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## The Environment for Development Initiative: lessons learned in research, academic capacity building and policy intervention to manage resources for sustainable growth

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## **The Environment for Development Initiative: lessons learned in research, academic capacity building and policy intervention to manage resources for sustainable growth**

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**ABSTRACT.** This article reviews the history of the Environment for Development (EfD) initiative, its activities in capacity building and policy-oriented research, and case studies at its centres in Chile, China, Costa Rica, Ethiopia, Kenya, South Africa and Tanzania. EfD promotes research-based policies to manage natural resources as engines of development. Since 1991, the Swedish International Development Cooperation Agency (Sida) has provided funding for students from developing countries to earn a PhD at the Environmental Economics Unit (EEU) of the University of Gothenburg. Returning home, these economists face institutional and academic gaps that limit the adoption of research-based policies. In response, the first EfD centre was founded in 2004, and six more followed. Research focuses on agriculture, climate, fisheries, parks, wildlife, forestry, energy and policy design. This has yielded 200 peer-reviewed articles. Successful policy outcomes depend on relationships with policy makers, community involvement in livelihood strategies, strengthened institutional support, interdisciplinary approaches, and dissemination of research results.

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## 1. Introduction

The purpose of this article is to review the history and purpose of the Environment for Development (EfD) initiative, its academic capacity-building programme based at the Environmental Economics Unit (EEU) of the University of Gothenburg, and selected case studies based on the research and policy activities of the EfD centres in Chile, China, Costa Rica, Ethiopia, Kenya, South Africa and Tanzania. Looking back over 10 years since the first EfD centre was established, we can assess the challenges of building the discipline of environmental economics and putting it to work for development.

The article proceeds as follows. Section 2 introduces EfD. Sections 3 through 9 present case studies from the EfD centres. Section 10 concludes with some lessons learned and suggestions for future work.

## 2. EfD: purpose, history, activities and members

EfD challenges the notion that conservation is a constraint on development and, instead, views natural resources as crucial sources of ecosystem service provision and as potential engines of development, provided that research-based policies are put in place to manage these resources within appropriate boundaries. This paradigm is essential in countries where a majority of people depend directly on soil, water, forests and fisheries for their livelihood.

The EEU and the Swedish International Development Cooperation Agency (Sida) were involved in academic capacity building and environmental policy in the developing world for several years before the first EfD centre was established in Ethiopia in 2004. When the Brundtland Commission introduced the concept of sustainable development in 1987, environmental economics was singled out as a particularly promising discipline to support this vision (WCED, 1987). The renewed interest in environmental economics led to a number of capacity-building networks, programmes and initiatives. EfD evolved out of those activities.

With these concerns in mind, Sida began in 1991 to provide funding for scholars from developing countries to study environmental economics at the EEU. Sida supported the PhD programme in environmental economics, run in collaboration with the Beijer Institute, based on the premise that the graduates would go back to their countries, carry out policy-relevant research, teach the next generation of academics and civil servants and provide advice to their governments. It soon became evident that it was often difficult for young academics to do this. On returning home, they found themselves overburdened with teaching and administrative work, with no research funds and little policy involvement. The expected straight road from capacity building to improved national policies turned out to be winding, and filled with gaps. In order to ensure that environmental economics would fulfil its expected role in improving resource management and would support sustainable development, we identified the following four gaps that needed to be addressed:

- (1) *The capacity gap.* The lack of support to develop serious academic capacity in developing countries might seem to imply that these

countries do not need advanced scientific capacity to analyze and address their development challenges. This is, of course, not true. Advanced domestic capacity is needed to understand the complex interaction between ecological systems that have barely been studied and economies that have been marred by market and institutional failures. Such capacity is needed for a country to be able to participate in global negotiations on the fate of the planet and simply to make use of the opportunities created – such as the Clean Development Mechanism (CDM) or Reducing Emissions from Deforestation and forest Degradation (REDD). Also, cost-efficient solutions are in most cases dependent on a thorough understanding of the functioning and limitation of local institutions. The most fundamental gap is therefore that there are far from enough professionals with these specialized skills in the developing countries, where the needs are the greatest.

Although some progress has been made during the last 20 years, there is still a severe lack of environmental economics expertise in most developing countries. The EEU PhD programme in environmental economics and development was set up to address that gap. The PhD programme is unique, in part because of the rich sequence of specialized environmental economics courses that more or less fills the second year of the programme. By now, 30 developing country PhDs (and another 20, mostly from Sweden) have graduated from the programme and some 250 graduate students and teachers have taken one or more of the specialization courses.

- (2) *The knowledge gap.* Closely linked to the limited academic capacity is what researchers do – generate new knowledge. Despite the fact that a majority of the poorest in the world are dependent on dwindling natural resources, insufficient attention is given to the best management of these resources. It is therefore unfortunate that, when PhDs return to their countries, they find it hard to carry out the needed research – there are simply no research funds available. EfD was created to make it easier for PhD students to return home. EfD has addressed this problem in various ways, such as providing a research fund where the researchers in the EfD centres first interact with policy makers in developing their proposals. These proposals are peer reviewed and presented at an annual conference before the research is funded, carried out and disseminated back to the stakeholders.
- (3) *The communication gap.* One of the key challenges is thus to go from general awareness of the importance of environmental management for poverty reduction to integrating this awareness in domestic and international policies and practice. Knowledge-based policy making is important in order to make this happen; however, relevant research or research expertise is rarely readily available as policies are shaped. This gap is particularly evident in many developing countries with a history of mutual distrust between the universities and the government. In order to make information useful to stakeholders, it has to be available. Hence, in order to be really influential, researchers need to be involved in a long-term dialogue with policy

makers. Such long-term policy interaction is becoming the 'Efd-approach to policy-research interaction'. It is also important to invest in websites and professional staff for policy interaction, including dissemination of research results.

- (4) *The institutional gap.* In the implementation of the capacity-building programme, it became clear that the problem is not only a matter of lack of capacity, but that there is often also an institutional gap. A platform is needed to which resources can be attracted to support good researchers in carrying out the much-needed policy-relevant research. Such a platform, or centre, should be characterized by a conducive research environment, a good policy interface and strong administrative support that can manage international and domestic funding. Our response to the institutional gap has been the establishment and support of the Efd centres. The ambition is thus to create sustainable and viable policy-research nodes that have lasting impacts on poverty alleviation and sustainable natural resource use.

The first centre was founded in 2004, and the Efd initiative was created in 2007. The initiative has grown to encompass research and policy centres in Chile, China, Costa Rica, Ethiopia, Kenya, Sweden (EEU), South Africa and Tanzania, as well as Resources for the Future (RFF) in Washington, DC. Efd's goals can be summed up as sustainable development and poverty alleviation. The means toward those ends are three-fold: international collaboration in environmental economics research; capacity building through educating economists from the developing world; and policy impacts, as research findings are communicated to decision makers. As green growth takes centre stage on the international development agenda, Efd continues its work on climate change, biodiversity, resilience, food security, forest and fisheries conservation, and more.

One of Efd's assets is its partnership with RFF. Founded in the 1950s, RFF was one of the first research groups to apply economic research to policies related to energy, transportation, pollution, climate change, biodiversity and environmental issues. Efd and RFF have had a relationship over several years; as of 2014, RFF is a member of Efd. The partnership began informally. Initially, RFF helped bring researchers from the US and the UK together with Efd to embark on collaborative projects in developing countries. RFF publishes Efd's discussion paper series and book series, both stemming from this collaborative research. In fact, the original concept behind Efd was to create 'mini-RFF' centres focused on environmental research in poverty-stricken areas of developing countries around the world. Efd's founders hoped to use RFF as a model for building a network of research centres all over the world, and the concept for Efd was first presented to researchers at RFF in the early 2000s.

Another characteristic of Efd is a focus on gender. It is impossible to promote sustainable development without thinking about the daily activities of women in the developing world, which include, for example, primary responsibility for gathering fuel products from forests. Gender is a research topic, as in a study on inequality in food security in Kenya (Kassie *et al.*, 2013). In addition, gender is given attention in research design; for

example, an experiment on recycling decisions in Costa Rica solicited as subjects 'the head of household *activities*', which elicited 85 per cent women (Alpizar and Gsottbauer, 2013). To carry forward this focus on gender, the Sida-funded PhD programme gives preference to female applicants; as a result, half of the PhDs in the past decade have been earned by women.

EfD is also a venue for 'south-south' dialogue among lower- and middle-income nations. For instance, when the 6th Annual EfD Meeting was held in Costa Rica in October 2012, the day before the meeting was 'Policy Day', an international forum for interactions between researchers and practitioners. One theme was south-south cooperation for green economic growth. Dr Yue Zhai, China's First Secretary for Science and Technology, based at the Embassy of the People's Republic of China in Costa Rica, gave his talk on this topic in Spanish.

EfD research focuses on six major themes: agriculture, climate change, fisheries, parks and wildlife, forestry and energy, and policy design. In 2013, for example, a significant proportion of the projects honed in on agriculture, forestry and energy, climate change and associated issues of policy design. The research areas build on each other. Forestry and energy, for example, are treated as a single research focus because so many people in the developing world depend on wood fuels for cooking and heating. The use of wood fuels, and the forest degradation associated with their collection, are major drivers of climate change. Similarly, carbon sequestration potential is lost when forests are cut down for the purpose of agriculture. These connections are illustrated by the research agenda of a representative centre. Of the six EfD-funded research projects at EfD-Kenya in 2013, two focused on household energy choice and conservation, two on forestry and climate change, and two others on water resources. Moreover, EfD's research supports capacity-building objectives, as PhD candidates conduct their thesis research and co-author articles for publication.

Hundreds of publications have flowed from EfD research (figure 1). Among the 200 articles published in peer-reviewed journals, researchers have studied: improved maize varieties in Tanzania (Kassie *et al.*, 2014); tourism eco-certification in Costa Rica (Blackman *et al.*, 2014); adoption of lower-carbon cook stoves in Chile (Gómez *et al.*, 2013); productivity growth in Chinese agriculture (Li and Zhang, 2013); fossil fuel and food tax incidence in Ethiopia (Mekonnen *et al.*, 2013); efficiency of irrigation in Kenya (Njiraini and Guthiga, 2013); and protection of endangered gorilla populations in Central Africa (Mukanjari *et al.*, 2013). The EfD/RFF book series has included *The Emergence of Land Markets in Africa* (Holden *et al.*, 2009), *Fuel Taxes and the Poor* (Sterner, 2012), *Agricultural Investment and Productivity: Building Sustainability in East Africa* (Bluffstone and Köhlin, 2011) and others.

The EfD Discussion Paper series is a very important part of the research, communication and publication strategy. Discussion Papers are expected as deliverables for EfD-funded research. Most are eventually published in peer-reviewed journals. EfD researchers also produce Research Briefs and Policy Briefs. These are summaries of research findings that are designed for a general audience. The briefs are part of EfD's communication and dissemination strategies, which include workshops and media outreach. The

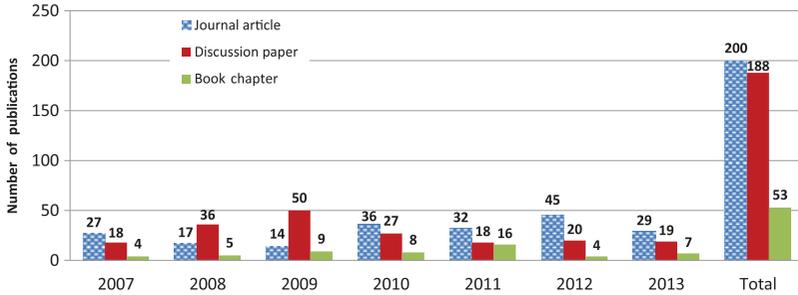


Figure 1. A snapshot of Efd publications

goal, of course, is the implementation of sustainable policies in the developing world. The feedback loop is closed with research projects evaluating the impact of policy innovations, so that both policies and research designs can be improved as part of future research. In the following sections, case studies from each country will illustrate lessons learned from that feedback loop.

### 3. Ethiopia: strategies for less deforestation and more irrigation

The director of the Environmental Economics Policy Forum for Ethiopia (EEPFE), Dr Alemu Mekonnen, earned his PhD in environmental economics at Gothenburg University and since 2009 has been the director of Efd-Ethiopia, which is based at the Ethiopian Development Research Institute (EDRI). EEPFE has been engaged in research and policy formulation on two issues that are crucial for the rural poor of Ethiopia: forests and water. As in much of Africa, Ethiopian farmers depend on forests for fuel and other products, and on rain to irrigate crops.

In 2007 EEPFE/EDRI hosted a workshop that brought together researchers and policy makers to discuss strategies to reduce the rate of deforestation and increase forest cover. The workshop was opened by high-level government officials and attended by a number of concerned stakeholders (Bane *et al.*, 2008). The officials present included Newai Gebre-Ab, Executive Director of EDRI and chief economic advisor to the prime minister of Ethiopia. Despite these promising links between policy and research, one of the issues discussed when EEPFE hosted another forestry workshop in December 2012 was the low attention given to forestry in the structure of government. At the time, the forestry ‘team’ was placed well below the ministerial level. This workshop got the attention of policy makers by stressing the connections among forests, livelihoods, carbon sequestration and the possibility of REDD payments. Shortly thereafter, in 2013, a new Ministry of Environment and Forest was created. For the first time, the word ‘forest’ appeared in the name of a ministry.

Meanwhile, Efd researchers were gathering data on how forests are managed at the community level in Ethiopia (see, for example, Mekonnen, 2009; Mekonnen *et al.*, 2010; Damte and Mekonnen, 2011; Gebreegziabher *et al.*, 2011; Damte *et al.*, 2012, 2013; Gelo and Koch, 2012; Damte and Koch, 2013). As in many other countries, most forest land in Ethiopia has

been government owned and, in theory, government controlled. In practice, local communities have used and managed forests as part of their livelihood, but *de facto* open access has resulted in deforestation and degradation. In response, devolution of forest management to local actors has been ongoing.

EfD surveyed villagers in 2013 and found that restrictive measures that were laid out by the government with the intent of protecting forests did not always translate well in small communities (Gebreegziabher *et al.*, forthcoming). Community-controlled forests, on the other hand, tend to have clear rules and sanctions and community participation, and are well monitored. As a result, community forests tend to be healthier and store more carbon than government-managed forests. The findings are based on satellite imagery and on-the-ground carbon estimates, as well as surveys with heads of households. The research team also evaluated where community management worked best. Using data from 110 community forests, they found that local forest management worked better in communities that had low infrastructure such as low access to main roads, as well as clear and enforceable rules about access to forests. This research gives grounds for optimism that community management can improve both conservation and livelihood outcomes.

The need to increase irrigation has been a public policy priority in Ethiopia for decades, but with limited success. Ethiopia has substantial unutilized water resources. Only about 4 per cent of the potential irrigable land is irrigated, half of that by traditional methods (Ethiopian Ministry of Water Resources, 2001) and even modern irrigation schemes are currently operating below 50 per cent of efficiency (Amhara Bureau of Water Resources Development, 2005). EEPFE has been deeply involved in efforts to increase irrigation and otherwise improve water management and related agricultural technologies, with the goal of improvements in crop yield and food security. For instance, in collaboration with the Ministry of Water, Irrigation, and Energy, EfD Ethiopia is engaged in a project that looks at irrigation water pricing as well as institutional aspects of irrigation water management. Preliminary results will be presented in April 2014 at a workshop with public sector stakeholders.

Better management of the impact of climate change requires implementation of sustainable water harvesting technologies. In order to address this, EEPFE, in collaboration with international research associates, has designed a randomized controlled trial to test whether Ethiopian farmers will be more willing to try new water management technologies as part of a package tailored to agro-ecological conditions on their individual farms. In the experiment, some farmers will be offered technology packages alone, and others will be offered packages accompanied by agronomy training. Uptake rates and crop yields will be measured for the treatment and control groups. The research design builds on previous research, such as the Nile Basin Development Challenge. That project ran from 2010 to 2013 and aimed to improve the resilience of rural livelihoods in the Ethiopian highlands through a landscape approach to rainwater management (Ayele *et al.*, 2013).

A crucial aspect of the proposed project is that it will build on existing panel data that focuses on adaptation to climate change in small-scale agriculture. The data set, collected by EEPFE, together with the International Food Policy Research Institute, Addis Ababa University and the University of Geneva, covers 1,000 households in the Blue Nile Basin of Ethiopia. The original sampling considered the traditional classification of agro-ecological zones in Ethiopia, and a number of climatic and socio-economic aspects, such as average annual rainfall, rainfall variability and vulnerability. The data cover 20 villages across the Blue Nile Basin. The first survey was done in 2005 and the second in 2013. The existing panel contains a wealth of information on agricultural production and technology adoption, as well as farmers' knowledge and attitudes related to the challenge of climate change. EfD work that draws on this research includes [Di Falco and Veronese \(2013\)](#). As a result of these cumulative efforts, there is hope that water management, like forest management, can be improved by developing solutions that are closely connected with livelihoods in poor rural communities.

#### **4. Costa Rica: conservation donations and payments for ecosystem services**

The Research Programme in Economics and Environment for Development (EfD-CA) is an integral part of the Tropical Agriculture and Higher Education Center (CATIE, using its Spanish acronym). The programme is based in Costa Rica, a country that is known worldwide for its success in designing economic growth strategies that are based on environmental sustainability, including ecotourism and protected areas. In this context, voluntary contributions for conservation and Payments for Ecosystem Services (PES) have been two topics of interest for researchers.

Ecotourism can generate revenue not only from admission fees, but also from voluntary donations. In fact, Cahuita National Park in Costa Rica depends entirely on voluntary donations for its management and operations. In 2007 and 2008, two EfD researchers conducted a study about this financing system. This research showed that information about what others donate, and how the donations are used, affects visitors' willingness to give a donation to the park ([Alpizar and Martinsson, 2012, 2013](#)). The researchers working on this study had considerable support from the park administration and the local community. As a token of gratitude, the research team designed a sign with information about the park's unique donation system and the importance of donations for both the park and the nearby community. In December 2011, the park rangers placed the sign where many visitors would see it: not at the entrance to the park, but by the showers.

EfD-CA has also been involved in the design and evaluation of PES schemes to compensate people who incur costs due to the provision of environmental services ([Robalino and Pfaff, 2013](#)). One of the most attractive characteristics of this type of programme is that it can increase the generation of ecosystem services while simultaneously reducing the negative economic and social costs that local people might face from land

use restrictions. Authorities are frequently tempted with the dual promise of improving environmental conditions while reducing poverty with one single policy instrument. Costa Rica has a PES programme aimed at maintaining forest cover. Efd-CA evaluated the impact of this programme on selected indicators of poverty based on data from 2007 and 2009. Estimating the effects of PES on social outcomes is challenging because localities with and without the programme vary in different dimensions that might in turn act as confounders. The researchers used national household survey data, which allowed them to control for individual and locality characteristics that affect decisions about where PES is implemented and, therefore, its impact. The result is that the effect of PES on poverty outcomes at a national level seems to be null: the effect is not statistically significant and/or the magnitude is very small (Robalino and Pfaff, 2013).

This finding could reflect countervailing effects: PES might slightly increase poverty in some places but slightly decrease it in others. In a further analysis, the researchers split the sample according to the slope of the land. They found that, as PES coverage increases, poverty decreases in high-slope places. In flatter places, PES coverage is associated with higher poverty (Robalino *et al.*, forthcoming). Poverty reduction generated from PES appears to increase in places where land use decisions are less affected (forest would have been forest in the absence of the policy), while in places where protection has more effect on land use decisions (forest would have been deforested in the absence of the policy), poverty shows an increase. In other words, high slopes are highly associated with low opportunity costs, low deforestation threat and, therefore, low deforestation impact; low slopes are highly associated with high opportunity costs, high deforestation threat and, therefore, high deforestation impact.

The researchers concluded that authorities need to be careful in the pursuit of a dual objective of poverty alleviation and improved forest cover. However, they emphasize that all of the effects on poverty are of very small magnitude. Overall, it seems that Costa Rica has successfully increased and maintained its forest cover with very little impact on poverty. These implications have been actively discussed with decision makers at the National Forestry Financing Fund (FONAFIFO), the government agency in charge of the PES programme in Costa Rica.

## 5. China: trees and cars

The Environmental Economic Programme in China (EEPC) is based in the National School of Development at Peking University. Well before EEPC became an Efd centre in 2007, its director, Jintao Xu, was building relationships with local and national policy makers in Beijing, and providing advice on how China can continue its economic growth in a sustainable manner. Two key issues have been forest management and automobile externalities.

EEPC has focused on China's forest sector – not only on gathering and analyzing data, but on convincing policy makers of its importance. In 2001, Dr Xu arranged a conference on PES, and then took the opportunity to tell the senior forest sector representatives at the conference to pay attention to

the potential of forest carbon trading. The officials took notice. A series of follow-up events after the conference led to the establishment of the Forest Carbon Management Office in the State Forest Administration. The EfD team went on to provide the office with an analysis of the potential size of a voluntary forest carbon market with recommendations on the policies needed to effectively develop such a market. For instance, a national accounting system is needed to calculate how much carbon is sequestered and how much carbon is eligible for forest carbon trade. These data can be collected with the use of remote sensing and satellite image data. Another result was the incorporation of the forest sector strategy into the National Climate Change Programme.

In 2011 EEPC completed its second-round forest survey in eight provinces that were surveyed in 2006–2007, and drafted a plan for future reform for the State Forestry Administration. These were among the provinces that adopted tenure reform beginning in the early 2000s, entitling individual households to land certificates for use rights, and involving over 100 million hectares of forestland and more than 400 million people nationwide. This study resulted in three international workshops, several peer-reviewed publications in both Chinese and English and ongoing impact on forest reform implementation. See, for example, [Jiang \(2014\)](#) and [Yi et al. \(2014\)](#).

Meanwhile, EfD China has played a major role in figuring out what strategies would – and would not – be likely to reduce the high price in pollution and congestion that Beijing residents have been paying for economic growth. See, for example, [Qin et al. \(2013\)](#). Traffic officials have been trying to figure out how to get cars off the road since the period of preparation for the 2008 Beijing Olympics. Command-and-control restrictions, such as restrictions on driving into the city based on license plate number, and a lottery for issuing license plates, have had only modest effects on congestion and pollution. In early 2014, a plan to adopt a congestion pricing strategy was publically announced by the city government.

This market-based solution has been five years in the making. To find out why command-and-control restrictions were not sufficient, EfD researchers used the annual Beijing Household Travel Survey, in which thousands of households fill out a one-day travel diary and complete a survey about their travel choices. Almost half of the drivers admitted to breaking the license plate rules. People covered plates, borrowed plates or cars on the days their license number was banned, or simply ignored the rules.

The problem lay in convincing Beijing transportation officials to take the politically unpopular step of charging a fee for driving at peak times. There is a popular perception that it is more fair to have a rule that applies to everyone, regardless of ability to pay a fee ([Rouwendaal and Verhoef, 2006](#); [de Grange and Troncoso, 2011](#)). However, the inadequacy of command-and-control driving restrictions had become clear in another city famous for its congestion and pollution: Mexico City ([Gallego et al., 2012](#)). Based on that knowledge, Jintao Xu started talking to planners in the Beijing Transportation Authority about the possible unintended consequences of the license plate rules adopted for the Olympics. This was the start of an

ongoing relationship between EfD China and the Transportation Authority, including a conference and internships.

A pair of massive gridlock incidents in 2010 emphasized the message (Yang *et al.*, 2014). Gradually, in line with EfD's advice, the Transportation Authority has developed more comprehensive traffic measures. As well as adopting congestion pricing in 2014, Beijing has increased both parking fees and penalties for breaking the license plate rules (Wang *et al.*, 2013).

To provide increased alternatives to driving, Beijing has been expanding its subway system. EfD research using the Beijing Household Travel Survey indicated that a recent round of subway expansion has had the desired effect of diverting commuters from automobile travel to subway travel (Xie, 2012). In sum, economic tools such as pricing are providing vital tools to address problems in both the transport and forestry sectors.

## **6. Kenya: roses and thorns**

EfD-Kenya has been based at the School of Economics, University of Nairobi, since 2012; previously, beginning with its inception in 2007, it was hosted by the Kenya Institute for Public Policy Research and Analysis. The Lake Naivasha basin, approximately 80 km northwest of Nairobi, has provided the setting for EfD researchers and international collaborators to evaluate competing uses of water, energy and land, and to make policy recommendations.

Close to 2 million Kenyans derive their livelihoods from the Lake Naivasha basin, a relatively high-income area, where flower farmers produce one-fifth of all roses on the EU market and generate about 10 per cent of Kenya's total foreign exchange revenue (EfD, 2012). EfD researchers were part of an international team that was commissioned to study competing demands on water, energy and land in the basin as part of the 2011–2012 *European Report on Development* (European Commission, 2012). Water, energy and land are increasingly interdependent and under considerable environmental pressure around Lake Naivasha, the only freshwater lake situated in the Kenyan Rift Valley. Different players compete for the Lake Naivasha basin's resources. Small-scale farmers grow crops upstream and flower farmers are active downstream. Both affect water quality and availability. Pastoralists need land and water for their livestock. A geothermal power plant located in the 'Hells Gate' National Park south of the lake produces renewable energy using the earth's heat beneath the Rift Valley, and thus reduces the need to burn fossil fuels. However, the plant requires water from the lake, as well as land. In addition, tourism requires quality water, and the Naivasha town is growing, causing higher population pressure on resources. The unabated encroachment of agricultural and commercial activities into the basin makes sustainable development more vulnerable to the impacts of drought and to the erratic weather patterns currently being experienced. Deforestation in the upper catchment causes extreme floods during the rainy season and low water volume during droughts.

The EfD research team saw its role as identifying changes that could harmonize these conflicting uses in pursuit of ecological integrity, social inclusion and sustainable growth. In order to shape this 'green economy' profile, the EfD team mapped a potential low carbon strategy for the basin area. Recommendations included controlling river abstraction upstream, so as to improve the availability of water for hydropower production and enhance the quality of water, and improving an existing PES scheme, in which flower farmers downstream contribute to crop farmers upstream to encourage them to adopt soil conservation and afforestation measures (EfD, 2012; Nyangena and Te Velde, 2012). Research has continued on irrigation efficiency in the Lake Naivasha basin (Njiraini and Guthiga, 2013).

Despite the importance of improving resource management in Kenya, budget constraints are always a challenge. For instance, the Ministry of Finance invited two EfD researchers to a public sector hearing held to discuss the draft budget proposal on Environment, Water and Sanitation for 2009–2011. The researchers were asked to give their comments and suggestions at a public hearing that included senior policy makers, government officials and representatives from the general public and donor agencies. The main message from the two environmental economists was that a larger share of the total government budget needs to be allocated to rehabilitate, restore and develop the country's natural resources. There were sound reasons for the proposal: the natural resource sectors, including forests, rivers and national parks, contribute 42 per cent of Kenya's GDP. This does not even count ecosystem services that are not captured in national accounts. But the sectors receive proportionately low budgetary allocations, even when the government's own development planning places high priority on them. For instance, in the development plan in place at the time of this hearing, the government recognized the importance of Kenya's five water towers – the five forested mountains. Rivers flowing from these mountains supply over 90 per cent of the country's water. But, despite the critical importance of these areas, only 50 million Kenyan shillings were allocated for their protection and for reforestation. (The Kenyan shilling to Euro exchange rate is about 100 to 1.) In total, the Ministry of Forestry and Wildlife requested 9,600 million Kenyan shillings for the natural resource sectors for the period 2009–2010. They received only 4,000 million, which was less than in the previous period. The reason for this was serious budget constraints. The silver lining was that the EfD presentation illustrated the need for funding from donors and laid a foundation for future budget planning.

## **7. South Africa: the national park heritage in the context of restoring indigenous rights**

The post-apartheid restitution of parkland to the Khomani San 'bushmen' and Mier 'agricultural' communities in May 2002 (Bluffstone and Köhlin, 2011) marked a significant shift in conservation in the Kgalagadi Transfrontier Park (KTP) and environs in South Africa. This has provided the setting

for dissertation research, discussion papers and at least one peer-reviewed publication at the Environmental-Economics Policy Research Unit (EPRU), the EfD centre at the University of Cape Town, South Africa.

As part of South Africa's land restitution programme, the Khomani San and Mier communities were awarded land inside and outside KTP (Bluffstone and Köhlin, 2011). This park, located between Botswana and South Africa, encompasses part of the ancestral site of the Khomani San, but was taken from their control when the park was established during the apartheid era. The Mier, who did not lose as much land, were not awarded the same rights inside the park.

South Africa's land restitution includes 'taking into consideration the intrinsic biodiversity value of the land, and seeking outcomes which will combine the objectives of restitution with the conservation and sustainable use of biodiversity' (Callicott, 1986; De Villiers, 1999; Wynberg and Kepe, 1999; Hall-Martin and Carruthers, 2003). Currently, South African National Parks (SANParks) co-manages the indigenous peoples' land inside the park on behalf of the local communities under a 'contractual park' arrangement (see Reid *et al.*, 2004).

The Khomani San and Mier are heavily dependent on natural resources, but their area is threatened by biodiversity loss. The challenge is how to manage the park in a manner that enhances complementary land-use practices, such as medicinal plant harvesting, and discourages conflicting practices such as excessive stock farming (Dikgang and Muchapondwa, 2013a). Conservation also needs to include communal and municipal lands adjacent to the park. Failure to conserve biodiversity in these unprotected areas will lead to more pressure inside protected areas, because of the access permitted under restitution, or because impoverished people simply encroach on protected areas (Dikgang and Muchapondwa, 2013a).

In this context, EPRU has examined several questions. First, biodiversity conservation will benefit from land restitution only if the local communities are good environmental stewards. An EfD study used the contingent valuation method to investigate the values assigned by the Khomani San and Mier communities to biodiversity conservation (Dikgang and Muchapondwa, 2012). The study was designed in a way that allows the identification of winners and losers from the proposed biodiversity conservation programme, in which many native trees, shrubs and grasslands would be planted and protected. For each proposed programme, there were winners and losers, although in each case the winners benefit by more than the cost that the losers suffer. The majority of respondents from both communities supported the implementation of the proposed biodiversity conservation programme on communal land and municipal land, as well as inside the park. The findings suggest that both the Khomani San and the Mier generally attach a significant economic value to biodiversity. The Mier generally had a higher willingness to pay (WTP). However, when adjusted for the higher median household income of the Mier, there were no significant differences in the WTP between the two communities. Thus, the Khomani San care about modern biodiversity conservation and can therefore be trusted to be good environmental stewards. This finding is especially important, as the attitudes of the Khomani San toward

modern conservation had not been previously studied, and they interact with nature more than do the Mier. However, in order for all members of the local communities to fully support biodiversity conservation, mechanisms for fair distribution of the associated costs and benefits should be put in place.

Another EPRU study involved setting the price for admission to the park. SANParks adopted the term 'conservation fee' in 2003 in place of 'entrance fee' to better describe its mission (McKinsey, 2005). Even though the primary mandate of SANParks is conservation, it also operates a tourism business, which is expected to generate operating revenue, as national parks are only partly funded by the National Treasury. The conservation and revenue-raising mandates are related. For example, activities that degrade the ecosystem could discourage tourism, thus reducing revenues available to plough back into conservation.

The rights of indigenous people under land restitution usually do not include a share of tourism revenue; they are limited to rental income in contract parks (Fay, 2009). However, if there is scope for generating more revenue, park pricing policy can be crafted to generate additional revenue, which can be shared with the local communities and also can be used for conservation efforts. Therefore, another EFD study used a contingent behaviour methodology to estimate optimal conservation fees (Dikgang and Muchapondwa, 2013a). The results suggest that there is sheer underselling of the recreational services offered by the South African park systems, which implies that there is room for improvement in the use of the conservation fee policy. An analysis of price elasticities showed that revenue could be maximised by increasing conservation fees for domestic tourists with little effect on visitation. Revising conservation fees to optimal levels could play a positive role in redistributing ecotourism revenue to the communities surrounding national parks, which could help address South Africa's heavily skewed distribution of income. This could act as an incentive for the local communities to participate in conservation even more. In addition, visitors showed some willingness to make voluntary donations above the required fees.

A pair of studies considered park visitors' and local residents' marginal willingness to pay (MWTP) for specific attributes (Dikgang and Muchapondwa, 2013b, 2013c). For instance, visitors want to see undisturbed wildlife and ecosystems, while the indigenous co-owners of the park value those resources as sources of livelihood. The studies employed a choice experiment to determine the valuation that the Khomani San and tourists placed on those attributes. The results suggest that the visitors' WTP is high enough relative to the co-owners' valuation that a PES system could be established to compensate the Khomani San for conservation. In sum, the research at Kgalagadi Park suggests promising avenues to simultaneously reduce poverty and promote conservation.

## **8. Tanzania: livelihoods from forests and fishing**

The people of Tanzania depend heavily on natural resources. Policies to preserve forests and fisheries so that those resources can provide

livelihoods in the long term inevitably entail short-term costs. EfD Tanzania is based in the Department of Economics at the University of Dar es Salaam. One asset that EfD Tanzania provides is particularly close relationships between researchers and policy makers. Key players in the country's decision making are members of EfD Tanzania's policy board; the chairman of the board is Amon Manyama, Assistant Resident Representative at the United Nations Development Programme (UNDP).

Alternative livelihood strategies are one way to encourage conservation. If local people can earn a living without degrading resources, those resources will have a chance to recover. In practice, however, it is hard to change longstanding livelihood practices. Take the sad example of fish ponds and bee hives. These were investments in alternative income sources for fishers in marine protected areas (MPAs) in Tanzania. But a child was killed by the bees, and the fish in the new pond did not survive (Robinson *et al.*, 2012; EfD, 2013). 'We are fishers by tradition,' one man explained to the researchers. 'Beekeeping is not our area.' These field observations by EfD researchers were reported directly to policy makers at an experts' policy meeting in 2012.

Fishers are angry. They are prevented from fishing in their traditional areas, and there are restrictions regarding the types of fishing gear, for example, concerning mesh size of fishing nets. The problem is that they still lack legal fishing gear, appropriate boats, and engines that allow them to go beyond the traditional fishing grounds. While some fishers have received fishing nets and boats from the government through the marine management programme, others have had their equipment confiscated. The limited funds for providing legal equipment have been used for those who heeded the call to form user groups. User groups allow communities to collectively manage resources in order to reduce the overuse of a common pool of resources. Talking with the fishers gave EfD researchers the opportunity to explain that regulating the fishery is key to increasing fishery productivity and sustaining incomes.

Alternative livelihood strategies have been implemented in Tanzania in forests as well as fisheries (Albers and Robinson, 2011). Deforestation and forest degradation threaten the livelihoods of people who depend on forest resources for fuel and other needs. In Tanzania, devolution of forest management to community groups has shown promise for maintaining forest cover and improving forest health (Albers and Robinson, 2011; Robinson *et al.*, 2013). In addition, there is the potential for communities to receive REDD payments if the rate of forest degradation is reduced under their management. In Tanzania, there are a number of pilot REDD projects. One of them, organized by the Tanzanian Forest Conservation Group (TFCG) and the Mpingo Conservation and Development Initiative, is underway in 31 villages (Robinson *et al.*, 2013).

However, this will be an uphill battle unless community groups are able to exclude 'outsiders' – people who do not have management or use rights in the forest – from extracting wood to make charcoal. The syllogism from charcoal to climate change is direct and stark. Charcoal is the most commonly used cooking fuel for urban households in Tanzania. Cutting trees

to make charcoal is a major cause of forest degradation (Albers and Robinson, 2011). Forest degradation is a major cause of climate change. Forests in Africa sequester billions of tons of carbon. Cutting down trees removes this carbon sink, and burning the charcoal releases carbon into the atmosphere. The charcoal process tends to involve degradation, in which trees are cut, but the forest still exists, rather than wholesale deforestation.

The problem is that REDD sets up incentives to change the behaviour of local villagers, or forest 'insiders', but most of the demand for charcoal comes from 'outsiders' – urban charcoal consumers – and much of the charcoal is illegally produced by people who do not live in the village that is receiving the REDD payments (Albers and Robinson, 2011). One solution might be a trade-off in which villagers have increased legal rights to collect resources for their own needs. EfD researchers have found cases where villagers do not report illegal charcoal activities because they too were breaking their own community's rules for extraction. If these local people were operating legally, they might be more likely to cooperate in enforcing rules against outsiders, the EfD team has proposed. An integrated approach to forest management is critical; otherwise, illegal harvesting will simply be displaced from a forest where enforcement is good to a different location where enforcement is weak.

In forests as well as fisheries, then, Tanzania illustrates the challenge of developing policies that are integrated across geographic regions and economic actors, in order to avoid unintended consequences.

## 9. Chile: managing the fisheries

Fisheries are also a research priority for the newest EfD centre, located in Chile, which had longstanding ties with EfD before becoming a member as of this year. The Research Nucleus on Environmental and Natural Resource Economics at the Universidad de Concepcion has been active for several years in bringing an environmental economics perspective into fisheries management in Chile (see, for example, Chavez Rebolledo *et al.*, 2010; Leal *et al.*, 2010; Chavez Rebolledo and Stranlund, 2013).

The Research Nucleus played a major role in the debate preceding the approval of the 2012 Chilean Fisheries Law and in making several suggestions that were later included in this law. Chile adopted its first law to regulate fisheries in 1991, but it was the El Niño effects on climatic conditions in 1997 that created an urgent need to revise some of these regulations. Jack mackerel landings, for example, fell dramatically in 1997, seriously impacting the livelihood of fishing communities. In 1999 Chile adopted its first limits on Total Allowable Catch (TAC) for its main species. But how should that total catch be divided among the companies and individuals engaged in commercial fishing? The market-based solution was based on Individual Tradable Quotas (ITQ). The system was called Maximum Individual Harvest Limit, and set catch shares that could be transferred between fishers.

Chile adopted a one-year harvest limit plan in 2001 and a 10-year plan in 2002. The Concepcion researchers were asked to evaluate the results midway through the 10-year plan. The results were generally positive.

Because the right to a share of the catch is assured, companies can plan to work throughout the season, creating more stable employment. Processors found that the security of fishing rights allowed them to diversify into more products. Because they are assured that they will get fish at the proper time and in the right condition, they can sign contracts to export these products. The workplace also became safer; the competitive atmosphere before harvest limits encouraged unsafe operation of fishing vessels.

The Concepcion team also identified several weaknesses in how the 2002 fisheries law operated in practice: enforcement of quotas; 'by-catch' (netting species that were not targeted); and 'high grading' (rejecting fish at a size that is not desirable for processing so that it will not be counted against the quota). In both cases, the unwanted fish are dead by the time they are thrown back in the water.

Another serious problem is political: who decides on the TAC for each species of fish? Under the 2002 law, the TAC was determined by the Undersecretary of Fisheries in consultation with stakeholders sitting on the National Council of Fisheries. While scientific evaluations of the level of each fish stock were taken into account, the council was weighted toward owners of fishing fleets and processing plants, as well as crew unions and small-scale fishers. The council tended to vote against the science-based proposal and offer a counter-proposal with a higher catch allowance, with the final decision made in a closed process which clearly prioritized short-term economic and social objectives over resource conservation goals.

The Concepcion economists – along with marine scientists – made recommendations to the Chilean Congress to improve the 2002 fisheries law when it expired in 2012. They also spoke directly to the public through a media campaign. The new law does not include everything that the economists and scientists recommended. But it does provide for improved enforcement, including a new design for sanctions that is more closely tied to economic incentives. For instance, the penalty for violating the quota is now three or four times the value of the fish that are illegally taken. The process for setting the total catch has also been changed, with greater weight given to scientific expertise, and a requirement to set the catch allowance closer to the scientific recommendations.

## **10. Lessons learned and concluding thoughts**

One fundamental conclusion permeates EfD's experience: it is possible to promote development and poverty alleviation in ways that do not destroy but instead help sustain the ecosystems on which we depend. Designing policies for forestry, fisheries, agriculture, ecosystem management, biodiversity, water or urban issues such as transport can be done and is not necessarily rocket science. It does, however, require knowledge of *both* the ecosystems concerned and of economics: it requires interdisciplinary collaboration. One of the reasons there are so many problems is that there is a dearth of capacity that understands and is interested in such work. There are many other important lessons, of which we can but mention some of the more salient.

*Listen, talk, develop relationships, and be patient.* A focus of EfD is to encourage policy makers to put evidence-based advice into effect in the face of budgetary, technical and institutional obstacles. A local research centre that involves policy makers in the research agenda from the outset is fundamental to increasing acceptance of policy recommendations. Tangible evidence of this cooperation now stands in Cahuita National Park in Costa Rica in the form of the sign that researchers made to encourage voluntary donations. Less concrete but no less important, improved forest and automobile policies in China are the result of several years of developing relationships with policy makers and educating them about the economics of the resources for which they are responsible. Relationships between researchers and decision makers are close in African countries as well. In Tanzania, government officials sit on EfD's Policy Board. In Ethiopia, the director of EDRI, the host institution for EEPFE, holds a ministry position. EfD research associates work in research and policy institutions and NGOs, as well as in academic departments; they lead or collaborate in international research, evaluation and pilot projects; and they frequently make presentations at conferences and workshops on topics on environmental and development economics.

*Patience is especially needed in light of political and budget constraints.* In Kenya, the natural resources budget remains below the level recommended by EfD researchers, but the groundwork has been laid for seeking out more financial support, whether in domestic budget processes or from international funders. In Chile, fisheries catch allowances are now mostly determined by science, but the right structure of incentives, including monitoring and enforcement, is also essential to balance individual and public interests, as well as short-term and long-term demands on the resource. No matter how urgent the environmental imperatives, policy making is seldom determined entirely by scientific advice. EfD researchers know this well because of their ongoing interactions with policy makers, and they keep political and budgetary constraints in mind when designing research projects and making recommendations.

*In the long run, and in the big picture, natural resources are the basis of livelihoods rather than constraints. At the same time, it is vital that we learn that the most fundamental of nature's boundaries must be respected. In the short run and on a small scale, there are trade-offs.* Efforts to establish alternative livelihood strategies in Tanzania's MPAs have had a slow start. The stories from Tanzania painfully illustrate the problem of short-term trade-offs. For the poorest people in the developing world, income is measured in terms of consumption poverty, a measure of bare survival. Yet, livelihoods based on fishing, for example, are in serious jeopardy if restrictions are not enforced. Similarly, villagers who have accepted a community forest management regime are sometimes tempted to break their own rules, despite potential long-term benefits ranging from REDD payments to greater ease of collecting products in a healthier forest. The same can be said of commuters in Beijing who find ways around driving restrictions. Managing the tension between short-term and long-term utility is an acute problem, given the immediacy of deforestation, fisheries collapse and greenhouse gas accumulation. Therefore, EfD researchers work in

close collaboration (within the Formas-funded COMMONS programme) with the late Elinor Ostrom's group in Indiana, to pay attention to individuals' responses to enforcement, perceptions of utility over time, and related issues, with close attention to the policy implications of economic behaviour.

*Keep feet on the ground, and talk to the people who depend on the resources.* EfD researchers have worked closely with the South African Mier and Khomani San peoples in identifying alternative uses of park resources, Tanzanian researchers have listened carefully to people affected by both fishery and forestry policies, and the proposed irrigation experiment in Ethiopia seeks to tailor solutions to the needs of individual farmers. The concept of environment *for* development recognizes the dependence of people in developing countries on natural resources. EfD's focus on empirical research draws on the experience of millions of people who currently depend on subsistence agriculture for food, forests for fuel and fodder, and so on. The people in developing countries who rely on these resources are the ultimate stakeholders.

*Sometimes conservation strategies can simultaneously reduce poverty; sometimes not.* Payments for Ecosystem Services in Costa Rica turn out to have a neutral effect on poverty. A neutral result is better than the trade-offs faced in Tanzanian fisheries, but still illustrates that it is difficult to accomplish multiple goals all at once. On the other hand, there are good prospects for using conservation fees in South African national parks to reduce poverty among people who bear the cost of refraining from extracting resources. Ecotourism is a promising win-win strategy, as illustrated by the prospect of voluntary donations by visitors to parks in South Africa and Costa Rica. Taxing transport fuels is actually good for both the environment and for the poor – but when it comes to kerosene, there is a trade-off because that is used mainly by the very poorest (Sterner, 2012).

*Integrated solutions are essential.* Good intentions are bedevilled by unintended consequences. A key task for environmental economists is to anticipate and suggest ways to mitigate such consequences. Turning once more to Tanzania, we see that community-based forest management does not operate in a vacuum, and is strongly affected by urban charcoal demand. In Beijing, a broad suite of policy tools has been necessary to reduce pollution and congestion from automobiles; indeed, the increase in automobile ownership is itself an unintended consequence of economic growth in China. EfD's work has included economic modelling, including the use of Computable General Equilibrium models (see, for example, Ferede *et al.*, 2013), in order to evaluate the wider impacts of economic and environmental policies.

*If it was simple, someone would have solved it already.* Irrigation has been a challenge in Ethiopia for decades. Patience doesn't just mean waiting; it means building on past efforts, and looking at past research to find out what has worked and what has not. A crucial feature of EfD is the constant interaction between research and policy. The current experimental proposal builds on years of policy experiments, evaluations, collaboration among regional and international NGOs, and inputs from all stakeholders, from ministries to farmers.

*But sometimes it is simple.* Can sustainable development be as simple as asking park visitors for donations in Costa Rica and South Africa? Usually not. But don't overlook the low-hanging fruit. EfD researchers have applied concepts of behavioural economics to voluntary behaviour – park donations, climate change and recycling – and to individual choices about breaking or following rules. Social norms related to reputation and altruism are mechanisms that can shape individual choices.

*Deliberate institutional support is needed.* If we go back to the original gap analysis presented at the beginning of this paper, the EfD experience shows that environmental economics can contribute to policy, but that a deliberate effort is needed for this to happen on a regular basis. There is enough capacity today to at least start such efforts in some of the more fortunate developing countries. However, all developing countries would need many more well-trained environmental economists. The need for more capacity is urgent, and reliable and dedicated research funding is also needed to support high-quality policy research. Academic institutions also need to invest in policy interaction and research dissemination. Most fundamentally, until there are well-funded, dedicated institutions supporting such policy interaction, we can't ensure that it will actually happen. Institutions such as the EfD centres have the added advantage of also forming south–south collaborations for increased institutional learning, as well as greater visibility and impact on international initiatives and institutions.

*Sustainable development demands conscious stewardship of natural resources.* We live in the anthropocene era: every human action affects the ecosystems on which life depends. The challenge is to design policies that guide these actions in a sustainable direction. In concrete terms, EfD is working to further develop its collaboration with ecologists, climate scientists and other experts in the natural processes affected by economic behaviour. Environmental economics is an increasingly interdisciplinary science. In Chile, for example, environmental economists and other social scientists worked with marine scientists to improve the quality of decision making in fisheries management. In Ethiopia, environmental economists are making the connection between agronomy and farmers' decisions to adopt new technology. As a final thought, this connection between natural and human systems underlies EfD's core belief in the connection between environment and development. Fostering the competence for such interdisciplinary research is challenging in the richest of countries. In low-income countries where the needs are largest and most relevant, the available resources are often the most scarce.

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