



PhD Reader

PhD Theses within the Framework of the Swiss
National Centre of Competence in Research
(NCCR) North-South

Status: 31 January 2008

NCCR North-South Dialogue, no. 19

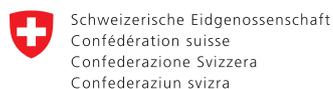
2008

dialogue

The present document was prepared at the following partner institution of the NCCR North-South:



Management Centre of the NCCR North-South
Centre for Development and Environment (CDE)
Institute of Geography, University of Bern



Swiss Agency for Development
and Cooperation SDC

The NCCR North-South (Research Partnerships for Mitigating Syndromes of Global Change) is one of twenty National Centres of Competence in Research established by the Swiss National Science Foundation (SNSF). It is implemented by the SNSF and co-funded by the Swiss Agency for Development and Cooperation (SDC), and the participating institutions in Switzerland. The NCCR North-South carries out disciplinary, interdisciplinary and transdisciplinary research on issues relating to sustainable development in developing and transition countries as well as in Switzerland.

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Claudia Michel, Manuela Born, NCCR North-South

Editing and translation

Theodore Wachs, Marlène Thibault, NCCR North-South

Cover Photos

Left: Students working on their PhD topics at an Integrated Training Course (ITC) conducted by the NCCR North-South from 1-12 September 2003, on the shores of Lake Isykkul in Kyrgyzstan, Central Asia. (Photo by Peter Messerli, NCCR North-South). Right: Group of researchers on a field trip in Vientiane, Laos. (Photo by Karl Herweg).

Distribution

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	201 Breu, Thomas	92
	208 Wolfgramm, Bettina	94
	702 Bichsel, Christine	97
5.5	JACS South Asia	100
	106 Premchander, Smita	100
	601 Thieme, Susan	100
	605 Strasser, Balz	104
	607 Shahbaz, Babar	106
	608 Schmid, Juan Pedro	108
	609 Gurung, Ghana	110
	908 Eyhorn, Frank	111
5.6	JACS South East Asia	114
	101 Epprecht, Michael	114
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	502 Hostettler, Silvia	127
	503 Dilla, Haroldo Alfonso	129
	506 André de la Porte, Cherryl	131
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1 Introduction

This PhD Reader presents an overview of PhD theses completed within the framework of the National Centre of Competence in Research (NCCR) North-South (“Research Partnerships for Mitigating Syndromes of Global Change”), an international programme with an international network. Doctoral studies constitute the core element of the programme. So far, 143 PhD candidates have benefited from fellowships offered by, or from affiliation with, the NCCR North-South since the programme was established in mid-2001; 54 of them have completed their PhD degrees to date. The share of fellows originating from developing and transition countries is 58%; the overall share of female students is 36%. All PhD fellows benefit from the programme through guidance and supervision in formulating and implementing their proposals, and through regular integrated global and regional training courses.

The PhD Reader is a compilation of the titles of all PhD theses, with summaries for those that have been completed. The titles are arranged by theme and the summaries by region. Of the completed PhD theses, 14 were undertaken in West Africa, 6 in East Africa, 6 in the Horn of Africa, 6 in Central Asia, 8 in South Asia, 5 in South East Asia, 5 in the Caribbean and Central America, 2 in South America, and 2 in the Alps. Whereas the majority of the PhD candidates are fully or partly integrated into the NCCR North-South, some are associated with it. Because of this looser integration, not every associated PhD thesis is represented with a summary in the PhD Reader.

We believe that the PhD Reader contains research results that are of fundamental relevance for development studies. Researchers in partnerships for sustainable development should always have it within reach. Representatives of development agencies will find a quick overview of research done in their field or region of practice. The PhD Reader contains empirical insights into the diversity and richness of research that has been made possible by the NCCR North-South.

2 The NCCR North-South Research Network

2.1 Swiss partner institutions

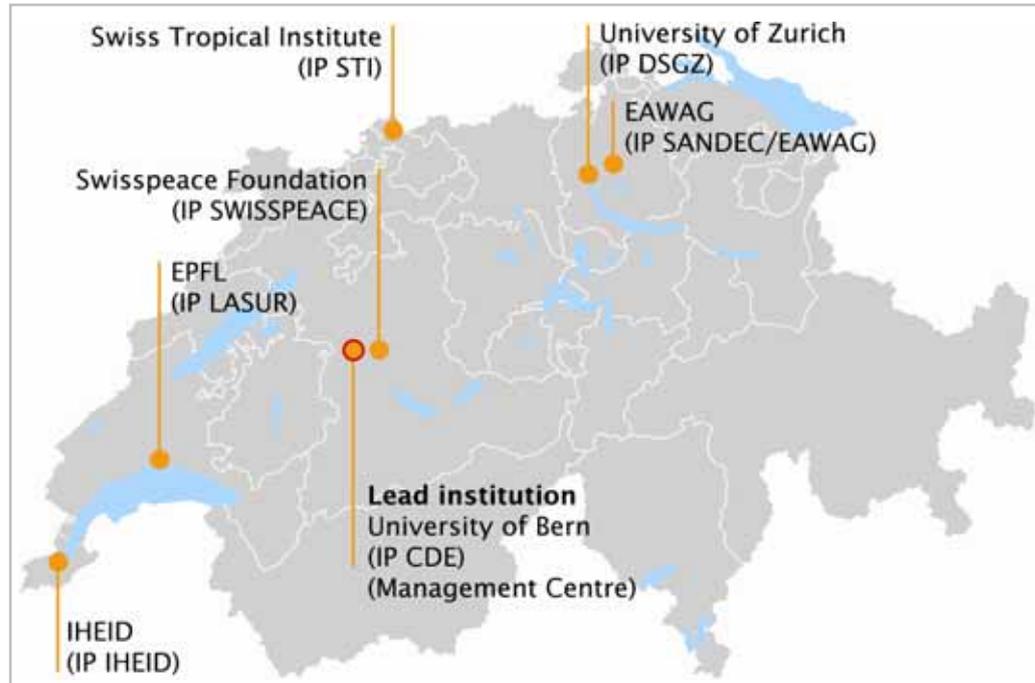


Figure 1: Swiss partner institutions in the NCCR North-South

Contacts for PhD issues at Swiss partner institutions

Swisspeace Foundation (IP SWISSPEACE)

Bern, christine.schenk@swisspeace.ch

IHEID (IP IHEID)

Geneva, anne-claude.gerber@iued.unige.ch

EPFL (IP LASUR)

Lausanne, dshamila.toscani@epfl.ch

University of Zurich (IP DSGZ)

Zurich, ulrike.mueller-boeker@geo.uzh.ch

Swiss Tropical Institute (IP STI)

Basel, patricia.schwaerzler@unibas.ch

EAWAG (IP SANDEC/EAWAG)

Dübendorf, elizabeth.tilley@eawag.ch

University of Bern (IP CDE)

Bern, andreas.heinimann@cde.unibe.ch

2.2 Joint Areas of Case Studies (JACS) and Regional Coordination Offices (RCOs)

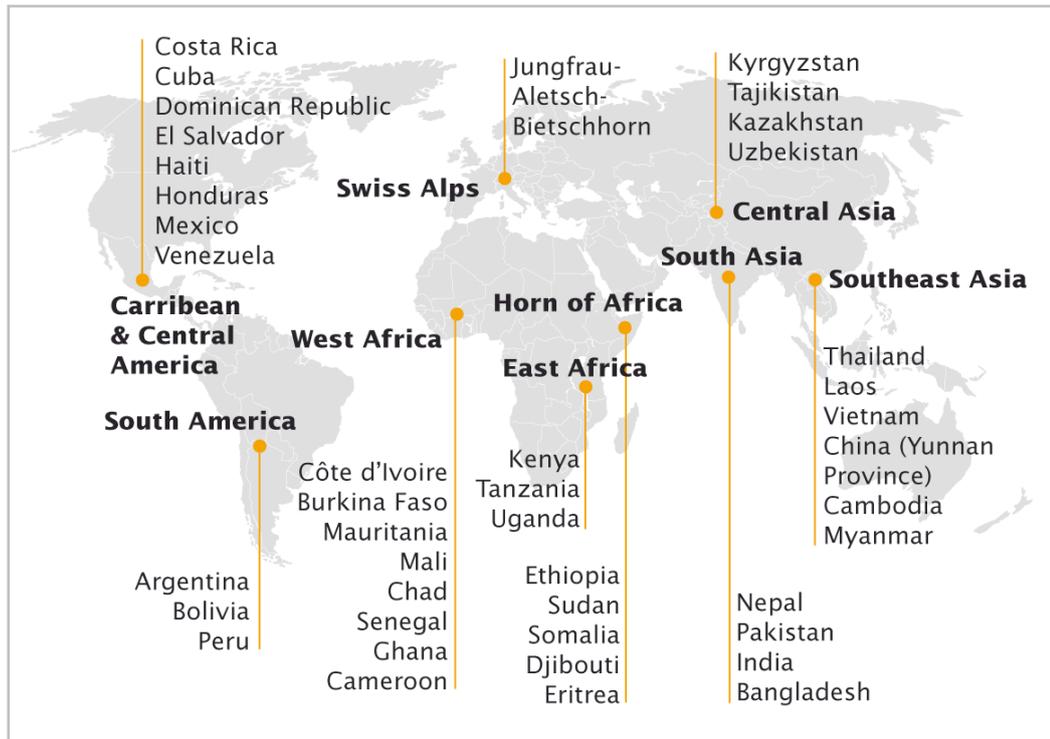


Figure 2: Joint Areas of Case Studies (JACS) and Regional Coordination Offices (RCOs)

Regional Coordination Offices

Central Asia (JACS CAS)

Bishkek, Kyrgyzstan, mira@camp.elcat.kg

South Asia (JACS SAS)

Kathmandu, Nepal, bupreti_nccr@wlink.com.np

Southeast Asia (JACS SEA)

Bangkok, Thailand, thamarat@ait.ac.th

Caribbean and Central America (JACS CCA)

San José, Costa Rica, mperez@flacso.or.cr

South America (JACS SAM)

Cochabamba, Bolivia, mdela Fuente@supernet.bo

West Africa (JACS WAF)

Abidjan, Ivory Coast, gueladio.cisse@csrs.ci

Horn of Africa (JACS HOA)

Addis Abeba, Ethiopia, nccrhorn@ethionet.et

East Africa (JACS EAF)

Nanyuki, Kenya, b.kiteme@africaonline.co.ke

Swiss Alps (JACS ALP)

Bern, Switzerland, astrid.wallner@cde.unibe.ch

3 Overview of NCCR North-South PhD Theses

3.1 PhD theses 2001-2008

Swiss Institutional partner	Main focus of research	Total number of PhD theses	PhD theses in progress	PhD theses completed
swisspeace	Conflict, natural resources and the state	18	12	6
Graduate Institute of International and Development Studies (IHEID), Geneva	Governance, citizenship and gender	20	18	2
Department of Water and Sanitation in Developing Countries at the Swiss Federal Institute of Aquatic Science and Technology (SANDEC-EAWAG)	Environmental sanitation	11	7	4
Swiss Tropical Institute (STI), Basel	Health and vulnerability	25	13	12
Laboratoire de Sociologie Urbaine (LaSUR), École Polytechnique Fédérale de Lausanne (EPFL)	Urban development	13	8	5
Development Study Group (DSGZ), University of Zurich	Livelihoods	16	10	6
Centre for Development and Environment (CDE-1), University of Bern	Natural resources in sustainable development	22	11	11
Centre for Development and Environment (CDE-2), University of Bern	Sustainable land management	16	8	8
Postgraduate Studies on Developing Countries (NADEL), Swiss Federal Institute of Technology Zurich (ETH)	Economics	2	1	1
Total		143	88	55

Table 1: Overview of NCCR North-South PhD theses 2001-2008

3.2 Location of PhD theses 2001 – 2008

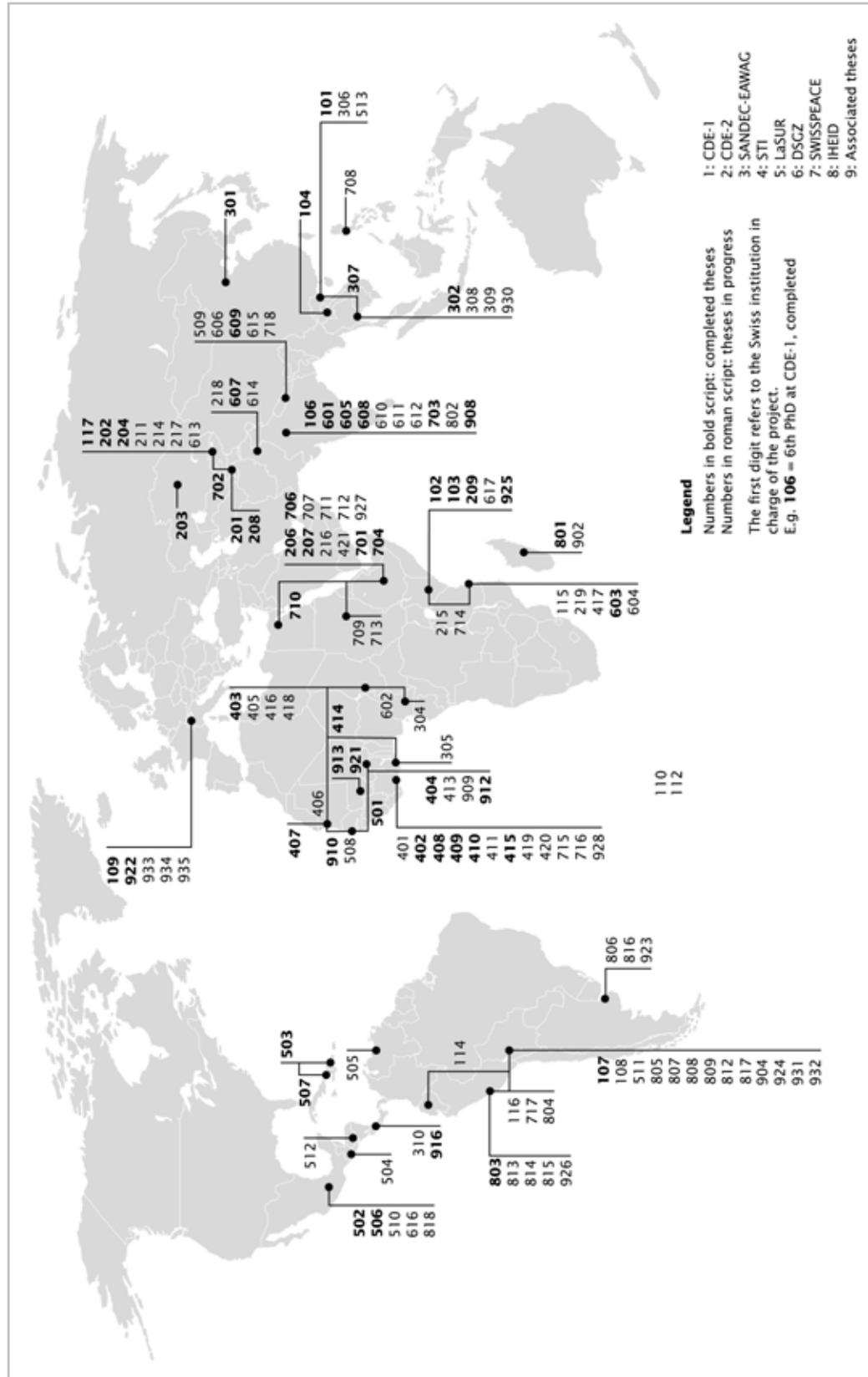


Figure 3: Location of NCCR North-South PhD theses in progress between 2001 and 2008

3.3 Overview of PhD theses by number on the map

PhD	Main focus	JACS	Page	PhD	Main focus	JACS	Page
101	Natural resources	SEA	26/114	309	Environm. sanitation	SEA	21
102	Natural resources	EAF	26/56	310	Environm. sanitation	CCA	21
103	Natural resources	EAF	27/58	401	Health and vulnerab.	WAF	21
104	Natural resources	SEA	27/116	402	Health and vulnerab.	WAF	21/31
106	Natural resources	SAS	27/100	403	Health and vulnerab.	WAF	21/33
107	Natural resources	SAM	27/137	404	Health and vulnerab.	WAF	21/35
108	Natural resources	SAM	27	405	Health and vulnerab.	WAF	22
109	Natural resources	ALP	27/142	406	Health and vulnerab.	WAF	22
110	Natural resources	various	27	407	Health and vulnerab.	WAF	22
112	Natural resources	various	27	408	Health and vulnerab.	WAF	22
114	Natural resources	SAM	27	409	Health and vulnerab.	WAF	22/36
115	Natural resources	EAF	27	410	Health and vulnerab.	WAF	22/38
116	Natural resources	SAM	27	411	Health and vulnerab.	WAF	22
117	Natural resources	CAS	28	413	Health and vulnerab.	WAF	22
201	Land management	CAS	29/92	414	Health and vulnerab.	WAF	22/42
202	Land management	CAS	29	415	Health and vulnerab.	WAF	22/44
203	Land management	CAS	29	416	Health and vulnerab.	WAF	23
204	Land management	CAS	29	417	Health and vulnerab.	EAF	23
206	Land management	HOA	29/76	418	Health and vulnerab.	WAF	23
207	Land management	HOA	29/77	419	Health and vulnerab.	WAF	23
208	Land management	CAS	29/94	420	Health and vulnerab.	WAF	23
209	Land management	EAF	29/62	421	Health and vulnerab.	HOA	23
211	Land management	CAS	29	501	Urban development	WAF	24/46
214	Land management	CAS	29	502	Urban development	CCA	24/127
215	Land management	EAF	30	503	Urban development	CCA	24/129
216	Land management	HOA	30	504	Urban development	CCA	24
217	Health and vulnerab.	CAS	21	505	Urban development	CCA	24
218	Land management	SAS	30	506	Urban development	CCA	24/131
219	Land management	EAF	30	507	Urban development	CCA	24/133
301	Environm. sanitation	SEA	20/119	508	Urban development	WAF	24
302	Environm. sanitation	SEA	20/122	509	Urban development	SAS	24
304	Environm. sanitation	WAF	20	510	Urban development	CCA	24
305	Environm. sanitation	WAF	20	511	Urban development	SAM	25
306	Environm. sanitation	SEA	20	512	Urban development	CCA	25
307	Environm. sanitation	SEA	20/124	513	Urban development	SEA	25
308	Environm. sanitation	SEA	20	601	Livelihoods	SAS	25/100

PhD	Main focus	JACS	Page	PhD	Main focus	JACS	Page
602	Livelihoods	WAF	25	804	Governance	SAM	18
603	Livelihoods	EAF	25/66	805	Governance	SAM	18
604	Livelihoods	EAF	25	806	Governance	SAM	19
605	Livelihoods	SAS	25/105	807	Governance	SAM	19
606	Livelihoods	SAS	25	808	Governance	SAM	19
607	Livelihoods	SAS	25/106	809	Governance	SAM	19
608	Economics	SAS	30/108	812	Governance	SAM	19
609	Livelihoods	SAS	25/110	813	Governance	SAM	19
610	Livelihoods	SAS	26	814	Governance	SAM	19
611	Economics	SAS	30	815	Governance	SAM	19
612	Livelihoods	SAS	26	816	Governance	SAM	19
613	Livelihoods	CAS	26	817	Governance	SAM	19
614	Livelihoods	SAS	26	818	Governance	CCA	19
615	Livelihoods	SAS	26	902	Governance	EAF	19
616	Livelihoods	CCA	26	904	Health and vulnerab.	SAM	23
617	Livelihoods	EAF	26	908	Natural resources	SAS	28/111
701	Conflict	HOA	17/79	909	Governance	WAF	20
702	Conflict	CAS	17/97	910	Health and vulnerab.	WAF	23/47
703	Conflict	SAS	17	912	Environm. sanitation	WAF	21/50
704	Conflict	HOA	17/81	913	Health and vulnerab.	WAF	23
706	Conflict	HOA	17/84	916	Natural resources	CCA	28/136
707	Conflict	HOA	17	921	Health and vulnerab.	WAF	23/53
708	Conflict	SEA	17	922	Livelihoods	ALP	26/143
709	Conflict	HOA	17	923	Governance	SAM	20
710	Conflict	HOA	17	924	Governance	SAM	20
711	Conflict	HOA	17	925	Natural resources	EAF	28/73
712	Conflict	HOA	17	926	Land management	SAM	30
713	Conflict	HOA	18	927	Health and vulnerab.	HOA	23
714	Conflict	EAF	18	928	Conflict	WAF	18
715	Conflict	WAF	18	930	Environm. sanitation	SEA	21
716	Conflict	WAF	18	931	Natural resources	SAM	28
717	Governance	SAM	18	932	Natural resources	SAM	28
718	Conflict	SAS	18	933	Natural resources	ALP	28
801	Governance	EAF	18/72	934	Natural resources	ALP	28
802	Governance	SAS	18	935	Natural resources	ALP	28
803	Governance	SAM	18/140				

Table 2: Overview of NCCR North-South PhD theses by number on the map (see Figure 3)

4 PhD Theses by Theme

4.1 Conflict, natural resources and the state

- 701 Pastoral conflict and resource management in Ethiopia's Somali Region**
Hagmann, Tobias (m); JACS HOA; Ethiopia; started 01.07.2002; completed
- 702 Dangerous divisions: irrigation disputes and conflict transformation in the Ferghana Valley**
Bichsel, Christine; JACS CAS; Kyrgyzstan, Tajikistan; started 01.06.2002; completed
- 703 Land, class, ethnicity: permutations of environmental conflicts in two districts of Assam**
Barbora, Sanjay (m); JACS SAS; India; started 01.04.2002; completed
- 704 The economics of shared irrigation water rights: an alternative analytical framework and application to Ethiopia**
Moges, Shiferaw (m); JACS HOA; Ethiopia; started 01.03.2003; completed
- 706 Ethiopia and the Nile: the dilemma of national and regional hydro-politics**
Arsano, Yacob (m); JACS HOA; Ethiopia; started 01.07.2001; completed
- 707 The transformation of violent conflicts in pastoral areas of Ethiopia: an ethnography on the notion of conflict among the Karrayu of the Middle and Awash Valley**
Mulugeta, Allemmaya (f); JACS HOA; Ethiopia; started 01.03.2003; in progress
- 708 Land titling in perspective: indigenous claimants, settlers, and investors on a southern Philippine frontier**
Wenk, Irina (f); JACS SEA; Philippines; started 01.05.2003; in progress
- 709 The national and indigenous management of environmental conflicts, Savannah Belt, Sudan (cases of the Ingessana Hills, Blue Nile state and the Nuba Mountains, Southern Kordofan State)**
Ahmed, Mey Eltayeb (f); JACS HOA; Sudan; started 01.09.2003; in progress
- 710 Double-edged hydropolitics on the Nile - Linkages between domestic water policy making and transboundary conflict and cooperation**
Luzi, Samuel (m); JACS HOA; Egypt, Ethiopia, Sudan; started 01.09.2003; completed
- 711 Decentralization and negotiating statehood in Ethiopia: the case of Oromia Regional State, 1991-2007**
Keno, Sibilo (m); JACS HOA; Ethiopia; started 01.01.2007; in progress
- 712 The political economy of chat in Ethiopia**
Tesema, Ephrem (m); JACS HOA; Ethiopia; started 01.01.2007; in progress

- 713 **Negotiating statehood in South Sudan**
Santschi, Martina (f); JACS HOA; Sudan; started 01.04.2007; in progress
- 714 **Assessing conservation, tourism and rural livelihoods conflicts in wildlife management areas in Tanzania and community ranches in Kenya**
Kengera, Zabron (m); JACS EAF; Kenya, Tanzania; started 01.06.2007; in progress
- 715 **Power, violence and accumulation in Côte d'Ivoire: the cocoa sector in transition**
Gasparini, Mathieu (m); JACS WAF; Ivory Coast; started 01.08.2007; in progress
- 716 **Côte d'Ivoire: Social phenomenology of "young patriots" and armed rebellion leaders**
Koné, Gnangadjomon (m); JACS WAF; Ivory Coast; started 09.11.2007; in progress
- 717 **Social representations of poverty in a gender perspective in Peru and Bolivia: issues of citizenship**
Nagels, Nora (f); JACS SAM; Bolivia, Peru; started 01.08.2007; in progress
- 718 **Role of tourism in conflict mitigation and peace building in Nepal**
Upadhayaya, Pranil (m); JACS SAS; Nepal; started 16.01.2008; in progress
- 928 **Negotiating citizenship in 20th century Côte d'Ivoire**
Yéré, Henri (m); JACS WAF; Ivory Coast; started 01.04.2006; in progress

4.2 Governance, citizenship and gender

- 801 **Deforestation and customary law in Madagascar [in French]**
Muttenger, Frank (m); JACS EAF; Madagascar; started 01.11.2001; completed
- 802 **Gender, participatory governance and politics. A case study in a lower class urban settlement in Thiruvananthapuram, Kerala, India**
Walter, Sandra (f); JACS SAS; India; started 01.04.2002; in progress
- 803 **Métisse knowledge. An analysis of strategies for protecting traditional knowledge in Peru [in French]**
Galvin, Marc (m); JACS SAM; Peru; started 01.01.2002; completed
- 804 **Democratizing global environmental governance: NGOs and Andean biodiversity**
Diaz Ramirez, Liliana (f); JACS SAM; Bolivia, Peru; started 01.01.2003; in progress
- 805 **Governance and management of biodiversity in the Tunari Park [in French]**
Ponce, Dora (f); JACS SAM; Bolivia; started 01.07.2003; in progress

- 806 **Governance, citizenship and labour in Argentina. The case of *fábricas recuperadas* in Buenos Aires**
Cavaliere, Sandra (f); JACS SAM; Argentina; started 01.08.2003; in progress
- 807 **Governance, participation and depredation: power stakes in the management of Bolivia's natural resources [in French]**
Bottazzi, Patrick (m); JACS SAM; Bolivia; started 01.08.2003; in progress
- 808 **The social regulation of urban environmental risks: a governance study of La Paz and Paute [in French]**
Nathan, Fabien (m); JACS SAM; Bolivia; started 01.09.2003; in progress
- 809 **Citizen participation in the construction of the public domain: the management of potable water services in Cochabamba [in Spanish]**
Hoffmann, Sabine (f); JACS SAM; Bolivia; started 01.09.2003; in progress
- 812 **Risk management policies in Bolivia and their articulation in the municipal space: the case of La Paz, 1985 – 2003**
Salamanca, Luis (m); JACS SAM; Bolivia; started 01.02.2004; in progress
- 813 **Governance and conservation in Peru. Distribution, land use and land property in the Reserva Comunal Amarakaeri [in Spanish]**
Alvarez del Castillo, Alex (m); JACS SAM; Peru; started 01.09.2004; in progress
- 814 **The Amarakaeri Communal Reserve: deforestation and governance [in Spanish]**
Alca Castillo, Jamil (m); JACS SAM; Peru; started 01.09.2004; in progress
- 815 **The governance of conflict resolution processes with indigenous peoples: a multi-level ethnography of mining and protected area conflicts in Peru**
Larsen, Peter Bille (m); JACS SAM; Peru; started 01.01.2007; in progress
- 816 **Growing up amidst the garbage: the process of identity construction in young men and women who live from informal waste gathering**
Freytes Frey, Ada Cora (f); JACS SAM; Argentina; started 16.01.2008; in progress
- 817 **State decentralization, citizen's practices exercised by women and the improvement of quality of life in urban and peri urban environments. The case of the city of Cochabamba, Bolivia**
Ramírez, Alejandra (f); JACS SAM; Bolivia; started 14.01.2008; in progress
- 818 **Governance and sustainable water management in the Río Santiago and Río Ayuquila watersheds in Western Mexico**
Guerrero de León, Aida Alejandra (f); JACS CCA; Mexico; started 16.01.2008; in progress
- 902 **Social and political practices of conservation: management of protected areas as a contribution to sustainable development [in French]**
Bukobero, Sajad (m); JACS EAF; Madagascar; started 01.10.2003; in progress

- 909 **Management of protected fauna reserves in Burkina Faso: institutional stakes in benefit distribution [in French]**
Kaboré, Alexis (m); JACS WAF; Burkina Faso; started 01.10.2003; in progress
- 923 **Social movements and the reshaping of economic institutions in Argentina**
Rosales, Lucia (f); JACS SAM; Argentina; started 01.09.2004; in progress
- 924 **A solidarity-based economy in the South: the case of the solidarity-based city of El Alto, Bolivia [in French]**
Hillenkamp, Isabelle (f); JACS SAM; Bolivia; started 01.11.2004; in progress

4.3 Environmental sanitation

- 301 **A discrete-event dynamic systems approach for environmental decision support**
Huang, Dongbin (m); JACS SEA; China; started 01.04.2002; completed
- 302 **Applying a material flow analysis model to assess river water quality pollution and mitigation potentials – a case-study in the Thachin River Basin, central Thailand**
Schaffner, Monika (f); JACS SEA; Thailand; started 01.09.2003; completed
- 304 **Potentials of vertical flow constructed wetlands for faecal sludge dewatering in Subsaharan countries**
Kengne Noumsi, Ives Magloire (m); JACS WAF; Cameroon; started 01.04.2004; in progress
- 305 **Use of co-compost under irrigated and rainfed (peri-) urban agriculture: effects on crop growth, nutrient uptake, soil characteristics and water use efficiency**
Adamtey, Noah (m); JACS WAF; Ghana; started 01.03.2004; in progress
- 306 **Integrated nutrient management in urban and peri-urban areas**
Forster, Dionys (m); JACS SEA; Vietnam; started 01.08.2004; in progress
- 307 **Material flow analysis for environmental sanitation planning in developing countries: an approach to assessing material flow with limited data availability**
Montangero, Agnes (f); JACS SEA; Thailand, Vietnam; started 01.07.2004; completed
- 308 **Applications of the anaerobic baffled reactor (ABR) and vermicomposting processes for treating household waste**
Sarathai, Yuttachai (m); JACS SEA; Thailand; started 01.07.2003; in progress

- 309 **Integrated material flow analysis (MFA) and quantitative microbial risk assessment (QMRA) methodology for health and environmental sanitation planning**
Narong, Surinkul (m); JACS SEA; Thailand; started 01.08.2004;
in progress
- 310 **Implementation of environmental sanitation policy in human settlements in Costa Rica: the case of the Household-Centred Environmental Sanitation (HCES) approach**
Horacio, Chamizo (m); JACS CCA; Costa Rica; started 01.09.2006;
in progress
- 912 **Towards sustainable urban environmental sanitation in sub-Saharan Africa: an innovative planning approach for faecal sludge planning [in French]**
Koanda, Halidou (m); JACS WAF; Burkina Faso; started 01.09.2003;
completed
- 930 **Nitrogen transformation in vertical flow constructed wetland treating faecal sludge**
Panuvatvanich, Atitaya (f); JACS SEA; Thailand; started 01.07.2005;
in progress

4.4 Health and vulnerability

- 217 **Socio-economic and health risk assessment of traditional and modern dairy commodity chains in Kyrgyzstan**
Mukaliev, Azat (m); JACS CAS; Kyrgyzstan; started 10.05.2007;
in progress
- 401 **An evaluation of sanitary risk in connection with rapid urbanisation in Abidjan and lagoon pollution in the village of Azito [in French]**
Kone, Brama (m); JACS WAF; Ivory Coast; started 01.10.2001;
in progress
- 402 **"In the city, everyone is in his everyone": an anthropological study of the importance of social relationships in the case of illness in Abidjan (Côte d'Ivoire) [in French]**
Bossart, Rita (f); JACS WAF; Ivory Coast; started 01.07.2001; completed
- 403 **Human and animal health in nomadic pastoralist communities of Chad: zoonoses, morbidity and health services**
Schelling, Esther (f); JACS WAF; Chad; started 01.07.2001; completed
- 404 **Combining photochemical and biological processes for the treatment of potential Endocrine Disrupting Chemicals (EDC) in water: physicochemical and engineering aspects**
Kenfack, Siméon (m); JACS WAF; Burkina Faso; started 01.02.2003;
completed

- 405 **Health, sexual practices and HIV/AIDS in schools: cultural and social risk factors in the vulnerability of adolescents in Chad [in French]**
Nodjiadjim Laoubaou, Abdias (m); JACS WAF; Chad; started 01.07.2001; in progress
- 406 **Health, vulnerability and tuberculosis among the Sahelian nomads of Mauritania and Chad [in French]**
Ould Taleb, Moustapha (m); JACS WAF; Mauretania, Chad; started 01.07.2002; in progress
- 407 **Exclusion, vulnerability, poverty and AIDS: the role of women's organisations in a deprived urban area [in French]**
Kablan N'Da, Cléopâtre (f); JACS WAF; Mauretania; started 01.02.2003; completed
- 408 **Social dynamics and fertility management in deprived urban areas [in French]**
Doumbia, Mohamed (m); JACS WAF; Ivory Coast; started 01.02.2003; completed
- 409 **"It is the palu that tires me." A study in medical anthropology of the local concepts and practices of malaria in Abidjan, Côte d'Ivoire [in French]**
Granado, Stefanie (f); JACS WAF; Ivory Coast; started 01.08.2002; completed
- 410 **The deterioration of a deprived urban community: Yopougan (Abidjan): a study of the influence of physical conditions and deficiencies in liquid and solid waste management systems [in French]**
Dongo, Kouassi (m); JACS WAF; Ivory Coast; started 01.02.2003; completed
- 411 **Mosquito resistance to insecticides: the threat of malaria and its transmission in an urban area: a case study from Abidjan [in French]**
Koné, Atioumouna Blaise (m); JACS WAF; Ivory Coast; started 01.02.2003; in progress
- 413 **GIS and health in urban settings: waste-related health risks [in French]**
Kientga, Mathieu (m); JACS WAF; Burkina Faso; started 01.02.2003; in progress
- 414 **Molecular epidemiology of mycobacteria: development and refinement of innovative molecular typing tools to study mycobacterial infections**
Hilty, Markus (m); JACS WAF; Chad, Mauretania, Ghana; started 01.02.2003; completed
- 415 **The effect of irrigated urban agriculture on malaria, schistosomiasis and soil-transmitted helminthiasis in different settings of Côte d'Ivoire**
Matthys, Barbara (f); JACS WAF; Ivory Coast; started 01.09.2003; completed

- 416 **Health service provision in extensive mobile livestock production systems in semi-arid zones**
Weibel, Daniel (m); JACS WAF; Chad; started 01.06.2005; in progress
- 417 **Malaria risk resulting from urban agriculture: persisting misconception or urgent need for mitigation? Combining physical and human geographic approaches in an operational setting in Dar es Salaam/Tanzania**
Dongus, Stefan (m); JACS EAF; Tanzania; started 01.11.2004; in progress
- 418 **Nutritional security and safety among pastoral communities of Chad: towards improved early warning**
Béchir, Mahamat (m); JACS WAF; Chad; started 01.07.2006; in progress
- 419 **Multi-scale assessment of equity effectiveness in water supply and sanitation projects in the framework of after-crisis impacts in poor urban areas**
Silue, Bétio (m); JACS WAF; Ivory Coast; started 01.12.2006; in progress
- 420 **Equity and accessibility to health care for people living with HIV/AIDS in Côte d'Ivoire**
N'Guessan, Tenguel Sosthène (m); JACS WAF; Ivory Coast; started 01.12.2006; in progress
- 421 **Sexuality, gender and culture in the context of HIV/AIDS with special emphasis on the Borena pastoral community, Southern Ethiopia**
Kaba, Mirgissa S. (m); JACS HOA; Ethiopia; started 01.06.2007; in progress
- 904 **Randomized-controlled trial to assess the efficacy of the solar disinfection technology for water**
Christen, Andri (m); JACS SAM; Bolivia; started 01.01.2004; in progress
- 910 **Land Transformation and Social Change in the Delta of the Senegal River: The Case of the Transborder Zone of Pourié Thiagar (Rosso Senegal) and Mpourié (Rosso Mauritania) [in French]**
Keita, Moussa (m); JACS WAF; Senegal, Mauretania; started 01.02.2004; completed
- 913 **In the shadow of the tents. Conceptions of illness and the health system of Tamasheq nomads in Mali**
Münch, Anna (f); JACS WAF; Mali; started 01.09.2004; completed
- 921 **Calf mortality and parasitism in periurban livestock production in Mali**
Wymann, Monica (f); JACS WAF; Mali; started 01.07.2002; completed
- 927 **Epidemiology and economics of bovine tuberculosis in Ethiopia**
Tschopp, Rea (f); JACS HOA; Ethiopia; started 01.07.2005; in progress

4.5 Urban development

- 501 A collaborative monitoring concept for developing cities: methodological approach and construction of an urban observatory [in French]**
Repetti, Alexandre (m); JACS WAF; Burkina Faso, Senegal; started 01.01.2002; completed
- 502 Land use changes and transnational migration: the impact of remittances in Western Mexico**
Hostettler, Silvia (f); JACS CCA; Mexico; started 01.11.2001; completed
- 503 Urban borderland intermediation in the Dominican Republic: three case studies**
Dilla, Haroldo Alfonso (m); JACS CCA; Dominican Republic; started 01.01.2002; completed
- 504 Space and social segregation in Central America and the Caribbean: the gated communities of San Salvador [in Spanish]**
Baires, Sonia (f); JACS CCA; El Salvador; started 01.01.2002; in progress
- 505 Urban security, insecurity and the fragmentation of public space in the global metropolis of Central America and the Caribbean [in Spanish]**
De Freitas, Julio (m); JACS CCA; Venezuela; started 01.04.2002; in progress
- 506 Integrated water resources management: limitations and potential in the Municipality of El Grullo, Mexico**
André de la Porte, Cheryl (f); JACS CCA; Mexico; started 01.08.2002; completed
- 507 Border cities and space transformation: Haiti and the Dominican Republic [in French]**
Poschet, Lena (f); JACS CCA; Dominican Republic, Haiti; started 01.10.2001; completed
- 508 Urbanisation, city design and the urban model in Western Africa: the position and stakes of the public space**
Chenal, Jérôme (m); JACS WAF; Mauretania, Senegal; started 01.05.2004; in progress
- 509 Social and territorial impact of armed conflict-induced displacement and the livelihood of internally displaced persons in rural and urban Nepal**
Ghimire Bhattarai, Anita (f); JACS SAS; Nepal; started 26.10.2006; in progress
- 510 Popular habitat, urban renewal and social mobilization in the centric barrios of Mexico City**
Monterrubio, Anavel (f); JACS CCA; Mexico; started 18.01.2007; in progress

- 511 **Webs and networks in urban communities: a case study in the metropolitan area of La Paz and El Alto, Bolivia**
Rodriguez, Luis Antonio (m); JACS SAM; Bolivia; started 15.03.2007;
in progress
- 512 **Territorial and social mutations in public spaces in Tegucigalpa**
Zelaya Ochoa, Marysabel (f); JACS CCA; Honduras; started 15.04.2007;
in progress
- 513 **Community/livelihood spatial transformation in a transitional urban context: a case study of Hanoi City**
Hoang, Pham Duc (m); JACS SEA; Vietnam; started 01.06.2007;
in progress

4.6 Livelihoods

- 601 **Social networks and migration: far west Nepalese labour migrants in Delhi**
Thieme, Susan (f); JACS SAS; India; started 01.09.2001; completed
- 602 **Common pool resource management, power relations and conflicts between fishermen, peasants and pastoralists in the Waza-Logone Floodplain, North of Cameroon [in French]**
Fokou, Gilbert (m); JACS WAF; Cameroon, Chad; started 01.07.2002;
in progress
- 603 **Common pool resource management and conflict resolution in the Rufiji Floodplain, Tanzania**
Meroka, Patrick (m); JACS EAF; Tanzania; started 01.05.2002; completed
- 604 **Common property and relations of power: resource management, change and conflicts in the Pangani River Basin Floodplain in Tanzania**
Mbeyale, Gimbage (m); JACS EAF; Tanzania; started 01.07.2002;
in progress
- 605 **"We are as flexible as rubber!" Livelihood strategies, diversity and the local institutional setting of rubber small holders in Kerala, South India**
Strasser, Balz (m); JACS SAS; India; started 01.05.2002; completed
- 606 **Sustainable livelihood patterns of marginal communities in peri-urban areas: a case study of Bajrayogini village, Kathmandu District**
Rajbanshi, Ashok (m); JACS SAS; Nepal; started 01.09.2002; in progress
- 607 **Analysis of institutional changes in forest management and their impact on rural livelihood strategies in NWFP, Pakistan**
Shahbaz, Babar (m); JACS SAS; Pakistan; started 01.07.2002; completed
- 609 **Reconciling biodiversity conservation priorities with livelihood needs in Kangchenjunga Conservation Area, Nepal**
Gurung, Ghana (m); JACS SAS; Nepal; started 01.07.2003; completed

- 610 **Globalization and its impact on workers in coir industries in Kerala**
Kalamani, Indu (f); JACS SAS; India; started 01.07.2002; in progress
- 612 **Ethnicity and livelihood practices at the confluence of the global and the local; a study of Paniyas of Wayanad, Kerala, India**
Vinod, C.P. (m); JACS SAS; India; started 01.04.2006; in progress
- 613 **Emergence of new livelihood systems on Central Asia's pastureland**
Steimann, Bernd (m); JACS CAS; Kyrgyzstan; started 01.07.2006; in progress
- 614 **Development policies and livelihood realities in the North West Frontier Province (NWFP), Pakistan**
Grünenfelder, Julia (f); JACS SAS; Pakistan; started 01.05.2006; in progress
- 615 **Access of Dalit and socially excluded people to land resources: livelihood insecurity and social conflict**
Nepali, Purna Bahadur (m); JACS SAS; Nepal; started 01.01.2007; in progress
- 616 **Household strategies and community. Migrations and socio-cultural processes of change in a peasant region: La Sierra, Chiapas, Mexico**
Angulo Barredo, Jorge Ignacio (m); JACS CCA; Mexico; started 01.03.2007; in progress
- 617 **Spatial variations in orphanhood: analysis of the effects of AIDS and traditional versus modern institutional coping strategies for sustainable community development in Kisumu district, Nyanza**
Ong' Anyi, Paul (m); JACS EAF; Kenya; started 16.03.2007; in progress
- 922 **The power of images in sustainable development: their construction, replication and strategic use in the shaping of Alpine development [in German]**
Müller, Urs (m); JACS ALP; Switzerland; started 01.01.2005; completed

4.7 Natural resources in sustainable development

- 101 **The geography of welfare: spatial dimensions of poverty and inequality in Vietnam**
Epprecht, Michael (m); JACS SEA; Vietnam; started 01.04.2002; completed
- 102 **Potentials, limitations and risks of geo-information technology for sustainable development approaches in Kenya**
Ehrensperger, Albrecht (m); JACS EAF; Kenya; started 01.03.2002; completed

- 103 Drought vulnerability and risk in agro-pastoral areas: an integrative approach and its application in Kenya**
Ifejika Speranza, Chinwe (f); JACS EAF; Kenya; started 01.01.2002; completed
- 104 Patterns of land cover change in the Lower Mekong Basin: the relevance of mesoscale approaches**
Heinimann, Andreas (m); JACS SEA; Laos; started 01.04.2002; completed
- 106 Exploring the meaning of money: a study of the impact of microfinance in the Koppal District of India**
Premchander, Smita (f); JACS SAS; India; started 01.01.2003; completed
- 107 The social construction of biodiversity in Andean communities: relevance for ecosystem diversity in the Tunari National Park**
Boillat, Sébastien (m); JACS SAM; Bolivia; started 01.12.2002; completed
- 108 Social interface between state and civil society in the context of the management of the Tunari National Park in Cochabamba**
Serrano, Elvira (f); JACS SAM; Bolivia; started 01.09.2002; in progress
- 109 Evaluation of landscape development projects in the Swiss Alps: the method of Discrete Choice Experiments**
Baumgart, Kati (f); JACS ALP; Switzerland; started 25.07.2003; completed
- 110 A participative system dynamics approach in a global research programme for sustainable development**
Gallati, Justus (m); various JACS; intercontinental; started 01.06.2004; in progress
- 112 Negotiating sustainable regional development – the relevance of meaningful spaces in times of change**
Liechti, Karina (f); various JACS; intercontinental; started 01.04.2005; in progress
- 114 Cultural identity as a resource for new forms of governance of biodiversity in the Andes**
Mathez-Stiefel, Sarah-Lan (f); JACS SAM; Bolivia, Peru, Ecuador; started 01.01.2006; in progress
- 115 Assessment of the effectiveness of institutional frameworks for sustainable water and catchment management and equitable water distribution in Pangani River Basin, Tanzania**
Msuya, Tuli (f); JACS EAF; Tanzania; started 01.07.2006; in progress
- 116 Towards regionalised forms of biodiversity governance in indigenous territories of Bolivia and Peru: potentials and limitations for enhancing social control over natural resources in multi-level and multi-actor negotiations**
Delgadillo Pinto, Jaime (m); JACS SAM; Bolivia, Peru; started 01.03.2007; in progress

- 117 **Legal and institutional framework for empowerment of rural populations in the Kyrgyz Republic: contribution to sustainable development**
Ibraimova, Asel (f); JACS CAS; Kyrgyzstan; started 01.04.2004; completed
- 908 **Assessing the potential for organic farming for sustainable livelihoods in developing countries: the case of cotton in India**
Eyhorn, Frank (m); JACS SAS; India; started 01.01.2003; completed
- 916 **An Analysis of the Use and Management of the Agroecosystem with Emphasis on Agricultural Activity in the Indigenous Villages of Talamanca, Costa Rica: An Agroecological Approach**
Martinez, Roger (m); JACS CCA; Costa Rica; started 01.07.2002; completed
- 925 **Multi-dimensional approaches to more sustainable natural resources management in highly dynamic contexts in East Africa**
Kiteme, Boniface Peter (m); JACS EAF; Kenya; started 01.01.2002; completed
- 931 **Comparative analysis of social learning processes for a sustainable territorial management of three biocultural systems. The case of "Ayllu Chipaya", the rural subcentral "8 de Agosto" and the communal land of "Origen Yuracare"**
Escobar Vasquez, Cesar Gabriel (m); JACS SAM; Bolivia; started 01.03.2007; in progress
- 932 **The potential of ethnoecological interactions considering the use of soil and woody species for sustainable land management in Waca Playa, Bolivia**
Brandt, Regine (f); JACS SAM; Bolivia; started 01.03.2007; in progress
- 933 **An analysis of the interrelationships between farmers', extensionists' and scientists' knowledge in the development of organic agriculture in Switzerland from a transdisciplinary perspective**
Aeberhard, Andrea (f); JACS ALP; Switzerland; started 01.03.2007; in progress
- 934 **Ecological, economic and social impacts of soil and water conservation activities on arable farmland in the Swiss Midlands**
Ledermann, Thomas (m); JACS ALP; Switzerland; started 01.03.2007; in progress
- 935 **Implementation of soil protection as a social learning process**
Schneider, Flurina (f); JACS ALP; Switzerland; started 01.03.2007; in progress

4.8 Sustainable land management

- 201 Sustainable land management in the Tajik Pamirs: the role of knowledge for sustainable development**
Breu, Thomas (m); JACS CAS; Tajikistan; started 01.01.2002; completed
- 202 The impact of land use and climate on the river runoff of Sokuluk River Basin: a contribution to sustainable water management in Chui Valley**
Ershova, Natasha (f); JACS CAS; Kyrgyzstan; started 01.06.2002; completed
- 203 Land degradation in selected landscapes of semi-arid zones in Kazakhstan and Kyrgyzstan: indicators, processes, dynamics and consequences for mitigation**
Plokhikh, Roman (m); JACS CAS; Kazakhstan; started 01.06.2002; completed
- 204 Livelihoods in transition: understanding current strategies, challenges and options for improvement (example of Sokuluk Rayon, Chui Valley, Kyrgyzstan)**
Shigaeva, Jyldyz (f); JACS CAS; Kyrgyzstan; started 01.06.2002; completed
- 206 Land Degradation and Options for Sustainable Land Management in the Lake Tana Basin (LTB), Amhara Region, Ethiopia**
Yitaferu, Birru (m); JACS HOA; Ethiopia; started 01.10.2002; completed
- 207 Landscape transformation and opportunities for sustainable land management in North-Wello, Ethiopia**
Bantider, Amare (m); JACS HOA; Ethiopia; started 01.01.2003; completed
- 208 Land use, soil degradation and soil conservation in the loess hills of Central Tajikistan**
Wolfgramm, Bettina (f); JACS CAS; Tajikistan; started 01.05.2003; completed
- 209 Monitoring and modelling crop growth, water use and production under dryland environment north-west of Mount Kenya**
Gitonga, Jeremiah Lewis Njeru (m); JACS EAF; Kenya; started 01.07.2003; completed
- 211 Land use changes and their impacts on land degradation and conservation processes in the lowland zone of Tajikistan**
Nekushoeva, Gulniso (f); JACS CAS; Tajikistan; started 01.08.2003; in progress
- 214 The water distribution and water use system in the Sokuluk River Basin: a contribution to sustainable water management in the Chuy Valley (Kyrgyzstan)**
Askaraliev, Bakyt (m); JACS CAS; Kyrgyzstan; started 01.09.2003; in progress

- 215 **Water-related environmental services and options for their sustainable use in Pangani Basin, East Africa**
Notter, Benedikt (m); JACS EAF; Kenya, Tanzania; started 01.07.2006; in progress
- 216 **The effect and impact of decentralization on the protection, use and management of protected areas with a particular focus on the Awash National Park**
Abdu Essa, John (m); JACS HOA; Ethiopia; started 01.03.2007; in progress
- 218 **Environmental functions of natural resources in North West Frontier Province, Pakistan**
Hett, Cornelia (f); JACS SAS; Pakistan; started 01.05.2007; in progress
- 219 **Biodiversity patterns in the Eastern Arc Mountains of Tanzania: species distribution along the environmental gradient and climate change implications**
Chitiki, Alfred (m); JACS EAF; Tanzania; started 01.03.2007; in progress
- 926 **GIS-based estimation of energy and water consumption, and emissions generated by major human activities in Latin American cities**
Ossés, Margarita (f); JACS SAM; Peru; started 01.01.2006; in progress

4.9 Economics

- 608 **Economic growth and poverty reduction in India: effectiveness and efficiency of social and economic policies of the centre and the states**
Schmid, Juan Pedro (m); JACS SAS; India; started 01.10.2002; completed
- 611 **Economic development, city and slums: a case study of Delhi slums**
Agrawal, Naveen Kumar (m); JACS SAS; India; started 01.07.2003; in progress

5 Summaries of Completed Theses by JACS

5.1 JACS West Africa

402 Bossart, Rita

2003. *“In the city, everyone is in his everyone”*: an anthropological study of the importance of social relationships in the case of illness in Abidjan (Côte d’Ivoire) [in French]

This medical anthropology thesis critically reconsiders common assumptions about African solidarity and explores the real importance of social relations in illness management in the urban context of Abidjan at a time of economic hardship and political insecurity. More specifically, it examines 1) the incidence of diseases and utilisation of the health care system, (2) the meaning of the term “help” for the local population, (3) the expectations put on the different network members, and (4) the assistance people offer to one another.

Research in Abidjan, the economic and administrative capital of Côte d’Ivoire, was carried out over 19 months from October 1998 to August 2002. The bulk of the study was conducted from April 2000 to April 2001 and focused on Niangon Sud, a socio-economically and ethnically heterogeneous district of Abidjan with about 57,000 inhabitants.

The study consisted of five parts and employed various methods. In the first part, participant observation during long-term residence provided valuable insight into the nature of everyday life in this particular district and discussions with neighbours and friends helped to clarify many open points. In a second part, interviews during a cross-sectional study of 100 households focused on concrete experiences with illness and were followed by a six-month prospective longitudinal in-depth study of a sub-sample of 20 households drawn from the larger sample. The third part collected data by interviewing patients seeking help in two dispensaries in the district, health care providers and representatives of local Christian and Muslim congregations. The fourth part was realised after a preliminary evaluation and concentrated on individuals affected by stigmatising illnesses. Therefore, interviews were carried out with patients and/or parents of patients at the psychiatric hospital in Bingerville (a suburb of Abidjan) and with members of Lumière Action (this NGO was created in 1994 by people affected by HIV or Aids). In the fifth part, a review of documents such as statistical reports and clinic registers provided complementary data

The results showed that various health problems confront the population of Abidjan. The incidence of parasitic and infectious diseases is high and chronic diseases – such as cardiovascular and mental disorders – are growing. Furthermore, HIV/Aids has been spreading rapidly since 1985. The individuals’ first reaction to an illness targets the relief of symptoms. Only if this first response shows no effect do people start to inves-

tigate the origin of their health problem. In a first instance, illnesses are attributed to a so-called “natural” cause, such as nutrition, climate or infectious agents. If the symptoms persist despite treatment, or if the affliction becomes chronic, the popular belief proceeds on the assumption that there is a “supernatural” or “mystical” cause. In Abidjan as well as in Niangon, there is a large variety of health care providers that includes experts who know to deal with illnesses provoked by “natural” and/or “mystical” causes.

The study findings illuminate that relations within and beyond the household can be an important asset which helps to cope with the burden of illness. Assistance in illness identification, treatment choice and treatment evaluation as well as practical aid can accelerate the healing-process. Furthermore, emotional support can relieve the suffering of sick persons by encouraging them. But most people in Abidjan do not have a much narrower perception of “help” and consider support rather in terms of financial and material assistance coming from non-kin individuals and groups. The help of family members living together with the sick person is taken for granted and considered an obligation. Relatives not living in the household, for their part, are only morally bounded to assist the patient.

The findings illustrate that in accordance with existing obligations, the main source of assistance in response to affliction is household members. Apart from emotional and moral support, relatives living outside the household and non-kin play only a minor role. Several factors influence the readiness to help. Young people up to 15 years of age normally receive aid and women generally find more support within their networks than men do. The most determining factor is the socio-economic level of the household; poor people receive less support than others. Another factor that influences the amount of assistance is the type of illness. Support is given more for acute than for chronic health problems. Patients with mental or emotional health problems receive help from close family members, but their condition is often hidden from others wherever possible. For people affected by HIV/AIDS, the situation is even worse. On one hand, they frequently live in poverty. Some have lost their husbands, who used to be the breadwinners of the family, while others can no longer work because of the illness, and still others have to spend a great deal of money on opportunistic health problems. On the other hand, most of the HIV/AIDS infected do not want other people – sometimes even close family members – to know that they are HIV positive. They fear social discrimination. Therefore, most of them do not receive any support – either financial or moral – and many of them live in misery and loneliness. Moreover, an aspect which is often neglected in the literature on social relations as a resource in illness management is that social relations may actually cause or be blamed for health problems.

In conclusion, it may be said that the importance of social networks in case of illness is often idealised and overestimated – in reality, many individuals are left alone in their health struggles.

When social networks tear and solidarity between members breaks down, alternatives have to be found in order to enable vulnerable individuals to cope with the stress of their illness. Our findings indicate the importance of strengthening formal and informal security systems. Therefore, further investigations should consider the potential and limitations of institutions which could offer support, such as general health insurance, rotating credit and saving associations, non-governmental organisations and religious congregations. But only a few individuals want to be passive receivers of assistance; they prefer being active managers of their lives. Therefore, measures should be taken to create new employment and income generating activities in order to enable people to provide for themselves and for their loved ones.

403 Schelling, Esther

2002. Human and animal health in nomadic pastoralist communities of Chad: zoonoses, morbidity and health services

The health of nomadic pastoralists is influenced by factors specific to their way of life. Nomadic pastoralists depend on their livestock for subsistence, especially on live-stocks milk. Veterinary services provide vaccination against feared livestock diseases such as anthrax. Agents transmissible between livestock and humans (zoonotic agents) may have an important impact on the health status of pastoralists because they live in close contact with their animals. However, morbidity among nomadic pastoralists in Chad had not been documented and their everyday use of health services was virtually unknown. A research collaboration between veterinary and public health officials was implemented to evaluate morbidity among nomadic pastoralists and their animals simultaneously and to test intersectoral pilot interventions following the concept of “one medicine”. The studies encompassed in this thesis were conducted in the framework of an interdisciplinary research and action programme.

Fulani and Arab cattle breeders and Arab camel breeders were visited during three consecutive samplings, two in the dry season and one in the wet season, between April 1999 and April 2000. A physician clinically examined 1160 women, men and children and completed a survey questionnaire. Sera, sputum and urine samples were collected from humans, as well as sera and milk from 1640 animals. Complementary interviews mainly directed at livestock health were recorded.

Brucellosis and Q-fever were selected to investigate a possible correlation between the occurrence of these zoonoses in livestock and in humans. No active foci of brucellosis were found. The impact of brucellosis and Q-fever on the health status of the three nomadic communities included in the study appeared marginal in comparison to other diseases recorded. Pulmonary diseases were frequent, e.g. bronchitis in children under 5 years of age (18%). Arab cattle and camel breeders were severely diseased by malaria during the wet season. Clinically diagnosed malaria was prevalent during the entire year among Fulani, who stayed in the vicinity of Lake Chad. Human serum retinol

concentrations were significantly correlated to livestock milk retinol, illustrating the significance of milk as a dietary component. However, serum retinol levels of women were generally low. A 24-hours dietary recall showed that nomadic pastoralists only rarely consumed fruits and vegetables.

The utilisation study provided an overview of health service utilisation patterns among sick nomadic pastoralists. Participants with respiratory disorders went early to a dispensary for consultation and thereafter also made more use of other health services. Dispensaries where anti-malarial drugs were known to be in short supply were rarely visited during the wet season. Our data suggest that young unmarried women and men had fewer opportunities to visit a marabout or dispensary than other members of the community. Women gave birth assisted by relatives in the camps, and prenatal health care was virtually unused. No fully immunised nomadic child was found in the study population. In contrast, livestock had been vaccinated by veterinarians visiting the nomadic camps during compulsory vaccination campaigns. Breeders observed an increasing inefficacy of anthrax, blackleg and pasteurellosis vaccines. Deaths of cattle after vaccination against contagious bovine pleuropneumonia and visits of veterinarians solely to take blood for rinderpest serosurveillance without treating diseased animals were recurrent complaints voiced by nomadic pastoralists about veterinary services. Nevertheless, the idea of joint human and animal vaccination campaigns was appreciated because nomadic pastoralists wanted vaccination for their children, especially against measles. To what extent knowledge and experiences with livestock vaccination were transposed to children vaccination remained unclear. A cost analysis of subsequent joint vaccination campaigns showed that the public health sector can save up to 15% of infrastructure and personnel costs when vaccination services for nomadic children and women are delivered together with interventions in the livestock production sector.

Improvement of the quality of dispensary services has a potential to increase the utilisation of dispensaries by nomadic people. Health workers belonging to the nomadic community itself and better able to reach the camps may, nevertheless, be more accessible to women and children. Static or outreach dispensary-based vaccination services do not have the same efficiency to reach nomadic children as mobile vaccination campaigns have. Private veterinarians, who almost exclusively have access to pastoralists in remote areas, would be interested in more fully capitalising on their transportation infrastructure. Joint human and animal vaccination campaigns should be extended to other services (such as the selling of drugs) and especially to information campaigns. The provision of appropriate information may be as important as health care interventions themselves.

404 Kenfack, Siméon

2006. *Combining photochemical and biological processes for the treatment of potential Endocrine Disrupting Chemicals (EDC) in water: physicochemical and engineering aspects*

Photocatalytic treatment of water has become increasingly important since the 1980s. In spite of the good management of existing biological water treatment plants and the constant reinforcement of wastewater discharge standards, the development of new water depolluting processes, including photocatalysis, is still relevant.

It is recognised that certain chemicals, mostly synthetic one, are not biodegradable or can only be biodegradable under very critical conditions. When these “biorecalcitrant” pollutants are rejected in a biological wastewater treatment plant, they very often pass through it without being degraded and thus accumulate in the environment and/or in living beings. Some of them, like the phthalates and the pesticides, are known for their carcinogenic and mutagen effects or they induce hormonal disruptions in animals, including humans.

In general, all the Advanced Oxidation Processes (AOP) whose characteristic is to generate hydroxyl radicals (OH) are able to degrade most of the organic molecules, including the biorecalcitrant chemicals.

As a technology using the photons emitted by a light source to excite a catalyst and facilitate the generation of the OH radicals, photocatalysis is a more environmentally compatible and less expensive process for depolluting such chemicals if the light source is natural, i.e. the sun.

For the first time, a study of potential application in the field of helio-photocatalysis was made in a sub-Saharan Africa country (Burkina Faso), profiting from the significant solar radiation present in that country, to validate certain results obtained using appropriated experimental and analytical methods at the Laboratory for Environmental Biotechnology (LBE) at the Ecole Polytechnique Federale de Lausanne (EPFL) in Switzerland.

The main objective of this thesis was to help evaluate some physicochemical and technical rules to guide the scaling-up processing of the helio-photo-Fenton process.

To achieve this, the task was organised in several phases of laboratory work at the EPFL and applied fieldwork at the Ecole Inter-Etats d’Ingenieurs de l’Equipement Rural (EIER) of Ouagadougou in Burkina Faso. To mitigate the deficit of sophisticated analytical material during the fieldwork, a simple analytical method requiring relatively modest equipment was developed and validated in the laboratory and in the field.

This thesis is organised in 5 chapters of which the first focuses on the problems of this research and presents the fundamental principles of the photocatalytic processes.

Chapter 2 presents the systematic development of a low-cost analytical method built up and validated in the laboratory for applied field studies of three phthalates: di-methyl phthalate (DMP), diethyl phthalate (DEP) and Diallyl phthalate (DAP).

Chapter 3 focuses on the optimal parameters influencing the helio-photo-degradation of the DEP.

Chapter 4 presents two case studies on the enhancement of the biodegradability of some biorecalcitrant wastewaters. The first evaluates the possibility of integrating photocatalysis into a global strategy of managing the effluents of a chemical industry, while the second treats the problem of the depollution of the water polluted by a pesticide.

The last chapter presents some modelling approaches, allowing for evaluation of solar UVA energy (needed for the helio-photocatalysis), based on the equation of the solar UVA irradiation which was proposed and tested with one year of solar data for Ouagadougou.

409 Granado, Stefanie

2007. *“It is the palu that tires me.” A study in medical anthropology of the local concepts and practices of malaria in Abidjan, Côte d’Ivoire [in French]*

Malaria is the most frequent reason for consultations in Côte d’Ivoire’s health centres. In the year 2004, 57% of all medical cases were attributed to malaria. The resulting social and economic burden on the local population is considerable.

This thesis in medical anthropology aims to better understand what malaria means for the inhabitants of the city of Abidjan and how they deal with it. More specifically, it pursues the following objectives: (1) to examine the experiences, meanings and practices in everyday life of adults concerned with the illness, (2) to compare the distribution of these topics in an urban squatter settlement and a middle-class area, (3) to study what meanings and practices constitute for an episode and (4) how they have changed over time.

The study was conducted in Abidjan, the economic capital of Côte d’Ivoire, and more precisely in the municipality of Yopougon. The rapid urbanisation of the area began in the 1970s, and today Yopougon is home to over one million inhabitants. The development of the urban infrastructure could not keep up with these fast population changes. In the context of the NCCR North-South programme, this study was carried out in a squatter settlement, a quartier précaire, and a neighbouring middle-class area.

The study combines classical anthropological methods and methods of cultural epidemiology. The ethnographic data were collected between 2003 and 2005 during a total of 13 months of field work. Ethnography included interviews, formal and informal

discussions, a literature review, and participant observation. A semi-structured interview catalogue (EMIC interview) based on cultural epidemiology was developed and used in interviews with 160 adults. In each area, 80 men and women were randomly selected, all of whom had experienced a self-diagnosed malaria episode within the previous fortnight.

The results illustrate that the biomedical term for malaria found its way into the local illness terminology. The abbreviation palu of the French term paludisme (malaria) is frequently used in everyday interaction. However, a more thorough analysis shows that even when the same word is used in the professional and the local context, the meanings only correspond to a certain degree. There is an overlap between the biomedical and the local classifications. The local use of the term essentially covers a much wider range of meanings, experiences and treatment options than the original biomedical term. Fever as a symptom does not have an outstanding position, but represents only one of numerous signs.

The concept of malaria was appropriated in a process during which an expansion of its meanings took place. The theoretical framework of appropriation, understood as an active process of interaction that makes something one's own, is most useful to trace this development and results. For this urban population, the causes of palu are not limited to the parasite transferred by the mosquito, but refer in particular to people's living conditions. Bad housing conditions shaped by environmental risks due to an insufficient infrastructure of difficult working conditions are experienced as causes of the illness episode. Furthermore, food that does not correspond to the local ideals can lead to palu. The people affected by palu thus express through palu a malaise that is due to a general vulnerability anchored in this urban field. In a more abstract sense, palu becomes an embodied metaphor for the adversities that people experience in their everyday life.

During the process of appropriation, not only the meanings but also the possible treatment options were expanded. The health system of Abidjan offers a great diversity of treatment options ranging from university hospitals to Chinese drug sellers offering their products at the roadside. For the treatment of palu, pharmaceuticals from official as well as illegal pharmacies and local herbal medicines are the most commonly used products. Self-treatment plays an important role. Local herbs and pharmaceuticals were used by 63% and 52% of the study participants respectively in order to fight their episode. Health services were visited mainly in combination with self-treatment. However, the study illustrates that overall only 28% and 42% received appropriate malaria treatment within 24 and 48 hours, respectively, of the onset of symptoms. Additionally, results show that inhabitants from the poor area had significantly less access to timely and appropriate malaria treatment compared to inhabitants of the middle-class area. Although spatial proximity to high-quality treatment exists in the urban context, access to it is not ensured. On the one hand, this can be blamed on factors, which concern the quality of care. The drugs sold do not correspond to the current treatment guidelines and many private facilities are not equipped with the qualified personnel and material

to diagnose and treat malaria appropriately. Above all, the moment of interaction between private health providers and their clients is not taken advantage of by the providers to advise customers regarding adequate treatment.

On the other hand, the study shows how social context and cultural concepts of illness may be considered in explaining timely and appropriate treatment for malaria. The expansion of the malaria concept and its relative treatment possibilities though appropriation incorporate the risk of over- and mistreatment. The complex interaction of these different factors therefore affects access to a successful cure.

The results illustrate that improved access to effective malaria treatment must make it easier for patients to select the appropriate treatment from the broad urban offer. On the one hand improvements in the quality of care are necessary. Training of health staff and, in addition, a clear marking of appropriate medicines is central. Introduction of the new ACT-anti-malarials should be limited to products that are clearly identifiable as recommended therapy. This improvement will allow for an informed choice about home management. The introduction of new drugs must be accompanied by close monitoring of information, education and communication campaigns. Thus, the appropriation process of these products is to be controlled in order to be able to limit an extension of their meanings as much as possible.

On the other hand, multi-layered interventions are necessary to reduce the general vulnerability of city dwellers with regard to palu. Improved work and housing conditions as well as a reduction of the urban environmental risks are indispensable.

410 Dongo, Kouassi

2006. Analysis of deficiencies in the management of urban drainage and solid and liquid waste in the slums of Yopougon (Abidjan, Ivory Coast): GIS mapping, modelling, and social anthropology approaches [in French]

Environment-related problems of health and well-being are an increasingly central concern of both the scientific community and decision-makers. The quality of the environment determines the health and well-being of populations. The high dependency on natural resources and the precarious conditions in which the majority of the ever-growing urban population live, make developing countries the most vulnerable ones in the world. Substantial efforts are needed in order to gain an understanding of environmentally-based sanitary risks in the urban zones of these countries, particularly in disadvantaged urban environments, where the main aggravating factors are very poorly managed. The persistence and even worsening of health and environmental problems show that the conventional and disciplinary approaches applied until now lack efficiency in improving the situation. Much more integrated and participatory approaches must be used to outline problems more clearly, with a view to finding solutions adapted to different contexts.

The city of Abidjan, the economic capital of the Ivory Coast, is also affected by these environment and health issues in disadvantaged urban settings. Among the 10 communes of the city, the most densely populated one, Yopougon, is among the most severely affected by environmental problems. Yopougon has numerous slums; acute problems due to insufficient drainage (erosion, landslides, flooding, etc.) and deficient management of solid and liquid waste are affecting these disadvantaged parts of town, as well as the quality of life of neighbouring populations.

The goal of this study is to contribute to mitigating syndromes related to deficient management of urban drainage and solid and liquid waste in the slums of Abidjan (Ivory Coast), with a view to improving the living conditions of its dwellers. The study analyses solid and liquid waste management in 6 slums (Doukouré, Yaoséhi, Mami Fитай, Yamoussoukro, Gbinta, and Niangon Continu) situated in Yopougon along a water drainage canal. The specific objectives are: (i) an analysis of the current situation of the drainage system and its relation with environmental factors; (ii) an evaluation of the perceptions and behavioural patterns of sectoral actors and of the inhabitants regarding solid and liquid waste management; (iii) recommendations regarding innovative solutions to mitigate the syndromes related to drainage insufficiency in these disadvantaged environments, with a view to improving their sanitary conditions.

The methodology used in this study combines a multi- and transdisciplinary approach. Multi-source information – from geotechnical, topographic, pluviometric and land-use analyses on the one hand, and a QUICKBIRD image, exogenous data and results from socio-environmental surveys, on the other hand – were integrated in a GIS. This investigation provided a basis for mapping urban geo-hazards (erosion, landslides, flooding) and environmental factors (spatial distribution of waste deposits, waste water, stagnant water, etc. in the streets) with a view to visualising the patterns of problems – i.e. the syndromes – in these disadvantaged areas.

The perceptions, behaviour, and practices of actors and inhabitants regarding management of solid and liquid waste in the slums were then evaluated using two complementary types of social anthropology approaches: a qualitative approach based on observation, semi-structured interviews and focus groups, and a quantitative approach based on a household survey (n = 1900 households).

The modelling approach chosen for this study used two types of modelling: hydrological (to calculate urban drainage) and hydraulic (to visualise the vulnerability of the slums in the event of flooding due to a drainage system overflow). The hydrological modelling consisted of integrating updated meteorological data in order to optimise existing rainfall simulation models, on the one hand, and of developing a new model that took into account climate variability in the area of Abidjan, on the other hand. This stochastic procedure was based on the use of the laws of statistics and probability. Hydraulic modelling combined a statistical survey using QUICKBIRD satellite images with a high spatial resolution and Bienaymé Tchebychev inequality, together with measurements of the specific infiltration of the town areas with Darcy's law. Based on

these investigations it was possible to evaluate the slums' vulnerability to flooding triggered by drainage system overflow, by analysing transmissivity (horizontal permeability) and water holding capacity (vertical permeability) in these areas.

Finally, a social anthropology approach was taken to achieve participatory development of integrated solutions for solid and liquid waste management in the slums. An integrated participatory workshop (IPW) was organised to this purpose, involving all actors (institutional actors, private actors, researchers, NGOs, inhabitants) and using PRA methodology (Participatory Rural Appraisal). In the analysis, results from the integrated participatory workshop were combined with results from the evaluation of perceptions, behaviours and practices and from the assessment of the current management scheme, in order to develop a systemic model of sustainable waste management in the slums.

The results reveal a discontinuity in the spatial distribution of structural stability in the study area. The slums are built on clayey sand ($d < 1$ mm), with medium to high erodibility indices. Most of the area is situated on gentle slopes ($< 2\%$). However, there are depressions that lead to waterlogging and flooding. Soils in the Yaoséhi and Mami Fatai neighbourhoods are highly prone to erosion and landslides, while soils in the Yamoussoukro neighbourhood are less susceptible to erosion. Furthermore, households situated near the un-reinforced part of the canal which flows close to Yaoséhi and Mami Fatai were identified as the most vulnerable to urban geo-hazards.

The maps of each of the slums drawn for the study are up-to-date and clear thanks to the high spatial resolution of the QUICKBIRD image. They show current land use in the disadvantaged areas. This updated cartographic information can serve as a reference and as a basis for all kinds of further investigations in these slums.

Furthermore, analysis of the sanitation environment has revealed a number of shortcomings in the sewage management system in the slums. The study shows that streets and urban wasteland are invaded by "wild" waste deposits, wastewater draining and stagnant pools that accommodate mosquito larvae. Poor access to drinking water and public health centres and a preference for dubious health care alternatives, increase the precariousness of life in these slums. The integrated analysis that takes into account all investigated environmental factors shows that the highest levels of insalubrity – 42% in the rainy season and 29% in the dry season – are found in the Doukouré neighbourhood, making it the most vulnerable. Looking at the impact on the quality of life, it appears particularly detrimental in the neighbourhoods of Yamoussoukro (59%), Yaoséhi (50%), and Gbinta (49%). Analysis and mapping of the main environmental factors thus provides a basis for the establishment of a monitoring system for the sanitation environment in the slums.

Perceptions of the waste problem in the slums are detrimental to an adequate and healthy waste management, thus increasing sanitary risks. The most essential drawbacks of the current waste management system are the lack of political will to lobby for the in-

clusion of these neighbourhoods in sanitation programmes, interference and a lack of collaboration among institutional actors, and frequent crises of collaboration between the municipality and the inhabitants, on the one hand, and private actors (“pre-collectors”), on the other hand. There is also an absence of basic sanitation infrastructure and a lack of knowledge about sanitation and waste disposal systems among the population. The behaviour of the slum inhabitants in terms of waste management reflects their perceptions. Consequently, the streets of the slums are mainly used for draining wastewater (365m³/d), and most households share insalubrious showers (61.2%) and/or latrines (58.5%).

Household waste collected in these neighbourhoods is in most cases dumped directly into the wastewater drainage canal, into the streets, or onto wastelands. In the section running through the slums, the wastewater canal absorbs more than 12 tonnes of waste per day, which amounts to 42% of the total waste produced in the slums. This situation increases the risk of contamination in these areas, and the study also reveals numerous ways in which these conditions impair the quality of life. A disease rate of 48% was recorded for the two weeks preceding the household interviews. Malaria is the most frequently reported disease in the examined period (47%). Other illnesses reported included rheumatism (25%) and diarrhoea (19%).

With regard to urban drainage, results indicate that for the agglomeration of Abidjan the simulation of the pluviometric dynamics over distinct periods can be improved by means of Gumbel’s and Galton’s laws. Their application allows for a more accurate approximation of maximum rainfall intensities for periods from 10 to 30 minutes and from 45 to 240 minutes, respectively. The hydrological modelling led to an optimisation of the parameters of the models of mathematical adjustment of Montana and Talbot’s pluviometric simulation models, which are often used to calculate urban drainage. Moreover, a new rainfall model that best simulates precipitation in Abidjan was developed.

With regard to the hydraulic modelling of slums in a situation of flooding due to system overflow, the statistical survey made it possible to determine what horizontal surface could be used for flow, and the slums were classified in terms of their susceptibility to flooding due to system overflow. This was achieved by means of an analysis of their specific hydraulic permeability and application of Darcy’s law. The slums were classified according to a hydraulic permeability gradient, making it possible to assess their water-holding capacity and their susceptibility to flooding. Supervised classification following the integrated combinatory analysis of the results gained from the statistical survey and by means of Darcy’s law indicates that the neighbourhoods of Doukouré, Yaoséhi and Yamoussoukro have a low vulnerability, while the Niangon Continu, Gbinta and Mami Faitai neighbourhoods are highly vulnerable to flooding due to system overflow.

The participatory workshop led to a concerted definition of consensual solutions for the sustainable management of solid and liquid waste in the slums of Abidjan. An action

plan was developed that defines the role and the level of intervention for each actor. The combination of information obtained at different levels in an integrated analysis made it possible to develop a Decision Support System (DSS) for the mitigation of risks.

The multi- and transdisciplinary dimension of this study made it possible to address different aspects related to shortcomings in the management of urban drainage and solid and liquid waste in the slums of Abidjan.

A drainage system based on optimised models should enable mitigation of erosion and landslide problems in Abidjan, particularly in the slums. The vulnerability levels evaluated for each of the slum neighbourhoods by means of hydraulic modelling can provide guidance for adapting prevention measures in a crisis situation of flooding due to system overflow in the slums of Yopougon in Abidjan.

The application of strategies developed with the help of the Decision Support System elaborated in this study will induce a change in the behaviour of the inhabitants and enable sound decisions at the level of the authorities, with a view to improving the living conditions of the inhabitants of the slums of Abidjan. The study results will be particularly useful for the authorities in charge of managing urban centres. They will contribute to developing a new administrative policy for restructuring the slums and integrating them in the urban tissue. One of the challenges this study will have helped to overcome is to raise awareness among decision-makers and encourage them to adopt an integrated and sustainable management approach to waste collection and treatment involving the participation of inhabitants and public-private partnerships at the level of the disadvantaged neighbourhoods of the city of Abidjan.

414 Hilty, Marcus

2006. Molecular epidemiology of mycobacteria: development and refinement of innovative molecular typing tools to study mycobacterial infections

One approach to molecular epidemiology of mycobacteria is the genotyping and comparison of DNA of infectious strains in order to monitor the transmission pathways of diseases. It is based on the assumption that patients infected with clustered strains are epidemiologically linked. Such results may help in understanding the modes of transmission and therefore in putting in place an adapted control strategy. To perform molecular epidemiological studies, appropriate genotyping tools are a basic requirement. For *M. tuberculosis* they are well developed but their appropriateness has to be evaluated in the geographical area of interest. Like *M. tuberculosis*, *M. bovis* is also a member of the *M. tuberculosis* complex (MTC) and causes bovine tuberculosis in cattle, humans and a wide variety of other hosts. However, compared to *M. tuberculosis*, it is generally much more homogenic, which renders the choice of an appropriate genotyping tool much more challenging. *M. ulcerans* appears to be even less diverse as, so far,

strains have only been differentiated between but not within continents (with the exception of Australia). Therefore, the overall aim of this study was to contribute to the development and refinement of innovative molecular typing tools in order to study *Mycobacterium tuberculosis*, *bovis* and *ulcerans* infections. Variable Number Tandem Repeats (VNTR) typing is a genotyping tool which evaluates the number of repeats at different loci distributed throughout the genome. We performed VNTR typing of 12 Mycobacterial Interspersed Repetitive Units (MIRU) and 3 Exact Tandem Repeats (ETR) for 40 *M. tuberculosis* strains from Chad. This revealed a similar discriminatory power to spoligotyping, which evaluates the presence or absence of 43 spacer DNA sequences between the 36 bp direct repeats (DRs) in the genomic DR region. Therefore, VNTR typing for *M. tuberculosis* is as valid a genotyping tool as spoligotyping. However, in contrast to spoligotyping, VNTR typing could also be useful in evaluating mixed infections within different members of the *M. tuberculosis* complex members in the future. Additionally, the use of both spoligotyping and VNTR typing could provide additional valuable information for future micro-epidemiological studies of the possible highly virulent Cameroon family clone. This clone is most prevalent in Nigeria, Cameroon and Chad, and is defined by the lack of spolio spacers 23-25 and by the loss of characteristic chromosomal deletions.

We also performed spoligotyping and VNTR typing based on 16 known loci (12 MIRUs, 3 ETRs and VNTR 3232) for 67 *M. bovis* strains collected sequentially at the slaughterhouse of N'Djaména, Chad. The strains originated from two different zebu breeds of which the Mbororo was found to be more susceptible than the Arabe breed. Genotyping of Chadian *M. bovis* strains confirmed the usual characteristically high homogenetic population structure of *M. bovis*. We even determined that the 67 strains are members of only 2 clones. The clones were defined by spoligotyping (lack of spacer 30 vs. lack of spacers 20-22) and the finding of characteristic chromosomal deletions, indicating that the strains derived from two ancestral, single cells in the past. However, ETR A, B, C and MIRU 26, 27 were most appropriate for first line typing of *M. bovis* strains from Chad and superior to spoligotyping. This finding could help in identifying risk factors for inter-animal and also zoonotic transmission and therefore have important public health implications. As VNTR-typing is very attractive for *M. tuberculosis* complex members, attempts to use VNTR typing for *M. ulcerans* have also recently been made. However, the presented resolution was not higher than other genotyping tools. This thesis identifies a new VNTR locus, designated ST1, which did not have any orthologues in the *M. tuberculosis* genome. In combination with a previously published MIRU locus, we were able to identify three different genotypes within Ghanaian *M. ulcerans* strains and therefore demonstrate diversity in African strains for the first time. We further showed that DNA sequencing of the different VNTR loci can refine the discriminatory power if the loci are analysed separately but, if analysed commonly, does not improve overall discriminatory power. In the latter, agarose gel electrophoresis of the amplification products of all polymorphic VNTR loci is normally sufficient and sequencing does not result in further refinement.

415 Matthys, Barbara

2006. The effect of irrigated urban agriculture on malaria, schistosomiasis and soil-transmitted helminthiasis in different settings of Côte d'Ivoire

Overall objective

The overall objective of this thesis was to enhance understanding of agricultural land use and typical agricultural activities and their effects on the frequency and distribution of major human parasitic diseases in different urban settings of Côte d'Ivoire. Particular attention was given to malaria, schistosomiasis, soil-transmitted helminthiasis (ascariasis, hookworm diseases and trichuriasis) and intestinal protozoan infections.

Main objective

The main objective was to determine contextual determinants and risk factors for major parasitic infections among urban farmers and their families by qualitative and quantitative methods.

Specific objectives

- To determine the socio-demographic profile of farming communities in two different urban settings of Côte d'Ivoire, and to assess the predominant farming systems, including main crop types, land tenure, and farming practices.
- To assess the socioeconomic status, water contact patterns and water use, and perceived health problems of urban farmers and to compare these with non-farming households.
- To assess and compare the prevalence and intensity of human parasitic infections (*Plasmodium* spp., *S. mansoni*, soil-transmitted helminths and intestinal protozoa) in farming and non-farming households and to identify risk factors for infection.
- To identify productive *Anopheles* breeding sites in selected zones of agricultural land use in the rainy season and the dry season.
- To propose environmental control measures taking into account local eco-epidemiological features.

Key findings

- *P. falciparum*, soil-transmitted helminths (and *S. mansoni* in humans) were heterogeneously distributed between the agricultural zones in both urban settings. Living in specific agricultural zones was a risk factor for infections with all three parasites for humans. The highest concentrations of these parasites were observed in a zone with a large rice perimeter.

- Identified risk factors for *P. falciparum*, *S. mansoni* and hookworm related to farming practices included living near permanent man-made ponds, periodic stays overnight in farm huts (*P. falciparum*), and water contact with irrigation wells (*S. mansoni*).
- The most productive *Anopheles* breeding sites in agricultural zones were man-made habitats (i.e. agricultural trenches, irrigation wells and flooded and recently transplanted rice paddies).
- Symptoms due to intestinal parasitic infections were underestimated by the farmers in Abidjan because of their latent nature. On the other hand, waste dumps and human defecation sites in the working environment were perceived as health risks.
- Farmers' community structures in some of the zones and the social networks among farmers represent "social capital" indicating the degree of stability in an agricultural zone with regard to the intensity of pressure on urban land.

Significance for the NCCR North-South

- Our work consisted in a multidisciplinary research approach, involving both quantitative and qualitative methodologies. The various parts of the research presented here were facilitated by multidisciplinary teams, consisting of biologists, laboratory technicians, health professionals, entomologists, agronomists, sociologists, epidemiologists and geographers, in order to apprehend the complexity of the contextual determinants contributing to parasitic diseases in urban farming communities.
- The findings illustrate typical agricultural land use patterns and farming practices in different urban settings, and how agricultural activities and subsequent land use patterns might be related to the frequency and distribution of major human parasitic diseases. The two case studies revealed the close connections between urban agricultural land use and specific parasitic diseases in urbanised areas of tropical West Africa.
- The outcomes from our research build a scientific basis for the design and implementation of environmental control strategies that hold promise of mitigating negative health effects for people living in the vicinity of agricultural zones. We propose farming-based environmental control measures that are integrated in professional farming training provided by extension services. This approach can improve the livelihood of marginalised groups (i.e. urban farmers in Abidjan), and can reduce the risk of transmission of major parasitic diseases, such as malaria, schistosomiasis and soil-transmitted helminthiasis.

501 Repetti, Alexandre

2004. A collaborative monitoring concept for developing cities. Methodological approach and realisation of an urban observatory [in French]

Cities in developing countries are experiencing considerable demographic growth. This makes their development difficult to foresee and plan, all the more so since technical and financial means are lacking to provide public management. Furthermore, the political context is affected by power and responsibility imbalances among the different actors. This situation has direct consequences for land-use, including classical syndromes of bad development: a large informal sector, precarious settlements, lack of infra-structure, low efficiency of public investment, environmental degradation, etc.

To analyse the processes of management in developing cities, we refer to two complementary models. On the one hand is urban governance, a reading grid for the transformation of territorial public action. It focuses on stakeholders and their interrelationships, on the balance of power and responsibilities, and on the capacity of the local entities to manage their decentralised responsibilities. On the other hand is a systemic analysis, based on a meta-model of the auto-organising systems, applied to land-use management.

The modelling of the urban management processes shows an important deficiency at the coordination level, between the various actors that intervene in land-use: a communication platform is missing and no common diagnosis or strategies guide their operations. It also shows that the solution will not come through the imposition of a land-use plan, but through the collective development of a strategic view of the city, through an intensification of networking.

This research work starts from the potential of information systems, land management techniques, and of participatory methods. It proposes a concept of monitoring for developing cities, based on the integration of two elements: a collaborative urban observatory, and a forum that brings together urban management stakeholders. Therefore it conceives and connects several methodological modules:

- a specific GIS, made up of data and indicators for the management of developing cities;
- a systemic model, to analyse the complementarity among the different indicators;
- an observatory computerised interface, making it easier to access the information System for the Monitoring of Urban Functionalities (SMURF);
- an implementation method for the monitoring system, within the urban processes, in the form of a succession of management workshops, run within a consultation forum;
- finally, a model of dynamic land management which integrates information and participation to improve urban governance.

The concept is applied to the city of Thies (Senegal), following an iterative approach, alternating the development of the tool with application and validation. Given its great demographic growth and lack of technical and financial means among its managers, this conurbation is representative of numerous medium-size developing cities.

The analysis presented shows that the elaborated monitoring system offers essential functionalities to its users, for information and communication: first, a land-use database, relevant to management priorities; second, a networking platform for the stakeholders; and third, indicators for decision support and monitoring. Improvement of the diagnosis allows them to realise more opportune and more effective projects.

The instrument integrates a forum of land-use actors for implementation within the management processes. Thus it allows strengthening of data exchange and coordination. The monitoring tool also serves to support consultation, providing clear elements on land-use. The diversity of the participants ensures the quality of the data and diversity of the points of view on the urban development. At a holistic level, the actors draw up strategies of development and land-use planning that take into account each other's claims. Through mutual reinforcement, information and participation then offer good conditions for coherent management and for the harmonisation of interventions on the land.

The research is based on a dynamic and spatial vision of urban management. It integrates original tools, adapted to the contextual specificities. It opens up interesting perspectives in the fields of collaborative land-use management and in the implementation of good governance, as well as for the realisation of real urban observatories for urban management support.

910 Keita, Moussa

2006. Land Transformation and Social Change in the Delta of the Senegal River: The Case of the Transborder Zone of Pourié Thiagar (Rosso Senegal) and Mpourié (Rosso Mauritania) [in French]

Introduction

The topic of land transformation and social change is at the heart of scientific research in the valley of the Senegal River. The issue of land problems in Senegal and Mauritania is related to changes in the valley brought about by dryness, the introduction of damming in the context of organising the development of the Senegal River (OMVS), and the application of new land laws that originally provoked many social and political conflicts, as the tragic events involving Senegal and Mauritania in 1989 testify.

The introduction of damming contributed to the development of irrigated agriculture in the valley of the Senegal River and accentuated the struggle for space, involving a bottleneck in the most fertile pockets. Reports on land problems in the valley of the Senegal River reflected a crisis involving management of natural stock, overall changes in social peace, and development in general.

This comparative study uses a multidisciplinary approach and dynamics to consider the history of the Senegal River, undertaking a systematic analysis of reports and power relations to determine how a process of peace and stability could be established between the communities and the states.

General objective

The overall aim of this thesis was to contribute to sociological reflection on the question of land transformation, social change, and the problems that can emerge between people whose fate condemns them to share the same natural environment: the Senegal River.

Specific objectives

- To describe social organisation and land transformation
- To give an outline of modern and traditional rights in the zone
- To discuss the border problem with a view finding a solution
- To account for land dynamics in the river valley
- To describe the population's perceptions of diseases in the valley
- To identify land problems in the zone in order to make a useful proposal for peace and stability
- To describe the traditional taxonomies of the forms of land tenure

Expected results

- Contribution to the process of sociological reflection
- Mitigation of problems on the border between Senegal and Mauritania
- Analysis of satisfaction of needs from the perspective of households
- Better knowledge of social organisation
- Knowledge of the degree to which the population accepts the new land reforms

The methodology is summarised in a quantitative investigation involving 50 Mauritanian legal claimants and 50 Senegalese legal claimants, and a qualitative investigation near the border involving migrants from abroad and traffickers in currencies and commercial x-rays, using semi-structured interviews.

The survey was established on the basis of the last census in the respective countries. It was carried out by eight young people, including four on each side of the bank, recruited on the spot, and spread out over a two-year period: a first group in 2000 for the

survey itself, and a second group in 2002. The questionnaire, divided into five sections, was formulated on the basis of terms of reference for the study:

Section 1 focuses on socio-demographic characteristics with the aim of identifying the targets and ascertaining certain information about nationality, ethnic composition, religion, marital status, and professional status.

Section 2 is concerned with data on the group's modes of acquisition and distribution.

Section 3 is concerned with households, which are considered the principal actors. It also considers the population's perception of what is at stake following damming and subsequent change.

Section 4 focuses on socio-demographic activity, providing information about social activities and economic actors and their ways of life. This makes it possible to determine whether land transformation in the study area improved production and what impact this had on urban life.

Finally, Section 5 focuses on the problems of land litigation and their evolution, primarily with respect to the relationship between Mauritania and Senegal. The study area is in the communes of Rosso Senegal and Mauritania.

Conclusion

Our goal was to find our way along a path strewn with obstacles, while attempting to present certain important details in a way that would be simple but not banal. The issue of land is an important one with an international dimension that is challenging for researchers.

It was difficult to determine responsibility. Better comprehension of the case of agriculture in MPourié would have to involve a top-down study, as poor administrative and management practices in the co-operatives contributed much to their disorganisation (fictitious lists, opacity in the management of appropriations, non-refunding of appropriations, banking, bad practical farming), and continued treatment of the co-operatives to follow up on this. Charging only decision-makers and managers with the causes of the failure of the projects is equivalent to skewing the diagnosis and distorting the conclusions. The lack of transparency in the management of the lists of the co-operatives should be noted, which was often worsened by others for personal benefit.

912 Koanda, Halidou

2006. Towards sustainable urban environmental sanitation in sub-Saharan Africa: an innovative planning approach for faecal sludge planning [in French]

Justification

In Sub-Saharan Africa, excreta and wastewater disposal is characterised primarily by on-site sanitation systems. This sanitation option is more likely to increase as governments, municipalities, communities, private operators and donor agencies strive to reach the Millennium Development Goals aimed at reducing by half the proportion of people without access to basic sanitation facilities. Due to increased urban population growth in Sub-Saharan Africa, faecal sludge volumes will increase to alarming quantities in the coming decades.

An evaluation of faecal sludge management practices reveals that the main shortcomings relate to the widespread lack of involvement and foresight by municipalities, the paucity of effective legal provisions and organisation, and the absence of stakeholder coordination.

Stakeholder involvement in planning and implementing faecal sludge management is virtually non-existent or excluded from urban sanitation planning processes. In the majority of situations, faecal sludge management is not financially viable. This is a major cause of the indiscriminate dumping of faecal sludge in urban areas or its untreated use in urban agriculture. These practices not only pose permanent and serious health risks but also contaminate both scarce ground and surface water.

Objective and general approach

On the basis of these facts, which present a real challenge to sector specialists, the overall objective of our research is to develop an innovative strategic planning approach to sustainable faecal sludge management in urban areas which allows minimising public health and environmental risks. Focus is placed on developing a reproducible methodology for stakeholder involvement, on enhancing population awareness for improved faecal sludge disposal, and attributing a leading role to the dynamic private faecal sludge emptying and transport operators. These aspects constitute the three pillars of our search for a comprehensive methodological approach. The municipality of Ouahigouya in Burkina Faso, with a population of about 65,000 inhabitants, was used as a pilot site to launch, implement and scientifically validate the approach.

Analysis and stakeholder involvement

The stakeholder-based planning approach developed in Ouahigouya relies on a combination of stakeholder identification and analysis, and participatory planning techniques (focus groups, workshops, informal meetings, all-stakeholder workshops). A quantitative survey among households allowed for collection of stakeholders' proposals and evaluation of suggestions for improvement of faecal sludge management and

neighbourhood hygiene proposed by the population. The main steps in the stakeholder involvement approach include:

- Jointly clarifying the objectives of the planning process together with the stake-holders;
- Identifying stakeholders and their interests;
- Classifying stakeholders according to their importance and influence based on defined criteria and confirmed by the stakeholders themselves;
- Identifying the interactions between the stakeholders;
- Verifying the results of the stakeholder analysis by the stakeholders themselves;
- Choosing stakeholder involvement techniques;
- Implementing the chosen method of stakeholder involvement: development of faecal sludge management scenarios, acceptance of the scenarios by the stake-holders in focus groups, choice and acceptance of a basic scenario for development of future strategy in an all-stakeholder workshop;
- Evaluation of the chosen involvement process by the stakeholders.

The experience gained with the planning methods developed and implemented in Ouahigouya reveals that the “Stakeholder analysis” method is efficient and provides answers to questions such as: Who are the important and influential stakeholders? Who should participate in the planning process and in which manner? This experience also revealed the need for capacity building of certain stakeholder categories (emptying operators, women’s associations, etc.) to increase their degree of involvement in the planning process. Improvement in stakeholder involvement was achieved thanks to a combination of workshops, focus groups and other informal meetings allowing less influential stakeholders (associations of local women, horticulturists, emptiers) to share information and to freely express their opinions and concerns and to defend their interests. This provided an excellent example of local democracy appreciated by all stakeholders of Ouahigouya. The approach developed provides tools for policy-makers and planners to ensure effective stakeholder involvement in the process of developing a common vision and implementation of improved urban sanitation measures. The conditions for replicating the approach developed and tested in Ouahigouya are due to participatory democracy, the great commitment of the local authorities, and the high motivation of the stakeholders involved.

Levers for the willingness to improve faecal sludge management and neighbourhood hygiene

The evaluation method of the willingness to improve faecal sludge management by the population was based on a combination of the planned behaviour model of Ajzen and the contingent valuation method, a financial analysis of pit emptying and faecal sludge enterprise, and on focus groups of stakeholders. By focusing on local practices, perceptions and individual behaviour, this method revealed that financial viability – often

reduced to willingness-to-pay – is not the only factor to consider when planning improvement of sanitation practices. Willingness to improve is highly dependant on psycho-sociological factors such as attitude towards and belief in an improved neighbourhood environment, social pressure on the households by the neighbourhood, and the subjective costs and benefits expected from improved faecal sludge management. These factors therefore present levers that allow planners and decision-makers to encourage, increase and develop the demand for improved latrine emptying services, e.g. through social marketing.

Promoting private entrepreneurs

According to market analysis of emptying services and stakeholders involved, small private and mainly informal enterprises play a leading role in faecal sludge management in most cities of Sub-Saharan Africa. These operators, dynamic but fragile, require an appropriate institutional, jurisdictional and economic environment based on a balanced partnership between the municipality (public) and the private sector. Our study reveals that for a company truck to be profitable, about 1,000 trips per year (at 6,000 FCFA per trip) are required for the equivalent of a city with 56,000 inhabitants. In the case of Ouahigouya, profitability is increased if the emptying operators apply the latest management and professional tools and techniques, and manage to provide emptying services in neighbouring towns.

Decision support tools

The research led to developing decision support tools for professionals and policy-makers. These tools facilitate the development of a tariff-oriented policy to avoid uncontrolled faecal sludge discharge into the environment, to render investments by private operators profitable, and still make emptying services accessible to low-income households. This involves:

- Analysis of the cost structure of 3 pit emptying companies , which revealed that fuel, maintenance/repair and personnel costs make up 45%, 20% and 30%, respectively, of an enterprise's operating expenses.
- An Excel programme was developed to allow municipalities and private operators to determine the operating costs of emptying services. This allowed establishment of a sustainable money flux between the different stakeholders involved and definition of the tariffs. To prevent faecal sludge discharges in the immediate residential environment or on unauthorised sites, it might prove necessary under certain circumstances and feasible to reimburse rather than charge entrepreneurs for delivering faecal sludge to the treatment sites and hence create a strong incentive for good emptying and haulage practice.
- Evaluation methods of the sludge quantities to be disposed of have been developed to allow faecal sludge planning by the municipal authorities,

assessment of the potential market, and return on investment by private operators.

Advantages of the approach for the population of Ouahigouya

Based on the results of our study, it was possible to formulate practical recommendations for organisation of the urban sanitation sector for the municipality of Ouahigouya – now in possession of a sustainable faecal sludge management strategy. Our study has also helped to promote local consultation and raise awareness of the role and contribution of each stakeholder group, in particular the previously neglected manual emptiers in their daily efforts to improve the living conditions of urban inhabitants. The “Strategic Excreta and Wastewater Sanitation Plan”, that was developed and supported by the Office National de l’Eau et de l’Assainissement (National Water and Sanitation Agency), provides an excellent framework for the implementation of the elaborated faecal sludge management model (as part of the this strategic plan).

921 Wymann, Monica Natalie

2006. Calf mortality and parasitism in periurban livestock production in Mali

Cattle production is very important for the Malian economy. However, as domestic milk production does not cover local demand, 60% of the dairy products consumed are imported. To increase local milk production, modernisation of livestock management in periurban areas has taken place during the last few decades, especially around Bamako. This change from traditional to modernised management, with cross-breeding with European breeds and increased investments in housing, nutrition and parasite control, may have an impact on calf mortality, for example with regard to the occurrence of ecto- and endoparasites, the main causes of health problems of cows and calves around Bamako. Calf mortality has a crucial negative influence on milk production, as local breeds need the stimulus of their suckling calves for milk let-down. West African studies with traditional and on-station managed herds report calf (0-12 months) mortality rates between 3% and 47%. Although modernised management becomes more and more important in periurban areas, no information had been available on calf mortality and its causes in modernised private periurban livestock production in West Africa. Neither had calf mortality in traditionally managed herds been compared to calf mortality in modernised managed herds in periurban areas. This is essential for economic evaluation of ongoing modernisation. The overall aim of this study was to determine mortality rates in different management systems and to elucidate causes and risk factors in calf mortality in the periurban area of Bamako, with emphasis on the effects of endo- and ectoparasites on calf mortality.

Within a longitudinal cohort approach including 762 calves in 38 herds of the periurban zone of Bamako, newborn calves were followed up from November 2002 until March 2004. Repeated examination of tick and trypanosome burden and determination of gastrointestinal egg excretion was done on calves aged 0-1 months, 2-3 months and 5-6

months. When a calf died, the cause of death was assigned based on its death history, postmortem inspection and routinely collected weight and parasitic data. Gastrointestinal parasite spectrum in dead calves was investigated as part of the postmortem examinations. Risk factor analysis for calf mortality stratified in age classes 0-1 months, 1-6 months and 6-12 months was done with demographic data, calf management-related questionnaire data, and routinely collected parasitic and weight data. To account for a clustering of calves in herds and repeated sampling of individual calves, survival analysis was done with a frailty model, and a Bayesian model with two random factors for herd and calves was used for analysis of parasitic data.

The overall calf mortality rate during the first year of life was 17%. This leads to a partial loss of lactation of every 6th cow and a loss of one sixth of all potential slaughter cattle, draught oxen and future dairy and breeding stock. Much higher calf mortality rates occurred in modernised management (19% in modernised private and 25% in modernised on station) than in traditional (10%) management (Hazard ratio 2.2, CI 1.2-3.8, $p=0.01$). This is an alarming finding in view of the ongoing modernisation of management practices in the periurban zones.

The causes of death were mainly management problems, consisting of accidental losses (14%), starvation (10%) and sepsis (5%), digestive disorders, consisting of gastrointestinal parasites (12%), non-parasitic diarrhoea (10%) and ileus (7%), and perinatal mortality (16%). Minor causes of death were vector-borne diseases (4%), respiratory disorders (4%) and nervous disorders (2%). The high number of management problems revealed a need for better herding, control of milk off-take, and better hygiene. Digestive disorders were more frequent in modernised than in traditional management ($p=0.02$), and were to a large extent responsible for the higher mortality rates in modernised management. An obvious reason for the high occurrence of gastrointestinal problems was poor hygiene in stationary enclosures.

Risk factors for the age class 0-1 month were birth complications (Hazard ratio 18.4, CI 4.4-75.9, $p<0.01$), birth during the rainy season (Hazard ratio 7.1, CI 2.9-17.8, $p<0.01$), parity of dam with calves of multiparous cows having a higher risk of mortality (Hazard ratio 5.2, CI 1.2-22.1, $p=0.03$), no contact with chickens (Hazard ratio 8.9, CI 2.1-38.1, $p<0.01$) and large herd size (Hazard ratio 3.4, CI 1.0-11.7, $p=0.05$). The risk factor found for the age class 1-6 months was a low number of herdsmen (Hazard ratio 3.5, CI 1.8-6.6, $p<0.01$). The only risk factor to occur more often in modernised than in traditional management was a low number of herdsmen. The risk factors herd size and number of herdsmen underline the importance of good supervision for calf survival.

Livestock owners and herdsmen had reported trypanosomes to be an important cause of calf mortality in their herds in the year preceding the study. However their perception was not confirmed by a *Trypanosoma sp.* prevalence of 1% in calves aged 0-6 months and only one identified loss due to trypanosomes. Frequent tick control conducted by the herd owners probably lowered tsetse fly density and led to the low tick burden of calves aged 0-6 months. Mean geometric half-body tick count was 3.1 (range 0-65)

with most calves being tick-free (76%). The most common tick genus was *Amblyomma sp.* (71%), followed by *Hyalomma sp.* (23%), *Boophilus sp.* (4%) and *Rhipicephalus sp.* (1%). Significant season, age and management effects on tick counts occurred, with *A. variegatum* being less frequent in modernised than in traditional management (Incidence rate ratio 0.4, CI 0.2-0.9). Tick-borne cowdriosis was not detected in autopsied calves.

The spectrum of gastrointestinal parasites was similar to that found in adult cattle. The spectrum included 11 nematodes, 1 trematode, 3 cestodes and 1 protozoan parasite. Calves in the age class 4-13 months carried up to 8 different parasite species. The most frequent parasites were *Haemonchus sp.* (Age class 0-1 month: 7%, 1-4 months: 38%, 4-13 months: 69%), *Cooperia pectinata* (0%, 33%, 44%), *Cooperia punctata* (0%, 33%, 38%) and *Moniezia sp.* (0%, 24%, 38%). Routine coprological examinations of live calves have shown a moderate prevalence of eggs of *Strongyloides papillosus* (Age class 0-1 month: 39%, 2-3 months: 59%, 5-6 months: 42%) and strongyle-type (14%, 24%, 36%) and coccidian oocysts (37%, 68%, 64%) and at low prevalence eggs of *Toxocara vitulorum*, *Moniezia sp.*, *Trichuris sp.* and *Paramphistomum sp.* Significant season and age effects on egg counts of strongyle-type eggs, *S. papillosus* and *T. vitulorum* and on coccidian oocyst counts were found.

Transmission occurred all year round but was lowest during the dry seasons. Gastrointestinal parasite control was more intensive in modernised than in traditional management. Even though hygienic conditions were poorer in modernised management, no management effect on egg counts in living calves was found.

In conclusion, overall calf mortality in periurban livestock production is high and has doubled with modernisation of livestock keeping. The main management problems were hygiene, surveillance and milk off-take. Vector and vector-borne diseases were of low importance, while gastrointestinal parasites were important causes of death in modernised management.

5.2 JACS East Africa

102 Ehrensperger, Albrecht

2006. Potentials, limitations and risks of geo-information technology for sustainable development approaches in Kenya

This thesis addresses the role - in terms of potentials, limitations and risks - of Geographic Information Systems (GIS) and related information and communication technologies in the context of sustainable development. Sweeping statements often characterise the debate on geo-information technology for sustainable development. The thesis proposes a differentiated analysis according to implementation contexts and stages of knowledge creation, diffusion and utilisation processes. It seeks to provide tangible recommendations for initiatives relying on information and communication technology within participatory approaches to sustainable development. The main question pursued is: 'In which way and at what stages and levels of an iterative knowledge cycle does the contribution of geo-information technology to sustainable development translate into concrete potentials?'

The approach to answering this research question is a combination of conceptual reflections on the importance of information and knowledge as resources for sustainable development with an empirical assessment of the potentials, limitations and risks of geo-information technology. The reflection underlying this assessment rests on the definition of five chronological stages within an iterative knowledge cycle (concept elaboration, data collection, data analysis, knowledge diffusion and knowledge utilisation) and the definition of five presumed potentials of geo-information technology. These presumed potentials pertain to the ability of geo-information tools to deal with large amounts of data, to enhance transparency of data collection processes, to foster participation, to integrate knowledge types stemming from different epistemologies, and to promote information-based decision making. The conclusions of this thesis are elaborated on the basis of a synoptic analysis of the five presumed potentials at the level of the five process stages. This analytical approach leads to a qualitative description and valuation of observed potentials, limitations and risks that characterise the use of geo-information technology in three case studies in Kenya. The case studies were selected according to their scales, contexts (urban and periurban, highland-lowland, and forest conservation and utilisation) and types of development problems. Fieldwork consisted of the inception and development of geo-information technology projects in these three case studies. Geo-information approaches were developed and integrated into socio-political processes in support of sustainable development. Empirical evidence leading to the main conclusions was gathered mainly through participant observation and was completed with surveys, expert assessments and a review of primary information.

The first case study in the urban and periurban context was conducted in the municipality of Nakuru, which has development problems similar to those in other medium-sized towns in Africa: Rapid population growth, an ailing economy and weak public institu-

tions have negative impacts on social development. This is mostly seen in terms of disparities in accessing information, infrastructure and services, and through lack of efficiency and transparency in conducting municipal affairs. A project was initiated as part of this thesis to build up an urban observatory featuring relevant information on urban development for local authorities and the community. The second case study in the highland-lowland context was conducted in the Upper Ewaso Ng'iro North Basin, which experiences increasing pressure from immigrating farmers from adjacent high potential areas where land has become unavailable. Conditions in climatically marginal areas force farmers to rely on irrigation. The resulting pressure on water resources has led to serious degradation and to conflicts between upstream and downstream communities. A project was conducted to put in place a water information platform based on spatial analysis tools for local water user associations, to assist in improving management of water resources. The third case study in the context of forest conservation and utilisation was conducted in the Eastern Mau Escarpment, which contains some of the largest stretches of protected forest in Kenya. In this region organisations concerned with the environment and representatives of marginalised indigenous minority groups entered into conflict with the government over politically motivated forest excisions and resettlements of landless farmers from other areas of the country. A project was initiated to create an atlas of indigenous people's ancestral lands and to support an extra-judicial consensus-building process to help mitigate the ongoing conflict.

Through these case studies, the thesis is able to show that geo-information technology has an important role to play in sustainable development initiatives. The potentials, limitations and risks of this technology are however heavily dependent on the context in which a project takes place, the type and objectives of a project, the information and knowledge it intends to disseminate, and the beneficiaries or project partners it works with: The context influences possible technical solutions and dissemination strategies. Complex information systems are more suited for urban settings, while in the rural context the simplicity and immediate utility of the disseminated information are key factors for enhancing the potential of geo-information technology. The perceived relevance of the disseminated information and the institutional setup in which an information system is implemented were found to be more important for a project's durability than the technical aspects of the information tool that is used. Thus, the thesis is able to invalidate the common assumption that it is the technical nature of geo-information technology that leads to a higher risk of failure than other approaches and tools.

The thesis also shows that potentials, limitations and risks of geo-information technology change significantly depending on the stages of a project's life cycle in which this technology is implemented. In projects with a strong participatory character, like the first and third case studies, geo-information technology has a high potential during the data collection, knowledge diffusion and utilisation stages. In such projects geo-information technology helps to enhance the transparency of the data collection process and has the ability to easily integrate tacit community-based and formal knowledge in the disseminated output. This assists marginalised groups, for example, in presenting their claims using the dominant rhetoric and linguistic typology, which enhances the

group's visibility, as well as its perceived credibility and self-confidence in a litigation process. In projects that are directed mainly to institutional partners, such as the second case study, the potential of geo-information technology is greatest during concept development and data analysis. The technical strength of geo-information technology, especially its ability to deal with large amounts of data, represents a potential, for example in building various project scenarios.

With a few exceptions, the three case studies tend to show that the risk associated with the use of geo-information technology in a development project is highest during conceptual preparation and during the utilisation of outputs, i.e. at the beginning and at the end of the iterative knowledge creation, diffusion and utilisation cycle. At the beginning of the cycle an 'availability bias', i.e. the orientation of the project's concept and goals according to data and technology availability rather than real priorities is a risk that mainly concerns projects that do not rely on the participatory definition of development goals. Knowledge utilisation is a stage over which a project has only little control, which explains the high risk identified at that stage. The most frequently observed negative outcomes are non-use or misuse of availed information. The thesis was able to show that this risk is mainly linked to the perceived value of information and to institutional circumstances, rather than the use of geo-information technology.

Finally, the thesis provides empirical evidence and reflection on the way in which geo-information technology influences a project's durability, its ability to use participatory approaches, and its ability to empower marginalised stakeholders. While critics mainly focus on these three aspects of sustainable development, the thesis is able to show that geo-information technology does not behave in a significantly different manner than other information and knowledge dissemination approaches. The thesis shows that the perceived value of information, rather than the medium with which it is disseminated, is one of the factors that significantly influences these aspects.

103 Ifejika Speranza, Chinwe

2006. Drought vulnerability and risk in agro-pastoral areas: an integrative approach and its application in Kenya

This study addresses the problem of drought vulnerability and risk in the semi-arid, agro-pastoral areas of Makueni District, Kenya. Drought is the major climatic hazard affecting agriculture and livelihoods in rural Kenya and often triggers food and livelihood crises. Makueni District was chosen for this study because it is almost always among the areas affected by drought and impacts have been found to persist in the area long after the drought that triggered them. Hence, this study aims to contribute to the understanding of drought risk and vulnerability at the household and village levels. An integrative methodology is used for assessing drought vulnerability and risk at local levels. Measures of drought risk and vulnerability at household level under non-drought and drought conditions are constructed. In addition, the study proposes measures

through which households can improve or be supported in improving their capacity to deal with drought and related livelihood stress. The implications for theory and practice of drought research are also examined.

The methodology implemented was guided by the adopted definition of vulnerability as ‘an aggregate measure of human welfare that expresses the degree to which a person, group or human-environment system is likely to be exposed to, adversely affected by, and unable to cope with and recover from drought’ (modified from Bohle et al. 1994; and Ipcc 2001).

The key assumptions that drove the integrative conceptual and analytical framework are:

1. Interactions between agro-pastoral households and their environment (biophysical, socioeconomic, cultural and political) cause their current vulnerability and predispose them to suffer future drought impacts. Hence household vulnerability is determined partly by current household characteristics and practices, by the ways in which households are influenced by their environment and how, in turn, they influence their environment.
2. The interplay between household practices, the semi-arid environment and a drought event affects households’ capacities to cope with and recover from a particular drought event, and also determines their exposure to a future one.

This integrative approach highlights the similarities and complementarities in the various definitions and concepts existing in literature. Three constituent dimensions of drought vulnerability and risk were thus defined: the agropastoral livelihoods context and its sensitivity to drought, household coping capacity and strategies, and the drought event, which portrays the risk aspect.

Data for this study were collected between January 2002 and March 2003 in a two-tier longitudinal survey of 127 agro-pastoral households in 8 villages of the Makueni District, Kenya. This was in the framework of the CETRAD Makueni Drought Monitoring Project covering the whole district. The first survey was on agro-pastoral livelihoods and strategies while the second survey was on drought impacts, vulnerability and households’ coping strategies during the 1999/2000 drought. In order to capture the meteorological aspects of drought, daily rainfall records (1961-2003) were also collected.

Both qualitative and quantitative methods were used to analyse the collected data. A scheme of indices was used to characterise and measure household welfare capacities, drought and various dimensions of vulnerability. A household welfare index comprising economic and social variables was developed to capture household welfare, as one measure of household coping capacity/vulnerability. Factor analysis was used to extract eight major underlying dimensions of the construct ‘household welfare’. In order of importance, these are: household income levels and access, livestock holdings,

land holdings, education levels, household structure and networks, household transport and media assets, household farm investments, and non-farm investments. Based on percentiles, households were categorised into five welfare classes to reflect their current vulnerability: 'very poor'; 'poor'; 'average'; 'less wealthy'; and 'wealthy' respectively. Hence the higher the welfare index, the higher the household welfare/wealth level. To identify the typical patterns of welfare in the categories, the median values were used to describe virtual typical households in each welfare category.

Based on daily, monthly and seasonal values, rainfall characteristics and drought were analysed using drought indices and other statistical measures. Results show that high rainfall variability - variable onsets, wet season duration, cessation, intra-season wet and dry spells, variable rainfall amounts - pose a basic risk, which a drought occurrence worsens. These identified forms of rainfall variability suggest that droughts not only destabilise agriculturally based livelihoods but also the constant pressure arising from dealing with variability in the quantitative, temporal and spatial distribution of rainfall. It therefore follows that agro-pastoral households have to account for this feature in their farming practices and strategies. It was found that droughts occur frequently and evidence suggests that in any one season or year drought should be expected. Results also show that most droughts are part of a run of droughts as they can occur in runs of more than 2 seasons, with breaks as short as one season to about two to three years.

Floods also occur and may have similar impacts on households. Since the impacts of drought in a season are felt in the following period, these findings imply that the study area is fundamentally under constant risk, posed in the first place by high rainfall variability and in the second place by drought. Because of this high frequency and time-lag, the impacts can become continuous and cumulative. Thus, the high rainfall variability and the frequent droughts are fundamental weaknesses of the dependent rain-fed subsistence agricultural system. Results suggest that rainfall variability is 'normal' and that coping with variability in rainfall distribution is a major challenge.

Households' drought perceptions and preparedness were also examined. A low level of drought preparedness was found among the households, be it in sowing time, crop variety mix or produce storage for stressful times. Also, only a third of the households consulted forecasts on the likelihood of the 1999/2000 drought while only about one quarter actually adapted their strategies in anticipation of the drought. Since many variables portray the multiple dimensions of drought vulnerability and risk, prior statistical and qualitative analyses were carried out to determine the influence of these factors on vulnerability and the relations between them. The factors were then weighted according to their negative or positive influence on household vulnerability and subsequently aggregated into sub-indices of vulnerability/capacity. These additional indices capture other dimensions of vulnerability and adaptive capacities such as households' experiences of drought impacts, household practices in crop production, post-harvest management, livestock production and marketing, and off-farm/non-farm activities. The relations between the household welfare index and these various vulnerability indices were examined in the context of rainfall variability and drought to arrive at results.

Results confirm that the interaction of multiple factors arising out of the cultural and political environments, and the constraining socio-economic and natural conditions together determine household vulnerability to drought and consequently the capacity to cope with future droughts. Such factors also include the basic risks posed by high rainfall variability in an already dry environment, the cumulative effects of frequent droughts, inadequate household capacities to use potentials, agro-pastoral drought perceptions and livelihood practices.

Livelihood analysis showed that crop production, livestock keeping and marketing as well as off-farm/non-farm activities contribute to household welfare, with livestock sales being the major household insurance buffer against periods of stress such as drought. It was found that already under non-drought conditions, many households produce below subsistence level. Despite the below-subsistence crop production, and due to lack of comparable income alternatives or credit facilities, many households are compelled to sell crops and livestock to obtain cash to meet other livelihood needs in non-drought periods. This means that later in a season as grain stock dwindles, such households are purchasing at higher prices the same crops which they had sold for lower prices earlier in the season. As a consequence, they suffer temporary food insecurity, which in many cases is persistent. About one quarter of the households were found to be chronically food insecure even in non-drought times, while about half of the households live below the rural poverty line. Also, many households mainly engage in low-income casual wage labour.

Due to the aforementioned lack of alternatives for income generation or credit, agro-pastoralists cultivate 'food crops' as 'cash crops'. This study found that households practise a yield maximisation strategy in addition to strategies of risk diversification and aversion at different levels: in the choice of crops, in the dominance of maize in the intercropped area, in the choice of the long-growing, high-yielding but less drought tolerant local maize variety, in the lack of mix in maize varieties grown and in the choice of cobs to preserve seeds for the next season. Through this yield maximisation and low-input farming strategy, households expose themselves to the risk of crop failure. Drought compounds these adverse conditions by intensifying food insecurity due to crop loss, and by intensifying liquidity constraints due to reduced incomes from crops and livestock sales, and thereby generally reduces household welfare. These are just a few dimensions of the identified issues associated with drought. The wide gap between policies and implementation also contributes to drought vulnerability.

Results also show that there is a geographical dimension to vulnerability and marginality in the Makunei district. Settlements to the south of the study area are likely to experience more drought impacts and generally have less capacity to cope with drought impacts. This may be explained by the marginal locations of these villages, limited means of transport, and the fact that they are new settlements compared to the earlier settled locations in the north.

This study recommends various measures to reduce household vulnerability, under the overarching themes of ‘creating an enabling environment’, ‘establishing infrastructures as frames of development’ and ‘disseminating information’. These include, among other things, strengthening household capacity and extension services, empowering women, and improving access to credit and education. With regard to research methodologies, this study suggests a shift from drought as a single event to drought in the context of high rainfall variability. Tools for field data collection that would enable comparison of research findings in similar contexts are needed. There is also a need for periodic reviews of theoretical definitions in terms of their practical relevance – for example, the issue of defining the ‘subsistence farmer/household’ and the issue of differentiating rainfall variability from drought. Finally, the indices developed in this study and used for describing household vulnerability to drought also need to be tested in other areas with a similar context.

209 Gitonga, Jeremiah Lewis Njeru

2005. Monitoring and modelling crop growth, water use and production under dryland environment north-west of Mount Kenya

The study area, the semi arid foot slopes and highland plateau West and North-West of Mount Kenya, is a typical tropical mountain environment characterised by high pressure on natural resources resulting from land use intensification on the mountain slopes and increasing demands on land and water resources in the surrounding lowlands. Crop production by small-scale farmers is very risky and yields are low and highly variable. This is caused by: (1) Severe water deficits during the crop growing period, (2) High population growth rates leading to heavy pressure on land and water resources and expansion of cultivation to marginal areas, (3) Limited knowledge of dryland farming by farmers, (4) Limited knowledge of natural resource potential and the impact of land use on the resources and (5) Lack of tools to develop, assess and demonstrate potential production improvement strategies. Despite the high risk, crop production is the main source of livelihood for small-scale farmers who make up 75% of the rural population in the area.

Against this background, the current study was initiated with the aim of using long-term monitoring data collected at two representative semi-arid stations to examine the impact of biophysical environment (climate and soil) and cultivation methods (with and without water conservation) on crop performance (growth and production). Using the knowledge gained from this analysis, the study evaluated and adapted the Agricultural Production Simulator (APSIM) model to develop a simulation tool for the production system practiced by the small-scale farmers in the study area. The adapted APSIM model was used to examine the impact of water conservation on maize growth and production.

The study investigated a 15-year period from 1986 to 2000. Daily rainfall, evaporation, temperature, wind speed, humidity, sunshine hours and radiation were compiled for the two monitoring stations and daily potential evapo-transpiration calculated using the new modified Penman-Monteith formula. Summarised climate statistics were then calculated for the two stations.

For crop growth and production, two cultivation methods and two cropping systems were assessed. The cultivation methods included: (1) Local, the cultivation method practiced locally by small scale farmers and (2) Mulch, a soil and water conservation cultivation method involving application of approximately 3 t/ha mulching material and minimum tillage. The cropping system included: (1) Maize-bean intercrop, the locally practiced cropping system with maize and beans inter-cropped on alternate rows and (2) Maize pure crop, maize pure crop system introduced into the monitoring network in 1993 for modelling purposes. The combination of cultivation method and cropping system resulted in four treatments at each station i.e. Local Intercrop, Mulch Intercrop, Local Pure crop and Mulch Pure crop.

Soil physical and chemical characteristics were assembled from soil profile descriptions for the two stations (Liniger 1991). Plant available water parameters (Field Capacity and Wilting Point) and total and available soil water content were computed from neutron probe calibration data and weekly neutron probe measurements under the different treatments at the two stations. Surface cover was computed from weekly surface cover assessment while surface runoff was assessed from surface runoff measured from 20m² runoff plots.

Various crop growth and production assessments were made for maize and beans. These included: (1) Duration of the different growth stages, (2) Maize height and leaf numbers, (3) Visually observed water stress, and (4) Maize and bean grain and total biomass production.

Water balance assessment was made for the maize bean intercrop for the period 1986 to 1992 using the water balance model defined by (Liniger 1991). This period was selected since it had a good set of data for the variables required to calculate the water balance. Crop water use was computed from rainfall, runoff and available soil water for Local and Mulch treatments. Further, water use coefficients were computed in relation to the potential crop water demand curve for the maize-bean intercrop. The knowledge gained from this long-term monitoring data analysis was used to evaluate and adapt the APSIM model. The model was then used to examine the impact of water conservation on maize growth and production.

The study found that rainfall variability had the greatest influence on land productivity. Rainfall (375 mm – 1086 mm per year) was distributed over three rain seasons (long, continental and short), which showed varying onsets and rainfall amount and distribution. The onset of the rainy season can be delayed by up to 2 months and can also fail to occur. Within a crop-growing period, total rainfall could be as low as 120 mm and as

high as 750 mm. Rainfall distribution during the growing period had important consequences on crop production and seasons with similar total rainfall, but different rainfall distribution showed different crop yields outcomes. The importance of the rainy seasons varied over space and as did the potential cropping pattern. Low mean temperature (16°C to 18°C) and absolute minimum temperature (0.5°C) lead to long growing periods and greater chances of frost damage especially on the western foot slopes (Matanya area) where absolute minimum temperatures were lower. The potential water demand (ET₀) averaged 4mm per day on the Northwestern foot slopes (Kalalu area) and 4.5 mm per day on the western foot slopes (Matanya area). Annually, rainfall was approximately half of ET₀. Over the growing period, rainfall accounted for 64% of ET₀ in the Kalalu area and 46% of ET₀ in the first growing period and 62% of ET₀ in the second growing period in the Matanya area.

The soil in the study showed a high water storage capacity and available soil water sometimes exceeded 200 mm for a 100 cm profile and 250 mm for a 160 cm profile. The soil had high organic matter content and moderate to high fertility, which was expected to decline with the continuous low input production practiced by small-scale farmers. The value of the high soil water storage capacity was limited by rainfall variability and high water loss through soil evaporation and runoff.

Crop growth varied from season to season and was mainly dictated by rainfall distribution during the growing period. With good rainfall distribution, crop growth was vigorous and maize hybrid 614 sometimes attained over 23 leaves and a height exceeding 3.5 meters over 6 months of growth. Maize hybrid 511 was capable of attaining over 17 leaves and a height exceeding 3 meters over 4.5 months of growth. However, in seasons with poor rainfall distribution, growth was very poor and in some seasons the crop died completely.

Crop grain yield showed a highly risky production environment with values ranging from complete failure to 8.7 t/ha for maize and 1.3 t/ha for beans. Without water conservation, in the Kalalu area, the average grain yield was 3.0 t/ha for maize and 0.4 t/ha for beans. In the Matanya area, during the long rains, average grain yield was 0.6 t/ha for maize and 0.3 t/ha for beans. During the short rains, average grain yield was 1.2 t/ha for maize and 0.3 t/ha for beans. This study showed that there is great potential to improve crop production using water conservation practices to minimise high water losses through runoff and soil evaporation. With water conservation, runoff loss was reduced from a maximum of 21 to 3% and 28 to 1% of the seasonal rainfall in the Kalalu and Matanya areas respectively. Reduction in evaporation losses, which can exceed 75% of the seasonal rainfall in most cases (model results) resulted in higher available soil water. Further, maize grain yield was increased by 27% in the Kalalu area and by 85% and 55% in the Matanya area during the long rains and short rains respectively. In good seasons, water conservation improved grain yield by more than 3 times at Kalalu and 2 times at Matanya. Water conservation reduced crop failure (<0.4 t/ha) from 21% to 14% of the seasons in the Kalalu area and from 62% to 38% of the seasons in the Ma-

tanya area. Bean yield was low at the two stations and average grain yield did not exceed 0.6 t/ha in the Kalalu and 0.4 t/ha in the Matanya area.

APSIM model evaluation and adjustment focused on soil water and maize growth and production. Final APSIM model adjustment showed good correlation between observed and predicted data (r^2 of 0.85 for non-grain biomass and 0.82 for grains yield). The calibrated model was sensitive to the effect of variable climate and water conservation on maize growth and production. It provides a flexible simulation tool with the capability to simulate crop production management options, especially under dry and limiting production environments.

The current model, however, requires future improvement in a number of areas: (1) Improvement in the prediction of surface runoff for cracking soils at Matanya, (2) Improvement in the prediction of weeds and their effect on water balance and production, (3) Further investigation of the inter cropping process and its effects on water balance and production, (4) Further investigations of mulch decomposition and the effect of mulch amounts on surface runoff, soil evaporation and soil water content, (5) Further investigation of soil evaporation under different management conditions, and (6) Further assessment of soil fertility parameters and validation of the soil fertility module.

Simulation with an adapted APSIM model demonstrated that water conservation had great potential for improving crop production in the study area. With water conservation, high evaporation loss (up to 65% of the growing period rainfall in the Kalalu area and 76% of the growing season rainfall in the Matanya area) was reduced by 20% in the Kalalu area and by 28% in the Matanya area. Runoff water loss was reduced from 15% to 6% and from 17% to 2% of the growing season rainfall in the Kalalu and Matanya areas respectively. Increase in grain yield reached 4420 kg/ha with an average of 1000 kg/ha in the Kalalu area and 3930 kg/ha with an average of 1400 kg/ha for the Matanya area.

The study recommended that the knowledge and experience gained from this and previous studies be extended on-farm. This will require assessment of conservation practices with appropriate water for different areas and farmer investment capacity. This can be done through participatory on-farm research between farmers, extension officers and researchers. Simulation models such as the one adapted in this study can be used to assess and screen different water conservation and water harvesting methods before they are tested on-farm. It is also recommended that further work be done to improve the APSIM model, as it provides an excellent tool for crop production management. Further, additional research on rainfall modelling and forecasting, including assessing applicability of remote sensed rainfall products was recommended. This will complete both on-farm water conservation and model development research. To increase the use of research results, it recommended that the results of the study be transmitted to farmers and extension friendly formats and shared through different avenues. At the policy level, the study recommends the use of research results and decision support tools in assessing, developing and promoting production improvement strategies.

603 Meroka, Patrick

2006. *Common pool resource management and conflict resolution in the Rufiji Floodplain, Tanzania*

Objectives

The overall objective of this thesis was to identify and assess degradation of common-pool resources (CPR) such as fisheries, wildlife, pasture and forests in the Rufiji floodplain area, Tanzania, and to analyse the role played by the absence of binding rules and regulations (institutions) in this process. The objective of this anthropological research was to understand how and by which cultural means resources were managed in pre-colonial and colonial times compared to post-colonial times. Research focused on institutional change, collective action, power relations and conflicts. In two different village settings one located closer to a Game reserve and a commercial centre. Social science methods were applied for this study such as participant observation and various interview techniques during three field trips between 2002 and 2005. It was of interest to understand whether there are differences between the two areas in regard to how local people were able to solve the problem of acting collectively in order to address overuse of resources and mismanagement. The research was also part of the comparative African Floodplain Wetlands Project (AFWeP) at the University of Zurich, comparing similar situations in Mali, Cameroon (see NCCR PhD of Gibrert Fokou), Zambia, Botswana and another area in Tanzania (Pangani River Basin, NCCR PhD of Gimbage Mbeyale)

Research hypothesis

The research was based on the New Institutional approach (North 1990; Ostrom 1990; Ensminger 1992). This approach argues that institutions (rules, norms, regulations, laws, etc) are of major importance in the management of CPRs because they structure activities and make human action predictable. If institutions work properly they reduce transaction costs and help to use CPR in a sustainable way, by contrast with the paradigm of the tragedy of the commons. However if overuse is observed, the institutional setting is not robust. What kinds of institutions develop and evolve, or how they change, is subject to external economic and political forces and to local power relations (Ensminger 1992). I argue that the dismantling of local institutions and lack of strong state institutions has led to de facto open access and has contributed to the degradation of fish, wildlife, and forests and to powerful actors shaping local rules for their own gain. These resources then leave the area for the market; locals do not have an interest in protecting resources unless they are empowered to control them in cooperation with the state. But this only works if state actors fulfil their duties and if a feeling of trust between the village and the district level can be increased. Not all the villages face the same problems and are capable of acting collectively. This depends on the resource and on marketing possibilities and the proximity of major market centres

The study areas in the floodplain

The Rufiji district is located in southwest Tanzania and covers an area of approximately 14,500 km², with an average population density of 14 persons per km². The study areas were twin villages in the floodplain. The village of Mtanza-Msona is located in the western floodplain close to the Selous Game Reserve and different lakes connected to the floodplain that are rich in fish. The residential area is located on the northern side of the river, but economic activities such as cultivation take place on the southern side of the river. Therefore, the villagers maintain two homes; one in the settlement area on the highlands formed in Ujamaa times and the other in the floodplain called *dungus* (traditional houses standing on high poles). These houses keep people high above the floods and fairly safe them from wild animals. The *dungus* are the original houses of the villagers before villagisation took place in the 1970s.

Mbunju-Mvuleni, the other village, is located in the central floodplain close to the important commercial centre of Ikwiriri, repaired roads and a new bridge. Rufiji is an area recently opened up due to improvement of infrastructure and privatisation policies. The opening of this area has increased interest in fish, game and timber at the regional and national levels, which is felt strongly in this village close to economic centres. Mbunju-Mvuleni existed in its present form during Ujamaa times and is one of the 98 registered villages in the Rufiji district. It has a lake called Uba (connected to the floodplain) and a forest within the village boundaries. The main settlement is in two sub-villages, Mbunju and Mvuleni, along the road that crosses the village from Ikwiriri to Mkongo. The villagers maintain two homes, as in the village of Mtanza-Msona.

The most prominent feature in the Rufiji District is the Rufiji River, which is 177.4 km long with a large floodplain and delta. It is the largest river in Tanzania, and has a catchment area that comprises about one fifth of the country's territory. Rufiji District has an overall mean altitude of less than 500 metres. Its vegetation consists mainly of tropical forests and grassland. The average annual precipitation in the district is 800–1000 mm. The area is therefore semi-arid and the only reason for its riches in resources such as fish, wildlife and agricultural land is the large amount of water transported by the Rufiji River and its tributaries such as the Great Ruaha and Kilombero rivers. The Rufiji floodplain is dominated by grasses, including *Echinochloa pyramidalis* and *Oryza* spp. The permanent swamps along the rivers are cyperus papyrus swamps, with the normal associated species. Upstream, the rivers support gallery forests, with zones of inundation and pockets of swamp forest. The fauna in this region include fish (bream, catfish), crocodiles, hippopotamus, elephants, Zebras, antelopes and other smaller wildlife. The floodplain is flooded during the long rains in the months of February to May. This area is semi-arid, characterised by flooding during the rainy season. Most of the resources (such as fish, forest, pastures, water, wild products, wildlife, agricultural land) are today held as common property and characterised by extreme seasonal variations in natural conditions throughout the year.

Ethnic groups and pre-colonial resource use institutions

There are eight different ethnic groups in the Rufiji area, which were summarised as Warufiji groups having a similar culture. However they differed notably in terms of occupation and can be seen as ethno-professional groups of agriculturalists, fishermen, and hunter-gatherers including the *Ndengereoko* (agriculture), *Matumbi* (hunting), *Makonde* (fishing), *Ndingo* (bee-keeping, hunting), *Pogoro* (lake and river people, fishing/farming), and *Nyanza* (from Malawi, fishing). They also differ in terms of their time of arrival and size¹ but all were matrilineal societies, organised politically under elders and religious leaders, but without centralised government. What had been described as chiefs were in reality religious leaders (*Mpindu*) and elders of a lineage (*Ukoo*). The major religion of the different *Rufiji* people was based on animistic beliefs, for they saw that spirits in the environment as well as ancestral spirits influenced daily life and access to resources (see below). Sacrifices and rituals were performed by ritual specialists in order to get into contact with these supernatural beings. But Islam also gained more and more of a hold in the *Rufiji* area during the time of the slave trade. It was a strategy of local people not to be captured by Islamic slave raiders, who would not enslave Moslem brothers. Yet these societies still retained their animistic beliefs.

In pre-colonial times the local people were organised in societies under the leadership of the traditional *Mpindo* ruler, who was assisted by a council of *Ukoo* elders. The management and distribution of CPRs such as fish, bush meat, pasture and water was organised through this structure. Rules of access were set up through membership in specific groups and for other groups by invitation. Resource areas were defined according to ethno-professional groups, and resource use (for example, access to fisheries in lakes and lagoons) was organised and co-ordinated by *Mpindu* leaders. This council of elders was to keep peace and order in the lineage or clan. The traditional ruler and the council of elders administered the traditional local courts but the traditional ruler made the final decisions once the council of elders was satisfied with the evidence given. The territorial boundaries were observed at all times and resources within the lineage or clan were open to the lineage members in all seasons, but reciprocity was applied in time of need.

Colonial and post-colonial impacts on CPR Management: Dismantling of CPR Institutions and de facto open access

Colonial governments, first under the Germans and then the British after 1916, changed the functions of the traditional ruler through the introduction of indirect rule. However, the colonial government retained the traditional rulers; management of the CPR was done through the application of government policies, which prevented the locals from having free entry to the resource sites without permission from a government official.

¹ The *Ndengereoko* are regarded as being the first comers and constitute the majority (40%), while the *Matumbi* represent 20%, the *Makonde* 16%, the *Ngindo* 12%, the *Pogoro* 6% and the *Nyanza* 2%, while the remaining significant minorities are the *Zaramo*, *Hehe* and *Ngoni* (2%).

The government also introduced resource management laws and regulations regarding fishing and hunting and began closing areas of forest and wildlife use in order to conserve nature. But all these areas had been cultural landscapes formed by local people and had been managed by common-property regimes. This included religious activities important for coordination of resource use and resolution of conflicts over resources.

During colonial times local traditional institutions were growing weaker but were still in place and were more or less abolished only by the independent government during the policy of Ujamaa in the 1970s. After independence and with the introduction of Ujamaa the political change in the Rufiji floodplain affected the management of the common pool resources drastically. Local ethno-professional groups ceased to exist in the same way as before because the government declared all people to be Tanzanians and ethnic boundaries were dismantled. The traditional rules and regulations were restructured and replaced by state institutions already in the colonial period but even more so by the post-independence government. The management of common pool resources, which were linked to local culture and beliefs, gradually eroded and disappeared in some areas. The dismantling of these institutions and their replacement by state institutions took place in 1968. The president of the Republic of Tanzania introduced Ujamaa (lit. "pulling together") as a means of development and unity in Tanzania. The ideologies of Ujamaa were stated in the Arusha Declaration of 1967. The implementation of Ujamaa policies weakened traditional institutions in the following way: traditional leadership was abolished and new village governments were introduced and all the scattered hamlets were consolidated into Ujamaa villages. Despite ethnic differences people were mixed together. The dismantling of the management and use of CPRs were becoming clear as the state of Tanzania underwent economic crisis in the 1980s, in which the management system controlled by the state could not be enforced and an influx of immigrants moved to the area because CPR were now freely accessible for all Tanzanians. This crisis was accelerated by the IMF's Structural Adjustment Programme (SAP) which demanded that the state budget and formal employment be cut, rendering commercial use of CPRs of high interest while state institutions were weakened. Therefore the area faced a situation of de facto open access, which led to an increase in fishing and hunting activities and a decline in the fish and wildlife population (for example elephants in the Selous Game reserve) due to poaching because of high prices for game and trophies on the national and world markets. But it was not only newcomers who had an interest in the commercial side of these resources. The other crucial local issue in the villages where research was carried out was that the village government officials were not on the payroll, although most government duties at the local level had to be administered by the village council officials. As officials are not well paid by the government, they are forced to seek alternative livelihood strategies. But other local people, especially young men, are also no longer interested in farming or other activities and have realised that common pool resources can be converted into money. The local people today make money out of the CPR themselves directly or they co-operate with traders and commercial fishermen, hunters or loggers.

Therefore, as traditional conflict resolution mechanisms are also lacking, an increase in conflicts between different resource users was found. This is especially the case since NGOs such as the IUCN and others try to introduce community approaches, and since land rights can be given to villages. These developments, on the one hand positive, have also triggered anger and conflict among resource users within and especially between villages, as this study has shown: villages that set up management plans for fisheries, for example, often exclude other villages also involved in fishing activities in the same area.

Differences between villages over the problem of collective action

Despite the twin villages being located in the same floodplain, there are differences in CPR management due to differences in location and exposure to external influences. Mbunju-Mvuleni is closer to commercial centres, by contrast with Mtanza-Msona, which is located in the western floodplain closer to the Selous Game Reserve and further away from such centres. The village, being close to Ikwiriri Township, has attracted more external fishermen to Lake Uba, close to the village. Therefore, many different people with different interests try to use the fisheries in the lake, and this has made resource management complicated. It is difficult for local people to exclude outsiders, because they have access rights through fishing licenses issued by the fishery department. The possession of licenses gives commercial fishermen the right to access fish. Nobody can stop them as long as this permission paper is in their hands. The continued increase of fishing boats and nets in Lake Uba has increased the competition between a) local fishermen and seasonal commercial fishers immigrating from Ikwiriri, and b) the neighbouring villages. This is contributing to over-fishing in the lake. In addition, changes in fishing technology have led to depletion and degradation of fish because of the use of small-mesh nets. Fishermen have reduced the mesh size of their fishing nets because big fish have become rare. Differences of interest exist between local villagers, some of whom use fish for subsistence, while young men co-operate with traders and external fishermen or sell fish by themselves, complicating the task of managing the fisheries. The joining of locals in commercial business has increased the demand for fish as well as conflicts on Lake Uba.

The village of Mtanza-Msona, being closer to the Selous Game Reserve and Kisarawe District, faces fewer problems with the management of fish than Mbunju-Mvuleni. There are fewer commercial fishermen in Mtanza-Msona and the local people are more united, so taking decisions on problems facing the fisheries is easier. Local people were even able to unite and successfully revitalise a traditional fish conservation technique for the breeding of small fish. Co-ordination at the village level is easier because the residents are only the people registered in the village. In Lake Mtanza fishing is still regulated by local people and collective fishing is organised around rituals. The ritual specialist controls crocodiles, and commercial fishermen have to submit themselves to local rules. If they do not do so, it is still believed that the spirit of the lake will send crocodiles and hippos to chase the fishers off the lake. Only after making an offering can the fishers conduct their activities without harassment. This belief is still strong

among the local communities and immigrants do not challenge it. Interestingly, local people take the view that too much fishing is not a problem, but fishing without respecting spirits leads to a decline in the availability of fish. This reflects the traditional belief that it is the spirits, and the major spirit Subiani, who control the fish and expose people to wild animal attacks and keep the fish in holes when respect is not shown. Hence local Rufiji groups are not aware of the concept of over-fishing.

While people from Mtanza-Msona are much better prepared to act collectively regarding the management of the fisheries than people in Mbunju-Mvuleni, management is difficult for the former when it comes to wildlife issues: The area is now easily accessible for poachers from Kisarawe District, which is the outlet route for bush meat to Dar es Salaam. Game has become more and more an open access resource because the Selous Game Reserve is no longer well monitored. Due to SAP, there are financial cut-backs in wildlife management. Scouts do not exist or are not well paid and therefore monitoring of the reserve and sanctioning of illegal hunting is becoming difficult. On the other hand wildlife sells well in Dar es Salaam and a lot of commercial poachers are civil servants who lost their jobs through the SAP and subsequent civil service reforms. They are now engaging in hunting as an income alternative. New infrastructure and new technology have also led to better access to wildlife resources by road and through use of new automatic guns and electronic geographic positioning systems (GPS) to track down animals and evade game scouts easily or pay off the game scouts. In addition animals seem to move out of the area for two reasons: One is connected to increased poaching and the other to climate change: Because of less rainfall, fewer pastures are available for wild animals. This leads in turn to problems with agriculturalists because wild animals feed on their fields.

Conclusions

This study has shown that overuse of CPRs and increased conflicts are based on institutional weakness owing to the dismantling of local institutions and inability to implement government rules and regulations. However, there are differences regarding exposure of areas to market pressure and the pressure of open access situations. This thesis supports the hypothesis that proximity to commercial centres via transport and institutional constellations as well as the ability to take collective action at the local level can make a difference. The major mitigation aspect of introducing community management as a project set up by the IUCN and also supported by a PAMS in the area is important and helpful. However, it is crucial to see that all local stakeholders are involved and have trust in the state and in NGOs, so that regulations are the product of negotiations by all users and that power is shared in the management of CPR. As long as this is not done, overuse due to open access and conflicts will increase, even with new decentralisation and participation models.

801 Muttenzer, Frank

2006. *Deforestation and customary law in Madagascar [in French]*

Since the enactment of a local resource management law in 1996, Malagasy land tenure policy has been re-discovering customary law, a trend confirmed by the new tenure legislation enacted in 2005. The study deals with the particular implications of this paradigm change for the organisation of the forest sector. It therefore looks at deforestation as a tenure problem whose solution may, for a variety of reasons, require the recognition of customary law.

Part One places discourses on environmental governance in the historical context of borrowing foreign legal models. It appears that customary law is not only a means to legitimise the governance model, but ensures some degree of endogenous political control over ongoing transformations of peasant economies. It reflects a particular conception of justice but is not limited to exclusive ethnic identities. Taking into account the needs of migrants, it differs from the recent model of integrated conservation which reinforces localisms, and separates the spread of a universal environmental ethic from its translation into customary orders. Behind the customary law, there remain a shared ethos and the material necessity to find a place to cultivate for one's own subsistence.

Part Two contains ethnographic accounts of contrasted settings and populations, and aims to compare the ways in which property relations are conceived, contested and made secure in the context of the Malagasy forest economy. Concerns analysed include the agricultural colonisation of rainforests in the Sambirano region and the biological corridor near Ambalavao, the organisation of rural charcoal markets in the lowlands of Mahajanga, and the extraction of raphia palm fibres on the Eastern coast. These case studies show that peoples' participation in the protection of nature is difficult to reconcile with existing representations of labour, ancestral domain, and political ethnicity. However, local forms of resistance to new laws do not prevent environmental action from gaining some legitimacy, as old customs are usually reinterpreted according to present needs and circumstances.

Part Three engages more specifically with theories of international environmental policy making, and links that discussion to the wider question of international development aid. It analyses the mechanisms of imposition of environmental norms and standards and shows their limits on the basis of concrete experience; pilot projects that appear hard to generalise, embezzlement of forest taxing regimes, disarticulation and inapplicability of new legislation, etc. In this way, the study tries to draw on peoples' various successful strategies to avoid a law designed to fulfil the requirements of a multi-faceted "green" international community.

925 Kiteeme, Boniface Peter

2006. Multi-dimensional approaches to more sustainable natural resources management in highly dynamic contexts in East Africa

The thesis was elaborated within the context of the Swiss NCCR North-South programme and consists of twelve publications. The overall aim of this series of publications is to identify and elaborate a broad framework and principles for approaches to promote sustainable development in the Upper Ewaso Ng'iro Basin located to the north and west of Mount Kenya. The study builds on and benefits from research carried out in partnership between Swiss and Kenyan scientists in the Basin over the last three decades. The thesis is structured into three parts. The first part assesses non-sustainable developments in the region, the second part focuses on innovative approaches geared towards sustainable development at different scales and levels by linking policies and the legal framework, and the third part consists of a comparative analysis and reflection on the findings against the background of the concept of transdisciplinarity.

The first part sets the stage for the thesis by describing how frequent land ownership changes and resulting loosely regulated subdivision of land coupled with immigration driven demographic growth in the last century had an adverse effect on the sustainable use of natural resources, especially water. Smallholder agropastoral settlements became the main agents of resource degradation and simultaneously the victims of natural resources limitation and degradation as they engaged in survival and coping strategies incompatible with the prevailing ecological conditions. Deforestation, devegetation, over-abstraction of river water etc., set in and their undesired effects started to manifest, raising the fundamental question of how eco-regional sustainability can be enhanced in the context of the underlying conditions.

The study confirms that such a strategy has to be anchored in two principle thrusts: The first thrust aims to foster acceptance and enhance implementation in the development of sustainable water supply, while the second thrust shifts from the supply perspective towards influencing or reducing the demand for water. Both parts of the strategy must apply at different spatial, societal, and institutional levels and cover local, regional, and national scales. Analysis of concrete implementation showed that only a combination of both thrusts has the potential to address the sustainability problem.

A 2003 field survey highlighted the importance of understanding local level actors and their development priorities in a basin context. Communities in the drier lowlands of the Upper Ewaso Ng'iro Basin do not perceive water as such a critical development issue as those living in the wetter upstream areas, implying their over-dependence on water to sustain their livelihoods. Against this background, demand for water will continue to rise in the areas upstream against a backdrop of limited alternatives and dwindling river water resources. This sets the stage for water use conflicts as competition for water is heightened.

On the trans-local level, Water User Associations (WUAs), as community based institutions, were studied and it is shown that they have great potential in addressing water-related conflicts. Besides direct intervention and dialoguing in conflict resolution, the WUAs also participate in other activities such as environmental education and awareness creation, water conservation, and catchment protection. The study also shows that the potential of the WUAs is limited by constraining factors such as lack of finances, technical skills and means, and limited managerial and leadership capacities. Based on the recent legal recognition of the WUAs (Water Act), the hope is justified that they will increasingly contribute to sustainable use and management of water resources in the basin. Besides the potential of the WUAs to address issues related to local water needs, the current study identifies the district level as the appropriate level of intervention in regard to a long-term perspective on sustainable use of water resources in the Basin. Hence an approach is developed and implemented that seeks an optimal balance between a flexible short-term strategy on water supply needs and a long-term perspectives on the potentials of water resources.

A critical investigation of the legislative instruments and institutional structures for water resources management revealed inconsistencies, lack of efficiency, and lack of coherence and harmony in their formulation and their application. According to the Water Act CAP 372, all rights of use and ownership of water are vested with the state. But in addition there are over twenty-six other Acts of Parliament concerning water use and management. Some of these directly or indirectly contradict the Water Act, thereby hampering its enforcement. Besides this obvious direct contradiction of policies, the present research highlights various other weaknesses in the institutional arrangements. They include among other things: Unclear mandates and functions of governmental agencies, lack of institutional coordination and integration, limited financial and personal resources, and the lack of control and regulatory mechanisms. In consideration of these limitations, a forum for sustainable resource management in the overall Basin is proposed. This forum will complement existing instruments by promoting resource use negotiations and advocacy and manage related divergent interests and claims among actors and stakeholder groups.

Based on the institutional arrangements in relation to sustainable water resource management and the respective ecological processes and socioeconomic dynamics, the thesis argues that research that aims to contribute to sustainable management of natural re-sources – in whatever context – must be built on the foundations of transdisciplinarity. Rooted in current research and analysing the experience of 25 years of Swiss – Kenyan research partnerships, the author concludes with several lessons learned in regard to transdisciplinarity: (1) A transdisciplinary process capitalises on an iterative process: on the one hand, between types of knowledge (systems, target, and transformation knowledge) and on the other hand, between transdisciplinary, interdisciplinary and disciplinary research, all of which are relevant to sustainable development; (2) Stakeholder selection in a transdisciplinary process should be requirement-driven and not just aim to serve political interests or respond to the needs by different water users; (3) Training in integrative issues is a crucial component in transdisciplinary processes;

(4) Target knowledge in a transdisciplinary process must be defined from a broad perspective of sustainability in order to embrace need-orientation and requirement-orientation; (5) A requirement-oriented database is an important steering and working tool of transdisciplinarity as it assists in the definition of common information references for planning and application and helps to forge trust and confidence among stakeholders, especially in policy dialogues and negotiations; (6) Long-term research involvement is a prerequisite for transdisciplinarity.

5.3 JACS Horn of Africa

206 Yitaferu, Birru

2007. Land degradation and management options in the Lake Tana Basin (LTB), Amhara Region, Ethiopia

Problems of land degradation and options for sustainable land management (SLM) were studied for the Lake Tana Basin (LTB) in the north-western highlands of Ethiopia. The study had two broad objectives: (1) To analyse the problems of land degradation, including land use/cover changes (LUCCs) and the associated changes in forest, water, soil, and climatic resources of the basin. This also included pressure factors responsible for the degradation of resources, as well as eventual societal responses to overcome the negative impacts. (2) To appraise SLM options and strategies for mitigating the problems of land degradation. In order to address these objectives effectively, the study was carried out at two spatial scales: the LTB as a whole, with an area of 15,070 km², was studied at a scale of 1:250,000, and three case-study locations with areas of 43, 71 and 154 km², respectively, were studied at a scale of 1:50,000. The study covered the period between the early 1950s and 2005.

Relating to the analysis of LUCC, positive changes were obtained between 1985/86 and 2001/03 for the cropland, forest, and urban land classes in the LTB. Croplands increased by about 4.2%, and forest cover increased by about 0.23% of the basin, or by 28% of the forest cover of 1985/86. More detailed studies were made in Gish Abbay Watershed and Wej Awramba Transect for the time between 1957 and 1982. They indicated that croplands increased by about 31% and 67%, respectively. Expansion of croplands was lower for the northern highlands, represented by Angereb Watershed, i.e. by about 14% for the time between 1964 and 1994. In the period from 1982 to 1994, expansion of cropland was negative for the highland areas of Gish Abbay and Angereb watersheds, whereas it remained positive for the foot-slope areas of the Wej Awramba Transect. Contrary to the other land use/cover types, the forest cover of Gish Abbay and Wej Awramba areas declined by 72% and 81%, whereas it increased by 200% for the Angereb Watershed, respectively. Along with the changing land use/cover of the LTB, changes in the forest resources in terms of loss of diversity and evenness of the species were found to be enormous. Forests of the LTB were found to be dominated by eucalyptus species, i.e. the lowest in diversity with great evenness in species, whereas the traditional agroforestry system was less even, followed by natural forests in enclosure and riverine areas, which showed the greatest diversities. Similarly, with the decline in forest cover and expansion of crop cultivation in upstream areas, runoff, soil loss and sedimentation of downstream reservoirs were found to be serious problems. It was also found that maximum rates of discharge of the rivers in the peak rainy months were increasing, whereas the minimum rates in the dry months were declining. Problems of soil degradation in the LTB largely occurred in the form of water erosion and loss of fertility of the agricultural lands. Currently, about 27% of the steep slopes (>15%) were found to be threatened by severe soil erosion (>60 t/ha/year; plot level prediction). Similarly, soil degradation in terms of loss of available phosphorus, total

nitrogen, and soil organic matter content was also found to be serious in areas where crop cultivation and grazing are intensive, i.e. on steep sloping lands. The LTB has relatively stable annual rainfall amounts, with low coefficients of variation (C.V. between 13-26%). However, the probability of extreme dry and wet events was found to be pronounced at the onset and end of the rainy season, with the probability being higher for the low rainfall areas in the north. Generally, these brief analyses of the LRCs, coupled with various biophysical characteristics, were used to classify the basin into eight physiographic units and four broader land degradation contexts: (i) mountain escarpments and riverine systems were found to be extremely prone to degradation (75%), (ii) foot-slopes and highland plateaus were highly prone (50-75%), (iii) areas in the lower plateaus were moderately prone (25-50%), and (iv) the swamp lands, the lake shore area, and the foot-hills were considered to be least prone to degradation (10-25%).

In terms of dynamics, the expansion of crop cultivation in areas sensitive to human inter-vention, deforestation, removal of the biomass from farm plots, overstocking of grasslands, and the traditional cropping systems and practices were found to be more intensive than ever before. In turn, much of the loss of the forest cover and the conversion of grasslands into crop cultivation ironically coincided with changing land policies and institutions in the 1970s and early 2000s. During these periods, contrary to the land use regulation policy of the region, fragile areas were converted into cropland, while livelihoods based on crop-livestock production remained unchanged. It can be concluded that societal responses to land degradation were weak.

SLM options were suggested based on the various degradation contexts. Since appraisals of SLM practices/systems required the opinions of various stakeholders, the appraisals were carried out with the involvement of farmers, development agents, and researchers. As a result, significant variations of interest were obtained between the three groups. Thus failure to adopt various land management technologies in the past might be partly attributed to the lack of common interest among stakeholders. In the appraisal process, it was also realised that improving the societal drivers of land resource changes, such as policies, institutions and other socio-economic factors, was crucial. Controlling the growing human population, and diversifying livelihoods and economic bases outside the agricultural sector, were some of the other factors involved. Finally, some crucial recommendations are advanced regarding the social and spatial units of management interventions, hierarchies of responsibilities among stakeholders, the involvement of stakeholders in land management decisions, and ensuring the availability and accessibility of a spatial database system for all levels of users.

207 Bantider, Amare

2007. Landscape transformation and opportunities for sustainable land management along the Eastern Escarpment of Wello (EEW), Ethiopia

Land Use and Land Cover Changes (LULCC) are an aspect of global change and among the rapidly changing global phenomena characterised by unprecedented rates of

change magnitude and spatial extent since the 1950s. LULCC research at regional and local levels contributes to efforts to promote sustainable land management and generates additional data for global-level LULCC studies.

This study was carried out in the Eastern Escarpment of Wello (EEW) in a highland-lowland context. It was conducted at the meso-level in an area of 8242 km² and at the micro-level in five selected case study areas, each between 500 and 2400 hectares. The overall goals were (i) to analyse the magnitude, direction, drivers and impacts of landscape transformation (principally LULCC) since the 1950s, with some reference to the historical past, and (ii) to investigate opportunities available to promulgate SLM in the region. The study followed mostly holistic and multi-scale approaches. Aerial photo and satellite imagery interpretations, biophysical resource and household surveys, focus group discussions, village-level sustainable land management appraisal conferences and participatory transect walks were the major methods of data collection.

The study showed that woody vegetation (forest plus shrub) cover in general and forestland in particular have been low in the EEW at least since the beginning of the twentieth century. Given the ruggedness of the topography, the cropland coverage, of which 59% is found in slope classes above gradients of 15%, was found to be high. Although woody vegetation cover was generally low, empirical investigations conducted since the 1950s at different spatial scales have revealed a variety of land cover changes from one land cover type to another. Thus, the pattern of change was not linear.

Since the 1930s three periods of rapid deforestation and a concomitant expansion of cultivated land, and two periods of improvement of woody vegetation cover and a concomitant decrease of cultivated land, have occurred. The deforestation and expansion of cultivated land phases took place from the 1930s to the 1950s, from the mid 1970s to 1980, and from 1990 to the mid 1990s. The major driving forces were found to be land tenure insecurity and episodic factors such as civil war, famine and drought, invasion and patriotic resistance, revolution and violent regime changes. The two periods of improvement of woody vegetation cover and its concomitant cultivated land decrease were from 1980 to 1990 and the mid 1990s to the present. The first period witnessed a state environmentalism policy and actions through massive land rehabilitation programmes, backed by international donors and global-level environmental movements. Forced relocation of farmers from steep slopes for closing/afforesting them was also a factor. The second period was characterised by the consolidation of policies/institutions related to land resource management that collapsed during the civil war in the early 1990s and in the early years of the present government, the restoration of tree tenure security that was stripped during the socialist-oriented Derg Government, the liberalisation of market forces, and the proximity of areas to roads. Unlike in other studies elsewhere, population in EEW did not turn out to be an important factor in driving LULCC; however, it made its own contribution to the changes. In general, many of the factors were operating concomitantly and as a chain of logical causation.

In addition, the study explored impacts of LULCC on both the ecology and livelihoods of farming households. Even though the study region experienced massive land rehabilitation programmes in the 1980s, it is still a hotspot for environmental degradation and for Malthusian trends in the livelihood of the farming community. The problem was found to be severe in areas far from roads. Steep slope soil erosion was estimated to be as high as 90 tons/ha/y, which is more than nine times the maximum tolerable limit on average. The current Organic Matter (OM) content in almost all slope classes of cultivated land was found to be more than 50% lower than the medium threshold level for agricultural activities, and more than 70% lower than the estimated original level. Regarding biodiversity loss, there was hardly any optimally large natural and unaltered habitat. For instance the forest cover of the region is below 1%.

The sharp drop in per-capita cropland was a direct impact of shrub and forest land increase due to afforestation measures since the 1980s, coupled with population increase. The per-capita cropland in the case study sites declined exponentially from about 0.9 ha in 1960s to 0.142 ha in 2006 and the rate of decline was 0.0467 ha/year. This study has revealed that the scarcity of cropland neither brought agricultural intensification nor led to diversification of income. Moreover, farmers did not respond to land shortages through large-scale out-migration. The finding is thus consistent with the Malthusian scenario of livelihood, because the majority of the farming households are destitute and unable to satisfy their own food demands.

Regarding opportunities for SLM in EEW, participatory appraisal of technologies and approaches for SLM was conducted. Moreover, potentials available and core problems hindering SLM were identified. Sustainable Development Appraisal (SDA) and Multiple Objectives Decision Support System (MODSS) were tools used for appraisal that were found to be suitable for further use in the region.

701 Haggmann, Tobias

2007. Pastoral conflict and resource management in Ethiopia's Somali Region

Why do African peasants fight over natural resources? How are these conflicts resolved? And which roles do customary and state institutions play in this process? The literature on environmental conflicts in sub-Saharan Africa presumes that violent conflict is a direct response to resource scarcity and rangeland degradation induced by climate change and demographic growth. According to this line of thinking violence is equated with rural societies' unfulfilled subsistence needs and a breakdown of communal land tenure. This thesis challenges this hypothesis by expounding on the political and institutional factors that mediate violence, inter-group relations and resource use in pastoral areas. It draws attention to the wider power relations in which social groups and ecosystems are embedded, the multitude of existing conflict management strategies, and the importance of state rules and resources in shaping pastoral conflicts. Rather than the

state of nature, the author argues, it is the nature of the state that accounts for contemporary resource conflicts in sub-Saharan African drylands.

Drawing from first-hand empirical material, the thesis scrutinises conflict and resource management practices in the Ethio-Somali borderlands characterised by ecological uncertainty, physical insecurity and weak state performance. Three case studies of i) contested rangeland enclosures, ii) tensions over access to riverbanks, and iii) competition over government budgets provide first-hand insights into the political economy of resource use in one of the most under-researched areas in the Horn of Africa. Neither resource scarcity nor ill-defined property rights account for the proliferation of violent conflicts in Ethiopia's Somali region since the arrival to power of the Ethiopian Peoples' Revolutionary Democratic Front (EPRDF) in 1991. Instead attention is drawn to the recursive power relations between state and customary authorities that shape Somali agro-pastoral livelihoods, collective action and peacemaking. The analysis demonstrates the central role played by the (Ethiopian) state, rather than the natural environment, in reconfiguring resource tenure and politicising kin-based clan divisions. Administrative decentralisation, bureaucratic spoils and the expansion of neo-patrimonial relations into remote rural areas alter the underlying causes of pastoral conflicts and the scope for resolving them peacefully.

Conceptually, the study elaborates an interpretative framework that integrates insights from conflict research, public policy analysis, new range ecology, and legal pluralism in order to explore the conditions that enhance pastoral conflict transformation in semi-arid sub-Saharan Africa. Analytically, it emphasises the interplay between customary and state conflict and resource management on the one hand, and between local ecosystems and their wider political economy on the other hand. Empirically, this study provides an account of violent conflict, politics and resource management in the Ogaden, one of Africa's most under-researched areas (neglected by both Ethiopian and Somali studies) and an ongoing conflict hotspot in the Horn of Africa.

Political scientists, human geographers, anthropologists, and development experts with an interest in resource conflicts in African drylands and local politics in the Horn of Africa will find a wealth of empirical material and conceptual innovation in this thesis.

Research context

Due to longstanding political turmoil, a dilapidated infrastructure and the ongoing rebellion by the Ogaden National Liberation Front (ONLF), Ethiopia's Somali region represents a particularly challenging field research context. Most of the empirical material was collected during three field research stays in Ethiopia's Somali region, where the author conducted fieldwork between April and July 2003, between May and July 2004, and between November and December 2005. Data collection mostly consisted of semi-structured interviews and extensive informal group discussions in different localities within Ethiopia's Somali region and the capital Addis Ababa. Interviews and dis-

cussions with pastoralists, elders, bureaucrats and other informants addressed issues related to natural resource management, livelihoods, clan and state politics.

704 Moges, Shiferaw

2007. The economics of shared irrigation water rights: an alternative analytical framework and application to Ethiopia

1. *Lack of appropriate theoretical and analytical models is the main impediment to empirical analysis of property rights and it is also partly the reason for the existence of paradoxes in common pool resources use and management*

Despite their importance and scarcity, it is paradoxical that most common pool resources are inefficiently utilised and poorly maintained in most parts of the world. How to best resolve this paradox has become a central concern, both in policy and academic circles. However, despite the need for empirical work and the vitriolic nature of policy debates, there is little current knowledge (empirical and analytical evidence) concerning the structure of co-owners' irrigation water rights with respect to water required for proper functioning of shared rights arrangements and the economic consequences of a lack of one or more elements of the property rights system. In our option, the major impediments accounting for absence of empirical work and efforts are partly due to lack of an appropriate theoretical and analytical framework that can be used to explore the economics of shared rights arrangements. Empirical analysis and success of shared rights requires an ideal shared property right model that can be used as a benchmark to compare with what is actually observed.

2. *A common pool resource is neither purely a single private good nor purely a single public good; rather it is comprised of a public good resource system (stock) and a private good resource flow unit.*

Since Samuelson (1954) and Musgrave (1959), economists have classified goods into private and public, based on subtractability in consumption and exclusion in production, respectively. Following this classification scholars also came up with a new class of goods called common pool resources (Ostrom et al. 1994), which share one attribute of pure private goods (subtractability) and one attribute of pure public goods (difficulty of exclusion). We argue that classification, considering a common pool resource as single private or public and even a common pool does not reflect the true characteristics of a common pool resource. We would argue that at least the two components of a common pool resource should be considered for a better understanding of common pool resources.

3. *Neither private nor communal property rights in isolation are efficient enough to address the tragedies in common pool resources management. Optimal integration of private and communal proprietorship (in our*

terms, quasi-private proprietorship), is arguably efficient to address the puzzles in common pool resource management.

The research confirmed that real property rights are more complex than the ones in economic models, which tend to focus on the advantages and disadvantages of a particular property right regime for allocating and managing a single use of a resource among a group of homogeneous users. Most common pool resources have multiple attributes - some attributes are conducive for private proprietorship and others are conducive for communal proprietorship. More specifically, a common pool resource is comprised of a resource flow that is conducive for private proprietorship and a resource system conducive for communal proprietorship. On these bases, the present research claims that a quasi-private property rights system is more compatible with the characteristics of common pool resources.

4. *A resource is a bundle of rights to valuable attributes including the ways each element of property rights to resources flows, as well as decision making rights in a resource system bundled and aggregated to determine the efficiency of outcomes rather than the property rights regime per se.*

Traditionally, the analytical framework or model used to analyse the efficiency of particular property rights is limited to an ideal (property rights regime at zero cost of transaction) and aggregated structure of property rights. The present research revealed that in real world transactions the cost is never zero and the structure of a particular property rights system is comprised of a bundle of rights and associated quality parameters. Each bundle of rights and quality parameters have substantial economic implications. Thus, it is argued that in the world of positive transaction costs and multiple users, what is important is not the ideal aggregation but the content of a bundle of user and regulatory rights, structural elements of rights such as different modes of bundling of rights, and different modes of aggregation of rights systems for purposes of efficiency. The research confirmed that ignorance of the optimal complexity of ownership and bundling of rights crucially impeded the effectiveness of property rights approaches in resolving the tragedies of water management and suggested a move from aggregated property rights regime analysis to a bundled rights-centred analytical framework.

5. *Irrigated agricultural growth is not necessarily a function of the amount of water resources consumed in the production process per se, if not a function of property rights structure and water entailments.*

Econometric evidence confirmed that efficiency of agricultural production is not necessarily a function of the physical availability of water. It is rather a function of access to water (the right to command over water) and security of water entitlements. For instance, empirical findings on Ethiopian irrigated agricultural growth indicate that Ethiopia has untapped potential to increase irrigated-agricultural growth by increasing the productive efficiency and efficient use of irrigation water among small scale producers by improving the structure of irrigation water rights, even without increasing the

volume of water as well as improving the current state of underdeveloped farming technology.

6. *Scarcity is not a lack of water as a physical entity. It is a socially defined structure of rights and entailments*

From empirical analysis of irrigation water, we have observed that scarcity is not a lack of water as a physical entity per se – but a lack of different water services at the required place and time. Recognising this fact the present research suggests conceptualising scarcity in terms of a structure of rights and entailments to better understand the logic of decision-makers. The empirical evidence revealed that investment and efficient water decisions are more influenced by the structure of rights and entitlements than the physical scarcity of water. This is because the structure of rights and entitlements provides both the incentive and the security to invest in water resources and transfer the water to its highest value use.

7. *A property rights reform or restructuring programme that does not contain all essential elements of the quasi-private property rights system (inefficient property right systems) will result in a Pareto-like inefficient outcome.*

The case studies, descriptive statistics and econometric analysis of Ethiopian irrigation water management confirmed that the Ethiopia irrigation water rights restructuring and irrigation water management devolution programme efforts failed to capture the most essential elements of rights. As a result, irrigation water rights reforms enacted in the name of property rights have resulted in substantial resource degradation and social conflict in the country.

8. *Equitable distribution of essential bundles of regulatory rights among co-owners significantly influences the level of multilateral bargaining over “the rules of the game”, which has in turn determined the establishment and maintenance of optimal rules and an optimal governance system that is equally beneficial to all co-owners.*

It was observed that at least in irrigation water management, multilateral bargaining could reduce irrigation water management externalities (provision and appropriation externalities) through fostering cooperation among co-owners and securing the benefits of their investment in collective action. Improving multilateral bargaining, however, merely required equitable distribution of collective choice rights (regulatory rights) that provides equal bargaining power over collective choice decisions.

9. *Getting the initial allocation or restructuring of the essential bundles of rights and structural elements correct is the only readily available efficient path to common pool resource management such as shared irrigation water.*

It was postulated that if we got the initial allocation of rights correct, the desired outcome could be achieved by rights holders themselves without substantial government intervention. The initial allocation of property rights shaped and detected the direction of incentives related to use and investment behaviour as well as externalities related to the actions of users.

10. *Bargaining under asymmetry requires making property rights structures efficient and allocation equitable*

Empirical evidence on surface irrigation water, where there is clear natural asymmetry between end users and upper users, indicates that improving property rights asymmetry counterbalances the natural geographic asymmetry that makes bargaining possible under the conditions of information asymmetry. What is required from the state is to make sure that any effort of structuring fulfils the following four conditions. i) to make sure that all four essential bundles of irrigation water use rights and associated quality parameters are in place; ii) to establish and enforce the three essential bundles of regulatory rights; iii) to ensure appropriate bundling of user and regulatory rights; and iv) to ensure equitable distribution of user rights over irrigation water and co-equitable distribution of regulatory rights over the irrigation system. If conditions i-iv are fulfilled, bilateral negotiations between individual co-owners over rights of use, and externality and multilateral negotiation among co-owners over operation rules, will be sufficient for optimal allocation of irrigation water as well as optimal allocation of externality over the irrigation system, even under the condition of information asymmetry such as surface irrigation water.

706 Arsano, Yacob

2004. *Ethiopia and the Nile: the dilemma of national and regional hydro-politics*

This chapter is divided into two sections: the first revisits and discusses the four hypotheses developed in the literature review section. The final conclusion summarises the key findings of the thesis.

Review of hypotheses

The following section is structured in four sub-sections, following the security, environment, economic and legal/institutional hypotheses developed at the beginning of the thesis.

The security hypothesis

The security hypothesis was formulated as follows: First, successful negotiation and establishment of a treaty regime will likely rid the protagonist riparian states of mutual insecurity. Second, a legal agreement becomes the basis for the long-term creation of a common security zone for mutual national interest through cooperative mechanisms.

The national level capacity of the riparian states will likely determine how soon and under what terms cooperative mechanisms will be achieved.

The interviews and literature in this thesis concerning the Nile Basin generally supported this security hypothesis, even though there is no legal agreement yet, and the hypothesis can therefore not be fully verified. Nevertheless, the nascent Nile Basin Initiative seems to be a promising attempt at creating a common security zone. In February 1999, in Dar es Salaam, Tanzania, the water ministers of the Nile basin states agreed on what they believed was a common concern to all the Nile basin countries. This common concern was expressed in a slogan: “Sustainable development of the River Nile for the benefit of all”. The water ministers in council explicitly expressed a shared vision: “to achieve sustainable socio-economic development through the equitable utilisation of, and benefit from the common Nile basin resources”. The ministers further agreed on the subsidiarity principle, which would help the riparian countries take decisions at the lowest possible level, and facilitate action on the ground. Any action under the shared vision is expected to be demonstrated by: (1) building mutual trust and confidence among and between the riparian communities; (2) meeting the needs of the populations with benefits accruable from the appropriate management of the Nile waters. It is further envisioned that action on the ground will have to be operational at local, national and sub-regional levels, with a hope that these will be integrated into a basin-wide framework.

The mutual satisfaction envisioned in the NBI from accruable benefits is likely to further enhance the interests of the Eastern Nile Basin countries to establish cooperation on the grounds of common security. A breakthrough, however, has not been achieved: the NBI is still a transitional mechanism. A substantial shift from unilateralism has not taken place, exemplified by the slow process of the NBI. Some of the main reasons for unilateralism and the absence of a regional legal framework are: 1) On the national level, the low level of economic development and low consolidation of institutional capacity has led to a lack of exertion of credible influence on counterpart states. 2) On the regional level, contested legal doctrines were used as a position articulation, due to uncertainty of the implications of a future common mechanism.

The environmental hypothesis

The environmental hypothesis was formulated as follows: The construction of dams in upstream Ethiopia, where the climate is temperate, can provide a more sustainable alternative to constructing a dam in the desert climate of a downstream area. Irrigation, generation of hydroelectric power and prevention of soil erosion in Ethiopia; eliminating the hazards of seasonal floods and silt accumulation in Sudan; and avoiding excessive evaporation for net increase of fresh water in downstream Egypt as well as in mid-stream Sudan are further benefits.

This environmental hypothesis is in line with the official Ethiopian perception. Famine and environmental degradation is familiar to quite a few Nile basin countries, and al-

most all the riparian countries are increasingly challenged by unabated population growth compounded by increasing poverty. Environmental degradation, mainly arising from a lack of cooperative watershed management, has reached an alarming state. Land cover loss and soil erosion in Ethiopia, flooding and sedimentation in Sudan and increased silt accumulation in Egypt will sooner or later be a threatening phenomenon unless mitigated through collaborative efforts. Recent indicators show that the eastern Nile countries have been moving towards extensive development of irrigated agriculture in the Nile basin within their respective national territories. As there are no commonly embraced or enforceable customary rules or amicably negotiated agreements, it is expected that the unilateral abstraction of water will continue to cause dispute and recrimination, further resulting in a deterioration of relations and the environment. Although dams in Ethiopia would increase net water availability, without comprehensive watershed management, effective control of reservoir sedimentation would be difficult.

The economic hypothesis

The economic hypothesis was formulated as follows: A basin-wide approach to water resource development of the Eastern Nile will result in more efficient use and increased economic benefits for all three riparian countries: Ethiopia, Sudan and Egypt.

There is a growing realisation that increased utilisation of water resources is indispensable for immediate remediation of food shortages as well as for other agricultural and agro/industrial development and power generation. In each of the three countries, especially in the upstream countries, water consumption will likely increase. This has already been indicated in the respective national water development strategies. Past observations of the limited degree of implementation of national strategies in the upstream countries are grounds for some caution. Nevertheless, some irrigation projects are actually being implemented at the moment (e.g. Fincha), so that the greater commitment at the national level to implement irrigation seems more likely.

On the regional level, in the interest of preventing water conflict, riparian states will have to address the issue of efficient water development and interstate security inseparably. An economic use of water on the national level would be beneficial both on the national and regional levels, as increased efficiency means less water consumed per economic output. There is little evidence in the region that an economic approach is being implemented, however.

The legal/institutional hypothesis

The legal/institutional hypothesis was formulated as follows: The legal and institutional frameworks are a 'sine quo non' for guiding and regulating inter-riparian cooperation over the utilisation of shared water resources. Existing doctrines and conventions do not yield cooperative behaviour among co-riparian states without negotiated and mediated agreements.

This hypothesis is strongly supported by the research. The provisional consensus with regard to the Shared Vision Program (SVP) and the Eastern Nile Subsidiary Action Program (ENSAP) can be appraised as an achievement at a level that has been able to create a corresponding level of trust and confidence among the three countries. It must be acknowledged that the present level of achievement is already a huge stride relative to the long-standing tensions in the Nile basin. There is, however, not yet room for any complacency. The intensive contacts in the NBI process seem to show that the three riparian states, or for that matter all the Nile basin states, have the potential capacity and the obvious need to bring the process to a satisfactory conclusion, whereby the Nile waters will have a regulatory regime and institutional framework.

The contention with regard to legal/institutional issues has been reviewed. The principal question that remains open is the non-existence of an acceptable legal framework that would be a binding principle for all the Nile basin countries. The project-by-project approach adopted in the ENSAP does not have an authoritative reference as to which legal principle should prevail in proceeding with projects, especially those to be implemented in the upstream countries. There is open acknowledgement of the need for such an instrument. Hence, a new legal framework has been suggested by the UNDP, and the riparian states have been negotiating a deal since 1999, trying to reach agreement from their upstream and downstream perspectives. This is taking a long time.

Overview and conclusion

This thesis set out to examine the elements and the driving forces in the dilemma of hydropolitics in the Eastern Nile Basin, and how these can be channelled in the direction of sustainable water development. The following section summarises key points of the thesis in light of this goal.

The Nile is the one central and constant factor that has linked the countries as well as their peoples together. The customary perception of the communities along the Eastern Nile basin is a holistic and unifying one. The livelihood, spirituality and thoughts of millions along the course of the Eastern Nile have for centuries been shaped or influenced by how they have been associated with the river. This great river has meandered for ages across the communities and states along its course. The depth of such association can be found in the vivid expressions of old stories, popular myths, in the verses of poets and in the writings of journalists. It is also interesting to note that the unifying features of the myths are still indomitable and help to influence the people's views, notwithstanding the political boundaries or contending national interests between the upstream and downstream countries. Seeking political harmony and a community of interest in the Eastern Nile region cannot be construed as wishful thinking or as an academic dream, but it can be viewed as both nostalgia and an earnest wish for some renaissance.

The geopolitical developments in the Eastern Nile basin do, however, contrast with the unifying physical/environmental reality and longstanding traditional heritage. Divisive

hydro-political development, notably since the beginning of the 19 century, has characterised the upstream-downstream competition and tension over the control of the Nile's waters. The pursuits of the riparian states have been conveniently explained in terms of perceived national interests. It seems evident that the political expression of these national interests has resulted in unabated water use controversies between the upstream and downstream nations. It is important to note that the riparian states have not been able to resolve the prevailing or future hydraulic controversies among themselves. The asymmetrical status quo embedded in the non-inclusive water agreements concluded during and after the colonial periods has been maintained and adamantly defended by the downstream states, even though this continues to be a recipe for tension and mutual insecurity in the region.

The states in the Eastern Nile basin have legitimate aspirations to enhance the economic development and overall welfare of their populations. Their aspiration for development, however, is dependent on the use and management of the water resources of the Nile, which is their common endowment. The practice of a unilateral approach to the use and exploitation of shared water resource has put the states in adversarial postures. Much can be expected from development at a legal and institutional level. The governments in the Eastern Nile region will have to resolve the problem of fear of each other on the one hand and the inescapable need to collaborate with each other on the other hand if they hope to make the best use of the common water resource for the welfare of their respective societies now and in the future.

With regard to Ethiopia there is a huge gap between the available water resources in the country and the country's insignificant level of development. There is also a huge gap between the need to develop the country's water resources and its institutional, regulatory, and financial capacity. Development of the available water resources is increasingly perceived by the government and the populace as a panacea for mitigating the recurrent problem of drought and the gnawing poverty of the millions. The situation of being perennially impoverished amidst plenty is something that needs to be changed as a matter of urgency. For this institutions will have to be established and will have to function smoothly, based on the memories of accumulated knowledge and wisdom and the vision of a brighter future.

There is also a clear need for a national water code, which will incorporate and integrate the existing state legislation, old water rulings (originating both from spiritual and secular sources), and the rules that continue to exist in customary and localised traditional forms in the diverse Ethiopian communities with their varying ecological zones and cultural differences. The need for a national water code remains all the more pressing, especially in view of its desired regulatory function and the stable legal authority it would establish for development of the water sector. The envisaged water code would have a presumed capacity and a mandate to synthesise diverse ideas and the various and long-standing traditions and philosophies of water utilisation and management in the country. Thus it would provide institutional stability and promote the efficiency development of the country's water resources.

No adequate mechanisms are in place in the Eastern Nile basin to overcome the legal, institutional, political, environmental and economic predicaments. To attain sustainable development based on shared water resources, however, immediate attention must be given to a search for the common good. The riparian countries are expected to look at one another with empathy and an open heart. Inasmuch as the cross-border waters create permanent bonds between the riparian countries, they should serve as the most indispensable elements of interstate relationships. These waters that flow through the countries of the Eastern Nile basin are a very immediate and practical incentive for the governments to rationalise their foreign policies towards one another in the framework of cooperating on the utilisation of the water resources, which no individual riparian state can possibly monopolise. There should at the very least be an inter-riparian attitude where, for instance, the downstream countries of Egypt and Sudan show sympathy with and understanding for the plight of the drought-stricken farmers in upstream Ethiopia. In a similar manner, upstream Ethiopia should sympathise with and understand the needs of the people in Sudan and Egypt, who depend on the waters they receive from further upstream.

The need for a cooperative framework cannot be taken as a matter of convenience, but should be seen as a compelling necessity to pre-empt a more precarious situation, given the shrinking availability of freshwater resources. The permanent aridity in downstream Egypt and Sudan, the recurrent drought in Ethiopia, the worsening desiccation and soil erosion in the headwater sections of the basin, excessive silt accumulation in the downstream sectors of the basin and unabated population increase in all the riparian countries can all be seen as alarming reasons for the riparian states to establish more committed cooperation in terms of a strategic action program as well as a regulatory mechanism.

Given the ecological characteristics of the Eastern Nile basin, one plausible suggestion is that construction of dams in upstream Ethiopia where there is less evaporation would provide a contrasting alternative to constructing a dam in the arid down-stream area. A water reservoir in an upstream location would provide possibilities such as: irrigation, generation of hydroelectric power, and prevention of soil erosion in Ethiopia; elimination of seasonal flood hazards and silt accumulation in Sudan; and avoidance of excessive evaporation in downstream Egypt. In addition the construction of dams in Ethiopia would increase the total availability of fresh water in all the riparian countries, including Egypt, which is the most downstream.

The states in the Eastern Nile basin face the inescapable obligation of rectifying the historically encumbered juxtaposition that was especially embedded in the colonial legacy and built into the various Nile waters agreements. In these agreements the interests of upstream countries were, at best, forgotten or ignored altogether. In the Eastern Nile basin the 20th century has been characterised by an unbridled unilateral approach to the otherwise shared water resources. The modest efforts to shed light on a cooperative approach are still insufficient to provide the riparian states with mutual trust and security. If the 20th century was characterised by hydraulic anarchy, the new millen-

nium will have to bring a transformation whereby all the riparian countries enjoy inalienable opportunities and benefits from their shared Nile waters.

In view of the growing international conventions on shared water resources, establishing legal and institutional frameworks are a *sine quo non* for guiding and regulating inter-riparian cooperation over the utilisation and management of shared water resources. The existing doctrines and conventions can render service on the basis of negotiated and mediated agreements, having the capacity to shape relations among copriparian states.

In actual fact, international cooperation between Ethiopia and the downstream states in the Eastern Nile region was difficult if not unthinkable prior to the end of the Cold War. In the colonial era the use and management of Nile waters was geared to British colonial interests. There was no space for the countries in the Eastern Nile basin or in the entire Nile basin to act bilaterally or multilaterally on water or any other resources of inter-state concern. Historically it can further be noted that the longstanding pre-colonial adventures of external forces, namely ancient Greece and Rome, the Crusaders and the Ottomans, also sought to control the source of the great river and exploit its wealth. But it was the European scramble for Africa and the colonial ambition for the control of the entire Nile basin, that planted the discord that has been inherited by the post-independence states of the basin.

During the Cold War period the political regimes in the sub-basin were, willy-nilly, engulfed as ideological and/or political-strategic proxies of either the “Western” or the “Eastern” camp, often on opposing sides of one or the other power bloc. In addition, the same country often switched sides, prompted by a change of political regime, or as a result of a change of political system under the same regime. Ethiopia, for instance, under Emperor Haile Selassie I, was a close ally of the United States in particular and the Western countries, in general; while under President Mengistu Haile Mariam the country became a close ally of the USSR and the Eastern Bloc. By the same token, Egypt under President Abdul Gamal Nasser was a close ally of the USSR and the Eastern Bloc; while under President Anwar El Sadat it became an ally of the United States and the Western bloc. Similarly, Sudan under President Jaffar El Nimeiri was an ally of the USSR and the countries of the socialist camp during his early years in power. His regime then switched its allegiance to the United States and Western countries during the latter period of his rule.

With the Cold War subsiding at the turn of the 1990s, both Egypt and Ethiopia proclaimed allegiance to the United States, and to “unified” world hegemony. The new international rule of the game is now to listen to the single centre of world power, to affirmatively respond to the development prescriptions of international financial institutions, and to subscribe to the conventional expectations of “good governance”, “human rights”, “democratisation”, etc. It can be said, therefore, that the end of the Cold War has reshaped the behaviour of the states in the Eastern Nile basin, to somehow

accept and respect one another's concern and interests. Hence, the Nile Basin Initiative can be attributed to this more or less externally induced process.

Learning from the concept of collective security, establishing an inter-state convention or treaty regime in the Eastern Nile basin will help the riparian states build mutual security. Such a common security zone would satisfy national interests through cooperative mechanisms. On the basis of historical observation, and also from a practical point of view, however, capacity on the national level will influence when and how such a cooperative mechanism can be realised.

Today's Eastern Nile basin, countries must create inter-state mechanisms to overcome the political, environmental, legal and institutional predicaments in order to attain a sustainable system of water utilisation and management in the sub-basin. They must collaboratively explore the available economic options as well as complementary and mutually beneficial options for national level water development approaches in the upstream and downstream basins. Using water resources in one country without considering the supply and demand patterns in other co-basin countries will likely lead to uneconomic utilisation. A basin-wide approach to water resource development of the Eastern Nile will encourage the efficient use and increased economic benefits for all three riparian countries: Ethiopia, Sudan and Egypt.

5.4 JACS Central Asia

201 Breu, Thomas

2006. Sustainable land management in the Tajik Pamirs: the role of knowledge for sustainable development

Widespread poverty, a malfunctioning economy, governance shortcomings, and a degrading ecosystem in the Tajik Pamirs are rooted in 80 years of politically motivated intervention by the Soviet Union. The Tajik Pamirs, which coincide with the Gorno Badakhshan Autonomous Oblast (GBAO), previously in a state of near-equilibrium involving humans and the high mountain environment, were thrown off balance by disproportionate investment and by a complete change in the local political system. In order to maintain a geopolitically advantageous position vis à vis China and the British Empire, the then USSR established a vast infrastructure comprising tactical roads, power stations, schools and health stations, and promoted population growth in a previously thinly populated mountain area. As a result, the population of the Tajik Pamirs enjoyed a decent standard of living but was completely dependent on outside support. With the withdrawal of the Soviet Union, the region was suddenly deprived of any external support and found itself in a desperate state. Major problems in all dimensions of sustainability persist to the present day and call for knowledge and strategies to promote sustainable development in this high mountain region.

Against this background, the present study aims to generate knowledge through a transdisciplinary approach to the status and dynamics of the different dimensions of sustainability in the Tajik Pamirs. This process includes not only a compilation of features in the economic, socio-cultural and ecological spheres, but also an appraisal of development opportunities and negotiation of objectives for a development strategy involving all stakeholder levels. In addition to this integral part of the research, special emphasis is given to appraisal of land resource problems and land management opportunities, which play a pivotal role in any further development of this area. Conceptually, this study attempted to investigate knowledge about land resources available at different stakeholder levels and to address its role in sustainable land management. From a methodological point of view, the study focuses on further development of a spatial land assessment approach.

Thematically, the study shows that non-sustainable processes in the economic, social and ecological spheres are widespread in the GBAO. The economic situation in the Tajik Pamirs is far from viable today, and is still characterised by the transition period that began in 1991. Income generation is inadequate both for individual households and for the local economy, and poverty and dependence on food aid are widespread. The structure of the GBAO economy is dominated by the subsistence-oriented primary sector, which cannot meet the basic needs of the population. Besides agriculture, some jobs are available in government institutions, whereas few employment opportunities are available in the private sector. Despite this overall negative picture, modest economic growth has been recorded in recent years. The social dimension of sustainable

development is characterised by growing inequalities among social groups and increasing development disparities between remote villages and the few centres in the region. A major concern is the de-professionalisation of public services and limitations in the political system. Shortcomings in the governance sector relate to non-transparent decision-making, lack of accountability, and limited adherence to democratic principles, and are further intensified by parallel structures established by the civil society organisations (CSO) working in this area. Negative trends are also apparent in the ecological sphere. As a result of extreme poverty and forced return to subsistence production, ecosystems have suffered further since Tajik independence. A survey of sustainable land management (SLM) revealed that the most serious degradation processes are perceived by the different stakeholder levels in the reduction of forest reserves and shrub-biomass, soil degradation processes resulting from overuse of arable land and settlement near pastures, and declining biodiversity. As a consequence of such degradation processes, natural productivity in the Tajik Pamirs is diminishing and, in combination with the effects of global warming, this mountain area is increasingly exposed to natural hazards.

Despite this overall negative picture, the situation in the Tajik Pamirs does not appear insurmountable in view of the numerous assets and development opportunities identified by this study, which were validated in the Strategy Workshop for Sustainable Development. They include well-established (family) networks among the Ismaili, Kyrgyz and Tajik communities, a high educational standard, the traditionally strong role of women, and the still above-average infrastructure. Among the greatest ecological assets are water resources that can be used for both energy production and irrigation. Additionally, the great biological diversity of the Tajik Pamirs offers the potential to attract tourism, allow controlled hunting, and gain international support for conservation and protection. If the recently much more relaxed geopolitical situation persists, opening of the borders to China and Afghanistan could provide important economic opportunities through market integration, thus serving as a major trigger for development. Following the multi-level stakeholder negotiations in the Strategy Workshop, objectives in the sphere of energy and infrastructure were accorded highest priority and urgency. Medium ratings were given to objectives relating to industry, trade, tourism and agriculture, whereas research and biodiversity conservation objectives were ranked as least important and urgent.

Conceptually, the thesis confirmed the relevance of the stakeholder level approach for analysing and initiating SLM. Compared to other potential variables such as sex, education, age, professional position or wealth class, the “stakeholder level” criterion is most suitable as a selection criterion for analysing SLM opportunities. This study confirmed that on average there is little differentiation in knowledge of SLM at different stakeholder levels. However, within the stakeholder levels substantial differences in terms of knowledge, innovative ideas and the preferred land management orientation, ranging from conservation through optimisation to intensification, could be observed. Against this background, classical knowledge transfer activities, from state agencies or development cooperation agencies to land users, are not likely to show a significant

impact. The research done for this study provides evidence that communication between stakeholder levels, and particularly within stakeholder levels, has been disrupted. Thus, initiating learning processes and knowledge generation within the respective levels seems to have the best potential for promoting SLM, at least in the short to medium term.

Methodologically, the present thesis adopts a spatial modelling approach for specific degradation phenomena, mainly applied on a smaller scale (e.g. global resource assessments), and further develops it for application at village level. This fuzzy logic-based modelling approach was used to determine the degradation risk for shrubby vegetation (teresken), which is nowadays extensively used as a fuel substitute to replace external fossil fuel deliveries. To arrive at a spatial teresken degradation risk model, physical accessibility had to be calculated for each of the villages (quantitative sub-model) and combined with a qualitative sub-model, taking into account the socio-economic features which describe the intensity of teresken use. This spatial modelling approach proved suitable for representing potential degradation risk areas through the combination of structurally different types of information (qualitative and quantitative data), with varying degrees of certainty. Based on experience in the present research, this spatial modelling approach seems to have the potential for successful application in modelling further human-nature interactions in other geographical contexts with incomplete and heterogeneous spatial information.

208 Wolfgramm, Bettina

2007. Land use, soil degradation and soil conservation in the loess hills of Central Tajikistan

Since Tajikistan's independence in 1991, the hill zone of central Tajikistan has undergone considerable land use change. The challenges of poverty and food insecurity triggered by the transformation of the economy and by the civil war were met with widespread cultivation of steep slopes. The hill zone consists of loess deposits, which are susceptible to water erosion. Today land degradation is widespread and severe, and only few areas appear to have developed well adapted field management systems successfully sustaining the land's productivity.

The overall objective of this study was to attain an improved understanding of the link between land cover/land use and soil resources, which will allow the identification of opportunities for sustainable land management in the loess hills of central Tajikistan. There was a specific focus on exploration of how GIS and remote sensing in conjunction with soil nearinfrared spectroscopy could contribute to planning and assessment of sustainable land management. The key question addressed in this thesis was whether it was possible to determine land cover classes which would characterise the impact of land use on soil resources in such a way as to highlight typical interrelations between

erosion, as the dominant soil degradation process, and soil organic carbon (SOC), as an integrative soil quality measure.

A data-driven, scientifically rigorous approach was adopted. A spatially explicit assessment was used, based on a systematic, clustered random sampling design. The sampling design complied with the assumption of randomised sampling and provided a dataset suitable for assessing spatial characteristics. Furthermore, it allowed efficient sampling of the variation of vegetation and soil within the study area. For prediction of soil properties on a large sample set, a soil spectral library based on diffuse infrared reflectance was used.

Input data consisted of Landsat 7 imagery from two different seasons, a digital elevation model, and extensive groundtruthing. Additionally, black-and-white Corona images from 1970 were acquired for detection of change. Field observations were collected from 600 sampling sites and included indicators on land cover/land use, soil degradation, and soil conservation measures.

Furthermore, at every sampling site, soil samples were collected and subsequently soil spectral reflectance was measured under standardised conditions in the laboratory. Sheet and rill erosion (affected site or non-affected site) and soil organic carbon were selected as indicators of different degrees of soil degradation and soil conservation. The high silt fraction is characteristic for loessial soils, and in the absence of sufficient clay, SOC is crucial for aggregate stability and soil nutrient cycling in these areas. To predict SOC content on over 1500 soil samples, reflectance readings were calibrated with results of SOC chemical analysis (N=254) using combined regression tree modelling. The resulting model statistics for soil degradation assessments were promising ($R^2=0.71$, $RMSEV=0.32$). Geological sub-groups did not influence model performance for the combined regression tree models established.

Classification tree modelling was applied to determine data-driven, statistically based decision trees for mapping of land cover types, soil erosion occurrence, and SOC content classes (“low” and “high”). This study showed that in an area in which difficult terrain and small cultivated plots prevailed, a spatial assessment of the three indicators was possible, with overall accuracy for classification of land cover types = 51%, for major land cover types = 72%, for erosion occurrence = 73%, and for SOC content classes = 75%. Decision trees established were not merely empirical constructs, but were interpretable in terms of physical processes. This increased confidence in the models. More importantly, empirically based rules and thresholds were determined, which are useful for gaining a better understanding of generally relevant controls on land degradation and conservation processes.

Critical indications with regard to land use dynamics were provided by a visual comparison between groundtruth data from 2004/2005 and Corona images from 1970. No expansion of cropland to virgin grazing land during the 1990s was observed. In fact, present-day cropland sites were almost identical with cropland sites in 1970. A histori-

cal reconstruction of changes in the agricultural system, direct and indirect drivers of change, and human well-being was conducted using the conceptual framework of the Millennium Ecosystem Assessment, and provided qualitative explanations for these land use dynamics. The main conclusion was that annual cropping on the slopes in the loess hills appears to have been an emergency measure, in the 1990s and likely also in Soviet times, in response to food shortage.

The soil occurrence and SOC content class maps elaborated were overlaid and interpreted according to the rules of a hot/bright spot matrix; this matrix was developed for application in loess areas, where land use strongly determines erosion and SOC content. The quarters of this hot/bright spot matrix may be interpreted as different stages of degradation, from well conserved land (bright spots) to hot spots of soil degradation. The analysis showed that large areas were affected by erosion, with 21% of the study area being classified as hot spots and 24% as degrading areas. Areas with well conserved soil resources accounted for 33% of the study area.

Finally, to address the hypothesis of this thesis, the land cover classes derived from classification tree modelling were linked with the hot/bright spot matrix. The results showed that sub-classes of a specific land cover type (e.g. annual cropland) may differ greatly with regard to erosion occurrence and SOC content. The high within-class variability of SOC and erosion, however, did not allow determination of significant differences (in erosion or SOC content) for any of the land cover classes. Nevertheless, there were strong indications of interrelations between high perennial fractional vegetation cover, low erosion occurrence, and high SOC content, and accordingly between low perennial fractional vegetation cover, high erosion occurrence and low SOC content. This pattern did not apply to perennial land cover classes on slopes < 14% and mountainous locations, where other degradation processes or inherently low SOC content were expected. Markedly lower SOC content levels were observed for areas with temporary crop cultivation, where cultivation was widespread during the 1990s and has now frequently been abandoned again. On the other hand, there were strong indications of afforestation and fruit orchards established in the 1980s being successful in conserving soil resources, also when transformed into intercropping systems. The sites with well conserved soil resources could be classified into the following land use systems: fruit, cereal and fodder plots, either traditionally cultivated or newly established during the 1980s; large area conservation systems implemented in Soviet times and diversified into agroforestry systems during the 1990s; and more recently, mainly agronomic conservation measures on cropland.

The maps elaborated for the “low” and “high” erosion occurrence and SOC content classes provide a baseline that enables future evaluation of the land conservation efforts currently being undertaken in the loess hills of central Tajikistan. Further, the hot/bright spot map is expected to be a valuable basis for planning of sustainable land management. The soil spectral library elaborated allows prediction of SOC content for soil samples from the loess hills in a rapid manner and at low cost.

702 Bichsel, Christine

2006. *Dangerous divisions: irrigation disputes and conflict transformation in the Ferghana Valley*

The study was elaborated in the context of the NCCR North-South and focuses on irrigation disputes and 'conflict transformation' in the Ferghana Valley in Central Asia. Irrigation has been a crucial agricultural practice in Central Asia for many centuries and has greatly influenced the social, political and economic development of the region. An important irrigation zone has emerged in the Ferghana Valley, a vast and fertile intramontane basin that is shared today by Uzbekistan, Kyrgyzstan, and Tajikistan. From the early agriculturalists to the Soviet centralised management system, irrigation schemes and their modes of organisation have altered many times in the Ferghana Valley. The most recent changes following the disintegration of the Soviet Union brought about discontinuities with the former, centralised system and uncertainties about the new nation-states' policies on water management. Particularly in the Ferghana Valley, this has raised concerns about the potential for violent conflict over water resources.

As a consequence of these concerns, a number of international and bilateral donors have implemented projects that aim to mitigate such conflict. The study analyses three of these projects. They all address conflict between specific communities that have either suffered from violent conflict or have great potential for it. Furthermore, they focus on communities composed of multiple ethnic groups in transnational settings that are seen as economically and socially disadvantaged. The approaches of these projects are analysed by means of qualitative methodology in three case studies. Case study 1 concerns a village and two municipalities within Kyrgyzstan that are connected by an irrigation canal. Disputes over irrigation water arose in the late 1990s. Case study 2 deals with three villages of which two are located in Kyrgyzstan and one in Uzbekistan. Conflicts have emerged over the distribution of spring water that originates in Kyrgyzstan and then flows into Uzbekistan. Case study 3 focuses on two villages, one in Kyrgyzstan and one in Tajikistan. The villages are connected by an irrigation canal. Disputes over irrigation water and land rights between the two communities date well back into the Soviet period.

The findings of the study are structured according to three elements identified in the projects approach. First, building or rehabilitation of infrastructure is a central component of this approach. Irrigation canals are built and rebuilt and should address the underlying or structural causes of conflict, related to the dysfunctional state of infrastructure or scarcity of natural resources. The study analyses this element by exploring social relations that shape irrigation systems. It was found that irrigation infrastructure is by no means an abstract technical dimension. Rather, social relations over water are inextricably embedded in infrastructure and shaped by it. In this sense, approaches to improving irrigation system performance and expanding the resource base seen as purely technical cannot but affect these relations. Irrigation infrastructure may constitute a burden to its owners, entail a strategy of conflict avoidance in conditions of power differences, represent a form of resistance by those downstream to counter the

power exerted by users upstream, and finally embody nodal points in irrigation systems that shape power relations and conflict systems.

The second element of the approach entails the establishment of community-based organisations (CBOs) with the aim of enabling communities to constructively address their problems based on acquired organisational skills. The study analyses this element by exploring three institutions, focusing on historical geneses, the societal models they promote, and the political linkages that they expose. At the same time, it addresses their social practices and interfaces. The analysis of the CBOs established by the projects shows that local societal arrangements and power relations inscribe themselves into the organisation. In this sense, existing social relationships exert influence on how such organisations constitute themselves. Yet new forms of power relations are equally established with CBOs by providing specific public spaces, giving importance to particular types of knowledge and expertise, and shaping specific forms of subjectivities.

The third element of the approach entails joint social activities that should improve inter-group relations between conflicting parties. This should happen by elaborating plans jointly and solving problems jointly, or through resolving contentious issues through negotiation. In addition, spaces should be created which bring the parties or parts of them together. The divided groups should thus improve communication and establish trust and personal friendship. The study explores this element with an analysis of social representations and political linkages in conflict escalation. Escalation brings to light particular players and forms of authority that shape decisions on whether violence is adopted or prevented. How such authority is constituted and ‘big men’ emerge and disappear opens a perspective on the wider interdependencies of such presumably ‘local’ conflicts. The projects’ perspective of the ‘endemic nature of irrigation conflicts’ thus comes under scrutiny, as power constellations, wider political contingencies and the very way of establishing knowledge about the conflict come into view.

The present thesis voices critiques regarding the donor projects and their approach on four main points: (1) The perspective that the sources of conflicts addressed are endemic to the local context. The approach apprehends irrigation conflict as disrupted relations between two or several communities, and thus solvable in the very same context. The study has demonstrated that such conflicts are not ‘local’ but embedded in wider political interests and power constellations. (2) The functional understanding of sources of conflict and parties that the approach exposes. Conflict is seen to emerge from ‘grievances’ over scarce resources leading to violent conflict. Moreover, conflicting parties are conceptualised as homogenous and uniform, shaped by essentialist solidarity that accounts for collective goals in a conflict. The study points out the relativity of scarcity, questions that primarily unsatisfied needs lead to the adoption of violence and finally deconstructs the monolithic representations of ethnic groups. (3) The assumption of homology between conflict parties. The donors presume such homology not only between the conflicting parties, but also between the projects’ implementing partners and for enabling and constraining conditions. The study shows that upstream–downstream configurations in irrigation systems are power relations and that conflict

and its mitigation do not take place outside power constellations. (4) The normative nature of the social change brought forward by donor projects. This critique maintains that by portraying irrigation conflicts and by proposing their 'transformation', the approach studied exposes normative accounts of evolution and moral progress. The study brings to light some of these assumptions and suggests that apart from their ethnocentric bias, such prescriptions also lead to forms of depoliticisation and disempowerment.

5.5 JACS South Asia

106 Premchander, Smita

2006. *Exploring the meaning of money: a study of the impact of microfinance in the Koppal District of India*

The proliferation of microfinance worldwide has been due to its claimed impacts on poverty reduction and women's empowerment. Conversely, it has been criticised for furthering the neoliberal policies of external agencies by using poor women's entrepreneurship and mutual trust as a joint liability mechanism to reduce the costs and risks for the capital provider. Set against this, Indian microfinance exhibits a wide spectrum of delivery models, from subsidised to unsubsidised and commercial credit. Microfinance impact literature considers its impact to be neutral to the process of delivery and therefore contains few cross-model comparisons. It privileges the dominant policy model of primarily positive impacts, and has overlooked rather than examined differing world-views. This research questions external perspectives and explores actor perspectives.

The research took place in a semi-arid livelihoods context in the Koppal district in Karnataka State, India. It takes a critical and interpretive approach and adopts a longitudinal case study methodology to examine use of money from women's own perspectives. The fieldwork showed that loan demand is context-dependent and low in a semi-arid region with uncertain and risky investment opportunities. Microfinance provided by informal sources was used for survival and social needs. Three models of formal microfinance delivery emerged, of which two relegated the poor to the margins but the SHG-Bank linkage model combined a focus on poverty and market orientation to offer a stable borrower-lender relationship.

The field research also considered the social learning process that takes place among Self Help Groups (SHGs) in the utilisation and repayment of microfinance. The women differentiate money delivered in different ways, and social relationships determined financial relationships. This research reveals multiple meanings of money, recognises new opportunities and vulnerabilities created by formation of SHGs, and highlights that microfinance models which provide women access and control over money enhanced their decision making ability and so were the most empowering.

601 Thieme, Susan

2005. *Social networks and migration: far west Nepalese labour migrants in Dehli*

It is a cross-cultural and historical phenomenon that people migrate to improve their standard of living. Because of poverty, unemployment, declining natural resources, and, lately, the Maoist insurgency, outmigration to other countries has become an increasingly important livelihood strategy in Nepal. Migration to the neighbouring country,

India, has a longstanding history and is the major destination for Nepalis. Migration to the Gulf and Tiger States, Europe, or the USA only commenced about 15 years ago.

Despite the importance of migration to India, it is noticeable that there are very few studies of the migration process and the situation of Nepalese migrants in India. This study helps to close this research gap with case studies carried out between 2002 and 2004 among migrants in Delhi coming from four villages from the districts of Bajhāng and Bājurā in the Far Western Development Region of Nepal. The case studies, as a whole and individually, provide a more profound understanding of the way migrants manage their daily lives in Delhi and what individual or structural backgrounds enable these migrants and their families to profit from migration, or what prevents them from doing so. For the analysis, selected aspects of the migrants' daily lives, such as reasons for migration, working and living conditions, management of loans and savings, and remittance transfers were analysed.

Four theoretical concepts were chosen for the analysis. The sustainable livelihoods approach and Bourdieu's theory of practice are two theoretical guidelines used for analysing migrants' daily practices and their impact on livelihoods. One focal idea is that people possess different kinds of capital such as social, financial, human, or physical capital. Choice, practice, and output of migration are dependent on access to, use of, and interaction among the various available assets. The third and major theoretical pillar originates from the concept of social capital, understood as social networks. Its importance is due to the fact that migrants mainly rely on kin and friendship networks to migrate and establish themselves in Delhi. Finally, the concept of transnational social spaces reflects the importance of different localities in a migration process and how families and migrants conserve existing links and create new links between each other. Data collection mostly involved use of qualitative research methods, such as semi-structured interviews, group discussions, and observations, complemented by a quantitative survey carried out in cooperation with a non-governmental organisation (NGO) in Delhi.

Far West Nepal is a marginalised area of Nepal with the lowest Human Development and Gender Equity Indices in the country. Impoverishment, food shortages, indebtedness, social discrimination, and lack of infrastructure in Bajhāng and Bājurā have been causing large-scale labour migration to India for generations. Usually men seek work in Delhi. Regardless of whether migration is seasonal or men spend most of the year in Delhi, the majority of migrants leave their extended families in Nepal. In some cases, wives and children are taken along later. In addition, women come from time to time for medical treatment, especially pre- and postnatal care.

Male and female migrants who took part in the case study in Delhi generally possess limited human and financial capital, and this affects their access to jobs, shelter, and physical infrastructure. Therefore, they rely on social networks to establish themselves in Delhi. The longstanding history of labour migration between Nepal and India has led to transnational social networks through which contacts between families in Nepal and

migrants in India are sustained. Family and kinship networks are the most important coping mechanisms. When these are insufficient, assistance is sought from caste networks or from trustworthy persons beyond caste. However, this bonding social capital, on which migrants rely, compensates for the lack of other capital only to a certain extent, and it provides only limited access to financial or physical capital or to limited improvement of human capital. Another factor is that these social networks are not the same for everyone.

For unskilled migrants, the job market is gender segregated to a substantial degree, and they occupy a distinct niche. The majority of men work as watchmen and car cleaners, regardless of caste. If women stay in Delhi for a long time they work as housekeepers. The job market is highly organised, since jobs are handed over and sold within the social networks. Men need substantial seed capital to pay their predecessors for the job. This fact disproves the popular belief that people who migrate from Nepal to India do not need financial capital, apart from travelling expenditure, unlike the Nepalese who migrate through recruiting agencies to the Gulf States.

To gain access to seed capital and loans, migrants formed two kinds of financial self-help associations, *cits* and *sosaitis*. Private money-lending and commercial banking are rarely used. The primary purpose of both self-help associations is saving and lending money. The migrants also experience social stability in the urban environment of Delhi. These associations show that marginalised people may not have access to credit from formal banks, but they have the capability to set aside substantial savings and gain access to loans by mobilising social capital.

In providing each other with access to loans and saving possibilities, migrants also increase their dependency and exposure to risks. *Cits* have more risks than *sosaitis*, due to the speculative nature and moral hazard of bidding. Access to both is solely based on trust, but peer group pressure to ensure repayment is very limited. Remittance transfer is also organised among social networks, and friends and co-villagers carry the money by hand to Nepal.

Migrants experience the impact of migration on their own and their families' livelihoods very differently. Migration contributes to improvement of people's livelihoods. It reduces the risks of seasonality, harvest failure, and food shortages. Every person less in the village reduces the total food consumption and even small transfers of cash can be extremely valuable in terms of securing nutrition for the whole year. One *sosaiti* even reduced food shortages for a whole village by financing and managing a food depot; and it also invested in a school.

Dense networks between Delhi and Nepal make migration less risky for individuals by circulating information among potential migrants and providing access to jobs. Family members regularly come to Delhi for medical treatment and migrants cover their expenses for it as well as for schooling for children rather than sending money to Nepal. These contributions may look small, but they are still vital to the maintenance or even

improvement of human capital such as health and education and diversification of risks. In addition to these contributions, migrants provide substantial sums for life-cycle events such as weddings and funerals.

If women come along and stay for a long period, men are a source of both financial and social capital. Women follow the traditional patrilineal and patrilocal family networks in which normative expectations, such as kinship obligations, are reinforced. Notwithstanding, in keeping these patterns, they gain a new economic independence, by earning their own money and managing their own *sosaitis*.

The migration ties between the villages and Delhi are inter-generational and reproduce social structures. At the same time, traditional structures are transformed and merged with modern patterns. While traditional elders, males, and the respective castes they belong to have leadership in the villages, people who were formerly excluded from power can also take the lead. Mixed membership in *cits* or *sosaitis*, or working in the same job regardless of caste, are examples. However, changing social structures is a long-term process and also depends on the personality and sense of responsibility of each person.

Despite positive experiences, migrants also have to deal with risks. Although migrants are not the poorest of the poor and do not have to struggle for daily survival, they are vulnerable and seem to live 'on the edge'. There is only a small step between ability to survive and thrive and sudden loss of ability to do so. For the majority of migrants, power relations change to a certain extent within their group. Nevertheless, the majority lack bridging social capital as well as human and financial capital to change power relations as a group. With their work as watchmen and their existing financial self-help groups in Delhi, migrants have found an economic and social niche. As the majority do not acquire new skills, it seems that their marginality is manifested once more. Migrants deal daily with poor working and living conditions, having to pay bribes, and lack of redress to mistreatment by employers. Their poor education, undocumented status, informal work, and lack of 'bridging' social capital contribute to this situation. Their strong social networks not only enable them to migrate and live and work in Delhi, but also render individual entrepreneurship difficult. Times of crisis and stress increase the vulnerability of the whole community.

No matter whether migrants participate in *cits* or *sosaitis* or in both, debt becomes a tool to manage their livelihoods. They borrow from one source to repay another. Migrants find themselves tied into an expanding network of credit dependency, and their whole family and even kin in Nepal are trapped in this cycle. Because of its tie to long-term debt, migrant labour in India is often unproductive and unprofitable for those involved, forcing them to remain migrants for their whole lives. The majority of migrants have families back home. No matter whether they migrate seasonally, or stay for most of the year in Delhi, all of them dream of going back to Nepal forever. Only for a small number of people does migration improve their standard of living substantially. Migration structures the everyday practices of the migrants and the people who remain in

Nepal, their social positions, and employment trajectories. The absence of certain types of social capital and a low level of human capital and knowledge about other places limits the extent to which migration is an option. Thus, even if migrants succeed in keeping their families above the poverty line, they do it at considerable social cost, and often at the cost of depleting other assets.

Since it does not appear that the socio-economic and political situation in Nepal will change in the near future, migration will remain a livelihood strategy. Therefore, the decisive development issue seems to be not how to reduce migration, but how to reduce its social and economic costs and increase its returns. The present study is exceptional in that results were communicated to international donors (Thieme 2003) and are applied in an actual project run by an NGO in Delhi (Thieme et al. 2005).

605 Strasser, Balz

2006. "We are as flexible as rubber!" Livelihood strategies, diversity and the local institutional setting of rubber small holders in Kerala, South India

In the face of economic liberalisation, the reduced role of the state, and the changing institutional setting affecting less developed countries, it has become important to understand the various impacts of these processes on the livelihoods of rural households. Empirical studies show, for example, that smallholders are facing more and more difficulties in dealing with declining terms of trade and the fluctuating prices of agricultural commodities, which play an important role in the income of many small-holder producers in rural areas. There is a hypothesis that, since the beginning of these processes, the opening-up of rural areas to the "global world" has induced a shift from solely agricultural and farm income towards a more diverse income portfolio. A second hypothesis is that the local institutional setting plays a key role in supporting or hindering the diversified livelihood strategies of smallholders. This study takes these hypotheses as the basis for research and seeks to validate them through a crop- and locality-specific case study.

The Indian natural rubber sector provides good opportunities for in-depth studies; it is an example of a sector that has undergone many changes since it was integrated into the New Economic Policy of the Indian government at the beginning of the 1990s. These processes have affected rubber holders in Kerala - around one million growers cultivating an average of 0.5 ha of rubber plantation - in different ways. The case study looks at natural rubber holders located in Thalanadu Panchayat in central Kerala.

Analysis has shown the need to distinguish between different types of smallholdings in order to come to any meaningful conclusions about livelihood situations. In fact, analysis of the income-generating activities of different types of rubber holdings in Thalanadu shows that there are multiple livelihood portfolios even within the same locality and context. Thus, this study gives a new perspective on these coping processes by developing a typology of rubber holders. The extent of the diversified status and the

type of income activities pursued depend on different factors, the most important of which are the total size of the holding and/or access to regular wage employment in the non-agricultural sector. The most diverse portfolios are to be found at the extremes of the holding size range, i.e. on the most marginal as well as on the largest holdings, which also represent the poorest and the richest ones. The holdings in the middle of the range are less diverse and more specialised in rubber cultivation. For marginal holdings, the key driving force towards a diverse income situation was found to be their vulnerability due to their limited monetary income. Other factors such as seasonality, climatic uncertainties, price fluctuations, and the greater overall geographical marginalisation of these holdings also influence their decision-making, which can be best described as risk-minimising. The key driving forces behind the diversified situation of larger holdings are their opportunities to access new activities due to investment capabilities, the availability of land resources and, in particular, their ability to take risks and cope with failure if need be. This thesis also analyses the change from one portfolio to another between 1995/96 and 2003/04, so as to study diversification as a process. In general, diversification was not very pronounced, since many holdings were already diverse beforehand. Thus, the study concludes that price fluctuations in the rubber sector (the “rubber crisis” in the mid of the 1990s) were not a major (or even important) reason to start or increase diversification - and this is true for all types of holdings.

Research on a range of local institutions and organisations - namely the Rubber Board replantation subsidies, the rubber marketing institutions, the Vanilla Promotion Scheme, loans from informal and formal institutions, and social networks and social status - shows their influence in supporting or hindering the diversified livelihood strategies of natural rubber holders. The study shows that most play an important role in promoting or hindering diversified incomes. However, each institution and organisation affects each type of holding in a different manner. Institutions can have a promotional effect on diversified livelihoods on some types of holdings, while having a restrictive effect on others. The study thus includes a differentiated analysis of selected local institutions and organisations.

In conclusion, the findings suggest that it is important to acknowledge that there are many different types of rubber holding, each with specific income strategies and portfolios. However, this diversity is not reflected in the approaches of the existing extension services. The extremely heterogeneous situations of rubber holdings would imply that any kind of institutional support that intends to improve the livelihood of rubber growers has to be tailored to the particular situation and the particular needs of each type of holding.

607 Shahbaz, Babar

2006. Analysis of institutional changes in forest management and their impact on rural livelihood strategies in NWFP, Pakistan

Introduction and background

Most of the natural forests of Pakistan are located in the North West Frontier Province (NWFP) of Pakistan. High rates of deforestation in NWFP has brought into focus the shortfalls of traditional state-controlled top-down systems of forest management. The participatory approach of forest management at a larger scale in NWFP was started, in 1996, through the Asian Development Bank's Forestry Sector Project (FSP) in the selected villages. In the context of FSP, the province's Forest Department was reformed, and village-level committees were created at local level. These committees are authorised to join the forest department officials in the preparation and implementation of local resource use plans. The FSP developed and implemented these processes in a number of villages, expecting the reformed forest department to spread the concept throughout the province. This thesis analysed the impact assessment of the participatory forest management on the (access to) livelihood assets, vulnerability and livelihood strategies based on a comparison of randomly selected project villages, comparing them with non-project villages, and thereby identifying the issues supporting or hindering the effectiveness of forest reforms and decentralisation process.

Key findings

The results showed that the forests were important natural assets for the mountain communities of NWFP. Wood from forests is intensively used as firewood for cooking and heating purposes as well as for construction/repair of houses, while forest land is also used as pasture for livestock; the use of forests was mainly for domestic needs rather than income generation. Significant differences were found regarding perceived change in forest cover and trends in illegal cutting. Perceived levels of trust and relationship among the respondents in project villages with the Forest Department, local government and other tribes were significantly higher than those of the non-project villages. The results also revealed that the participatory forest management paradigm has considerable potential to enhance human capital through non-formal education (extension education) of the residents in the project villages.

The overall results regarding livelihood strategies indicated that a majority of the local people (in both project and non-project villages) were not dependent on natural resources (forest, land, water etc) for cash income. Rather, they had adopted diverse non-natural resource-based activities. Remittance was the main contributor to household income. It was therefore concluded that migration was the main livelihood strategy for most of the respondents in project and non-project villages, followed by daily wage workers. Nevertheless, forest use patterns revealed that the majority of the respondents were dependent on forest wood for their household needs. In the context of institutional change, it can be argued that although institutional change in the forestry sector did not

help to enhance cash-oriented livelihood strategies, the participatory approach enhanced the non-cash (subsistence) oriented livelihoods of the people of project villages, slowing down deforestation by reducing illegal cutting by outsider bandits.

Analysis of interaction, level of trust, and emerging conflicts (as different actors were trying to adjust to their new roles and responsibilities in the context of the participatory forest management) revealed that the institutions responsible for the enhancement of trust between state officials were weaker than the state (forest department) and the timber mafia. The major obstacles in this regard were;

- a. In decentralising forest management, the Forest Department maintained the priorities of forest conservation, while local people used forests in a variety of ways, among which subsistence needs (e.g. firewood, soil, timber for house construction) had priority. Financial livelihood concerns are not met from forests (e. g. by selling timber), but by selling labour in the context of migration. Local people's top priorities are to secure the financial means required for a living, and related basic needs (e.g. physical infrastructure, schooling, health). Thus their expectations were in these fields. The thesis shows that this divergence of expectations was not taken account of by the FSP.
- b. Besides this livelihoods-related mismatch between the intentions of the FSP and the expectations of local people, another dimension surfaced during field research. This concerns the noticeable (historically rooted) lack of trust, friendly relationship and interaction between local people and the State (Forest Department) in NWFP. The decentralised forest management model introduced by the FSP has the potential to bridge this gap, as a slight improvement in the level of relationship and trust was recorded in the project villages. But the results showed that the poor people had less trust in selected institutions and comparatively rich people (with more income) had a higher degree of trust in the institutions, meaning that the project interventions had taken care to include socially excluded and marginalised sections of the society
- c. Participatory forest management can be an effective strategy to deal with the illegal timber trade, by developing a sense of awareness and ownership among forest residents. But there is another weakness in the new institutionalism. The responsibility (as delegated by the state) of these newly created institutions is more for the protection of the forests than for management, meaning that no sense of local ownership can evolve again. The officials of the Forest Department who earn revenue from the (illegal) sale of timber did not fully co-operate with the local committees. As a result the members of these committees as well as the local communities were losing interest. The local stakeholders were not convinced about the sustainability and continuity of the institutional changes owing to deeply rooted mistrust of state institutions and the inability of the new institution

to bridge the gap. Under these conditions neither trust and friendly relationships nor sustainable forest management can be expected.

- d. Various non-state, non-business groups (civil society) were trying to operate within this contested political space. They include more modern forms of NGOs, the traditionally powerful local institutions (jirga – the assembly of elders) and groups working to foster traditional values (for example religious organisations). However, on the one hand, the FSP did not really engage in a dialogue with these social entities, and on the other hand these entities themselves were not in a position to initiate a change in local resource use.

Recommendations

It was recommended that institutional access to forest resources (fuelwood, timber) should be made simpler and easier by empowering local institutions to enjoy access and benefit sharing with respect to forest resources. More emphasis should be given to enhancing human capital through non-formal education, and training should be given according to local needs. The participatory agricultural extension system should be added to the process of institutional change in the forestry sector of NWFP by providing training to the members of village committees in the latest innovations, for further transmission of knowledge to local people by these members.

The FSP was a donor-driven project, although it was claimed that civil society was involved at the planning stage but “civil society” as perceived by development donors is limited to a few NGOs. The donors should therefore consider the broader spectrum of civil society such as CBOs, religious groups, “jirga”, and local governments, etc., before implementation of such mega projects. A holistic analysis of the power and interests of all actors involved in the participatory paradigm is inevitable before making recommendations. The nexus of powerful timber dealers, politicians and state officials should be carefully analysed to ensure the success of the participatory approach in the context of NWFP.

608 Schmid, Juan Pedro

2007. Economic growth and poverty reduction in India: effectiveness and efficiency of social and economic policies of the centre and the states

This dissertation addresses different aspects of the interactions between economic growth, poverty reduction and human development. It consists of four separate studies. All papers contain an extensive empirical part, based on a broad range of data for the 15 major States of India for the period 1970-2001. The basic hypothesis of the thesis is that the observed differences in the development of the Indian states are, at least partly, attributable to differences in the effectiveness and efficiency of social and economic policies. This hypothesis contrasts with explanations that seek the causes in differences

in the growth rates, initial conditions or the amount of government expenditures. The four individual studies investigate the importance of efficiency and effectiveness of government policies from different perspectives.

In the first study, I investigate whether differences in the impact of government expenditures play a role in poverty reduction. I carry out this analysis by using a model that relates poverty to economic growth and development expenditure, allowing the regression coefficients on development expenditures to vary across states. My results show that the impact of development expenditure on poverty varies across states. I found two types of states: those in which development expenditures cause a decrease in poverty of a similar magnitude, and those in which there is no relation between development expenditures and poverty.

The second study investigates whether medical expenditures affected infant mortality in India between 1970 and 2000. I focus on the influence of political conditions on the amount as well as the effectiveness of medical expenditures. I find a significant contemporary effect of public health expenditures on mortality. In addition, I find that political competition, voter turnout and media circulation have an impact on the effectiveness of public health expenditures. In a second step, I investigate whether these political factors also determine the amount of health expenditures. Only per capita income and the deviation of rainfall from its average exhibit statistically significant effects on per capita health expenditure.

My third study investigates accelerated educational progress in rural India in the 1990s. The various educational programmes introduced in many states in the 1990s probably contributed to this progress. The largest of them is the District Primary Education Program (DPEP), covering almost half of the 600 districts in India, and involving funds amounting to over \$2.4 billion, mostly from international donors. I evaluate to what extent this important and expensive program had an impact on educational progress in the 1990s. My results show that DPEP contributed substantially to improvement in educational indicators in the 1990s in India. Progress was greater for girls, Scheduled Castes and Scheduled Tribes, three groups which are traditionally lagging in terms of education. My results for females imply that around one third of the annual changes in school attendance, literacy rates, and the share of female students that finishes primary school were due to the DPEP. In the case of male school attendance, only one quarter of the change can be attributed to the DPEP. Nonetheless, I also show that the DPEP had no impact in some states, pointing to the importance of state-specific conditions for the success or failure of developmental programs.

The last paper complements the other studies with an analysis of poverty determinants at the household level. The focus lies on the relation between individual characteristics, employment and poverty. The results indicate that employment characteristics play a major role in poverty reduction. At the same time employment is no guarantee of escape from poverty. The major determinant of poverty is the educational level of the worker. Only workers with rather high levels of education can substantially reduce the

risk of poverty for a household. The need for education is especially great in urban areas. I also investigate the effects of employment status and occupation on poverty. The results for these factors are less clear. Salaried workers in general face a lower risk of poverty. The problem is that a rather high level of education is needed to become salaried in the first place. Also, salaried employment is very scarce in rural areas, where most of the poor live. I also find mixed results for occupation by industry. Depending on status and education, employment in all sectors can help to reduce the probability of being poor.

609 Gurung, Ghana

2006. Reconciling biodiversity conservation priorities with livelihood needs in Kangchenjunga Conservation Area, Nepal

In response to the challenges associated with the ‘fines and fences’ approach to nature protection, participatory approaches, widely known as ICDPs, have been applied in conservation since the 1980s in an attempt to reconcile conservation and livelihood interests in protected areas in Nepal and elsewhere. Nevertheless, three decades of ICDPs have yielded mixed results globally. Hence, the practitioners of people-oriented conservation approaches continue to struggle to find ways and means to balance biodiversity conservation with human welfare that are ecologically sound, socially just and economically feasible. The major challenge now is to find effective and efficient operational strategies to be applied in participatory conservation based on lessons learned.

In the national context, Nepal has made outstanding progress in nature conservation by transforming conservation approaches. Nepal has allocated over 18% of its land for protection, enabling various forms of protected area management systems to evolve within the last three decades. Hence, Nepal offers ample learning opportunities concerned with ways to overcome conservation challenges practically, in one of the most biogeographically and socio-culturally diverse yet least developed countries.

This case study empirically investigates the successes and obstacles of the Kangchenjunga Conservation Area Project (KCAP) in addressing biodiversity conservation priorities together with the livelihood needs of the local inhabitants. The research examines the participatory conservation interventions, implementation strategies and processes applied by the KCAP to address nature conservation and community development needs, using qualitative and quantitative research methods. Over one hundred local inhabitants of the KCA and fifty experts involved directly in ICDPs were interviewed to achieve an enhanced understanding of the subject under investigation.

The research results indicate an improvement in forest conditions in the area and a perceptible growth in the wildlife population—judging from the increase in crop and livestock depredations—as well as enhancement of the livelihoods of most of the local inhabitants and the creation of a positive attitude towards conservation among most of

the local people. The results show that people-oriented conservation projects have a potential to reconcile biodiversity conservation interests with the livelihood needs of local communities effectively. However, the results also indicate that this requires long-term interventions that holistically and carefully integrate community development-oriented issues into conservation strategies and are implemented transparently through local institutions with the facilitation of skilled and committed personnel, mostly from the locality.

The results also show a number of challenges emerging from the project's success. These challenges are primarily related to increasing crop and livestock depredations caused by wildlife, the growing expectations among the local people of further livelihood enhancement-oriented activities, and the need to enhance the institutional capability of the KCA Management Council to manage and sustain conservation efforts. Factors such as the country's current political instability and economic trends often affect conservation and livelihood issues more than any project intervention. Nevertheless, it is imperative to address local livelihood needs while also receiving constant external support for the conservation of endangered species. This requires a good balancing act, backed up by periodic monitoring, evaluation and research feedback for an enhanced learning process.

The case study results, as well as global conservation experiences, clearly signal that people-oriented conservation approaches that provide the space to negotiate human-wildlife conflicts are a desirable alternative to traditional nature conservation approaches. In fact, there are very few alternatives to inclusive participation for sustainable conservation that are compatible with democratic values and norms. Therefore, people-oriented conservation approaches should be pursued and refined for sustainable conservation and to meet the livelihood needs of local people, as well as to allow their voices to be heard.

908 Eyhorn, Frank

2006. Assessing the potential for organic farming for sustainable livelihoods in developing countries: the case of cotton in India

Based on the example of cotton farming in India, this research examines the extent to which conversion to organic management can be a viable option for improving the livelihoods of farmers in developing countries. While cotton cultivation provides a livelihood for an estimated 10 million Indian households, stagnating cotton yields, high input costs and low cotton prices have led many of them into indebtedness. By substituting synthetic fertilisers and pesticides with own-farm resources and labour, organic farming not only could have the potential to improve natural resource management, but also to reduce production costs and obtain a better price for the produce. Agencies and companies are increasingly trying to utilise this potential by organising organic farmer groups and linking them to the growing market demand in industrialised countries.

Maikaal bioRe® in central India is one of these initiatives, involving 1500 small and medium-sized farms with a production of 1000 t of cotton fibre in 2005.

The study analyses the impact of organic farming on rural livelihoods, and whether conversion is a feasible option from the perspective of the farmers. To approach these two questions, a conceptual framework that captures the relevant dimensions of livelihoods and of the adoption of innovation was developed. The widely accepted Sustainable Livelihoods Framework was complemented with approaches that make it possible to address non-economic aspects of rural households and the process of developing livelihood strategies. This conceptual framework formed the basis for designing a comparative farming system study in which 60 organic and 60 conventional farms were monitored over a period of two cropping seasons. With a range of qualitative studies, decision-making processes and obstacles in the adoption of organic farming were further analysed.

The results of the comparative study based on Maikaal bioRe show that, in addition to not using synthetic inputs, organic farms applied about twice the amount of organic manures, had more diverse cropping patterns, and kept more cattle than conventional farms. Despite the widespread belief that organic farms are less productive, cotton yields in organic farms that had completed the conversion period were on a par with those in conventional farms. At the same time, nutrient inputs and input costs per crop unit were lower by a factor of two, indicating greater efficiency in the organic system. Surprisingly, the organic cotton system did not require significantly more labour than the conventional system. Due to 10–20% lower production costs and a 20% organic price premium, average gross margins from organic cotton fields were, depending on the year, 30–40% higher than in the conventional system. Although the crops grown in rotation with cotton were not included in the extension system and were sold without a price premium, organic farms achieved 10–20% higher incomes from agriculture.

In addition to these economic benefits, organic management does not burden soil and groundwater with synthetic fertilisers and pesticides. Most organic farmers have observed a considerable improvement in soil fertility after conversion, especially of soil structure and water retention. Nevertheless, analysis of soil organic matter, water retention capacity and nutrient content in soil samples of organically and conventionally managed fields only detected minor differences between the farming systems. Soil analysis results probably did not reproduce the improvements perceived by the farmers due to the large heterogeneity in site conditions and management practices.

Most of the conventional farmers in the study area expressed little confidence in the future of farming, as decreasing net returns and increasing indebtedness are jeopardising the economic viability of their farms. Accordingly, the main motivation of those who converted to organic farming was to secure and improve their livelihoods by improving soil fertility in order to stabilise yields, reduce production costs, gain access to markets with higher cotton prices, and reduce their dependency on loans and money lenders. While adopters of organic farming perceived the long-term outcomes mainly

as positive, during the transitional phase most of them were confronted with income losses and additional workload. In the initial 2–3 years of conversion, yields usually dropped by 10–50%, and the reduced production costs and organic price premium were not sufficient to compensate for lower revenues. In the initial years of the Maikaal bioRe project, therefore, mainly wealthier farmers and farmers who were leaders in their community adopted organic farming, while marginal farmers hesitated to take the risk of conversion.

Managing the economic constraints of the conversion period emerged as an important entrance barrier to organic farming, especially for small and resource-poor farmers. In the long term, however, smallholders are likely to be better off in the organic farming system, as they can substitute expensive off-farm inputs with own-farm resources and underutilised family labour. Lower production costs and stabilised incomes help them to reduce their vulnerability to drought and market price fluctuations. Eventually, improved economic performance enables them to escape the previous debt cycle and re-invest in agricultural intensification and in diversifying their livelihood base. This not only improves their quality of life, but also their social status in the community.

The relatively large number of farmers who dropped out of the organic farmers group because they had used banned inputs demonstrates that not all farmers who once decided to convert to organic farming stick to this system. The fact that mostly farmers of high socio-economic status defaulted indicates that an opportunistic calculus is involved. At the same time, the particularly high indebtedness among defaulting farmers seems to stimulate opportunistic behaviour. The strong spread of Bt cotton in the region further tempted many farmers to try out the new technology in order to reap fast benefits. In addition, defaulting farmers were probably less suited for organic farming in the long term, as they had lower availability of cattle and labour.

In sum, the results show that smallholder organic farming systems can produce similar yields as in conventional farming after completing a transitional period of 3–4 years. However, if innovation in farming is really to improve rural livelihoods, the focus needs to shift away from yields to a broader perspective that includes sustainable management of the production base, economic viability of the farm operations (i.e. the relation of costs and revenues), and livelihood security. It is in these fields where organic farming offers the most promising potentials. The challenge in utilising these potentials lies in enabling poor farmers to overcome the obstacles of the conversion period. Appropriate extension approaches that facilitate conversion, and mechanisms for bridging the initial income gap are thus needed. Adoption of organic farming, however, not only requires acquiring new know-how and skills, but also a change in attitude. Only if the involved farmers develop emotional ownership of the organic cotton initiative and identity as a group can free-loading be prevented and the long-term sustainability of the undertaking be ensured.

5.6 JACS South East Asia

101 Epprecht, Michael

2006. *The geography of welfare: spatial dimensions of poverty and inequality in Vietnam*

The thesis was elaborated within the context of the Swiss NCCR 'North-South' and consists of five publications (one book, three papers, one socio-economic atlas). It addresses human poverty and welfare inequalities in Vietnam, a problem that ranks high on the agendas of the government and of development agencies. As reliable data on the spatial distribution of poverty are not available, but would be imperative for effective pro-poor policies and interventions, the study aims to provide spatially differentiated information on welfare inequalities and underlying factors.

The study further develops the relatively new method of 'small area estimation' (e.g. Elbers et al. 2003) and estimates poverty and welfare inequality for provinces, districts, and communes in Vietnam, as well as for specific population sub-groups. The principle sources of information for estimating welfare are the 1997-98 Vietnam Living Standards Survey and the 1999 Population and Housing Census. In order to allow spatially differentiated poverty analysis and targeting, the reliability of the welfare estimates is crucial. The study establishes that the estimates of poverty generated through the original small area estimation techniques are reliable for provinces and districts, but that estimates at a higher level of spatial disaggregation – e.g. small communes – are not very precise. Methodological advancement was therefore envisaged to overcome these limitations. The method of small area estimation involves estimating poverty as a function of household characteristics using household budget survey data and then applying the estimated equation to the same independent variables from census data. Regional differences are taken into account either by including regional dummy variables or by running separate regression analyses for each region. Either approach assumes, somewhat unrealistically, a discrete change in the relationship at regional borders. The study modifies and extends the method by relaxing this restrictive assumption using spatially-weighted local regression models that allow for local variations in relationships. In addition, it includes and applies a three-dimensional spatial weighting scheme that is sensitive to topography to generate estimates and maps of poverty and inequality for Vietnam. The study demonstrates that the enhanced models can significantly improve the reliability of poverty estimates at a high level of spatial disaggregation and also allow for decomposition analysis of poverty and inequality among population sub-groups.

The results indicate that the poverty rates are highest in the remote and mountainous areas of the country. These areas contrast the large river deltas of the Red River in the North, and the Mekong and Saigon rivers in the South, as well as the lowland areas along the coast, where poverty rates are much lower. The lowest poverty rates are found in the towns and cities, and in the southeast region. However, poverty rates vary widely across districts and communes, even within individual regions. Furthermore, the

analysis shows that, since the poor remote upland areas are sparsely populated, most of the Vietnamese poor live in densely populated river deltas and cities. Nevertheless, remote upland areas have not only the highest incidence of poverty, but also – unexpectedly – exhibit the greatest poverty gaps, and poverty here is most severe. Fighting poverty in remote areas of Vietnam is therefore significantly more challenging than poverty reduction in non-remote areas.

Analysis of agro-climatic variables as determinants of poverty reveals that three-quarters of the variation in district-level rural poverty can be explained by agro-climatic variables, which implies a very strong relationship between environmental factors and poverty. Since these factors per se can typically not directly be influenced through pro-poor policy interventions, this finding is important in pointing towards variables that affect human welfare which can actually be influenced by appropriate policies (e.g. soil fertility through appropriate soil conservation and soil improvement measures, physical remoteness through improving access to services, etc.). The study further reveals that the way those variables are related to poverty varies greatly across space, which reflects varying vulnerability to environmental stress in the different regions.

The study further explores the observed spatial coincidence of widespread and severe poverty, and threatened natural resources, proxied in the study by measures of forest cover and forest quality. Forests of high local and global value are located in areas where relatively few poor people live, but where the incidence, gap, and severity of poverty are greatest, and where the livelihood strategies are based on agricultural and forest activities. Forest resources are currently important for the rural poor, and have the potential to create new income opportunities. Nevertheless, forest-consuming activities such as conversion from forest to agricultural land are often the only option for rural dwellers to increase living standards. This complexity underscores the importance of research which carefully distinguishes between areas where forest conservation and restoration do or do not support the wellbeing of local populations. It is therefore important to investigate dependence on forest resources in remote, high forest cover areas, and future preferences about what to do with forest cover. In some areas, preferences to keep forests standing could be high, not just because of high current dependence, but also because the reasons for converting forests are absent. Conversely, there are areas where the two major paths out of poverty are either out-migration or converting the forests to support a growing population and to reduce poverty.

Finally, the study develops maps of poverty and inequality for population sub-groups, and investigates the societal versus geographical underpinnings of poverty and inequality patterns in space. It demonstrates that poverty and inequality maps may be misinterpreted if spatial patterns specific to important sub-populations remain uncovered. Spatially disaggregated welfare indexes for population subgroups in Vietnam show that overall inequality is shaped by an urban-rural welfare divide, closely followed in importance by sharp welfare differences between ethnic minorities and majorities. Geographic remoteness is a weaker determinant of poverty than expected, though accessibility to local infra-structure and services is a more important factor in poverty than

travel distance to larger cities. Instead, the spatial distribution of poverty in Vietnam is predominantly shaped by socio-cultural, rather than by geographical factors: the higher levels of poverty in upland areas are largely attributed to the high proportions of ethnic minorities there, and the higher levels of inequality in poor upland areas are attributed to ethnically based welfare differences. These findings have important implications for the targeting of rural development investments. Targeted allocation along ethnic lines is likely to be the most efficient option for development policies aimed at reducing social and economic inequalities in Vietnam.

104 Heinemann, Andreas

2006. Patterns of land cover change in the Lower Mekong Basin: the relevance of mesoscale approaches

Unchecked economic and population growth over the last three decades has left scars on the landscapes of the Lower Mekong Basin. Widespread deforestation and rapid land cover changes have deprived structurally advanced Thailand and Vietnam of large parts of their original forests. The two less developed countries in the centre of the Basin, Cambodia and Laos, are still comparably well endowed with forest resources, partly due to their recent political history. The distinct development disparities between Cambodia and Laos in the centre of the Basin and the surrounding countries of Thailand, Vietnam and China have resulted in great dependencies mainly on the part of the poorer nations. The ongoing economic opening of Cambodia and Laos brought about by recent political tendencies, coupled with the enormous economic growth in the entire region, puts the remaining forests in the centre of the Basin under ever-increasing pressure. As the riparian countries of the Lower Mekong Basin share a common resource pool, and consequently also the environmental impacts of land cover change in a watershed context, it is crucial that comprehensive and comparable information on land cover status and land cover change becomes available for the entire Basin. Such regional level knowledge, however, is not readily available as yet owing to the huge gap between the site-specific information provided by local case studies on drivers of change and the static large-scale land cover inventories based on remote sensing data. The widely available land cover inventories are frequently not exploited to their full potential due to the lack of appropriate methods and because of institutional obstacles related to the mandates of the data producers.

Against this background, the present study seeks to generate a comparable information and knowledge base about land cover change on a mesoscale level for the entire Lower Mekong Basin. Such information is crucial to both informed decision making and transboundary negotiations on the use and protection of the shared natural resources in regional bodies such as the Mekong River Commission. It may form the basis for achieving a common understanding regarding resource management in the Basin despite diverging national interests.

The present study argues that, while being of major policy relevance, regional-level or mesoscale approaches offer a great potential for land cover research as well. The mesoscale is highly appropriate for amalgamating the contrasting concepts and methods of both locally oriented and large-scale research realms. Furthermore, the mesoscale allows the multiscale nature of land cover change processes to be taken into proper account: On this scale large-scale external driving forces may still be detectable before disappearing in the heterogeneity of the local context, and local conditions may not yet have been aggregated to a level where the respective processes or proxies forming them are no longer recognisable.

Mesoscale analysis of the 1993 and 1997 land cover data shows the distinct scars that various long-term land cover change processes – related to the level of market integration and depending on the political context – left on the landscape in the riparian countries. While in Thailand and Vietnam only 5% of the areas less than 0.5 hours' travel time from any village are still covered with forest, this value is still well above 30% in Laos and Cambodia. Similarly, the threshold of population density at which the forest cover of an area drops below 25% is three to five times higher in Laos and Cambodia than in their neighbouring countries. This study proposes to use such figures as indicators for the status of natural resources in a region instead of the classical indicators (e.g. how much forest remains in a given area). The advantage of such new indicators is that they are rectified with regard to different levels of development (e.g. infrastructure), and hence allow for a more precise comparison of different regions.

Despite the logging bans in place in all riparian countries, deforestation averages 0.55% per year and remains the dominant and most disturbing form of land cover change across the Basin. Assuming that deforestation rates remain stable, the forest cover of the LMB will be reduced by more than half – to below 16% – by the year 2100, with unpredictable consequences for the hydrological cycle and the livelihoods of millions of people. Secondary forests and shrubby vegetation types show by far the highest level of human interference. Considering the ecological value of these vegetation types, as well as their importance for the livelihoods of the rural population in the Basin, greater emphasis has to be placed on the sustainable management of the areas concerned.

The present study was able to confirm the global tendency that logging paves the way for agricultural expansion: This is also the case in the LMB. In all riparian countries besides Thailand, the increase of permanent agricultural areas is largely attributable to prior logging. There are, however, signs that the enhanced integration of Laos and Cambodia into the regional and global economy is leading to increased direct conversion of secondary forests to cash cropping.

The statistical models developed indicate that of all the factors considered, village accessibility and population density are the dominant large-scale factors “driving” deforestation. This applies to all riparian countries with the exception of Thailand, where protection (i.e. the presence or absence of protected areas) is the most important factor. Even though the relative influence of village accessibility and population density varies

greatly among the countries, village accessibility is generally more dominant throughout the LMB. Consequently, it is crucial that large infrastructure development projects, that will enhance market access, be accompanied by adequate measures to ensure the sustainable use and management of natural resources.

The study further highlights the varying impact of the vicinity of towns on the intensity of intensification and deforestation processes, depending on the general development of the urban centres in a country: While the vicinity of a town decreases deforestation risk in Thailand, it increases the same risk in Cambodia and Laos. On the other hand, improved accessibility of a town increases the probability of intensification to a much greater extent in Thailand and Vietnam than in Cambodia and Laos. Furthermore, empirical evidence is provided that total forest loss as well as deforestation rates in Cambodia and Laos are extraordinarily high in areas that are easily accessible from Thailand, Vietnam or China. With regard to protected areas, it is shown that the lower deforestation rates observed in protected areas in Laos are not mainly attributable to protection per se but are related to the rather remote location of these protected areas in regions with very low population densities.

In terms of methodology, the overall approach developed and applied in the present study comprises a variety of techniques ranging from cross-tabulation matrix analysis and spatial modelling to multivariate statistics. This combination of analytical tools offers considerable insights into the land cover system of the LMB and the different larger-scale processes active in the riparian countries. The approach has the potential of being adapted and replicated for application in other regions of the world, thus enhancing knowledge of land cover systems and active processes on the policy-relevant mesoscale.

To overcome some of the shortcomings of classical large-scale land cover monitoring approaches (e.g. cost, long intervals between cycles, limited resolution), first steps towards a new, more cost-effective approach are presented. Based on the characteristics of this approach – e.g. regarding spatial and temporal resolution – a fundamental shift in the manner of gaining insight into the nature of human interactions with the land cover system over large regions may be initiated. The geometric shapes of land cover changes, and their spatial and temporal arrangement on the landscape (i.e. patterns), may be linked to categories of proximate causes (e.g. shifting cultivation or infrastructure development) driving these changes. However, concrete pattern recognition algorithms and methodologies still have to be developed, or adapted to land cover science by other disciplines (e.g. statistics and computer science), respectively.

The thesis concludes with a set of specific recommendations addressed to producers and users of regional land cover data (e.g. regarding the exploitation of available data, the need for a critical view of public domain large-scale data), researchers in the field of land cover science (e.g. regarding the desirability of linking patterns to processes) and policy makers in the LMB (e.g. regarding the aim of strengthening regional coordination, policies on secondary forests).

301 Huang, Dongbin

2006. A discrete-event dynamic systems approach for environmental decision support

The thesis aims to develop a model structure matching environmental strategic planning and policy research to facilitate identification of the multiple elements of a strategy and explore the multidimensional effects of a strategy through time in an efficient way. It conceptualises a strategy as a set of sequential or concurrent events planned to achieve a certain strategic goal, and develops a new form of causal networks as an interfacing component between decision makers and environment models. The causal network receives a strategic plan as input in a discrete manner and then outputs the updated parameter sets to the subsequent environmental models. Accordingly, the potential dynamic evolution of environmental systems caused by various strategies can be simulated in a stepwise fashion.

The thesis advances the state-of-the-art method of environmental strategic planning for large-scale, long-term projects with the following originalities: Firstly, it specifies and digitalises a strategy with decision variables, and makes the multiple elements of a strategy accessible to decision makers. Secondly, it develops a timed causal network for identifying decision variables and modelling the boundary conditions of environmental systems. And thirdly, it develops a distributed representation of material flow diagrams and cellular networks enhancing the interpretability and extendibility of a complex model.

In general, the thesis advances a computational policy or strategy experimentation method that incorporates discontinuous changes. It also offers a way to identify the operational attributes of a strategy to be formulated. The scenario analysis based on the model structure is quantitative and dynamic. The computational method it applied also advances dynamic material flow analysis, or dynamic life cycle inventory analysis, that may be used as a new tool in the field of industrial ecology. The generality of the model structure makes it appropriate for wide application in environmental strategic planning and policy research, as well as environmental case studies.

As a result of this improved method, its application to the study of Kunming urban water management provides the following practical benefits: (i) it integrates the cross-scale interdependencies of the urban drainage system and the regional water balance system; (ii) it identifies as many as eighteen decision variables for constructing various strategic assumptions on urban water management and simulates present as well as long-term impacts; (iii) it provides an holistic overview of the current situation, future limitations, and potential solutions with sequence and timing attributes, and (iv) it is a tool decision-makers can use to explore strategies for achieving preferred and attainable future conditions.

The above-mentioned merits, together with the illustrative power of the model structure, render it potentially very useful in the field of environmental decision support.

302 Schaffner, Monika

2007. Applying a material flow analysis model to assess river water quality pollution and mitigation potentials – a case-study in the Thachin River Basin, central Thailand

Pollution and overuse of renewable natural resources is a core problem related to current syndromes of global change. In particular, major rivers in developing and emerging countries are suffering from increasingly severe degradation of water quality. The conventional approach to river water pollution in these countries is based on mathematical models which allow simulation of hydrodynamic and water quality transformation processes within the river water. These models require a large data base in order to attain the desired accuracy. They focus on the points where pollution is discharged into the main river but do not investigate the actual origins and the processes generating the pollution. The simulated mitigation scenarios are generalised and lead to strategy plans that fail to clearly identify and prioritise effective water quality remediation measures.

In this study, a Mathematical Material Flow Analysis (MMFA) was applied as an alternative approach to conventional river water quality models. Applied to analyse river water pollution, the MMFA makes it possible to trace pollution flows and their transformations, from their input into the system through waste production, separation, treatment and finally to their output as a product or a discharge into receiving water bodies. In this way, the perspective is widened to get an overview of the river system and to understand the origins and the main processes involved in the chain of nutrient pollution generation. The key parameters influencing the pollution flows were determined, based on which concrete and effective mitigation measures can be devised and evaluated.

To investigate the potentials and limitations of the MMFA approach as a basis for river water quality remediation in developing and emerging countries, the Thachin River Basin (Central Thailand) was selected as a case-study area. The Thachin River Basin is a flat tropical lowland river system, flowing through the intensively used rural and peri-urban delta area to the west of Thailand's capital, Bangkok. In 2000, massive basin-wide death of fish, attributed to a sudden decrease of oxygen levels in the river, triggered public awareness and political efforts to rehabilitate water quality in the Thachin River Basin. By 2002, surface water quality degradation in the basin had become of great governmental and public concern, to the extent that the river was considered as the country's most polluted river. A review of the available water quality datasets shows that the crucial parameters of concern are ammonia, phosphorus and low oxygen levels, particularly in the lower basin.

In several consecutive studies, conventional catchment water quality models such as WASP, QUAL2E and MIKE11 had been applied to estimate the quantity of pollution discharge from various sources. Yet no study explicitly compared the nutrient loads produced at the origins of the different sources and in particular, non-point source pollution was not adequately assessed. The resulting scenarios for river water quality remediation did not sufficiently specify concrete remediation measures, or their respec-

tive effects, which would make it possible to reach the targeted pollution load reduction. The Action Plan for Protection, Remediation and Improvement of Water Quality in the Thachin River Basin elaborated in 2001 was formulated in a broad manner, without identifying concrete measurable targets and not accounting for solutions specific to Thachin River conditions. As a result, despite the commitment of government and associated research institutes, water quality in the basin has remained at a critical level, with the implementation of the ambitious action plan having fallen years behind schedule.

To determine a solid basis for possible water quality remediation measures in the Thachin River Basin, the current thesis applies an MFA model focusing on the nutrient flows and loads, i.e. total nitrogen and total phosphorus, from the various pollution sources within the basin. The MFA modelling includes several steps: (1) the system analysis defines the temporal and spatial system boundaries and the relevant pollution sources to be modelled; (2) based on an acquired system understanding, equations are formulated which describe the system (model approach); (3) the input data for these equations is acquired from available primary, secondary and tertiary sources; (4) with the compiled dataset, the current state of the nutrient flows is simulated; (5) the plausibility of these results is cross-checked with primary measurements and the literature and (6) a Monte Carlo simulation allows assessment of the uncertainty of the model results; (7) with the aid of a sensitivity analysis, the key parameters which influence the nutrient flows are identified, on the basis of which (8) mitigation scenarios can be devised and evaluated.

The model simulations show that, at the current state, aquaculture is the most critical nutrient pollution source in the Thachin River Basin, contributing roughly 60% of the total net N and P loads to the river system. In view of the considerable global growth of aquaculture production, this finding is of particular significance. Rice cultivation also produces a large share of the basin's nutrient loads; considering the probability distribution of our simulations, the sector could in fact contribute nutrients in the same range as aquaculture. This finding underlines the importance of non-point-source pollution control in the Thachin River Basin, particularly with its dominant rice production sector. Surprisingly, pig farming, which is believed to be one of the most important pollution sources in the Thachin River Basin in terms of BOD, contributes less than 15% of the total basin's nutrient loads.

Fieldcrop and poultry production are of moderate significance in the basin, with a relatively low uncertainty range. According to the simulations, fruit and vegetable cultivation and waterplants could in fact extract nutrients from the system via plant uptake from irrigation and river water. The uncertainty of these contributions, however, is high, ranging from possible negative (nutrient extraction) to positive nutrient contributions. More in-depth investigations into the production parameters and nutrient loss coefficients would be required to more precisely quantify the nutrient pollution-related role of these subsystems.

Households contribute a small share of the total nutrient load to the basin, even if we account for all the uncertainties of our parameter set. This is an interesting finding if we consider that current river water quality remediation efforts focus strongly on this pollution category. Note, however, that this finding only applies to nutrient pollution and not to other potential pollutants present in household wastewater.

Industries, by contrast, could produce nutrient loads as high as those of rice cultivation and aquaculture if we account for the uncertainty of our parameter estimations. The high uncertainty range of industrial wastewater flows points to the need for more detailed investigations into the pollution flows of this subsystem.

The relative dominance of the different pollution sources shifts when our model results are down-scaled to the provincial level: while rice farming plays the most important role in the upper basin province of Chainat, aquaculture is the dominant source in all other provinces. In Nakhon Pathom province, which is Thailand's third most important pig production area, pig farming indeed contributes a significant share of nutrient loads. Industries are only relevant in the highly industrialised Samut Sakhon province (50% of the province's nutrient loads).

Related to N and P loads, households are not significant in any of the provinces, not even in the partly urbanised areas of the Bangkok Metropolitan Region. These variable roles of the pollution sources in different provinces point to the importance of provincial-level model calculations: not all provinces require the same interventions in order to effectively reduce the nutrient loads in their respective river reach.

Cross-checks with local and international field data on pollution discharge characteristics show that despite the great uncertainty of some variables, our model results are in a plausible range. Realistic and effective mitigation scenarios are devised which target the sensitive system parameters identified. The simulated scenarios illustrate that with an improved management of aquaculture pond sludge and drainage water, over 50% N and 30% P of the basin's total loads could be reduced. Lower fertiliser application rates in rice farming would allow a potential total basin load reduction of 15% (N) and 12% (P). A combined optimum scenario for pig farming would produce an overall basin load reduction of only 8% (N) and 4% (P). While these scenarios show the order of magnitudes of load reductions which could be achieved, more detailed (MFA) models and in-depth investigations into certain model parameters would allow more specific quantification of the nutrient load reduction potentials.

Comparing the simulated nutrient loads to the basin with water quality and flow measurements in the river system, a large discrepancy is apparent. The average total net nutrient load from all pollution sources to the Thachin River Basin is roughly 25,000 tN/yr and 7700 tP/yr. However, despite this high nutrient contribution to the basin, the available measurements do not show any significant nitrogen increase along the river reach; phosphorus does increase, by roughly 30% of the total net P input. This pattern is confirmed by corresponding provincial level cross-checks.

Even if we keep in mind the uncertainty of our model simulations as well as the water quality and flow measurements, this discrepancy indicates a considerable nutrient retention within and/or loss from the system. Considering the “bathtub” character of the Thachin River Basin, with its warm water temperature, slow flow velocities, partially closed water gates and widespread aquatic plant coverage, such high retentions and losses are indeed plausible: retention in the form of sedimentation, within the stagnant canal system or via uptake by aquatic plants, and loss from the system by aquatic plant harvest and N emission to the atmosphere.

The tropical, stagnant flow conditions of the Thachin River, with relatively long water retention times and high water temperatures, favour microbial degradation which consumes large amounts of oxygen. These low oxygen levels are in fact the key concern voiced by local stakeholders regarding water quality in the Thachin River. The issue is confirmed by the water quality measurements in the basin, which indicate low oxygen levels as the most critical water quality indicator. We argue that the nutrient and oxygen content in the river system are closely linked: nitrogen and phosphorus serve as an easily accessible source of nutrients to water plants and algae. Excessive supply of nutrients (eutrophication) causes infestation with water plants and algal blooms. The degradation of decaying plant material, together with the degradation of organic pollution loads, requires large amounts of oxygen. This leads to the critical oxygen-deficient conditions observed in the Thachin River Basin system. In this light, a closer investigation of the oxygen conditions in the area would be an interesting complementary study to the current one.

The MFA model presented for the Thachin River Basin is a simple input-output model and does not account for non-linear and complex interdependencies such as between the nutrient input, yield and losses in a rice crop. The calculations are based on broad parameter assumptions which were taken to best represent a large area and an average year. As such the model results cannot represent a single pollution source unit or year, or the temporal dynamics and processes within the subsystems. Rather, the model enables quantification of the orders of magnitude and the minimum and maximum nutrient loads that can be expected from the different point and non-point pollution sources to the Thachin River Basin. The main problems and their origins can be identified and the pollution sources compared and classified according to their range of possible contributions. Based on the results of the uncertainty and sensitivity analysis, the need for further investigations can be concretely specified: (1) to further pursue the key pollution sources identified, in particular with a more detailed model for rice farming and (2) to look more closely at those pollution sources with a high model uncertainty: industries (variability of wastewater types), fruit and vegetable cultivation (variability of crop types) and water plants (especially in regard to “natural” nutrient retention/removal from tropical lowland rivers).

In order to realize the potential of MMFA as a basis for effective and participatory environmental management, it is essential that key stakeholders be involved in the modelling process from the start. In the current study, this was accomplished in the course of

model formulation (establishing the model approach and calibrating the input data) and in the preliminary stage of determining possible and suitable mitigation scenarios. However, the final step of evaluating and determining most effective (environmental point of view) and accepted (local point of view) scenarios jointly with concerned stakeholders could not yet be completed within the scope of this thesis.

Once established, the MFA model for the Thachin River Basin can serve as an alternative scientific basis for decision-making on effective river water quality remediation in the basin. Concrete measures can be evaluated amongst concerned stakeholder representatives and existing action plans and projects revised. To effectively realise this ultimate potential of the MMFA, the concrete interest of the stakeholders is now required. A workshop among key stakeholders at various levels and in various sectors would be an ideal way to jointly discuss river water quality remediation, thereby merging the scientific results with the needs, perspectives and priorities of the people concerned.

Based on the findings of the MFA model for the Thachin River Basin, transfer functions are specified which quantify average per-unit nutrient contributions from different nutrient pollution-related activities. If these specific nutrient loads are extrapolated using available statistical figures (population numbers, land use areas, etc), they can be used in a first step to broadly quantify the nutrient contributions of different pollution loads in comparable river basins.

307 Montangero, Agnes

2006. Material flow analysis for environmental sanitation planning in developing countries: an approach to assessing material flow with limited data availability

Most of the wastewater generated worldwide is discharged untreated into aquatic systems, thus leading to water pollution and loss of valuable nutrients. Furthermore, since most of the nutrient load that finds its way into water bodies cannot be recovered for food production, artificial fertilisers must cover the agricultural demand for nutrients. Production of artificial nitrogen fertiliser is energy-intensive and phosphate rocks have to be mined for the production of phosphorus fertilisers. Phosphorus reserves are, however, likely to be depleted in the near future. To secure water and phosphorus reserves for future generations, new environmental sanitation concepts are required to promote the saving and reuse of limited resources and preserve the environment.

The material flow analysis (MFA) method can be used to develop such concepts by simulating, for example, the impact of different types of sanitation infrastructure, consumption patterns and agricultural reuse practices on resource consumption and environmental pollution. However, application of this method in developing countries is constrained by limited data availability and data collection means.

This thesis therefore aims to develop the scientific basis of an approach to assist environmental sanitation planners in establishing and calibrating a reliable material flow model despite limited data availability and to enhance understanding of nutrient behaviour in the environmental sanitation system.

A tool was developed for planning environmental sanitation options with limited data availability and data collection means. It allows assessment of the impact of different scenarios on water and nutrient consumption, nutrient discharge into the environment, and nutrient recovery for food production. The main element of the tool is a stochastic model describing goods as well as nitrogen and phosphorus flows within a regional environmental sanitation and agricultural system. The tool also integrates in the MFA method concepts for uncertainty analysis and plausibility assessment. Moreover, it includes a database with default values for various model parameters and for plausibility criteria. The different elements of the tool were implemented in Microsoft Excel® spreadsheets. A case study was conducted in Hanoi, Vietnam, to test the tool and calibrate the model.

The following conclusions can be drawn based on experience gained with use of the tool in Hanoi's case study. Uncertainty analysis is essential when developing and calibrating material flow models with limited data availability. Application of an iterative approach is also of key importance. Parameter values should first be assessed on the basis of a literature review and by eliciting expert judgement. Assessing prior probability distributions for model parameters by eliciting expert judgement is a highly promising method if data availability is limited but expert knowledge is available. If parameter or variable values obtained from preliminary assessment are not plausible, parameter values should be reassessed more accurately. Sensitivity analysis allows optimisation of data collection campaigns by identifying parameters requiring further assessment.

The model was applied to simulate the impact of different changes in Hanoi's environmental sanitation and agricultural system on groundwater abstraction, nutrient discharge into the environment, and nutrient recovery for food production. Greywater reuse for toilet flushing and leakage loss reduction are the most efficient measures for reducing groundwater abstraction in Hanoi. However, even if these measures were implemented, groundwater withdrawal would still be of the same order of magnitude as the aquifer recharge rate. Strategies such as promoting the development of small to medium-size satellite cities and thus reducing Hanoi's population growth as well as replenishing groundwater and improving surface water quality should therefore be further discussed.

Septic tanks are the most widespread on-site sanitation installations in Hanoi. However, unlike septic tanks, which are inefficient in retaining nutrients, urine diversion latrines make it possible to immobilise most of the nutrients contained in human excreta. Replacing septic tanks with urine diversion latrines would result in a considerable nutrient load reduction in surface water and nutrient recovery increase for food production, thus reducing the need for artificial fertilisers. Both the agricultural nutrient demand and the

amount of nutrient in waste would be considerably reduced if livestock production were replaced by a greater production of fish, vegetables, beans, soybean, and nuts. Moreover, the percentage of nutrient recovery in Hanoi's peri-urban agriculture would further increase. This indicates that the type of sanitation option selected has a significant influence on nutrient cycles in a region, and that consideration of the peri-urban agricultural sub-system and reuse practices is also of key importance in improving nutrient management.

Plausibility assessment and careful characterisation and analysis of uncertainty allowed conclusions to be drawn based on the model outcomes despite significant uncertainties. The tool therefore proved able to support the planning of environmental sanitation options helping to minimise resource consumption and environmental pollution despite limited data availability. It should be further tested and adapted as part of a comprehensive environmental sanitation planning project.

5.7 JACS Caribbean and Central America

502 Hostettler, Silvia

2007. *Land use changes and transnational migration: the impact of remittances in Western Mexico*

The present study focuses on the economic, political/institutional, technological, cultural, demographic and environmental drivers of land use change. It aims to understand the factors influencing land use decisions at the household level, in particular the influence of migration. The study is guided by the hypothesis that international migration is driving land use change through the investment of remittances, funds sent back by migrants to their families in the country of origin. This research is based on a political ecology approach and the conceptual framework relies on three theoretical concepts. First, the concepts of *proximate causes* and *driving forces* were used to identify the factors behind changing land use. In addition, the concept of *remittance landscapes*, a concept developed in the framework of this study, which is defined as an *emerging type of landscape driven by the investment of remittances*, was used to evaluate the impact of remittances on land use in the study area.

Fieldwork was conducted in the municipality of Autlán in the state of Jalisco in Mexico over a total period of 8 months between 2002 and 2004. Land use changes between 1990 and 2000 were quantified based on satellite image analysis. Underlying driving forces of these changes were examined based on land use change data collected by survey as well as data available from municipal, state and federal agencies.

Land use changes observed in the study area between 1990 and 2000 include slight increases in agricultural land (2%), urban land cover (0.5%) and pine-oak forest (0.7%). Over the same period, pasture increased by 18% while dry forest decreased by 10%. Rapid and extensive land use change is occurring on rainfed agricultural land, as maize cultivation is converted to the cultivation of *agave azul* used for the production of tequila. The first plantations of *agave azul* were established in 1996 and by 2002, *agave azul* was planted on 33% of all rainfed agricultural land in the municipality. 84% of owners of rainfed land included in the survey had changed land use from maize to agave during this time period.

The dynamics of several proximate causes are driving this change: 1) Market prices for maize decreased by 46% between 1994 and 2004 while the costs of agricultural inputs continually increased so that cultivation of rainfed maize was no longer economically profitable; 2) The variability of rainfall combined with a lack of irrigation water limits the choice of economically viable alternatives to *agave azul*; 3) In the large majority of cases, landowners rent out their land to tequila companies in reverse leasing arrangements for seven-year periods (the duration of one growing cycle of *agave azul*). During this time they do not have to work on their own fields and are free to find off-farm employment or migrate to the US and; 4) Landowners continue to receive agricultural subsidies even though the land is rented out, as *agave azul* is one of the eligible crops.

Overall, the main driving forces identified in the study area are economic (market prices), environmental (variability of rainfall, soil quality, topography), political/institutional (agricultural subsidies, land tenure) and demographic (labour availability). Technology and culture appear to be less important. Results of the present study confirm the hypothesis that global factors, especially international trade agreements such as NAFTA (North American Free Trade Agreement) increasingly influence land use change. However, they are not sufficient to function as a sole driver of land use change. Environmental factors are a critical determinant of whether a certain land use change will occur or not. The decisive aspect behind the observed land use changes is the multiple interactions between specific factors at different levels and not the predominance of one particular driving force functioning at a particular level.

International migration is a significant livelihood strategy in the study area, especially for lower-income communities. On average, 50% of all households have or had at least one family member in the US as a migrant between 1980 and 2004, and remittances represent 45% of total household income. In general, the bulk of remittances income is used for subsistence needs and to repay debts. Nevertheless, on average, 30% of migrant households invest remittances in land, livestock, agricultural production and house construction. All these investments lead to land use changes. The impact of remittances on land use changes is variable, and depends on the socio-economic, political and environmental context of the community and the individual situation of the migrant household. In low-income communities, remittances might be used to repair existing housing, while in higher-income communities, they are used to construct a new house, converting agricultural to urban land. With regard to changes in labour availability due to out-migration, the results are ambiguous. Migration can drive land use change by encouraging a shift to low-labour land use systems, but these land use changes that require less labour can also drive migration.

The concept of remittance landscape developed by the author has proved useful for analysing the impact of remittances on land use changes. A combination of area-based and actor-based evaluation criteria is effective in order to describe quantitative as well as qualitative landscape transformations driven by the investment of remittances. Landscapes where the investment of remittances leads to a change of land use from subsistence to cash crop cultivation should be included as a potential type of remittance landscape, even though the basic landscape type (agricultural) remains unchanged. Accordingly, at least six different types of transformation into remittance landscapes are possible: a) forest to pasture, b) forest to agriculture, c) forest to urban, d) agriculture to pasture, e) agriculture to urban and f) change of agricultural system. In conclusion, the study area on which this research focused is not considered to contain any remittance landscapes because remittances are only partially driving the extensive land use changes occurring in the region.

503 Dilla, Haroldo Alfonso

2006. *Urban borderland intermediation in the Dominican Republic: three case studies*

The main objective of this thesis is to analyse how three Dominican cities located at the border with Haiti —Dajabón, Comendador, and Pedernales— digest the flows of merchandise, people, and information derived from their border conditions, and how they produce answers to these stimuli, particularly in social practices. This main objective is disaggregated into eight secondary objectives and is accompanied by a series of hypotheses that have been confirmed or enriched during the course of this research.

The thesis has seven chapters, as well as an introduction and an extensive bibliography. It also includes more than two dozen maps —some of which were drawn specifically for this study—and aerial photographs.

Essentially, this study addresses a border in transition from a closed border to one with growing economic exchanges and uneven inter-dependencies. Such openings occur almost exclusively guided by the market and commercial interests. Consequently, they are fragmented openings.

In spatial terms, the opening is accompanied by a profound regional restructuring with the emergence of trans-border corridors. These corridors constitute urban networks of multiple subordinations. And the border cities are inserted within them as “factory cities”; i.e., commercial enclaves that benefit external actors.

This unfavourable situation limits the capacities of the cities and their actors to accomplish more beneficial intermediation in terms of local/urban sustainable development. One manifestation of such incapacity is that cities cannot operate as providers of services and merchandise for their hinterlands. Nor can they be incorporated into the commercial dynamics as providers of foods and other products acquired by Haitian consumers. Consequently, there are no economic clusters. The cities and their immediate hinterlands experience a decapitalisation processes that benefits economic actors in the large and medium-size cities.

The “factory cities” studied here compensate this inequality by subordinating their Haitian counterparts and developing what we call “urban trans-border complexes.” These complexes imply a number of conditions: geographical proximity, sharing of the environment and natural resources, the establishment of strong economic links, and the generation of mutual perceptions of indispensability, among others. And in all cases they also imply highly contradictory systems where the urban sense of the deprived Haitian border cities is only understandable when they are perceived as huge slums of the Dominican cities.

This study focused on three of these complexes: Dajabón/Ouanaminthe, Comendador/Belladère, and Pedernales/Anse-à-Pitre. The effect these cities have on these processes varies. Evidently, an economic dynamics is generated, which informally and pre-

cariously brings many settlers, and also helps to relieve the hardships of poverty. But this influx is not enough to generate a sustainable climate of welfare and to retain the younger, more educated population. Hence, the cities suffer an overall loss of human resources while absorbing growing numbers of impoverished peasants from their hinterlands.

In social terms, this means the re-stratification of urban societies with the emergence of a professional middle class. It also means expansion of poor population groups, through a growing immigrant Haitian population. The cities' notable demographic growth — including cases such as Dajabón and Comendador whose provinces are being depopulated— puts very heavy pressure on urban services and spatial restructuring.

Finally, the thesis explores the situation of organised social practices and their transforming potentialities. Even though these practices have had some positive effects in areas such as benefits from commercial surplus or defence of the human rights of Haitian labourers and traders, one cannot overlook their limitations. Particularly when we observe that these practices and the organisations sustaining them have occasionally suffered processes of oligarchisation and have operated in an exclusive manner.

A crucial observation was that when these organisations and practices achieve a sustained link with external agents (churches, international cooperation agencies, etc.), they acquired the necessary methodologies and resources for a more innovative social projection. This has been the case of the cooperative societies generated by the networks induced by the Jesuit organizations.

A final question refers to the future of this border and its uneven and fragmented opening process, and the place of the cities in this process. The present situation of the Dominican-Haitian border is highly conflictive from all standpoints. The most visible reason is the combination of a highly depredatory and short-term accumulation scheme with an obsolete judicial-political regime. This situation may vary in the near future, particularly if the trends set by economic and political actors interested in liberating the exchange of merchandise from arbitrariness, and in generating a climate of prevision, continue. But even if this happens, the border will continue to be a controversial area, marked by uneven exchange and the burden of the ideological and cultural tradition that perceives what is “Haitian” as opposed to what is regarded as “Dominican”. The eternal wondering of Eros and Thanatos in their multiple and capricious reaffirmations.

506 André de la Porte, Cherryl

2007. Integrated water resources management: limitations and potential in the Municipality of El Grullo, Mexico

Decreasing water availability per capita in more and more countries is the result of bad management over the past centuries. The ‘world water crisis’, however, is not inevitable.

The concept of Integrated Water Resources Management (IWRM) has been promoted over the last ten years as a possible way of reversing such a trend. One of its most fervent promoters is the Global Water Partnership, according to which “IWRM is a process which promotes the co-ordinated development and management of water, land and related resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems”(Global Water Partnership 2000: 22).

A number of authors are critical of an appropriation of the IWRM concept by the Global Water Partnership without consideration of its historical evolution over more than 70 years (Biswas 2005; Mollard and Vargas 2005a). As a result of this omission, these authors question the applicability and usefulness of the concept and call for assessing the effectiveness of IWRM implementation. The difficulties of practical IWRM implementation are manifold and include issues of scale, as well as institutional, political, and social constraints on sectoral and environmental integration (Tortajada 2005; Duda and El-Ashry 2000; Mitchell 1990) that can be more or less specific to developing countries (Thioubou 2002).

The 1992 Mexican Water Law, amended in 2004, explicitly refers to IWRM as a national objective. As a result, there has been fairly extensive research on the implementation of IWRM in Mexico at the national level. This study assesses the implementation of IWRM efforts in the municipality of El Grullo (Jalisco), to identify the local and necessary conditions to enhance these.

We first recall the innovative aspects of the IWRM concept, as compared to more traditional water management. Ambitious, integrated water resources management is a holistic approach that includes both the natural system (water and its diverse components –surface water/groundwater, quantity/quality– but also all other environmental resources such as land, forests and biodiversity in general) and the human system, including all the different uses (domestic, agricultural, industrial, etc.) (Mitchell 1990). Integrated water management is an indicator of what Gleick (2000) calls a change in paradigm between the 20th Century –where infrastructure development enabled better exploitation of resources, perceived as unlimited– and the 21st Century, where finite resources are to be managed in order to maintain ecological integrity. Integrated water resources management is necessary to realise this ‘blue revolution’ (Calder 2005). It requires, on the one hand, a participatory and negotiation-oriented institutional frame-

work and, on the other hand, water pricing tools, so as to balance demand and supply (Meublat and Le Lourd 2001).

At the level of a municipality, implementing IWRM efforts translates, on the one hand, to ensuring good quality municipal water and sanitation services without impacting surrounding ecosystems and, on the other hand, participating –with other municipalities and institutions – in coordination activities at the level of the basin or sub-basin (Smits and Butterworth 2006).

Seven months of fieldwork over a three-year period made it possible to conduct a number of interviews, both with households in the El Grullo municipality (in four urban neighbourhoods and three villages) and with key informants (the local authorities of El Grullo and five neighbour municipalities, members of the Ayuquila-Armería Watershed Commission and researchers from the partner institution IMECBIO). These interviews were complemented by direct observation as well as secondary sources of information.

Our results show that despite being well endowed with water resources, the municipality of El Grullo does not manage to provide good quality potable water services. Water distribution is irregular, forcing households to resort to appropriate social practices (e.g. use of various storage methods and alternative water sources). The inequity of irregular water service quality is reinforced by a fixed water fee system, in the absence of meters. Further, the lack of any wastewater treatment station impacts riparian villages and aquatic ecosystems located downstream from the wastewater discharge. Efforts are currently underway to address these issues: the municipality wishes to have water meters installed, and is also negotiating a concession with a private company for a constructed wetland to treat municipal wastewater.

At the regional level, the Ayuquila-Armería Watershed Commission, which was established in 1998, is criticised for the poor effective participation it generates and its lack of means and concrete results. Created in response to local finance priorities, the Inter-municipal initiative of the lower Ayuquila watershed, a negotiation platform that convenes ten municipalities, is in comparison relatively successful. Developed through a ten year trust-building process by researchers from the University of Guadalajara and the directorship of the Sierra de Manantlán Biosphere Reserve, it has enabled the Ayuquila River to regain its original state, as well as set up a series of measures to protect the environment (e.g. the establishment of fire brigades and solid waste separation and recycling programmes). The Ayuquila-Armería Watershed Commission wishes, in turn, to replicate this model throughout the whole watershed. Although the management plan is still to be designed at the basin scale, these inter-municipal initiatives are indeed judged more flexible and better adapted to IWRM implementation.

These results show that in order for the El Grullo municipality to enhance its efforts in terms of IWRM, important changes must take place. More specifically, decentralisation must be reinforced, at the level of both the municipal water board and the Ayuquila-

Armería Watershed Commission. First, potable water tariffs should be set independently by the municipal water board, on the basis of its operating costs – and not on the basis of political calculations, as is actually the case with the Jalisco State Congress. This would help to put an end to the vicious circle entailed by the municipal board's insufficient financial capacity (i.e. lack of staff, limited infrastructure maintenance, heterogeneous water services, lack of meters, non-payment of fees, etc.), along with other factors at stake (such as encouraging a culture of payment). The Ayuquila-Armería Watershed Commission should also benefit from more freedom and resources, in order to increase its credibility among the municipalities its territorial borders encompass. The effective transcription of the 2004 reform of the Water Law, which seems to point in that direction, is awaited by all those interested in this issue.

This thesis thus confirms previous analyses of problems surrounding IWRM implementation in Mexico (Mollard and Vargas 2005b; Tortajada 2005; García L. 2004; Centro Del Tercer Mundo Para El Manejo Del Agua 2003; Martínez R. and Santana 2002b). It also highlights the importance of finding country-specific ways for ensuring effective IWRM implementation. In particular, this may mean considering other scales than those of river basins.

507 Poschet, Lena

2006. Border cities and space transformation: Haiti and the Dominican Republic [in French]

Few borders exist which separate two countries as dramatically disparate as the Dominican Republic and Haiti. Both share the territory of the Island of Hispaniola, but a profound process of differentiation rooted in the colonial division of the island between France and Spain and ideologically maintained by both modern nations, has led to what Théodat (1998; 2003) calls the “twofold insularity” – each country behaves as if it were located on a separate island. In spite of all prejudices and ethnic, historical, linguistic, social, economic or religious differences, people living in the border regions established cross-border relations which, even if largely based on economic interests, are much more frequent and important to both nations than officially admitted (De Jesus Cedano and Dilla 2005; Sillé et al. 2002).

The local dynamic created by this exchange becomes palpable when one observes the busy bi-national market in the border towns of Ouanaminthe (Haiti) and Dajabón (Dominican Republic). Twice a week, people from nearly the whole northern part of both countries travel to these towns, located on either side of the Masacre River, in order to buy and sell goods or to offer services in the market of Dajabón. On the other days, tons of cargo transit to Haiti, to the extent that the once small borderland settlements have become an important junction in the economic subsystem of the northern part of the island. Moreover, the construction of a free zone in Ouanaminthe in 2002 – to pro-

duce textiles for the US-market – has connected the borderland towns to the international economy.

This recent development is set within a context of progressive opening of borders (Martínez 1994). It is the result of international policies that have been decided in the capitals, without consulting the concerned regions. In Ouanaminthe and Dajabón, local institutions are weak and receive little or no financial and administrative support from the central administration. They do not have the means to cope with growing pressure on land and infrastructure, as the emergence of legal and illegal livelihood opportunities in the borderland has generated a threefold increase of the overall population in the past twenty years (Dajabón grew from 8,500 inhabitants in 1980 to 16,000 in 2002 and Ouanaminthe from 7,000 in 1981 to 39,000 in 2003).

How did these recent economic, political and societal transformations shape the urban space in the two borderland towns? I addressed this issue by analysing the motivation of stakeholders involved in the process of spatial transformation, and the impact of their actions. In my work I refer to the conceptual framework of urban intermediation (Bolay and Rabinovich 2004), i.e. the spatial issues that each town has to address according to its internal characteristics, its function in national and international networks, and its relation to the direct rural environment. In order to use this framework for borderland issues, the conceptual part of this study proposes to develop the concept of “borderland intermediation”. To the existing urban intermediation concept, it adds the influence of the characteristics of the border (based on policy and political aspects, economic issues, local identities, social networks, national defence issues and geographical insertion). By doing so, it relates the bi-national system of borderland towns to the intermediation concept.

Data were collected over three and a half years during several periods of fieldwork: observation and mapping of occupation and use of urban space, cartography, and qualitative interviews with local stakeholders and residents, completed by other primary and secondary sources.

This study shows that recent transformations have accentuated the existing unbalanced relationship between the two towns. The powerlessness of the municipality of Ouanaminthe to meet population growth and to impose regulations or taxes related to the growing trade has enhanced its dependency on the Dominican town. For a growing number of Haitians, it is of existential importance to cross over to Dajabón in order to seek income, healthcare and education, despite latent racism and mistreatment. Based on a strong feeling of exploitation, Haitians often criticise the capitalist or even colonialist relationship imposed by their neighbours: not only the fact that the bi-national market takes place in Dajabón, but also that Dominican enterprises develop subsidiaries in Ouanaminthe, taking advantage of cheap labour and the absence of local production.

On the contrary, the majority of Dajabón residents interviewed do not need to cross the river for their living. Most of them have never been to Ouanaminthe, but consider it insalubrious, out of control and dangerous.

Both towns lack application of regulations in urban planning matters. Thus, spatial growth has entirely been ruled by landowner structure and land occupation practices. Around Dajabón, the adjacent land belongs mainly to two landowners, whose strategy – to enhance soil value through development of equipped middle class neighbourhoods – has restricted urban sprawl. In Ouanaminthe land belongs to a multitude of small peasants. The selling and illegal occupation of rather small plots leads to sprawling urban growth, guided by rural pathways and leaving entire parts of neighbourhoods inaccessible to motor vehicles. Population growth has also been absorbed by high densification of existing neighbourhoods.

No formal collaboration exists between the two municipalities. There is informal collaboration involving the two mayors, but overall, cross-border collaboration is left to NGOs and professional associations who militate for human rights, environmental issues and fair treatment inside the bi-national market. International development agencies present in the borderland initiate projects of bi-national concern, but these are disconnected from the local level and strongly influenced by the fact that these agencies relate directly to the central governments.

We also observed a process of internal segregation in both towns, as commercial establishments progressively occupy parts of the town centres and the emergent middle class gathers in specific neighbourhoods. Ouanaminthe and Dajabón are functionally inter-linked and their transformation is undeniably governed by the progressive permeability of the border. Nevertheless, this border separates two completely different urban landscapes that are deeply marked by the internal characteristics of each town. Furthermore, the unequal and complex relationship of both populations creates the paradox that their spatial proximity accentuates segregation in both towns, as it allows the citizens of both countries to stay in their environment and to commute, if necessary even daily.

This study shows that application of the intermediation concept is relevant to the study of complex relationships that govern borderland space. The analysis based on this concept has made it possible to study, on a local level, processes that are taking place on a global level. In so doing, it has allowed us to provide some answers to the central question: “How do local populations, national and international firms and governments react when a territorial economy, based on agriculture, is progressively linked to international networks? “

916 Martinez, Roger

2003. Indigenous agriculture in Talamanca, Costa Rica

The various forms of the use and management of the indigenous agroecosystem of Talamanca are analysed using an applied agroecological focus. The study focuses on ways of living, thinking, producing and valuing indigenous dynamics, based on activities concerned with economic production, techniques and assumptions that take account of the links between culture and nature. The indigenous culture of Talamanca is a socio-historical construct in which agricultural practices are subject to rules and rituals governed by the relationship between spirituality, nature and society. Traditional indigenous knowledge and survival strategies are evaluated on the basis of their own structure of cultural codes established in the KA and Siwa. The indigenous way of life and its forms of social and cultural reproduction emphasise traditional local approaches and reflect important potential elements for sustainable rural development in which the practices of agricultural production and local knowledge in Talamanca correspond with the agroecological approach to agroecosystem management. Hence the multiple forms of managing the Talamancan agroecosystem: gardens, crop rotation, farms with polycultures of bananas and complementary uses (hunting, river fishing, harvesting) are, contrary to the conventional model, a feasible alternative form of sustainable rural development and of resolving the ecological, social and economic problems of the rural sector marginalised by and excluded from the neoliberal globalisation process. Therefore, analysis of the indigenous villages of Talamanca and their relation to the agroecosystem allows for an understanding of their existence, characteristics and importance and what they contribute to an agroecological approach through their agricultural practices. In order to initiate a process of agroecological policies it is necessary to question conventional development with structural changes. Agroecology offers the most viable alternative form of sustainable development where indigenous concepts and their relation to the environment are a livelihood option.

5.8 JACS South America

107 Boillat, Sébastien

2007. The social construction of biodiversity in Andean communities: relevance for ecosystem diversity in the Tunari National Park

The Andean Tunari Mountain Range, located to the north of Cochabamba, the third most important city in Bolivia, was declared a National Park in 1991. However, conflicts between the authorities in charge of implementing the Park, illegal traders of land titles in the Park area, and the affected local population consisting mainly of indigenous Quechua peasants, have so far hindered efficient and ethically acceptable implementation of the Park. This situation can be found in many other protected areas in the world. As a consequence, a “paradigm shift” is taking place: The management of protected areas is shifting from a conservationist approach to a concept of “nature-society hybrids.” This new approach seeks models that allow a use of natural resources capable of maintaining and enhancing both cultural and natural heritage, based on long-term conservation of biodiversity and improving human livelihoods. The potentials and limitations of this paradigm shift are still the subject of wide debate among scholars and practitioners of conservation and development. Whereas some see indigenous and traditional people as the best conservationists, others ignore their ability to conserve biodiversity and promote the return of enforcement-based approaches.

The overall goal of this thesis was to contribute to the development of the emerging approach of “nature-society hybrids” by establishing the basis for a dialogue between the needs of biodiversity conservation and the needs and claims of indigenous and traditional people. It is based on the assumption that indigenous and traditional people may not be conservationists “by default”, because the concept of biodiversity conservation has emerged from a concern of modern science and global policy in the developed world that they do not necessarily share. Nevertheless, indigenous communities may have traditional land use practices that are at the same time deeply rooted in their traditional knowledge and specific cultural worldview, and highly relevant to the conservation of biodiversity. The main objective of the thesis was to analyse the links between traditional ecological knowledge (TEK), land use and the diversity of ecosystems, as a basis for promoting sustainable development – understood in terms of the results emerging from the dialogue between scientific and traditional ecological knowledge.

The thesis takes an extended ethno-ecological approach, in the sense that it considers indigenous people’s traditional ecological knowledge (TEK) as well as specific scientific ecological knowledge (SEK), used for identifying ecosystem diversity in the area, as representations of different forms of knowledge. Each form of knowledge is understood in terms of terms of specific ways of categorising and valuating the environment, and also relative to specific basic assumptions about the nature of the natural, social and spiritual world (ontology) and what humans are able to know about it (epistemology). Methodologically, the thesis combines methods from the social and natural sciences: on the one hand, the different dimensions of TEK, including worldview, values,

and eco-cognitive and practical aspects are assessed using ethnological methods. On the other hand, biodiversity is assessed at the ecosystem level using the phytosociological method, which takes plant communities as a proxy for ecosystems.

The empirical work is based on quantitative and qualitative data generated in two peasant communities located in the Park. In the first one, Chorojo, the Park's regulations are not applied and peasants still practice their traditional activities independently of the restrictions prescribed by Park law. In the second one, Tirani, Park law was partially applied and has forced the peasants to significantly adapt their traditional ways of life to urban influences which are also strong because of the fact that their territory is at the border of the expanding urban area of the city of Cochabamba.

The results of the study of TEK show that current land use in the two peasant communities cannot be understood by considering only specific cognitive and technological aspects of knowledge. Rather, land use builds on the ontological, epistemological and normative principles that are inherent in TEK: the basic ontological assumption consists in the idea of the non-separation of nature and culture. As a consequence indigenous people do not perceive something like "wilderness" as opposed to cultural landscape: all human activities are distributed and diversified throughout the territory of the community, privileging extensive over intensive use of natural resources. The peasants characterise the territory as either "high-dry-cold" (male expression) or "low-wet-warm" (female expression). Land use is organised in such a way that these characteristics are complemented, configuring a specific system of natural resource use and associated forms of production. The crop fallow system and the grazing circuits are organized according to a cyclical perception of space-time units which link natural resource use to mythical and spiritual aspects.

Finally, peasants conceptualise changing ecological conditions as the result of the intentionality and agency of Pachamama, the "mother of everything in space and time." The consistent interpretation of the indicators of these ecological conditions as "signs" of Pachamama provides the basis for a highly dynamic and flexible system of land use.

The results of the study of plant communities show that most plant communities (defined on the basis of their floristic composition and structure) identified in the area depend on current or past land use. Long fallow periods, as well as different intensities of grazing and burning of pastures, have the effect of multiplying the number of human-induced plant communities. Ecosystem diversity is greatest in areas where plot-based rain-fed cultivation and agroforestry are practiced in rotation with grazing; it is lower in areas where grazing or crop cultivation is more intense as well as in areas with less human intervention. This suggests that the "intermediate disturbance hypothesis" may also apply to ecosystems. The traditional community of Chorojo lives in a dual landscape (based on the non-separation of used and protected areas), which is, however, partially threatened by soil erosion processes and lack of regeneration of vegetation due to high stocking rates. In Tirani, the implementation of the Park created a first version of a dual landscape (creating protected versus used parts in the territory). This results in

a loss of TEK mainly due to the abandonment of the use of the higher areas and the exotic tree plantations in the central part of the community's territory. This has translated into lower degrees of ecosystem diversity, revealing a negative impact of the Park.

A comparison of the different dimensions of SEK and TEK shows that, firstly, SEK divides the landscape into ecosystems according to pre-defined indicators of vegetation: characterisation precedes definition. On the contrary, TEK divides the landscape into evidently perceived, culturally and historically shaped or spiritually revealed units. These "places" or toponyms are assumed to be living parts of the living landscape. In this case, definition precedes characterisation. Secondly, whereas SEK ascribes an intrinsic value to the global diversity of nature, TEK tends to ascribe an intrinsic value to the local diversity of relationships between nature and society. This difference may, however, lead to overlaps in practice, because ecosystems characterised by intermediate disturbance are highly valued by both forms of knowledge. Thirdly, SEK and TEK are based on different ontological assumptions: in SEK, nature and culture, object and subject, and the material, social and spiritual worlds are separate. In TEK, all these aspects are merged in a fundamental unity of the natural, social and spiritual world. SEK and TEK share, however, the characteristic of being highly dynamic and non-dogmatic forms of knowledge. This opens the possibility of a dialogue through which pathways for more sustainable development of the Park area could be envisaged: The resulting negotiation and learning processes between the representatives of the different forms of knowledge allows translation of the highly general principles of sustainable development into concrete socio-environmental, cultural and historical contexts. This is only possible if the dialogue embraces self-reflective communication within and between the actor categories involved concerning the ontological, epistemological, normative, eco-cognitive and practical dimensions of each specific form of knowledge. The ethno-ecological approach has proven to be a powerful tool to address the knowledge and values of social groups, and thus promote conflict mitigation at the local level. Further research should be carried out to make this approach operational at broader scales.

The main recommendations for promoting sustainable development through the establishment of "nature-society hybrids" are, on the one hand, that the potential of indigenous peasants' traditional ecological knowledge should be acknowledged. The revitalization of TEK in the framework of endogenous processes of knowledge production should be enhanced to provide a solid basis for a dialogue between forms of knowledge which can be broadened to fundamental dimensions. On the other hand, conditions of action that enable practical implementation of the knowledge gained through endogenous and dialogue-based processes should be sought. This implies strengthening collective property rights as well as developing a positive social and economic attitude towards traditional activities and their products. If protected areas are thought of as a tool to establish "nature-society hybrids", they should be reconceptualised in order to support cultural landscapes and their dynamics as well as to respond to the demands of local communities. In the case of the TNP, this means clearly that the category of the Park and its legal framework should be reviewed. In this context, the establishment of

social, political and economic support from the valley for the highland communities could be a key element in addressing unsustainable processes.

In addition to promoting and up-scaling the ethno-ecological approach, theoretical recommendations include, on the one hand, supporting the emergence of global and regional forms of knowledge based on different ontologies rather than what is inherent in scientific knowledge. On the other hand, scientific ecological knowledge should be used jointly with TEK to study and promote ecosystems characterised by intermediate disturbance and resilience.

803 Galvin, Marc

2004. Métisse knowledge. An analysis of strategies for protecting traditional knowledge in Peru [in French]

This study examines the mechanisms at work in the production of international norms and their enforcement at the national level. Among these mechanisms, which are supposed to generate local answers to global issues, the study focuses more specifically on interests (of diverse nature) that are not openly voiced: individual benefits produced in collective action, which are more often reaped by the instigators than by the supposed target group. The thesis in hand proposes an explanation for this mechanism, which it analyses in the context of multi-level governance currently characterising global action to regulate natural resources and traditional knowledge. The hypothesis is proved by combining the deconstruction of a concept (traditional knowledge) with an examination of the networks (international and national) of actors who exerted a strong influence in the development of the Peruvian Law for the Protection of Collective Knowledge of Indigenous Peoples (Law 27811 of Peru), which was adopted in 2002. Case studies offered a framework for empirical observations with regard to social practices related to capitalising on local knowledge.

The debate is framed in the following manner. Based on studies in ethnobiology and cultural ecology, certain international forums – among others, that of biodiversity – took over the topic of traditional knowledge in the early 1990s, gradually integrating the concept in the normative framework regulating environmental issues. The best example is Article 8.j) of the United Nations Convention on Biological Diversity (UNCBD). The ideological postulates of the UNCBD have permeated Law 27811 of Peru, which, since its adoption in 2002, has established a national legal framework for protecting the collective ecological knowledge of indigenous populations. In a way, this law demonstrates the procedural efficiency of the UNCBD. Above all, however, we consider this application at the national level to be the result of intellectual influences exerted by specialists throughout its development, from the initial conception of ideas up to their institutionalisation.

It is particularly interesting to see how the principles and ideologies promoted by epistemic communities (global networks in charge of producing expert assessments) flow into national-level debates, while at the same time they are updated and contextualised in consideration of national realities and influences (policy and economy), and thus directed in new, unexpected directions. These national influences also mask issues of dependency at the international level.

Our case studies show that under indirect pressure from the international system of development cooperation, negotiations regarding Law 27811 gradually drifted away from the initial objectives. These were corrected after reviewing the issues at stake, strengthening certain actors at the cost of others. Law 27811 is more the random result of an accumulation of diverse interests and of the opportunism of certain Peruvian actors, than a response to locally perceived and expressed needs. Although many actors showed great interest in the development of this law, the reluctance of the administrative bodies in charge of enforcing it seems to confirm that the main stakes in the process concerned the transactions around its development and exploitation, rather than successful implementation from the perspective of the target populations.

There is little chance that the official policy for the protection of traditional knowledge in Peru will be capable of achieving its announced objectives. However, this failure is relative in so far as the policy also generates benefits (symbolic, political, economic) for certain actors, based on a shift of objectives at different levels (international, national, local). This shift in objectives fits into the logic of mechanisms (brokering) inherent to the procedures that structure the application of norms in the context of international aid (for both development and conservation).

Finally, the failure (even the relative failure) of a public policy in a context of strong conditionality by international networks can be explained precisely by the logic of this system of normative transmission – a system that relies on indispensable mediators who are primarily interested in the advantages that this transmission confers to them. This system transports ready-made answers (ideologies) that despise local contexts (social realities) and needs (political participation).

5.9 JACS Alps

109 Baumgart, Kati

2005. *Evaluation of landscape development projects in the Swiss Alps: the method of Discrete Choice Experiments*

The landscapes of the Swiss Alps have been subject to an accelerated process of change with durable visual effects in recent decades. Different kinds of landscape development projects ranging from infrastructure development to conservation projects add to this process of change. When it comes to the evaluation of effects and benefits of landscape development projects, conflicts arise between different stakeholders and interest groups from inside and outside the region. In particular, the question of evaluating landscapes' visual properties cannot be answered, due to the fact that these visual properties are – in terms of economic theory – a public good and therefore without market value. Since landscape and its visual properties are a limited resource, it is most important to integrate visual properties and a reference value in the evaluation process of landscape development projects.

The aim of the research was to use the method of Discrete Choice Experiments to evaluate landscape development projects in the Swiss Alps and determine a monetary value for the visual properties of landscape and landscape change. The results will enable more comprehensive evaluations in the process of regional planning and decision making and will help to mitigate land use conflicts between different stakeholders.

Using the quantitative method of Discrete Choice Experiments, 889 tourists and 750 local inhabitants were questioned in the Bernese Oberland-Ost between winter and summer of 2004, adding up to almost 20,000 decisions in regard to the evaluation of landscape development projects. In each Discrete Choice Experiment, the person questioned was asked to choose between the status quo (situation without project) and the demonstrated variant of the project. By applying a Random Effects Probit Model to this data, it was possible to estimate (marginal) willingness to pay (WTP) a particular price (in CHF) for different attributes of the projects (e.g. change in the visual properties of landscape) as well as for different variants of the projects.

The results of the study showed, for example, that the WTP of local inhabitants for the preservation of today's landscape is as high as CHF 40 in additional taxes per year. The WTP for the project attribute increase of habitats (flora/fauna) is CHF 118-140 in additional taxes per year, which is an estimate three times higher than for the preservation of today's landscape. For the change in visual landscape properties due to a housing development project, a maximum negative WTP of CHF 637 was assessed. That means that the local population is not willing to accept a change in landscape due to a housing development project until they receive an annual reduction in taxes of CHF 637 as compensation. In a second step, socioeconomic characteristics of the individuals were tested for their influence on the decision: e.g. the WTP of local women for the visual properties of landscape is significantly higher than the corresponding WTP of men

(CHF 36 CHF and CHF 12, respectively). Furthermore, in contrast to older tourists, tourists younger than 30 years of age were willing to pay CHF 2 more per day per transportation ticket for a one-month prolongation of the skiing period.

This research can lead to a more comprehensive evaluation of landscape development projects, based on estimated monetary values for the visual properties of landscape and other attributes of such projects, while the predominant socioeconomic characteristics influencing the decisions of different stakeholders can also be more clearly identified. Of course, the application of Discrete Choice Experiments to assess the visual properties of landscapes as one part of a comprehensive evaluation process is linked with higher costs and is time-consuming. But if investors in landscape development projects are willing to invest in Discrete Choice Experiment to achieve additional information, conflicts could be recognised and solved at an early stage of the planning process.

922 Müller, Urs

2006. The power of images in sustainable development: their construction, replication and strategic use in the shaping of Alpine development [in German]

This research project examines the visual and verbal communication of the UNESCO Biosphere Entlebuch (UBE) and the Jungfrau-Aletsch-Bietschhorn World Heritage Site (JAB). Both are model regions with regard to sustainable development and were approved by their inhabitants in popular votes. Analysis of information material on each of the two projects reveals the mental images that actors involved in material image production associate with sustainable development. In more concrete terms, analysis based on human geography is intended to reveal which types of land use and space appropriation are considered desirable in a sustainably developing region according to the visualised perceptions of different image producers. Since the information and illustrations succeeded in persuading majorities of the respective populations to grant their approval, it can be assumed that the presentations of the two projects also correspond to the conceptions of the image consumers. Consideration of earlier and later presentations in addition to the information material issued immediately before the votes made it possible to determine whether and how perceptions change. A comparison of publications produced within the respective region with publications produced by outsiders, for an outside target public, revealed different perceptions.

When looking at visual and linguistic images produced with a view to communicating, it is necessary to consider the fact that the meaning of these images is constituted in a trilaterally structured process. Mental images of certain image producers are – more or less intentionally – expressed in material images. Generally, these are produced with the intention of influencing the mental images of other actors, or of appealing to them with a view to inducing certain actions. How the material images are perceived and how they take effect depends on the previously internalised mental images of the recipients. Communication can be considered functional when the meanings perceived by

image producers and image recipients are roughly identical, i.e. if producers and recipients collectively share interpretation schemes (social images). Each of the three aspects of the meaning of an image – intended, inherent and received meaning – requires its own methodological approach. A comprehensive understanding of visual communication is, finally, achieved through a synthesis of the various approaches. In the sense of a triangulation of methodologies (Backhaus 2001) this study approaches the trilateral constitution of the meanings of the images from various perspectives with several different methods. The analysis of material images, with a focus on visual images, constitutes the methodological priority and entry point. Visual images are taken as a basis for determining social images, collectively shared assignments of meanings and forms of appropriation – and, thus, the values associated with sustainable development – in the two case study regions.

It is imperative for a study that intends to explore the power of images in sustainable development to consider various understandings of sustainable development. There are two reasons for this: First, a concrete understanding of sustainable development determines how the notion is conveyed, i.e. by means of which contents, values and associations. Each concrete understanding of sustainable development is based on certain values that visual communication can appeal to. For example, someone who understands sustainable development as intergenerational justice might communicate this through positive images of children, while someone who understands sustainable development as nature conservation will seek to appeal to the values that the recipients assign to nature, through images showing the beauty of nature. A widespread strategy in environmental communication and fund-raising campaigns is to appeal to negative emotions. This strategy uses images that represent threats to central values held by the recipients (images showing natural disasters, environmental destruction, famished children, and similar motifs).

Second, any interpretation of concrete visualisations of sustainable development must refer to a clear concept of how sustainable development should be understood. The present study subscribes to a constructivist understanding of reality, according to which any unmediated perception of so-called facts is considered impossible. This means that images do not simply reproduce reality, but construct it with reference to existing interpretations and interests. Based on these reflections, the present study adopts a discourse on ethical, deliberative understanding of sustainable development as a benchmark (Habermas 1999). Accordingly, sustainable development is to be understood as a long-term process of searching, learning and shaping, where project objectives are negotiated in a shared social dialogue. (Visual) communication of sustainable development should thus be inviting, rather than excluding, with a view to convincing as many people as possible of the project and empowering them to act. Measured against this standard, horror scenarios that spread a sense of helplessness and biased interpretations of sustainable development that polarise society are equally useless.

The present study examined around 530 visual images (mainly photographs) from eight media (including information brochures and articles in the two main regional newspa-

pers). No advertisements or campaign posters were issued during the study period. The individual visual images were evaluated by means of content analysis, in order to reveal the mental images of the two regions and their sustainable development that the visual images transported. The method of abduction (Scheff 1990) was used to develop suitable categories of space appropriation, which were approximated to the context-specific interpretations by referring to the captions, as well as verbal images contained in the surrounding context. A detailed review of the respective histories and characteristics of the two projects provided a framework for incorporating the insights gained from image analysis, thus creating a basis for understanding the power of images. The content analysis was complemented with a structural hermeneutic symbol analysis (Müller-Doohm 1997) of selected visual images.

Image analyses of the various media revealed striking differences in how the projects and the notion of sustainable development were presented. In the case of the UBE there was a marked contrast between the internal and external views, as well as between publications issued before the vote and after. With a few rare exceptions, the external view of the UBE upholds the clichés of a natural, idyllic and traditional Entlebuch. The chosen images convey impressions from this model region for sustainable development that shape the recipients' conceptions in understanding sustainable development primarily as nature conservation and musealisation of precious cultural landscapes. The comprehensive, multidimensional meaning of sustainable development is left aside, the model character of regional development efforts is presented in a biased way, and interests other than conservation are excluded.

By contrast, media within the Entlebuch itself presented the biosphere as a modern space for living and economic activity, while the beauties of nature were practically entirely left out. An important share of the image area was taken up by role models – individuals demonstrating concrete ways of implementing sustainable development. At the same time, the initiators of the UBE succeeded in convincing nearly all opinion leaders to support the project. This internal view can be understood when seen against the context in which the biosphere project developed. Great significance must be attached to the Rothenthurm popular initiative of 1987, a vote that resulted in protection of the Rothenthurm mire landscape. The protected areas required for the UBE core zones had thus already been approved, and the biosphere project did not involve any further establishment of protected areas. Consequently, it was not presented as a conservation project.

While the difference between internal and external perspectives is striking, the analysis also showed that the recognition of the UBE by UNESCO was followed by a marked change in the images used both in internal and external presentations. There is a clear tendency of the internal perspective to adopt the external perspective, and vice versa. Two years after the votes, the UBE had clearly begun to showcase its natural highlights, intending, on the one hand, to reach a target public outside the region itself and therefore seeking to appeal to the values held by this target public, and, on the other hand, aiming to raise awareness of the region's natural beauty also to its own inhabitants. By

contrast, outside perspectives had begun to show an interest in the economic boom taking place in the Entlebuch, as well as the innovative people behind it, thereby conveying to the outside public a new image of mountain inhabitants that transcends the clichés, along with a more comprehensive understanding of sustainable development.

In comparison with the UBE, the JAB was presented through images of a strikingly different type, the majority of them being aesthetic, professional photographs of landscapes, with the Aletsch Glacier staged as the dominating motif in both internal and external presentations. The Aletsch region is shown to be clearly more natural and traditional than the Entlebuch, as if the information was addressed to visitors from outside, rather than the inhabitants of the region itself. The constant repetition of picture-book landscape impressions acted as “visiotypes” (Pörksen 1997) that were surrounded with a strong associative aura of emotions and values. The aesthetic images were intended to evoke positive emotions and thus motivate people to support the project. However, eager to learn about both the advantages and the disadvantages of the World Heritage Site status, some of the directly involved inhabitants deplored a lack of information. The JAB was visually presented as a conservation project and was thus not able to appeal to values based on economic needs. Unlike in the Entlebuch, there were no pictures of individuals demonstrating innovative ways to build a sustainable future. Generally, the topic of sustainable development hardly entered public debates during the study period (up to recognition by UNESCO).

The present study provides an exemplary demonstration of how image analysis can be used to access (socioculturally influenced) mental images, i.e. the usually unreflected, routinely working value structures of, and assignments of meaning by, image producers and recipients. According to structuration theory, these constitute the actual motivations for action (Giddens 1984). The space appropriation categories developed in this study made it possible to translate predominantly visual presentations of spaces into a clearly structured overview similar to a land use statistics and identify different, possibly conflicting notions with regard to space appropriation.

The insights gained from the case studies allow for conclusions that go beyond the context-specific power of images, applying also to other attempts to urge actors towards sustainable development. Reflecting the habits guiding the use of images is particularly important considering the continuing significance and, thus, the increasing number, of visualisations in communication in general. External perceptions of rural areas, in particular, should be questioned. The use of images should comply with criteria that reflect the multitude of existing perspectives. The categorisation of images developed in this study can serve as a basis for image selection in media in the context of space and landscape representation.

Securing a diversity of perspectives in visualisations of sustainable development also constitutes an inviting strategy for appealing to different population groups and individuals by referring to their respective values and interests, with a view to involving them in the participatory process. Based on the fact that activities of other individuals

play an important role in influencing our own behaviour, images showing individuals who demonstrate that sustainable products can be successfully produced and marketed are of pivotal importance in establishing sustainable development. In fact, there is no other way of convincing people to switch to sustainable production, than showing them successful examples.

In conclusion it should be noted that images can certainly support, but by no means replace discourse. While images can encourage discourse, their emotional effects can also hinder or block it. The use of images in the media should therefore be subject to critique and debate. Critical, but fair, regional newspapers as forums for different perspectives play a pivotal role as media of participatory sustainable development, as they accommodate a type of communication that is considerate of its recipients and relates to everyday experience. Care and cultivation should therefore not only be given to cultural landscapes in the narrow sense of the word, but to media landscapes, as well.

5.10 References

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List of Abbreviations

AFWeP	African Floodplain Wetlands Project
AOP	advanced oxidation processes
APSIM	agricultural production simulator
CBO	Community based organisations
CETRAD	Centre for Training and Integrated Research in Arid and Semi-Arid Lands Development
CHF	Swiss Frank
CPR	common pool resources
CSO	civil society organization
DPEP	District Primary Education Program
DRs	direct repeats
ENSAP	Eastern Nile Subsidiary Action Program
ETR	exact tandem repeats
FSP	Forest Sector Project
GBAO	Gorno Badakhshan Autonomous Oblast
GIS	geographic information system
ICDP	Integrated Conservation and Development Project
IMEC BIO	Instituto Manantlán de Ecología y Biodiversidad
IUCN	World Conservation Union
IWRM	integrated water resources management
JAB	Jungfrau-Aletsch-Bietschhorn
KCA	Kangchenjunga Conservation Area
KCAP	Kangchenjunga Conservation Area Project
LMB	Lower Mekong Basin
LTB	Lake Tana Basin
LUCCs	land use/cover changes
LULCC	land use and land cover changes
MFA	material flow analysis
MIRU	mycobacterial interspersed repetitive units
MMFA	Mathematical Material Flow Analysis
MTC	M. tuberculosis complex
NAFTA	North American Free Trade Agreement
NBI	Nile Basin Initiative
NCCR North-South	National Centre of Competence in Research North-South
NGO	non-governmental organization
NWFP	North-West Frontier Province
PAMS	Partnership Actions for Mitigating Syndromes
SAP	structural adjustment programme
SEK	scientific ecological knowledge
SHG	self help group
SLM	sustainable land management
SMURF	system for the monitoring of urban functionalities
SOC	soil organic carbon
SVP	Shared Vision Program
TEK	traditional ecological knowledge
UBE	UNESCO Biosphere Entlebuch
UNCBD	United Nations Convention on Biological Diversity
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
VNTR	variable number tandem repeats
WTP	willingness to pay
WUA	Water Users Association

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The NCCR North-South is one of twenty National Centres of Competence in Research currently supported by the Swiss National Science Foundation (SNSF). It was created in the understanding that development research and cooperation are matters of primary concern to Switzerland. The purpose of the NCCR North-South is to create an institutional structure for sustainable development studies in Switzerland. Additional substantial funding for research and cooperation projects in developing and transition countries is provided by the Swiss Agency for Development and Cooperation (SDC).

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- Integration of disciplinary, interdisciplinary and transdisciplinary research
- Interactive exchange of development research and practice
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