

2nd Scientific
Conference
UNCCD

09-12 April 2013 • Bonn, Germany

UNCCD 2ND SCIENTIFIC CONFERENCE

Economic assessment of desertification, sustainable land management and resilience of arid, semi-arid and dry sub-humid areas

**PROGRAMME AND
SHORT ABSTRACTS**



United Nations Convention
to Combat Desertification



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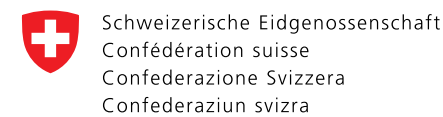
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WELCOMES

Chairman's welcome



It is my pleasure to welcome you to the Second Scientific Conference of the United Nations Convention to Combat Desertification. Your participation is fundamental for the success of the Conference and for the improvement of our knowledge in regard to the economics of desertification, land degradation and drought in the world as a whole and in each region.

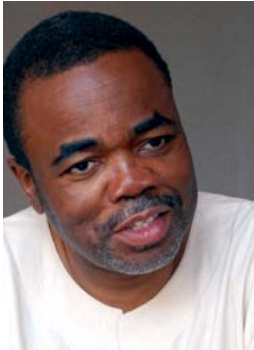
This Second Scientific Conference happens in a moment when different parts of the world face serious problems of DLDD, with droughts causing heavy economic and social impacts in developed and developing countries.

I wish you a happy and productive stay in Bonn.

Antonio Rocha Magalhães
Chairperson of the Committee of Science and Technology CST, United Nations Convention to Combat Desertification



UNCCD Executive Secretary's welcome



Time to Overcome Apathy Towards Land Degradation

Desertification, land degradation and drought entrench poverty and undermine global progress towards sustainable development. Productive land and soil are finite resources, which must be well-managed and carefully nurtured. The failure to mainstream sustainable land management (SLM) into relevant policy areas limits the dissemination and application of best practices.

To improve livelihoods in the drylands, we need to advance our understanding of the economics of land degradation. Scientific knowledge as it relates to land degradation/desertification is central to building the resilience of dryland communities and ecosystems, it also creates conditions leading to food, energy and water security, it further contributes to the prevention of biodiversity loss and climate change adaptation.

The UNCCD 2nd Scientific Conference offers a unique opportunity to sharpen our understanding of the real value of drylands, and its associated ecosystems services. The outcomes of this Conference should provide the evidence needed for bold actions and justify the need for a sustainable development goal on land. I hope efforts made in this activity could drive future policy to secure soil productivity in the drylands and move toward land-degradation neutrality for the well-being of present and future generations.

Luc Gnacadja

Executive Secretary

United Nations Convention to Combat Desertification



UNCCD conference organizer's welcome



As President of the Global Risk Forum GRF Davos, I feel very honoured that the UNCCD has mandated our foundation with the organization of its 2nd Scientific Conference.

DLDD (Desertification, Land Degradation and Drought) are not sudden events, but slow onset processes – a silent, emerging disaster – and a major global concern. The widespread loss of fertile topsoil in terms of quality and quantity is often not conspicuous, but nevertheless potentially very damaging, it has adverse impacts on land productivity, food security, environmental sustainability, economic development and on livelihoods.

Supporting the provision of adequate platforms for the exchange of inter-sectorial experience and trans-disciplinary know-how is one of GRF Davos' main goals. In today's era of rapid global change, resource depletion, hunger, poverty and environmental degradation, it is of vital importance to build bridges between different disciplines, sectors and society as a whole, in order to develop integrative solutions for a more sustainable future.

We anticipate a successful and worthwhile conference, providing excellent opportunities to extend personal and professional networks. Our thanks go to Luc Gnacadja, UNCCD Executive Secretary and to the UNCCD Secretariat, to the Conference Steering Committee, the Scientific Advisory Committee, and to the Working Groups, to the conference sponsors, to the high-level speakers and panellists, to the authors of all the papers and posters to be presented, to the reviewers, to the special session and workshop organizers, and to the affiliates. We are very thankful for the provided leadership, guidance, commitment, support and hard work. Last but not least we would like to thank you as participants and wish you enriching discussions.

Walter J. Ammann

President Global Risk Forum GRF Davos

Organizer of the UNCCD 2nd Scientific Conference on behalf of UNCCD

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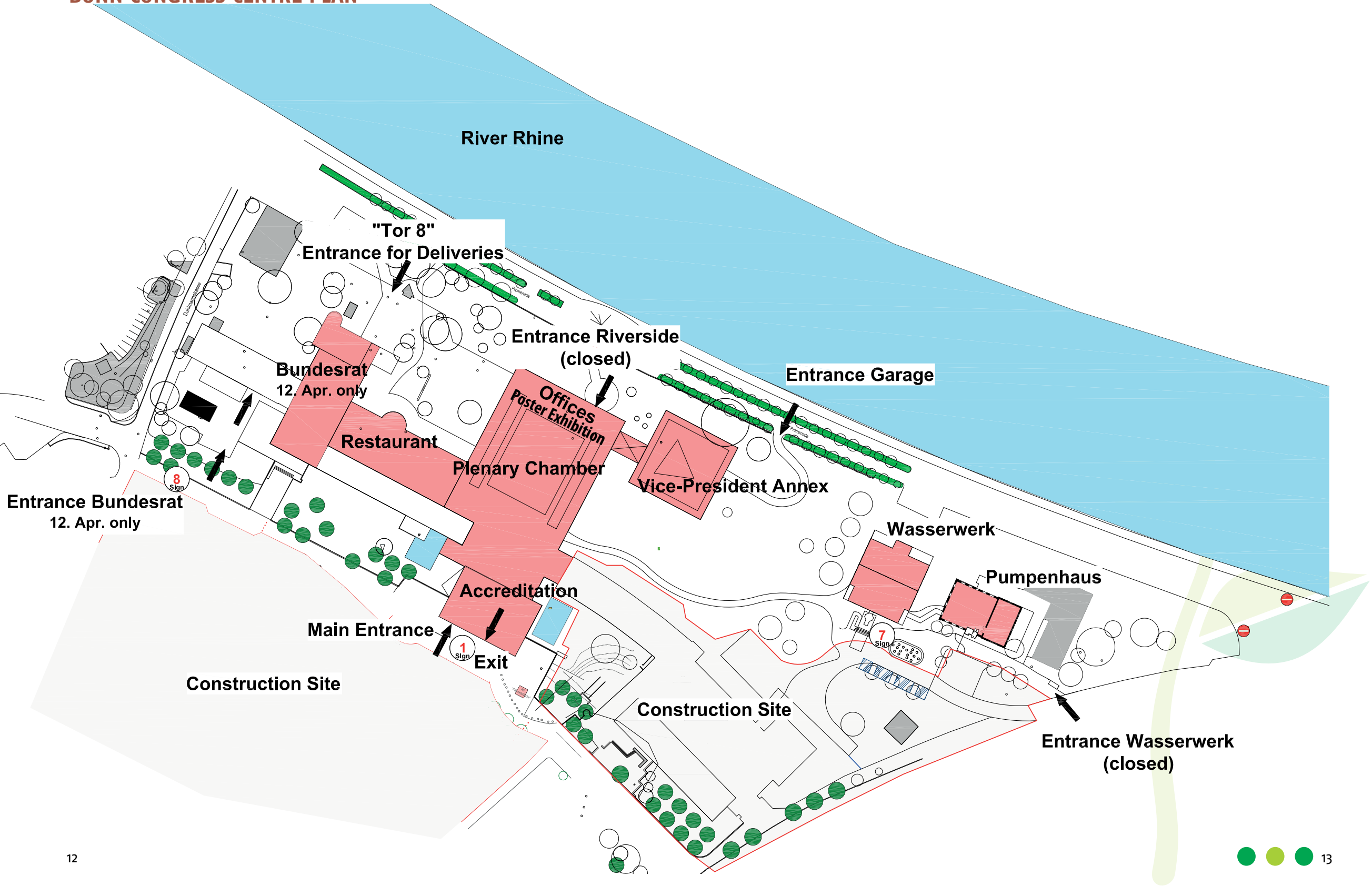
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BONN CONGRESS CENTRE PLAN



PROGRAMME OVERVIEW

Date: Tuesday, 09/Apr/2013

15:00-15:40	Opening Ceremony Location: Plenary Chamber Translation into the official UN languages available!
15:40-16:20	Keynote Location: Plenary Chamber Translation into the official UN languages available!
16:30-18:00	Plenary I: Economic and social impacts of desertification, land degradation and drought Location: Plenary Chamber Translation into the official UN languages available!

Date: Wednesday, 10/Apr/2013

8:30-9:45	Session: The New World Atlas of Desertification contributing to economic valuation of land degradation Location: Plenary Chamber	Session: Good practices in SLM and lessons learned (Part 1) Location: Wasserwerk	Session: Economics of land use change Location: Pumpenhaus			
10:00-11:20	Session: Toward an analytical framework to assess the value of action and inaction against land degradation: new insights, and policy challenges Location: Plenary Chamber Translation into the official UN languages available!	Session: Identification and valuation of ecosystem services Location: Wasserwerk	Session: Economic and social impacts assessment of DLDD at a local scale Location: Pumpenhaus			
11:30-13:00	Plenary II: Cost and benefits of policies and practices addressing land degradation and drought in the drylands Location: Plenary Chamber Translation into the official UN languages available!					
13:00-13:50	Lunch break					
13:50-14:50	Workshop: Practical Tools for Monitoring and Assessment of DLDD for Economic Assessments Location: Plenary Chamber	Session: Economic and social impacts assessment of DLDD at a regional/national scale Location: Wasserwerk	Session: Community based approaches for sustainable land management Location: Pumpenhaus			
15:00-16:30	Session: Global Environment Facility Session: Carbon – a valuable global benefit of sustainable land management Location: Plenary Chamber Translation into the official UN languages available!	Session: Sustainable dryland management for multiple benefits: opportunities for linking carbon storage, ecosystem services and livelihoods Location: Wasserwerk	Workshop: COST Action ES1104 – Arid lands restoration and combat of desertification: setting up a drylands and desert restoration hub Location: Pumpenhaus			
16:40-18:00	Workshop: Economics of Land Degradation (ELD) Initiative – Bridging the science-policy-practice divide – Making a case for tackling land degradation through valuation of ecosystem services Location: Plenary Chamber Translation into the official UN languages available!	Session: Assessing actions to combat desertification, what valuations Location: Wasserwerk	Session: Water and sustainable land management Location: Pumpenhaus			
18:15-19:15	Poster Session: Soil functions and related ecosystem services	Poster Session: Forest management and multifunctional forestry	Poster Session: Indicators for DLDD	Poster Session: Tools and methods to assess DLDD	Poster Session: Landuse practices to combat DLDD	Poster Session: Techniques and good practices to combat DLDD

Date: Thursday, 11/Apr/2013

8:30-9:45	Session: Catastrophic shifts in drylands: how can we prevent ecosystem degradation? Special Session on how to overcome the difficulties of successful engagement of non-scientific stakeholders Location: Plenary Chamber	Session: Adapting to climate change and disaster risk reduction through sustainable land management: experiences in Tajikistan, East Africa, US, Argentina and Mongolia Location: Wasserwerk	Session: Good practices in SLM and lessons learned (Part 2) Location: Pumpenhaus			
10:00-11:20	Session: Scaling-up SLM: what is the missing link? – Bridging the science-policy-practice divide, making the case through valuation of ecosystem services Location: Plenary Chamber Translation into the official UN languages available!	Session: Cost and benefits analysis of (in)action Location: Wasserwerk	Session: DLDD and climate change Location: Pumpenhaus			
11:30-13:00	Plenary III: Drivers of change and resilience increase Location: Plenary Chamber Translation into the official UN languages available!					
13:00-13:50	Lunch break					
13:50-14:50	Workshop: Agroecology as a powerful tool for the development of drylands? Location: Plenary Chamber	Session: Macro-economic policy drivers of land management Location: Wasserwerk	Session: Traditional knowledge related to DLDD/SLM Location: Pumpenhaus			
15:00-16:30	Session: Towards a land-degradation-neutral world: from science to policy Location: Plenary Chamber Translation into the official UN languages available!	Session: Tackling key challenges in the economic assessment of desertification, sustainable land management and resilience of arid and semi-arid and dry sub-humid areas: Perspectives from DesertNet International's Working Groups Location: Wasserwerk	Session: Indicators for DLDD and SLM Location: Pumpenhaus			
16:40-18:00	Session: Towards a land-degradation-neutral world: from science to policy Location: Plenary Chamber Translation into the official UN languages available!	Session: Integrated modelling of climate impacts on food and farming at regional to supra-national scales Location: Wasserwerk	Session: Methodologies and tools for assessing DLDD Location: Pumpenhaus			
18:15-19:15	Poster Session: Local knowledge and good practices related to DLDD/SLM	Poster Session: Water scarcity and land – the nexus aspects	Poster Session: Economic and social impacts assessment of DLDD	Poster Session: Governance and policy analysis	Poster Session: Climate change, related risks and impacts on DLDD	Poster Session: Causes of DLDD

Date: Friday, 12/Apr/2013

8:30-9:45	Workshop: From agroecological practice to policy: bridging the gap in dryland management Location: Plenary Chamber	Session: DLDD and SLM assessment tools Location: Wasserwerk	Session: Policy analysis and good examples Location: Pumpenhaus
10:00-11:30	Plenary IV: Strategies and policies for local, national, regional and international level Location: Plenary Chamber Translation into the official UN languages available!		
11:45-13:00	Closing Ceremony Location: Plenary Chamber Translation into the official UN languages available!		

DETAILED PROGRAMME

TUESDAY 09 April 2013

15:00–16:00

Location

Welcoming Remarks

Opening Ceremony

Plenary Chamber

Antonio ROCHA MAGALHÃES; Chairperson of the Committee of Science and Technology CST, United Nations Convention to Combat Desertification, Brasil

Luc GNACADJA; Executive Secretary, United Nations Convention to Combat Desertification, Bonn, Germany

Walter J. Ammann; President/CEO, Global Risk Forum GRF Davos, Davos, Switzerland

Special Guest

Tarja HALONEN; Former President of the Republic of Finland (2000–2012), Helsinki, Finland, *“Looking at the challenges of Post 2015”*

Translation into the official UN languages available!

16:00–16:15

Break

16:15–18:00

Location

Chair

Plenary I: **Economic and social impacts of desertification, land degradation and drought**

Plenary Chamber

Anneke TRUX; Team Leader, Convention Project to Combat Desertification (CCD Project), Division Environment and Climate Change, Deutsche Gesellschaft für Internationale Zusammenarbeit GIZ GmbH, Bonn, Germany

Desertification, Land Degradation and Drought (DLDD) directly affect 1.5 billion people who depend on dry and degraded lands for their livelihood. 42% of the world’s very poor live in degraded areas compared to only 15% of the non-poor. Therefore, the economic and social impacts of DLDD are significant. For instance, it has been estimated that the direct economic costs of desertification for Burkina Faso and Nigeria were 9% resp. 17% of GDP in 1995. Concerning social impacts, DLDD leads to increasing poverty as poor people’s livelihoods are highly dependent on the productivity of land, and to urban migration in communities whose livelihoods lack resilience to low farm productivity. DLDD can also have secondary social impacts in malnutrition and disease that arise through poor farm productivity, poverty and constraints on water quality and availability. The social impacts of DLDD are affecting about 870 million people who are suffering from chronic undernourishment and 1 billion with no access to safe drinking water. For efficient

and effective prevention and mitigation measures against DLDD, it is essential to clearly assess the economic and social impacts of DLDD and identify the important actors such as land users, landowners, governmental authorities and industries. Further, it is necessary to analyse how institutions and policies influence those actors. However, both the implementation and effectiveness of prevention or mitigation measures of DLDD are limited by a range of barriers such as insufficient financing and resourcing, rather weak scientific basis and knowledge exchange in DLDD, insufficient advocacy and awareness as well as inadequate legal basis. Based on White Paper I, panellists in this session will assess the economic and social impacts of DLDD, consider the gaps in impact assessment, and review possible means to achieve better impact analysis.

Panellists

Stefan SCHMITZ; Head of division rural development and food security, German Federal Ministry for Economic Cooperation and Development BMZ, Bonn, Germany, *Keynote: “Better evidence for better policies. A paradigm shift is needed to counter vulnerability and increase people’s resilience.”*

Edward B. BARBIER; John S Bugas Professor of Economics, Department of Economics and Finance, University of Wyoming, Wyoming, USA, *“Land degradation and the rural poor: economic and social impacts”*

Joachim VON BRAUN; Director, Center for Development Research (ZEF) and Professor for Economic and Technological Change, University of Bonn, Germany, *“Economic and social impacts of land degradation and drought – framework, assessment and policy implications”*

Maria Laura CORSO; Technical Adviser to the Department of Land Conservation and Desertification of the Ministry of Environment and Sustainable Development of Argentina, Buenos Aires, Argentina *“Evaluación socioeconómica de la desertificación a escala local. Aplicación de la metodología LADA en Argentina”*

Pak Sum LOW; TUKM–YSD Chair in Climate Change in the Faculty of Science and Technology, University Kebangsaan in Malaysia (UKM), Bangi Selango, Malaysia (tbc)

Lindsay STRINGER; Co–Director, Sustainability Research Institute and reader in Environment and Development, University of Leeds, UK, *“Unpacking the economic and social impacts of land degradation, desertification and drought: lessons from southern Africa”*

Translation into the official UN languages available!

WEDNESDAY 10 April 2013

08:30-09:45

Session: **The New World Atlas of Desertification contributing to economic valuation of land degradation**

Special session organized by the European Commission

Location

Plenary Chamber

Speakers

CHERLET, Michael

A new global atlas of desertification: why, how and findings

by CHERLET, Michael; SOMMER, Stefan; IVITS, Eva; European Commission, Italy, Republic of

LEÓN, Alejandro

Economic causes and consequences of population changes

by LEÓN, Alejandro (1); CHERLET, Michael (2); 1: Universidad de Chile, Chile, Republic of; 2: European Commission, Joint Research Centre

MORALES, Cesar

Economic valuations integrating remote sensing derived layers

by MORALES, Cesar (1); Dascal, Guillermo (1); Cherlet, Michael (2); 1: ECLAC, Chile, Republic of; 2: European Commission, Joint Research Centre

VON MALTITZ, Graham Paul

Too few, too many or the wrong type of trees – economic

implications of changes in tree cover in Southern Africa by VON MALTITZ, Graham Paul CSIR, South Africa, Republic of

ZDRULI, Pandi

Agriculture and soil in WAD by ZDRULI, Pandi; CIHEAM Mediterranean

Agronomic Institute of Bari, Italy, Republic of

08:30-09:45

Session: **Good practices in SLM and lessons learned (Part 1)**

Location

Wasserwerk

Chair

Mohamed Imam BAKARR, Global Environment Facility

Chair

Hanspeter LINIGER, Centre for Development and Environment, University of Berne

Speakers

NILL, Dieter

20 years of watershed management in Niger: Approaches, impacts and economic aspects of large scale soil and water conservation

measures by NILL, Dieter; ACKERMANN, Klaus; SCHOENING, Alexander; TRUX, Anneke; VAN DEN AKKER, Elisabeth; WEGNER, Martina; GIZ, Germany, Federal Republic of

DORJI, Karma Dema

Land resources under threat: strategies and options to address

land degradation due to landslides in the context of Bhutan by DORJI, Karma Dema (1); GYELTSHEN, Phuntsho (1); NORBU, Chencho (2); 1: National Soil Services Centre; 2: Department of Forests & Park Services

08:30-09:45

Location

Chair

Chair

Speakers

AHMED, Shamseddin Musa

Topsoiling and subsoiling as sustainable tillage practices for arid climates: A case study from Sudan by AHMED, Shamseddin Musa; University of Gezira, Sudan, Republic of

ARGAMAN, Eli

The effect of intense soil erosion event on farmer and stakeholder's perception of sustainable land management in Harod valley, Israel by ARGAMAN, Eli; YAACOBY, Beny Soil Erosion Research Station, Israel, State of

KOIRALA, Pashupati Nath

Forest entitlement and benefit sharing in community forests

in Nepal by KOIRALA, Pashupati Nath (1); WIERSUM, Freerk (2); 1: Department of Forests, Nepal, Federal Democratic Republic of; 2: Wageningen University, The Netherlands

REINOSO PÉREZ, Mario

Agroforestry: A viable alternative for sustainable land management

by REINOSO PÉREZ, Mario; Centre for Environmental Research and Services, Cuba, Republic of

DIALLO, Marieme

Evaluation of the conditions and trends of forest ecosystems

and their services in Senegal by DIALLO, Marieme; NDIAYE, Dethie Soumare; Centre de Suivi Ecologique, Senegal, Republic of

Session: **Economics of land use change**

Pumpenhaus

Mark SCHAUER, GIZ

Alisher MIRZABAEV, ZEF

FLESKENS, Luuk

Spatial variation in costs of sustainable land management

technologies – a review by FLESKENS, Luuk; University of Leeds, United Kingdom

RANGASWAMY, Vidhya

Use of empirical land use dynamics models including climate and

socio economic parameter: a case study in rainfed agriculture area of South India by RANGASWAMY, Vidhya; RAJU, Manonmani; Anna university, India,

SHRESTHA, Bijaya Krishna

Land pooling system in the Kathmandu valley – Successful in

financing infrastructure but failure in achieving urban environment by SHRESTHA, Bijaya Krishna S3 Alliance: Development forum for habitat, Nepal, Federal Democratic Republic of

CUSTOVIC, Hamid

Land use changes and loss of soil in Bosnia and Herzegovina

as consequences of the war and socio-economic transition by CUSTOVIC, Hamid; LJUSA, Melisa; University of Sarajevo, Faculty of Agriculture and Food Science, Bosnia and Herzegovina

	<p>AMBALAM, Kannan <i>Desertification, land grabbing and food sovereignty: the unexplored link</i> by AMBALAM, Kannan; Wollega University, Ethiopia, Federal Democratic Republic of</p>
09:45–10:00	Break
10:00–11:20	<p>Session: Toward an analytical framework to assess the value of action and inaction against land degradation: new insights, and policy challenges <i>Special session organized by the International Food Policy Research Institute</i></p>
Location	Plenary Chamber
Speakers	<p>DE PINTO, Alessandro <i>Predicting Future Land Degradation and its Economic Effects</i> by DE PINTO, Alessandro (1); HARUNA, Akiko (1); ZHU, Tingju (1); NKONYA, Ephraim (1); GERBER, Nicolas (2); GRAW, Valerie (2); KATO, Edward (2); KLOOS, Julia (2); WALTER, Teresa (2); 1: International Food Policy Research Institute, United States of America; 2: Center for Development Research, University of Bonn</p> <p>GERBER, Nicolas <i>The economics of land degradation and the costs of action versus inaction</i> by GERBER, Nicolas; University of Bonn, Germany, Federal Republic of</p> <p>NKONYA, Ephraim Maduhu <i>Exploiting provision of land economic productivity without degrading its natural capital</i> by NKONYA, Ephraim Maduhu International Food Policy Research Institute, Washington DC.</p> <p>MIRZABAEV, Alisher <i>Adapting to climate change and addressing land degradation through sustainable land management practices</i> by MIRZABAEV, Alisher (1); NKONYA, Ephraim (2); KIRUI, Oliver (3); 1: ZEF, Germany, Federal Republic of; 2: International Food Policy Research Institute, Washington; 3: Center for Development Research, University of Bonn, Bonn, Germany</p>
	Translation into the official UN languages available!
10:00–11:20	<p>Session: Identification and valuation of ecosystem services</p>
Location	Wasserwerk
Chair	Mélanie REQUIER-DESJARDINS , IAMM Institute Agronomique Méditerranéen de Montpellier
Chair:	Nabil BEN KHATRA , Sahara and Sahel Observatory
Speakers	<p>DARACHANTHARA, Souphith <i>Economic valuation of ecosystem services and poverty alleviation: A case study of land uses in Oudomxay Province, Lao PDR</i> by WONG, Grace (1); DARACHANTHARA, Souphith (2); SOUKKHAMTHAT, Thanongsai (2); 1: CIFOR – Center for International Forestry Research, Indonesia,</p>

	<p>Republic of; 2: National Economic Research Institute, Ministry of Planning and Investment, Lao PDR</p> <p>ABDULLAEV, Umid <i>Economic valuation of ecosystem services to support sustainable water and land management in the Amudarya River Delta</i> by ABDULLAEV, Umid (1); KHASANKHANOVA, Gulchekhra (1); TALSKIKH, Vladislav (2); TARYANNIKOVA, Raisa (2); SCHLUTER, Maja (3); 1: Design and Research UZGIP Institute, Ministry of Agriculture and Water Resources, Uzbekistan; 2: Research Hydrometeorological Institute, Uzhymet, Uzbekistan; 3: Stockholm Resilience Centre, Stockholm University, Sweden</p> <p>BROUWER, Joost <i>Are the most valuable resources in drylands areas wetlands?</i> by BROUWER, Joost; Brouwer Envir. & Agric. Consultancy, Netherlands, Kingdom of the</p> <p>SZALAI, Sandor <i>Development of a framework for cost/benefit analysis of ecosystem based CC adaptation actions in the Carpathian region</i> by LAMBERT, Stijn (1); BOGAERT, Sarah (1); ADRIAENSSENS, Véronique (1); LAMMERANT, Johan (1); SZALAI, Sandor (2); INTERWIES, Eduard (3); GÖRLITZ, Stefan (3) 1: ARCADIS Belgium; 2: Szent Istvan University, Hungary; 3: InterSus, Germany</p> <p>RAJA, Omer Muhammad <i>Restoring ecosystem services of rangelands through sustainable land management in salt range, Pakistan</i> by RAJA, Omer Muhammad (1); ABBASS, Iftikhar (1); SHEHZAD, Tayyab (1); MEHMOOD, Saqib (2); 1: Ministry of Climate Change, Pakistan, Islamic Republic of; 2: Forestry, Wildlife & Fisheries Department, Punjab, Pakistan</p> <p>BOROTO, Ruhiza <i>Guidelines for inland wetlands development in Sub Saharan Africa</i> by BOROTO, Ruhiza; QUEDRAOGO, Paul; FAO, Ghana,</p>
10:00–11:20	<p>Session: Economic and social impacts assessment of DLDD at a local scale</p>
Location	Pumpenhaus
Chair	Alan GRAINGER , University of Leeds
Chair	LianYou LIU , Beijing Normal University
Speakers	<p>VARGHESE, Nisha <i>Linkages between desertification and human development in the western dry region of Rajasthan</i> by VARGHESE, Nisha; Indira Gandhi National Open University, India, Republic of</p> <p>DOSSOU, Bernadette <i>Desertification impact on rural women in Zou Department (Benin)</i> by DOSSOU, Bernadette; Université d'Abomey calavi, Benin, Republic of</p>

HENG, Naret

Social vulnerability in the Kampong Speu Province, Cambodia by HENG, Naret; Royal University of Phnom Penh, Kingdom of Cambodia

OLOUKOI, Joseph

Degradation of vegetation formations in the centre of Benin Republic: socio-economic factors and implications by OLOUKOI, Joseph Regional Centre for Training in Aerospace Surveys (RECTAS), Nigeria, Federal Republic of

GAMBIZA, James

Socio-economic drivers of abandonment of cultivated land in the smallholder farming sector in Peddie, Eastern Cape, South Africa by GAMBIZA, James; MILLAR, Belinda Jane; Rhodes University, South Africa, Republic of

GALVEZ DIAZ, Judith

The economic impact of environmental degradation and poverty dimensions of the indigenous community Benancio Cumillan, Lonquimay, Araucania Region, Chile by GALVEZ DIAZ, Judith; BAEZ BARRAZA, Karen; University, Chile, Republic of

Break

11:20-11:30

11:30-13:00

Location

Chair

Plenary II: **Cost and benefits of policies and practices addressing land degradation and drought in the drylands**
Plenary Chamber

Noel Maxwell OETTLE; Rural Programme Manager, Environmental Monitoring Group EMG, Nieuwoudtville, South Africa

Are the benefits of action worth the additional costs, or are the costs of action greater than the costs of inaction? This session will address the important issues of cost and benefits of policies as well as practices addressing Desertification, Land Degradation and Drought (DLDD). Despite the increasing impacts of DLDD, such as increasing poverty and migration, a global consensus on the increasing economic costs of inaction is missing. This makes the prioritization of measures to prevent or mitigate DLDD at the national and international levels substantially more difficult using an economic argument. The benefits and costs of counter measures could be analysed within a comprehensive cost benefit analysis (CBA), but is CBA an adequate tool and powerful enough to help decision-makers objectively choose among different land use management strategies and pursue effective and resilience building interventions? Are there other (non-economic) methods to evaluate the costs of action versus the costs of inaction? Where are the obstacles and where are the opportunities to improve the adoption of sustainable land management practices? Based on White paper II, the aim of this session is to find a consensus on the economic benefit of providing resources to prevent or mitigate DLDD. Panellists will discuss the

Panellists:

rationale of including policies toward national development plans. The session will also address the need to build capacity for ongoing DLDD cost assessments at national and international levels and highlight possible investment opportunities.

Hannah BEHRENDT; Program Economist, Global Partnership for Wealth Accounting and the Valuation of Ecosystem Services (WAVES), Agriculture and Environmental Services Department, The World Bank, Washington, D.C., USA, *"The bigger picture on drylands - using a natural capital accounting approach"*

Cesar MORALES ESTUPIÑÁN; Agronomist engineer specialized in Agricultural Economics, University of Chile, Chile, *"From science to policy; from local to global"*

Lene POULSEN; Independent consultant, Karl International Development, Frederiksværk, Denmark, *"A system approach for valuation of sustainable dryland and drought risk management"*

Richard THOMAS; Assistant Director, United Nations University, Institute for Water, Environment and Health, McMaster University, Hamilton, Canada, *"Analysis of decision making for sustainable land management"*

Translation into the official UN languages available!

13:00-13:50

13:50-14:50

Location

13:50-14:50

Location

Chair

Chair

Speakers

Lunch Break

Workshop: **Practical Tools for Monitoring and Assessment of DLDD for Economic Assessments**
Workshop organized by USDA ARS
Plenary Chamber

Session: **Economic and social impacts assessment of DLDD at a regional/national scale**

Wasserwerk

Niels DREBER, North West University

Leslie Elizabeth TORRES, individual

FORTUNATE, Muyambi Benda

Land degradation assessment in the IGAD Region - Its extent and impact by FORTUNATE, Muyambi Benda; IGAD Climate Predictions and Application Centre (ICPAC), Kenya, Republic of

YATSUKHNA, Valentin

Evaluation the cost of land degradation at the national level (experience of Belarus) by YATSUKHNA, Valentin; SAUCHANKA, Uladzimir; GHARKINA, Natalia; Belorussian State University, Belarus, Republic of

	<p>MORALES, Cesar <i>Estimated models to measure the value of land degradation in Bolivia</i> by ARANIBAR SEMINARIO, Mercedes Zoraida; MORALES, Cesar; GLOBAL MECHANISM/ECLAC, Peru, Republic of</p> <p>KHASANKHANOVA, Gulchekhra <i>Assessment of extent, cost and impact of land degradation to enhance sustainable land management – learning from CACILM Partnership program in Uzbekistan, Central Asia</i> by KHASANKHANOVA, Gulchekhra (1); Taryannikova, Raisa (2); KHAMZINA, Tatyana (1); IBRAGIMOV, Rustam (1); SHULGINA, Natalya (2); Kadirov, Bakhtiyar (2) 1: Design and Research UZGIP Institute of the Ministry of Agriculture and Water Resources, Uzbekistan, Republic of; 2: Research Hydrometeorological Institute, Uzhydromet, Tashkent, Uzbekistan</p> <p>LEÓN, Alejandro <i>Estimation of the total economic value of water in the Huasco river basin in the Atacama Desert, Chile</i> by LEÓN, Alejandro; SOTO, Jorge; MESSUTTO, David; Universidad de Chile, Chile</p> <p>DASCAL, Guillermo <i>Land degradation and climate change: vulnerability analysis of desertified areas in Latin America</i> by DASCAL, Guillermo; CEPAL UN, Chile, Republic of</p>		<p>ARAUJO, Beatriz Azevedo <i>Reeducation of family agriculture and sustainable practices in the combat to desertification in Irauçuba city</i> by ARAUJO, Beatriz Azevedo; PONTES, Fernando Demétrio Federal University of Ceara (Universidade Federal do Ceará – UFC), Brazil, Federative Republic of</p> <p>KUTLUAY, Duygu <i>NGOs role in disseminating scientific knowledge on land degradation</i> by KUTLUAY, Duygu (1); VAN HAREN, Nathalie (2); NAGHIZADEH, Nahid (3); 1: TEMA Foundation, Turkey, Republic of; 2: Both ENDS, Amsterdam, The Netherlands; 3: CENESTA, Tehran, Iran</p> <p>CARVALHO, Luzineide Dourado <i>Contextual Education for a Convivência with the Brazilian Semi-arid: fundamentals and practices</i> by CARVALHO, Luzineide Dourado; REIS, Edmerson dos Santos; Universidade do Estado da Bahia, Brazil, Federative Republic of</p>
13:50–14:50	<p>Session: Community based approaches for sustainable land management</p>	14:50–15:00	<p>Break</p>
Location	Pumpenhaus	15:00–16:30	<p>Session: Global Environment Facility Session: Carbon – a valuable global benefit of sustainable land management</p> <p><i>Special session organized by GEF</i></p>
Chair	Patrice BURGER , Cari	Location	Plenary Chamber
Chair	Elena María ABRAHAM , IADIZA-CONICET	Speakers	<p>BAKARR, Mohamed Imam <i>Sustainable land management in the Global Environment Facility – enhancing ecosystem services in production landscapes</i> by BAKARR, Mohamed Imam; Global Environment Facility, United States of America</p>
Speakers	<p>NYANDIGA, Charles Onyango <i>Case studies of community projects on sustainable land management from different archetypes and regions of the world: experiences of the GEF Small Grants Programme</i> by NYANDIGA, Charles Onyango; UNDP, United States of America</p> <p>WELDESEMAET, Yitbarek Tibebe <i>Economic contribution of communal land rehabilitation to rural livelihood</i> by WELDESEMAET, Yitbarek Tibebe; Frankfurt Zoological Society, Ethiopia, Federal Democratic Republic of</p> <p>VILLARREAL WISLAR, Cristino <i>Community participation in the sustainable land management of the Mapimi Biosphere Reserve in the states of Chihuahua, Coahuila and Durango, México</i> by HERNANDEZ MARTINEZ, Jaime Eliberio; VILLARREAL WISLAR, Cristino; RAMOS PEÑA, Baldomero; GARCIA MORALES, Rodolfo; MARIANO GUZMAN, Samuel; IBARRA VAZQUEZ, Edgar Nelson; GARCIA BARRERA, Cynthia Manuela; Comision nacional de areas naturales protegidas/reserva de la biosfera Mapimi, Mexico</p>		<p>MILNE, Eleanor <i>A new tracking tool for carbon benefits</i> by MILNE, Eleanor; MALTA, Stoecio; Colorado State Univeristy, United Kingdom</p>
			<p>GOVERS, Gerard <i>Soil organic carbon management for global benefits – A review for STAP</i> by GOVERS, Gerard; MERCKX, Roel; VAN OOST, Kristof; VAN WESEMAEL, Bas; KU Leuven, Belgium, Kingdom of</p>
			<p>COWIE, Annette <i>The value of soil organic carbon: the case for biochar</i> by COWIE, Annette; SINGH, Bhupinderpal; VAN ZWIETEN, Lukas STAP-GEF, Australia</p>
			<p>STOCKING, Michael Anthony <i>Looking to the future – a new land degradation strategy. audience and panel discussion</i> by STOCKING, Michael Anthony; Global Environment Facility, United Kingdom</p>
			<p>Translation into the official UN languages available!</p>

15:00–16:30

Location

Speakers

Session: **Sustainable dryland management for multiple benefits: opportunities for linking carbon storage, ecosystem services and livelihoods**

Special session organized by the University of Leeds

Wasserwerk

DOUGILL, Andrew John

Soil organic carbon, poverty alleviation, climate smart development, payment for ecosystem services by DOUGILL, Andrew John; University of Leeds, United Kingdom

FAVRETTO, Nicola

*Is *Jatropha curcas* energy crop cultivation a viable land management and poverty reduction strategy? Livelihood lessons from Mali* by FAVRETTO, Nicola; University of Leeds, United Kingdom

KUHN, Nikolaus

Erodibility of biochar from a sandy soil in Denmark by FISTER, Wolfgang (1); HECKRATH, Goswin (2); GREENWOOD, Philip (1); KUHN, Nikolaus (1); 1: University of Basel, Switzerland; 2: Aarhus University, Department of Agroecology, Aarhus

THOMAS, Andrew David

The carbon conundrum in communal African rangelands by THOMAS, Andrew David Aberystwyth University, United Kingdom

RUEFF, Henri

Sustainable land management and carbon finance: a case study on landless mobile pastoralists in the Hindu Kush Himalaya mountains of northern Pakistan by RUEFF, Henri (1); REHMAN, Syed-ur (2); RAHIM, Inam-ur (3); MASELLI, Daniel Maselli (4); 1: University of Oxford, United Kingdom; 2: Centre for Development and Environment, University of Bern; 3: Department of Environmental Sciences, University of Peshawar, Pakistan; 4: University of Central Asia, Bishkek, Kyrgyzstan

FALCÃO, Dania Marina Magane

Carbon benefits from dry Miombo woodlands in Mozambique: the case study of Nhambita project by FALCÃO, Dania Marina Magane; agrarian developing fund–Ministry of agriculture, Mozambique, Republic of

STRINGER, Lindsay Carman

Combating land degradation and desertification and enhancing food security: towards integrated solutions by STRINGER, Lindsay Carman (1); AKHTAR-SCHUSTER, Mariam (2); MARQUES, Maria Jose (3); AMIRASLANI, Farshad (4); QUATRINI, Simone (5); ABRAHAM, Elena M. (6); 1: University of Leeds, United Kingdom; 2: Secretariat DesertNet International (DNI), c/o Biocentre Klein Flottbek and Botanical Garden, University of Hamburg, Ohnhorststr.18, 22609 Hamburg, Germany; 3: Geology and Geochemistry Department, Faculty of Scie

15:00–16:30

Location

Speakers

Workshop: **COST Action ES1104 – Arid lands restoration and combat of desertification: setting up a drylands and desert restoration hub**

Workshop organized by COST Action ES1104

Pumpenhaus

KOTZEN, Benz

COST Action ES1104 – Arid lands restoration and combat of desertification: setting up a drylands and desert restoration hub by KOTZEN, Benz; University of Greenwich

KUELLS, Christoph Jan

The eco-hydrological perspective of desert restoration by KUELLS, Christoph Jan (1); BERKOWICZ, Simon (2); COSTANTINI, Edoardo (3); GEISSEN, Violette (4); KVAERNO, Sigrun (5); MARTON, Laszlo (6); RITSEMA, Coen (7); 1: Albert Ludwigs University of Freiburg, Germany, Federal Republic of; 2: Institute of Earth Sciences, Hebrew University Jerusalem, Israel; 3: Research centre for agrobiolgy and pedology, Florence, Italy; 4: Wageningen University, Netherlands; 5: Norweg

ZDRULI, Pandi

Impacts of agricultural practices on manmade soils and ecological restoration efforts in a protected NATURA 2000 area in the Apulia Region, Italy by ZDRULI, Pandi; CIHEAM Mediterranean Agronomic Institute of Bari, Italy, Republic of

BRANQUINHO, Cristina

Improving ecosystem services in drylands: microclimate matters for the natural regeneration of forests after agriculture abandonment by BRANQUINHO, Cristina (1); SILVA, Adriana (1); PINHO, Pedro (1,2); NUNES, Alice (1,3); GAIOLA, Giulia (1); ROSARIO, Lúcio (4); CORREIA, Otilia (1) 1: Universidade de Lisboa, Faculdade de Ciências, Centro de Biologia Ambiental, Campo Grande, Bloco C2, 5º, Piso, sala 37, 1749-016 Lisboa, Portugal; 2: CERENA–Centre for Natural Resources and the Environment, Universidade Técnica de Lisboa, Instituto Sup

NUNES, Alice Maria Rodrigues

Restoration trials and management in a highly degraded site in southern Europe – the benefits of a functional approach for dryland restoration by NUNES, Alice Maria Rodrigues (1,2); OLIVEIRA, Graça (1); MEXIA, Teresa (1); CLEMENTE, Adelaide (1,3); CORREIA, Patrícia (1); BRANQUINHO, Cristina (1); CORREIA, Otilia (1); 1: Faculdade de Ciências da Universidade de Lisboa, Portugal; 2: CESAM–Centre for Environmental and Marine Studies, Universidade de Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal; 3: Jardim Botânico, Museu Nacional de História Natural

Break

16:30–16:40

16:40-18:00	<p>Workshop: Economics of Land Degradation (ELD) Initiative – Bridging the science-policy-practice divide – Making a case for tackling land degradation through valuation of ecosystem services <i>Workshop organized by the ELD initiative</i></p> <p>Location Plenary Chamber</p> <p>Translation into the official UN languages available!</p>
16:40-18:00	<p>Session: Assessing actions to combat desertification, what valuations <i>Special session organized by CSFD</i></p> <p>Location Wasserwerk</p> <p>Speakers REQUIER-DESJARDINS, Mélanie <i>Methodological reflections and the practice of evaluation, main outputs of the Montpellier seminar</i> by REQUIER-DESJARDINS, Mélanie (1); CORNET, Antoine (2); 1: IAMM Institute Agronomique Méditerranéen de Montpellier, France; 2: IRD, CSFD</p> <p>ROJO-SERRANO, Leopoldo <i>Prevention and restoration actions to combat desertification. An integrated assessment. PRACTICE Project</i> by ROJO-SERRANO, Leopoldo (1); VALLEJO, Ramón (2); 1: Ministerio de Agricultura, Alimentación y Medio Ambiente. Spain; 2: Centro de Estudios Medioambientales del Mediterráneo (CEAM)</p> <p>LEROY, Maya <i>Delivering on environmental commitments? Guidelines and evaluation framework for an “On-Board” approach</i> by LEROY, Maya (1); MERMET, Laurent (2); 1: AgroParisTech, MRM, CSFD; 2: AgroParisTech, CERSES</p>
16:40-18:00	<p>Session: Water and sustainable land management</p> <p>Location Pumpenhaus</p> <p>Chair Joost BROUWER, Brouwer Envir. & Agric. Consultancy, member of IUCN’s Commission on Ecosystem Management</p> <p>Chair Dieunedort Wandji NJANKOUA, UNEP</p> <p>Speakers KEIJZER, Marie <i>Restoring microbial drivers of the earth’s hydrological dynamics, climate and our future</i> by KEIJZER, Marie; WeForest, BE</p> <p>ACKERMANN, Klaus <i>Water and soil conservation practices in the Sahel. Analysing their potential to increase the resilience of rural livelihoods</i> by ACKERMANN, Klaus; NILL, Dieter; SCHOENING, AlexanderSchoening; VAN DEN AKKER, Elisabeth; TRUX, Anneke; WEGNER, Martina; GIZ, Germany, Federal Republic of</p> <p>BEKCHANOV, Maksud Bahodirovich <i>How benefit sharing based water allocation can improve water use efficiency in the Aral Sea basin?</i> by BEKCHANOV, Maksud Bahodirovich; BHADURI, Anik; ZEF, Department of Economics and Technological Change, Germany</p>

18:00-18:15	<p>KUELLS, Christoph Jan <i>Ecohydrological principles in economic models of water resources in drylands and desert restoration</i> by KUELLS, Christoph Jan; Albert Ludwigs University of Freiburg, Germany, Federal Republic of</p> <p>SHERIEF, Youssef Shawky <i>Flash flood mitigation and water harvesting in Wadi Al-Khoud, Sultanate of Oman</i> by SHERIEF, yousef Shawky SQU University, Oman, Sultanate of</p> <p>ADENIJI-OLOUKOI, Grace Olufunmike <i>Rethinking vulnerability to water scarcity in the sub humid environment: the example of the Water Vulnerability Index in Oke-Ogun region, Nigeria</i> by ADENIJI-OLOUKOI, Grace Olufunmike (1); BOB, Urmilla (2); AFOLABI, Funso (3); 1: Lead City University, Nigeria; 2: University of KwaZulu-Natal, South Africa; 3: University of Ado-Ekiti, Nigeria</p> <p>RUMBAUR, Christian <i>Sustainable management of river oases along the Tarim River, P.R. China (SuMaRio)</i> by RUMBAUR, Christian; DISSE, Markus; Universität der Bundeswehr München, Germany, Federal Republic of</p> <p>RAKOTO RATSIMBA, Harifidy <i>Forest ecosystem resilience and rainfall variability in the southeastern part of Madagascar</i> by RAKOTO RATSIMBA, Harifidy; RAKOTO, Percy Yvon; RATOVOSON, Arimino Aina Navale; RABENILALANA, Fetra Mihajamanana; Ecole Supérieure des Sciences Agronomiques, Université d’Antananarivo, Madagascar, Republic of</p>
18:15-19:15	<p>Break</p> <p>Poster Session: Soil functions and related ecosystem services Poster Exhibition Area (see page 46 for more details)</p> <p>Poster Session: Forest management and multifunctional forestry Poster Exhibition Area (see page 46 for more details)</p> <p>Poster Session: Indicators for DLDD Poster Exhibition Area (see page 47 for more details)</p> <p>Poster Session: Tools and methods to assess DLDD Poster Exhibition Area(see page 47 for more details)</p> <p>Poster Session: Landuse practices to combat DLDD Poster Exhibition Area (see page 48 for more details)</p> <p>Poster Session: Techniques and good practices to combat DLDD Poster Exhibition Area (see page 48 for more details)</p>

THURSDAY 11 April 2013

08:30–09:45	<p>Session: Catastrophic shifts in drylands: how can we prevent ecosystem degradation? Special Session on how to overcome the difficulties of successful engagement of non-scientific stakeholders</p> <p><i>Special session organized by the European Commission</i></p> <p>Location Plenary Chamber</p> <p>Speakers BAUTISTA, Susana <i>Introduction of the CASCADE Project and ways in which we plan to involve non-scientific stakeholders</i> by BAUTISTA, Susana; Ecology Department, University of Alicante, Spain</p> <p>FLESKENS, Luuk <i>Economic assessment of the financial effects of (not) adopting land management measures</i> by FLESKENS, Luuk; Sustainability Research Institute, School of Earth and Environment, University of Leeds, UK</p> <p>STRINGER, Lindsay <i>Channelling science into policy: Enabling best practices from research on land degradation and sustainable land management in drylands</i> by STRINGER, Lindsay; DOUGILL, Andrew John; Sustainability Research Institute, School of Earth and Environment, University of Leeds, UK</p>
08:30–09:45	<p>Session: Adapting to climate change and disaster risk reduction through sustainable land management: experiences in Tajikistan, East Africa, US, Argentina and Mongolia</p> <p><i>Special session organized by the Centre for Development and Environment, University of Bern</i></p> <p>Location Wasserwerk</p> <p>Speakers LINIGER, Hanspeter <i>Adapting to climate change through sustainable land management: experiences of a pilot project in Tajikistan</i> by LINIGER, Hanspeter (1); WOLFGRAMM, Bettina (1); ZÄHRINGER, Julie (1); LEHRMAN, Zvi (2); STEVENSON, Shane (3); 1: Centre for Development and Environment, University of Berne, Switzerland; 2: Hebrew University; 3: Consultant</p> <p>BUNNING, Sally <i>Adapting to climate change through sustainable land and water management: ongoing experiences in 6 countries and 2 projects in East Africa</i> by BUNNING, Sally (1); RIOUX, Janie (1); MALO, Meshak (1); OKOBA, Barrak (2); 1: Food and Agriculture Organisation (FAO); 2: Kenya Agricultural Research Institute (KARI)</p>

08:30–09:45	<p>Session: Good practices in SLM and lessons learned (Part 2)</p> <p>Location Pumpenhaus</p> <p>Chair Muyambi Benda FORTUNATE, IGAD Climate Predictions and Application Centre (ICPAC)</p> <p>Speakers KUST, German <i>Sustainable land management oriented projects in Tajikistan: experience and lessons learned</i> by KUST, German; MOTT, Jessica; SAMPATH, Thirumangalam; JAIN, Nandita; ARMSTRONG, Angela; World Bank. Sustainable Development Department. Europe and Central Asia Region</p> <p>WASWA, Boaz Shaban <i>Monitoring land degradation patterns: lessons and implication for sustainable land management in Kenya</i> by WASWA, Boaz Shaban (1); VLEK, Paul LG (1); WASKE, Björn (2); TAMENE, Lulseged D (3); OKOTH, Peter (4); 1: Center for Development Research, University of Bonn, Germany; 2: Institute of Geodesy and Geoinformation, University of Bonn, Germany; 3: International Center for Tropical Agriculture (CIAT), Lilongwe, Malawi; 4: International Center for Tropical Agric</p> <p>OETTLE, Noel Maxwell <i>Re-examining economic orthodoxies: interactions of poverties and wealth and the creation, verification dissemination and adoption of SLM approaches</i> by OETTLE, Noel Maxwell; Environmental Monitoring Group, South Africa, Republic of</p> <p>DJANIBEKOV, Utkur <i>Cooperative institutions for increasing rural livelihood under CDM forestation on marginal croplands</i> by DJANIBEKOV, Utkur (1); DJANIBEKOV, Nodir (1,2); KHAMZINA, Asia (1); LAMERS, John P.A. (1) 1: Center for Development Research (ZEF), University of Bonn, Germany, Federal Republic of; 2: Leibniz Institute of Agricultural Development in Central and Eastern Europe (IAMO), Halle (Saale), Germany, Federal Republic of</p> <p>MOHAMMED, Hasen Yusuf <i>Sustainable rangeland management: how grazing management and woody cover can alter herbaceous diversity, forage quantity, and carbon stocks in semi-arid rangelands of Ethiopia</i> by MOHAMMED, Hasen Yusuf; TREYDTE, Anna; SAUERBORN, Jouchim; University of Hohenheim, Germany, Federal Republic of</p>
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	<p>PAULSCH, Axel <i>Sustainable land management – a solution oriented funding programme</i> by PAULSCH, Axel; PAULSCH, Cornelia; Institute for Biodiversity Network, Germany, Federal Republic of</p>
09:45–10:00	Break
10:00–11:20	<p>Session: Scaling-up SLM: what is the missing link? – Bridging the science-policy-practice divide, making the case through valuation of ecosystem services <i>Special session organized by the Global Mechanism</i> Plenary Chamber</p> <p>Translation into the official UN languages available!</p>
Location	
10:00–11:20	<p>Session: Cost and benefits analysis of (in)action Wasserwerk</p> <p>Alessandro DE PINTO, International Food Policy Research Institute</p> <p>SCHWILCH, Gudrun <i>Economic benefits and costs of technologies for sustainable land management – Analysis of WOCAT data from three continents</i> by GIGER, Markus; LINIGER, Hanspeter; SCHWILCH, Gudrun; CDE</p> <p>GRAINGER, Alan <i>A cost-benefit analysis tool for planning national zero net land degradation schemes</i> by GRAINGER, Alan; University of Leeds, United Kingdom</p> <p>ARONSON, James <i>Minimizing costs and maximizing benefits of dryland restoration and rehabilitation</i> by ARONSON, James (2); JUANTEGUY, Sasha Alexander (1); 1: Society for Ecological Restoration, United States of America; 2: Centre d'Ecologie Fonctionnelle et Evolutive, France</p> <p>MORALES, Cesar <i>Two economic evaluation methods of land degradation and desertification: the convergence of results</i> by MORALES, Cesar (1); MATALLO, Heitor (2) 1: cepal; 2: unccd</p> <p>BAUTISTA, Susana <i>Integrating action assessment and knowledge exchange in combating desertification: The PRACTICE Integrated Protocol</i> by BAUTISTA, Susana (1); ORR, Barron (2); VALLEJO, Ramón (3); 1: University of Alicante, Spain; 2: University of Arizona, USA; 3: CEAM Foundation, Spain</p> <p>HERRICK, Jeffrey E <i>A Land-Potential Knowledge System (LandPKS) based on local and scientific knowledge of land productivity and resilience</i> by HERRICK, Jeffrey E (1); URAMA, Kevin (2); KARL, Jason (1); BOOS, John (3); JOHNSON, Mari-Vaughn (5); SHEPHERD, Keith (9); HEMPEL, Jon (10); BESTELMEYER, Brandon (1); DAVIES, Jonathan (4); LARSON-GUERRA, Jorge (6); KOSNIK, Chris (3); KIMITI, David W. (11); 1: United States Department of Agriculture, Agricultural Research Service,</p>
Chair	
Speakers	

10:00–11:20

Location

Chair

Chair

Speakers

11:20–11:30

USA; 2: African Technology Policy Studies Network, Kenya; 3: United States Agency for International Development, USA; 4: International Union for the Conservation of Nature, Kenya;

Session: **DLDD and climate change**

Pumpenhaus

Annette COWIE, STAP-GEF

Guillermo DASCAL, CEPAL UN

MEZA, Laura Erika

Research in agriculture and climate change: a bibliometric appraisal for Latin America by MEZA, Laura Erika; RODRIGUEZ, Adrián; LAMOUR, Anais; FAO, Chile, Republic of

CONRADT, Sarah

Reducing meteorological basis risk in a semi-arid agricultural region by CONRADT, Sarah; BOKUSHEVA, Raushan; Swiss Federal Institute of Technology (ETH) Zurich, Switzerland

AL-HATRUSHI, Salim Mubarak

Assessment of the impact of climate change on water resources in The Sultanate of Oman by AL-HATRUSHI, Salim Mubarak; Sultan Qaboos University, Oman, Sultanate of

CHAVULA, Geoffrey Mudolole

Assessing the vulnerability of water resources in the drought prone lower Shire Valley in Malawi to Climate Change; and proposed adaptation strategies by CHAVULA, Geoffrey Mudolole University of Malawi – The Polytechnic, Malawi, Republic of

GUCCIARDI GARCEZ, Catherine Aliana

Climate change adaptation, vulnerability and resilience: four case studies in the Brazilian semi-arid by NASUTI, Stéphanie (1); LINDOSO, Diego P. (1); GUCCIARDI GARCEZ, Catherine Aliana (1); BURSZTYN, Marcel (1); IBIAPINA, Izabel (1); LITRE, Gabriela (1); RODRIGUES FILHO, Saulo (1); FETTER, Raquel (2); HENKE-OLIVEIRA, Carlos (2); 1: Centre for Sustainable Development, University of Brasilia, Brazil; 2: Laboratório de Ecologia Aplicada/Universidade de Brasília, Brasília, Brazil

DJANIBEKOV, Utkur

Risk coping options and carbon value of afforested irrigated marginal croplands in drylands: The case of Uzbekistan by DJANIBEKOV, Utkur; KHAMZINA, Asia; Center for Development Research (ZEF), University of Bonn, Germany, Federal Republic of

PIYADASA, Ranjana Udaya Kumara

Ingenious water management practices for climate change adaptation in Sri Lanka by PIYADASA, Ranjana. Udaya. Kumara; University of Colombo, Sri Lanka, Democratic Socialist Republic of

Break

11:30–13:00
Location
Chair

Plenary III: **Drivers of change and resilience increase**

Plenary Chamber

Michael Anthony STOCKING; Professor of Natural Resource Development/ Senior Adviser to the Chair of GEF–STAP, Global Environment Facility, London, UK

To effectively tackle Desertification, Land Degradation and Drought (DLDD), and increase the resilience towards it, the drivers of change have to be systematically addressed. Social, economic, ecological and political drivers of change embed many different stakeholders, policies and solutions. Solving problems posed by global environmental change, requires coordinated research that pays at least as much attention to social sciences as it does to natural science. Paying attention to social sciences implies going beyond observation and monitoring of elements of biodiversity and soil status, to monitoring 'human' drivers of change, and how they affect both ecosystems and livelihoods. Additionally, while climate change, biodiversity loss and DLDD share common drivers or causes, the responses are also embedded in the same overarching targets and policy formulations. This session aims to identify the underlying drivers of change and policies that increase the resilience of ecosystems and people dependent on them, as well as the capacity of individuals, communities and systems to survive, adapt and grow in the face of changes, even catastrophic incidents. What are the thresholds that determine whether ecological communities can survive or not? Are some types of ecosystems more resilient to change than others? What characteristics improve resilience? These will be the guiding questions for the panellists that will represent the different fields of science and therewith highlight the possible collaboration amongst them.

Panellists

Elena Maria ABRAHAM; Scientific Researcher of the National Council of Scientific and Technical Research CONICET, Director of the Argentine Institute for Research on Arid Lands IADIZA, and Professor of Environmental Planning & Management, Congress University, Mendoza, Argentina, *"Challenges for sustainable development of drylands"*

Dennis GARRITY; Former Executive Director of ICRAF, UNCCD Dryland Ambassador, Nairobi, Kenya, *"Transformative land regeneration"*

Elizabeth MIGONGO–BAKE; Task Manager, Drylands Ecosystem, United Nations Environment Programme UNEP, Nairobi, Kenya, *"Drylands ecosystems services, drivers of their erosion and the benefits of their functionality in enhancing resilience of drylands environment and human well being"*

Ephraim NKONYA; Senior Research Fellow, International Food Policy Research Institute IFPRI, Washington, D.C., USA, *"Can the poor afford sustainable land management SLM? Drivers of SLM in poor countries"*

Translation into the official UN languages available!

13:00–13:50

13:50–14:50

Location

Speakers

Lunch Break

Session: **Agroecology as a powerful tool for the development of drylands?**

Special Session organized by CARI

Plenary Chamber

OETTLE, Noel Maxwell

Agro-ecological rooibos production by OETTLE, Noel Maxwell; Environmental Monitoring Group, South Africa, Republic of

BURGER, Patrice

Agrécologie, une opportunité pour le développement? Paroles d'acteurs by BURGER, Patrice (1); BILLAZ, René (2); BERTON, Sylvain (3); LEBRETON, Amandine (4); 1: CARI centre d'actions et de réalisations internationale/Drynet; 2: AVSF agriculteurs et vétérinaires sans frontières; 3: AGRISUD International; 4: Fondation Nicolas Hulot

BERNOUX, Martial

Managing soil carbon through agro-ecological practices: a win-win strategy attending both global (fight against climate change) and local problems (soil degradation) by BERNOUX, Martial (1,2,3); CHEVALLIER, Tiphaine (1,3); CHOTTE, Jean-Luc (1,3); 1: IRD (Institut de Recherche pour le Développement); 2: CSFD (French Scientific Committee on Desertification); 3: PPR-SREC (Prog. Pilote Regional SREC)

13:50–14:50

Location

Chair

Speakers

Session: **Macro-economic policy drivers of land management**

Wasserwerk

Marc STAL, Global Risk Forum GRF Davos

ABRAHAM, Elena María

Drylands, desertification and macro-economic policy drivers in Argentina's central west: a case study in Mendoza province by ABRAHAM, Elena María; TORRES, Laura; IADIZA-CONICET, Argentine Republic

TORRES, Leslie Elizabeth

Towards an environmentally-adjusted macroeconomic index by TORRES, Leslie Elizabeth; CANDELORI, Massimo; individual, Germany, Federal Republic of

BOTONI, Edwige

Sustainable land management and possible solutions for sustainable food security by SUBSOL, Sebastien (1); BOTONI, Edwige (2); 1: CILSS; 2: CILSS

NJANKOUA, Dieunedort Wandji

Assessing social-environmental cost of the management policy of the dry forest ecosystems: An application of the safe minimum standard model in Cameroon and Senegal by NJANKOUA, Dieunedort Wandji UNEP, DEPI (Forest Eco-taxation project), Senegal.

13:50–14:50
Location
Chair
Chair
Speakers

MORA, Leonardo
Economic valuation of lands in Colombia by MORA, Leonardo; Independent consultant, Colombia, Republic of

Session: **Traditional knowledge related to DLDD/SLM**
Pumpenhau

Luuk FLESKENS, University of Leeds

Karma Dema DORJI, Ministry of Agriculture & Forests

PASTOR, Gabriela Claudia
Redimensioning tensions for old structures: traditional technological devices in drylandscapes and territory management by PASTOR, Gabriela Claudia; TORRES, Laura María; Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Argentine Republic

MANNACIO, Stefano
Bioeconomy and Development by MANNACIO, Stefano (1); PIERI, Massimo (1); JAPPELLI, Valentina (2); 1: COBASE Basic Technical Scientific Association; 2: Gherush92 Committee for Human Rights

ESTEGHAMAT, Mina
Reviving Indigenous Community Conserved Areas (ICCA) in customary territories of Abolhassani mobile pastoralists, Iran by ESTEGHAMAT, Mina; AHMADI KAMALI, Fatemeh; RAZAVI, Khadija Catherine; Centre for Sustainable Development and Environment (CENESTA), Iran, Islamic Republic of

PARK, Soo Jin
Fung Su and self-organized landforms: an old but new conceptual framework for sustainable land management by PARK, Soo Jin Seoul National University, Korea, Republic of

GEDDA, Abule Ebro
Assessment of rangeland degradation using indigenous and scientific knowledge basis in Northern Afar, Ethiopia by KEBEDE, Lemlem (1); GEDDA, Abule Ebro (2); NIGATU, Lisanworke (3); 1: Tigray Ministry of Agriculture, Mekele, Ethiopia; 2: Adami Tulu Agricultural Research Center, Ethiopia, Ethiopia, Federal Democratic Republic of; 3: Haramaya University, Dire Dawa, Ethiopia

HAILE, Bereket Tsehaye
An assessment of community management of traditional woodland enclosure (Hiza'ti): A case study in the highlands of Eritrea by HAILE, Bereket Tsehaye; Ministry of Agriculture, Eritrea

15:00–16:30
Location
Facilitator

Session: **Towards a land-degradation-neutral world: from science to policy and law**
Part A
Special session organized by IUCN and UNCCD
Plenary Chamber

Jonathan DAVIS, International Union for the Conservation of Nature

Speakers

GNACADJA, Luc
Welcoming Remarks by GNACADJA, Luc; UNCCD

GRAINGER, Alan
Zero Net Land Degradation: definitions and divergences by GRAINGER, Alan; University of Leeds, United Kingdom

SCHAUER, Mark
The Economics of Zero Net Land Degradation by SCHAUER, Mark; GIZ

POULSEN, Lene
The Economics of Resilience by POULSEN, Lene; IUCN Commission on Ecosystem Management

HEUSER, Irene
Options for reaching a global agreement on ZNLD by HEUSER, Irene; IUCN Commission on Environmental Law

Followed by a Panel Discussion and Questions from the Audience in PART B

Translation into the official UN languages available!

15:00–16:30

Session: **Tackling key challenges in the economic assessment of desertification, sustainable land management and resilience of arid and semi-arid and dry sub-humid areas: Perspectives from DesertNet International's Working Groups**
Special session organized by the University of Leeds
Wasserwerk

Location
Speakers

CHERLET, Michael
Baseline information and monitoring for integrated assessment of DLD by CHERLET, Michael; SOMMER, Stefan; European Commission, Joint Research Centre, Italy, Republic of

15:00–16:30
Location
Chair
Chair
Speakers

Session: **Indicators for DLDD and SLM**
Pumpenhau

Edith VAN WALSUM, ILEIA – AgriCultures Network

Bruno Oreste BELLETTINI, UNDP

DREBER, Niels
Towards improved decision-making in degraded drylands of southern Africa: an indicator based assessment for integrated evaluation of restoration and management actions in the Kalahari rangelands by DREBER, Niels (1,2); KONG, Taryn M. (3); KELLNER, Klaus (1); VAN EEDEN, Albert (1); OCAMPO-MELGAR, Anahi (3); 1: North-West University, Botany: School of Environmental Science and Development, Private Bag X6001, Potchefstroom, 2520, South Africa; 2: University of Hamburg, Biodiversity of Plants, Biocentre Klein Flottbek and Botanical Garden, Ohnhorststrasse 18

	<p>MATIN, Shafique <i>Characterizing indicators of drylands and desertification in Ganga river basin, India</i> by MATIN, Shafique; Indian Institute of Technology Kharagpur, India, Republic of</p> <p>BOUKCHINA, Rachid <i>Case studies of indicators evaluation at local level using direct observations and modelling methods</i> by BOUKCHINA, Rachid; SGHAIER, Mongi; Institute of Arid Lands, Tunisia, Republic of Tunisia</p> <p>BRANQUINHO, Cristina <i>Searching for universal early-warning indicators of desertification: anticipating tipping points at ecosystem level</i> by BRANQUINHO, Cristina (1); PINHO, Pedro (1,2); NUNES, Alice (1,3); MATOS, Paula (1,3); BATISTA, Melanie (1); SILVA, Adriana (1); FERREIRA, Andreia (1); ROSÁRIO, Lucio (4) 1: Universidade de Lisboa, Faculdade de Ciências, Centro de Biologia Ambiental, Campo Grande, Bloco C2, 5º, Piso, sala 37, 1749-016 Lisboa, Portugal.; 2: CERENA-Centre for Natural Resources and the Environment, Universidade Técnica de Lisboa, Instituto Su</p> <p>AGUIAR BEZERRA, Karine Rocha <i>Assessment of environmental vulnerability to desertification processes in the hydrographic basin of the Médio Jaguaribe – Ceará</i> by AGUIAR BEZERRA, Karine Rocha; SILVA BEZERRA, Francisco Gilney; Instituto Nacional de Pesquisas Espaciais, Brazil, Federative Republic of</p> <p>LODOUN, Tiganadaba <i>Forecasting rainy season's features under a semi-arid climate of Burkina Faso using rainfall-based predictor variables</i> by LODOUN, Tiganadaba (1); SANOU, Moussa (1); TRAORE, Pierre Sibiry (2); GIANNINI, Alessandra (3); MILLOGO, Jeanne Rasolomdympi (4); SOME, Leopold (1); 1: INERA, Burkina Faso; 2: ICRISAT, Bamako; 3: Columbia University, USA; 4: University of Ouagadougou</p> <p>KIRWA, Everlyne Cheptarus <i>Impact of land-use change from ranching to smallholder agro-pastoral system on ecological resource base in Machakos-Makueni Districts, Kenya</i> by KIRWA, Everlyne Cheptarus (1); NYANGITO, Moses Moywaywa (2); NYARIKI, Dickson (2); 1: Kenya Agricultural research institute, Kenya.; 2: University of Nairobi, Kenya</p>	16:40-18:00
16:30-16:40	Break	
16:40-18:00	<p>Session: Towards a land-degradation-neutral world: from science to policy <i>Part B</i> <i>Special session organized by IUCN and UNCCD</i></p>	
Location	Plenary Chamber	
Facilitator	Jonathan DAVIS , International Union for the Conservation of Nature	
Panel Discussion	UNCCD Focal Point South Africa UNCCD Focal Point, and Chairman of the COP, Republic of Korea	

UNCCD Focal Point France (to be confirmed)

UNCCD Focal Point Costa Rica (to be confirmed)

Civil Society representative from CENESTA, Iran

Global Mechanism of the UNCCD

Translation into the official UN languages available!

Session: **Integrated modelling of climate impacts on food and farming at regional to supra-national scales**

Special session organized by the Johann Heinrich von Thünen-Institut

Wasserwerk

BANSE, Martin

A European network of crop, livestock and trade modelling activities for assessing impacts of climate change on food security by BANSE, Martin (1); KÖCHY, Martin (1); TIFFIN, Richard (2); 1: Johann Heinrich von Thünen-Institut, Germany, Federal Republic of; 2: Centre for Food Security, University of Reading, UK

DONO, Gabriele

Economic assessment of the impact of uncertainty associated with short-run change in climate variability in Mediterranean farming systems by DONO, Gabriele (1); CORTIGNANI, Raffaele (1); DELIGIOS, Paola (2); DORO, Luca (2); GIRALDO, Luca (1); LEDDA, Luigi (2,3); MAZZAPICCHIO, Graziano (1); PASQUI, Massimiliano (4); ROGGERO, Pier Paolo (2,3); 1: Department of Science and Technology for Agriculture, Forestry, Nature and Energy, University of Tuscia, Viterbo; 2: Desertification Research Centre (NRD), University of Sassari; 3: Dipartimento di Agraria, University of Sassari; 4: Institute for Biome

GUTIERREZ, Luciano

Short and long-run impact of climate changes on worldwide grains prices by GUTIERREZ, Luciano; PIRAS, Francesco; ROGGERO, Pier Paolo; University of Sassari, Italy, Republic of

PODHORA, Aranka

Bridging science and stakeholders: integrated impact assessment for multifunctional land use in drought-prone Inner Mongolia, China by PODHORA, Aranka (1); KÖNIG, Hannes Jochen (1); HELMING, Katharina (1); ZHEN, Lin (2); YAN, Huimin (2); BINGZHEN, Du (2); BAUMEISTER, Tom (1); WIGGERING, Hubert (1) 1: Leibniz Centre for Agricultural Landscape Research (ZALF), Germany; 2: Institute of Geographic Sciences and Natural Resources Research (IGSNRR), CAS, China

BROUWER, Floor

Climate change risk assessment for European agriculture and food security by BROUWER, Floor; Wageningen UR, Netherlands, Kingdom of the

Detailed Programme Thursday 11 April 2013

16:40–18:00

Location

Chair

Chair

Speakers

Session: **Methodologies and tools for assessing DLDD**

Pumpenhäus

Soo Jin PARK, Seoul National University

Jeffrey E HERRICK, USDA-ARS

ROSSODIVITA, Alessandra

Governance in managing the risks of extreme events and disasters. The global environmental changes from climate changes to desertification, drought and famine. A new global network of information sharing to guarantee and protect our planet, our health by ROSSODIVITA, Alessandra (1); BRACCO, Diana (2); GUIDOTTI, Matteo (3); TIKHOMIROV, Alexei (4); TROUFANOV, Andrey (5); UMEROV, Rustem (6); LA PORTE, Ron (7); GURSKY, Elin (8); GALINDO, Fernando (9); SHUBNIKOV, Eugene (10); 1: San Raffaele Hospital Scientific Foundation, Milan, Italy, Republic of Italy; 2: Bracco Foundation, Milan, Italy; 3: National Research Council, CNR, Italy; 4: International Informatization Academy, Moscow, Russian Federation, RF; 5: Irkutsk State Te

LINIGER, Hanspeter

Assessment and mapping of LD and SLM as a direct support to planning and up-scaling of SLM interventions to combat desertification by LINIGER, Hanspeter (1); VAN LYNDEN, Godert (2); BIANCALANI, Riccardo (3); BUNNING, Sally (3); LINDEQUE, Lehman (4); NDIAYE, Dethie Soumare (5); 1: Centre for Development and Environment / WOCAT / University of Berne, Switzerland; 2: ISRIC; 3: FAO; 4: Department of Agriculture, Forestry and Fisheries, South Africa; 5: CSE – Senegal

AIRES DE MACÊDO, Mônica Larrissa

Using multivariate statistics in the study of desertification in São João do Tigre / PB by AIRES DE MACÊDO, Mônica Larrissa; RODRIGUES VIANA DE LIMA, Eduardo; NASCIMENTO, Sebastiana; 1: Universidade Federal da Paraíba, Brazil, Federative Republic of;

LIU, LianYou

Desertification and blown sand disaster in China by LIU, LianYou (1,3); SHI, PeiJun (2,3); ERDON, Hasi (1); WANG, JingAi (1); TANG, HaiPing (2); HU, Xia (1,3); GUO, LanLan (1,3); ZHANG, GuoMing (1,3); QU, ZhiQiang (3); LUE, YanLi (2,3); YANG, YanYan (3); WANG, JingPu (3) 1: Key Laboratory of Environment Change and Natural Disaster, Ministry of Education, Beijing Normal University, Beijing 100875, China; 2: State Key Laboratory of Earth Surface Processes and Resource Ecology, Beijing Normal University, Beijing 100875, China

RAMADAN, Ashraf

Optimisation of a kiser-developed integrated sand control system using wind tunnel simulations by RAMADAN, Ashraf (1); AL-DOSARI, Ali (2); 1: Kuwait Institute for Scientific Research, Kuwait, State of; 2: Kuwait Institute for Scientific Research, Kuwait, State of

Thursday 11 & Friday 12 April 2013 Detailed Programme

MUHAMMAD, Ismail

Developing an integrated mechanism for combating rangeland desertification in Hindu Kush Himalayan region by MUHAMMAD, Ismail; International Centre for Integrated Mountain Development, Nepal,

Break

Poster Session: **Local knowledge and good practices related to DLDD/SLM**

Poster Exhibition Area (see page 48 for more details)

Poster Session: **Water scarcity and land – the nexus aspects**

Poster Exhibition Area (see page 49 for more details)

Poster Session: **Economic and social impacts assessment of DLDD**

Poster Exhibition Area (see page 49 for more details)

Poster Session: **Governance and policy analysis**

Poster Exhibition Area (see page 50 for more details)

Poster Session: **Climate change, related risks and impacts on DLDD**

Poster Exhibition Area (see page 50 for more details)

Poster Session: **Causes of DLDD**

Poster Exhibition Area (see page 51 for more details)

18:00–18:15

18:15–19:15

Location

18:15–19:15

Location

18:15–19:15

Location

18:15–19:15

Location

18:15–19:15

Location

18:15–19:15

Location

FRIDAY 12 April 2013

08:30–09:45

Location

08:30–09:45

Location

Chair

Chair

Speakers

Workshop: **From agroecological practice to policy: bridging the gap in dryland management**

Workshop organized by ILEIA – AgriCultures Network
Plenary Chamber

Session: **DLDD and SLM assessment tools**

Wasserwerk

Laura Erika MEZA, FAO

Simone QUATRINI, Global Mechanism of the UNCCD

LINIGER, Hanspeter

Tools for better SLM knowledge management and informed decision making to address land degradation at different scales – the WOCAT / LADA methodology by LINIGER, Hanspeter (1); SCHWILCH, Gudrun (1); MEKDASCHI STUDER, Rima (1); PROVIDOLI, Isabelle (1); BUNNING, Sally (2); BIANCALANI, Riccardo (2); 1: Centre for Development and Environment / WOCAT / University of Berne, Switzerland; 2: FAO

SALINAS, Carla Ximena

Numerical model to assess the impact of the strategies to mitigate desertification by SALINAS, Carla Ximena; MENDIETA, Jon; CAZALAC, Chile, Republic of

DE BOEVER, Maarten

Nursing role of Acacia plantations in the restoration of degraded environments by DE BOEVER, Maarten (1); GABRIELS, Donald (2); OUESSAR, Mohammed (3); CORNELIS, Wim (1); 1: Department of Soil Management, Soil Physics Research Unit, Ghent University, Belgium; 2: Department of Soil Management, UNESCO Chair for Eremology, Ghent University, Belgium; 3: Institut de Régions Arides, Médenine, Tunisia

BINDRABAN, Prem S.

Mapping global ecosystem degradation by BINDRABAN, Prem S. (1); TEN BRINK, Ben (2) 1: ISRIC – World Soil Information, Netherlands, Kingdom of the; 2: Netherlands Environmental Assessment Agency, Netherlands, Kingdom of the

KUST, German

Assessment and geographical zoning of desertification in the Russian Federation by KUST, German; ANDREEVA, Olga; Institute of Ecological Soil Science, Moscow Lomonosov State University. Russian Federation

VANDECASTEELE, Ine

Mapping of current and projected Pan-European water withdrawals by VANDECASTEELE, Ine (1); BIANCHI, Alessandra (1); MUBAREKA, Sarah (1); DE ROO, Ad (1); BUREK, Peter (1); BOURAOU, Faycal (1); LAVALLE, Carlo (1); BATELAAN, Okke (2); 1: Institute for Environment and Sustainability (IES), JRC, Ispra, Italy; 2: Vrije Universiteit Brussel, Belgium

Session: **Policy analysis and good examples**

Pumpenhuis

Chair **Charles Onyango NYANDIGA, UNDP**

QUILLEROU, Emmanuelle

Costs of land degradation and benefits of land restoration: A review of valuation methods and suggested frameworks for inclusion into policy-making by QUILLEROU, Emmanuelle; THOMAS, Richard J.; UNU-INWEH, Canada

VON MALTITZ, Graham Paul

Establishing a dryland fund for SLM projects in South Africa by CLARKE, Julie (1); VON MALTITZ, Graham Paul (2); 1: Development Bank of Southern Africa (DBSA), South Africa, Republic of; 2: CSIR, South Africa, Republic of

NJANKOUA, Dieunedort Wandji

In measuring trade-offs values of the policy management options: case study of dry forest land of the national park of Djoudj in Senegal by NJANKOUA, Dieunedort Wandji; DIONE, Abdou; UNEP, DEPI (Forest eco-taxation project) Senegal.

08:30-09:45

Location

Chair

Speakers

VITAL RODRIGUES, Maria Ivoneide

Analysis of plans, programs and policies to combat desertification in the state of Ceará – Brazil in the period 2004 to 2012 by VITAL RODRIGUES, Maria Ivoneide (1); SILVA BEZERRA, Francisco Gilney (2); AGUIAR BEZERRA, Karine Rocha (2); SALES LIMA, Patrícia Verônica Pinheiro (1); 1: UNIVERSIDADE FEDERAL DO CEARÁ, Brazil, Federative Republic of; 2: Instituto Nacional de Pesquisas Espaciais

SHAHZAD, Tayyab

Enabling policies for supporting local area development initiatives to combat desertification TPN-6 of UNCCD for Asia and the Pacific by SHAHZAD, Tayyab Sustainable Land Management Project, Pakistan, Islamic Republic of

DAVANSO, Marcela B ergo

Translating policies into actions: the implementation of public policies to combat desertification in Brazil by TRAJANO, Vânia Apolônio (1); DAVANSO, Marcela B ergo (2); CAMPELLO, Francisco Carneiro Barreto (2); 1: Inter-American Institute for Cooperation on Agriculture – IICA – Brazil; 2: Ministry of Environment of Brazil – MMA, Brazil, Federative Republic of

Vanina PIETRAGALLA

Institutionalization of desertification monitoring in Argentina: Development and implementation of the National Observatory on Land Degradation and Desertification by Vanina PIETRAGALLA(1); María Laura CORSO (1); José CUEVA(1); Patricia MACCAGNO(2); Almut THERBURG(2); Elena ABRAHAM(3); Dario SORIA(3); Donald BRAN(4); Néstor MACEIRA(4); Stella NAVONE(5); Marcela ROMÁN(5); 1: Secretariat of Environment and Sustainable Development, Argentine Republic; 2: National Scientific and Technical Research Council (CONICET); 3: National Research Institute of Drylands (IADIZA); 4: National Institute of Agricultural Technology (INTA); 5: School of Agriculture, University of Buenos Aires (FAUBA)

09:45-10:00

Break



10:00–11:30

Location

Chair

Plenary IV: Strategies and policies for local, national, regional and international level

Plenary Chamber

Jonathan DAVIES; Coordinator of the Global Drylands Initiative within IUCN's Ecosystem Management Program, Nairobi, Kenya

Land degradation can be prevented, degraded lands restored and drought mitigated through sustainable land and water use techniques supported by relevant institutional measures and policies. Understanding the causes of inaction (or of inappropriate action) is the key in delivering effective land degradation policies. Policies and programmes should focus on addressing and changing the behavioural patterns that lead to land degradation. Moreover, it is uncontested that policies and programmes are better accepted in communities and by population if enacted by local councils than by higher authorities. The local communities must be empowered to manage natural resources and it is essential that the users of the land receive direct benefits from preventing or mitigating land degradation. Based on the previous plenary sessions, the White papers I and II and the Background Document, this session aims at discussing the transfer from research to policy making to implementation; how to balance policy making with top down and bottom up approaches; how to ensure compatibility between science and local knowledge and institutions; and how to implement efficient measures at local councils, regional and higher authorities as well as the main hurdles that prevent these measures from being realized.

Panellists

Mohamed BAKARR; Senior Environmental Scientist, Global Environment Facility GEF, Washington, D.C., USA, "*Investing in policies and strategies for sustainable land management – catalytic role of the Global Environment Facility*"

Mahboub MAALIM; Executive Secretary of the Intergovernmental Authority on Development IGAD, Headquartered in Djibouti, Djibouti

Chris REIJ; Sustainable Land Management Specialist, Centre for International Cooperation, Free University Amsterdam, The Netherlands and a Senior Fellow, World Resources Institute, Washington, USA, "*Strategies and policies for scaling up re-greening successes*"

Christina SEEBERG-ELVERFELDT; Desk Officer, Division 314, Rural Development, Agriculture and Food Security, Federal Ministry for Economic Cooperation and Development (BMZ), Bonn, Germany "*Seizing opportunities for sustainable land management through targeted policies and strategies*"

François TAPSOBA; FAO Chief Technical Advisor to the African Union Commission in charge of the Great Green Wall for the Sahara and the Sahel Initiative GGWSSI, Addis Ababa, Ethiopia, "*Initiative de la grande Muraille verte et restauration des zones arides en Afrique Sahélienne*"

Translation into the official UN languages available!

11:30–11:45

Break

11:45–12:30

Closing Session

Jonathan DAVIES; Chair of the Scientific Advisory Committee SAC

Walter J. AMMANN; President/CEO, Global Risk Forum GRF Davos, Davos, Switzerland, "*Conference Draft Summary Report*"

Translation into the official UN languages available!

12:30–13:00

Closing Ceremony

Antonio ROCHA MAGALHÃES; Chairperson of the Committee of Science and Technology CST, United Nations Convention to Combat Desertification, Brasil

Luc GNACADJA; Executive Secretary, United Nations Convention to Combat Desertification, Bonn, Germany

Translation into the official UN languages available!



POSTER PRESENTATIONS

WEDNESDAY 10 April 2013

18:15 – 19:15 / Location: Poster Exhibition Area

Soil functions and related ecosystem services

DE MATOS, José Carlos Rodrigues; Universidade Estadual do Ceará–UECE Centro de Educação, Ciências e Tecnologia dos Inhamuns– CECITEC; *Mini museo itinerante de ciencias naturales como herramienta para la conservación, conciencia y lucha a la desertificación del Bioma Caatinga.*

ABDALLA, Mubarak Abdelrahman; University of Khartoum; *Use of uncomposted sewage sludge and clay based ameliorant for production of wheat (*Triticum aestivum*) in desert soils*

IBRAHIM, Badreldin Siddig; University of Khartoum; *Production of grain sorghum (*Sorghum bicolor*) in sandy soils*

ARAÚJO, Beranger Arnaldo; SERHMACT; *Resilience action to recover an area in degraded ad Brazilian Semiarid through plant cover recomposition*

TANG, Haiping; Beijing Normal University; *Study of carbon flux under different land use patterns in an agro-pastoral ecotone in Inner Mongolia, China*

OLIVEIRA, Paulo Roberto Abreu; UNIVERSIDADE ESTADUAL DO CEARÁ; *The ratio of soil types and degraded / desertified as proposed for identifying the susceptibility of these areas*

Forest management and multifunctional forestry

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Further information is available under <http://bit.ly/1o8a1Bv>





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Oral Presentations, Posters,
Sessions & Workshops



We would like to extend our sincere appreciation to, in particular, the Governments of Germany, Finland, the Republic of Korea, Spain, Sweden and Switzerland for their contributions and generous support. Voluntary financial contributions have helped in the preparation and organization of the United Nations Convention to Combat Desertification (UNCCD) 2nd Scientific Conference and are strengthening our scientific understanding of the social and economic drivers and consequences of desertification, land degradation and drought. By investing in science and ensuring the participation of scientists in the decision-making processes, these voluntary contributions have significantly advanced the implementation of the Convention.

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Oral Presentations

Economic valuation of ecosystem services to support sustainable water and land management in the Amudarya River Delta

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The desiccation of the Aral Sea and Amudarya delta caused significant damage to aquatic and terrestrial ecosystems which have for centuries supported the local population with a multitude of ecosystem services. The goal of the presented study is to identify and assess the value of ecosystem services to restore wetland functions and improve livelihoods and rural well-being. The assessment is based on empirical data and reports as well as stakeholders' knowledge elicited during field studies, consultations, expert workshops and social surveys. We develop a classification system and vulnerability indicators for the 13 deltaic lake systems and

estimate the hydrological regime required to maintain the provisions of valuable ecosystem services in the Amudarya delta. Community measures have been identified to improve local livelihoods such as small-scale fisheries, advanced technologies and practices for household farming and development of local handicrafts and commercial hunting enterprises. Our findings indicate that a rehabilitation of the lake system infrastructures could facilitate the water inflows needed to restore an estimated 234 000 hectares of wetland area. The expected benefits are: i) increase in fish, muskrat, and reed productivity as well as meat and milk production; ii) improvement of the environmental legislation and capacity building of the water institutions. The IRR for the Project is 16.4% with a net present value (NPV) of 25 Bln Uzb Sum (\$13 Mln.US). The paper highlights the importance of institutional changes to ensure water management and water allocation planning among local communities and decision makers and a move towards multi-purpose water use.

Keywords: valuations, ecosystem services, vulnerability indicators, community measures, restoration of wetlands, benefit

Drylands, desertification and macro-economic policy drivers in Argentina's central west: a case study in Mendoza province

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Argentina's central west encompasses a vast dryland territory, organized on the basis of a great contradiction: the confrontation between oasis and rainfed area (desert lands with no irrigation). Within a territory under conditions of aridity with different desertification levels, Mendoza is a paradigmatic case. The development model fostered at the end of the XIX century was based on the supremacy of strategic resources: water and soil. A mode of regional development reliant on irrigated lands was supported there from to consolidate the wine exporting model. Nowadays, Mendoza's non-irrigated lands and their people are marginal not merely by the effect of a restrictive environment but also by the combined action of a fragile environment and the weightier social, political and economic forces that have banished them to the system's margins. Analysis of the region's history informs that non-irrigated spaces provided both strategic natural resources for development of irrigated areas and labour to start production activities. Simultaneously, non-irrigated lands were restricted in their right to access strategic resources for their social reproduction: water, land and identity. This report delves further into the analysis of the dynamics of territory construction whereby some territories stand as central while others are relegated to marginal positions. The analysis goes deeper into a case study with signs of a serious process of territory impoverishment, social exclusion and progress of desertification and poverty, and presents the efforts to encourage a rural development strategy for non-irrigated drylands that allows full inclusion of these territories and actors as rights-bearing subjects.

Keywords: Desertification/land degradation, argentine drylands, Mendoza case, macroeco-

nomie policy

Water and soil conservation practices in the Sahel. Analysing their potential to increase the resilience of rural livelihoods

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In the Sahel people always faced extreme climate conditions with a high rainfall variability. Rising population density, unsustainable cultivation practices and degradation of resources, particularly of soils, are progressing and lead to desertification. The effects of climate change have already further exacerbated these difficult conditions and will continue to increase the stress on the ecosystem, leading to higher vulnerability of the rural population. Since the 1980s, German development cooperation has been providing support to people in the Sahel region with the development and implementation of improved natural resource management strategies and approaches. A special focus has been given to soil and water conservation (SWC) and soil protection and restoration (SPR). In the paper several techniques and approaches of SWC / SPR will be presented and their contribution to improving the resilience of the prevailing agro-sylvo-pastoral systems and to reducing the vulnerability of the rural population will be examined. A special focus will be on water spreading weirs as a relatively new technology for the rehabilitation of degraded dryland valleys, which has been introduced in the Sahel by Swiss and German development cooperations. This technique has to be embedded into a spatial approach combining several land management techniques, which reduce soil erosion and improve soil fertility and food security. In the conclusion the paper gives policy and technical recommendations for the upscaling of the presented techniques in order to contribute to sustainable land management

and resilience building on the ground.

Keywords: soil and water conservation, soil protection and restauration, water spreading weirs; resilience of agro-sylvo-pastoral systems

Rethinking vulnerability to water scarcity in the sub humid environment: the example of the Water Vulnerability Index in Oke-Ogun region, Nigeria

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Access to water in the sub-humid areas is influenced by many biophysical and socio-demographical contexts which can trigger vulnerability or modify adaptive capacity of local communities. Within the context of future climate change and climate variability, the Oke-Ogun region is likely to get drier and impacts of water stress becomes more severe in the future because the area depends solely on water resources that are climate sensitive for livelihoods supports. The study provides a method of assessing vulnerability to water scarcity in semi-humid areas by generating a Water Vulnerability Index (WVI) for Oke-Ogun region, Nigeria. Data were captured through a household survey in three local communities in the study area alongside with key informant interviews and document review. Frequencies of responses to study variables were categorised to form the sub-components of WVI such as access, resources, capacity, and environment. Equality of ranking (Kruskal-Wallis with Chi Square)) was done to determine the significance differences in the observed WVI of the case study communities. Results indicate that within the study region, there are significant variances in the CVI components of each community depending on land and water-related livelihoods and in relation to different socio-demographic characteristics. The critical areas are the predominant agrar-

ian communities which have less CVI, pointing to the fact that households living in most biophysically vulnerable places are more affected by water stress and are in needs of critical interventions for adaptation.

Keywords: Semi-humid environment, socio-demographic factors, water stress, Water Vulnerability Index, Oke-Ogun

Assessment of environmental vulnerability to desertification processes in the hydrographic basin of the Médio Jaguaribe - Ceará

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The process of desertification is the focus of many studies, but the association of social aspects in this analysis is still underutilized. The objective of this study is to evaluate the environmental vulnerability to desertification processes in the hydrographic basin of the Médio Jaguaribe - Ceará. Therefore, the data used were collected from different sources, processed and manipulated in such a way as to provide the generation of indexes (partial indexes of vulnerability - social and natural aspects, environmental vulnerability index) in cell units with a spatial resolution of 10x10 km. It was found that the vulnerability in the study area was primarily low when considering the social and natural association and that the social aspect was crucial in this type of analysis. Assume, then, that these factors are important for studying the degree of environmental vulnerability to processes of desertification. Thus, further study of each indicator used as well as the inclusion of other social factors, is needed.

Keywords: cells, indexes, social aspects

Topsoiling and subsoiling as sustainable tillage practices for arid climates: A case study from Sudan

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Yield of rainfed crops show a declining trend due to mismanagement aspects rather than water availability in Sudan. The objective of this study was to evaluate and recommend the best in situ rainwater harvesting techniques that can ensure sustainable crop productions under arid conditions of the central Sudan. This was done through monitoring of soil moisture content, soil moisture depth, infiltration rate, crop evapotranspiration (ETc), yield and green water footprint. Data collection was lasted for two consecutive experimental seasons, using the 1-factor completely randomize design. The tested in situ rainwater harvesting techniques were topsoiling and subsoiling tillage. The conventional bund rainwater harvesting techniques coupled with zero tillage that adopted widely by the local farmers was taken as a control. It was found that the collected data of both topsoiling and subsoiling were better than that of the control, suggesting that topsoiling and subsoiling were win-win techniques (increasing crop yield and improving soil hydrological properties) under the arid conditions of the central Sudan. For instance the sorghum water footprints were found to be 1100 m³ ton⁻¹ under both topsoiling and subsoiling practices compared with 4000 m³ ton⁻¹ of the zero tillage. These results questioned the current Sudanese governmental believe/policy on zero tillage for upgrading the rainfed agriculture.

Keywords: Topsoiling; subsoiling; zero tillage; rainwater harvesting; arid conditions

Using multivariate statistics in the study of desertification in São João do Tigre / PB

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The proposed study aims to identify areas where desertification process in São João do Tigre, Paraíba. These areas were defined using indicators proposed by monitor software and the IBGE (Brazilian Institute of Geography and Statistics) and analyzed using the techniques of GIS and Multivariate Statistics Multiple Correspondence Analysis and Cluster Analysis. It was possible to define indicators of greater importance and greater contribution to the existence of these areas as well as the formation of maps identifying both physical and socio-economic aspects are related to this phenomenon. Three areas are defined, shown in all areas, comprised of semi arid conditions, high percentages of degraded land, density of vegetation cover regular and high illiteracy rates.

Keywords: Multivariate analysis, indicators, desertification

Assessment of the impact of climate change on water resources in The Sultanate of Oman

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The Sultanate of Oman belongs to the arid region of the earth, and its climate is determined by interactions between regional physiography and atmospheric circulation. The mechanism of rainfall variability in Oman was investigated using time series of monthly precipitation as measured by a dense observational network. In this work we consider only data from common windows, focusing on the period 1984–2010, during which a large number of measuring stations

are available. The selected stations clearly show a significant negative trend in the total annual precipitation. For the assessment of the future climate projection over Oman, the 21st century IPCC scenario is used. The obtained results show a decrease in the winter rainfall systems that affects the northern part of the country and increases in the summer monsoon that affects the southern part of the country. The threat of changing climate and higher average temperatures will decrease the availability of fresh water resources. Water availability has been identified as the main development constraint with absolute water scarcity predicted by as early as 2020. Currently, the domestic water use in the country is about six times above the natural renewal rate, which has resulted in an increase of salinity levels in ground water from saltwater intrusion and a sharp drop in water table level.

Keywords: Rainfall variability, Oman, water resources

Desertification, land grabbing and food sovereignty: the unexplored link

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Over the past several years, there has been a recent surge of interest in foreign investment in agricultural land. The convergence of global crises in food, energy, and environment has lead to search for 'empty' land often in distant countries. Though many factors contribute for this growing trend of land grabbing, water and desertification are the most significant drivers. For example, Saudi Arabia, which for many years encouraged wheat production, decided to phase out by 2016 because of depletion of freshwater. Equally many firms in the Gulf countries abandoned agriculture due to alkalinity. Now they invest in foreign agriculture land. Food sovereignty is the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable

methods, and their right to define their own food and agriculture systems. The changing nature of foreign investment in agricultural land increases the potential to shift rights from domestic to foreign actors. In many of the host States, there is an inadequate legal framework to protect rights of people. Many rural African dwellers consider land as one of the tangible assets that they could utilise in perpetuity, subject to traditional terms of use. Today, many livelihoods are insecure because it is quickly becoming lucrative for foreign agricultural investors to acquire pieces of land in rural Africa. Therefore land grabbing seriously affects food sovereignty of people. This paper attempts to analyse in detail about the link among desertification, land grabbing and food sovereignty.

Keywords: land grabbing, food sovereignty, desertification

Reeducation of family agriculture and sustainable practices in the combat to desertification in Irauçuba city.

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Irauçuba city, Ceará, is one of the sites in the Brazilian territory highly affected by desertification. The desertification effects jeopardize regional social-economic development, especially familiar agriculture, main source of income and subsistence of Irauçuba. The desertification has increased poverty, already significant due to factors as income concentration, adverse climate conditions and ineffectiveness of social rights. Local society has still low access to information regarding the problematic. Thus, our goal is to educate the local community on the theme of sustainable management and emphasize the importance of social relation with the surrounding environment, to enhance familiar agricultural income. The specific goal is: publicizing already efficient methods on the combat to the

phenomenon, avoiding prejudicial practices as burning soil to clean the land, mobilizing local youth to disseminate the program to next generations, developing along with the rural community new means of preservation and recovery of the soil. The methodology is based on field research, interviewing local citizens; and qualitative research, throughout broad bibliography, comparing previous successful experiences with local initiatives developed in collaboration with the people of Irauçuba, in order to improve social and environmental conditions. Preservation programs that work with local communities have shown more efficiency than those that exclude the people's participation. Once the community assumes the ecosystem as their home, they start contributing to its conservation and recovery. Therefore, sustainable management practices have potential to not only restore and preserve the ecosystem but also to diminish the high levels of poverty in Irauçuba, providing better social conditions.

Keywords: Irauçuba, desertification, sustainable management practices, social participation, semi-arid areas

The effect of intense soil erosion event on farmer and stakeholder's perception of sustainable land management in Harod valley, Israel

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Frequent rainstorm events that occur during the early wet season, while agricultural land is bare and vulnerable due to intensive cultivation, can result in severe soil erosion. During the October 2006 an extreme soil erosion event occurred in the northern part of Harod watershed, located at the semi-arid Yizrael Valley, Israel. Although the total rainstorm amount was moderate (i.e. 66 mm) the combination between high rainfall intensity, of above 90 mm/h peaks, and partially cultivated bare land resulted with approximately loss of 60 m³/ha fertile soil even though large area of the catchment (~40%)

was dealt with soil conservation measures that were tolerant to runoff. Laboratory analysis of soil texture, from the cultivated upper horizon (0-5 cm) showed a reduction of 11.5% and 44.4% of clay and sand fraction (respectively), comparing pre-storm conditions, which negatively affected the soil hydraulic properties. These results imply that, without sustainable interface, future occurrence of intensive rainfall events will impact soil condition and eventually would result in an accumulated effect on land degradation mechanisms if no measures of sustainable land management (SLM) activities will be implemented. This extreme erosion event led to a significant change in the standpoint of farmers and stakeholders at the local and regional scale. Following the analysis of the rainstorm event, implementation processes (e.g. workshops, practical courses and field excursions) took place to increase awareness of the effectiveness of soil conservation measures. Another substantial phase resulted with the ministry decision to intensify national incentives for enhanced measured of SLM.

Keywords: SLM, land degradation, soil erosion

Minimizing costs and maximizing benefits of dryland restoration and rehabilitation

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Land degradation refers to the diminishment of biodiversity and ecosystem services that negatively affect food, fiber and fodder production, access to water and ultimately livelihoods. It is caused by a variety of human activities and natural processes which are intricately linked to climate change and biodiversity loss. In addition to unsustainable agricultural and livestock management practices, mining, forestry, and urbanization also contribute to land degradation and re-

duced socio-ecological resilience in dryland ecosystems. As conservation and sustainable use are no longer sufficient to halt or reverse these trends, ecological restoration clearly must now be integrated in the global campaign "to achieve a land degradation neutral world in the context of sustainable development". Dryland restoration and rehabilitation embrace a broad range of activities that protect and augment our stocks of natural capital and thus ensure adequate flows of ecosystem services, such as provisioning, regulating and other services. In the arid, semi-arid and sub-humid regions where approximately 40% of the world's human population lives, restoration activities can serve to complement and enhance the benefits from sustainable land management, and often include traditional agricultural, livestock and agro-forestry practices as well as sustainable harvesting of non-timber products, such as food and medicinals. In this context, we need to reassess the widespread notion that dryland ecosystems have low productivity and slow rates of recovery. Restoration and rehabilitation activities are often a pre-requisite to sustainable management as many drylands have been seriously degraded. These activities must therefore be pragmatic and focus on what can be done within the limits imposed by local socio-economic circumstances and stakeholders' capacities. Traditional knowledge and practices can often be integrated with western science for restoration outcomes that minimize costs and maximize benefits. In fact, as will be highlighted in this special session, these approaches have already been proven effective in parts of Africa, Asia and Latin America.

Keywords: dryland restoration, ecosystem services, cost/benefits, sustainable livelihoods, traditional management

Sustainable land management in the Global Environment Facility – enhancing ecosystem services in production landscapes

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The Global Environment Facility serves as financial mechanism of the UNCCD and provides financing through the Land Degradation Focal area, which focuses on addressing desertification and deforestation in production landscapes (agriculture, rangelands, and forest landscapes). Over the last two decades, the GEF has invested close to \$500 million in sustainable land management (SLM) projects in more than 50 countries, and leveraged more than \$3 billion in co-financing through bilateral, multilateral and private sector sources. The focal area investment also leverages GEF financing through other windows to maximize potential for global environment benefits at scale. This is exemplified by the Sahel and West Africa Program in support of the Great Green Wall Initiative, a country-driven initiative for integrated natural resource management in the Sahel and broader West Africa region. The program, to be implemented by the World Bank, utilized a total of \$108 million in GEF resources from multiple windows and builds on a series of planned sustainable development investments of nearly \$1.8 billion in 12 countries. It will lead to the sustainable management of land, water and vegetation on up to two million hectares of production landscapes per country, protection against erosion and desertification, and the potential for sequestering 0.5 to 3.1 million tons of carbon per year. By financing interventions that improve soil fertility, enhance soil and water conservation, increase vegetative cover, reduce soil erosion and run-off, millions of hectares of production landscapes can be successfully transformed to enhance sustainable flow of ecosystem services for human well-being. Monitoring and quantifying these ecosystems services is crucial, especially in light of the need to manage potential tradeoffs and maximize synergies for sustained productivity of soils in the landscapes.

Keywords: carbon, global environmental benefits, valuation of ecosystem services, sustainable land management, soil organic carbon

A European network of crop, livestock and trade modelling activities for assessing impacts of climate change on food security

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MACSUR is a three-year project for assessing the current state of the art of modelling climate impact effects on food security in the areas of crop production, livestock and trade. Suitable models will be selected to be linked at farm, national, and continental level. The linked models will be used to assess climate change effects on food security in pilot regions representing the variation of European farming systems. In addition, the project will identify the consequences of adaptation and mitigation measures. Stakeholders will be involved in setting acceptable references of food security and uncertainties in factors. Modelling activities will also provide a hands-on education of a new generation of integrative modellers. For enhancing global assessments of food security, MACSUR collaborates closely with other international networks like AgMIP.

Keywords: climate change, food security, international network, modelling

Integrating action assessment and knowledge exchange in combating desertification: The PRACTICE Integrated Protocol

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Essential knowledge on the feasibility and cost-effectiveness of actions to combat desertification remains scarce. There is a growing demand for land management assessment, which ultimately can provide essential

inputs for decision-making. PRACTICE Integrated Protocol, IAPro, is a methodology for the assessment of management actions in drylands and, in particular, for the assessment of actions to combat desertification. IAPro is a multi-step participatory protocol aimed at promoting learning in the assessment process. It is structured as a sequence of steps that offers a path for knowledge exchange among the variety of stakeholders and between scientists and stakeholders. It integrates expert and local knowledge as well as assessment data and stakeholder perspectives. IAPro assumes the mutual human-environment interactions in land-use change and simultaneously considers both biophysical and socio-economic attributes. IAPro bases the assessment of actions on (1) science-based common indicators that represent key ecosystem services and overall functioning of drylands and that are also relevant for the objectives of CBD and UNFFC, and (2) site-specific indicators identified by local stakeholders that are relevant to the particular context conditions. All indicators are grouped into categories representing biodiversity, ecosystem services, and socioeconomic conditions, and then their relative weights are elicited from the stakeholders. The process is iterative and provides a path towards consensus building. This approach has been successfully tested in 14 dryland sites distributed across nine countries, demonstrating its potential for the consistent but also adaptive assessment of a large variety of management actions in varying socio-economic, cultural and environmental conditions in drylands.

Keywords: Desertification, Integrated assessment, Indicators, Management actions, Participatory evaluation

Introduction of the CASCADE Project and ways in which we plan to involve non-scientific stakeholders

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The aims and objectives of the large EU-FP7 funded CASCADE (Catastrophic shifts in drylands: how can we prevent ecosystem degradation?) project (www.cascade-project.eu, 2012-2017) are to obtain a better understanding of sudden shifts in drylands that may lead to major losses in biodiversity and concomitant ecosystem services. By focusing on drylands in Europe, CASCADE will build on existing knowledge regarding shifts in these vulnerable ecosystems and further improve the current understanding of the biogeochemical mechanisms underlying sudden and catastrophic shifts. CASCADE aims to further develop instruments and tools to predict the proximity of dryland ecosystems to thresholds in such a way that these predictions can be used by policy makers and land users, for more sustainable management of drylands worldwide. Creating an understanding of ecosystem catastrophic shifts is one thing, but ensuring that that knowledge subsequently finds its way to better land management practices and policies is another. To achieve this ultimate aim, in CASCADE we will, simultaneously to ecological experiments and model development, identify ecosystem management practices and evaluate them according to their resilience to change and their sustainability over time and spatial scale. This assessment will be done in a participatory way with the help of stakeholders, including land users and local policy makers (Schwilch et al., 2012). Guidelines will be prepared on best practices for ecosystem management. Stakeholders will also be involved in scenario analyses and recommendations for up-scaling preventive and restorative measures. This will be done through an analysis of local land users' adaptation strategies across a spectrum of degradation states, providing insight into how people have responded to past shifts, and how they are responding as a result of current changes, to potentially avoid such shifts. Looking into the future, scenario analyses will be made of promising sustainable land management strategies that increase resilience and move away from a cata-

strophic shift, scaling-up in time and space. These scenarios will be evaluated at multiple scales with policy makers to finally formulate policy recommendations for preventive and restorative dryland management and identify entry points to inform policy change.

Keywords: Land degradation in drylands; catastrophic shifts; stakeholder engagement; participatory research; resilience

How benefit sharing based water allocation can improve water use efficiency in the Aral Sea basin?

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Water scarcity is imminent in many parts of the world due to increased demand and limited water supply. Mounted costs of developing new water supply necessitates water use efficiency improvement through water demand management measures. Economists offer water rights trading as a solution for efficient use of restricted resources. This study analyzes the role of benefit sharing based water transfers as an alternative to administrative water allocation (fixed water use rights) in the Aral Sea basin of Central Asia where inefficient use of water resources for irrigation development over decades led to the desiccation of the Aral Sea, the fourth largest inland lake in the world. Hydro-economic model which consists of irrigation profit functions, environmental benefit function, and river node model are developed to compare water use, benefits, and marginal water productivities of four scenarios - fixed water use rights, inter- and intra-catchment water trading, and optimization – under dry, normal, and wet years of water supply. Results show that additional gains from intra-catchment, inter-catchment, and optimization compared to the fixed water use rights are 210-238, 366-539, and 389-707 million USD respectively and vary due to water

availability in the basin.

Keywords: administrative water allocation, efficient water use, hydro-economic model, environmental benefit, water trading, Central Asia

Managing soil carbon through agro-ecological practices: a win-win strategy attending both global (fight against climate change) and local problems (soil degradation)

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Agriculture sector is a major source of greenhouse gas, contributing directly 14% of total global emissions. When combined with related changes in land use including deforestation (for which agriculture is a major driver), agriculture's contribution rises to more than one-third of total GHG emissions. But in the same time the potential for technical mitigation in this sector is high and with 74% of it is in developing countries. Many of the technical options are readily available and could be deployed immediately. It consists mainly in reducing emissions of carbon dioxide through the reduction of the rate of deforestation and forest degradation, adoption of improved management practices of rainfed and irrigated croplands, animal productions, livestock's waste, and rehabilitation of degraded lands. In arid and semi-arid regions, soil degradation is widespread and most of the drylands are already degraded or are at high risk of degradation. Consequently to the natural constraints drylands soils contain very small amount of carbon (typically below 1 percent). Thus maintaining a minimum soil organic matter level and thus minimum soil carbon content is critical to maintain these soils functioning. It is evident that in arid and semi-arid regions soil carbon sequestration is more important for the side-benefits (ero-

sion control, fight against desertification and land degradation, increased water efficiency, livelihoods of people living in drylands...), brought in terms of economic and social aspect, than the absolute amount of carbon sequestered! Managing carbon in drylands consolidates the resilience of cropping systems against both excess and lack of water, as well as increases resilience to changing environmental conditions and stresses. Therefore it strengthens the capacity for smallholders to face extreme events.

Keywords: Soil carbon sequestration, cobenefice, indicator, soil quality, local to global

Mapping global ecosystem degradation

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The awareness that ecosystem degradation has detrimental implications for livelihood, nature and greenhouse gas emissions has resulted in the renewed call by policymakers for quantitative information on degradation, the implication on ecosystem functioning as a basis for food, water and energy security and the cost of rehabilitation. Land degradation is highly and much research over the past decades has given partial views on various components. We elaborate a methodology to integrate knowledge from various disciplines for quantitative estimates of global soil degradation and loss of ecosystem functioning. Advances in information technology and remote sensing facilitate analysis of massive amounts of remotely sensed and legacy data and the integration with complex quantitative crop, soil and climate modelling into global assessment methods. Changes in net primary production world-wide over the past three decades and geographically specified information on climatic variations, soil and land use provide the basis for iden-

tification and mapping of ongoing ecosystem degradation. Pristine soil conditions, including soil depth, top soil depth, soil organic matter and sand, silt and clay content, prior to the agricultural period are obtained through back casting from knowledge about the impact of land use on soil characteristics and productivity. Subsequently, the loss -and consequently- restoration potential of the above mentioned ecosystem functions can be assessed by using the global models IMAGE, GLOBIO, LPJmL and PC-GLOBWB. Costs of restoration can be estimated based on a global database WOCAT that contains over 400 case studies of location specific conservation measures and impact on productivity.

Keywords: land productivity, analytical methodology, ecosystem functioning, global development

Guidelines for inland wetlands development in Sub Saharan Africa

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Wetlands are known to perform many functions for the benefit of humanity. Because of increased pressure for use of these wetlands to alleviate poverty and attain water and food security, particularly in rural Africa, these wetlands are likely to become degraded and lose their ability to continue to supply valuable ecosystem services. FAO in partnership with Ramsar Convention elaborated guidelines so that development of wetlands does not compromise their ecological functioning while seeking to maximize the benefits that they can provide. Inland wetlands occupy about 5% of the African continent's land area. Some of them are designated Ramsar sites. The guidelines address sustainability of inland wetlands use from an ecosystem perspective which seeks to achieve a balance between economic efficiency, social equity and environmental sustainability. The guidelines present a broad outlook of wetlands and the target audience. They respond

to an identified need that is aligned with the Rio declaration 'the Future we want' in its vision statement 4 on 'changing unsustainable and promoting sustainable patterns of consumption and production, and protecting and managing the natural resource base of economic and social development are the overarching objectives of an essential requirements for sustainable development.' The document discusses the hydrology, water chemistry, soils and ecology of inland wetlands. It is also providing guidelines on importance rating of Inland Wetlands based on their hydrological, socio-economic and ecological factors. These ratings should be used to inform types of development projects and the guidelines will be mainstreamed into various pieces of legislation.

Keywords: Inland Wetlands; Agriculture, economic valuation, sustainable use

Sustainable land management and possible solutions for sustainable food security

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This article proposes a prospective evaluation of sustainable land management (SLM) upscaling in Niger and Senegal. These countries are threatened by chronic grain shortages balanced by imports and food aid. The level of degradation of their agricultural lands is about 50 % of total rain-fed farming surfaces and is not sufficient to ensure food security. Since the 70' and 80's droughts, these countries have produced extensive efforts to restore their agricultural areas, by classical SLM processes such as erosion-control and tree protection. More recently they have defined National Agricultural Investment Programmes, under the frame of ECOWAS (Economic Community of West African States) agricultural policy. Nonetheless, they remain subject to frequent coarse grain deficit and are exposed to prices and productions shocks that lead to food crises. A finer economical costs and benefits

prospective analysis of different SLM techniques is adjusted to agro-ecological areas. It improves policies by calibrating medium-term investments. Costs and benefits of each technique are adjusted following current prices of potential crops surpluses. Different upscaling options are tested, taking into account estimated degraded surfaces, financial management capacity of actors, demographic trends. Finally the analysis proposes to policy makers scenarios at national level and for each agro ecological area: additional GDP per capita, level of food self sufficiency, import decrease, livestock feeding capacity, potential return on investment rates. The scenarios tested are beneficial for both countries and SLM upscaling should be an important axis for their agricultural policies.

Keywords: upscaling SLM investments, agricultural policies

Case studies of indicators evaluation at local level using direct observations and modelling methods

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Over the past two decades there has been increasing interest in developing indicators to monitor environmental changes at the local level. The purpose of this paper is to introduce a set of indicators developed to assess the general ecological condition and to highlight human environment systems functioning in relation to desertification in Menzel Habib and Haddej Bou Hedma - Tunisia observatories. The ROSELT/OSS (Long-Term Environmental Monitoring in a Circum-Saharan Network) was the framework of the monitoring program of this study. Two approaches were used to monitor the environment. The first is designed to monitor biophysical parameters through measurements and evaluations of changes in natural resources. The second is based on surveys for the regular collection of socio-economic data. Monitoring results showed that the

studied areas were marked by an increased aridity and variable drought frequencies, loss of vegetative cover; decrease in water availability and soil degradation due to improper irrigation practices. From the socio-economic perspective, the last four decades have been marked by major changes that have seriously altered the state of environment, the relations between the local populations and the environment, uses, practices, life styles and the adaptation of the local populations to ever-changing environmental conditions. Population growth, sedentarisation of livestock producers, land privatisation, economic liberalisation and agricultural "modernisation" interact as part of the ecological and socio-economic dynamics. Data from these surveys have already been used in Local Environmental Information Systems (LEIS) and in making the first models of the socio-economic functioning of territories in the ROSEL/OSS observatories.

Keywords: Arid; Desertification; Indicators; Local Environmental Information Systems; Monitoring

Searching for universal early-warning indicators of desertification: anticipating tipping points at ecosystem level

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As a result of human activities and climate change, ecosystems are experiencing changes at a global scale. Learning how to anticipate the effects of these global factors on ecosystems is therefore a major need. Many ecological systems can exist in two or more states that differ in abundance or composition of species, rates of ecological processes, and the level of ecosystem services provided. This transitions can be abrupt and unexpected (tipping points). This leads to rapid and difficult-to-reverse degradation of biodiversity, ecosystem services and human well-being. Thus, we need to develop early warning signals for predicting approaching tipping points and strategies to steer away from thresholds. We studied a desertification process based on spatial gradients produced by important ecosystem transitions from sub-humid to semi-arid ecosystems in Portugal and Brazil. Our aim is to found common indicators of the proximity of ecosystem transitions and those patterns, will be used as tools for developing universal indicators that allow us to stay away from the edge and to avoid ecological typical points over time. We found that both vegetation and lichen functional-groups can be used as early-warning indicators of desertification process at global scale. We are contributing to the three UN "sister Conventions": on biodiversity-CBD, climate change-UNFCCC and desertification-CDD, that relay in ecological indicators of biodiversity and ecosystem goods and services evaluation. We are reinforcing the capacity-building of EU researchers and of non-EU teams facilitating the emergence of global alliances focused on the same environmental problems, enhancing outcomes, global reach and policy impacts.

Keywords: indicators of DLD, tipping points, biodiversity, ecosystem services, climate change

Improving ecosystem services in drylands: microclimate matters for the natural regeneration of forests after agriculture abandonment

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The natural fragility of dryland ecosystems renders them extremely vulnerable to inappropriate land use exploitation in particular agriculture. Farmers often over-cultivate the few available areas of fertile land in an attempt to increase production. This implies that these dryland communities are likely to become vulnerable to climatic variations. Since the economic revenue is generally very low in drylands they are prone to agriculture abandonment. This was what happened in the driest area of Portugal, SE of Alentejo. The agriculture abandonment occurred since the 40's up to the 70's and natural regeneration was allowed up to the present. Currently, the area shows some spatial differences in what concern the cover of forest related with topographic differences and slopes aspects, so we expected that microclimate can be a crucial factor for the natural regeneration under dry conditions. To test that, we selected a study area where abandonment occurred on the last 60 years and we followed the natural regeneration, using a chronosequence of several aerial photographs. This was done along a microclimatic gradient related with slope aspect, and estimated through potential solar radiation (PSR) which is an estimation of the amount of radiation that a site has along the year. With this work we found that the two most important variables determining the rate of natural regeneration of forest areas

were the PSR and the number of years after abandonment. Then we constructed a model that estimated the rate of natural regeneration at the regional scale. The model showed that the rate of natural regeneration of forest in the region increased with increasing time since abandonment and decreasing PSR values. Sites more exposed to radiation showed less than 20% of tree cover, even after 60 years. This model was successfully validated in other areas within the region. Some discussions about the factors that prevent the more exposed areas to fully regenerate are examined. Previously, some efforts of ecological restoration lead to the plantation of holm oaks trees in areas that we showed now to expect very low rates of natural regeneration. It was interesting to observe that tree plantations in those areas were completely unsuccessful. Thus, this model can be used to guide the investment in tree restoration in dry lands and for improving ecosystem services in the SE of Portugal, which are one of the areas more prone to desertification in the country.

Keywords: Desert restoration hub, integrated restoration approach, dissemination and distribution of knowledge, restoration techniques, stakeholder participation

Climate change risk assessment for European agriculture and food security

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Present the existing modelling infrastructure in Europe on economic and trade models to link climate change risk assessment with European agriculture and food security. An overview is presented of more than 20 operational modelling tools. The models and tools are tested and compared, linking the existing tools with scenarios. The outputs from the models will be presented in a way to make conclusive comparisons.

Keywords: climate change, European agriculture, food security

Are the most valuable resources in drylands areas wetlands?

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In dryland regions wetlands stand out as areas where water and nutrients accumulate, plant and animal production potential is high, and production risk is low. Wetlands are therefore much sought after in dryland regions, by farmers, pastoralists, fishermen, collectors of natural products, and also wildlife. Economic data from reports on some of the 1,000 isolated wetlands in Niger demonstrate this importance to people living at the isolated wetlands as well to people living farther away. The importance of the isolated wetlands is even greater in times of drought. At the same time the isolated wetlands are under threat of disappearing because of increasing human pressure, climate change, land use change in their catchments, etc.. Descriptions of selected wetlands in Niger visited in the mid-1990's and again twelve years later show this, too. Integrated participatory management of wetlands in dryland regions must be effectuated as soon as possible, so that these very important natural resources will be used sustainably and not used up. The UNCCD should put this high on its list of priorities.

Keywords: Sahel, wetlands, ecosystem services, degradation, integrated management

Adapting to climate change through sustainable land and water management: ongoing experiences in 6 countries and 2 projects in East Africa

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In the context of FAO's work on land and water management, two projects in six countries of East Africa are implementing SLM prac-

tices and demonstrating how these are contributing to building agro-system resilience and farmers adaptive capacity. The overall objectives of the GEF Kagera Transboundary Agro-ecosystem Management Project in Burundi, Rwanda, Tanzania and Uganda includes the management of land resources in the basin for reversing land degradation, improving agricultural production and the sustainable use of agro-biodiversity, sequestering carbon and adapting to climate change, and contributing to enhanced food and livelihood security and the protection of international waters. One of the key project outcome is improved land and agro-ecosystem management practices implemented and benefitting land users for the range of agroecosystems in the basin. Moreover, the SIDA climate change adaptation project in Ethiopia, Kenya and Tanzania aims to identify a set of adaptation possibilities based on land and water management, and test their effectiveness in strengthening community adaptive capacity for climate change adaptation in sub-Saharan Africa. Some adaptation pathways are through increasing soil health, water harvesting / water use efficiency, livelihoods diversification and institutional collaboration networking and capacity building. Resilience indicators are being identified to assess how SLM practices are contributing to climate change adaptation. The developed WOCAT climate change adaptation questionnaire is being further reviewed and tested for use in the projects, and initial results are expected by early 2013.

Keywords: Adaptation, climate change, resilience, SLM

Agrécologie, une opportunité pour le développement? Paroles d'acteurs

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Among the agricultural sustainable production systems in dry areas, agroecology has gradually become a reference that has developed in Latin America before spreading on every continent. Surprising enough, this distribution was not made by the institutional extension but often challenging the agricultural model of the Green Revolution. The results of agroecology in various contexts highlighted by many researchers in the world are now a credible alternative approach for the development of drylands. Combining environmental and economic benefits, agroecology is also an important tool to reduce food insecurity and poverty.

Keywords: agroecology, dryland, land

Contextual Education for a Convivência with the Brazilian Semiárid: fundamentals and practices

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The workshop on Contextualized Education for Coexistence in the Brazilian Semiárid (ECCSAB) aims to present and discuss the formation of the Education Network of Brazilian Semiárid (RESAB), established in 2000 and what the reasons for the proposed Education, which invests in new ways of thinking and acting on the environment in which the school is, in order to change the network of community relations, regional and territorial in which social actors and subjects are territorialized. Debating the inflections curriculum that need to be oriented to the school link to the forms of life and issues of existing Brazilian Semiárid. Analyze the situation of public schools in official Brazilian Semiárid, and as such still work primarily with programs and materials produced outside the region, with content that deny territorial identity and cultural hinterland. Present Guidelines and principles of Contextual Education for Coexistence and the route that the

network has trodden RESAB for territorial development project of Brazilian Semiarid. Highlighting the interdisciplinary dimension, Inter sectoral and institutional aspects of the socio-cultural, political and environmental education within the faculty and student, discussing the need for a reorientation curriculum that values dialogue with local knowledge of the universal teaching and learning materials that resinifiquem speeches and Semiarid and images attributed to their different contexts, whether the city or the countryside. The workshop also aims to present the methodology in this context Contextual Education, its educational field based on the contextualization of knowledge. Discuss the notion of context as a scale space-time, which the subject is located in the world, and understand that their place is the reference in which he know about themselves and the world, ie, the experience produced by reference material and immaterial. Present itinerary guided by the methodological context and how this integrates the quotidian / community of students with disciplinary content, motivating them to think about the community (whether urban or rural), to better understand the reality around you and allowing them to know their histories, their geographies and their socio cultural and environmental. Finally, the workshop aims to assess the importance of inclusion of Contextual Education for Coexistence in the Brazilian Semiarid development processes of territorial Semiarid, contributing to the construction of other / new signs and emblems of identity territorial hinterland. Contextual Education will be presented as a new logic to see, perceive and conceive nature and semiarid territory, and that, from the same, one can perform the classification of individuals and institutions to act with the logic of Coexistence. Finish the Workshop that through education you can give yourself a process of cultural change, in which the Education Contextualized brings possibilities to form a new generation of professionals in the areas of technical and scientific knowledge, to make it apt to think and develop territorial development projects guided by the 'Coexistence'.

Keywords: Coexistence with the Brazilian semi-

arid region', contextual education, territory

Assessing the vulnerability of water resources in the drought prone lower Shire Valley in Malawi to climate Change; and proposed adaptation strategies

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The Lower Shire Valley is one of the areas in Malawi prone to drought conditions. El Nino and Southern Oscillation (ENSO) phenomena are major causes of severe drought spells that the area experiences almost every year, resulting in serious water shortages for domestic consumption and frequent crop failures. The annual rainfall value of 700 mm recorded in the Lower Shire Valley is the lowest in the country. Climate change scenarios generated by a suit of General Circulation Models (GCMs) suggest that the Lower Shire Valley will experience more frequent drought conditions in future with CO2 doubling. Vulnerability assessment results of the water sector using water balance models in combination with rainfall and temperature data obtained from GCMs suggest that water scarcity will worsen in the Lower Shire Valley with climate change. In this respect, water supply and water demand management measures will remain key adaptation strategies for alleviating the deleterious effects of climate change on domestic water supply; and that the promotion of irrigated agriculture will ensure sustainable crop production and guarantee food security for the citizenry.

Keywords: Lower Shire Valley, Drought, El Nino, Adaptation

Baseline information and monitoring for integrated assessment of DLD

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The DNI "Dryland Observation Systems" group analyses requirements and options to provide baseline information to meet global and regional land degradation assessment needs. Integration of socio-economic and environmental data is essential in assessing impact of land degradation on human wellbeing, and in determining the benefits of preventive measures and counteractions expressed through land use adaptation and sustainable land management (SLM). Baseline information for land degradation assessments can be acquired and integrated in nested hierarchies spanning sub-national/national to regional and global scales, where data collection is scale-specific, following a common logic of integrating biophysical and socio-economic issues to account for human-ecosystem interactions at multiple scales. Practical examples from regional to local scale highlight existing options/experience allowing associated spatial analyses of socio-economic impacts and assessment of the costs and benefits of changing land uses. Current initiatives towards pan-European land degradation assessment strive at being a pragmatic exercise and illustration of applying at regional levels novel scientific concepts of DLDD assessments that have been described in recent literature. They include the MEA approaches, based on evaluation of ecosystem goods and services, the evaluation of complex Syndromes of global change and desertification proximate causes and pathways, having in common that they are integrating and addressing combined land degradation/desertification issues in a structured but flexible way. However, besides aspects of tackling inherent problems of data availability/accessibility and quality, these approaches require methodological extension to allow for more direct expressions of socio-economic cost and benefits of mapped land degradation states and trends.

Keywords: DLD Monitoring and Assessment, Indicators, Sustainable Land Management

A new global atlas of desertification: why, how and findings

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Food security and agriculture production are threatened by various factors and climate change has been mentioned as a major threat. However, the global importance and potential impact of land degradation on agricultural land, its food production and economic value becomes more and more obvious. Loss in biological and economical productivity of the land is considered the ultimate expression and measurable aspect of land degradation. To achieve the recent RIO+20 target that strives towards a land degradation neutral world all facets of degradation have to be known and assessed. Also the economic value of the land productivity changes is needed to better assign policies and to communicate the issue to the many stakeholders of this land market place. The new global atlas of desertification (WAD) therefore aims at documenting the major environmental and anthropogenic issues and their changes and impact that play a role in the land degradation processes. Global level baselines on the status of land degradation and the current probable extent of land degradation are shown in the WAD illustrating the local dynamics at play. The Atlas, which was called for by stakeholders of the UN Convention for Combating Desertification (UNCCD), is being compiled in partnership with the UN Environment Programme (UNEP) and in collaboration with a worldwide network of top experts in the field. Land degradation is complex and there is no agreed measurement protocol today. The WAD pragmatically illustrates implementation of an agreed assessment concept based on stratified interpretation of global variables including the complex biophysical, social and economic processes that drive land productivity. The JRC developed a repeatable method for global assessment and mapping of land-productivity dynamics. Results show

the added value of integrating contextual information for reaching final judgments on land degradation. Linking such spatial information with econometrics is crucial for economic assessment of LDD.

Keywords: WAD, Desertification and land degradation, mapping, assessment

Reducing meteorological basis risk in a semi-arid agricultural region

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Kazakhstan is one of the most important wheat exporters worldwide. However, the country is regularly challenged by extreme droughts, which distress agriculture production. To deal with the resulting yield variability and income insecurity, adequate risk management strategies are necessary. For many actuarial applications however, proxies to represent these extreme events are necessary. For simplicity reasons, often basic weather indices such as cumulative rainfall are used. However, drought is a complex phenomenon and especially with regard to the implications on plant growth, simple indices do not explain sufficiently the yield variability. By balancing index performance with data requirements and complexity, we analyzed yield time series as well as weather data of different counties from Northern Kazakhstan for the period 1980-2010. At first, we applied a screening procedure to identify critical phenological wheat phases with regard to the moisture requirements and the temperature optima. Based on these results we tested different weather indices on their performance using quantile regressions. This approach allows to separately analyze the lower tails of the distribution. Our findings suggest that using quantiles as well as distinguishing between weather in different vegetation phases increases the explanatory power of still relatively simple indices. Thus, this research contributes to the quantification of drought severity and their impli-

cation for plant growth in a semi-arid agricultural region.

Keywords: drought, weather indices, semi-arid agricultural region, quantile regression

The value of soil organic carbon: the case for biochar

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Biochar is a potential contributor to climate change mitigation and land management. The global technical potential for abatement of greenhouse gas emissions through biochar has been estimated at 6 Gt CO₂-e annually; biochar has been shown to stimulate plant growth by up to 100%, and enhance soil water holding capacity. However, sustainability concerns have been identified: demand for biochar could encourage deforestation or inappropriate removal of crop residues, exacerbating land degradation; biochar may contain toxic components, which could contaminate soil; biochar production may contribute to air pollution. Also, biochar systems may deliver lower emissions abatement than alternative uses of biomass.

New knowledge of biochar properties and interactions with soil, plants and microorganisms gives greater understanding of the benefits and risks of biochar. Biochar properties are dependent on the biomass feedstock and the production process: biochars from wood residues have greater mitigation value and stability than biochars from manures; biochar systems utilising existing biomass residues have greater benefit than systems based on purpose-grown biomass crops. At higher pyrolysis temperatures the biochar produced has greater stability in soil but there is a lower biochar yield. Life cycle assessment studies have estimated net abatement for biochars based on residue feedstocks ranging from 1.7 to 3.1 t CO₂e per t dry feedstock. The major contributions to abatement arise from organic

matter stabilisation, avoided nitrous oxide and methane emissions, and displacement of fossil fuel emissions. The total abatement can be greater than the CO₂ sequestered in biomass, and can be greater than if the biomass was used solely for bioenergy.

Current research is developing methods to characterise key properties of biochar and allow matching to crop and soil requirements. Sustainability guidelines, which could be applied within a domestic or international certification scheme, are being developed to manage identified risks.

Keywords: carbon, global environmental benefits, valuation of ecosystem services, sustainable land management, soil organic carbon

Land use changes and loss of soil in Bosnia and Herzegovina as consequences of the war and socio-economic transition

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The 1992-1995 war, as well as the post-war developments in Bosnia and Herzegovina have made incalculable impact on changes of the land use where permanent land loss, change of purpose and land market are the most apparent ones. One of the numerous factors is certainly the migration of the population (about 2 million people were displaced) from rural areas, which contributed to an intensified process of urbanization. Land value does not come as an economic factor. This is the main cause of a general misperception that agricultural land is an abundant and cheap resource in transition countries, which provides grounds for manipulation, illicit enrichment and corruption. An obstacle to the agricultural land market development is lack of systematized data on demand and supply, insufficient interest in the purchase of land etc. The purpose of this paper is to analyze both permanent and interim losses of agricultural land in BiH, as well as to primarily de-

termine the impact of demographic changes and war related activities in the country on the occurrence of these losses. The analysis employed CORINE land cover digital database, according to which in the period 2000-2006 the total agricultural area was reduced by more than 5,000 ha, whereas the construction land areas were increased by approximately 4,500 ha. In addition, the paper analyzes fundamental constraints in the development of land market, trends in the price of agricultural land, change of its purpose and possibilities of illicit enrichment and corruption, using the Sarajevo Canton as an example.

Keywords: land use, soil loss, socio-economic transition

Economic valuation of ecosystem services and poverty alleviation: A case study of land uses in Oudomxay Province, Lao PDR

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The Government of Lao PDR has prioritized poverty reduction and the key strategy to achieve it is through development of its natural resources and agriculture commercialization. Abundant land and forest resources and a cheap workforce have enticed foreign investments into Lao PDR over the past decade, with a sizeable portion towards establishing rubber and maize plantations. This has led to dramatic change in land use from subsistence traditional farming systems to commercial mono-crop agriculture. This change however has caused environmental health impacts and soil degradation, and raised questions on the sustainable implications of poverty reduction in rural communities where this change is taking place. Our

study examined the implications of this rapid change in Oudomxay province in northern Lao PDR, by evaluating the long-term financial and economic costs and benefits of four different land use practices: non-timber forest products collection, rotational upland rice cultivation, commercial maize farms and rubber plantation. Using data collected from household surveys and participatory assessments, a series of integrated cost-benefit analyses were applied to assess the production, socio-economic and environmental impacts of the four land uses. Results from the study demonstrate that traditional financial analyses often overstate the returns from commercial agriculture as they do not take into account the longer-term environmental and socio-economic costs, which can potentially cancel out any short-term gains from the land use. Such environmental factors must be considered within the local and national development planning process to ensure that Lao PDR can fully achieve a sustainable growth that benefits Lao people.

Keywords: ecosystem service valuation, cost-benefit analysis, sustainable land use, Lao PDR

Land degradation and climate change: vulnerability analysis of desertified areas in Latin America

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Under the joint ECLAC / GM Project of Economic valuation of land degradation in Latin America and the Caribbean, a study on the vulnerability of degraded and desertified areas facing climate change scenarios was held in five countries of the region: Argentina, Chile, Colombia, Paraguay and Peru. A series of climatic indicators were analyzed and projected to the year 2100: the aridity index, the number of dry months, the concentration index of rainfall and rainfall intensity index (Fournier, modified). Surfaces of degraded and desertified lands affected by such indicators were measured at present and analyzed their evolution in the future.

As a conclusion it is shown that desertified and degraded areas in the countries considered would be seriously affected by climate change, mainly due to the increase in the number of months with a negative water balance or with more concentrated rainfall. The area with higher levels of aridity would also increase, which would generate significant negative economic impacts. A series of maps and tables show in detail the results for each of the countries analyzed.

Keywords: land degradation climate change vulnerability Latin America

Translating policies into actions: the implementation of public policies to combat desertification in Brazil

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Brazil ratified UNCCD in 1997. The objectives of the convention must be translated and enforced into national public policies. The study aimed at assessing UNCCD implementation in the country, identifying major actions and milestones, establishing relevant phases and future challenges. Three phases were identified: the first one (1997-2004) describes the efforts to establish a baseline knowledge, to characterize major desertification processes and to define Desertification Susceptible Areas (ASD). National Action Program to Combat Desertification (PAN-Brazil) is the benchmark of this phase; the second (2004-2011) is marked by the establishment of the National Committee to Combat Desertification (CNCD) and the strengthening of actions of Brazil's Federal States that contributed for the releasing of State Action Programs (PAE) in all 11 states comprising ASD. Furthermore, Brazil's Early Warning System for Drought and Desertification has been under planning since 2010;

from 2011, the focus is on the strengthening of participatory management and operationalization. The Ministry of Environment carries out coordinated actions with several environmental development funds to promote specific lines to combat desertification. GOB invested about 11 million dollars in grants to combat desertification projects, and 100 million in soft-loans until June 12. Moreover, CNCD has been enhanced to ensure participatory management, as a strategic role for empowering stakeholders. Next challenges are the approval of the National Policy to Combat Desertification and the establishment of a government plan to guide population coexistence and adaptation to drought, to climate change, assuring environmental balances and sustainable production and social inclusion.

Keywords: Public Policy, Fund, Desertification Susceptible Areas, Adaptation

Nursing role of Acacia plantations in the restoration of degraded environments

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Reforestation of arid zones is gaining importance because of its potential in restoring degraded environments. Plantations have strong influence on their abiotic environment. They often function as 'nursing trees', facilitating the recruitment of other plants. The study was conducted in an Acacia forest-steppe ecosystem in central Tunisia where several reforestation campaigns took place. The most critical factor controlling plant productivity in those arid regions is soil water availability. In this respect, the nursing role of Acacia trees regarding the

herbaceous layer was investigated in terms of the near-surface soil water balance (0-10 cm). To evaluate the impact of the plantation on the water-related ecosystem services, an indicator (TWI) based on the green water flow was used. The evaporative (green) flow is indispensable for the productivity and functioning of terrestrial ecosystems. Plantations can have a positive or negative impact on the ecosystem services with TWI values ranging between 1 and -1. The impact is minimal (TWI=0) when the evaporative flow underneath is equal to outside the canopy. The actual evapotranspiration (E_a) was estimated underneath and outside the canopy using the water balance equation method during 21 days after an extreme rainfall event. A higher mean E_a underneath compared to outside the canopy was found (1.30 vs. 1.18 mm/day). TWI showed a value of 0.29, indicating a positive effect of tree on the evaporative flow underneath the canopy. This approach of impact assessment provides a sustainable management tool for (green) water flows and a straightforward valuation method of the nursing role of trees.

Keywords: Reforestation, tree nursing, water-related ecosystem services, indicator

Predicting Future Land Degradation and its Economic Effects

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Land degradation – loss of potential in land's productivity – poses a threat to ongoing efforts in many aspects of economic development from food security, to poverty reduction, to sustainable development. A significant number of empirical studies have investigated the drivers and the outcomes of land degradation, mostly at regional and national lev-

els. Although widely cited and of recognized influence, existing global analyses are few in number due to a general shortage of global data. Acknowledging all its limitations, while at the same time recognizing that it is one of the few data sets consistently collected at the global level, we use the Normalized Difference Vegetation Index (NDVI) as a proxy for land-carrying capacity. We employ an econometric model to statistically measure the predictive power of a set of explanatory variables commonly reported in the literature as drivers of land degradation and find that the model has a reasonably good capacity to predict NDVI values ($R^2 = 0.71$). We then proceed to simulate the impact of future changes in some of these variables and identify areas with greatest drops in predicted NDVI, which we interpret as future hot spots of degraded productivity potential and hot spots of land degradation. Our results indicate that some of these areas overlap with regions characterized by high agricultural productivity, implying substantial economic loss due to future land degradation. More importantly, model results can be used to prioritize areas of intervention against land degradation.

Keywords: Normalized Difference Vegetation Index

Evaluation of the conditions and trends of forest ecosystems and their services in Senegal

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Land degradation is a major concern due to its adverse effects on ecosystems and livelihoods. With a deforestation rate estimated at 45 000 ha/year, Senegal is facing forest degradation. For many local communities, this situation results in a loss of access to forest ecosystem and the services they provide and that are vital to their livelihoods. The assessment of condition and trends seeks to describe the current condition and historical

trends of forest ecosystem services (FES) in 10 selected assessment sites. The purpose was to improve knowledge on FES and build sustainable tools for their management in a context of poverty alleviation by protecting biodiversity. A Sub global Ecosystem Assessment (SGA) was conducted as a pilot study to explore the linkages between human wellbeing and ecosystem services. The approaches and methods used in this SGA were based on the Millennium Ecosystem Assessment. They included also community interviews and focus-groups, literature reviews, field observation and GIS and spatial data analysis. The study has shown that changes are most significant for provisioning services and that protected areas contribute to improve regulation and supporting services. Cultural services and leisure have also benefited from functions of conservation. The assessment of FE goods and services was a prerequisite for the exercise of economic evaluation. Hence, the results were used for the quantification of their financial and social values.

Keywords: ecosystems services, forest degradation, conditions and trends, Millennium Ecosystem Assessment, biodiversity, community perception

Cooperative institutions for increasing rural livelihood under CDM forestation on marginal croplands

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Establishing tree plantations on farms' degraded croplands supported by Clean Development Mechanism (CDM) could contribute to climate change mitigation and increasing rural welfare as has been illustrated for the

arid regions in Central Asia such as Uzbekistan. However, launching CDM is restrained due to its high establishment costs. A way to tackle these costs is via formation of cooperative agreements between farmers that would join together and share benefits and costs of a CDM project. The case study was the irrigated drylands in the downstream of the Aral Sea Basin in Uzbekistan. We developed a model of farmers' cooperation that maximizes benefits of CDM afforestation projects comprising of four different farm types over a period of 25 years. The sustainability of the assumed cooperative was considered through the positive increments in net benefits. The study used data from farm surveys and empirical information on tree species planted on marginal croplands. Findings showed that farmers participating in a CDM project would be able to buffer land use risks. Introducing cooperatives has the option to increase overall farmers' income and grain production, and the supply of tree leaves as a fodder, fuelwood as a cheap energy resource and fruits for consumption. The proposed cooperation may also result in losses for some participating farms. Development of compensation transfers would be required to distribute the income of farmers benefiting from cooperation to disadvantaged farmers. The arrangement of a fair division of benefits among farmers should therefore become a subject of early negotiations.

Keywords: farm cooperation, CDM benefits distribution scheme, cooperative game model, sustainable development.

Risk coping options and carbon value of afforested irrigated marginal croplands in drylands: The case of Uzbekistan

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Afforesting marginal croplands under Clean

Development Mechanism (CDM) can contribute to climate change mitigation, encourage cropland rehabilitation practices and irrigation water saving and increase rural incomes. We analyzed the impact on farm income and valued carbon prices of on-farm CDM afforestation in marginal, highly salinized cropland areas, in an irrigated dryland region of Uzbekistan, Central Asia. The expected utility approach was used to determine carbon payments that would incentivize CDM afforestation on marginal croplands, and to investigate options of trees for hedging the risks of variability in returns of land use activities. The datasets were compiled through farm and market surveys and empirical information on tree species planted on salt-affected cropland. Model results show that considering uncertainties in land use returns the current price of carbon of 4.76 USD t⁻¹ would be sufficient to incentivize CDM afforestation on marginal lands. Besides, presently cultivated crops on marginal lands are less financially attractive than tree plantations. Afforestation would change the pattern of the farmer's land use activities, and increase the incomes by about 100,000 USD over seven years comparing to conventional cropping. Due to less irrigation demand of trees afforestation on marginal croplands would account as one of the main income source of farmers in case of decreased irrigation water availability and in turn when crops generate low profits. Such land use change would diversify farm activities and manage agricultural risks, while release irrigation water and funds for cropping on farm's productive lands.

Keywords: land use uncertainties, diversification, expected utility.

Economic assessment of the impact of uncertainty associated with short-run change in climate variability in Mediterranean farming systems

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We assessed the economic impacts of climate change (CC) on a near future time span (10-15 years) in a Mediterranean agricultural district including irrigated and rainfed farming systems. Irrigation is supplied from water accumulated in a reservoir during the wet cool season. We used a process-based cropping system model (EPIC) to estimate net crop evapotranspiration. The yield of rainfed durum wheat and autumn-spring haycrops, were used as a proxy to assess the impact of CC on the rainfed cropping and forage systems supporting the local dairy sheep livestock. The shift of the probability distribution of these variables over twenty consecutive years along sixty years of observed weather in the catchment was used as an indicator of CC impact. The latest dataset (1990-2010) was considered as most representative of the near future probability distribution. The impact of the uncertainty on farm direct costs and related choices were assessed with a DSP model representing both irrigated and rainfed agricultural systems. The expected changes were assessed in the context of current technology, market conditions and policy and most affected farm types. Climatic trends revealed that the change of the probability distribution of ETN is leading to substantial modifications of crop irrigation requirements and increased variability of water availability in the reservoir. The shift of the probability distribution of rainfed crop yields were analysed in relation to changes in temperature and rainfall in critical periods. The results were discussed in relation to address adaptation strategies at the farm, district and EU policy making level.

Keywords: climate variability change, discrete programming stochastic, EPIC, adaptation, drylands

Land resources under threat: strategies and options to address land degradation due to landslides in the context of Bhutan

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Occurrence of landslides poses a very serious threat in Bhutan. It causes both on-site and off-site impacts, of which the latter extends beyond the political boundaries. At the source, landslides degrade arable land, posing potential threat to food security. Further down, water pollution due to the sediment loads generated by landslides can affect hydro-power generation. This is a concern since the revenue from hydro-power is the biggest contributor to the GDP (19.10%) of the country. Therefore, this phenomenon necessitates introduction of appropriate interventions and communicate its hazards to the stakeholders. To achieve this, it has become crucial to: adopt the cross-sectoral approach to address landslide issues, bring the communities on a forefront and jointly design appropriate technologies that would reduce landslides, have an in-depth understanding about the local farming systems and the geophysical attributes of the landscape. Bhutan has been making continued effort to mitigate landslides since 2004, through introduction of bio-technical slope protection measures and installation of retaining structures at the toe of the landslides. Efforts were also made to reduce ill effects of other landslide triggering agents such as poor water management practices from irrigation, drinking water and roadside drains. Hitherto, the results have shown that: 1) mitigation of landslides depend not only on the type of bio-technical slope protection measures placed, but also on the stage of landslide initiation and other bio-geophysical factors and 2) on-site practical demonstration serves as good tool for communicating landslide hazards in contrast to media.

Keywords: landslides, food security, mitigation,

bio-technical, bio-geophysical, Bhutan

Desertification impact on rural women in Zou Department (Benin)

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Background: Desertification is a phenomenon whose impacts particularly affect rural women in their socio-economic roles as agricultural producers, mothers and managers of food biodiversity, and plant biodiversity. The objective of the study is to assess the impact of desertification on rural women in terms ecological, socio cultural and economic aspects. Methodology: Data will be collected from direct observations, surveys of 120 women and individual and focus group interviews with rural development officers; gender and participatory approaches will be applied. Expected outcomes: It will emerge the proportion of women affected by direct and indirect impacts of desertification; impacts on their socio economic and cultural life will be described. Regarding women vulnerability, appropriate solutions will be proposed for their adaptation to desertification effects.

Keywords: women, desertification, gender, impact, Zou, Benin

Soil organic carbon, poverty alleviation, climate smart development, payment for ecosystem services

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Community-based projects that aim to store carbon and generate livelihood benefits increasingly incorporate payments for ecosystem services (PES) approaches. This presentation reviews recent research on community-based projects from across the sub-Saharan African miombo woodland eco-region and analyses the development and implementation of multi-stakeholder

project partnerships between communities, NGOs, private sector companies and government across four southern African countries. Analysis of Community-Based Natural Resource Management (CBNRM) projects shows that strong existing local institutions, clear land tenure, community control of land management decision-making and up-front, flexible payment schemes are vital for successful project design and implementation. Community-based PES projects also require consideration of project boundaries, benefit distribution, capacity building for community monitoring of carbon storage together with local awareness-raising to enable the benefits of carbon-friendly land management to be realised by all members of a rural community. Ongoing studies from four countries in southern African (DRC, Zambia, Zimbabwe and Mozambique) demonstrate the importance of key project partnership principles to enable the delivery of financial benefits to smallholders. These include: community input to project design; clearly defined multi-stakeholder partnerships for project implementation; efficient communication channels for partnerships across levels; and the need for strong national network systems for sharing experiences and informing policy development. Studies also highlight a need for regional networks to better share lessons. International pushes for climate compatible development offer scope to enable greater awareness of the local socio-economic benefits of CB-PES projects and to build and extend partnerships, but they also require resource investments to support local implementation systems that integrate traditional and formalised governance systems. Financial resource support and empowerment of trained local-level project staff need to be prioritised.

Keywords: soil organic carbon, poverty alleviation, climate smart development, payment for ecosystem services

Towards improved decision-making in degraded drylands of southern Africa: an indicator based assessment for integrated evaluation of restoration and management actions in the Kalahari rangelands

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The loss of ecosystem resilience and land productivity is a major problem in savanna rangelands of southern Africa. This needs to be addressed in an integrated way linking science to society. Identifying best practices for land restoration and sustainable land management in a process combining local knowledge with ecological expertise is therefore very important as regional perspectives are created and knowledge shared among affected land-users. A corresponding framework was suggested by the multinational EU-project PRACTICE (www.ceam.es/practice), which has been tested in Kalahari rangelands of South Africa. Following the identification of a multi-stakeholder platform (MSP) related to the farming community of the study area, the baseline assessment and site-specific indicators for the evaluation of locally applied restoration and management actions to combat desertification were obtained in a participatory process. The MSP ranked the relative importance of the indicators on an individual basis using pack-of-cards method, and re-ranked these indicators following group discussions. The individual ranking results were combined and integrated with biophysical measure-

ments for the indicators through a multi-criteria decision analysis, which ranked the alternative restoration and management options according to their relevancy and performance based on field assessments, local knowledge, and stakeholder perspectives. Shared back with the MSP, this outcome provides guidance for identification of best practices and improved decision-making in Kalahari rangelands. The presentation traces the steps in the process of the collective and integrated evaluation of local restoration and management actions, and critically discusses its potential for selecting improved socio-economic approaches for combating desertification in southern Africa.

Keywords: local knowledge, participatory processes, indicator identification, rangeland degradation, Kalahari

Reviving Indigenous Community Conserved Areas (ICCAs) in customary territories of Abolhassani mobile pastoralists, Iran

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The Abolhassani tribal confederacy lives in the north-eastern margin of the central desert of Iran, known as Khartouran, one of the nine Biosphere reserves in the world. Despite being a dry area, the rich ecological and biodiversity value of this tribal territory is outstanding. In recent years, the frequent and long drought periods is making pastoralists' livelihoods increasingly difficult and have caused some detrimental impacts, e.g. decreased livestock and agricultural productions, water shortage, decreased fodder, moving sand dunes and loss of rangeland vegetation cover. However, the small Abolhassani tribal confederacy has learnt to deal with this natural disaster by implementing some adaptation strategies through customary laws and practices based on their

indigenous knowledge. They gave innovative responses to this phenomenon by Water storage, reducing the number of livestock, lengthening the migration path, renting the farmlands residues and using the agricultural by-products to feed the livestock, etc. A participatory research was conducted with the cooperation of UNDP/GEF Small Grant Program and facilitation of CENESTA, to identify the effects of drought in mobile pastoralist's territories, assessment and analysis of applied initiatives and indigenous knowledge in coping with the drought and expansion of local initiatives to other tribal communities. The project implementation model is based on real experiences through several hands-on mutual training-planning workshops among stakeholders. The main achievements in dealing with drought crisis effects summarized in; developing the cycle of "coping with the drought" and establishing a revolving fund (micro credits) to compensate the losses and provide sustainable livelihoods.

Keywords: Drought, ICCA, Indigenous Knowledge, Adaptation, Participatory approach, Sustainable livelihood

Carbon benefits from dry Miombo woodlands in Mozambique: the case study of Nhambita project

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Miombo woodlands are one of the main forest eco-types found in Mozambique, it extends from the Rovuma River in the North to the Limpopo River mouth in the South. The common Mozambican miombo is dry, characterised by having a canopy height of less than 15 m and vegetation that is floristically impoverished. It occurs in areas with rain fall between 600 to 1,000 mm per year. A case study was carried out in Nhambita community area located at buffer zone of Gorongosa National Park (GNP), Gorongosa District, in

the centre of Mozambique, to analyse the impact of Nhambita Community Carbon Pilot Project (initiated in 2003) on community livelihoods and conservation of the woodlands. This study shows that improvement in the community well being and natural resource conservation can be achieved with sound forest management and agricultural practices related with trade of carbon offsets. Carbon finance is seems as catalyser for rural development while create a state of food security and economic development for the communities of the GNP buffer zone. The agroforestry and forest conservation has helped to raise financial resources to create and diversify household's income. On the other hand social-economic infrastructures and facilities were developed such as 2 schools, a health centre, bore wall, carpentry, sawmill, community nurseries, vegetable garden, and grind mill, among others. About 140 new jobs were created. An area of about 9,000 hectares of indigenous forest is under community management and about 1,000,000 trees were planted.

Keywords: Dry Miombo woodlands, Carbon, communities.

Is Jatropha curcas energy crop cultivation a viable land management and poverty reduction strategy? Livelihood lessons from Mali

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Ecosystem services including terrestrial carbon storage are particularly important to the livelihoods of many households in low-income countries, as they provide food, fuels, fiber and play a key role in regulating air quality, climate and water. Energy provision and preservation of the natural ecosystem are prominent challenges facing the rural poor in drylands, where energy use has considerable impacts on deforestation, land cover and livelihoods. A clear example can be found in Mali, which is considered a Least Developed Country and where more

than 50% of the national territory is classified as arid or semi-arid, traditional fuels such as wood and charcoal comprise 89% of total energy use and 93% of households use firewood for fuel. Great hopes have been pinned on the oil-bearing tree *Jatropha curcas* (*Jatropha*) to restore degraded land, reclaim marginal soils, combat desertification, reduce deforestation, improve household energy security and enhance rural livelihood options. Nevertheless, empirical data on the prospective benefits and on-the-ground challenges of *Jatropha* is lacking. This paper presents new mixed-method assessments of the potential of *Jatropha* to improve land use and enhance livelihoods at household level in rural Mali: a leading promoter of *Jatropha* agriculture. Since 2007, the opportunities offered by market-based instruments such as the Clean Development Mechanism to generate financial resources through commercialisation of *Jatropha*-based carbon credits have driven the implementation of major *Jatropha* pilot activities by the NGO community and industry. The trade-offs, challenges and opportunities of these activities are presented here. The role played by small-scale *Jatropha* agriculture in the determination of different livelihood outcomes – particularly improved land use and food security and revenue generation – is evaluated. By doing so, this study provides essential insights on the future of *Jatropha* promotion as a land management strategy to fight global poverty and contributes to major global debates surrounding biofuels.

Keywords: soil organic carbon, poverty alleviation, climate smart development, payment for ecosystem services

Spatial variation in costs of sustainable land management technologies – a review

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In studies of the likelihood of adoption of SLM technologies by land users, plot location is

often found to be of importance. The spatial variation in investment costs of SLM technologies and distance to markets are likely to play a key role, although explicit studies of variations in costs are scarce. Frequently, cost-benefit analyses of SLM technologies ignore the influence of environmental conditions. Mostly, average investment costs are reported which might make sense at an aggregate project or regional level, but which play out very different for individual land users with specific landholdings. With the increased use of high resolution GIS-based modelling for the feasibility analysis of technologies to mitigate land degradation and/or adapt to environmental change, reliable algorithms for cost differentiation become important. Much data on spatial variability of the cost of different types of SLM technologies probably exists in design manuals, project documents, and other grey literature. This paper intends to conduct a review of those materials in order to define some generic relations that can be used to improve model-based feasibility assessments of SLM. It is thereby hypothesized that spatial cost variability can be expressed as a function of one or few variables (e.g. slope, soil type). The compilation of such generic relations of investment cost to environmental conditions will be of great help when assessing the scope for transferring successful SLM technologies from one area to another.

Keywords: investment costs, sustainable land management, spatial variability, spatially-explicit cost-benefit analysis

Economic assessment of the financial effects of (not) adopting land management measures

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Information on the costs of ecosystem degradation and the benefits of preventive or restorative land management is crucial for

stakeholder decision-making. Assessing such costs is not an easy task due to various uncertainties and feedback mechanisms. Among the most difficult aspects are the timing of costs and benefits and their attribution to stakeholders. In this presentation, an overview is given about economic assessment methods, with special reference to complexities in drylands at risk of catastrophic shifts. The aim of this presentation is to provide background information for discussing essential information needs for stakeholders. The economic assessment will be framed along three dimensions (costs and benefits, on- and off-site, and with and without case). Costs include the consequences of degradation but also the investment in sustainable land management. Although uncertainty over the long-term costs and benefits is the most important, it is shown that even required investments are often not well-known and may vary considerably. Some example assessments will illustrate the current state-of-the-art. The presentation will conclude with highlighting the intended CASCADE approach to temporal analysis of investment in relation to likely costs and benefits at different stages of preventive and restorative action. A plea will be made for the integration of modelling in impact assessment studies. Data requirements for this approach will be discussed alongside with user engagement opportunities. Attention will finally be paid to ex-ante and ex-post economic assessments and the roles they play in building a knowledge base for supporting sustainable land management.

Keywords: catastrophic shift; cost-benefit analysis; impact assessment; participatory evaluation methods

Land degradation assessment in the IGAD Region - Its extent and impact

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The main goal is to assess and monitor land degradation, which is key to policy formulation and decision making in addressing food insecurity and poverty and is crucial in planning and implementing adequate mitigation measures. Land degradation index map (LDIM) focuses on areas that are exposed to natural soil erosion. The importance of the slope, the soil sensitivity and the current state of the landcover observed by satellite imagery are the most important factors of this product. It takes into consideration also the highly populated places and rainfall intensity as factors potentially responsible for an increase of the land degradation. The final product offers a vision of areas where the degradation is actually expected. The land degradation index maps help to warn about possible food security problems by giving an index of potential risks of agricultural disturbance on highly exposed areas. The results show that 45% of the IGAD region (10 African countries) is affected by considerable degradation. The most significant areas, where the land degradation appears increasing, are located in Burundi, Rwanda, western part of Uganda, eastern part of Ethiopia and in the south Sudan. The lack of economic estimates of impact of land degradation is attributed to the deficiencies in the collection or dissemination of natural resources information by the relevant institutions.

Keywords: land degradation assessment, IGAD region, Impacts

The economic impact of environmental degradation and poverty dimensions of the indigenous community Benancio Cumillan, Lonquimay, Araucania Region, Chile

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In this paper, we develop a case study of the families that make up the indigenous community of Lonquimay Cumillan Benancio, Araucanía region, with the aim of characterizing rural poverty, determine which factors

influence families facing this situation and role that poverty plays in productive development policies in an environment in which the presence of soil desertification is a limiting factor for development. The results of this investigation show that the poverty of rural households is directly related to natural capital that they possess. Natural resources such as land and forests, for generations have been the basis of their subsistence economies. However, an increasing deterioration of these resources due to over exploitation of the soil by excessive stocking, the indiscriminate felling of forests for firewood and also generate the inclusion of new areas for livestock. Income in these silvopastoral systems depend heavily of soil productivity. The soil erosion Lonquimay with extreme weather conditions have influenced the observed poverty in families of this community. The results which have confirmed the two-way relationship of poverty and environmental degradation given by Azqueta, (2000) which suggests that poverty is one of its main causes and the poor, one of the groups most affected by this deterioration. The households with few assets to address the impacts, they develop strategies that only mitigate poverty. Furthermore, the vulnerabilities affect the use of the assets, so that families in activities that are of low profitability that prevent them from breaking the vicious circle of poverty.

Keywords: Impact economic, poverty, environmental degradation, Chile

Socio-economic drivers of abandonment of cultivated land in the smallholder farming sector in Peddie, Eastern Cape, South Africa

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The projected growth in the global human population will increase demand for food. Food production will be required to grow substantially to meet the increased demand. Drought and land degradation, however, are

likely to threaten the world's food security by reducing crop yields and causing abandonment of cultivated land. There is evidence of an increase in abandonment of cultivated land in poor rural areas in southern Africa. Abandoned fields have been shown to be extremely susceptible to gully erosion. Information is needed on the causes of land abandonment if we are to combat land degradation and improve food security. We investigated the socio-economic drivers of land abandonment and the challenges that smallholder farmers faced. A structured questionnaire survey was used to gather data. We interviewed 150 cultivators and 150 non-cultivators. The major reasons for abandoning cultivation included poor soil quality (56% of respondents), inadequate labour (54%), drought (51%), irregular rainfall (50%), lack of fencing to exclude livestock (22%) and insufficient funds for agricultural inputs (18%). The main challenges that cultivators faced included drought (70%), irregular rainfall (46%) and decreasing crop yields (61%). The yield of the staple food crop maize was only 134 kg ha⁻¹. Most smallholder farmers are now dependent on social grants for their livelihoods. About 72% of non-cultivators received social grants compared to 61% of cultivators. There is therefore a need to promote sustainable land management practices to reduce degradation of arable land and to reduce dependence on social grants as a livelihood strategy.

Keywords: land abandonment, social grants, land degradation

Assessment of rangeland degradation using indigenous and scientific knowledge basis in Northern Afar, Ethiopia

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A study with the objective of assessing land degradation using indigenous and scientific knowledge basis was undertaken in the Aba'ala district North Eastern Ethiopia. Community perceptions were studied using group discussions and semi-structured questionnaires (90 households). Data on vegetation, soil and land use/land cover changes were gathered to represent some of the approaches within the scientific knowledge. In addition, data on woody vegetation composition, density, height classes, soil physical and chemical properties were gathered from the three villages at three different distances from settlement (near, middle and far). The changes in land use were studied using Landsat and Spot images of 1986 and 2006. All of the respondents indicated that the rangeland was degraded and the main causes were drought, population pressure and deforestation. There was a significant difference ($P < 0.05$) in woody vegetation density among the near, middle and far sample units from settlement. The results of GIS analysis showed that there was an increase in the size of the cultivated land, bare-land and settlement while there was a decrease in bush-land, grassland, and shrub over the last two decades. The amount of available organic matter, phosphorous, potassium, and nitrogen contents of the soil in all of the study areas were low. Therefore, necessary interventions like effective soil and water conservation, enclosure of highly degraded areas, introduction of drought tolerant trees and grasses will be effective and for future development interventions by incorporating both the community perceptions and scientific knowledge as deemed necessary.

Keywords: Rangeland, degradation, Ethiopia

The economics of land degradation and the costs of action versus inaction

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The costs of land degradation (LD) are high

but not well known. With rising competition for productive agricultural land, its price has increased sharply since the start of the century. Further, we can expect a sustained increase in the demand for "land-based" products and services, as: land and its cover needs to be managed as improved climate change mitigators, more food per hectare is required to feed a growing world population with a growing appetite, and more biomass-based products are directed at the new value chains of a growing bioeconomy. Action against LD and investment in SLM are most likely to take place if the actors are informed about their costs & benefits. Such assessments exist for other global public goods (e.g. climate, biodiversity), but the body of evidence on the costs of action versus inaction in the case of soil and land degradation is slim. ZEF and IFPRI are currently engaged in an open partnership of scientists and policy makers aimed at building up that body of evidence, at determining cost effective actions against LD and at facilitating actions through science-based evidence. The first step in this process is to establish a master framework for local specific ELD assessments. We illustrate the master framework with a number of case studies. Further, we develop a new methodology which shall enable the aggregation of local ELD assessments into a global estimate of the costs of land and soil degradation worldwide.

Keywords: ELD assessment, methodology

Economic benefits and costs of technologies for sustainable land management – Analysis of WOCAT data from three continents

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Costs and benefits of Sustainable Land Management (SLM) play a crucial role for adoption and spreading of practices. But economic information of SLM practices is very often difficult to collect and usually not

quantifiable neither by local actors nor by project experts. Experience in collecting data (such as recently in the context of the TerAfrica and the DESIRE projects) from the field level has consistently shown this lack of information. Moreover, such costs and benefits of in many cases well-known technologies, vary significantly depending on the economic, social and bio-physical context. Nevertheless donors are asking about the benefits and costs of land management investment programmes. The WOCAT (World Overview of Conservation Approaches and Technologies) network has collected, documented and assessed more than 400 case studies on promising and good practices of SLM. On- and off-site benefits of different SLM types, in monetary and non-monetary terms, as well as investment costs are available, sometimes in quantitative and but often only in qualitative terms. The paper evaluates and describes the information available in the WOCAT database. Simple cost-benefit analysis based on tangible and quantified costs and benefits is complemented with an analysis of qualitative information. Different types of SLM technologies applied in various land use systems and their regional differences are compared, including data on the context. The objective of the paper is to better understand what kind of economic benefits are accrued to local stakeholders, and how these benefits compare to investment and maintenance costs.

Keywords: Sustainable Land Management Cost-Benefit Analysis WOCAT

Payment for environmental services aims to combating the desertification in Irauçuba, Ceará-Brasil.

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According to the Brazilian Institute of the Environment (IBAMA), Irauçuba city (located in the Brazilian northeast) is classified as one of the cores of intense desertification.

Therefore, there are problems of overuse or improper use of natural resources such as overgrazing, expansion of monocultures and the cutting and burning of trees for timber. These problems have intensified the phenomenon of desertification and it is decreasing the living conditions of the population. Economic and market instruments are being used in recent decades for the conservation of ecosystems, most of them trying to prevent negative externalities through taxes or environmental rights based on polluter pays principle. The frame of payments for environmental services represents a new approach different to the principle before, while it focuses on generating positive environmental externalities through economic and social incentives for custodians of ecosystem resources. In order to propose management tools that seek to solve the problems mentioned before, this paper presents a model of local public management payment schemes for environmental services (PES) by means of the participation of communities. The study presented has important results. On one hand, it analyzes the impact that had the implementation of such schemes in some countries. On the other hand, it determines the agricultural economics value that aims to establish an opportunity cost. Finally, the study proposes an innovative way to change the land use by improving forest vegetation.

Keywords: Biodiversity, Environmental degradation, Desertification, Command and Control, Payment for Environmental Services.

Environmental education as a tool for strengthening participatory management for sustainable use of water resources in the high mountains region of the State of Veracruz (Mexico)

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Water wasting, water pollution and water scarcity in general is a rather underestimated topic, although in the recent years the public opinion has shown a significantly growing interest for these aspects in connection with global warming caused by climate change. However, the problem of sustainable water use is vital because without available water resources for human consumption, human society will be affected. In Mexico, the water use threatens it, because despite an optimistic view that water is a renewable natural resource, the reality is that due to its waste and pollution, water sources are becoming increasingly scarce. Unfortunately, in Mexico there is no generalized culture towards a sustainable use of water. This contribution deals with strengthening the water culture in the high mountains region of the State of Veracruz through environmental education, with focus on participatory management for sustainable use of water resources. Four social instruments of environmental education on water are analyzed (information and communication, education and training, social participation and social research and evaluation). Opportunities and barriers are furthermore identified, creating a model with success, response and transfer factors in order to develop an environmental education strategy to strengthen participatory management regarding the sustainable use of water in the region.

Keywords: environmental education, Mexico, participatory management, sustainable use, water scarcity

Soil organic carbon management for global benefits – A review for STAP

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The total global Soil Organic Carbon (SOC) reservoir exceeds 2000 Pg. Sound management of this natural carbon reservoir is critical, both with respect to the mitigation of global climate change and also the

maintenance and improvement of soil quality for sustainable land management. In this review we analyze the existing literature on SOC dynamics and derive principles to guide strategy for SOC management for global benefits. We also identify important knowledge gaps that should be addressed to improve understanding of the potential response of the SOC reservoir to both natural (climatic) and management practice changes. SOC management requires an integrated approach, considering the system/landscape level to account for important Organic Carbon transfers between different landscape components of agricultural systems. While the use of adequate fertilization is a prerequisite to the increase of the SOC storage on arable land, it is far from sufficient: initiatives focusing on improving SOC storage and management should not only assess how local social economic conditions may affect SOC management projects but should also assess the socio-economic implications of such projects. SOC stocks can indeed be increased through sound management but realistic targets should be set, based on both socio-economic and bio-physical constraints. Scientifically, there is a great need for a better understanding of the (interacting) effects of changes in temperature, moisture regime and land use on the SOC stock, to reduce the uncertainty of predictions on the future evolution of the global carbon stock. Furthermore, we should capitalize as strongly as possible on technical advances in SOC measurement to develop monitoring techniques that are both more rapid and more accurate, as we will need to assess management-induced SOC changes against the backdrop of a baseline that is continuously changing in response to both climatic change and increasing atmospheric CO₂ concentrations.

Keywords: Soil Organic Carbon, Climate Change

A cost-benefit analysis tool for planning national zero net land degradation schemes

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A goal of zero net land degradation by 2030, proposed by the African Union, was approved by the UN Conference on Sustainable Development ("Rio + 20") in Rio de Janeiro in 2012. It could be achieved through a combination of (a) reducing the rate of degradation by making land management more sustainable, and (b) increasing the rate of restoration of degraded land. Since dry areas cover more than a third of the Earth's land surface, and up to 40% of these areas could be significantly degraded, donor agencies will need an economic tool to optimize the locations where they invest in these two strategies. This paper will build on previous research in environmental economics and climate change mitigation to propose a practical cost-benefit analysis tool to identify which areas of degraded land in a country should receive highest priority for restoration, and which interventions in existing land uses in dry areas could yield the highest reductions in the rate of desertification for each US\$ invested. It will suggest how the tool can be integrated into national planning systems.

Keywords: dryland degradation and restoration, cost-benefit analysis, environmental economics, national land use planning

Is zero net land degradation in dry areas a feasible operational goal?

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A Zero Net Land Degradation (ZNLD) goal, which in dry areas would reduce the rate of desertification and increase the rate of restoration of desertified land, has been proposed as an intermediate step toward halting desertification completely. This presentation

evaluates the feasibility of this proposal, and suggests that while the goal could attract widespread political support among the Parties to the UN Convention to Combat Desertification (UNCCD) and be feasible at local scale, national implementation of a scheme with such a compound goal would be difficult, owing to societal and environmental factors and the complexity of land use and land cover change in dry areas. Monitoring restoration of desertified land by re-vegetation would be feasible immediately, but monitoring a reduction in rates of desertification would not, because no baseline rates are currently available and national and international scientific capacities to measure desertification are lacking. This paper therefore suggests introducing a ZNLD scheme in phases. Phase 1 would focus on restoring degraded lands, improving national land use planning systems, and establishing international and national monitoring capacities, which would be used initially to identify baseline desertification rates. Phase 2 would reduce desertification rates with the support of fully integrated systems for land use planning and monitoring. Phase 3 would set a target year for realizing a ZNLD goal, based on experiences in Phases 1 and 2.

Keywords: land degradation, zero net, dry areas

Climate change adaptation, vulnerability and resilience: four case studies in the Brazilian semi-arid.

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This paper presents preliminary results of

four case studies conducted in the Brazilian semi-arid region in 2011 and 2012 by the interdisciplinary team of the Regional Development sub-network of RedeClima. It will compare data collected from approximately 1000 interviews held with smallholder farmers related to their perception of and adaptation to climate variability. Their responses are compared with historical series of precipitation data. The four case studies have been chosen from a socioeconomic and environmental point of view and represent examples of vulnerability to climatic change. From this comparison, the goal of the paper is to identify the principle vulnerabilities and adaptive capacity to climate change of the rural communities under analysis. More amply, the study will reflect on the larger problematic related to the sustainability of smallholder farming in Brazil's semi-arid region in the context of climate change vis-à-vis the efficiency of climate change-oriented public policies. Some initial findings include: (1) Existing public policies help reducing vulnerability to droughts, but local populations remain very vulnerable to the abundance of rains and to the lack of trustful forecasts; (2) in spite of the overall perception of a displacement and disruption of the rain season (including frequency and even the size of the rain drops), farmers have short memory about the climatic events; (3) cultural and religious aspects are important factors related to climate change adaptation alternatives, both in agriculture and in water storage; (4) Climate is an important element disrupting livelihoods of the rural population.

Keywords: perception, adaptation, vulnerability, climatic change, smallholder farming

Short and long-run impact of climate changes on worldwide grains prices

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Conventional models have not provided a complete picture of recent price spikes in

agricultural commodity markets, while there is an urgent need for appropriate policy responses. New approaches are needed that shed light on international spillovers and the feedback between the real and the financial sectors. Models should also assess the impact of climate changes and consider the link between food and energy prices. In this paper, we present results from a worldwide dynamic model that provides short and long-run impulse responses of specific grains commodity prices to various real and financial shocks. We used the Global Vector Autoregressive modelling approach with exogenous variables, to estimate a Global Agrifood Vector AutoRegressive model. The methodology allows to model EU and non-EU countries, and to aggregate the single regional VARX models into a global model by using weighting matrices mainly based on the value added shares of each country respectively into EU and non-EU area. It provides a general and practical modelling framework for quantitative analysis of the relative importance of different shocks on agro-food sectors. Specifically, using this strategy we analyze channels of transmission from external shocks, as extreme weather changes that alter crops productivity and production of grain prices. The model also assesses the response of feedstock crop prices to other variables such as an increase/decrease in oil-based fuel prices, i.e. it can take into account the use of agricultural commodities to produce biofuels. Further, we analyze the integration properties of the series and the long-run relationships among the variables.

Keywords: commodity prices, financial drivers, policy responses, modeling

An assessment of community management of traditional woodland enclosure (Hiza'ti): A case study in the highlands of Eritrea

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Several villages in the highlands of Eritrea have traditional management of forests and woodlands. The hiza'ti system (traditional woodland enclosure) which is practiced by systematically restricting grazing and biomass harvesting is an example. However, efforts to dig out such traditions and assess their effectiveness using accepted design principles which are considered to be characteristic of successful Common Pool Resources (CPRs) management systems is not common. This research mainly aims to explore how communities manage their traditional enclosures (hiza'ti) and to assess its effectiveness. A single case qualitative study was conducted in a village located in the highlands of Eritrea to assess the effectiveness of the hiza'ti system. To deeply understand the management system, focus group discussions with different age and sex groups, interview with key informants and household survey with semi-structured questionnaire were conducted. Ostrom's design principles were used to analyse the robustness of the management regime. This study explored that communities in the case study village have deep traditions of managing their woodland enclosure. They play major roles in protecting and monitoring it. Analysis of the research data showed that the hiza'ti system fulfills most of Ostrom's design principles and the institutional arrangement to manage it is robust. The study also identified some potential threats to the system particularly in relation to interference of lower level government institutions and other government involvements, which can weaken the autonomy of village assembly (baito) and their minimal right to organise.

Keywords: Traditional woodland management, Traditional enclosures (Hiza'ti), CPR management regime, Ostrom's design principle, traditional institutions

Social vulnerability in the Kampong Speu Province, Cambodia

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Climate change has brought more problems, particularly increases in the occurrence and the severity of drought and floods, which have strongly affected the food security and livelihoods of Cambodians. Some people, however, are able to cope with impacts of climate change while other people cannot. Through in-depth interviews, key informant interviews and using survey tools, this study was able to analyze social vulnerability as results of climate change in Kompong Speu province. From 1999 and 2010, the Kompong Speu province was exposed to three main hazards: drought, flooding and windstorms. Drought was the most severe hazard over this period because it occurred in both the lowland and mountainous areas. Agriculture was considered the most sensitive sector. Women were more vulnerable than men to hazards due to high workloads, less opportunity for education and on average being more prone to health issues. However, women played an important and active role in mitigating and responding to natural hazards at the family level. Different strategies based on the location were adopted to cope with climate change. Bonding social capital played a very important role in the mitigation of hazard issues in the province. People in mountainous areas had a higher adaptive capacity than people in the lowland areas. In order to cope with the serious problems caused by climate change, irrigation restoration and changing rice seeds to three-month instead of six-month rice seed varieties were an effective coping mechanism.

Keywords: social vulnerability, sensitivity, exposures, adaptive capacity, and social capital

A Land-Potential Knowledge System (LandPKS) based on local and scientific knowledge of land productivity and resilience

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Economic assessment of land use change in drylands depends on understanding potential productivity, degradation resistance and resilience, all of which vary widely and are often ignored. Rapidly increasing demand, together with new technologies, migration and global capital mobility are driving dramatic land use changes. Management practices that are productive and sustainable on one type of land may, when applied to adjacent lands, result in irreversible degradation due to differences in soil, topography and climate. Conversely, lessons learned on land separated by thousands of kilometers are often relevant, provided that similar conditions exist. New technologies, including cloud-computing, digital soil mapping, GPS-enabled camera phones, and mobile 'apps' now provide the opportunity to gather, integrate and share new knowledge and information about land potential, while global databases make existing knowledge more accessible and easier to match to relevant conditions. A new "Land-Potential Knowledge System" (LandPKS) will integrate existing natural resource databases with targeted field data collection of knowledge and information using new cell phone-based tools. An under-

standing of land potential can be used to determine where: (1) land is not meeting its productive potential (for all ecosystem services), (2) unrealistic expectations are driving unsustainable development investments, and (3) proposed intensification is likely to lead to irreversible degradation. Decision tools will support land use planning and targeted interventions by governments, development and conservation organizations and farmers. Knowledge of land potential can dramatically increase the return on investment by focusing resources on sustainable land uses and management strategies.

Keywords: assessment, sustainable land management, inventory, land potential, economics

A general approach for resilience-based management in the US, Argentina, and Mongolia

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Resilience-based management seeks to enable communities to understand and respond to societal and ecological change in ways that sustain the benefits provided by ecosystems. Steady state management approaches that characterized much of the past century are unlikely to sustain these ecosystem services. We are working to develop a general approach for resilience-based management in the US, Argentina, and Mongolia, taking advantage in several new natural resource management concepts and technologies. The approach includes 1) definition of the focal landscapes, direct engagement with natural resource managers, and careful identification critical natural resource and management problems, 2) development of state-and-transition models and ecological site concepts for focal landscapes, 3) production of maps or site-level classifications of ecological states (land units that differ in management responses) using remote sensing and process-linked indicators that convey the different management needs

and evaluation criteria for distinct parts of a landscape, 4) design of management practices for individual or multiple combined land units based in part on local societal realities, 5) implementation of a structured monitoring program using scientifically sound protocols, 6) cooperative interpretation of the evidence, and 7) updating ecological models and identification of societal barriers to management goals. We discuss examples of this approach and argue that ecological site-based information alongside a suite of interlinked tools can serve as an operational basis for resilience-based management. Finally, we will briefly reference development of a global system for defining land potential, that complements the work described here.

Keywords: Adaptation, climate change, resilience, DRR, SLM

Assessment of extent, cost and impact of land degradation to enhance sustainable land management – learning from CACILM Partnership program in Uzbekistan, Central Asia

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Based on application of the FAO LADA approach and tools we provide detailed analysis of the causes, extent and impacts of DLDD and the interpretation historical and seasonal change of NDVI, using MODIS and LANDSAT-7 data. Economic and financial analyses were undertaken based on the field survey and farm level data sets. The study indicates that productive ability of irrigated soil, estimated on land fertility rate, has decreased on the average from 3 points to 7-10 points, which cause decrease in productivity

of crops, and in crop production per capita. The losses of the yield of grain crops within a severe drought in 2000-2001 have made 14-17 %, on other crops - from 45-52 % up to 75 % (downstream areas). The finding highlights that the technical interventions need to be accompanied by institutional change and resource mobilizations. The paper underlines the need for analyses of the SLM policy framework that recognizes needs and benefits of mitigation impacts of DLDD at local and national levels for decision making.

Keywords: Cost of land degradation, economics, impacts of DLDD, FAO LADA, mitigation benefits

Impact of land-use change from ranching to smallholder agro-pastoral system on ecological resource base in Machakos-Makueni Districts, Kenya

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Subdivision of ranches and subsequent change in land-use in the rangelands has been on the increase. A study was carried out to analyze the impact of these subdivisions and the shift in land-use from commercial ranches to smallholder agro-pastoral production systems on the vegetation and soil. Vegetation and soil attributes in non-subdivided cooperative ranches and subdivided ranches under smallholder agro-pastoral farms (SMFs) were sampled. Analysis for vegetation attributes and physical and chemical properties was done using standard methods. Ranching had higher percent ground cover (53.7±1.63) than the SMFs (29.49±1.22). Percent ground cover and biomass production for perennial grasses and litter was significantly higher in the ranches while the SMFs had higher (p<0.05) frequency and biomass production for annuals grasses. The SMFs recorded lower levels of nitrogen, phosphorus, magnesium, man-

ganese and sodium than the ranches while soil organic carbon significantly reduced with increasing period of subdivision and settlement. These findings suggest that the SMFs were more degraded than the ranches partly due to continuous cultivation and overgrazing. Subdivision of ranches and change in land-use to smallholder agro-pastoral production systems in the area should be done in tandem with adoption of technologies that will allow sustainable exploitation of land-based resources. Therefore, there is need to determine land use thresholds that will not affect land productivity while meeting household requirements of the agro-pastoral system. Also, there is need for development and application of appropriate technologies that would contribute to reversing degradation trends and increase land productivity in the agro-pastoral systems.

Keywords: Agro-pastoral systems, land-use change, land subdivision, rangelands, soil

Forest entitlement and benefit sharing in community forests in Nepal

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The aim of this research is to gain insight and explore the relationship of forest benefits and their distribution mechanism among users by evaluating existing institutional arrangements in the community forestry (CF). Although, the community forestry is an approach of Sustainable Forest Management (SFM), it has been facing many challenges in benefit sharing among forest dependent users and stakeholders. The forest entitlement approach has been used for in-depth understanding of the entitlement of users. An in-depth explorative approach of case studies had been used as a research strategy. Two community forests were purposively selected in Makawanpur District. One hundred and two respondents, based on three

kinds of wealth ranking, were randomly selected for an interview. A trend over seventeen years' of timber distribution among users shows a stable trend among rich, mid-wealthier, and poor category users. As a result, the marginal and the poorest users may not be benefitted in forthcoming period, too. Moreover, the generated livelihood resources have not influenced livelihood improvement of them. The challenge remains how to share the benefit based on equity among users without antagonising the community sections to maintain SFM principles. This research recommends studying gaps on the differentiated role of forests products in livelihood enhancement of marginal user and developing new strategic mechanism to address the issues for meaningful livelihood support.

Keywords: Community, Forestry, Livelihood, Environmental entitlement, Benefit Sharing

COST Action ES1104 - Arid lands restoration and combat of desertification: setting up a drylands and desert restoration hub

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The Arid Lands Restoration Hub was initiated under the umbrella of the COST European Science Foundation (COST protocol), specifically to address the practical issues of arid and dry lands restoration and combat of desertification particularly with regard to the practical measures of establishing and maintaining vegetation which is key to the success of the UNCCD's and other agencies agenda. Key information and data is most often extremely difficult to find and it largely remains within academic circles. The objectives of the 'Desert Restoration Hub' is to fix this broken circle where scientists and practitioners and stakeholders in one country or region do not know the importance of what is happening in other countries. Thus information remains hermetic and the cycles of desertification and the consequential en-

environmental and socio-economic degradation follows a pernicious cycle. The COST Action members consist mainly of scientists from EU signatory countries, from reciprocal agreement countries (Australia, South Africa) and potentially from a group of near neighbor countries. This is one of the few instances that a broad spectrum of scientists (soils scientists, hydrologist, agronomists, ecologists, landscape planners...) have been brought together for the first time to tackle his issue. The significance of this COST / EU funded Action cannot be under estimated. It not only has significance for the EU, in countries which are becoming increasingly desertified (Spain, Portugal, Italy, Romania, Greece etc.), in near neighbor countries across the Mediterranean and the Sahel region (where economic migration is a direct or indirect effect of desertification) but the significance is global. The importance of this Action has been recognised by UNCCD by Louise Baker Senior Adviser - Partnerships UNCCD, Bonn and the participation of Bertrand Vincent UNCCD at the 2nd Management Committee Meeting held in Brussels, June 2012. The intention is that the UNCCD is invited and participates in the Action and collaboration ensues. The paper introduces and discusses the need for a desert restoration hub and opens up discussion on how the hub can be inclusive and increase stakeholder participation, beyond Europe to include affected countries, organizations and indeed local people around the world. Additionally the paper discusses the requirement for an holistic approach to restoration and the advantages of bringing experts together from a variety fields to better get the job done.

Keywords: Desert restoration hub, integrated restoration approach, dissemination and distribution of knowledge, restoration techniques, stakeholder participation

Ecohydrological principles in economic models of water resources in drylands and desert restoration

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Water resources management of drylands requires a nexus between water, land, vegetation, societal factors related to water use and economy. WRM concepts exhibit a strong asymmetry in representing these five aspects. Progress has been made in the integration between hydrology, soil science, biosciences and agriculture: The disciplines of ecohydrology, environmental hydrology, landscape ecology and socio-hydrology have evolved in recent years to address these issues and to overcome the lack of knowledge in interdisciplinary studies. A review of the representation of eco-hydrological principles in economic models reveals deficiencies in the representation of fundamental principles of ecohydrological systems. These issues become even more important in drylands as water, land and vegetation become the limiting factors of economic development. The foundation of modern quantitative hydrological science, mass balance sufficiency based on known resources renewal and lateral flow compensation is generally neglected in even complex economic models of water resources. The high variability and interdependency of ecohydrological system properties between mountain areas and lowlands and their potential role in restoration should be taken into account in economic models. Ecohydrological systems in drylands often have response times ranging from decades to hundreds of years while economic models operate on shorter times scales. It is proposed to initiate an open dialogue and exchange between economic and ecohydrological disciplines. The focus is on improving the mutual representation of principles and processes. We hypothesize that a more realistic, scientifically sound modeling and more efficient management and restoration of degraded can be achieved based on this cooperation.

Keywords: Degradation, restoration, land use, hydrology, economy, nexus

The eco-hydrological perspective of desert restoration

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Eco-hydrology is a recently emerging discipline combining the realms of water and ecology and exploring the interactions between ecosystems and hydrological processes. In few areas this close interaction is more pronounced, visible and decisive than in desert restoration. The degradation of drylands leads to a decline in ecosystem functioning and especially hydrological functions of water storage. The field of eco-hydrology offers new and promising approaches to desert restoration. In the same way the decline of dryland ecosystem is characterized by negative feedback mechanism, the conjunctive restoration of ecosystem functions and of important hydrological system properties can lead to positive feedbacks re-inforcing the restoration process. These interactions and feedbacks have been discovered in many compartments of dryland ecosystems: The role of topography in creating distribution networks for water and matter (carbon, nutrients) is not just related to the potential application of micro-catchment and rainwater harvesting but involves all distribution processes on the surface and in the underground. A broader perspective of the role of topography for ecohydrological systems in drylands is proposed. The investigation of bio-crusts and their impact on surface prop-

erties, runoff generation, evaporation and nutrient cycling deploys its full relevance for desert restoration when seen in an eco-hydrological context. A better understanding of soil functioning, especially the role of carbon-water feedbacks for water storage and hydrological processes, offers perspectives of developing and restoring desert soils. Finally, an overview of current techniques of desert restoration at larger scales involving the use of rainwater harvesting technologies and MAR (managed artificial recharge) is given. The workshop contribution aims at presenting and reviewing the lines of activities in the COST working group on the role of hydrology in desert restoration and at opening it to a wider scientific community based on the eco-hydrological concept.

Keywords: Desert restoration hub, integrated restoration approach, dissemination and distribution of knowledge, restoration techniques, stakeholder participation

Erodibility of biochar from a sandy soil in Denmark

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In recent years, the influence and effect of biochar on soil properties has been intensively investigated, particularly in the context of its potential to mitigate the effects of anthropogenic climate change by acting as a net carbon sink. However, a lack of evidence to support the influence and positive effects of biochar on physical and chemical processes in edaphic ecosystems represents a major limitation in its viability as a 'soft' geo-engineering option to contribute to ameliorating anthropogenic climate change. One major question that remains unanswered concerns the mobilization, fate and erodibility of biochar in the landscape. Since biochar has a lower bulk-density than soil, its susceptibility to erosion is expected. This lack of informa-

tion is important and could have profound economic implications for farmers committed to its use, since a high net annual loss of biochar by erosion could exceed any net annual economic gain in terms of increased TOC stocks, increased crop yield, and concomitant soil quality. Crucially, therefore, any positive gain on biogeochemical cycles depends on the amount of biochar remaining within the soil profile. The overall objective of this study was to explicitly investigate the tendency of biochar to preferentially erode from a sandy soil exposed to a newly developed Portable Wind and Rainfall Simulator (PWRS). The investigation was conducted on a recently cultivated field located in the agricultural region of Jutland, north Denmark. Six plots, each measuring 15 m², were delineated on the upper, middle and lower sections of a hillslope with an overall ca. 20% gradient. Biochar was applied (i.e. 'seeded') to the soil surface of three plots at a concentration equivalent to 1.5 kg m⁻² and manually incorporated within the till-zone. The three remaining plots were un-seeded and used as controls. A 30 min. erosion simulation was conducted on each plot using the 2.2 m² PWRS. Eroded sediment was collected over 2.5 min intervals and respective sediment / biochar yields are compared and the implications outlined.

Keywords: soil organic carbon, poverty alleviation, climate smart development, payment for ecosystem services

Assessment and geographical zoning of desertification in the Russian Federation

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The desertification assessment and mapping (1:1.5 mln.) of the southern (semi-arid) belt of the Russian Federation has been taken out using the comprehensive methodology based on the UNCCD approaches and

space imagery processing. The map shows the areas of the main chains of causes and impacts and the rate of desertification trends and risks. One of the distinctive peculiarities of the assessment is demonstration not only of degradation but both land improvement (progradation) trends. It has been shown that about 1 220 000 sq. km in the Russian Federation or 7.2% of its area are prone to desertification or desertification risk. A set of indicators and diagnostic keys has been elaborated for the purpose of desertification assessment at the regional and local levels. For economic purposes a geographical zoning of desertification has been developed, which includes 15 desertification provinces subdivided into 58 districts differ in combinations of desertification risks, trends and rates, and in regional peculiarities of land use.

Keywords: desertification, assessment, mapping, zoning

Sustainable land management oriented projects in Tajikistan: experience and lessons learned

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Three cross-linked projects with SLM component have been/are implemented/ in Tajikistan : Community Agriculture and Watershed Management Project (CAWMP): 2004 – 2012; Land Registration and Cadastral System for Sustainable Agriculture Project (LRCSP): 2005-2014; Environmental Land Management and Rural Livelihoods Project (ELMARL): proposed for 2013-2017. CAWMP and ELMARL have a GEF supported component. The projects' SLM policy is successive, although different projects cover diverse directions of agricultural development: community actions and participatory capacity building, peculiarities of land privatization and fragmentation, and

climate change adaptation. The synergy of the projects environmental results appears in: Awareness raising in environmental risks assessment, application of environmentally and economically effective technologies in farm production; experience in water-, soil- and energy-saving technologies in rural areas; improvement of sanitary and ecologic conditions in villages; rehabilitation of degraded lands (incl. irrigated) and increase of soil fertility; rehabilitation and access to pastures; fixing erosion on slope lands by woodlots, horticulture, haying, etc. Lessons learnt for further results development: (1) Negative lessons learnt: (a) low skills of project environmental stuff; (b) weak contacts with governmental stakeholders responsible for environmental issues; (c) lack of information sharing and low use of Web opportunities; (d) weak integration with other projects and donors. (2) Positive lessons learnt: (a) growth of level of national environmental NGOs; (b) high effectiveness of local small interventions (bottom-up) in comparison with national-level activities (top-down); (c) replicability and sustainability of environmentally sound activities; (d) increasing attention to pastures as an important natural resource; (e) rising possibilities and capacities to space imagery use.

Keywords: sustainable land management, mountainous regions, best farmers practice

NGOs role in disseminating scientific knowledge on land degradation

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This article aims to make an argument for close cooperation between NGOs and scientists, based upon experiences from members of Drynet, an international network of NGOs joined forces in order to counter the degradation of drylands. Three forms of cooperation are being distinguished: coopera-

tion on the ground, in policy arenas and in academic discussions.

Keywords: NGO, land degradation, sustainable land management, participatory research, nexus policy and science

Estimation of the total economic value of water in the Huasco river basin in the Atacama Desert, Chile

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Water in the arid regions of the planet is usually the factor that limits an adequate provision of ecosystem services, especially when there are competing uses. Such is the case in the Huasco river basin, located in the hyper-arid Atacama Desert. This basin has three medium- to small-size cities, large copper mines, agriculture, animal husbandry, that together threaten the future provision of fresh water due to increased consumption. The risk of facing future shortages due to unbalanced consumption vs. water recharge moved the local government to fund a research project aimed at estimating the total economic value (i.e., use and non-use values) of water in order to have scientific information to enlighten the future decision-making process in terms of the development of an integrated water resource management policy. Thus, we applied a survey to a sample of urban as well as rural dwellers (such as farmers, ranchers, miners, wetland managers), and interviewed several local experts and public servants. Our results include an estimation of the willingness to pay for water conservation of different stakeholders through econometric models, and a general overview of the main actors' desires regarding the needs for improved management in a water-scarce basin.

Keywords: willingness to pay, water, hyperarid basin, Chile

Economic causes and consequences of population changes

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The majority of the world's population lives in cities as a result of affluence and rural-urban migrations. The latter are a result of a long-term process of abandonment of rural areas in many cases due to Land Degradation and Desertification (LDD) entangled with the absence of adequate agricultural policies. Population dynamics affect land degradation and in parallel several economic forces have been reported as a triggering factor of LDD. This is a process especially relevant in countries with drylands that usually have low input agriculture, or for dwellers depending on pastoral systems, which result in low rural economic output. In many cases forces such as market conditions and the presence or absence of development and agricultural policies have resulted in LDD, increased poverty and outmigration. On the other hand, and as a consequence of LDD, inequality in natural capital availability, increasing rural poverty, and unsustainable management of soil and water may result in population movements in time and space, adding pressure to the environment. Hence, population pressure can also operate as a relevant factor for LDD since migrant farmers may be forced to apply improper agricultural practices, such as cultivation of too shallow or too steep soils, or ploughing fallow land before it has recovered its fertility in an attempt to ensure survival. These degradation processes invoked by population dynamics influence the land productivity, hence the economic value of the land, and condition trade-offs for development. The WAD describes these local dynamics while providing global thematic compatibility for land degradation assessment.

Keywords: Population dynamics, Migration, land degradation assessment, markets

Delivering on environmental commitments? Guidelines and evaluation framework for an "On-Board" approach

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In contemporary contexts of complex, integrated policies, it has become ever more essential to assess whether environmental political commitments are effectively implemented. Endeavouring to find out, the evaluator finds himself "on-board": committed to one problematic, under strategic pressure, caught between paperwork and field investigation and looking for markers in ever changing situations and discourses. Based on evaluative research on environmental management programs in an arid region, the Senegal River valley, this paper reviews the pitfalls the evaluator has to confront, the successive deconstruction, reconstruction and assessment phases the evaluation has to go through, and proposes an "on-board" framework evaluation to prevent blurring of the environmental bottom-line.

Keywords: Strategic evaluation, Environmental policy, Strategic environmental management, Environmental efficiency, Senegal River.

Assessment and mapping of LD and SLM as a direct support to planning and up-scaling of SLM interventions to combat desertification

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Global investments in Sustainable Land

Management (SLM) have been huge in the past. However, an overview of "where" land degradation takes place, and "how" land users are addressing this problem through SLM is still missing in most countries and regions. Existing maps not only focus on degradation but have been compiled following different methods, making comparison of benefits of SLM interventions impossible, in turn hindering good informed decision making on proper investments in the land. To fill this knowledge gap, the World Overview of Conservation Approaches and Technologies – WOCAT, FAO - Land Degradation Assessment in Drylands project (LADA) and the EU project – Mitigating Desertification and Remediating Degraded Land (DESIRE) have collaborated to establish a generally applicable mapping method. The method generates information on the distribution and characteristics of land degradation and SLM activities and can be applied from village scale to country or region level. It is based on participatory expert assessment supported by documents and surveys, spatialised on a Land Use Systems base map. The method allows the mapping of the DPSIR framework for degradation and conservation providing key information for decision making. The mapping method can also be used for monitoring land degradation and conservation after project implementation. This contribution will explain the method highlighting some of the findings made at different scales (national and local) by the LADA (South Africa and Senegal) and the DESIRE (East Africa and Mediterranean) projects.

Keywords: SLM, mapping, decision support, participatory expert assessment

Tools for better SLM knowledge management and informed decision making to address land degradation at different scales – the WOCAT / LADA methodology

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Desertification research conventionally focuses on the problem, that is, degradation, while neglecting the appraisal of successful conservation practices. Based on the premise that Sustainable Land Management (SLM) experiences are not sufficiently or comprehensively documented, evaluated, and shared, the global WOCAT initiative (www.wocat.net) in collaboration with FAO-LADA project (www.fao.org/nr/lada/) has developed standardised tools and methods to compile and evaluate the biophysical and socio-economic knowledge available about SLM. The tools allow SLM specialists to share their knowledge and assess the impact of SLM and on a national, regional and global level. Hence, the methodology serves on the one hand as documentation and self-evaluation and impact assessment tool for SLM practices, and on the other hand as knowledge base for knowledge sharing and decision support in the field and at the planning level and in up-scaling identified good practices. Successful SLM depends on flexibility and responsiveness to changing complex ecological and socio-economic causes of degradation. To meet these expectations and those of end users WOCAT is constantly developing and/or adapting its tools mainly in the field of data analysis (impact and cost/benefit), cross-scale mapping, climate change adaptation and disaster risk management, and to support reporting on SLM best practices for UNCCD. Newly WOCAT is 'giving voice to land users' by back upping documentation with video clips right from the field.

Keywords: SLM, decision making, WOCAT / LADA methodology

Adapting to climate change through sustainable land management: experiences of a pilot project in Tajikistan

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Tajikistan is particularly exposed to the risks of climate change. Its widely degraded landscapes are badly prepared to cope with changes in precipitation patterns, increased temperatures, droughts, and the spread of pests and disease. Sustainable land management (SLM) provides a “basket of opportunities” to address these challenges, particularly for increasing land productivity, improving livelihoods, and protecting ecosystems. Within the Pilot Program for Climate Resilience (PPCR) in Tajikistan 70 SLM technologies and approaches on how to implement SLM were documented with the World Overview of Conservation Approaches and Technologies (WOCAT) tools in 2011. For this purpose a climate change adaptation module was developed and tested in order to enhance the understanding about climate change resilience of SLM practices and community workshops conducted to on adaptation mechanisms by rural communities in Tajikistan. The analysis came up with four guiding principles for applying SLM for adapting to climate change: 1. Diversification of land use technologies and farm incomes; 2. Intensification of use of natural resources; 3. Expansion of highly productive land use technologies; 4. Protection of land and livelihoods from extreme weather events. Furthermore, SLM must be up-scaled from isolated plots to entire zones or landscapes and the project developed the concept of three concentric villages zones, the in-, near- and off-village zones. Land users, advisors, and decision- and policy makers face the task of finding management practices that best suit site-specific conditions. This task is most efficiently addressed

in collaborative effort, and building up and managing a respective knowledge platform.
Keywords: Adaptation, climate change, resilience, DRR, SLM

Use of multi-media for spreading the experiences

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The global World Overview of Conservation Approaches and Technologies (WOCAT) initiative has developed standardised tools and methods to compile and evaluate knowledge available about SLM. This knowledge is now combined and enriched with audio-visual information in order to give a voice to land users, reach a broad range of stakeholders, and assist in scaling up SLM to reverse trends of degradation, desertification, and drought. Five video products, adapted to the needs of different target groups, are created and embedded in already existing platforms for knowledge sharing of SLM such as the WOCAT database and Google Earth application. A pilot project was carried out in Kenya and Tajikistan to verify ideas and tools while at the same time assessing the usefulness of the suggested products on the ground. Video has the potential to bridge the gap between different actor groups and enable communication and sharing on different levels and scales: locally, regionally, and globally. Furthermore, it is an innovative tool to link local and scientific knowledge, raise awareness, and support advocacy for SLM.
Keywords: Adaptation, climate change, resilience, DRR, SLM

Desertification and blown sand disaster in China

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The arid and semi-arid regions, in which land desiccation, vegetation degeneration, wind erosion, sandification, Gobi-pebblication and salinization occur, take up one third of China's total land area. Vegetation degradation is most serious in lower flood plains of the inland rivers and the semi-arid Agropastoral Ecotone. Studies by the methods of aeolian sand transport, soil texture analysis, Cs137 tracing and archaeology confirmed that the rate of wind erosion is between 1000 to 2000 ton km⁻¹ a⁻¹. The severity of sandification has been manifested by the twelve sandy deserts and lands occupying 710,000 km². Salinization of surface water and ground water is unfavorable for crop growth and natural vegetation. Desiccation of terminal lakes causes emission of salt dust. The frequent occurrence of sand and dust storm disasters is the ultimate outcome of desertification. Blown sand disaster is caused by various blown sand activities. It can lead to casualties of people and livestock, declining productivity of farmland and meadow, damage to buildings, roads, communication and other facilities, and deterioration of atmospheric environment. Sand and dust storm has been a notable natural phenomenon in the north of China since ancient times. Due to increasing of human's activities, the combined effect of land desertification and climatic aridification has been strengthened and thus enhances the risk of blown sand disaster in the north of China. This presentation discusses spatiotemporal distribution of desertification, sand and dust storm, blown sand disaster and its influences, and blown sand disaster risk governance in China.
Keywords: Desertification, Vegetation Degeneration, Soil Erosion by Wind, Sand and Dust

Storms, Blown Sand Disaster

Forecasting rainy season's features under a semi-arid climate of Burkina Faso using rainfall-based predictor variables

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To help small scale farmers cope with negative impacts of the high spatial and temporal variability in Sahel precipitations, we attempt to identify rainfall-based predictors for early forecasting of the actual onset date of the rainy season, and the seasonal precipitation amount in Burkina Faso. To that end, we analyze daily rainfall records of 51 stations, spanning the 1920-2008 period, for locating homogeneous climatic zones in Burkina Faso based on the intra-seasonal distribution patterns of precipitations. Then, we perform linear discriminant analysis to find, amongst 15 rainfall-based predictors, the best to distinguish between the true and false onsets of the growing season; and amongst 21 other indicators those to discriminate between the normal/humid and dry rainy seasons. We found 9 homogeneous climatic zones in Burkina Faso; and in each of them, linear models to predict the true and false onset dates, and the normal/wet and dry rainy seasons. The models' accuracy, confirmed by a validation procedure, is very high since around 7 cases out of 10 are well classified.

Keywords: intra-seasonal rainfall, dry spells, Sahel, climate variability, sowing period

Bioeconomy and Development

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Because we think that to protect in itself the environment (from desertification) is not possible, we need a new vital and productive approach to such a problem and a combination of traditional knowledge with up-to-date modern know-how too. Bio-economy is an environmental and economic theory and practice, a vital process, by which you can define new areas of research and develop serious programs for an appropriate use of natural, biological and local resources and to combat desertification. We will be introducing bioeconomic principles, systems, plans by which you can proceed towards a new ecological and social development and overcome drought and desertification. In this regard, we propose to launch a bio-economy strategy for bioeconomy and desertification based on the creation of a specialized and targeted program especially in arid areas. In view of the world's population increase and the scarcity of natural resources. The objectives of such a program could be represented, among others, by the achievements of the following subjects and projects, that we will be discussed during the conference: (1) Water Treatment and Recovery System (WTR); (2) Sustainability-Security-Quality System (SSQ); (3) Drought Early Warning System (DEWS); (4) Agroecological Parks (PAE); (5) Productive Ecological Parks (PPE); (6) Asymmetric Structure Systems.

Keywords: development, bioeconomy, traditional knowledge, agroecology

Characterizing indicators of drylands and desertification in Ganga river basin, India

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Lack of agreement on the choice and application of indicators has been a major handicap in attempts to assess the status and trends of land degradation and desertification. DLDD is a complex process, which requires possible indicators among physical, biological, human, and socio-economic phenomena. Besides the UNCCD core indicators, here we have addressed seven (phenology, vegetation mapping, indicator species, long-term climatology, vegetation fragmentation, disturbance index (DI) and SDM) indicators of land degradation and desertification for tropical regions. The study conducted in test site of the Ganga river basin; a highly fertile and densely populated basin running along Himalayan range of mountains. Decadal LULC map were prepared using satellite images of 1975, 2005 and 2010 for two seasons to understand the phenology and spatial vegetation changes. Indicators species were identified for salinity, temperature and drought. Prepared vegetation type map were also used to calculate the fragmentation and DI map using customized SPLAM software. 101 years climatological data were used to calculate the decadal gradient and aridity index using arc-object. To predict the future scenario of species in fast climate change scenario, SDM was used for indicators species in A1B emission scenario. Major change in LULC was observed after 1985 and high fragmentation and DI values were observed along with Ganga river. Maxent model for SDM suggested that distribution of species would tend to move in direction of shorter cold seasons. Early results also showed increasing trends of aridity between 1901-1930 with some decline between middle, and maximum changes in 1990 onwards.

Keywords: Desertification indicators, remote sensing, river basin hydrology, Ganga, SDM

Research in agriculture and climate change: a bibliometric appraisal for Latin America

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During the past two decades, valuable knowledge has been generated in the Latin America and the Caribbean related to agriculture and climate change. This study used a bibliometric appraisal of scientific papers to evaluate the state of the art on agriculture and climate change. Scientific production on climate change and agriculture grew exponentially in the 2000's. A meta-analysis of 3180 publications on climate change and agriculture in LAC, published between 1990 and 2011, revealed an increasing number of papers from LAC, but concentrated in a small number of countries. Brazil is at forefront (40%), followed by Mexico (17%), Argentina (15%) and Chile (7%). Further studies will evaluate available manuscripts and segregate by specific topics, but preliminarily data suggest a need to strengthen R&D in Agriculture and climate change, especially in the vulnerable countries. Collaboration among countries is another area requiring attention.

Keywords: Climate Change, Agriculture, Research, Latin America, Bibliometrics

A new tracking tool for carbon benefits

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The Global Environment Facility's Carbon Benefits Project has developed a suite of tools for land management projects to monitor, measure and model the impact of a project on carbon stock changes and greenhouse gas emissions (carbon benefits). The tools are freely available online with options for projects with different remits, resources and expertise. The Simple Assessment is suited to projects with few resources for carbon monitoring and reporting or those developing project proposals. It uses pre-populated information in drop down menus

and is available in five languages. Able to be used via a web portal, it requires information on land management activities and where they occur under a baseline and a project scenario. The Detailed Assessment has the extra functionality of allowing the user to create their own grassland, forest, cropland or agroforestry type. In addition users can replace 'factors' used in the calculations with their own project-specific measures. This reduces the uncertainty of the estimated carbon benefit. It is suitable for projects with more emphasis on carbon reporting. The third option uses a dynamic model and is suited to users with a scientific background who wish to model carbon stock changes in projects with a carbon focus. Some knowledge of ecosystem modelling and geographical information systems is required.

We use the example of "The South West Amazonia Project" in Brazil which considers the environmental impact of agricultural expansion in the Amazon frontier area to demonstrate: 1) How the Simple Assessment can be used in an ex-ante capacity to explore the impacts of different land use scenarios, 2) How the Detailed Assessment runs with project specific emission factors to reduce uncertainty 3) Application of the dynamic modelling option to estimate the long-term impacts of agricultural expansion on soil carbon stocks in the region.

Keywords: carbon, global environmental benefits, valuation of ecosystem services, sustainable land management, soil organic carbon

Adapting to climate change and addressing land degradation through sustainable land management practices

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Land degradation and climate change are key threats to food security and poverty reduction in the developing world, including in Central Asia. Interactions and feedback loops between climate change and land degradation are complex. However, little is understood, especially in terms of their economic implications for the livelihood of the poor, who have disproportionately higher dependence on marginal lands and climate-sensitive sectors, such as agriculture. This study seeks to contribute to a better understanding of the joint economic impacts of climate change and land degradation on the incomes and food security of agricultural households at the microeconomic level in Central Asia (Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan). It also seeks to illuminate the potential macroeconomic implications of thereof at higher provincial and national scales. We study if and how the negative impacts of land degradation and climate change could be counteracted through the use of sustainable land management practices. To achieve these research objectives, we mobilize nationally representative household surveys in the four countries as well as a panel dataset at the provincial level for the period of 1990-2010 ($n = 38$, $t = 21$). We employ cross-sectional Ricardian and fixed-effects panel models with incorporation of climate change and land degradation variables, as well as of their interactions. The results confirm that sustainable land management practices could serve as viable no-regret adaptation options to climate change through their immediate beneficial effects on agricultural livelihoods by reducing land degradation.

Keywords: economics of land degradation, climate change, Central Asia, Kenya

Sustainable rangeland management: how grazing management and woody cover can alter herbaceous diversity, forage quantity, and carbon stocks in semi-arid rangelands of Ethiopia

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Semi-arid savanna rangelands are currently under threat by overgrazing, which can lead to dense woody cover and often results in the suppression of herbaceous plants. On the other hand, woodland expansion might result in a large increase in Carbon(C) storage in the grassland ecosystem, an important aspect for climate change mitigation potentials. Particularly the influence of grazing intensities on the belowground herbaceous root biomass, where large amounts of C can be stored, has never been tested systematically. We compared the effect of livestock enclosures under varying woody cover in pastoral grazing systems of southern Ethiopia. Caged plots and transects were established to assess species composition, dry matter and above-and below-ground C stocks of herbaceous plants, as well as total ecosystem C under the different treatments. Herbaceous above-and belowground dry matter yield declined whereas overall ecosystem C storage was higher with increasing woody cover. Grass dry matter yield was significantly higher in enclosures compared to open grazing lands but was dependent on woody plant density and cover. Herbaceous species composition did not significantly vary across grazing management while root biomass and total soil organic C positively responded to higher grazing intensity. We conclude that high woody cover suppresses herbaceous dry matter yield but we also highlight that thinning of the woody plants to increase the herbaceous layer productivity would involve a compromise of losing significant woody C-sequestration potential. While enclosures represent important management tools rotational grazing should be fostered to restore herbaceous vegetation and its C stocks.

Keywords: Grazing intensity, Bush encroachment, species composition, drymatter, Carbon sequestration

Economic valuation of lands in Colombia

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Colombia has a total area of 1.233,736 km², and is crossed from the south to north by the Andes mountain range with two major branches located in the central and western part of its territory arising therefore, a great variety of geographical regions, climates and vegetation. Currently have been identified the following percent figures of desertification according to the total area by each geographical region: Caribbean 65% (132.218 km²), Orinoco and Amazon 18% (713.348 km²), Andean 15% (305.000 km²) and Pacific 7% (83.170 km²). This document describes the status of land degradation and desertification in Colombia, and its impact on the production of the five main agricultural products of its economy (rice, banana, sugarcane, coffee and potatoe). It is used for this purpose an econometric model that identifies the impacts of desertification on the yield, production and area harvested by product. Also, the main indicators available, used by the national government, to measure the impact of their policies in the fight against desertification are analyzed taking as reference the Colombian National Action Plan for the year 2004.

Keywords: Colombia, agricultural economics, desertification, land degradation, yields, crops.

Two economic evaluation methods of land degradation and desertification: the convergence of results

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The paper shows two methods of assessment of economic losses due land degradation. The first one is based on the comparison of the differences between agricultural production value and total productivity factors in degraded and non-degraded areas.

The difference between the agricultural outputs in the two areas is taken as the economic loss. The method has been applied in Argentina, Peru and Paraguay and Central American countries, and shows the impact of the economic losses in the agricultural product. The second method is particularly applied when empirical data and agricultural statistics are available. The method uses the Universal Equation of Soils Losses (UESL) and it was applied to eleven Latin American countries. It is based on some historical figures estimated for soils and water losses and it assess some figures presented by some authors and taken as reference in the context of the UNCCD. The first method is based on productivity and agricultural output and the second one is based on soil and water availability losses, but the results of both methods are convergent. The convergence is particularly identified in the impact they represent in the GDP. The small discrepancies are probably due to the estimation of degraded areas since the data used in both cases are from different periods. The main conclusion is that both methods could be used in different situations for those countries or regions where data is available as well as those areas where no empirical data is available.

Keywords: ECONOMIC VALUATION, INACTION COST, ECONOMETRIC METHODS, METHODS BASED ON UNIVERSAL EQUATION OF LOSSES OF SOILS (UESL)

Estimated models to measure the value of land degradation in Bolivia

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The principal goal of this paper is submit the current costs of inaction by the land degradation in the agricultural sector in Bolivia, and the potential impact of climatic variables futures scenarios. Since Bolivia has no recent census data, it was decided to find the

best possible econometric specifications of models in which the yield is the dependent variable and climate variables, are the explanatory variables. Yields functions were estimated for degraded and non-degraded areas based on time series information provided by the Ministries of Agriculture of Bolivia. These functions correspond to a selected set of major crops performed, considering criteria such as contribution sectoral output, employment, food security importance among other criteria. Finally, we made estimations of yields and from them, gross values of production from affected and non affected areas by degradation processes, in order to construct a baseline and make projections for the future considering some selected cutting years. The values for the baseline corresponds to the first objective of the project, which is a first approximation to the actual value or cost of land degradation, and the second one, the consideration of the impact of variables future climate scenarios.
Keywords: Degradation, climate change, Impacts

Economic valuations integrating remote sensing derived layers

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Desertification and land degradation is a relevant issue for LAC countries affecting important areas, where lives a significant part of the rural population. As it was defined by the UNCCD, Desertification and land degradation is a result of climatic and anthropological factors that reduce the economical and biological productivity. At the same time and very close related, the climatic change will influence this process and at the same time will be influenced by it. In spite the fact that all the countries are members of the UNCCD and all have NAP to combat desertification and land degradation, the inaction costs of desertification and land degradation

still remains almost unknown making difficult to allocation resources process to combat desertification. ECLAC and the GM are working in a joint project aimed to measure the economic and social value of desertification and land degradation in 7 countries in C. America and 7 countries of S. America. Methodologies based in micro data from agricultural census have been developed for countries that count with this information. In the other cases, an approach based on Time Series has been applied to measure that, using production functions specified on the basis of the phenology of main cultures made in affected areas. The main preliminary findings shows that the annual cost of land degradation is around 7 to 12% of agricultural GDP in Ecuador and can reach higher such as in Honduras in Central America. For the impacts of climate change, were made estimations of the vulnerability of land to degradation using criteria based on a combination of Fournier modified index, number of drought month index and aridity index.

Keywords: WAD, economic valuation, time series analysis, climate change, LD assessment

Developing an integrated mechanism for combating rangeland desertification in Hindu Kush Himalayan region

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Rangelands represent the largest land-use in the world and cover about 54 percent of the Hindu Kush Himalayan region. In spite of their global, regional and local ecosystems service significance, the rangelands continue to be most neglected. A key factor causing rangeland desertification is mismanagement of rangelands through combination of overstocking, improper grazing, conversion of rangelands. A study was conducted in Ruergai in the Tibetan Plateau. It used to be a marshland till 1960s, but massive human-induced drainage of wetland in 1970s changed the situation. When the hu-

man intervention interacted with currently accelerating climate change impacts, the wetland ecosystem was disrupted, situation got worse by the national policy of privatizing livestock on communal rangeland to boost production. The disruption of ecosystem has led to reduced productivity and desertification. Currently, some 47,000ha of Ruergai County is sandy desert, with an annual conversion rate of 11.8%. the efforts made by the government in the last two decades have worked at different extent, but there are not yet any systematically effective rangeland management mechanisms for the area. ICI-MOD supported an integrated desertification controlling mechanism which integrates local people's active re-vegetation efforts and adequate scientific supports, with focus on climate change adaptation strategies and the payment of ecosystem services. This project, integrated wise use of collective intelligence and available resources to enhance ecosystem services and local livelihoods; build up the capacity of local communities in combating desertification to adapt to the changing social-economic and climatic environment.

Keywords: Climate change, Desertification, Ecosystem, Rangelands

20 years of watershed management in Niger: Approaches, impacts and economic aspects of large scale soil and water conservation measures

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Since more than 20 years, German Development Cooperation is fighting against desertification in Niger. More than 400,000ha of private and communal land have been treated with different soil and water conservation (SWC) and restoration techniques (stonebunds, dykes, Nardi-ploughing etc.) as well as with management regulations. The programme has been implemented

with intensive participation of the population contributing a major part of the work. Today the programme is the world largest German-funded SWC-programme. The large-scale application of SWC techniques on rainfed fields and grazing areas has resulted in reduced soil erosion and increased infiltration causing significant increases of cultivated area, grain and biomass yields. Groundwater tables have increased and tree growth and biodiversity enhanced. Long-term measurements of yields and biomass for a period of 14 years show long-term grain yield increases of around 200 kg/ha on rainfed fields and a biomass production between 200 and 1,400 kg/ha on formerly completely degraded laterite plateaux. Cost benefit calculations indicate overall low investment costs for the SWC measures and positive returns on investment for almost all techniques. Techniques applied in fields turned out to be more profitable than techniques on communal grazing land. Overall, agricultural has been intensified by applying organic fertilizers or mulch and by integrating trees. The eco-physical changes of the environment have led to improved food security and income and have improved social cohesion in villages and strengthened the role of women. Today additional food is produced for around 400,000 people.

Keywords: soil and water conservation, cost, impacts, yield, Niger

In measuring trade-offs values of the policy management options: case study of dry forest land of the national park of Djoudj in Senegal

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This study made an attempt to account for the contribution of forest ecosystem services to the economic wellbeing of neighboring households of the national park of Djoudj in

northern Senegal. The study also focused on the comparison of the economic value of the conservation of the protected area with other alternatives of land used (agriculture and extensive livestock). The study established values for a number of major products and services from the protected area. Rural communities were found to derive a total value of 131287 CFA (averagely 275 US dollars) per household every year in the form of different services related to the presence of the park through ecotourism, fishing, firewood, and jobs indirectly created by the park. The study also estimates the opportunity costs of biodiversity conservation in the Djoudj national park area from the potential net returns of agricultural and livestock production. Using a safe minimal standard approach within a timeframe of 25 years, the opportunity cost of maintaining Djoudj national park is substantial, and conservation comes in the second position with a net return of 6256 CFA or 14 USD/ha/year after farming (225 178 CFA or 460 USD /ha/year and before livestock which provides 2182 CFA or 5USD/ha/year which is about a third of that of conservation management option.

Keywords: Ecosystem services; opportunity cost; biodiversity; Agriculture and livestock

Assessing social-environmental cost of the management policy of the dry forest ecosystems: An application of the safe minimum standard model in Cameroon and Senegal

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This study is an attempt to solutions to the questions raised by a comparison of the economic value of protected land with those from other forms of land use (agriculture, breeding). The main objective is to analyze, from total economic effectiveness point of view (i.e., by integrating the ecological costs and advantages), the rationality of the op-

tion to preserve the dry forest ecosystem of Northern Cameroon and Senegal to the detriment of the other possible alternatives of land uses. The safe minimum standard approach with a dynamic scenario in a time frame of 25 years was conducted in similar agro ecological regions of Cameroon and Senegal. Although without all the nonmarket benefits included, land conservation is the second best management option after agriculture. The study also estimated social cost or trade-offs value associated with the adoption and or change in the long run (25 years) management options of these fragile ecosystems. There is a challenging issue related to the distribution of the supporting cost regarding different scales and different involved stakeholders. The convergence of the results obtained in the two countries is confirming the robustness and the usefulness of scenario assessment as a tool for guiding policy making in the sustainable management of fragile ecosystem under high social demand and great pressures.

Keywords: Dry forest; social cost; trade-offs; land uses; protected areas

Exploiting provision of land economic productivity without degrading its natural capital

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About 16% of the global terrestrial land area saw improvement while a quarter of the area experienced degradation between 1981-2006. Much of land improvement occurred on managed ecosystems – namely rangelands, forests and croplands. About 42% of the very poor and 32% of the moderately poor live on degraded lands and this contributes to poverty and hunger. The major reason for severe land degradation and its impact on poverty is the limited investment in land improvement in developing countries. A number of strategies are required to achieve

sustainable natural capital management and socio-economic characteristics in countries and regions which have succeeded in prevention of land degradation and/or rehabilitation of degraded lands offer useful lessons. We highlight four major strategies, which empirical evidence has shown that they could effectively enhance sustainable natural capital management if they are simultaneously provided: (i) Economic incentive for sustainable natural capital management exists. A number of studies in developing countries have shown that when poor land users receive remunerative prices of their land-based products, they are likely to sustainably manage their lands. For example, the famous study in Kenya – “more people less erosion” – showed that farmers in Machakos in Kenya managed to invest in prevention of soil erosion because they had better market access and received remunerative prices for their agricultural produce. (ii) Strong national and local institutions & policies. A recent study showed consistently that government effectiveness - government’s capacity to implement policies with independence from political pressures and with respect to the rule of law – positively affects land improvement. Additionally, policies and institutional favorable to land management lead to better land improvement and to prevention of land degradation. For example a rural code statute in Niger gave farmers tree tenure and this led to more widespread protection of trees. (iii) Access to rural services: access to technical advisory services, market services and other rural services favors sustainable land management. (iv) Payment for ecosystem services (PES): Since sustainable land management (SLM) can provide both local and global benefits, PES can help internalize the off-site benefits SLM. However, PES have been working best in countries with efficient markets and less so in countries with poor markets.

Keywords: Sustainable land management, land improvement, government effectiveness, economic incentives, rural services, institutions

Restoration trials and management in a highly degraded site in southern Europe – the benefits of a functional approach for dryland restoration

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Desertification and land-degradation are increasingly affecting drylands, seriously compromising critical ecosystem services. Since these areas support over 38% of the human population, there is an urgent need to prevent the crossing of irreversible degradation thresholds mainly through restoration actions. In the last decades, ecotechnological tools to promote plant cover restoration in drylands underwent substantial advances. However, restoration programs often lead to undesired or unpredicted outcomes and/or fail to restore ecosystem functioning and/or resilience. In addition, climate change projections of increased drought and extreme meteorological events will contribute further to the unpredictability of restored ecosystems’ trajectories. Dryland restoration research has been largely dedicated to the improvement of a few species performance (e.g. late-successional shrubs), while the recovery of ecosystem functioning as a whole and the contribution of biotic interactions have received less attention. Plant functional traits are a promising and integrative tool in restoration by considering species functional role and thus their contribution to ecosystem processes and functioning. They embody synergistic effects between ecosystem components leading to restoration thresholds

which may provide high benefit at low restoration cost. In this work we describe several research trials aimed at improving restoration success in a highly degraded ecosystem – a limestone quarry - located in a dry sub-humid area in the southwest of Iberian Peninsula. We test techniques to improve soil condition and species selection and establishment. We discuss functional diversity of “restored ecosystems” as well as their sustainability and resilience. Overall, our results emphasize the importance of i) species selection (and their relative densities) based not only on the morpho-functional advantages and provenance of individual species but also on their functional complementarity/redundancy for ecosystem functionality; ii) post-restoration monitoring and management to check (and redirect if necessary) ecosystem trajectory and evaluate its functional status. General conclusions and guidelines apply to drylands worldwide.

Keywords: drylands restoration, functional complementarity, plant functional diversity, post-restoration management, restoration thresholds

Case studies of community projects on sustainable land management from different archetypes and regions of the world: experiences of the GEF Small Grants Programme

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The Global Environment Facility Small grants Programme has implemented over 14,500 community based and managed projects. About 322 projects are from the sustainable land management area with more than \$20 million in the form of direct grants and co-financing. Through the country driven process, communities have remained innovators, thrifty and conscious in managing their land based resources for themselves and posterities. The key drivers of resilience of communities come from

the need to survive, secure long term livelihoods. The investments in traditional knowledge, volunteerism lifestyles, learning by doing, banking on the youth energies are the social capitals in which these are based. The methods highlighted are driven by the need for adaptation to impacts of pressures, such as population growth, food security and climate change variability. Experiential learning is the key driver within the practices embraced by community groups. The paper discusses evidence and present findings on selected practices to manage degradation of land resources at local levels and the need for applied research from initiatives to inform better handling of drivers of change. It also present an argument, on how much and in what ways it may take, in the form of human and capital resources - to rehabilitate a degraded land area into a productive landscape by communities.

Keywords: Community based, Adaptation, SLM

Re-examining economic orthodoxies: interactions of poverties and wealth and the creation, verification dissemination and adoption of SLM approaches

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Perceived financial incentives for farmers to adopt sustainable approaches to land use are constrained by competing demands on scarce financial and labour resources, and by relatively short time horizons for earning returns on marginal improvements. This paper examines how farmer participatory SLM interventions were initiated in the west of South African to support the objectives of the farmers and enhance land use practices based upon local knowledge, culture and tradition whilst drawing on external sources of technology and enabling innovation. Participatory Action Research has shown that from the perspectives of the land users and development agents, low-cost in-

terventions have enhanced sustainability. Interventions have been situated within a wider interactive learning process that has created opportunities for peer assessment and evaluation of the technologies and their contribution to sustainability of the family farming enterprise. Land use practices have evolved through iterative learning cycles and have created conditions in which greater resilience of the farming systems has been achieved. By contextualising extreme climatic events within the learning process as opportunities for learning, further stimulus has been provided for enhancing sustainability. Over the past 12 years the intervention has strengthened linkages between learning and livelihoods, stimulated the development of a local, market linked institution and provided a range of appropriate incentives for additional investments by, and recognition of the land users. Analysis of costs and indication of long-term benefits of the interventions is provided.

Keywords: farmer participatory SLM, learning, costs/benefits

Agro-ecological rooibos production

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In the arid west of South Africa an isolated farming community descended from the ‘first people’ applies agro-ecological approaches in producing a tea from indigenous *Aspalathus linearis*, or rooibos. Drawing on traditional knowledge and adapting to evolving climatic, economic and market circumstances, small-scale farmers of the Suid Bokkeveld have joined together to form a co-operative that promotes and exports their product as an ecologically-sound product made in the traditional manner. The production area is situated at the northern extremity of the Cape Floristic Region, one of the world’s major floristic kingdoms, and immediately adjoins the species-rich Succulent Karoo biome, with its high levels of endemism. The

locally occurring sub-species of *Aspalathus linearis* is particularly drought-resistant and has been utilised since pre-history for the production of rooibos tea. A fast-growing cultivar is planted to produce rooibos tea using broad-acre techniques. Application of modern farming techniques has caused environmental destruction, land degradation and biodiversity loss. Small-scale farmers of the Suid Bokkeveld farmers have embraced ecological agriculture as a vehicle to achieve more sustainable and improved livelihoods. Farmer participatory research has verified traditional management approaches, broadened local knowledge and contributed to expanding the horizons of academic knowledge. The research has generated new knowledge and transformed practices regarding the sustainable management of wild rooibos populations and the propagation of cultivated organic and wild rooibos. New and more sustainable practices have evolved for fire management, pest management, provision of ecosystem services by pollinators and predators and land and water management.

Keywords: local knowledge, rooibos, farmer participatory research

Degradation of vegetation formations in the centre of Benin Republic: socio-economic factors and implications

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The present paper analyzes the degradation of the vegetation formations in the centre of Benin. It evaluates the factors and implications of the regression of the vegetal ecosystems. The regression of the vegetation areas has been analyzed using remote sensing multispectral and multitemporal data, Landsat TM 1986, ETM 2000 and NigeriaSat1 of 2006. A field investigation with questionnaires using a stratified sampling technique was carried on 430 actors in order to assess the socio-economic factors of the vegetation

degradation. The contingency analysis was carried out to know the cost of the vegetation regression when a tree is cut down, in each district of the centre of Benin. The vegetation areas changes at an annual rate of -4.3 %, with the regression of dense vegetation formations and the expansion of farmlands, settlements and savannahs between 1986 and 2006. It has been noted the emerging of new economic activities such as wood exploitation and commercialization, charcoal production, activities that are seriously hawking even forest reserves in the area. The contingency analysis reveals that the cutting down of trees is easy for timber producers and other actors. Those actors consent to pay a cost of about 12 USD per tree to be allowed to continue cutting down trees for their businesses in Bassila and about 295 USD in Ketou districts. This means people face less opposition to damage forests in Bassila than Ketou. Protective actions are therefore required in Bassila district to preserve the sustainability of the forest ecosystems.

Keywords: Vegetation, satellite images, Benin, degradation, environmental cost

Fung Su and self-organized landforms: an old but new conceptual framework for sustainable land management

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Feng Shui is an oriental system of geomancy that was widely practiced in ancient agricultural communities in Far East Asia. Contemporary interpretations of Feng Shui are mixed, ranging from a superstitious belief system to a plausible landscape design principle. Despite recent growing interests from cultural studies, architects, and landscape ecology, relatively little attention has been paid to its implication on sustainable land management. This study aims to identify land management components in Korean Feng Shui (hereafter Fung Su) from the perspective of a nonlinear dynamic system theory of landform evolution, and to derive

any applicable rules for modern land management practices. We found Fung Su has a unique set of multi-scale approaches to classify the hierarchical nature of environmental processes related to landscape characteristics. The most important aspect of Fung Su, however, is to capture three-dimensional forms of landscapes to characterize unique combinations of landform forming processes, also called Hyung Kuk. This procedure shows a close resemblance to the identification of scale-free, self-organized landforms in current geomorphological studies. When such Hyung Kuk landforms are identified, human interventions are mostly limited to enhance evolutionary pathways of self-organization. Such activities are called Bi bo (making up for the weak points) that include digging a small reservoir, planting trees, filling up ground etc. We conclude that Fung Su offers a unique conceptual framework to classify landscapes, to characterize three-dimensional landform processes, and to manage landscapes in a holistic manner. This principle can easily be transferable to other environmental conditions with minor modifications.

Keywords: Fung-Su, Self-organization, Landform evolution, SLM, Complexity

Redimensioning tensions for old structures: traditional technological devices in drylandscapes and territory management

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Traditional knowledge is a field of exploration which, in its construction phases, was crossed by a valuation/devaluation pendulum. In the case of knowledge linked to desertification processes and land management, it has been mediated by a valuation based on criteria stemming from the technical field rather than by the comprehension of the logic of production/reproduction. This

situation has led to conceive extreme paradoxes like the destruction of devices that act as nature conservation strategies. Hence, we ask: What do these artifacts mean to the communities that produce, use and maintain them? What are the benefits these communities get from them? In an attempt to answer these questions, this work addresses the role that traditional technological devices play in constructing landscape in drylands and explores their potential use for a more sustainable management of territories affected by desertification processes. From a case study, and using qualitative methodologies and in situ surveys, we identify the technologies and devices that are part of the traditional knowledge associated with access to water, with special emphasis on “jagüel” wells and landscapes emerging from these practices. Then, we evaluate the potential use traditional knowledges in strategies for heritage conservation in land management. Finally, the conclusions put forth some theoretical-conceptual considerations, and raise new questions in light of the resilience capacity of these systems in the new scenarios.

Keywords: Traditional knowledges, drylandscapes, wells, territory management

Sustainable land management – a solution oriented funding programme

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The funding programme “Sustainable Land Management” of the German Federal Ministry for Research and Education (BMBF) supports 12 collaborative regional scientific projects in different ecosystems. The projects are designed for a five years period (mainly started in 2011) and try to find applied solutions for problems caused by unsustainable land management practices. Stakeholder participation and partnerships with local scientific institutions are required parts of each project. Several projects explicitly deal with

arid or semi-arid ecosystems: (1) SuMaRiO (Sustainable management of river oases along the Tarim River / China) tries to build up a science based decision support system for problems of irrigation, desertification, soil salinity and alternative crop production systems in an area dominated by cotton production in China; (2) SuLaMa (Participatory research to support sustainable land management on the Mahafaly Plateau in South-Western Madagascar) tries to provide sustainable solutions for land management in a semi-arid forest region, where the problems of overexploitation are deepened by climate change; (3) KULUNDA deals with the problem of Russian steppe ecosystems which run the risk to turn into global dust bowls under changing climate conditions. Adapted agricultural management and tillage operation together with advanced restoration efforts might help to mitigate degradation and desertification processes. All regional projects are supported by the scientific coordination project GLUES that provides climate scenarios, communication support and outreach activities.

Keywords: sustainable land management, funding programme

Institutionalization of desertification monitoring in Argentina: Development and implementation of the National Observatory on Land Degradation and Desertification

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On the basis of the Land Degradation Assessment in Drylands (LADA, 2003-2011) project, that successfully addressed the problem of land degradation in Argentina, the Secretariat of Environment and Sustainable Development (SAYDS), the National Scientific and Technical Research Council and its institute with involvement in the theme (IADIZA), the National Institute of Agricultural Technology (INTA) and National Universities designed and realized the National Observatory on Land Degradation and Desertification. The structure of the Observatory consists of a Steering Committee presided by the SAYDS which includes the coordinator and an Advisory Council, which is a consultative and advisory body, and the public in general with differential access to the information. The observatory was created in December 2011 to support decision-making in land management. Further purposes are the consolidation of permanent bio-physical and socio-economic monitoring and assessment of land degradation and desertification, as well as encouragement of mitigation, adaptation, prevention and restoration practices. Therefore the observatory is in charge of collecting, standardizing and generating information at different scales and offers a WebPage with synthetic indicators and maps based on updated information from rigorous and reliable sources. The observatory is a successful example of partnership building between the political and scientific technological sectors in Argentina, whose first tasks were to provide the two impact indicators demanded by the UNCCD: Land Cover Status and Proportion of population living below the poverty line. The second indicator has been replaced by a proxy: Unmet basic needs, because the existing data did not allow its construction.

Keywords: National Observatory; Land Degradation, Desertification, Decision-making

Ingenious water management practices for climate change adaptation in Sri Lanka

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Sri Lanka, being a tropical island with a poor majority depending on weather-reliant livelihoods, is highly vulnerable to impacts of climate change. Surface runoff water receiving from monsoon rains in dry zone of Sri Lanka can be harvested and used immediately to agriculture irrigation or can be stored for later use to minimize the climate change impacts. Sri Lankan ancient surface water harvesting tank cascade systems were experienced very long time in the dry zone of Sri Lanka. Each system in the cascade is connected to the next tank through canal. Cascade system consisted with 4 to 10 or more small tanks and all tanks are located along the main inland valley or side valleys. Some of these tank cascade village irrigation areas also continue to remain as poorest areas of the country. Therefore, there is a real need to harness the beneficial aspects of cascading systems for combating the droughts as well as for alleviating poverty. On the basis of the Sri Lankan ancient tank cascade systems form and appearance, it is likely that cascading system would have operated as an ideal rainwater harvesting technology. The research study was conducted to identify foreseeable adverse impacts of climate change is the exacerbation of extreme climatic events such as droughts and floods in the cascade system of Sri Lanka. The study revealed that improvement and stabilize of cascade systems may prove beneficial to minimize climate change impacts and drought proneness or flood proneness in view of its time-tested buffering capacity.

Keywords: cascade, river basin, runoff, rainfall

Bridging science and stakeholders: integrated impact assessment for multifunctional land use in drought-prone Inner Mongolia, China

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Land intensification and droughts have caused tremendous land degradation problems in Inner Mongolia. Climate change, economic development and increasing demands for natural resources reinforce the transition of traditional land use in Inner Mongolia towards more economically oriented land use. Local decision makers are asking for science-based decision support that help to design and implement sustainable land use strategies. The objective of this study was to conduct an impact assessment of alternative land use scenarios in the drought-stricken case study of Inner Mongolia. The 'Framework for Participatory Impact Assessment' (FoPIA) approach has been selected for this study that takes the economic, social, environmental and institutional dimensions into account. A regional stakeholder workshop was conducted to identify the regional land use problems, sustainability issues and policy fields. Water scarcity and low economic development were identified two main land use problems. The sustainability preferences identified were attached to employment and the maintenance of soil and water resources; followed by the provisioning of biotic resources, infrastructure, food supply and cultural aspects, respectively. In a next step, expert knowledge will be used to assess the impacts of alternative land use scenarios on the identified sustainability issues. Results of the assessment will be reflected against the available scientific literature and presented back to stakeholders with the aim

to mutually elaborate sustainability oriented land use strategies.

Keywords: impact assessment; land use changes; scenario study; sustainable development; stakeholder-participation; science-policy interface

Costs of land degradation and benefits of land restoration: A review of valuation methods and suggested frameworks for inclusion into policy-making

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Land degradation has become a growing concern with the current increase in demand for arable land. Sustainable land management and land restoration practices are required in order to meet the demands to provide food and other services. Adoption of improved practices has however not been widespread partly due to a lack of clarity on the true economic value and setting of proper financial incentives. This article focuses on the economic costs of land degradation as a prelude to two on-going initiatives involving the United Nations Convention to Combat Desertification (UNCCD). We review how ecosystem services derived from land have been economically valued to date. Economic valuation has mostly focused on the use value of provisioning services and cultural services, with limited valuation of non-use value of cultural services. Also, no unique valuation method has been applied following methodological developments, varying study objectives and data availability constraints. These factors impair coherent and consistent estimation of the total economic value of land degradation across countries. We identify a need to develop harmonised valuation methods to estimate total economic value under strong data and capacity constraints. We propose two alternative frameworks for harmonised total economic valuation of land degradation at country-level to guide further research in making environmental valuation

more relevant and practical under strong data and capacity constraints.

Keywords: land restoration, economic valuation, ecosystem services, limited data, limited capacity

Restoring ecosystem services of rangelands through sustainable land management in salt range-Pakistan

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A Participatory Grazing Management Plan (PGMP) for 7,540 acres of rangeland was prepared of village Dhurnal located in the salt range of Pakistan, with the joint effort of local community organization (CO) and Forest Department (FD). The management of existing rangelands was improved through compartmentalization of rangeland to streamline rotational grazing system by using the information available on the productive potential of the rangeland. The local CO was empowered under an agreement signed with the FD to use the rangeland in accordance with the carrying capacity instead of auctioning the land area to private parties for management purposes. Furthermore, implementation of grazing schedule was jointly monitored by the representatives of CO and the FD. Range rehabilitation was demonstrated on 400 acres. The carrying capacity of rehabilitated rangeland increased to 2.3 acres/AU/year as compared to 22 acres/AU/year on the non-rehabilitated area. The total rehabilitation cost of 400 acres was Pak Rs. 3.378 million in which the contribution of CO was Pak Rs. 0.336 million. The CO expects to earn Pak Rs. 5.25 million from sale of 1750 sheep units to be supported on additional feed produced from 400 acres. The second part of the PGMP suggests measures for resource mobilization to reduce the span of rangeland rehabilitation process. The PGMP

intends to encourage private sector to rehabilitate rangeland of Dhurnal through horti-pastoral (olive+grass) model, silvo-pastoral (fodder trees+grass) model, introduction of ranching system or any other innovative mode that does not jeopardize the recorded rights of the local communities.

Keywords: Participatory Grazing Plan, Rangeland Services

Forest ecosystem resilience and rainfall variability in the southeastern part of Madagascar

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Remote sensing digital image analysis is applied to monitor the behaviors of the southeastern forests of Madagascar where rainfall values have been decreasing for the last decades. This study investigates the vegetation reacts in relation with rainfall variability using vegetation indices as NDVI (Normalized Difference Vegetation Index). Six Landsat images distributed in three time series (1984 November/ 1991 July, 2001 September/ 2002 January, 2009 June/ 2009 November) were exploited. Results indicate that significant and high correlation coefficients between the two variables were observed in the dry and in the transitional forest. Seasonal variability combined with year-to-year variability and a frequency of low rainfall values could involve degradation of the soil moisture and subsequently reduce the resilience capacity of the transitional forest.

Keywords: Normalized Difference Vegetation Index (NDVI), remote sensing, rainfall, Transitional forest, Dryforest, Rainforest, South-eastern of Madagascar.

Optimisation of a kiser-developed integrated sand control system using wind tunnel simulations

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Sand control methods have largely been utilized on trial-and-error basis in Kuwait and the rest of the Arabian Peninsula countries. To date, no specific technique/material has been identified as the most suitable for sand stabilisation. Short-term, inexpensive solutions, though attractive, are actually more costly and their effect is short-lived. The application of sand encroachment control measures without proper understanding of their impact on the overall pattern of sand transportation and accumulation can lead to the activation of Aeolian processes that enhance sand encroachment. An integrated sand control system (SCS) which combined elements of the three sand stabilisation techniques (i.e., mechanical, biological, and chemical) was developed by researchers at Kuwait Institute for Scientific Research (KISR) as a result of an intensive research project. Though based on strong theoretical and field-based knowledge and experiments, the SCS has not been tested as a whole system. This paper sheds some light on a current project at KISR with the objective of assessing the effectiveness of this SCS through a series of wind tunnel experiments on a small-scale model of the SCS. The work will start by assessing the original design. This phase will be followed by a detailed parametric study to fine-tune the design to achieve the optimum sand control. In addition to its research value, the experimental results will boost the confidence in KISR's SCS and hopefully encourage its implementation in Kuwait and other Gulf States where the conditions are similar.

Keywords: Sand Control, Revegetation, Simulation, Sand Transport

Use of empirical land use dynamics models including climate and socio-economic parameter: a case study in rainfed agriculture area of South India

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Land use/ Land cover changes encompass some of the most important human and natural alteration affecting the surface of the earth. The increasing population leads to pressure on land is regarded as serious threat to food availability. Remote Sensing and Geographical Information System coupled with empirical modeling is recognized as a powerful and effective tool in detecting land use changes and analyzing the drivers of changes towards to predict future changes. In this study, land use changes occurred between 1985-2005 were studied with two different land use models and the drivers of the changes related to climate and socio-economic parameter were studied in a rainfed agriculture area. The land use change of 1995-2005 was predicted based on this model and validate using Receiver Operating Characteristics. This model was effectively predicted for 2005-2015. This was applied on dry land area of Pudukkottai district of Tamil Nadu, India which failed to receive rainfall for several consecutive years. About 31.23 sq km land is lost from agriculture to scrub due to the scarce rainfall and migration of people outside the districts. Other land such as scrub to agriculture about 18 sq km of transformation happen due to the state sponsored development scheme to improve the productivity. The ROC model was found to be 0.63 for logistic regression model and 0.65 for Geographical regression model. It was found that Geographical weighted Regression (GWR) is better suited for spatial modeling than logistic regression. Visualization of images and effects of land use dynamics is very helpful in planning strategy

Keywords: Remote Sensing, Receiver Operating Characteristics, Geographic Information System, Logistic regression, Geographically

weighted regression and degradation

Agroforestry: A viable alternative for sustainable land management

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The purpose of his paper is to share on-farm research findings on agroforestry as a model to sustainable land management under Cuban conditions. The research was carried out in 6 livestock agroecosystems: 4 devoted to dairy production and 2 to beef production. In 3 dairy farms and 1 fattening farm was planted *Leucaena leucocephala* in its grazing area with a density of 3440, 5480, 6350 and 14 298 trees ha⁻¹, respectively. The remaining two agroecosystems were used as control. Holstein x Zebu crossbreds were used. Lactating cows were milked twice a day, whereas fattening cattle were subjected to a growth-fattening period of 110 and 154 days during rainy and dry seasons, respectively. As sustainability indicators were measured: (i) botanical composition of grassland, (ii) quality and yield of biomass, (iii) milk yield, (iv) reproduction performance, and (v) body weight gain. All these indicators were significantly higher in agroforestry systems, when the tree density ranges between 5000 and 6500 trees ha⁻¹, and a botanical composition is dominated by improved grasses. However, when the tree density was higher than 14000 trees ha⁻¹ the biomass yield was affected, and when it was lower than 3500 trees ha⁻¹ there was no signs of sustainability. It is concluded that agroforestry, mainly with *L. leucocephala*, is a viable alternative to achieve the sustainability of land management. For this purpose 5000-6500 trees ha⁻¹ is recommended.

Keywords: Agroforestry, leucaena, livestock, agroecosystems

Methodological reflections and the practice of evaluation, main outputs of the Montpellier seminar

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The communication is a review of evaluations main meanings, methodologies and uses, based on various experiences and coming out of a variety of disciplines in social sciences. It aims at presenting a set of types of evaluations and discussing their strengths and weaknesses regarding methodologies and impacts on sustainable land management. It relies on concrete examples resulting from several scientific research programmes/projects/. It is based on the Montpellier seminars analyses and outputs. Economic or financial evaluation is often presented as the major approach because it gives results in terms of financial and economic return of actions to combat desertification. However, economic evaluation implies comparing two situations, one with the action, and the control situation through time, but this can only be done through heavy protocols of experimentation. External factors in the analysis can change the meaning of the results comparing both situations. From a purely natural resources management perspective, evaluation implies first elaborating a relevant environmental baseline as a condition for assessing an action. This approach (if it's the natural resource management perspective ?) enlightens more the socio-political context of projects, policies and programmes and help to guide their implementation. A last category of evaluation puts the local actors at the heart of the evaluation process. Then evaluation can be presented as a direct tool for enhancing local development and not just as a tool for funding and implementing bodies to report on their activities or to elaborate further policies and projects. It is strongly linked to local actors' organization and capacity building for

land planning in a context of decentralization of the management of natural resources.

Keywords: Evaluation, disciplines, approach, indicators, projects, programmes and policies to combat desertification

Prevention and restoration actions to combat desertification. An integrated assessment. PRACTICE Project

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PRACTICE (Prevention and Restoration Actions to Combat Desertification. An Integrated Assessment) is a Support Action of the European Commission Seventh Framework Programme for Research and Technological Development. The central goal of PRACTICE is to link science to society in order to share and transfer evaluation methods and practices to combat desertification. To pursue this goal, PRACTICE first aims to develop and implement an integrated evaluation protocol to assess the effectiveness of prevention and restoration practices, applicable worldwide. The evaluation protocol of PRACTICE considers the mutual interactions between human and environment. The assessment protocol also represents an integrated approach because considers simultaneously both, biophysical and socio-economic attributes. The protocol is based on (1) key common indicators that represent overall ecosystem and human-environmental system functioning, (2) site-specific indicators identified by local stakeholders that are relevant to the objectives and the particular context conditions, and (3) stakeholder perspectives. Indicators are selected in the framework of ecosystem services developed by the Millennium Ecosystem Assessment (MEA), focusing on human well-being and trying to be consistent with the desertification impact indicators selected by the UNCCD (United Nations Convention to Combat De-

sertification) and with recommendations by CBD (Convention on Biological Biodiversity) and UNFCCC (United Nations Framework Convention on Climate Change). Multi-criteria decision models will be used for integrating the information provided by the various biophysical and socio-economic indicators and for integrating the stakeholder perspectives. This paper presents the project and its results, which are directed to meet specific needs of UNCCD in the field of project evaluation

Keywords: Desertification, Restoration, Assessment, Socioeconomic, Stakeholders

Governance in managing the risks of extreme events and disasters. The global environmental changes from climate changes to desertification, drought and famine. A new global network of information sharing to guarantee and protect our planet, our health.

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In the 21st century the global environmental changes due to climate changes, desertification, drought, famine, water scarcity and poverty open a new matter of the discus-

sion on population protection, causing a dramatic increase in the demand for emergency medical care and global policy. Disasters are generally considered “low probability –high impacts events”, always arise from some disequilibrium between hazards in the environment and the vulnerabilities of human communities. The prediction of a future disasters could drive the efforts of the public policy and government funding. The aim is to create a Global Network of Information Sharing on Disaster Emergency (DE) to protect people, to guarantee and protect our planet, our health and our future with a multidisciplinary, trans-disciplinary approach according with the principles of governance and resilience. The idea is to develop a new network that interacts and works according with the ICT new tools, focusing the attention on emergency preparedness, mitigation and disaster risk reduction. The emergency of scarcity and the biodiversity crises will represent the “File Rouge” of this network activity. This network will improve the sharing of public health information, balancing the different countries security and preparedness governance tools related to any disaster and humanitarian medicine emergencies. Saving lives, livelihoods, promoting human security, attention to human dignity, no-discrimination and administrative coherence should be represent some crucial points of a future policy in management and building future network of information sharing.

Keywords: Climate Changes, Desertification, Drought, Disasters, Public Health, Networks, Governance, Resilience, Information Communication Technology.

Sustainable land management and carbon finance: a case study on landless mobile pastoralists in the Hindu Kush Himalaya mountains of northern Pakistan

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Landless mobile pastoralists in the Hindu Kush Himalayan Mountains of Pakistan produce milk and meat, maintain biodiversity and conserve soil. However, the provision of these services is at risk as some herders' cash cropping activities have encroached over alpine summer pastures decreasing grazing land availability. Tilling high altitude steep slopes degrades soils and requires increasing fertilization to sustain yields. This study quantifies carbon (C) in cropping and pasturing land uses in the Naran Valley, hypothesizing that (i) cropping over pastures reduces C stores, and that (ii) avoided emissions from preventing the conversion of pastures into cropping fields may yield more C payment than conventional improved pasture mitigation activities. For (i) a one-way analysis of variance on mean soil organic C shows that all variables taken separately have a significant effect ($P < 0.01$) ($n=72$) [g kg⁻¹]: (land use) crop/pasture 13.3/15.9, (aspect) North/South 16.1/13.2, (elevation) low/middle/high 10.9/16.2/16.8, (soil depth) shallow/deep 1.4/1.53. For biomass C, only land use has a significant effect ($P < 0.01$) with more than twice the amount in pastures ($n=36$) [g m⁻²]: crop/pasture 127/318. Enteric methane from livestock in the pasture scenario is largely nullified by increasing greenhouse gas releases due increasing fertilizer inputs needed in the cropping scenario. For (ii), preventing the conversion of pastures into cropping fields avoids an average loss of 12.2 t C ha⁻¹ or 44.8 t CO₂e ha⁻¹. This ongoing study aims at demonstrating whether renouncing cropping based on REDD+ principles of avoided emissions can further SLM on fragile alpine pastures.

Keywords: soil organic carbon, poverty alleviation, climate smart development, payment for ecosystem services

Sustainable management of river oases along the Tarim River, P.R. China (SuMaRiO)

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In northwestern China, the endorheic Tarim River is running along the northern rim of the Taklamakan desert. It is the solely water source for the whole region as precipitation is low. The river is mainly fed from water of snow and glacier melt, causing floods in the summer months. Due to the global climate change the annual water discharge is increasing. But not sufficient water flows downstream, as the region is the main production area of cotton in China. A conflict arises between water users of the upper reaches and water users of the lower reaches of the Tarim River as well with the natural vegetation. The central question of the Sino-German SuMaRiO project is how to manage land use, i.e. irrigation agriculture and utilization of the natural ecosystems, and water use in a very water-scarce region, with changing water availability due to climate change, such that ecosystem services and economic benefits are maintained in the best balance for a sustainable development. The overall goal of the project is to support oasis management along the Tarim River under conditions of climatic and societal changes by: i) developing methods for analyzing ecosystem functions/ ecosystem services, and integrating them into land and water management of oases and riparian forests; ii) Involving stakeholders in the research process to integrate their knowledge and problem perceptions into the scientific process; iii) Developing tools (Decision support system) with Chinese decision makers that demonstrate the ecological and socio-economic consequences of their decisions in a changing world.

Keywords: water-scarcity, irrigation, decision support system, ecosystem services, land and water management

Numerical model to assess the impact of the strategies to mitigate desertification

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Desertification is considered a global environmental problem with political and socio-economic implications. Desertification, exacerbated by climate change, is the largest environmental problem in Chile affecting almost two third of the national territory. This study takes place in a latitudinal gradient of the north-central Chilean drylands, where desertification is a threat to agriculture, livestock and forestry (ALF). In the context of the United Nations Convention to Combat Desertification (UNCCD) and the implementation of the Chilean National Action Programme (NAP), the country is conducting policies and investing in mitigation strategies to combat land degradation and desertification. The main objective of this paper is the development of an integrative methodological approach using real data of the territorial and socioeconomic indicators. With the proposed methodology we assess the impact of the mitigation and land degradation strategies supported by the ALF promotion agencies in the fight against desertification, projecting different scenarios of change. The data were collected in 2008 in Santiago, Chile. The results of the Principal Component Analysis (PCA) suggest that technical irrigation and the improvement of grasslands and pastures play an important role in the fight against desertification. The results of the model projections are consistent, suggesting that the efforts of the ALF promotion agencies have a positive impact in fighting desertification. Inaction of ALF mitigation strategies would increase desertification. This methodological approach, performed with real data, is a contribution for the development of integrative assessments, for replication and for forthcoming discussions.

Keywords: Mitigation investments - Atacama Desert - Climate change - Desertification - Dry lands - Indicators - Mitigation strategies- Mod-

eling - Water scarcity

Enabling policies for supporting local area development initiatives to combat desertification TPN-6 of UNCCD for Asia and the Pacific

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Thematic Program Network 6 (TPN6) "Assistance for the Implementation of Integrated Local Area Development Initiatives" is aimed at promoting bottom-up and participatory approach through involvement of community based stakeholders on mitigating issue of drought and desertification. Member countries of TPN-6 include China, Fiji, India, Indonesia, Iran, Kyrgyzstan, Lao PDR, Lebanon, Mongolia, Pakistan, Philippines, Samoa, Sri Lanka, Syria, Tajikistan, Thailand, Uzbekistan, Viet Nam and Yemen. Review of national policies, programmes and plans of TPN-6 member countries that specifically support local area development was conducted. Better solutions for future were suggested. The main inputs were provided by some of the TPN-6 member states for which a questionnaire was developed and circulated among the focal points of TPN-6 member countries. A regional consultative workshop was organized at Islamabad in July 2008 to disseminate findings of the study to stakeholders including those representing regional countries. China's Agenda 21, desertification related national policies and main programs and projects of Fiji, India, Pakistan, Lao PDR, Lebanon, Philippine, Syria, Thailand, Vietnam and Yemen were particularly discussed with respect to encouraging community participation and CBOs' role in DLDD and SLM related programs and recognizing gender aspect; decentralization of land management; access to land and land tenure reforms; micro-credit, subsidy and financial support; recognition of societal solutions & encouraging indigenous / traditional knowledge and market access. Impacts of

such policies, possible financing sources and recommendations for future policies were also discussed. Options for mobilizing further resources for DLDD were discussed. Previous data in the report was updated.

Keywords: Enabling policies to combat desertification

Flash flood mitigation and water harvesting in Wadi Al-Khoud, Sultanate of Oman

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Arid and semiarid regions are increasingly suffering from water resource shortage as a result of increasing populations, urbanization, and global warming. Oman's water resources are under increasing pressure. This could soon lead to a several problems for the development. We need to find the best solution to benefit available natural resources. Water harvesting could be one of the best methods to solve decreasing water in the area. Although the Flash flood in Oman caused hazards, but at the same time is considered fresh water resources which we can benefit from. In fact, floodwater harvesting could be a solution to provide another conventional water resource and at the same time to mitigate flash flood hazard. In this study, a methodology for selecting the suitable site to construct the storage, charging dams along the main stream of Wadi Al-Khoud. The sites of the suggested dams were selected using GIS and remote sensing techniques. The primary results showed a promising potential of water harvesting. The selection of the sites is based on several factors undertaking physical, socio-economic, ecological data. The study concluded that the potential of water harvesting exists and implementing to charge the sustainable development in the study area.

Keywords: rainfall- water harvesting- flood hazard- hazard mitigation- storage dam

Land pooling system in the Kathmandu valley - Successful in financing infrastructure but failure in achieving urban environment

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The detail analysis of planned neighbourhoods in the Kathmandu Valley through land pooling system based on the structured questionnaire survey, discussion with local community and the concerned agencies reveals that such practice has been limited to small scale land development with formation of residential plots, successful only in financing basic urban infrastructure but failure in achieving lively urban environment. Absence of master plan and development control of the Kathmandu Valley, lack of planning standards and guidelines for land subdivision and infrastructure provision combined with poor technical and managerial capabilities of the implementing agencies namely Kathmandu Valley Development Authority and Municipalities and absence of other mechanism in financing the development cost other than contribution from the benefited landowners all have not only reduced the scope of using land pooling technique for large scale urban development but also limited the effectiveness of land pooling projects in realising the planning goals of city development. To reverse this trend, designating the land pooling area as 'comprehensive development zone' and formulating planning standard and urban design guidelines under the leadership of urban designer together with enhancing coordination and cooperation with the concerned line agencies (of infrastructure development) as a short term solution and preparing master plan and development control regulation at city level as a long term strategy is essential. Moreover, the strengthening of the implementing agencies and identification of alternative financing mechanism together with involvement of private sectors based on the scale, size and nature of the project is recommended.

Keywords: Land readjustment (pooling), Kathmandu Valley, Infrastructure provision, Urban environment, Master layout plan

Looking to the future - a new land degradation strategy. audience and panel discussion

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The current (GEF-5) Land Degradation Focal Area Strategy continues to 2014. It has successfully catalysed investments to promote system-wide change necessary to control the increasing severity and extent of land degradation. Nevertheless, there is recognition that with the current approach the scale of resources necessary to achieve lasting wide-scale benefits is far greater than can be provided. New approaches that address ecosystems and natural resources as multi-functional units providing co-benefits for the environment and for human development need to be developed. This Special Session has suggested that Soil Organic Carbon presents one opportunity to meet the challenge. Our final segment of this Session will invite dialogue between the audience and presenters on issues and approaches that should be included in the new GEF Land Degradation Strategy. Questions to be posed will include: (i) What technologies bring most benefits; and under what conditions? (ii) Are there pilot approaches worth replicating? (iii) Do we need new or enhanced support systems to support the choice of approach and technology? (iv) What policies and incentives will be required to deliver truly global benefits?

Keywords: carbon, global environmental benefits, valuation of ecosystem services, sustainable land management, soil organic carbon

Channelling science into policy: Enabling best practices from research on land degradation and sustainable land management in drylands

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Demands are increasing for scientific research to be explicitly and demonstrably policy relevant. Research funders are requiring greater returns on their investments and scientists are expected to demonstrate clearly how their research can inform policy and regulation to deliver positive consequences for societal, economic and environmental wellbeing. Within the co-evolving context of environmental management research in dryland Africa and the policy approaches designed to mitigate land degradation, few academic analyses have deconstructed the practical 'bottom-up' actions that can help to channel scientific research into national decision-making and policy. Similarly, while international platforms developed by the United Nations Convention to Combat Desertification have started to facilitate greater knowledge exchange between scientists and policymakers, analyses have failed to consider the powerful informal actions that scientists can take to allow their research to inform evidence-based international policy. Drawing on examples in the literature from research on land degradation and sustainable land management across sub-Saharan African drylands, we identify key enabling activities that help make scientific research more visible, accessible to, and compatible with, policy processes at local, national and international levels. We argue that these enablers are applicable to other environmental research areas beyond land degradation, and suggest that improved understanding of science into policy processes that look across multiple scales and levels will help researchers and policy-makers to better match information supply and demand to the mutual benefit of both groups. The presentation

will conclude with an outlook on how the lessons from African dryland research can be relevant for the CASCADE project.

Keywords: CASCADE project

Combating land degradation and desertification and enhancing food security: towards integrated solutions

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This presentation reports on the activities of the Food Security Working Group of DesertNet International, with specific focus on a recent paper that has been submitted for publication. Although theoretically the world produces enough food for everyone, approximately one billion people are estimated to be undernourished. Evidence further suggests that producing more food in an unsustainable way may place a much larger share of the population at risk of food insecurity. In the context of a growing world population and other important sustainability challenges

(such as land degradation and desertification, biodiversity loss, a decline in the availability and quality of water, and a changing climate), ensuring that agricultural and food systems are sustainable is a particularly urgent issue, both at present and looking forward to the future. This paper provides an overview of the relationships between food insecurity, land degradation and desertification, and its antithesis, food security and sustainable land management. It situates the review within the wider context of global food systems and the macro-processes that drive land degradation and desertification, placing particular focus on the world's drylands (i.e. arid, semi-arid and dry sub-humid areas). Despite their limited rainfall and high evapotranspiration rates, the drylands contain more than 40% of the planet's cultivated land area, thus making a significant contribution to global food production as well as being important for pastoralist and other livelihood activities. It is revealed that food insecurity can be attributed to a range of demand-side and supply-side causes, which include political, economic, social and environmental factors. Land degradation and desertification are shown to be exogenous issues that can amplify and aggravate food insecurity. Addressing desertification, including land, soil, water and plant degradation, can ease the food security dilemma, but may not completely solve it in the presence of other underlying causes.

Keywords: desertification, land degradation, sustainable land management

Development of a framework for cost/benefit analysis of ecosystem based CC adaptation actions in the Carpathian region

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An exact and complete description of the cost/benefit ratio of ecosystem services is often missing. Some studies investigate the costs, but not the benefits. Furthermore, in general, benefits of ecosystems focus on production functions, not on 'other' ecosystem functions. There is a gap in non-use benefits and secondary benefits. Therefore, a complete framework for assessing all relevant costs and benefits of ecosystem-based adaptation measures to climate and which is based on recent insights and developments in ecosystem services based CBA will be developed. Next to an approach to quantify all costs of an adaptation measure the framework will contain an approach for economic valuation of predicted changes in ecosystem services. During the further elaboration of the subsequent activities the framework will be refined to adapt it to the specific situation in the forestry, grasslands and wetlands of Carpathian region which is located in the Central-Eastern part of Europe. The Carpathian mountains are the second longest mountain range in Europe, but relatively low, therefore, according to the geographical situation, could serve as a good example of the integrated research on adaptive measures.

Keywords: ecosystem service, cost benefit analysis, climate change, Carpathians

The carbon conundrum in communal African rangelands

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The soil organic carbon (SOC) content of dryland soils is low compared to most other environments, typically <50 tons ha⁻¹ to 1m depth. Yet this C underpins the productivity of grazing lands which support the livelihoods of millions of pastoralists across southern Africa. The main sources of SOC are biological crusts (BSCs) and perennial grass roots, which means SOC is preferentially concentrated at the surface where it is highly responsive to changes in land use and climate. Recent research has shown that graz-

ing intensification depletes SOC stores by reducing C inputs from BSCs and grasses whilst also increasing C losses in CO₂ efflux. Light grazing impacts, however, had few adverse effects on the SOC store. Financially incentivising reductions in herd size could be a way of minimising grazing-related impacts, increasing SOC stores whilst maintaining farmer income. There are, however, several challenges which need to be reconciled before such schemes could work in dryland grazing areas. Firstly, because the absolute amount of C in dryland soils is small, any land use change seeking to optimise C storage will not result in large SOC gains or attract significant financial reward. Secondly, most of the benefits of SOC derive from its utilisation and depletion rather than its storage. Thirdly, grazing management schemes based on ideas of carrying capacity and rotation are problematic in fenceless communal rangelands. Fourthly, cattle are much more than an income source, they have broader cultural significance and convey social standing to families within their communities. Finally, precipitation and biological productivity are inherently unpredictable and conservative grazing strategies which fail to take advantage of the abundance of resources in good years are not appropriate. Farmers with larger herds gain maximum benefit from good rain and increase the chance of some animals surviving when drought returns and productivity drops.

Keywords: soil organic carbon, poverty alleviation, climate smart development, payment for ecosystem services

Towards an environmentally-adjusted macroeconomic index

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It is internationally acknowledged that GDP is a poor welfare measure of economic performance or society well-being - as it often ignores the true values of non-renewable re-

sources - and ultimately people aim at false targets (Stiglitz, 2008). Since the '70, researchers have worked towards generating methodologies to better reflect these missing GDP values into actual development indexes (Measure of Economic Welfare, 1973; Index of Sustainable Economic Welfare, 1989; Genuine Progress Indicator, 1990). Fast growing economies have felt necessary migrating from traditional to Green GDP (GGDP), which includes unaccounted loss of assets. There was much debate in Rio+20 and the ensuing review of MDGs, as to how and which particular indicators should be included in a Green GDP (Lomborg, 2012), but this would require a balanced judgment to establish a comprehensive integrated sustainable development index. Green GDP accounting does not include land depreciation (Zhishen, 2011), it only attributes on-site value to land. Also, externalities and land services beyond agricultural productions - such as common ecosystem services - are usually not accounted for. When marginal social costs of land degradation are higher than marginal private costs, the resulting rate of degradation is higher than socially optimal, and total social welfare is suboptimal (von Braun, 2011). The research aims at assessing current green indexes relevance to land use - beyond agricultural production - and at identifying ways and means to bring them into the global environmental and sustainable development agenda with particular regard to land degradation neutrality.

Keywords: green economy; social, economic and environmental indicators; gross domestic product; millennium development goals; ecosystem services; land degradation neutrality

Mapping of current and projected Pan-European water withdrawals

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Water scarcity remains a problem in Europe. Although there have been significant technological improvements over the last few decades, and per capita withdrawal is actually decreasing in several countries, there is still a need to assess and monitor the withdrawal and consumption of water resources, especially in the naturally more water scarce Mediterranean countries. We map both water withdrawals and consumption for the public, industrial (manufacturing), energy, and agricultural sectors. Water withdrawal statistics for the reference year 2006 were compiled from EUROSTAT, AQUASTAT, and national statistical and environmental agencies, where possible at regional level. The sectorial withdrawal maps were then created by disaggregation of these figures to the associated sectorial land use classes. Public water was assigned to the combined resident and tourist population density maps, industrial withdrawals to industrial land and selected infrastructure, and energy withdrawals to the most intensive industry class. Agricultural withdrawals were assigned according to the livestock density maps calculated by the FAO, and the irrigated areas. We projected water withdrawals to 2030 using a combination of historical water withdrawal trends, modelled land use change, and various other driving factors (ie. population and tourism growth, industrial GVA, and energy consumption projections). The impact of withdrawals in all sectors on the water supply was assessed by calculating the water exploitation index at regional level, that is, the ratio of water withdrawn to that available. The final maps indicate both the regions which are currently experiencing water stress, and those which are predicted to by 2030.

Keywords: Water withdrawal, land use, water scarcity

Linkages between desertification and human development in the western dry region of Rajasthan

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The Planning Commission of India has identified 15 resource development regions in the country, also known as the Agro Climatic Zones. Among the various regions, the Western Dry Region covers nine districts of the state of Rajasthan. The huge portion of Rajasthan is desiccated and houses the biggest Indian desert- the Thar Desert. The forest cover in these nine districts is showing a declining trend owing to the land being diverted to cultivation. Besides forests, the area under other land uses is also being diverted to cultivation. This can have serious implications on sustainability of the livelihoods and extent of poverty of the people in these districts. This in turn has implications on the health and other human development indicators. In this paper, the author has used the Markov Chain analysis to see the direction of change in the land use pattern in the districts covered under the Western Dry Region. The author has also examined the linkages between various human development indicators of these districts in light of the changing land use pattern in the districts.
Keywords: Desertification, human development, Rajasthan

Community participation in the sustainable land management of the Mapimi Biosphere Reserve in the states of Chihuahua, Coahuila and Durango, México

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With the aim of to order the use land in rangeland of the Mapimi biosphere reserve common assemblies were held and meetings with farmers of which were obtained community maps of natural resources, infrastructure and conservation indicators as animal load based on dry matter production plant, percentage of vegetation cover, diversity and density of vegetation, birds and turtles and site quality. The baseline was determined but such indicators, which served to establish the geographic information system and a program of restoration and monitoring of vegetation, wildlife and soil with the active participation of owners and users of lands through social programs financed by the federal Government of Mexico and NGOs. The results of these actions are as follows: from 2002 to 2012 increased vegetation cover in restored areas by 23%, floristic diversity increased 6 species, we identified 17 colonies bolson tortoise (*Gopherus flavomarginatus*, endemic and endangered species) eradicating their consumption and implementing monitoring strategy and community vigilance in 17 sites mentioned above; facilities were built for environmental education and training, vigilance and monitoring in three commons, tourism activity was ordered to integrate a group of a common for the implementation of ecotourism as an alternative economic activity to livestock, collaboration agreements were performed with 3 common and 1 small property to order the land use based on production capacity and distribution of wildlife, destining approximately 50,000 hectares of land for conservation of vegetation and wildlife and for soil restoration with the participation of 200 persons benefited directly from sustainable land management.

Keywords: Community participation, vigilance, land management, conservation indicators, collaboration agreements

Analysis of plans, programs and policies to combat desertification in the state of Ceará – Brazil in the period 2004 to 2012

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According to the State Programme of Action to Combat Desertification and Mitigate the Effects of Drought (PAE/CE), the State of Ceará-Brazil has three centers configured with areas susceptible to desertification which are the Hinterlands of Inhamuns, the Hinterlands Irauçuba and the Center North and the Hinterlands of Medium Jaguaribe, encompassing twelve municipalities and covering a total area of 26.432,65km². It is known that the problem of desertification in the State of Ceará acquired more notoriety from the Arid Project which subsidized actions such as the elaboration of the National Programme of Action to Combat Desertification and Mitigate the Effects of Drought. Since then, although with a smaller intensity than expected, noted that strategies to combat the phenomenon is being implemented in the State. In this context, the objective of this study is to conduct a systematization of the major Plans, Programmes and Policies (PPP) in the State of Ceará in the period from 2004 to 2012. To this end, documentary and bibliographic searches were carried out. The systematization was made taken as parameters: objective of intervention, implementation year, managing agency, participation of society, geographical area, obstacles faced and benefits from the results obtained. It was found that the low participation, the supervision of PPP and reduced integration between policies are factors that limit the implementation and the control of actions.

Keywords: Desertification, Public Policy, State of Ceara

Establishing a dryland fund for SLM projects in South Africa

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South Africa has established a drylands fund as a public-private sector partnership to assist in funding sustainable land management (SLM) practices in response to an increasing threat to the national ecosystem goods and services. The fund is administered through the Development Bank of Southern Africa in close collaboration with the National Department of Environmental Affairs, the National Steering Committee of the South African UNCCD and the private sector. The fund aims to replace the ineffective, adhoc, conventional financial methods in order to strengthen partnerships, finance ecosystem management and create positive linkages between rural and urban divides as well as private and public sector divides. The presentation covers the evolution of the Drylands Fund, the way it has been structured and its work to help break the poverty and land degradation spirals associated in communal lands adjacent to national parks and critical water sheds. The first four funded projects will be reviewed to demonstrate how payment for ecosystem services, easements, offsets and integrating environmental footprints/costs are being explored as mechanisms to sustainably finance SLM. The seed for the dryland fund where sown through Global Mechanism funding and it has taken over 10 years to move from a concept to a viable and operational program. South Africa successes and challenges in this regard will be valuable learning to other countries attempting to initiate a similar process.

Keywords: private-public-partnerships, funding, payment for ecosystem services

Too few, too many or the wrong type of trees - economic implications of changes in tree cover in Southern Africa.

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The World Atlas of Desertification highlights environmental issues that play key roles in land degradation. Globally deforestation is a major driver of degradation with its associated costs. Within Southern Africa deforestation is a major problem and is driven by a number of factors including agricultural expansion, wood harvesting and the production of charcoal. In countries such as Mozambique, Tanzania and Zambia the charcoal industry, one of the many contributors to deforestation, has become so important to rural and urban livelihoods that its value has been estimated by some studies to exceed that of small scale agriculture (e.g. Mwampamba 2007, Sepp 2010). However, in many area of South Africa and Namibia it is tree densification (bush encroachment) that is having a huge economic impact on livelihoods (de Klerk 2004). Two distinctly different processes are involved. One relating to the spread of alien invasive species (IAS) and the other to densification of natural woody species. In the case of IASs there is evidence that this is resulting in a substantive reduction in streamflow with associated economic impacts, natural biodiversity is also being threatened as well as the flow of other ecosystem services such as grazing and many of the regulatory services. IASs also have the potential to radically change fire frequency and intensity (Turpy 2004, van Wilgen et al 2004). In the case of bush encroachment from indigenous species it is the cattle and game ranching sectors that are most affected. In addition there are groundwater and biodiversity impacts (Joubert 2003, CCA 2010). Livestock carrying capacity can be reduced to as little as one-tenth of the initial stocking density (de Klerk 2004). In the Southern African context reduction in

tree cover may well be a sign of degradation, however interpreting increased tree cover as a sign of SLM, or an improved environment, must be made with caution as in many instances this is actually a sign of major environmental degradation with high social, environmental and economic cost.

Keywords: Forest degradation, Shrub encroachment, LD assessment, LD mapping, WAD

Monitoring land degradation patterns: lessons and implication for sustainable land management in Kenya

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Strengthening of the information and evidence base on the scale and determinants of land degradation is a central starting point for designing effective sustainable land management practices. This study conducted in Kenya demonstrates a systematic approach of mapping land degradation patterns from national to plot level, and highlights key lessons for policy intervention. At national level, the study employed the use of 250-m resolution Moderate Resolution Imaging Spectroradiometer - Normalized Difference Vegetation Index (MODIS/NDVI) for the period 2000-2009 to determine the long-term change in vegetation patterns as a proxy for land degradation or improvement. Negative NDVI trends (indication of degradation) was observed for areas around Lake Turkana and several districts in eastern Kenya while positive NDVI trends (indication of improvement) were observed in areas such as Wajir and Baringo. NDVI difference between the baseline (2001-2003) and endline (2007-2009) showed that 21% of the land was ex-

periencing a decline in the vegetation cover, 12% was improving, while 67% was stable. Detailed field measurements conducted in western Kenya, showed that over 55% of the farms lacked any form of soil and water conservation technologies. Soil erosion was the most dominant form of soil loss and most of the major soil chemical properties were below the critical thresholds needed to support meaningful crop production. There was a general consensus that the productivity of the land resources had declined. Combining methods and approaches for land degradation monitoring and assessment enabled capturing different insights on the problem, information that is relevant when designing intervention strategies.

Keywords: Kenya, Land degradation, Land resources, Normalized Difference Vegetation Index (NDVI), Sustainable land management (SLM)

Economic contribution of communal land rehabilitation to rural livelihood

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Rehabilitation activities have significant potential in restoring previously degraded areas, thereby increasing the economics of the area. Despite such qualitative assertions, quantitative economic impact of rehabilitation in Ethiopia and specifically in the study area is hardly ever assessed. Based on the present limited experience with this methodology, this study attempted to quantify the economic impact of rehabilitation to the rural livelihood through Income Generation (IG) and communal land Value Addition (VA) assessment. Subsequently extrapolation scenarios were built to ballpark the future maximum benefit from this area and other agro-ecologically comparable large scale communal holdings. The rehabilitation byproducts economically assessed are tree volume, biomass, soil carbon, and grass fod-

der. The results from this area showed that, beneficiaries increased their income (IG) with an average 800Birr/annum using only the benefit from fodder, while the value added (VA) to the area until 2008 was 4,111,783Birr (Birr is Ethiopian currency 9.97Birr=1USD, as of 2008). The future maximum income expected from this site is more than 2,000%; while, rehabilitating the total communal holdings in the area would result in over 8,000% increase, from the current average per capita income. However, to realize this, it will require thorough research for the development of such markets for different bio-geographic zones and evolving appropriate working plan prescriptions. Moreover the possibilities of linking these services to international protocols in the field of conservation of natural resources, global warming, and world trade have to be explored to take advantage of flow of technology and money from north to south.

Keywords: Communal land, rehabilitation, IG, VA, and scenario

Evaluation the cost of land degradation at the national level (experience of Belarus)

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Land degradation in Belarus reveals itself more than in 20 forms. There are mainly water and wind erosion of soils; chemical, including radioactive, contamination of lands/soils; degradation of drained peat soils affected by fires, unstable use in agriculture, soil compaction, overgrazing, etc. Values of the economical damage caused by different forms of land degradation are validated at the government level since 2008. The cost of the damage caused by the land degradation is calculated from the direct cost of the lost biological productivity of ecosystems as a result of degradation processes revelation as well as an indirect use value of land assim-

ilative functions losses (decrease of carbon dioxide absorption, loss of biodiversity, disturbance of water regulative ability of soils, etc.). Taxes for the detection of the amount of damage caused by land degradation processes are established according to their revelation rate (low, moderate, high, very high) for different land types. Tax amount, for example, for arable lands is varied from 2,6 to 7,7 thousands USD per hectares. The report will display the experience of the methodology development of the assessment of the costs of the land degradation with participation of all DLDD actors, such as governmental authorities, land users, landowners, industries, nongovernmental organizations. Unfortunately, actual methods of economic assessment of degraded lands have some gaps and drawbacks related to the accounting of temporal factor.

Keywords: cost, land degradation, damage, economic assessment

Impacts of agricultural practices on manmade soils and ecological restoration efforts in a protected NATURA 2000 area in the Apulia Region, Italy

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Located in the southeastern part of Italy, the Apulia region is the nation's largest producer and exporter of fresh grapes but other fruit trees such as almonds, cherries, peaches and olives are wide spread throughout the region. Due to favourable climate and soil conditions and market demands, land users have expanded fruit trees and grape's cultivation at the expense of natural pastures by grinding the rocky topsoil with heavy machinery and thoroughly changing soil conditions towards the formation of manmade soils. Over the last 20 years such process expanded in an estimated area of more than 20,000 hectares but it is most widespread in the province of Bari. For worst, even slopes on pastureland were converted to cropland

for cereal cultivation followed by increased soil erosion. The impact on natural vegetation cover and loss of biodiversity is dramatic. On the opposite, another positive scenario appears in the Natura 2000 site of the marine protected area of Torre Guaceto in the province of Brindisi where areas cleared for cropland 30-40 years ago are being reconverted to forest and scrubland with an impressive impact on vegetation cover improvement and biodiversity richness. The process though is rather sporadic and not the mainstream since agriculture play an important economic role in the mostly rural south of Italy. Finding an equilibrium between vegetation restoration efforts and land user's income proves problematic, unless public incentives are implemented to support these ecological land use changes.

Keywords: Land use change, manmade soil, biodiversity loss, land governance, ecological restoration

Agriculture and soil in WAD

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Globally agriculture is practiced on 1.5 billion ha but the distribution of cropland is very uneven. China and India, accounting for more than 35 per cent of the total global population both have exploited most of their land and water resources available for agriculture. Similar situation occurs throughout the Mediterranean and in particular in North Africa and the Middle East where only 5 per cent of the land is suitable for agriculture. As population grows farmers will have to produce 70 per cent more food by 2050. The latest UN data on the state of world's land resources indicate that 25 per cent of all land is highly degraded, a trend that must be quickly reversed. Fifty two per cent of the land used for agriculture worldwide is moderately or severely affected by soil degradation, and nearly 2 billion ha – an area twice the size of China – are seriously de-

graded. Thirty five per cent of severely degraded land worldwide is due to adverse agricultural activities and globally the average amount of agricultural land per capita decreased from 0.39 ha per person in 1960 to 0,21 ha in 2007. Yet the world is endowed with good soils, primarily those occurring in humid climate, favourable terrain and easy access. Overall this category barely cover 3 per cent of the world's land area, and yet produce more than 40 per cent of the global food and over 90 per cent of cereals. It is a paramount priority that especially these soils are protected against any form of degradation. However, there is no substitute to sustainable soil management and any effort to ensure food security, as well as economic and social stability should consider practices that limit the release of C, restore degraded soils, and sustain well-functioning of the soil ecosystem.

Keywords: Global food, population growth, soil quality, crop production, soil ecosystem

Poster Presentations

Use of uncomposted sewage sludge and clay based ameliorant for production of wheat (*Triticum aestivum*) in desert soils

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Managing water and organic matter are essentials in cultivation of desert soils. A two year study was initiated to determine effects of incorporation of uncomposted sewage sludge and clay based materials for River Nile cleaning on soil quality (pH, OC, TN, electrical conductivity, soluble nutrients, mineral N and water retention capacity) and yield of wheat in arid regions. Treatments

were control, recommended inorganic fertilizer, clay based (10 t ha⁻¹) with or without inorganic fertilizer, sewage sludge (10 t ha⁻¹) with or without inorganic fertilizer and inorganic fertilizer. Results showed significant positive increase in soil organic matter, mineral N, N content and water retention capacity with sewage sludge supplied with inorganic fertilizer. Supplementing clay and sewage sludge with inorganic fertilizer had significantly resulted in 6 and 11 folds straw dry matter yield and 27 and 88 folds grain yield. It could be concluded that cultivation of desert soils could possibly be achieved through incorporation of local ameliorants.

Keywords: Desert cultivation, soil quality, wheat, amelioration.

Investigation of geological criterion on land degradation in geomorphological units (case study: eastern part of Shoor river watershed)

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In investigation of the effect of geological criterion on land degradation in geomorphological units, first a part of Shoor river watershed was selected on geological map in such a way that different consolidated and unconsolidated geological materials which are effective on land degradation and desertification are included. After determination of the studied area, the maps of slope and land uses were prepared and overlaid and the map of homogeneous units was prepared. In this research, three indices consisting of erodibility, salinity and permeability of rock units were chosen, by field and laboratory analyses and finally their classified maps were prepared, they were then overlaid and zonation map of the area according to the three indices were presented. Due to the fact that the determination of desertification intensity or potential in homogeneous units by using mathematical or statistical equations is not possible, therefore, the concept of fuzzy logic was used for zonation that after determination of the weight or value of the factors, fuzzy algebraic sum, fuzzy algebraic product and fuzzy gamma were used. The results obtained from the comparison of maps prepared using different fuzzy operators with a control map and maximum and minimum measured desertification in the studied region has shown that the most suitable fuzzy operator for desertification potential or intensity in the studied area is 0.8 gamma fuzzy functions.

Keywords: Keywords: Desertification, Fuzzy logic, Geological criterion, Evidence map, Erodibility, Salinity, Permeability.

Economic and social impacts of land degradation in mountain area in transition period of economics

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Tajikistan is a mountainous agrarian country and any change in land use management leads to both negative and positive consequences. After Tajikistan has got its independence and civil war (1992) has been accomplished the country faced economic and agricultural problems.

Stabilization of economics has been started since 1997 and it influenced standard of living of the population. The whole land use history can be divided into three periods: before 1925 (before soviet period), from 1925 till 1992 (soviet) and after 1992 (independence period) and every period has its own features.

The dynamics of land use change and its impact on environmental situation and development of country economic were investigated. It was identified that significant negative changes in land use have taken place in irrigated as well as rainfed areas. Destruction of irrigated and drainage systems has led to increasing of underground water table and secondary salinization process. And as a result of it the harvest level of agricultural crops have been decreased and subsequently it caused the lowering of standard of living of the population

The damage inflicted by erosion processes of different branches of economy and agriculture has been calculated It was stated that the total annual soil losses from wash out can achieve 127.1 million tons, that conducting the lowering of standard of living of the population.

Different methods of rational and irrational land management were collected and described.

Keywords: impacts, land degradation, agrarian country, secondary salinization, ground water

Environmental and socio-economic impact assessment of desertification in AlBatinah plain -Sultanate of Oman

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The Sultanate of Oman by virtue of its geographical location of dry areas with fragile ecosystems, severely affected by desertification on all its provinces. This study aims to clarify the environmental and socio - economic Impact of desertification in the plain of Batinah region in northern Oman. The Batinah region is situated along the sea of Oman. This coastal plain is approximately 25km wide and lies at the foot of the Western Hajar Mountains. After Muscat the capital of Oman, it is the most densely inhabited area in Oman. The problem of salinity in this region started in the mid 1990 due to the extensive agriculture activities, accompanied with increasing population, through the use of lands for farming and overdraws of fresh groundwater to a degree of causing seawater intrusion. This region is also characterized by low amount of annual rainfall (less than 100mm) and high evaporation ration.

This study will be based on field work and statistical analysis of data related to indicators of desertification, such as loss of biodiversity, soil degradation, declining production, abandoning of productive farms, lack of employment opportunities and migration from the countryside to the centers cities.

Keywords: AlBatinah plain, loss of biodiversity, soil degradation, declining production, abandoning of productive farms

Soil and water salinity dynamics and their impacts on land degradation in the coastal Bangladesh

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Bangladesh, a deltaic plain, has a very flat

and low topography in the southwest coastal region. About 10 % of the country is hardly one meter above the mean sea level and one-third is under tidal excursions. Land degradation owing to soil salinity in the coastal region was on the increase. Between 1973 and 2009, salt affected area has increased by 26.7%. Of the saline soil, 351,690ha moderate (8.1-12dS/m) to strong saline (12.1-16dS/m) and 101,920ha very strongly saline (>16dS/m) where only salt tolerant or very tolerant agricultural crops can yield satisfactorily. Salt accumulation in the soil varied horizontally and vertically, and highest salt accumulation was observed in Ganges tidal floodplain. Higher salt content in surface soil was decreased with increasing depth and then increased again due to capillary rise of saline ground water. Surface soil salinity also varied with seasons where soil salinity increased in dry season that decreased in the wet season followed by rainfall. Surface water salinity followed similar salinity pattern. Soil and water salinity in dry season appeared as severe constraint that reduced cropping intensity. Two major causes like manmade e.g. shrimp cultivation, reduce upstream flow by construction of barrage etc. and climatic events e.g. low rainfall, high temperature, cyclone and tidal surge are responsible for salinity intrusion and increase in both soil and water salinity in the coastal belt of Bangladesh.

Keywords: soil salinity, water salinity, land degradation, coastal soil, seasonality

Tree resilience after clear-cutting in sustainable forest management of semi-arids areas

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What is the regeneration model of Caatinga vegetation after clear-cutting in sustainable

forest management? This question is the aim of this research carried out in Fonseca Farm (8°35'S 38°00'W), localized in Floresta city, state of Pernambuco, a strategic area of sustainable forest management established by the Government of Brazil. In this area were monitored three variables among 2001 to 2011: leaf area index (LAI), normalized difference vegetation index (NDVI-Modis) and aerial biomass of vegetation (Mg·ha⁻¹). Two sample groups were delimited: i) preserved area - without forest management, and ii) management area - with cut down of total trees happened at 2006. The growth model of trees was calculated by regression analysis, between the temporal line (2001-2011) and the biotic variables. In the preserved areas the growth model rose exponentially to maximum with three parameters to all variables ($R^2 > 0.93$, $p < 0.001$). In the management area, the growth model also rose exponentially to maximum to LAI and NDVI, and exponential growth of five parameters to biomass data ($R^2 > 0.95$, $p < 0.015$), mainly after 2006. This result explicit the difference growth model between leaf and biomass trees of Caatinga. The satellite images could overestimate data of tree resilience. This data is used by Brazilian government institutes to evaluate forest management that is carried out trough of leaf and green indexes. The tree biomass of Caatinga delays to grow for industry use and could not be recommended to insert a sustainable forest management, corroborated with traditional communities. (Financial support: FACEPE and CNPq)

Keywords: biomass, leaf area, aerial biomass of vegetation, growth model.

Resilience action to recover an area in degraded ad Brazilian Semiarid through plant cover recomposition

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Promoting resilience in a degraded area in severe stage of desertification located in Paraiba Seridó, on Caatinga domain. With the average annual rainfall of around 550 mm, irregularity in its temporal and spatial distribution, it is necessary to appropriate knowledge, locally, on three fronts in basic botanical aspects, edaphic and climatological. In this sense, was made the recognition of the floristic composition of the remainder of the area, identifying the ecological group of species. One portion was demarcated, adjusting the soil by building nanobacias to capture rainwater and another portion to the pits for normal seedling planting native forest and finally settled an automatic weather station to monitor the moisture soil and evapotranspiration by Penman-Monteith method. These knowledge are tools to determine: i) what to plant, ii) how to plant, and when to plant, to increase the take rate of the seedlings were planted 360 seedlings up nine species native pioneer, pioneer, secondary and climax, being 180 in a plot with nanobacias and 180 in the plot with holes made in the soil is not worked. The nanobacias provide moisture in the soil longer making them less vulnerable to periods of no rainfall and prevent erosion caused by runoff. The take rate after 36 months of planting was 42.2% in the plot with nanobacias and 16.1% in the share of direct planting in pits normal.

Keywords: Recovery of degraded areas, Forest Restoration, Resilience.

Desertification and poverty: is there a low level equilibrium?

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This paper examines whether there is an equilibrium between the phenomenon of desertification and income generation in a given region, and consequently, in its poverty

rates. The methodology analyzed the impact of desertification on the production of corn and beans in the last 20 years in the State of Ceará, Brazil. We performed a comparative approach between municipalities considered most susceptible to desertification in relation to municipalities less likely. The results show the negative impact of desertification in the production and productivity of crops in the counties more susceptible to the phenomenon, as well as suggest an influence on the lower GDP growth. The analysis suggests the influence of environmental conditions on the level of desertification, which in turn, reduces the yield and productivity of the crops, and which in turn influences, and is influenced by the use of agricultural techniques that contribute significantly to the desertification process, such as deforestation and burning. The results confirm the existence of equilibrium between variables and can be considered low level, requiring efficient public policies, such as income transfer and investments in more sustainable management technologies to break this equilibrium condition, and promote increases in the income levels and environmental quality.

Keywords: Desertification, Poverty, Agriculture, Productivity, Ceará,

Manejo de conflictos por escasez de agua y suelo en zonas semiáridas en México

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Understanding the dynamics of conflicts related to water and soil can become a deciding factor in the performance of environmental policy: Public issues require governance, so that the systematization of existing conflicts and the variables associated with each case is to start a public policy agenda and a preliminary assessment of the conflict. In

ERRAC-UNOFOC develops a comparative project on conflicts related to the use and management of water and soil conservation based on different data systems semiarid regions with similar conditions. We estimate that the contributions that can generate this type of analysis are: the construction of a model of conflict for water and soil in semi-arid regions of Mexico, a map of actors with corresponding analysis, and a typology of the conflict in Mexico from which to develop a policy agenda that identifies not only the most urgent public problems and areas that show hot spots, but also the group of variables (social and biophysical) associated with each type of conflict. A detailed analysis of the actors involved in each case, their ways of interaction, resources and organizational forms. We project that the results of the database are of importance to develop a typology of conflict, conflict prevention and development of political feasibility.

Keywords: agua, suelo, capacidades, organización, desarrollo, conflicto, revegetación,

Geoprocessing in riskmanagement: a case study in Brazilian semiarid region

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The scientific information on the patterns of risks to the disaster in the municipality of Picuí, State of Paraíba, is an important subsidy for the creation of public policies for local development, environmentally and socially sustainable. The geoprocessing appears as a major tool in managing the risks of degradation of land and water resources. The water an essential natural resource to life lacks tools that local people can better manage it and cope with its shortage and at the same time, to allow the understanding the hydrometeorological processes The aims of this work is to subsidize public policy for managing the risks of degradation of land

and water, when much of its territory is at high risk of desertification. Economically, the livestock sector is developed so extensively and the largest herds are of goats. The ceramic industry today has 10 potteries mid-range, and the wood is their energy source. Water resources are highly committed to land degradation that interferes with water supply for the rural population both domestic as for agricultural production. Thus, the rural becomes an environment incapable of producing and the region increasingly difficult to be inhabited. While the decades of the 70s the rate of urbanization was around 40%, this index is now above 70%, which portrays the exodus from rural to urban. The situation is very worrying, because the more degraded areas are the areas with the highest concentration of poverty and misery, with a population highly vulnerable socially, environmentally and economically.

Keywords: risk, land and water degradation, vulnerability

Mapping areas at risk to process of desertification in the municipality of Araripina-PE.

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The municipality of Araripina is located in the State of Pernambuco, comprising an area of 1893 km² and an altitude of 622 meters. This study aimed to map the areas at risk to the process of desertification, in order to support public policies that come to mitigate the environmental risks. Based on the use of Landsat 5 TM image interpretation, complemented with field data, it was possible to create maps of land degradation levels for the years 1987, 2003 and 2008. The main economic activities that contributed to the increase of land degradation, are related to mining, which among other things is responsible for deforestation of the savanna vegetation used as energy matrix by the indus-

trial sectors of the Plaster Pole of Araripe, followed by cattle ranching and deforestation of the areas of Red Yellow Eutrophic Latosols for planting cassava, whose initial tillage operations is carried through the burning. It is noted that for the year 2008 the level of land degradation considered very serious occupied 25.45% of the municipality, which indicates an advanced process of desertification, and moreover, an area already quite anthropized of 10.2% of the territory, where was identified the moderate-serious level, is at risk of advancing to level serious to very serious. So, in the period of two decades (1987-2008) the increase of the serious and very serious level of land degradation has been significant and requires urgently the direction of public policies for this region, aiming at the sustainability of the local population.

Keywords: Araripina-PE, risk, desertification

Sustainable land management practices to cope with climate change in the Republic of Mauritius

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Mauritius, a basaltic, 2040Km² island in the Indian Ocean is gifted with a healthy marine ecosystem, clear unpolluted lagoons and beautiful white sandy beaches which make it a very popular tourist destination. Post-independence has seen massive economic development invested along 323 Km of these coastal lines from both government and the private sectors. Coastal zones are not only home to many fishers' families that depend on coastal fisheries for subsistence but are also the major pillar of the Mauritian economy after agriculture. Due to economic pressures, government aims to double tourism arrivals to 2 M by 2015, which will far exceed the present local population. Unfortunately, coastal zones are also recipients of pollution from inland land management practices,

which is severely affecting these coastal resources. The changing climate associated with extreme events is also changing our coastal features; beach erosion is a visible example. In small islands developing states, an integrated approach to coastal zone management should also include sustainable land management practices such as sound agricultural practices, appropriate irrigation and fertilisation techniques, innovative plantation methods and weeding. All lands are only a few kilometres from coastal zones, wise use of these lands and manage in a sustainable way can considerably decrease pressure exerted on coastal zone ecosystems and its resources, including shocks associated with climate change. Therefore, to maintain the intact state or to improve services of these resources, the decision making processes of a long term integrated coastal zone management plan should include sustainable land management practices.

Keywords: Mauritius, coastal zone, development, land management, climate Change

Precision agriculture as a mitigation measure in the process of desertification (Brazil)

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The globalization of food production requires protection, management and precision, compared to adverse conditions in some regions of Brazil. The northeast of Brazil is characterized by semi-arid climate, which suffers the action of weathering agents, being marked by water deficit generated by dry periods (drought), and associated with irregular spatio-temporal distribution. Besides natural factors present exists anthropogenic inputs. The processes can act simultaneously exposed or isolated favoring the spread of desertification process. Because of the need

to adopt techniques and technologies to meet the demand of few developed regions without losing the perspective of sustainability, has seen the implementation of precision agriculture tool, which subsidizes the optimization of resources to be used production systems in order to ensure the efficiency of the economic returns to be maximized productivity while reducing the environmental impact significantly, from an efficient application of inputs. By means of geostatistical techniques and use of GIS tools, which combined guarantee reproduce the spatial variability of the attributes under study, from thematic maps interpolated by kriging method, serving as a planning tool in heterogeneous areas in different spatial scales and time, allowing the systematic approach and periodic monitoring, providing information to support decision-making systems.

Keywords: planning, geostatistics, spatial variability

Precision forestry in supporting the recovery of degraded areas

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The increasing destruction of forest ecosystems from human activities aimed at socio-economic development, has caused a great threat to biodiversity conservation. To ensure the process of resilience of degraded areas, it is necessary a systematic, ensuring the adoption of practices and techniques aimed at environmental rehabilitation. Thus, studies of the spatial distribution of species in forest fragments describing biodiversity as a whole has been developed, supporting phytogeographical and phytosociological surveys. Analysis of the spatial structure by means of contour maps allows us to understand the interaction of species borders and also the inner parts of the system. The silvicultural

systems are spatially structured in different geographical scales, and dependent on the natural regeneration process such variability can be affected when compared with areas in their natural state. Thus, the spatial variability of forest systems shall be considered through the use of geostatistical techniques, incorporating the rational management process a lot of information that were previously ignored, allowing to analyze the spatial variability of vegetation attributes (dendrometric characteristics), related to reclamation. The precision forestry is based on the collection and analysis of geospatial data on forest sites, enabling localized interventions in the forest, with adequate accuracy and precision. Allowing evaluate the development of ecological evolution of the fragment to be recovered.

Keywords: forest ecosystems, systematic, environmental rehabilitation

Assessment of the dynamics of surface temperature in semi-arid areas in Brazil from satellite images

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Over the years, the northeast region of Brazil has faced major problems arising from the irregularity of its rainfall patterns, affecting mainly agriculture. The degradation from the practices of unsustainable land use, coupled with adverse weather conditions conducive to the process of desertification in fragile areas or likely. Aiming to act as engine management, the space techniques for monitoring and mapping of desertification with multitemporal satellite images in conjunction with local databases and maps, have been used to examine the nature, trend and quantify the process of desertification in different environments. The delineation and mapping of affected areas are made to establish a

reliable basis for monitoring desertification process and appropriate strategies to combat it. The quantification, risk assessment and monitoring of desertification can be data from biophysical parameters (vegetation indices) and physical (albedo, surface temperature, emissivity, etc.). Obtained from satellite images. The surface temperature acts as an indicator of areas prone to fires, whose water stress conditions (low humidity, high wind speeds and high insolation), favoring the worsening desertification process.

Keywords: space techniques, mapping, management

Afforestation and poverty reduction in the Northern part of Cameroon: case study of fight against desertification project "Green Sahel"

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In the current context of increased land degradation in affected country Parties, there is a need for action as a priority to address desertification. However, the economic conditions of those countries do not enable people to be effectively involved in the fight against desertification. This study highlights the case of a project initiated within the framework of the implementation of the action plan to fight desertification in Cameroon. The study is intended to show how an environmental action allows beneficiaries to improve their incomes. It requires the involvement of people who are among the most influential actors of land degradation in the Sudano-Saharan zone of Cameroon. Following a reminder of objectives and approaches of the project, this work presents a quantitative and qualitative assessment of the effects of the project to reduce poverty of the local populations living at the project sites. The conclusion is that the project workforce, the tree-nurseries production sector, and producers of improved stoves are the main aspects that contribute

to improve the living conditions of the populations who at the same time, benefit from the environmental actions of the project.

Keywords: Desertification, afforestation, poverty, North of Cameroon.

Water access in the State of Ceara, Northeast Brazil: from the historical neglected problem to nowadays in the context of juridical sciences

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The aim of this work is to describe the water access situation in the State of Ceara, Northeast Brazil in the context of juridical sciences. The United Nations Organization recently affirmed the access to water, as well as to basic sanitation, as an objective of international law linked to the States (resolution 15/9, 2010). The water access is a relevant study subject, being target of conflicts and debates, which requires multidisciplinary efforts to be understood. The present research brings out the fact that several Brazilians do not have access to water in the semi-arid area of the Ceara State and this region does not meet the perspectives of an inclusive and sustainable development as a mean of facing climate changes. The results of the last auditing from the Court of Auditors of the Union, 2009, which deals with the public policies regarding the climate changes in the semi-arid, were analyzed. Data from the research about the "Development Goals of the Millennium", which proposes to decrease the number of people without water and sanitation access in a half, were also studied. The main results evidenced that piped water supply was available for 87% of urban households and 26% of rural houses, while basic sanitation covered only 37.2% of urban households and 0.5% of rural ones. Our findings bring to discussion the local reality, which is far from the ideal. Unfortunately there are still several citizens without water

and sanitation access, evidencing a disrespect of human rights.

Keywords: Water, Water supply, Sanitation, Sustainability, Brazil

The coexistence with the Brazilian semi-arid: the tessituras for a territorial development project

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The study discusses the emergence of "coexistence with the Brazilian semi-arid" their proposals, documents and social actors who take on this development proposal for the territorial Brazilian Semi-arid. The analyzes focus on the correlation of "Coexistence" with contemporary global movement of reappropriation and redefinition of social nature, allowing the Brazilian Semi-arid contribute new meanings technical, economic, cultural and symbolic about the semi-arid lands. It also assesses how the proposal has been strengthened within the spheres of government and civil society sectors in favor of contextualized practice with the characteristics and dynamics of semi-arid environments. The objectives of the study aimed to analyze the new position of civil society in Northeast Brazil, from the 1990s, proactively, and active articulator, raising flags historical and emerging social struggle. Analyze the Coexistence as an idea-project, which constitutes a sort of umbrella, combining different expressions and movements: NGOs, Churches, Pastoral, Rural Workers Unions etc. The findings consider Coexistence is not a social movement and not the institution, but a nascent state that keeps the enthusiasm, charisma and a sense of utopia. The research methodology is anchored in Boff (1998), Heidegger (1981), Santos (1996), Haesbaert (2007) to understand the joints and mobilization of networks of "Coexistence", considering that these are configured by the social nature rhizomatic, decentralized and

multi-scale, promoting the inclusion of Co-existence in positions of power and propose policies for the Brazilian Semiarid.

Keywords: Coexistence; Brazilian Semiarid; Social Networks; Contextualization; Territorial Development.

Climate change impacts and land degradation in Anambra State, Nigeria

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The study area, Anambra state located in the south-eastern part of Nigeria, has 40% of the land area severely degraded, due to soil erosion. This erosion is occasioned by heightened flooding, accounts for 65% of land degradation resulting from gully erosion incidences in the country. The topographic features of the area which consist of pronounced rolling hilly terrain and long steep slopes enhance runoff velocity which speedily detach and transport the loosely formed soil particles thereby forming gullies. The soil type of the study area is porous, with the soil particles being loose not compacted, thus making them easily detachable. The nature of the soil accelerates the process of erosion when exposed to external forces such as flooding and human disturbances. With increases in precipitation levels and intense flooding, as indicated by IPCC fourth assessment report for UNFCCC, extensive land degradation in this area severely impact on agricultural productivity, livelihoods and food security. The land management measures employed by the indigenous people are traditionally-based which is grossly inadequate to address the challenges of climate-induced erosion and land degradation in the area. The paper contributes to the knowledge on soil structure, climate-induced land degradation and land management strategy of local people in sub-Saharan Africa.

Keywords: climate change impacts, erosion,

land degradation, flooding, traditional knowledge

Land use changes and deforestation in the Romanian Carpathian region – impacts and options for sustainable development

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Mountain regions are fragile ecosystems which provide key resources such as minerals, wood and agricultural products. The aesthetic value of mountain landscapes offers the base for tourism and recreation. As major ecosystems with intricate and interrelated ecology, mountain environments are important at national and international levels. Many mountain ranges are affected by degradation in terms of deforestation and accelerated soil erosion resulting in rapid loss of habitats and genetic diversity. The Carpathian Mountains are the largest, longest and most fragmented mountain chain in Europe. They cover some 209,000 km² and stretch over 1,600 km, forming a natural ecological bridge between Western and Eastern Europe. The mountains shelter a wealth of flora and fauna species and contain some of the most intact ecosystems in Europe. The Romanian section of the Carpathian Mountains (South-Eastern Carpathians) occupies 27.8% of the country's territory and 60% of the Romania's forests are located within the Carpathian mountain range. In spite of their natural wealth, the Carpathians are currently affected by higher zoo-anthropogenic pressures than other mountain systems in Europe. This is further compounded by impacts due to globalization (including the rapid transition to aggressive market-based economies) and climate changes. In this context, land use changes, deforestation associated with soil erosion and landscape degradation are discussed and their importance for sustainable development in the region is assessed.

Keywords: Carpathian Mountains, land use change, Romania, sustainable development.

Challenges for implementing biodiversity conservation strategies in Romania to minimize the effect of climatic changes on wildlife

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The Intergovernmental Panel on Climate Change (IPCC) stated in its fourth assessment report that warming of the Earth's climate system is unequivocal. A global warming of about 0.2°C per decade associated with greenhouse gas emissions is projected to take place within the next two decades. In Europe, annual mean temperatures are predicted to increase by 1.0°C-5.5°C, depending on scenarios, by the end of this century. In Romania, current climate models indicate the same trend, suggesting that the country will be affected by severe droughts during this century. These changes could have significant impacts on biodiversity, depending on their duration, intensity and species vulnerability. The present contribution is focused on three directions, as challenges for implementing appropriate strategies in Romania to minimize the effects of predicted climatic changes on the country's biodiversity, as follows: i) the need for an improved coordination between institutions at various levels in order to assure optimal planning, management and monitoring of Romanian natural protected area network, with special focus on vulnerable species and regions at higher risk from climate changes; ii) the need to take into account climate changes, models of future environmental conditions and species responses when implementing conservation planning and actions; iii) the need to consider simultaneously, both spatial and temporal perspectives in biodiversity management and conservation and the use of actions that build ecosystem resilience.

Keywords: Climate change, ecosystem resil-

ience, global warming, Romania, wildlife.

Microbiological indicators to evaluate green sewage substrate quality for agronomic purpose in Brazilian north-west semiarid region

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Water reuse is a feasible alternative for soils with limited available water, organic matter and nutrients and its application is being strongly considered in areas where access to water is scarce. Green sewage modules technology appears as an option for a better domestic effluent destination once soil-plant system has a depurating capacity, supplying plants with reusable water and nutrients from disposable sewage. It is relevant however to know about the generated substrate quality for an acceptable plant development. The aim of this work was to evaluate the use of microbial substrate biomass-C (SMB), substrate basal respiration (SBR) and metabolic quotient (qCO₂) as quality indicators for green sewage modules (GSM) substrates. Samples were collected from five GSM substrates at a 20cm depth in the "25 de maio" land reform settlement (Ceará/Brazil) under differentiated managements: GSM1-with good banana and tomato development; GSM2-with a poor banana development; GSM3-with good papaya, banana development and some poppy plants, indicating high vegetal species diversity; GSM4-with good pepper, banana and tomato development, and GSM5-with good banana development. Modules received effluent from domestic restrooms in an intermittent water discharge, except GSM5 that received effluent from a health center in a constant water discharge. SMB and BSR were calculated using irradiation-extraction method and CO₂ evolution quantification by titration with HCl, respectively. qCO₂ was obtained

by BSR/SMB ratio. The results indicated that micro-bioindicators can be used in monitoring GSM substrate quality due their reflected changes occurred in microbial activity and biomass carbon hold capacity influenced by management.

Keywords: microbial C-biomass, substrate basal respiration, effluent reuse, rural sanitation, semiarid region

Successive dams of loose stones and its environmental impacts occurring in the micro-basin of the Cangati River, Canindé

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This study evaluates the environmental impacts occurring in the micro-basin of the Cangati River, Canindé, after seven years of the construction of the successive dams of loose stones by Hydro-Environmental Development Project in Ceará. The used strategy in this study was done by comparative techniques and observations.

After knowing the various technologies for the reclamation of the semi-arid, aimed to evaluate the simplest and cheapest ones, with successful results in the reclamation/preservation of the environmental resources.

The successive dams tend to reduce the kinetic energy of water, which results in a less pronounced erosion of the soil and it's interconnected due to the reduction of the intensity of sediments, nutrients and organic matter transport.

The results indicated that the successive dams in the micro-basin of Cangati implemented by the Project PRODHAM is a successful experiment, through the reclamation of degraded areas in the nascent rivers and upstream of the reservoirs, restoration of riparian vegetation at the banks of water courses and the gain on soil reclamation.

Keywords: Barragens Sucessivas, Transporte de Sedimentos, Recuperação.

Drought in Brazilian semiarid: a social problem

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The drought in northeastern semiarid climate is a phenomenon that cuts across several generations. This phenomenon causes damage social, economic and environmental objectives for the population inhabiting these regions. Droughts are characterized by both the absence and scarcity as the high spatial and temporal variability of rainfall. This study aims to discuss about the problem of drought in northeastern Brazil, defining actions that will reduce the impacts of drought in the Brazilian society. The research it is a literature review on which one tries to understand through studies involving the problematic aspects of drought in the Brazilian semiarid. Water scarcity, causes serious problems for farmers and livestock producers that without economic resources tend to suffer from poverty and unemployment. In this sense, some actions should be prioritized, among them are: Water distribution through car-kites, construction of dams and reservoirs, encouraging implementation of projects that will provide economic development of the regions affected by drought, and etc. Finally drought is a social problem that tends to increasingly get worse if not taken preventive measures and mitigation, contributed to increased poverty and misery. Hence it makes extema importance of strengthening public policies with regard to the development of programs that viabiliz the development of both social and economic sector in the Brazilian semiarid.

Keywords: dry, semi-arid, water,

21st century environmental technology incorporates the social ecological perspective creating solutions for physical and economic resilience to land degradation and desertification

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This paper identifies water as central to the cause and solution of DLDD and consequently introduces established Russian ionic technology offering a variety of proven solutions to critical challenges being faced within the humanitarian and environmental sectors of disaster reduction and sustainability relating to DLDD. It reviews concerns by international bodies and potential causations and social ecological perspectives influencing changes within the environment, generating adverse effects, such as soil moisture depletion, resulting in a critical increase in dust movement, generating consequences upon rural production and sustainability. It is emphasized that rural communities need financial support to reverse the economic migration from farms to cities and the land abandonment and consequential ecological degradation, which the paper suggests is a major contributory factor to desertification and loss of fertile land. The paper advocates for multiple stakeholder collaborative contributions from all disciplines including technology R&D, engineering construction, socio-economic, environmental and ecological sectors if long term resilience to DLDD is to be achieved. Technology is outlined offering alternative approaches to water and agriculture resource management, minimizing the effects of environmental crisis being generated by climate change and trends in human social economic activity; detailing specific ionic technology to; desalinate contaminated ground; modify brackish saline water for irrigation; enhance agricultural production; disperse water pollution within rivers and static waters; Influence Local Atmospheric processes generating rain clouds targeting

catchment and storage facilities for agriculture and hydro-electric systems; using the same ILAP technology for shielding from pollution and dust movements; all potentially contributing curtailment of DLDD.

Keywords: Magnetism, Drought, Pollution, Rain, Sandstorms

Mini museo itinerante de ciencias naturales como herramienta para la conservación, conciencia y lucha a la desertificación del Bioma Caatinga.

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Actualmente, debido a los avances tecnológicos, podemos observar que la humanidad está menos dependiente de los recursos proporcionados por el entorno natural, a lo que se refiere a sus necesidades diarias, en gran mayoría, hemos olvidado nuestras continuas dependencias de la naturaleza. Pasando, por lo tanto, a no observar y valorar los recursos naturales que nos rodean, por lo que es necesario democratizar la ciencia a través del diálogo entre el campus universitario y la comunidad; una forma también de atraer la atención sobre la rica biodiversidad de la región a que sea conocida, respetada y valorada. Por lo tanto, nuestra propuesta se basa en la creación de un mini

museo de las ciencias naturales, no estático, sino dinámico e interactivo, traspasando los muros de la universidad, hacia las escuelas, los eventos culturales de la ciudad y los condados vecinos, llevando informaciones sobre la biodiversidad de la Caatinga y la necesidad de su conservación. Durante todo el año se realizó un curso de capacitación, recolección de insectos, el montaje de cajas de colecciones entomológicas del material vegetal y la captura de imágenes del Bioma en diferentes momentos climatológicos de la región para la producción de paneles; Pronto, el Museo de visita escuelas de la zona y eventos para las actividades de difusión, exponiendo el material y promoviendo a su vez, las explicaciones sobre las actividades desarrolladas y sobre todo la frágil situación en el proceso de desertificación que se encuentra en la ciudad de Taua, en el interior de Inhamuns, Ceará, Brasil. El objetivo es atraer la atención sobre la rica biodiversidad de nuestra región a ser conocida, respetada y valorada por la población local y en otras regiones a través de diversos talleres; la conciencia y la reflexión sobre el estado del Bioma Caatinga, única selva brasileña por antonomasia, que deberá ser conocida y respetada en vista de su importancia para la región y su temeroso proceso de desertificación. Comenzamos nuestra jornada con las presentaciones de la flora y la fauna, componentes de la rica zona de la Caatinga, sin embargo, despreciada, por ser desconocida para muchos. Siempre se centra en los productos esenciales para la supervivencia del hombre del Nordeste, ya que esta formación vegetal se considera inútil, e incluso un impedimento para el desarrollo de la región, por aquellos que no tienen conocimiento de su importancia. Los puntos relevantes se dirigen siempre como el uso en la generación de energía, recolección de productos forestales, y la generación de ingresos para muchas familias, además de su importancia ecológica intrínseca. El objetivo principal es la explotación sistemática, que está acelerando la degradación y desertificación de la Caatinga.

Keywords: Caatinga Biome, Mini Itinerant Museum, Natural Sciences

Using demand side management to adapt to water scarcity and climate change in the Saïss Basin, Morocco, funded by the International Development Research Center of Canada (IDRC)

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The Saïss basin, located in the upper eastern reaches of greater Sebou basin, represents 11% of Morocco's annual water endowment, providing water for 1.8 million people. It constitutes about a quarter of Morocco's arable land and sustains some 8 000 commercial and subsistence farms. The Saïss basin serves many competing water users – local industry, a diverse agricultural sector, and towns and cities in the region, which include the major centers of Fez and Meknes. Declining levels of precipitation in the region over the last 40 years have been accompanied by a 1°C increase in the average temperature. Given that there is little prospect of water supplies increasing to meet the needs, a research team led by Al Akhawayn University is working with local communities and authorities to examine whether managing the demand for water can protect the basin's future in the context of growth and climate change. This project has been working with multiple stakeholders which focuses on the benefits for the most vulnerable and disadvantaged communities within project sites. The focal point of this Climate Change Adaptation in Africa's project (CCAA) here is agriculture as it accounts for over 82% of water consumption in the Saïss basin. The Saïss aquifer has experienced increasingly unsustainable levels of exploitation since 1980. Its waters are only partially replenished each season, making it susceptible to rapid depletion. With decreasing precipitation and increasing groundwater use, some small rivers and springs have disappeared and flows in what remains has

been significantly reduced.

Keywords: Climate Change, Adaptation, Water, Agriculture, Morocco

Building partnership with rural communities to manage the ecosystems and natural resources for improved livelihoods and food security in the Nigerian Savanna

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The Savanna is a densely settled agrarian zone where livelihood is substantially tied to land resources. The climate is highly variable and responds to local land surface processes. Future climate projections suggest that the Savanna will become drier with severe implications for land and water resources that presently support food production. The objective of this study was to find out indigenous knowledge and perception on climate, ecosystems, and livelihoods and to establish the role rural communities are willing to play in ecosystems management for improved food security and sustainable livelihoods. Data on climate and land change were integrated within a GIS. 191 households were engaged across 11 communities. Focus group discussions and key informant interviews were also conducted with traditional rulers, community associations, local and state government officials and ecosystems management related agencies. A stakeholder forum was also convened to discuss the results from the social surveys. The result suggests future ecosystems change is projected to substantially follow the water (rainfall) footprint. The general perception on the present climate including declining rainfall and increasing temperature, declining number of rainy days and increasing number of

hot days, and late onset and early cessation of the rains substantially agrees with analysis from recorded data. The Shea-butter tree (*Vitellaria paradoxa*) emerged as the most used tree. It is also the most preferred wood for making charcoal. The partnership agrees to pursue the domesticating of this tree in private and communal woodlots and this will have significant impact for ecosystems management in the area

Keywords: Climate change, rural communities, ecosystems, partnership, Savanna

Climate change, water access and irrigation system in urban farming: the case study in Cotonou/Benin

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In Africa sub-Saharan region, more than 50% of people live in urban area. This urban population growth increases the cities food needs and households consumption and incites increasing of urban farming production. But, climate change defines a new environmental context in particular in water access process. This context influences the urban farming system which ensures 30% of vegetables consumption in Cotonou town. Besides manual irrigation practices, to improve the water access system various irrigation techniques are developed. The objective of this study was to analyze the socioeconomics and environmental impacts of irrigation system used by urban farmers' as adaptation practice in context of climate change in Cotonou. The mean irrigation system used is spraying through a motor-pumps and pipelines system. This option reduces the physical efforts and times needed in watering task, in particular manual watering, which remains the first irrigation practice for more than 75% of urban farmers. Motor-pump irrigation system is also an opportunity for urban farmers to reduce their daily farming times to involve

in another's activities such as small business or urban transport with require less professional competences. But, besides the financial resources needed, the lack of land access reduces the installation and adoption of system which is actually only used by 10% of urban farmers'.

Keywords: urban farming, water access and irrigation

Potential impacts of climate change and its relation to extreme events ENSO on Binational Basin Puyango - Tumbes

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Binational Basin Puyango - Tumbes is the center of the impacts of El Niño, specifically Tumbes Region, presents critical conditions of vulnerability that constantly expose its people and production systems to natural events. In this context, it was considered essential to analyze the potential impacts associated with climate change and its relationship with physical events, threats and climatic variables ENSO extreme events. Information was processed and systematized in Weather Station, National University of Tumbes. Furthermore, climate scenarios were designed for basin, trends in temperature, precipitation, water balance, recurrent drought, indicating evidence of climate change in this important Binational Basin, identified following impacts: Threats and presence of ENSO, presented significant abnormalities in the hydrological regime, presence of heavy rains causing flooding and landslides scour; presence of tides and strong waves, variation of surface and ground water availability. During ENSO 1997 - 1998 showed large anomalies are significant in hydrological regime, highlighting the ranges of variation of river flows, with respect to normal situations. The maximum

flow in Tumbes River Basin was 2318 m³/sec (registered on 12 April), while 1982-1983 year was 1277 m³/sec registered on 30 January). The study confirms that under a global warming Cycle El Niño / Southern Oscillation (ENSO) could be more frequent and intense. Also found that in the Binational Basin, climate change means greater recurrence of ENSO events, it is likely that in the period 2011 - 2015 is presented at least one episode of rainfall with intensity similar to ENSO 1982 - 1983.

Keywords: Climate change, ENSO, binational basin

Challenges and handicaps to settle down 12 step program to stop drought and desertification of World Watch Institute in Iran

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Approximately 65% of Iran is covered by arid and semiarid areas. National Bureau of Forest, Rangeland and Watershed reported that 20 million hectares of the country susceptible to wind erosion. Several programs are offered to combat desertification and or reduce the impacts. 12 Step Program to Stopping Drought and Desertification, as a classified scheme, which is provided by World Watch Institute may be applicable for a developing country as Iran. The program prefers twelve purposes including: Agroforestry, soil management, increasing crop diversity, improving food production from existing livestock, diversifying livestock breeds, "Meatless Mondays", smarter irrigation systems, Integrated farming systems, Agroecological and organic farming, Supporting small-scale farmers, re-evaluating ethanol subsidies and finally agricultural research and development. This study focused on challenges and handicaps which prevent to establish the program, using documents and experts' overviews. The results demonstrated lack of investments, limited access to basic schooling and technical training in rural areas,

social conflicts between governmental institutes and indigenous people and rural poverty are crucial obstacle to achieve the program goals. The study, also recommended some solutions to make the implementation of program possible.

Keywords: desertification, iran, soil management

Developing strategies against land degradation and desertification: a heat-map for priority intervention areas

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Forests are the largest terrestrial carbon reservoirs. Most of the approaches to maintain or enhance carbon stocks in forests focus on moist or deciduous (tropical) forests (e.g. REDD+, CDM). However, especially in drylands, representing nearly 50% of the African continent, pressures on forest ecosystems are high. These forest ecosystems provide a multitude of goods and services, harbour endemic species adapted to extreme ecological conditions and are vital for the mitigation of further climate change. Forests in drylands are often more important, both biologically and socio-economically, than elsewhere and play a major role in combating further land degradation or desertification. The Institute for World Forestry develops new management strategies for dryland forests in a multi-institutional project in south western Madagascar (SuLaMa) that aims at promoting and supporting sustainable land uses. Deploying data on climate, climate change, biomass distribution and soil properties we have developed a model to identify regions on the African continent that already show the same properties and conditions as our project area. Furthermore, a heat-map resulting from the model shows the likelihood for regions on the African continent to face the same challenges as the

project area due to climate change. By identifying priority intervention areas, the heat-map allows avoiding severe disturbances of dryland forest ecosystems and their goods and services even with constrained resources. In these priority intervention areas adaptable management approaches as developed in SuLaMa will need to be applied to combat further land degradation or desertification. This enables preventing further negative impacts of climate change.

Keywords: Forest ecosystems, drylands, heat-map, priority areas, climate change

Production of grain sorghum (Sorghum bicolor) in sandy soils

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A field experiment (two seasons) was conducted in a farm located in a semi-arid climate of west Omdurman city at latitude to examine the effects of amendments [chicken manure 5 ton per hectare (CH1), chicken manure 10 t ha⁻¹ (CH2), sewage sludge 10 t ha⁻¹ (SS1), sewage sludge 20 t ha⁻¹ (SS2), Camel manure 10 t ha⁻¹ (CA1), Camel manure 20 t ha⁻¹ (CA2) and control (C)] on chemical and physical changes of soil properties and sorghum production. Treatments were arranged a randomized complete block design with three replications. After harvesting, the plant samples included stems and leaves were collected beside the soil from 0-30 and 30-60 for analysis. Statistical analysis showed that CH1 and SS1 had significantly ($P < 0.0010$) higher grain yield of 4750 t ha⁻¹ and 4546.9 t ha⁻¹, respectively. Nutrient uptake showed significant differences among the treatments where N uptake in CH1, SS1, CH2 and SS2 treatments and showed significantly ($P < 0.0001$) highest values (40.475 kg ha⁻¹, 39.878 kg ha⁻¹, 33.257 kg ha⁻¹ and 31.924 kg ha⁻¹, respectively as compared with control (15.646 kg ha⁻¹). Chemical and physical properties of soil changes depicted

that CEC was significantly increased in all amended soils than the control (21.8417 cmolc kg⁻¹) with the highest value recorded in chicken manure (CH1, CH2) 24, 23.2583, respectively followed by SS1 and SS2 (22.1667, 21.9167) respectively. It could be stated that application of amendments clearly supported plant by necessary nutrients in sandy soils as it reduced leaching and improve water holding capacity.

Keywords: Sewage sludge, chicken manure, camel manure, sorghum, sandy soils

Understanding land use by small holders' households the perspective of desertification and climate change mitigation in semi-arid areas of Cameroon

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Land use by smallholders' households can be an important entry point to desertification and climate change mitigation. Strategies that address land use by such households can bring together the efforts of the two conventions of United Nations Framework Convention on Climate change and United Nations Convention to Combat Desertification. Identifying the typology of the current land use is an important first step in mobilizing smallholders in halting or reversing desertification. It can also lead to understanding how biomass might be management toward climate change mitigation efforts such as Clean Development Mechanism and REDD+ (Reducing Emissions from Deforestation and forest Degradation including conservation, sustainable management of forests and enhancement of forest carbon stocks). From this perspective, a survey of

612 households in six divisions in the far north cameroon was conducted using a semi structured questionnaire. Preliminary results reveal six main land uses, some of which overlap: cropped field (managed by 96% of local households), fallow (23%), grassland (24%), orchard (3%), tree parkland (25%) and savanna (72%) that significantly contribute to local livelihoods. In 70.3% of cropped fields, annual crops (particularly cereals) are mixed with some perennials species such as: *Acacia* spp., *Azadirachta indica*, *Balanites aegyptiaca*, *Mangifera indica*, *Tamarindus indica* and *Ziziphus mauritiana*. Beside these preliminary results on the main land uses and the type of the main vegetation found in the region, the findings of the survey are discussed from the perspective of climate change mitigation, halting or reversing desertification, and biodiversity conservation in this semi-arid area of Cameroon.

Keywords: land use smallholders'household, semi-arid area, climate change mitigation, desertification, Far North Cameroon

Environmental hazards

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There is a need to assess the damages caused by the earthquake on the environment, such as the impact on agriculture and pasture land; trees and forests; wetlands, springs and irrigation systems; water quality; ecosystems and biodiversity; protected areas, cultural heritage etc. These damages need to be evaluated in economic terms. Additional environmental damages will occur in the aftermath of the earthquake. Some of them may only be visible after a year or later.

The most important need is to look for and identify environmental risks, which could cause further damages and losses, if not taken care of adequately. The most prominent among them are as follows: (1) landslides, mudslides and flashfloods; (2) water contaminations; (3) debris and waste; (4) health risks; (5) ecosystem depletion; (6)

destruction of cultural heritage; (7) affected livelihoods options.

Keywords: Green Economy, Water Quality, Ecosystems, Biodiversity, Protected Areas

Vulnerability assessment of climate change impacts on South African biomes

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South Africa is home to a significant portion of global biodiversity, and many of its natural ecosystems are relatively intact. With the envisaged potential impacts from climate change, Department of Environmental Affairs has developed the biodiversity and climate change policy framework that is based on the premise that biodiversity and healthy ecosystems are critical for human wellbeing and quality of life. Given the general consensus that climate change is affecting our biodiversity species and ecosystem processes, there is a need to adapt to increased climate variability as well as long-term climatic shifts. The vulnerability assessment of climate change impacts on biodiversity study was conducted to assess the potential exposure of biomes and their biodiversity to projected climate change over the medium and long term (i.e. from 2020 to 2050), and identify which biomes, or ecosystems are likely to be most strongly affected by projected changes. The study took into account ecosystems, natural resources and distribution patterns. Results observed from climate projection scenarios predict that the Grassland, Fynbos, Albany Thicket, Forest and Indian Ocean Coastal Belt biomes display vulnerability and sensitivity to climate change by being reduced in area under changed climatic conditions, especially with drying trends. The Succulent Karoo is likely to be the most resilient biome to climatic change vulnerability.

This is evident in all the projection scenarios whereby the Succulent Karoo shows signs of persistence throughout. Threats to biodiversity includes climatic variability, biome shift, land degradation, land use changes, unsustainable use of natural resources, and invasive species.

Keywords: Biomes, Ecosystem, Natural resources, Species.

Degraded forest management through leasehold forestry for poverty alleviation in Nepal (Experiences from Leasehold Forestry and Livestock Programme)

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The leasehold forestry is executing in 22 districts. The forestland is allocated or handed over to a group as an endowment with entitlement for a 40-year period to create livelihood opportunities. Leasehold Forest User Groups (LFUG) institutionalizes access to decision-making process, for forest products. These accesses are depicted into the rules and regulation through a provision to collect forest products, to distribute, and to make decisions. A household has received about 0.52 ha forestland from the government. The experiences contribute in obtaining a better insight into the implications and operational significance of the concept through pro-poor leasehold forestry to several proactive institutions. Ten per cent sampling intensity was used among 3439 groups and interviews were organized with stratified random sampling method. This paper describes the temporal changes in impacts of leasehold forestry. The major positive results are rehabilitating two thirds of the degraded forests land into forested vegetation cover and improving in women's and poor people's access rights to resources including higher level of representation of dalits and women in decision-making process. Similarly, the saving fund mobilized more

than 76 per cent for income generation and productive sector investment. The goatherd size has increased from average of 3 to 5 goats/household within a two-year period. However, the study suggests developing the interface between environmental conservation and poverty alleviation to be more compatible and commensurable position for the diversified positive outputs and impacts for fast momentum.

Keywords: Leasehold Forestry, Livelihood, Poverty alleviation, Social mobilization, entitlement

Combating land degradation and desertification: An attempt at wasteland development in Rajasthan, India

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Gram Bharati Samiti (GBS) means Society for Rural Development implemented a project "Combating desertification: An attempt at wasteland development in Rajasthan, India" at Gandhivan in collaboration with local village communities. The main object of the project of Gandhivan was to experiment the development of wasteland towards poverty alleviation, improve the ecological balance and check the land degradation and process of desertification. Key activities: (1) Awareness among the community leaders, women and youth; (2) Harvesting the rain water; (3) Plugging gullies and ravines to conserve the soil and moisture and stop land degradation; (4) Regenerating the endangered indigenous plant species of medicinal value; (5) Stabilizing sand dunes in order to check the process of desertification. Results: (1) Rain water harvested and made available for 5,000 cattle of the area; (2) Soil and moisture conserved at over 5,000 hectare land; (3) Problem of fuel and fodder of about 15,000 community people solved; (4) Land degradation successfully checked in a radius of 3 km. area; (5) Roots of 35,000 of indigenous plants and trees of medicinal and other values regenerated; (6) Shifting

and marching sand dunes were stabilized; (7) Flora and fauna was flourished and biodiversity enriched in the area of 5 km. UNDP film division developed a film on Gandhivan project as a success story of wastelands development. Wasteland development using indigenous knowledge and community participation could be a promising attempt to combat land degradation and check the process of desertification.

Keywords: land degradation, wasteland development, sand dunes stabilization

The influence of meteorological and environmental factors on temporal and spatial distribution of ground-level ozone

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Climate change and its impact on the natural processes occurring on the Earth is an urgent problem of the last couple of centuries. The share of anthropogenic factors, both regional and global scale, remains a significant problem. Polluting elements emission in the atmosphere directly affects not only human and ecosystems, but also produces harmful substances. A secondary pollutant is ozone, which is the main component of smog. Besides, it is also one of the gases causing the "greenhouse effect". Based on the observed data in Tbilisi city (Georgia), the change of ground-level ozone and the influence of meteorological (wind, humidity, temperature, solar radiation) and environmental factors on the spatiotemporal distribution was studied. The following features of the ground-level ozone concentration temporal variation were revealed: 1. diurnal variations (up from 11 to 17 hours) were clearly identified. The concentration of ozone in the night hours is increased during the events connected with the passage of the atmospheric front, a thunder, a pouring rain, strong wind; 2. Sea-

sonal changes (in the summer in 2-3 times more, than in winter) are mainly depended on the frequency of temperature inversion and isothermal processes. The value of surface ozone in the heat balance of Tbilisi city atmospheric air and the orographic factors influence on them were estimated. The existence of a relationship between the greenhouse gases concentration and the amount of ozone in the atmosphere was revealed. Thus the atmosphere pollution degree can be evaluated according the ozone concentration in the lower layers.

Keywords: Ozon, Climate change, Tbilisi, Georgia

Public policy analysis for desertification, family agriculture and sustainable development at semiarid Brazilian semiarid

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The Brazilian Semiarid is among the most susceptible areas to desertification in the world. Strongly connected to this process, there are substantial economic, social, and political specificities. The region has a considerable portion of the Brazilian low income population, and especially the majority of family farmers of the country. Given this situation, this article aims to analyze the convergences and divergences of sectorial public policies aimed at combating desertification, to strengthen family agriculture and the development of Semiarid. The methodology is based on the treatment of primary data obtained through interviews with farmers, local public managers, representatives of associations and cooperatives, and secondary data obtained through desk research and literature review. The semiarid of Bahia state was chosen as the target of research, in particular the Irecê Territory. Public policies selected are: the National Program for

Strengthening Family Agriculture (Pronaf); National Program for Sustainable Development of Rural Territories (Pronat), both linked to the Ministry of Agrarian Development; the Strategic Plan for Sustainable Development in Semiarid (PDSA) from Ministry of National Integration, and the National Action Program to Combat Desertification (PAN), from the Ministry of Environment. The level of coordination between sectorial policies plays a crucial role in the formation of a political and institutional environment propitious to rural poverty reduction, strengthening of family agriculture and combating desertification process in semiarid, and however, coordination of programs can pose difficulties on the design and implementation of sustainable development strategies for the region.

Keywords: Semiarid; Desertification; Family Agriculture; Development.

Sustainable land management and resilience to climate change in Tajikistan

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In Tajikistan, the increasing pressure on available land combined with inappropriate land use practices has led to widespread unsustainable land management. As a consequence, rural livelihoods that support the majority of the population are being negatively affected. For the coming years, it is expected that Tajik agriculture faces varying climate change impacts which, on the whole, will further deteriorate production conditions and thus adversely affect the economy and rural livelihoods. Hence, sustainable land management (SLM) strategies and practices become even more critical. In order to develop strategies for climate resilient adaptation of land management, knowledge is needed on SLM opportunities for climate change adaptation. Therefore, an inventory of relevant past and current projects/initiatives in SLM was prepared using the WOCAT (World

Overview of Conservation Approaches and Technologies) framework. Case studies on SLM technologies as well as SLM approaches covering all major land use types were documented through interviews with land users and SLM specialists. The case studies were then assessed for their climate resilience applying the newly developed WO-CAT climate change module. In workshops experienced and anticipated climate change impacts on the communities were discussed and land users selected and assessed SLM practices they regarded most suitable for climate change adaptation in their context. The goal of this study was to identify best SLM technologies and approaches to improve rural livelihoods and resilience to climate change and to make recommendations for their up-scaling.

Keywords: Adaptation to climate change, sustainable land management, resilience, rural livelihoods

Modeling of the potential impact of the climate change using two environmental quality indicators at north of Mexico

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Modeling of local impacts, characterized by deterioration of natural resources, especially water and soil, over the global effects of climate change has become a powerful tool in the search of mitigation and adaptation measures. The objectives of this research were: 1) Evaluate through processes of modeling the potential impact of climate change for the period 2010-2039 and 2) Advise the future risks from the identification of local radiative forcing or critical areas, considering the index of aridity and soil erosion as two indicators of environmental quality. Similar

evaluation techniques of natural resources, applied by National Institute of Ecology (INE, Spanish acronym) for studies of ecological-use land (SEL) were used; the inputs include climate information (current and future), soils covering and edaphic properties related to the municipality of Gómez Palacio, Dgo., Mexico (Latitude 25.886° N and longitude -103.476° E). According to calculations made out from the anomalies for the annual averages of rainfall (AAR) and temperature annual average (AAT), it was found that the municipal territory in the A2 scenario could have an average impact of 63% caused by wind erosion, and the aridity index would change from the historical from 9.3 to 8.7 in the future scenario A2; it is estimated that the average impact on the aridity index in the future will be 0.53 ±0.2.

Keywords: Climate Scenarios, Modeling, Ecological Zoning.

Analysis of causes and impacts of flood risks in Niamey region in 2010 and 2012

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With regard to its geomorphologic context, Niamey is one of the most flooded places of the Sahel in 2012 than in 2010. The recorded rainfall compared to the 2011 in this zone has increased of 70% with very important koris' streaming. The Niger River has witnessed an exceptional water level -618 cm- which has never been reached since 1929, with a rate of flow of 2300 m³ /second on August 21, 2012. This study intends to determine causes and factors of the frequent floods in Niamey region in order to analyze

the socio-economic stakes related to the disaster and suggest sustainable strategies to manage the risks. According to the Comity in charge of managing the flood risks, the provisional outcome is greater in 2012 than in 2010. 9 people died and 12,365 households or 82,982 people were affected. 9,200 houses collapsed and 5,000 others are still in water. 8,105.10 acres of farming and 17,538 acres of grazing lands have been destroyed affecting 34,254 farmers. It's necessary to act for the stricken and work out sustainable urban solutions to prevent these risks in this climate change context.

Keywords: Niamey region, Niger River Valley, koris, exceptional water level, floods, frequent floods, sustainable strategies, natural risk, climate change

The ethnopedology as a new paradigm for mapping soils in Semiarid Ceará: a case study in the municipality of Taua.

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One of the factors responsible for the weaknesses of sustainable development policies in the semiarid Ceará is the lack of involvement of local communities in the policymaking. The development projects, unlike the guidelines placed on the State Plan of Action to Combat Desertification and Mitigate the Effects of Drought (PAE-CE), have not consulted the people potentially benefited by the actions of coexistence with the semiarid. Thus, ethnopedology, branch of Ethnoecology, emerges as a discipline that rescues the importance of local knowledge regarding the management of soils. The adoption of technological packages from the Green Revolution and socioeconomic disruption of communities affected by drought have led to the erosion of intergenerational knowledge built by the communities. These skills result from intimate coexistence between the

communities and the semiarid environment where they live. The ethnopedology discusses, among other topics, the local soil classification. Some studies in the semiarid Ceará attest the applicability of this methodology to survey land. This work, by ethnopedological methodology, conducted the survey of soils in Angicos Settlement, located in the municipality of Taua, Inhamuns Region, one of the main centers of desertification of semiarid Ceará. Through mental maps, interviews, field explorations guided by the settlers, analysis of his speeches and soil surveys, were made local soils maps and were ranked the following types of soils: Barro Vermelho, Barro Branco, Terra Arisca, Arisco Branco and Massapê.

Keywords: ethnopedology, soil, Ceará

Desertification motivated by ceramist activity in RN

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The desertification according to the United Nations Conference on Environment and Development of 1992 is: "land degradation in arid, semi-arid and sub-humid and dry, resulting from various factors, including climatic variations and activities human. The northeastern region fits this concept. Reaching an area of over 900,000 km², no other environmental problem in the country reaches such dimension. The Rio Grande do Norte to have most of its area in the semi-arid region is a risk. An economic activity that contributes to the acceleration of desertification in the state is the production of red ceramic currently has 206 active companies, divided into 39 municipalities and concentrated in three re-

gional centers: Seridó, Apodi / Assu and Natal. This study aims to analyze the process of desertification driven by activity in RN ceramist. As methodological procedures, data collection was conducted through a literature review and documentary. According to the researched material, the population does not recognize desertification as a major problem in the area studied, the activity potter is a major anthropogenic cause of desertification in the region and said that the performance of the government in combating desertification is still very small. The solution to the problem is: the adoption of environmental education projects for public awareness and an Environmental Management System for enterprises, development of environmental management policies and punishment to the applicants polluting actions by the government.

Keywords: Desertification, ceramics, RN

The desertification process and its consequences for Brazilian semiarid

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In recent decades, Brazil has been hit by environmental problems of all sorts, highlighted those related to desertification. This process applies to areas that, besides having the character of aridity, has low rainfall, defined by average annual rainfall is less than 250 mm, and its distribution is concentrated in a short period of time, such a months or even several days. There are various definitions of desertification, but in general conceptualized as land degradation in arid, semi-arid and sub-humid areas. Against this background this article it is a qualitative study intended to investigate the process of desertification and its consequences in semiarid northeastern Brazil. As a methodological strategy, was

conducted bibliographic some publications of greatest relevance with reading articles, dissertations that addressed the issue of desertification of semi-arid Northeast, and other environmental impacts, as well as make use of the analytical method and descriptive, so to achieve the proposed objectives. We conclude that the causes of desertification are related to deforestation, extraction, burning, irregular agriculture, among others. The main implication for the semiarid in Brazil are popular migrations, regional imbalance, economic loss, reduction or elimination of vegetation, loss of biodiversity (genetic resources), worsening of regional imbalance, decreasing arable land, soil loss, salinity added the prospects of climate change and rising poverty.

Keywords: desertification; droughts; brazilian semiarid

The problem of drought in Northeast semiarid: workarounds water supply

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The availability and use of water in northeastern Brazil, particularly in the semiarid region, remains a crucial issue with regard to its development. It is a fact that great efforts have been undertaken in order to deploy infrastructure able to provide enough water to ensure supplies and feed and facilitate irrigation. Within this scenario, this paper aims to present alternative solutions to water supply available to families in communities located district of the city of Sobral - Ceará. As methodological strategies were performed bibliographic effective along with field visits in order to ascertain the existence of alternative supply for rural populations. It is concluded that strengthening water infrastructure northeastern policy as living with drought has been increasingly intense. In

places near the district's main solution Caracará supply is through the construction of water tanks with a capacity cumulative normal between 7 and 15 m³ representing the supply of 50 liters of water daily. It is important to argue that the cisterns were built through government projects and that the amount is still insufficient to meet the rural population. The supply of these reservoirs is offered by the civil defense of the city of Sobral - Ceará, which periodically makes the attendance of local residents. However, one should bear in mind that in the semi-arid climate the tank fails, no other sources, provide sustainability to the people.

Keywords: water supply tanks, water scarcity; tanks.

Lack of resilience in the semiarid agriculture: exploring measures to enhance the adaptive capacity of local communities to climate and non-climate factors

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Semiarid agriculture plays an important role in the socio-economic development of the semiarid Region of Cameroon and is highly sensitive to climate. Climate variability and change places further stresses on already vulnerable populations. Understanding the drivers and structure of climate risks to the semiarid agriculture is a necessary requisite for effectual adaptation. The research project provided an opportunity to understand the risks faced by at-risk groups using field observation as well as exchange with farmers at the local level using action research. It has helped examine the different aspects of climate-related risks in the semiarid agriculture, including the role of institutions to respond appropriately to these changing circumstances in order to reduce vulnerability and future threats to food security and environmental integrity in the semiarid region of Cameroon. It makes the point that

agricultural systems are becoming less reliable in the semiarid region of Cameroon, as ecosystems are degraded and the relevant structures in place to support farmers' efforts are often absent. The research project examines the "social vulnerability" of at-risk groups and the "biophysical vulnerability" of natural and managed systems. Here adaptive capacity is viewed as a component of vulnerability in the context of evolving risks. Overall the research work provides a synthetic assessment of vulnerability across the Far North semiarid region of Cameroon, and seeks to draw lessons about risk and vulnerability in the semiarid agriculture.

Keywords: Semiarid Agriculture, Action research, Adaptation, Vulnerability Risk, Resilience

Indigenous nested people institutions for effective governance of tanks for poverty reduction and food security in the peninsular south India

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The DHAN Vayalagam (tank) Foundation has been created by the DHAN Foundation as an NGO and registered under Indian Trust Act have promoted a concept called Tankfed Agriculture Development with the governance model created is having four elements namely primary people institutions at every tank in the villages and then the tank cascade at group of tanks which are hydrologically linked and block level federation for these entire primary and cascades people institution structures. All these three levels of nested People institutions are non hierarchical independent institutions promoted with the users of the tanks and federated at cascade and at block level for their mutual and self reliance support and cooperation as solidarity to collectively address the issues. The DHAN Foundation has started this kind of actions in 1990s and so far has created 3000 more such primary people institutions around 3000 water bodies called tanks with

160 more cascades and 31 more block level federations in south India as model for effect people governance and mutual cooperation among them and through this model 225000 members of small and marginal farmers have realized their livelihoods support and food security as all these farmers are situated in the command areas of these many tanks. All these people institutions have collaborated with mainstream institutions for getting the resources support for rehabilitating their tanks to get the required water for their agriculture and they also contributed 25% of the cost as their own contribution and implemented the rehabilitation through the people institutions promoted by them.

Keywords: tanks, early warning, flood, drought, monsson

Calculation of the Normalized Difference Vegetation Index in support of desertification studies in São João do Tigre Saint John and São Domingos do Cariri in the Cariri State of Paraíba

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This study aims to identify areas where desertification process in the municipalities of São Domingos do Cariri and São João o Tigre with the goal of a comparative analysis between these two cities which despite belonging to the same micro exhibit peculiar characteristics that make edaphoclimatic the ecosystem respond differently to the process of desertification. Therefore we sought to analyze the density of vegetation cover through field research and calculating the Index Normalized Difference Vegetation (NDVI) from satellite images LANDSAT 5/ TM sensor on the orbit 215/065 and 215/066 24-05-2010. We used the IDRISI software version 32 to generate the NDVI. The result obtained for São Domingos do Cariri shows that the

dense vegetation occupies a relatively small area in its north and in the southwest portion, in other locations the vegetation has degraded to the heavily degraded in these areas as observed in locus, the process of desertification is a severe stage, where the vegetation is scarce and there is a strong presence of bare soil and the predominance of species with more xerophytic Caatinga. Compared to São João do Tigre strongly degraded areas are located in virtually every portion This covers a narrow strip of the municipality. In other locations it is observed that the vegetation is preserved ranging from the somewhat degraded, but when compared to the NDVI in São Domingos do Cariri, there is a prevalence of vegetation in better condition.

Keywords: Semi-arid, Desertification, Environmental Indicators.

Traditional practices for Sustainable Land Management: the case of sacred groves in southern Senegal

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In Senegal, as in many other African countries, modern laws and approaches to nature conservation and sustainable management of natural resources have shown little success. In places where modern legislation has not completely eliminated traditional rules of natural resource management, those have generally found higher acceptance among local communities and enticed a more sustainable management of natural resources. This study presents a traditional practice that is still prevailing in the South of Senegal (Casamance region): the sacred grove. This practice was assessed applying a standardized questionnaire for the assessment of Sustainable Land Management technologies, developed by the WOCAT (World Overview of Conservation Approaches and Technologies) network. The

results show that the forest fragments which still persist in the midst of the urban environment of Oussouye have been exempt from anthropogenic pressure due to their sacred character. The local populations are very much attached to this traditional management scheme as only through the presence of these remains of natural forests their spiritual well-being is guaranteed. These green spaces constitute precious islands for biodiversity and they provide a cool and pleasant micro-climate. They further positively impact a number of ecosystem services e.g. as they regulate the flow of runoff towards the rice cultivation zones in the valley depressions and play an important role as a natural wind-break to reduce soil erosion.

Keywords: Sacred grove, Casamance, traditional rules, ecosystem services, Senegal

Geochemical characteristics as tracers for provenance study of aeolian sediments in central Iran (Case Study: Ashkzar Erg, Yazd Province)

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Desertification is one of the most important consequences of climate change; and also, wind erosion is one of the undesirable consequences of desertification. Wind erosion includes three phases of entrainment, transport and deposition of soil particles that has some undesirable effects. Effects of wind erosion are divided in two categories including on-site and off-site, which have negative effects on sustainable development. The most important on-site effects are land degradation, abrasion damage and other damages and also off-site effects include short terms (reduced visibility, deposition of dust on houses, roads, agricultural crop, etc.) and long terms effects. Now days, there are

several methods to study of provenance Aeolian sediments. One of the most common methods is using geochemical tracers. In this study, various geochemical tracers were used for provenance Aeolian sediments in Ashkzar Erg in central Iran as the case study. The results showed that different tracers have different capability for provenance study.

Keywords: Climate change, Wind erosion, Desertification, Aeolian Sediments, Geochemical Tracers.

Environmental management strategy for desertification in Africa

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Establishment of environmental monitoring system is crucial for environmental management. About one third of the earth's surface is threatened by desertification. This phenomenon which is caused by degradation of arid land is one of the greatest environmental challenges of our times. Desertification in Africa is threatening due to the effect of land degradation which is a result of global climate change and some conditions of the soil. Sahara desert of Africa is the world's largest desert and is expanding south at a fast rate of 48 kilometres every year. Global warming has been a major contributing factor to desertification and is undermining the progress for sustainable development in Africa. Earth observation and environmental monitoring is crucial for achieving the development goal because of its effectiveness in gathering detailed information about the earth. Satellite remote sensing is a management option that is effective for collecting valuable information required to tackle the problem of desertification. This is due to its high-resolution capacity for acquiring images in many narrow, contiguous, spectral bands. However, identification of the best management option is critical due to the trend of land

degradation in Africa. Because of sustainability, environmental monitoring system will play a significant role in the Green Belt reforestation program for Africa.

Keywords: environmental, desertification, monitoring, management, degradation

Agriculture and new energy sources: new hopes and new crops

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The ideal energy for sustainable economic development is a widely debated theme in social studies. There is no spectacular breakthrough on new energy sources, as related research outcomes are still disappointing. However, some experiences indicate that agriculture can generate alternative energy. Production of selected oil seeds does not impose negative impacts on the environment, contributes for sustainable jobs, preserves soil and water and improves social inclusion. This research shows that bio-fuels based on selected oil seeds, such as castor oil, despite neglected by traditional economic models, have sustainable development perspective in semiarid regions. This research shows that bio-fuels, derived from selected seeds have shown strong economic potential to change social conditions in semiarid regions. The objective was to analyze social and economic feasibility to cultivate castor oil, a traditional oil seed grown in semiarid regions. Despite many controversies, the research does show advantages in growing that crop, when sowing together with other crops. The studies show that the main criticisms made against biofuel based in castor oil are extremely weak due to net benefits brought for the small farmers who live and

take care of the land. Castor oil is not suitable for plantation but well designed for the typical agriculture of small farmers in semiarid areas. The research reflects the point of view of the small farmers who have shown satisfaction with the economic results of that culture. The relevance of this paper is to present the point of view of small farmers that are rarely taken into consideration.

Keywords: Biofuel. Semiarid. Castor oil. Alternative energy. Small farmers. Community organization.

Sustainable production and poverty alleviation: from backward farming to vanguard entrepreneurship

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Pressure to alleviate poverty, create employment and generate growth in deprived communities is often argued as reason for overlooking environmental concerns. The argument is twofold. First, environmental-friendly production often entails higher costs, reduces productivity and requires complex technology. Second, poor communities neither cannot afford environmental-friendly production, neither be punished by environmental regulation. Likewise, poor and developing countries frequently push for privileged treatment when it comes for pollution control, resource conservation and other environmental protection measures. Sustainable production faces resistance, delays and restriction based on alleged trade off between growth and environmental conservation. This paper focuses on a goat farming community located in a semi-arid region and that has managed to develop sustainable and diversified businesses, create jobs and generate local development, by strengthen social capital and governance. These ingredients

were the key to mobilize locals to devise and stick on an envisioned strategy, while attracting partnerships and support from key developing agencies. The research is based on intense field work in the community, focusing on production, social and environmental issues. The conclusion points out that the strategies to reduce poverty can go hand in hand with environmental conservation when the stakeholders show a clear conscious of the importance of these combined targets and have both the organization capacity and stamina to pursue them. Hence, factors such as environmental education, social capital and entrepreneurship need to be taken into account in policies to promote inclusive local growth and environmental conservation.

Keywords: Semiarid region. Poverty. Community organization. Development

The ratio of soil types and degraded / desertified as proposed for identifying the susceptibility of these areas

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This research aims to analyze the process of degradation and desertification in semiarid region of Ceará; identify soils fragile and susceptible to degradation semiarid Ceará compared with thematic maps of soil types and areas already degraded or prone to degradation. Thus pointing ratio of soil types and susceptibility to degradation and desertification. The theoretical and methodological line is based on a holistic view, favoring the synthetic approach and multicomposition, understood through Geoenvironmental Integrated Analysis (Souza, 2000; Souza and Oliveira, 2003). The fragility of the soils of Ceará, misuse and allied occupation constant droughts and irregular rainy seasons, leads to problems of environmental deterioration. After analyzing maps of geographical positioning of degraded and desertified, it

was found that the same geographical location coincide soil Neosols Litholic the eutrophic and dystrophic. Showing that these soil types in Ceará are the most likely to deteriorate, along with aspects of the use and occupation as well as disorderly difficult to reverse the process. Therefore, it is understood that the identified location and causes environmental degradation, as well as the regions most likely, it is suggested that addition of preparing management plan that includes recovery of components geoenvironmental, contemplates also the “social components” to improve the quality of life that inhabits these areas prone to environmental degradation.

Keywords: soils, degradation / desertification, the semiarid region of Brazil

An assessment of livelihood impacts of global environment facility project in Yankari Games Reserve, Bauchi, Nigeria

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This study examines the relationship between climate change, ecosystems and human livelihood activities using the Global Environment Facility (GEF) project in Bauchi, Nigeria. One of the four protected areas where GEF has concentrated its resources in the last few years is the Yankari Games Reserve (YGR). The GEF project placed significant emphasis on the sustainable management of environment as a pre-requisite to sustainable livelihoods and development. One of the focal objectives of GEF in YGR is to create alternative means of income generating activities for people living in the support zone communities so as to increase household income and reduce their pressure on the protected area. The Sustainable Livelihood Framework approach was adopted in the study. Primary data was collected

using a structured questionnaire administered to two hundred households in four selected communities bordering the reserve. The questionnaire covered issues related to livelihoods, access to resources, agricultural production facilities, local practices to protect ecosystems, perceptions of climate change and willingness to embrace adaptation techniques. Findings revealed that the project has impacted on the quality of life of the beneficiaries as indicated by 86 per cent of the respondents while another 87 per cent also showed that they were less poor than before the implementation of the project. In terms of contribution to biodiversity management, 97 per cent of the beneficiaries agreed that the project has contributed to prevention of encroachment on the protected areas.

Keywords: Climate Change adaptation, Sustainable livelihoods, ecosystem management, Food security

Erosión bioclimática en ambientes semiáridos: caso partido de petagones en el sur de la Provincia de Buenos Aires utilizando percepción remota

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El objetivo de este trabajo fue realizar un diagnóstico expeditivo de cuál es la superficie y en qué grado la erosión eólica afectó a los suelos destinados a la agricultura y ganadería. Se utilizó tecnología de percepción remota con información que provee el satélite Terra que incluye el sensor MODIS el Índice de Vegetación Mejorada (EVI). Para esta evaluación se planteó la hipótesis que una superficie sin cubierta vegetal expuesta a vientos cierta cantidad de tiempo y a las condiciones climáticas de sequía, sería más susceptible a la pérdida de suelo. Para corroborar los datos de la clasificación se realizaron transectas, tomando 156 puntos con GPS para georeferenciar los sitios en que se encontraron lotes con distintos grados de erosión eólica. La superficie del

partido es de 1.360.717 ha de las cuales se estimó que hay un total de 393.511 ha de suelos erosionados: 47.337 ha leve a moderada, 219.204 ha moderado a grave y 126.970 ha grave a severo.

Keywords: erosión eólica, terra - MODIS, Patagones

Teleconnection patterns related to dry years in the Extreme South of Brazil

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Precipitation data measured at Rio Grande, located in the extreme south of Brazil, during the years 1991 to 2010, was analyzed. The years of 1994, 1995 and 1999 were identified as the driest ones for this period. This study investigates the existence of relationships between teleconnection patterns and the drought in the extreme south of Brazil. We selected the months that contributed the most to one dry year, and evaluated the value of six teleconnection indices for those months. The indices are Oceanic Niño Index, Antarctic Oscillation Index (AAO), Pacific Decadal Oscillation (PDO), Madden-Julian Oscillation Index (MJO), Tropical Northern Atlantic Index, and Tropical Southern Atlantic Index (TSA). Moreover, we included sea surface temperature anomalies (SST) index near the south of Brazil and the cyclones monthly anomalies. The analyses showed that the drought in 1999 can be associated to an El Niño-Southern Oscillation coupling to PDO. In 1994, the cold STA in the west of South Atlantic Ocean is probably responsible for the dry period. Different teleconnection patterns can be related to the dry months of 1996. In May, there is a contribution of the positive phase of AAO and TSA and negative anomalies of cyclones and SST. In June, there is a positive phase of MJO and TSA and in July, a positive phase of MJO and TSA and negative anomalies of cyclones

and SST. Therefore, there is not only one pattern that contributes to the drought in the southern region of Brazil, but actually a combination of several patterns.

Keywords: extreme south of Brazil, drought, teleconnection

State and society in fighting with desertification, land degradation and drought: topological scope

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The 'Declaration of Niamey', Fight Against Desertification in Africa conference, Niger, October, 2011, highlighted the need for interdisciplinary research in the fields of desertification, land degradation, and drought (DLDD) focusing on social, economic and environmental issues. Moreover the issues in the DLDD field are not only of Natural and Socio-Economic aspects but those of Technology and Politics. Current work has attempted to bridge diverse disciplines and address the issue of DLDD to government, public, and private sectors of a global, national and local level. In current work a spatial Comprehensive Network Lace (CNL) topological approach previously applied for enhancement of state regulation processes has been proposed to study DLDD

as a multidisciplinary problem. Outside its innovation core, CNL is supported by three conventional pillars: Ontologies, GIS, and Complex Networks. With taking into account governmental & social factors the CNL has been stratified into formal and informal state layers to find key indicators of topological DLDD risks. Even most sensitive CNL parameters (common and for each layer) has been assessed the Prime advantage of the approach is in its general cross-disciplinary topological interpretation of the DLDD problem. CNL brings a new conceptual and integrated scope through: (1) description and quantitative detailing of governmental and social roles; (2) visualization as a common language for experts of diverse disciplines; (3) clarification of interlevel and interagency collaboration; (4) topological assessments of ecosystem vulnerabilities.

Keywords: Desertification, State Power, Social Environment, Complex and Supercomplex Networks, Topology

Mitigation and adaptation investments for desertification and climate change: an assessment of the socioeconomic return

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Climate change will further increase the risk of desertification, which is already affecting large areas of the world. Many countries are making investments for the implementation of mitigation and adaptation strategies to combat desertification. The long term effectiveness of these strategies necessarily requires a socioeconomic return for its sustainability. The main goal of our paper is to assess the relation between the mitigation and adaptation investments and the socio-economy of the rural population. The area of study is located in north-central Chile. The northern regions are mostly composed by arid land, which can be considered as a marginal area for agriculture. The area formed by the southern regions is optimal

for the agricultural activity which is characterized by an industrialized agriculture with and increased use of technology. The indicators we have used for our study are the following: the Investments provided by the Chilean Agriculture Livestock and Forestry (ALF) promotion agencies, the ALF Gross Domestic Product (GDP) and the Population Employed in ALF. The results show that the relationship between the investments and the socioeconomic return varies among the regions analyzed. Investments are positively correlated ($P \leq 0.05$) with the ALF GDP and the labor in ALF in the northern regions, but do not seem to be directly related to labor in ALF in the southern regions ($P \geq 0.05$). Therefore, our conclusion is that the Investments are significantly relevant for the agricultural activity in the arid northern regions, while in the southern regions they have no direct impact on ALF.

Keywords: Adaptation investments; Atacama Desert; Agriculture Forestry and Livestock GDP; Climate change; Desertification; Ecosystem services; Land abandonment; Mitigation; Socioeconomic return; Modern Irrigation

Can the deterioration of the plant's diversity be an indicator to the desertification?

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The desertification in Brazil is reaching alarming rates in these last decades, as example the Paraiba State (Northeast region) with more than 70% of its territory susceptible to this process. Although still not widely used, biological indicators are a powerful tool for these researches. Herein, the aim was to test the following hypothesis: desertified and non-desertified areas present dissimilarities concerning to the components of plant community. In addition, it was pretended to identify bioindicator species of

these environments. The data were sampled using transects (40x5m), covering desertified and non-desertified areas into three municipalities of Paraiba. Abundance and richness were measured in situ, while the Shannon-Wiener's diversity and Piellou's evenness were calculated by the computer. Student T tests were performed to check differences in components of plant community between the desertified and non-desertified areas. All the vegetation variables showed highest values in non-desertified areas, but there were only found significant differences for richness ($t = 3.71$ $p = 0.02$) and diversity ($t = 2.38$ $p = 0.04$). For the richness, this can be associated to the exclusive occurrence of *Bauhinia cheilantha*, *Bombax coraceae*, *Manihot glaziovii* and *Myracrodruon urundeuva* in the non-desertified areas. The diversity reduction is a pattern recorded throughout the world, which may act as indicator of desertified areas. The high abundance of *Mimosa tenuiflora* under anthropogenic environments can be a bioindicator of desertified areas in the Caatinga biome. These results corroborate, in part, with the formulated hypothesis, highlighting the reduction in richness and diversity of plants in desertified areas.

Keywords: desertified and non-desertified areas, bioindicators, Brazilian Semiarid

Socio-economic impact of gated and in-let structures and channeling permanent flow of hill-torrents in Shaikh Haider Zam area of D.I. Khan

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Sustainable Land Management Project provided inputs to an NGO VEER Development Organization for SLM activities, through participation of local communities, related to (i) construction of 12 gated structures in main earthen dikes to control flood water in heavy flood season that would prevent the breaking of dike; (ii) construction of 30 water in-

let structures at farm water inlet points that are used to control the flow in to farm fields when it has been filled out and (iii) lining of channel for permanent flow of hill-torrents in Shaikh Haider Zam area. The results of the activity were collected through informal interviews with the local communities. It was noted that 9000 acres agricultural land down the point of construction of the structures was sufficiently irrigated in first flood season benefiting 580 households. Conflicts among communities and land erosion over an area of 2000 acres reduced because of availability of more water for irrigation. Prevention of on-farm activity has resulted in the saving of water resource that was usually lost to the river in form of heavy floods that could not be controlled by earthen dikes. Because of irrigation community saved their income by not migrating to other villages for labour in harvesting. Livestock is the main source of income and compare to previous year they save their livestock because of fodder availability. Lining of channel for permanent flow of hill-torrents resulted in provision of more water and increasing the number of benefiting villages from previously 3-5 to now 10.

Keywords: Gated & inlet structures water-course lining

Use of low quality groundwater for sustainable crop production

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The scarcity of water is growing in almost all parts of the world and agriculture sector is by far the largest user. Currently, the rainfall and canal supplies in Pakistan are insufficient to meet crop water requirements. Groundwater is another major source of irrigation however most of these supplies are far inferior to canal water. The increasing demand for water especially in the arid and semi-arid regions has forced the farmers to use low quality water for irrigation. For use

of low quality irrigation water, sufficient information is available in the literature however, physical, chemical and biological methods alone may not be sufficient for safe use of low quality water. A strategic combination of methods and proper cultural practices could nevertheless help without the risk of salinity build up in the root zone. The main theme of the current study was to design and test strategies for conjunctive use of low quality groundwater at farm level. A study was carried out in Sargodha District, Chaj Doab, Pakistan on four farmers' fields for experiments viz: i) one site with saline groundwater, ii) one with sodic groundwater, and iii) two sites with saline-sodic groundwater. The testing of developed strategies showed the workability of developed strategies. In almost all of the cases, the developed strategies provided yield higher than farmer plot and stability in the soil properties. On an average, the farmers may increase use of low quality groundwater by about 15-40% relative to existing groundwater use, with about 15-40% more cropped area.

Keywords: Low quality water, saline sodic soils, conjunctive use

Which governance options promote sustainable landscapes and economic viability in a semi-arid reservoir area?

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The Itaparica reservoir has been concluded in 1988. It dams the Sao Francisco River in the semi-arid portion of the watershed. About 40.000 people were resettled. The current resource use suggests unsustainability. The recently formed comprehensive Brazilian-

German collaborative research project INNOVATE addresses the complex situation by an inter- and transdisciplinary approach, employing constellation analysis as a bridging concept. First, a common understanding of the current situation (=constellation) is made explicit by visualization with researchers and stakeholders. Then, opportunities for innovations, put forward by co-workers, will be analyzed as modified constellations. First results show that compensation infrastructure for the dam's construction takes long to be realized due to external political challenges. The experience from the existing irrigation projects is controversial. Some farmers make their living from the irrigated plots (between 1.5 and 8 ha per farm), others stopped cultivation after massive salinization of the shallow soils. None of the farms is operating under full cost coverage as water and energy for pumping are for free. Descendants and new farmers also request access to water. Part of the allotted native dry-forest areas (caatinga), meant for animal-browsing or beekeeping, has been cleared and irrigation infrastructure extended, bearing own costs. Absolute reserve areas of caatinga are similarly invaded. Livestock keeping on natural range suffers from irregular feed supply. Severe droughts, like in 2012, cause emergency sales of animals at low price preventing total loss by starvation. Paternalistic thinking, the partial absence of the state and knowledge gaps exacerbate sustainable adaptation to the new conditions.

Keywords: Caatinga biome, constellation analysis, economic viability, resettlement, sustainable landscapes

Analysis of landscape fragmentation and its contributions to the susceptibility to desertification processes in the Sub-Basin Jaguaribe, Ceará.

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Natural environments are responsible for the generation and maintenance of ecosystem functions that contribute to a healthy environment. The study of landscape structure shows up as an important tool in planning and management of remnant native forest, beyond the understanding of the dynamics of spatial patterns arising from human action in areas of high environmental vulnerability to desertification processes. The objective was to analyze the spatio-temporal evolution of the patterns of landscape structures in Sub-Basin Médio Jaguaribe between 2000 and 2011 and their contributions to the processes of desertification. The use of this tool allowed the evaluation of the dynamic behavior of the main spatial patterns related to human activities, as well as the contribution of the remaining trees to natural habitats, showing up with a management tool for decision makers. There were also changes in the dynamics of spatial patterns by implementing Açude Castanhão. Besides these, the work served to corroborate the research that has been developed, which demonstrate the need for a strategic action plan for combating and mitigating the areas with the greatest potential to desertification, for the rational use of fragile natural resources of the region, yet are responsible for direct and indirect maintenance of local biodiversity and water security.

Keywords: Anthropism, landscape ecology, watershed

Agrosylvopasture as sustainable agriculture systems for combating land degradation in dry subhumid areas in Indonesia

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Eastern part of Lombok island in Indonesia

is known as dry subhumid area. Farming practices in this area were generally traditional with simple techniques. The farmers in these area were practicing shifting cultivation even on steep land. By these practices the farmers were generally quite poor and so was their land. This was because the poor farmers could not give any input to the degraded land and consequently the land gave low production to the farmers. The objective of this research was to find sustainable land management systems for combating land degradation in dry subhumid areas in Indonesia. To achieved this objective various Agrosylvopasture systems were introduced in this area since 2006. The results of this research showed that, one ha of Agrosylvopasture systems using multirows of legume trees (*Sesbania* sp) for fodder mixed with livestock and food crops had provided enough food (carbohydrate + vegetables + protein) for a family with 3 - 5 members. After three years, these systems had increase farmers income from almost nothing to USD 258 per month. In 2011 these systems have been adopted by more than 1500 farmers. It is believed that these systems will also be effective to increase biodiversity in this area as well as carbon sequestration; a further in-depth study will be carried out to proof this believed

Keywords: Agrosylvopasture, Sustainable Agriculture, Land Degradation

Practical technique and extension method for improvement of crop performance with wind erosion control

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Desertification remains a serious problem in the region despite commitments from the international community, including the UN-

CCD (1994), to address it. Difficulty of desertification control may be explained from its complexity and causes directly related to human activities of basic survival and daily livelihood, such as cropping an animal husbandry. Setting the study site in the Sahel of Niger, West Africa, the objectives are 1) to verify a practical technique effective to improve crop performance with wind erosion control and 2) to examine the applicability of social-network survey to integrate into extension method for rural development assistance. We designed a practical technique, so-called "fallow-band system", in rain-fed millet cultivation to reduce wind erosion and concurrently to improve crop yield without the inputs of additional labor and materials. On-farm experiment verified its effectiveness with 60 - 70 % of wind erosion reduction and 30 - 50 % of yield increase. We have introduced this technique to western and southern part of Niger and, as of December 2011, the technique has been practiced by 381 households, in 44 villages, 9 districts and 3 regions. In a selected village, the state of dissemination of the technique was examined by using social-network survey. It revealed that the technique was disseminated almost through the network of a village chief who functioned as an entry point. We also identified some persons situated in the converging points of the network. Component of social-network survey may be applicable to modify extension method for rural development assistance.

Keywords: crop performance, extension method, fallow-band system, social-network survey, wind erosion control

Study of carbon flux under different land use patterns in an agro-pastoral ecotone in Inner Mongolia, China

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The terrestrial carbon cycle plays a vital role in the global carbon cycle, and the changes due to land use cover and management style are considered to be the main driving factor for the global carbon cycle. Agro-pasture ecotone is more fragile than the other ecosystems, it includes different land use patterns at the same region, it is a better research platform for studying the carbon flux to land use change in patch scale. In order to better understand the impact of land use on carbon flux, we investigate the correlation between carbon flux and soil moisture (Sw), soil temperature (Ts) and aboveground biomass (AGB) due to land use change. The four land use patterns are: free grazing (FG), cropland (CL), grazing enclosure (GE) and abandoned cultivated (AC). We measured in situ carbon flux with LI-8100 and air chamber (50cm x 50cm) from 6:00 AM and 03:00 AM during two growing seasons (July-October) in 2011 and (June-September) in 2012, soil moisture (0-5cm) and soil temperature were measured simultaneously.

Keywords: Carbon flux, Soil moisture (Sw), Soil temperature (Ts), Aboveground biomass (AGB), Land use pattern

The environmental impacts of irrigation

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Aiming to evaluate the efficiency of irrigation application and resize the current drainage system in the irrigated Curu-Pentecost, which has irrigated area delivered to the family farmers of 885.41 ha., 103.10 ha and 40.0 ha saline-prone salinization. To the Research Group in Engineering Water and

Soil - Semiarid (GPEAS), Federal University of Ceará, the percentage of degraded areas by salts, this perimeter, reaches 26.24%, while for Gheyi (2000), cited Araújo et al. (2010), in the Northeast, is 25%. The Brazilian Northeast, as Rodrigues and Viana (1997) is the most vulnerable area the incidence of environmental degradation, a fragile medium, with large tropical and semi-arid areas, exposed to strong demographic pressure. Data in the Irrigation Curu-Pentecost, located in the municipality of Pentecost, Ceará, belonging to the National Department of Works Against Droughts - DNOCS, confirm and climate of the region is semiarid and the perimeter soils are Entisols type of texture between average and heavy. The 175 irrigators family based, with lots of 4 to 5ha, with predominant cultivation of coconut, banana, sugar cane, beans and corn, maize 5200 m³ of water per crop, practicing surface irrigation, and drainage by gravity collector surface that contribute to the damage. Since changing this procedure is possible in the medium term, prevent the advance of the degradation of irrigated areas, mainly by salinization, irrigators are oriented parallel to an agroecological transition in order to consolidate a model of sustainable agriculture development.

Keywords: impact, salinization, efficiency of irrigation

The propensity to desertification in the municipalities of the state of Ceará - Brazil according to local social aspects

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The State of Ceara-Brazil, in recent years,

has gone through a redefinition of its economy suffering a process of modernization and restructuring productive that reaches the urban and rural sectors. One can observe the existence of investments in irrigation, rural electrification, water resources and so on. It is consensus that such transformations bring economic growth. However, linked to them, are often associated with aggression to the environment with emphasis on the exploitation of natural resources in addition to their ability to support, what intensifies and desertification processes enhances social problems. It is known that the relationship between desertification and social problems can be considered of type cause and effect, so this research proposes to analyze the propensity to desertification for the 184 municipalities of the State of Ceara from the construction of an Index of Propensity Desertification on social aspects as recommendations of the United Nations Organization. For that, it made use of factorial analysis model and cluster analysis, it was found that 134 municipalities of Ceara had relatively low propensity indexes desertification with lower densities, but the worst conditions of sanitation. Educational campaigns on the consequences of desertification, programmes to combat rural poverty with alternative employment and income, in the end, an improvement in the quality of life of the population, are ways to minimize the action of man over nature, often their only form of sustenance.

Keywords: Social impacts, Propensity Index Desertification, State of Ceará

Rehabilitation of degraded peatlands in Belarus: the best practical result

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The mire ecosystems occupy 14.2 % of the territory of Belarus and they play very important role in the mitigation of the droughts and drought phenomena consequences on

territory of Belarus. They are very important for biological and landscape diversity conservation. Large-scale drainage during the Soviet period decreased the number of natural peatlands in Belarus by more than half. Peatlands, once degraded, contributes to progressive loss of productivity and declining harvests, disruption to the carbon cycle, shrinking habitats for globally important species, increased risk of fire overall and special risk of radioactive contamination in the Chernobyl zone. The influence of anthropic factor on mires and peat deposits by their amelioration is exhibited especially scaly. According to official data, about 200,0 thousand ha of Belarus' drained peat land and inefficiently managed agricultural land is in critical condition. Over 11,000 peat fires, on average, have occurred annually over the last 10 years. Rehabilitation of degradation peatlands world contribute to a better environmental situation in the country due to elimination of peat fires, reduction GHG emissions, improvement of regional climate and hydrological regime, and restoration of the biodiversity. Activities on peatlands' rehabilitation also often evoke support and interest from local residents, by providing new places for recreation, fishing and berry-picking. On 17 project sites of Belarus with total area 40,000 hectares practical activities have been implemented for rehabilitating various types of damaged mires and depleted peat deposits. As a result is reduction of CO₂ emissions about 300,000 tons annually.
Keywords: peatlands, rehabilitation, biodiversity, mitigation of the droughts

What future for the Mediterranean land resources?

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Land area of the Mediterranean region is about 854 Million ha, but only 118 Million (or 14 per cent) are suitable for agricultural production. In North Africa and the Middle East

(MENA) agricultural land accounts for 5 per cent but in Egypt and Algeria is less than 4 per cent and in Libya less than 2 per cent of all nation's land. Region wide land cover include also natural pastures/rangelands (15 per cent) and forests/woodlands (8 per cent). The remaining 63 per cent consists of desert sands, shallow, rocky, saline, sodic soils and areas sealed by urbanisation. Land degradation is severe in most countries. The average agricultural land area per capita in the Mediterranean EU countries is 0.30 ha and the agricultural land per agricultural worker is 11.4 ha. In the South Eastern Mediterranean countries, these areas reduce to 0.25 ha and 1.9 ha respectively indicating less agricultural land and more rural people (about 41 per cent of the population). Estimates for the period 1961 - 2020 show that while the Mediterranean population is likely to more than double, 8.3 million ha of agricultural land may be lost (7 per cent) if the present rates of urbanisation and degradation remain unchanged. Agricultural land per capita would drop from 0.48 ha in 1961 to an estimated 0.21 ha in 2020. MENA countries are already water stressed but climate change will worsen the situation with consequences on food security and socio-economic disturbances. This situation requires a major reassessment of Mediterranean agricultural policy

Keywords: Mediterranean, land stresses, demographic pressure

Global Land Degradation Information System (GLADIS): first results

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The LADA team at FAO has been developing a global land degradation information system (GLADIS) aiming to assess both the status and the process of land degradation for both degraded and degrading land. Results are visualized using radar graphs with six axes for six different aspects of land degradation. They include: biomass, soil health, water resources, biodiversity, economic production, and social/cultural wealth to provide a comprehensive representation of land degradation. The use of radar diagrams is an innovative and efficient methodology for GLADIS to indicate the status and trends of land degradation, provided data are being made available with sufficient quality, which is often not the case at national and sub-national level. The economic part of the system is still a component under development, which has been delayed by the lack of satisfactory statistics at the sub-national level. A worldwide peer-review survey on GLADIS was conducted in 2011 and concluded that GLADIS is an interesting database for land degradation studies and assessments but still only partly satisfies stakeholders' needs, despite its recognized user-friendliness. Several of the reviewers considered the system very innovative and useful, but point out at the needs for further refinement of the content, methodology, and its validation especially at national level. Once the system is finalised, expectations are that it could become a particularly useful tool for assessments and decision-making at global level, whenever reliable global data are made available.

Keywords: LADA, GLADIS, radar diagrams, global assessments

Session & Workshops

Integrated modelling of climate impacts on food and farming at regional to supra-national scales

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Climate change is expected to have severe effects on the production of food, especially in dry regions. Many models accounting for the effects exist but are specialized to particular agricultural products, agricultural sectors, regions, and scales or cannot account for all climatic drivers. To address these issues, a tighter integration of models is needed that can go beyond the niches of individual models and address interactions among

products, sectors, and scales. Presentations in this session will address the use of trade models as a means of integration, show examples of model integration in the Mediterranean and other hotspots, examples of integrated land use assessment tools in developing countries and report on on-going or emerging international initiatives that will contribute to greater overarching assessments of climate effects on food production and vice-versa for political stakeholders. The integration of models across spatial scales and disciplines will enhance our understanding of measures to cope with climate change, improve land management and secure food supplies.

Keywords: climate change, food security, trade, international networks, policy

Agroecology as a powerful tool for the development of drylands?

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Agroecology is subject to many epistemological controversies amongst different schools of thought on different continents and amongst the movements that have supported its development. In most cases agroecology is mentioned as an alternative option to conventional agriculture in order to overcome the deadlocks and deficits manifested by repeated food crises and degrading production systems. Patently the challenges of agriculture are not limited to the quantitative aspects of production, but also include food security and food sovereignty, the maintenance and restoration of land and biodiversity, water resource management, adaptation to climate change etc. Would Agroecology be the antidote to these threats? Is it only a slogan or concept added to the range of terms generated by sustainable agriculture,

where its novelty means that there is as yet insufficient evidence to assess the limits of its validity as a solution to local and global problems?

A review of agroecology shows three dimensions: technical, socio-economic, socio-cultural and socio-political. In many cases these practices show a great potential for development, and in particular income generation for the improvement of the livelihoods of small-scale family farms. Agroecology has shown significant impact and relevance for large-scale production in countries such as Bolivia where biological control of pests and diseases has been achieved on more than 60 crops on 250 000 hectares.

Beyond the controversy, a review of various scientific and research conducted in 2012 and several earlier publications tend to confirm these facts by comparing the advantages of agroecology to the outcomes of other production systems. There is considerable and mounting evidence that in many areas and production systems the green revolution has failed. On the other hand, agroecology has produced increased yields, improved soil fertility, water saving and conservation, reduction of external inputs, reduced pollution, rising incomes and increased resistance to climatic variations. In this session the parameters of these results will be specified.

Agroecology also shows a very specific relevance to the drylands of the world in agronomic terms, maintenance and restoration of degraded land and development. Based on the work and results presented by different stakeholders, including the Working Group on Desertification (France) and supported by about sixty cases in dryland areas, a special session will highlight the scientific and technical achievements of agroecology and the hopes and proposals that it relate to drylands development and the fight against poverty. This session will address a number of critical questions: (i) What major achieve-

ments are evidenced? (ii) What lessons have been learned regarding all relevant parameters of sustainable agriculture in a warming world? (iii) What are the parameters that are significant for achieving transition to sustainable agroecological production systems? (iv) What is the impact of public policies, and what is needed to implement appropriate policies? (v) What areas of innovation are needed to introduce agroecology in programs and projects within the framework provided by the UNCCD, particularly at the national level? (vi) What opportunities may be used to revitalise TPN6 (Thematic Programme Network 6) "sustainable production systems", the official framework of the UNCCD in this regard? Under the aegis of the global DRYNET network and the Working Group on Desertification, practitioners from South Africa (EMG), France (CARI) and The Netherlands (Both ENDS), Iran (CENESTA) and Senegal (ENDA), will participate in a series of presentations followed by a debate whose outcome should be a feasible roadmap for the UNCCD Thematic Programme Network 6 on Sustainable Production Systems, Parties to the Convention and other actors to improve agriculture production systems in drylands on an agroecological basis.

Keywords: agroecology, fertility,

The New World Atlas of Desertification contributing to economic valuation of land degradation

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To address complex global challenges, decision makers and environmental managers have to be able to rely on up to date information on the state and trends of the degradation of the land, its causes and effects, and be offered routes for solutions, such as sustainable land management options including economic valuations and trade-offs. The JRC coordinates an international activity to compile a new global reference on where land degradation and desertification

(LDD) happens, the World Atlas of Desertification (WAD). This endeavor is undertaken in partnership with the UN Environment Programme (UNEP) and in collaboration with a vast network of the best experts worldwide. Further to the implementation of this initiative, the JRC developed an integrated concept to approach this stocktaking and also took the lead for the development of a scientific, transparent and repeatable methodology for global assessment and mapping, a complex open challenge. WAD addresses the economic aspects of LDD and offers a first global base reference to be included in econometric models. The WAD, to be made available during 2013 as digital information portal and published reference atlas, is a new foundation to better address LDD in policy strategies and an important contribution towards reaching the challenging UNCCD goal for a land degradation neutral world as endorsed at RIO+20. The goals of the session include: (1) Inform the community on the New World Atlas of Desertification (WAD) as updated conceptual and data base reference for the state of LDD at global scale (paper and digital portal); (2) Inform on the specific findings related to the assessment and mapping and the status of LDD at global and regional scales; (3) Illustrate how in the WAD information and base reference is or can be integrated into econometric models used for the valuation of LDD. Expected Outcomes of the session are as follows: (1) Understanding of the contribution of the WAD to: (a) addressing SLM options for dealing with LDD as global problem; (b) economic assessments and valuation of LDD (spatial data layers integrated into economic models). (2) UNCCD stakeholder community informed about first results on the estimation of the actual global extend of LDD and the economic consequences. The structure of the session is proposed as follows: (1) Introductory statements from main stakeholders; (2) Introductory Statements (Not Confirmed); (3) L. Gnacadja (Secr. Gen. UNCCD); (4) A. Magalhaes (Brazil, Chairman UNCCD CST); (5) P. Wegerdt (European Commission); (6) short presentations giving insight in all aspects of the WAD and especially related to

economics valuation; (7) A new global Atlas of Desertification: Why, How and Findings (M. Cherlet); (8) The value of WAD for LDD policies and economic valuations (U. Safriel); (8) Water as issue for LDD and economics: focus on Africa (S. Mbow); (9) LDD and Ecosystem trade offs in the Southern Africa Region (G. Von Maltitz); (10) Economic valuations integrating remote sensing derived layers (C. Morales/G. Dascal); (11) Economic causes and consequences of population changes (A. Leon); (12) Agriculture and soil in WAD (P. Zdruli); (13) Panel discussion (+30mins). Support to cover participation of speakers/panellists will be provided by JRC where needed.

Keywords: LDD, WAD, global assessment, economic valuation, mapping

Towards a land-degradation-neutral world: from science to policy

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Decision maker's dialogue at the UNCCD Second Science Conference. "...the time has come for the international community to commit itself to a land degradation neutral world by setting sustainable development goals on land use, with targets towards achieving zero net land degradation." This was the Africa Consensus Statement, developed in Addis Ababa (25 October 2011) and presented at Rio+20, calling for concerted action to combat desertification, through the establishment of agreed targets on land degradation and rehabilitation of land. Yet the Rio +20 Outcome Document – "The Future we want" – falls short of these expectations by simply committing to "strive to achieve a land-degradation neutral world in the context of sustainable development." Although there is clear global interest in tackling land degra-

ation, as evidenced by support for the UNCCD, parties to the UNCCD have concerns over the establishment of targets and over how the concept of Zero Net Land Degradation is defined as well as how it can be operationalized.

Moving from science and political rhetoric to securing global commitment is a lengthy and challenging process. The First UNCCD Science Conference showed that targets can be established and monitored cost effectively. The second Science Conference will show the costs of inaction compared to the benefits of action. Nevertheless, science alone is unlikely to sway decision makers and other avenues of discussion need to be considered if global leaders are to take tangible action. The objective of this session is to examine legal and policy options and pathways for reaching global consensus on how to achieve a Zero Net Land Degradation world, and to identify steps for moving the debate forward.

The decision maker's dialogue will consist of expert presentations from scientists and economists and an accompanying facilitated panel debate, with interventions and questions from the floor.

Presenters: (1) Dr. Alan Grainger, University of Leeds – Zero Net Land Degradation: definitions and divergences; (2) Dr. Mark Schauer, GIZ – The Economics of Zero Net Land Degradation, (3) Dr. Ian Hannam, IUCN Commission on Environmental Law – Options for reaching a global agreement on ZNLD.

Panellists: (i) Dr. YongKwon Lee, Delegation of the Republic of Korea; (ii) Mr Muleso Kharika, Delegation of the Republic of South Africa; (iii) Representative from the Delegation of France (to be confirmed); (iv) Representative from the Delegation of Brazil (to be confirmed); (v) Simone Quattrini, the Global Mechanism, (vi) Sergio Zelaya, UNCCD Secretariat; (vii) Civil Society representative (to be confirmed)

Keywords: zero net land degradation, policy

Toward an analytical framework to assess the value of action and inaction against land degradation: new insights, and policy challenges

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Healthy soils and terrestrial ecosystems are essential for sustaining human life and livelihoods. In spite of this, the provisioning of ecosystem services is often taken for granted and their value underestimated. According to some estimates (Nkonya et al., 2011) about a quarter of global land area is degraded, affecting some 1.5 billion people worldwide. Land degradation is particularly damaging for the livelihoods and well-being of the poorest households in rural areas of developing countries. Self-reinforcing mechanisms involving poverty and land degradation, with effects on food security, and overall economic performance, critically hamper economic development processes. Climate change can exacerbate these effects by increasing people's risk exposure and by increasing uncertainty in the returns on their land improvement investments. Increased temperature, extreme events, and disruption of known weather patterns alter and potentially strengthen the effects of the geophysical and socioeconomic drivers of land degradation. The objective of this special session is to highlight the need for, and delineate the role of, a global comprehensive economic assessment of action and inaction

against land degradation, and to illustrate a scientific framework to conduct such an assessment. The robustness and usefulness of such an assessment crucially depends on the reliability of scientific information on the degree, the extent, the location and evolution of land degradation thus requiring close interaction among scientists from different disciplines. The complex dynamic interactions between poverty and land degradation and between climate change and land management will be specifically illustrated. Moreover, a method that allows the prioritization of action against land degradation will be presented. This special session will lead to concrete steps toward a global economic assessment of land degradation, discussing the needs and contributions of the different disciplines and how they can be synergized to provide society and policy-makers with an operational understanding of the human impacts on land degradation and of the costs of delaying action to prevent it.

Keywords: land degradation, climate change, poverty, economic assessment

Catastrophic shifts in drylands: how can we prevent ecosystem degradation? Special Session on how to overcome the difficulties of successful engagement of non-scientific stakeholders

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We already know quite a bit about the co-existence and interdependencies of human communities, animals, and plants, but we must learn more about the thresholds that determine whether or not ecological communities can survive in drylands in the future. Are some types of ecosystem more resilient to change than others? How easily can

degraded land be restored? A series of experiments in different sites across European drylands will seek to provide some answers. The aims and objectives of the large EU-FP7 funded CASCADE (Catastrophic shifts in drylands: how can we prevent ecosystem degradation?) project are to obtain a better understanding of sudden shifts in drylands that may lead to major losses in biodiversity and concomitant ecosystem services. By focusing on drylands in Europe, CASCADE will build on existing knowledge regarding shifts in these vulnerable ecosystems and further improve the current understanding of the biogeochemical mechanisms underlying sudden and catastrophic shifts. CASCADE aims to further develop instruments and tools to predict the proximity of dryland ecosystems to thresholds in such a way that these predictions can be used by policy makers and land users, for more sustainable management of drylands worldwide. The CASCADE project faces a real and, we believe, not unique challenge in ensuring from the start, that relevant non-scientific stakeholders can engage with the concepts being studied and that the management implications the project will produce are clear, effective, and appropriate for decision makers and land managers in order to guarantee the long-term sustainability, both in economic and ecological terms, of land management strategies in the CASCADE study sites, and drylands in general. The specific objectives of the session are as follows: (1) obtain a better understanding of how complex concepts such as ecosystem shifts, thresholds, and tipping points may be more effectively conveyed to non-scientific stakeholders in order to engage with local land users; (2) generate ideas from a (hopefully!) diverse audience about the type of preventive and restorative measures for sustainable management of dryland ecosystems that would address potential catastrophic shifts; (3) develop a set of criteria to be used by potential stakeholders to assess the value of different SLM measures, in order to develop sound dissemination outputs for reporting to national and international policy-makers, as well as identify entry points for policy changes to

ensure maximum policy output; (3) offer the audience an insight into processes to think about stakeholder engagement, and impact creation from a large interdisciplinary SLM research project. Participants will receive a short questionnaire regarding the topics to be discussed in the ensuing discussion round. The presentations (3 x 12 minutes) will include: Introduction of the CASCADE Project and ways in which we plan to involve non-scientific stakeholders, including analyses of local land users' adaptation strategies and multi-scale evaluation of scenario analyses with land managers and policy makers; Ecological characteristics and consequences of catastrophic shifts in drylands; Economic assessment of the financial effects of (not) adopting land management measures. The discussion will be structured around the following topics: (1) SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis of the CASCADE setup for stakeholder engagement; (2) Themes and terminology for stakeholder engagement; (3) Inventory and assessment criteria for SLM strategies addressing potential catastrophic shifts. We are in the process of developing an online information system (CASCADIS) on the CASCADE website, which will include an interactive presentation of this Special Session with drop-down features that can be used by the readers to find basic information on the session, view the presentations and questionnaires, as well as find further information according to their interests. We also plan to include video clips as a powerful information sharing tool.

Keywords: Stakeholder engagement, Catastrophic shifts, Sustainable land management, Drylands, Ecosystem services

Practical tools for monitoring and assessment of DLDD for economic assessments

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The economic assessment of desertification, sustainable land management and resilience requires simple, monitoring and assessment tools that can be used by farmers, development organizations and governments. We will provide a series of brief introductions (4-8 minutes each) to a suite of practical tools that are being applied by land managers and policymakers throughout the world. The remainder of the side event will be devoted to hands-on demonstrations. The presentations will include both a description of the tools, and how they are being applied to guide land management at the local scale and (for some) to support national reporting to the UNCCD by the United States. The tools to be highlighted include (among others) (1) an entire dryland monitoring system that requires only a 1m stick, a single sheet of paper, and no ability to read or write, (2) additional simple field tools including a 10 minute test for soil resistance to erosion, (3) a user-friendly database for streamlining and standardizing data collection, and automatically generating land health indicators, (4) an assessment system for 3 key attributes of land health that has already been applied at over 30,000 locations, (5) simple tools for analyzing aerial photography that do not require a background in GIS or remote sensing, and (6) a tool for estimating how many measurements are needed at multiple spatial scales. All of the tools and guides can be freely downloaded at jornada.nmsu.edu (click on 'Monitoring'), and some are available in several languages, including Chinese, Mongolian and Spanish. Participants will leave the workshop with a set of simple, practical monitoring and assessment tools, as unlimited access to online and CD-based training materials, as well as user-friendly databases and electronic field data collection systems.

Keywords: monitoring, assessment, evaluation, valuation, degradation

COST Action ES1104 - Arid lands restoration and combat of desertification: setting up a drylands and desert restoration hub

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The Arid Lands Restoration Hub was initiated under the umbrella of the COST European Science Foundation (COST protocol), specifically to address the practical issues of arid and dry lands restoration and combat of desertification particularly with regard to the practical measures of establishing and maintaining vegetation which is key to the success of the UNCCD's and other agencies agenda. Key information and data is most often extremely difficult to find and it largely remains within academic circles. The objectives of the 'Desert Restoration Hub' is to fix this broken circle where scientists and practitioners and stakeholders in one country or region do not know the importance of what is happening in other countries. Thus information remains hermetic and the cycles of desertification and the consequential environmental and socio-economic degradation follows a pernicious cycle. The COST Action members consist mainly of scientists

from EU signatory countries, from reciprocal agreement countries (Australia, South Africa) and potentially from a group of near neighbor countries. This is one of the few instances that a broad spectrum of scientists (soils scientists, hydrologist, agronomists, ecologists, landscape planners...) have been brought together for the first time to tackle his issue. The significance of this COST / EU funded Action cannot be under estimated. It not only has significance for the EU, in countries which are becoming increasingly desertified (Spain, Portugal, Italy, Romania, Greece etc.), in near neighbor countries across the Mediterranean and the Sahel region (where economic migration is a direct or indirect effect of desertification) but the significance is global. The importance of this Action has been recognised by UNCCD by Louise Baker Senior Adviser - Partnerships UNCCD, Bonn and the participation of Bertrand Vincent UNCCD at the 2nd Management Committee Meeting held in Brussels, June 2012. The intention is that the UNCCD is invited and participates in the Action and collaboration ensues. The raisons d'être for this special session/workshop in Brazil is mainly to widen participation in the Action, to initiate a global network of knowledge, rather than an EU focused centre. A special Workshop will allow a spreading of stakeholders across the world as the UNCCD conference will host 'movers and shakers' from around the globe. Full stakeholder global participation is a key prerequisites for tackling the UNCCD mandate to combat desertification. It is also our remit. This special session will in particular allow scientists and other stakeholders to become participants (providers and disseminators of information) with its consequential socio-economic benefits form countries which we could not easily reach, particularly in South America and Asia. The Workshop would include talks by the Chair Dr Benz Kotzen (UK) and colleagues Dr Pandi Zdruli (Italy) and Dr Cristina Branquinho (Portugal). These talks would focus on the situation in Europe and the perspectives of the nearly 40 members of the Action from 20 countries. The session would open discussions on the status quo in restoration and other socio-

economic aspects related directly to restoration in areas worked on by the participants and particularly how the participants in the session can contribute and participate in the 'Desert Restoration Hub'. The EU Science Foundation has recognized the importance of this initiative for the EU and its reciprocal and neighbor countries. The UNCCD's 2nd Scientific conference in Brazil offer a unique opportunity to get the world involved in this project. Please refer to: http://www.cost.eu/domains_actions/essem/Actions/ES1104 and <http://desertrestorationhub.com>.

Keywords: COST ES1104, Desert Restoration Hub, Worldwide Stakeholder Participation, Knowledge Base and Knowledge Dissemination

Assessing actions to combat desertification, what valuations

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The session is based on the outputs of the seminar co-organized by CSFD and IAMM-CIHEAM held in Montpellier on the 29 and 30 of June, 2011, "policies, programmes and projects to combat desertification, what evaluations" and on the publication of its main results in a special issue of the peer-reviewed journal "Secheresse et changement planétaire" entitled "assessing actions to combat desertification, what valuations?". Land management is regulated through policies, formal and informal institutions, at various levels. The session focuses on the valuation

of projects, programmes and policies of sustainable land management in drylands. This encompasses both institutional issues and concrete changes in the local uses of natural resources, especially land, through agriculture and breeding on one hand, forests and related products on another. Relying on a variety of disciplines and of approaches in social sciences, the session aims at identifying the meaning of valuation, the objectives and the related tools /methods for valuation. Economic or financial valuation is one aspect of valuation, often presented as the major approach because it can give results in terms of financial and economic return of actions to combat desertification. This is indeed much demanded by the main actors dealing with policies and projects, such as cooperation institutions, organizations and decision-makers. Economic rate of return is thus a common valuation tool used for ex ante and ex post valuation. Still it is generally strongly linked to the content of a logical framework and using this indicator can hamper the consideration of the externalities of the projects. Economic valuation implies to compare two situations, the one with the action and the control situation through time, but can only be done through heavy protocols of experimentation. External factors in the analysis can change the meaning of the results comparing both situations. For natural resources management approaches, valuation implies first to elaborate a relevant environmental baseline as a condition for assessing an action. These approaches enlighten more the socio-political context of these projects, policies and programmes and help to understand the reason for success and failure, including during the implementation. In that sense, it encompasses external factors in the valuation process. Lots of examples can be here developed from the Montpellier seminar. A last category of valuation put the local actors at the heart of the valuation process. Then valuation can be presented as a direct tool for enhancing local development and not anymore just as a tool for funding and implementing bodies to report on their activities or to elaborate further policies and projects. It is strongly linked to local actors' organiza-

tion and capacities building for land planning in a context of decentralization of the management of natural resources. Numerous tools are available, the selection on the way local actors are mobilized into the exercise of valuation. Indicators are very much demanded by decision-makers and cooperation institutions, and their use is essential in all these types of valuation approaches. Still, each considers indicators in a different way within the process of valuation. Through exchanges between scientists and operational actors (administrations, NGO's) this special session will attempt to clarify when it is preferable to follow one or another type of valuation, according to their specific added value and limits, more specifically from a scientific point of view. It will at the same time aim at exploring some of the linkages between the many uses and functions of assessment and valuation (by decision-makers especially) and the practice of development. Various experiences and examples on desertification and land degradation issues will therefore be presented.

Keywords: Valuation, disciplines, approach, indicators, projects programmes and policies to combat desertification

Adapting to climate change and disaster risk reduction through sustainable land management: experiences in Tajikistan, East Africa, US, Argentina and Mongolia

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Many regions of the world are vulnerable to impacts of climate change and increasing occurrence of disasters. Current problems

which local people are already facing are among others erratic and irregular rainfall patterns, longer dry spells, droughts, which have implications for agriculture, e.g. calendar, productivity, new pests. Food security and health becomes a challenge. These impacts are embedded in a matrix of other environmental and social stresses, such as migration, population growth, changes in local land-use, and introduction and removal of species, adding to the complexity of the issues. Therefore, ensuring sustainable use of natural resources, hence Sustainable Land Management (SLM) linked to Disaster Risk Reduction (DRR), is crucial for maintaining the basis for sustainable livelihoods. In many parts of the world, land users and communities are paying increasing attention to find sustainable ways of managing their land to ensure that soil, water, and other resources are conserved. In light of the growing challenges to reduce disasters and adapting to climate change still a lot of efforts are needed to document innovative knowledge on SLM adaptation strategies. Many win-win solutions in SLM exist, traditional as well as innovative practices which are technically, ecologically, economically, and socially sound which need to be further tapped. The special session will share and discuss experiences from different regions, namely from Tajikistan, East Africa, US, Argentina and Mongolia. Within the Pilot Program for Climate Resilience (PPCR) in Tajikistan 70 SLM technologies and approaches on how to implement SLM were documented with the World Overview of Conservation Approaches and Technologies (WOCAT – www.wocat.net) tools in 2011. For this purpose a climate change adaptation module was developed and tested in order to enhance the understanding about climate change resilience of SLM practices and community workshops conducted on adaptation mechanisms by rural communities in Tajikistan. The developed WOCAT climate change adaptation questionnaire is being further reviewed and tested for use in East Africa within an FAO land and water management for climate change adaptation project funded by SIDA in Kenya, Tanzania and Ethiopia and in the Kagera ba-

sin in the context of a GEF transboundary agroecosystem management project (Rwanda, Burundi, Tanzania and Uganda). Initial results will be presented. Furthermore, a general approach for resilience-based management in the US, Argentina, and Mongolia, taking advantage in several new natural resource management concepts and technologies will be presented with a brief reference to the development of a global system for defining land potential, that complements the work described here. Land users, advisors, and decision- and policy makers face the task of finding management practices that best suit site-specific conditions. These studies support them in the decision making process, which is most efficiently addressed in collaborative efforts by building up and manage a respective knowledge platform. Based on data from the growing global WOCAT database SLM practices are presented in an attractive standardized soft and hard-copy format. However, what is lacking is offering informative audio-visual messages from land users to land users showing how SLM works, what problems it solves, how challenges can be overcome and what benefits, locally, regionally and globally can be achieved. WOCAT applies video and new media as an innovative, audio-visual tool supporting and complementing WOCAT knowledge on innovative SLM technologies and approaches. Through the combination of audio-visual information, based on local experiences and scientific knowledge on SLM, a powerful package for knowledge sharing and decision-making in SLM is currently created for use by different stakeholders and for various purposes.

Keywords: Adaptation, climate change, resilience, DRR, SLM

Scaling-up SLM: what is the missing link? - Bridging the science-practice divide, making the case through valuation of ecosystem services

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The degradation of ecosystems has – to a large extent – been induced by unsustainable human activities. Humans have both caused these changes and are directly affected by them. This positions people at the very centre of the issue and requires them to take responsibility and action. Understanding the value of ecosystems and their services is essential to construct preventive solutions and conservation methodologies that deliver socio-economic benefits and sustainability.

Unsustainable land management has visible and measurable negative outcomes, which go beyond productivity losses. Through the integrated valuation of the ecosystem services (ES) that land provides, economic valuation of land (EVL) can effectively quantify the impacts of land management practices. The holistic assessment of costs and benefits facilitates more informed decision making and encourages the development of sustainable solutions, thus making EVL an integral element of policy and planning processes. Sustainable land management (SLM) provides a viable pathway to green development and has been implemented in a wide diversity of geographical and economic contexts. Assessing the variety of available methodologies of EVL and understanding their relation to SLM is essential for the identification of land use options that benefit all stakeholders. Valuing ecosystem services and approximating outcomes of SLM practices can significantly strengthen the case for sustainable development and stimulate responsible land-based investments. This panel discussion will serve as an exceptional opportunity to unite knowledge across disciplines and stakeholder groups to provide a new perspective on the transition to a green economy for both private and public sectors. The professional diversity of participants ensures that EVL and SLM are understood from academic, scientific, financial, entrepreneurial and practical angles. It is expected

that such a platform will generate a fruitful discussion and further engagement by the scientists, policy makers, country officials and representatives of civil society present in the audience. The overall objective of this workshop is to facilitate an overarching, multidisciplinary understanding of SLM and EVL and thus contribute to the identification and promotion of practices benefiting natural resources, societies and the economy. More specifically, the workshop will pursue the following objectives: (1) Foundation of a mutual understanding of the importance of valuation of ES in promoting responsible land use; (2) Critical review of the available methodologies for EVL, including strengths, bottlenecks, transferability between contexts, overlaps and complementarities; (3) Overview of results achieved to date through case studies, policy-oriented recommendations, enabling regulations and pioneering investments; (4) Identification of research gaps or areas where additional work would be required, in order to bridge the science-policy-practice gap; (5) Capacity building, through better understanding of the win-win opportunities offered by SLM, both sectorally and geographically; (6) Exploration of synergies and networking opportunities with the organizations participating in the workshop; (7) Sharing a vision about the possible role of ecosystem benefits in a “green economy”. The workshop will revolve around case studies introduced by keynote speakers that reflect the application and implementation of ES/EVL valuation methods. The discussion will unfold methodological and practical issues and will locate research gaps and potential entry points for further development, providing fertile ground for continuing cooperation in terms of methodological research, policy uptake and practical implementation. The workshop will have tangible outcomes: It will both bring valuable input to the envisaged products of the 2nd UNCCD Scientific Conference, and provide a series of pointers for policy makers, researchers, the business sector and civil society regarding SLM and the integration of EVL in land-based decision making processes. It is also envisaged that the main conclusions of the workshop will be

elaborated in the form of a short commentary or perspectives piece for a high impact scientific journal.

Keywords: sustainable land management, economic valuation of land, research gaps, capacity building

Sustainable dryland management for multiple benefits: opportunities for linking carbon storage, ecosystem services and livelihoods

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This proposed special session targets the theme 'economic, environmental and social assessment of DLDD' and cross-cuts several of the sub-themes therein, including 'soil functions and related ecosystem services'. The session will provide a platform to improve understanding of the dynamics and processes affecting dryland carbon stores and fluxes, and their role in affecting other ecosystem functions and services, critical to the livelihoods of the poor. Particular focus is placed on understanding the trade-offs, risks, challenges and new opportunities that terrestrial carbon storage and its related

services can bring for sustainable growth in drylands (considering socio-political and economic dynamics under present and future conditions), and the challenges and opportunities caused by the development of payment for ecosystem services schemes. Carbon-poverty interactions in drylands are generally under-researched compared to tropical forest systems despite being home to many of the world's poorest rural communities. Many ecosystem processes and functions in drylands remain only partially understood and existing payment schemes rewarding land users for carbon storage linked to Sustainable Land Management (SLM) practices are ill-adapted to dryland systems. This is because they do not consider issues such as unclear project boundaries, mobility, and lower carbon sequestration levels over vast areas. The proposed session has potential to inform solutions to several key global challenges aimed at integrating dryland degradation and climate change policies and practices. Organic carbon in soils is hugely beneficial for a range of ecosystem functions, assisting the provision of adaptation options as well as supporting natural-resource based livelihoods. Simply by its presence, soil organic carbon (SOC) improves soil structural stability and water holding capacity, while its decomposition generates direct benefits through the recycling of nutrients and maintenance of soil fertility. This, in turn, contributes to other supporting, provisioning and regulating ecosystem services that support dryland livelihoods, particularly food and timber production. SLM techniques seek, among others, to increase the amount of organic carbon stored in soils and biomass. However a trade-off exists because to realise many livelihood and ecosystem service benefits from SOC requires its depletion (e.g. through crop production) and thus, in some cases, a net release of CO₂, contributing to climate change. Understanding how different land use and management systems in drylands can deliver environmental benefits through the storage and turnover of carbon, and how these can link to social, economic and livelihood benefits along with payment for

ecosystem services, are key policy-relevant research challenges. Presentations in this proposed special session will tackle these challenges and seek to inform the development of solutions. Speakers will consider the environmental, economic and social benefits from SLM practices that manage the tension between carbon storage and use. Presentations will encompass a range of dryland land use systems (e.g. woodlands, coastal forests, rangelands and agro-ecosystems). The 90-minute session will include 2 invited speakers who will talk for 15 minutes (+ 5 minutes each for questions). We will also issue a call for contributions in the form of 5 presentations of 10 minutes each.

Keywords: soil organic carbon, poverty alleviation, climate smart development, payment for ecosystem services

GLOBAL ENVIRONMENT FACILITY SPECIAL SESSION Carbon Sequestration – A Valuable Global Benefit of Sustainable Land Management

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This Special Session supports the two conference topic themes of (1) Economic and social impacts of DLDD; (2) Costs and benefits of policies and practices addressing

DLDD.

Therefore, we shall identify the following themes in our Special Session: (1) the significant investments already being made in the GEF LD Strategy and their impact; (2) how a focus on carbon – above- and below-ground – could add value, economically and socially, to future GEF investments; (3) how we can track and measure the benefits of SLM in terms of carbon sequestered; (4) the policies and practices that will enhance the benefits brought by carbon in future GEF strategies.

Our objectives are to: (1) demonstrate the importance of the current work of the Land Degradation Focal Area of the Global Environment Facility, with special reference to Sustainable Land Management – SLM - and the potential benefits derived from above- and below-ground sequestration of carbon; (2) show how GEF investments and strategic planning support the UNCCD; (3) consult the scientific community on issues related to SLM that might be included in future GEF Strategic plans.

Keywords: carbon, global environmental benefits, valuation of ecosystem services, sustainable land management, soil organic carbon

Tackling key challenges in the economic assessment of desertification, sustainable land management and resilience of arid and semi-arid and dry sub-humid areas: Perspectives from DesertNet International's Working Groups

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Enhancing understanding of the biophysical and socio-economic processes of desertification is DesertNet International's (DNI) core aim. DNI provides a platform for scientifically-based discussions, addressing knowledge gaps and identifying key research areas through its Working Groups. This session brings together presentations from across DNI's Working Groups, each of which tackles a different challenge associated with the economic assessment of desertification, sustainable land management and resilience of arid, semi-arid and dry sub-humid areas. Presentations encompass the economics of sustainable land management, food security, the DNI land and soils task force and dryland observation systems. Economics of SLM: The worth of land is usually assessed in terms of simple production and extractive uses; most ecosystem services are unaccounted, un-priced, and therefore, outside the domain of the market. This lack of information on the total economic value of land has hindered the development of incentives at the policy level that could encourage sustainable land use. As a contribution to the global Economics of Land Degradation initiative, this DNI working group suggests an urgent need for: the harmonization of approaches/methods on the economic valuation of LD/SLM that recognises the varying bio-physical and economic conditions across different regions; more regional and country-level case studies linked to capacity building, and a global synthesis and major report for policy-makers on the economics of LD/SLM. Food Security: This presentation provides an overview of the relationships between food insecurity, land degradation and desertification, and its antithesis, food security and sustainable land management. Food insecurity can be attributed to a range of demand-side and supply-side causes, which include political, economic, social and environmental factors. Land degradation

and desertification are shown to be exogenous issues that can amplify and aggravate food insecurity. It is argued that addressing desertification, including land, soil, water and plant degradation, can ease the food security dilemma, but may not completely solve it in the presence of other underlying causes. Land and soils task force: The DNI land and soils task force was established following calls for independent scientific advice on land degradation issues. The absence of such guidance may explain the weakness of policy measures concerning the prevention of dryland degradation – the very mandate of the UNCCD. We use bibliometric methods and publication data mining to map the key actors involved in research on land and soils. Assessing their commonalities and differences, we extract hidden information from organised databases, allowing visualisation of the links and gaps between scientists, organisations, policymakers and other stakeholders. Interpretation of the 'cloud' of disciplines, keywords, and techniques used across a large set of data will enhance understanding of interconnections between actors and their strengths and weaknesses. This may help explain why land degradation remains a serious global problem that lacks attention, and will help to change this in the future. Baseline Information and Monitoring for Integrated Assessment of DLD: The "Dryland Observation Systems" group analyses requirements and options to provide baseline information to meet global and regional desertification assessment needs. Integration of socio-economic and environmental data is essential in assessing the impact of land degradation on human wellbeing, and in determining the benefits of preventive measures and counteractions expressed through land use adaptation and SLM. Baseline information for desertification assessments can be acquired and integrated in nested hierarchies spanning sub-national/national to regional and global scales, where data collection is scale-specific, following a common logic of integrating biophysical and socio-economic issues to account for human-ecosystem interactions at multiple scales. Practical examples from regional to

local scale highlight existing options/experience allowing associated spatial analyses of socio-economic impacts and assessment of the costs and benefits of changing land uses.

Keywords: Food security, global dryland observation, land and soils, economics of DLDD

Economics of Land Degradation (ELD) Initiative - Bridging the science-policy-practice divide - Making a case for tackling land degradation through valuation of ecosystem services

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Land degradation and desertification threaten fertile land throughout the world. The consequences are alarming: smaller harvests, reduced availability of clean water, increased vulnerability of the affected areas to climate change and, last but not least, food insecurity and poverty. It is estimated that 1.5 billion people in all parts of the world are already directly affected. In view of the world's growing population, food security is one of the most pressing challenges of our time. The Economics of Land Degradation (ELD) is an initiative for a global study on the economic benefits of land and land based ecosystems. The initiative highlights the value of sustainable land management and provides a global approach for analysis of the economics of land degradation. It aims to make economics of land degradation an integral part of policy strategies and decision making by increasing the political and public awareness of the costs and benefits of land and land-based ecosystems. Our vision is to transform global understanding of the value of land and to create awareness of the economic case for sustainable land management in preventing the loss of natu-

ral capital, preserving ecosystem services, combating climate change and in addressing food, energy and water security. The discussion will serve as an exceptional opportunity to unite knowledge across disciplines and stakeholder groups to provide feedback to the ELD Initiative and suggest constructive ways forward. The workshop will focus on the achievement of the following objectives: (1) Obtain feedback from a range of audiences on the approach taken by the ELD initiative and its relevance to each audience; (2) Critically review the list of identified gaps and identify additional gaps; (3) Obtain feedback on the priorities allocated to each of the gaps to be filled in by the ELD. The discussion will unfold methodological and practical weaknesses and will provide fertile ground for establishing new collaborations or developing existing ones. The panel discussion will have tangible outcomes: It will both bring valuable input to the envisaged products of the 2nd UNCCD Scientific Conference, and provide a series of pointers for policy makers, researchers, the business sector and civil society regarding the cost of land degradation to society and the economy. It is also envisaged that the main conclusions of the workshop will be elaborated in the form of a short summary to be published on the ELD website (<http://eld-initiative.org/>).

Keywords: ELD initiative, Valuation, DLDD

From agroecological practice to policy: bridging the gap in dryland management

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Successful innovations in dryland farming are mostly borne from the experiments of family farmers on the ground, with or without the involvement of scientists and civil society. Agro-ecological farming practices that use local resources to regenerate degraded soils play a large role in reviving dryland communities. Despite convincing evidence that these practices are successful in increasing production and resilience, this is not yet recognized in agricultural policy which continues to favour the use of imported technology, economies of scale, and specialization. This is the case even in ecologically fragile and diverse dryland areas where approaches depending heavily on the use of chemical fertilizers and other external inputs have rarely benefited small-scale farmers. Various institutional and political factors contribute to this gap between agro-ecological evidence (from practice) and mainstream policies/funding priorities.

In this workshop we will explore the disconnect between the impressive spread of agro-ecological practices from farmer to farmer and from community to community, and the extent to which agro-ecology, as a practice and a science, is supported by policymakers as a strategy to address dryland challenges. We will start with a brief exploration of agro-ecology, which puts resilience of farming communities and their ecosystems centre stage. Over the past 28 years the global AgriCultures Network has been documenting and disseminating experiences of farmers, scientists and CSOs working with an agro-ecological perspective, through its global Farming Matters magazine and several regional editions. These experiences are the starting point for this workshop.

We will have two short presentations reviewing successful agroecological experiences in dryland settings in Africa and India:

K. V.S. Prasad (director of AME Foundation) will present experiences from South India where AME Foundation, over the past 25

years, has assisted many thousands of family farmers and their organisations in applying agro-ecological practices. AME Foundation engages in participatory technology development with farmers and scientists, often in a watershed context. Prasad will share lessons learned out of decades of knowledge brokering in the South Indian drylands, connecting farmers, scientists, consumers and policy makers. AME Foundation publishes LEISA India magazine.

Bara Gueye (director of IED Afrique) will discuss West African experiences with agro-ecological practices to combat desertification, and their integration into policy. He will explore the factors that helped or hindered bridging the practice – policy gap. IED Afrique, an NGO based in Senegal with fifteen years of experience, works on sustainable development and citizenship issues, with emphasis on participatory approaches, promotion of inclusive policies and practices of decentralization and environmental governance. IED Afrique supports CSOs, farmers' and pastoralists' organisations and their networks, and publishes the AGRIDAPE magazine.

A key lesson learned from these experiences is that strengthening agro-ecological resilience requires a fundamental change in agricultural investment patterns, towards enabling small-scale family farmers to develop their skills, expertise and voice, and towards full-fledged support for the upscaling of agro-ecological practices.

Building on concrete and diverse experiences in the room and around the world, the participants in this workshop are invited to join in an exploration of the main institutional and political factors contributing to the frequent gap between evidence and mainstream policies, and in identifying and sharing strategies to overcome these gaps.

Keywords: Agro-ecology, family farming, practice-policy gap, knowledge building, innovation.

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