



ZEF news

No. 20 | May 2008

Special issue on Biodiversity

Editorial

Biodiversity is a central research topic at ZEF. Our biodiversity research is oriented towards the UN Convention on Biological Diversity (CBD). In the context of the CBD, biodiversity was recognized – internationally for the first time – as the basis for sustainable development. Development processes are highly complex, and the research approach at ZEF is, therefore, interdisciplinary and gives equal consideration to all three of the CBD's objectives: the conservation and sustainable use of biodiversity as well as the fair sharing of the benefits resulting from its use. Biodiversity research at ZEF to date has revealed three important general findings:

1. Research results are hardly transferable, as they are site-specific and situation-dependent. The concrete implementation of the CBD is thus difficult and time consuming.
2. Evidence of the economic value of biodiversity does not automatically lead to its conservation.
3. It is not a lack of knowledge on biodiversity, but a lack of concepts on how to implement this knowledge in practice that makes the conservation and sustainable use of biodiversity so difficult. Implementation concepts must be based on transdisciplinary research, which is research that also involves local actors and stakeholders. Not an easy task, but ZEF is working on it.

Manfred Denich

Project leader of the CoCE project (Conservation and Use of Wild Coffee in Ethiopia)

Trans-disciplinary biodiversity research: Not an easy exercise

Whereas most people are familiar with the term species extinction, little is known about what can be done to stop it. The matter is complicated by the fact that a single species cannot survive alone, but only in interplay with a variety of other species. This also applies to the *Homo sapiens* species. Reconciling the preservation of biodiversity with other societal interests is a difficult task, even for experts.

The UN Convention on Biological Diversity (CBD) sets out to achieve this objective. One of the three central aims of the CBD is the sustainable use of biodiversity and its components. This is a political target. All stakeholders in society are called upon to participate in its realisation. Of course, new knowledge and new technologies play an important role, but the key question is: How can ecological, economic and social aims and interests be integrated in a joint, long-term strategy? The answer to this question is through sustainable development as a societal process.



Scientists from different disciplines working closely together.

Practice to date has taken little account of sustainability. Interests are pitched against one another. Often just one of the aims mentioned above, usually the economic aim, is pursued at the expense of the others. The world is still a long way away from sustainable development and from the sustainable use of biodiversity. Nevertheless, first steps are being taken in this direction.

Science and research are also expected to contribute towards implementing the CBD and towards the necessary societal processes.



Trans-disciplinary research involves local stakeholders.

The CBD and the research programmes which are based on it explicitly demand such contributions. The German Federal Ministry of Education and Research (BMBF) has set up corresponding research programmes, such as the BioTeam programme: "Biosphere Research – Integrative and Application-Oriented Model Projects". ZEF is leading one of these model projects: CoCE – "Conservation and use of the wild populations of *Coffea arabica* in the montane rainforests of Ethiopia". The aim of the project is to support the implementation of the CBD in Ethiopia. We would like to illustrate a few special features of this type of research using the example of the CoCE project.

Different interests lead to a complex local situation

The global process of deforestation is not sparing Ethiopia's montane rainforests. In Ethiopia too, economic interests often conflict with nature conservation and for Ethiopian farmers it is often simply a question of survival: The forests serve as a source of firewood and building materials, or are cleared to provide land for agricultural uses. A growing population is adding to the pressure on the forests. From the point of view of environmental protection, this would appear to be an unresolvable situation.

But in fact, there are also economic reasons for conserving the forests. The montane rainforests are the place of origin of the coffee plant. Coffee, like oil or steel, is one of the world's most important export goods. The forest ecosystem is therefore of considerable importance as the "cradle" of the *Coffea arabica* genetic resource. The destruction of the ecosystem would also destroy the natural development of this genetic resource and would potentially have negative effects on the development of coffee breeding, and, hence, coffee production.

The CoCE project is, in a first step, conducting classical basic research in order to contribute to the sustainable use of the rainforest and its wild coffee resources. It is studying the genetic diversity of wild coffee, its resistance to diseases and its various qualities, such as taste or caffeine content. The project has also estimated

the economic value of wild coffee as a genetic resource – this was set at between US\$ 0.42 billion and 1.46 billion per year.

A further area of the project can be described as applied research or research and development. The Internet-based "Coffee Forest Information System", COFIS for short, is being developed as a technological innovation for conservation planning in Ethiopia. It compiles the most important information on the coffee forests in cartographic form and is intended to support decision-makers on the spot.

But how can this knowledge and this technology actually contribute to the sustainable use of the forest? In order to achieve this goal, the CoCE project transcends the classical forms of basic and applied research in so far as it is implementation-oriented.

Setting targets – The basis for implementation-oriented research

The overarching aim of CoCE is to promote the establishment of a protected area in the Ethiopian forest region. In consultation with the stakeholders, the project chose the form of a UNESCO biosphere reserve as the most promising approach. This combines the preservation of the forest in zones which are particularly worthy of protection with the careful use and targeted – economic and social – development of other zones. Once this form had been decided, the further project aims were put into concrete terms and focused towards the biosphere reserve: For example, the development of management guidelines for the coffee forest in the various zones, or certification mechanisms for coffee produced in the biosphere reserve (see article by Till Stellmacher in this ZEF news, P. 5).



Field experiments on coffee in Ethiopia.

All in all the project team identified eight implementation targets. An interdisciplinary approach was chosen to ensure that basic research in the various disciplines contributes towards these targets. This demands that the scientists work together to realize each of the implementation targets – an uncommon exercise. Conclusions must be drawn from the data collected and concepts developed. For instance, genetic and ecological factors play just as important a role in establishing the zones of the biosphere reserve as social, cultural, administrative or economic factors.

Certain results in specific disciplines may be particularly interesting from the scientist's perspective. But when it comes to drafting management guidelines, it is the perspective of the potential users which plays the principal role. The users are therefore involved in developing the guidelines. This procedure also increases the likelihood that the management guidelines as well as other solutions which have been jointly developed will actually be implemented in practice.

In order to ensure the practical transfer of results into the specific context of Ethiopia, CoCE is working with the "Ethiopian Coffee Forest Forum" (ECFF), an NGO which was set up during the first phase of the project. Once the project has finished, it is intended that the ECFF will continue the work of establishing a biosphere reserve in Ethiopia's coffee forests.

New methods and other framework conditions

The involvement of non-scientific stakeholders in the joint development of solutions is also termed transdisciplinary research. The pioneers have drafted transdisciplinary approaches and methods in those areas which deal with complex societal problems, such as development and sustainability research. In science as a whole, this type of research is still rather uncommon. However, the increasing urgency of societal problems which cannot be remedied by technical solutions alone will significantly increase the demand for transdisciplinary and implementation-oriented research in the future.

Apart from new methods, this kind of research also needs different temporal and financial framework conditions. The normal project duration of 3–4 years is too short for the lengthy consultations with local stakeholders and institutions. The research approach

described above requires more intensive co-ordination and more time for the integration of research results from the various disciplines and for internal and external communication, as well as for analyses of the situation of and strategic relations with stakeholders. This cannot be achieved by merely involving experts in communications and stakeholder management. Every single person involved in the project must put aside time and funds for the tasks of integration, management and communication in his or her particular field. Instead of the normal 5–15% of the project budget earmarked for those tasks, one must think



Many branches, one goal.

in terms of 30–70%, depending on the type of project. The renowned International Institute for Sustainable Development (IISD) has a rule of spending at least 50% of its project budget on management and communication. The fact that the IISD has been voted the "Most effective sustainable development research organization" several times in international polls is possibly due to this strategy.

But ultimately, the distribution of the budget, the structure of a project and the methods employed depend on what one wants to achieve: Is the main interest to extend scientific knowledge or to provide effective contributions to sustainable development? Both are important and both are needed increasingly and more urgently than ever.

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Report from Kakamega Forest in Kenya: Biological richness under threat

In this article, Tobias Wünscher and Paul Guthiga, both ZEF researchers in the BIOTA East project (Biodiversity Monitoring Transect Analysis) report on their research on Kakamega Forest in Kenya.

Heavy wafts of early morning mist are slowly rising from the ample forest area as an orange sun makes its way up the horizon. We got up a little earlier today to climb Buyangu Hill and catch a glimpse of a tropical dawn's play with light and vapor. Before us lies Kakamega Forest: It is the only remaining patch of Kenya's Guineo-Congolian rain forest. Famous for its rich diversity of animal and plant species, it is home to about 330 bird species, 400 species of butterflies and over 390 species of vascular plants, many of them endemic. Its rich biodiversity



Early morning mist above Kakamega Forest.

makes Kakamega Forest an important global conservation area. In 1995, the World Conservation Union (IUCN) ranked it as the third highest conservation priority among Kenyan forests. Apart from being an important biodiversity reservoir, the forest is also used by adjacent communities as a source of firewood, charcoal, building materials, forage, bush meat, fruits, mushrooms and medicinal plants.

Pressing population growth

The entire region, including the forest area, has potentially fertile soils. Nevertheless, the surrounding farming communities are very poor due to an extraordinary high population density, a lack of fertilizers and various other reasons and draw heavily on the forest's resources. The area has an average population density of 461 people per km², making it one of Africa's most densely populated rural areas. It is precisely this mixture of poverty, high population density and the immediate forest vicinity that puts the future survival of this marvel in jeopardy. Recent studies show that up to 20% of the forest has been lost in the last two decades, resulting in the current forest cover of only 100 km². We can see this while standing on

Buyangu Hill, recognizing thinned out patches of forest and pockets of light green pastures – clear signs of an ongoing degradation process.

Economics at work

The assignment of the BIOTA East research project is to assess Kakamega Forest's unique biodiversity and find ways to preserve it. BIOTA research groups from Germany and Kenya are focusing on very different components of this overall goal. Our BIOTA group at ZEF is specialized in the economic aspects of conservation. As such, one of the group's first challenges was to estimate the costs and benefits of conservation of Kakamega Forest.

Considered as an economic undertaking, forest conservation involves the use of resources such as land and cash as well as the generation and distribution of benefits. From an economic perspective, these resources ought to be allocated in a way that generates maximum net benefits to society. Kakamega Forest generates substantial benefits to the local communities and since the majority of these benefits are not marketed, they are 'priceless'. However, this does not mean that they are without economic value. Using state-of-the-art techniques, ZEF scholars have captured these values and translated them into monetary terms, a language that policy-makers tend to understand best. The estimated economic value of extracted products in the year 2005/06, for example, averaged US\$72/ha. However, these benefits are offset by the forgone opportunity of using the forest land for farming, which averages about US\$148/ha/year. Conservation is a losing business for the local people when



Thatching grass harvested in forest and transported home.

all the local benefits of conservation are compared to the costs that they have to bear. But the picture changes completely when an analysis is conducted from a global perspective: total benefits outweigh costs and conservation becomes 'profitable', mainly due to global recreation and carbon mitigation benefits. The global community currently receives the latter free of charge. ZEF's findings suggest that the global community ought to make payments for these benefits in the form of transfers to local communities to reduce their large share of forest conservation costs. Such conservation payments could be a way to halt extracting activities and conserve Kakamega Forest.

Ways to action

However, scientific recommendations are one thing, implementation another. Although the findings are congruent with an initiative by UNEP, IUCN and the CBD Secretariat to establish an international scheme for ecosystem service payments, it is unlikely that such payments will come into effect soon.

Here on the ground in Kakamega, at the interface of conservation and forest utilization interests, we have to develop practices that allow limited extraction at a sustainable level. Backed by the Kenyan forestry law, our ZEF BIOTA team is now designing, modeling and testing management approaches that integrate adjacent communities and are thus more likely to gain their support and compliance. In one approach, the assignment of private forest parcel utilization rights aims



The authors: Tobias Wünscher (l.) and Paul Guthiga (r.).

to counteract the overexploitation so typical for resources with unrestricted public access. Other approaches include communal monitoring systems, innovative forest product marketing strategies and competitive bidding for the implementation of conservation measures.

We hope that we will achieve our goals and many years from now will be able to stand on Buyangu Hill again to enjoy this magnificent morning display above the tree tops of Kakamega Forest.

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The BIOTA-East project is being financed by the German Federal Ministry of Education and Research (BMBF).
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Is certification a suitable marketing tool for biodiversity conservation?

Can certification contribute to the conservation of biodiversity? A group of researchers within the ZEF project on "Conservation and use of wild populations of *Coffea Arabica* in the montane rainforest of Ethiopia" (CoCE) is searching for answers to this question. They are assessing the prospects and challenges of the certification and marketing of Ethiopian forest coffee. This article presents their initial results.

Reasons for certification

A growing demand for healthier and socially and environmentally-friendly products has generated a boom in certified products on the global market. Certification is based on the idea that consumers are motivated to pay a higher price for products that fulfill certain criteria, such as not using child labor or chemical fertilizers.

Standards can also be adopted for geographic origin or a specific genetic trait. Being able to label a product as 'Ethiopian Fairtrade Kaffa Forest Coffee', for example, and to protect the label from fraud is considered a valuable marketing advantage in today's coffee market.

Since the 1980s, certification concepts and standards have been developed and implemented worldwide by

various organizations under different agendas in response to different ecological and socio-economic concerns. Each certification standard sets up its own criteria with a set of indicators serving as a parameter for verification and as a basis for evaluation.

An increasing number of commodities produced in extensive eco-agrosystems have been certified and marketed in recent years in compliance with the current boom in consumers' willingness to pay for ecosystem services. These products include Brazil nuts from Bolivia, Argan oil from Morocco and forest coffee from Ethiopia. The latter is a prominent case for pricing ecosystem services. It grows in the Ethiopian montane rainforests, which are famous for their rich biodiversity. Coffee beans are collected by the local population and sold to cooperatives. So far, 12 local wild coffee cooperatives are working according to the certification standards of Fairtrade, Bio and UTZ Certified Standards.

Additional conditions required

However, making certification work effectively implies more than the certification and marketing of products alone. Our research shows that additional conditions



Certification needs a trustful cooperation among the stakeholders.

have to be fulfilled to make certification a successful tool, especially when it is simultaneously supposed to meet socio-economic as well as ecological goals:

Certification needs trust. As literature on social capital has shown, trust between actors is the lubricant within a value chain as it lowers the transaction costs involved in working together effectively. Supply chains tend to collapse when trust is lacking. This is even more the case when certification is applied to new products such as forest coffee from Ethiopia. In practice, trust and cooperation between the actors is impeded by differences in actors' preferences and interests, as well as disparities in their access to power, resources, and information.

Certification needs human capital. Those involved should have an understanding of business management and be committed to the goals and concepts of certification. Research shows substantial differences in expertise and information levels among people involved in producing and trading Ethiopian forest coffee. The majority of peasants organized in coffee cooperatives do not know whether their cooperative is certified and what the respective standards are. This not only makes it difficult to find a common language among the actors, but also lowers credibility.

Certification needs controls. Certified goods are often produced by smallholders living in poorly accessible rural areas of developing countries where an effective and regular verification of the certification requirements by accredited inspectors is

time-consuming and costly. In many producing countries there are no free media to report on personal or organizational abuse of certification.

Certification for biodiversity

Certification needs the 'right' concept and standards, especially when it is linked with biodiversity conservation. Biodiversity is a multifaceted dynamic system that is difficult to measure and monitor. In the Ethiopian case, the local population traditionally collects forest coffee in small quantities. The payment of price premiums for certified coffee, however, is an incentive for the producers to intensify forest management – e.g. by slashing undergrowth and cutting larger trees to provide the coffee with more sunlight – and prevent forest degradation and loss of biodiversity.

The current modes of forest coffee certification in Ethiopia face structural problems and do not offer sufficient incentives for the producers to preserve the forest ecosystem and biodiversity. In order to overcome these bottlenecks, the researchers recommend developing and implementing a consistent and distinctive certification concept for Ethiopian forest coffee. Forest management guidelines that balance economic benefits and biodiversity conservation in the concrete ecological, socio-economic and institutional context thereby need to be linked to incentives for compliance. This is, of course, not an easy task. A public-private partnership with the "Ethiopian Forest Coffee Forum" may provide the necessary capacity. Nevertheless, certification can only be one tool for conserving biodiversity. In addition, participatory forest conservation programs as well as education and training measures are required.

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Certified goods are often produced by smallholders in rural areas.

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About the value of biodiversity valuation

Ethiopia's montane rainforests are part of the Eastern Afromontane Biodiversity Hotspot, which means that the area has a rich biodiversity and that it is highly endangered. A special feature of the Ethiopian forests is that they are not only the birthplace of *Coffea arabica*, but also contain the world's only wild *Coffea arabica* populations today. From here, Arabica coffee has been distributed around the world to become the world's most famous and best quality coffee.

Despite the distinct and unique features of this eco-region, deforestation threatens the existence of the wild coffee populations and their rainforest habitat. At current deforestation rates, the last tree may be felled within about 30 years.

Ecologist's perspective

From an ecologist's perspective, the situation is obvious: to lose the world's only wild *Coffea arabica* populations is reason enough to invest in conservation. Economists,

however, perceive the situation differently: only if society values these genetic resources highly enough will it invest in conservation. But even if society is aware of and



The project assessed the economic value of wild coffee's genetic resources.

willing to pay for conservation, the efficient conservation of biodiversity is often hampered by market, institutional and political failures. That is the "willingness-to-conserve" view. Whereas in the first case, biodiversity is lost as a result of society's non-willingness to pay, in the second, it is the result of society's non-ability to transform its willingness into action. In both cases, we lose biodiversity – but what values do we lose?

In order to answer this question, researchers at ZEF and members of the CoCE project conducted an analysis of the economic value of *Coffea arabica*'s genetic resources in the Ethiopian highland forests. The valuation is based on an assessment of the potential costs and benefits of using *Coffea arabica*'s genetic information in breeding programs for enhanced coffee cultivars. The study considers the breeding of three types of enhanced cultivars: increased pest and disease resistance, low caffeine contents and increased yields. Costs and benefits are compared for a 30-year discounting period and result in an estimated net present value of coffee's genetic resources of between US\$ 0.42 billion and 1.46 billion. This estimate is prone to considerable uncertainty and only gives a first indication of this particular service supplied by coffee forests. Note that the forests also provide a whole range of other services, such as the supply of timber and non-timber forest products, river water retention, carbon sequestration and nature conservation. The study only demonstrates the high economic value of wild coffee's genetic resources. However, as demonstrated by the case of the Ethiopian coffee forests, calculating these economic values will in itself not be sufficient to conserve the genetic resources, since biodiversity loss is also a consequence of broader institutional and political failure.



For a "social person" biodiversity has a value of its own.

Re-thinking valuation

Accepting that biodiversity loss is also a problem of institutional and political failure requires a re-thinking of how valuation methods are applied to elicit the value of biodiversity. Apart from speculating on the reasons why different actors show no interest or willingness to pay for conservation, we take a self-reflective view and consider the value of economic valuation for biodiversity.



Forests provide a whole range of eco-services.

The method itself, i.e. the way in which the values are generated, influences the outcome of the valuation. Our method was not only based on the assumption of benefits from different breeding programs, but also on the assumption of people's rationality, perceptions of biodiversity and decision-making behavior – assumptions which, in our case, belong to the efficiency stance, or to the specific way an "economic man" would perceive the world. While the efficiency stance only refers to the realm of relatively simple systems, individual rationality, and values in use, the complexity stance, in contrast, transcends these boundaries into the realm of complex systems, social rationality and includes intrinsic values.

Economic man

To demonstrate this difference, imagine a person A who has complete knowledge about coffee forest biodiversity and decides on whether to conserve it or not by attaching values to different options – values he simply has at his disposal. He decides by ranking the options, weighing positive against negative values and finally choosing the option which maximizes his personal benefit. This person A is an "economic man" and he takes the efficiency stance. For him, biodiversity does not have a value in itself and he would not conserve it for its own sake. Instead, he would only conserve it if it made him happy or if he found it useful for himself or future generations. Our valuation of wild coffee genetic resources works with the perceptions and decision-making behavior of this type of person.

Social man

In contrast, imagine person B who did not previously know much about the coffee forests and for whom it is hard to acquire that information. Before he can decide whether to conserve or not he needs to inform himself and ask others about their opinion on the matter. He decides by trying to weigh positive and negative values against each other. However, because his knowledge is incomplete and because he has never been in such a situation before, he also takes into account conventions and norms which tell him how he should behave as a responsible member of society. This person B is the "social" or "political man". For him, biodiversity can have an intrinsic value which

means that it can be conserved for its own sake because he also regards himself as part of earth's biodiversity and he thinks that people have a right to exist for the sake of being human beings. Person B, apart from behaving within a set of social norms which enable him to make decisions, even in novel decision-making situations, needs others to discuss and construct those values which they think should be attributed to the conservation of wild coffee genetic resources. By choosing the valuation method of person A, we neglected the importance of values which are constructed in social processes and we ignored the importance of certain social processes which need to take place before people can actually decide and take action.

A matter of perspectives

Therefore, to conclude, in order to come up with values for biodiversity conservation which can actually be transformed into real benefits and trigger real commitment

to a willingness to pay, we need to choose valuation methods which take into account the market as well as institutional and political reasons for biodiversity loss. People who are part of the same life system they are supposed to value and who may feel that their own existence and that of biodiversity should not be justified on the grounds of economic efficiency alone will decide and act as social and political beings. Whereas economic valuation provides an insight into the economic motivations for conserving or exploiting biodiversity, social and institutional values are better captured by evaluating social processes. It is a matter of how we perceive people and biodiversity that determines our choice of how to value and conserve biodiversity.

Franz Gatzweiler and Lars Hein

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Payments for Environmental Services – Pioneer Costa Rica

My forest is what you see stretching from the river up to the hilltop," says Milton Villalobos, pointing proudly across the valley. "There is plenty of wildlife in it. It produces water and fresh air, helps the climate, they say, and it looks pretty, too. That's why they pay me for keeping it." Don Milton is a landowner and cattle farmer on Costa Rica's subtropical Nicoya Peninsula, our study area. "So, would you cut down the forest if you were not paid?" we ask. "No way. The forest has been here since I can remember. The soil is full of rocks and not profitable for cattle ranching". Don Milton receives payments for environmental services (PES) and our conversation illustrates a key issue of PES: in the absence of an immediate threat of deforestation, do the payments provide additional environmental benefit? This and other issues are addressed in our recently completed study on PES.

PES – a popular tool

Payments for environmental services are a voluntary transaction between a service buyer and a service provider, conditional upon the actual provision of a well-defined environmental service (ES) or a land use likely to secure that service. PES has become an increasingly popular tool worldwide to preserve ecosystems and their services, such as those described by Don Milton. Their popularity is due to the recognition that, unlike traditional conservation approaches such as command-and-control or integrated conservation and development, PES is a negotiated and

direct approach – conditional upon desired conservation outcomes – which promises to be more cost-efficient, and may raise new funding sources especially from the private sector.

Don Milton is a participant in Costa Rica's PES program, which is implemented by the National Forest Financing Fund (FONAFIFO, in its Spanish acronym). Costa Rica is the first developing country to have implemented a nationwide PES program. This has drawn a lot of attention worldwide, including our own. FONAFIFO pays landowners for conserving, restoring or planting forests, expecting these to provide biodiversity, water, carbon and landscape-beauty services. FONAFIFO does not examine whether Don Milton's forest actually "produces" water,



Forest areas in the PES program have to be marked with signs.

Facts & news

More WISDOM in Vietnam

ZEF opened a project office for its WISDOM project in the city of Can Tho in Vietnam in January 2008. All ZEF project activities in the field will be coordinated from here – including support for ZEF PhD students.

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GLOWA Volta project active in Dam Dialogue in Ghana

"Bringing research findings on dams closer to the people" was both the title and the target of the second Ghana Dams Forum, which was held in Accra, Ghana, in February 2008. The major focus of discussion among the roughly 100 participants was the impact of climate change on the Bui hydropower project. Scientists from ZEF's GLOWA Volta project co-



organizing the Forum presented recommendations for political action in a GLOWA Volta Policy Brief entitled 'Impact of Climate Change on the Black Volta Basin and the Bui Dam'.

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Eddy towers above Uzbekistan: New Eddy Covariance Station established on project site in Urgench



A new Eddy Covariance Station was set up in the field in Urgench, Uzbekistan, in March 2008 to measure turbulent fluxes of water, energy and carbon dioxide between vegetation, the earth's surface and the atmosphere. This "Eddy Tower" is the only one in Uzbekistan so far.

Contact: Ulrike Falk (ZEF), e-mail: ulrike.falk@uni-bonn.de

Alexander Stein wins this year's "Prize for the best doctoral thesis at ZEF".

This prize is awarded annually by the "Friends of ZEF", an association supporting ZEF's research and outreach activities. Alexander Stein, a researcher from Germany, won the prize for his thesis on "Micronutrient malnutrition and the impact of modern plant breeding on public health in India: How cost-effective is bio-fortification?"



The ceremony took place at ZEF on April 21 2008. **Contact:** Günther Manske, Coordinator of the BIGS-DR, e-mail: gmanske@uni-bonn.de

At a glance

ZEF project will be at a "hot spot" at the Conference of the Parties on Biodiversity (COP 9) in Bonn

The project on "Conservation and Use of Wild Coffee in Ethiopia" (CoCE) will be at a "hot spot" at the international Conference of the Parties to the UN Convention on Biological Diversity (CBD), which is to be held in Bonn from May 19–30 2008. The project will present its research activities at the stand of the German Federal Ministry of Education and Research (BMBF) in the German government's tent.

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"Innovative Research for Sustainable Land and Water Use" will be the overall topic of a workshop organized by the ZEF/UNESCO project in Uzbekistan. The workshop will be held in Tashkent and Urgench, Uzbekistan, from May 27–30 2008. Target groups are national decision makers (Tashkent) and local stakeholders (Urgench).

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"Global Change and Water Resources in West Africa"

is the motto of an international conference to be held in Ouagadougou, Burkina Faso, where the German-African GLOWA Projects will present their research output from August 25–28 2008. The conference is financed by the German Federal Ministry of Education and Research (BMBF) and organized by ZEF.

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Registration and information at:
<http://africaconference.glowa.org>



as he puts it. No attempt is made to estimate the service potential of forest parcels. FONAFIFO simply presumes that forest cover in its program areas always provides a significantly beneficial amount of services and rewards landowners who conserve forests like Don Milton with a fixed US\$60/ha/year, primarily funded through an earmarked petrol tax.



The Black Spinytail Iguana (Ctenosaura similis) prefers arid habitats with tree populations.

New mechanism

However, Don Milton might also have been satisfied with a lower payment. With no intention to deforest, even no payment at all would probably have produced a similar conservation outcome. Conversely, there is a shortage of funds for enrolling other high-value forest plots that may truly be at risk. Our study addresses this issue and questions how the scheme's design could be improved to achieve more ES with a given budget. We have developed a mechanism that increases the amount of services per dollar spent by selecting forest parcels that are (1) 'cheapest' to include in the program, (2) at highest risk of being deforested, and (3) most proficient in providing ES. Using individual landowner ES

provision costs from survey calculations, deforestation probability estimates from historical deforestation data, and indicators such as slope and habitat size to estimate ES proficiency levels, we have been able to show that our mechanism could more than double the amount of benefits purchased with a fixed budget. In the Costa Rican case, what pays off is primarily the notion of varying payment levels according to landowners' ES provision costs (above all the foregone profits from

forest conversion). In continuation of our work, a team at ZEF's currently conducting auction experiments to examine how ES provision costs can be determined in a more cost-efficient way. This would be a big step towards actual implementation of the developed tool, and towards the best possible use of scarce conservation funds.

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Looking for coffee: The Coffee Forest Atlas

The Ethiopian montane rainforests are home to hundreds of plant species, many of them rare or endemic. The most important species in an economic as well as a cultural sense is the coffee plant, *Coffea arabica*. Popular around the world and widely planted in the tropics, its wild populations are highly endangered by deforestation, threatening its centre of origin and genetic diversity.

The development of concepts for the conservation and use of wild coffee and its forest habitat requires information on the extent of forest cover and areas with wild coffee populations. To this end, forest areas are mapped on the basis of current satellite imagery. Satellite images from the 1960s are used as a reference for estimating long-term deforestation rates.

Suitable habitat areas for the occurrence of wild coffee populations are determined by means of ecological niche modeling, considering site factors and environmental gradients. This analysis provides guidance for locating wild coffee stands, particularly in less-known regions.

All spatial information is compiled in a Coffee Forest Atlas and in an online Coffee Forest Information System. Besides the coffee forest maps, the atlas includes further ecological and socio-economic information, e.g. population density, relevant to the location and design

of coffee forest conservation areas. It thus facilitates the planning of a protected area for wild coffee in its forest habitat.

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The Atlas includes information on Ethiopia's forest cover.



Viewpoint

"We need to show the advantages of biodiversity conservation"

Interview with Prof. Dr. Beate Jessel, President of the German Federal Agency for Nature Conservation (BfN)

You have been President of the Federal Agency for Nature Conservation (BfN) since November 2 2007. The Agency has a high profile in Germany. How do you view its international profile?

We have a strong international profile – after all the effects of globalisation can also be felt in nature conservation and international networking is becoming increasingly important. A large number of BfN staff serve on international bodies and act in an advisory capacity, for example on various EU committees, in the IUCN commissions and within the framework of international conventions such as CITES. Among the Agency's trademarks are the many conferences and workshops held at the International Academy for Nature Conservation (INA), our branch office on the isle of Vilm. The Academy is a recognised Capacity Building Center for Eastern Europe for the Convention on Biological Diversity (CBD). Regular specialist meetings at European level are held there to prepare for meetings of the CBD Scientific Committee. In the meantime, the Academy's annual UNEP Capacity Building course has become tradition, as have the two seminars on topics in the area of nature conservation and development collaboration in cooperation with the GTZ.

The BfN has also earned itself a good reputation through its long-term cooperation with various partner countries, for example, with the Russian Federation, Georgia, Mongolia and Ethiopia, which all value the BfN's expertise and advice.

What key focuses do you intend to introduce into the medium and long-term international work of the Federal Agency for Nature Conservation? Have you any regional preferences?

In the past, the BfN has focused strongly on Eastern Europe and on the Russian Federation and the Soviet Union's successor states. This cooperation developed after the turnaround in Eastern Europe. At the time, Germany had an advantage over other Western European states with regard to establishing relations with these regions. Of course, it is now a matter of continuing this successful cooperation. However, we would also like to become more involved in other regions in the future. We have recently become engaged in projects in Africa, in the fields of nature conservation and the fight against poverty. Cooperation projects are currently emerging with China, where nature conservation is becoming increasingly important due to the serious environmental problems there.

One of the most important preconditions for international cooperation in the field of nature

conservation is finding partners with whom one can continue to work together successfully in the medium and long term. This is often not easy in areas where there is a high level of staff fluctuation. I see the role of the BfN as a federal authority less in concrete model projects – a large number of other organisations are active in this field, particularly in the area of economic cooperation – but rather in promoting networking and the international exchange of information between stakeholders who are ideal multipliers. Our International Academy for Nature Conservation (INA) provides a perfect platform for this. I therefore see our preferences focused less on particular regions than on specific key topics. Apart from the areas of nature conservation and the fight against poverty, which I have just mentioned, these topics include, for example, the development and further development of recognised criteria for reserve systems.

In the light of your own background, how do you regard the interplay between science, civil society engagement and state institutions such as the BfN in the (joint) conservation effort?

This interplay is very dear to me. I personally have worked in all three areas which you mention and am familiar with the various approaches and methods. In the future, we will have to make a greater effort to link stakeholders. As a scientific institution with a strong focus on political counselling, we also see ourselves as mediators. We try to perform this task through working groups which accompany projects and involve experts from the various fields. Of course, it is often not easy to reconcile the different time horizons of science, politics and civil society engagement. Scientific research simply needs time, whereas politics is based more on the events of the day. In my experience, it is helpful to jointly formulate the problem in hand and to take political and civil society options into account at an early stage when designing research projects. This requires a dialogue.

The 9th meeting of the Conference of the Parties to the CBD will be taking place in Bonn in May. Which of the topics on the agenda do you consider to be particularly significant for the international engagement of the Federal Republic of Germany?

There are four topics at the top of the agenda: First of all, access to genetic resources and a fair sharing of benefits (ABS), one of the three main goals of the Biodiversity Convention. Here it is a matter of ensuring that the economic benefits resulting from the use of genetic resources are shared fairly. An International

ABS Regime is to be approved within the framework of the CBD negotiations by 2010. This regime will contain internationally binding measures regarding access and benefit sharing.

A second important topic is the establishment of a global network of reserves with appropriate funding. Special attention should be given to marine nature conservation sites. There is an enormous diversity of marine lifeforms, which are still not adequately protected by nature reserves.

Thirdly, there is the question of financing the preservation of biological diversity in general (genes, species, habitats) using both existing as well as new funding instruments. This requires a lot of creativeness and innovative ideas. One possibility is to charge for the use of global environmental goods. In exchange, bonus payments could be agreed for renouncing the use of valuable natural commodities. And it is also a question of creating alternative sources of funding.

Finally, existing resolutions on forest protection must be extended, not least with regard to climate change. Germany will back this proposal at the conference in Bonn.

What results are you hoping for from the Conference, particularly with regard to developing countries?

An important precondition for the success of the negotiations in general is that we manage to clearly demonstrate the advantages which the conservation of biological diversity affords to the various groups of stakeholders, not only in developing but also in industrialised countries. In particular, I would like to see progress in the field of ABS. As far as the so-called developing countries are concerned, the equitable and

fair sharing of benefits from the sustainable use of biological resources could mean long-term support for nature conservation and sustainable development. The linking of conservation and development will prove essential in the long term.

Despite all the commotion of settling into your new office, have you been able to gain an impression of ZEF's project for the protection and sustainable use of wild coffee in Ethiopia, a project in which the BfN is strongly involved?

This project is a good example of the successful combination of science and the implementation of research results. ZEF has not only supplied important research results, it has also made a significant contribution to Capacity Building in one of the poorest countries in the world by training numerous Ethiopian diploma and doctoral students. We at the BfN have been able to carry on from these research results and from the good contacts in Ethiopia and have been able to contribute our expertise in the area of implementation. A training workshop on landscape planning has succeeded in laying the foundations for the establishment of a biosphere reserve for the protection and sustainable use of wild coffee in southwest Ethiopia.

I am also delighted that this project provides a good example of inter-departmental cooperation and activities, i.e. between the Federal Ministry of Education and Research (BMBF) and the Federal Ministry of the Environment (BMU). Linking such activities enhances the effectiveness of the support which Germany is providing.

Interview by Alma van der Veen

Biodiversity in tropical farming systems

Agriculture is one of the main sources of income for the people in South America. At the same time, it is also one of the major drivers causing environmental conflicts such as loss of biodiversity. Agroforestry, which combines agriculture with forestry, is one possibility of conserving biodiversity in agricultural landscapes. Incentives that support ecologically sound agricultural management practices are therefore urgently needed. These incentives can be compensation payments. These, however, have to be based on an adequate evaluation of biodiversity in the farming system. For this purpose, a multi-criteria analysis-based tool to assess biodiversity in agroforestry systems has been developed in this PhD study.

Biodiversity was assessed on 70 farms in the Brazilian Amazon region within the framework of this study, taking into account ecological and socio-economic criteria. This multi-criteria analysis reveals that the most relevant factors supporting biodiversity in agroforestry systems are the farmers' technical qualifications and preference for low impact techniques, their capacity to adapt to environmental, social and political changes, the diversity of species at plot level, the increase in the share of perennial species and the

financial profitability of the system. The tool developed can be used to optimize biodiversity on farms and to support decisions regarding compensation payments.

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The multi-criteria analysis tool assesses biodiversity in agroforestry systems.

Wild, valuable and vulnerable – Ethiopia's *Coffea arabica* in danger

An overview on ZEF's project on the Conservation and Use of *Coffea arabica* (CoCE)*

Did you know that Ethiopia is the birthplace of coffee? Did you know that this plant that we have been using for many centuries is still growing wild in the under-story of the Afromontane rainforests of Ethiopia today? This might end if we do not take measures to keep the plant alive there. Researchers at ZEF went to the rain forests in Ethiopia to start activities for preserving this unique plant.

The origin of *Coffea arabica* lies in the highlands of southwest and southeast Ethiopia. Here, it grows wild in the mountain rainforests at altitudes between 1,000 and 2,000 m. However, this wild coffee is highly endangered because the forests are being converted into agricultural land and settlements for the poor and growing human population. In addition, farmers are taking advantage of the diverse legal regulations on use and ownership of the forests and are converting forests into agricultural or pastoral land in order to secure their livelihoods. In other places, large coffee plantations are being established to increase productivity. These interventions destroy the forest habitat, irreversibly leading to the loss of a valuable resource: the wild *Coffea arabica*'s genetic diversity.

All about coffee

ZEF's project on the use and conservation of *Coffea arabica* (CoCE) aims at developing solutions for the sustainable use and conservation of wild coffee populations in Ethiopia. *Coffea arabica* has a unique value for the coffee sector and is well-suited as a model species in biodiversity research. This is because its wild populations can still be found in Ethiopia's natural rainforests and it is one of the few economically important crops whose origin is restricted to one country. However, the gene pool of *Coffea arabica* is highly endangered. An irreversible reduction in the gene pool would result in huge benefits forgone in coffee breeding and production.

Ethiopia is currently the seventh largest coffee producer worldwide. Coffee has an enormous economic value for Ethiopia, being the country's most important export crop. One third of the total amount of exported coffee goes to Germany. Coffee accounts for 41 % of the country's foreign currency income. Seventy percent of the coffee produced in the country is cultivated privately as garden coffee, whereas 25% is collected in forest and semi-forest coffee systems. A mere 5% is cultivated as plantation coffee.

Ethiopian wild coffee populations could become important for international coffee breeding efforts aiming to improve the disease tolerance of the coffee plant and stabilize its production. Breeding and selection measures for increasing the disease tolerance so far have focused on coffee leaf rust and coffee berry disease. In

the future, they will also have to focus on coffee wilt disease. Furthermore, coffee cultivation in many parts of the coffee-growing world is being moved to marginal land. Thus, coffee varieties have to be adapted to adverse ecological conditions, such as drought stress, in order to achieve production stability. To be able to adapt to these changing cultivation conditions, it is of utmost importance to have a diverse coffee gene pool for breeding. Ethiopian wild coffee populations provide highly diverse genetic material for future coffee breeding and selection.

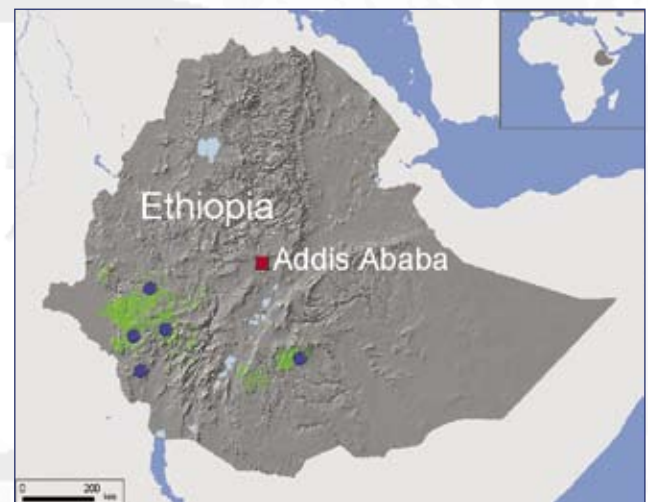


Figure 1: CoCE research sites (blue dots).

Trans-disciplinary research

The project's scientists have done research on the diversity and economic value of the Ethiopian coffee gene pool and its forest habitat as well as on the institutional framework in which the forest users operate. A proper investigation of the wild coffee populations in their comprehensive biodiversity context requires a trans-disciplinary approach, taking into account natural and social sciences as well as economics.

Field studies were carried out mainly in Bonga, Berhane-Kontir, Maji and Yayu forest located to the west and in Harena forest in the Bale Mountains east of the Great Rift Valley (see Figure 1). In its first phase from 2002 to 2006, the CoCE project covered six main research areas corresponding to six subprojects:

- Studies on the vegetation and floristic composition of the rainforests.
- Studies on the genetic diversity of wild coffee and genetic differences between wild coffee and land races as well as other coffee varieties.
- Investigations on site-specific tolerance of the wild coffee populations to drought.

- Investigations on tolerance of wild coffee populations to fungal diseases, coffee berry disease, and coffee leaf rust.
- The economic value of the coffee-genetic resource for international breeding programs and the economic value of forests with wild coffee occurrence.
- The institutional framework: investigations on how the conservation and use of wild coffee and forest resources are organized, regulated, and managed.

Main scientific findings

The vegetation surveys found more than 700 plant species on the sites of the field studies. That amounts to 10% of the Ethiopian flora. The vegetation analyses reveal that the montane forests of the five study regions show floristically significant differences. However, the floristic compositions of forest areas with wild coffee occurrence are cross-regionally very similar. That is why these areas can be defined as coffee forests. The occurrence of wild coffee depends on altitude and the intensity with which the local coffee collectors manage the forest. Forest management includes measures such as removing competing vegetation from the undergrowth. This has an impact on species composition as well as on the structure of the coffee forests.

Molecular-genetic analyses conducted in the course of the project confirm the high genetic diversity of wild *Coffea arabica*. The analyses also show that wild coffee is genetically clearly different from land races and varieties. Moreover, in some regions there are genetically similar, in other regions very different wild coffee populations. In general, there is a high level of diversity within regions. We found that the forest management measures carried out by coffee collectors often include enrichment plantings which lead to the abundance of wild coffee plants. However, increased harvesting of coffee berries does not seem to have negative impacts on the genetic diversity of coffee. Eco-physiological studies reveal that the coffee plants' tolerance to drought is site-specific.

Moreover, the water use efficiency of wild coffee plants increases with decreasing mean annual rainfall. In addition, drought-stressed coffee plants recover faster at the end of dry spells when they originate from dry environments, such as Harena or Bonga. Another outcome was the variability of coffee plants and populations regarding their tolerance to coffee leaf rust and coffee berry disease. In wild coffee populations, 30 to 70% of the plants are infected by coffee leaf rust. However, no major damage could be found, let alone the total eradication of a coffee stand as happens in plantations in other parts of the world. Field experiments with plants artificially infected with the fungus which causes coffee berry disease demonstrate that 53–100% of the coffee berries are tolerant to coffee berry disease.

The research team dealing with the economic value of wild coffee genetic resources carried out a cost-benefit analysis to assess its global economic value for coffee breeding. This analysis was based on the assumption of the following benefits of a breeding program for wild

coffee populations: (1) reduction of yield losses due to diseases and pest attacks amounting to 2.5 billion US\$ per year, (2) reduction of costs for decaffeination through the provision of low-caffeine plants amounting to 300 million US\$ per year and (3) 10% yield increase. The costs comprise a breeding program of more than 15 years and the introduction of newly bred varieties. Based on these assumptions, the resulting potential economic value of coffee genetic resources amounts to between 0.42 and 1.46 billion US\$.

The economic valuation of the coffee forests was carried out from the perspective of the farmers as well as society as a whole. An income analysis reveals that, from the farmers' perspective, the conversion of forests into arable land is more profitable than the sustainable management of forests – in the short run. After all, forest conversion allows them to sell timber and produce maize and therefore generates income immediately. The income from measures aiming at sustainable forest management would only amount to 65–75% of the benefits from conversion measures. Private and social economic analyses differ with regard to the type and amount of values taken into account. Under certain conditions, sustainable forest management achieves higher net benefits as compared to exclusionary conservation or conversion into arable land. These achieve, respectively, only 50% and 70–85% of the benefits from sustainable forest management.

Management concepts aiming at the simultaneous conservation and use of natural resources might create conflicts. In Ethiopia, all forests are nationalized. Most coffee forest areas are located in so-called National Forest Priority Areas. Here, local forest users have limited rights of access and use, which conflict with traditional property rights. The project's research group focusing on



Representatives of the coffee industry visiting the birthplace of its commodity.

institutional issues found that traditional use and ownership rights are still being practiced in the communities. The ambiguous legal situation in combination with a shortage of incentives, as well as absent monitoring and enforcement activities has led to an open access situation in many places. Although there are a lot of functioning traditional and informal community-based institutions, there is hardly any co-ordination between the informal

and formal institutional levels. Such institutional links are, however, necessary to develop effective concepts for the conservation and management of natural resources.



Local brand: ECFF.

Conclusions

Four basic problem areas have to be tackled in the ongoing second research phase in order to achieve the conservation and use of wild coffee populations in the mountain rainforests of Ethiopia:

- As natural forest areas are shrinking in Ethiopia and coffee production is increasingly based on modern coffee varieties, practical measures have to be developed to preserve the wild coffee gene pool in situ, i.e. in the species' habitat of origin. Different types of in situ gene banks are envisaged. The advantage of conservation in the species' habitat of origin is that it maintains the plant's natural selection and adaptation mechanisms with regard to changing site and environmental conditions.
- 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.
- Implementation strategies have to be developed. These include communication and public awareness building, education as well as strengthening institutions for the conservation and sustainable use of forest resources. To realize this, a non-governmental organization, the Ethiopian Coffee Forest Forum (ECFF), was founded in November 2005.
- In the course of the first research phase, new research questions have evolved which require further attention. These include genetic diversity, coffee diseases, coffee quality as well as the relationship between rules and regulations of forest management and the condition of the forests.

Capacity building

In the CoCE project, nine students have finished their PhDs so far, among them five young Ethiopian and four German scientists. Four Ethiopian doctoral students and two Ethiopian master student are still involved in the project. Furthermore, the field research of ten Ethiopian MSc students was supported by the project. Also, a molecular-genetic laboratory has been set up at the University of Addis Ababa by the project. The CoCE project has also massively invested in the establishment of one of Ethiopia's first conservation NGOs, the Ethiopian Coffee Forest Forum (ECFF). ECFF is carrying out research, education, training and public awareness-building activities and thereby building capacity where it is most needed: with our local stakeholders.

* This article is a revised version of a former publication in the "10 Years of Development Research by ZEF" report, published by ZEF in October 2007.

The CoCE project is being funded by the German Federal Ministry of Education and Research (BMBF) and is part of the BMBF's Biosphere Research Program – Integrative and Application-Oriented Model Projects (BioTeam).
Project duration: 2002 – 2009.

Project homepage: www.coffee.uni-bonn.de

IMPRINT

Publisher:
Center for Development Research (ZEF)
University of Bonn
Walter-Flex-Straße 3
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ISSN: 1438-0943
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Editors: Constanze Leemhuis, Tobias Wünscher,
Alma van der Veen (resp.),
Lynn Benstead (language editing)

Layout: Katharina Moraht

Photos: all photos by ZEF except p.4 (left: Wolfram Freund), p.5 (Melina Heinrich)

Printers: BGoMedia GmbH & Co. KG, Bonn

Number of copies: 3,000

ZEF news is published in English and German twice a year and can be ordered free of charge.