have substantially changed the situation with international migration over Eurasia region and beyond. After seventy years of being closed state with a minimal external population exchange, Russia within ten years has turned into one of the most active agents of international migration process.

New migration space, which Russia represents nowadays, can be characterized by the unique combination of features:

- geographical location between Europe and Asia (East and West) which provide the space for in-out- and transit migration routes;
- neighboring China - the greatest traditional donor country - in the Far East and newly sending CIS states in the West and South;
- enormous demographic misbalance between overpopulated North China and under-populated Russian Far East that produces considerable migratory pressure over this region;
- lower living standards in Russia as compared to the developed countries and at the same time higher ones as compared to the CIS, northern provinces of China, Vietnam, North Korea - the main sending countries;
- economic chaos within Russia including huge dimensions of shadow economy and informal activities in the labor market;
- liberalization of migratory legislation under the weakness of Russian laws and poor experience in migration regulations, lack of effective immigration control.

This unique combination of socio-economic, geopolitical, and legal factors provokes unprecedented situation causing a considerable grows of migration flows and arising new patterns of spatial mobility. Under such conditions lack of adequate legislative and legal basis of migration caused a huge wave of irregular movements shaping the process more and more into illegal framework. The situation becomes more dramatic because of economic turmoil and tide of crime activity within Russia, that makes it easier for illegals themselves and structures involved "to fish in troubled waters". Thriving business connected with trafficking of people from Russia to the West attracts a big deal of transit migrants from Asian countries. In the late 1990s there are hundreds of thousands of foreigners who stay and work in Russia illegally.

The principal idea of the paper is to reveal illegality as a specific feature immanent to contemporary migration developments in Russia and a basic form of implementation of migration pressure which Russia experiences as a host and transit country.

Paper focuses on a few principal questions:

- ⇒ tendency, scale and directions of illegal immigration into Russia;
- ⇒ forms of illegality concerning migration and activity of migrants;
- ⇒ factors and consequences of illegal migration
- ⇒ role of migration in shaping new geopolitical environment in Eurasia region.

Data are drawn from statistics, sample survey and expert estimates conducted in 1997-1998.



## **REGIONAL CONCEPT OF MATERIAL FLOW ANALYSIS TOWARD SUSTAINABLE WORLD - JAPANESE EXPERIENCE OF A NEGATIVE SUM GAME -**

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### **Keywords**

regional sustainability, inter-regional material flow, dual decay

Last couple of decades, in the field of environmental studies, there has been notable progress in constructing conceptual frameworks of sustainability, criterion and evaluation methodology. These days, in addition to the global approach, regional concept of sustainability has been more and more important because of some reasons include: first, ecosystem is highly region-dependent; and second, material cycle in the ecosystem is geographically near-closed.

Trade in forestry and agricultural products disturbs these natural mass (nitrogen) balance through significant migration of organic materials. Environmental problems caused by the distorted material balance are now observed all over the world and are accelerated by rapidly growing free trade. Significant scale of material flow from one region to another causes environmental destruction at both ends of the flow: overnourished on one end and undernourished on the other. This structure is what we call "dual decay". Concerns such as deforestation of resource exporters and landfill shortages of importers used to be regarded as two totally different problems. However, it could be understood as a set of problems observed at each end of unnatural material flow.

Material flow per area (MFPA) is the proxy to the regional mass balance which is closely related with regional sustainability. The idea of MFPA has no role in global approaches to sustainability since the earth as a whole is closed in terms of material. MFPA indicates materialistic interdependency of regions that could cause the structure of dual decay. We are going to discuss about the concept of MFPA and regional sustainability, through the case study of Japanese experience of dual decay, related with forest resource trade.

## REDUCING ENVIRONMENTAL IMPACT BY SERVICE USE LIFESTYLE: THE POTENTIAL OF TRANSITION IN INDIVIDUAL TRANSPORT

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### **Keywords**

*lifestyle, consumer theory, service use, mobility, public policy and attitudes*

Transport evidently has become an area of activity among those most strongly causing global environmental change. This paper analyzes the shift from ownership to service use as a means to foster an alternative development path in the future. It reports a research line within one of the five Austrian Human Dimensions research areas (<http://www.kfunigraz.ac.at/vwlwww/HDP>).

In private vehicle mobility the lifestyle of service use has recently become available in western and northern Europe by car sharing organizations. Currently 38,000 people in a number of cities in Germany, Switzerland, Austria, the Netherlands, Italy, Denmark, and Norway are participating. Similarly as in many economic areas, in many instances it is not the "material" product that is desired by an individual, but the service it renders. The economic structure then is to organize the availability of just this service, which can be satisfied on the basis of one material product for many users. This paper analyzes the characteristics of people sharing one material product to satisfy their individual mobility needs. It further investigates which services they actually render. Different views on the latter ("mileage", "waiting obedience", and/or "prestige") are shown to imply different evaluations of the size of the market potential and different conclusions on the effectiveness of various policy instruments.

As the empirical basis three polls have been carried out. Poll I surveys all current Austrian CSO-members to determine their characteristics. Poll II surveys 350 households in two residential areas in Austria's second largest city of Graz (240,000 inhabitants). It is used to propose different approaches to the (urban) membership potential. Poll III offered a two-month test-membership to the 1200 households in one residential area to determine the immediately attainable membership share. The service use lifestyle is found to ease car access for some while it moves car use closer to full cost consideration for others. The net impact is shown to be an overall mileage reduction. Different views on the service rendered give market potentials between 69% and 9% of urban industrialized countries' households. When service use is a separate lifestyle, policy instruments have to ultimately foster it directly, rather than changing economic costs at the margin only.

## ALTERNATIVE PATHS OF TRANSPORT DEVELOPMENT: EFFICIENCY, SUSTAINABILITY, AND SOCIO-ECONOMIC ANALYSIS IN THE INDIAN CONTEXT

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### Keywords

sustainable development, transport, mode choice, data envelopment analysis, goal programming.

The effect of growing transport demand has a serious effect on the economic growth of India, which is an oil-importing developing country. During 1997-98, India imported 50.5% of its domestic oil demand worth US\$8,227 million, which is very significant for a capital scarce country like India. The money formed about 24% of its export earnings and about 20% of total imports during the year. Hence, it is important to study the efficiencies of energy utilization in transport modes, their sustainability implications and to assess the socio-economic impacts of alternative paths of sustainable transport development.

Normally, it is not possible to directly compare the energy efficiencies of different transport modes because they are used for both passenger and freight transport at varying levels. However, in this study, a holistic analysis of energy efficiencies of different transport modes is carried out using Data Envelopment Analysis (DEA). The DEA analysis shows that, for the year 1993-94, bus transport and rail transport are relatively 100% efficient, while road transport is just 30% efficient. Bus transport has been highly efficient over the years, while rail transport was relatively inefficient some years back but showed significant improvements in recent years. For example, bus transport in 1986-87 was 99% efficiency relative to the 100% efficiency of rail transport in 1993-94, while rail transport in 1986-87 is only 46% efficient. The improvements in the efficiency of rail transport are due to the decreasing share of coal traction.

These energy efficiencies have a strong correlation with local and global environmental emissions. Past trends indicate a very high modal share is expected in favour of road in the future. Emissions of Carbon dioxide (CO<sub>2</sub>) from transport sector are showing rapid increase, which can be arrested by promoting rail and bus transport. For example, if rail could improve its modal split so as to take 50% of the total traffic in the year 2005-06, it can result in nearly 35% reduction in energy consumption and CO<sub>2</sub> emission over the "Business-As-Usual" scenario.

Strong policies are required to achieve a higher modal split in favour of rail or bus transport. Huge investments are needed. In addition to privatisation and deregulation, a very important strategy to promote investment in railways can be the international Climate Change Policy Instrument "Joint Implementation". To avoid the rebound effect of increasing both rail and road performance, it is necessary to control the growth of road transport through pricing and other suitable policies.

Sustainable paths of transport development would promote rail and bus transport, and discourage personalised transport. It requires a drastic change in attitudes, behaviour and life-style. We consider the specific case of shifting from private transport to bus transport for an urban commuter in Mumbai. We analyse the incentives needed for induce such a shift using a goal programming based mode-choice model. The model employs cost, comfort and time as important criteria in deciding modal choice, and analyses the trade-off needed in private, bus and rail transports. Some additional socio-economic issues associated with inducing shift towards bus or rail transport are discussed in the paper.

## ENERGY TRANSITION AND ITS IMPLICATIONS FOR ENVIRONMENTALLY SUSTAINABLE DEVELOPMENT IN AFRICA

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### Keywords

energy transition, environmentally sustainable development, Africa

In the years ahead, African countries must face up to the major challenge of a transition from traditional sources of energy to one, which entails a greater utilization of commercial/conventional sources of energy. This challenge poses two major problems. First, with the exception of Algeria, Egypt, Gabon, Libya and Nigeria, all countries within the continent are dependent on imported oil for petroleum products and power generation. Second, there is a high dependence on traditional energy. This involves an over-exploitation of natural resources, leading to deforestation, desertification, soil impoverishment and other forms of environmental degradation.

Energy transition is the process whereby there is an increase in the volume and proportion of commercial energy to the extent that it replaces traditional fuels as the major form of energy consumption. This replacement process is complex, and can include, together or in succession the introduction of commercial energy into new sectors, or new uses of commercial energy, or the replacement of traditional energy in existing uses. It is also possible for the energy transition process to commence without any actual substitution in established uses. This then produces an increase in commercial energy consumption without any reduction in the consumption of traditional fuels.

In Africa, there exists a dearth of scholarly research on the energy transition process and its likely impact on the environment. While the nature, pattern and factors governing energy transition in regions such as South and Southeast Asia, as well as Latin America are known with a high degree of certainty, that of Africa remains conjectural. A study of the energy transition process in Africa is important for a number of reasons. First, energy transition is intricately linked to the global environmental process. The different forms of energy production and consumption not only constitute major factors in environmental degradation, but also are at the forefront of the development process. Second, Africa has one of the highest rates of population growth in the world, and contains some of the world's poorest countries. These two factors have clear-cut implications for the energy transition process in this region.

The purpose of this paper is shed light on what has become a marginalized issue in the African energy-environment research, namely, the energy transition process. By adopting a regional approach, the paper seeks to examine and account for variations in the nature and pattern of the energy transition process among African countries. In so doing, answers would be provided to the following questions. What is the pattern of the energy transition process in Africa? How does the energy transition process vary between African countries? How do environmental, human and development-related factors affect the process of energy transition in the various African countries? What are the environmental implications of the process of energy transition, and how do these impinge upon sustainable development? Answers to these questions are pertinent, as they would further enhance our understanding of this important, but neglected aspect of African energy-environment research.

## THE PROBLEM OF INSTITUTIONAL INTERPLAY

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### **Keywords**

regimes, institutions, vertical interplay

Institutions that loom large in causing or confronting global environmental changes are not self-contained arrangements, even though researchers sometimes find it helpful to treat them as discrete entities for purposes of analysis. Institutions interact with one another both horizontally at the same level of social organization (e.g. interactions between regimes for trade and the environment at the international level) and vertically across levels of social organization (e.g. local systems of land tenure and national regulatory systems dealing with land use). The resultant interactions may be positive (e.g. regional regimes gain strength from being embedded in global regimes) or negative (e.g. national regulations dealing with land use contradict or undermine traditional systems of land tenure at the local level).

This paper focuses on vertical interplay and addresses problems arising from interactions among institutional arrangements at two different scales. First, while the provisions of international environmental regimes (e.g. the climate change regime, the biological diversity regime) are framed in generic terms, they can only become effective to the extent that they are implemented within the domestic systems of member states. The challenge here is to provide sufficient flexibility to allow for implementation in a wide range of domestic settings, without losing substantive content in addressing global problems. Second, while national governments strive for uniformity in devising rules governing the use of natural resources, most of the relevant behavior takes place at the local level. The challenge here is to reap the benefits of uniformity in terms of considerations like efficiency and equity, without undermining traditional mechanisms of social control operative at the local level. The result is an analytic framework that should prove helpful in organizing empirical research on vertical interplay across issue areas and across geographical regions.

## **INSTITUTIONAL INTERPLAY AMONG ENVIRONMENTAL INSTITUTIONS IN THE ARCTIC**

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### **Keywords**

institutions, environment, arctic, interplay

The last decade has witnessed a proliferation of international institutions seeking to ameliorate various problems relating to environment and natural resource issues in the Arctic. The actual implementation of measures to resolve such problems does however require action from institutions at a national level. the interaction of institutions at various levels of societal organisation - vertical interplay - is therefore an important determinant of the eventual success of efforts to come to grips with various environmental challenges.

## IMPLICATIONS OF POLITICAL TRANSFORMATION IN SOUTHEAST ASIA FOR ENVIRONMENTAL GOVERNANCE

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### **Keywords**

environmental governance, political transformation, Southeast Asia, forest, coastal zones

Over the past decade the formal political institutions of many nations in Southeast Asia have been undergoing a transformation that is changing a closed public policy process into a much more open and participatory one. The implications of these on-going changes for natural resources and environmental management, through changes in land tenure and resource use rights, to controls on environmental pollution are not straightforward, but potentially profound. Power is shifting along at least two major axes. Firstly, a move from subsistence-based agriculture through to more market-oriented systems and land uses and, secondly, a decentralisation of power away from central governments to local authorities and communities. This paper examines, by drawing on examples from forest and coastal land development in Burma, Vietnam, Indonesia and Thailand, the way political transformations have directly and indirectly influenced environmental governance. These analyses suggest a research program on the relationships between social and political transformation and environmental governance in Southeast Asia. The paper concludes with some initial ideas for such a research program.

## **Social Cultural Dimensions and Present Decision Making Process: Scenario in a Developing Country - Nepal**

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Modernization and transformation, which have occurred in the western world, have recently begun to effect the lives of the people in the developing countries. Still in many respects the economy is rural or old fashioned. We are looking here the mountain communities in the Himalaya particularly Nepal. The settlements in this region were developed in isolated patches dictated mainly by the availability of natural resources. The rugged terrain, absence of roads, seasonal pattern of rainfall has all contributed to the development of the life pattern and culture with fewer interactions with the outside world. The compulsions inherently present to be self-supporting have created a unique style in resource mobilization. The adaptive technology developed here needs a special note.

Traditional rural economy has been based on optimization of resource use to be self reliant and independent of external intervention. Technological advances in the outside world and political transformations within have prompted the central government to assume the right of institutional interventions. These institutional interventions though designed for the betterment of the lives of the rural people have created complexities. The rural poor neither can return to their traditional system nor there is adequate safe guard mechanism for them to get the minimum level of the quality of life they were experiencing traditionally.

These development activities have also raised the scale of economic activity much higher. The scope of environmental problems triggered by such activities has transcended both geographic and generational boundaries. Local communities typically were in control of the local natural resources. They had managed efficiently. As the institutions proliferated local commitment to manage resources has been lost. Along with the institutionalization of development activities, the encroachment of the local resources from outside the community also progressed rapidly. This unhealthy competition on the utilization of resources brought many of the rural community to a level of poverty.

The present notion of globalization has made the sustainable development path much more difficult. This globalization process not only affected the local institutions in their decision making process but also enhanced the economic woes of the rural poor disturbing the very basis of socio-cultural fabric. These external interventions have caused further proliferation of local institutions as well as frequent changes in their administrative setup. Furthermore, poor infrastructure, frequent changes in decisions, decisions made under duress and uncoordinated and incoherent interactions with subsequent implementation practices all contributed to the failure in the development process.

Examples of both success and failure of institutional interventions in Nepalese context are cited and the effectiveness of institutions is discussed as a case study.



## A Historical Analysis of Japan's Desulfurization Experiences for the "Eco-Policy Linkage" Design

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### Keywords

Eco-policy, air pollution, pollution reduction, damage

Japan's experiences in the battle against pollution suggests a lot of important factors which can be considered to encourage Asian developing countries in their efforts to balance environment and economic considerations, especially to design "Eco-Policy linkage".

Japan's first air pollution measures were those reducing fuel sulfur content in FY 1964<sup>1</sup>, and various fuel conversion and energy conservation measure have henceforth been devised. Among them, flue-gas desulfurization measures peaked (when viewed in terms of investment sums) in 1974.

When we take the year 1974 as a standard year and consider the theoretical effect of response timing, it is estimated by our economic model that damages resulting from air pollution would have exceeded an estimated cumulative amount of 12 trillion yen had response been delayed by 10 years. The rise of GDP over this period would have stopped short of 6 trillion yen, indicating an overall loss of approximately 6 trillion yen. Even had the timing been delayed by only six years, losses of over 1 trillion yen would have been incurred. On the other hand, had response timing been accelerated by about eight years, it is highly likely that a resultant decline in damages would have exceeded a resultant decline in GDP, making this more economically profitable than the actual case. Although Japan's air pollution response was somewhat late, the dramatic rise in air pollution prevention investment during the 1970s eased and eliminated previous pollution damage. We can say that consequently, an anticipated subsequent rise in damages was pre-empted. In the end, Japan's air pollution response was economically profitable. Further, had Japan's air pollution response been delayed, difficulties would have possibly arisen not only in terms of damage, but also in terms of focused pollution prevention investment. The 1970s was an era when industry had enough the 1980s, many industries initiated restructuring upon which they staked their survival, and the capacity and incentive for industry investment in areas including pollution control declined.

Our historical analyses also show the Japan's relationships between economic growth and pollution reduction as follows: (1) technological development was essential to reduce the costs of pollution abatement; (2) a competitive market gave an environment which was crucial in giving companies the incentive to invest in technology development; (3) environmental investment created new businesses and industries in Japan, which increased Japan's GDP, and (4) such environmental investment improved not only the quality of products, but also production processes and recycling processes in factories, which in turn encouraged Japan's long-term development. Of course, it is very important to remember the role local residents, and local governments, have played in encouraging the introduction of environmental policies. It is also important to recognize the role of company staff in encouraging business enterprise and environmental initiatives.

## Integrated Environment Policy Assessment for China

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### Keywords

climate change, SO<sub>2</sub> Emission, Integrated Assessment, Energy model, China

To response for climate change is the common action for all the members in the world. After several years negotiation the Kyoto Protocol was agreed in last year in Japan. The Protocol is regarded as an important step towards meeting the objective of stabilizing greenhouse gas (GHG) concentrations in the atmosphere. It is also notable that developed world accepted the reduction commitment under the protocol while developing world is out of the round. By considering the different social and economic development background, it is understandable the way for developing countries. For environment issues, GHGs emission reduction is not yet the first concerning in developing countries. Local pollution is becoming the key point for environment with the rapid economic developing. In the case of China, because the economy is growing quickly after 1980's and the energy consumption mainly relies on solid fuel, local pollution such as acid rain caused by energy use already became a serious problem. In order to understand the benefit on local environment from the climate change policies, it is necessary to analysis not only the GHGs emission reduction but also the other pollution reduction. This is the purpose of our study. It focus on the assessment for climate change policy by considering the effect of the policy on local environment issues, we analyzed the both CO<sub>2</sub> emission reduction and SO<sub>2</sub> emission reduction for China. We use the Asian-Pacific Integrated Assessment Model(AIM) for this study and several cases were defined. The study results show that the construction of perfect market mechanism and adoption of climate change oriented policy will cause significant emission reduction not only on CO<sub>2</sub> emission but also on SO<sub>2</sub> emission.

## Energy Policy and Reduction of Air Pollutant in Asia and Pacific Region

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### Keywords

air pollution, energy consumption, environmental impact, clean technology, policy option

Now, the Asia-Pacific region consumes 26% of global commercial energy consumption, and its economic growth and rising energy consumption has resulted in increasing air pollution, particularly in many urban areas of the region. The effective energy policy taking account of reducing air pollution is strongly required in order to reconcile economic growth and environmental cares in this region.

In this study, the environmental impacts of policy options to reduce the emissions of air pollutants include utilization of clean technologies, fuel switching and increasing energy efficiency, promotion of non-motorized and public transport are analyzed using the Asia-Pacific Integrated Model (AIM).

It is estimated that the SO<sub>2</sub> and NO<sub>x</sub> emissions levels in 2030 in the BAU case would be about 3 times of the 1990 emission levels. Air pollution problems similar to those experienced in Japan in 1970s have emerged in many developing Asian countries. The concentrations of these pollutants in some industrialized areas have already exceeded the critical level experienced in Japan in 1970s, when serious health damage was observed. In the case of the accelerated introduction of clean technologies beginning at 2005, SO<sub>2</sub> and NO<sub>x</sub> emissions levels in Asia Pacific region in 2030 would increase by 6% and 60% respectively as compared to the 1990 levels. With the introduction of public mass transport system, SO<sub>2</sub> and NO<sub>x</sub> emission levels would increase by 1.5 % and 45% respectively as compared to 1990 level. Considering regional energy resources and energy policies, one should consider various aspects for fuel switching. In our analysis of the various policies packages (except the mixed one), fuel switching with accelerated introduction of clean technology turns out to be the most efficient in term of SO<sub>2</sub>, NO<sub>x</sub>, and SPM emissions reduction. SO<sub>2</sub> emission level in 2030 is reduced by 17% as compared to the 1990 level while the NO<sub>x</sub> emission level would increase by 40%.

## Comparison of Strategies to Reduce Greenhouse Gas Emissions

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### Keywords

integrated model, global warming, emission trading

In Kyoto meeting on climate change, they agreed to reduce the greenhouse gas emissions of the Annex I countries by at least 5 per cent below 1990 levels in the commitment period 2008-2012. They also proposed several regimes to realize emission reduction with international collaboration. This study estimates CO<sub>2</sub> emissions and economic impacts under the Kyoto agreement using the Asian-Pacific Integrated Model (AIM).

The AIM model is an integrated computer simulation model consisting of a greenhouse gas emissions model (AIM/emission), a climate change model (AIM/climate) and a warming impact model (AIM/impact). The AIM/emission model comprises top-down and bottom-up models. The AIM/top-down model is a recursive general equilibrium model and is used to analyze post-Kyoto scenarios. Differences among scenarios mainly arise from the setting of emission trading; no trading, Annex I trading and global trading. For non-Annex I countries, the emissions are bounded by their business as usual emissions when they are involved in trading.

It was found that Japan's marginal cost of CO<sub>2</sub> reduction is the highest among the USA, the EU, and Japan in 2010 in the no trading case. The highest GDP loss is observed in the USA. The marginal cost becomes much less in the global trading case. The countries of the Former Soviet Union sell emission rights and the USA buys the largest amount of them. Emission reductions by trading will account for a large part of the total emission reductions if there is no restriction on trading. The GDP gain of the Former Soviet Union is the largest in 2010 in the trading cases. The GDP change in China is negative while that in India is positive, although the values are small. The GDP change in Middle East Asia is negative, and reaches the highest level in the no trading case. Carbon leakage is particularly observed in the no trading case.

## HOUSEHOLD VULNERABILITY TO CLIMATE CHANGE/VARIABILITY IN SEMI-ARID NORTHERN CHILE.

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### Keywords

vulnerability, drought, environmental degradation.

As global warming is likely to continue, more research is needed at the local scale in order to document how human communities have adapted and survived (or not) under harsher conditions. The information generated through scientific research should serve as an aid for policy-makers to design adequate mitigation measures.

This paper will present some partial results obtained through an on-going research project in the semi-arid region of northern Chile, an area drought-prone and subject to an intense environmental degradation process. The rural inhabitants are considered among the poorest in the country, and their livelihoods depend basically on subsistence agriculture. The project attempts to document (1) the intensity and direction of climatic change at the local scale, (2) the land-cover change process, (3) the different degrees and types of vulnerability to negative climatic events along an E-W river basin, and (4) the effectiveness of different governmental programs designed to mitigate the effects of drought and degradation.

Among other research instruments, an anthropological questionnaire was applied to 120 households that attempts to determine different income levels, access to food, markets and infrastructure. Different uses of technology, access to credit, and participation of public mitigation programs were investigated also. Coping strategies were specifically addressed.

Some of the expected preliminary results to be presented at the 1999 Open Meeting are (1) a socio-economic characterization of households and an estimation of their vulnerability, (2) a description of their coping strategies, and (3) a description of the land-cover change process.

## ASSESSING VULNERABILITY ACROSS "NOT-IMPLAUSIBLE" FUTURES

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### Keywords

risk and impact assessment, triage strategies for adaptation studies, not-implausible futures

This paper offers the framework of a simple method designed specifically to help the research community come to grips with assessing the vulnerability of systems as we contemplate how they might adapt to a wide range of futures that cannot presently be ruled-out. The focus, then, is on first-round assessments across a collection of futures that are "not-implausible". It suggests that we build on "first generation" impact *cum* adaptation analyses to determine how various sources of cascading uncertainty might alter our view of how systems might respond to what might happen. The method applies a vulnerability indexing scheme recently developed by Schimmelpfennig and Yohe (1998) to existing case studies of vulnerable systems (or even heuristic descriptions of the sources of stress on systems that are thought to be vulnerable).

Each such study or description will have identified critical *impact variables* that are the sources of stress and which frame the associated adaptation questions. Each may have worked through some of the possible adaptive strategies along a few selected climate scenarios. Perhaps its author discarded some adaptive strategies that are not "adoptable" given the specifics of the systems' cultural, socio-economic and/or political structure. Perhaps it will have looked into the informational constraints that can limit the potential efficacy of adaptation. Perhaps it will have placed climate stress into the context of other stresses facing the systems. Maybe climate variability has been considered explicitly. Perhaps not. The method described here requires only that the existing study or story has identified critical impact variables that drive prospective change and define the context of potential adaptation. Indeed, the point is to see if it would be more beneficial to devote resources to a careful analysis or to move on to another system.

The foundations of the vulnerability index have been described in Schimmelpfennig and Yohe (1998). The Schlesinger and Williams COSMIC construction (1998) can offer a wide range of "not-implausible" climate futures for any country in terms of one or more of a wide variety of parameters drawn from 16 different general circulation models (GCM's). Multiple emissions scenarios with and without significant sulfur emissions can be used with varying degrees of climate sensitivity. Yohe, Jacobsen and Gapotchenko (1999) have already applied the method to traditional maize agriculture in Mexico where summer precipitation and growing season were critical. A more integrated and multi-dimensional application to the coastal and agricultural zones of Egypt is in the works.

The approach offers the potential for good and bad news, depending upon how the future might unfold. It offers insight into the timing of each. It indicates which GCM's support which type of news along what type of emissions scenario. And it can identify when careful exploration of the degree to which vulnerability might be diminished by autonomous or planned adaptation can pay the largest and most timely dividends.

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## ECONOMIC IMPACTS OF CLIMATE CHANGE IN THE U.S. SUSQUEHANNA RIVER BASIN

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### Keywords

climate, computable general equilibrium model, regional, response

Much progress has been made in recent years in modeling the impacts of greenhouse gases on global climate and impacts of global climate change on regional climates. Much less progress has been made in modeling economic impacts and responses to climate change, particularly at a regional level. We generally lack information on potential responses of economic actors (companies, institutions, households, and individuals) to these changes. We also lack information on how economic actors in one region might respond to climate-induced economic changes in another region. In addition, little is known about how economic actors in one economic sector might respond to climate-induced economic changes in another sector.

Broadly speaking, climate change can have four types of economic impacts at a regional level. First, it can affect the supply of climate-sensitive market goods and services within the region. Market goods and services are those sold by an economic actor to another economic actor, with payment being in cash, in kind (barter transactions), or both. Second, climate change can affect the supply of climate-sensitive nonmarket goods and services within the region. Nonmarket goods are those that are not traded, and in which property rights are not well defined. Unlike a market good, the value of a nonmarket good (what people would be willing to pay for it if it were bought and sold) is unaccounted for by the market. Third, climate change can have indirect effects on economic sectors within the region that are not directly affected by climate change. Fourth, climate change can have indirect effects on the region through effects on other regions of the same country or other countries. These impacts could in principle be positive or negative.

Impacts on the supply of climate-sensitive market and nonmarket goods can operate through three channels: (a) impacts on human health that affect the time available to people for production of market and/or nonmarket goods and services; (b) infrastructure, property, or asset losses due to extreme weather events; and (c) impacts on productivity in climate-sensitive sectors (e.g., agriculture, forestry, fisheries, outdoor recreation) apart from health impacts and assets losses.

This paper examines the economic impacts of climate change within the U.S. Susquehanna River Basin (SRB). To accomplish this objective, we construct a computable general equilibrium (CGE) model of the SRB. Preliminary results indicate that the overall effects of climate change on market production of market goods and services are likely to be moderate, but that much more significant impacts are possible for nonmarket goods and services. Even among market goods and services, some economic sectors in the SRB could be affected significantly, including agriculture, forestry, and coal mining. Preliminary results also indicate that the SRB could benefit economically as a result of climate change if insurance payments and government aid in response to extreme weather events were sufficiently generous. Even if the SRB did not benefit directly from climate change, it could still benefit indirectly if economic impacts of climate change in other regions and countries led to favorable changes in the SRB's terms of trade (prices of exports relative to prices of imports).

## **Learning from Disaster. The Vulnerability of Latin American Cities to Climate Change and Climate Variability**

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The 1997-1998 El Niño event had a devastating impact in several parts of the world. Some of the dramatic consequences in Latin America include natural disasters ranging from flooding and mudslides to draught and fires. Flooding and mudslides in Mexico, Ecuador, Peru and other countries caused the death of hundreds of people and millions of dollars in economic losses in several cities, and paralyzed complete regions. Draught also caused death, environmental distress and heavy economic losses. It disrupted energy and water supply in major urban areas, and massive fires in Mexico and Central America had severe consequences on the environment and on the health of inhabitants in major urban areas. These disasters illustrate the increasing vulnerability of Latin American societies to climate variability and climate change.

This paper studies the vulnerability of cities in Latin America to climatic phenomena in an effort to learn from these disasters. There are several reasons why the paper focuses on cities. Present and future growth in Latin America is intrinsically associated with the qualitative and quantitative growth of its cities. Cities concentrate the majority of the economy and population in Latin America and they are key interfaces between countries and global social, economic and political processes. The paper also focuses on cities in an effort to increase attention to this topic neglected by the literature and international efforts studying global environmental change.

The first part of the paper characterizes the social, economic and environmental structural causes of vulnerability in Latin American cities. The paper seeks to create a broad perspective and better understanding of vulnerability to climate phenomena in Latin American cities by linking those structural causes to global and national economic and social processes that impact local communities in the region. The conclusions of the paper illustrate the importance of linking global environmental change to global social and economic processes and stress the need to avoid fragmented perspectives in the study of the human dimensions of global environmental change.



## Generalized Thünen Model for Asian Land Use Change and LU/GEC Project

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### Keywords

LU/GEC project, Generalized Thünen Model, rent-bidding, ability, urbanization, sustainability

Land use phenomena is the basis for almost all global environmental problems at ground level such as desertification, deforestation, conservation of species and cultural heritages, pollution in developing countries; besides it has both natural and social scientific aspects because human activities are the principal driving forces causing land use changes.

LUCC is the joint core project of IGBP and IHDP for 'land use/cover change'. LU/GEC (Land Use for Global Environmental Conservation) is the largest LUCC-related project in Japan by NIES (National Ins. for Environmental Studies). The purpose is to construct land use prediction models in Asia-Pacific region by many teams of researchers. Phase I (1995.4-1998.3) has successfully finished with 5 original land use models. 4 of them consist of land use representation function 'f' relating land use ratios to socio-economic variables:

$$P_{ik} = f_c(\{X_{ik}\}_k)$$

and economic growth function 'g' relating future values to present values:

$$X_{ik}^{(t+1)} = g_k(\{X_{ij}^{(t)}\}_j)$$

Thus future land use can be predicted as

$$P_{ik}^{(t+1)} = f_c(\{X_{ik}^{(t+1)}\}_k) = f_c(g_k(\{X_{ij}^{(t)}\}_j))$$

For the better choice of f function, 'GT(Generalized Thünen) Model' is found as the extension of traditional normative Thünen model, the exact fundamental theory of land market, to be able to explain the real land use ratio data. This new model successfully give a exact theoretical interpretation to the intuitive picture of 'movement of land use frontier' such as deforestation or desertification, and enables us to predict the land use change in the future. Application results to Indonesian land use especially Java will be presented during the session. Observed regularities in Indonesian land use such as 'intermediate region phenomena', 'proportional law', 'megacity growth between Jakarta and Bandung' are explained by GT model.

Also GT model shows that the land use with strong rent-bidding power have large possibilities to be realized and urbanization processes driven by globalization is the prime factor producing land use changes. Thus, one of the environmental implication of land use is how to reconcile both globalization and sustainability: the search for land use activities with low environmental impact and high rent-bidding ability.

## **Agricultural Adaptation to Climate Change: Perspective from the Spatial-EPIC model**

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The natural environment is a complex interactive system. Simultaneous multiple perturbations of this atmosphere-soil-plant system induce further complexities which are compounded by effects of scale and the unknown human adaptive responses. As natural and physical scientists, many important aspects of food security are not within our 'control', for us, the challenges lie primarily in sharpening our modeling skills and predictive capabilities to provide possible certainties in answers to questions like climate change impact over agricultural productivity in general and more on how adaptation can devised on farm level is being addressed in this paper. After reviewing several research papers we found that there are lot of studies existing on potential agricultural productivity but to relate actual crop productivity, model based simulations are not adequate. Estimates of on-farm and off-farm productivity are being done using experimental/point based model. Biophysical spatial based models are still lacking to compute them at regional or national level. As a basis, point based Erosion Productivity Impact Calculator, EPIC (Williams, 1990) originally developed by USDA, ARS was used to develop its spatial version so that a large area can be modeled based on microscopic information at each piece of land in an efficient way.

Keeping this entire in mind, a spatial biophysical model, Spatial-EPIC (Satya and Shibasaki, 1998) was developed to simulate actual agricultural productivity for both present and possible future climate conditions with CO<sub>2</sub> fertilization effect on different agricultural crops. To evaluate this three major cereal crops (Maize-Wheat-Rice) in one of the north-eastern Indian state namely Bihar was modeled for different climatic and farm-adaptation scenarios using a cell/pixel based agrohydrological information/database and their final output were coordinated using a Geographical Information Systems. These farm level adaptations included change in planting date, change of cultivar, irrigation, fertilization and crop rotation, hence choice of adaptations to be tested was examined to find the possible responses to the worst climate change as well as to optimize the agricultural productivity from sustainability viewpoint. The result of this study shows dependence of production/crop yield on the intra-seasonal and inter-seasonal variations of climate information, which also varies with the types of crop species and different level of adaptations. Therefore, it is expected that the said approach may help the researchers and decision-makers to understand the status of climate effects on global processes in above crops.

## **AGENT-BASED LAND USE CHANGE MODEL - A NEW CONCEPT IN UNDERSTANDING HUMAN-LAND INTERACTIONS**

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### **Keywords**

agent, bio-physical, change, land use, land cover, modeling, socio-economic.

Land use is an integral part of all modeling initiatives in case of global change studies. As such, it is necessary to have reliable information on the land use/cover and an understanding of the changes that occur within them. So, there arises a need for time-series data of land use/cover. As such, for predictive purposes, we need suitable land use models to explain the land use changes and also to forecast them. The model should be able to simulate land use/cover changes in response to changes in both the biophysical characteristics and socio-economic conditions. At present, the global models and studies of land use changes capture the broad sectoral trends based on the changes in some of the macro variables, like population, quality of life and technology level. The statistical data shows a strong support in concluding that these variables may be the underlying drivers of environmental changes. Nevertheless, studies at the local level suggest the existence of other factors too, such as the farmers' preferences to certain crops and changes driven by migrations within the national boundaries. So, in order to get a complete picture of the land use changes, we need to account for the drivers based on both the micro-characteristics and the macro-economic scenario that exists.

The model proposed here deals with the development and application of a new concept in simulating the land use/cover changes - the presence of an "agent" as the decision-maker. The decision-making process of the agent is autonomous in deciding the next course of action based on the information available to him, from both the worlds of micro and macro-information, at a particular point in time and space. The biophysical characteristics of the specific lot of land (grid) and its economic potential (based on the macro-economic information) are considered within the existing demographic conditions at a given point in time, in arriving at the choice of the land use. The changes are simulated annually and the entire process is carried out on a grid (1km square) basis and is aggregated at the different scales, to analyze and compare the results with the prevailing macro-condition. These kind of inter-scale comparison helps to develop a more realistic scenario of the land use changes. The use of GIS platform and its tools has helped in analyzing the micro-information (spatial) within the boundaries of the available macro-level (non-spatial) data. The model was developed and its application was tested to simulate the land use changes, for the period of 1980 to 1990, within the national boundaries of the Royal Kingdom of Thailand. As the model considers the agent behaviour explicitly and at the same time considers the different drivers to landuse, the model can also be used to understand the human responses to the changes in the environment.

## **WATERSHED CONSERVATION IN THE ETHIOPIAN HIGHLANDS: APPLICATION OF A BIOECONOMIC MODEL**

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### **Keywords**

bio-economic models, watershed, degradation, mathematical programming

Land degradation including soil erosion, nutrient depletion and deforestation are serious problems in many parts of the developing world. It is generally agreed that natural factors affecting land degradation are better known and understood than socioeconomic, policy and institutional factors. Consequently most recommended solutions to the problems of land degradation are of biological and ecological nature. However, it is argued that biophysical solutions that incorporate farmers' traditional knowledge and experiences in coping with and utilizing the heterogeneity of the micro-environment under various economic and policy constraints are likely to be more effective in bringing about a sustainable management of the natural resource base.

A study was conducted to look at the impact of integration of ecological, socioeconomic and policy objectives of a community on its welfare. A dynamic bioeconomic model was applied in a watershed framework to simultaneously optimise biophysical and socioeconomic goals. The model was applied in the case of Ginchi watershed in the highlands of Ethiopia where a package of land conservation technologies are being tested. Preliminary results indicate that when different agricultural activities are allocated to different parts of the watershed on the basis of land suitability, 50% increase in marketable output and 25% reduction in soil erosion can be achieved. Moreover, a land tenure policy that ensures long-term security encourages conservation investments, e.g. planting trees.

## CAN THE CDM WORK FOR TROPICAL CARBON SINKS? INTEGRATING ECONOMICS AND ECOLOGY TO EVALUATE POLICY OPTIONS

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### Keywords

forest, carbon, global warming, Costa Rica, deforestation, sequestration, certification

The IPCC (1996) suggests the potential of tropical forest initiatives to offset carbon emissions, and the Clean Development Mechanism could fund such initiatives. Two uncertainties must first be addressed: one, what are the expected time paths of land use with and without such initiatives? and two, can the level of carbon sequestration from such initiatives be reliably measured? However, not only must these uncertainties be addressed, so also must an important tradeoff identified in this paper, one regarding the benefits and costs of increasing the complexity and effort involved in addressing these uncertainties. Greater effort and a more complex approach have benefits, to the extent that they yield unbiased and more precise estimates. Estimates must correspond to some extent with reality for a certified emission reduction (CER) system to produce sequestration effectively (and to avoid weakening Annex 1 commitments). However, there are costs of more complex and informationally demanding approaches: direct costs will rise and, at least as important, promising trades will be discouraged and the scope for manipulation of the system may increase.

Given the need to address both these uncertainties and this tradeoff, this paper describes the approach that the authors are now applying to Costa Rica, combining the economics of land use to address land-use time paths with the ecology of carbon storage to address sequestration. In each disciplinary component, the value of the best existing data, as well as its limitations, are noted. The integration of these two components permits policy analyses, such as the estimation of both the supply of CERs from tropical sinks and the potential gains for the suppliers of those CERs. Finally, in light of the tradeoff identified above, within both disciplinary elements we attempt to transform these state-of-the-art analyses into somewhat simpler "best practice" land-use and carbon-sequestration analyses.

This presentation paper has grown out of ongoing research on carbon sequestration and land use in Costa Rica. We would like to thank for generous support the Tinker Foundation's Institutional Grant in support of the project "Achieving Greatest Benefits from Sequestration in Costa Rica", the Center for Environmental Research and Conservation at Columbia University, the Harvard Institute for International Development, and the National Center for Ecological Analysis and Synthesis at UC-Santa Barbara, a Center funded by NSF (Grant #DEB-94-21535), the University of California - Santa Barbara, and the State of California, where we have been supported as the Carbon Sequestration Working Group.

## THE KYOTO PROTOCOL AND THE PROSPECT OF SINO-JAPANESE COAL TRADING

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### Keywords

climate change, trade, energy

China is a "super-power" of coal production and coal resources. In recent years, China's coal production has been ranked number one in the world. On the other hand, Japan's primary energy resources are scarce. It has relied upon imports to fuel the number two economy in the world.

To find external demand for its abundant coal resources and to finance its industrial modernization through "open door" policy, exporting coal to Japan has been a long-term strategic trade policy of China. China targets Japan as a major potential market for its coal industry in the future.

Due to geographic vicinity, coal trading between China and Japan is mutually beneficial and economic. Over the last two decades, China has invested substantial amount of money in the infra-structural projects aimed at facilitating Sino-Japanese coal trade. One famous project is Datong-Qinhuangdao railroad that links major coal production site to a port closed to Japan. As a result, the volumes of Chinese coal exported to Japan increase steadily over the last two decades.

However, Japan's commitment to the Kyoto protocol will definitely change the existing pattern and trend of Sino-Japanese coal trading. In complying with the Kyoto protocol, Japan needs to cap its GHG emission at 94% 1990 level by the year 2012. Given coal is one of the "dirtiest" GHG sources, the commitment will reduce Japan's demand for coal significantly.

In this paper, I examine the effects of the Kyoto protocol on Sino-Japanese coal trading and consequently its impact on both economies. First, I describe the status quo of Japanese energy demand structure, trends and prospective of Sino-Japanese coal trading. Then, using a general equilibrium modeling framework, I investigate the changes in energy demand structure in Japan due to the implementation of the Kyoto protocol. Particularly, the structural changes in Japanese import demand on coal. In addition, the negative shocks on Chinese economy through Sino-Japanese trade pattern changes are quantified.

In summary, this paper is an important case study of the impact of international environmental agreements on international trade. Specifically, this study reveals how a passive on-looker (the likely position of China toward global climate change) will be affected by others' unilateral actions through trade.

## **Institutional Dimension of Sink Issue for Cooperation under the Kyoto Protocol**

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### **Keywords**

*Sink, Kyoto Protocol, Institutional Dimension, Cooperation, Regime*

There have been many debates about how the sinks of GHG should be accounted under the Kyoto Protocol. Article 3.3 of the Kyoto Protocol is about the so-called "Kyoto Forest", which includes "Aforestation, Reforestation and Deforestation". However, the definition of these terms has not been described explicitly in the Kyoto Protocol. Especially, depending on the several options of the definition of "Reforestation", the carbon sequestration accounting of forest management activities will be greatly changed. This difference in the institutional arrangement of sinks has large implications for both economical and environmental condition of the countries under the Kyoto Protocol. In this paper, we analyze these implications of the different definition of sinks from the institutional dimension point of view. This analysis of implication is conducted in a quantitatively manner with 3 steps. Firstly, the basic difference of sinks among the countries is analyzed based on the current GHG inventory data. Secondly, the carbon sequestration during first commitment period of the Kyoto Protocol is predicted based on a forest ecosystem model. And thirdly, several implications to the countries under the Kyoto Protocol will be analyzed based on these data. Finally, in addition to the implication of different definitions of the sink activities, several issues concerning the cooperation between countries under the Kyoto Protocol is discussed from the regime formation theoretic perspective.

## Tightening the System: Central Allocation of Emission Rights

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### Keywords

climate policy, emissions trading, initial allocation, deposit-refund system

A whole bundle of so-called "flexible mechanisms" has been foreseen by the Kyoto Protocol in order to help industrial countries to fulfil their agreed reduction targets in the most cost-effective way. Emission permits will act as the backbone of all market-orientated mechanisms. Therefore, their initial allocation to the market participants is crucial. Grandfathering to current emitters is rejected by the developing countries on equity grounds. The deposit-refund model of Central Allocation is an alternative to the distribution of emission permits actually discussed in the context of flexible mechanisms. A Climate Bank (CB) is proposed that issues permits equal to the aggregate budget of all Annex-B countries. The CB issues permits at the end of every budget year to the national banks of Annex-B countries. The central banks pay a fixed deposit per ton of CO<sub>2</sub> - equivalent. One could accommodate for basic needs by introducing a threshold from which the deposit operates. The quantity given to every central bank is determined by the share of the overall emissions budget the country has been agreed to at Kyoto. Central banks sell or auction permits to private entities and can return unsold permits to the CB with full refund of the deposit. If private entities have to hold permits for their domestic GHG emissions they will buy the corresponding amount at their national central bank or on the international market. At the end of the budget period, each government has to possess enough permits to cover the country's emission inventory. If it does, the CB returns the deposit to the government. The upper limit of the refund is the country's initial Kyoto budget. This is thought to make domestic action attractive. If the government fails to hold the quantity of permits needed, the entire deposit will be lost. The dramatic opportunity costs in the case of non-compliance can be avoided by buying up the surplus of other market participants. This all-or-nothing solution makes negative sanctions obsolete. The project-based mechanisms CDM and JI create permits that are exempt from the deposit to be paid by the investor. Permits from CDM projects are subtracted from the overall Annex B budget.

The system of Central Allocation is aimed to achieve an equitable distribution according to real emission needs, a positive sanction for compliance and overall system integrity.



## SUSTAINABLE LIFESTYLES AND BEHAVIOUR CHANGE

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### Keywords

sustainable lifestyles, behaviour change

Domestic resource consumption and waste production are increasingly being acknowledged as a significant contributor to detrimental global environmental change, and a key component in the progress towards sustainable development. It is becoming an ever more significant issue as household numbers in Western nations continue to increase amidst zero population growth. Also, the prevailing political ethos in some of these nations stress the role of individual responsibility in the changing of lifestyle consumption practices, thereby making a contribution to the slowing of negative environmental changes. Therefore social science research into the domestic site of sustainable lifestyles has a vital contribution to make to a global environmental change research agenda.

This paper presents key findings from on-going graduate research investigating Global Action Plan UK's *Action at Home* programme. *Action at Home* is a structured pro-environmental programme, which aims to encourage the self-selected participating households to live in a more sustainable manner through the use of their domestic resources. This is achieved by following and making small behaviour changes detailed in action/information packs over a six month period. To assess the effectiveness of this programme, participating households were enrolled to take part in qualitative research, which entails in-depth individual and group interviews before, during and after taking part in the programme. The research findings to date show that *Action at Home* **does** make a contribution to participating household members making no cost or low cost behaviour changes, as well as becoming more aware of local and global environmental issues. It also raises questions about the assumptions behind such behaviour change programmes. For example, it suggests that the 'information deficit' model commonly used in socially marketed behaviour change programmes does not engage fully with, or allow researchers access to, the complexity of participating households responses and contestations with the *Action at Home* material. That is, household members were found to interpret, situate and debate the material, and its economic and social implications, in light of factors such as current lifestyles, life history, sense of place and participation in environmental discourses. This paper highlights these findings and the implications that these findings have for behaviour change models.

## **SOCIETAL CHALLENGES OF ENVIRONMENTAL SUSTAINABLE DEVELOPMENT IN THE COUNTRIES IN TRANSITION: A CROSS- CULTURAL ANALYSIS OF BULGARIA, POLAND AND RUSSIA**

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### **Keywords**

environmental risks, pro-environmentalist attitudes and behaviour, public support for  
environmental protection

On the basis of survey research data, obtained within the International Social Survey Program (ISSP) module on environment, this paper presents a cross-cultural analysis of public attitudes towards the key issue of the eco-price for economic development in three post-socialist countries: Bulgaria, Poland and Russia. In the scenario of transition from central planned to a free market economy these societies face lots of serious problems, but the research results reveal that the crisis has not blunted people's senses to the quality of their living and working environment. More over, the cross-national representative data give convincing evidences that the anxiety about environmental issues and protection is not a luxury accessible only for people enjoying high living standards. However, environmental values, attitudes and behaviour, as well as public support to the philosophy of environmental sustainable development, are under the strong impact of the general changes and the main characteristics of the transforming situation. This report explores survey results related to the contradictory attitudes towards relationships "environment - human activity" and "environment - economic development". For example, almost two thirds of Bulgarians, Polish and Russians consider that "economic growth always harms the environment". At the same time over 80 per cent of them reach the general conclusion that "in order to protect the environment the country needs economic growth". The analyses focuses on: societal attitudes to and perception of environmental issues in the context of economic transformations and individual strategies for coping with the crisis; mass understanding about the major industrial hazards in front of the dilemma "jobs or environmental protection"; awareness, perception and acceptability of environmental risk factors; public expectation to environmental responsibilities of business and consumers; main motives for environmental protection in the situation of objective environmental, economic and social problems and subjective concern for avoiding the poverty trap; intra and inter-generation linkages between Materialist/Postmaterialist values and pro-environmentalist attitudes; directions of public support for environmental protection in the process of transforming economies along environmentally sustainable lines. Special attention is paid to the energy consumption patterns and individual willingness to contribute to global environmental protection activities and improvement the quality of the environment. Further, it is analysed cross-national similarities, differences and trends at cross-level linkages between environmental pollution and mass attitudes toward environmental protection.

## IN SEARCH OF INNOVATION CO-ORDINATED RESEARCH ON GLOBAL ENVIRONMENTAL CHANGE AS STARTING POINT FOR SUSTAINABLE BEHAVIOR

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### **Keywords**

behavioral change, innovation, research networks

Research on environmental change is even more than other topics in the need for an integrated inter- and transdisciplinary organization which facilitates the innovativeness of the projects and the researchers which are involved. A new way to produce and transfer results is called for by representatives from universities, funding organizations, and from possible 'users' of the results. The diffusion of innovative solutions for environmental problems is crucial for social science research on environmental change. The aim of this paper is to show, which factors are important for the innovative potential and power of research networks towards a sustainable behavioral change in peoples life.

This paper presents the results of a conceptual and empirical study with data from interviews (n=12) with leading representatives (members of the steering committees, research managers, co-ordinators, etc.) of the German priority-programme of the Deutsche Forschungsgemeinschaft: 'Global Environmental Change', the Swiss priority-programme: 'Environment' and the programme of the European Science Foundation (ESF): 'Tackling Environmental Resource Management'. The interviews focused on questions about the management of transdisciplinary research and on factors which might facilitate innovation or inhibit researchers to create innovative solutions for environmental problems. The results of two questionnaire samples (n=46; n=21) with the members of the DFG-Programme are also presented.

The results give strong evidence for the need to develop corporate communication tools and to create boundary roles in the communication process like gatekeepers etc. This is important to structure the information-flow within the programme and to facilitate the diffusion of results to the scientific community and to meet people in their daily life. Such tools should emphasize the communication between the programme and its environment which means that a sufficient exchange of information between the members of the programme and between the programme and other partners is necessary. Major tasks for a communication officer in this field are to plan the flow of information in general and to initiate new measures and to adapt instruments of communication. The role of programme managers in the future will be to provide the methodological know-how for supervising not only the research process but also the transdisciplinary process of the research network.

Other factors that facilitate mainly the diffusion of research results are a focus on oriented research with integration of 'users' from the beginning of the research project and a negotiated framework of research questions and topics.

Details of the corporate communication functions and a step by step analysis of the diffusion process will be outlined in the presentation.

## CONSUMERS' VALUES AND THE SUSTAINABLE USE OF ENVIRONMENT

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### Keywords

consumers values, behavior, mixture logit models, bayesian framework, environmental concern

Consumers' environmental concern has been considered by scientists, politicians, and the public to be necessary prerequisite for global sustainability. However, while the last decades have witnessed a dramatic increase in environmental consciousness worldwide, environmental degradation still advances at high rates. The same individuals who express concern seldom engage in environmentally responsible behaviors. Consumers' Values are thought to be relatively stable behavioral predisposition that strongly affect consumer attitudes and behavior (Rokeach, 1973; Schwartz and Bilsky, 1987)

The theory of the psychological content and structure of human values proposed by Schwartz and Bilsky (1987, 1990) provides a framework to analyze the homogeneity and stability of values. This theory views values as cognitive patterns by which individuals orient themselves in their surrounding world. Values are thus criteria used to select and justify actions and to evaluate people, including the self, and events. Values are both self-centered and social-centered. Five main features of values can be outlined (Schwartz and Bilsky, 1987): Values are (1) concepts or beliefs (2) about desirable end states or behaviors (3) that transcend specific situations, (4) guide the selection or evaluation of behavior and events, and (5) are ordered by relative importance.

This paper explores the role and importance of consumer's value systems in determining environmental behavior. Furthermore, the rate of change of consumer value systems is analyzed, since it may be the major determinant of behavioral changes regarding the environment.

The data used in the research have been collected by the Dutch market research agency NIPO, in the framework of the Netherlands Environmental Monitor (MilieuGedragMonitor), sponsored by the ministry of the Environment (VROM). The data have been collected from a representative panel of 1000 households. Three waves comprise 1993, 1994 and 1995. The data base contains Rokeach values-rankings by subjects (Rokeach, 1973) and psychological traits such as involvement with the environment as well as attitudes and behavior related to environmental issues.

Exploratory analyses of the Rokeach values-rankings over a two-year period revealed that values are much less stable than previously been thought. Even over a two-year period changes in value system occur that may affect behavior towards the environment. We further investigate the homogeneity and stability of values. We try to answer the question whether there are value-systems common to all subjects, or whether subsystems of values exist that are dependent on socio-demographic variables and their change. It will be assessed to what extent changes in these variables are associated by changes in value-systems. This enables us to draw conclusions on the stability of value systems, as well as their relation with consumer-welfare, a major determinant of environmental concern.

The approach used builds upon the model developed by Kamakura and Mazon (1992) and extended by Kamakura and Novak (1993). These authors developed a mixture logit model for value segmentation, where the rank orders of values by respondents are modeled using the rank-explosion rule. That model is extended along the lines of random coefficients models, to allow for the values structure to vary across successive waves, as well as by allowing the prior probabilities to depend on concomitant variables such as income and socio-economic class (Kamakura, Wedel and Agrawal 1994). It accommodates part of the value system being common to all subjects, and other parts of the value structure being segment specific. The first results show that segments exist that have a stable value structure over time, while other segment's value-system is much more volatile. The estimated parameters enable us to investigate the stability of value segments and to build causal model of consumer values, environmental attitudes and behavior.

## The Floating Population in Megacity, China - Facts and Problems

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### **Keywords**

female floating, female problem, China floating population

The definition of the floating population has been discussed. The categories and increase rate of the floating population in major cities of China in the 1990's have also been studied. According to their occupation and the time they left their hometown the floating population have been classified. The paper has also discussed the reason of the population's moving, and the difference in characteristics of the floating population in China and out side China.

Some sex-age structure, education level, occupation, marriage and fertility status, as well as the original area distribution in China of the floating population have been summarized and compared with the permanent residents in the paper by using the census data in 1990 as well as survey data in 1997. Some logic conclusions are drawn in the paper.

The paper put a special attention on the female floating in Magacity, China. The studies found some problems during female moving in urban as following. The background and source of the female floating is rather complicated. Their economic status was poor, educational level was low and fewer people would take care of them in the city. Their situation was discrimination and isolation in the city. They usually have a poor marriage quality (unstable marriage, unhappy family life and high divorce rate) and high fertility rate due to various socioeconomic reasons (not well understand before marriage).

There is still some illegal marriage (earlier marriage, their husband already have married before) between the females. The terrible sex abuse and the crime of prostitute also can be found of the female floating. In general, the floating, especially the female floating has made some contributions to the development of the urban areas in China. They have provided good service for families and served as the substitutes for the insufficient labor power in the urban areas. They have established stable families with men who feel difficult in finding their marriage partners in the city. The responsibility for the society is to provide them with timely education on law and professional training. And at the same time to punish those criminals who raped, killed, or violated the right of the floating.

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## Sustainable Urbanization and Religion in Southeast Asia

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### Keywords

sustainable urbanization, religion, the Philippines, Thailand

This study aimed to clarify the effects of religion, particularly the Islam, on sustainable urbanization through women's status and their demographic and environmental attitudes and behaviors based on field works (focus group discussions and interviews) conducted in the Philippines and Thailand in collaboration with demographers at the University of the Philippines and Chulalongkorn University. They were conducted in Islamic and non-Islamic communities in two cities with higher and lower concentration of Muslims (Manila and Davao in the Philippines and Bangkok and Hatyai in Thailand) in November and December 1998. It focused on the adaptation of migrant and non-migrant women to urban life and environment and the help and support for their adaptation extended by the neighbors and community organizations including administrative, religious and women's organizations.

Filipino researchers found interesting results regarding the effects of religion on environmental behaviors and attitudes. First, non-Islamic women tended to discuss gender role views relating to environmental conditions not only of subordinate but also of dominant roles for women while Islamic women tended to focus more on the former. Second, while non-Islamic religious teachings have indirect reference to the environment, Islamic teachings emphasize hygiene and sanitation. Third, while non-Islamic religions have no gender-specific roles pertaining to the environment, the Islam has women-specific roles pertaining to cleanliness. They also detected the effects of religion on migration. First, the accessibility to church/mosque is a factor deciding the place to live for migrants and non-migrants. Among Muslims, living close to other Muslims is an important reason for move. Second, Muslims sought support from Muslim leaders in adapting to urban life and environment. Muslims experience less adaptation problems since neighbors and community leaders extend them support.

Thai researchers found similar results. First, Muslim women seemed to be much closer between long-term residents and migrants than among Buddhist women, and in providing assistance to the newcomers. Second, while Muslim women accepted that religion does not confine their freedom to play roles either in their own family or the community as much as it had been perceived as others, they admitted that somehow they had a limit on certain aspects what they can or cannot do, and what they should or should not do according to religious teachings. Third, women tended to agree that Islamic religion had touched upon the issues of environment protection more explicitly than Buddhism. Actually, Islamic leaders in some communities taught people about environment (mostly on cleanliness) by adding into religious teachings, while no Buddhist leaders played role or taught people about environment protection. This study was supported by a research grant from the Environment Agency of Japan (FS-7, Global Environment Research Program for FY 1998) to the NIPSSR (PI: H. KOJIMA).

## **The Effect of Climate on Internal Migration in China and the United States**

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### **Keywords**

climate, migration, China, the U.S.

This paper examines the role and effect of climate on internal migration. Karp and Kelly (1971) and many others have argued in favor of the importance of climate as a determining factor of the destination location in internal migration. Put simply, it is assumed that most persons prefer to avoid exposure to bitter and cold winters, and excessively hot and humid summers, preferring temperatures that are between these extremes. When engaging in migration decision-making, therefore, to the extent possible considerations involving climate are brought into the calculus.

In this paper we undertake aggregate-based analyses of the effect of climate on migration in the United States and in China. The effect of climate will be evaluated in the context of a broader application of sociological human ecology. Attention will be first directed to the varying effects of a series of climate variables on various kinds of migration, including gross, in, out, and net; these empirical tests will be conducted with U.S. data. We will then turn to considering climate per se as a major independent variable along with other predictors pertaining to organization, population and technology. The effects of climate on migration thus will be examined in the context of competing ecological hypotheses. These broader tests will be conducted for both the U.S. and for China.

This comprehensive investigation of migration will allow us to evaluate the specific role of climate on migration. Its effect will be considered in light of the effects of other ecological hypotheses. The results of this paper will contribute to the general literature on the determinants of migration, as well as to current thinking about the specific contribution of climate to migration.

## CITIES AND INDUSTRIAL TRANSFORMATION

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### Keywords

industrial transformation, urban environment, sustainable cities, environmental indicators, urban infrastructures

As *The European* editorialized in 1996, "The city of the future is the future of our world." The next millennium will be the first in which the majority of humans live in urban areas, and the proportion of urban dwellers is projected to continue to increase for some time. Human effects upon the global environment will largely be urban effects. Cities' environmental effects will span the globe, for their demands for food, water, and energy link them to the periphery at both near and remote locations.

Human interactions with the environment are at their most intense in cities or in the far-flung activities such as agriculture and mining that support cities. Because of the dense concentration and large scale of human activities in cities, the effects of even a small per capita reduction in negative environmental impacts may have large cumulative effects globally, particularly if transformations can be achieved in citizens' consumption patterns, and in the infrastructural areas of transportation, water and energy supply and solid waste management. Moreover, the opportunity for radical industrial transformation is great today, for many of the large cities of the next millennium are being built or expanded now. They could be built using the technologies that presently sustain most cities in the developed world, most of which date from the late 19th century, or they could be built with more environmentally benign technologies. Such improvements would substantially assist efforts to avert or mitigate global-scale environmental changes.

The purpose of this research project is to discover whether and how there could be a de-coupling of the improvement of human well-being from the negative environmental effects of the production and consumption systems that sustain life in cities. Relying upon systematic quantitative and qualitative measurements, simulation modeling, and comparative data analysis, the project will develop new information about the ways in which humans interact with the global systems that sustain all life on earth, and new knowledge about the macro systems and incentives that structure those interactions. The involvement of stakeholders beyond the research community -- urban planners, citizen interest groups, business and industry, and government officials -- is intended from the start of the project. The project will produce practical scenarios for the future of human cities, offering alternatives that will fit economically, culturally, socially, and technologically into the myriad kinds of urban conditions.

The Institute for Global Environmental Strategies (IGES) has initiated a research project of cities in Asia, focusing on urbanization and industrialization processes and mechanisms, on successful innovations in urban environmental management, on ways to achieve sustainable cities, and on systems of environmental indicators abroad. The project wishes to collaborate with other on-going projects for data collection and exchange of research ideas in order to create an international network of comparative case studies in the research framework of "Cities and Industrial Transformation."



## Food and the Global Environment: Mapping, Modelling and Making Scenarios

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### Keywords

food consumption, food production, sustainability, scenarios

The general objective of the IHDP-IT Food Core theme is to promote research to increase the understanding of the social mechanisms and human driving forces that can lead to the transformation of Food Consumption and Production Systems (FCPSs) towards sustainability

A large part of all human activities is directly or indirectly related to food. The ways in which systems of the consumption and production of food are organised is thus of great importance for sustainability in all regions of the world. In addition, global and regional environmental changes connected with climate, land-use and biodiversity are of critical importance to the production of food.

FCPSs include the whole 'chain' of human-organised activities from agriculture (and its inputs), through food processing, food distribution (including retailing and transportation), food 'service' (in restaurants/canteens/take-aways) and the time-consuming, usually unwaged, household activities of shopping, cooking, eating and clearing-up. Industrial Transformation in pursuit of sustainability needs to take account of the *system as a whole*, with all its industrial and household-based 'sectors' and their interrelationships, with their strongly connecting regional, national and international dimensions.

Over the next 50 years, FCPSs will inevitably go through major transformations, due to changes in macro-systems and economic structures, changes in social values and food tastes (with a greater emphasis on food safety, 'healthy foods' and convenience) and due to applications of biotechnology and IT.

There has been much research devoted to exploring the problems of sustainability in the agricultural sector. However, changes in consumption habits and their dependency on economic and demographic changes are less understood. Links between different parts of the chain are also under-studied, especially with regard to regional and international connections and the changing power relations between food producers, food retailers and final consumers.

Research is needed to:

- \* provide the necessary data and frameworks to assess the impact of FCPSs on Global Environmental Change
- \* explore alternative incentive structures at the local, regional and global levels that may induce FCPSs' transformation leading to sustainable production and consumption patterns.
- \* generate knowledge to support the design of local, regional and global policies with a view to meeting development needs that are sustainable with respect to Global Environmental Change.
- \* to develop measurement tools for progress in the sustainability of FCPSs

We can do this by *mapping* the structure of FCPS, *modelling* global and regional FCPS with respect to the environmental impacts of changing technologies, industrial structures and final consumer demand and *making Industrial Transformation Scenarios* to explore policy options and institutional transformations for achieving sustainability under different conditions.

## INFORMATION AND COMMUNICATION

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### Keywords

electronics industry, media, producer, consumers, governments, EPR, sustainability, production and consumption patterns

Information and communication (I&C) systems are playing a key role in the process of industrial and social transformation toward a more environmentally responsible and sustainable world. Industrial production and consumption around these systems is an important part of the modernization of society and a keystone of the move from an industrial to an information age. We can expect I&C systems to undergo significant development and to contribute to the transformation of socio-technical systems over the next 100 years. It is expected that the I&C systems will continue to undergo significant transformation at a number of levels. Each of these levels will influence our success in bringing about more sustainable development.

In IHDP Industrial Transformation, this particular core research theme aims to investigate and understand better the nature of the transformation occurring in production and consumption patterns around I&C systems. It involves research that engages industry, public policy-makers, consumers and society. It covers both the developed and the developing worlds. The core research theme will also address the increasingly important transformative concept of extended producer responsibility (EPR), which has the capacity to close the material loop in industrial and consumption systems. This theme will also consider the implications of I&C systems as the means to distribute ideas and images about consumption patterns or life-style in a globally interconnected world, and the extent to which this supports or undermines progress toward sustainability. This core theme, based on the assumption that I&C will create change and they will affect the sustainability of consumption and production patterns, is to address the overall research question: What is the contribution of the transformation in I&C in supporting more sustainable patterns of production and consumption?

Three international, multi-disciplinary research directions are proposed within the I&C Core Research Theme. They provide a first round of priorities that connect to the descriptions of levels of transformation mentioned above.

The first research direction is guided by the following three questions:

- \* In their role as I&C system organizers, how are leading companies bringing about industrial transformation?
- \* To what extent and in what ways are sustainable development issues incorporated in the strategic processes of these companies?
- \* How might processes be improved to bring about more sustainable forms of change?

The second research direction is guided by the following question:

- \* What are the driving forces and constraints that impact the adaptation of production and consumption as a consequence of product take-back and recycling programs related to EPR?

The third research direction is guided by the following question:

- \* What impacts do the images carried by I&C systems have on expectation and consumption patterns of those living in OECD and non-OECD countries, and how can I&C provide and support images of sufficiency with respect to OECD consumers, and what influence do I&C have on consumption potentials?

## TRANSFORMATION PROCESSES

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### Keywords

industry, environment, Asia

Rapid urban-industrial growth is one of the key drivers of human-induced change in the global environment. As evidence mounts that such human-induced change threatens the very functioning of the biosphere, researchers and policy makers have expressed growing interest in promoting a transformative dynamic that would dramatically reduce the environmental impact of industrial activity, as exemplified by the possible 'de-coupling' of industrial development from increased pollution and other environmental pressures. While the scope and scale of such decoupling are left undefined, presumably this implies reductions in energy, materials and waste intensity of economic activity that go well beyond those achieved in the OECD economies over the past thirty years. The paper examines the need for, and possible drivers of such reductions, focusing upon patterns of development in the rapidly industrializing economies of Asia.

As it happens, the rise in policy interest in the environmental performance of industry is occurring at a time of profound change in the dynamics of industrialization worldwide. Among the more evident aspects of industrial transformation are the increasing integration of economies on a global scale, the rise of newly industrializing economies, the development of information technologies, the ever greater marketization of economic processes, the changing role of the nation state in regulating economic activity, the rise of civil society, and the increasing availability of information on the environmental performance of industry. At the same time, rapid industrial development in many countries is occurring within a context of profound social and political transformation. These changes suggest that the need to understand the ways in which ongoing transformative dynamics within the global economy can be harnessed to the goal of improved environmental performance.

The paper begins by considering the scale of improvement in energy and materials efficiency of industrial activity that would likely be achieved in Asia through a continuation of existing efforts at environmental regulatory reform, incremental increases in regulatory pressure, and widespread adoption of cleaner technologies. The dynamic of concentrated urban-economic development and population growth in industrializing Asia carries with it a huge environmental burden of increasing energy and materials use, greenhouse gas emissions, pollution, waste and resource degradation. Under conditions of rapid growth, projected incremental improvements in energy and materials efficiency are overwhelmed by the scale of new industrial investment. We conclude that traditional regulatory drivers are neither fully suitable nor sufficient to meet the challenge of industrial transformation in rapidly industrializing Asia. The paper then examines a variety of possible new drivers of environmental performance within a global economy, namely, standardized performance reporting, market pressure, supply chain management, and various private law models of industrial regulation. One of the key challenges is shaping the technology choices associated with new industrial investment.

## Environmental change and social conflicts in the Brazilian Amazon

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### Keywords

Environmental change, environmental side-effects, latent and manifest conflicts.

I argue that the two most important factors of contemporary Amazonas are *environmental change* and *social conflicts*. Although the Brazilian Amazon as study object has got enormous attention, most of the literature dealing with it has been preoccupied with the phenomenon of deforestation. As a result the other side of the coin (social conflicts) has been underestimated, and what is more important no analyses has been done relating both variables. Due to the above circumstance, it is essential to analyse these two phenomena in a holistic and integrative way, this is as a whole. Therefore, the following paragraphs attempt to answer synoptically the following question:

*To what extent does environmental change as a source contributes to social conflicts in the Brazilian Amazon?*

I argue that environmental change normally does not lead directly to conflict in the Brazilian Amazon. Instead, environmental change generates several interrelated social effects (externalities), than in not few cases end up in social conflicts. Thus, it acts more as an *accelerator* factor than as a direct source. The web linking these two variables in the Brazilian Amazon can be understood as follow:

#### Phase I: *Environmental change*

Deforestation

Pollution form mining

Floods caused by hydroelectric projects

#### Phase II: *Side-effects*

Population displacement

Economic disruption

#### Phase III: *Conflict-issues*

Land conflicts

Mineral conflicts

Bifurcation on Indian lands

#### Phase IV: *Conflict-types*

Consensual conflicts

Dissensual conflicts

Considering that environmental change works basically through its side-effect I will illustrate such contribution. The most important side effect of environmental change has been population displacement. In the Amazon the process of environmental change has increased pressure on people, particularly on native population. The relocation of people because of the spatial impacts of environmental change has produced that these people themselves become agents of further project-triggered effects, by displacing one another.

A second important side-effects has been disruption of economic activities which are base on the utilisation of natural resources. In fact, this side-effect could be linked to potential manifest conflicts as can be observed in the negative effects on the traditional shifting agriculture. This kind of agriculture which is fundamental in the living of native population in the Brazilian Amazon requires regeneration of second growth which is modified when large tracts of forest are cleared and converted to pasture. Thus, once the base for practising shifting agriculture has been disrupted, the population making a living from this system get constrains their opportunities, and social stress becomes notorious.

This type of side-effects have provoked an important number of latent and manifest conflict associated to the issues of land, mineral exploitation, and bifurcation of Indian lands. In addition, most of the conflicts resulting from the above web can be classified as consensual conflicts which are the ones related to the dispute on a concrete object (land), and dissensual conflicts which are conflicts of values, norms and beliefs.

In short, the process of environmental change in the Amazon has provoked as side-effects a strong process of population movement and economic decline, with clear influence in the dynamic of latent and manifest conflicts as well. Thus, not surprisingly the areas most affected by environmental change in the Brazilian Amazon such as southern Pará are the most violent areas. On the contrary some of the areas with the lowest level of environmental change such as Amapá score very low when it comes to the level of violence.

## THE NIMBY AND NIABY SYNDROME IN FACILITY SITING

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### **Keywords**

facility siting, NIMBY, conflict-resolution instruments, sealed bids.

The siting of hazardous and non-hazardous facilities has only recently become an important public concern in Asia. Not too many years ago, the siting of a landfill, a pulp mill, a sewage treatment plant, a hospice or a chemical plant within a community generated very little controversy. Factories and jobs were seen as progress, managing accidents and risks was something that business and governments knew how to deal with, and pollution emissions were considered to be inevitable by-product of growing economies.

Today, facilities that produce, use, store and/or emit hazardous substances and generate external effects are the subject of intensive public scrutiny. Thus while these facilities offer useful services to the general public, and are often considered 'necessary' by society, almost everyone agrees however that they should be located at places outside their neighbourhood - the aptly called NIMBY (not-in-my-backyard) syndrome (Popper, 1983; O'Hare et al, 1983; Quah and Tan, 1998). This is because these facilities which serve more than just a local area are perceived to create net local welfare losses.

A cost-benefit analysis study of an environmentally obnoxious facility based on a national accounting stance rather than a local or regional one, would in most cases, lead to acceptance of the facility, bowing to the demands of a greater general public. People who live in these neighbourhoods where such facilities are sited, and who are the direct recipients of the negative externality often go uncompensated under a Kaldor-Hicks efficiency criterion.

Attempts to impose these NIMBY facilities on unwilling recipients are one of the most difficult challenges faced by governments today. The literature seems to suggest that active public involvement together with mitigation and compensation auctions during a siting decision process is a potentially useful and successful strategy (Wiltshire, 1987; Kunreuther et al, 1988; Kleindorfer, 1996). However, it is without doubt that the decision process can be time-consuming and in most cases, a costly exercise. Where local residents are opposed to the siting of the facility, the larger public, on the other hand demands a faster response in meeting their needs.

The purpose of the paper is to provide a review of existing methodologies used by economists and public planners to address this siting problem of NIMBY facilities. The paper evaluates the available conflict-resolution instruments used for the siting of these facilities such as zoning alternatives, environment impact assessments, licenses and permits, compulsory acquisition of land, incentive mechanisms, compensation and mitigation policies, and auction mechanisms. Usage of these instruments in Asian countries is also highlighted. In an effort to examine some solutions to the NIMBY situation, the paper presents a systematic alternative to conceptualising the siting problem. The paper also proposes two alternative auction mechanisms which might be useful for such facility siting purposes.

## **BRINGING THE LOCAL PEOPLE BACK IN: COMMUNITY-BASED STRATEGY OF ENVIRONMENTAL CONFLICT-MANAGEMENT IN THE NIGER DELTA, NIGERIA**

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### **Keywords**

environmental conflict, Bonny, Niger Delta, local people, state violence, community-based conflict management

The high incidence of conflict surrounding petroleum exploration in the Niger Delta, Nigeria is well known. The widely publicised case of the Ogoni, an ethnic minority in the area is only symptomatic of an ever-expanding spiral of violence involving local oil-bearing communities, petroleum exploration companies and the Nigerian state. Most oil companies in the area have recently been claiming a new people orientation for their projects, ostensibly having learnt from the violent eruption of local anger since the mid-1980s. This paper seeks to interrogate the new approach, if it exists, and to evaluate the prospects of developing an effective system of managing environmental conflicts in the Niger delta.

The paper is based on an ongoing research on a massive natural gas project in the town of Bony called Nigeria Liquefied Natural Gas Company. The project is said to be the largest of its kind in the Third World. Estimated to cost some \$11 billion, it is a joint project of a number of major international oil companies and the Nigerian government. Fears about the existence of a peaceful environment for a fruitful operation of the project still loom large, especially in the light of the continuation of military rule in Nigeria. In fact, many Nigerians criticise the multinational oil companies, particularly Shell for their insensitivity by co-operating with a discredited military regime. The recent opening up of the democratic political space, following the death of Nigeria's military dictator, General Abacha, has raised hopes of developing a more stable and productive conflict management regime in the Niger delta.

The paper argues that the prevalent conflict management regime in the oil belt of Nigeria remains state-centric. As such, it is hierarchical, bureaucratic and criminalises dissent. This has deepened with the long period of military rule. In the circumstance, state violence, which manifests both structurally and directly, is distinguishing feature of conflict management.

In evaluating the prospects for an effective system of environmental conflict management in the gas project, the paper argues for bringing the local people back in by developing a community-based strategy of conflict management. Such a strategy must be one which eliminates state violence, de-emphasises monetary compensation, marginalises state bureaucracy, employs local/comunal/traditional conflict management structures and processes, re-orientates oil companies to see themselves as local corporate citizens, emphasises investments that build local capacity and social capital, and ensures sustainable environmental practices. The value orientation of such a strategy should privilege the community over individuals, consultation over imposition, negotiation and bargaining over force, right of dissent over criminalisation of dissent, local culture over foreign culture, and public accountability of oil companies over public relations.

The paper concludes that the attainment of this new orientation to environmental conflict management in the Niger Delta is organically linked to the wider project of democratisation in Nigeria.

## Developing an Index of Human Insecurity

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### Keywords

environmental security, early warning, indicators, human security, data

There have been numerous discussions over the past decade about the need for early warning systems to allow for better planning in cases of environmental catastrophes, political instabilities and social unrest. As part of the overall GECHS project of the IHDP, we have been trying to address this need through the development of an Index of Human Insecurity (IHI). The IHI involves combining indicators in four categories - environmental, social, economic, and institutional - into a single index for each country in the world. The index is calculated and mapped annually from 1975 - 1995, and then projected to the year 2025.

The development of an IHI provides for more than a simple indicator of insecurity. It allows for a rigorous analysis of data quality and reliability throughout the range of human dimension indicators; it assists in better defining terms such as environmental security and human security; it links to the ongoing work on indicators of sustainable development; and it serves as the focus for discussions among academics, policy makers and NGOs on environment and security issues. The paper will outline the development of the IHI, present a comparison to other indices (such as the Human Development Index) and then discuss issues of data quality and reliability.

## **Policy implementation, indicators of global climate change and policy design**

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policy design, process of implementation

While greenhouse gas emissions can lead to climate change, the formulation of climate policy in terms of emissions monitoring and control is far removed from the issue of concern which is minimization of the adverse impacts of climate change. Focus on emissions targets may be incompatible with a realistic evaluation of human detection of changes in the environment and its control through policy actions.

Environmental decision-making will be more successful with better policy design. Good policy should consider: (i) the ability to monitor the target of control and meet the targets with some accuracy; (ii) send consistent signals for efficient long-term planning to consider the need for controls; and, (iii) allow smooth mid-course corrections (in case realized impacts are higher or lower than expected). I use an integrated assessment model, with simulated human detection and response behavior to show the relative merits of different climate policy designs. The study shows significant differences between indicators of global change as targets of policy design.



## **The Indian Science-Policy interface: Insights from the process of Indian climate policy formulation**

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### **Keywords**

science-policy interface

The process by which climate policy is formulated and executed offers useful insights into the interface between science and policy, particularly since the climate change issue is often strongly science-driven. Limitations and weaknesses in the science-policy interface could strongly affect the abilities of countries to respond to the climate change problem, and also to participate effectively in the international negotiation process.

This paper traces the history of Indian climate policy, starting from the 1992 Earth Summit and earlier, to the Fourth Conference of Parties at Buenos Aires in 1998. This history is placed in the context of the different actors that try to influence the process of policy formulation, including Government ministries, scientists and non-governmental organisations. We find that the traditional positions and roles of these actors determine to a large extent both the degree of influence that they exert on the policy process, as well as the final outcome. Thus, some of the actors approach the climate change issue in a manner similar to other environmental problems, while others use traditional geopolitical framings to deal with the climate negotiations. We conclude with some observations regarding the importance of creating an explicit science-policy interface, and the need to broaden and deepen the supporting policy-analytic infrastructure; both of which appear to be critical activities in the climate change context, and review some current efforts in this regard.

## **Managing complexity across scales from common resources to common policy/security**

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Common resources across scales for those resources that are today characterised as classical local CPRs or as global commons, managing institutions and actors can seldom be confined to one specific level, be it local, national, regional or global. Many resources stretch out across all levels in a variety of ways (space, time, ownership, interest, sense of responsibility, driving force, effects, responding institutions etc). The resulting situation is one of a high degree of complexity. As pressure on resources increases, the composite qualities become more obvious. How does this "activated" complexity influence the ability to manage the resource? The elements of a theory for successful management of local CPRs developed by e.g. Ostrom are used to widen the scope by including the above more complex stretch of resources. If policies are needed at several levels, what challenges does that raise for the switch from disconnected to co-ordinated action?

Common understanding across scales In the outlined situation of complexity and change, we still assume a logical link between goals and means. An assumption about leadership is that a decision regarding the management of common resources is reflected in an outcome; what actually happens. Contrary to such an assumption, a spectrum of factors influence and filter the decision on CPR management; goals, plans, situations, traditional culture, decisions about change, information, instructions, individuals psychological needs, interests, values. In short, governance and implementation are not value free but greatly dependent on the context of a decision-maker, prior to that for an objective resource use. How much more so in situations where links and interdependencies exist between institutions across levels.

The diversity and heterogeneity in the reality that individuals and institutions at various levels face, and the resulting complexity in interpretations of what constitutes the problem, raise challenges of how to converge varieties in problem structuring into a more complete, and yet not over-simplified, consensual understanding of the issue at hand. A vital factor in this process is the question of whose knowledge and what knowledge reaches institutions and how they value it.

Common policy? The complexity in structural levels' demands on CPRs under constrained circumstances requires changes in the structure and quality of leadership. For CPRs it is easy to see the starting point (collective utilisation of fairly unlimited resources, typically based on detailed leadership management based on social position) as well as the end point (an active, flexible and problem solving leadership with development oriented supportive attitudes to the proper management of scarce resources). The key problem, and that is what makes the picture look so complex, is how to get there. A strategic policy must draw on principles for knowledge formation in situations hampered by now constraints to common resources.

What elements of policy approaches should be common if at all across scales? This paper propagates a combined resource and knowledge perspective. The suitability in a measure is given not by a specific logical goal but by the decision-maker's role.

## **Integrating Policies for Combating with Climate Change: A Case Study of the Japanese Inter-ministerial Coordination for the Kyoto Protocol**

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### **Keywords**

inter-ministerial coordination, joint conference

Japan hosted the third session of the Conference of the Parties (COP3) to the United Nations Framework Convention on Climate Change (UNFCCC) at Kyoto in December 1997. The process of producing the Kyoto Protocol for Japan was a challenge to deal with the international treaty-making by getting rid of domestic constraints at the same time. During the Japanese government's decision-making process to deal with the multi-faceted inter-sectional issue of its policy creations for combating climate change, it overcame the inter-ministerial conflicts by setting up a joint conference of relevant advisory councils from ministries and agencies concerned.

The Joint Conference on Relevant Advisory Councils on Domestic Measures Addressing the Global Warming Issue (hereafter, the Joint Conference) was established in August, 1997. Following the Prime Minister's decision, eighteen members from nine advisory councils were appointed to integrate this inter-ministerial issue at a single forum. The Joint Conference met five times and adopted the report on the basic direction of policies and measures to be taken by the Japanese government, in November, 1997, before the COP3.

Preparing for the Joint Conference, the ministries and agencies were forced to bring separated measures set by each agency into one integrated policy of the Japanese government. The inter-ministerial coordination, in accordance with the open process set by the Joint Conference, worked to create the momentum for integrating policies. The Joint Conference took a significant role as an institution that arranged ministries and agencies to shift their positions into dealing with the requested concerns.

In my paper, I will first provide some background information on establishment of the Joint Conference. Only a short period of time left before the COP3, the Prime Minister instructed the Cabinet Secretariat to organize the Joint Conference to get things done. The role of the Cabinet Secretariat in the formation of the Joint Conference will be examined.

Next, I will examine the functions of the Joint Conference in the domestic policy-making process. The ministries and agencies presented their policies and measures at the Joint Conference; the members of the Joint Conference gave comments, exchanged views among members, and requested further development. The paper will provide the analysis of how the members gave influences on integrating policies and measures.

Furthermore, I will show the influence of the progress of the international negotiation to the Joint Conference. Japanese government, as the host of the COP3, provided various inputs to the international negotiations of the Ad Hoc Group on the Berlin Mandate (AGBM). Especially, Japan presented its proposal at the AGBM8, which was consistent with the report by the Joint Conference.

From the approach taken by the Japanese government, we may draw some lessons not only for this particular matter but for universal issues regarding multiple parties. By examining the decision-making process for arranging the Joint Conference, I will explore how effectively inter-ministerial issues can be integrated.

## URBAN WATER CONTAMINATION IN RAPIDLY GROWING MEGACITIES OF ASIA: A SERIOUS THREAT TO HUMAN SECURITY

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### Keywords

urban environment, urban water supply, water contamination, Asian megacities, groundwater

There has been a frenzy for economic and industrial growth in economically and industrially developing countries. This has resulted in the urban population of these countries to increase at twice the rate of national average. Thus, most of the megacities are in Asia and the number is rapidly increasing. Essential services like water and sanitation in these cities can not keep pace with this increasing urban population and the resulting industrial and economic development. This results in the residents of these cities to seek alternative sources of water. Groundwater provides a viable alternate source. In arid areas where groundwater may not be present in adequate amounts, untreated sewage becomes a source of recharge for groundwater. In humid areas not only the sewage becomes a source of groundwater recharge, poor sanitation also adds contaminants to all urban groundwater aquifers. Even the deep aquifers become contaminated due to poor well development or cross contamination. Due also to very poor state of water and sewage lines, the city water supply also gets contaminated. Lack of sanitation facilities also cause degradation of other aspects and parts of urban environment besides the contamination of water supply.

This paper provides a status of water supply contamination in the urban areas of these megacities in the developing countries in Asia. Case studies of two megacities, Karachi, under arid climate, and Jakarta, under humid climate, are cited. The problem is seriously acute in Karachi. The water supply from all sources and in all areas is badly contaminated. While the bacteriological contaminants are ubiquitous, heavy metals like lead and arsenic are most widespread. Other heavy metals like chromium, nickel, cadmium, etc. and organic substances, such as petroleum hydrocarbons and phenolic compounds occur scattered in many areas. Conventional models studying groundwater contamination in industrially developed countries can not be applied in these cities due to unique nature of groundwater contamination in Asian megacities of developing countries. While groundwater contamination in the urban areas of developed countries originates predominantly from point sources, a complex mixture of both point and non-point sources introduce contaminants to groundwater in the urban communities of developing countries.

The effects of this water contamination on human health are obvious and significant as indicated by various social and health indicators. The long term effects of the problem on human welfare, e.g. lowering of children's I.Q., are especially alarming and threatening. Lack of financial resources are often cited as a stumbling block in providing city-wide solutions. Staggering economic losses due to health hazards far exceed the financial resources needed for effective solutions. In the absence of any long term city-wide solutions, sporadic solutions are evolving at various scales. Unfortunately these solutions only transmute the contamination problems to other spaces and time.

## URBANIZATION PROCESS AND SOCIO-ENVIRONMENTAL VULNERABILITY: THE CASE OF CAMPINAS, BRAZIL

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### Keywords

urbanization, vulnerability, environmental change

Large cities and their metropolitan areas are responsible for some of the principle global environmental problems faced by humanity at century's end. Life styles in the world's large cities present heavy **energy** demands, generating both atmospheric pollution and greenhouse and ozone-depleting gasses. These urban agglomerations also concentrate industrial activity, increasing their contribution to global problems as well as accentuating local environmental impacts.

The industrialism/consumerism logic produces both greenhouse gasses and socio-spatial patterns which locate vulnerability in specific social groups. Examining the intersection of spatial, infra-structural and socio-economic-demographic processes, we see that unequal distribution of urban services is an important component of socio-environmental vulnerability. In this paper, we focus on aspects of socio-environmental vulnerability directly related to the distribution of urban services within the metropolitan area. Geographic information systems brings a new level of refinement to this analysis, allowing more precise evaluation of the environmental factor.

Within any specific city there are distinct situations as to the population's living conditions. The lack of access to **market** goods is accompanied by the lack of **public** goods,

aggravating living conditions of these vulnerable populations. Understanding vulnerability as a process which involves both social dynamics and environmental conditions, this paper proposes a discussion of a specific region of Brazil, representative of the urban situation prevailing in the country as a whole.

The process of urbanization observed in Brazil since 1970 has redefined spatial distribution of population, with concentrations in well-defined metropolitan areas in all regions of the country. Campinas, 100 km from the mega-city of São Paulo, had 380,000 inhabitants in 1970 and 910,000 in 1996. Campinas' intense communication with the cities of its immediate hinterland has constituted a new metropolitan region, increasing population from approximately 700,000 in 1970 to nearly two million in 1996. This paper restricts its focus to the city and its sub-regions, permitting a more detailed characterization of socio-environmental vulnerabilities.

In this paper, we seek to verify a correlation between the social vulnerability of domestic groups and environmental vulnerability. To achieve these objectives, we work with socio-economic-demographic at the census tract level, characterizing households in terms of income and education, as well as identifying the family in life cycle terms. We also group families in various categories, identifying which groups are more susceptible to environmental vulnerabilities. A second data set relates to areas whose populations are at greater risk of contracting illnesses related to environmental conditions. In terms of the physical dimensions of vulnerability, we work with physical relief, information about floodable areas and areas subject to erosion and mudslides.

The paper reinforces a perspective which emphasizes the social dimensions of environmental degradation; links causes of global environmental change to social inequalities at the local level; and contributes to a methodologically more refined analysis of the spatial dimension of socio-environmental vulnerabilities. Such analyses help to promote more efficacious interventions in cities and illustrate that improving quality of life of urban populations may follow other paths than the consumerist spiral which threatens the integrity of global and local environmental ecosystems.

## The Metabolism of a City: A case study from India

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### Keywords

energy, environment, impact, urbanisation, utilisation

As the world moves into the twenty-first century where more than half of its population lives in urban centres, the problems it faces, particularly in the areas of energy and environment, will shift to the developing countries. Even though, it is an accepted fact that most of the energy resources are utilised by the developed world, it is equally true that a significant portion of these resources are consumed by the urban population, majority of which live in developing countries. In this paper we take a close look at different aspects of Urbanization and the related energy and environmental systems. As a typical example of a rapidly urbanizing center in a developing country, we consider the case of Bangalore City of India and present a detailed analysis of its energy system and its environmental implications.

This study tries to assess how a modern urban area consumes energy either directly or indirectly including the impacts of energy consumption on forests, environment, transportation, and the economy as a whole. This is being done through **fuel cycle approach** involving the source of energy, the mode of transportation and the pattern of energy use. The study showed shifts in energy utilization patterns with income levels, from traditional fuels (firewood and charcoal) to modern fuels like petroleum products and electricity, which has an important bearing on the environment.

This study provides an understanding of the energy utilisation and its environmental impacts in Bangalore for a period of 10 years, i.e., 1985 and 1995. During this period, the end-use consumption of wood-based fuels (firewood and charcoal) increased from 8,207 to 9,065 TJ while their share in the total energy consumption decreased from 27.6 to 20.1%. Kerosene consumption increased from 2,966 to 6,452 TJ and that of LPG from 422 to 1,420 TJ. The consumption of electricity has increased from 3,697 to 8,364 TJ while that of petroleum products (petrol, diesel, HSD and LDO) rose from 9,029 to 28,151 TJ. The use of coal declined sharply from 5,398 to 1,788 TJ. The end-use analysis of various energy carriers shows that residential sector consumed about 30% of total energy out of which water heating accounted for by about 25%. In the case of transport sector, 80% of energy was for passenger transport of which two-wheelers accounted for 60%.

The present pattern of urban energy consumption has a number of negative impacts on forests, transportation system, and the environment as a whole. It has been estimated that firewood usage results in clearing of about 14 hectares of forests per day, and the transportation of energy carriers involves 120 trucks and 10 railway wagons. In the case of urban transport, vehicles emit carbon monoxide, unburnt hydrocarbons, nitrogen oxide and sulfur dioxide, which pollute the environment thereby causing serious damage to the health of human and other living things. The total CO emissions during 1995 were 33,000 tonnes in which the contribution of 2-wheelers and cars were 38 and 21.5% respectively. Diesel-driven vehicles are the major contributors of NO<sub>x</sub> (90% of total). In the coming years, the figures will increase further due to increase in the number of personal vehicles such as two-wheelers and cars due to their availability and increase in personal incomes.

It is obvious from the data that urbanisation is a resource-expensive process and the developing countries' aspirations for a Western Urban form are likely to increase the burden on the environment. Thus, strategies for resource conserving urbanisation are warranted. It suggested here that the afforestation programmes and the energy conservation measures through efficient technologies will decrease the stress on natural resources such as wood and oil. In the case of electricity conservation policies should be tailored more to the stock of appliances. Fuel shifts from traditional to modern fuels and from oil to natural gas will decrease the environmental stress. This study would be of immense use for policy formulation and implementation. The general approach developed in this paper can easily be adapted to other urban concentrations, particularly in developing countries.

## **COPING WITH URBAN VULNERABILITY IN AFRICA: THE ROLE OF URBAN AGRICULTURE**

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### **Keywords**

urban vulnerability, poverty, urban agriculture, Africa

One impact of structural adjustment in Africa has been a growing crisis of vulnerability in urban areas. For large segments of the urban poor in Africa, a major response to vulnerability is the growing use of the natural environment to produce food for self-provisioning. Among others, the works of Drakakis-Smith, Freeman and Mougeot underscore the expansion and widespread presence of cultivators in African cities. These observers stress that urban agriculture is expanding in much of Africa as a consequence of the crisis of vulnerability, the negative growth of the formal economy and of limitations posed on the development of an informal economy of growth or on the operations and livelihoods of survivalist enterprise. In policy circles a re-thinking is occurring on the role of urban agriculture in Africa and of its potential contribution to feeding the cities as a broader element of sustainable economic development. Indeed, researchers from the United Nations Centre for Human Settlements argue that urban farming has become a critical variable in sustainability in Africa.

The objective of this paper is to examine the changing role of urban agriculture in African cities. More specifically, in the context of sub-Saharan Africa, the paper will investigate the use of natural resources in urban areas as a coping mechanism against increased vulnerability, particularly by the urban poor. Key themes of concern will be, inter alia, urban farming as household survival or coping strategy, the role of women, the position of urban cultivators in the wider economy, national and local level policy towards cultivation, and impacts upon the urban environment. The paper will examine these themes across a range of African cities but with a special focus on urban areas in Eastern and Southern Africa.

## The Use of GIS for the Study of Land Use/Cover Change

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### Keywords

GIS, LUCC, land use maps, land use survey

GIS (Geographic Information System) is a system with a set of computer-based hardware, software, and data. It is developing fast in recent years, and is expected to become an essential means of the study of land use/cover change. However, there are still many kinds of gaps in its effective use, despite the remarkable progress in the computer hardware and commercial GIS software. The reasons of these gaps include the following:

- 1) lack of understanding in land use/cover changes and the research requirements related with them
- 2) allergy to GIS among human scientists
- 3) lack of relevant data
- 4) over-dependence and over-credit on commercial GIS software and high-tech machines which are not necessarily designed for academic purposes
- 5) ignorance on geographical problems such as scale problem or boundary problem
- 6) lack of imagination on the wide-ranging potential of the use of GIS

The paper discusses the above points with actual examples, and draw attention to the nature, roles, future prospects and new challenges of GIS for the study of land use/cover change. It is argued that GIS can be an essential part of the whole research system and can develop further if the above problems are fully recognised.

The paper is based on the observation of actual researches, and include the views on data compilation, data integration, data analyses, model simulations, and system construction.



## GPS-GIS-RS Integration for the Study of Land Use/Cover Change

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### Keywords

GPS, GIS, remote sensing, topographic maps, LUCC

The spatio-temporal identification of land use/cover changes is one of most fundamental, and difficult, tasks for the study of land use/cover changes. It is particularly difficult when a large area and/or long time period are to be covered. However, new tools of spatial sciences, namely GPS (Global Positioning System), GIS (Geographic Information System) and RS (Remote Sensing), have been proving themselves as effective tools for it. This paper proposes a new integrative system of GPS-GIS-RS, which has been successfully applied in the study of land use/cover changes in North East China.

In this study, we used old topographic maps at 1:100,000 from the 1930s and new land cover maps derived from remote sensing data (AVHRR, 1990s) in order to identify differences, and ultimately changes, of land use/cover between the two time periods. However, the first type of information source, i.e. old maps, have been found to have the problem of locational inaccuracy, while the latter, i.e. AVHRR, is of little use if it is not validated by the ground truth. These problems were solved by conducting a specially designed field survey of land use/cover assisted by GPS, with which we could obtain precise locational information of observation sites. The data obtained on the field were added into an ArcView GIS system, where digital land use maps derived both from the historical maps and AVHRR are already existent.

The whole system, which we may term a GPS-GIS-RS Integration System, provides us with a means to identify land use/cover changes during the long time periods and/or substantially large area in a relatively short field survey. The findings of an experimental survey conducted in July 1998 in North East China include the facts that a large area of wetland in the 1930s has been converted to paddy field, and that there are entirely new towns in some areas. The findings have been proved to be highly consistent with the information derived from other authoritative sources.

## Challenges of Remote Sensing for Land Use/Cover Change Studies

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### Keywords

remote sensing, estimation, data integration, socio-economic, indicators, agricultural productivity, water use/balance, population distribution, LUCC

So far, remote sensing technologies are expected to contribute to LUCC studies by providing land cover classification data or maps. Recent drastic improvement of satellite remote sensing data enables new contributions beyond land cover classification. This presentation introduces recent innovative development of remote sensing techniques and clarifies their possibilities, limitations and a possible framework of land use change model development which can take advantage of abundant spatial data, from the viewpoint of how those data can contribute to the development of land use/cover change models and related environmental models such as soil, water and vegetation dynamic models.

Concretely, the following topics will be discussed;

- 1) Estimation of distribution of socio-economic indicators such as population, employment by industrial sectors and fixed properties.
- 2) Estimation of agricultural land productivity and water use.
- 3) Parameter estimation/adjustment techniques for spatial models.
- 4) Spatio-temporal reconstruction of land use/cover changes by integrating observational data such as RS data and land use change models.

## **SOCIAL FACTORS IN COASTAL LAND USE AND LAND COVER CHANGE IN INDIA: REMOTE SENSING AND GROUND TRUTH APPROACHES**

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### **Keywords**

GIS, LUCC, remote sensing, India

More than 3800 coastal villages scattered along the 7500km length Indian coastline. About 170 million population concentrated in the 100km coastal belt and the literacy rate is 53 percent. Of the ten bio-geographic zones of India, the coastal zone is very significant as it stretches to over 7500 km. In the past, assessment and monitoring of changes in coastal land use and land cover due to increase in population pressure on a large scale was not possible due to lack of comprehensive spatial data. Presently 3 IRS optical remote sensing satellites provide frequent monitoring to study the changes in land use and land cover. In this study various human induced factors responsible for the changes in coastal LUCC has been analysed using remote sensing data combined with ground truth. The recently available high resolution data of IRS LISS-III provides very detailed information (up to level III land use and land cover classes) and also helps the coastal managers/planners to understand the underlying causes for the changes in LUCC. Additionally, the other relevant spatial information like reserve forest boundary, urban sprawl, user villages, etc. are overlaid on the LUCC maps derived from satellite data using a GIS software. This method helps to understand and analyse more precisely to quantify the changes in LUCC and the various driving forces. Due to changes in life style and increase in resource base despite increase in population, the improvement in land use and forest cover have been witnessed in few places along the coastal zone. The changes in watershed and irrigation practices and diversion of freshwater resources in the adjoining areas of the coastal zone having direct impact on the coastal land use and land cover change. Also the increase in coastal population, man-made activities like port construction etc. also altered the coastal land use and land cover considerably. This study concludes that the social causes on changes in LUCC are not unique and differs from site to site. These can be studied in more detail using remote sensing data.

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## **The Contested Mosaic: Social and Ecological Dimensions of Land Use Change in the Lacandon Rainforest of Chiapas, Mexico**

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### **Keywords**

Tropical Forest Restoration, Land Cover Change—social aspects, Landscape Ecology, Lacandon Forest, Chiapas, Mexico.

Long-term research on changing patterns of land use and human occupation of the Lacandon rainforest reveal a complex and dynamic mosaic of human and natural disturbance. This paper focuses on the mediation of 'global driving forces' by regional social and economic structures resulting in this land use pattern. The Maya have occupied the rainforest for many centuries and have shaped biodiversity and landscape ecology of the forest in what is sometimes referred to as the "managed mosaic". Evidence suggests that it is likely that Maya presence has had an overall positive effect on biodiversity and forest regeneration. The situation of the past four decades, characterized by massive recolonization by Mayan people and the advent of formal conservation and development policies, has resulted in a new level of intensity of land cover change, yet popular images of massive deforestation by land hungry peasants do not do justice to the actual socio-ecological complexity of the Lacandon region. Landscape analysis reveals that patterns of change are complex and that some areas during some periods have probably achieved a balance between forest conversion and regeneration. These patterns suggest strategies for encouraging forest restoration. The creation of the Montes Azules Biosphere Reserve in the late 1970s, while contributing to land cover protection, is shown to have provoked many of the social conflicts currently affecting land use change in the Lacandon region and may have had a net negative effect on land cover change in the region as a whole. In areas outside the reserve, initial projects promoted by development agencies, particularly those involving extensive cattle grazing, have resulted in widespread deforestation and degradation, thus increasing demand for forest conversion. However, Maya communities have proposed and attempted to carry out their own conservation and development projects and to maintain a dialogue with conservationists and government agencies concerning the conciliation of conservation and development goals. Some of these proposals are evaluated in terms of their potential impact on forest cover. Geographical, ethnographic, ecological and economic data are combined to estimate the potential social and cultural resources for restoration and conservation of forest land cover in the Lacandon area and to suggest policy alternatives. There is clearly a potential to direct change towards large scale restoration of forest cover in the near future if local and regional social and cultural resources are taken into account and mobilized for this purpose.

## **Methodological Considerations in Linking Household Behavior to Land Use Change: Nang Rong, Thailand**

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*Steve Walsh*

For many parcels of land around the world, decisions about their use are made at the household level, as opposed to community, business, or governmental levels. Further, it is frequently the case that households live in nucleated settlements (villages, towns, cities) and own more than one parcel of land. Linking households to all their land parcels, in a manner that permits linking social science data with satellite data, is a formidable challenge in such situations.

This paper reports on tests of several approaches in Nang Rong district, Thailand - an area where we have longitudinal land cover and household level behavioral data. Nang Rong is a relatively poor area in Northeast Thailand. Rice is the dominant crop. Agriculture is rain fed, which means that there is but one rice crop per year.

Cassava and sugar cane are also grown as cash crops. We begin with a discussion of why linkage at the household level is important scientifically. We also discuss the implications of beginning with land parcels or households. Then after describing the study area, we discuss the methodological variations attempted. In discussing our results, we not only describe two methods that worked well, but we also discuss the methods that did not work, including one that failed spectacularly.

## **Social Dimensions of Land Cover Change: Survey and Analysis of Case Studies from India**

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### **Keywords**

participation, preferences, gender, disparity

The participation of beneficiaries is the most important and significant factor contributing towards effectiveness and sustainability of any land cover change programme. Hence, it is necessary to know and understand social dimension of land cover change. This study, undertaken in three states of India, viz., AndhraPradesh, Karnataka and Orissa, covers six villages, viz. B.Tanda, C.Palle, B.Hally, M.Hally, P.Sara and K.Had where land cover change programmes through tree growers' cooperative societies (TGCS) are taking place in government leased wastelands. Stakeholder-level surveys were carried out to obtain the beneficiaries' own perceptions and views about the plantation programme through which they get fuelwood, fodder and timber.

The data show that farming is major occupation and most of the inhabitants are small and medium farmers. Fuel-wood is the main cooking fuel and collection is done mostly by the females. This indicates, women's higher stakes in plantation programme. Before starting TGCS, villagers are being informed about the programme and 3-6 months of preparatory period is taken for capacity building and information sharing by staff of National Tree Growers Cooperative Federation (NTGCF) which provides funds. Important factor is TGCS membership, which is voluntary, and usufruct rights are only to the members. Another important factor is selection of tree species - who takes decisions and whether preferences of beneficiaries are accounted or not. In the present case, final decision is left to the members of the society.

The study reveals many important social factors for the successful implementation of land cover change programme. The data indicate that fair distribution of benefits and participation of beneficiaries particularly, from low income groups, in decision making are important. In all the TGCS, distribution is perceived as fair and is being decided by all the members of the society. Only at B.Hally TGCS this decision is being taken by the office bearers of the TGCS, and people find the distribution of benefits as unfair. Hence, conflicts arises during distribution. Another issue is the gender biases. In all the TGCS, membership is confined mostly to males despite females having higher stake. Disparity in the wage rates were found in all the TGCS except for B.Tanda.

Most of the respondents rank employment generation as the most preferred benefit followed by fodder and fuel wood. Environmental protection ranks fourth. These six selected TGCS are ranked according to performance (based on views from villagers, and interviewers). The results indicate that B.Tanda and P.Sara TGCS are performing well followed by C. Palle, K.Had and M. Hally. B.Hally TGCS is not performing well.

These results confirm the need for gender equality, good interaction and transparency among the members and office bearers of the society. As results of the survey showed, there is a good reciprocal interaction among the members of the TGCS in all the TGCS except for B.Hally TGCS, which seems to have interference from the politicians and landlords of the village and people don't have clear idea about the implementation aspects of the TGCS programmes which is solely in the domain of the office bearers.

## Loss of Agrobiodiversity and Changing Scenario in the Cropping Patterns of the Indian Central Himalaya, India

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### Keywords

Himalaya, Traditional agriculture, Socio-economic change, Sustainable development.

Traditional farming in Central Himalaya is complex in that crop husbandry, animal husbandry and forests constitute interlinked production systems. Inaccessibility, environmental heterogeneity and ecological fragility favoured evolution of subsistence production systems sustained with organic matter and nutrients derived from the forests. Above 80% of people of this region largely depend on this agriculture. Land holdings are small and fragmented. Terraced slopes, covering 85% of total agricultural land, are generally rainfed, while the valleys, covering 15% of area are irrigated. Mixed cropping is common in rainfed agriculture. Over 40 crop species and numerous farmer-selected land races are cultivated. This huge diversity has been maintained through a variety of crop compositions, cropping patterns, crop rotations and a wide range of variation in edaphic, topographic and climatic conditions.

Recently, a variety of changes including loss of genetic diversity in traditional farming systems in Central Himalaya have emerged in response to population pressure, socio-cultural changes, technological innovations, market forces and land tenure/ownership policies. A recent study conducted in 150 villages located along an altitudinal gradient (between 500 to 3000 amsl) in the Ganges catchment of Central Himalaya reveals surprising facts on declining diversity of the traditional crops during a very short period of two decades (1974-1994). Area under *Avena sativa*, *Fagopyrum* spp., *Hordeum himalayens* and legumes like cowpea, matbean, adjuki bean (*Vigna* spp.) and *Macrotyloma uniflorum* declined by 72-95%. These crops are mostly replaced by cash crops like potato, soyabean, kidney bean, pigeon pea, mustard and amaranths. About 65% of the area under *Panicum miliaceum* and *Setaria italica* is now cropped with high-yielding rice varieties and soyabean. Cultivation of *Perilla frutescense*, *Macrotyloma* and *Vigna* spp. is now on the verge of extinction. Though the area under rice and wheat has not changed much, the farmer-selected cultivars grown till 1970s have been completely replaced by artificially bred HYVs of rice and wheat. In the Himalayan Gazetteers of 1882, Atkinson listed 48 varieties of rice and stated that there were thousands of other nondescriptive varieties. Today only 7-8 traditional cultivars including Ramjawan, Thapachini, etc in irrigated and Ghyaasu in rainfed areas are rarely observed.

The recent decline in agrobiodiversity is due to cumulative effect of a variety of factors including (a) degradation of the natural forests; (b) illusions about coarse and fine grains; (c) large scale migration for off-farm employment; (d) supply of HYV seeds at subsidized price by the government; (e) tendency for maximization of profits through monocropping of cash crops; and (f) lack of incentives for marketing of traditional crops. Social, ecological and policy factors significantly influence the cropping patterns. Policy interventions have encouraged improvement in production of a selected few common food crops like paddy and wheat ignoring the diversity and specificities of the Himalayan agriculture. Pragmatic multidisciplinary research efforts are needed to evolve farming systems which can provide enough quality food and economic security to the people of the region together with conservation and sustainable development of traditional agricultural system. The rate, causal factors and impacts of the declining trend in agrobiodiversity are discussed in this paper.

## International Comparison of Public Perception of Global Climate Change: Bulgaria and the United States.

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### Keywords

climate change, perception, Bulgaria

Under the aegis of the Center for Integrated Regional Assessment at the Pennsylvania State University, broad comparative surveys to explore the uniqueness and similarities of regional perceptions of climate change are being initiated in different countries -- US, Bulgaria, Japan, Costa Rica, and Sweden. The survey in Bulgaria, organized and implemented in cooperation with the Institute of Sociology of the Bulgarian Academy of Sciences, was undertaken subsequent to a similar study in the United States. This survey explored how different cultural and economic characteristics affect perception of climate change using Bulgaria as an example of a country with an economy in transition. This paper looks at the various implementation stages of the survey and its results. In 1997, preliminary preparation for a pilot survey and adapting the contents of the questionnaire and survey procedures to fit the specific cultural background of Bulgarian respondents were completed. At the same time the adaptation and translation of the survey was done in a very cautious and precise way so that it did not change the uniformity of measuring procedures and contents in order to maintain validity for comparative purposes across countries. In 1998, initial outcomes and comparative data provided important feedback for further adaptation and improvement of the final version. The final survey was conducted in August-October 1998 with a representative national sample of 799 Bulgarian informants; results and comparisons are described.

The survey focuses on measuring and comparing public opinion on issues affecting personal lives and society as a whole -- private concerns related to family well-being and social problems like crime, pollution or global warming are integrated in basic explorative questions. The analysis continues by exploring the public's knowledge about global warming; its causes and consequences (human health, natural environment, economic activities); views about the role and importance of science in mitigating global warming; social activity concerning reduction of CO<sub>2</sub> emissions; and personal initiatives, responsibilities, and willingness to pay for reduction of greenhouse gases with increases in taxes and prices or improvement of appliances and home insulation. Beliefs and opinions related to religion, trust in national government and business corporations are also studied according to their importance as viewed by the corresponding cultures. Analysis and conclusions about similarities and differences are discussed in relation to (1) approaches, content, and procedures useful as feedback and guidelines in conducting the comparative survey in Japan, Costa Rica or other countries; and (2) public opinion on environmental threats, global warming issues and personal responsibility, as well as factors leading to similar or different views among the American and Bulgarian people whose cultural and economic heritage differ greatly.



## COMMON KNOWLEDGE? PUBLIC UNDERSTANDING OF CLIMATE CHANGE IN NEWCASTLE, AUSTRALIA

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### Keywords

public understanding, institutions, participation, Australia

The injunction to think globally and act locally has become common currency in debates about the global environment. This paper examines how public thinking about the global environment has been conceived and, drawing on recent research in Newcastle, Australia, offers an alternative framework which emphasises the ways in which public understandings of climate change are socially and institutionally embedded.

Public participation is increasingly seen as a core element of environmental policy making, both as a means of achieving more effective outcomes and through a recognition of the value of community involvement in and of itself (Macnaghten and Jacobs 1997). Within policy and research communities such participation is seen as restricted by public confusion and an apparent gap between 'attitudes' and 'behaviour'. The approach in policy initiatives aimed at addressing climatic change has been to emphasise the need to further inform communities as a necessary precursor to participation. However, recent research suggests that such an approach, in which information is seen as the key to overcoming the gap between attitudes and action, rests on a mis-conception of public responses to environmental issues as contained within individual consciousness (Blake 1999; Bulkeley 1997; Burgess and Harrison 1998; Eden 1993, 1996; Macnaghten and Jacobs 1997). It is argued that public responses are constituted through social processes, and encompass ideas of nature, society, and the relations between the public and the institutions that lay claim to manage environmental risk (Macnaghten and Urry 1998; Wynne 1996). Empirical findings from research undertaken as part of a doctoral thesis in Newcastle, Australia, are used to suggest that although there is considerable confusion regarding the scientific facts of climatic change amongst this community, this does not represent a lack of understanding of global issues (Thompson and Rayner 1998). Public understandings draw not only on scientific information, but also on local knowledges, values and moral responsibilities for future and distant environments and societies. Actions taken by individuals to reduce emissions (using public transport, switching to renewable energy), were seen as largely ineffective in a context of inertia from influential institutions (business and government) in which people held little trust. However, where institutional realignment has occurred within the energy sector to provide renewable energy to householders, public participation has been forthcoming. These findings suggest that a lack of information is not necessarily the most significant barrier to either public understanding or action with respect to the global environment.

Reconciling global and local objectives demands that communication between publics and policy communities should be a two-way process. Before public participation can be either constructive in shaping, or effective in implementing, climate change policy, there needs to be recognition on the part of policy and research communities that public understandings of global environmental issues are worth engaging with. Given the diversity of meanings attached global environmental issues such engagement could strengthen climate policy, as well as making it relevant to the communities who are crucial for its implementation.

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## CLIMATE CHANGE AND LAY OBSERVATIONS

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### Keywords

climate change, lay observation, living environment, way of life, climate risk, cultural protection

Climate risk - a matter of human impact or of natural hazard ?

French philosopher Michel Serres (1990) has described the relationship of modern Man to Nature as parasitic. Man has no scruples in taking from Nature everything it has to offer, without giving anything back in return. In his pursuit of ever greater affluence, Man is causing extensive damage to the natural environment, sometimes without noticing. This parasitic relationship to the natural environment has become an integral part of the modern way of life.

The sharp increase during the past decades in levels of atmospheric carbon dioxide is expected to accelerate the greenhouse effect during the 21st century and consequently cause the earth to warm up to a higher temperature, although other, less predictable changes or disruptions in the climate are also possible.

From a social point of view it is hard to allocate responsibilities for the climate risk because the effects which increase that risk are not immediately visible. Yet, the debate waged in recent years among experts on the acceleration of the greenhouse effect, has gradually begun to reach ordinary citizens as well, chiefly through the mass media. The globalized environmental issue related to the acceleration of the greenhouse effect may be described as a *climate risk*. It is still open to debate how far human industry is accountable for climate change and how far the changes witnessed are a matter of *natural variation*. Most recently experts have been backing the position that it is in fact possible for the climate to change as a result of human industry.

Study on the social dimension of climate change

In the study "Living environment, ways of life and climate change", Finnish environmental experts as well as ordinary citizens (N=121) were interviewed by qualitative theme interview strategies. Some results:

Firstly, the climate risk was universally associated with *vitally important* environmental conditions. This is an "environmental problem" that potentially concerns "all people". This fact was recognized even though other dimensions of climate risk in terms of time, space and intensity of adverse effects, were either poorly understood or perceived as very remote.

Secondly, the phenomenon of climate change is one which takes on *mythical* qualities. Climate change produces strong impressions as to "what may be". The invisible environmental risk is consciously made visible at the level of images. People need to take some stand on what fundamentally is a vitally important issue.

Thirdly, people need to take a preliminary position on *cultural protection*, which is related both to aspects of the vital importance of the phenomenon and to its mythical level. The setting up of cultural protection is important from a lay perspective in that mythical elements appear as categories of vital importance and, on the other hand, the elements of vital importance take on mythical dimensions. In the last instance the issue boils down to the question of whether it is possible to construct cultural protection in the face of climate risk and if so, how.

In weighing the relative seriousness of different global threats, citizens ranked climate change as the second most serious risk together with ozone depletion and the destruction of rain forests. The most serious hazards, as considered by the majority of the interviewees, were nuclear energy as well as air and water pollution. Even so a great majority of the Finnish citizens shared the view that it was necessary to have international agreements for climate protection. This was interpreted by the research group as an intuitive choice to favor the *principle of caution*.

## CLIMATE CHANGE IMPACTS AND SUGGESTIONS FOR MITIGATION: AN ASSESSMENT OF COASTAL ISLANDS

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### Keywords

vulnerability, mitigation, cyclones, awareness

The coastal zone of Bangladesh, known as its "food basket" for centuries, is frequently affected by natural hazards such as cyclones, storm-surges, tidal bores, periodic flooding, coastal inundation, erosion etc., causing grievous harm in terms of human casualties, socio-economic loss, and damage to the environment. The low-lying islands in the southern parts are susceptible to cyclones, storm-surges and vulnerable to climate changes and their effects. The present paper is an attempt to assess the impacts of climate change and possible mitigation options through questionnaire survey.

Changes in weather conditions and evaluation of people's capacity to endure the effects of such changes have been included in the study. It has been observed that the percentage of thatched houses is 55 percent in the study area, and these are more vulnerable than other existing types of dwellings. Agriculture is the main occupation of the people of the study area (31%). Coastal flood immediately affects the pastureland and the suffering ultimately passes on to the livestock sector of the coastal islands. Regarding perception of the local people, it has been found that in an event of storm-surge the present risk associated with crop production in the islands is observed to be lower compared to that in the recent past. About 58 percent of the respondents identified transplanted aman rice as the most affected crop, followed by spices and vegetables. During the survey of the causes of crop damage, it was reported that high winds and tidal surges were the main causes. Locally evolved techniques, which are more acceptable to the islanders, are helping to produce more groundnuts. The people of the islands suffer from water-borne diseases. Seventy-three percent of the respondents identified diarrhoea as a major disease, followed by dysentery and influenza. In general, the prevalence of diseases is decreasing gradually over time. In reply to a question about the devastation and damage from cyclones and storm surges, it was observed that people living in the study area had a high level of awareness of the same. About 87 percent mentioned that there is an increasing trend of frequency of cyclone, and 82 percent opined that the damage and its severity have increased in recent years. To sum up, it is seen that people are coping with the situation through self-evolved methods and techniques. Ninety percent of the people do not evacuate, they have a fatalistic attitude towards cyclonic storm-surges. Ten recommendations concerning mitigation have come out from the study, where the main five mitigation options suggested by the local people are as follows: i) building new cyclone shelters and their proper maintenance, ii) setting up of new tube-wells through government and NGOs, iii) setting up of hospitals especially family planning centers, iv) setting up new infrastructure, and v) digging and re-digging of the canals.

## **Decision-making in the Coastal Zone: Involving People through Deliberative and Inclusionary Processes.**

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### **Keywords**

coastal zone, stakeholders, deliberative processes, decision-making

The coastal zone is increasingly the site of conflict between different stakeholders faced with pressures to plan for climate change, coastal erosion, wetland preservation, biodiversity conservation, and human development in the form of housing, roads, and other infrastructure. This conflict can delay or prevent decisions being taken, implemented, or the desired outcomes achieved. If there is to be a move beyond conflict to decision-making investment is required in new processes and structures for involving all stakeholders, including crucially the people that live and work there. Thus there is a need for the most innovative social science techniques to be applied in order to understand the political social and environmental dimensions of these issues, and to help develop new institutional forms for better decision-making processes.

Deliberative and inclusionary processes (DIP) are emerging as one way forward for decision-making and for research. DIP involve, through various methods, all stakeholders in a process of discussion and debate with the aim of moving towards a solution, or policy response, to a problem that is commonly acceptable. The process is time and resource intensive. However, the potential trade-off is higher levels of support for the outcome, than with other policy-making methods. There is also a potential long-term benefit: capacity has been built that can be utilised again for policy evaluation and for future issues. By developing more positive working relationships between the all stakeholders, the aim is to improve the quality of the decisions made and the likelihood of the desired outcome being achieved.

There is no one model of DIP and they are highly context dependent. This paper will discuss DIP, with reference to the coastal zone, and in particular action research carried out in the North Norfolk Coast, UK. The aim is to illustrate through one case study, and with reference to other research on DIP, what these processes can achieve, where problems lie, and how far it can be developed in other decision-making contexts in the coastal zone and beyond.

## Linking Watersheds and Coastal Estuaries: Material Flows and Economic Approaches for Lingayen Gulf, the Philippines

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### Keywords

residual generation, input-output models, fishery economics

Research reported here in the Philippines, under the LOICZ/WOTRO/SARCS Southeast Asian core project, poses three general questions:

- 1) how does economic activity affect the flow of materials (nitrogen, phosphorus, suspended solids, and carbon) into coastal waters?
- 2) how does a change in such residual flows affect coastal habitats?
- 3) how will a change in coastal water habitats affect economic activity?

To address the first question, two related approaches are adopted. The first approach represents a rapid assessment methodology where residual generation coefficients are linked with exogenous measures of economic activity in order to produce estimates of residual production. When feasible, these residual estimates can be adjusted for natural assimilation processes in order to determine residual discharges into coastal waters. The rapid assessment methodology may be readily incorporated into a geographical information systems model allowing for detailed simulation of changes in land use patterns, economic activity, and demographic pressures.

The second approach to the first question involves the creation of a regional input-output model that incorporates residual generation coefficients. The IO approach has the advantage of capturing the interrelationships between economic sectors. The rapid assessment approach has the advantage of allowing a greater disaggregation of activities, thus providing a more detailed scenario analysis capability. The ability of each approach to provide for the needs of the natural scientists in addressing question number two will be discussed.

In addressing the impact of these environmental changes and fluxes on the economic system, attention is focused on fishery activities, as this the primary economic activity of the study area. The link between changing habitat quality and fishing activity is expressed by explicitly incorporating a carrying capacity expression into a surplus growth fishery production function. From such an expression, changes in potential fish harvest brought about by changing habitat quality can be determined. To the extent that such information may be given a spatial dimension, a GIS model may be developed to determine potential changes in the behaviour of fishermen as they respond to the changing profitability of exploiting fishery resources. Thus the paper argues that a comprehensive set of research techniques within an interdisciplinary framework are required to understand the dynamics of social and environmental change in coastal zones.

## Engaging with Stakeholders and Trading off their Preferences: Marine Protected Areas in the Caribbean

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This paper reports a methodological approach developed to support decision-making for sustainable management of natural resources. The approach involves assessing economic, social and ecological criteria both quantitatively and qualitatively within a multiple criteria analysis and engaging with stakeholders to prioritise alternative development paths. It places participation of stakeholders at the centre of the process of decision making, and adopts an iterative and constructivist approach to defining weights for the criteria. Hence, the method explicitly recognises the different priorities and values of stakeholders and their interests. This method is developed in the context of coastal resources in Tobago, West Indies, and focuses on tourism development options in the Southwest of the island, and management of a marine protected area, Buccoo Reef Marine Park.

The participation of stakeholders in making decisions about natural resources which directly or indirectly affect them, represents a major challenge to researchers, policy makers, and practitioners alike. Many approaches which have been advocated rely on consensus building techniques or on feeding direct information on preferences to decision-makers within a hierarchical structure. Alternative frameworks have been developed by economists such that information from stakeholders can be translated into monetary terms, or to validate economic valuation studies. Although these approaches engage stakeholders in order to derive information, they rarely address the need to incorporate stakeholders at the outset in framing the resource management issue or bring about actual management improvements through the participatory process itself.

This paper reports on research which addresses marine park management by engaging with stakeholders in defining development options for South West Tobago, and estimating the impacts of these on economic, social and ecological criteria through social and ecological modelling and survey. The weight given to economic, social and ecological criteria, as derived through focus group discussions and other techniques, are then used as the basis for comparison of options in an iterative series of stakeholder meetings. An appraisal of the efficacy of this approach is discussed. The results of this example of quantitative and participatory research for coastal and marine resources, demonstrate that there are trade-offs between the identified management criteria, and that different stakeholders weight these criteria differently. However, involvement by stakeholders in the process of developing the model, and in discussing the recommendations derived from different weights, provides an opportunity to explore and construct different development outcomes. This makes explicit the different perceptions and values of the different actors, and enables decision making and management based on consensus rather than conflict. The paper argues that such an approach is likely to lead to sustainable resource management in a variety of contexts.

## CLIMATIC VERSUS INSTITUTIONAL CHANGE IN NORTH ATLANTIC FISHING COMMUNITIES

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### Keywords

North Atlantic, fishing, communities, ocean climate

The North Atlantic is a primary area of climatic change. Ice cores from Greenland indicate that major climate swings occurred in the area during the last glaciation. Though the climate has been less variable over the last 9000 years, the region still experiences oscillations. The cooling by the Icelandic low of the Gulf Stream drives the global ocean conveyor. Changes in this cooling regime may have long-term consequences for the global climate. Recent studies suggest links between oceanic climate and commercially important fish species, such as cod. Given the importance of the North Atlantic to cod and climate, one would suspect a link between climatic variation, fishing and fisheries-dependent communities. This link may be useful for both understanding the impact of climate change and as a bellwether of changes in the North Atlantic. North Atlantic fishing communities are, however, undergoing major changes brought about by improved technology, national policy and international markets. These changes are evident in declining human populations. A primary driver of change has been quota systems for commercial fishing. Quotas have reduced the capacity of fishing fleets, and the need for fishers. We will describe these forces for two major fishing nations, Iceland and Norway, then focus on two regional case studies. In one case study, the area has been experiencing declining populations over the last 20 years. In the other, the population has actually been increasing. We will provide estimates of how large a climatic effect will have to be observable above other global changes. Development of methods for sorting out the different causes of changes in fisheries and communities will help understand the relative importance of drivers of change, including climate.

## Study on Business-Administrative Theory of Environmental Management/Audit

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### Keywords

environmental management, lifecycle costing, material balance

Corporate business activities are considered theoretically from the point of view of the lifecycle assessment to reveal the essential characteristics of an environmental management/audit. In addition, an assessment program to develop them is proposed.

Resources (organic and inorganic substances), etc. invested from ecosystems such as natural environments into econo-systems (administrative actions) circulate with their forms changing in all the processes from production to consumption, and they discharge their excess entropy in the form of waste material/heat. In a way, material circulation is a process to deliver the entropy and, if it stagnates, the material circulation system becomes unable to function.

In actual situations in which administrative actions are becoming more active and the amount of resources collected from nature is increasing, the input and output are unbalanced and failure to correct this leads to environmental destruction.

Administrative action is a circulating activity in which resources are collected in the production process, these resources are converted into final products, waste materials are generated through the consumption process, and these are discharged to nature. To obtain good administrative results including the effects on the environment, assessment which covers the whole lifecycle (LCA - Life-Cycle Assessment), taking into consideration all processes from the collection of resources to disposal after the use of the final products, is required.

The costs for handling industrial wastes are divided into two types, the costs for disposing final industrial wastes and the costs for recycling reusable industrial wastes, the total costs of both types should be borne as the minimum. In addition, if pollution is generated at a level beyond the purifying ability of nature, the amount for negative environmental loading will have to be borne as social costs. As a matter of course, the costs for preventing such pollution will be necessary.

Also in the production department, not only the amount of initial-cost investment necessary for production but also the costs for handling industrial wastes or the amount of resulting damage to the environment will have to be recognized.

In the consumption department, products are received from the production department, they are consumed as necessary, wastes are collected separately per classification in the household-waste disposing process, and they are separated into those to be sent to the public disposal department and those to be supplied to the recycling industry department as reusable resources. In the public disposal department, after disposal, the wastes are discharged to the natural environment as final non-industrial wastes or those which can be used as reusable resources are supplied to the recycling industry department.

A series of such waste disposal costs are borne by the household or local government, but there is a possibility that the costs for recycling such as classified collection may be offset partially by the returned money from the recycling industry department (deposit, etc.) However, if not enough returned money such as a deposit to provide the recycling costs is available, the remaining amount after the returned money, etc. has been deducted is the recycling cost which the household or local government must actually bear. In addition, if the discharge of household wastes exceeds the purifying ability of nature, the amount to be borne by the environment for such excess must be paid as social costs.

It is important to have an accurate grasp of these for informationization and proper action.



## Meaning of Environmental Protection and Environmental Audit

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### Keywords

environmental audit, environmental according, environmental information

Environmental audit stands on the premise that the environmental management system exists. Within that premise, environmental audit as an internal audit is carried out.

In this case, its framing contains two different requests.

The first is a request to promote corporate autonomous programs as far as possible. For today's environmental protection, the conventional method by means of official restriction realizes the limitations and it is most desirable that corporations who have the best grasp of corporate activities voluntarily conduct environmental management/audit

The second is to respect the autonomy of corporations, while having a third person inspect and prove the reasonableness in order to maintain a high protection level.

For this purpose, it is necessary to check officially approved procedures, field surveys, and activities. In checking these, it is necessary to measure the attainment of the goals for environmental protection by whether corporate activities for environmental management are carried out based on the environmental plan.

Here, environmental information is released and the establishment of an environmental audit system to certify this and what the corresponding environmental accounting system should be are proposed.

## **Actual Situation of HACCP as Environmental Management/Audit in Europe and America**

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### **Keywords**

hazard analysis, critical control point, quality risk management

Safety programs in the food distribution industry are based on the fundamental rights of consumers (four rights: right to seek for safety; right to be notified; right to select; right to be asked) in the Kennedy bill of 1962 in America. In Japan, with such a background, consumers' awareness of the safety of food, typically found in artificial sweeteners (dulcin, cyclamate, etc.), harmful barrel-family dyes, and so on, started to come out in the 1960's. In the 1970's, their demand for safety became stronger during the times when retail business prospered. Demand for safety was mainly against environmental pollutants such as PCB, mercury contamination of fish and shellfish, food additives such as AF2, saccharin, and edible red II which may cause cancer. In the 1980's, the safety of SHA, OPP-Na, hydrogen peroxide, etc. was discussed under the sovereign power of consumers. In the early 1990's, the indication on food additives was revised and the duty to put an indication of the expiry date for consumption and quality keeping on food was assigned. In 1995 the P1 law was enforced and, with these as a turning point, the importance of HACCP as a concrete protective measure against the P1 measures was recognized and the approval system of the general sanitary controlling production process of the Ministry of Health and Welfare was brought into effect.

It cannot be said that corporate self-responsibility principles such as prohibition of the export of fishery products such as scallop to the EU, restriction on the export of meat and fishery products to America, etc. which the world requests, have been established sufficiently. However, for the last few years, as international coordination is required by the WTO agreement and deregulation is in progress, self-responsibility as a corporation also has been strongly required by the business world of food-related industries including food distribution. It also can be said that for the future the "existence of a corporation" in the times of PL depends on whether the food-related industries have a business structure which makes it possible to establish a self-management system in their roles and that they fulfill their self-responsibilities. The introduction of HACCP is supposed to play an important role as one of the measures for this.

## Actual-State Analysis of Environmental Audit Certification

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### **Keyword**

environmental cost

First, the merits of the introduction of ISO14001 are considered. The merits of the acquisition of the certification are divided into 2 patterns; external merits and internal merits. The former are merits brought by the acquisition of the certification and the latter come from the introduction of ISO14001. External "certification" merits are to improve the corporate image, to promote the export of products to the EU, to satisfy the requests from interested parties such as customers, to obtain green procurement reception from the government or autonomous community, to promote deregulation with autonomous programs, to let interested parties know that the corporation has a system for environmental risk prevention, to respond to the environmental consciousness of the neighborhood residents, and so on.

Internal "introduction/operation" merits are to prevent environmental risks, to reduce the environmental-related costs, to realize energy/resource saving, to improve the environment consciousness of all employees, to help develop environment-friendly products, and so on.

Among the above, the certification merits may bring short-term effects but internal merits are supposed to play an important role in business administration in that they bring long-term continuous effects.

If we want higher performance in environmental management, we must know the specification of the basic software called "ISO14001". The fundamental function of ISO14001 is an intrinsic potential function. This function does not bring effects if we do not have an intention to use it and it will be a useless possession if we do not know how to use it. I have no hesitation in saying that at least ISO14001 can provide corporations with the following six fundamental functions.

Those are to enhance responsibility against changes, to prevent administrative risks, to enhance the autonomous checking function, to clarify the responsibility/role of the manager, to improve the degree of clearness of the organization, to improve continuously, and so on.

## **Does Environmental Harm Cause Political Instability? Lessons from the CIA Task Force on State Failure**

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### **Keywords**

environmental security, deforestation, political instability, quantitative analysis

This paper is based on a large-n quantitative study that sought to test the hypothesis that environmental deterioration causes political instability. The study was conducted by a task force established by the US Central Intelligence Agency, at the request of US Vice President Al Gore. Levy was a member of that task force, and a co-author of its July 1998 report (unclassified). The study, using only open-source data, had an overall mission of finding reliable indicators of major political instability ("state failure"). Over 800 variables were tested in a series of multiple regression models. The effect of environmental harm was tested both in the general models of state failure and in separate models designed specifically to locate the environment's impact.

The main environmental findings are as follows:

- 1) Environmental deterioration, using measures currently available, is not a reliable direct indicator of major political instability.
- 2) But environmental deterioration DOES have an indirect impact on political instability by affecting physical quality of life factors that have been shown to serve as reliable indicators of political instability. In the Task Force's general model, infant mortality was a strong precursor of state failure; our environment model shows a statistically significant relationship between environmental deterioration (measured either as deforestation or as soil degradation) and rising infant mortality.
- 3) The connection between environmental deterioration and rising infant mortality was significant only in models that controlled for the level of vulnerability to environmental harm and for the level of state capacity to cope with environmental harm. Therefore we conclude that rather than looking for simple associations between environmental harm and political outcomes, it makes more sense to study the interconnections between environmental harm, environmental vulnerability, and state and social capacity.

## Water Resources and Social Conflict

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### Keywords

environment and social conflict, water resources, Global Marshall Plan

In the coming decades, the global management of water resources is likely to become one of the most urgent problems for international environmental diplomacy. Recent research suggests that freshwater use for agriculture will be an even more pressing issue for food security than availability of arable land. Population growth, increasing income per head, and the spread of meat-based diets are likely to lead to severe water scarcity in many regions of the world. This will exasperate existing disparities in welfare, as highly industrialized regions like North America and Europe have abundant rainfall, while large parts of Africa, the Middle East, and important regions in Asia are faced with severe limitations of rainfall.

Climate change is likely to amplify these disparities rather than reducing them. Genetic engineering cannot be expected to change water productivity in agriculture by the relevant orders of magnitude. Freshwater production from desalination is severely constrained by huge energy requirements. Improvements in runoff-management and irrigation technology will be crucial, but cannot overcome the physiological need for considerable evapotranspiration if food is to be produced at all.

Under these circumstances, the ability to handle regional conflicts about water resources will be a critical factor in managing the global commons. The agriculture of North America and Europe is likely to become increasingly vital for producing food needed in less affluent regions of the world. In order to finance these food imports, countervailing exports from regions struggling with water scarcity will be required. To prepare for this situation, the capacity for such exports must be generated soon. This will require huge financial flows from highly industrialized countries. Given the recent financial crisis in South-East Asia, fostering these investments is a challenging task.

The most interesting experience of deliberately creating an export base through financial flows from abroad is the Marshall plan after World War II. One crucial element of this scheme was the possibility to use domestic currency to pay back credits in foreign currency. The opportunities provided by such a scheme are considerable. They may become an important element in fostering the use of political negotiations and commercial operations - rather than military and paramilitary means - in future conflicts over water resources.

## CLIMATE CHANGE AND SECURITY: REGIONAL CONFLICT AS A NEW DIMENSION OF IMPACT OF CLIMATE CHANGE

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### **Keywords**

environment and security, conflict, climate change

As global environmental problems became increasingly prominent within international politics, debates that attempt to link environmental issues and security have been rapidly developing among researchers of international politics since the late 1980s. Although such trend may have stimulated those that engage in international politics and foreign policies to be aware of global environmental risks, it has had little effect for suggesting new aspect to solve environmental issues. This paper aims to indicate political impact of climate change that has not yet been dealt within the works of Intergovernmental Panel on Climate Change (IPCC) by introducing "environment and security" concept.

This paper first reviews studies on environment and security, and categorizes them into three types of approaches, which are; (1) consequences between environmental degradation and regional as well as international conflict, (2) enhancement of conventional security concept to global environmental issues, nation still being the main actor, and (3) human survival against ecological/biological threats, which deals not only with nation states but individuals.

Then, starting with these three categories of approaches on environment and security, this paper attempts to link regional impact of climate change that are estimated by the IPCC with security perspective, and to show what kind of political instability are expected in which region. These impacts are regional changes in ecosystems, hydrology and water resources, food and fiber production, coastal systems and human health.

The author argues that there are social, economic and/or political aspect of impact that are plausible when climate change occur, but studies on impact of climate change needs to come up with results of higher certainty to indicate more convincing conclusion on these indirect effects of climate change. As for the IPCC studies, it is recommended that it should start covering these indirect social, economic and/or political effect of climate change, such as environmental refugees and conflict for food and fresh water, should be taken into consideration, since it is actually one of the concerns of policymakers. Considering climate change as "insecurity," to "securitize" means not only reduction of greenhouse gas emission and adaptation to climate change. It means also to change institutional aspects of social system, such as immigration, trade, management of water resources, and regional and international cooperation.

## **The GLASS Model: Preliminary Results from an Integrated Approach to Global Environmental Security**

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### **Keywords**

conflict and the environment, food security, water security, integrated assessment

Although political scientists have made good progress in describing the connection between environmental change and human security, not too much work has been done on quantifying this connection. In this paper we present a new integrated model that quantifies several aspects of global environmental security. The model is called GLASS (Global Assessment of Environment and Security) and is being developed by several researchers at the Center for Environmental Systems Research. The aim of the model is to investigate the linkages between extreme environmental changes (such as droughts, flooding, and large-scale soil degradation) and the response of society to these changes. It is hoped that model results can contribute to designing strategies to lessen security threats (such as avoiding famine through strategic food reserves or early warning systems).

The model takes a unique approach in using linked submodels for calculating "slow" and "fast" global environmental changes, and how they interact to increase the potential of crisis in society. In the first version of GLASS, slow environmental changes are represented by changes in susceptible population, land cover, and long-term average climate. Fast environmental changes include the year-to-year variability of climate, crop yield, water availability, and involuntary migration.

At the core of the model is the Crisis submodel which contains a proposed relationship between environmental stress, the susceptibility of a state to this stress, and the occurrence of crises such as water shortages or famine. In the first version of GLASS, environmental stress in a particular year is estimated to be high if the water availability in a particular watershed, or the crop productivity in a grid cell, are far below their long-term averages. These calculations take into account the year-to-year variability of climate, and are carried out by two global submodels - the WaterGAP model and the FAO Crop Suitability model. The susceptibility of a state is estimated to be high if either its national income is low or its political capability is low. (An index of political capability for most countries is available from the literature). The Crisis submodel is calibrated to international data of crisis events (such as drought-related water shortages and famines) between 1901 and 1995.

After calibration, the model is used for scenario analysis of the global potential for environmental crises for the period 2000 to 2100. These scenarios roughly estimate where and how often future crises may occur at the country-level, and the number of people at risk.

## GLOBAL CHANGE INFORMATION FOR U.S. COASTAL ZONE AND WATER RESOURCE MANAGEMENT: LINKING INSTITUTIONS ACROSS SCALE AND OTHER BOUNDARIES

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### Keywords

climate change, institutions, cross-scale, coastal zone, agriculture, information, assessment, policy-making

This research explores how the linkages between research, assessment and decision-making institutions from international to local levels influence the management of global environmental risks in the coastal zone and in the agricultural sector in the U.S.

Cross-scale environmental problems -- those in which events or phenomena at one level influence phenomena at other levels -- have historically created unique challenges and pitfalls for assessment and management, particularly when scales of biogeophysical and human systems are mismatched, or when connections across scales are ignored by decision-makers or scientists.

Global change has increasingly been the subject of concerted international scientific and diplomatic efforts (e.g., ozone depletion, climate change, biodiversity loss). With a growing understanding of the importance of identifying the potential impacts and options for mitigation and adaptation to global risks, the focus is shifting to smaller than global scales. In the climate change arena, for example, recent studies have attempted, with varying degrees of success, to assess a variety of different impacts such as extreme events and weather variability, at regional, national, and subnational scales. Despite these efforts to study impacts at different scales, little effort has been made to try to understand how information gathered, constructed, and produced at the international or even national level influences decision-making at subnational levels.

To address this gap, this research explores and compares information and decision-making systems in two impact domains: (1) the agricultural sector in the U.S. Great Plains, investigating how both climate change, and the analogous, related large-scale environmental risk -- drought and depletion of the Ogallala Aquifer -- is being addressed at a variety of levels; and (2) coastal zone management in Hawai'i and Maine, focussing on how both states address sea-level rise and associated risks - e.g., coastal erosion, increased storm-related flooding -- in the context of state and local management programs.

The conceptual model which underlies this research emphasizes the role of iterative, two-way, interactions between scientists and decision-makers in the production of useful knowledge, and the role of institutions and individuals in facilitating the use of such knowledge. This model also stresses the importance and function of boundaries between scales and between science and decision-making. We explore how boundaries are constructed, bridged, and mediated by information brokers/translators, boundary organizations, and boundary spanners to create information needs, facilitate fora for knowledge exchange and discussion, coordinate information and decision systems across scale, and over time build relationships of trust and credibility between information providers and decision-makers. The case studies illustrate to what degree institutions and individuals are successful in integrating information and decision functions for a more effective use of global change information in daily water resource and coastal zone decision-making.



## **ENVIRONMENTAL PROTECTION IN AN INDUSTRIALIZING, DEMOCRATIZING NATION: DEVELOPING LINKS BETWEEN INTERNATIONAL, NATIONAL, AND LOCAL AIR POLLUTION INSTITUTIONS IN SPAIN**

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### **Keywords**

international, air pollution, Europe, environmental policy – Spain, scale

This paper presents findings on research into the development of local-national-international institutional linkages (i.e., cross-scale links) in Spain over the last 20 years, and how these linkages affected air pollution policy.

Since the late 1970s Spain has emerged from a long period of political authoritarianism, economic isolation, and central planning. Over the last two decades, the nation has made considerable progress on the parallel roads of democratization and industrialization while it has also become an active member of the international community. During this time, Spain's environmental conditions began to become those of an industrialized country, including such things as urban smog and increased volumes of solid waste. Not surprisingly, Spanish environmental policies began to reflect this change by requiring cleaner automobiles and better waste management. Thus, Spain's recent history is much like the course which many Less Industrialized Countries (LICs) find themselves on now, or hope to soon find themselves on, and in many ways, recent Spanish achievements offer a remarkably successful example for LICs.

However, the case history of Spanish environmental regulation has not been clearly described, much less analyzed in detail in order to discover just what lessons can be learned from it. As part of the Global Environmental Assessment (GEA) Project based at Harvard University, an effort was made to partly fill in this gap by examining the Spanish experience with one of the best-studied examples of international environmental policy, the monitoring and control of European air pollution. This paper will describe how Spanish cross-scale links developed, including participation in international air pollution treaties, membership in the European Union, and formation of local air pollution authorities.

This paper will show that significant cross-scale links have been developed in Spain, and that some of the most important ones (in terms of decisions affecting air quality) are not environmental links at all, but linkages between political and trade institutions. In particular, the importance of the European Union (EU) to Spanish air quality policy will be discussed. The linkages between scientific institutions will also be described, showing that international environmental institutions often paid little attention to Spanish air quality concerns but that Spain nonetheless participated in them actively. This paper also highlights how the process of democratization has presented real difficulties in the transfer of "useful" information between the assessors and Spanish users of information. Finally, the implications for the effectiveness of cross-scale environmental institutions in LICs will be discussed.

## CORPORATE STRATEGIC REACTIONS TO CLIMATE CHANGE SCIENCE

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### Keywords

climate change, automobile industry, environmental science, institutional theory

Corporations possess immense technological, financial, and organizational resources which, if directed toward low-emission technologies, could play a key role in reducing emissions of greenhouse gases (GHGs). The automobile industry is a key sector responsible for substantial emissions of GHGs, accounting for around one-third of the total in the United States. Automobile companies have traditionally been amongst the most ardent opponents of mandatory GHG emission reductions, pointing to uncertainties in the science of climate change and the high costs of mitigation. Nevertheless, most companies are increasing their investments in low-emission products and technologies, some are bringing these products to market, and some are expressing tentative support for international efforts to control GHGs.

Based on a case study of the automobile industry in the U.S. and Europe, this paper explores why companies in the same sector exhibit different strategic responses to climate change, and suggests policy responses that would encourage more positive corporate strategic responses. We argue that there is no simple interface between climate science and corporate strategy. Rather, companies respond to information, actions, and pressures from a range of actors in their institutional environments, including regulators, consumers, industry associations, competitors, and environmental NGOs. Each of these actors interprets and responds to the climate issue in particular ways, which in turn drives corporate responses. Thus, corporate responses to global environmental science is strongly influenced by the nature of boundary spanning activity between firms and their external scientific, economic, and political contexts.

Corporate responses to climate change are also shaped by internal organizational structures and processes. The larger multinational automobile companies have their own scientists who monitor climate science, engage with the external scientific community, and advise their companies' senior management. Formal assessments such as the IPCC do not appear to play a major direct role in this process. Corporate perspectives on climate change are thus influenced by the perspectives of these internal scientists, and their relationship to other corporate functions, such as regulatory affairs, product divisions, and top management.

These institutional factors play a particularly important role in mediating corporate responses to climate change because companies cannot easily discern their economic interests in a clear, objective manner. Companies are faced with a high level of uncertainty concerning environmental science, technological and market developments, and policy responses. Investments in low emission products and technologies entail high risk but may secure first mover advantages. Under these circumstances, firms have a degree of strategic discretion but are more susceptible to institutional influences.

Companies in the US and Europe face significantly different institutional environments, which help to explain differences in corporate responses to climate change. U.S.-based automobile companies are embedded in an historically adversarial regulatory structure, they serve consumers who are used to large vehicles and enjoy very low gasoline prices, and face relatively quiescent environmental NGOs. Although these companies are large multinationals serving global markets, corporate attitudes and strategies concerning climate change still tend to be informed by a home country perspective.

The paper concludes with a discussion of the implications for policy. Uncertainty concerning regulatory responses is a significant barrier to corporate investment, which could potentially be ameliorated. Incentive structures can be tuned to encourage early investment and participation in policy formation and implementation. Institutional mechanisms can be strengthened for the communication and discussion of assessments of climate science, economic impacts, and mitigation options.

## Human Dimensions: International Trade as a Driving Force to Improve Environmental Technologies and Production Process

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### Keywords

Brazilian Industry, environmental strategies, international trade

The main objective of this paper is analyze and evaluate the relationship between the trade openness process in developing countries and the technological changes linked to environmental practices. In particular, the paper does an assessment of the Pulp and Paper Industry in Brazil.

This paper intend to explore the consequences of the liberalization and trade openness process in business environmental behavior. In special, the main effects and relations between the adoption of best friendly environmental practices and the enterprise share in the international market.

There are several interrelated channels by trade liberalization can affect the intensity of adoption of new technologies. First, by the possibility of import environmental friendly technologies, inputs and capital goods. Second, by the rise of competition inducing best quality and efficiency in the products and production process. Third, by the perspective of rising economic scales, as a result of new investments, looking ahead to the international market. Forth, by the adoption of more exigent environmental standards of demand. And last, by the acceleration of technology progress, stimulated by the rapid growth of the international market.

In particular in the Brazilian industry, many sectors have been involved in restructuring process, with different productive, technological and environmental dimensions as reduction and changes of product lines and process, adoption of quality programs and new managerial techniques. In the pulp and paper industry, some enterprises adopted measures to reduce the environmental impact of their activities and adapted international standards.

In this sense, this paper can permit understand this process and discuss some mechanisms that can be use to create and implement Environmental Policies in developing countries and to assess the perspective to improve the trade integration of Brazil in the global markets.

The main purpose of the paper is identify and characterize the importance of trade openness process in Brazil, in the nineties, in induced changes in the productive process in the pulp and paper industry and, in particular, in the adoption of technological and managerial innovations linked to environmental improvements.

The key points to be analyzed are:

- (1) Identify, in a historical perspective, the development of the Brazilian Pulp and Paper Industry, to understand: the dynamics industry and the evolution of Brazilian industry share in the international markets;
- (2) Identify the strategies of Brazilian enterprises related to environmental aspects as changes in products and process, adoption of environmental practices and standards, pollution control practices; trade strategies based on environment aspects;
- (3) evaluate the environmental impacts, in a economic and social perspective, analyzing some questions as: i) the land use and occupation, ii) level of protection of ecosystems to be preserved and the recovery of degenerated lands and iii) level of air, water and ground contamination;
- (4) identify the polices adopted by govern and enterprises to mitigate the environmental problems and their social and economic dimensions as investments in environmental programs.

## IMPORTANCE OF ISO 14000 FOR TRADE AND THE ENVIRONMENT IN DEVELOPING COUNTRIES OF ASIA AND THE PACIFIC

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### Keywords

Asia-Pacific region, carbon dioxide, forest resources, ISO 14000

The Asia-Pacific region which is the home for more than 60 percent of the world population, has achieved very high economic growth rate. The region's economic growth was mainly propelled by rapid industrialization, and rise in intra-region as well as inter-region trade. In the last decade, the share of exports in gross domestic product of developing countries of the region, which is the basis for openness, has exceeded that of developed economies and the aggregate of all developing countries. However, both the region's rapid industrialization, and rising trade (mainly exports of goods from developing countries) are among the major environmental concerns of today. In developing countries, there is already over-extraction of natural resources, and goods are not produced in a sustainable manner although the share in the production and export of natural resource intensive goods has a declining trend, while that of manufactured products is increasing.

At the same time, demand for environmentally benign or green products is rapidly rising in today's environmentally conscious globalized society. People living in developed economies are especially concerned for such products where developing countries of the region have large access of their goods. Recently, people living in many of the rapidly developing countries of the region have also shown their preferences for green products. It is the time for the enterprises of developing countries of the region to act properly so that their products would be more environmentally benign and face no environmental related non-tariff barriers when entering to the world market. By meeting the criteria of the ISO 14000 family of standards, exports of goods to any country will face no environmental related non-tariff barriers. The ISO 14000 family of standards is also concerned with the management of forest resources for sustainable trading of the forest products.

This study analyzes the existing trade dependency of developing countries of the region, their trade related environmental deterioration focusing on the emission of carbon dioxide, and the depletion and degradation of forest resources. It is observed that during the period 1990-95, total exports of goods from and the share of exports of goods in gross domestic product of developing countries of the region rose sharply while those of the world are moderate. These countries' share in total carbon dioxide emission resulting from commercial energy use and cement production in 1995 is over 25 percent, which is 5 percent higher than that in 1990. Moreover, during the period 1990-95, the region's developing countries share nearly 27 percent of the world annual average clearance of forest cover which releases additional amount of carbon dioxide to the atmosphere. The study indicates that trade has a significant role in such environmental deterioration although it is not the sole cause of the same in developing countries of the region. Finally, this study stresses the importance of ISO 14000 in developing countries of the region for free and environmentally sound trade among different nations and regions, and for building a path towards sustainable development of the Asia-Pacific region.

## INTERNATIONAL TRADE IN A DYNAMIC RICARDIAN FRAMEWORK WITH TRANSBOUNDARY POLLUTION

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### **Keywords**

international trade, transboundary pollution, environmental capital

Concentrating a polluting industry in one country eliminates its degenerative effects in the other. International trade thus allows for spatial separation of two incompatible industries. This paper extends the analysis by allowing for transboundary pollution. Thus specialization has indirect repercussions on the level of pollution in the other country. We show (i) how cross-national differences in pollution give rise to comparative advantage, and (ii) how the emerging trading pattern combined with transboundary pollution may or may not lead to an attrition of environmental capital, decreasing productivity and global welfare losses. The theoretical findings are put in perspective with a discussion of the role of trade in actual cases of transboundary pollution and with the emerging consensus among trade economists that in the presence of transboundary pollution trade restrictions can be an efficient means of achieving environmental goals.

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The paper is from a chapter of my dissertation at Brandeis University, Massachusetts. I would like to thank Rachel McCulloch, Hirofumi Uzawa as well as seminar participants at Brandeis University and at the Research Center on Global Warming, Japan Development Bank, Tokyo, for helpful comments. All remaining errors are mine. The paper does not reflect the views of the International Monetary Fund (IMF).

## GLOBAL ENVIRONMENTAL CHANGE AND ITS IMPACT ON HUMAN DISEASES IN A TROPICAL ENVIRONMENT: A CASE STUDY OF INDIA

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### Keywords

climate change, global environmental change, vector-borne diseases, tropical environment, global warming

The sustained health of human populations requires the continued integrity of Earth's natural systems. The disturbance, by climate change, of physical systems (e.g. weather patterns, sea level, water level) and of ecosystems (e.g., agroecosystems, disease vector habitats) would therefore pose risks to human health. The scale of the anticipated health impacts is that of whole communities or populations (i.e. affecting public health as a whole). The health impacts on human dimensions would occur in various ways, via pathways of varying directness and complexity causing an inequilibrium in the natural and managed ecosystems. The impacts due to global environmental change would be adverse and some would occur by direct pathways (e.g. deaths from heat waves and from extreme weather events) and also by indirect pathways (e.g. changes in the range of vector-borne diseases). These impacts may vary over time and in space in relation to the climate change. Since many diseases are extremely sensitive to climate, there are going to be many shifts in the distribution and spatial patterns of diseases over time. Many studies have indicated that Global warming is responsible for emerging infectious diseases in the Tropical environment particularly in the case of Malaria. Malaria as a whole generally does not afflict regions with annual temperatures below 16 C but when minimum temperatures increase the disease could spread into previously malaria free regions. Many tropical diseases, whose distributions are now restricted by climate may move into the temperate zones where the majority of human beings live. Such diseases kill 15-20 million people annually. Malaria could extend its range by tens of millions of square kilometers and this is supported by extensive empirical information on the coupling of malaria outbreaks and climatic fluctuations, particularly those associated with the El Nino-Southern Oscillation. Climate change appeared to have played a role in India's recent bout with bubonic plague as well. The present study attempts to analyse the spatial pattern of human diseases in a Tropical environment with special reference to India. The study also probed into the details of the impact of climate change on human diseases and also attempted to explain the regional and intra-regional variation in relation to climate factors, changes in geographic ranges and incidence of vector-borne, diarrhoeal and other infectious diseases at regional and sub-regional levels. An attempt was also made to explain the populations with different levels of natural, technical and social resources in relation to their vulnerability to climate-induced health impacts. The data were collected from secondary sources and wherever necessary the questionnaire survey at random was administered among human populations to collect the data on perceived morbidity pattern of frequent diseases and their variation over space and in time in relation to climate change. The data were analysed with the help of simple descriptive statistical techniques. The interrelationships between climate change and human diseases were studied and analysed with the help of multivariate statistical technique (factor analysis) and the dimensions were interpreted so as to explain the conceptual relationships. It was inferred from the study that most of the impacts were adverse. Nearly 43% of the human diseases (malaria, T.B, Cholera, Plague and water-borne diseases) revealed an association with climate change of physical system (e.g. weather patterns, sea level, water supplies) and 33 % were related to ecosystem changes (e.g. agroecosystems and vector-borne disease habitats) which posed increased risks to human health. The urban areas are largely affected than rural areas because of the behavioural change associated habitat transformation. Deaths from heat waves and extreme weather events (flood associated calamities) were found to be higher (27%) in the northern, northeastern and northwestern parts of India and largely associated with water-borne diseases. Cholera incidence was sporadically noticed higher and increasingly associated with floods and also with famine than any other diseases of epidemiological perspective. Changes in both seasonal and daily temperature and humidity increased the concentration of airborne materials in major cities like Delhi, Calcutta, Bombay and Madras and thereby increased the incidence of airborne respiratory diseases 11% higher and mostly the diseases like bronchitis and asthma when compared to the earlier decades. The diseases such as Malaria, Cholera and Tuberculosis have become drug-resistant and most of the cases reported clearly indicated the ongoing spread of drug-resistant malarial strains and this would likely to make the situation worse than current expectations. The outbreak of Dengue in Delhi and sporadically in some parts of India added evidences that the Dengue fever tend to reveal its ability to respond to changing conditions. Recent warming helped spark an outbreak of dengue that burned through Delhi in last summer. The outbreak of Cholera in various parts of India stressed the condition between the warming waters of the Indian ocean in relation to health and climate change explaining the association between the incidence of Cholera and rising water temperature. In general, the diseases such as Malaria, lymphatic filariasis, Dengue and Cholera reported in India have established the association between larger global environmental change and changing spatial distribution pattern of infectious and vector-borne diseases. Climate change thus appeared to have played a role in India's recent outbreak of infectious and vector-borne diseases of many types.

## **Disease Control-Human Migration-Environment Interactions: An Assessment of the Impacts of Trypanosomosis Control**

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### **Keywords**

disease control, environment, impact assessment, migration

While the demand for meat and milk products is expected to decline in the industrialized countries, in Africa, this demand is expected to triple by the year 2020 (World Development, 1997). There presents, therefore, a challenge to researchers and policy makers to respond to the need for livestock and crop products in Sub-Sahara Africa where 47% of the world's poor live. The International Livestock Research Institute (ILRI), has been involved in research geared towards reducing the risk of livestock production to improve the lives of the poor in Africa for many years. One such activity involves looking for strategies to reduce the risk of trypanosomosis (animal sleeping sickness), which affects an area of about 10,000 km<sup>2</sup>, 28.6 million people, 45.6 million livestock and 247.6 million livelihoods. In addition to looking for viable strategies to reduce the disease, ILRI has been conducting an impact assessment study to investigate the effects of controlling this disease on human welfare and the environment.

One consequence of trypanosomosis control is immigration of people into areas where trypanosomosis has been controlled to take advantage of the reduced costs of agricultural production. Net immigration will occur into these areas if the expected earning potential of these areas is higher than that of the immigrants' original place of residence. Migration literature shows that immigrants are likely to use natural resources in their new homes more aggressively than the indigenous population. This creates concern for the biodiversity of plant and animal species and, hence, the sustainability of agricultural production in these areas. Reid (1995) has shown that as human use intensifies there are tremendous impacts on birds, large mammals and tree species. While humans cause these changes to the environment, they also find ways to mitigate the consequences of their activities by adopting sound soil conservation and land management technologies as well as livestock management strategies. This is likely to create a balance between current agricultural production to provide food and a stable livelihood for millions of people, and sustaining the natural resource base on which the livelihoods of future generations are based.

This paper explores disease control-human migration-environment interactions, drawing lessons from Ghibe Valley Ethiopia where ILRI has been conducting tsetse and trypanosomosis control research for over ten years. Spatial and econometric analyses of household and community level data are used to quantify these relationships.

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## HEALTH RISKS FROM AIRBORNE PARTICULATE MATTER IN MEGACITIES OF INDIA: UNCERTAINTIES AND THE HAZARDS OF EXTRAPOLATION

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India, urban air pollution, health risks

Indian megacities are among the most polluted in the world, with air concentrations of a number of air pollutants much higher than WHO recommended levels. It is quite clear that air pollution poses enormous health risks to the residents of these cities. Despite the magnitude and urgency of this issue, scientific understanding of health risks from air pollution in Indian cities is poor. Lack of adequate data on sources, sparse measurements of pollutant concentrations, and paucity of epidemiological research have all contributed to this situation. Consequently, there is a lack of studies that attempt to systematically evaluate health risks in Indian cities. The few notable exceptions that do such analyses, boldly extrapolate from studies performed in industrialized countries without paying adequate attention to the hazards inherent in such calculations. In this paper, we provide a characterization of the uncertainties in the calculation of health risks in Indian cities using particulate matter as a case study, and provide cautionary lessons for performing and using health risk calculations.



## ASSESSMENT OF RISK OF THYROID CANCER DEVELOPMENT IN DIFFERENT GROUPS OF POPULATION AFFECTED AFTER THE CHERNOBYL ACCIDENT

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### **Keywords**

thyroid cancer, radiation risk, chernobyl accident

This study was based on a data of national statistic reports of three countries (Ukraine, Belaruss, and Russian Federation) as well as publications about collective and average per capita doses in the population of regions adjacent to Chernobyl. 12 large regions of these countries were under the study: Cherkassy, Chernigov, Kiev, Vinnitsa, Zhytomir regions and Kiev city belong to the Ukraine; Gomel, Mogilev regions belong to Belaruss; Bryansk, Kaluga, Orel, Tula regions belong to Russian Federation. They account more than 17 millions of population.

In all analysed territories there were registered increase of thyroid cancer incidence rate, especially in children and adolescents. In the last time period most significant increase was registered in 10-14 and 15-19 age groups. In adult population there were increase of incidence rate in relatively younger group, and latent period was more prolonged.

Appearance of first radiogenic thyroid cancer cases was revealed in 1990. Their quantity increases permanently. Because of different collective population dose burden there were observed different increase of thyroid cancer incidence rate in analysed territories. Territorial variation of this pathology was increased, and ratio max/min, coefficient of variation were increased as well.

The most pronounced increase of thyroid cancer incidence is in Belarussian regions.

There was discovered statistically significant correlation between average per capita thyroid dose and thyroid cancer incidence rates in these regions in 1993-1996. Regression model "dose-effect" was constructed on this basis and it shows increase of thyroid cancer incidence rate in 3.17 per 10<sup>4</sup> at increase of dose in 1 Gy.

Using EPICURE software excess absolute risk (EAR) was estimated as 2.4 per 10<sup>4</sup> PY-Gy (95% CI 1.9 - 2.8), excess relative risk (ERR) - as 5.1 per 1 Gy (95% CI 3.8 - 6.3).

## **Transdisciplinary Land Use & Land Cover Change Analysis by Syndromes**

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Global Environmental Change (GEC) in general, land use & cover change (LUCC) in particular offers a very complex bundle of issues not to be addressed by socio-economic research alone. Interdisciplinary knowledge, including natural science information & methods, is inevitable. Experience shows this to be quite difficult, especially as problems of integrating different "languages", methods & problem definition occur. The so-called "Syndrome approach", proposed by the German Advisory Council for Global Environmental Change (WBGU) and propelled by the QUESTIONS core project at PIK, is an effort to deal with complexity in an interdisciplinary way, using system analytical tools (like Fuzzy Logic or Qualitative Differential Equations), expert knowledge & Geographic Information Systems (GIS) in order to get a qualitative overview, a phenomenologically striking & analytically valid picture of GEC & LUCC. The main characteristics of the Syndrome approach are: (1) Transdisciplinarity; (2) integration of multiple (qualitative and quantitative) data & information (esp. expert knowledge); (3) pattern analysis of LUCC, focusing the human-nature-interface; (4) openness to correction and improvement at the symptom and mechanism level; (5) modelling our knowledge of LUCC, not LUCC "itself" in a detailed manner; (6) orientation towards policy options for mitigating or combating syndromes (interface to Sustainable Development).

The main features & first results of the approach are outlined by referring to the SAHEL-Syndrome as an example. This pattern addresses the issue of overuse of marginal production sites by poor rural people (or people threatened by impoverishment) under additional pressure by policy failures in many developing countries. The key concepts of the approach are illustrated, as network of interrelations (expert knowledge based reconstruction of the human-nature-interactions characteristic for the syndrome), syndrome intensity measurement (detection of the basic mechanism by using global data sets), or disposition space (geographic identification of the possibility space specific to the SAHEL syndrome).

The final part of the presentation will address the procedural aspects of syndrome research, characterizing it as a quasi hermeneutic circle beginning with rather intuitively postulated mechanisms, development of indicators for measurement, case study & expert knowledge comparisons, again leading to an improved hypothesis about the detailed mechanisms and regional manifestations of poverty driven agricultural land use changes in marginal areas. This leads to a research strategy that heavily depends upon qualitative integrated assessment tools and a cooperative or network like structure of expert interaction.

## **New Tools for Transdisciplinary Research in Land Use and Land Cover Change**

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There is a growing awareness that the integration and generalization of regional or local case studies can supply significant new information for the analysis of Global Change in general and land use and cover change in particular. Yet the question arises whether there is a formal method for this generalization or at least for an ex post validation of an inductively formulated aggregation. The method should be able to include the vague, uncertain and incomplete information extant in the analysis of Global Change phenomena.

In this paper we will present a new approach to this problem based on the theory of qualitative differential equations or qualitative simulation (QSIM). Within this approach it is possible to consider, speaking mathematically, entire classes of differential equations, i.e. naturally generalized cause-effect schemes purely defined in terms of monotones, signs and corresponding values. The theory provides a well-based method to calculate the possible time-developments - there is always an entire set of solutions - compatible with the ubiquitous wiring diagrams of boxes and arrows, representing mental maps of causes and effects. If the conceptions used to formulate these mental maps are general enough to be applicable for different phenomena from different case studies, the diagrams for the various case studies can be compared and subsumed into a general frame. This frame can be viewed to be representative for an entire class of local or regional case studies, if the corresponding qualitative time developments computed by QSIM coincide with the various observations of qualitative trajectories from the case studies. This representative cause-effect mechanism, which might be called a model, can then be used to obtain a weak prognosis of possible future pathways of the various regions included.

The approach will be illustrated for the well-known degradation-impoverishment spiral which is one major causal pattern of land use and land cover change in the developing world. As a basis we have made use of a number of case studies from all over the world, which have been interpreted in terms of a catalogue of so-called symptoms of Global Change formulated as an aggregated language by the German Advisory Council on Global Change (WBGU) and the QUESTIONS core project at PIK. Based on a number of case studies a general cause-effect pattern is suggested which is then checked to be valid with regard to the reconstruction of the observed time developments. Together with a global assessment of the sensitivity of the spiral processes towards climate change the model is used to identify some hotspots of poverty induced soil degradation.

## **Trajectories of Regional Land Use Changes - Integrating Qualitative Information in Global Change Research**

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Comparisons of regions and regional case studies are an important issue for land use and land cover change (LUCC) research. At the same time it turns out to be very difficult to define criteria for comparisons that are necessary for obtaining globally valid results. Most regional studies, often carried out by social scientists and geographers, use very different approaches, focus upon different problems and levels of aggregation. Furthermore their descriptions are full of qualitative information that are very important for GEC and LUCC research but rarely applicable in integrated assessments recurring mainly on quantitative data. Based upon a comparison of nine environments threatened by human action and use - documented in the volume "Regions at Risk" - a new approach in comparing regional environments and their dominant human usage is presented. Its main focus is (a) upon the identification of major LUCC related environmental states and trends, (b) their interlinkage to natural science research, and (c) the social groups involved and social mechanisms behind these critical interactions. The paper will discuss the ways in which trajectories of change can be derived especially from qualitative information, how they can be interpreted in terms of environmental criticality and it outlines possible ways how these trajectories could be integrated in globally relevant models of regional human-nature-interactions.

## **FROM CATTLE TO SEED BEANS - WHO BENEFITS FROM LAND USE CHANGE AND CHANGING INSTITUTIONS IN RESOURCE ADMINISTRATION IN NORTHERN TANZANIA ?**

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### **Keywords**

land use change, political reform, pastoralism, resource management institutions  
semi-arid Africa

In 1979 a Tanzanian-Dutch joint-venture open a several hundred ha farm for the production of seed beans in the semi-arid Maasaisteppe in Northern Tanzania. This innovation in land use attracted many new investors from the urban elite as well as from elite local Maasai. The main cost for establishing the farms, i.e. clearing the savannah woodland, was done cheaply by seasonal migrants to the area, that were producing charcoal for an increasing urban market.

Land use change from pastoralism to mechanised farming was accelerated in the early 90s by :

- \* economic liberalisation that facilitated acquisition of land titles.
- \* a tremendous loss in purchasing power from salaries due to inflation and government spending cuts that resulted in lower demands for meat in the cities. A fall in meat prices resulted in higher incentives for the pastoral Maasai to start farming;
- \* a breakdown of de facto power of village governments as a result of political reforms and cuts in government spending.

The contribution will show how political and economic reforms intentionally or unwillingly produced incentives for different groups of people to become engaged in mechanised farming in a area that is crucial for the survival of Tarangire National Park.

A second focus of the contribution will be on the changes in the functioning of traditional and state's institutions for the administration of natural resources that accompanied land use change. Today the traditional Maasai institutions still function in the administration of water and grazing resources. But farmers, the district administration and aid agencies are not aware of how these institutions function and who are the members of the traditional administration. The establishment of elected 'village councils' resulted in the formation of an 'information elite' and facilitated the abuse of power.

These are the reasons behind an increasing number of conflicts about natural resources in the area and within the local Maasai society. Our project recommends the establishment of moderated round-tables on resource use on village level. These meeting should facilitate learning of the user groups about each other and set up better control of elected bodies. Later village by-laws might be passed that all users can agree on.

## Environmental Desertification in Argentine Patagonia Social dimension of use and soil cover

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### Keywords

desertification, use of the soil, soil cover, social-environmental pattern, Patagonia

In the Argentine Patagonian region (800.000 square kilometres) the increasing desertification is considered the main evident environmental problem for reasons of physical extension (94 % of the total surface presents some risk of desertification; 28 % from light to moderate and 72 % from moderate to very severe status) and for the serious social and economic conditions which result in the loss of habitats and population isolation. Said situation basically is related with either the decrease or the destruction of the biological potential production of the livestock agroecosystem by natural and anthropic causes. There exists multidisciplinary consensus about a system of complex causalities that attributes the "making and provoking deserts" which accelerates itself to the extensive practices of sheep raising, historically non "sustaining" for the managing of sheep cattle. It is considered that latter is a consequence of lack of real potential productive knowledge of basic natural resources since the end of the XIX century and the first twenty years of this century. To this we have to add an overappraisal of the pastures receptivity which is expressed both in land prices and animal overloading in the grazing lands. The balance reveals an economic rent for medium and small enterprises approaching to zero since 1950. In which year the stock of sheep was in its highest level with 20 millions of heads of sheep. Currently, there are 12.000 cattle enterprises whose rent depend on a stock of 5 millions of heads of cattle. In addition, more than 90 % of the exploitations are under the "economic environmental unit", which is about 6.000 heads of sheep. Up to date have been carried out different studies which are technically and scientifically rigorous about the biophysical grounds of desertification related with factors and conditions as well as their most evidence revelation, particularly the eolic and hydric erosion process on soil as the vegetal covering has disappeared. All is relay through techniques of satellite images of digital analysis. On the contrary, the studies about how the actors and agents and other anthropic components, participate and are involved in the desertification, through the detection of a set of significant social variables as well as they express different levels of use and cover of the soil, has been neglected theoretically and methodologically.

The present study analyses the social spatiality of environmental desertification in that Argentine region in the context of an integrated project named "Integrative methodology of the social dimension for the research of desertification in Patagonia. Design and Application. 1998-2000", Secretary of Science and Technology in the University of Buenos Aires. The study of the social spatiality is considered emerging from the articulation between the use of soil from "behaviors" and different "rationalities" of individual and institutional actors and the "social-environmental" concept which takes into account the use of soil as spatial pattern expressing the social relations of production.

## A STUDY OF DROUGHT AND LAND DEGRADATION IMPACT ON BIOPHYSICAL AND SOCIO-ECONOMIC ENVIRONMENT IN KARONGA CENTRE, KARONGA MALAWI

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Recent years have witnessed increasing interest in the conservation, protection and utilization of land resources and attention has been directed to the need for environmental monitoring programmes. These programmes are important in order to establish a baseline against which to evaluate future changes; provide a synoptic view of contemporary environmental conditions; detect current changes and afford a basis for predicting future trends. Thus a monitoring programme often starts with an inventory and remote sensing studies that follow concentrate on mapping the changes over time. These environmental monitoring studies have increasingly become critical in developing countries, Malawi not an exception, due to wide spread symptoms of land resources degradation. Land degradation inevitably jeopardizes sustainable livelihoods.

The central objective of the study was to investigate the drought and land degradation problems in Karonga ADD by focusing on their impacts on the biophysical and socio-economic environment. In particular, the research study determined land use change and management from the 1970s to date, the extent and impact of soil erosion and deforestation, long term trends and drought frequency, rainfall reliability and distribution and effects on crop production, and also investigated locally initiated or indigenous knowledge systems for survival.

### METHODOLOGY

Based on the analysis of spatial changes in land use patterns, through aerial photo and satellite images interpretation, this study highlights the importance of location specific studies on the understanding of land degradation processes. Land cover change analysis was done on the 1972, 1990 and 1995 aerial photographs of scale 1:25,000. Photograph elements of tone, texture and pattern were used to delineate land use types. Satellite images covering the study area for period 1984 and 1994, path 169/row 67-68 and path 169/row 067 respectively were used. Landsat Thematic Mapper (TM) bands 2, 3 and 4 were used to get the visual impression of the land cover change that occurred between the two periods which support the statistics generated by aerial photo interpretation. The assessment of soil erosion and sedimentation was based on the Soil Loss Estimation Model for Southern Africa (SLEMSA), using the Land Resources Evaluation project (LREP) classification of soil types, average slope from topographical maps and the rainfall intensity data from Karonga Airport meteorological station in the area.

Pentade analysis was used to determine the interannual climatic variability. Thus long term trends and drought frequency, rainfall reliability and distribution and their effects on crop production were investigated.

Finally an investigation of locally initiated or indigenous knowledge systems for survival strategies was undertaken through Participatory Rural Appraisal approach and execution of a household farming system survey.

### RESULTS

The value of remote sensing in this study has lain in the identification of 'hot spot' areas. In general within the period of analysis, i.e. 1972 - 1990 - 1995, there is significant change in land use cover over the area. The study shows a significant increase in the area under woodland (43%), notable in the upper and middle slopes of Nyika ranges. This is an area which had been converted from customary land into public land as buffer zone for the Nyika National Park. There is notable increase (12%) in rainfed cultivation. The increase in rainfed cultivation corresponds to the significant decline in a dry grassland/scrub (57%). Most of the greener areas on the 1984 satellite image turned brownish and bluish green in the 1994 image, a clear indication of the ground being bare or cultivated fields. The changes in the size of Mlare and Chiwondo lagoons on the two images signifies that a significant amount of sedimentation is taking place in the area. The estimated soil loss for the three physiographic scenarios, ranging from over 60 to above 270 tonnes per hectare per year, is very high.

### DISCUSSION

The extent of land cover change and the high amount of estimated soil loss could be an expression of the varied interrelationships of large number of physical, economic and social factors working over a period of time. Pentade analysis results indicate that the area is arid or semi-arid. It can to some extent be a valid argument that drought initiates the land degradation rampart in the area. In the wake of frequent experiences of drought as indicated by 63% of the respondents that the area has suffered twenty one times since 1964, it is no wonder that the community response has been to utilize available natural resources to cope with the natural hazards. Furthermore, the excessive human and livestock population pressure in association with inappropriate agricultural extension messages also lend to an explanation for widespread symptoms of land degradation. The local people themselves are aware of the prevalence of land degradation. Over 50% of the respondents indicated that their villages land were showing visible signs, such as declining production, occurrence of numerous rills and gullies, and destruction of gardens by floods. Field observation by researchers revealed that rivers have no defined channels in the plain with resultant extensive flooding.

### RESEARCH AGENDA

The farming system household survey revealed a lot of constraints to sustainable land resource management that in a way propel local people to exploit the available natural resources for survival. However, the survey results do not establish the criticality of specific factors in the land degradation process in the area. It is in such direction that research need to be further undertaken into the causal linkages of the degradation problem.

## DRIVING FORCES OF THE AGENTS ACTIVITIES AND ENVIRONMENTAL CHANGE ILLUSTRATED BY MEXICAN MANAGERS AND PEASANTS

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### **Keywords**

Linkages between driving forces, proximate causes and environmental change, values, attitudes and behaviour

This paper is divided into three parts and reflects the results of two investigations of the human dimensions of environmental change: a) a review of three different groups of peasants, and b) a group of executive managers within the Mexican industrial sector.

The first part discusses several theoretical approaches (neoclassical economy, psycho-sociology) which help to describe the forces which drive the proximate causes (agents activities) of environmental change.

Based on that theoretical framework, the paper in the second part suggests that the agents activities and environmental change they provoke are driven by a specific set of factors which operate in different scales, that is:

- a) environmental and demographic factors (environmental conditions and changes, demographic dynamics);
- b) socio-economical and political driving forces (world and national commodity markets; public social, economical and environmental policy; power relations; national and local institutions);
- c) the social values and attitudes of the agents (the "cognitive", "affective" and "conative" components of the attitudes<sup>1</sup>), and last but not least;
- d) the structure of the production unit itself (size, applied technology, production system and environmental performance).

The third part of the paper describes the results obtained through the application of the set of factors mentioned above to the analysis of representative groups of two Mexican economic sectors: agricultural and industrial. The first one is focused on target groups of small scale peasants in the states of Tlaxcala and Michoacán as well as large scale farmers of Guanajuato-state; the second deals with industrial textile managers of Mexico-City.

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1 The first component (cognitive) refers to the knowledge of the environmental change; the second (affective), to the emotional response to the environmental change as well as to the actions undertaken in order to manage it; the third (conative), to the willingness to do something for the improvement of the environment.



## ETHNIC MINORITIES AND ENVIRONMENT IN VIETNAM

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### **Keywords**

ethnic minority, shifting cultivation, fixed cultivation and sedentarization, environment

Decrease of forest cover is one of the most important factors of environmental change in Vietnam. In this context the ethnic minority groups play crucial role as their life depends very much on forest land and forest products. Particularly, 52 among 53 ethnic minority groups in Vietnam still practice shifting cultivation that lead to great environmental consequences as big damage of watershed forest, high frequency and power of floods, strong soil erosion and decrease of biodiversity... Since late 1960s vietnamese government has tried to change ethnic minority lifestyle and improve their living conditions to decrease their pressure on forest by big campaign for fixed cultivation and sedentarization. But the success is still limited. The number of people practicing shifting cultivation has increased from 2 millions in the mid of 1970s (after country unification ) to more than 3 millions in 1995. In this report, we would like to highlight some lessons from these experiences both positive and negative and try to show main directions in improving situation, taking into account socio-economic and cultural characteristics of the ethnic minorities. It is necessary not only for forest and environmental protection in Vietnam but also for eliminating hunger and poverty to contribute to achieving sustainable development in the country.

## **Citizen Participation in Risk Ranking A Multiple Perspective Method**

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### **Keywords**

participation, perception, decision-making, risk management

Societies often face more risks than they can manage effectively, or even understand well. In such cases, they need to decide what is worth worrying about, lest their resources be dispersed ineffectively. For several years, we have been developing a method for allowing ordinary citizens to participate in setting priorities, even when the risks are highly technical. It builds on research results in risk analysis, communication and evaluation, as well as the practical experience in citizen participation. It summarizes risks in a standardized format, intended to capture magnitudes of those aspects of risk that might concern citizens, while enhancing their mental models of the processes creating and controlling those risks. It uses a combination of group and individual elicitation process, intended to help participants articulate their own values, while understanding the social construction of risks. It offers several ways of characterizing the kinds of agreement that are possible. It is designed to be readily adapted to local circumstances. Both the general method and some empirical results will be presented.

## **ANALYZING MODES OF CONSUMPTION AND CHANGE OPTIONS - THE CASE OF FOOD AND AGRICULTURE IN A PROCESS CHAINS PERSPECTIVE**

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### **Keywords**

consumption patterns, process chains approach, food and agriculture subsystem

Beside other sectors, like energy, mobility etc., the food supply sector is an essential functional subsystem of society with very important effects on the climate system. Effects are due to land use changes, irrigation measures, and emission of gases which influence the radiation balance of the climate system. In our approach, we try to analyze in detail the whole supply system, driven by demand patterns of human diet, with respect to emissions of greenhouse gases. Aims of these efforts are:

- \* Determining the orders of magnitude the sectors are responsible for in causing greenhouse gas emissions (e.g. for the supply system of a nation);
- \* Identifying those components in the sectors being the most relevant sources for emissions;
- \* Identifying options which are worth to be implemented in order to minimize effects on the climate system.

As distinct from approaches using input-output-methodology to identify the effects of certain demand patterns we apply the so-called process chains approach and a related computer-based tool "GEMIS". In that approach, the supply sectors are represented by networks of small (prototypically described) input-output systems in which material is modified, energy is mobilized, a change of location is realized and primary production is taking place. Starting with a certain demand pattern, e.g. the food supply for the people of a city, the networks are passed through until primary production is reached (cultivation of plants, mining activities). Side-streams represent needed energy and the delivery of production factors (like gasoline or nutrients). Emissions are calculated wherever they occur in the networks and are summed up into an overall emissions account.

Our preliminary analyses of the German food and agricultural system show some important results relevant for lifestyle discussion and the description of alternative developmental paths. First of all, and this not a new insight at all, extremely wide differences exist with respect to greenhouse gas emissions in considering different compositions of human diet. Secondly, the consumers activities like shopping, preparation of meals etc., are responsible for a great deal of the entire emissions. And thirdly, options do already exist which could provide considerable potentials for reducing greenhouse gas emissions in the food and agricultural sectors. Examples are changes in agricultural cultivation and animal breeding modes as well as decreasing or increasing portions of "convenience products" in human consumption.

## Human Dimensions of Long Term Ecological Research on Agroecosystems

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An integrated model of agricultural and natural resource ecosystems requires a multidisciplinary systems approach which studies the points of interaction between natural and social systems. Key points of integration within various natural and social ecosystems include chemical, biological, geomorphological, and human dimensions. Human dimensions are characterized by basic components of a social system: a) demographic---population size, distribution, growth, migration; b) economic---composition of markets, patterns of economic activity, shifts in labor market, changing bases of capital; c) cultural---norms, values, attitudes, knowledge and information which define the "lens" through which people view ecosystems; and d) social structure and relations---patterns of interaction and relationships, social organizational networks, institutional structure (interrelationship of political, economic, legal, and social institutions), patterns of ownership, power structures, and intersections of inequality. Both natural and social systems have histories and the essence of long term ecological research is to mark changes in agricultural and natural ecosystems. Human dimensions that have long term impacts on these ecosystems are explored at both a micro and a macro level.

At the micro level, the understandings that farmers have of agro-ecological processes are related to their management of land. The farmer is seen as embodying: 1) the imperatives of culture of the local community, 2) the incentive structure established by agricultural institutions, and 3) the constraints imposed by the social organization of agriculture. These factors from the levels of the social system above the farm impact the agroecosystem through the farm operator's decision-making about the farm.

At the macro level, we explore how historical patterns of global environmental change in agricultural and natural resources are impacted by long term transformations in the complex interactions among demographic, economic, socio-cultural, and legal changes and the environment. Changes in property rights, worldviews that consider resources as unlimited, and short-term economic logic produce adverse impacts on the ecosystem. Sustainability requires the emergence of conservation ethics that follow a longer term economic logic, which asserts the rights of whole communities to take responsibility over the environment. Shifting social trends interact with each other and with changes in landscape and land use, water quality, and natural resource issues. The result are increasing conflicts and debates over public or private control over the environment, its resources, and their development and management. These complex interactions are approached in a set of conceptual models defining the human dimensional impacts on global environmental change and key points of integration between natural and social systems.

## NEW GLOBAL CIVILIZATION AND ENVIRONMENTAL EDUCATION

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### Keywords

global civilization, sustainable society, environmental education, eco-consciousness, and ecological thinking

The world is beset with a multitude of problems emanated from direct interaction of man, nature and man-made environment. Consequently, the rampant and injudicious use of resources continues and natural resources have been continuously depleting, thereby causing their abject deterioration and degradation, which has awakened the contemporary society to the danger of imminent ecological disaster. This phenomenon has led to the emergence of numerous global problems such as climate change, depletion of ozone layer, population growth, transboundary pollution, waste disposal, acid rain, deforestation and devegetation, loss of biodiversity, environmental deterioration and so forth. These problems are quite different from the conventional ones and needs to be coped cautiously without hampering the momentum of growing scientific advancement and human resource development. This appeal warrants a new perspective in our lifestyle, norm and values, coupled with the development of appropriate social and economic structures. Taking this backdrop into consideration, this paper has been designed as the title implies to explain the meaning of a new global civilization in the first part and then it attempts to suggest new ways to achieve a sustainable society in the second part.

In the paper, the term "new global civilization" is conceived as a dynamic society based on equity, where the principal aim is to achieve sustainability in the future. This civilization embodies principles of recycling approach, maintaining social carrying capacity and development of environmentally friendly technologies. In other words, this civilization will be a global environment-concern age, where social values and norms need to be redefined and new social and economic structures are developed in the wake of emerging changes of patterns in the society. The paper argues that sustainability is possible only after when we are able to modify human knowledge, attitudes and behaviors.

Achieving this civilization will not be an easy job but is possible when we strategically plan to change knowledge, attitude and practices of people to adapt to the rapidly changing society. So the second part of the paper suggests that the changes are possible only when we gear our educational system to suit the needs of this new civilization, which means we need to make a big shift on our existing paradigm of education. The major paradigm shift should be geared toward a substantial change in personal responsibility for environment and concept of stewardship. The paper argues that environmental education is not just saving 'the sum total' but saving 'the whole' with its wonders and melange of beauty and instilling in people a sense of protecting mother Earth. This is what has been commonly called the development of ecological thinking (or environmental ethics). The paper suggests four strategic areas where environmental education needs to stress emphasis in the future. These areas are (1) fostering eco-consciousness, (2) promoting the concept of "education in (from), about and for the environment", (3) enhancing the notion of "perceive newly, think globally, act locally" and (4) developing environmentally responsible family.

## Quality Assessment in Modelling Human-Environment Interactions

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The problem of quality assessment of models is well known, and is particularly acute in the domain of human-environment interactions. In such domains the pitfalls are everywhere dense and it is often difficult to problematize the introduction of assumptions into the model and to relate them back to the actual systems being modelled. Maintenance of quality in such domains requires use of heuristics that encourage self-evaluation of methods and reflexivity on pitfalls. There is no simple solution, as both the production and application of models are too variable and complex to permit of uniform, routine grading. Yet the practice of human-environment modelling would definitely be aided by some system of partly standardized information, whereby a general idea of a model's capabilities, strengths and weaknesses could be conveyed. We have devised a checklist for this function, which is designed for use as a sort of elicitation by competent practitioners, to give form to their own judgements about the models they know intuitively. The checklist we present provides for a plurality of sets of diagnostics, each corresponding to a named intended function, application, or client. Results are presented from use of the checklist in a variety of human-environment modelling domains.

## Urbanisation in the Pacific: Resources, Security and Adaptations

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### Keywords

urbanisation, vulnerability, environment and security, institutions

In the 1996/97 World Resources Institute (WRI) Report, it was observed that "The world is in the midst of a massive urban transition unlike that of any other time in history". The report predicts that within a decade, 3.3 billion people will live in urban places and that by 2025 almost two thirds of the world's population, close to 5 billion people, will be urban dwellers. What is significant also is that most of the growth in urban population will occur in the developing world.

For developing countries the process of rapid urbanisation and industrialisation places enormous stress on urban infrastructure, human well being, cultural integrity and socio-economic arrangements. Urbanisation also exerts tremendous stress on the hinterlands of cities, imposing what Rees has called 'ecological footprints' which are far larger than the cities themselves. Pirages (1997) observed: "Cities in the less industrialised countries are giant resource sinks, creating a large 'ecological footprint' on the surrounding countryside. Large quantities of food are imported to sustain ever-increasing numbers of urbanites. But growing cities also need tremendous amounts of water for drinking and sewage treatment; water which is often not available".

The pressures vary from place to place. To date, most of attention has been focused on the world's mega cities - Sao Paolo, Mexico City, Calcutta, Jakarta and several others that promise to expand beyond 10 million in the near future. These cities face the prospect of inadequate infrastructure, serious declines in environmental quality, impacts on human health, and widespread ecological destruction in their hinterlands. The cities of the Pacific Islands are far less dramatic in their size and indeed the populations of entire island nations are magnitudes smaller than those of the mega cities in other developing nations. However, very similar urbanisation processes are occurring and while the populations are smaller, the rates of urbanisation and the population densities in some urban settlements rival those of Asia. Over the period 1990-95, for example, Papua New Guinea had an urban growth rate of 3.6 per cent, while in the Solomons the rate was 6.5 per cent. Like other cities globally, those in the South Pacific are experiencing a rise in social tensions evident from increases in suicide rates, crime rates, domestic violence, and unemployment. There are also ecological vulnerabilities which exist because of limited freshwater supplies, fragile natural environments, and problems of waste disposal.

In this paper we will examine the global and local drivers of urbanisation in the South Pacific. These include the structural transformation of Pacific economies, characterised by a decrease in subsistence activities, a changing balance in the relative economic earnings of agriculture and urban sectors, increases in tourism and light industry, expansion of the public sector, increases in foreign investment and control, and changing patterns of foreign aid and remittances. Of significance also are demographic transformations in South Pacific, particularly patterns of rural-urban migration, immigration and natural population increases. We then consider the implications of rapid urbanisation for resource use and environmental quality in Pacific Island nations. Water and energy resources are of concern, as are the implications of urban expansion for land resources in these small island states. There are significant concerns also for environmental quality, particularly as a consequence of waste disposal. In the third part of the paper, we consider regional and local responses that may be effective in increasing the resilience of urban settlements in the Pacific. Although geographic isolation, fragile environments and small populations of these countries all contribute to their vulnerability, the paper will explore the factors specific to place which provide opportunities for increased resilience, given current human and physical global change processes.

## **Infrastructure, Ecostructure and Human Security**

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### **Keywords**

human security; environment and security; infrastructure

The concept of "human security" often has been presented with reference to changing notions of security and development. In both of the latter cases, conceptual change has been driven in large measure by recognition of the importance of unconventional factors such as environmental degradation and scarcity, and by appreciation of the benefits to be derived from a more holistic or comprehensive approach for both analysis and policy making. From this perspective, human security--which assumes a broad and holistic approach to identifying, assessing and addressing the principal sources of vulnerability and insecurity experienced by individuals and groups in the late twentieth century--may be said to bridge new thinking in the fields of security and development. At the same time, the concept of human security offers new insights into contemporary world affairs and the major challenges facing humankind today.

This paper presents an interdisciplinary framework for understanding the concept of human security. Such a framework helps to clarify the complex linkages within and between social systems or infrastructures (notably states, markets and human rights) and ecosystems or ecostructures (such as water basins and climate systems). The utility of this approach is assessed and illustrated with reference to the various sources of insecurity faced by coastal communities in the Pacific Basin. Limitations of this approach are also examined.



## CRIME VERSUS ENVIRONMENTAL SECURITY IN RUSSIA

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### Keywords

environmental security, natural resources, environmental institutions

A great deal of attention in the West has been paid recently to the threat of the organised crime in Russia. Its impacts on environmental security are shown in such forms as cross-border trafficking of drugs, of radioactive materials, and of endangered species of flora and fauna, illegal fishing, large-scale poaching, wastes disposal, etc. These are ecological violations that are quite traditional, and they have been widely analysed before. However, organised crime is only a fraction in the vast process of criminalisation in Russia. Corruption, and particularly, a shadow economy, are playing much higher role in this country. The major reason is in their influence on all spheres of societal organisation, and on its major institutions. An important question is how and to what extent the criminalisation in these forms has affected the environmental sphere. Analysis indicated that, unfortunately, it has a serious impact both on the national environmental security in Russia, and on international environmental security and it has even more significant negative environmental effects.

New dimension of the environmental security problem is shaping nowadays in Russia. Currently, this country is highly dependent on development and exports of natural resources, and criminal forms of control over natural resources are rapidly spreading (mining activities without licenses, falsification of mining data, establishing of control over mineral reserves with illegal instruments, etc.). They result in natural resource plundering and their unsustainable development. Russia, which during a long period of time has been the world leader in mineral reserves, currently is spending these reserves rapidly; this trend is not accompanied by adequate exploration activities, and the country might even turn into net importer of minerals and oil. It would lead to the growing pressure on their world reserves.

Crime is affecting protection of the environment from pollution as well. New mechanisms and linkages emerged through which the criminalisation has destabilising effects on the entire national system of environmental protection (which has been thoroughly reorganised recently according to the Western standards). It results in weakening the control functions of the state in the environmental sphere. The peculiarity of the current situation is that the use of instruments of the shadow economy allows heavy polluters to block major environmental protection mechanisms.

Specific environmental threats to international community, and to the global environment emerged, originating under the impact of criminalisation in Russia. Development of the shadow economy affects negatively Russia's compliance with international environmental agreements. Among the external implications of a shadow economy is its distortive impact on reliability of national reporting to the UN FCCC, and of data to be used as a basis for functioning of the international GHGs emission trading market where Russia is supposed to be one of the leading sellers of carbon credit, and on calculation of the baseline within joint implementation projects.

It is important to identify and assess new threats emerging in this respect, and to outline possible strategies to counteract them. One of the important issues is to block particular environmental threats emerging as a result of criminalisation in Russia through possible joint actions of the West and Russia; however, it would be hampered by powerful interest groups in this country.

## **Regional Environmental Security: The Case of the Baltic**

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NATO expansion, having excluded the Baltic States, has drawn renewed attention to regional security questions around the Baltic region. Fundamentally, the debate centers on what constitutes security in the Baltic region and on what (or who) constitutes the region itself. The growing literature on Baltic regional security issues commonly is characterized by five overlapping themes: (1) political-military issues; (2) border definition, control and management; (3) economic issues associated with interdependence and transitions; (4) collective (regional and national) identity issues; and (5) environmental issues. The investigation reviews changing regional security contexts around the region, with special emphasis on environmental security, the fifth theme.

Following discussion of the changing contexts of the NATO expansion debates, we offer a typology of environmental security linkages to organize thinking and discussions about connections between environmental concerns and security issues. The next two sections focus examination on specific manifestations of environmental security discourse and policy around the Baltic Sea, highlighting Nordic input on these discussions as well as perspectives from the newly independent Baltic States. Next, we argue that the current redefinition of security around the emerging Baltic region implicitly and explicitly includes environmental considerations. Lastly, as scholars and policymakers at various levels explore environment and security linkages by trying to operationalize environmental security concepts, the regional level must not be neglected.

## SHAPING KNOWLEDGE, DEFINING COMMUNITY: GLOBAL ENVIRONMENTAL ASSESSMENT AS A COMMUNICATION PROCESS

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### **Keywords**

assessment, decision making, uncertainty, framing, communication

This paper explores the relationships among assessments, knowledge, and knowledge communities, including those who produce and those who interpret or use knowledge. Assessments have classically been viewed as reports or reviews that communicate information from scientists to policymakers. Here we develop an extended model of assessments as a dynamic, social process of communication among multiple producers and users. This view focuses attention on who is communicating, what is (or is not) communicated, and how the assessment process shapes the identities of the assessors and those who use or contribute to knowledge derived from assessments.

The first part of the paper considers the roles of assessments in framing and communicating information among scientists, policymakers and citizens in modern democracies. The concept of "framing," drawn from recent work in sociology, policy analysis and science studies, focuses on the processes of selecting and making sense of particular aspects of global environmental change from amongst the wide array of biophysical and social phenomena taking place at any given time. Any such selection not only singles out certain aspects of a problem for attention, but also connects them with explicit or implicit theories of how things happen (causation), what things matter (normativity), and how important they are (salience). Framing is thus related to the organization of knowledge that people have about the world in the light of their underlying judgments about the reliability and relevance of competing knowledge claims, their notions of agency and responsibility, and their attitudes toward key social values. We ask how the design and practice of assessments affect issue framing, and how that framing feeds back into creating new forms of knowledge about the environment.

The second part of the paper explores how viewing assessments as a social communication process alters the conventional understanding of participation in assessments and the importance of assessments to the growth and legitimation of new knowledge communities. Typically, assessors have assumed that the boundaries of relevant knowledge are known in advance and that the challenge lies mainly in overcoming gaps and uncertainties in knowledge. Work in science and technology studies suggests, by contrast, that the perceived adequacy of knowledge claims is closely tied to who participates in knowledge-making and what efforts are made to secure public trust in assessments. As new participants from scientific or non-scientific communities enter the debate, they may question previously unchallenged assumptions and methods, sometimes (as in the case of impact assessments or valuations of life) with considerable authority. Through processes of communication among scientific, policymaking, and lay communities, assessments may therefore bring to light areas of missing expertise not evident from the perspective of any specific participants in the process.

The final part of the paper addresses the institutionalization of the assessment process, with particular attention to the capacity of assessors, policymakers, and other groups to produce, validate, and authoritatively transmit information through assessments. The consequences of different institutional designs for the characteristics of the knowledge produced, and the trust of policy makers, scientists, and publics in the overall assessment process will be discussed.

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## CONSENSUS AND DISSENT IN GLOBAL ENVIRONMENTAL ASSESSMENTS

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### Keywords

assessment, consensus, dissent, uncertainty

Global environmental assessments (GEAs), as "bridges between science and policy," seek to integrate knowledge from multiple national, sectoral and disciplinary approaches in ways that are useful for the policy-making process. How are assessment processes structured to build consensus and deal with dissenting views about the state and interpretation of knowledge? What are the implications of the ways that assessments handle consensus and dissent for their influence on the policy and decision making process?

Based on findings from an international research project conducted over the last three years, we argue that most global environmental assessments - and many "local" assessments connecting global concerns with local decision making - have sought some form of consensus among the participants in the assessment process. However, there are a number of different interpretations of what is meant by 'consensus'. Some assessment processes have simply excluded topics from consideration on which consensus was unlikely to be achievable (eg. the absence of treatment of discontinuous changes in ocean circulation or ice sheets from many climate assessments). Others have negotiated consensual conclusions in the face of widely diverging judgements through expanding the range of possible values reported for key findings (eg. the wide range of global temperature change estimates associated with a "doubled CO<sub>2</sub>" emissions scenario). Still others - though this has been rare for global environmental assessments - have resorted to "minority reports." Finally, perhaps the most important factors shaping "consensus" and its implications in GEAs related to design decisions about who gets to participate in the assessments in the first place: which disciplines, which countries, which interests. The paper analyzes a wide range of assessment experiences to evaluate the prevalence and origins of these various approaches to the problems of consensus and dissent.

The paper goes on to suggest that the consequences of how assessments are structured to address consensus and dissent can be profound. These range from the cognitive disregard of potentially important - if contentious - scientific findings, through the political disregard of apparently contested assessments. It also explores circumstances in which dissent can be used to the benefit of the assessment. For instance, the Netherlands has nurtured the emergence of dissenters, since they keep public interest in an issue alive. The media pays attention to loud dissenters but then often asks other experts for their views. Consensus is not so newsworthy, so the dissent, if it is "kept under control", can be used to maintain public interest in an issue. Consensus about the process of an assessment can also be as important as consensus about the outcome.

While agreeing that the process of consensus-building can be important in creating a shared view of a problem (i.e. "buy in"), the paper concludes that not enough attention appears to have been given in GEAs to other possible approaches. For example, rather than a consensus-based lowest common denominator opinion on a scientific topic, expert elicitation could be used to show the range of opinions. Testing of multiple hypotheses, an approach with a long tradition in the science realm, would be another alternative approach.

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## LINKAGES ACROSS SCALES IN MANAGING GLOBAL ENVIRONMENTAL ISSUES: ASSESSMENTS AS INFORMATION AND DECISION SUPPORT SYSTEMS

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### Keywords

assessment, decision making, scale, information

The study and practice of environmental management and policy making increasingly recognize the importance of scale and cross-scale linkages and dynamics. Challenges arise from the facts that biophysical phenomena and the processes of human causation and response are intricately linked, but incompletely understood, and that the scales at which they manifest themselves are frequently mismatched. A number of disciplines have stressed the importance of scale in ecological, social and human-environment interactions, and have begun to investigate selected cross-scale processes. These linkages have proven to be complex, however, and few strong generalized propositions of assistance to management have emerged to date. There is also little understanding of the role that assessments do or can play in supporting effective policy-making and management of environmental phenomena that span different scales.

This paper raises five questions regarding cross-scale linkages in global environmental issues and how they are captured in assessments of those issues: 1) How does scale matter in the framing of global environmental issues and their assessment? 2) What does experience suggest have been the principal challenges and pitfalls involved in using assessments to provide cross-scale information and decision support to the management process? 3) Under what conditions do such cross-scale assessments matter most for management? 4) What forms of participation matter for effective cross-scale environmental assessment and decision-making? 5) How can assessment and decision processes addressing global environmental problems best capture and exploit scale-related comparative advantages?

The paper addresses these questions by drawing on new research results from comparative studies of the use of global change information by local scale decision makers in the agricultural, coastal management, and industrial communities. It also examines contemporary efforts to develop cross scale assessment systems in the context of the ongoing US National Assessment of Climate Change and Variability.

The following broad propositions emerge from this work as candidates for further discussion and investigation:

- \* Cross-scale interactions significantly shape the character and effectiveness of responses to global change issues, if not basic understanding of the issues themselves.
- \* Effective response requires coordination of decision-making across scales. Resources are managed locally; impacts are perceived and mediated locally; local decisions that affect mitigation, large-scale resources, or processes/ products with significant economies of scale or network externalities require coordination; decisions at one level can enhance or thwart the effectiveness of decisions at other levels.
- \* Decision-makers at different scales have different capabilities, perceptions and needs; decision authority, resources, and the provision of information should be tuned to these capabilities and needs, to exploit comparative advantages in the allocation of authority.
- \* Useful assessment of local impacts and responses requires a combination of local and global information, so information must flow between levels of assessment bodies, and provide information in forms that is useful to the potential user.

We conclude by arguing that systematic attention to cross-scale relationships and their systematic inclusion in assessment designs can and should improve environmental policy and decision making.

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## GLOBAL ENVIRONMENTAL ASSESSMENTS AS GENERAL INFORMATION INSTITUTIONS: THE ROLE OF INFORMATION IN INTERNATIONAL RELATIONS

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### Keywords

assessment, international, institution, information

This paper reflects our initial effort to delineate a set of research questions related to how states and nonstate actors use institutions as mechanisms to promote transparency and reduce uncertainty in international relations. Although our interest in these questions grows out of, and relates to, global environmental assessments (GEAs), our goal in exploring these questions is to make linkages with other arenas of international affairs such as security and arms control, trade and finance, and human rights. Information plays an important role in all these arenas and institutions play important roles in fostering the collection, analysis and dissemination of that information. Our goal is to distinguish how informational institutions differ from institutions primarily concerned with other tasks, to look for variation among informational institutions, and to explore the determinants of the demand for information, the supply of information, and the legitimacy of information in these institutional settings.

Global environmental assessments represent cases of a larger class of institutionalized processes whose primary functions involve the processing, transmission, and legitimization of information. Although many institutions focus primarily on allocating and redistributing resources, regulating behavior, or other political activities, we center our attention on what we call "general informational institutions" or GII's. The focus of GII's on developing, evaluating and legitimizing information and knowledge distinguishes them from those institutions focused primarily on distributional bargaining or regulation and enforcement.

To clarify our argument about the distinctive properties of GIIs, the paper briefly considers the broad range of international institutions and how they differ both in function and in instruments of influence. Differentiation in the function of international institutions also implies differentiation in the primary resources of influence at their disposal. Certainly information often plays an important role even outside GIIs, in institutions focused on bargaining or regulation and enforcement. However, other resources may prove more important in the effective performance of these functions. The paper considers both these different institutions and mechanisms of influence, and how information flows produced within GIIs may link to the functions of bargaining, regulation and enforcement.

We argue that GIIs constitute an important class of institutions deserving separate analytic attention from institutions that focus on bargaining, regulation and enforcement for two reasons. First, they perform a distinct function. Within GIIs, the generation and legitimization of information constitutes an important end in its own right, rather than simply a means of ascertaining whether given actors or behaviors conform to specified rules. Examples of institutions that are almost completely GIIs include the Intergovernmental Panel on Climate Change (IPCC) and the Convention on Long-Range Transboundary Air Pollution (LRTAP). Second, where GIIs are embedded in a broader institutional context, the generation and legitimization of information has consequential links to the other important functions of diverse international institutions. We argue that some features of the European Court of Justice (ECJ), the International Monetary Fund (IMF), and the World Trade Organization can be properly characterized as GIIs, and in these settings the information function links quite directly to bargaining, monitoring, and enforcement.

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## Population and land use change in Jitai Basin and the Pearl River Delta, China

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### Keywords

Guangdong, Jitai, Pearl River, Jiangxi, population, land use, migration, new economic zone, deforestation

With the rapid development of the Chinese economy in the last decades the patterns of land use and land cover have been modified significantly, especially since the reforms of the early 1980s. But due to different natural and socio-economic conditions, the speed and scale of land use change are very diverse in different parts of the nation. The study of the Pearl River Delta and the Jitai Basin reveals the phenomena, the process and the mechanism of land use change and may provide a solid basis for the sustainable planning of land use in the future for regions with different conditions. The sites are characterized by rapid urbanization and conversion of agricultural land in the Pearl River Delta, and a rural area undergoing a restoration of forested land; both are heavily affected by internal migration, one as recipient and the other as donor.

## Population and land use change in Haryana and Kerala States, India

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### **Keywords**

population, land use, Kerala, Haryana, agriculture, migration

Kerala and Haryana states represent a contrast in land use patterns and demography within the Indian context. Kerala, with its advanced social sectors, has been an exporter of labor, and remittances have significantly supplemented incomes from traditional agriculture. However government policies have also encouraged internal migration within the state and affected agriculture and land use in a major way. Haryana is a major food producer that has benefited from green revolution technologies and receives migrant workers from other states. The studies and the comparison between them reveal important interactions among population movement, land use, and government policies. The status of women in the two sites is also explored.



## Population and land use change in South Florida and Greater Chicago, United States

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### **Keywords**

population, land use, migration, government policy, economic integration

The landscapes of South Florida and Greater Chicago were created during moments of dramatic transformation during the mid to late 20th century and the late 19th and early 20th centuries, respectively. Historically, both sites witnessed a sequence of landscape transitions from natural land to agricultural land, and finally to urban land. More recent patterns, particularly in South Florida, have involved direct conversions of natural land to urban land. While natural rate of population increase and migration certainly played a significant role in this process, other drivers of land use and land cover change are identified in the two case studies. In both cases, government investment and policies, particularly with respect to infrastructure development, played a significant role. Local economic diversification and integration within national and international trade economies can be seen as important drivers of change. Beyond these macro level forces, contextual and regional factors were important in influencing the exact location and rate of land use conversion within each study site. For example, zoning laws, location of flood control measures, and building practices influenced where land cover change is more likely to take place in South Florida.

## Population and land use change: a comparative analysis

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### Keywords

population, land use, China, India, United States

The study regions of the Tri-Academy Project are each unique, as all places are, but there are discernible patterns of population growth and redistribution and land use change in these regions that provide insight into the dynamics of how people and places interact. We examine and compare the patterns, timelines, and associate attributes of population and land-use change in the six case studies. The intertwined fates of forested or natural land, agricultural land and built-up land are considered in the light of population shifts and government policies that act on both population and land use. We seek to answer the questions: how do the changes in land use documented for the regions relate to changes in population, technology, and policy? What are the environmental and social impacts of population growth and the land-use changes? These are discussed in the light of the current theories of population and land-use change, and recommendations for management of environmental changes are presented.

## **Influence of Changes in Land Use and Land Cover on Biophysical Feedback to Climate**

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### **Keywords**

climate change, land cover change, biosphere - atmosphere interactions

Integration of key earth-system processes is a distant and defining goal for natural and social scientists. The inclusion of physical and chemical dimensions of the earth system has progressed farther than inclusion of many anthropogenic factors. Consideration of different atmospheric compositions has dominated much of the analyses to date. However, the land-atmosphere interface is shaped by land cover, and modulated by human land use.

In this study we use a stand-alone land surface model to explore the effect of changes in land use on surface characteristics and energy and water fluxes. We explore the possible range of perturbations to the biophysical coupling between land surface and the lower atmosphere by changing patterns of agriculture and urbanization.

The stand-alone land-surface model is forced with 1xCO<sub>2</sub> and 2xCO<sub>2</sub> simulations performed by the UIUC atmospheric general circulation/mixed-layer ocean model. The land-use scenarios are developed using the Integrated Climate Assessment Model ICAM-3 where the influences of the demographic, socio-economic, and policy milieu are explicitly considered. The current distributions of vegetation, urban and agricultural areas are derived from the 1 km Land Cover Characterization database. The analysis includes an explicit discussion of the key uncertainties and heterogeneity in surface characterization (e.g., LAI, surface roughness, and albedo) and in the partitioning of atmospheric turbulent heat flux under different assumptions about socioeconomic factors and resource-management policies. Such sensitivity and uncertainty analyses are a necessary prerequisite to the development of a new generation of interactive biosphere-climate models.

## **COLONIZING LANDSCAPES: LAND-USE INDUCED CHANGES IN ECOLOGICAL ENERGY FLOWS AND CONSEQUENCES FOR BIOMASS AND CARBON STORAGE IN THE ABOVEGROUND VEGETATION - THE CASE OF AUSTRIA**

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### **Keywords**

human appropriation of net primary production, carbon balances, socio-economic driving forces, land use, socio-economic metabolism

The production of various kinds of biomass in agriculture (including crops, grazing and hay production) and forestry usually accounts for the largest part of land use, however, the area needed for infrastructure which is necessary to process, transport and consume products and services is growing. Both aspects of land use can be assessed with the indicator "human appropriation of net primary production" (NPP appropriation). Two processes contribute to NPP appropriation: (1) Land-use induced changes in vegetation alter the productivity (i.e. the NPP per m<sup>2</sup>) of ecosystems and (2) the harvest of biomass reduces the amount of NPP available for food chains. NPP appropriation can be defined as the difference between the NPP of the potential vegetation on a defined area and the part of the NPP of the actual vegetation remaining in nature after harvest. NPP appropriation reduces the standing crop of ecosystems, i.e. the biomass in live vegetation and thus influences the amount of biomass and carbon stored in terrestrial vegetation.

Using Austria as an empirical example, we will analyze current patterns and historical development of NPP appropriation and reduction of standing crop (aboveground vegetation). There will be three interlinked examples:

(1) A spatially highly resolved analysis of the current patterns of productivity and NPP appropriation, reflecting the spatial distribution of land use intensity in Austria. In total, 50% of the aboveground NPP in Austria is appropriated.

(2) A time series of primary productivity and NPP appropriation from 1830 to 1995 based upon an appraisal of the changes in land use, productivity on cropland and grasslands, and harvest. Our calculations show that, during the past 165 years, overall NPP appropriation declined slightly despite a considerable growth (+205%) in harvest. This was achieved by increasing the NPP on croplands and grasslands through agricultural intensification. This time-series will also be used to discuss socio-economic driving forces by interpreting these trends in connection with socio-economic indicators (e.g. workers in the respective sectors, contribution to the GDP, etc.).

(3) An analysis of the extent to which current land use reduces the carbon storage in aboveground vegetation. Land use reduces the aboveground standing crop (and thus the carbon storage) by about 70% compared to the potential vegetation. This is equivalent to a net carbon release since the beginning of agriculture of 633 MtC which is 40 times higher than the current annual carbon emissions resulting from fossil fuel combustion of Austria.

## CLIMATOLOGICAL IMPACT OF LAND USE CHANGE DURING RECENT 150 YEARS IN JAPAN

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### Keywords

land use change, climatological impact, numerical simulation, urbanization, database

LUIS (Land Use Information System) is a digital land use data set covering all Japan with 2 km grid (Himiyama, 1993). The land use on each grid point in circa 1850, circa 1900, circa 1955 and circa 1985 were compiled in LUIS and it is published by UNEP/GRID-Tsukuba. LUIS shows 2 significant characteristics of land use change during recent around 150 years in Japan. One is an expansion of urbanized area in the plains. The other is a recovery of forest in the mountainous areas. These types of land use change have a probability to cause the variability of surface heat budget. The variability of surface heat budget in large areas should contribute the regional climatological impact. In this study, numerical simulations of regional climate in a summer day about 150 years ago were performed with a meso-scale model. By the numerical simulations referring to LUIS, the author attempted to pick up the regional climatological impact of land use change during recent 135 years. The topic of this study itself might be out of the range of HDP research but the method of this study became possible by the aid of the output of HDP research. The numerical simulation model used in this study was based on the Colorado State University Mesoscale Model (CSU-MM) (Pielke, 1974). Each rectangular area around Tokyo, Osaka, Sapporo, Fukuoka and Sendai with the horizontal scale of several hundred kilometers was divided by a grid system with grid cells whose horizontal size is around 10 km. The surface boundary conditions in each grid cell, i.e., albedo, evaporation efficiency, roughness length, density, specific heat capacity, heat diffusion coefficient, were calculated by the method of a weighted average for each share of land use referring to LUIS. To evaluate the potential warming related with land use change, sea surface temperature around each studied area was set to be constant during 4 periods.

The results of this study are summarized as follows;

- 1) During 4 periods, the area showing the regional warming related with land use change has expanded. Especially, this feature was significant around where urbanization was significant.
- 2) In 4 cities except Sapporo, the maximum difference between circa 1850 and circa 1985 emerged at 9 PM and the minimum emerged at 6 AM. The former was 1.8 Celsius degrees in Tokyo (Otemachi) and 2.2 Celsius degrees in Osaka.

## **THE ROLE OF HUMAN BEINGS IN DISTURBING ENVIRONMENTAL CONDITIONS FROM THE VIEW POINT OF FOREST FIRES - A CASE STUDY IN INDONESIA**

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### **Keywords**

air pollution, El Niño, fire, land clearing, population growth

The rapidly increasing population density of Indonesia year by year has increased the peoples needs for food, clothing and also for wood. Unfortunately, a lack of raw materials forces the government to provide those things by creating new product centers, established by state owned and private companies seeking to fulfill the needs. With this view point and resulting activities, serious air pollution problem have been created.

The new product centers have been established by cutting down forest and clearing it by burning. Fire has been used particularly for land preparation in establishing forest plantations, oil palm and rubber plantations. As a consequences, many large of logs were burned without any clear guidelines. This irresponsible use of fire has resulted in high fire temperatures and air pollution. In 1997 and 1998, the El Niño faster increased the spread of fires logged forest and in land preparation areas.

As a result, in 1997 and 1998, thousand of people in Riau, Jambi, South Sumatra, and Central, West and East Kalimantan were hospitalized for related illness. Black smog spread for at least two months, at which time the lack of sunshine reduced food production and caused many people to seek emergency food sources. Hundreds of peoples also died in Irian Jaya because food and other supplies could not reach their areas due to smoke. Additionally, orangutans in Kalimantan, elephants and tigers in Sumatra, fish and other wildlife were affected by the blazes. This condition, along with an El Niño related drought also reduced water stock in the river. The losses may have been as much as a billion US\$.

## Impacts of Climate Change on Forest Land Cover: an Expert Elicitation of Terrestrial Ecologists

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### Keywords

ecology, expert elicitation, climate change impacts

Detailed interviews have been conducted with a group of leading forest ecologists in order to obtain qualitative and quantitative judgments about the likely impacts of climate change on northern and tropical forests. Topics covered include the identification of factors and processes that the experts consider important in determining forest response to  $2\times[\text{CO}_2]$  induced climate change; likely changes in standing biomass and soil carbon; migration in the face of climate change with and without potentially obstructing human land-use; extinctions of mammals, birds and vascular plants over historical time and prospectively for a century with and without climate change; changes in the mix of biota over time; impacts of rapid climate change; and research needs and budgetary priorities in the field of terrestrial ecology and climate change. The paper will describe the interview protocol used and report and compare the quantitative and qualitative judgments by the different experts.

## VALUING OUTDOOR RECREATIONAL IMPACTS OF CLIMATE CHANGE IN A REGIONAL NON-MARKET COMPUTABLE GENERAL EQUILIBRIUM MODEL

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### Keywords

integrated assessment, ecosystem valuation, regional economic models, household production function

This paper presents a framework for the valuation of climate-induced changes in ecosystem services in a computable general equilibrium model, with an empirical application to outdoor recreational services in the Susquehanna River Basin in the Northeastern United States. The main feature of the approach is the use of a household production function (HPF) specification to model consumer behavior. Modeling household use of environmental goods and services in a HPF framework greatly facilitates the analysis of the role of ecosystems in households' welfare. Combining the structural focus of the HPF with the integrated modeling capabilities of computable general equilibrium (CGE) models provides a powerful tool for integrated assessment of the economic-wide impacts of climate induced change in ecosystems. Existing applications of CGE models to climate change and other environmental issues have concentrated on the evaluation of policy instruments. Relatively little work has been done with CGE models on the impacts of environmental change, due to the difficulty of incorporating environmental services in this class of models. This is because most ecosystem services are non-market and therefore elude the price mechanism that is the core of standard CGE models. The use of the HPF in this paper resolves some of these difficulties.

Our empirical implementation of the framework introduces constant elasticity of substitution (CES) cost functions for recreation services that are demanded by households. Climate change effects are incorporated in these cost functions as a constant elasticity function of several climate indices namely temperature, precipitation, and resource changes. We also simulated several climate change scenarios and calculated welfare measures. Our results show that climate change may exert a net positive or net negative impact on recreational activities in the region depending on the magnitude and direction of the various climate change indices. Overall, the results suggest significant recreational impacts of climate change with economy-wide effects.



## THE ENVIRONMENTAL COSTS OF THE GROWTH: PUBLIC PERCEPTIONS AND ENVIRONMENTAL EVALUATION OF IMPACTS ON THE FORESTS

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### Keywords

environmental evaluation, environmental cost and economic growth, forest degradation, public perception, willingness to lower the standard of living (WTLSL)

Last 30 years, Japan had experienced both rapid economic growths on the cost of the environmental degradation and natural capital depletion. Today, GDP per capita of Japan is higher than any other countries in the world beside Switzerland; however, many of the environmental changes are irreversible. Also, a lot of environmental problems, such as landfill shortage, chemical contamination of foods, heat island phenomenon with urbanization, forest environment degradation are getting more serious with economic growth these days.

One of those urgent environmental problems is forest degradation. Some people may think that there are no forest degradation problems in Japan, because Japan has 25 million hectares of forests, which cover almost 70% of the country. Despite of the rich stock of domestic resources, Japan is the largest importer of the forest resources in the world. Japan seems to save its own natural capital by depleting somebody else's resources. Timber from abroad is substantially less expensive than domestic products. Inexpensive resource flow from abroad lowers the economic value of Japanese domestic natural resources, which eventually lowers their environmental values as well. We are going to show how forest degradation in Japan occurs as the structural problem of the growth.

Evaluation of the environmental costs of the growth is needed in order to explain the structural relationship between Japanese economic success and the environmental depletion such as forest degradation. It, however, is not easy to compare the benefits of the economic growth with its environmental costs, especially in monetary terms. Our challenge is to estimate the environmental costs of Japanese economic growth in the past thirty years by survey. In our survey, we asked the public how much the WTLSL (Willingness To Lower the Standard of Living) to remove environmental risks is. Most of people think that economic growth has caused the environmental impacts in Japan. More than half of respondents agreed to lower their (economic) standard of living by average 20 percent, which means the GDP level of 10 years ago, in order to remove the risks from environmental degradation. According to our estimation, the WTLSL to avoid environmental risks due to forest degradation is not negligible.

Until today, pursuing the economic growth has been the primary object of the governmental policy in Japan, just as what happens in many other countries. However, with the recognition that the environment is not free, the balance of Japanese economic growth may not be positive. The result of our research shows that not many Japanese are looking for farther economic growth with lower environmental qualities. That means Japanese people no longer regard the growth as the synonym of better life.

## A "Constructivist" Approach to Eliciting Monetary Values, If You Must

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### **Keywords**

valuation, decision-making

Political and legal processes often require assigning monetary values to environmental "goods." When that happens, there may be little substitute for asking people what they think (or want). Doing so poses analytical challenges, for adapting market thinking to the specification of nonmarket exchanges. It poses cognitive challenges, for articulating basic values in these novel settings. It poses institutional challenges, for knowing what credibility to afford to what study participants say. These difficulties are seen in the continuing controversy over stated preference methods, such as contingent valuation and conjoint analysis. We offer an alternative, "constructivist" method, drawing on research and experience in individual and community value elicitation. It differs from other stated preference approaches in two fundamental ways. One is assuming that measure is often necessarily reactive; people cannot simply "read off" values to any conceivable question, but need (unbiased) help in structuring their thought processes. The second is considering the social context within which the environmental good is being evaluated; such contextualization restricts the set of questions that can meaningfully be posed. The talk will describe the method and some applications, as well as some basic research and policy issues that it raises.

## **Status and Perspectives towards the Early 21st Century of the "Environmental Risk Transition" in Relation to Awareness and Perception of the Environmental Risks in Asian Countries: An Overview of Our HDP Approach**

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### **Keywords**

environmental risk transition, Urban and rural areas in Asia, Risk assessment and management, risk awareness and perception

In our HDP study entitled as "An HDP study on development and quality of life (QOL), and risk perception/behavior in Asian countries" (1997-99), urban areas in Indonesia and China and also rural areas in the South Asia (India, Bangladesh and Nepal) have been surveyed to know the profiles of major environmental risks in both regional categories and also to know risk awareness and perception among the public in those areas. The rural areas in the above 3 countries of South Asia were regarded as one, since they are characterized with deforestation, desertification, water problems and so on in addition to overpopulation and are located in the similar phase of the so-called "environmental risk transition". Urban studies have already been conducted for Beijing and Chengdu, China and Jakarta, Bandung and Lampung, Indonesia, whereas rural studies have been performed for hundreds of villages in the above 3 countries. Shanghai and Chongqing are now under investigation in China.

In the urban studies, awareness and perception of the major risks associated with both regional and global environment have been surveyed with interview methods on the individual basis for more than 1,000 household heads and their spouses aged under 50 years in each of the cities with several cooperative institutes. The subjects were selected as equally as possible from each of the residential, commercial, industrial, suburban or other areas. As part of the subjects, samples of the floating population from rural areas were also included. Moreover, health effects of air pollution in terms of respiratory symptoms have been evaluated for children aged under 15 years if the family has any in the same household. In addition, semi-qualitative assessment of the major environmental risks and their trends toward the early 21st century for each of the cities are being performed based on the available information in terms of the cause-specific mortality and morbidity data, demographic data and various environmental pollution data. It should be noted that there are some rough estimations of health impacts of air pollution and their future trends in case of Indonesia and China by some international organization such as World Bank, WHO and so on. At the meeting, some results of analysis will be described in relation to the profiles and trends of the location on the "environmental risk transition".

Anyway, together with the results of rural studies, which will be described in the following papers, it is hoped that this study could provide possible measures for developing or promoting risk management with respect to both regional and global environmental risks associated with diversified status of development and quality of life (QOL).

## **Dose-Response of Air Pollution and the Economic Cost: A Case Study of Students and Their Parents in Indonesia**

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### **Keywords**

dose-response, respiratory symptoms, economic cost, air pollution, Indonesia

A total of 16,633 junior high school students and their mothers in Indonesian cities, Jakarta and its surrounding areas (Bogor, Tangerang, and Bekasi), Cianjur, Bandung, and Lampung, were surveyed by giving them a self-administered questionnaire to study the effect of air pollution on respiratory symptoms and the economic cost associated with it.

Air pollution was estimated by measuring NO<sub>2</sub> in these cities using filter badges, Toyo Advantec Co. Ltd. NO<sub>2</sub> concentration in these cities and area were measured for 4 years (1994-1997). The questionnaire was applied in 1997 for Jakarta and its surrounding area including Cianjur, and in 1996 for Bandung and Lampung. On the economic cost, students' mothers were asked about their expenditure for the treatment of respiratory illness for their family members and their own in the past month. The mothers were also asked about the indirect cost, that is in the form of days lost due to the illness. To arrive at the actual health cost associated with NO<sub>2</sub> pollution, the slope of the dose-response function was multiplied by affected population and then multiplied again with average household's health expenditure for treating the illness.

The highest average concentration of NO<sub>2</sub> was found in Central Jakarta (37.8 ppb), and the lowest were in Cianjur and Lampung (both 10 ppb). The average health expenditures a household spent ranged from Rp 11,300-25,000 per person per episode, with the lowest in Lampung and the highest in Central Jakarta. The percentages of having respiratory illness, excluding Bekasi, ranged from 20-33%. Days lost due to illnesses ranged from 3.1 to 5.5 days.

It is believed that by understanding the economic cost of such relationship, pollution control decision making could be more effectively applied because Indonesian government could decide more comprehensively on setting the environmental standard and the investment they are willing to spent for it. This study is also believed to may well be applied for other similar developing countries in Asian region in assessing the economic cost of their air pollution problems.

## Primary Health and Environmental Care in Rural Areas of South Asian Countries

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### Keywords

primary health and environmental care, community-oriented development ecology, rapid assessment, South Asia

As a part of "An HDP study on development and quality of life (QOL), and risk perception/behavior in Asian countries," this study was designed to ascertain what kind of community-based information on primary health care (PHC) and primary environmental care (PEC) is necessary to mitigate the global environmental and health problems and whether rapid assessment procedures can contribute to an effective monitoring. For this purpose, field investigation was conducted in India (State of Madhya Pradesh), Bangladesh (country as a whole) and Nepal (country as a whole), by interview with the villagers in cooperation with the local institutions, i.e. National Institute of Forestry Management in India, Institute of Epidemiology, Disease Control and Research in Bangladesh, and Tribhuvan University in Nepal. After the preliminary survey in 1996-97, the authors conducted the main survey in 1997-98, in which fifty villages were randomly selected from each country, and the interviewee were at least five villagers, including both sexes as far as possible, in each village. The structured interview items were concerned with both health and environmental issues, and the interview took from two hours to eight hours. The three geographical regions chosen for the study are environmentally and culturally different. For instance, most Indian and Bangladeshi villages are flat in terrain and fertile in soil whereas most Nepali villages are hilly and less fertile; culturally, religion and caste system differ among them; and population density of Bangladesh is, respectively, four and six times higher than that of India and Nepal. Manifest differences in the socioeconomic developmental extents were also observed among the villages in each country. Thus, the authors' attempts were made to clarify similarities and differences between the countries and among villages within a country.

Though the data analysis has not been completed, there are several findings predicted. When the three countries are pooled, the major items for wanted primary health are "safe water supply," "curative medical services within the village," "latrine construction," and "food and nutritional supplement." Major primary environmental problems are "unqualified drinking water," "soil degradation," "food shortage" and "deforestation," and most of them are recognized to have been worsened in the last decade. As an example of inter-region differences, a significant part of the working time is spent collecting firewood in both India and Nepal, while the bulk of the villagers in Bangladesh purchase firewood because of shortage of forest in the nearby environment.

It will be concluded that this rapid assessment system is particularly useful when applied to longer-term intervention for improving health and environmental conditions.

## Deforestation, Water Resources, and Health in Rural India

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### Keywords

deforestation, drinking water, fuelwood, livestock, health

In this study, we identify the causes of deforestation at village level and examine the consequences of the deforestation on villagers' welfare, especially on drinking water and health status using data collected in 60 villages in Madhya Pradesh, India in 1998.

Our econometric analysis shows that deforestation in the past twenty years took place where the growth rate of village population is high and the growth rate of agricultural productivity is low. This is because villagers converted forest into agricultural field either legally or illegally for their subsistence. In addition, fuelwood collection and animal grazing cause the degradation of forest resources and finally make the forest land barren.

The reduction of forest resources can affect villagers' welfare in several ways: first, no. of livestock has declined since the availability of grazing land has decreased; second, time to collect fuelwood and drinking water has become longer; third, health condition has worsened due to low nutrition and poor water quality.

No. of livestock has declined in most villages from 326/village ten years ago to 236/ village now, on the average. Our analysis shows that the growth of livestock units/village in the past 10 years negatively correlated with the change in forest density around the village and positively correlated with the forest density of ten years ago, indicating that the growth of livestock units causes the reduction of forest density where forest density is relatively high.

Regarding drinking water collection, villagers tend to use river where forest density is low, while community wells are utilized where forest density is high. Drinking water collection time and forest density are negatively correlated. Out of 60 villages, 14 villages claim the drinking water shortage. Such villages spend significantly more time to collect fuelwood than villages without water shortage problem, although current forest density does not differ between the two types of villages, suggesting some kind of relationship between forest resources and drinking water resources. However, current forest density does not correlate with hours spent for fuelwood collection/. Instead, villagers spend more hours/day to collect fuelwood where the growth of bush and/or barren land is high in the last 20 years. Hence, bush and barren land may have a negative effect on water conservation. Finally we measure health status using the rate of infant survival up to 5 years old. Forest density, percentage of households using river for drinking water, and time to collect drinking water are all negatively affecting the survival rate, whereas livestock units/village and the ratio of irrigated agricultural field have positive effect on it. All these results suggest that deforestation has a negative effect on villagers' health status via several paths including nutrition and drinking water.



## **Poster Session**



## LAND USE CHANGE AND HYDROLOGY OF A HIMALAYAN WATERSHED

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### Keywords

discharge, land-use, nutrients, sediments

Large quantities of sediments go out of the Himalaya through its rivers. These rivers are charged with sediments depending on the types of land-uses in the watersheds. Information's on land-use/cover with on hydrological linkages in the Himalaya are very important for considering the management strategies. Therefore, the land-use/cover change and hydrology was studied in a watershed in the Sikkim Himalaya. The watershed land-uses are mainly temperate natural forest (25.38%), sub-tropical natural forest (0.70%), large cardamom based agroforestry (4.08%), mandarin based agroforestry (0.63%), cropped area (44%), and wasteland (25.41%). The land-use change from forest and agroforestry to open agriculture has increased by 15% from 1988 to 1997. During the same period substantial area of dense mixed forests have been converted to open mixed and degraded forests as a result of high pressure on natural resources. This has been a general trend in the Himalaya as a consequence of population increase and farm family fragmentation. Stream-flow was recorded highest in rainy season and lowest in all the streams and all the three years (1994-97) of the study. The water quality of streams from different micro-watersheds varied significantly between seasons and streams. Sediments and nutrient loss was estimated in micro-watersheds and soil loss from the total watershed ranged from 4.18 to 8.82 t/ha during three years period of study. The annual total nitrogen loss estimated at the watershed outlet was at the rate of 33 kg/ha, organic carbon 267 kg/ha and total phosphorus 5 kg/ha. This study suggests that the upland micro-watersheds can be hydro-ecologically sustainable only if good forest cover and dense forest with large cardamom based agroforestry are maintained.

## **Land use/Land cover changes in Sadiyagad Watershed in Kumaon Himalaya -the sustainable livelihood options.**

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### **Keywords**

land use/land cover change, GIS/RS technology, natural resource management, environmental conservation, sustainable livelihood options

Land use changes and social attitude changes shows close interrelationships in Himalaya where traditional societies are in transition to modernity. The pressures such as rapid disintegration of joint family systems, diversification of occupations, intensification of economic crops played major role in influencing the land cover patterns. While the national priorities require the 66% of land cover in this region (Himalaya) to be under forest land use (tree cover) the local priorities require both vertical and horizontal expansion of agriculture to meet growing consumerism in the societies. The literacy rate is increasing. The per capita land availability is decreasing alarmingly. In addition to this the land is highly fragmented and these fragmented sites are highly dispersed. This is causing the use of traditional natural resource based low input agriculture more time consuming and stress on the resources. Such land parcels are also not suitable to the modern economic cropping sequences. Marginalization of production area is increasing the soil losses and thus posing environmental problems. The tree cover depletion and domestic animal number increase is also linked to the degradation processes. The rural settlements are fast changing in terms of infrastructure availability and accessibility. But the environmental costs in terms of soil losses, proneness to land slips and slides also increased with them. Ecosystem restoration efforts by both national and international agencies sustained major problems due to their failure to address the problems in an integrated manner. The sector based approaches while met the targets set for each sector failed to provide balance with each other. While development addressed the human life quality in terms of modern amenity systems their natural resource dependence and limits of land were neglected. The social dimensions of changing land use in Sadiyagad watershed of middle Himalaya is discussed in the paper and sustainable livelihood options are suggested based on the existing resource availability and technological constraints.

## REFRIGERATION AND CFCs IN BOTSWANA: THE GABORONE CASE STUDY

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### **Keywords**

ozone, CFCs, refrigerants, climate conventions, policy

Although appliances such as refrigerators, room and car air conditioners comprise a small proportion of municipal waste, they pose a serious environmental concern in that they are potentially sources of class I CFCs. These substances represent complex compounds containing chlorofluorocarbon molecules and capable of releasing chlorine which in turn may destroy stratospheric ozone. Following a number of ozone conventions from the late 1980s to mid 1990s, a production phase out of CFC rich coolants has been effected in the north. This study was conducted in Gaborone using a questionnaire survey to find out to what extent conventional and non-conventional refrigeration companies are using ozone friendly coolants in the repair of home refrigerators, home and car air conditioners. Existing government policy instruments and enforcement guidelines were also analyzed. Conventional repair shops are aware of banned refrigerants but use them nevertheless side by side with new ones. Continued use of old refrigerants such as R12 is ascribed to expenses involved in replacing and oiling valves in old refrigerators. It was felt that consumers would not afford to pay for repairs if new coolants are used to refill compressors of old refrigerators. Most repairers do not belong to professional organizations for professional guidance on new technologies. New trends are usually obtained from magazines and electronic media. Government regulations on CFCs are in their formative stages and therefore lack enforcement. The refrigeration industry is therefore a potential source of CFCs to the atmosphere in Gaborone.

## IMPACTS OF LAND-COVER CHANGES ON TERRESTRIAL CARBON CYCLE IN CHINA

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### Keywords

land-cover change, terrestrial carbon cycle, biomass

For Earth's land surface, the most important component of global change for the next several decades at least is land-use and land-cover change. However, our scientific understanding of the patterns and processes of land-use and land-cover change is far from adequate. Process-based models of terrestrial ecosystem biogeochemical cycling have frequently been used to estimate the influence of environmental factors on land surface-atmosphere carbon fluxes. Scientists are also developing both empirical diagnostic models and integrated models with predictive capabilities for assessments of environmental security and vulnerability. Recently, because of highly economic development and population growth, cultivated land is decreasing continuously and changing rate of land-cover is rising. All these aspects made CO<sub>2</sub> emission increasing from soil and deforestation led to more unbalance of terrestrial carbon cycle in China. Through researching the history of regional land-cover change in China and using GIS technique and RS data, we can obtain the latest data to analysis the spatial distribution of emitting CO<sub>2</sub> from changes in one region land-cover and to study the impacts of it on regional terrestrial carbon cycle.

In order to estimate changes in carbon and fluxes to the atmosphere, this paper used RS image data to calculate the extent of one region land-cover change to different lengths of period. Image processing and classification methods were adopted. At first, using spectral indices estimates vegetation biomass changes. Second, estimates of carbon pools and fluxes to the atmosphere were carried out using the results of RS image analysis and published data about carbon stocks in vegetation and soil. In the third, the impact of land-cover changes and net land surface-atmosphere carbon cycle fluxes is discussed. Understanding changes in one region terrestrial pools of carbon over different periods helps identify management strategies that might be used to enhance the storage of C on land in future, so as to provide available data and theory base for government making kinds of effective policy.

## **GKSIM: A NEW MODEL FOR PROJECTING LAND USE CHANGE IN LONG-TERM**

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### **Keywords**

GKSIM, land use change, simulation model, LU/GEC

Many models can be used to simulate the temporal change of particular land use, such as cultivated land, grassland, forest or urban area. There are few models, however, which simulate the temporal changes for all land use categories. We have developed a new land use change simulation model, GKSIM, to simulate changes in long-term for all land use categories. GKSIM satisfies the following 3 conditions that are essential to models of this kind:

(a) No projected area of land use exceeds its marginal value, which is determined by natural conditions such as slope and climate, or by socioeconomic factors such as population and gross domestic product (GDP). If the area of forest plus those suitable to be converted to forest, for example, equals a particular value,  $F$ , any projected forest area of more than  $F$  will be unacceptable.

(b) The sum of all areas always equals the total area of the region studied.

(c) Statistical testing can be done. This ensures that calibration accurately simulates historical trends in land use change. Otherwise projected results would not be reliable.

Conceptually, GKSIM can be applied if data for 3 time periods are available. It is applicable to simulation of land use change in developing countries where land use data are scarce and sparse. GKSIM has been used to project the land use change to 2050 in more than 10 Asian countries including China and Thailand. GKSIM is one of the models of land use change developed in the project LU/GEC (Land Use for Global Environmental Conservation). GKSIM, being written in Microsoft Visual Basic Application Edition (VBA), can be run simply inside Excel. For more information, refer to the REFERENCES below or write to [gongjian@nies.go.jp](mailto:gongjian@nies.go.jp).

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## The Transformation of Land from Agricultural to Non-Agricultural Uses in the U.S. Great Plains

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### Keywords

landuse, population, agriculture, suburb, urban

The role of human factors in determining land use and environmental change lies at the heart of much research in the human dimensions of global change. This paper attempts to look at human factors as determinants of land use in a crucial area: the transformation of land from non-agricultural to agricultural uses as a settlement process progresses, and then the reversal of that process as urban and suburban uses take agricultural land out of production. This last process is a subject of considerable interest to citizens and policy makers in the United States and around the world, as land that has been used for agriculture for some length of time is converted to non-agricultural uses.

The subjects of this research are the 450 counties that make up the Great Plains of the United States, the broad region bounded by the Rocky Mountains on the west and the Mississippi River on the east, which is the major grain-producing area of the nation. At the heart of this analysis is fundamental work by the authors and others about the role of environmental factors in determining land uses. Once the land had been completely settled, almost all of the variation in agricultural land use in the Great Plains is explained by variations in environmental variables, especially precipitation, temperature, soil texture, and slope. Not much room is left for human intervention. All the variation controlled by the human population lies near the margin, in deciding whether to irrigate, in deciding which crop to plant, and in the fundamental conversion of unused land to agriculture, and agricultural land back to non-agricultural land, especially for housing and urban development.

The Great Plains region began to be settled for agriculture by European-origin Americans in the 1870s and 1880s, and the region was completely settled by the 1930s. Since then, the agricultural population declined while acreage used for agriculture increased and then decreased. In the average of 450 Great Plains counties, the amount of land not in farms has doubled from about 7% at its minimum in 1964 to about 13% in 1992. This paper will examine the determinants of land use transformations in the Great Plains, from about 1950 to 1992. It will explore the extent to which land has been taken out of agriculture because of urbanization and suburbanization, or because of farm abandonment caused by climate change or changes in markets. The paper will be especially sensitive to both the environmental and economic contexts. The independent variables will include a wide variety of environmental, economic, demographic, and social determinants of land use change. The methods will include sophisticated tests for both spatial and temporal autocorrelation. This is an important issue that links agricultural with non-agricultural land uses, and has potential environmental consequences.

## **Scholarly Networking in the Human Dimensions of Global Change Research Community**

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Forty participants at the HDGEC conference in Laxenburg, Austria in June 1997 responded to our survey asking for information about their communication with scholars, cutting-edge research specialties, where that research is being conducted, and what journals they read. We examine the results by traditional disciplinary identifications of the respondents and within the context of the "invisible college" phenomenon. Journals, newsletters, conferences, and workshops are integral parts of the community. But so are those from the natural, social, and policy sciences who utilize email, listservs, and the WWW to keep abreast of research and to communicate regularly with colleagues. Electronic communication is especially important to those residing in Europe and North America, the regions where most HDGC research is conducted. The community gives strong evidence of international and transdisciplinary networking on human/environmental problems at regional and global scales. Key Words: electronic scholarly networks, HDGC research clusters

## **The present condition of the walnut-fruit forests of Kyrgyz Republic**

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### **Keywords**

Kyrgyz Republic, walnut-fruit forests, source of rich genetic variety, critical situation

Unique natural forests of walnut and fruit bearing plants grow in the mountains of Fergan and Chatkal ranges of the Southern region of Kyrgyzstan. The variety of types represented are: different forms of *Juglans regia*, *Malus* spp., *Pyrus* spp., *Crataegus* spp. as well as a number of other plants which are particular to these forests. The walnut-fruit forests are an extremely important source of rich genetic variety. Approximately 70 years ago, these forests occupied 60 000 hectares. Now they occupy only 48 000 hectares. They are in critical situation. The main reasons of this reduction are:

- \* the grazing of livestock occurs in forests almost everywhere. The majority of cases animals completely destroy the first and second year growth of valuable types;
- \* the local population's harvesting of hay in the main part of forests land leads to severe disruption of the natural reproductive cycle of all tree plants;
- \* almost 100 per cent harvesting of walnuts prevents any natural reseeding of walnut trees;
- \* cutting of trees for firewood is largely uncontrolled, making rational forest management impossible.

The above listed problems prevent regeneration of walnut-fruit forests, threatening them with extinction.



## MONITORING URBAN HEAT ISLAND

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### Keywords

heat island, landuse/cover, energy use, monitoring, mitigation

#### 1. Introduction

Urban heat island(UHI) is a phenomena that temperature in a city center is higher than that of outside of the city. This phenomena has been found in many large high- and mid-latitude cities in Europe, North America and some Asian cities since 19th century. The phenomena is more obvious in minimum temperature in cold seasons, thus generally the phenomena has been studied well in cities with cold weather. In recent years, UHI studies in low-latitude cities has been started as more serious affections may cause with warmer climate.

#### 2. UHI formation

UHI is a complex phenomena. There are several major reasons;

- (1) land cover change: decrease of vegetated area and open water in particular
- (2) building density and patterns: reflection of heat waves between walls, or/and between ground and walls increase solar heat absorption
- (3) anthropogenic heat release from human activities
- (4) wind barrier: tall buildings block wind path and various other physical and socio-economic reasons.

#### 3. UHI v.s. global warming

UHI relates to global climatic change. Unlike global warming, UHI is a local phenomena which only affects large cities. Thus affected area of UHI is very small percentage in global scale, however, percentage of affected population may go up to 50% in 21st century.

#### 4. Affection of UHI

UHI may cause environmental problems in warm regions such as;

- (1) increase of energy use for air-conditioning
- (2) increase of peak electricity demand, which causes unstable electricity supply, or may cause black out
- (3) change in biodiversity
- (4) higher mortality in hot seasons
- (5) acceleration of air and water pollution
- (6) human unpleasantness, which may affect to life style and culture

#### 5. UHI Project

In 1996 with financial support from Japan Science and Technology Corporation, and partial funding from the Ministry of Education, Science and Culture, Heat Island Monitoring and Management System Project (UHMP Project) was started. This project aims to understand UHI formation mechanism as the first step, and to find policies for mitigation as the second step.

The Project selected three test sites; Tokyo, Shanghai and Bangkok, where physical and socio-economic conditions are different.

##### (1) UHI monitoring

High-density network of automated monitoring stations was built for continuous observation. In Tokyo, 123 stations provide 15 minutes interval data. 6 and 7 stations have been active in Bangkok and Shanghai. Satellite imagery from NOAA AVHRR and LANDSAT TM thermal bands are also used for analyzing spatial structure. To study 3D structure of the heat island, balloons, cherry picker trucks, towers and aircraft are used to capture vertical profile of temperature.

##### (2) Land use/cover analysis

Land use/cover data is collected by both satellite image analysis and existing map and GIS data. Historical change is analyzed by using old maps. Data on building height for Tokyo is obtained from existing GIS data, where Bangkok and Shanghai data was measured by field survey.

##### (3) Alternative planning methodology for UHI mitigation

As UHI is a man-made climate, it should be possible to control and/or mitigate UHI. In this project, to create alternative urban planning which is able to take account of thermal conditions is the final goal.

##### (4) UHI model building and simulation

Thermo-dynamic and fluid-dynamic models have been applied to simulate UHI. Alternative planning scheme is checked by the simulator.

#### 6. conclusion

It must be difficult to mitigate UHI in existing large cities such as Tokyo, however, it is possible to apply alternative planning methods in newly growing cities in warmer regions.

## **THE ROLE OF LIFESTYLES, ATTITUDES AND BEHAVIOR IN ENVIRONMENTAL MANAGEMENT: THEORY AND ILLUSTRATIONS FROM SOUTHERN AFRICA**

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### **Keywords**

perception, attitude, environmental change, environmental degradation

Perception and attitude studies have been much sidelined in the environmental degradation debate. The common charge is that such studies produce data that are too subjective and of limited temporal validity. The thrust of the proposed paper will be that understanding human perceptions and attitudes towards certain environmental change issues is a pre-requisite to effective policy intervention. The paper will outline the appropriate conceptual framework and then use data from perception and attitude studies from Southern Africa in general and Botswana in particular to make a case for more of such studies in the environmental change activities of the IHDP.

## **Changes in land use and human management and their impact on degradation in two presaharian piedmonts by remote sensing.**

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### **Keywords**

degradation, remote sensing, arid and semi-arid areas, land use changes, pre-Sahara

Increasing degradation processes occur in the northern pre-Sahara in relation to droughts exacerbated by land use and demographic pressures as evidenced by several previous field studies.

The cumulative effects of man activities and of drought, especially on the steppic vegetation, are assessed by comparing two presaharaian regions: the south piedmont of the djebel Amour (Algerian Saharian Atlas) and the Dades wadi basin in Morocco. Both piedmonts present close physical, climatic and human characteristics:

- \* climate is arid to semi-arid, with 100 to 200 mm average rainfall determining a steppic vegetation;
- \* calcreted hamadas forming wide incised plateaus in Algeria, compared to an intramontane basin with broad calcreted glacia in the Moroccan piedmont;
- \* land mainly devoted to pastoralism;
- \* similar tribal structures relatively well preserved in Morocco

but highly destructed in Algeria, with significant local exceptions.

During the last decades, the changes in social and agrarian structures have been accelerated by recurrent droughts, especially during the 1970-1986 rainless period, and by increase of direct or indirect State hindrance in nomadic "traditional" land management rules.

These social and economical changes are not homogeneous throughout the presaharaian zone studied, nor on the piedmonts. Temporal monitoring by remote sensing and aerial photography shows specific local response of the steppic vegetation to droughts in relation to the evolution degree of the social structures. Degradations are important and easily detected by remote sensing in areas where the nomadic system has completely disappeared, however, they are more diffuse and identified with more difficulty in areas where the traditional land use management rules are still present or preserved.

## Land Use/land Cover Change Due to Human Dimensions: A case study of North-East India

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### Keywords

Bongaigaon, satellite, IRS, Landsat, SOI

A comprehensive information on land use/land cover is a basic prerequisite for land resource evaluation, environmental assessment, utilisation and management. Today, with increasing population pressure on land and the resulting change in the land use pattern and processes, a considerable degree of land transformation and environmental deterioration is being witnessed. Therefore it is important to understand the 'cause and effect' of the change through scientific studies.

Bongaigaon Refineries & Petrochemicals (BRP), a Govt. of India undertaking, is currently setting up Hydro treatment plant at their existing refinery in Bongaigaon. The scope of the present study is limited to know the environmental impact, the past and present land use/land cover patterns, their assessment, spatial distribution extent and their change due to human interference in the study area for a period of 27 years with the available satellite data and other collateral data.

Satellite Data of Landsat TM for 1986; IRS-1B (LISS-II) for 1992 & IRS-1C (LISS-III) for 1997 was utilised. Survey of India topographic sheets on 1:50,000 scale, other collateral data and limited ground truth were used for the study.

The study area can broadly be divided into mounds and valley topography. The land portion is constituted by mixed vegetation with settlements with diverse land uses. The past and existing land use observed in the study area is predominantly agricultural. The various land use categories observed in the study area for 1997 include Built-up land of 34.25 sq. kms or 10.93%; Agricultural land 125.35 sq. kms or 39.88%; Forest 11.20 sq. kms or 3.56%; Wastelands 36.69 sq. kms or 11.67%; Water bodies 10.86 sq. kms or 3.46% and others 95.83 sq. kms. or 30.49% of the study area.

The study on change analysis of land use patterns of 1970, 1986, 1992 & 1997 showed that there is a decrease in crop land from 169.41 sq. kms or 53.90% of 1970 period to 119.95 sq. kms or 38.17% of 1997. Area under Built-up, Scrub land & Settlements with mixed vegetation has increased due to human dimensions.



# Demonstration

## SUSTAINABLE DEVELOPMENT PLANNING IN SIMULATION & GAMING

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### Keywords

planning dimension, sustainable regional development, decision making, simulation, system dynamics model, gaming simulation, space-use

The concept of "sustainable development" was promoted at the Earth Summit '92, and it has since been widely accepted and supported by both developing and developed countries. It is now generally recognized that anyone involved in development tasks needs to give due consideration to "sustainable development" in the pursuit of their objectives. Thus, sustainable development must rest on political will. This definition provides conceptual guidance and states the goal to be targeted. However, it is not an operational definition from which we can draw a plan of action. This is the reason why the concept of sustainable development allows a broad interpretation and has been so frequently overused. In this context, various research institutes, universities, governments and international organizations are now trying to establish theories, applications, practical tools or technologies for sustainable development.

This session is essentially treated with how decision making and its process will affect to sustainable development. Sustainable development is just a result of previous planning with better balance forecasting between socio-economical development and environmental mandates. Decision-makers may decide more better sustainable development policies supported by professional planners who can recognize the concept of sustainable development projected with their current conditions and should design practical way of achieving their goals within their sustainable development. Then professional planner should be learning skills and technologies for achieving sustainable development in some way or other. Simulation and gaming is good for learning them. This is reason why this session covers new challenges for sustainable development in simulation and gaming fields.

United Nations Centre for Regional Development (UNCRD) keeps engaging in training of professional planners in developing countries more than 25 years. UNCRD have been developing original training methods, training materials and training tools through the experiment. UNCRD and Japan Association of Simulation And Gaming (JASAG) will present this session.

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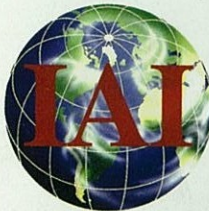
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