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## ZEFNEWS

### Coffee, cash crops and circularity

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## LEAD ARTICLE

## KENYA'S COFFEE IS PREMIUM, FARMERS' LIVING CONDITIONS OFTEN ARE NOT

### THE RIGHT TO FOOD AND SUSTAINABLY CERTIFIED COFFEE PRODUCTION



Coffee beans drying at the Kangunu Factory  
Photo: Tina Beuchelt

**K**enyan coffee is world-famous for its good quality. The major coffee-growing regions are located around Mount Kenya and the Aberdare Range, where the soil and altitude provide the best conditions for growing premium coffee. Kenyan coffee is one of the main contributors to the country's foreign exchange earnings after tea and horticulture, and around 75% of Kenya's coffee is produced by smallholder farmers.

The journey of a coffee bean from tree to cup is straightforward: It is harvested, milled and dried in the coffee-producing countries, then exported to, roasted and packed in the consumption countries. Kenyan coffee is traded at comparatively high prices on international markets. But what does this say about the well-being and food-security situation of the smallholder farmers who grow the coffee plants?

#### Smallholder coffee production in central Kenya

The central highlands, including Murang'a County where our team worked, are much more densely popu-

lated than the rest of the country. Due to Kenya's growing population, there is hardly any land left for smallholders to buy or rent. Whereas it is estimated that a person needs at least 1.5 ha to lead a life above the poverty line, on average six persons live on a small farm of 0.5-1.5ha. Around 10-15% of the population in Murang'a County suffer from food insecurity. Much of the younger generation is moving to urban areas to seek employment and more reliable sources of income than from the coffee-farming sector.

Smallholder coffee farms in central Kenya are highly diversified. The average coffee farm has 150 to 250 coffee trees forming the main source of cash income for most of the farmers. Apart from coffee, the farmers grow food for their own consumption and fodder for their few cows and goats. Depending on the farm size, they also grow tea as a second cash crop. The farmers are mostly organized in cooperatives for bringing the coffee to the market.

The joint ZEF, Welthungerhilfe and World Wildlife Fund (WWF) project, "Food Security Standard (FSS)", tested the rights-based food security criteria and tools within a regular sustainability certification audit (from Rainforest Alliance) at the Kangunu Cooperative in Murang'a County.

The Kangunu cooperative consists of around 2,500 active members who grow coffee and deliver it to the cooperative's own wet mill. The Coffee Management Services Ltd., a marketing agency, has sold the Kangunu coffee on the global market since 2007, as a ruling of the Kenyan Government prescribes the use of marketing agencies.

During our field research farmers were found to be at risk of food insecurity: Some had to skip a meal for a couple of weeks per year, but overall no severe hunger situation occurred. The phases of food insecurity were reported to be caused mainly by food price peaks in local markets and falling coffee prices in the international coffee market. These lead to lower incomes, with the result that farmers faced difficulties breaking-even. In the 2018/19 coffee season, farmers were additionally hit by unusually cold weather conditions causing very low yields. According to Coffee Management Services Ltd., only 21% of the coffee farms were economically viable in that season.

The aim of Coffee Management Services Ltd. is to fetch better prices at the coffee auction by producing higher-quality coffee. It therefore offers, jointly with the cooperative, training to farmers on good agricultural practices. Food security is also addressed through training on the cultivation of food crops, food preparation and healthy food, provision of improved vegetable and maize seeds, and support for dairy production and marketing by farmers. However, when global coffee market prices are low these diverse activities and additional projects are insufficient to guarantee year-round food security to all farmers.

#### Certification eases the implementation of the Right to Food

Integrating the Food Security Standard into sustainability audits enables companies like Coffee Management Services Ltd. to have a closer picture of the food security situation, allowing them to identify gaps and areas for improvement. The Kangunu cooperative would be able to integrate the requirements of the FSS with some initial support by external stakeholders. However, if there is no market demand linked to fair prices for producers, the outcome will be limited. The FSS could also be used in coffee-price negotiations. Coffee-importing companies in consumer countries, who also have to respect the Right to Food in their international supply chains, should pay prices that exceed production costs. This would allow farmers to make an income and to make the investments necessary to maintain production of high quality coffee, such as the rejuvenation of trees and the replacement of varieties with those better adapted to changing climate conditions.

By incorporating the FSS into sustainability standards, a higher level of sensitivity for local food security can be reached by all actors and companies involved in the supply chain. This would enable all the actors involved in the coffee value chain to follow their due diligence to respect the Human Right to Food of farmers.

## EDITORIAL

## COFFEE, CERTIFICATION, AND THE RIGHT TO FOOD

Coffee is the second most valuable commodity worldwide, just topped by oil. Contrary to popular belief, coffee is not your typical plantation crop but is mainly produced by millions of smallholders in Africa, Asia and the Americas. For many of these producers, coffee is the only source of cash income, making them extremely vulnerable to the often extreme fluctuations of coffee prices on the world market. One way of better insulating smallholder coffee growers from these market forces are certification schemes, and nowadays an increasing share of the coffee sold in Europe and North America is subjected to one of the main certification systems. However, how these changing prices affect the food security of coffee growing communities has often been ignored. In this issue of ZEFnews, ZEF senior researcher Tina Beuchelt and colleagues report on a joint ZEF project with WWF and Welthungerhilfe, which analyses the realization of the human Right to Food in global agricultural supply chains and tests, jointly with the private sector, solutions for food security in Africa, Asia and Latin America.

In Kenya, the impact of fluctuating coffee prices on the food security situation of smallholder coffee growers in the Central Province turned out to be a major problem. Despite their ability to produce 'specialty coffee' that fetches premium prices on the world market, Beuchelt and her colleagues could document that many of the growers and their families suffer greatly from fluctuating prices, with some families going hungry during parts of the year. Hence, the aim of the project is to develop a 'Food Security Standard' that should become part of more holistic and sustainable certification schemes, thereby assuring that agricultural production systems and commodity prices ascertain the Right to Food.

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## THE POTENTIAL OF EDIBLE INSECTS IN MADAGASCAR AND MYANMAR

RESEARCHERS INVESTIGATE AND INFORM ON OPTIONS

The potential of edible insects to provide an alternative source of protein and nutrition has only recently been recognized in the Global North. Legislation adopted by the European Union last year makes it now possible for processors, supermarkets and restaurants to offer insect-based products to customers. At the same time, the agricultural sector has developed huge interest in using insects for feed, reflected in ongoing application and screening processes.

In contrast, in Madagascar and Myanmar insects became an integral part of food cultures in the form of daily meals, emergency foods or expensive delicacies a long time ago. In these parts of the world, insects help overcome protein deficiencies in lean times and contribute to diversified diets. Whereas insects in Madagascar are cheaper than meat, in Myanmar insects are more expensive – and mostly collected in the wild and sold on the market to affluent urbanites. In both countries the collection of insects in the wild, either for household consumption or for sale, has put ecosystems and insect populations under stress. This stress is exacerbated by a rising demand from consumers for egg-bearing female insects (e.g. giant crickets or water beetles) because of their superior taste. The farmers, likewise, fetch a higher price for such females. One detected problem for consumers is that wild insects often accumulate pesticides in their bodies absorbed from agricultural production.

### ProciNut researchers on the ground

Researchers from the ZEF-led ProciNut project, are attempting to establish functioning and safe insect production and processing systems by promoting insect rearing, providing training, and developing training materials for extension services in both Myanmar and Madagascar. In addition, the project group develops curricula for universities, value chains and organizes policy events. In Madagascar, trials were started on alternative feeds for the wild silk worm (*Borocera cajani*), on rearing local crickets (*Gryllus madagascariensis*), and on a locust species not classified as pest.

The non-governmental organization “New Generation Nutrition” from the Netherlands and the International Centre of Insect Physiology and Ecology (icipe) from Kenya have conducted training sessions on black soldier fly rearing and on cricket production in the central highlands of Madagascar. The participating farmers welcomed the training and will now try to establish their own small-scale production systems. In Myanmar, trials are currently being conducted on rearing house crickets (*Acheta domesticus*) at the Kengtung University and with farmers in the area. At Yezin Agricultural University, Myanmar, trials are running on the semi-domestication of giant crickets (*Brachitrupe portentosus*), which is the most consumed insect in the country. So far, it has been unsuitable for rearing because of its long life cycle (the shorter the life cycle of insects, the higher the viability). First trials on different processing techniques in both countries and on the production of insect powder for serving as local snacks or side dishes are underway.

### From theory to practice: unexpected constraints

Research has so far revealed unexpected constraints. The first is the absence of insight by farmers and policy makers that insect rearing is feasible and has the potential to enhance livelihoods and serve as a source of nutrition. The second is the lack of markets. Most insect markets in Madagascar are highly localized, whereas in Myanmar country-wide value chains only exist for giant crickets, silk worms or bamboo borers (partly imported from Thailand and China). Compared with conventional livestock rearing, which has a long tradition and hundreds of years of breeding experience, insect rearing is a new field and still requires extensive baseline research. This is especially the case if one targets species beyond the dozen or so that are currently reared across the world. Even with regard to these better known species, issues such as ideal rearing conditions, productivity or food safety are yet to be sufficiently handled.



Edible insects offered at a market in Myanmar  
Photo: Sarah Nischalke

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## INTERVENTIONS IN CASH CROP VALUE CHAINS CAN IMPROVE NUTRITION

EVIDENCE FROM A NATURAL EXPERIMENT IN RURAL SIERRA LEONE



Drying cocoa beans and PROACT training group  
(photo below) in Sierra Leone  
Photos: Isaac Bonuedi

The production of cocoa, coffee and non-food cash crops is central to the livelihoods of many smallholder farmers in parts of rural Africa. These high-valued crops are also important to processors and end consumers in advanced and emerging economies. However, high rates of food insecurity and malnutrition prevail among producing families at the base of value chains in major cash-crop growing areas.

### Sustainability of cash crop sectors in peril

Widespread hunger and malnutrition threaten the sustainability of these sectors with productivity losses from diminished work capacity, increased health expenditure and reduced educational attainment. Sustainability standards, certification schemes, and other interventions and programs have mainly focused on increasing yields and incomes as well as addressing concerns related to the social and environmental sustainability of production methods. Nutritional considerations have hitherto been neglected.

### The PROACT intervention in Sierra Leone

In a bid to achieve food security and end all forms of malnutrition by 2030, policy makers are increasingly pushing for integrated interventions and investments. However, there is lack of evidence on the impact of inter-

ventions which combine the conventional promotion of market-oriented production with nutritional training. The Pro-Resilience Action 2015 (PROACT) program was implemented by Welthungerhilfe (WHH) and its project partners in Sierra Leone, a post-conflict and least-developed country in West Africa. PROACT integrated a nutrition-based component into a tree crop value chain intervention. It provided additional farm inputs and training to smallholder cocoa, coffee and cashew farmers. The goal of the project was to improve the livelihoods as well as the food security and nutrition situation of the farmers.

### Research results

Combining both value chain and nutrition training significantly improved dietary diversity and the consumption of nutritious food at household and individual levels. However, compared to households who were not part of the program, no positive impact was found on the dietary diversity of those households who only received support for cash crop production through the value chain intervention. The nutrition intervention alone improved the maternal intake of micronutrient rich food groups. The results show that improvements in caregivers' nutrition knowledge and confidence are the potential channels through which the combined intervention improves dietary outcomes. Nutrition-sensitive investments in cash crop sectors promise to be an effective way to increase dietary diversity and reduce micronutrient deficiencies among nutritionally vulnerable smallholder families.



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## OVERCOMING CHALLENGES OF WATER MANAGEMENT IN NIAMEY, NIGER

RARSUS PROJECT FOCUSES ON SUSTAINABLE URBAN RESOURCES SUPPLY

The project 'Risk Assessment and Reduction Strategies for Sustainable Urban Resource Supply in Sub-Saharan Africa (RARSUS)' aims to strengthen the resilience of urban supply systems. ZEF's role in this consortium is geared towards sustainable water management in the urban and peri-urban zones of Niamey.

Flood management in small urban river basins is challenging everywhere in the world, but in most of Africa the situation is especially difficult. Oftentimes, there is a lack of data on the smaller scales. In addition, the very quick response of small water basins to intensive rainfall implies that a flood can follow almost immediately after heavy rainfall. This is even intensified in urban areas where buildings and roads take up most of the available space. Limited availability to store water poses an additional challenge for Africa's densely populated urban areas.

### First aim: Flood management concepts for Niamey

Our study looks into Niger's capital Niamey, one of the fastest growing cities worldwide. Areas close to water resources are heavily contested, mainly for housing and vegetable gardening. The first aim of this research was to advance flood management concepts within Niamey. We analyzed flood-coping mechanisms in a small urban basin of about 60 km<sup>2</sup>, which is almost completely located within the city borders, and conducted a flood risk assessment and management study using hydrological modeling, monitoring and statistical analyses. We were able to develop better flood-management strategies for Niamey by strengthening the storage capacities for excessive water outside of the city where more space is available, by upgrading the hydraulic capacity of the drainage system in the city during heavy rainfall, and by enhancing infiltration as well as roof-water harvesting in the city. These measures should be taken in combination with early-warning systems and awareness raising within the population.

### Second aim: Strengthen irrigation facilities

The study's second aim was to strengthen the small and medium-scale irrigation facilities in the urban and peri-urban zones of Niamey. Our results show a huge potential for water saving as gross water input by far exceeded



Water level markers at a lake near Niamey  
Photo: Sarah Verleysdonk

the crop water requirements. This water saving potential can be mobilized via improved irrigation-scheduling and advanced handling of irrigation techniques without lowering yields (thus resulting in productivity gains). Improving irrigation schedules in Niamey's medium-size rice irrigation schemes therefore creates a win-win situation in terms of water and energy saving, because a huge share of the irrigation water is pumped from the river Niger.

### Remote-sensing, modeling and capacity development

Use of remote-sensing techniques enabled us to develop a high spatial-resolution land-use map of Niamey. This information provides valuable input to hydrological and water-management modeling and can support the integration of water-management concepts into future spatial-planning. The research activities were carried out in close connection with capacity building measures via an online Summer School and e-learning materials. Moreover, we integrated research conducted by Master students of the Abdou Moumouni University of Niamey. The participation of local and regional students in the project means that its impacts are more likely to be sustained once the project ends.

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## ENVIRONMENTAL FLOWS

MOVING FROM CONCEPTS TO IMPLEMENTATION IN SOUTH ASIA



Rivers play a crucial role in freshwater ecosystems  
Photo: Tina Beuchelt

Demand for freshwater to fulfill the diverse societal and developmental needs of domestic, agricultural, industrial and commercial sectors continues to rise. This situation has led to plans to harness evermore water resources from rivers and streams.

When we talk about environmental flows we describe the quantity, quality and timing of the water flows needed to sustain freshwater ecosystems as well as the benefits they provide to humans, such as fresh water, fish and other aquatic species, flood control and climate change mitigation. Many people in non-industrialized countries directly depend on such ecosystem services for their livelihoods and well-being. The overuse of water and continuing degradation of aquatic ecosystems therefore reduces the well-being and livelihood options for many people.

### Ecological significance of hydrological regime components

All components of the natural hydrological regime have a certain ecological significance. In regulated basins, the magnitude, frequency, and duration of some or all flow components are modified. Such modifications should ideally be limited to the protection of aquatic habitats and ecosystem processes. A compromise must therefore be found between river conservation and river development, including dam construction. The science of environmental flows is a rapidly advancing field. New concepts, methods and tools are added to an ever-expanding knowledge base.

### India's first environmental flow assessment was in 2007

Although there is general acceptance and agreement on the importance of maintaining river health, there is still a lack of clarity on the implementation and enforcement of environmental flows, especially in South Asia.

India's first-ever holistic environmental flow assessment was conducted on the iconic Ganges River in 2007. In addition to taking into account ecological water requirements, the project examined livelihood, spiritual and cultural needs, including the volume of water required for ritual purifications. This was the first time that "spiritual flows" were included in an environmental flow assessment. This endeavor raised a lot of interest within government agencies and was supported by the National Clean Ganga Mission. Nevertheless it did not translate into concrete environmental flow policies and regulations. In Nepal, another country in South Asia, environmental flows are now mentioned in national level policy documents such as the Irrigation Master Plan but there is as yet no enforcement of environmental flows in river management.

### Efforts made so far are not enough yet

In the last decade, environmental and research organizations in South Asia have succeeded in bringing the idea of environmental flows into river management practices. However, more efforts are needed to move from concept to actual implementation through policies and regulations.

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## REALITY CHECK ON A HAPPY COUNTRY: ACADEMIC LIFE IN BHUTAN

INTERVIEW WITH ZEF ALUMNUS SONAM TASHI

**S**onam Tashi is an agricultural scientist and ZEF-alumnus from Bhutan. The interview was conducted by Andreas Haller via E-Mail.

**After obtaining your doctoral degree from the University of Bonn in 2014, you returned to Bhutan to become an Associate Professor at the Royal University. What topics and research projects have you been working on?**

I teach modules related to Medicinal and Aromatic Plants and Organic Agriculture. It is a full-time teaching job! There are about 40 students in each class. The research projects I run are also in these fields. However, the setting up and running of major research projects is constrained by limited research funds and a lack of time. Full-time teaching, supervision of students' projects and their theses in addition to other daily academic chores consumes a huge amount of time. This is a bit unfortunate, as there are so many potentially interesting fields of research in Bhutan that have yet to be explored.

**Do you think developing countries should focus more on research to be able to face the world's future challenges?**

All faculty members have to do the following: teaching - 60%; research - 30%; and community service - 10%. Research is very important, but so is education and teaching. Of course, research forms the basis of teaching and is our top priority. However, the reality on the ground is



that we do not have adequate manpower to handle both teaching and research. So teaching consumes most of our daily resources. Research may catch up in the coming years, say, maybe five, seven or so years from now.

**You were at ZEF in Bonn for four years. What do you consider the benefits of your education at ZEF?**

My time at ZEF strengthened my research skills and also exposed me to various development concepts and approaches. Looking back, I nostalgically recall how ZEF conducted several events related to academia, including workshops on leadership, food security, research ethics language classes, and intercultural skills. These and other events have helped my academic development.

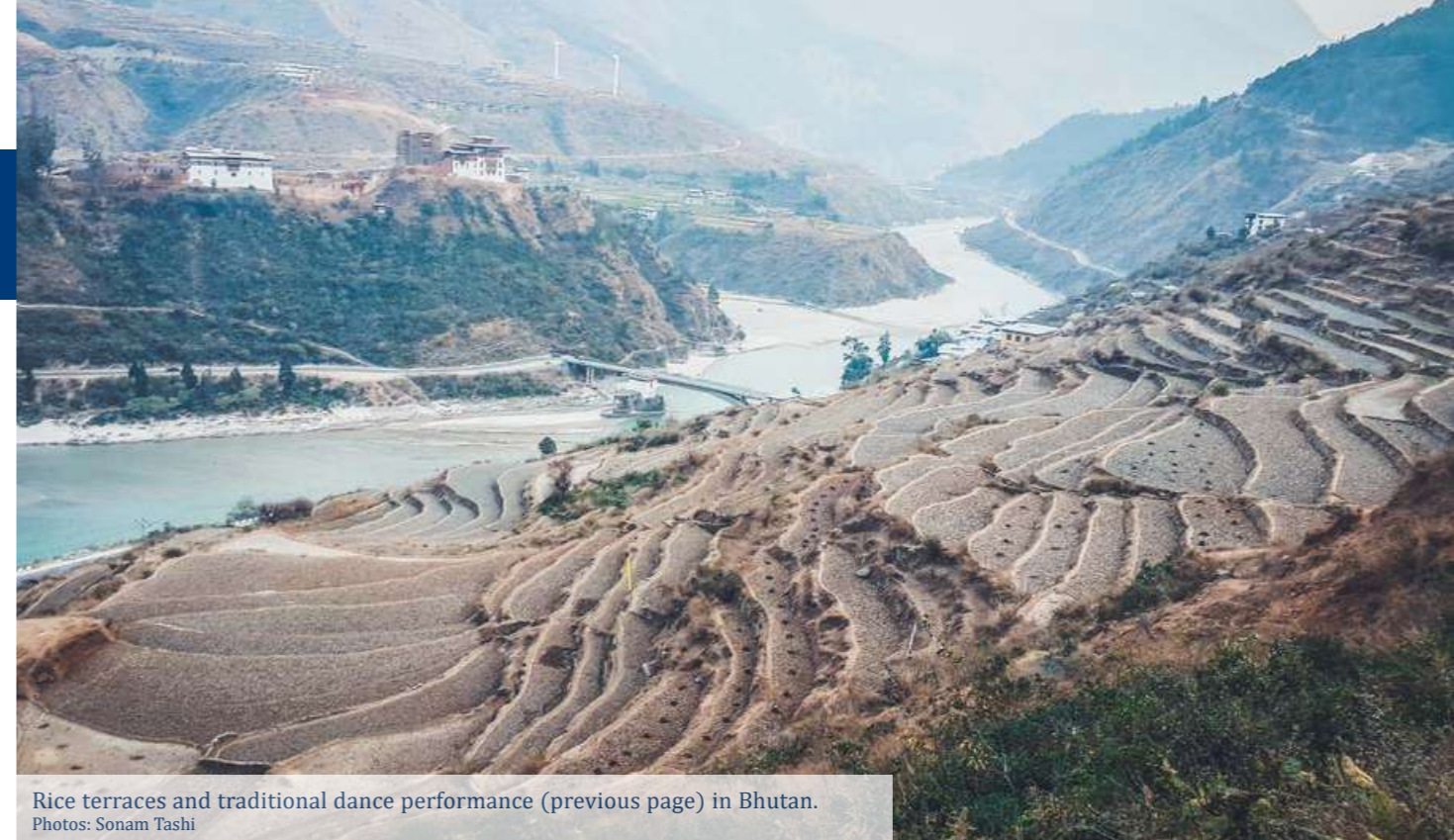
At ZEF I also got the opportunity to interact and network with many eminent academics and scholars from a wide academic and scientific spectrum. A strong work and research culture, and the transdisciplinary nature of the academic courses and research at ZEF continue to make a difference in my professional life.

I will always fondly cherish my time at ZEF and feel profoundly blessed that I had the opportunity to study at ZEF. I would like to sincerely thank everyone there.

**You conducted your doctoral research at ZEF about organic agriculture in Bhutan (see interview in ZEFnews No. 30). Back in 2014 Bhutan's agriculture was projected to be 100% organic by 2020. What is the situation in Bhutan at the moment? What are the challenges for sustainability?**

True, Bhutan has set an ambitious goal to fully convert the country to organic agriculture. However we will miss the 2020 deadline for various reasons.

Our farms are small, scattered and situated on slopes and terrains. Hence, accessibility has been and continues



Rice terraces and traditional dance performance (previous page) in Bhutan.  
Photos: Sonam Tashi

to be a major constraint. Labor shortage, human-wildlife conflict and farm inputs are other critical challenges hampering agriculture development in general.

Nevertheless, Bhutan is determined to go fully organic one day, even if not by 2020. To this effect, the Royal Government of Bhutan launched a five-year organic flagship program just last July. Around the same time, my College also started a four-year formal BSc degree in Organic Agriculture. We are a kind of a pioneer in this given that there is hardly a university across the world which offers a BSc degree in Organic Agriculture.

**Bhutan measures its development not merely in economic terms, but instead famously focuses on "Gross National Happiness". How does this pursuit of happiness relate to your work as a scientist, specifically in regard to the issue of organic agriculture? And on a broader scope: What does it mean to set happiness as a development goal?**

Both the organic agriculture and Gross National Happiness philosophies share many commonalities. They ultimately aspire to achieve long-term sustainability through the conservation of ecosystems upon which the health and well-being of all lives on the planet depend. By adopting organic agriculture, Bhutan is also promoting Gross National Happiness. We look at Gross National Happiness as development with values, and, similarly, organic agriculture as farming with values.

The relevance of value is becoming even more significant in the 21st century in a world full of mindless consumerism, which is groaning under the stress of a capitalist economy. Our value system is not captured by a development model measured only through Gross Domestic Product indicators.

Measuring growth or development through the indicators of Gross Domestic Product, as practiced elsewhere, misses out on so many important facets of life and living

such as family, relationships, health, the natural environment and so on. True growth should bring happiness, well-being and balance. The Gross National Happiness development model seeks to do exactly that through its four pillars, namely Conservation of the environment, Good governance, Equitable and sustainable development, and Preservation of culture. All new projects in Bhutan have to go through a Gross National Happiness screening tool to ensure that the plans do not contradict the Gross National Happiness values. If we consider health as wealth then the Gross National Happiness model helps to measure the true wealth of a country.

**All over the world young people are demonstrating against climate change. What is the perspective of students and young academics in Bhutan on sustainable development? Are there demonstrations too?**

We don't have demonstrations in Bhutan, peaceful or otherwise. My College offers a three-year Bachelor's degree in Environment and Climate Studies and a three-year Bachelor's degree in Sustainable Development. Our students conduct and participate in various climate-related events such as exhibitions, debates and skits both on and off the campus. Students also do academic projects on climate change adaptation and mitigation, causes of climate change, impact assessment, Sustainable Development Goals and so on.

I feel that our students are becoming more aware of and concerned about climate change and the need to adopt practices such as "sustainable behavior" that can ensure long-term sustainability. In our College, we continue to reinforce ideas on sustainable living through mindful and value-based education. We have student clubs such as The Earth Guardians, which consistently conduct activities on things that we can do to protect and promote the health of our ecosystem and planet.



## CONDEMNED TO CIRCULARITY

### THAILAND'S EMERGING BIOPLASTIC INDUSTRY



Bioplastic and waste recycling (next page) in Thailand  
Photos: Jan Janosch Förster

**W**aste bags on the streets of Bangkok, overloaded dumping sites, plastic waste in national parks and on the country's beaches: Thailand faces a considerable waste management challenge.

This applies in particular to plastic waste from single use items. Moreover, Thailand is the world's sixth largest plastic waste polluter of the oceans. For these reasons, the Thai government is attempting to phase out a number of single use plastic items, such as bottles, bottle caps, straws and plastic bags (effective from January 2020). Promoted as a future industry in Thailand's Bio-Circular-Green Economy model, Thailand's bioplastic industry benefits from abundant supplies of agricultural feedstock: sugarcane and cassava.

Recent field research on Thailand's bioplastic industry development explored the degree to which plastics based on natural feedstock can provide an alternative to conventional, oil-based plastics, as well as the drivers and constraints of this potential change. The research explored policy and regulatory aspects, end-of-life solutions, biodegradability, and compostability of bioplastic products in soil and marine environments.

#### Production-related aspects

Global bioplastic production capacity is projected to increase from 2.1 million tons in 2018 to 2.6 million tons in 2023. Early study results indicate that domestic demand for bioplastic has so far been limited, mainly due to its relatively high price. Around 95% of Thailand's annual production of around 75,000 to 100,000 tons of the bioplastics PBS (polybutylene succinate) and PLA (polylactic acid) are exported.

Our research findings indicate major constraints to the use and production of bioplastics in Thailand's different economic sectors including the high production costs for bioplastic as compared to those for oil-based plastics. While the current market price for a ton of conventional PE (polyethylene) ranges in between 1,200 to 1,600 USD per ton, one ton of PLA from locally-sourced sugarcane or cassava is approximately three times higher. This poses a major obstacle to the increased use of bioplastic products by domestic converters and manufacturers along the value chain. Due to the relatively cost-intensive biochemical production processes of bioplastics in Thailand, only larger petro-chemical conglomerates have so far invested in the production of plastics based on natural feedstock.

For small and medium-sized enterprises contemplating a transition to bioplastics production, high investment costs, the necessary research and development, a change of production machinery and related learning processes, as well as time-consuming procedures to apply for state funding and the long and costly process of product certification all pose considerable constraints.

#### Material composition, properties and their consequences

The material properties of current bioplastics cannot yet match those of conventional plastics in terms of temperature resistance, moisture absorption, chemical reactivity, durability, flexibility and degradability. These material performances are, however, crucial for specific applications in different sectors (space technology, mobil-

ity sector and health-related sectors). International certification and standards for bioplastics exist and further ones are under development, yet a clear definition of bioplastic remains elusive (see box). The manifold material compositions make a differentiation between conventional plastic and those based on natural feedstock for recycling purposes difficult in practice.

#### Outlook for bioplastics in an interconnected world

Experts interviewed for this study explained that without a more advanced waste-management cycle of sorting, collecting, recycling, or reuse, bioplastic might just become another source of waste; thus turning the potential solution into an additional problem. Globally, sustainability trade-offs have to be considered, e.g. potentially negative land-use effects on food security and the role of CO<sub>2</sub> emissions in the production and degradation of bioplastics. Nevertheless, especially compostable bioplastics and related products exemplify the potential of mimicking natural cycles in economic practices (i.e. in circular economy approaches) while providing a potential pathway towards greater sustainability for developed and developing countries alike.

### What is bioplastic?

The term *bioplastic* encompasses a number of different materials. A blend or a compound from biomass and conventional plastic is called *biobased* plastic. If bacteria under the right biophysical conditions completely assimilate a plastic's constituent parts as food for their energy, it is called *biodegradable* plastic. The results of degradation vary and depend on the structure of the polymer chain, not on the origin of the raw material. As part of a biodegradation, *compostable* plastics fully decompose biochemically in soil or in controlled environments of industrial composting facilities.

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DOCTORAL RESEARCH @ ZEF: INTERVIEW WITH MEKDIM DEREJE REGASSA

## HOW URBAN AND RURAL SPACES IN AFRICA ARE INTERLINKED



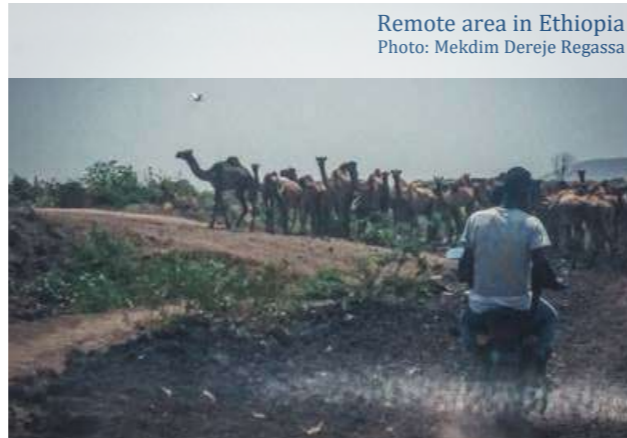
**M**ekdim Dereje Regassa is a junior researcher from Ethiopia who writes his doctoral thesis at ZEF on “Rural-Urban Linkage and Household’s Welfare in Sub-Saharan Africa”. The interview was conducted by Andreas Haller via E-Mail.

**Could you please tell us a little bit about your research?**

I study how geography determines economic development. Specifically, I investigate if and how proximity to urban areas of different size and type influences household welfare in sub-Saharan Africa. Previous empirical studies establish that households in rural areas are, in general, poorer, less productive, and more susceptible to price risks than households in urban areas. However, this broad conclusion conceals two key points that have become more evident owing to recent developments in the region. First, rural and urban areas are not distinct spaces. Rapid urbanization, improvements in infrastructure networks and developments in information and communication technologies have blurred the distinction between the two spaces. Now, it is widely acknowledged that rural and urban areas coexist along a continuum with many in-between stages. Second, urban areas are not homogeneous and different urban areas can have different degrees of influence on their surrounding population. Therefore, a proper empirical study that deals with a rural-urban linkage requires an objective measure of the level and dynamics of urbanization. My thesis addresses these issues. I employ a continuous measure of urbanization – nighttime light – to simultaneously account for the continuum between rural and urban areas as well as the heterogeneity of urban areas. By examining one of the understudied underlying factors of spatial development – public service delivery, I also aim to forward a menu of policy recommendations to address the high turnover and low motivation among agricultural extension agents.

**Which insights did you get thus far?**

In countries like Ethiopia, the physical distance of a household from roads, markets and urban areas is not a robust measure of remoteness. Households at similar distance to town could experience different access to market and economic opportunities depending on the existence and quality of infrastructure, telecommunication, degree of market competitiveness, and personal network. While location of residence and proximity to urban areas in general matters, the size and economic base of the urban area equally matters for welfare. Specifically, intermediate towns, in contrast to small towns and the capital city, seem to lead to growth that is more inclusive.



Remote area in Ethiopia  
Photo: Mekdim Dereje Regassa

**What were your experiences during the field research? Did you encounter any problems or challenges, or were there any pleasant surprises?**

There is a huge benefit in preparing the field research well before traveling to the actual survey location. An extensive review of the place of study and preparation of the survey instruments is helpful to avoid unpleasant surprises. It also helps to check for existing conflicts and labor strikes in the study area during field visits. In my case, fortunately, there was only one minor incident when my focus group discussion was disrupted by gang violence. A pleasant surprise was to see that the expansion of irrigation is altering the dynamics of the rural labor market in Ethiopia. Given the large unemployment rate and the potential of rivers and underground water in the country, I came to believe that small-scale irrigation holds a huge potential to transform the agricultural sector.

**How does your research benefit from your participation in the doctoral program at ZEF?**

The doctoral program at ZEF offers a commendable academic and welcoming environment for aspiring international students. Bonn is a calm and hospitable city and due to the availability of several international organizations, it provides an opportunity to experience intercultural working and living conditions.

**What are your plans for the future after you finish your PhD?**

I would like to work on human capital development, particularly on health and education of children, in an academic research organization.

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DOCTORAL RESEARCH @ ZEF  
PAKISTAN'S MILITARY: A DISTINCTIVE BRAND OF HEGEMONY

**S**ince its independence in 1947, Pakistan has had three military coups – in 1958, 1977 and 1999. In each instance, public opinion was initially overwhelmingly in favor of the military, however subsequent popular uprisings and civic movements against the military led to its removal from power.

Pakistan’s current situation is particularly intriguing. Even though there is a ‘democratically elected civil government’ in Islamabad, de facto power resides with the military, and public sympathy favors the military as opposed to the elected government. This very paradox prompted me to select this topic; to look into the hegemony of the Pakistan military, which is not limited only to the duration of a coup.

**Pakistan's military's brand of hegemony**

My research is unique in the Pakistani context in that I concentrate on the symbolic and cultural aspects of hegemony. I show that Pakistan military’s hegemony does not depend on overt displays of power or subversion of the democratic process. Rather, this hegemony is extended equally effectively through the provision of social sector amenities. To this end I use two case studies – the Frontier Works Organisation (representing the infrastructure sector) and the Fauji Foundation (representing the welfare sector).

**Development or nation-building?**

One of the main findings of my research is that the military is conducting development activities under the rubric of nation building. The military is well aware of the legal and constitutional boundaries to its presence in the non-defense sectors. My data, however, shows that within its own consciousness, ‘development’ and ‘nation building’ are understood and employed interchangeably. Over the years this has been embedded in the military mindset to such an extent that they themselves are no longer aware of their own perceptions and subsequent decisions. The net result is that, while they do not hold themselves

responsible for development as such, they refer to the overtaking of developmental activities from the civilian government as ‘nation building’. I call this the military’s cognitive dissonance.

**Two case studies: Frontier Works and Fauji Foundation**

I use the administrative and procedural structures of the two case studies to demonstrate how this is practically implemented. While on the one hand both the Frontier Works Organisation and the Fauji Foundation are military-owned and military-run organizations, they are also profit-maximizing commercial entities. They are structured in such a way that there is no money trail leading either to or from the military. This lends a veneer legitimacy to their operation. Moreover, neither the public nor the hegemon consider it a legal violation.

**Benefactor of the people**

My research concludes that the Pakistan military has perfected a distinctive brand of hegemony. By conflating development and nation building, the military have secured the image of ‘benefactor of the people’. By distancing itself financially, it has been able to legitimize its activities. The net result is that it does not matter if the space is snatched away from civilian institutions, or if they fail due to their own ineptitude. Military hegemony has space to expand and public support is guaranteed. As long as it controls the socio-cultural elements via the development sector, the military no longer needs to assume direct political control.

**About the author**

**Rabia Chaudhry**  
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PAC JF-17 Thunder, Pakistan Air Force  
Photo: Kami Rao (CC BY 2.0)



## THE PROMISING POTENTIAL OF RENEWABLE ELECTRICITY IN AFRICA

THE CASE OF PEDIATORKOPE, A VILLAGE IN RURAL GHANA

Many countries in sub-Saharan Africa are implementing state-led investments towards electrification through hydropower. Sole dependence on hydropower is increasingly challenged by high construction costs, massive environmental and social impacts, as well as climate change. To diversify and decentralize energy sources, mini-grid systems such as solar panels are getting increasing prominence, especially in rural areas.

The challenges of electrification in rural Sub-Saharan Africa are more than technical. On the one hand, electricity access rates are very low. On the other hand, access to nationwide electricity grids does not guarantee reliable energy supply. These issues have been taken up by the ZEF research project Climate Information for Renewable Electricity Generation (CIREG) in West Africa.

### The CIREG approach

The CIREG study follows ethnographic approaches using qualitative and quantitative data. In-depth interviews and field observations have been conducted with local households and private energy enterprises in Burkina Faso, Ghana and Togo. We have interviewed a total of 300 households and 75 enterprises. One research village is Peditorkope, located in one of the poorest rural areas in Ghana.

### Electrification and reliability of power supply

The households in Peditorkope are fully supplied by off-grid electricity from solar panels. The electricity is mainly used to charge mobiles (95% of all households),

to listen to the radio (71%) and to watch TV (67%). 96% of the households experience power blackouts, of an average of two hours per day. Due to the unreliability of the electricity power supply, most households still use traditional biomass sources of energy. For example, 78% of the households still use charcoal for cooking. A common phenomenon is a feeling of insecurity and lack of trust on the electricity system as such. Being asked about his interest to change to cheaper electricity options if available, a farmer in Peditorkope answered "I don't want to change to another cheaper option as I am not sure about it and the problems it brings."

### Affordability and willingness to pay

Affordability and willingness to pay are strongly linked to income and expectations. The households in Peditorkope have limited cash income. The self-reported mean annual household income is about 462¢ (Ghanaian Cedi), or roughly 75 Euros. The households spend their income mainly on clothing, schooling, public transport, weddings and funerals, and mobile phone cards. Electricity service costs 12.4¢ per month, about half of the income of many households.

Some households would, however, pay more to gain access to more reliable electricity services. The statement of an interviewee captures a general perception: "The Volta River Authority says 'people cannot afford it.' However, electricity is like sweets – once you've tested it, you would like to always have it. With stable and higher power, people would be able to develop businesses, generate income and pay more for a higher energy." There is hope among some households that electricity can help them to start small businesses. About 64% of the households would pay more for improved quality services which address energy shortages and blackouts.

### Does the source of energy matter to local people?

Sustainable development has an inherent assumption of using resources for development without destroying the environment. In this line, renewable energy is seen

as an alternative. But to what extent does this matter to people who are suffering most from electricity shortages?

When the interviewees in Peditorkope were asked about their preferred sources of electricity, 98% said they would prefer renewable energy, which is their current source. This, however, should not be interpreted as solely an environmental concern. Rather it has pragmatic reasons. Ease of access and fixed prices make the off-grid system an attractive option for many interviewees, but there are actually no alternatives to compare with. Since the service quality of the off-grid system from solar panels is poor and a pressing issue, fossil-based technologies with better service quality might be preferred, if made available.

### Implications

The planning of electrification systems should give particular attention to local needs, reliability and quality of services provided. The national statistical reports of Ghana show a high rate of countrywide electrification (83%), which makes Ghana one of the most electrified countries in Sub-Saharan Africa. While the Ghanaian and other African electrification initiatives have made appreciable progress in terms of coverage, focus should also be put on improving quality and reliability. In addition, national electrification programs should support mechanisms for rural people to improve their household incomes which would make electricity more affordable.

## A NEW GENERATION OF WEST AFRICAN CLIMATE CHANGE ECONOMISTS

CONFERENCE ON CLIMATE CHANGE AND FOOD SECURITY IN DAKAR



Conference participants (photo left), Prof. Aly Mbaye interviewed by Senegalese journalists (right)  
Photos: Alisher Mirzabaev

Enhancing food security under climate change in Western Africa calls for stronger interdisciplinary research collaborations and more active communication between researchers and policymakers across the region.

These were the conclusions of the Conference on Climate Change and Food Security in West Africa co-organized by Université Cheikh Anta Diop de Dakar (UCAD) and Center for Development Research (ZEF), University of Bonn, on 17-18 November 2019 in Dakar, Senegal.

The conference demonstrated significant outcomes of the capacity building activities conducted in the region under the West African Science Service Centre on Climate Change and Adapted Land Use (WASCAL) Program. In total, more than 250 full research papers were submitted, of which 35 outstanding papers were competitively selected by leading climate change academics from the region. Many of these papers were from the alumni and students of the WASCAL Graduate School on Climate Change Economics. For young researchers, the conference provided an opportunity for close interactions with experienced senior researchers and detailed feedback on their ongoing research.

"Adapting to climate change is key for maintaining and

enhancing food security in Western Africa", highlighted Prof. Aly Mbaye, Director of WASCAL Graduate School on Climate Change Economics. "The conference clearly showed that climate change is projected to have huge impacts on agricultural production and value chains, and on human and plant health in the region, but also that many adaptation options and policy solutions are available".

"I am very pleased that a strong new generation of climate change researchers is emerging in West Africa. Regional research collaborations, links to global science – these are the opportunities which make me very optimistic about the future potential of these young academics from West Africa", added Prof. Joachim von Braun, ZEF Director.

### About the author



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Power cables in Burkina Faso  
Photo: Roberto Cantoni



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# Facts & news



Lobby space at ZEF  
Photo: ZEF

## COVID-19 and its impact on research realities

ZEF set up a webpage with contributions, impressions, and academic insights into aspects of the COVID-19 pandemic. Visit: <https://www.zef.de/2129/zef-covid-19.html>. Though most of our "live" events had to be cancelled, our website [www.zef.de](http://www.zef.de) and social media keep you up-to-date! We will continue to **organize seminars online** so if you want to join register with [presse.zef@uni-bonn.de](mailto:presse.zef@uni-bonn.de)

## Our latest publications:

**What drives antibiotic use in the community? A systematic review of determinants in the human outpatient sector.** Dennis Schmiege, Mariele Evers, Thomas Kistemann, Timo Falkenberg. *International Journal of Hygiene and Environmental Health*. Volume 226, May 2020, 113497. <https://doi.org/10.1016/j.ijheh.2020.113497>. See press release (in German): <https://www.uni-bonn.de/neues/057-2020>.

**Focus on Leakage: Informing Land-Use Governance in a Tele-Coupled World;** *Environmental Research Letters*. Jan Börner University of Bonn, Toby Gardner Stockholm Environment Institute, Rachael Garrett Boston University, Javier Godar Stockholm Environment Institute, Krisztina Kis-Katos Georg-August-Universität Göttingen, Patrick Meyfroidt Université Catholique de Louvain, Britaldo Silveira Soares Filho Federal University of Minas Gerais, Sven Wunder European Forest Institute. <https://iopscience.iop.org/journal/1748-9326/page/Leakage-Land-Use>. See press release (in German): <https://www.uni-bonn.de/neues/070-2020.ddfdff>.

## New ZEF-Project on Soil Biodiversity

ZEF is participating in the new project Soil Biodiversity Governing Tipping Points in the Amazon (PRODIGY). The Amazon region at the borders shared by Bolivia, Brazil, and Peru is subject to increasing pressure by endogenous, national, and transboundary forces. In this context, PRODIGY aims to research the role biodiversity plays in potential tipping points in ecological, economic, and social systems, and to investigate strategies to avoid the surpassing of them. By carrying out comparable studies at three research sites, PRODIGY expects to generate specific but also regionally valid lessons for increasing the resilience of local social-ecological systems.

The project is funded by the German Federal Ministry of Education and Research (BMBF) for the period 2019 to 2022. The project consortium is led by the University of Koblenz-Landau and comprises the universities of Berlin, Bonn (ZEF), Hannover, Hamburg, and Kassel in Germany, as well as universities, research centers and NGOs in the Latin American partner countries.

Website: [prodigy.uni-landau.de](http://prodigy.uni-landau.de)

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