Though Choices - Land Use under a Changing Climate

Report on the German-US Conference
Berlin, October 2nd and 3rd 2008
and
Opportunities for joint German-US research activities
in the field of land-use and on Global Change

Imprint

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Ann Arbor/Munich, June 2009

Preface

As the impact of climate change varies enormously across regions, coping with these changes requires local action as well as the potential need to coordinate such actions on a regional or even global level. Mitigation of the causes of climate change and adaptation to its inevitable impacts will therefore have to take place on multiple scales whilst taking into account the different cultural, economic and ecological backgrounds of each region. Each region should be able to select the appropriate mitigating actions from a sufficiently large portfolio of options in order to develop intelligent strategies for reducing CO_2 emissions, increasing the efficiency of energy use, sequestering carbon in natural and engineered pools and making energy production sustainable. Communities also need to be able to choose options for adaptation that will reduce vulnerability to climate-change impacts and to increase their capacity to adapt land-uses and livelihood strategies to a changing climate.

In this context, land resources and their interactions with the climate system play an increasingly important role. Land resources are an important component of the global carbon cycle and can be used to produce renewable energy and to sequester carbon. Moreover, changes in land use reflect different lifestyles and these changes then have an impact on the vulnerability of human populations as well as creating opportunities for societies to adapt to climate change. However, this potential is limited by competing demands for land resources in terms of space for human settlement, the production of renewable energy, food and fibre, and other ecosystem services. Decisions in favour of one or the other land-use option inevitably affects both the climate system and human well-being. Tough choices lay ahead of us.

We currently lack both the scientific basis and the proper management tools to analyse the trade-offs between land-use alternatives for mitigation of and adaptation to climate change as well as to achieve sustainable allocation decisions. This problem requires integrated scientific studies that transcend the disciplinary boundaries of social and natural science. Furthermore, regional mitigation and adaptation strategies strongly influence global processes. In order to enhance communication about research strategies on a global level, there is a need to transcend national boundaries. As a first step in this direction, this German-US conference was initiated and co-sponsored by the German Research Foundation (DFG), the German Federal Ministry of Education and Research (BMBF) and the US National Science Foundation (NSF).

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We gratefully acknowledge the German Research Foundation (DFG), the German Federal Ministry of Education and Research (BMBF) and the US National Science Foundation (NSF) for co-sponsoring this conference.

DFG

Federal Ministry of Education and Research

NATIONAL SCIENCE FOUNDATION

The conference was organised by the Scientific Secretariat of the German National Committee on Global Change Research.

NKGCF

Content

1 Executive Summary

On the 2nd and 3rd of October 2008, the German Research Foundation, in cooperation with the German Federal Ministry of Education and Research and the American National Science Foundation, convened the German-US conference *Tough Choices – Land Use under a Changing Climate* in Berlin, Germany. The focus of this meeting, in which over 80 German and American scientists were invited to participate, was land use and conflicts resulting from the limitations of global land resources and climate change. This report addresses researchers from both countries who work in the field of global change research and have a particular interest in the interactions between land use and climate change as well as research funding organisations in both countries.

Although there are strong research communities in both the US and Germany working on land use, global change and climate change, perceptions, backgrounds and approaches can differ from one side of the Atlantic to the other. The purpose of the German-US conference was to initiate a dialogue and to identify the potential for future transatlantic cooperation in land-use research. Scientific attention is now turning to a search for local to global land-use strategies for coping with climate change that also meet the requirements for food and fibre production, ecosystem services, human settlement and the production of renewable energies.

To assess current knowledge and approaches, the first day of the conference was dedicated to keynote speeches and case studies focusing on the land-use requirements of food and fibre production, ecosystem services, human settlement and the production of renewable energies. Posters presented single aspects of research approaches and gave an in-depth view of the research activities of young scientists. During the second day, small group and panel discussions focused on identifying common research goals and encouraging the mutual exchange of ideas.

The conference "Tough Choices – Land Use under a Changing Climate" was a first successful step towards closer collaboration between American and German scientists in the field of global change research. It initiated a discussion on the common research interests of American and German researchers with main foci on regional and global land-use strategies and on the potential for transatlantic cooperation, something that would be greatly welcomed by the DFG, BMBF and NSF. The conference paved the way for those interested in a larger integrative activity to build networks, prepare more structured workshops and conferences for the future and identify ways in which collaboration could be intensified.

The next section of this report presents a background paper, prepared before the meeting that aimed at defining the scope of the conference and framing the informal discussions. Following the background paper are summaries of the plenary presentations and workshop outcomes, based on the small-group and panel discussions. Finally, we include abstracts of poster presentations and a list of conference attendees.

The conference participants agreed to

1. Aim at establishing in the long run a joint **US-German research programme** with the focus on **land-use interactions in the context of global change**

2. Organise a **follow-up** meeting in order to consolidate the initial discussion, broaden the participation of research communities and focus on research issues of common interest

3. Identify **research fields** where collaboration is mature and propose a joint research programme on an **integrated and transatlantic level**.

2 Background Paper: Tough Choices – Land Use under a Changing Climate

Recent scientific achievements have clearly documented that the global climate is changing. The planet will continue to warm in the foreseeable future. Beyond the mounting evidence for a changing climate, scientific attention is now turning to a search for effective and efficient ways to cope with climate change.

Although global in origin, the impact of climate change varies enormously across regions. Coping with these changes therefore requires local action. In many cases, these actions may require regional, or even global, coordination. Mitigation of the causes of climate change and adaptation to its inevitable impacts will therefore have to take place on multiple scales and will have to take into account the different cultural, economic and ecological situations in each region. Therefore, each region should be able to choose mitigation options from a sufficiently large portfolio of options in order to develop clever strategies for reducing CO_2 emissions, increasing the efficiency of energy use, and storing consumed carbon to make energy production sustainable. Organisations, communities and regions also need to be able to choose options for adaptation that will reduce vulnerability to climate change impacts, increase capacity to adapt land-use and livelihood strategies to a changing climate, and increase resilience in both managed and natural systems.

In this context, land resources (biosphere, soils and water) and their interaction with the climate system play an increasingly important role. Although clearly limited in overall extent of the surface area, land resources are an important component of the global carbon cycle and they can be used to produce renewable energy and to sequester carbon. Additionally, changing land use and its associated livelihood systems can represent a way in which societies can adapt to changes in climate. This potential, however, is restricted by existing demands on land resources for the provision of human settlement, food and fibre production, and other ecosystem services (like maintenance of water quality), as well as broader societal and natural conditions that limit land-use options.

Bioenergy production, food and fibre production, ecosystem services and human settlement of land all rely on the same limited land resources. The metabolism of half of the planet's land surface is already altered due to human activity, mostly agriculture, forestry, urbanisation and industry. At the same time, land-based activities are becoming increasingly stressed by greater climatic variability and uncertainty to which they must adapt. Even the choice to abandon, conserve, or preserve land in some parts of the world is, and increasingly will be in the future, a deliberate decision.

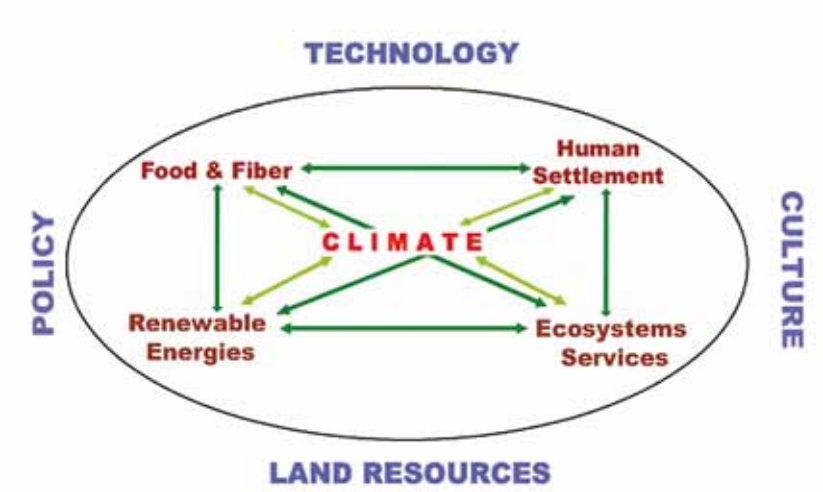
Climate change itself will release large areas from permafrost, reducing a large natural carbon sink. Northern communities that depend on frozen conditions associated with permafrost will be forced to make new choices for human land use, which may threaten their cultural livelihoods.

On the other hand, we will most likely lose large arable areas through desertification. With increasing utilisation of global land resources, human settlement, food production, energy production and ecosystem service provision are increasingly in conflict with each other. Decisions in favour of one land use over others inevitably affect climate, through changes in the interactions of the land surface with the atmosphere and society and through effects on the vulnerability and resilience of people to the inevitable climate changes that they face. Tough choices lay ahead of us.

Humans have a long experience in and manifold technologies, policies and traditions for managing land resources. These approaches are usually applied by local entities that make local and regional land-use decisions rarely with a global scope. Today, whilst the globalisation of markets connect food, fibre and fuel through world market prices and trade links, these market processes do not significantly take into consideration climate mitigation and adaptation.

We currently lack both the scientific basis and the proper management tools to analyse the trade offs of land-use alternatives for mitigation and adaptation to climate change to achieve more beneficial allocation decisions as well as using land resources for this purposes in more sustainable ways. This multi-objective research task goes far beyond the scope of a single discipline involved in global change research. This complex field of research needs new integrated scientific approaches that go beyond disciplinary boundaries and that cover social, economic and natural science.

There are strong research communities already working on climate change and its impacts in both the US and Germany. Nevertheless, perceptions, backgrounds and approaches differ on each side of the Atlantic. Based on the strong belief that both sides could benefit from a mutual exchange of ideas, we organised a scientific conference dealing with "Land Use under a Changing Climate." The aim of the German-US conference was to initiate discussion, to identify where we stand, and to look for common research goals.



“With regard to climate change land use and land use changes have become important research issues.“

“Trade-offs are easiest to see in terms of comparative statics. But that’s not how the trade-offs are managed in real life.”

Some statements of participants

2 Summary of Plenary Presentations

Matthias Kleiner, President of the German Research Foundation (DFG), underlined in his speech that the issue of land use in a changing climate has huge potential to strengthen ongoing and to initiate new collaboration between German and US scientists in the field of global change research. He emphasised that the DFG would play a role in fostering such approaches and would work closely with its partner, the NSF, to find the best programme and application procedure.

Thomas Rachel, Parliamentary State Secretary of the German Federal Ministry of Education and Research (BMBF), underlined that research activities in the field of global change would need to transcend national borders. The productive partnership between outstanding research centres in the US and the German scientific community would provide an excellent basis for the dialogue on future research collaborations. Thomas Rachel invited the participants to strengthen the existing cooperation in land-use research.

David Lightfoot, Assistant Director for Social, Behavioural and Economic Sciences at the National Science Foundation (NSF), underlined that the National Science Foundation was pleased to be a partner in this joint activity between American and German researchers to address questions related to land use in a changing climate. The NSF expressed its hope that the conference would spur the scientific collaborations needed to tackle the global issues arising from climate change.

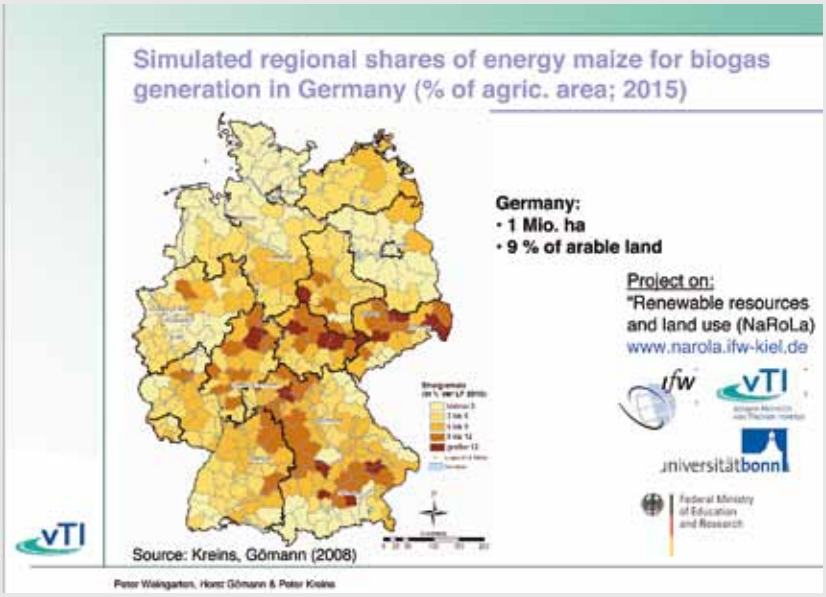
back (from the left) :
J. Karte (DFG)
W. Mauser (LMU)
D. Brown (Univ. Michigan)

front (from the left) :
T. Rachel (BMBF)
D. Lightfoot (NSF)
A. Frodl (DFG)
T. Baerwald (NSF)
M. Kleiner (DFG)

Peter Weingarten is Director of the Institute of Rural Studies at the Johann Heinrich von Thünen-Institut (vTI), Federal Research Institute for Rural Areas, Forestry and Fisheries. His main research interests are the future of rural areas in an enlarged EU, employment in agriculture and the relationship between agriculture and groundwater protection.

Trends in German Agricultural Land Use

Peter Weingarten , Horst Gömann & Peter Kreins



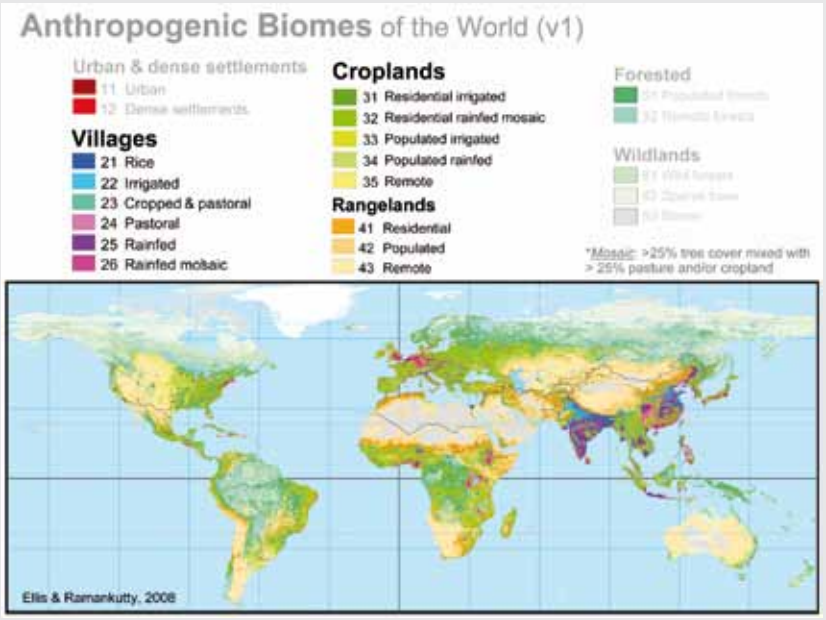
snapshot of presentation

The drivers of land-use changes and potential impacts of climate change on agricultural land use in Germany were discussed. At present identified main drivers are energy and environment policy. Furthermore, land use and land-use changes have become important research issues with regard to climate change.

Erle Ellis is Associate Professor at the Department of Geography & Environmental Systems, University of Maryland, Baltimore County. His research and teaching interests include landscape ecology, biogeochemistry, Global Change and sustainable ecosystem management.

Agriculture in a global context - Anthropogenic biomes, land use systems and global change

Erle Ellis

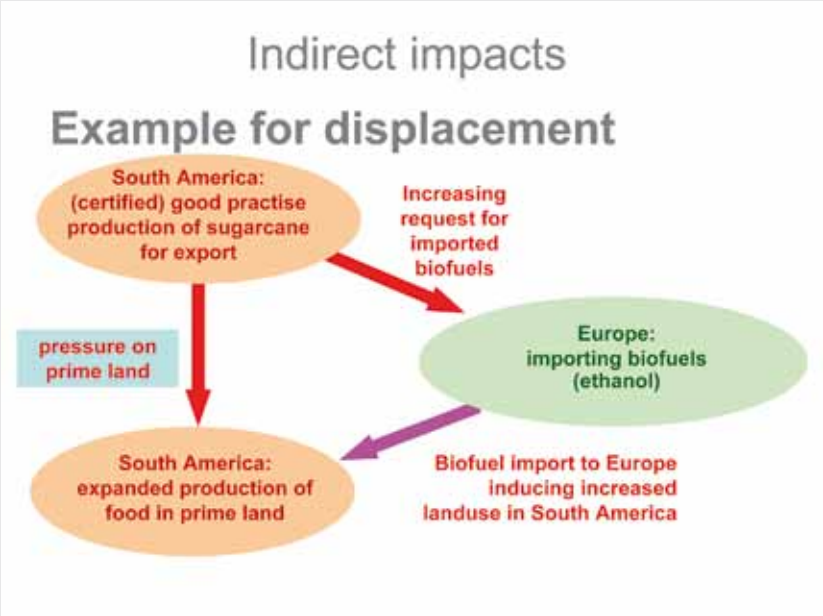


snapshot of presentation

The speech focused on measurement and modelling approaches of changes in a global and regional level in multifunctional anthropogenic biomes (anthromes). In the context of climate change, the observation of global changes in agricultural mosaics and modeling of interactions between climate and management will become a challenge.

Possible Land Use Demand for Renewable Energy

Axel Friedrich



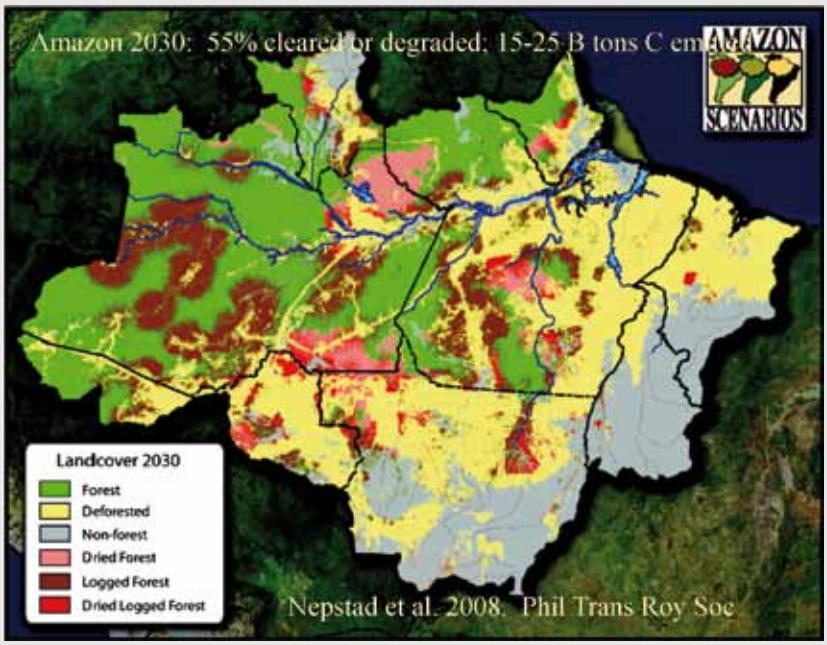
snapshot of presentation

The development of German and EU-wide targets regarding renewable energy and issues of sustainability with respect to biofuel production were discussed. Thereby a special focus should be on the global consequences of biofuel production on land use and the associated ecological and economic consequences.

Axel Friedrich was head of the Environment, Traffic and Noise Department of the German Federal Environmental Agency until 2008 when he retired. With a background in technical chemistry, his work focuses on sustainable transport (land, air and sea) and renewable energy.

Managing the forest-climate-land crisis: Biofuels, meat eating, hunger, and corporate responsibility

Dan Nepstad, Claudia Stickler



snapshot of presentation

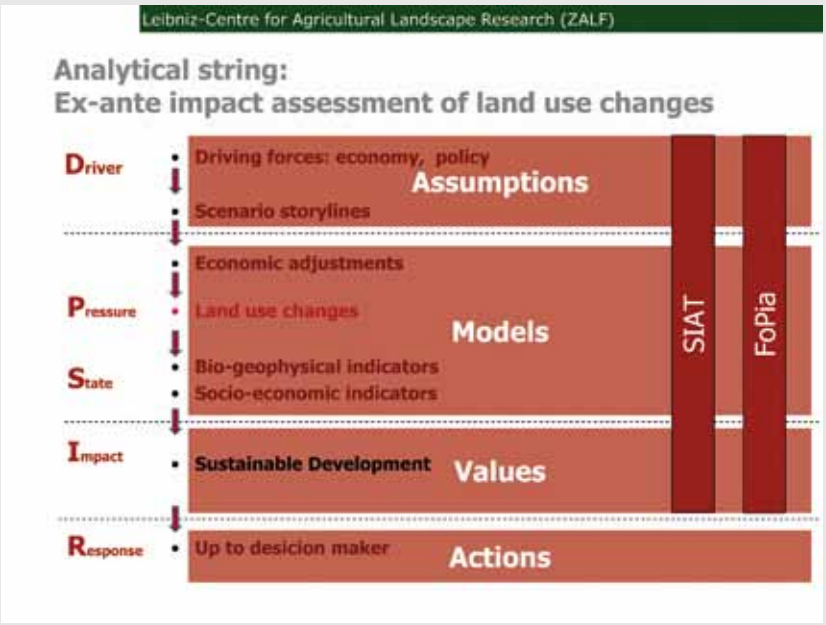
The growing scarcity of new agricultural land in the temperate zone was discussed as well as the intensification of production and the global interaction between biofuel production, the increase in meat consumption, famine and agricultural expansion and the resulting consequences.

Daniel C. Nepstad is Senior Scientist at the Woods Hole Research Center, in Falmouth, MA. As tropical forest ecologist, Daniel Nepstad has studied tropical forestry and strategies for their extensively conservation for the last 24 years. At the Woods Hole Reserach Center Daniel Nepstad leads Amazon program and coordinates the program on "REDD" (Reductions in Emissions from Deforestation and forest Degradation).

Katharina Helming is Senior Scientist at the Directorate of the Leibniz-Centre for Agricultural Landscape Research. Currently Katharina Helming conducts research on the future of landscapes, on the on- and offsite environmental impacts of runoff and soil erosion as well as on the environmental, social and economic effects of multifunctional land use in European regions.

Tools for impact assessment of land use changes and rural urban interaction

Katharina Helming, Armin Werner, Annette Piorr, Ingo Zasada



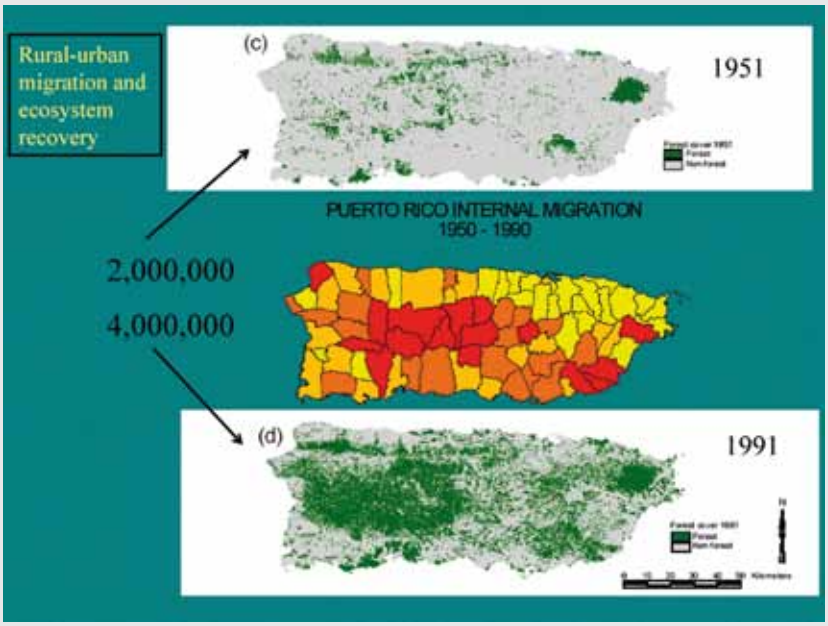
snapshot of presentation

With respect to trends in human settlement, strategies for the impact assessment of land-use changes with a focus on the impact of rural-urban interactions were presented. The speech focused on the integrated assessment of land-use changes on a European scale based on different land-use functions.

T. Mitchell Aide is Professor at the Department of Biology, University of Puerto Rico. His research and teaching interests cover a diversity of topics, including biogeography, conservation, forest dynamics, global change, and restoration ecology. Mitchell Aide has conducted research in tropical ecosystems in Puerto Rico, Dominican Republic, Panama, Colombia, Argentina, and China.

The effects of a globalized world on land-use patterns in Latin America and the Caribbean

T. Mitchell Aide

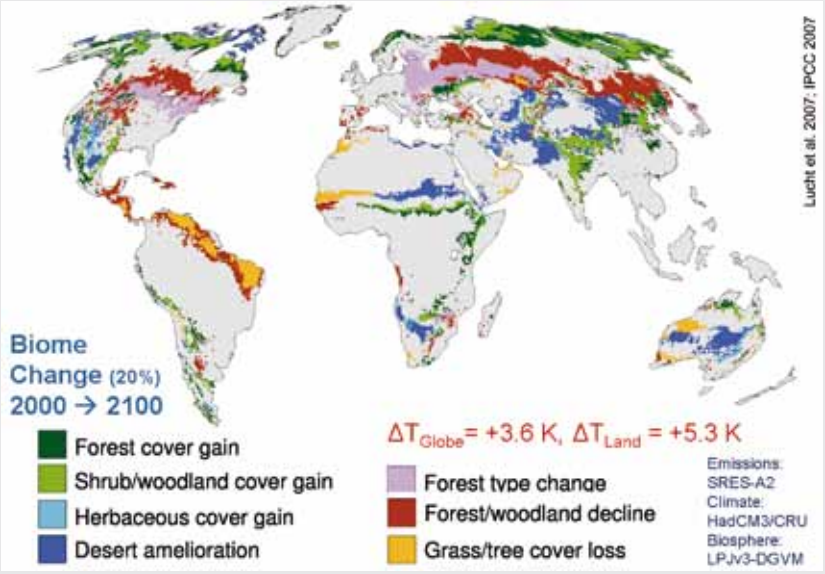


snapshot of presentation

With a focus on the interaction between poverty, rural-urban migration, ecosystem recovery, agricultural land use and biodiversity conservation the effects of a globalised world on land use patterns were discussed.

Maintaining Ecosystem Services on Land

Wolfgang Lucht, Dieter Gerten, Hermann Lotze-Campen, Tim Beringer



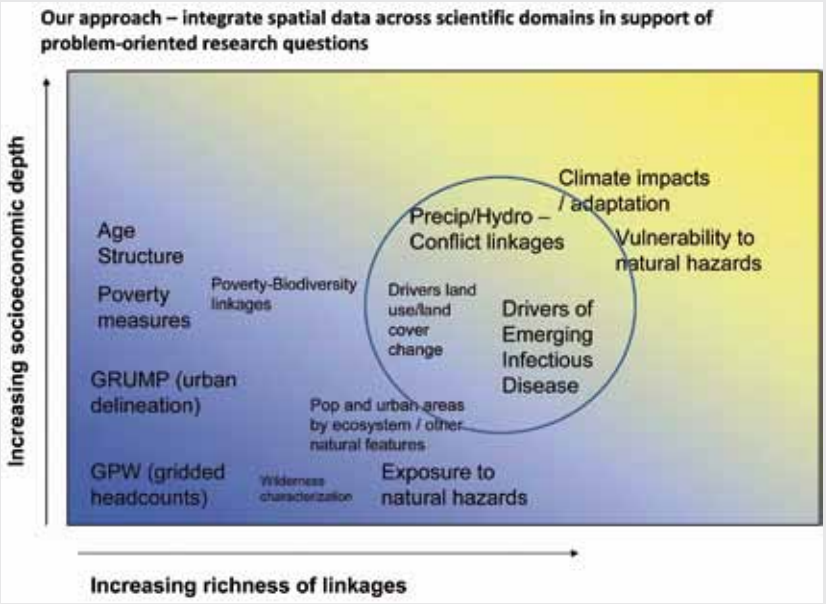
snapshot of presentation

The presentation demonstrated the metabolic effects of industrialisation with a special focus on biome change, human-induced change in agricultural productivity and the biomass-based global energy potential. It was suggested that maintaining ecosystem services on land means managing material consumption.

Wolfgang Lucht is Chair of the research domain "Climate Impacts and Vulnerability" at the Potsdam Institute of Climate Impact Research in Germany. He is also a professor of Biosphere Dynamics and Earth System Research at the Institute of Geoecology at Potsdam University. Wolfgang Lucht studies the future of the biosphere, the effects o climate and land use change on global landscapes and the role of humans in the Earth's environment.

Global examples involving biodiversity conservation, poverty reduction and disease prevention

Marc Levy



snapshot of presentation

The speech discussed the trade-offs between biodiversity conservation and poverty reduction as well as between biodiversity and the risk of emerging infectious diseases. Furthermore, the challenge of how to describe, model and manage these trade-offs was underlined.

Marc Levy is deputy director of the Center for International Earth Science Information Network at Columbia University's Earth Institute. At CIESIN he leads work on water-conflict linkages, anthropogenic drivers of emerging infectious diseases, climate vulnerability, and other projects seeking to understand human-environment interactions in a context of global change.

Paul Vlek is Professor and Director of the Department of Ecology and Natural Resources of the Centre for Development Research (ZEF-Bonn) at the University of Bonn. With a background in Agronomy his research and teaching focuses on Tropical and Subtropical Agroecology and Food and Horticultural Crop Production.

Beyond the Aral Sea Syndrome: Economic and Ecological Restructuring of Land and Water Use in the Region Khorezm (Uzbekistan)

Paul L.G. Vlek, Ahmad M. Manschadi, John P.A. Lamers, Christopher Martius

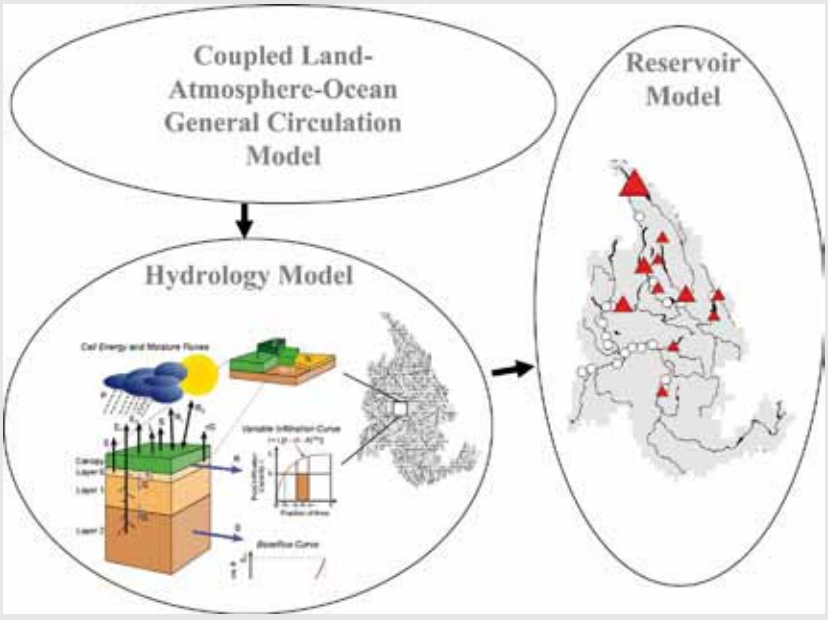
snapshot of presentation

The Khorezm project focuses on the economic and ecological restructuring of land- and water use in the Khorezm region (Uzbekistan). The overall goal is to increase agricultural productivity in a sustainable way, provide alternative land-use options and develop a science-based decision support system for reconstruction.

Dennis P. Lettenmaier is Professor at the Department of Civil and Environmental Engineering at the University of Washington. His areas of specialisation are Hydroclimatology, Surface Water Hydrology, GIS and Remote Sensing. Dennis Lettenmaier is also a member of the Surface Water Hydrology Research Group at the University of Washington.

Climate change and water resources: The Colorado River basin as a case study

Dennis P. Lettenmaier

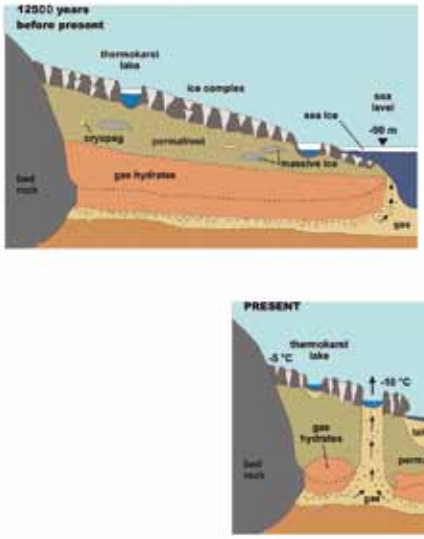


snapshot of presentation

Using the Colorado River basin as a case study, a downscaling and modelling approach of the use of water resources under climate change were presented.

Arctic warming and its consequences for permafrost landscapes

Hans-Wolfgang Hubberten



Schematic models of Coastal and Submarine Permafrost under different climatic conditions (Romanovskii & Hubberten)

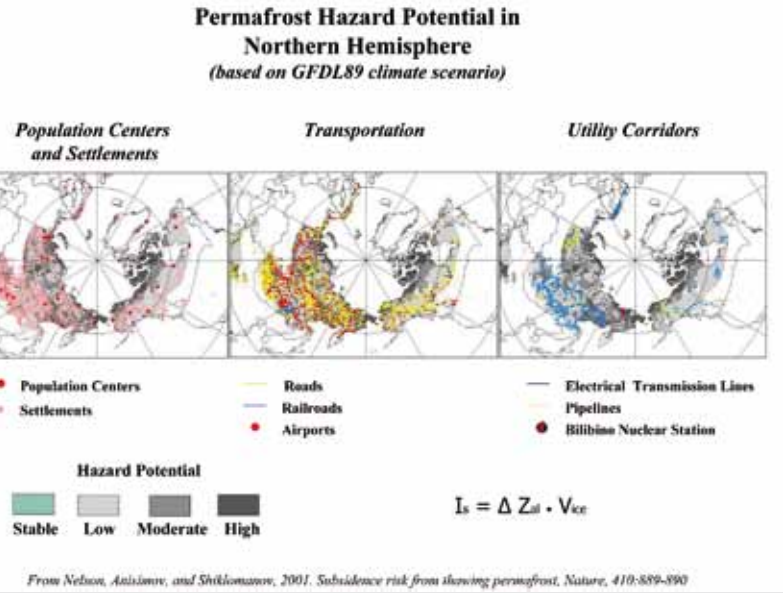
snapshot of presentation

The response and role of permafrost on a warming plantet (e.g. permafrost degradation on arctic coasts) was demonstrated, as well as its influence on human infrastructure and greenhouse gas release. The results indicate that in order to minimise risks and manage the changing environmental conditions, new strategies and technologies have to be developed.

Hans-Wolfgang Hubberten is Head of the Research Unit Potsdam of the Alfred Wegener Institute (AWI) for Polar and Marine Research. He also is Professor for isotope geochemistry at the University of Potsdam. His areas of specialisation are climate reconstruction, permafrost research and isotope geochemistry.

Permafrost and Land-Use Issues in Alaska

Frederick E. Nelson



snapshot of presentation

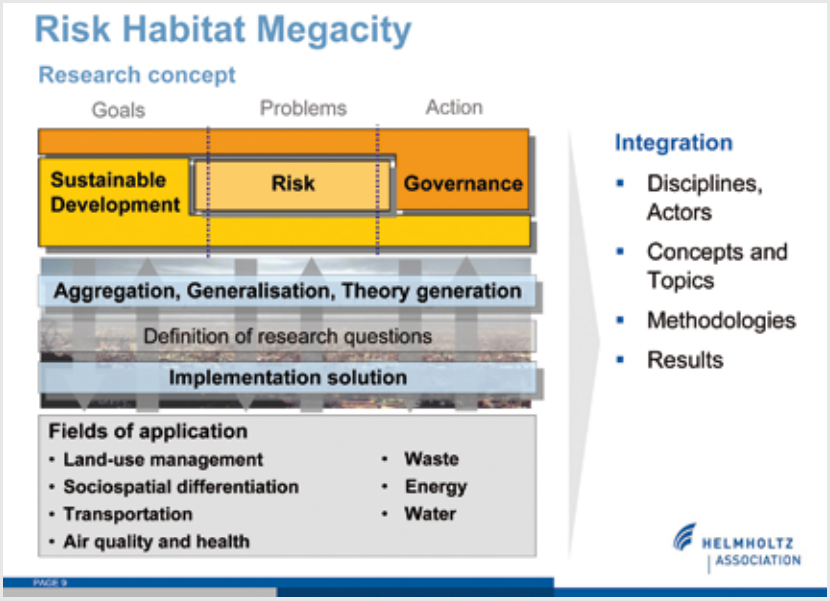
From a historical perspective, land use and land-use change in a permafrost environment, the role of climate change and the impacts of civil infrastructure were discussed. The results show that permafrost is an important element of climate change science that needs an interdisciplinary approach and should be used as an integral part of land-use studies.

Frederick E. Nelson is Professor at the Department of Geography, University of Delaware. His research and teaching interests are permafrost, periglacial and climatic geomorphology, topoclimatology, spatial analysis, the history of cryospheric research and American geography.

Bernd Hansjürgens is Spokesman of the Helmholtz Association Program „Sustainable Use of Landscapes“ and Head of the Department of Economics at the Helmholtz Centre for Environmental Research (UFZ). His areas of specialisation are Environmental Economics, New Institutional Economics and Public Finance.

Megacities and Urban Agglomerations

Bernd Hansjürgens



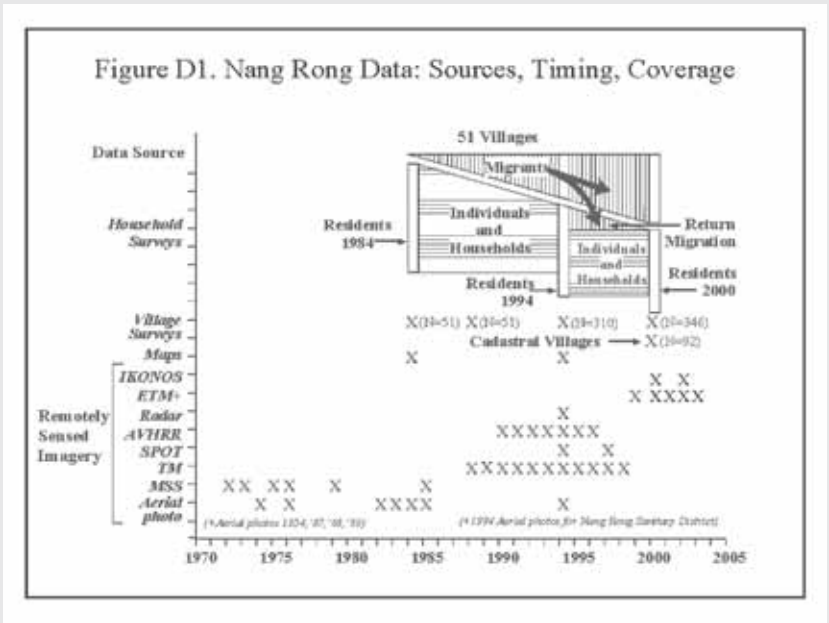
snapshot of presentation

Presenting German and international research initiatives on megacities with a focus on the Risk Habitat Megacity project (Santiago de Chile), the need for interdisciplinary research on urban agglomerations as highly dynamic growth regions under the theme of global change was emphasised.

Ronald R. Rindfuss is Distinguished Professor of Sociology, Adjunct Professor at the Department of Geography and Carolina Population Center Faculty Fellow at the University of North Carolina, Chapel Hill. Ron Rindfuss studied extensively the interactions Population-Environment. Thereby he is particularly interested in the relationship between Population Change and Land Cover/Use.

Highly Dynamic Growth Regions

Ronald Rindfuss

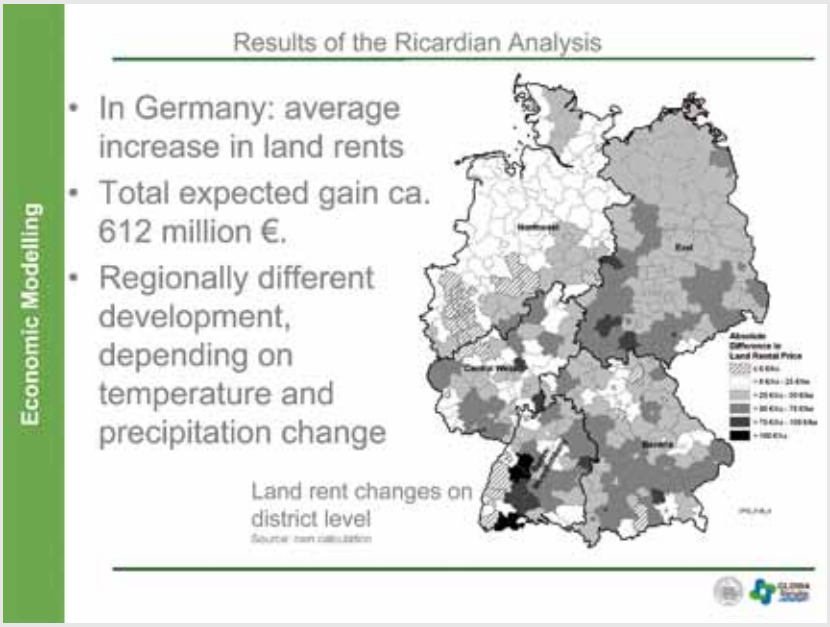


snapshot of presentation

Comparing the cases of Thailand and the Galapagos islands, the differences in vulnerability to climate and global change were demonstrated and land-use decision-making on multiple levels was highlighted. The study concludes that interdisciplinary teams and sharing of data sets are needed to meet the challenge of land-use change in a changing climate.

Economic modelling of agriculture under global change in Southern Germany

Stephan Dabbert



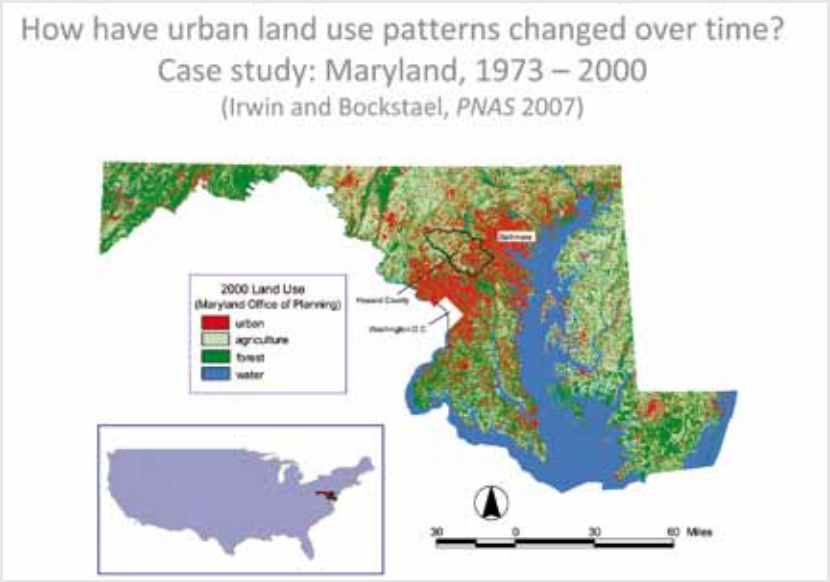
snapshot of presentation

The case study GLOWA-Danube (Southern Germany) focused on the linking of economic models with natural science-based models to achieve an understanding of agricultural land-use change in the context of global change on a district/local level. The research indicates that agent-based models can be a tool for a better understanding of detailed processes/ decisions. However, several questions still remain unanswered.

Stephan Dabbert is Professor at the division of Production Theory and Resource Economics at University of Hohenheim. He is Managing Director at the Institute for farm management. His research interests are in socio economic modeling of agricultural landscapes.

Urban and rural land use change in the U.S.

Elena G. Irwin, Darla K. Munroe



snapshot of presentation

The discussion focused on ex-urban land use in the US, the influences of ex-urban pattern changes (caused by regional economic structure, management policies) and the impacts of ex-urban land-use patterns on climate change. Issues relating to individuals' responses to policy changes and the full costs and benefits of alternative policies were addressed.

Elena Irwin is Associate Professor at the Department of Agricultural, Environmental and Development Economics at Ohio State University. Her research and teaching is in regional and community economics. Her primary research interests focus on the causes and consequences of growth in local and regional areas.

4 Workshop Outcomes

The conference "Tough Choices – Land Use under a Changing Climate" was a first successful step: It initiated the discussion of common research interests among American and German researchers and emphasised the potential and need for focused transatlantic cooperation, which is of interest to the DFG, BMBF and NSF. The conference paved the way for those interested in a larger integrative activity to build networks, to prepare more structured workshops and conferences for the future and to decide how collaboration can be intensified. The overall medium-range aim discussed during the conference is the formulation of a proposal for an integrated, transatlantic joint research programme.

The participants agreed that transatlatic cooperation would need more detailed consideration. More coordinated collaboration requires infrastructure, adjustment of understanding, adjustment of language and frameworks. Most importantly it requires more efforts in the identification of overlapping interests and specific joint research activities or projects.

Discussions during the conference revealed significant overlap in the views of the participants, particularly regarding the need for scaling up insights and models relating to the interactions between people, land, and climate at the local level to regional and global scales and the need to find ways to better integrate natural and social science.

Identified research challenges and needs within land use and regional modelling:

- Monitoring and modelling of land use dynamics on different scales with multiple spatial and temporal resolutions, including agricultural change in multifunctional land mosaics (e.g. urban, suburban, exurban and rural settlements (USER) and human livelihood systems)
- Identify, model and project land use relationships and interactions between rural, peri-urban and urban areas at continental scales
- Evaluate and implement multiple alternative approaches (e.g. econometric, agent-based simulation, spatial optimization, etc) to formalise and model the interactions between drivers, land-use changes and their impacts
- Derive response functions for drivers, pressures, impacts, and interactions in and among urban, suburban, exurban and rural settlement regions
- Develop tools for linking of models (ABM, integrated assessment, mathematical programming, ecosystem process models) at different scales
- Identify and model cross-scale interactions, including spatial, temporal and social organizational scales including global models, to find hot spots, then use specific regional models to address impacts

- Adapt IPCC SRES scenarios to indicate changes in drivers of land-use changes in urban, suburban, exurban and rural settlement regions

- Create and share comparative, spatially explicit global and regional data sets and case studies that examine both land use and land cover

Identified research challenges and needs within land use and trade-offs:

- Evaluate how the demand for food production, human settlement and biodiversity can be balanced within available land areas

- Evaluate land use tradeoffs where conflicts or complementarities exist in land use for biodiversity conservation, agricultural production, ecosystem services, poverty reduction, infectious diseases, etc.

Identified research challenges and needs within land use and (regional/global) governance:

- Evaluate the implications of land-use, land-tenure, and land-economics policies for the vulnerability and adaptive capacities of various communities to environmental change and hazards.

- Better understand the economic teleconnections that global markets facilitate, e.g. through markets for agricultural commodities, and the opportunities for intervention to achieve specific ecosystem related goals by global environmental agreements, e.g. through environmental certification programs or project based financial mechanisms

Identified research challenges and needs within land use to other linkages:

- Quantify the possibilities of using land management within agricultural, forest, and USER areas to achieve higher levels of carbon storage in vegetation and soils.

- Investigate alternative energy projects that do not compete for land with food production and biodiversity or the increased areal demand for human settlements

Steps ahead

Conference participants agreed to

1. Aim at establishing, in the long run, a joint US-German research programme focused on land-use interactions with Global Change

2. Organise a follow-up meeting (in the next year) in order to consolidate the discussion initiated, broaden the participation of research communities, focus on research issues of common interest

3. Identify research fields where collaboration is mature enough to aim at implementing research activities and propose a joint research programme on an integrated and transatlantic level.

“Since biofuels are not going to disappear, there is an overwhelming need for an integrated approach to food, fibre, fuel, and climate change.“

“A certification scheme of carbon credits has to be installed world wide with strong implementation and control.“

Some statements of participants

5 Poster Abstracts

The fate of arctic permafrost coasts: Increasing threats and expected impacts

1

Hugues Lantuit
(Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany)

There is no question that the Arctic is particularly affected by climate change as was shown not only in IPCC's recent 4th Assessment Report, but also specified in the Arctic Climate Impact Assessment (ACIA) and Arctic Human Development Report (AHDR) as well as in the Science Plans of the Second International Conference of Arctic Research Planning (ICARP II). Of particular interest is the response of geophysical and ecosystem features in the Arctic coastal zone to effects of global warming, i.e., the decreasing sea ice cover, the destabilization of permafrost systems and increased exposure of the coast to storms. Embedded in a coupled socio-ecological context are issues of societal response to these changes. This includes both adaptation to changing living conditions bearing threats and options for human welfare as well as new forms of land and sea use such as enhanced access to and exploitation of resources, or increasing ship traffic.
Despite heightened media coverage and imminent changes to the coastal zone environment in the Arctic, little is known about the actual evolution of the shoreline and related socio-economical and ecological impacts. This paper provides a rapid overview of the current knowledge on arctic coastal dynamics and the gaps that new programs initiated during the IPY are attempting to fill.

Studying the Critical Zone in an alpine tundra environment - Examples from the Boulder Creek Critical Zone Observatory (BC-CZO), Rocky Mountain Front Range of Colorado, USA

2

Matthias Leopold, Jörg Völkel
(Technical University Munich, Freising, Germany)

The Critical Zone (CZ) is defined as the thin, porous covering of the earth, within which rocks, soil, gases and water interact. Three CZ-observatories, funded by US NSF, will focus on the development and the structure of the CZ. Data from a DFG funded project are added.
We present initial results from the Green Lake watershed, an alpine tundra, situated at 3600 m a.s.l. in the Rocky Mountains of Colorado which functions as a main water source for the City of Boulder. Large areas are underlain by permafrost which reacts sensibly to warming climate.
The geophysical methods of Ground Penetrating Radar, Electric Resistivity and Shallow Seismic Refraction were used to portray the CZ in considerable details. Integrating hydrological data from the nearby Long Term Ecological Research Site (LTER) at Niwot Ridge offers a possibility to crosscheck and predict hydrological changes of water discharge and permafrost degradation within the city's watershed.

3

The Role of Soil Dust Emissions in the Climate System

Bernd Heinold, Ina Tegen
(Leibniz-Institute for Tropospheric Research, Leipzig)

Mineral dust emission from bare soil surfaces is suspected to be an important climate factor, influencing the atmospheric radiation budget directly, and also indirectly by modifying cloud processes.
Regional model experiments show that dust clouds that may be transported over thousands of kilometers can modify atmospheric stability and weather features. The atmospheric dust effects cause a negative feedback upon dust production itself. The Sahara is the world's largest source of atmospheric desert dust, contributing at least 50% to global dust emissions. Different data indicate that dust export from the southern Sahara toward the tropical northern Atlantic strongly increased between the 1950s and the 1980s.
While it is suspected that drought conditions led to an increase of dust source area, model results indicate that changes in surface winds were the main cause for this increase. Regional climate change will cause changes in dust emissions from both natural and agricultural surfaces.

4

The Periglacial Legacy of the New Jersey Pine Barrens, USA: Geomorphic Heritage as a Land-Use Management Tool

Mark Demitroff, Frederick E. Nelson
(University of Delaware, Newark, United States)

Although the New Jersey Pine Barrens is a UN world biosphere preserve rich in both cultural elements and natural history, intense development pressures and increasingly lax land-use management threaten the area's natural heritage. Cold, dry, and windy (periglacial) conditions created landscape features in the Pine Barrens that serve as critical habitat for rare contemporary flora and fauna. The Pine Barrens' lifeblood, shallow groundwater, is slowly drying up in response to exurban sprawl. It is imperative that increased scientific and public attention be focused on the region's Quaternary history. Better recognition, understanding, and appreciation of the region's periglacial heritage may become an effective tool in attempts to preserve it from exurban sprawl. Geomorphology is an underutilized tool in land-preservation efforts in the USA. Creation of broader interest in the Pine Barrens' periglacial legacy may be a key factor for the preservation of its remarkable landscapes prevention.

Modeling multiple stresses placed upon a groundwater system in a semi-arid brackish environment

5

Mathias Toll, E. Salameh, M. Sauter
(Göttingen University, Göttingen, Germany)

In semi-arid areas groundwater systems are frequently not sufficiently characterized hydrogeologically and long term data records are generally not available. To overcome these problems an integrated approach for the provision of a reliable database based on sparse and fuzzy data is proposed. The aquifer geometry and composition is described with the help of geological, hydochemical, and geophysical methods. As far as the water budget is concerned, the recharge to the considered aquifer is estimated with geological methods and available data sets, while the abstraction from the aquifer is estimated with the help of remote sensing techniques. On the basis of the findings a numerical 3-D transient model integrating all important features of the hydrogeological system was developed. In order to be able to give reliable predictions about the impacts of climate change scenarios on the groundwater system the flow model was tested against stress periods depicted during the historical review of the test area. These stress periods include periods of intense rainfall, of drought, and of anthropogenic impacts, like building of storage dams and of violent conflicts.

A Ricardian Analysis of the Impact of Climate Change on Agriculture in Germany

6

Christian Lippert, Tatjana Krimly, Joachim Aurbacher
(Hohenheim University, Stuttgart, Germany)

Based on a Ricardian analysis accounting for spatial autocorrelation and relying on recent climate change forecasts at a low spatial scale, this study assesses the impact of climate change on German agriculture. Given the limited availability of data (e.g., the unknown average soil quality at the district level), a spatial error model is used in order to obtain unbiased marginal effects. The Ricardian analysis is performed using data from the 1999 agricultural census along with data from the network of German weather observation stations. The cross-sectional analysis yields an increase of land rent along with both a rising mean temperature and a declining spring precipitation, except for the Eastern part of the country. For the subsequent estimation of local land rent changes, an IPCC climate change scenario is evaluated and entered into the estimated regression equations. This forecast contains spatially processed data for the period between 2011 and 2040 from the regional climate simulation model REMO. The resulting expected benefits arising from climate change vary over the districts; the calculated overall rent increase corresponds to approximately 5-6% of the net German agricultural income. However, this assumption can only be expected to hold true within a moderate bandwidth of temperature and precipitation change.

7

From forest to fuel and feed: tropical forests in the pathway of agricultural expansion

Claudia M. Stickler[1,2,3], Daniel C. Nepstad[2,3], Michael T. Coe[2], Holly K. Gibbs[4], Gregory J. Fiske[2]
([1]University of Florida, School of Natural Resources and Environment, United States; [2]The Woods Hole Research Center, Falmouth, United States; [3]Instituto de Pesquisa Ambiental da Amazônia, Belém, Brasil; [4]University of Wisconsin, Madison, United States)

Rising global demands for biofuels, animal feedstocks, and food crops are increasing the demand for new agricultural land, potentially speeding tropical deforestation and associated carbon emissions, and making conservation more costly. A new international mechanism for rewarding tropical nations that reduce their carbon emissions from deforestation could soon counteract this trend. However, slowing deforestation may be difficult where tropical forests occupy land that is biophysically suitable for agroindustrial commodities or densely occupied by smallholder farmers. We estimate that three-quarters of the world's remaining dense tropical forests, containing approximately 150 Gt of carbon, are edaphically and climatically suitable for the cultivation of oil palm, soybeans, or sugar cane, or are densely populated. However, over the next ten years, projected expansion of these three crops is less than 6% of remaining tropical forest area, suggesting near-term conservation opportunities. Long-term susceptibility is much higher, thus forest conservation will depend on well-planned agricultural expansion.

8

Conversion of degraded cropland to tree plantations for biofuel and co-benefits of C sequestration in northwest Uzbekistan

Asia Khamzina, John P.A. Lamers, Paul L.G. Vlek
(Center for Development Research, Bonn, Germany)

Advancing degradation of irrigated croplands is a major concern in Uzbekistan because of the adverse impacts on the environment and rural livelihoods. Field experiments in northwest Uzbekistan evaluated the option of afforesting the agriculturally marginal areas to locally generate fuelwood while regionally contributing to land restoration. Tree plantations grown on highly saline land included Elaeagnus angustifolia, Populus euphratica and Ulmus pumila. Over five years, this land use change increased soil organic carbon stocks by 20% adding 8 t ha $^{-1}$. In the 5th year, the energy value of the plantations equated 6-10 tons of oil equivalent per hectare, sufficient to cover the annual energy need of 55-90 persons in rural areas. The carbon sequestration in trees remaining after the fuelwood harvest (2,300 stems per hectare) amounted to 10-20 t ha^{-1}. The tree based systems rather than annual cropping in degraded areas can be beneficial to farmers and help mitigate environmental deterioration.

Modelling Plant Growth Under Climate Change Conditions - Applying an Explicit Description of Photosynthetic Processes

9

Tobias Hank, Wolfram Mauser
(Ludwig-Maximilians University, Munich, Germany)

With the developing public awareness of the tense nutrition situation and the increasing energy demand of a rapidly growing world population, the management of the landsurface with respect to its potential of agricultural use has gained importance in many different scientific publications. Especially questions concerning the regional impacts of climate change on agricultural production are of major interest in that context.
In order to create a model system that would be able to reliably assess the diverse problems of climate change on the regional scale, a well established model of photosynthesis was combined with a model of stomatal conductance, enabling a detailed mapping of the gas fluxes between the living canopy and the atmosphere. The biochemical growth model was integrated into the physically based model environment of the multiscale landsurface process model PROMET (Process of Radiation Mass and Energy Transfer) and was enhanced by plant physiological submodels. The model results show that the introduced model approach is highly sensitive to the effects of climate change and well allows for an assessment of the vegetation behaviour under climate change conditions. A climate scenario, tracing the characteristics of the moderate IPCC A1B storyline, returned clear trends for a 100-year calculation period ranging from 1960 to 2060.
The projections indicate an increase of biological productivity under elevated CO_2 and temperature conditions, accompanied by a strong increase of situations with low surface water supply and drought stress. Besides an introduction and overview of the model architecture, the poster includes model results for the 100-year calculation period. Modelled time series and spatial patterns of net primary production and drought stress events are presented for the region of the Upper Danube subcatchment.

Climate hazards in the Florianópolis city-region of southern Brazil

10

Sandra R. Baptista
(Columbia University, Palisades, United States)

Rapidly expanding, intermediate size cities in the coastal zones of developing countries face the linked challenges of managing accelerated urban growth, maintaining ecosystem services, and preparing for climate hazards. This poster presents a preliminary assessment of current and projected climate hazards in metropolitan Florianópolis, a dynamic globalizing coastal city-region of approximately one million inhabitants located in southern Brazil. The poster addresses recent demographic, socioeconomic, land use, and ecosystem change in the study region. It discusses the sociospatial inequalities associated with contemporary human settlement patterns in Greater Florianópolis and the implications of these inequalities for vulnerability and adaptation to climate change. Ongoing efforts to formulate participatory municipal master plans represent important institutional mechanisms for sustainable development planning and adaptation to climatic change.

11

Flood risk assessment in Santiago de Chile

Annemarie Ebert, Ellen Banzhaf, Ulrike Weiland
(Helmholtz Centre for Environmental Research, Leipzig)

Urban expansion accompanied by the loss of natural spaces and the gain of impervious surfaces is a worldwide phenomenon and typical in a large number of cities in Latin America. In this study, the main focus is laid on the assessment of the influence of urban expansion on flood risk in Santiago de Chile.

Land use changes have an influence on the urban water balance as the conversion from natural to impervious surfaces leads to an increase in surface runoff and therewith of the flood hazard. The Mediterranean climate of the metropolitan region of Santiago de Chile and its geographical position in the central basin between the Coastal Cordillera and the major Andean mountain range are the cause of heavy rainfalls during the winter months, when most floods occur.

The goal is to assess the impact of urban expansion on flood risk using a hydrological model (HEC-HMS) in combination with a hydraulic model (HEC-RAS) to simulate the flow of the waterways during heavy rainfall events. Flood hazard maps will be the result gained from this analysis .

Remote sensing and GIS data are used to describe the urban infrastructure which is located in the hazard zone in terms of number (elements at risk) and vulnerability. In combination with census data, the population living in each building block will be typified. The overlay of this information with hazard maps will be combined to risk maps. Finally, solutions for flood mitigation will be pointed out from the perspective of land use management.

This study is implemented in the Helmholtz-funded project "Risk Habitat Megacity" and part of the sub-project "Land Use Management".

12

Moving towards carbon storage estimates based on integrated land-use and forest process models

Derek Robinson T., Daniel G. Brown
(University of Michigan, Ann Arbor, United States)

An understanding of the interactions between ecosystem function, e.g. carbon storage, and land-use and land-cover change (LUCC) is needed to 1) accurately quantify anthropogenic forcings on climate and 2) identify how land use management and policies can be used to mitigate those forcings. Our research addresses the implications of land use policies in exurban jurisdictions for carbon sequestration within the context of residential development in Southeastern Michigan. Specifically, we built an agent-based model to evaluate the effects of land use policies on forest cover in the region. Then we applied an ecosystem process model to the highly fragmented and human-dominated landscape to evaluate the inclusion of within-patch microclimate heterogeneity and landscape-scale climate heterogeneity on carbon storage. We are now linking these efforts to improve our evaluation of the ecological effects of land-use policies and how those policies could be used at coarser scales to mitigate the effects of climate change.

Linking land management and land cover change: An examination of the impact of protected area management on savanna heterogeneity

13

Cerian Gibbes, Jane Southworth
(University of Florida, Gainesville, United States)

One of the challenges to researchers and land managers is understanding the interactive effects of land management decisions and ecosystem structure and functioning (GLP 2005). This poster presents the preliminary results of research uses a multi-scalar approach to examine the impact of human land management decisions on land cover change in southern African savannas. Partly driven by and partly in the context of significant climate variability and possibly directional climate change, southern African states are experimenting with varied resource management approaches, including the establishment of protected areas. An inadequate understanding of the linkages between drivers of landscape change and land management decisions limits the implementation of effective management strategies. To increase to our understanding of the linkages between land management decisions and landscape change we combine quantitative land cover analyses and qualitative social data to compare management decisions within and around protected areas and the resulting impacts on land cover.

Forest commons and climate change

14

Ashwini Chhatre[1], Arun Agrawal[2]
([1]University of Illinois, Department of Geography, Urbana, United States; [2]University of Michigan, School of Natural Resources and Environment, Ann Arbor, United States)

Forests produce multiple benefits that can be channeled into strategies for climate change mitigation and adaptation. Building on recent policy trends towards greater decentralization of ownership and management of forests in favor of local communities, our research examines the promise of forest commons in generating rural livelihoods while also sequestering carbon and protecting biodiversity. We argue that national and international policy incentives can be used creatively to address trade-offs between multiple benefits at local and higher scales. The strategy of decentralized management allows for the tailoring of incentives to spatial heterogeneities in social, biophysical, ecological, and economic factors, complementing other policies for augmenting rural livelihoods, conserving biodiversity, and mitigating climate change. However, new research is called for that links policy incentives to outcomes at multiple scales.

15

Legal recommendations for improving the forest permission procedures in indigenous communities in Peru

Siu Lang Carrilo Yap
(Göttingen University, Göttingen, Germany)

This document is a result of a transfer project of InWEnt - Capacity Building International, Germany, with the NGO "Paz y Esperanza" in Peru (January - May 2008). The objectives of the project were to analyse the legal aspects of the forestry permissions of the Awajun indigenous communities and to propose recommendations for improving the administrative procedures for forestry permissions.
Analysing the forestry permissions, the main problems were found in the environmental impact assessment and its procedures.
Among others the following recommendations are given: enhancement of the advisory activities of the National Authority for Natural Resources to the indigenous communities regarding the making of the environmental impact assessment required for the forestry permissions, producing forms and guiding documents in the language of the indigenous communities, and signing of the documents in the communities with the participation of their members.

16

Urban land use change and Lake Erie: an empirical analysis of the relationship between urban land use and water quality plus a discussion of the use of qualitative sketch maps to inform agent based models

Grey Evenson[1], Darla Munroe[1], Elena Irwin[2]
([1]The Ohio State University, Department of Geography, Columbus, United States; [2]The Ohio State University, Department of Agricultural, Environmental, and Development Economics, Columbus, United States)

Lake Erie, one of five Great Lakes in the United State's Midwest, is composed of several complex interacting subsystems – physical, biological and social. A proposed theoretical model of the greater Lake Erie system accordingly supposes a number of influential physical and social variables and interrelationships. In part 1 of this project, the model's hypothesized negative relationship between urban land conversion and water quality is examined through an empirical analysis of regional water quality and land use data. While this analysis intends to inform and validate these and other modeling efforts, it also examines a number of associated data issues and the importance of accounting for natural system dynamics. In part 2 of this project, a methodology is discussed for inclusion of qualitative social variables relevant to agent level land use decision making processes within the system. Sketch maps are discussed as a possible means to inform an agent-based model.of the ecological effects of land-use policies and how those policies could be used at coarser scales to mitigate the effects of climate change.

17

"God (rain) is not coming": climate change and challenges to pastoralist weather forecast knowledge in Kenya Maasailand

Joana Roque de Pinho[1], K.A. Galvin[1,2], R.B. Boone[1], S. Zahran[2] , G. Bucini[1]
([1]Colorado State University, Natural Resource Ecology Laboratory, United States; [2]Colorado State University, Anthropology Department, United States; [3]Colorado State University, Sociology Department, United States)

Pastoralism, as practiced by Maasai in Kenya, is a land use adapted to climate variability, and, thus, responsive to climate change. Awareness of rainfall patterns and predicting the onset of the rains is vital for herding and grazing management decisions. We present data on Maasai weather forecast knowledge and ritual activity pertaining to rain. We then compare local perceptions of rainfall patterns (quantity and variability) with meteorological data. According to pastoralists, the quantity of precipitation has decreased and rainy season onset has become more difficult to predict by using traditional weather indicators. The meteorological data show an insignificant increase in rainfall and no increasing variance in annual monthly rainfall over the last three decades. We discuss reasons for the mismatch between Maasai perceptions and the meteorological data, which include cognitive biases, political-economic constraints that exacerbate the effects of drought and measurement problems.

18

Identifying land use conversion patterns, the effect of zoning on rural land conversion, and land use spillovers

Carmen Carrión-Flores[1], Elena G. Irwin[2]
([1]University of Florida, Department of Food and Resource Economics, United States; [2] The Ohio State University, Department of Agricultural, Environmental, and Development Economics, Columbus, United States)

Urban dispersion has led to increased conversion of rural lands in many exurban regions of the U.S. The resulting pattern of residential development is characterized by low density, often scattered, development. Concerns over the economic, environmental and social impacts, as well as spillover effects of these conversion patterns have led many communities to adopt land use policies (e.g. zoning) to control urban growth. However, identifying the effectiveness of zoning as a deterrent to rural land conversion has proven difficult because of the challenges involved in separately identifying the zoning effect from other factors that influence land use change at a local level. One solution is to exploit natural discontinuities in the data to identify causal effects of zoning and land use conversion. However, empirical estimation of these causal effects is still challenging due to problems of simultaneity and unobserved spatial heterogeneity which may induce spatial error autocorrelation.

19

Exploration of Research Themes: Anthropogenic Biomes, Land Use and Climate Change

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([1]University of Maryland, Department of Geography & Environmental Systems, Baltimore, United States; [2]McGill University, Department of Geography & Earth System Science Program, Montreal, United States)

To prepare for climate change, it is critical to take into account the risks associated with future land use in particular locations, and to make connections globally. Anthropogenic Biomes (Anthromes) provide a model with which to accomplish both of these tasks. By providing a framework which directly depicts connections between land use and climate, they can provide insight as to the nature of the interactions between people and their environment in specific locations. Anthromes can also provide a way of extrapolating successful planning methods to distant locations with similar climate and land use patterns. By adequately assessing the hazards of change and being able to relate valuable climate-resilient approaches to the global context, it should be possible to create systems that could be generally applicable in other regions, and evaluate their relevance for potential international utilization.

20

Combating Degradation and Deforestation by Improving Economic Sustainability of Natural Forest Management in the Tropics

Krug, Joachim
(Johann Heinrich von Thünen Institute, Hamburg, Germany)

The project 'Economic Sustainability of Natural Forest Management in the Tropics' aims on the development of baselines and methodological analysis approaches for the evaluation of economically sustainable management of natural forests in the tropics. The goal is to optimise the management and increase benefits from natural forests, and by that making sustainable forest management more attractive compared to destructive land use systems. Next to the cost-benefit calculation of respective management options, especially the consideration of critical interlinkages between conservation and development aims and pro-climate forestry goals are focussed at.

For this, approaches for forest management optimisation (close-to-nature forestry, reduced impact logging, rehabilitation and management of degraded secondary forests etc.) and alternative land-use models (forested-landscape mosaics), market-orientated links (certification, SFME, PES, soft forest products etc.) and the integration of climate-protection goals (REDD) are assessed and evaluated in consideration of micro- (rural income support) and macro-economic impacts. Legal and organisational framework conditions for sustainable forest management are considered; existing successful and unsuccessful management approaches are evaluated.

On the base of conceptual models, supporting measures are implemented and economic consequences of different management options are evaluated in praxis-orientated pilot projects in SE Asia, Africa and S America in cooperation with international partners and local research institutes.

The results are expected to provide baselines for the implementation of NFP, SFM, FCPF measures and REDD, as well as recommendations for post-2012 negotiations. The project's duration is planned for four years (2008 – 2011).

The research approach (geared to the guidelines of UNFF, CPF and IPCC) is carried out by the Institute of World Forestry, Federal Research Institute for Rural Areas, Forestry and Fisheries (vTI, Hamburg / Germany) and financed by the German Government (Federal Ministry of Food, Agriculture and Consumer Protection, BMELV).

The Use of CCS in Global Carbon Management: Simulation with the DICE Model

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Narita, Daiju
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This study attempts a numerical simulation of potential CCS (carbon dioxide capture and storage) use by using a modified version of the DICE (Dynamic Integrated model on Climate and Economy) model (Nordhaus, 1994; Nordhaus and Boyer, 2000). In DICE, CO_2 emissions are controlled to the extent in which a hypothetical optimal carbon tax justifies CO_2 reduction by firms: in our analysis, CCS is used when the optimal tax level is higher than the price of CCS. The analysis assesses the economic optimality of CCS use with a range of different assumptions. The simulation particularly focuses on the difference of results originating from two sets of general assumptions on climate change modeling, reflecting the current debate on the economics of climate change: (1) Parameterization of the standard DICE; (2) Alternative assumptions whose hints are drawn from Stern (2007). In the standard DICE cases, the model calculation shows that at the price level of $25/tCO_2$ ($92/tC), CCS is introduced around in the middle of the twenty-first century. With the alternative assumptions (e.g., near-zero discount rate), CCS begins to be utilized massively earlier in the century. The two sets of results lead to contrasting policy implications on the future CCS use; this has particularly significance in the CCS context since its benefits are not always clear-cut (e.g., limitedness of secondary benefits besides CO_2 reduction, uncertainties about the validity of technology itself).

Modeling Household Response to Endogenous and Exogenous Changes in the Ecuadorian Amazon: Design and Implementation of an Agent-Based Model

22

Carlos F. Mena[1], Stephen J. Walsh[2,3], Brian G. Frizzelle[3], Yao Xiaozheng[3], George P. Malanson[4]
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This poster describes the design and implementation of an Agent Based Model (ABM) used to simulate household response to endogenous change, exogenous impacts (including climate change), and land use land cover on household farms in the Northern Ecuadorian Amazon (NEA). The ABM simulates decision-making processes at the household level based on a longitudinal, socio-economic and demographic survey that was conducted in 1990 and 1999. Geographic Information Systems (GIS) are used to establish spatial relationships between farms and their environment, while classified Landsat TM imagery is used to set initial conditions for the spatial simulation, assess from-to land use/land cover change patterns, and describe trajectories of land use change. Results from prior studies in the NEA provide insights into the key social and ecological variables, describe human behavioral functions, and examine human-environment interactions that are linked to climate change, deforestation and agricultural extensification, population migration, and demographic change.

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Longterm impact of climate change on biosphere-hydrosphere-atmosphere interactions in an Alpine grassland catchment - introduction to the experimental concept

Nicolas Brüggemann, H. Papen, H. Kunstmann, K. Butterbach-Bahl, R. Kiese, A. Marx, S. Louis, J.-P. Schnitzler, H.P. Schmid
(Research Center Karlsruhe, Garmisch-Partenkirchen, Germany)

The concept of a planned longterm lysimeter field study in an Alpine grassland on the effects of precipitation and temperature changes on biosphere-hydrosphere-atmosphere (BHA) interactions is presented. In the framework of a larger network of longterm Terrestrial Environmental Observatories (TERENO), funded by the Helmholtz Association of German Research Centers, a lysimeter network will be realized in which soil monoliths with grassland vegetation will be transplanted along an existing natural temperature and precipitation gradient within an Alpine catchment (Ammer river) in Southern Bavaria, Germany. The main objectives are to characterize and quantify climate-driven changes in (i) the coupled C/N cycles and C/N storage, (ii) biosphere-atmosphere trace gas and energy exchange, (iii) vegetation and microbial biodiversity and the temporal dynamics of the matter turnover and exchange associated with it, and (iv) hydrology, i.e. water budget, precipitation variability, extreme hydrometeorological events, seepage water quality/quantity, and water retention capacity.

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Ecological assessment of agricultural production practices - the example of CO_2, CH_4 and N_2O emissions

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([1]Leibniz-Centre for Agricultural Landscape Research, Institute of Socio-Economics, Muencheberg, Germany; [2]University of Applied Sciences, Faculty of Landscape Management and Nature Conservation, Eberswalde, Germany)

The poster presents an indicator-based ecological assessment approach of single agricultural production practices. The approach is built as an integral component of the modelling system MODAM (Multi-Objective Decision support tool for Agro-ecosystem Management). MODAM holds a comprehensive database describing a multitude of different production practices for integrated and organic farming, which constitutes the basis for the ecological assessment. The assessment was done for altogether 15 environmental indicators. Here the assessment procedure is outlined for the indicator of greenhouse gas emission (CO_2, CH_4 and N_2O) as an example. For the calculation of the emission potentials, direct (e.g. caused by fuel consumption) as well as indirect emissions (e.g. caused by production of inputs like seeds, pesticides, fertilisers, machinery) are taken into account. Eventually, the emission potential is translated into a dimensionless index value ranging between zero and one that indicates the suitability of a certain agricultural management practices to reduce the risk of greenhouse gas emissions. The index value can then be directly compared to the other indicator-related indices.
In this way, the assessment helps to identify production alternatives that are suitable in regard to more than one indicator.

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Agricultural Land Use under Climate Change: An Overview of Livestock Management in African and South American Agriculture

Niggol S. Seo[1], Robert Mendelsohn[2], Ariel Dinar[3]
([1]Basque Foundation for Science, Spain; [2]Yale University, United States; [3]World Bank, United States)

Livestock is an essential component of agriculture, but has often been overlooked by climate researchers. Researches on livestock management in Africa and Latin America reveal that climate change will affect livestock profit, livestock species composition, and a joint management of crops and livestock. An increase in temperature would decrease livestock net revenue of large commercial farms but would increase that of small household farms. A wetter climate would decrease livestock net revenues of both small and large farms. Farmers would switch from beef cattle and chickens to goats and sheep as temperature gets higher. They would switch from cattle and sheep to goats and chickens when it gets wetter. Sub-Saharan savannahs are well suited to certain livestock species such as goats and sheep. Global warming would shift farmers from specializing either in crops or livestock to a joint management of crops and livestock.CO_2 reduction, uncertainties about the validity of technology itself).

“Agricultural policy becomes a less important driver of land use change in Germany. Energy and environmental policy are emerging as major agricultural land use drivers.“

“Maintaining Ecosystem Services on Land = Managing Material Consumption (in space and quantity).“

Some statements of participants

6 List of participants

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