



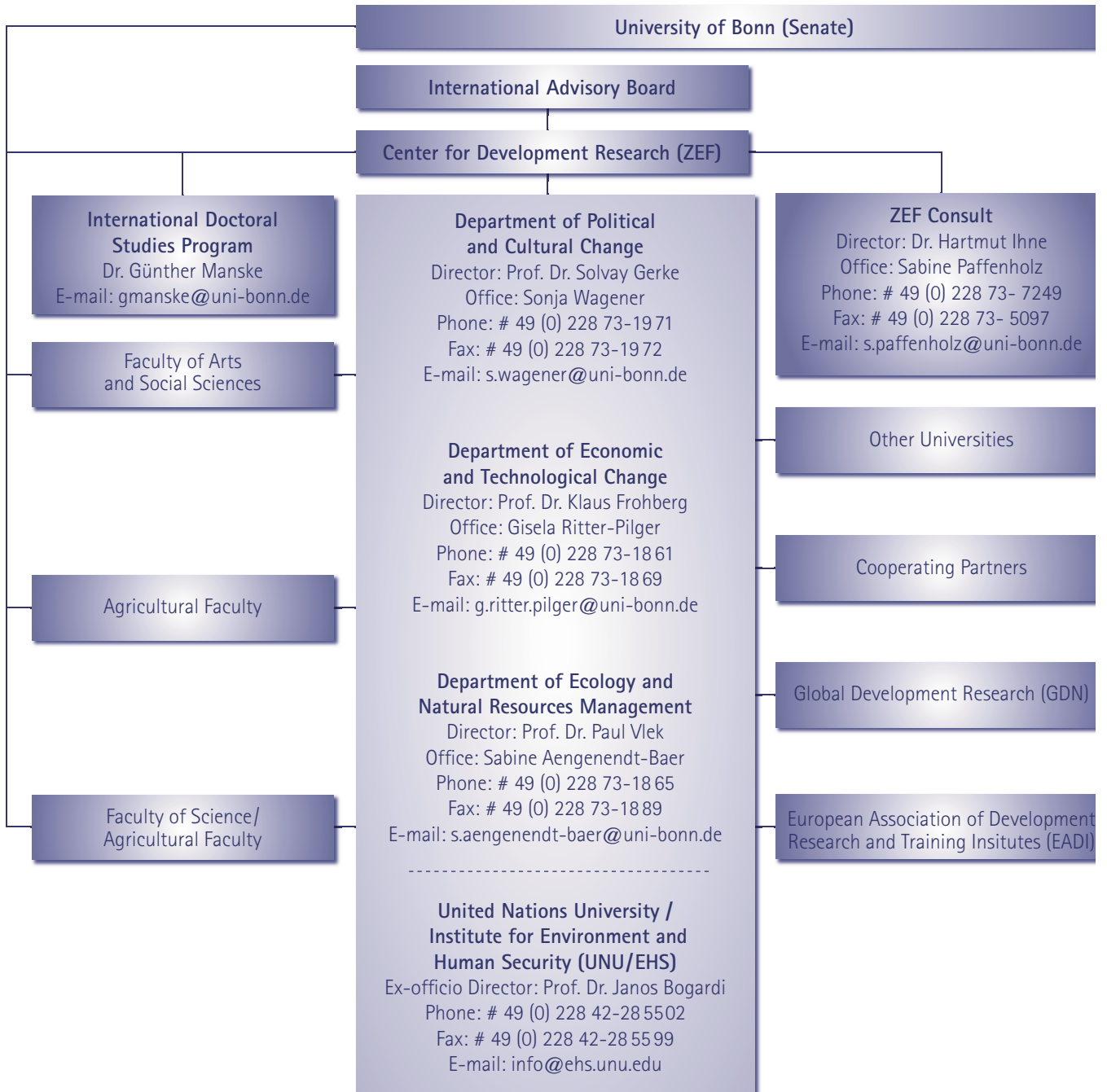
Zentrum für Entwicklungsforschung
Center for Development Research
University of Bonn

ZEF Annual Report 2005/2006



Knowledge and Development

Organizational Structure of ZEF



Preface by Prof. H. J. A. van Ginkel.....	3
Introduction.....	4
Lead Article: Knowledge and Development.....	7
Chapter 1. ZEF Projects with a Focus on Knowledge Systems and -Management.....	16
■ Knowledge and Development in Uzbekistan.....	16
■ Local Governance and Statehood in the Amu Darya Border lands.....	19
■ Knowledge Management for the Conservation and Use of Wild Coffee in Ethiopia.....	22
■ E-learning in Developing Countries.....	24
Chapter 2. Interdisciplinary Research.....	26
2.1. Governance.....	26
■ Governance and Conflict.....	26
■ Governance of Natural Resources.....	28
2.2. Land and Water Use.....	29
■ Economic and Ecological Restructuring of Land and Water Use in Khorezm.....	31
■ Climate Change in the Volta Basin (GLOWA Volta).....	35
■ Social Water Management.....	40
■ New Approaches to Adaptive Water Management under Uncertainty (Newater).....	41
2.3. Trade and Globalization.....	43
■ Trade, Social Standards, Labeling.....	43
■ Agricultural Trade Liberalization.....	45
2.4. Biodiversity.....	47
■ The CoCE Project on Coffea arabica in Ethiopia	47
■ BIOTA West Africa.....	51
■ BIOTA East Africa.....	53
■ Genetic Resources Policy Initiative (GRPI).....	54
Chapter 3. Research with Cooperation Partners.....	56
3.1. UNU-EHS: Tsunami.....	56
3.2. GWSP: Virtual Water Trade.....	56
Chapter 4. Capacity Building.....	58
■ The International Doctoral Studies Program.....	58
■ Outstanding Doctoral Theses.....	62
Chapter 5. Policy Dialogue: ZEF Consult.....	71
Chapter 6. Public Awareness	73
Chapter 7. Academic Output	77
Chapter 8. Budget/Funding Partners	82



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Preface: What to Know about Knowledge

"Knowledge is like light. Weightless and tangible, it can easily travel the world, enlightening the lives of people everywhere" is a by now famous quotation of a World Bank report stressing the crucial role of knowledge in human development. Nevertheless, knowledge resources seem to be as unequally shared around the globe, as is the case with natural resources.

This is why issues such as the digital divide, knowledge gaps as well as knowledge traps are dominating the development discourse in disavowal of the weightless global journey of knowledge. If knowledge is one of the driving forces of development, lacking knowledge or lacking access to knowledge can entrench poverty and inequality and further widen the gap between the "haves" and "not-haves" on this world.

ZEF acknowledges the crucial role of knowledge for sustainable human development. It considers itself a knowledge producing, knowledge sharing, and capacity building institute contributing to sustainable human development. Research issues are tackled in long-term projects based on transdisciplinary research strategies in which knowledge sharing between ZEF researchers and cooperating national and international research institutes and other stakeholders are of critical importance.

Therefore, ZEF has chosen the role of knowledge in human development and in development research as the focus for this Annual Report. The lead article covers among others the causes of the so-called knowledge gap and shows ways on how to close the gap. It further relates how to counteract the loss of local, traditional, and indigenous forms of ecological knowledge and rather how to build on it. Further on in the report you will find examples of the role knowledge loss and transfer play in ZEF's research projects and how these issues are being dealt with. Moreover, this Annual Report shows how ZEF is contributing actively to capacity development and building.

It is a pleasure for me to write this preface in my function as the new Chair of ZEF's International Advisory Board. I am looking forward to cooperating with ZEF's directors and staff in developing further strategies to bridge gaps between the knowing, the apparently knowing, the non-knowing, and the eager-to-knowing in this world. To make the right distinction between these different categories of human resources might in the end be as much a challenge as making an index of the availability and distribution of natural resources. ZEF's research strategy, which has just been updated, its research experience, as well as its track record in capacity building, are a promising basis for further efforts in generating and sharing knowledge. Thus, development research can contribute to a better life in a safer world for all, including future generations.



Hans van Ginkel



Prof. Dr. Hans J. A. van Ginkel is United Nations Under-Secretary General and Rector of the United Nations University.



Introduction



Paul Vlek

This Annual Report highlights the progress made in our research and outreach activities since mid 2005. We can look back on a stable and productive year. Stability is no excuse complacency. As we approach the 10th anniversary, ZEF's directors and senior staff members have been exploring new avenues of science which will culminate in an updated strategy paper with a research road map for the next 10 years. The paper is due to be published this year. But new directions and plans do not mean discontinuity. In fact, ZEF's large transdisciplinary projects on water, land and biodiversity, by now the institute's trademark, have all been through a process of evaluation and are or are close to being approved for continuation. A number of other projects have been submitted to approval and funding procedures, for instance a transdisciplinary research project on Wetland management in Vietnam in collaboration with the German Aerospace Agency (DLR). A project on Governance of Diversity in the Straits of Malacca is under consideration by the DFG.



Solvay Gerke

The Federal Ministry of Education and Research (BMBF) has approved funding of the third research phase of the ZEF-led GLOWA Volta project on the regional impact of global environmental change in the West African Volta basin. This is an important milestone not only for ZEF as an institution, but also for the around 40 scientific staff members involved in the project, two-thirds of them coming from Westafrica. Twenty-five students have completed their doctoral and master studies in the context of the program in June 2006. The cooperation with the local partners as well as the local stakeholders, already a hallmark of ZEFs research approach, is going to be intensified in the final research phase.



Klaus Froberg

The project on "Conservation of Coffea arabica in the montane rainforests in Ethiopia" (CoCE) has attracted an enormous amount of public and media attention during its first research phase, which expired in July 2006. The BMBF has already cleared the next research phase without interruption. ZEF's focus on knowledge transfer has led to the establishment of the ECFF (Ethiopian Coffee Forest Foundation), a non-governmental organization in Ethiopia. It has been set up to play an important intermediary role between the project's stakeholders and in the envisaged implementation of the research results into practice.

ZEF has also submitted a proposal for a third research phase for its project in Uzbekistan on "Economic and ecological restructuring in Khorezm" due to be examined by the BMBF this year. Local capacity building is an important component of this project, involving 78 international scientists (mid 2006). Supported by an excellent research infrastructure set up by the project in Khorezm, 25 bachelor students and 27 master students are being educated in Uzbekistan, while 22 students are participating in ZEF's International Doctoral Studies Program for Development Research (IDSP). Nine students have finished their doctoral theses so far, seven of them are from Uzbekistan.

ZEF's IDSP can now reap the fruits of seven years of hard labor. A survey carried out this year among former participants shows that the main target of the program, which is to train future decision-makers from developing as well as from industrialized countries for international careers in a development-related context, is being achieved. One of the outcomes of the survey was that 60% of the graduates from developing and transition countries returned to their home countries to take up promising positions. Others took up positions in international organizations and research institutes.

ZEF's project on "Local governance and fragile statehood in the Amu Darya Borderlands", focusing on border relations in the region between Uzbekistan, Tajikistan, and Afghanistan is making significant progress despite difficult research conditions in parts of the area. The project—funded by the Volkswagen Foundation—benefits from the excellent cooperation with the non governmental organ-

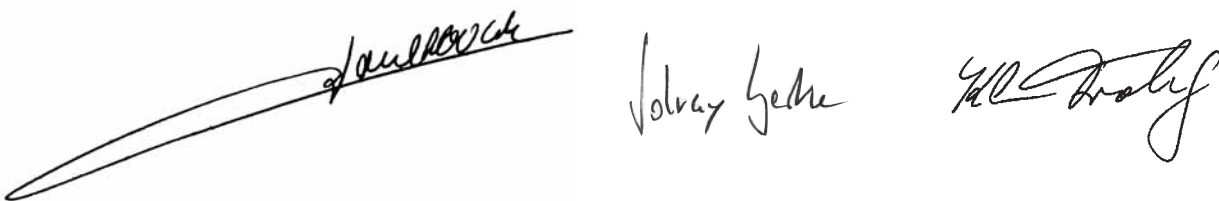
isation "German Agro Action" (DWHH). This NGO has experts and infrastructure in Afghanistan, facilitating ZEF's research under sometimes difficult circumstances. This also applies to ZEF's research on "Social management of water in Afghanistan", being carried out in cooperation with Wageningen University and the EU-funded project on "New approaches to adaptive water management under uncertainty" (NeWater), in which ZEF is carrying out a research component in Uzbekistan.

ZEF's asset of being a stepping stone to promising careers, has an unfavorable institutional side effect: Also in the past year ZEF had to part with a number of excellent staff members pursuing their careers all over the world. However, ZEF's alumni and experts network is guaranteeing a continuous close cooperation with them.

ZEF has consolidated and intensified its collaboration with its international research partners especially in the framework of its projects. But it also strengthened local ties with research partners such as the United Nations University's Institute for Environment and Human Security (UNU-EHS) and the Global Water System Project (GWSP) in the context of joint research efforts and the International Doctoral Studies Program. In addition, ZEF, the UNU-EHS, and the Global Water System Project (GWSP) organized a joint lectures series on issues related to water ("Water Lectures") reaching out to the expert community as well as to a general audience. Moreover, ZEF intensified its cooperation with several institutes of the University of Bonn, especially with the Faculty of Agriculture on planning a joint graduate program on "Global Change: Challenges for food security and sustainable resource management". ZEF also institutionalized its efforts to have policy impact by establishing a unit called ZEFConsult. As you can read in this report, ZEFConsult focuses on improving ties and exchange between policy makers and science.

At this point we want to express special thanks to our main donors, which are the German Federal Ministry of Education and Research (BMBF), the Federal Ministry for Economic Cooperation and Development (BMZ) and the German Technical Cooperation (GTZ), the German Academic Exchange Service (DAAD), the Robert Bosch Foundation, the Dreyer Foundation and the Volkswagen Foundation. Also our partners in Germany and abroad deserve our gratitude and are a source of pride. Their solid support enables ZEF to continue its efforts to make a substantial contribution to development research and capacity building.

We wish you an interesting read of our Annual Report.

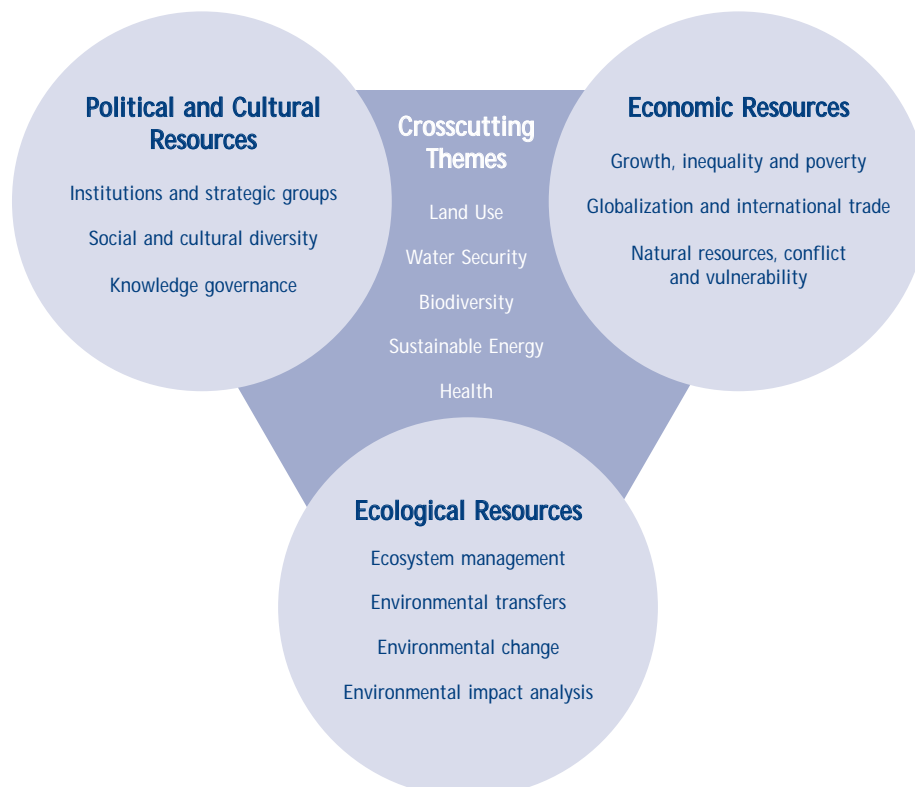
Three handwritten signatures in black ink, arranged horizontally. The first signature on the left is a long, sweeping stroke. The middle signature is more compact and legible. The signature on the right is also compact and legible.

ZEF's Directors

ZEF's Research Approach

The Center for Development Research (ZEF) is an international and interdisciplinary scientific research institute of the "Rheinische-Friedrich-Wilhelms" University in Bonn. It was founded in 1995 and started its actual research activities in 1997. ZEF's research aims at contributing to solutions to global development issues. ZEF's approach is built on three pillars:

- **Research:** By covering three main research areas, which are interrelated through interdisciplinary research projects, ZEF offers a broad and integrated perspective on development. Since development is rarely constrained by a single problem within a single discipline, ZEF works on crosscutting themes of central importance for the developing world. The research programs build on the methods and analytical styles of the disciplinary research areas and link and integrate knowledge and capacities from different ZEF's departments. ZEF's major three research areas are: Political and Cultural Change; Economic and Technological Change; Ecology and Natural Resources Management. Results of ZEF's research are published in its own series, the ZEF Discussion Papers on Development Policy, in books, and renowned scientific journals.
- **Capacity Building:** Through its International Doctoral Studies Program for Development Research, ZEF intends to strengthen the international development research community in Germany, Europe and the developing world. The program aims at educating highly qualified scientific staff, advisers and managers for both the private and public sectors. In its size and concept, the program is unique, and ZEF has already become an institution of high and worldwide reputation.
- **Policy Dialogue & Public Awareness:** ZEF's research and other activities are carried out in close cooperation with national and international partners. In addition, ZEF maintains an active dialogue with representatives from governmental and non-governmental bodies, with national and international organizations for development cooperation as well as the private and business sector. To support its objectives and tasks, ZEF organizes international workshops and conferences, expert rounds and its Public Lectures on development issues.



Lead Article: Knowledge and Development

by Hans-Dieter Evers, Franz Gatzweiler, Solvay Gerke, and Paul Vlek

1. Knowledge—the Basis of Capacity Building and Capacity Development

Since the 1990s the concepts of "capacity building" and "capacity development" have been among the major topics in development discourse. Capacity development according to the World Bank Institute (WBI) means "unleashing the power of knowledge to enable a world free of poverty". According to the United Nations Development Programme (UNDP), capacity building aims at "improvements in the ability of public sector organizations to perform appropriate tasks". Both organizations focus on the development of local capacity in developing countries.

Capacity building was originally authorized as a development strategy in 1993 at a conference of the African-American Institute in Reston, Virginia, USA. By putting capacity building on the agenda of the World Bank, UNDP, and other international and national development agencies were channeling funds into programs with capacity building as one of their components. Capacity building in their perspective was an instrument for developing countries to improve the ability to implement structural reform programs or other development strategies.

Adoption of the capacity building strategy implied recognition of the fact that developing countries can rarely pull themselves up by their bootstraps and capacities need to be built up by expatriate agencies. Often, development experts lay claim to superior knowledge in various fields and sectors. Capacity building then becomes the transfer of this knowledge to others that use it to perform functions in the development process. Local knowledge and locally existing capacities are often ignored in the process (unless they fit into the expert scheme of thinking).

Knowledge is increasingly recognized as the key to capacity building and capacity development. It is said to make the difference between poverty and wealth. A famous example is cited in the World Development Report of 1998/1999. Ghana and the Republic of Korea started off with almost the same GNP/cap in 1960. Thirty years later the Korean GNP/cap had risen more than six times, the Ghanaian GNP/cap was still hovering at the same level (in 1985 prices). According to World Bank experts half the gap could be explained in terms of traditional factor inputs (in classical economic terms: land, labor, and capital), the other half was attributed to knowledge as a factor of production (World Bank 1999). To date, knowledge has been added as a new factor of production in the development debate and it is regarded as one of the main driving forces of innovation and development.

The idea is, indeed, fascinating. If natural resources are scarce, and Foreign Direct Investments (FDI) do not flow into a country as expected, if land is not fertile or scarce, knowledge can make the difference when put to effective use. In the almost poetic words of the World Bank, "Knowledge is like light. Weightless and tangible, it can easily travel the world, enlightening the lives of people everywhere" (World Bank 1999: 1). Knowledge



Knowledge can make a difference between poverty and wealth.



A knowledge system is more than ICT facilities.

seems to be an important factor in explaining the gap between developed and underdeveloped and between poor and rich countries. Several countries, particularly in Asia and Latin America, have recognized this and have undertaken efforts to close the knowledge gap between them and the OECD countries, inter alia, by bridging the digital divide. They invented a framework to produce and utilize knowledge for economic and social development and pursued an active policy of knowledge governance. The question remains of whether this "production factor" can be universally shared without losing some of its

value. In particular, we still need to investigate which policies are most suitable for developing regions with divergent endowment of natural and human resources.

A recent Capacity Development Brief of the WBI distinguishes three levels of capacity building: institutional, organizational, and individual. These three levels can, respectively, be translated into knowledge sharing (epistemic culture), knowledge management (organizational learning), and transforming tacit to explicit knowledge (training, education).

The production of new knowledge and the growth of ICT

The term "knowledge" has a wide connotation in every day language. In the development literature there is a tendency to define knowledge in a more limited, action oriented sense. For the purpose of this paper we will use the following working definition: Knowledge is a human resource that is used to guide social action. As Bertrand Russell has argued, ultimately all factual knowledge is derivable from experience. Knowledge is needed to produce and/or acquire knowledge and to turn data into information.

Nowadays, new knowledge is being generated at an unprecedented pace (Menkhoff et al. 2005). This knowledge is primarily governed, managed, and monopolized or shared among industrialized countries. World-wide access is increasing due to modern means of information and communication technology (ICT). These technologies are growing fast, though at different rates. In 2001 in Northern Europe and North America between 40 to 60% of all households had Internet access (OECD 2002). Even with double digit growth rates in other parts of the world it will be years before they catch up. The use of cell phones has also increased substantially world-wide, not only in Asian and Latin American countries, but also in Africa where cell phones are leapfrogging the landline deficit (Evers et al. 2006). What counts is whether these tools are finding their way to those actors that depend on them for development purposes. ZEF is currently assessing the potential role of ICT in Africa in a project financed by the German parliament (see p. 72).

Institutions for knowledge production and dissemination remain, however, unevenly distributed. About 30% of Research & Development (R&D) expenditure world-wide is spent in OECD countries (UNESCO 2000). The same holds true for components of the information and communication technology infrastructure. In 2000 in the USA about one-third of the work force was employed in ICT-related sectors, in contrast with Korea (only 4%) and much lower in most of the rest of the world. The result is a widening digital divide and an uneven access to knowledge, which mirrors the income differences between developed and underdeveloped economies (World Bank 1999). There are nodal points where knowledge is produced, where digital equipment is concentrated, and from where knowledge can be globally distributed. This raises the issue of how far knowledge is

being produced to meet the interests of a global community of scholars or the R&D interests of multi-national corporations rather than to meet development needs.

As outlined in ZEF Policy Brief No. 6, the creation of a knowledge system requires not only a backbone of ICT but also an appropriate institutional framework and a vibrant epistemic culture of knowledge creation. A poly-centric competitive system of knowledge creation, utilization, and dissemination therefore requires coordination between public administration, private companies, and civil society organizations.

The widening GAPS: The knowledge gap and the digital divide

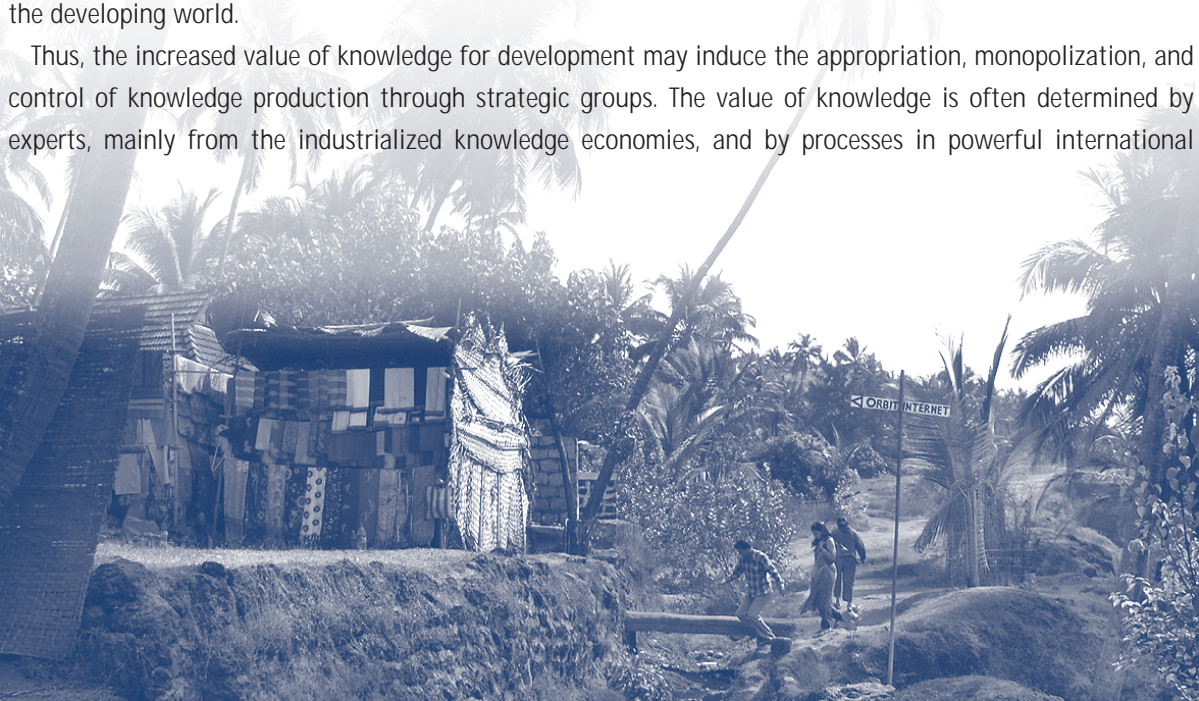
Optimistic commentators argue that the fast expansion of information and communication technology has improved access to knowledge (see for example the Global Information Technology Report 2004-2005). In particular, the spread of personal computers and the Internet has connected millions of people to the information necessary to acquire knowledge through the World Wide Web. But access to this knowledge resource is skewed geographically and socially. The term digital divide, coined for this phenomenon, refers to the gap between individuals, households, businesses, and geographic areas at different socio-economic levels with regard to their opportunities to access information and communication technologies and their use of the Internet. It reflects differences among and within countries (OECD 2001). Usually the concept of digital divide is used to relate to the technological aspect of the digital divide at the expense of social exclusion aspects.

The knowledge (management) gap is a more complex phenomenon and refers to the uneven intensity of knowledge production, availability, and dissemination world-wide. There appears to be a connection between the two: The digital divide determines to a large extent the capacity of accessing and using new knowledge.

Some national governments and development agencies like the World Bank, GTZ, or DFID have been outspoken proponents of a gap-closing strategy. However, statistical indicators show that the global knowledge gap as well as the digital divide are widening. This holds true for comparisons within as well as between countries, because some regions within countries develop faster than others and richer countries are on a faster track towards a knowledge society than their less endowed counterparts.

Moreover, the knowledge gap is deliberately or inadvertently widened by the monopolization of the application of knowledge through patents and the insistence on securing intellectual property rights by powerful organizations, especially the WTO. The TRIPS Agreement, concluded in 1995, determines rights over intellectual property and grants temporary monopolies for innovations and inventions. Poorer countries and people are excluded from access to vital knowledge goods, such as medicines, seeds, and educational materials (Oxfam 2001). Selling knowledge in the form of licenses, franchising, and overseas education has developed into a multi-billion dollar business for the OECD countries, which capitalize on the knowledge gap between them and the developing world.

Thus, the increased value of knowledge for development may induce the appropriation, monopolization, and control of knowledge production through strategic groups. The value of knowledge is often determined by experts, mainly from the industrialized knowledge economies, and by processes in powerful international



organizations, vast transnational corporations, and government departments. In fact, they determine what knowledge is essential and what is not and thereby actually define the knowledge gap. Thus, the concept of a gap also indicates a hierarchy between haves and have-nots or haves and have-less and implies a valuation of the type of knowledge.

Developing nations are thus commonly advised to follow a strategy of improving their knowledge base by investing heavily in ICT and by following the model of the most highly developed knowledge-based economies in the North. As this model is evolving fast, developing countries (and a large part of the other industrialized economies) often end up in a futile race of catching-up. They may consider instead trying to improve their competitive advantage by stressing local knowledge resources, occupying niches, and forming strategic alliances among themselves and with selected others.

The production of knowledge often takes place in a framework of markets and power structures and caters to their need. It is not necessarily guided by the use-value of knowledge to poor people. New insights may make traditional knowledge obsolete and lead to its replacement, but useful local knowledge may also vanish with the onslaught of knowledge systems that are perceived to be superior. Thus, research not only produces new knowledge but also may destroy old knowledge without its true value being assessed. In this sense, ignorance rather than knowledge is enhanced. The cost of this loss is only now being recognized in technology-based societies. Developing countries should take full advantage of the indigenous knowledge that is still available, which might even give them an edge. One of ZEF's research foci is to analyze and evaluate such strategies.

The knowledge gap can work against development efforts based on modern strategies. An example is water use and water management, which is being investigated in the framework of the ZEF-led GLOWA Volta Project in Ghana and Burkina Faso (see Chapter 2.2., p. 35). Often water reform processes initiated by the international donor community do not take into account local traditions and power structures. In most African societies, water has value connotation other than it has in the Western world. According to this concept, people do not own water, and water cannot be refused to someone who needs it, be it for drinking, for irrigating land or watering cattle. This is in contradiction to water reform measures such as water pricing for local water users. Thus, in the end there often is an inexplicable delay or blockade of international and national reform efforts, if local knowledge systems are not considered adequately.

Also, in the framework of the project on "Conservation of *Coffea arabica*" (CoCE) (see Chapter 2.4., p. 47) research has been done on the role of local institutions in conserving and managing the montane rainforests in southwestern Ethiopia. These forests are the habitat and place of origin of wild coffee populations and many other forest products. Research results so far show that poverty and population pressure have contributed to deforestation but local knowledge on the value of the forests and their products such as coffee as well as traditional forest management have also supported their conservation.



Developing countries should take advantage of indigenous knowledge available.

Evers and Kaiser (1993) advocate a comprehensive approach that will capture and integrate the various types of knowledge in their new "architecture of knowledge" needed for building capacity for a balanced knowledge economy. ZEF's research on culture, knowledge, and development has identified a series of measures that will help set a society on a sustainable development course. This "integrated capacity building" cannot be carried

out piecemeal, but has to be combined in a package. This argument is spelled out in greater detail in ZEF Development Brief No.6 by Evers et al. 2006, where "integrated capacity building" means:

- creating knowledge hubs, competence centers and centers of excellence,
- creating knowledge clusters as "learning regions",
- transferring knowledge to local stakeholders in civil society and the government,
- transferring knowledge through global networks (including GPNs), and
- making use of local knowledge to build comparative advantage.



Developing countries often end up in a futile race of catching up with industrialized states.

2. The role of traditional ecological knowledge

Traditional ecological knowledge is the "cumulative body of knowledge, practice and beliefs, evolving by adaptive processes through innovation and feed-back learning and is handed down through generations by cultural transmission" about local ecology (Berkes 1999: 8). Adaptive management strategies are achieved by educational and experiential practices (Gadgil et al. 1993). It may or may not be indigenous, but has roots firmly in the past. It is acquired and used through a social process of learning and sharing knowledge.

Most of this knowledge is local knowledge (Gerke and Evers 2006) that is largely oral and based on experience rather than formal education or book learning. Such knowledge may involve a world view that is different from that of scientists and government decision-makers and which is generally indigenous in nature. It provides values and norms regarding nature that are easily lost in the modern world. On the other hand, local and traditional knowledge may, in some cases, incorporate elements of scientific knowledge. Clear delimitations of kinds of knowledge are difficult, if not impossible (Agrawal 1995). However, local and traditional ecological knowledge systems can provide insights that can help manage resources and ecosystems that should not be ignored.

Linking global and local knowledge

The Millennium Ecosystem Assessment (MEA 2005) actually makes some prognoses on what might be the outcome of development scenarios with different mixes of global-local knowledge and value systems with regard to the various ecosystem services provided (economic, ecological and cultural). Fig. 1 depicts the possible impacts of the global and local/regional MEA scenarios on different types of knowledge and environmental governance. Global scenarios include those termed "Global orchestration" and "TechnoGarden", whereas regional/local scenarios include "Adaptive mosaic" and "Order from strength". Global scenarios assume a globally connected society, global trade, economic liberalization, strong efforts to cope with poverty and inequality, investments in global public goods, such as infrastructure and education, engineering approaches to govern the environment with new technologies and new markets for ecosystem services. These scenarios eventually reduce poverty and inequality, improve education and income levels, make strong use of scientific knowledge and innovative technology but create vulnerability and dependence on these technological solutions; hence the reliability of ecosystem services is increasingly difficult to ensure. The reliance on technological solutions increases vulnerability against new and unexpected problems and large environmental collapses become more common. Although global public ecosystem services (e.g. climate change) are more efficiently governed, global scenarios lead to a loss of local knowledge and cultural diversity for managing local ecosystems.

Figure 1. MEA scenarios and their impact on different types of knowledge and environmental governance. Arrows pointing upwards depict a positive or increasing impact and those pointing downwards, a negative impact. The small horizontal arrow illustrates evolutionary change as communities cope with increasing impacts from global changes and create networks.

	Knowledge		Environmental governance	
	Modern/scientific	Traditional	Efficiency of ecosystem management	Ability to manage risk, uncertainty and complexity
Global MEA scenarios: „Global orchestration“ „TechnoGarden“	↑	↓	↑	↓
Regional/Local MEA scenarios: „Order from strength“ „Adaptive mosaic“	↓	↑	↑	↓ → ↑

The local scenarios strengthen traditional knowledge and make use of cultural diversity for the efficient management of local/regional ecosystems. Local/regional institutions and governance focus on the defence against economic and ecological insecurities but make lesser use of technological innovations and modern scientific knowledge in doing so. Inequalities and poverty are dealt with less successfully and global environmental problems, such as climate change and pollution intensify. The "islands" of well-managed ecosystems, however, are negatively affected by global environmental change on which these scenarios have little or no impact. The ability to deal with uncertainty, risk and complexity from larger scales is limited. However, as global environmental problems intensify, communities develop networks to deal with them. Slow acquisition of new knowledge from success and failure eventually improves the provision of global ecosystem services.

The key to the ability of ecosystems to cope with the pressures imposed by the drivers of change lies in the rate and scale of the process. Just as ecosystems have re-arranged and adapted themselves under the influence of climate change over the ages without catastrophic consequences to the Earth as a "living organism" (Lovelock 2000), so did ecosystems cope with the occasional invasive species or early human expansion. The pace of change, however, has dramatically accelerated over the past few hundred years with social-cultural change typically occurring on a time scale of decades, while economic change tends to occur even more rapidly.

Many communities possess local, indigenous, or traditional knowledge (Gerke and Evers 2006) based on experiences of prior abuse and trial-and-error management. They developed local management systems that included locally formed norms and rules, organizations, and technological innovations that enable people to cope with, adapt to, and influence change, in positive or negative ways. These management systems are continuously evolving; some may disappear while others are revived or created from scratch (MEA 2005).

In today's world traditional knowledge systems are often overwhelmed by the pace and scale of change. "(...) In many parts of the world, the degradation of ecosystem services is exacerbated by the associated loss of the knowledge and understanding held by local communities—knowledge that sometimes could help to ensure the sustainable use of the ecosystem. This combination of ever-growing demands being placed on increasingly degraded ecosystems seriously diminishes the prospects for sustainable development (...)"(MEA 2005).

Although our knowledge about the state of our ecosystem and its degradation has grown dramatically, it is proving difficult to act upon this knowledge effectively. Awareness is growing that our "global" knowledge still depends on "local" institutions for corrective action. These local institutions heavily depend on traditional

norms, values, and knowledge systems to serve their regulatory functions. Thus, one of the key development challenges for today lies in the linkage of the vast knowledge being generated about our environment—as described in the MEA and international conventions—with local and traditional knowledge systems (Figure 1).

Integrating traditional knowledge into transdisciplinary research

As we have postulated, modern knowledge systems may benefit from traditional ecological knowledge. After all, modern societies ultimately face the same struggle for survival as indigenous societies. To date, however, the struggle may not be man versus nature but man versus disappearing nature. Traditional ecological knowledge might be an essential link to sustainable development. The potential value of traditional knowledge has also been acknowledged in the context of international environmental efforts, such as the program to halt the loss of biodiversity: "There is today a growing appreciation of the value of traditional knowledge. (...) Most indigenous and local communities are situated in areas where the vast majority of the world's plant genetic resources are found. Many of them have cultivated and used biological diversity in a sustainable way for thousands of years. However, the contribution of indigenous and local communities to the conservation and sustainable use of biological diversity goes far beyond their role as natural resource managers. Their skills and techniques provide valuable information, ensure the continued delivery of ecosystem goods and services to the global community and are a useful model for new biodiversity policies. Furthermore, as on-site communities with extensive knowledge of local environments, indigenous and local communities are most directly involved with conservation and sustainable use" (UN Convention on Biological Diversity).

Valuing the integration of traditional knowledge in development concepts is an important preoccupation of ZEF. The role of traditional ecological knowledge in the conservation of biodiversity, for instance, is a major issue in the framework of ZEF's project on the "Conservation and use of wild *Coffea arabica* in the montane rainforests of Ethiopia" (see Chapter 2.4., p. 47). In this project, we make an effort to integrate traditional and modern knowledge into a system for knowledge management and transfer through a novel institutional design: the Ethiopian Coffee Forest Forum (ECFF).



The value of traditional knowledge is increasingly being appreciated.

Founded by Ethiopian and European researchers and stakeholders with the goal of preserving, creating, and sharing knowledge with and between the different stakeholders, the forum seeks to guide policy- and decision-makers who are responsible for sustainable development in the region.

The price of discarding traditional knowledge was painfully brought home in the Aral Sea region in which ZEF conducts another transdisciplinary project. Over half a century of misguided agricultural development, directed from Moscow, has cast aside all local knowledge of balancing in the allocation and use of water, which sustained agriculture in the region for thousands of years. In the process it caused the loss of the Aral Sea as a major ecological and fisheries resource. It also all but wiped out the traditional knowledge of farming through the process of collectivization. In the project on ecological restructuring of land and water use in Uzbekistan (see Chapter 2.2., p. 31) this loss of local knowledge is proving to be a major constraint in efforts to find ways and means for the re-establishment of private farms.



Conclusions

- Knowledge is by now recognized as a major driving force of development. Many governments have embarked on a development strategy to create a knowledge-based economy and a knowledge society. Though there is increasing attention on this topic, the contours of a knowledge strategy for development are still hazy. In particular, we still need to investigate which policies are most suitable for developing regions with divergent endowment of natural and human resources.
- The creation of a knowledge society requires not only a backbone of information and communication technology (ICT) but also an appropriate institutional framework and a vibrant epistemic culture of knowledge creation. A polycentric competitive system of knowledge creation, utilization, and dissemination therefore requires coordination between public administration, private companies, and civil society organizations. Developing countries are therefore to be stimulated to develop their own strategies to build capacity for the creation of knowledge economies and knowledge societies. Given ZEF's focus on sustainability, the question we ask is whether postmodern knowledge societies can solve the economic growth-environment conundrum.
- Ecosystems may provide a sense of place and identity to local people. Spiritual and cultural values of ecosystems can be as important as other services for local communities. These intangible values often strengthen social capital, providing an ethical reference system for management, which result in care taking and custodianship. As such, indigenous knowledge differs from scientific knowledge in its moral, ethical, spiritual, intuitive, and holistic nature; it has a large social context. Social relations are not separated from those between humans and non-human entities. It is here where possibly some of the traditional knowledge may be traded off with the global community for the benefit of all concerned.
- A re-appraisal of the value of traditional or indigenous knowledge is urgently required and being recognized at the international level, for example in the United Nations' Millennium Ecosystem Assessment report. A promising strategy for finding innovative and transdisciplinary approaches for the sustainable use and management of terrestrial resources seems to lie in the linkage of global insights with local and traditional knowledge systems. ZEF's transdisciplinary research approach aims at creating innovative strategies for the sustainable use and management of terrestrial resources to better serve human-environment systems by taking local knowledge, local ecosystem expertise, and local interests into account.

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Chapter 1. ZEF Projects with a Focus on Knowledge Systems and -Management

PhD study in the framework of the project on Economic and ecological restructuring in Khorezm, Uzbekistan.

For more information on this project see p. 31.

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Knowledge and Development in Uzbekistan

In the framework of the transdisciplinary development research project "Economic and ecological restructuring of land and water use in Khorezm", ZEF deals with land and water management in this region of Uzbekistan. By addressing the ecological and economic restructuring of agrarian activities, this project works on the creation of development-relevant knowledge and touches upon the ongoing trend of knowledge loss. This loss, attributable to the collapse of the Soviet system, refers to the use and management of natural resources, especially in the context of agriculture at the local farming level in Uzbekistan.

Crucially, the project sets out to work with local partner institutes within Uzbekistan, especially Urgench State University (in Khorezm Province) and regional government structures such as the Hokimiat (province administration), as well as with research institutes in Tashkent. This research and capacity building project seeks to address some of the key problems in rural Khorezm, which include desertification and increasing soil salinity associated with the increasing pressure on natural resources, diminishing yields and economic returns from agriculture, and improper and sometimes wasteful agricultural practices. In particular, poor irrigation management has led, at the tail-end of this system, to the drying up of the Aral Sea—this well-known "creeping ecological disaster" has been ongoing for more than 50 years.

In fact the Aral Sea crisis showcases how localized decision-making, which does not address the complex behavior of systems, over many years can create problems in remote areas. The knowledge applied—as subjectively sound and wise as it may be meant to be—does not recognize the complex, intertwined systems' dynamics of the coupled human-nature interface. The drying out of the Aral Sea was never planned—it is simply the result of land-use decisions (based on strategic considerations) made decades ago in the distant capital of that time, Moscow. If these problems are not dealt with by addressing them through transdisciplinary approaches, failure is a logical consequence.

The ZEF project has concluded from the past five years of operation that the current problems in the region can be addressed through a transdisciplinary research approach, in which knowledge plays a crucial role. Initially this involves working with local knowledge holders and subsequently building capacity in local partner institutes as well as addressing the information needs of the government administration that deals with resource management.



Different local knowledge holders are involved in the project.

Lost Local Knowledge

Khorezm has sustained human life for three thousand years and has been the stage for historical achievements that history textbooks in Western schools normally ignore. The Amu Darya River (formerly the Oxus)—once crossed by Alexander the Great—flows east of Khorezm and the region has witnessed the continuous struggle between East and West—at various times occupied by the Huns, the Golden Horde, Ghenghis Khan, and Timurlane. The ancient capital of Khiva, today a UNESCO heritage site, was founded in 1511 and was a flourishing center of Arab culture until the early nineteenth century.

The territory constituted the Khorezm Soviet People's Republic from 1920 to 1924, when the area was divided between the Uzbek SSR and the Turkmen SSR (now Uzbekistan and Turkmenistan). The Soviet history of Uzbekistan started in 1924 and had a considerable impact on the development of local knowledge in Khorezm. Traditional forms of lore were discounted during the Soviet period and the industrialization of agriculture—as well as state control of agricultural production and the centralization of post-harvest processing—led to the loss of much indigenous knowledge. Former farmers became employees on communal farms and were awarded only partial, specialized tasks (such as tractor driving).

The knowledge accumulated during the Soviet period was subsequently lost during the period of independence, starting with the fall of the Soviet Union in 1991. This had a very negative effect on the ecological situation in Khorezm because the majority of the new land users were badly prepared for private farming and unable to cope with the challenges of new farming operations. Therefore, there were insufficient local skills and know-how to prevent erosion, salinization, and rising groundwater levels. Moreover, the new class of private farmers often inherited saline, polluted, and impoverished soils, constraining the returns from their use.

The attendant economic decline and failure of many previously state-owned industries in the newly built state of Uzbekistan made the need for local knowledge acute. Agricultural inputs such as seeds and fertilizer, machinery or industrial equipment no longer arrived from the Soviet Union. Likewise, livestock and animal products were no longer sent away for central processing. Therefore, local knowledge was required to make up for these weaknesses. However, decades of neglecting traditional knowledge resulted in its disappearance. In many cases, such as livestock rearing, local knowledge has only achieved rebirth since 1991—this process could be improved and accelerated considerably through training and education.

Thus, there is a real role for international support to stem such knowledge loss, to introduce new knowledge at the local level, and to unlock the potential of local knowledge for development.



ZEF first built up an infrastructure for its research in Khorezm.



There are insufficient local skills to prevent rising groundwater levels in Uzbekistan.



Capacity Building

Capacity building is an important component of the project. This is going to be extended specifically in collaboration with the GTZ-led agricultural training foreseen for the next phase of the project due to start in 2007. To help build in-country capacity to respond to ecological problems in Khorezm, ZEF cooperates closely with several key local partner institutes. The approach has been to promote two-way knowledge sharing between ZEF and these institutes. This entails ZEF learning from the previous experiences of the research institutes, accessing their data, and benefiting from local support and know-how on the ground. In return, ZEF provides access to international science and facilitates world-class research in Khorezm. Thus local institutes have increased their levels of collaboration and knowledge-sharing as a result of connections built by their work with ZEF.

To ensure that these linkages and research are sustainable the ZEF approach towards building capacity includes support for talented undergraduate and MSc students from Uzbekistan who are conducting their research in the framework of the project. ZEF staff and PhD students deliver lectures, attend training seminars, and provide educational support for the Faculties of Ecology and Economics at Urgench State University. The results to date have been encouraging with a discernible increase in the quality of research being conducted by local partners and with jointly authored publications in local and international journals.

In-Project Knowledge Management

The ZEF project, as a creator of knowledge, also needs to manage its own knowledge resources wisely. In the first phase of the project, an inventory of already existing knowledge was compiled into a Meta Data Base, which is basically an online list of all the knowledge resources of the project. It is the entry point to a Central Data Base, where all types of data—geo-referenced, labeled, and quality-checked—are stored for the user. This includes not only a considerable amount of remote sensing and GIS data, but also many data from field research on bio-geophysical processes, which forms the core of the decision support tool currently being developed. This now hugely increased database physically resides on the project servers in its GIS center in Urgench, which is part of a deliberate strategy to make the data accessible to the local users.



Agricultural inputs no longer arrive from the Soviet Union.

Outlook: Project phase III

In the planning for the third phase of the ZEF project in Khorezm (due to start in 2007) the knowledge created and stored in the past four years will be mobilized for development. Furthermore, the considerable data generated by the project and stored in its Central Data Base will be made operational by feeding them into functional and structural computer models of the relevant socio-biophysical processes in Khorezm. These models will allow the running of simulations of different policy scenarios and allow the forecasting of their effect into the near future. This should help to prevent the typical and vicious cycle of decision-making in complex situations that does not acknowledge the long-term, long-distance effects of local decisions.

Thus, with regard to how local knowledge can be used for development, the project is making encouraging progress in harnessing scientific and local knowledge to promote development in Uzbekistan. However there is no dependence on local knowledge only—it would be naive to assume that the "locals" got it all right all the time; rather it is blended into advanced decision-making tools generated by groundbreaking research that integrates the various layers of knowledge to create a long-term, science-based vision of how development could be sustainably introduced in the region. Thus, the integrated knowledge created in this project can contribute to improved social services, protecting the environment, and laying the foundations for long-term economic growth and development in Khorezm, Uzbekistan.



The project aims at improving social services.

Local Governance and Statehood in the Amu Darya Border lands

Background

One of ZEF's research foci is governance—be it the dimension of knowledge governance, the role governance plays in post conflict situations or local governance, where state and non-state institutions overlap. The research project "Local governance and statehood in the Amu Darya border lands" deals to some extent with all these aspects of governance. However, this article focuses on the role of knowledge transfer in our research.

ZEF is keenly interested in the local structures of this border region between Afghanistan, Tajikistan, and Uzbekistan because its historical development led to the unique current setting.

Until the advance of the Russians at the end of the nineteenth century, the Amu Darya River had meandered through a region in which local communities on both sides of the river shared more or less the same institutional settings. During the Cold War the Amu Darya border region between Afghanistan and the Soviet Union marked very different aspects of development: On the northern banks of the river the Soviet Union realized remarkable modernization of society according to Soviet ideology; on the southern

Project title:

"Local governance and statehood in the Amu Darya border lands"

Keywords:

Local governance, transboundary resource management, cross-border interaction, regional conflict complex

Countries of research:

Afghanistan, Tajikistan, Uzbekistan

Research objectives:

Analyzing the interrelationship of local governance, cross-border activities and state influence

ZEF staff involved:

Conrad Schetter (project coordinator),
Hafiz Boboyorov, Bernd Kuzmits, Katja
Mielke, Henrik Poos

Timetable:

April 2005 - April 2008

Main cooperation partners:

University of Termez
Academy of Science, Tashkent
German Agro Action, Kunduz
National Center for Policy-Research, Kabul

Main funding partner:

Volkswagen Foundation

Project coordinator/contact:

Conrad Schetter: c.schetter@uni-bonn.de

Homepage:

www.zef.de/amudarya.0.html

banks the Afghan state was barely able to influence or change the traditional social order.

Over the last 30 years, this border region has not only faced the collapse of the Soviet Union and the independence of Tajikistan and Uzbekistan, but also civil wars in Afghanistan (1979-2001) and Tajikistan (1992-1997) as well as several refugee movements in the 1990s and the development of new economic structures (narcotics, labor migration). All of these changes resulted in alterations to the once clear-cut frontier of development between the post-Soviet states and Afghanistan and in high dynamics at the local level: Traditional institutions have re-emerged within the local communities of today's southern Tajikistan and Uzbekistan, which compete, supplement or overlap with state institutions. Additionally, the international community tries to implement its ideas for good local governance in Tajikistan and Afghanistan.

It goes without saying that studying knowledge transfer plays a crucial role in this research project. For example: (1) We intend to draw attention to the slow starting pace of knowledge transfer in the Amu Darya today. (2) Our research in Afghanistan considers on the one hand the clash of knowledge between self-governance models of the international community and the Afghan state and local realities on the other.

Cross-boundary knowledge transfer

It is widely perceived by their northern neighbors that Afghans are underdeveloped; this is due to an education gap inherited from Soviet times. Literacy rates in Uzbekistan and Tajikistan are still much higher than in Afghanistan. But economic decline has generated various downturns (public underfunding of schools, very low wages for teachers, children working instead of studying) and subsequent deterioration in education. On the other side of the river, the educational system lay idle until recently.

At the moment, knowledge transfer across the Amu Darya cannot be described as very active. This is even more accurate between Uzbekistan and Afghanistan. However, it appears that both sides have skills to offer to each other: While Central Asia has retained more educated professionals (civil engineers, teachers, doctors), Afghans have better business and entrepreneurial skills, because when there was no real state, the market was the only force that kept the country going.

There are quite a few Tajik experts who work for international development organizations in Afghanistan. But, as in other areas, the employment situation is tense because Afghan refugees search for jobs as well (teachers of Afghan origin are preferred for educational development efforts). Even if this was not the case, such employment is

Knowledge transfer among the riparian states of the Amu Darya river is slow.



not the most attractive prospect for most Tajik teachers for security reasons. Knowledge exchange is embryonic in small non-governmental arenas with Tajik and Afghan participants. Knowledge exchange that is supported by governmental institutions clearly falls behind rhetorical claims.

However, there are some issues where cross-border sharing of knowledge could not only be fruitful on both sides of the river but could also turn into a future need. Most issues, like flood prevention or integrated water management, are related to the joint use of the Amu Darya. Examples of water resource management may also reveal to Soviet successors that they have to revise their negative perceptions of Afghans.

Local knowledge in Kunduz, Northern Afghanistan

Within the research project, Afghanistan is a special case a propos knowledge and knowledge transfer because the recent history of roughly 23 years of violent conflict contributed to enormous loss of communication and exchange between the different layers and levels of society as well as huge gaps in research. This resulted in a situation where today very little is known about the functioning of societal processes, the interrelationship between state and local actors, the dynamics that shape local decision-making, and how current state-building efforts are constrained by power structures that have evolved over the last 30 years.

With this as the background for current state-building efforts undertaken by the Afghan Government in collaboration with the international community, the mandate to improve the economic situation and to establish democracy, peace, and security would appear to be somewhat difficult. Moreover it is conditioned by an urgent policy need for political action and development without adequate information about the appropriateness of the intervention.

Preliminary research results from fieldwork in Kunduz Province, Northern Afghanistan, support the assumption that policy interventions at the local level are more donor-driven and determined by the electorate of western politicians instead of addressing the needs and perceptions of targeted people. For example, the implementation of new local decision-making bodies—the so-called Community Development Councils (CDCs)—within the framework of the National Solidarity Programme (NSP) in the wider context of political decentralization does not establish democratic and equitable power structures in the local arena. Local people consider it to be just more outside interference in a sequence of manifold attempts to modify local structures over the last decades—in the interests of external actors—since the Soviet invasion. Significant confusion exists about the roles, aims, and even names of these councils among people who are (s)electd as CDC-members, not to mention the rest of the population because the implementation largely mirrors a top-down process in which the potential role of traditional decision-making mechanisms, and in this sense local knowledge, are not adequately taken into account by implementing agencies and the elite in Kabul.



Knowledge exchange clearly falls behind rhetorical claims.



Flood prevention is related to the joint use of the Amu Darya river.

Knowledge Management for the Conservation and Use of Wild Coffee in Ethiopia

For more information on this project see p. 47.



Project Workshop in Addis Abeba in October 2006.



Southwest Ethiopia is the birthplace of Arabica coffee.

The "Conservation and use of the wild populations of *Coffea arabica* in the montane rainforests of Ethiopia, CoCE" (www.coffee.uni-bonn.de) is one of ZEF's international research projects on biodiversity. During its first three-year phase, the CoCE project has collected much information and has generated knowledge on ecological and socio-economic aspects of wild coffee and the montane rainforests in Southwest Ethiopia where wild coffee grows. Southwest Ethiopia is considered to be the center of origin and diversification, or literally the birthplace of Arabica coffee.

Within the project, natural scientists have assessed species diversity of the forest ecosystem and genetic diversity of the wild coffee as well as the tolerance of wild coffee to diseases and drought. Economists have calculated the economic value of the Ethiopian wild coffee genetic resources. Furthermore, the rules and regulations as well as organizations related to the management of coffee forest resources have been documented.

From this enormous amount of information gathered and compiled by researchers from different disciplines, the researchers working in CoCE have started assembling the pieces of the puzzle for successful biodiversity conservation in developing countries. The puzzle has not been put together completely yet, however, first important insights have been made:

- Data collection needs time and access. Based on a collaboration agreement between ZEF/Bonn University and the Ethiopian counterpart, the Ethiopian Institute for Agricultural Research (EIAR), and the active involvement of Ethiopian partners, researchers have had the time and access required for data collection.
- Information needs to be passed on and exchanged. Regular workshops reported research progress and difficulties encountered to the scientific community, policy-makers, and via TV to the public.
- Communication can be regarded as a process of knowledge creation. Making sense of the assessed data can be done by theoretical and analytical reflection. Policy-relevant knowledge, however, can often only evolve when information is communicated to relevant stakeholders. In this sense, process is more important than product, e.g. by collectively defining a common vision for the future of the coffee forests. Participatory modeling was conducted with CoCE stakeholders to better understand the manifold actors, interests, and relationships within the system of "coffee forest conservation".

The next step towards implementation of scientific results can only be taken by adequately addressing the issue of how knowledge can be managed (disseminated, communicated, processed) to be useful for implementation and policy-making. CoCE has addressed this problem of organizing knowledge management by active institutional design: the project initiated the

Ethiopian Coffee Forest Forum (ECFF) which was officially constituted as an NGO by the Ethiopian partners.

The objectives of the ECFF are:

- to be a joint communication and consultation forum for coffee forest conservation and use;
- to develop a strategy for sustainable use of wild coffee and other non-timber coffee forest products;
- to engage in conservation education, curriculum development, and public awareness raising activities;
- to facilitate and disseminate research in the field of coffee forests;
- to support the process of science-guided policy- and decision-making; and
- to coordinate CoCE project activities during the second project phase starting in August 2006.



Data collection needs time and access.

The ECFF as an intermediary institution enables more direct communication between science and policy and facilitates the linkages between decision-makers and local resource users. It therefore has an important function to communicate, educate, and (re)establish trust between state- and local-level actors and to create awareness on coffee forest-related issues among all stakeholders.

The forum has a crucial function in circumstances where social capital is fragmented and ethnic, linguistic, and political diversity require appropriate governance structures to achieve sustainability in coffee forest diversity conservation and use.

The achievements of the ECFF so far have been:

- organization of a policy panel on the issue of the new Ethiopian forest policy and proclamation to contribute to forest policy formulation and amendment of the forest proclamation;
- organization of a stakeholder workshop for defining a common vision for the future of coffee forests and understanding the systemic complexities of coffee forest conservation and management;
- bringing together actors in the field of participatory forest management for mutual learning;
- launching of occasional policy briefing papers.

Beside its various conservation education and communication activities, the ECFF is currently working towards organizing two international conferences:



Maxi Pia Louis, Hartmut Vogtmann (President of the German Federal Agency for Nature Conservation, BfN), Manfred Denich and Tadesse Woldemariam on a field trip in Ethiopia.



- "Biodiversity Conservation and Poverty Reduction: The Role of Protected Areas", together with BfN, ZEF as well as the local government and civil society organizations in Ethiopia, which took place in October 2006.
- "Participatory Forest Management, Biodiversity and Livelihoods in Africa", with other government and civil society organizations in Ethiopia, which is scheduled for February 2007.

Project title:

"Acting in e-learning markets of developing countries—strategies for development co-operation"

Keywords:

Knowledge transfer, e-learning, aid efficiency, development policy

Country of research:

India

Research objectives:

Main objective of this PhD study is to identify structural reasons for the underachievement of e-learning projects and potential ways for improvement.

ZEF staff involved:

Ellen Pfeiffer, Ulrike Grote

Timetable:

October 2002 to end 2006

Main cooperation partners:

University of Augsburg/Germany, Institute for Media Pedagogics
University of Goa, India, Department for Social Sciences

Main funding partner:

GTZ

Project coordinator/contact:

Ellen Pfeiffer: zef@ellen-pfeiffer.de

E-learning in Developing Countries

The last decade not only witnessed massive investments in information and communication technologies (ICTs) and e-learning in development cooperation, but also raised concern about a major gap between expected benefits and measurable outcomes. This study therefore focuses on the achievements of international distance education courses employing interactive ICTs by non-commercial organizations in the framework of development cooperation. The theoretical analysis revealed systematic deficits in the planning of such e-learning projects. These deficits were mainly generated by the conflicting goals of development organizations, fragmented research, and weak strategies for project success. But as there is still considerable debate on how knowledge transfer and aid exactly affect development, better strategies are hard to capture. So the options for the immediate improvement of e-learning projects are limited. In a second step, the theoretical results were related to the political debate on the impacts of development aid and to mainstream policies in development cooperation—such as aid conditionality, participation, and good governance.



The University in Goa.

Modeling

The analysis showed that these policies consistently fail to integrate interdependencies between the decisions of recipients and the decisions of donor agencies. Therefore an extended structural model of aid impact was developed, based on game theory and power relations. The model was then adjusted to the case of e-learning in development cooperation and tested in a field study in Goa, India. The study included interviews with politicians, representatives of civil society, and professors, as well as a student survey.

Results

The preliminary results include, inter alia:

- 1) Judging from interviews with educational experts and e-learning practitioners, a participatory approach to project planning is unlikely to improve either the efficiency or the local "fit" of an e-learning project in Goa. E-learning in Goa is the exclusive domain of a small group of experts, so participation will by default cater to vested interests. In addition, many high-ranking officials who are involved show only limited knowledge of the local population's skill levels and rely on outside information such as donor reports, while the teaching in the observed e-learning projects in India was mostly outdated and certainly not adapted to local conditions. There is scant interest in international cooperation and most local e-learning projects had been started individually without checking for existing solutions or the possibilities of external funding. Accountability seems to be actively avoided, conditional funding even more so.
- 2) The student survey cast doubt on the effectiveness of international e-learning provisions for students in Goa: Donor agencies planning e-learning projects mostly focus on contents and the medium of delivery. Indian education centers on degree generation—the whole public sector depends on it. Donors often want to provide good education but students want to obtain good degrees. Moreover it is highly likely that such students would not appreciate good education because they are barely aware of what qualifications they will require for a job anyway. So supply just does not match demand. The quality of educational curricula is such an abstract concept for most Indian students that it is simply not a selling point. As long as donors fail to realize that quality education needs to be accompanied by an attractive certificate, there will continue to be a division. So ensuring that e-learning programs deliver prestigious degrees to satisfy local employers seems to be one of the most underrated issues in donor provision of e-learning.
- 3) Regarding the broader question of the impact of development aid, the field test generally supported the assumptions of the suggested structural model. At this stage the model does not provide conclusive suggestions for development policy, but raises some highly relevant issues: Current mainstream donor policies are based on the assumption that good governance leads to self-enforcing policies and efficient use of donor funds. Therefore good governance is promoted and financially rewarded. But the model implies that these assumptions might be wrong, that good governance is not necessarily stable or self-enforcing, and that development aid is an external intervention which might help to overturn the institutions it tries to support. The preliminary support found in the field therefore calls for further formalization and empirical testing.



E-learning in Goa is the domain of a few experts.



Internet café in Goa.

Chapter 2. Interdisciplinary Research

2.1. Governance

Introduction

Part from patterns of power, authority, and collaboration, which are fundamental to governance, a special focus is on the generation, proliferation, evolution, and decay of institutions. Institutions include laws, rules, regulations, norms and values, as well as organizations in which they are implemented. The making, implementation, supervision and enforcing of rules and norms are social processes constituting societies and organizations. Institutions have the potential to reduce or increase the transaction costs of social interaction and define the distributional outcomes of social interaction and resource exploitation.

Being at the core of governance and defining socially accepted behavior patterns as well as access to resources, institutions are, like authority itself, frequently debated and contested. Social actors creating, changing or ignoring institutions directly affect power structures and the distribution of benefits. Therefore, special attention has to be addressed to the way in which different actors are involved in these processes. Institutional and strategic group analysis, therefore, pays attention to the ways in which various actors invest their respective bargaining power to shape or ignore institutions in ways that suit their interests.

(Excerpt from ZEF's new Strategy Paper. Forthcoming.)



Non-state actors in Afghanistan.

Governance and Conflict

Project title:

"State failure and local governance in Afghanistan and Somaliland"

Keywords:

Governance, violent conflict, peacebuilding

Countries of research:

Afghanistan, Somaliland

Research objectives:

This project compares the local, regional, and national formation of governance structures after state collapse in Afghanistan and Somaliland.

Timetable:

January 2005 - December 2006

This research project focuses on Afghanistan and Somaliland (the former Northwest Somalia)—two countries which are frequently mentioned as showcases of complete state collapse in the course of civil wars. Usually they are portrayed as countries ruled by anarchy, where social order has broken down completely. While this might seem true at first glance, so far our research shows that new governance structures at the local and regional level usually emerge at the same time as state collapse. The authorities managing public matters are the actors of war, such as military faction leaders; but they also include remnants of the former state administration, revitalized traditional authorities, religious courts, local entrepreneurs, etc, who continue or begin to exercise authority as functional equivalents of the former state, at times aspiring to replace it. Therefore, the project examines the social processes driving the survival and reconfiguration of governance institutions, the subordination or transformation of powerful actors of violence, and the dynamics of governance structures emerging in the virtual or effective absence of a state.

Case studies in Somaliland

In 2005, ZEF carried out case studies in Somaliland. The former British colony formed part of Somalia until the state collapsed in 1991 and the northwestern clans agreed to declare independence from the defunct state. Relying heavily on traditional clan authorities, an innovative system of governance was set up, which included a national council of elders as the upper chamber of parliament. Except for two brief periods of fighting in the early 1990s, Somaliland has managed to resolve internal conflicts without resorting to violence. Meanwhile, local, presidential, and parliamentary elections have taken place, all of which were largely described as being free and fair by international observers. The two case studies concentrated on the interrelations between traditional governance and structures of the new state, as well as the role of clan identities in this context. The Awdal and Sanaag regions in Western and Eastern Somaliland respectively, were of particular interest because they are not (Awdal) or only partly (Sanaag) populated by Somaliland's predominant Issaq clan. As a consequence, power-sharing, modes of representation, and local acceptance of the central state have to be managed between former enemies of war, as well as in asymmetric majority-minority constellations. This poses challenges both to the establishment of Somaliland's new local and regional administrative structures as well as the regions' integration in the self-declared republic.

Power structures

Two key actor surveys carried out in 2005 revealed that the extent of authority attributed to individuals in formal offices (of the new state) on the one hand, and to religious and traditional authorities on the other, was roughly the same in each region (approximately one-third). Whereas the new administrative structures tend to be identified with only one of the respective subclans in the regions, all clan groups maintain their own, strong



Women queuing to vote in Somaliland's first parliamentary elections, September 29 2005.

Main cooperation partners:

Institute for Development and Peace (INEF), University Duisburg-Essen Academy for Peace and Development (APD), Somaliland Tribal Liaison Office (TLO), Afghanistan

Main funding partners:

German Foundation for Peace Research (Deutsche Stiftung Friedensforschung)

ZEF staff involved:

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Homepage:

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traditional authorities. Establishing effective formal governance has proved to be more challenging the more diverse the local clan-setting is. Governance matters that run across subclan and clan lines (such as the resolution of disputes) are usually taken care of by the traditional structures, underlining their continuing significance for the country's stability and the benefits of amalgamating them into the new political system.

Governance of Natural Resources

Project title:

"Alternative institutions for natural resource management in developing countries"

Keywords:

Co-management, decentralization, payments for environmental services, participatory resource management

Countries of research:

Ghana, India, Indonesia, Costa Rica, Tanzania

Research objectives:

The objectives of this research are to analyze the impacts of decentralization in natural resource management on local communities and the environment in developing countries. Specific issues include: Why are some communities more successful than others in implementing institutions for sustainable resource management? Who really participates in "participatory" resource management, and why? In addition, the research analyzes the potential of payments for environmental services for improving resource management outcomes by translating external benefits into real financial incentives for local people.

ZEF staff involved:

Stefanie Engel, Ramón López, Bhagirath Behera, Charles Palmer, Tobias Wünscher, Sebastian Scholz, Melanie Zimmermann, Astrid Zabel

Timetable:

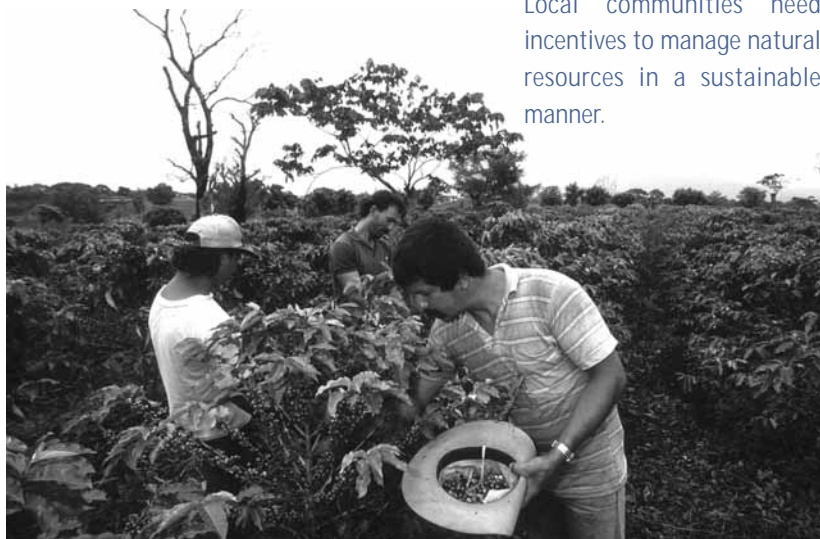
April 2001 - September 2006

The research results from India and Indonesia highlight the fact that, while decentralization in forest management and a devolution of rights to local communities is a step in the right direction, current programs often suffer from important design problems. In particular, the weak definition of community rights, lack of state enforcement of such rights, and the failure to deal with the external nature of important forest benefits are poor incentives for local communities to manage forests in a sustainable manner. Furthermore, globalization increases the complexities of decentralization by reducing community capacity for collective action and by increasing the importance of community interactions with commercial actors. The poorest communities are also the most disadvantaged in such interactions as their self-enforcement of rights is weak and they also have a weak bargaining position in negotiating resource extraction agreements.

Effects of decentralization

Globalization, by raising community opportunity cost (time) and reducing resource dependence, weakens local community capacity to self-enforce rights and also further weakens their bargaining position. Thus, globalization reinforces the need to overcome the weaknesses of current decentralization programs. First, there is a very important role for the state to provide secure rights to local communities. Second, there is a need to translate external benefits from more sustainable resource management (e.g. climate and bio-

Local communities need incentives to manage natural resources in a sustainable manner.



diversity benefits) into real financial benefits for local people. Payments for environmental services (PES), the provision of secure rights, and poverty alleviation all have the potential to improve the environmental outcomes of decentralized natural resource management as well as community welfare. However, the design of such policies, particularly in the context of community-company interactions, is a complex task.

Important complementarities also exist between the above three policy options. Specifically, the provision of secure community rights helps to reduce the complexities in the design of the other two policies and to assure benefits to the poorest of the poor. In the case of India, the research also analyzed intra-community decision-making processes. The Joint Forest Management Program has been somewhat successful in assuring that poor and marginalized groups within the communities become members of executive committees and also attend meetings where important decisions are made. Nevertheless, the results indicate that actual decision-making processes are still dominated by traditional hierarchies.

PES in Costa Rica

Costa Rica is the first developing country to have implemented a nationwide PES program and it plays a leading role in experimenting with new structural designs. However, research results indicate that the efficiency of the program could be increased considerably through better targeting techniques. A site-selection tool was developed within the project, which takes into account the spatial diversity of environmental services, risk of deforestation, and opportunity cost. Given a fixed budget, it was shown that selecting sites according to their service delivery potential increases the amount of environmental services that can be purchased significantly. The increase is even more considerable when opportunity costs are taken into account and payment levels are varied accordingly.

2.2. Land and Water Use

Introduction on Land use ...

The Millennium Ecosystem Assessment (MEA 2005) reports on an increasingly serious degradation of natural resources and the ecosystems that depend on them, threatening ecosystem goods and the services they provide. Some 40 percent of agricultural land has been degraded in the past half-century by erosion, salinization, compaction, nutrient depletion, pollution, and urbanization. The growth of population, expansion of croplands, and destruction of vegetation, global warming and emergence of yield-enhancing technologies all seem to have played a role in this acceleration. Land degradation in a context of continued population growth has also had far-reaching social consequences in some parts of the

Main cooperation partners:

Center for International Forestry Research (CIFOR), CATIE (Costa Rica); Sokoine University of Agriculture, Morogoro, and TIST - The International Small Group & Tree Planting Program (Tanzania); International Water Management Institute (IMWI); Ministry of Agriculture/Regional Office, Bolgatanga (Ghana); Centre for Economic and Social Studies, Hyderabad (India); University of Maryland

See also project webpage below

Main funding partners:

Robert Bosch Foundation, IMWI, DAAD

Project coordinator/contact:

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Homepage:

<http://131.220.109.9/index.php?id=devcom>



The project developed a site-selection tool.



Farmers in Uzbekistan.



Waiting for a better future...

world. It is estimated by the UNCCD that over 250 million people are directly affected by desertification, but up to one billion may be at risk.

Understanding land degradation and its drivers is not only a major challenge for science, but also a prerequisite for designing policies and actions to alter the course of events or temper their effects. In many areas of environmental change, no solutions or adequate strategic responses have been found; in others, there is a lack of societal awareness and political will for corrective measures. Proper land management or reclamation is therefore not a task for land managers or soil specialists alone. It also requires a policy environment that supports sustainable changes in land use, such as sound policies on land tenure and water rights. These should provide incentives for farmers to invest in improvements of the productivity of land and water, thus allowing them to continue living off this land without destroying it.

... and water use

Access to water sufficient in quantity and quality for domestic, agricultural, economic, and cultural requirements is a sine qua non for development in any meaningful sense of the word. Apart from its essential role in supporting healthy, productive and dignified domestic living conditions, water is the factor that defines agricultural productivity in many of the world's most densely populated regions, that directly influences the energy sector via hydropower generation and power demand for pumping; and that protects and promotes ecosystem health and biodiversity. Transdisciplinary research on water in its physical, ecological, socio-economic, political, and legal contexts is thus integral to ZEF's research agenda.

The livelihoods of roughly 70% of the world's poor are tied closely to agriculture, and irrigation development has been demonstrated clearly to increase employment and income and to reduce the price of food. The negative impacts of irrigation development on the physical environment are equally well documented, and it has been estimated that reductions in irrigation water use relative to present levels will be required to maintain ecosystems health globally. Efforts to reconcile poverty alleviation and ecological sustainability objectives will require protocols for the management of water resources that take full account of the value of water in supporting ecosystem function, which in turn must acknowledge the complex system of rights and entitlements that underlies the water governance process. Finally, existing technological options represent an additional framework of constraints that will have to be negotiated in the process. The broad objective of ZEF's water management research agenda is to arrive at integrated approaches, in partnership and collaboration with actors in the "problem sheds" that are the subject of our investigations. *(Excerpt from ZEF's new Strategy Paper. Forthcoming.)*

Economic and Ecological Restructuring of Land and Water Use in Khorezm

Background

Formerly the Aral Sea was the fourth largest freshwater lake in the world. Since the 1960s, the sea surface has been reduced by 60% due to the immense expansion of irrigated land for the production of cotton during the Soviet era. Uzbekistan was one of the main providers of cotton, which was a strategic commodity for the Soviet Union. Nowadays, the "Aral Sea crisis" is considered a textbook example of human-induced rapidly advancing soil salinization and exhaustion, which threatens both the ecological sustainability and economic viability of the small-scale farms in the region.

The project "Economic and ecological restructuring of land and water use in Khorezm" started in 2000 and works on providing science-based policy



Agricultural livelihoods can be improved in the region.

recommendations for sustainable resource use in those regions of Central Asia stricken by the Aral Sea crisis. Khorezm, an administrative district of the Republic of Uzbekistan in the irrigated lowlands of the Amu Darya River—the major tributary to the Aral Sea—serves as a case study. Integrated research will provide blueprints for restructuring land and water use in the irrigated lowlands of the Amu Darya River in the Aral Sea Basin.

The project scientists are developing concepts for optimized and sustainable resource use; these concepts are necessary to interrupt the vicious links between increasing rural poverty and the misuse of natural resources. Initial results show that the ecology and agricultural livelihoods in the region can be preserved and improved with judicious approaches based on transdisciplinary research results. At the heart of the project's research is the agricultur-

Project title:

"Economic and ecological restructuring of land- and water use in the region Khorezm (Uzbekistan): A pilot project in development research "

Keywords:

Sustainable natural resource use, agricultural knowledge, improving rural poverty, irrigated agriculture of cotton, wheat and rice

Country of research:

Uzbekistan

Research objectives:

Provide sound, interdisciplinary science-based policy recommendations for sustainably improving the natural resource use and rural livelihoods in Khorezm, Uzbekistan. Khorezm, a district of the Republic of Uzbekistan, serves as case study for providing blueprints for restructuring land and water use in the irrigated lowlands of the Amu Darya River in the Aral Sea basin. Long-term forecasts of policy scenarios will be developed using computer models and validated through on-farm research. The development of innovations follows a stakeholder-oriented process ("follow-the-innovation") to ensure maximum embeddedness of solutions in the local society.

ZEF Staff Involved:

ZEF Senior Staff: Irina Forkutsa, Mirzakhayot Ibrakhimov, Asia Khamzina, John Lamers, Christopher Martius, Peter Mollinga, Marc Müller, Rolf Sommer, Bernhard Tischbein

ZEF Doctoral Students of the project are listed on the project homepage

Timetable:

2002 - December 2006 (approval for 3rd phase, 2007-2010, expected for December 2006)



Main cooperation partners:

UNESCO Science Sector
International Maize and Wheat Improvement Center (CIMMYT)
German Remote Sensing Data Center DFD of German Aerospace Center (DLR)
Urgench State University (UrSU), Urgench, Uzbekistan
Tashkent Institute for Irrigation and Mechanization (TIIM), Tashkent, Uzbekistan

Main funding partners:

German Ministry for Education and Research (BMBF), DAAD

Project coordinators/contact:

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al sector, which is the backbone of Uzbekistan's economy. Thirty-three percent of Uzbekistan's gross domestic product (GDP) was derived from the agricultural sector in 2002 and over 50% of the country's labor force was employed in this sector. In Khorezm, 65% of the local population makes a living from agriculture.

The project strives to improve the economic efficiency and ecological sustainability of the agrarian sector; this requires implementing appropriate measures at policy and technology levels. The integrated research seeks solutions to regional problems via changes in three intervention levels: enabling policies, implementing institutions, and technological innovations for improving farm and water management.

This contribution describes how careful, integrative analysis of selected problems of the Aral Sea Basin will lead to their reformulation as a first step to finding adequate solutions.

Understanding the agricultural transformation process

The transition from the centralized economy and collective farming to more market-oriented frameworks with private farming involves many changes. The first years of transformation of the agrarian structure in Uzbekistan have seen a focus on the re-definition of land tenure: The former sovkhoses and

kolkhozes were dismantled into private land-holdings. By 2006 all land was allocated to private farms. However, the land reform produced a gap in agricultural services provided by the state. The absence of an organization for local water management has led to the establishment of Water User Associations (WUAs) since 2003, in an attempt to bridge the gap between higher-level administration that provides water and the farmer. A ZEF study has shown that this first occurred in an experimental setting on a few former shirkats only and led to full coverage in 2006. Likewise, the government has started the introduction of water-pricing experiments in selected WUAs

throughout the country, with the double purpose of cost recovery and resource savings. This started in May 2006, and has also been taken up by ZEF scholars as an entry point for collaborative work.

Addressing water scarcity

About 95% of the water in the Lower Amu Darya Basin is used for irrigation and the irrigated land has steadily been expanded. At the same time, ZEF



Agriculture is still the backbone of Uzbekistan's economy.

research showed that the average probability of a farmer obtaining water for cultivation declined by 16%; i.e., the farmer now has a substantially higher risk of crop loss due to insufficient water supply. This is exacerbated by year-to-year variation of water availability, and often non-transparent water distribution procedures.

A PhD study at ZEF dealt with farmers' responses to this situation and revealed that groundwater levels in the study region quickly rise after leaching of soils (a common practice for salt decontamination) in spring. The groundwater levels remain high during the summer, often at levels that bear high risk of further surface salt accumulation, and only drop after harvest, when irrigation has ceased. ZEF showed that in irrigated fields, the groundwater contribution to crop water uptake ranged between 29 and 61% of the actual cotton transpiration. It was observed that farmers often reduce the outflow in the drainage channels, very likely as a strategy to deal with the increased risk of not obtaining sufficient water for their crops. Hence, water insecurity forces farmers to rely on groundwater contributions, and consequently, hydrological textbook recommendations would do little to improve water use efficiency, unless they addressed the water risk experienced by the farmers.

Diversifying land use

Cotton, wheat, rice, and maize fodder dominate the present crop portfolio of the Uzbek farmer. Not many crops are suitable for the local conditions, but a possible avenue for improvement has been demonstrated successfully in the project's collaboration with German Agro Action (Deutsche Welthungerhilfe, DWHH) on seed potatoes, subsequently adopted by many farmers. Also, ZEF has been successful in introducing sorghum and a "niche" cash crop—indigo—in collaboration with UNESCO, which promotes natural dyes for silk carpet manufacturing.

Intensive work on native tree species has demonstrated that trees grow well even if they are under-irrigated, but must be carefully selected to provide required ecological "side" effects such as biodrainage, or input of organic matter to the soils. Biodrainage could be coupled with technical drainage systems to control secondary soil salinization stemming from high groundwater tables. More important may be the beneficial economic effects on the farmer's wallet when trees are grown on otherwise marginal land, producing valuable construction material and fuelwood as well as leaves for fodder.

Furthermore, the cropping systems of the presently dominating crops must be improved for more rational resource use. Supported by Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT) in Uzbekistan, ZEF has demonstrated already that conservation agriculture (CA) works very well for the standard Uzbek crops of cotton and wheat. It reduces water use, saves costs by reducing the number of necessary plowings, and contributes to the control of soil salinity. If combined with mulching, CA conserves soil



Crop variation is a successful tool for improving agriculture.



In Khorezm, 65% of the local population makes a living from agriculture.



Conservation agriculture works well for wheat.

moisture and builds up soil organic matter (SOM), thereby reducing the need for fertilizer inputs. Encouragingly, CA is proving to be of great interest to farmers. Even without resorting to CA, the efficiency of the standard cropping systems (cotton-wheat rotation) can be improved: Proper fertilization not only improves crop yield but also improves crop quality, which is important, given the notoriously low baking quality of Uzbek wheat. The inclusion of mung bean in the rotation has also proved to be effective. In the near future, this work on fertilizers will be incorporated in the CA approach by ZEF. Also, household surveys have shown that rice is a locally important crop and that animal husbandry is rapidly gaining importance in the rural economy. Both rice and livestock production will therefore be part of the next research phase of the project.

Government control and farm privatization

The Soviet heritage created a major "path dependency" of agriculture on centralized administrations. This is often said to create strong disincentives for more rational resource use. The transformation of former communal farms (kolkhozes, then shirkats) into small private agricultural businesses and generally a stronger market orientation are two of the solutions that have been advocated. The government sets production targets on cotton and wheat, and thus effectively controls the prices of inputs and produce. The revenues of agriculture are said to be channeled into industrial build-up. This system is often seen as exploratory for farmers, but for many of the—mostly undercapitalized—new farmers it reduces risks, because they concurrently receive inputs at low, subsidized prices. Moreover, it provides a form of social security: The government wrote off the debts farmers incurred in the recent drought years of 2000 and 2001. Steps to overcome the errors of this system therefore need to be carefully and judiciously designed.



ZEF has analyzed various privatization scenarios based on different degrees of substituting subsidized input and commodity prices for world market price levels. World market prices for inputs are on average 4.4 times higher than domestic prices, but the ratios vary considerably, between 0.2 (rice seeds) and 9.5 (diesel fuel). Prices paid for commodities are on average 3.3 times higher. The results show, for different types of farms, an improvement under the world market scenario for cotton and huge rice profitability, but non-profitability for wheat.

Privatization and the adoption of world market prices thus can increase profits, but this depends on the crop and the individual farm situation. Farms that are currently unprofitable under the present situation may become even more unprofitable without the social security net currently provided by the state order. Furthermore, the adoption of world market prices might have unwanted negative effects on the ecological sustainability of agricultural production, given that rice, a crop consuming five times more water than cotton, is much more profitable under world market prices.

Conclusions

ZEF's research on the three intervention levels -enabling policies, institutions, and (farm-level) technologies, has shown that there are no simple textbook solutions. A transdisciplinary and integrated research approach appears to be the right approach to analyze and address the problems and help to improve the lives of the rural population in the Aral Sea region.

Although most experts agree that Uzbekistan needs to create a market-oriented policy environment that supports changes in land use, it has become clear from ZEF research that this transformation process has to be very carefully designed in order to avoid major social inequities. It has also become clear that Uzbekistan needs to strengthen institutions responsible for land and water management; this includes capacity development, re-organization, and enhancing infrastructure. The type, speed, and depth of restructuring of the formerly collectivized agriculture must be designed carefully to avoid the pitfalls of the past and of some neighboring countries.



A restructuring of the formerly collectivized agriculture has to be designed carefully.

Climate Change in the Volta Basin (GLOWA Volta)

Background

The potential regional impacts of global environmental change present extraordinary challenges for the users and managers of water resources. This is particularly true in regions already subject to water stress, regions possessing weak or inadequate water management infrastructure, and regions anticipated to exhibit high local sensitivity to broad-scale changes in climate. The Volta River Basin, occupying over 400,000 km² within the subhumid to semi-arid West African savannah zone, is characterized by these and

Project title:

"GLOWA Volta: Sustainable water use under changing land use, rainfall reliability and water demands in the Volta Basin", a project in the framework of the GLOWA (Global Change in the Hydrological Cycle) Program of the German Federal Ministry of Education and Research (BMBF).



Keywords:

Global climate change, water and land use, decision support, hydrological cycle

Countries of research:

Burkina Faso and Ghana

Research objectives:

The impact of climatic and land use change on the Volta basin

ZEF staff involved:

Charles Rodgers (project leader), Luna Bharati, Jörg Szarzynski, Barnabas Amisigo, Halidou Compaore, Eva Youkhana, Wolfram Laube, Maria Plotnikova

Timetable:

1st Phase: 2000 - 2003

2nd Phase: 2003 - 2006

3rd Phase: 2006 - 2009

Main cooperation partners:

In Germany:

University of Bonn, Department of Computer Science and Informatics III
German Aerospace Center (DLR)/University of Wuerzburg
Institute for Meteorology and Climatology (IMK-IFU)

In Ghana:

The United Nations University,
The International Water Management Institute,
The Kofi Annan Centre for Excellence in ICT,
The Ghanaian Council for Scientific and Industrial Research (CSIR),
Ministries and line agencies in Ghana and Burkina Faso.
The Ghanaian Water Resources Council

In Burkina Faso:

Institut de l'Environnement et de Recherches Agricoles (INERA), Burkina Faso
Dr. Leopold Somé (lisme@liptinfor.bf)

Linked Projects:

BIOTA West Africa, CGIAR challenge program on water and food (small reservoirs project; governance and modeling project); others

other vulnerabilities, including low incomes and a rapidly expanding population—around 2% per year. Volta Basin inhabitants are overwhelmingly rural and small-scale rain-fed agriculture is the dominant economic activity, employing roughly two out of three basin residents. Agricultural productivity is low, however, at roughly one tonne of cereal yield equivalent per hectare, reflecting erratic and unreliable precipitation and lack of irrigation infrastructure. Enhancing agricultural productivity is perceived to be the key to improving economic growth and the focus is on more efficient and sustainable use of water resources. Due to seasonal droughts and the steep south-to-north precipitation gradient, water availability is neither predictable nor distributed equitably among users geographically.

To reduce friction between upstream and downstream water users, the governments of Burkina Faso and Ghana have initiated measures for trans-boundary, integrated water resource management on the basis of international guidelines; this involves regional and local stakeholders and water-use associations. To facilitate the success of this management concept, scientists need to provide local and regional decision-makers with scientifically sound information, thereby supporting the political decision-making process.

To provide a scientific basis for water management, the GLOWA Volta Program (GVP) provides analysis of the physical as well as the socio-economic factors determining water demand and water availability in the Volta Basin. Data and research results from the three primary research clusters— atmosphere, land use, and water use—are being integrated to provide a Decision Support System (DSS) which can be used by the relevant decision-makers to improve water use and distribution among users, sectors, and regions.

Extension to Research Phase III:

Following the successful review of GLOWA Volta Phase II by the Federal Ministry of Education and Research (BMBF) in May 2005, ZEF scientists focused on the development of a comprehensive research and implementation plan for moving the GVP from data collection and model development to an operational mode. The ensuing proposal, "GLOWA Volta Phase III: Synthesis and Transfer", was successfully submitted in late 2005, and subsequently awarded funding for June 2006 to May 2009.

The Phase III proposal introduces some additional components to the GVP science plan, as significant program resources have been allocated to software engineering tasks, facilitating the integration of models, databases, and visualization tools required to construct a fully functional DSS. Another significant feature of the Phase III science plan is the building of a research consortium in West Africa to ensure the successful transfer of GVP scientific products, infrastructure, and ongoing data collection activities to stakeholders within the Volta Basin following formal completion of the program in May 2009.

Atmospheric science

During 2005, scientific activities within the atmosphere research cluster centered on: (1) efforts to provide credible regional climate simulations for present and near-future conditions; (2) development of an operational hydro-meteorological monitoring system; and (3) development of models and methodologies to evaluate the onset of the rainy season. The capacity to generate credible simulations of linked climate-land surface-hydrological processes is central to the GVP's broader objectives, because regional climate drives the entire basin's hydrological cycle and because livelihoods here depend extensively on rain-fed agriculture, making them highly vulnerable to rainfall variability and climate change.

The core tasks of calibrating, validating, and linking the mesoscale climate model MM5 to the physical hydrological model WaSim ETH were completed successfully in 2005. The coupled, validated model ensemble was then used to generate two 10-year time slices: 1991-2000 (present climate) and 2030-2039 (future climate) for reference purposes. These time slices provide the basis for a wide range of empirical water management studies involving climate change scenarios. The results of the coupled regional climate-hydrological simulations suggest an increase in annual mean temperature of 1.2 to 1.3°C in the Volta Basin over the next 30 to 40 years. This temperature change significantly exceeds interannual variability. Mean annual precipitation over the Sahelian and coastal regions of the basin increases by about 5% on average. Climate simulations also suggest that precipitation will decrease in April, traditionally marking the beginning of the rainy season, implying not only smaller seasonal rainfall totals but also a delay in the onset of seasonal rains by about nine days in the Sahelian region. These projections, which are consistent both with statistical analysis of historical records and with the recollections of farmers in the region, suggest that cur-

Main funding partners:

German Federal Ministry of Education and Research (BMBF)

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Mean annual precipitation increases in coastal regions.



The Volta Basin is characterized by a rapidly expanding population.



rent rain-fed farming practices will become more risky, and alternative, irrigated cropping systems must be developed and tested for suitability within the basin.

GVP scientists are also working to develop tools and protocols so that real- or near-real-time data can be assimilated into the integrated model framework. Thus predictions of river discharge and reservoir storage can be updated with sufficient timeliness to improve water management decisions, or forecasts of the onset of seasonal rains can afford farmers sufficient time to make informed planting decisions. During 2005, significant progress was made in three critical research areas supporting hydro-meteorological monitoring capacity. Two remote sensing-based methods, the "modified Makkink-vegetative fraction" and Surface Energy Balance Algorithm (SEBAL) models were developed and tested. Finally, work on an innovative hybrid statistical approach to predict the onset of the rainy season over the Volta Basin was completed; the toolbox is now available and able to predict the onset of rains on the basis of regional circulation patterns. Each of these developments is an important step towards the realization of an operational, near-real-time basin water management system.



The Volta Basin is a mainly rural area.

Land use

The primary objectives of research conducted under the land-use cluster during 2005 and 2006 were first to understand interactions between the social and natural environment in order to model land-use change within the Volta Basin; and second to provide soil- and vegetation-related input parameters and their dynamics for meteorological and hydrological models. Substantial progress was made in many areas, particularly in the assembly of basin-wide land cover maps derived from remote sensing; and in the community-scale modeling of human-landscape interactions.

In order to gauge the extent of land cover change within the recent historical period, mosaics of Landsat images comprising the entire basin for two time slices—1990 and 2000—were retrieved, atmospherically corrected and automatically classified. Ground truth data were also collected on key variables. These time slices will provide the basis for a cellular automata-based model of land conversion, as well as an improved basis for the land surface parameterization of atmospheric and hydrological models.

The program on soil classification by pedo-transfer function and an artificial neural network was expanded to encompass major areas in Northern Ghana. Field sampling work is now complete, and laboratory work and analysis by neural net algorithms will be completed by mid-2006. Soil erosion research conducted in 2005 employed an integrated approach to measuring the sediment budgets of upland catchments common to Burkina Faso and Northern Ghana. Fieldwork was completed on three small reservoir-catchment systems in Burkina Faso. Isotope analysis (Cs-137) was used successfully to evaluate erosion and re-deposition within the catchments.

Finally, the community-scale model GV-LUDAS was used successfully to



A household survey for Ghana was completed in 2005.

simulate human-landscape interactions dynamically within a representative community in the Upper East of Ghana, and parallel work is underway at the Dano field site in Western Burkina Faso. When complete, GV-LUDAS will support rapid progress in the development of the Cellular Automata (CA) land cover change model at the basin scale; GV-LUDAS will provide stand-alone DSS capacity for local natural resource decision-making.

Water use

The primary objectives of research conducted under the water-use cluster include (1) evaluation of irrigation potential and economic benefits from



Volta Basin scenery.

irrigation, accounting for hydrological, agro-ecological, farm household, and farming characteristics; (2) analysis of domestic water use, management, and policies; and (3) evaluation of the health and livelihood impacts of patterns of agricultural and domestic water use. Work completed during 2005 focused primarily on the development of the modeling tools and the completion of databases required for integrated analysis.

Specification, calibration, and validation of the physically based, distributed parameter hydrological model WaSim ETH for the entire Volta Basin were completed in 2005, and this model is now available as a simulation tool to support a wide range of water resource management and investment studies. A WaSim model of the White Volta tributary was also calibrated and validated; this will form an essential component of the White Volta Pilot Project Decision Support System. The Atankwidi Catchment groundwater study was also completed in 2005, and significant progress was made in the companion Burkina Faso study. ZEF scientists, working with members of the CPWF Small Reservoirs Project, have nearly completed an important geo-spatial database on small reservoirs and associated irrigation systems in the Upper East Region of Ghana.



Local market.



Church in Ghana.

To support a comprehensive analysis of water demand by sector (irrigation, domestic, commercial) within the Volta Basin, a second round of the Common Sampling Framework (CSF) household survey for Ghana was completed in 2005, which greatly expanded the coverage of irrigating households. A first round of the CSF sample survey was also conducted in Burkina Faso.

Research on institutions

The development of an "institutional map" of the water sector of Ghana was a priority activity during 2005. An overview was required to provide a framework for case studies concerning interrelations among selected actors and institutions. The process of preparing the institutional map of the water sector revealed an extraordinarily complex picture, both with respect to the number of actors involved directly or indirectly with water resource decision-making and to the complex, overlapping, and often unclear mandates held by each institution. This project component was completed in 2005; the primary output takes the form of a comprehensive inventory that will facilitate formal approaches to modeling decision-making in the water sector, and will also serve as a valuable reference for a wide range of stakeholders and policy-makers in Ghana and throughout the international research community. A parallel institutional analysis for Burkina Faso was initiated in 2005 and completed in early 2006.

Capacity building:

During 2005 and 2006 several research milestones were completed, as well as the completion of an additional 14 PhD and master degrees. Since 2002, thirty-two students completed their studies, mostly candidates from the Volta region.

Publications: see <http://www.glowa-volta.de/publications/publist.htm>

Social Water Management

Project title:

"Social management of water in Afghanistan (SWMA)"

Keywords:

Irrigation, local governance institutions, participatory resource management, water and land use

Country of research:

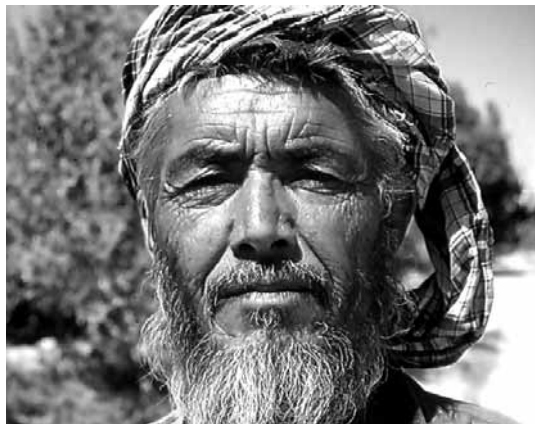
Afghanistan

The SWMA project is part of the larger Kunduz River Basin Programme (KRBP). It comprises a research component—undertaken by ZEF—and an implementation-oriented, community-mobilizing component carried out by our cooperation partner the Deutsche Welthungerhilfe (DWHH, German Agro Action). This initiative results from combined efforts of the UN, the EU, the Afghan government, and many international donors to re-establish and strengthen the governance institutions and to reconstruct the infrastructure after more than 20 years of war and political unrest in Afghanistan. During that period the rural population in the Northern Afghan Provinces has been severely affected by fighting, massive migration, and a disruption of its former social organization. As a consequence, many local communities can no longer maintain their major water resources and irrigation canals, which

previously were managed by a sophisticated system of land-water use and local repair mechanisms. The SWMA project aims at facilitating sustainable participatory water management institutions for the affected people at the local level. Therefore, it addresses the key issues threatening the former management system of five selected river surface irrigation schemes, such as:

- the decrease of water availability due to drought, deforestation, physical damage, and degradation of embankments and canals;
- a collapse of managing capacity and communication on canal maintenance and labor supply between up- and downstream communities;
- the vested interests of major landowners and local commanders;
- decreasing support to locally elected water managers;
- knowledge gaps regarding hydrological conditions, farm water use, and social water management;
- an unregulated increase of water use through the extension of tertiary canals and ditches or water intensive crops.

ZEF's research component comprises at least five in-depth field studies by expatriate MSc students from different international universities, who are conducting field research in the course of their theses under the coordination of a Postdoctoral graduate from ZEF.



Especially the rural population has suffered from more than 20 years of war in Afghanistan.

New Approaches to Adaptive Water Management under Uncertainty (Newater)

The European Union-funded NeWater project aims at developing new scientific methods and practical tools for the participatory assessment and implementation of adaptive water management. It will put a strong emphasis on establishing science-policy dialogue at local, basin, and global scales. The central tenet of the NeWater project is a transition from currently prevailing regimes of river basin water management into more adaptive regimes in the future. This transition calls for a highly integrated water resource management concept. NeWater identifies key elements of the current water management system and focuses its research on transition processes for these elements into Adaptive Integrated Water Resources Management (AIWRM). Adaptive management can be defined more generally as a systematic process for continually improving management policies and practices by

Research objectives:

- (1) A better understanding of the physical infrastructure, the livelihoods, the water rights and the functioning of actual institutional arrangements operating in and governing five irrigation schemes in the Kunduz River Basin in Northern Afghanistan.
- (2) Developing a social design for criteria for these irrigation systems.

ZEF staff involved:

Peter Mollinga, Conrad Schetter, Jan Monsees, Katja Mielke

Timetable:

April 2006 - April 2008

Main cooperation partner:

Deutsche Welthungerhilfe (German Agro Action, DWHH)

Main funding partner:

European Union

Project coordinator/contact:

Peter Mollinga: pmollinga@uni-bonn.de

Project title:

"NeWater project—New approaches to adaptive water management under uncertainty"

An integrated project in PRIORITY 6.3 Global Change and Ecosystems in the 6th EU framework programme.

Keywords:

Governance, institutions, participation, integrated water management

Country of research:

Uzbekistan



Research objectives:

ZEF will assess the existing governance structures in Uzbekistan within the Amu Darya Basin and discover how these structures can be changed into an institutional arrangement that is clearly targeted at adaptive management.

ZEF staff involved:

Peter Mollinga, Resul Yalcin

Timetable:

January 2005 - January 2007

Main cooperation partners:

Project coordinator:

Claudia Pahl-Wostl, Institute for Environmental Systems Research, University of Osnabrück

Main funding partner:

European Union (EU)

Project coordinator/contact:

Resul Yalcin: ryalcin@uni-bonn.de
Peter Mollinga: pmollinga@uni-bonn.de

Homepage:

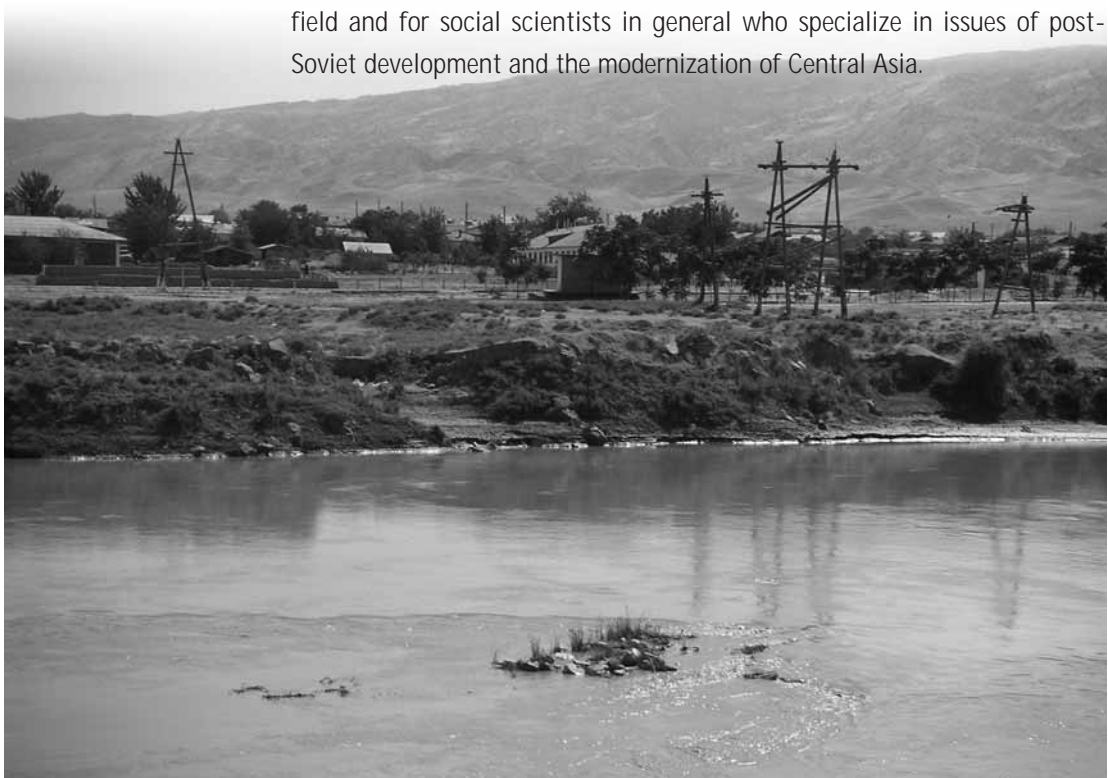
www.newwater.info

learning from the outcomes of implemented management strategies.

Water management is facing major challenges world-wide due to increasing uncertainties caused by climate and global changes and by fast changing socio-economic boundaries. Adaptive management is advocated as a timely extension of Integrated Water Resources Management (IWRM) to cope with these challenges. The study is part of the global EU NeWater project that covers seven case studies of large river basins: the Rhine, Elbe, Tisza, Guadiana, Nile, Orange, and Amu Darya. ZEF is a partner in the NeWater project through a case study on the Amu Darya, which has conducted research on governance, institutions, and participation in water management in Uzbekistan in close cooperation with other local Uzbek and European partners, in particular with ZEF's Khorezm project (p. 31).

The objective of the Amu Darya case study is to conduct comprehensive research on issues related to governance, institutions, and participation in Uzbekistan. The study also provides an institutional analysis of water resource bureaucracy and water sector reform processes in Uzbekistan, and examines the changes that take place and have taken place in the water sector since the republic's independence.

Through this research we aim to provide a better understanding of how policies are formulated within Uzbek water resource management; what the prerequisites for participation in the decision-making process are; and to decide whether they serve the overall objectives of the country's and the water sector's policy. This study aims at offering information to people who participate and/or initiate policy-making in developing countries and as input for Uzbek authorities working in the water sector. It will also provide source materials for further study for those with a special interest in this field and for social scientists in general who specialize in issues of post-Soviet development and the modernization of Central Asia.



2.3. Trade and Globalization

Globalization and International Trade

Changes occurring throughout the world - such as regional integration, the development and opening of new markets, shifts towards more liberal trade regimes, or the increasing concern about food safety - are all having a major impact on economic development. In this large research area ZEF focuses on two specific issues: first, the impact of globalization and international trade on the development of especially low-income countries endowed with rich resources; and second, environmental and social standards as parts of global governance.

Too little is known about the impacts of increasing global market integration (globalization), global trade liberalization, as well as regionalism on human welfare, especially in poor, but resource-rich countries. The opening of new markets, the reduction of subsidies and lowering of trade barriers in the context of the World Trade Organization (WTO) as well as the increase in regional trade arrangements provides opportunities for increased export earnings through the exploitation of natural resources but is expected to have different distributional effects in and among low-income countries.

For many developing countries, the export of agricultural products is of immense importance. They offer opportunities to many small- and medium-scale farmers who often produce more than half of the exports. However, there is the concern, that decreasing trade barriers for food imports and exports as pursued by WTO, will be replaced by new forms of non-tariffs trade barriers, i.e. stringent product standards like quality and traceability of food as well as environmental or social standards in the production process. These are viewed by a great number of developing countries as substantial constraints on their ability to export agricultural and food products to the EU or other industrialized countries.

(Excerpt from ZEF's new Strategy Paper. Forthcoming.)



Small market in Tamale, Northern Ghana.

Trade, Social Standards, Labeling

Most internationally traded goods are subject to labor and environmental standards and the numbers continue to rise. Such developments have created a hot debate about the impact of labor and environmental standards on trade, but there has been no clear international consensus on the net costs and benefits arising from such regulations on market access, export performance, and competitiveness as well as the welfare of children in developing countries. Three studies have examined these issues: A ZEF study contributes to the debate by providing results from a survey of 83 firms in the textiles and ready-made garments industry in Egypt. The main result from the descriptive analysis reveals that child labor is a phenomenon that exists

Project title:

"Trade, environmental and social standards, labeling"

Keywords:

Labeling, child labor, trade liberalization

Countries of research:

Egypt, Nepal



Research objectives:

This research program focuses on the economics of standards and labeling, including assessment of the impact of standards on competitiveness, especially of developing countries, as well as the impact of social labeling programs on the welfare of children in developing countries.

ZEF staff involved:

Ulrike Grote, Arnab Basu, Cristina Carambas, Sayan Chakrabarty, Nancy Chau, Ahmed Ghoneim, Guido Luchters, Dina Mandour

Timetable:

Started in 1998
 Completion of several articles in 2005/2006
 Completion of two PhD theses in 2006
 Conference proceedings in 2006

Main cooperation partners:

Hans-Rimbert Hemmer, University of Giessen
 Dieter Bender, University of Bochum

Main funding partners:

GTZ, DAAD

Project coordinator/contact:

Ulrike Grote: u.grote@uni-bonn.de

Homepage:

<http://131.220.109.9/?id=274>

in the textiles and ready-made garments industry with a relatively high share in the sample (16%). All destinations receive exports derived from child labor; however, non-Western destinations seem to receive the lion's share, and many firms that use child labor export more than 50% of their output. The econometric findings suggest that several variables related to labor standards have a significant effect on the probability of a firm exporting more than 50% of its output and exclusively to the West (namely the EU and the US). Also, variables which ensure the enforcement of labor standards have a higher explanatory power for the probability of a firm performing well in exports rather than compliance and awareness variables. Moreover, firms are likely to self-enforce labor standards based on their expectation of improving their market access and the competitiveness of their export products. Thus, the driving forces leading to the implementation of higher labor standards at the firm level are more of an economic rather than a social nature. And finally, for those firms with a high volume of exports to Arab countries and for smaller firms (both exporting to the West or Arab countries), the effect of standards might lead to export diversification.



A survey in Nepal examined the influence of NGOs.

Case study in Egypt

A dissertation on the impact of health and environmental (H&E) standards on Egyptian agricultural food exports to the EU was confined to testing the validity of the conventional argument that standards act as non-tariff barriers. By employing the inventory approach, it was evident that a considerable percentage (40.5%) of agricultural food exports to the EU are subject to H&E constraints in terms of the percentage of the value of total food exports to the EU. However, descriptive and econometric analyses of a survey revealed that H&E measures do not represent a significant threat to Egyptian food exports and that firms have the ability to accommodate them and even gain from the benefits of compliance. Nevertheless, there are many domestic and external institutional constraints that deprive exporters from achieving optimum benefits from compliance. Domestically, this is especially evident in the poor conformity assessment procedures in Egypt. Externally,

this is represented in unexpected and abrupt changes in regulations and lack of rigorous scientific risk assessment for most trade disruptive measures.

Case study on child labor in Nepal

Another dissertation on social standards analyzed the question "Does the labeling of products which have been produced without any child laborers contribute to increased welfare of children?" A survey in Nepal examined which factors determine the probability of a child having to work, the influence of non-governmental organizations (NGOs) engaged in social labeling, and the incidence of child labor and child schooling. Data were obtained from interviews with 410 households in Kathmandu Valley in Nepal. The results of the econometric analysis show that the probability of child labor decreases if (1) the carpet industry has implemented a labeling program, (2) the adult's income increases ("luxury axiom"), and (3) the head of the household is educated. However, it increases with (1) the age of the head of the household, and (2) in the presence of more children (aged 5 to 14) in the household. Also, labeling NGOs have a significant positive influence on sending ex-child laborers to school, since they have a control function.



Hundreds of households were interviewed in Kathmandu Valley.

Agricultural Trade Liberalization

In addition to presenting the results of scholarly research, ZEF Policy Briefs also address decision-makers and practitioners involved in international policy-making with pointed comments on current and emerging issues. Policy Brief No. 4 was written in the run-up to the 6th WTO Ministerial Meeting in Hong Kong from 13 to 18 December, 2005; the meeting was conducted to reach agreement on the key parameters for the final stage of negotiations in the so-called "Doha Round", the ninth round of international trade negotiations. The Brief provided an assessment of the stage of these negotiations and the chances of success.

The battle lines in these negotiations are drawn around the size and the sequence of agricultural trade liberalization. The commitment to make Doha a "development round" is the major reason that agriculture plays such an important role in the negotiations. First, agriculture remains the most protected economic sector. Second, many developing countries enjoy a comparative advantage in agricultural production. And third, most poor people in poor countries live in rural areas. Thus, the removal of trade distortions in agricultural markets, which would benefit farmers in developing countries, can contribute to reducing poverty as stipulated in Goal 1 of the Millennium Development Goals (MDGs). From the perspective of developing countries, reducing protection of agriculture in high-income countries is a precondition for further negotiations on trade in manufactures and services.

In general there seems to be agreement about the net benefits of a removal of all trade-distorting measures for developed and developing

Agricultural Trade Liberalization—
Stumbling Block of the "Doha Round"?

Summary of **ZEF Policy Brief No. 4** by
Klaus Froberg and Ulrich Hiemenz
(published in December 2005)



In the streets of Tamale, Ghana.



Women in Ghana are the backbone of development.



countries alike. However, the Policy Brief expresses some doubt whether the "liberalization formulae" put on the table by the US and the EU would really serve the purpose of creating a level playing field for all participants in international agricultural markets. These doubts are related to the differences between bound and actual tariffs, the importance of middle-income developing countries (not only as exporters but also as importers of agricultural goods), and the impact of liberalization on poor countries:

- The huge gaps between bound and actual tariffs, for example in the EU, suggest little impact, even of a substantial reduction of bound rates.
- Notably larger middle-income countries have built up agricultural protection levels similar to those in the US or the EU hampering an expansion of trade among developing countries.
- Many poor countries are likely to suffer from a unilateral liberalization of agricultural trade as world market prices for many food products will increase.

The Policy Brief concluded that given the state of preparatory negotiations it was not likely that the required compromises would emerge in Hong Kong. The actual course of events has proven this conclusion to be correct. Even in July 2006 negotiations do not seem to have made much progress compared to December 2005. A positive outcome is, however, all the more urgent as failure could seriously undermine the credibility of the WTO and political commitment, especially in larger, richer countries, to abide by its rules and disciplines. This would be very dangerous for the smaller, poorer countries that benefit disproportionately from a system based on rules rather than on power.

2.4. Biodiversity

In the face of accelerating global losses of biodiversity the international community has committed itself in the United Nations Convention on Biological Diversity (CBD), to conserve and sustainably use biodiversity, to grant access to genetic resources, to fair and equitable benefit sharing, and to the transfer of relevant technologies. Today it is recognized that biodiversity loss can undermine the chances of future generations to adequately respond to environmental changes, diseases, changing consumer trends and other challenges, which we currently cannot foresee or predict. Human population growth, policy and institutional failures, and poverty have been frequently identified as causes of biodiversity loss, which need to be dealt with for achieving sustainable development.

ZEF recognizes that driving forces and measures for the conservation and use of biodiversity vary within and between cultures and depend on a multitude of factors such as resource availability, skills for exploitation, education, availability of information or market access. Because of the different features and functions of biodiversity and the attributes of the users of biodiversity and their abilities in responding to environmental change by adaptive social organization, exploring and understanding biodiversity requires transdisciplinary approaches. ZEF, therefore, works on biodiversity conservation and management concepts that equally consider ecological, economic, and cultural factors.

(Excerpt from ZEF's new Strategy Paper. Forthcoming.)



The international community has committed itself to the conservation of biodiversity.

The CoCE Project on *Coffea arabica* in Ethiopia

Introduction

Arabica coffee (*Coffea arabica*) has its center of origin in the highlands of southwest and southeast Ethiopia where wild coffee populations grow naturally in the undergrowth of the Afromontane rainforests. The forests and hence the gene pool of wild Arabica coffee are highly endangered by increasing settlement and land-use pressures. For instance, 60% of the forests of southwestern Ethiopia has been converted into agricultural land during the past 30 years. The importance of the Ethiopian montane rainforests has been internationally acknowledged as they have been part of the "Eastern Afromontane Biodiversity Hotspot" since January 2005. The research project: "Conservation and use of wild coffee populations in the montane rainforests of Ethiopia" (CoCE) was implemented to assess the biological diversity and economic value of forests in which wild coffee occurs—"coffee forests" and to develop transdisciplinary concepts for models concerning the conservation and use of forest biodiversity.

Project title:

"Conservation and use of the wild populations of *Coffea arabica* in the montane rainforests of Ethiopia".

Keywords:

Biodiversity, conservation and use, coffee, economic valuation of diversity, rainforest

Country of research:

Ethiopia



Research objectives:

The aim of the research project is to assess the diversity and the economic value of the Ethiopian coffee gene pool and to develop concepts of model character for conservation and use of the genetic resources of *Coffea arabica* in its center of diversity in Ethiopia. The concepts are to be based on the conservation of the montane rain forests as the natural habitat of the wild coffee populations and the forest coffee systems as the traditional use of the wild coffee populations.

ZEF staff involved:

Manfred Denich (project leaders), Franz Gatzweiler, Tadesse Woldemariam (project coordinators), Alice Beining, Taye Kufa, Georg Lieth, John Mburu, Peter Mollinga, Anke Rojahn, Christine Schmitt, Feyera Senbeta, Admasu Shibru, Till Stellmacher, Kassahun Tesfaye, Teklu Tesfaye (Gole team members)

Timetable:

August 2002 - June 2006
New project phase: August 2006 to July 2009

Main cooperation partners

Ethiopian Agricultural Research Organization (EARO)
Addis Ababa University (AAU)
Ethiopian Economic Association (EEA)
Institute of Biodiversity Conservation (IBC)
Nees Institute for the Biodiversity of Plants (University of Bonn)
Institute of Plant Nutrition (University of Bonn)
Institute of Phytopathology (University of Bonn)
Foundation of Sustainable Development (University of Wageningen)
Amber Foundation, Freiburg
GEO schützt den Regenwald e.V.
Kraft Foods Deutschland
German Technical Cooperation, GTZ

Main funding partners:

This project is being carried out in the framework of the BioTEAM Biosphärenforschung - InTEgrative und Anwendungsorientierte Modellprojekte) - Program of the Federal Ministry of Education and Research (BMBF), Germany

Floristic diversity of Ethiopian forests

In vegetation surveys carried out in five different forest regions, more than 700 plant species were found. This amounts to 10% of the Ethiopian flora. The vegetation analyses revealed that the montane forests of the five study regions are significantly different floristically. The floristic compositions of forest areas with wild coffee occurrence, however, are cross-regionally very similar, thus, allowing the definition of "coffee forests". The occurrence of wild coffee strongly depends on altitude (highest abundance between 1,300 and 1,600 m, range 1,000-2,000 m) and management intensity by local coffee collectors. Management intensity, i.e. the extent to which competing vegetation is removed from the undergrowth, determines species composition and structure of the coffee forests.

Genetic diversity of wild coffee

Molecular-genetic analyses based on Inter-Simple Sequence Repeat (ISSR) markers confirm the high genetic diversity of wild *Coffea arabica* and show that wild coffee clearly differs genetically from landraces and cultivars. In particular, it can be shown that some regions have genetically similar populations and other regions very different wild coffee populations. In general, high levels of diversity within regions can be observed. Forest management by coffee collectors often increases the abundance of wild coffee plants; harvesting of the coffee berries, however, does not seem to have negative impacts on the genetic diversity given the fact that coffee trees are self-regenerating.

Drought tolerance of wild coffee

From a strictly utilitarian perspective, genetic diversity is not a priori a value. In combination with the variability of the ecological and physiological properties of the coffee plants, however, genetic diversity gains in importance. Therefore, the drought tolerance of wild coffee populations along a rainfall gradient has been analyzed. Ecophysiological studies reveal that drought tolerance is site-specific and the water-use efficiency of wild coffee plants increases with decreasing mean annual rainfall at the study sites. In addition, drought-stressed coffee plants recover faster at the end of dry spells when they originate from dry environments.

Fungal diseases of wild coffee

To support the practical importance of the genetic diversity of wild coffee, the variability of coffee plants and populations in the context of their tolerance towards coffee leaf rust (CLR) and coffee berry disease (CBD) was assessed. In wild coffee populations, 30 to 70% of the plants are infected by CLR, but major damage could not be observed, let alone the total eradication of a coffee stand as happens in plantations in other parts of the world. Artificial infections in the field with CBD demonstrated that 53 to 100% of the wild coffee berries are tolerant to CBD. It can be concluded that the dis-

ease situation in the coffee forests is relaxed and germplasm exists for breeding for CLR and CBD tolerance. Furthermore, field studies revealed that coffee wilt disease, a fungal disease formerly known only in *Coffea canephora* (Robusta coffee), now also attacks *Coffea arabica* in Ethiopia, a fact that deserves closer attention.

Economic analysis of the coffee forests

By means of a cost-benefit analysis, the global economic value of the wild coffee gene pool as a resource for coffee breeding was estimated to be around US\$0.42 billion at a 10% and US\$1.46 billion at a 5% discount rate. The economic valuation of the coffee forests has been carried out from the



Wild coffee differs genetically from landraces and cultivars.

farmers' and society's perspective. From the farmers' perspective, the conversion of the forest into arable land is more profitable in the short term than sustainable forest management. The income from the latter would only amount to 65 to 75% of the former. Examining the value of coffee forests from a societal perspective includes, inter alia, sustainable timber production, collection of wild coffee and its sale for a premium price, and the ecosystem services the forest cover provides. Under these conditions, sustainable forest management achieves higher net benefits compared to strict protection or conversion into arable land which only achieve 50 and 70 to 85%, respectively, of the benefits from sustainable forest management.

Institutional research in coffee forest areas

In Ethiopia, all forests are nationalized. Most coffee forest areas are located in so-called National Forest Priority Areas (NFPA), where local forest users have limited access and use rights, which conflict with traditional property rights. Combined with a lack of incentives and the absence of monitoring and enforcement activities, this has led to a de facto open access situation. Institutional research has found that traditional use rights in the forests are still practiced, i.e. the forests are subdivided into clearly defined plots, each of which is the property of an individual family. This fact is very often unknown or ignored by new settlers or newly initiated Participatory Forest Management Projects and predetermines conflicts.

Outlook

In general, research results support the assumption that wild coffee has contributed to maintaining at least a patchy minimum of the Ethiopian forest

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www.zef.de/index.php?id=367



The different project measures will be merged in a protected area concept.



Poverty can be a cause of biodiversity loss.



Exploring and understanding biodiversity requires a transdisciplinary approach.

resource as it has been used traditionally for time periods within living memory and locally traded as an important cash crop. Nevertheless, high population and agricultural land-use pressures reduce the remaining forest fragments together with the wild coffee populations.

CoCE I concludes that four problem areas have to be addressed in a second project phase (CoCE II) to realize the conservation and use of wild coffee populations in the montane rainforests of Ethiopia:

1. As natural forest areas are shrinking and Ethiopian coffee production is increasingly based on modern coffee cultivars instead of landraces and wild coffee, practical measures have to be developed to preserve the wild coffee gene pool, preferably in situ, but also detached from strict forest conservation.
2. The potential economic value of the wild coffee-genetic resource has to be transformed into real economic benefits for the rural population through adequate incentives and financing mechanisms related to conservation and use efforts.
3. Implementation strategies for conservation and use concepts have to be developed, including communication and public awareness building, education as well as strengthening institutional capacity for the conservation and sustainable use of forest resources.
4. In addition, new research questions have evolved in the course of CoCE I, which require further attention. These include genetic diversity, coffee diseases, coffee quality as well as the relationship between the rules and regulations of forest management and the condition of the forests.

CoCE II, which started in August 2006, is aiming at the development of implementation strategies for models concerning conservation and use concepts developed in CoCE I. These strategies will be based on concrete conservation and use activities for the wild coffee gene pool, communication of wild coffee and rainforest-related topics, environmental education, and public awareness of biodiversity as well as the quest for the transformation of the potential economic value of wild coffee and the forest resource into real economic benefits through suitable incentive and financing mechanisms. The different measures will be merged in a protected area concept, which includes conservation and development aspects at the landscape level. As an innovative component in biodiversity research, a (project-initiated) newly founded NGO, the Ethiopian Coffee Forest Forum (ECFF), will bridge the gap between research, practice, and politics.

BIOTA West Africa

With regard to future threats to biodiversity and the development of sustainable management strategies, it is important to know how land cover changes affect regional patterns of climate and biodiversity, and vice versa. The scientific research of ZEF within the BIOTA subproject W02 focuses on hydrometeorological and biophysical parameters that affect the local biocoenoses.

The accelerated loss of biodiversity around the world caused by anthropogenic impact is of major concern to present and future human well-being. This is a threat in particular for areas with high population density and growth that are biologically rich but economically weak, such as most parts of West Africa. The region has been densely populated and cultivated by humans for thousands of years. They have created innovative adaptation processes to changing population densities, but the present surges in population size as well as the endangering impact of climatic change aggravate the negative impact of human activities on the diverse and unique ecosystems. West Africa is characterized by a strong rainfall gradient leading to highly diverse vegetation cover. The gradient passes from the humid tropical and subtropical zones in the south that had been largely forested in the past through the heterogeneous forest-savannah mosaic of the Guinea Zone to the dry ecosystems of the Sudanian and Sahelian zones in the north. Large-



and small-scale land cover changes, habitat degradation and fragmentation as well as massive and profound habitat conversion accompanied by unsustainable use of natural resources such as deforestation, excessive hunting, overfishing, are diminishing crucial ecosystem goods and services vital for humans.

Facing these ecological, environmental, and socio-economic problems, BIOTA West addresses these challenges by using an interdisciplinary, inte-



The project focuses on hydrometeorological parameters.

Project title:

BIOTA West Africa subproject W02: "Assessment of Africa's biodiversity and development of sustainable conservation strategies considering climate and land cover changes" (new title).
"Biophysical and hydrometeorological parameters within the framework of Terrestrial Biodiversity Research" (former title).

Keywords:

Biodiversity, climate change, vegetation dynamics, land surface-atmosphere interactions

Countries of research:

Burkina Faso, Benin, Côte d'Ivoire

Research objectives:

Based on experiences from the BIOTA West Africa pilot phase our prime objective is to generate a multi-scaled scientifically sound climatological framework derived from reliable experimental field measurements and a profound analysis of regional climate variability including vegetation dynamics and land cover/land-use changes.

ZEF staff involved:

Jörg Szarzynski (project coordinator),
Lazare TIA (PhD student)



Timetable:

BIOTA 1st phase: January 2001 - March 2004
 BIOTA 2nd phase: March 2004 - March 2007
 BIOTA 3rd phase: March 2007 - March 2010

Main cooperation partners:

Burkina Faso :
 Université Ouagadougou; Institut de l'Environnement et de Recherches Agricoles (INERA)
 Benin : Université Abomey-Calavi
 Côte d'Ivoire: Université d'Abobo-Adjamé; Université de Cocody; Station d'Ecologie Tropicale de Lamto; Institut de Géographie Tropicale (IGT)

Main funding partner:

BMBF

Project coordinator/contact:

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grative, and participatory approach with the ultimate goal of: a) Identifying the drivers and processes leading to biodiversity loss; b) developing methods for the preservation of biodiversity at various scales from local to continental levels (integrating scenarios on the effects of global change); and c) creating and proposing tools that contribute to the gender-balanced sustainable use of biodiversity. These involve combined with flexible adjustments in management strategies that take into account the dynamic nature of the systems, socio-economic requirements, and the cultural background of the users. The main thrust of BIOTA West is on three countries in West Africa, Côte d'Ivoire, Benin, and Burkina Faso whereby several aspects of our research are ultimately brought up to the continental scale.

First phase research results

The first phase of BIOTA was devoted to the establishment of the project's infrastructure. As a basic component of the participatory approach, we initiated mutual capacity building by forming tight links with our African partners ranging from local stakeholders and decision-makers (e.g. farmers, fisherfolk, healers) to cooperation and consultations with universities and ministries at the national level. The inventory approach is centered on the joint effort of BIOTA in establishing Biodiversity Observatories for long-term monitoring of changes in biodiversity. All of these activities take into account the relevant socio-economic and cultural framework.

Second phase results

In the second phase we have been taking our interdisciplinary, comparative approach of undisturbed habitats versus disturbed habitats affected by human activities much further. The basic monitoring tasks in the first phase set the stage for a broad spectrum of studies on strategies that ultimately shall permit sustainable use of biodiversity. In this phase, special emphasis is laid on assessing human-induced large- and small-scale habitat conversions, overexploitation of natural resources, unsustainable harvesting, and improper management practices that lead to severe biodiversity deterioration. We also began with the assessment of the current status and deficits of selected protected areas that are important for the preservation of biodiversity. For this, selected datasets have been analyzed to answer fundamental questions in ecology, taxonomy, and biogeography. Building on these efforts we aim to address applied questions on biodiversity conservation in the final phase.

Outlook

In the third and final phase, we will further shift our main emphasis to the final topic: "BIOTA-Africa—Support for Conservation and Sustainable Use of Biodiversity". The primary goals of the final phase are the delivery of clearly defined, applicable products such as databases on animal and plant taxa referenced to international standards, models and scenarios derived from



In the first phase of the project, an infrastructure was established.

remote sensing and field data, an atlas on biodiversity patterns and dynamics as well as a "gap-analysis" for conservation and priority setting, identification guides.

These are the indispensable backbone for the sustainable use of natural resources and conservation of biodiversity. Our African partners are fully involved in all BIOTA West activities, including data collecting and processing and have full access to and use of the extensive databases. We will intensify data exchange and tailor strategies that provide our African partners with all of the tools and the background necessary to carry on with the projects after BIOTA has ended. To this end, BIOTA West is counting on South-South cooperation and exchange, feeding into and contributing to important cross-linking activities such as NEPAD (New Partnership for Africa's Development). Furthermore, BIOTA West has started cooperation with working groups in BIOTA Southern Africa, BIOTA East, and GLOWA. The networking between research institutions, stakeholders, and decision-makers is of paramount importance to perpetuate sustainable development in a regional and national context beyond the funding period of BIOTA and contributes to the equitable benefit sharing of the partners. Ultimately, all of the deliverables of the third phase will be handed over to stakeholders and decision-makers.



Ecosystem goods and services are threatened in West Africa.

BIOTA East Africa

During the past year, considerable progress was made with regard to the understanding of ecological processes and economic driving forces involved in forest loss and degradation. Data collected from 102 randomly sampled villages in Kakamega, Kenya, were analyzed and economic models were developed to characterize and explain why deforestation or land conversion occurs. Geo-biophysical, socio-economic, demographic, and agricultural shock factors are the major driving forces of land-use and land cover changes in this region. In particular, population growth was shown to cause conversion of forests to agricultural land.

The project evaluates the economic value of rainforest systems.



Project title:

"Socio-economic analysis of maintaining and utilizing biodiversity in East African rainforest systems (Biota E13)"

Keywords:

Biodiversity conservation, economic valuation, degradation factors, cost-benefit analysis, incentive mechanisms

Countries of research:

Kenya, Uganda

Research objectives:

- 1) To conduct a spatial analysis of forest fragments in Kakamega, Kenya, and to develop spatial models to assess the driving forces behind land-use and land cover change.
- 2) To evaluate the economic value of rainforest systems in Kenya and Uganda, along the gradient of degradation, and assess whether these systems, with all their unique and endemic biodiversity, are able to compete with alternative forms of land use, e.g. farming.



3) To assess the magnitudes of different categories of costs and benefits of utilization and maintenance of forest resources. This is done from the perspective of different management approaches and along the gradient of degradation. The aim is also to develop models that provide an understanding of efficient and sustainable approaches for conserving biological resources.

4) To enhance human capacity on the application of economic tools for decision-making apropos environmental and natural resource conservation issues.

ZEF staff involved:

John Mburu, Jan Börner, Iason Diafas, Paul M. Guthiga, Magda Ohly

Timetable:

January 2005 - May 2007

Main cooperation partners:

IUCN Eastern African Regional Office, Nairobi,
 Zoologisches Forschungsmuseum Alexander Koenig (ZFMK), Bonn
 University of Nairobi, Kenya
 Kenyatta University, Kenya
 Makerere University, Uganda

Main funding partner:

German Federal Ministry of Education and Research (BMBF)

Project coordinator/contact:

John Mburu: jmburu@uni-bonn.de

Homepage:

www.biota-africa.org
www.zef.de/index.php?id=biota



Exploitation of forest for timber.

An equally important task accomplished by the project in 2005 to 2006 was determining the economic value of the forest resources. The rationale for this task is the fact that in order to manage natural resources, their economic value has to be measured first, in the same way that financial

resources are accounted for. The results of this analysis indicate that Kakamega forest generates about US\$66 worth of forest products extracted by local people per household per year. Thus, the forest is an important source of livelihood for the local communities.

In another analysis, factors that could prevent extraction of forests were investigated. The local households are likely to extract fewer forest resources if they are located far from the forest edge, are well educated, have been allocated enough land for cultivation, and are involved as participants in forest conservation activities. In Uganda's Budongo forest similar data on the direct benefits of forests were collected but the results are not yet ready for reporting.

In addition to the aforesaid direct economic values, indirect economic values, such as soil erosion control, carbon uptake and storage, etc., will also be estimated from the data collected during the past year. Preliminary results show that the magnitude of these values is high and therefore cannot be ignored. Additional data on the opportunity costs of conserving the forest were also collected. Eventually the results of this project will be used in a cost-benefit analysis to determine whether resources are efficiently allocated. Further, the economic values of biodiversity and the opportunity costs of conservation, i.e. returns from alternative land uses, will be compared, so that policies that prevent or reduce biodiversity losses can be justified on economic grounds.

Genetic Resources Policy Initiative (GRPI)

Project title:

"Genetic resources policy initiative (GRPI)"

Keywords:

Agro-biodiversity conservation, legal and policy options, economic analysis, capacity building

Countries of research:

Ethiopia, Kenya, Egypt

For the past year and within the framework of this multi-partner project, ZEF has been involved in stakeholder activities evaluating genetic-resource policy issues in Ethiopia and Kenya. In mid-2006, ZEF's involvement in the project was extended to Egypt. Among other issues, ZEF is assisting genetic-resource stakeholders in these countries with initiatives that consider economic analysis relevant for sustainable agro-biodiversity conservation. In Ethiopia, major policy gaps, synergies, and conflicts have been identified. Further, the project has discovered several technical challenges in genetic-

resource policy-making. These include priority setting needs, property rights, valuation of biological diversity, and uncertainty-related issues. Harmonizing the development of genetic-resource conservation, addressing the problem of market failure for better genetic-resource outcomes, fixing prevailing institutional constraints, and placing genetic-resource policy in the development context are the most needed genetic-resource policy actions in Ethiopia.

In Kenya, a study on the expected socio-economic impact of the country's "Seeds and Plant Varieties Act" on in situ conservation of crop genetic resources was initiated in early 2006. The study is being conducted in collaboration with the Department of Agricultural Economics of the University of Nairobi, Kenya. In Egypt, ZEF assisted the country's stakeholders in selecting the most appropriate economic tools, methods, and data-collecting procedures tailored for the specific research questions they plan to pursue. Particularly in Ethiopia and Egypt, lessons derived from the GRPI's 3M (multi-stakeholder, multi-sectoral, and multi-disciplinary) approach suggest that genetic-resource policy-making should be seen as part of the whole development policy process. Conservation of these important resources has to be placed within the framework of the broader agricultural development policy perspective. The results re-inforce the need to develop mechanisms for integrating policies, strategies, and programs in other sectors with policies that are meant to address genetic-resource problems. The 3M approach has proved to be useful for identifying the priority issues for addressing genetic-resource loss and development problems. By engaging all relevant stakeholders in each project country, the cross-cutting nature of genetic-resource policies has been shown and acknowledged.



Research objectives:

(1) To identify and advise task forces and stakeholder groups in project countries on ways in which economics can play a role in national policy-making apropos genetic resources.

(2) To conduct economic analyses of legal and policy options concerning the conservation, sustainable use and control of genetic resources for food and agriculture in Ethiopia and Kenya.

ZEF staff involved:

Edilegnaw Wale, John Mburu

Timetable:

February 2005 - January 2008

Main cooperation partners:

GTZ, Germany
International Plant Genetic Resources Institute (IPGRI), Rome,
Institute for Biodiversity Conservation (IBC),
Ethiopia Department for Agricultural Economics, University of Nairobi, Nairobi, Kenya
Ethiopian Economic Policy Research Institute, Addis Ababa, Ethiopia

Main funding partners:

BMZ/GTZ through the International Plant Genetic Resources Institute

Project coordinator/contact:

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Homepage:

www.zef.de/index.php?id=grpi and
www.grpi.org



Chapter 3. Research with Cooperation Partners

3.1. UNU-EHS: Tsunami

Project title:

"Vulnerability, migration and natural disasters"

Keywords:

Tsunami, floods, vulnerability

Countries of research:

Sri Lanka, Bangladesh

Research objectives:

This research program aims at determining the major dimensions of vulnerability in the context of natural disasters. In addition, it looks at the impact of natural disasters on migration.

ZEF staff involved:

Ulrike Grote, Stefanie Engel, Israt Rayhan, Benjamin Schraven

Timetable:

Project with UNU-EHS:

2005 - 2006

Dissertation: 2004 - 2007

Main cooperation partners:

UNU-EHS University of Colombo, Sri Lanka

Main funding partners:

DAAD, Platform for the Promotion of Early Warning (PPEW) of the UN Secretariat for the International Strategy for Disaster Reduction (UN/ISDR)

Project coordinator/contact:

Ulrike Grote: u.grote@uni-bonn.de

A survey of 500 households in the Sri Lankan urban area of Galle has been conducted in cooperation with several institutes under the direction of the Institute of Environment and Human Security of the United Nations University (UNU-EHS) to achieve a better understanding of the diverse vulnerabilities of different social groups affected by the tsunami in December 2004 in Sri Lanka. An important aim of the project is to analyze the determinants and effects of the migration decision at the household level to support the development of appropriate prevention, assistance, and resettlement policies. In the context of this project, a framework for analyzing the factors which impact on household decisions to stay in or migrate from a tsunami-affected, risky area, was developed. By using a logistic regression analysis, this framework later provides a basis for the examination of the significance of each factor. To what extent the same factors determine the probability of a household receiving financial, material, or psychological support was also studied.

The results of the regression analysis indicate in particular that households seriously affected by the tsunami (e.g. high mortality of, missing or seriously injured household members), or households with negative sea-related experiences before the tsunami are more likely to migrate than others. Possibly living with relatives elsewhere as well as having received financial and/or material support such as tents or tools also have a "driving" impact on household decisions to leave the area. This implies that most current support schemes encourage people to leave the high-risk areas. Factors which decrease a household's likelihood of migration are higher education, good access to information, and the ownership of land and a house, as well as support programs providing households with building material. Research in the context of a dissertation focuses on vulnerability to floods in Bangladesh. A survey of about 1,200 households was conducted in four different regions of Bangladesh in 2005/2006. In the context of migration, preliminary results indicate that hardly any migration occurred as a result of flooding.

3.2. GWSP: Virtual Water Trade

Project title:

"Nutrient and virtual water flows"

Keywords:

Nutrient flows, virtual water flows, international trade, environmental degradation

Globalization, trade liberalization, and increasing population pressure on land and water resources have stimulated interest in nutrient and virtual water flows at national and international levels. As the research has revealed, West Asia/North Africa, Southeast Asia, and Sub-Saharan Africa are net importers not only of nitrogen, phosphorus, and potassium (NPK) but also of virtual water in agricultural commodities. Nevertheless, the widely

recognized declines in soil fertility and problems related to water shortage continue to increase, especially in Sub-Saharan Africa. The nutrients imported are concentrated commonly in the cities, creating waste disposal problems rather than alleviating deficiencies in rural soils. Also the water shortage problems continue to contribute to intensified desertification processes, which again lead to increased urbanization and thus water shortage problems in cities.

Countries with a net loss of NPK and virtual water in agricultural commodities are the major food exporting countries—the US, Australia, and some Latin American countries. As the research has pointed out, a wide range of policy measures influence agricultural trade, nutrient and virtual water flows and balances. Agricultural trade liberalization and the reduction of production subsidies is expected to reduce excessive nutrient and water use in nutrient and water surplus countries and make inputs more affordable to farmers in nutrient and water-deficient countries. In an ideal world, this should result in a more efficient global allocation of natural resources, including water and nutrients, and reduced environmental costs, although some level of subsidy to developing country farmers may be justified to introduce them to fertilizer technologies. Policies that encourage diversified production systems should have similar effects by ensuring that animal wastes are not concentrated in areas with no opportunities to recycle nutrients on arable crops.

For environmental problems related to poor soil or water quality, innovative policy options such as nutrient and virtual water trading are being examined. For nutrient and water-deficient countries, institutional strengthening and infrastructure development are valid approaches. Finally, it has to be pointed out that environmental costs need to be factored into the debate on nutrient and water management as highlighted in the research. Such costs include moving and disposal of waste from millions of tons of nutrients in feed grains used for intensive livestock production. Because of the increased demand for meat as incomes rise in developing countries, meat-exporting industrialized countries will increase production to meet the demand, increasing the hot spots of nutrient and water pollution in these countries, and the costs will be passed on to their taxpayers. Knowledge of the scope and the long-term costs of these problems should prompt societies and politicians in these countries to support reductions in agricultural subsidies and opening up of their markets. The resulting economic development would reduce the need for handouts and probably help stem the out-migration from developing countries.

More transdisciplinary research on these important problems is advocated. While hydrologists, soil scientists, or engineers determine what is technologically feasible and set maximum allowances, economists identify the relatively cost-effective options and their distributive effects. The results of the research should better inform the society whose perceptions and values play a major role in the final choice of the products they purchase.

Countries of research:

Worldwide

Research objectives:

This research aims at describing major trends, causal factors as well as impacts and policy implications of nutrient and virtual water flows.

ZEF staff involved:

Ulrike Grote, Eric Craswell, Paul Vlek

Timetable:

Papers published in 2005 and 2006

Main cooperation partners:

Global Water System Project (GWSP)

Main funding partner:

ZEF

Project coordinator/contact:

Ulrike Grote: u.grote@uni-bonn.de



The concept of virtual water trade is an innovative policy option.

Chapter 4. Capacity Building

In many chapters of this annual report, ZEF's efforts in the field of building human capacity for and in developing countries have been described. The exchange of knowledge and close cooperation with local partners as well as the integration of a new generation of young academic professionals in its research activities play an important role in ZEF's set up. Also, ZEF is training talented students in the framework of its International Doctoral Studies Program for Development Research.

The International Doctoral Studies Program

The International Doctoral Studies Program (IDSP) primarily aims at building capacity in the field of development-related research for national and international organizations in Europe and in the developing world. Target groups are scientists and future decision-makers from developing countries and Europe who are striving for an international career. Since its inception in 1999 over 300 PhD students from 66 countries have participated in the IDSP. The program has become internationally renowned because it is unique in its size and interdisciplinarity. Two-third of the participants comes from developing countries and one-third from Organization for Economic Cooperation and Development (OECD) countries, mainly from Germany.

2006: Survey of ZEF alumni careers

In June 2006, 130 PhD students had graduated in the IDSP since its inception in 1999. An IDSP survey conducted in mid-2006 on the career progress of its alumni showed that 60% of the graduates from developing and transition countries returned to their home countries to take up positions in the fields of research, teaching, and (governmental) administration. Fifteen percent found jobs in international organizations such as the World Bank, CGIAR research centers, and United Nations' organizations. Eleven percent of the former students found postdoctoral positions at universities and research institutions in Germany. The remaining 11% of the interviewees were still searching for a job, had to leave the program for personal reasons or poor performance, or did not respond to our questionnaire.

The monitoring of the careers of former German participants also confirms the success of the IDSP concept: Immediately after completing their theses, most of them took up positions in national or international organizations in a development-related context, either in German ministries or in developing countries.

Academic concept

The IDSP is a mixture of the German and the Anglo-American graduation systems. It has a strong research component, combined with a structured



Bhagirath Behera (from India, here with his supervisor, Stefanie Engel) received the Global Development Medal 2006, awarded by the World Bank.

and intense course program of about 700 teaching hours per year. The entire program is conducted in English, which applies to both the courses and the dissertations. The structure of the doctoral program is tailored to the individual needs of the students. Normally, students will qualify for entry to the research phase within six to 12 months, followed by a research phase of one to two years. A final period of six to 12 months for synthesis and writing completes the program. Although the individual phases of the doctoral thesis can vary according to discipline and subject, its duration is limited to three to three-and-a-half years. This requires enormous efficiency apropos the program's set up as well as from the students. Therefore, only the best-qualified students are selected for participation; they are tutored intensively and provided with adequate resources to conduct their research overseas.

The academic goal of the educational program is to offer the students a combination of knowledge, methods, and tools to consolidate their specializations, as well as to give them an overview and insight to development-related issues and methods in general. This innovative approach enables our graduates to perform as specialists in their own academic fields and to tackle development-related issues with a broader view and on a multidisciplinary scientific basis.

During their stay at ZEF, students are encouraged and supported by ZEF in particular to publish their work and participate in international conferences, workshops, and congresses in order to polish their public speaking skills, gather experience, and establish contacts with international colleagues in their fields.

As many of the students are involved in ZEF's major interdisciplinary projects, one of the criteria for selecting the students is that their research proposals fit with ZEF's existing research agenda.



PhD students of the 2005/2006 batch.

Courses, teachers, and tutors

Courses are held in all of ZEF's research fields.

Besides the involvement of ZEF senior staff members, some of the lecturers are professors or teachers from other, often international, universities, so that a high academic standard and a broad perspective on development-related issues is ensured. The cooperation with several institutes of the University of Bonn is particularly intensive. Eighty percent of the PhD graduates obtain their degrees from the faculties of the University of Bonn.

The Doctoral Course Program is organized in:

Module I: A four-week interdisciplinary course, addresses the complex and interlinked problems of global change in development and research. It intends to open the minds of the doctoral students to other disciplines and

ZEF Doctoral students...



...at the GTZ-workshop "System Approach",



...learning teamwork,



...exercising their intercultural competence.

to change their working mentality for their future doctoral research. The course embraces the classical fields of environmental disciplines within natural sciences, and the economic, political, and socio-cultural dimensions of development. Parts of the course are seminars on boundary concepts, which are concepts that are used in different disciplinary domains but have different meanings in these domains (for example "value and valuation", "risk and vulnerability" or "What is a Model?").

Three additional weeks are dedicated to reflective activities (writing, literature research) and writing a term paper. This is done in teamwork and is obligatory for the successful completion of the course and the Certificate of "Doctoral Courses in Development Research at ZEF".

Module II: Three disciplinary courses (Development Economies and Politics, Development Sociology and Policy, Natural Resource Management and Ecology.) provide specific knowledge separately for each program area about theory and methodology that is essential for the empirical study of the students.

Module III: Consists of special courses and lectures on "Contemporary Development Issues and Methods". Invited prominent guest scientists and institutions deliver lectures on selected frontier level topics. Each set comprises two to three days of lectures and individual discussions on specific PhD research topics. In 2005/2006, one of our partners, the United Nations University for Environment and Human Security (UNU-EHS) offered a course on "Disaster Risk Reduction" and ZEF organized a master class for its doctoral students on "Gender and Development". Module III can also be conducted in the form of specific training for individual students in laboratories at the University of Bonn or other cooperating institutes in Germany or abroad.

Selection procedure

Owing to the high academic standard of the IDSP, less than ten percent of the roughly 300 applicants a year can be accepted. University marks to date and the quality of the research proposal are the decisive criteria for selecting students for attendance in the IDSP. Representatives of ZEF and the main funding partners take part in the selection procedure.

Application

Those who apply for participation in the International Doctoral Program for Development Studies should have the following profile:

- An excellent master's or diploma degree in Economics, Political Science, Agricultural and Resource Economics, Engineering, Geography, Mathematics, Natural Science or Agriculture.
- Excellent proficiency in English.
- Be younger than 32 years of age.

At first the applicant has to register online at www.zef.de before sending a hard copy of the application (in English), which should include: a letter of application; ZEF application form; an abstract of the master's or diploma thesis; a research proposal; two letters of recommendation; a curriculum vitae; and certified copies of all relevant certificates. The application forms can be downloaded from ZEF's website or be mailed on request.

The deadline for applications for participation in the doctoral program and for scholarships is August 31, yearly, for non-EU citizens and DAAD scholarships (available only for applicants from developing countries), and May 31, yearly, for EU citizens and scholarship holders of the Robert Bosch Foundation.

Proof of excellence: prizes and awards

ZEF is proud that doctoral students of the IDSP received prizes and nominations for their excellent theses in 2006: Dr. Bhagirath Behera, an economist from India, received the Global Development Medal for Outstanding Research, Second Prize, awarded by the Global Development Network for his thesis on "Determinants of Sustainable Management of Natural Resources: The Case of Joint Forest Management (JFM) in India". Dr. Behera has taken up a research position at the renowned TATA Institute for Social Science in Mumbai, India. He is the second winner after Dr. Konseiga, who was awarded this prestigious prize in 2005. Caleb Wall, a social scientist from New Zealand and participating in the IDSP received a GEO-4 Fellowship awarded by UNEP. Many of the IDSP participants were invited to present their research at international conferences (travel grants included).

Budget and donors

The € 1.8 million annual budget of the International Doctoral Studies Program is up to 90% third-party funded, including €850,000 for stipends. The BMZ finances the research expenditures of most of the doctoral students from developing countries through GTZ, as well as through scholarships via DAAD. Another major funding partner for students' research and scholarships is the German Ministry for Education and Research (BMBF), via the large interdisciplinary ZEF projects (e.g. the GLOWA Volta program in Ghana/Burkina Faso; the project on ecological and restructuring in Uzbekistan; and the project on wild coffee in Ethiopia) elaborated on in this annual report.

The Robert Bosch Foundation is currently the only donor that sponsors German doctoral students: It provides two students a year with stipends and research money in the fields of Agriculture and Forestry.

The academic coordinator and the working facilities (building, office space, maintenance of the computer network, and library) are financed by the state of North Rhine-Westphalia (NRW).

Other important current donors are, inter alia, the German Science Foundation Deutsche Forschungsgemeinschaft (DFG), Volkswagen



Dina Mandour (from Egypt) and Alexander Stein (from Germany) after receiving their doctoral degree.



Sultana Nayeem with her supervisor, Hans-Dieter Evers, during her field research in Malaysia.



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Foundation, governments from the home countries of doctoral students, the European Union, Deutsches Fernerkundungsdatenzentrum DFD im Deutschen Zentrum für Luft- und Raumfahrt (DLR) in der Helmholtz-Gemeinschaft (DFD-DLR), Kreditanstalt für Wiederaufbau (KfW), Katholischer Akademischer Ausländerdienst (KAAD), Friedrich Ebert Stiftung, and Konrad Adenauer Stiftung Eisenstiftung.

Outstanding Doctoral Theses

Land-use Modeling in the Central Vietnam Uplands

Human-induced changes of land use and land cover serve human well-being, but also are a latent threat to ecosystem functioning and ecological sustainability. Proper methods to project the possible consequences of such changes are required to provide a better basis for land management policies. This is a challenge owing to the complex behavior of both human and natural drivers. By mimicking the causal mechanisms, feedback loops, and interactions among components within the human-landscape system, multi-agent system models can simulate the complex behavior of land-use changes.

This PhD study developed a multi-agent system to simulate land-use change and the interrelated socio-economic dynamics at the community-catchment scale in the rural forest margins of Central Vietnam, which emerge from micro socio-ecological interactions and land-use policy interventions. The study site is a mountainous watershed of about 100 km² with around 2,500 inhabitants. The spatially explicit data were obtained from satellite images, thematic maps, an extensive forest inventory, and an intensive household survey. Field data were used for calibrating the agents' parameters and developing an initial database for simulation runs. Scenarios of land-use changes under different policy options regarding forest protection zoning, agrochemical subsidies, and agricultural extension were generated to evaluate the consequences of such policy interventions.

The human community in this model was represented by heterogeneous decision-making agents (i.e. human actors). Land-use decisions would be based on integrating household, environmental, and policy information. The natural landscape was divided into land units, which were also considered as (landscape) agents. Each land unit hosted natural processes and changed its nature in response to local conditions that either directly influenced the unit or indirectly via its neighboring units. Ecological models, e.g. biomass productivity and vegetation succession models, were integrated into the structure of landscape agents. A multi-agent-based protocol coordinated the flexible interactions among human and landscape agents, and monitored land-use changes and socio-economic dynamics.

Preliminary simulation runs have been performed with ten different policy options for the area of research. A comparison of the simulated outputs

among these policy options suggested that: If the current proportion of protected areas (90%) is reduced to 50%, while protection of the areas is enforced and juxtaposed by provision of agricultural extension services to 30% of the population (as well as subsidizing 5% of the population with agrochemicals) gross income per capita, on average, would increase by 15%. In addition, forest degradation in the protected zone would be reduced significantly compared to the scenario based on the status quo. This suggests that the better communities have access to forestland and the more efficient their use of land is, the less pressure there is on the protected areas in the catchment.

The multi-agent model thus constitutes a suitable system for analyzing the complex processes of land-use and land cover change. By showing how stakeholders' choices influence future developments, the land-use change model may thus help to design policies that will improve livelihoods while conserving essential ecosystem functions.

Afforestation of Degraded Agricultural Land in the Aral Sea Basin

One of the main challenges for scientists working in the Aral Sea Basin is how to effectively combat deforestation and salinization in the region. This is also a major issue being addressed in ZEF's project "Economic and ecological restructuring of land and water use in Khorezm" (see Chapter 2.2, p. 31). A PhD study carried out in the framework of this project analyzed the potential for afforestation as a measure against land degradation in Khorezm, ZEF's project-region in northwestern Uzbekistan.

In an irrigation-based production system such as that of Uzbekistan, land degradation impedes agricultural development enormously. In Uzbekistan, the adverse effects of desertification are especially ubiquitous in Khorezm's irrigated lands where large areas are affected by various degrees of so-called "secondary" soil salinization. Here, the scorching desert sun evaporates water from the shallow saline groundwater table and leaves crop-damaging salts in the topsoil. As a result, some 20% of irrigated land is only marginally suitable for cropping. Afforestation is one option to make use of this unproductive cropland and even to mitigate land degradation by lowering the groundwater table via biodrainage—the removal of soil water through the transpiration of trees. However, judicious selection of tree species that can actually provide these benefits is needed. This PhD study aimed to identify the most suitable tree species in two field experiments.

In the first field trial, the study team measured root system establishment, stem growth rates, production, and quality of fodder (from leaves) and fuelwood, and transpiration of ten local multipurpose tree species on two soil types under adequate irrigation for 24 months. Analysis of variances allowed a ranking of the species according to physiological and socio-economic criteria and selection of the most suitable candidates for further study.

Based on these results, a two factorial split-plot experiment was then

Asia Khamzina, Uzbekistan

Agricultural Faculty, University of Bonn



conducted on severely saline land to further evaluate the performance of the selected species: *Populus euphratica*, *Elaeagnus angustifolia*, and *Ulmus pumila* (Euphrates poplar, Russian olive, and Siberian elm). As one goal was to establish such trees on marginal (and therefore, water-deprived) land, all trees were subjected to deficit irrigation amounting to less than 40% of the locally recommended rates. Conventional furrow irrigation was compared with water-saving drip irrigation.

Mixed linear model analysis showed that drip irrigation significantly enhanced the growth of poplar, but the other species appeared to be insensitive. Root analysis showed that the roots of these species grew down to the saline groundwater and effectively used this water resource to become independent of irrigation. With this adaptation, a three-year-old Russian olive was able to produce 40 tons of aboveground biomass per hectare of severely saline land, similar to the biomass produced on only slightly saline, well-watered land.

The fodder quality from Russian olive and elm trees, characterized by good crude protein and metabolizable energy content in their leaves, was high and comparable to alfalfa hay, which is common high quality fodder. These trees could therefore become a good source of fodder to complement the low-quality livestock feeds available locally.

The total transpiration of Russian olive stands reached 1,800 mm annually, suggesting a significant capacity for biodrainage. However, as biodrainage plantations grown over shallow saline groundwater could not eliminate the problem of existing soil salinity, they should be used in addition to conventional irrigation systems rather than alone.

The findings of this study highlight the potential of using tree plantations to design improved land-use systems for marginal lands rather than continuing to crop them with limited success. Particularly good news for farmers is that costly drip irrigation did not show significant advantages over traditional furrow irrigation and is therefore unnecessary for the successful establishment of such plantations, at least on lands with shallow, moderately saline groundwater—conditions that prevail in the region.

Overall, given its high transpiration, fast growth, and nutritious fodder, the fruit tree, Russian olive, is the most appropriate species for afforestation in the region. The added ability of the Russian olive to retain its nitrogen-fixing capacities under such saline conditions widens the scope for improving degraded lands with tree plantations and will be the subject of further research.



Reservoir Siltation in Ethiopia: Causes and Management Options

Shortage and variability of rainfall in Ethiopia have led to substantial declines in agricultural production that have claimed the lives of thousands of humans and livestock in the country in the last decade. In an effort to provide a more stable water supply, micro-dams have been built in different parts of the country during the last 15 years. However, their benefits have not been sustainable, because reservoir water storage capacity has been rapidly declining due to siltation. In order to analyze the situation and to offer advice on improvements, this PhD study was conducted in selected catchments of northern Ethiopia.

Initially, surveys were carried out to acquire information on the rate of siltation in reservoirs that showed a high average sediment deposition rate of over 20,000 tons per year. With this rate of sedimentation, most of the reservoirs were being filled with sediments so quickly that they could be used for only half as long as their projected service lifetime. This reduced the availability of water and reduced food security—thus negating the objective the dams were mainly built for. To reduce the rapid sedimentation of the reservoirs and to sustain their potential benefits, implementation of better management measures is required.

Analysis of the relationship between sediment deposition in reservoirs and the environmental variables of the respective catchments shows that height difference, surface irregularity, surface lithology, gullies, and surface cover determine upland erosion and downstream sedimentation in the studied catchments. This means that prior conservation measures and management practices need to be targeted in catchments characterized by the above attributes to reduce erosion and siltation risk.

As all positions of catchments experiencing high soil loss could not be addressed, it was necessary to pinpoint landscape positions from where most of the sediment originated. To achieve this, soil erosion models were applied. The models showed that erosion was above the tolerable limit on slopes that were steep—steepness greater than 15%—and around gullies. Now that landscape positions that require prior conservation planning have been identified, the next issue is to evaluate the significance of different management practices that effectively reduce sediment deposition in reservoirs.

For this purpose, a GIS-based distributed model was used to compare different land-use planning-based scenarios. The scenarios focused on specifically protecting those tracts of the landscape that were associated with gullies, steep slopes, and a high intensity of erosion. The simulations showed that afforestation of landscapes that experience high soil losses of over 25 tons per hectare per year could reduce sediment deposition in reservoirs by approximately 60%. This means that protecting these hot-spot areas of erosion with trees could moderate reservoir water storage loss by approximately 50%. However, most of these scenarios require a relatively large sacrifice in the proportion of cultivated sloping land before a reasonable decrease in

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sediment deposition in the reservoirs can be observed. This means that compensation payments are needed to make the change economically feasible for sloping land farmers.

Lulseged Desta Tamene received the Josef-Knoll-Prize 2006 for his doctoral thesis, awarded by the Eiselen Foundation.

Water and Land-use Reforms in Uzbekistan

Marc Müller, Germany

University of Bonn, Faculty of Agriculture



A leading question for this PhD study was, why, after more than a decade of independence from the former Soviet Union and despite continuous imports of capital goods ever since, the overall structure of the Uzbek economy has not been subject to significant shifts away from agriculture towards an economy with a higher share of private, non-agricultural sectors. The aim of this study was therefore to analyze the impacts of the current legal-administrative setting related to the agriculture sector of Uzbekistan on the economy as a whole. Especially, the policies related to cotton production and processing were addressed in detail. The complex linkages between production and processing sectors, the government, and external trade demanded a general equilibrium approach, in which these elements were represented. A necessary step before implementing a macro-economic model of the proposed type was to establish a consistent database. Because a comprehensive set of macro-economic data was not available from a single Uzbek authority, the dataset had to be compiled based on various sources, such as international organizations and diverse branches of regional and national Uzbek ministries.

The thus derived, yet inconsistent items of information were used as starting points for the estimation of a balanced dataset, which in turn was used for simulations. Thus, based on the compiled data the patterns of water usage for irrigation were assessed. Besides purely quantitative aspects such as water demand of cropping activities, in addition the computation of a shadow-price for water was addressed. It turned out that the shadow price of irrigation water in Khorezm lies within US\$0.06 and 0.08 apropos the water charges for farmers in Cyprus and Tunisia. Another water-related finding came from the analysis of water supply and demand for Khorezm. The total value of crop production for each district in Khorezm was compared with the probability of obtaining at least a certain minimum quantity of water. The probability of obtaining enough water was within 61 to 67%, the lowest being in the off-stream located districts. Not surprisingly, it turned out that the probability to obtain enough water in these districts coincided with crop losses from 1999 to 2001.

The analysis of water availability was one of many intermediate steps in the development of the general equilibrium model. Another surprising insight during the establishment of the database was the fact that within the agriculture sector animal production, not cotton cultivation was the largest sub-sector. In 2001 it contributed 48.4% to the total agricultural

output value of Uzbekistan, whereas cotton production contributed only 15.7%. These and other intermediate results were used to build the general equilibrium model, which was finally used to evaluate changes in policies related to the agriculture sector, especially for the cotton market. One of the more surprising results came from an experiment in which the cotton market was liberalized by assuming, that production targets were abolished and taxation as well as subsidization of producers and processors of raw cotton decreased by 50%. Instead of decreasing total governmental revenues, the policy change caused an increase by 3.3%. There are basically two reasons behind this outcome. First, the government loses tax revenues from the cotton sector, but on the other hand has less expenditure on input subsidies, so that the negative effect on the revenues is netted out to some extent (decline of indirect taxes less subsidies: 3.8%). Second, the allocation effects caused by the deregulation generate higher capital incomes for the cotton-related producers and consequently higher payments of direct taxes (income and profit taxes). The direct tax revenues increase by 12.9%. The incomes from wages, however, decrease by 3.5%, which cause a net income loss for the households whose capital incomes are low compared to the labor income—i.e. the urban and rural poor.

The outcome of this experiment sheds new light on the discussion about the effects of the cotton market regulations in Uzbekistan. If only policies like production targets, fixed prices, and export taxes are considered then the Uzbek cotton system is a generator of income for the government, which in turn might be used for public investment in non-agricultural sectors. But if the input subsidies for producers and the effects on the general equilibrium of the national economy are considered as well, it appears that one aim of the regulations is supporting the households whose incomes depend mainly on their labor force. Thus, it can be assumed that the cotton market regulations have indeed a strong social objective as opposed to purely generating governmental revenues.

Coffee Forest Conservation: Institutions in Southwest Ethiopia

The objective of this PhD study was to assess the role and influence of local-level institutions regarding the conservation and use of coffee forests in southwest Ethiopia. The study was part of the institutional research in the framework of the CoCE (Conservation of *Coffea arabica* in Ethiopia) project, which analyzes the biological, ecological, social, economic, political, and institutional causes of coffee forest disappearance and the loss of wild coffee populations. The study was carried out in Sheko Woreda of the Oromiya Regional State and Yayu Woreda of the Southern Nations, Nationalities, and People's Regional State. Data were collected through selected interviews and discussions with individual farm households, farmers' groups, key informants, and selected members of the local community as well as through a formal household survey. In addition, documents pertain-

This PhD study was conducted in the framework of the project on "Economic and ecological restructuring of land and water use in Khorezm" (see Chapter 2.2., p. 31).

Teklu Tesfaye, Ethiopia

Agricultural Faculty, University of Hohenheim





This PhD study was part of the project "Conservation of *Coffea arabica* in Ethiopia (CoCE)" (see Chapter 2.4., p. 47).

ing to policy, legislation, and strategy as well as institutional reports were reviewed.

The study showed that the management of coffee forests at the local level is strongly influenced by interaction between formal (associated with policy, legislation, and strategy as well as organizations and international/national programs) and informal (community-based, indigenous) institutions. Formal institutions have been formulated mainly in a unilateral top-down mechanism with narrow technocratic perspectives. Besides, they often have specific short-term economic and production considerations that predominate over long-term management objectives. In this context, the full range of benefits that local people could obtain from coffee forest management is often ignored. Instead, formal institutions restrict opportunities to access coffee forests and consolidate administrative-based coffee forest allocation and management. Moreover, they are weak in ensuring effective and sustainable management of coffee forests and protecting the users' rights of those who ultimately depend on them. Furthermore, they restrict the development of markets and the mobility of goods and services flowing from the management of coffee forests. Institutional structures (organizations), although established at various levels, are poorly organized. They lack the necessary human, financial, and physical resources as well as decision-making power and authority. In fact, they do not have the freedom to plan either, because planning is highly centralized and top down. Besides, they are subjected to frequent restructuring and often operate through a quota system that has forced them to stretch beyond their capacity because they are required to cover many activities that do not always match their resources and decision-making capacity.

Informal community-based institutions operating in the study area include religious, territorial-based administration, rotating credit and savings groups, labor organizations as well as informal arrangements for land contracting and oxen sharing. Some of these institutions have reciprocal relationships and social safety net mechanisms while others substitute for absent or poorly functioning formal institutions and organizations. They assist communities in enhancing societal relationships, achieving economic needs, and gaining access to basic production factors such as land, labor, and oxen. However, results show that the role they play in the management of natural resources in general and in coffee forest management in particular has been diminishing over time—mainly due to external factors. Subsequent governments have issued policies and legislation that officially ousted them and hastened their demise. Owing to institutional change and pressure from external forces, some informal institutions have evolved into social and even self-help organizations. Their mandates are constrained by not having direct relationships or linkages with formal organizations, not to mention very limited government efforts to use them effectively for enhancing the management of coffee forests. With proper understanding of the way in which informal institutions function and the forging of effective link-

ages, they could perhaps be reinvigorated and thereby contribute to the sustainable management of coffee forests.

A major problem that poses a significant threat to the sustainable management of coffee forests is the fact that their ownership and management are the responsibility of the central government via its legislation on public property rights. This is the status quo despite the fact that these are common pool resources exhibiting high subtractability, low excludability, low storage in the system, and relatively small size. Evidence derived from this study shows that institutional measures crafted by the government or informal community-based institutions have not been effective or efficient enough to ensure the sustainable management of coffee forests or enhance the production of goods and services such as coffee, honey, and spices in sufficient amounts to meet demand. Therefore, it is recommended that the existing property rights system should be re-evaluated. Alternative and yet flexible property rights systems should be implemented and robust institutional measures to ensure the sustainable management of coffee forests should be introduced. In addition, effective and efficient linkages need to be forged between formal and informal institutions so that they complement each other and thereby ensure the production of goods and services from coffee forests in sufficient amounts.

Irrigation Management and Institutional Change in Central East Burkina Faso

The objective of this PhD study was to investigate the influence of the ongoing decentralization process, as well as land and water sector reform in the context of water management within small-scale irrigation systems in Burkina Faso. The question was whether these processes lead to the expected reinforcement of local development and empowerment of marginal groups, and consequently enhanced sustainable water and land management, and if this is not the case, the reason(s) and the actual outcomes.

This thesis investigated various aspects of small reservoir water management in Burkina Faso, i.e. the implementation of integrated water management policies on the ground and the management of two irrigation systems. Special foci were the relations between the state (such as extension officers and administrators) and the population, as well as the state's influence on the functioning of the water users' associations, and the impact of security of access and control rights to land on the productivity of the irrigation systems. For this purpose research was conducted in two small reservoir irrigation systems in the province of Kourittenga, Burkina Faso.

The research shows that due to an increasing demand for irrigable land, land rights are being contested. This has forced the disputants to look for various means to obtain and secure their rights. Disputes have been resolved through multiple social and political channels and by using claims based on various laws and regulations, both modern and customary. However custom-

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This PhD study was part of the Glowa Volta research project (see Chapter 2.2., p. 35).

ary institutions eroded because customary practices were partly adapted. The new land tenure situation became more complex and thus land rights within and around irrigation systems became more insecure.

Examining the functioning of the water user groups, it was revealed that without taking the historical, socio-economic, and political context of the irrigation system and the influence of the state representatives into account, improving the efficiency of irrigation management in Burkina Faso cannot be considered. The particular water user groups in this study were new units, initiated and implemented by the state in order to manage the irrigation system and its production. This meant that they were not built on existing social structures, but were composed of social groups with different backgrounds and differing interests. This led to struggles over resources and to weak management structures. The water user groups were the outcome of the state's interests and their functioning was also influenced by the type of relationship they had with the state bureaucrats dealing with these organizations.

Consequently, an easy conclusion on the impact of policy implementation at the local level is not possible. The outcomes of a certain policy at the local level on the one hand depend on the specific social, economic, and political situation in particular areas and on the other hand on the interests and incentives of the specific state institutions that intervene in the area, and the way in which they maintain their authority.

The main conclusion that can be drawn is that political and administrative reforms, such as decentralization, agricultural production policies, and land tenure reforms have to be considered collectively. There is a tendency in Burkina Faso to implement several policies and laws parallel to each other, often linked to the multiple agendas and interests of the various international donors, without considering the implications on one another's legitimacy and jurisdiction. The research has shown that this insecurity and ambiguity leads to conflicting interests, power struggles, and the vulnerability of certain population groups (mostly marginal groups) in the struggle for resources, thereby frustrating the democratic and equity aims of the policy-makers.

Doctoral defense of Fabré Bagayoku (from Mali) at the University of Delft.



Chapter 5. Policy Dialogue: ZEF Consult

ZEFConsult is a unit within ZEF that was launched in the summer of 2005 to strengthen and improve the consultancy and advisory capacity of the Center and the University of Bonn. ZEFConsult provides research-based advice to governments, parliaments, institutions, and non-governmental organizations in the fields of development policy, development politics, and development cooperation.

The core philosophy of ZEFConsult is, on the one hand, to enable policy-makers to make use of research findings and move towards research-based policy-making and, on the other hand, to enable researchers to have an impact on politics by communicating their findings properly to the right people. The key question therefore is: How can the interaction between researchers and policy-makers be improved? ZEFConsult's approach to this is combining both traditional and innovative methods into one transfer concept.

This ambitious project is a component within the efforts to transfer scientific knowledge to the German political level. ZEF has been dedicated from the start not only to interdisciplinary research, but also to capacity building and policy advice as interlinked dimensions. Being aware that the link between research and policy is of growing interest to researchers, policy-makers, and donors alike—and that more can be done to achieve a better transfer—ZEF decided to strengthen its capacity in policy advice, complementing the efforts already being made.

Against this setting ZEFConsult has been working out a policy-oriented profile of development research. In line with international discourses on development issues and with its commitment to the "European Code of Ethics" ZEFConsult introduces scientific results into policy dialog and brings research into the sphere of political impact and public awareness. One of ZEFConsult's assets is that it can build on the broad- and long-term experience of ZEF in interdisciplinary and disciplinary research, capacity building as well as policy dialog.

ZEFConsult follows a fourfold, parallel concept for take off: (1) Development of strategic, thematic, and operational guidelines, (2) composition of working capacity and infrastructure, (3) networking, and (4) acceptance of projects.

ZEFConsult works in the context of the thematic portfolio of ZEF, its main topics being land use, water security, biodiversity, health, and sustainable energy. Additionally, ZEFConsult is demand-oriented on topics from the development agenda, e.g. the strategic orientation of actors in development, the implementation of international decisions and recommendations (e.g. the Millennium Development Goals), and the development of innovative tools/instruments to increase the efficiency of development cooperation (reforms, financing etc.).

Staff:

Hartmut Ihne (Director)
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Stefan Haffner (research assistant)
Carsten Friedland (researcher)
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Christopher Martius (senior researcher)
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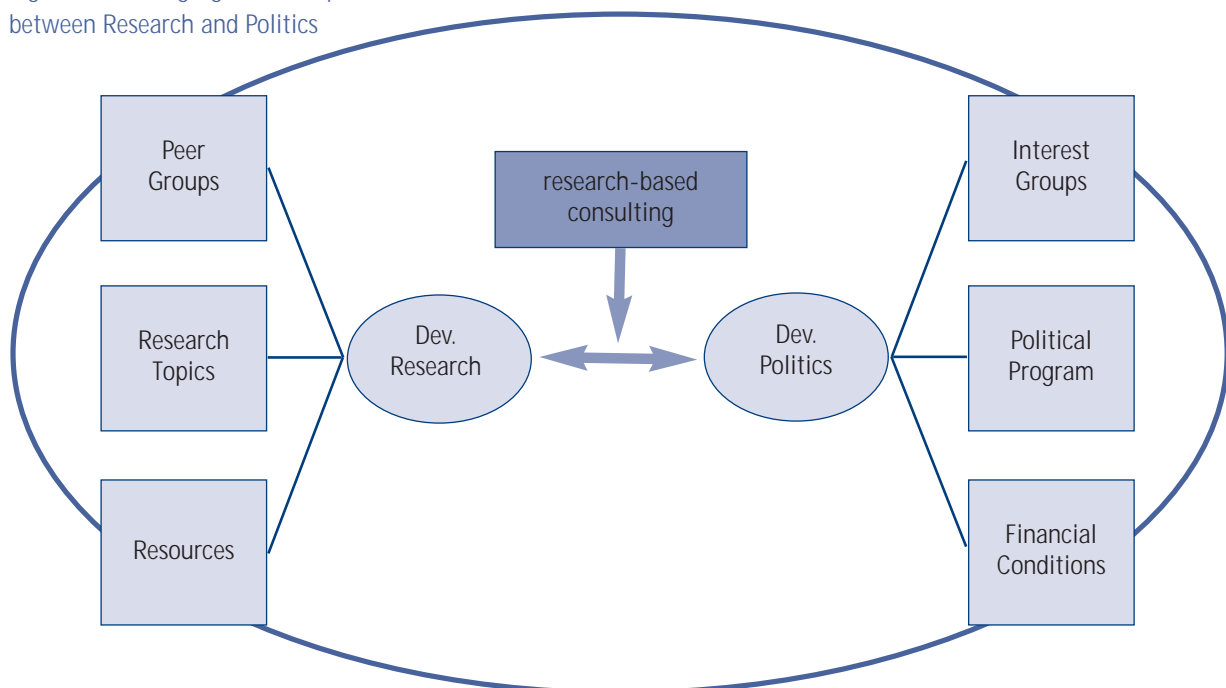
Quality control is addressed by internal and external groups of advisors. Researchers from outside a project supervise it. The expert capacity for ZEFConsult projects is being generated from a pool of internal and external experts, whose data are being collected in a thematically and regionally structured database.

ZEFConsult operates within a growing network of partners from research, politics, and consulting. These include: the World Bank, the African Development Bank, InWEnt, GTZ, the European Union, the German Bundestag, the German Federal Government, the Land of North Rhine-Westphalia, DIE, IRD, ODI, EuropeAid, IT-Powers, SAP, etc. ZEFConsult is also one of the founding partners of the Forum Media and Development (FoMe), the German platform for media as well as for issues on information and communication technologies related to development. In addition, ZEFConsult is about to link relevant German development research institutions involved in development consulting and policy advice in order to improve the advisory capacity of German development research.

Projects that have been carried out recently as well as embryonic projects target ICT and NGOs in sub-Saharan Africa and capacity building for renewable energies in Africa. ZEFConsult is also going to assist European Commission departments in analyzing and identifying needs, in assessing the impact of external aid as well as in defining strategic priorities regarding countries, regions, and sectors. Within the academic EUROPAEUM network ZEFConsult is preparing a joint study project on bridging the gap between development research and policy.

Together with leading German development research institutes ZEFConsult monitors on behalf of ZEF the editing of a new publication series on "Development Research and Development Politics". By developing and running a module on research-based consulting, ZEFConsult contributes to capacity building in the framework of the International Doctoral Studies Program of ZEF.

Figure 2. Bridging the Gap between Research and Politics



Chapter 6. Public Awareness

Selection of ZEF's Public Awareness activities mid 2005 - mid 2006

ZEF participated in the European Association of Development Research and Training Institutes (EADI) 11th General Conference on "Security and Development", Bonn, September 21-24 2005. ZEF staff presented paper and gave (keynote) speeches, and ZEF had an information stand.

See: www.eadi.org

ZEF staff participated in the German "Tropentag" in Hohenheim on "The Global Food and Product Chain - Dynamics, innovations, conflicts, strategies" (October 11-13 2005): ZEF staff member presented posters and research papers. See: www.tropentag.de/2005

Visit to ZEF by Dr. Darni Daud, Vice Rector for Academic Affairs of the Syiah Kuala University in Banda Aceh, Indonesia, on October 27 2005. The visit led to a cooperation on academic capacity building with the University in the framework of reconstruction measures in the region after the tsunami catastrophe.



Prof. Dr. Akilagpa Sawyer, Secretary-General of the Association of African Universities (AAU) based in Accra, Ghana, visiting ZEF and discussing with doctoral students.

The "United Nations Foundation" and "The People Speak Program" organized an international videoconference titled "The Impacts of Climate Change on the World and What Lies Ahead" on October 25 2005 at ZEF. The videoconference linked-up students and members of the environmental community in Washington D.C., Sao Paulo (Brazil), and Bonn. It enabled the participants to speak with other students and experts around the world about the challenges our world faces in respect to climate change and how we can contribute as a global community to slow down global warming.

Press Review

Frankfurter Allgemeine Zeitung (FAZ) (national daily newspaper). October 6 2005. "The Sahel: Drought does not have to be followed by hunger" ("Sahlezone: Auf Trockenheit muss kein Hunger folgen")

WDR 5 (regional radio channel). October 8 2005. Panel-citizen discussion with A.J. Stein on "Biotech Food: Much ado about nothing?".

Das Parlament (weekly national newspaper). Nr. 41. October 10 2005. "Between the tribe and the state" ("Zwischen Stamm und Staat").

The Economist. November 5 2005. "Economics focus: Fruit that falls far from the tree".

Berliner Zeitung (regional daily newspaper). November 24 2005. "Ethiopia's green asset" ("Das grüne Kapital Äthiopiens").

Zürcher Oberland (ZO). December 14 2005, p. 12. Ulf Terlinden and Hannelore Wallner "Africa's best hidden secret" ("Das bestgeheütete Geheimnis von Afrika").

NDR (regional radio channel), Redezeit. December 20 2005. Christopher Martius was guest speaker in a talk show on "world population growth".

Development and Cooperation (D+C). January 2006, p. 41. Hartmut Ihne "EU Consensus: Overdue but incomplete".

General-Anzeiger Bonn (local daily newspaper). January 3 2006. "Development researchers successful in raising funds" ("Entwicklungsforscher werben erfolgreich Drittmittel ein"), article on ZEF's Annual Report 2004/2005.



General-Anzeiger Bonn (local daily newspaper). January 4 2006. "Research positions guaranteed" ("Forschungsplätze sind vorerst gesichert"), article on ZEF's Annual Report 2004/2005.

Rheinischer Merkur (national weekly journal). No. 7/2006. "Master of nepotism" ("Meister für Kungelei").

Bonner Rundschau (local daily newspaper). March 7 2006. Congratulations for Paul Vlek for being reappointed by the German Research Foundation (DFG) as a member of its National Committee on Global Change Research (NKGCF) ("Glückwunsch!").

Bonner Rundschau (local daily newspaper). March 13 2006. "Alumni" ("Ehemalige"), article about ZEF alumni.

General-Anzeiger Bonn (local daily newspaper). March 21 2006. "Edilegnaw Zegeye Wale from Ethiopia was awarded the prize for the best doctoral thesis at the Center for Development Research (ZEF)".

Schweizer Radio DRS (Swiss national radio channel), Echo der Zeit. April 31 2006. Interview with Conrad Schetter on "War against Terrorism in Southern Afghanistan".

Rhein-Sieg-Anzeiger (local daily newspaper). April 29 2006. Kerstin Viering "Amazing beans. Researchers from Bonn worry about the remaining wild coffee sources" ("Tolle Bohne. Bonner Forscher sorgen sich um die letzten Wildkaffee-Vorkommen").

SWR 4/RP (regional radio channel), Blickpunkt. May 29 2006. Interview with Conrad Schetter on "Deadly rioting in Kabul".

Der Tagesspiegel (national daily newspaper). May 30 2006. Conrad Schetter "The soldiers are part of the conflict" ("Die Soldaten sind Teil des Konflikts").

HR (regional radio channel), Info Radio. May 30 2006. Live-interview with Conrad Schetter on "Deadly rioting in Kabul".



Doctoral students attending a course.

ZEF was invited by the "Americans for Informed Democracy" to participate in a videoconference on "Global Governance: The Future of the United Nations" on February 28 2006. The video-conference linked-up students and staff of universities in the USA with other universities worldwide. The conference was part of a series called "America and the World Together", which is being supported by a coalition of non-profit organizations, including the Open Society Institute, the Rockefeller Brothers Fund, Connect US, the Hewlett Foundation, the DarMac Foundation, and the United Nations Foundation, as part of their broader effort to involve Americans in discussions about US foreign policy.

A delegation from Uzbekistan, consisting of the Rector of the State University of Urgench, Prof. Dr. Azimboy Sadullaev, the Dean for Natural Sciences, Dr. Ruzimboy Eshchanov, and a representative of the Natural Science Sector of UNESCO, Dr. Moustafaev, paid a visit to ZEF from January 30 to February 6 2006. The main goal was to discuss the Uzbek authorities' expectations of the upcoming 3rd phase of ZEF's Uzbekistan project.

"Africa beyond Aid - how Democracy promotes Prosperity and Peace" - was the motto of a public panel discussion at ZEF on April 5 2006. The event was co-organized with the Konrad Adenauer Stiftung, speakers were Joe Siegle, Senior Advisor for Democratic Governanc at the development Alternatives Inc. in Bethesda, and Gregg Mills, Director of the Brenthurst Foundation, Johannesburg, both from South Africa.

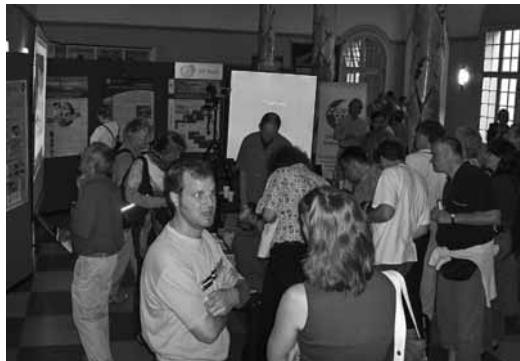
InWEnt and the World Bank Institute organized a public videoconference workshop on April 10 2006 at ZEF. During this event the "Report on Fighting Poverty - a Business Opportunity" was simultaneously published at Washington DC and Bonn. The conference provided a forum to discuss how to ramp up engagements between the private sector, civil society, academics, and the development community to generate partnerships for human development.

ZEFConsult director Hartmut Ihne facilitated the founding workshop of the Forum Media and Development (FoMe) on May 19 2006. The FoMe is to be

the German platform for issues on media and development and was initiated by the Friedrich-Ebert-Foundation, the Konrad-Adenauer-Foundation, Deutsche Welle, the Catholic Media Council, the Protestant Academy of the Rhineland and ZEF.

ZEF presented its Uzbekistan, GLOWA Volta and BIOTA West projects on the occasion of the "International Day of Desertification" in Bonn on June 10 2006. Several NGOs and institutions presented their activities parallel to a panel discussion in the "Deutsche Welle" on desertification.

On July 7 2006, ZEF had a well-visited stand during the University of Bonn's "Science Night". This year's overall topic was "Water", so ZEF presented its GLOWA Volta project, sharing its stand with the GWSP (Global Water System Project).



"Science Night" at the University of Bonn on July 7 2006

The "Water Lectures" is a series on water-related issues that ZEF has organized in cooperation with the United Nations University Institute for Environment and Human Security (UNU/EHS) and the Global Water System Project (GWSP). The contributing speakers had an academic, political, and non-governmental background and gave talks and/or participated in panel discussions on topics such as the effects of the tsunami, water and governance, privatization, environmental flows and the outcome of the world commission on dams. With this variety of topics, the lectures series reached out to an expert community as well as to a more general audience and was therefore well visited.

Development and Cooperation (D+C). June 2006, p. 246-247. Hans-Dieter Evers, Solvay Gerke and Thomas Menckhoff "The Knowledge Trap - How not to bridge the digital divide".

Die Wochenzeitung (WOZ) (Swiss weekly newspaper). June 1 2006. Conrad Schetter "Afghanistan: What is going wrong in the occupied country?" ("Afghanistan: Was läuft falsch in dem besetzten Land?").

Süddeutsche Zeitung (national daily newspaper). June 1 2006. Conrad Schetter "The re-education camp of the West" ("Das Umerziehungslager des Westens").

Radio Bremen/NDR (regional radio channel). June 1 2006. Interview with Conrad Schetter on "German Bundeswehr in Afghanistan".

MDR (regional radio channel), Info. June 1 2006. Interview with Conrad Schetter on "Deadly rioting in Kabul".

WDR 2 (regional radio channel), Mittagsmagazin. June 03 2006. Interview with Conrad Schetter on "Future of Afghanistan".

Deutsche Welle World Radio (Bengali section). June 12 2006. Interview with Sayan Chakrabarty, ZEFb doctoral student from Bangladesh, on child labor in South Asian Countries on the occasion of the "World Day Against Child Labour".

HR 2 (regional radio channel), Der Tag. June 22 2006. Interview with Ulf Terlinden on "The takeover of Mogadishu (Somalia) by the Union of Islamic Courts".

Deutsche Welle International (radio and TV channel). June 23 2006. Interview with Hartmut Ihne on "New patriotism, globalization, and World Championship".

HR (regional radio channel), Info Radio. June 29 2006. Live-interview with Conrad Schetter on "Violence in Afghanistan".

Eurasisches Magazin (monthly magazine). July 1 2006. Interview with Conrad Schetter on "Afghanistan: There is something brewing" ("Afghanistan: Da braut sich was zusammen").

WDR (regional radio channel), Funkhaus Europa, Piazza. July 6 2006. Live-interview with Conrad Schetter on "Violence in Afghanistan".

General-Anzeiger Bonn (local daily newspaper). July 3 2006. "Water as explosive stuff. Researchers develop strategies for global water management" ("Zündstoff Wasser. Wissenschaftler entwickeln Strategien für globales Wassermanagement").

General-Anzeiger Bonn (local daily newspaper). July 3 2006. "Introduction to development policy" ("Einführung in die Entwicklungspolitik").

General-Anzeiger Bonn (local daily newspaper). July 25 2006. "A treasure worth a billion" ("Milliardenschatz im Regenwald").

Deutsche Welle TV (international TV). August 13 2006. Miniportrait on ZEF alumni Damaris Odeny from Kenya.

General-Anzeiger Bonn (local daily newspaper). August 15 2006. "The unquenchable thirst for water" ("Der unstillbare Durst nach Wasser").

Rhein-Zeitung (regional daily newspaper). August 24 2006. "On the trail of the monsoon. Scientists explore the climate in West Africa. ("Auf den Spuren des Monsuns. Wissenschaftler erforschen Klima in Westafrika").

Deutsche Welle (www.dw-world.de). August 24 2006. "Uzbekistan's irrigation crisis".

Also, the "Silk Road Lectures", another public lectures series held at ZEF had a considerable public impact. The series covered the political, historical, and social background and development in the region of the former silk road. International experts on central Asia held talks on issues such as processes of nation building, growth inequality, security policy, the drug economy in Afghanistan, as well as (a special lecture) on the nuclear crisis in Iran. With this interesting selection of current hot political issues, the "Silk Road Lectures" attract experts as well as interested laymen.

ZEF's homepage (www.zef.de) has been reshaped and our "ZEF news" has been given a new layout.



Chapter 7. Academic Output

Selection of Publications

Books

Ehlers, E. and T. Krafft (2006): *Earth System Science in the Anthropocene. Emerging Issues and Problems.* Berlin/Heidelberg/New York: Springer.

Evers, H.-D. and R. Korff (2005): *Urbanisme Asia Tenggara.* Jakarta: Yayasan Obor.

Ihne, H. and J. Wilhelm (eds.) (2006): *Einführung in die Entwicklungspolitik.* Münster/Hamburg/Berlin/Wien/London: Lit.

Menkhoff, T., Evers, H.-D. and Y.W. Chay (eds.) (2005): *Governing and Managing Knowledge in Asia.* Singapore/London/New Jersey.

Reviewed Articles and Book Chapters

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Academic Awards / Careers

Eckhart Ehlers, ZEF senior fellow, was awarded an Honorary Membership of the Geographical Society of Hamburg 2006.

Caleb Wall, doctoral student from New Zealand and member of the Uzbekistan project, was awarded a GEO-4 Fellowship by UNEP in September 2005.

An official inauguration ceremony for the honorable professorship awarded to Paul Vlek took place in the presence of the members of the Science Council of the University of Urgench in May 2006.

Starting April 1, 2006 Stefanie Engel has taken on a position as Professor of Environmental Policy and Economics at the Eidgenössische Technische Hochschule (ETH) in Zurich, Switzerland.

Stefanie Engel has been elected member of the German Economics Association's Research Committee on Environmental and Resource Economics.

Ulrike Grote has taken on a position as Professor of Environmental Economics and World Trade at the Leibniz University of Hanover in October 2006.

Further publications

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Appendix: Budget / Funding Partners*

Indirect Support**)		in Euro	in %
Deutscher Akademischer Austauschdienst (DAAD)/Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (BMZ)		561.200,00	65,0
Deutscher Akademischer Austauschdienst (DAAD) Regional Referate/ Auswärtiges Amt (AA)		85.400,00	9,9
Own funds		45.000,00	5,2
Scholarships from Lybia		38.000,00	4,4
United Nations University / Institute for Environment and Human Security (UNU-EHS)		25.400,00	2,9
Deutsche Forschungsgemeinschaft (DFG)/ Golden Rice Humanitarian Board		18.000,00	2,1
Centre d'Etudes et de Recherches sur le Développement International(CERDI), France		14.400,00	1,7
Higher Education Commission Pakistan / Deutscher Akademischer Austauschdienst (HEC/DAAD)		12.700,00	1,5
SAP (Software Provider)		12.700,00	1,5
Konrad-Adenauer-Stiftung eV (KAS)		12.700,00	1,5
Nationaler Forschungs- und Technologierat, Mexiko/ Deutscher Akademischer Austauschdienst (CONACYT/DAAD)		12.200,00	1,4
International Maize and Wheat Improvement Center (CIMMYT)-ZEF-Hohenheim		11.300,00	1,3
Fundación Gran Marisal de Ayacucho, Venezuela /Deutscher Akademischer Austauschdienst (Fundayacucho/DAAD)		9.000,00	1,0
Evangelischer Entwicklungsdienst (EED)		4.800,00	0,6
Total		862.800,00	100
External Funds***)			
Bundesministerium für Bildung und Forschung (BMBF) via	<i>Projects:</i>	4.302.586,91	71,4
· Deutsches Zentrum für Luft- und Raumfahrt (DLR), or	Biota East Biota West		
· Forschungszentrum Jülich	Coffee in Ethiopia		
	Glwa Volta		
	International Advanced Study Courses (IPSWaT)		
	International Project Office (IPO), Global Water Systems Project (GWSP)		
	IWRM Olifant, South Africa		
	Land Use in SouthEast Brazil		
	Uzbekistan		
Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (BMZ) via	<i>Projects:</i>	503.487,44	8,4
· Deutscher Akademischer Austauschdienst (DAAD)	German Language Courses and PhD Study Support		
· Gesellschaft für Technische Zusammenarbeit (GTZ)	Development Research and Teaching		
	Doctoral Program		

Robert Bosch Stiftung	<i>Projects:</i>	218.637,52	3,6
	Agriculture in Europe and Africa		
	Doctoral Scholarships		
	Natural Resource Management		
Forschungszentrum Karlsruhe	<i>Single Project: Virtual Institute</i>	213.914,40	3,5
Volkswagen Stiftung (VW)		192.049,51	3,2
Land Nordrhein-Westfalen (NRW)		123.149,00	2,0
European Union (EU)		98.138,47	1,7
Stadt Bonn		75.969,00	1,3
Deutsche Welthungerhilfe (DWWH)		55.469,39	0,9
Kraft Foods Deutschland GmbH		54.434,72	0,9
Deutsche Forschungsgemeinschaft (DFG)		48.347,81	0,8
International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)		34.503,32	0,6
International Plant Genetic Resources Institute (IPGRI)		25.504,00	0,4
Agence française de Développement (Afd)		20.000,00	0,3
Deutsche Stiftung Friedensforschung (DSF)		17.332,01	0,3
Institute for Environmental Studies (IVM)		13.775,42	0,2
Concern Worldwide		8.333,33	0,1
International Human Dimension Program (IHDP)		6.303,85	0,1
World Climate Research Programme (WCRP)		6.257,30	0,1
International Geosphere-Biosphere Programme (IGBP)		4.161,46	0,1
Diversitas - International Programme of Biodiversity Science		3.451,00	0,1
Total		6.025.805,86	100
Core Funds****)			
Personnel Costs		1.167.087,10	77,7
Administrative Costs		290.000,00	19,3
University Bonus System*****)		44.656,00	
Total		1.501.743,10	100
Indirect Support & External Funds & Core Funds		8.390.348,96	

*) Funds budgeted for 2006.

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***) Third-Party Projects of ZEF, funds budgeted i.a.w. Annual Financing Plans.

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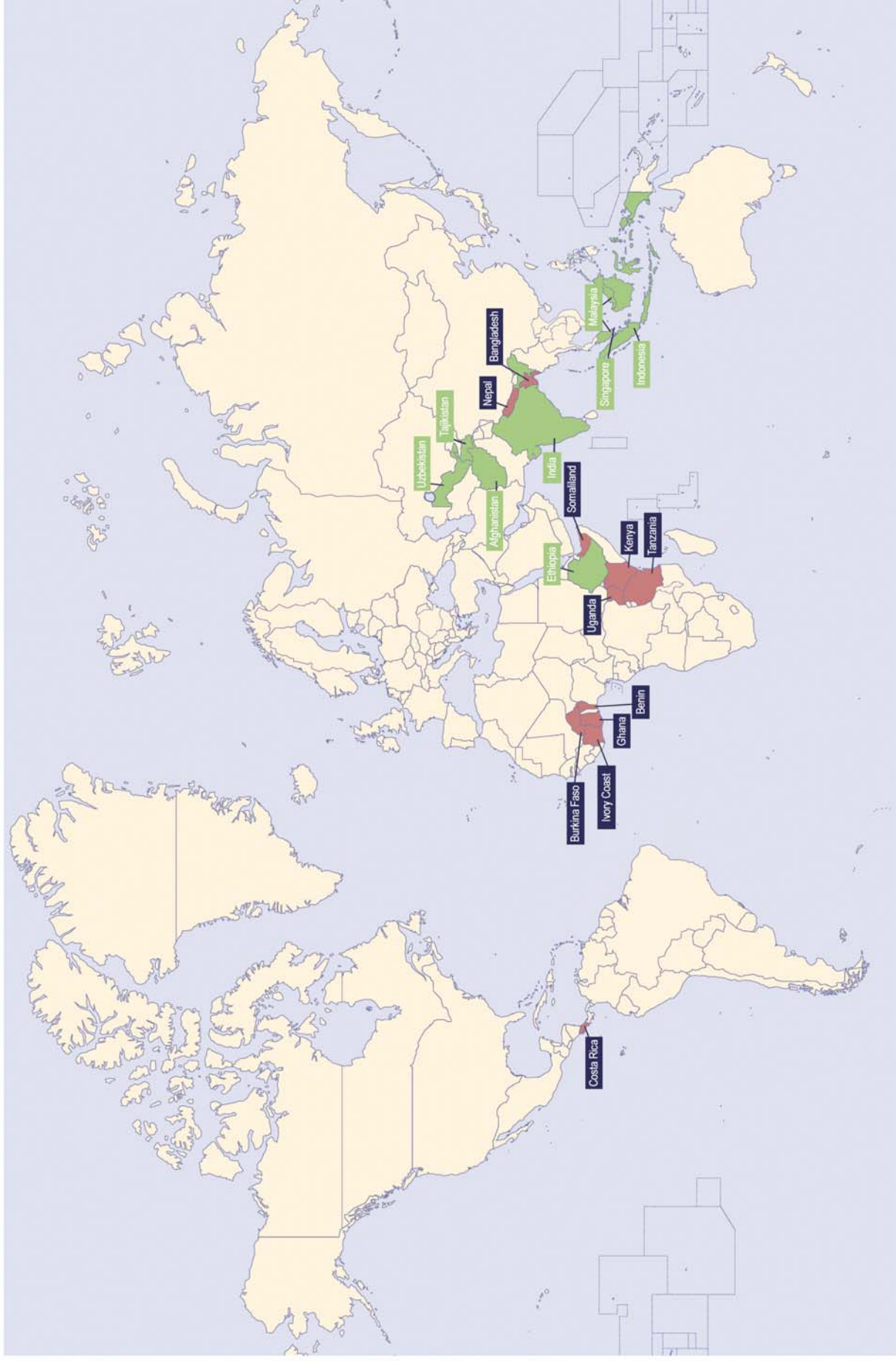
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