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**SUPPORTING
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SOIL FAUNA REACTIONS TO LAND USE CHANGE

Agriculture: a global driver of biodiversity decline

Land-use intensification is widely recognized as a significant contributor to the decline in global biodiversity and the primary factor exerting pressure on soil biodiversity. It is therefore crucial to comprehend how soil biodiversity responds to various land-management practices, as this would enable us to design appropriate strategies for potential future land-use changes.

However, there is still a lot we do not know about the consistent responses of different soil-faunal groups to land-use intensification. Often, various taxa [groups of organisms classified based on their shared characteristics], exhibit divergent reactions to more intense land-use practices, and the composition of the soil faunal community is seldom linked directly to the level of land-use intensity. This observation suggests that the drivers influencing community composition may differ from those affecting overall biodiversity.

A global meta-analysis to quantify effects of land-use intensification

A ZEF research team systematically assessed and quantified the effects of land-use intensification on soil organisms in global agroecosystems by conducting a meta-analysis. We then analyzed if and to what extent these effects depend on abiotic factors such as climatic variables and soil characteristics. At the taxon level, it is evident that land-use intensification exerts a more pronounced impact on diversity than on individual population sizes. Among various agricultural practices, conventional agriculture making use of tillage, fertilization, herbicide, and monocropping has shown the most detrimental effects on soil fauna when compared to less intense forms of agriculture.

So we see that the influence of intensification varies significantly across different taxa highlighting the diverse and complex responses exhibited by various species and communities to changes in land-management practices. The mechanisms governing the response of different taxa to land-use intensification are likely influenced by alterations in the plant community and abiotic environmental factors. Understanding these intricate relationships is vital for making informed decisions regarding land management and biodiversity conservation.

The future is for more sustainable agricultural practices

The above findings imply that transitioning towards sustainable agricultural practices is crucial to mitigate the negative effects on soil fauna. Beyond, adaptive land-management strategies should be adopted to account for the diverse responses of different taxonomic groups. Continuous research, monitoring, and the implementation of robust policies and regulations are necessary to achieve a balance between increased agricultural productivity (required for food security) and environmental sustainability while safeguarding biodiversity.

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<https://doi.org/10.1111/ejss.13321>
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ILLEGAL ARSON, CIVIL RESISTANCE AND COLLECTIVE ACTION IN ROSARIO, ARGENTINA

Rosario, February 2023. We return from Cordoba, Argentina's second-largest city, where we paid a visit to one of the nine global Right Livelihood Campuses. There, we met with Raul Montenegro, an RLC-laureate who received the Right Livelihood Award in 2004 for his work with local communities and indigenous people protecting the environment. The journey leads through the eternal pampas of Argentina and passes Rosario, a city 280 kilometers north of Argentina's Capital Buenos Aires. A heat wave has gripped this part of South America, lasting several months from November 2022 to March 2023 and keeping the entire country in suspense.

Argentina's exceptional heat wave

In Buenos Aires, the Argentine Weather Service recorded the highest temperatures since 1961. This record was replicated in Rosario, Argentina's third largest city, counting 1.3 million inhabitants. It is located in the Province of Santa Fe, between the two huge rivers the Paraná and Paraguay, in the middle of a delta with 5,600,000 hectares of wetlands. These extremely fertile soils have made the region an attractive place for agriculture and livestock since the colonization by the Spanish. And it still is the country's main area for industrial agricultural and livestock production. Unfortunately, Rosario is also the epicenter of wetland fires, which have gotten completely out of control since 2020, during the Covid-19 pandemic.

Rosario: Famous past, furious present

Rosario is known as the 'Cradle of the Flag', as it was here that the Argentine national flag was hoisted for the first time in 1812. A monument honoring this event, the Monumento a la Bandera, completed in 1957, is an emblematic

and symbolic construction for the national state. But, it is also a site of numerous official, civic, and protest acts such as marches and demonstrations. The wetland fires have provoked unprecedented protests by manifold environmental movements.

Since colonial times, natural land has been transformed on a large scale. This so-called 'pampeanization' of the wetlands is a kind of historical given and rarely questioned. Thus, fires are set repeatedly to gain new land for human activities such as cattle herding, new cropland but also intensive agriculture, and construction, as the city of Rosario is expanding.

Fires threaten livelihoods and habitats

Many wetlands fires are caused by illegal arson, a phenomenon plaguing the whole country and continent, as fires have also been destroying large areas of the Gran Chaco and the Amazon region. The dynamics are similar everywhere: Agricultural companies intentionally burn supposedly 'unused' land to later buy it up at knock-down prices for cattle ranching or soybean production. Thus, the boom of soy production in the late 1990s and the growth of the cattle industry have contributed to a rising number of fires.

The fires in Rosario's wetlands affect not only the population living in the surrounding areas but also the flora and fauna - to such an extent that stricter legislation would be needed to protect the wetlands. The fires pose a threat to the resilience of native species and the unique biodiversity landscape in the floodplains, which are already under stress from droughts and further impacts of climate change.





Making a difference: Environmental and civil movements in Rosario

The environmental movement in Rosario has been gaining momentum since 2020. It consists of a variety of actors ranging from citizens, university students, left-wing political groups, conservationist activists and feminists. They are organizing massive acts of protests, expressing a repertory of new 'languages of valuation'. The environmental activists' demands are clear: Stricter legislation for the protection of wetlands and more consistent punishment of illegal arson.

These demands are creatively staged, with people and things merging into collective protest assemblages. The feminist art collective Thigra regularly organizes acts of protest against ecocide. In a protest under the motto "Tu fuego es complice" staged in November 2020, more than 200 people participated in a human chain with buckets of water to extinguish the fire in the National Monument, which stands for freedom and Argentina's independence.

Through these protests the collective wants to point to the responsibility of the state and municipal administration. Who seem to ignore the problem deliberately. People regularly undertake breakneck and life-risking actions such as attempts to extinguish the fires, especially when they

reach the islanders' houses, while representatives of the city administration and state stand by idly.

Twenty years after Raul Montenegro was awarded the Alternative Nobel Prize, ecosystems in Argentina and throughout South America are under threat. This makes everyday protests by people affected by this threat all the more important. Their creative protests exemplify that resistance practices can be collectively organized, while new sources for alternative ideas of knowledge production and concepts for living can be created.

This article is based on a previously published ZEF [blog post](#).



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TIME USE, TECHNOLOGIES AND WELL-BEING IN GHANA



The differences in the time men and women spend on various types of activities are often underpinned by gender and social norms. In turn, these differences have implications for men's and women's life outcomes such as incomes, wealth and well-being. We can see not only gendered patterns in the allocation of adults' time; even the time-use of children and adolescents are gendered. This has implications for their life outcomes including health and education. Research on patterns of men's, women's and

children's time use in countries of the Global South is relatively scarce, as time-use data are seldom collected. We know even less about how these differences affect the health and nutrition of different household members. We are undertaking two research projects in Ghana, Ethiopia and Uganda to fill this gap.

First study: Time-use of household members in Ghana, Ethiopia and Uganda

In a cross-country study on 'Innovations, Technology, and Time Allocation' we collected survey data from rural households in Ghana, Ethiopia and Uganda. This data includes the time that each household's primary adult man and woman spend in various activities. Moreover, we gathered data on the time use of the eldest child above the age of 10 in each household. The analysis of this data, unsurprisingly, shows gendered patterns of time use. Men spend more time in paid work and women spend considerably more time in unpaid work while overall working hours are longer for women than for men. Similarly, girl children spend more hours in unpaid work than boys do. But, the differences in the hours that boys and girls spend in paid work are not consistent across countries. For example, in Ghana girls and boys spend a similar number of hours in paid work.

Why women's unpaid workload is relevant

The time consumed by women's unpaid work is of particular interest for several reasons. First: Sustainable Development Goal no. 5 on *Gender Equality and Empower all Women and Girls*, sets the target to 'recognize and value unpaid care and domestic work'. Thus, an analysis of women's time-use makes women's work visible. Secondly: The time that women spend on unpaid work potentially impacts the diets, health and nu-

trition of members of the household including children. Nutrition levels are determined by many factors including food intake, food quality/quantity, nutrient absorption and retention, physical activity, and external environment including hygiene and sanitation. As the primary caretakers of children, women play a key role in these interactions. Being primarily responsible for handling, preparing and providing food and water, as well as care in addition to maintaining hygiene, the amount of time women spend on these activities has implications for children's nutrition.

Second study: How women's domestic work affects children

In the second, smaller project on 'Women's Time Use, Well-being and Children's Diets' we looked into the effects of women's domestic and care work on children's diets and nutrition. Using data from women traders in two markets in Ghana, we have been studying the impact of women's time use on their children's diets. Preliminary results indicate that the days on which women traders are under more time pressure, their children consume less diverse diets. While this result highlights how significant women's unpaid work is for children's nutrition, these results can also be misinterpreted. They seem to suggest that if women spent more hours in domestic work their children's nutrition status would improve. However, there are different options to address the trade-offs between women's unpaid and paid work. In industrialized countries, domestic technologies, access to electricity and piped water have been effective in this regard. We tested this for our data and a preliminary analysis indicates that in households with access to piped water, or a lower-than-average distance to a water source, women spend fewer hours in domestic work compared to households without piped water or with a longer-than-average distance to a water source. This brings about a very small improvement in children's dietary diversity.

Background of this research: PARI and partners

These research activities are part of the 'Program Accompanying Agricultural Research (PARI)'. PARI is committed to policy-oriented, collaborative research in partnership with other research organizations and higher education institutions. In the same spirit, these projects are collaborative research undertaken with partnerships in three countries. The Institute of Social, Statistical and Economic Research (ISSER), University of Ghana and CSIR-STEPRI are partner-institutes in Ghana. In Uganda, we are partners with the College of Agriculture and Environmental Sciences of [Makerere University](#) and in Ethiopia with the [Policy Studies Institute](#).

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HOW CAN CONTRACT FARMING IMPROVE THE WELFARE OF TANZANIAN CASHEW FARMERS?

Smallholder farmers in sub-Saharan Africa often live in poverty and are food insecure. This is caused by high dependence on subsistence farming, low agricultural productivity, and the lack of off-farm job opportunities. Moreover, high transaction costs [these are costs that do not refer to using factors of production such as capital, labor, and land] are a major hindrance to market access for farmers, posing a further constraint on productivity growth and impeding improvement in rural livelihoods.

Why transaction costs matter

Low-income countries often face pervasive transaction costs which are even more pronounced for smallholder farmers in these countries. In rural Tanzania, for example, transaction costs are incurred by farmers in searching for and accessing markets to sell their products. Transaction costs are also associated with monitoring and enforcing contracts, marketing and price information costs, and transportation costs.

Cashew, a key cash crop

Cashew is a traditional cash crop that is the mainstay of over 700,000 livelihoods in Tanzania, an East-African country with around 72 million inhabitants. As the country's second-important export product, cashew cultivation generates a major part of the scarce foreign currency. Given the experience of other countries with producing cashew and compared to other crops, cashew contract farming has the potential to minimize transaction costs and increase both agricultural production and food security. We compare this growing scheme with a government-run auction system that fails to deliver both satisfactory prices to farmers and low-price variability, which increases risk. Although selling in these auctions is mandatory, farmers have the option to sell directly to processing firms through formal contracts.

How better market connections can improve smallholder farmers welfare

ZEF research conducted in Tanzania finds that cashew farmers that engage with local processors in contract farming produce a higher output and have lower food insecurity compared to farmers that engage solely on the auction system run by the state's Cashewnuts Board. Since contract farming is a recent institutional innovation in this sector, our study considers only simple contract farming schemes that cover prices, quantities, and a rough quality standard. The main explanation for this positive effect is twofold. When farmers connect with markets in a more formalized and direct manner they cut transaction costs

and these effects are mediated by a reduction of price and market risks. The former has to do with higher output prices received and lower price fluctuations, whilst the latter is related to an assurance that farmers will have a buyer. Although off-farm employment was not specifically analyzed, we can conclude that more jobs in agro-processing firms reduce risk through income diversification.

Why farmers benefit from contract farming

In sum, smallholder farmers accrue welfare benefits by participating in contract farming, namely higher output and better food security. Contract farming schemes and other direct linkages between smallholders and processors can play an important role in modernizing agrifood systems.

Policy recommendations

We propose three policy recommendations. First, improve the efficiency of rural markets by targeting policies to support the engagement between processing firms and smallholders. Second, promote contract farming in the cashew sector to reduce smallholders' price risk and market risk. Last, support effective government policies, especially the coordination between different government ministries and agencies, which is especially relevant for cross-cutting measures, such as connecting farmers to processors.



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WATER AND ENERGY SECURITY FOR AFRICA

As part of the BMBF-funded [WESA](#) project (2016-2021), ZEF has been working with partners such as the Pan African University Institute for Water and Energy Sciences (PAUWES) in Niger and with the University of Tlemcen in Algeria. ZEF's task was to provide strong support for PhD research, especially on topics related to water within the water, energy, food, and climate nexus.



In this context ZEF has provided support for two PhD students, Sadame Mohammed Yimer from Ethiopia and Bougara Hanane from Algeria, who have both been working on water resources management.

Both doctoral theses were completed successfully, and both students have received their doctoral degrees, **Sadame Mohammed Yimer**, on April 3, 2023 and **Bougara Hanane** on June 23, 2022, from the Faculty of Technology, University of Tlemcen, Algeria, Department of Hydraulics, specialty in Water Resources Management.

Sadame Mohammed Yimer's wrote his doctoral thesis on 'Modelling the impacts of land use/land cover changes, climate changes and hydropower reservoirs on hydrological responses and sediment load in the Upper Tekeze-Atbarah, Eastern Nile river basin, Ethiopia'.

For his doctoral thesis, Sadame Mohammed assessed the impacts of land use and climate change, as well as of hydropower reservoirs, on water resources and sediment load in the Eastern Nile river basin. A climate model ensemble for future climate projection was formed. We found that random forest was found to be the most accurate classification technique among other machine-learning algorithms for land-use classification. The study highlights the need

for sustainable land-use policies and careful model selection for climate projections. A calibrated and validated Soil and Water Assessment Tool (SWAT) model assessed the impacts of Land Use Land Cover (LULC) and climate on hydrological response and sediment load. LULC changes, climate changes and hydropower reservoirs are influential factors in water-resources availability and sediment load. A new dynamic hydropower reservoir operation method was proposed, which showed promising results in simulating water levels and reducing sediment load downstream.

Bougara Hanane conducted his doctoral research on 'Hydrological modeling in the Tafna Basin in north-west Algeria'.

Bougara Hanane analyzed the hydrological response to climate variability in five Tafna sub-basins in northwestern Algeria. Objectives included selecting climate types, simulating hydrological behavior under different conditions, and comparing results. Homogeneity testing and evaluation of drought indices concluded that wet periods were in the early 2000s and dry periods were between 1990 and 1999. The two lumped models (called GR4J and HBV light) that were applied showed good performance for two calibration periods and provided insight into factors affecting hydrological processes and model structure. The hydrological response to rainfall time-series variations was inconsistent due to groundwater storage and infiltration. The models were found to be useful tools for predicting water availability under different climatic conditions in similar areas.

More info on the WESA-project [here](#).

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(NO) ELECTRICITY: ONLY ONE OF MANY ISSUES TO TACKLE IN LIBERIA'S CAPITAL MONROVIA

Everyday-urban life in precarious settlements in Liberia's capital Monrovia, West Africa, is characterized by risks. Like many fast-growing cities in the Global South, Monrovia's infrastructure is incomplete, especially after Liberia went through two civil wars between 1989 and 2003. After the second civil war ended in 2003, post-war Liberia has been facing the monumental task of reconstructing, restoring, and improving livelihoods. An estimated 64% of Liberians still live below the poverty line today. While the 2008 national census recorded around one million people living in Monrovia, which is one third of Liberia's population at the time, it is likely to be many more today. The city is Liberia's political, economic, and cultural center. The study presented here was conducted through in-depth empirical fieldwork in Barnesville Township in Greater Monrovia. It examines how incomplete infrastructure shapes actors' practices and influences community strategies.

Slow electricity roll-out

The Liberian civil wars damaged Monrovia's electrical infrastructure. Post-war power development and restoration projects are ongoing, but many city areas remain partially or completely cut off from the power grid. The state-owned Liberia Electricity Corporation is the sole provider of formal electrical services. Fewer than 7% of the whole country and about 22% of people in Monrovia have official access to electricity. Liberia's total installed capacity in 2022 was 126 MW, still well below the pre-war peak of 191 MW. Electricity tariffs in Liberia are among the highest in the world. Post-war electricity roll-out has been slow and characterized by delays, triggering a risk-and-possibilities landscape. Residents face the risks that illegal connections may cause, such as fire hazards, or they are forced to spend more of their meager resources on alternatives such as generators.



New possibilities emerge

However, the situation of insufficient electricity infrastructure also creates new possibilities as it is exploited strategically by both community actors and state actors. In areas, for example, where grid connection is delayed, residents hire technicians to connect their homes. They pay for materials (cables, poles, wires, etc.), labor, and obtain official meters of Liberia Electricity Corporation through a third party. Officially, the Liberia Electricity Corporation rejects this arrangement, but they often accept these grid connections later on as legal. Thus, new patterns of community building and social interactions emerge. Sometimes those new patterns reflect existing governance problems and resource scarcity, but they can also provide practical solutions, like the unacknowledged cost-sharing between neighborhoods and the Liberia Electricity Corporation. This way, the ongoing electricity problems spur a multitude of experimentation processes that unpack options for creating community strategies and strengthen both institutional and adaptive capacities.

The power of collective action

Monrovia's story demonstrates that aside from posing challenges and limitations, incomplete infrastructure can also be productive. It can spark collective action, new commons, and new strategies. Both neighborhood-community and state actors actively shape and use incompleteness, are energized to resist, collaborate, respond, and strategize. In this sense, infrastructure incompleteness offers a landscape of risks and opportunities for all actors. The incompleteness should not be measured against the modernist norms of technical designs but as an adaptation to scarcity and possibilities.

This article is based on a paper published recently together with ZEF senior fellow Kristof Van Assche (Faculty of Science - Earth & Atmospheric Sciences, University of Alberta, Canada):

Innis, P. G., and van Assche, K. (2023). Permanent incompleteness: Slow electricity roll-out, infrastructure practices and strategy formation in Monrovia, Liberia. *Energy Research & Social Science*, 99, 103056. <https://doi.org/10.1016/j.erss.2023.103056>

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VIEWPOINT: "WE HAVE BENEFITTED ENORMOUSLY FROM THE BILATERAL EXCHANGE BETWEEN COLOMBIA AND GERMANY"

Interview with Professor Tomás León Sicard, project leader of the German-Colombian Doctoral Studies Support Program (DSSP) at the National University of Colombia (UNAL)

How do you think the National University of Colombia (UNAL) has benefitted from participating in the DAAD-funded SDG Graduate School program and from the cooperation with ZEF?

We have benefitted from this arrangement in so many ways. First of all, we have improved our capacities in different areas. Not only our logistic capacity to organize courses but also our capability to conduct research, mainly interdisciplinary research, in so many fields. We have had students working on issues of health, air quality and city transportation in Bogotá, and another student working on the effects of beetles on soil fertility and managing agrobiodiversity. This shows that we work by combining different fields and offer a study program with a highly comprehensive approach. With ZEF, we share the same philosophy of what environment is. For us, the environment entails the relationship between ecosystem and culture, between nature and society. We show these relationships in our research but also in our academic courses. We engage in conversations about this with colleagues from ecological economics, from agro-ecology and from the conflict areas in Colombia. Colombia has many problems due to the internal conflict stretching over the past 60 years. However, we have been studying not only the conflict but also the resolution of conflict. We think the alternative to conflict lies in bringing together the interests of the environment, which includes society and nature.

You are the project leader of the SDG Graduate School DSSP in Colombia. What has been the feedback of the students about the program so far?

The students have had the possibility to exchange knowledge, for example by writing a term paper in groups of three students with different academic backgrounds. Students write their term papers about any subject based on an exchange of visions and ideas related to environmental issues. The SDG program also has improved our capacity of publishing our academic outcomes. The cooperation between ZEF and IDEA has resulted in publishing together in IDEAS' journal 'Gestión y Medio Ambiente'. Thanks to the DSSP support, colleagues in Colombia have been able to publish their articles in scientific journals.

In addition, due to the support of the SDG program we have published three to four books in other fields, such as agrobiodiversity. Finally, we have been able to discuss the concept of sustainable development from a different approach, looking beyond pure economy. Sustainable development is also about education, technology, symbolic ideas, and ethics. With this interdisciplinary approach, our students are able to understand life in a better way.

What are the challenges the students and the program have been dealing with?

First of all, we are very happy with the program. It has enabled us to extend our master program to a program on environment and development and to other cities and Campuses of the National University (UNAL). We have been hosting professors and students from Germany, one of them doing his thesis in our country. But, if there is something to improve it would be the exchange on the level of professors, with more Colombian professors and lecturers going to Germany, and not only the German colleagues teaching in Colombia. This would make a real exchange and discussion of experiences possible and enrich perceptions of Latin America studies. I dream about this kind of exchange, doing some classes, courses, lectures in Germany about Colombia. Our country and the other South American countries are very complex, and this complexity is quite difficult to understand for outsiders. That is why I think that we can improve the exchange by having professors from Colombia going to Germany.

Watch the full interview on ZEF's Youtube channel: <https://www.youtube.com/watch?v=J5Pc4NqYU4A>

The ZEF-led Doctoral Studies Support Program (DSSP) is funded by the German Exchange Service (DAAD) in the framework of its SDG Graduate School program. The seven SDG Graduate Schools met in Bonn in June 2023.

More info about DSSP: <https://dssp-colombia.org/>

The interview was conducted by **ZEF PR Team**
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IN BRIEF: NEW ZEF RESEARCH AND PROJECTS

SUSTAINABLE LAND MANAGEMENT IN SUB-SAHARAN AFRICA: MAJOR RESEARCH PROJECT SETS OFF

Four regional transdisciplinary research projects on sustainable land management in sub-Saharan Africa and the accompanying project INTERFACES met for their first Status Seminar in Bonn on April 26-28, 2023. The projects are funded by the German Federal Ministry for Education and Research (BMBF) under their FONA platform on research for sustainability.



More than 100 participants both in-person in Bonn and virtually from across the participating countries met to share the outlines of the five projects, which are:

COINS (Co-developing innovations for sustainable land management in West African smallholder farming systems), **DeClaRe** (Decision support for strengthening land resilience in the face of global challenges), **InfoRange** (Increasing efficiency in rangeland-based livestock value chains by co-designed digital technologies and machine learning approaches), **Minodu** (Fostering local sustainable development through technology and research), and **INTERFACES** (Supporting Pathways to Sustainable Land Management in Africa).

ZEF is the lead institute of INTERFACES, which is planned to run for four years and is funded with around 1.3 million euros.

More on the project here: <https://www.zef.de/interfaces>

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8.1 MILLION EUROS FOR INNOVATIVE RESEARCH GREENHOUSE - "START" PROJECT

The German Federal Ministry of Education and Research (BMBF) is funding a novel research greenhouse project titled 'Sustainable Greenhouse Production Types and Resource Efficient Technologies for Future Cultivation (START)' with €8.1m. It will be located on the Klein-Altendorf Sustainability Campus of the University of Bonn. The project aims to make greenhouse production more sustainable and resource-efficient by recycling water and nutrients, generating energy through sustainable methods, and eliminating expensive and energy-intensive substrates. The project will focus on deep-water cultivation, in which plants are grown directly in water troughs.

The project is being carried out by a team of experts from different institutions, including the Institute of Crop Science and Resource Conservation (INRES) and ZEF, both part of University of Bonn. The bio innovation park Rheinland e.V. is also a partner in the project. The goal is to provide high-quality food in a sustainable way, while also reducing environmental impacts. The project is expected to begin its demonstration operation in 2024. ZEF will study whether such a greenhouse concept could help reduce micronutrient deficiency, particularly in developing nations such as Ghana. The project will run for four years, with the demonstration operation scheduled to begin in 2024.

Read the press release by the University of Bonn [here](#) (in German available only)

More on the project [here](#)



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