



Environment for
Development

The 16th EFD Annual Meeting

Proceedings

22-26 September 2022



www.efdnitiative.org

A Publication of:

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“In the years to come, it would be very interesting to follow the research by Efd and others on decarbonizing economic development in sub-Saharan Africa and learn how to enhance the green economy”

H.E. Maria Håkansson,
Ambassador of Sweden to Uganda.

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About EfD

The environment for Development initiative (EfD) is a global network of environmental economics research centers tackling the world's most challenging problems at the intersection of poverty, the environment, and climate change. We strive for inclusive and sustainable economic development, in which everyone has the chance to participate and benefit from advancements.

Our specific intervention is to build local capacity, by developing a vibrant community of scholars in the Global South who devote their careers to solving central sustainability challenges in their societies. Established in 2007, the EfD network has since grown to over 200 accomplished environmental economists based in the Global South. Our scholars are equipped to create knowledge with high-quality research, educate future generations, and advise policy leaders on the evidence-based management solutions needed to get development right, so that it both reduces poverty and is environmentally sustainable.

Our focus on policy-relevant research, at the intersection between the environment and development, is energetic, networked, engaged, and optimistic while our ambition for 2021-2025 is to further develop EfD as a dynamic and impactful international organization that fills critical societal gaps in 1) human capital (i.e. capacity), 2) research, 3) meaningful communication with policy actors, and 4) institutional development.

EfD's vision

Inclusive sustainable development in the Global South is founded on evidence-based management of the environment, natural resources, and climate change impacts.

EfD's overarching objective

Through integrated capacity development, research, and policy engagement we contribute to evidence-based domestic and international policies for poverty reduction, environmental and resource management, and climate change impacts in the Global South.

Contributions to filling the identified pillars a

- Capacity development.
- Policy-relevant research.
- Policy engagement.
- Institutional development.

EfD centers are hosted by leading local academic research institutions in 13 countries: Chile, China, Colombia, Central America, Ethiopia, Ghana, India, Kenya, Nigeria, South Africa, Tanzania, Uganda, and Vietnam.

The EfD Global Hub coordinates the network from the School of Business, Economics, and Law, University of Gothenburg, Sweden.

Financial support is provided by the Swedish International Development Cooperation Agency (Sida).

The Annual Meeting

EfD is a leading global network for environmental economists in Global South.

Each year the network convenes for the Annual Meeting hosted by any of the centers that form the network. The EfD Annual Meeting is a forum for researchers from the wider EfD network, research collaborators, and other key stakeholders to interact and exchange research ideas, seek collaborations, discuss research proposals, and present research results from EfD projects.

After two years of virtual interactions due the COVID-19 Pandemic, the 16th Annual Meeting ushered us back into the much familiar territory of in-person interaction with some sessions running hybrid.

On September 22-26, 2022, the 16th Annual Meeting was held at the Munyonyo Commonwealth and Speke Resort along the shores of Lake Victoria in Kampala-Uganda. The meeting was organized by the EfD Cente at Makerere University.

The six-day program entailed keynotes, parallel sessions, and social interactions.



Keywords - Acronyms and abbreviations

BlueRforD	Blue Resources for Development
CATIE	Tropical Agricultural Research and Higher Education Center
CECFEE	Center for research on the Economics of Climate, Food, Energy and Environment
EEPSEA	Economy & Environment Partnership for Southeast Asia
EDF	Environmental Defense Fund
EDRI	Ethiopian Development Research Institute
EfD	Environment for Development
EPfD	Emission Pricing for Development
FC	Forestry Collaborative
GIMPA	Ghana Institute of Management and Public Administration
GU	University of Gothenburg
IEG	Institute of Economic Growth
ISID	Institute for Studies in Industrial Development
ISI	Indian Statistical Institute
MCC	Mercator Research Institute on Global Commons and Climate Change
NatCap	Natural Capital Collaborative
TSE	Toulouse School of Economics
SETI	Sustainable Energy Transitions Initiative
SCOPE	Sustainable Consumption and Production
TSS	Teton Science Schools
WinEED	Women in Environmental Economics for Development

Committees

Organizing Committee

Gunnar Köhlin

Director, EfD

Susanna Olai

Program Manager, EfD

Franklin Amuakwa-Mensah

Research Manager, EfD

Alejandro Jose Lopez-Feldman

Coordinator – Collaborative Programs, EfD

Edward Bbaale

Director, EfD-Mak Centre

Research Committee

Franklin Amuakwa-Mensah

Research Manager, EfD

Prof. Vic Adamowicz

University of Alberta, Canada

Prof. Francisco Alpizar

Wageningen University, Netherlands

Dr. Jessica Coria

University of Gothenburg, Sweden

Prof. Pam Jagger

University of Michigan, USA

Dr. Menale Kassie

icipe, Kenya

Prof. Rohini Somanathan

Delhi School of Economics, India

Local Organizing Committee

Edward Bbaale

Director, EfD-Mak Centre

Johnny Mugisha

Deputy Director, EfD-Mak Centre

Fred Kasalirwe

Data Manager, EfD-Mak Centre

Hilda Eve Makune

Administration, EfD-Mak Centre

Bruno Yawe

Researcher, EfD-Mak Centre

Eria Hisali

Researcher, EfD-Mak Centre

Peter Babyenda

Policy Engagement Specialist, EfD-Mak Centre

Jane Anyango

Communications Officer, EfD-Mak Centre

Nicholas Kilimani

Researcher, EfD-Mak Centre

Description of Collaborative Programs' Meetings

Emission Pricing for Development (EPfD)

One part of an integrated and coherent climate policy is to make it to price emissions. To do so is, however, politically difficult since it tends to threaten the privileges and business of the rich and of the fossil fuel lobbies. It is also sometimes unpopular since it may be thought to be unfair to the poor (even if it is not). Many other arguments against fuel taxes are used, such as that they are inflationary. Furthermore, there is fear in many low-income countries that people will start using fuels like manure for cooking, which leads to massive indoor air pollution and may then be a worse problem from the viewpoint of local pollution. It is therefore complicated to analyze and even more complicated to actually introduce and enforce emissions pricing. In this collaborative program we would like to discuss various opportunities for joint and or comparative research in this area. During this open session we will discuss various aspects of the problem of emissions pricing in developing countries and discuss opportunities for research and funding.

Forest Collaborative

The Forest Collaborative (FC) host institution, Peking University, invites everyone to our open session. During the session, which will be moderated by Randy Bluffstone and Jintao Xu, we will provide a brief background on past FC activities and accomplishments. We will also welcome the new advisory committee, learn about their research interest areas relevant to the FC, and discuss how to involve all advisory committee members most effectively. The focus of the meeting will be the FC five-year strategic plan, our research agenda, and especially plans for 2023, which importantly is the third year of the UN Decade on Ecosystem Restoration. These discussions will be both in terms of research topics and potential outputs, including books, special issues, and Collaborative-wide funding proposals. For reference, the FC strategic plan topical areas include forests and human health, which is an area of on-going research, and five potential new areas for work. These identified possible topics for future research include the following: Forestry and Land Use as Nature-Based Solutions to Climate Change, Forest Policies Relevant for a Low Carbon Transition, Forest Restoration and Special Values for the Global South in Mitigating Climate Change, Forest Restoration and Migration, Forest Restoration and Private Investments.

Natural Capital Collaborative NatCap *Biodiversity and Ecosystem Services*

Biodiversity and Ecosystem Services is one of the three components of the Natural Capital Collaborative hosted by EFD South Africa (EPRU) at the University of Cape Town. The Biodiversity & Ecosystem Services stream will focus on estimating and maintaining the benefits from natural systems. This includes research areas pertaining to protected and conservation areas, ecosystem services valuation and accounting, sustainable resource management, nature-based solutions including ecosystem-based mitigation and adaptation, and incentive and financing measures such as

payments for ecosystem services. During the open session on 25 September we will identify research priorities within this sub-theme, find areas of common interest, and identify potential opportunities for collaboration and funding. We also will introduce an early-stage EfD-wide research proposal on provisioning ecosystem services.

Sustainable Agriculture

The Sustainable Agriculture and Food Systems initiative is one of three such initiatives under the NatCap collaborative program. The philosophy behind it is that a lasting change could be brought about through thinking in terms of “system change” instead of “paradigm shift” for agricultural R&D - a key potential driver of development for the South. This calls for a move away from regime-based technology development efforts towards a more flexible enrichment of food systems through paying more attention to indigenous, sustainable African systems while at the same time building on previous technology development and dissemination experience. EfD provides the ideal platform for bringing about such systems-based change with its geographical and thematic diversity. The open session aims to discuss ways of developing a Community of Practice around the 15 sub-themes of sustainable agriculture and food systems that EfD researchers focus on. It also aims to further shape the initial proposal developed by a core team of the initiative.

Water Systems

NatCap has sought to identify and explore the ever-growing water scarcity and cleanliness problem throughout the Global South. As individuals migrate to increasingly dense urban areas with deteriorating infrastructure and climate change threatening water supply, the need for substantial policy-impacting research is vast, as billions lack access to safe water. Water Systems aims at i. Investigate and advocate for equitable burden-sharing arrangements concerning water scarcity through behavioral economics principles and tariff structures; ii. Develop novel strategies that strengthen urban and rural water systems' resilience to climate change and human activity; iii. Stimulate sustainable approaches for developing and protecting natural and artificial water infrastructure. The open session will discuss ways to increase policy impact, develop high-quality scientific research and identify opportunities for further collaboration and funding.

Sustainable Energy Transitions Initiative (SETI)

This meeting will be open to all members of the Sustainable Energy Transitions Initiative and to those who may be willing to engage in our activities. The main objective is to present the work of SETI in the past years, and to define new pathways of development with the participation of its members. This will imply the inclusion of a set of presentations from the Co-Leaders and Founders of the collaborative, a presentation for the strategy, and breakout sessions for participants to discuss about urgent topics to be addressed by the collaborative. In addition, interactive questions will be included during the session, via the SOCRATIVE platform.

Sustainable Consumption and Production (SCOPE)

A transformative change towards sustainable lifestyles, food, waste, and circularity. Unsustainable consumption and production patterns cause major planetary crises such as biodiversity loss, climate change, and pollution. More urgent and ambitious “transformative changes” are needed to how we live, i.e., we need a fundamental, system-wide restructuring of the root causes of nature degradation. The overarching goal of SCOPE is to identify leverage points and associated interventions for triggering and enabling transformative changes at the level of consumers, producers, and organizations, thus accelerating diverse transformative pathways toward consumption and production that is in harmony with the natural environment (SDG12). The major themes developed by SCOPE are i. Food waste: sustainable food consumption at home and in the hospitality sector; ii. Sustainable lifestyles: sustainable practices in fashion, travel, and tourism/hospitality; iii. Circular economy: economic incentives to reduce, reuse and recycle. The open session during the Annual Meeting welcomes new collaborators on these topics to develop high-quality research, implement capacity-building programs and increase policy engagement in the Global South.

Women in Environmental Economics for Development (WinEED)

In this joint session WinEED and SETI will discuss the current stage of Women in Academia (economics) in general. We will talk about barriers that women in academia face at each stage of their careers. We will also discuss women participation in the different EfD Centers and give examples of how some centers are addressing this issue and incorporating a gender perspective into their research. Finally, we will open the discussion so participants can share their experiences, as well as their ideas and proposals on how WinEED can collaborate with EfD Centers to increase women participation and representation.

Annual Meeting Program

East African Time.

All plenary recordings are available on the EfD YouTube Channel which you can access [here](#).

Thursday, September 22. Academic Program Day I	
08:00 – 08:30	Registration
08:30 – 10:00	Parallel sessions 1
10:00 – 10:30	Coffee break
10:30 – 12:30	Parallel sessions 2
12:30 – 13:45	Lunch
13:45 – 15:30	Plenary: Official opening and presentation of collaborative programs
15:30 – 16:00	Coffee break
16:00 – 18:00	Collaborative Program Meeting (EPfD)
18:30 – 19:00	Transfer to dinner venue (meet at Lobby)
19:00 – 21:00	Dinner
21:00 – 21:30	Transfer back to the hotel if needed
Friday, September 23 - Academic Program Day II	
08:30 – 10:00	Parallel Sessions 3
10:00 – 10:30	Coffee break
10:30 – 12:30	Parallel sessions 4
12:30 – 13:45	Lunch
13:30 – 14:30	Policy talk
14:30 – 15:30	Keynote 1: <i>“The economics of water -- too important to be left to economists?”</i> by Michael Hanemann
15:30 – 16:00	Coffee break
16:00 – 18:00	Collaborative Program Meeting (WinEED)
18:30 – 19:00	Transfer to dinner venue (meet at Lobby)
19:00 – 21:00	Dinner
21:00 – 21:30	Transfer back to hotel if needed
Saturday, September 24 - Academic Program Day III	
08:30 - 10:00	Parallel sessions 5
10:00 – 10:30	Coffee break
10:30 – 12:30	Parallel sessions 6
12:30 – 13:45	Lunch
13:45 – 14:30	Policy talk by Haileselassie Medhin (WRI)
14:30 – 15:30	Keynote 2: <i>“Lessons from 10 years of household energy access research in East and Southern Africa”</i> by Pamela Jagger

15:30 – 16:00	Coffee break
16:00 – 18:00	Collaborative Program Meeting (SCOPE)
18:30 – 19:00	Transfer to dinner venue (meet at Lobby)
19:45 – 21:45	Dinner
21:45 – 22:30	Transfer back to the hotel if needed
Sunday, September 25 - Academic Program Day IV	
08:30 - 10:00	Parallel sessions 7
10:00 – 10:30	Coffee break
10:30 – 12:30	Parallel sessions 8
12:30 – 13:45	Lunch
13:45 – 14:30	Awards Session
14:30 – 15:30	Keynote 3: “ <i>Climate, Risk, and Uncertainty</i> ” by Gernot Wagner
15:30 – 16:00	Coffee break
16:00 – 18:00	Collaborative Program Meeting (NatCap)
18:30 – 19:00	Transfer to dinner venue (meet at Lobby)
19:45 – 21:45	Dinner
21:45 – 22:30	Transfer back to the hotel if needed
Monday, September 26 – EfD Annual Meeting Day V	
08:30 - 10:00	Collaborative Program Meeting (SETI), COVID-19 Global Survey Meeting and Early-career Fellowship course on Policy Engagement and Science Communication
10:00 – 10:30	Coffee break
10:30 – 12:30	Collaborative Program Meeting (Forest), Research Committee Meeting and Early-career Fellowship course on Policy Engagement and Science Communication
12:30 – 13:45	Lunch
13:45 – 15:30	Collaborative Program Meetings (Natcap, SCOPE, EpfD, and Forest) and Early-career Fellowship course on Policy Engagement and Science Communication
15:30 – 16:00	Coffee break
16:00 – 18:30	Collaborative Program Meetings (NatCap, EpfD, and Forest Collaborative) and Workshop on Policy-Research Partnerships for Pragmatic Evaluation of Climate Change Adaptation and Development Models in the Agriculture-Energy Sector
19:45 – 21:00	Dinner at Speke Resort

Official Opening, Keynotes, and Policy talks

The official Opening was graced with the presence of the Ambassador of Sweden to Uganda, Her Excellence Maria Håkasson, the Vice Chancellor Makerere University, Professor Barnabas Nawangwe, a representative from the Ministry of Water and Environment - Assistant Commission Mr. Mafumbo Julius.

This session was presided over by the EfD Director Gunnar Köhlin, while the Director EfD-Mak Centre delivered opening remarks.

[Here is the video link](#)



L-R: Director EfD- Gunnar Köhlin, Vice Chancellor Makerere University - Prof. Barnabas Nawangwe, Ambassador of Sweden to Uganda - H.E. Maria Håkasson, Assistant Commissioner the Ministry of Water and Environment - Mr Mafumbo Julius, Director, EfD-Mak Centre - and Prof Eward Bbaale.

Keynote Sessions



[“The economics of water -- too important to be left to economists?”](#)

Professor Michael Hanemann

[Video Link](#)



“Lessons from 10 years of household energy access research in East and Southern Africa”

Professor Pam Jagger

[Video Link](#)



“Climate, Risk, and Uncertainty”

Professor Gernot Wagner

Policy Talk



The policy talk was delivered by **Haileselassie Medhin** the Africa Director of Strategy and Partnerships at the World Resources Institute.

[Video Link](#)

Awards [Video Link](#)

Peter Berck's Best Discussion Paper Award

The Peter Berck's best discussion paper award went to Nkechi Srodah Owoo, Monica Puoma Lambon-Quayefio, and Ebele Amaechina for their paper titled: *Exploring the Evidence for Inward Diffusion of Soil Practices among Farmers in Nigeria: A Spatiotemporal Analysis*.

Criteria:

- Involvement of researchers in Global South (EfD funded project, young researcher)
- Policy relevance
- Research design
- Analysis



The winning trio

L-R: Monica Puoma Lambon-Quayefio, Ebele Amaechina, and Nkechi Srodah Owoo,

Gunnar Köhlin's Best MSc. thesis Award

The Gunnar Köhlin's Best MSc. thesis Award was awarded to Sofia Castro Vargas for her thesis titled: *Turning up the Heat: Warming Oceans and their Effect on Armed Conflict in the Philippines*.

Sofia's submission was through EfD Colombia.

Criteria:

- Rigor in the application of environmental economics,
- Relevance in affecting policy to reduce poverty and increase sustainability,
- Clarity in writing that makes the text easily accessible and fun to read.



Sofia Castro Vargas

EfD Policy Impact Award & recognitions

The Policy Impact Award went to Dr. Pham Khanh Nam and the EfD Center in Vietnam.



Dr Pham Khanh Nam



L-R: Daniel Slunge, EfD Policy Engagement Director with representatives from the winning teams

Award Motivation

Winner: Dr. Pham Khanh Nam and the EfD center in Vietnam

Initiative: Inclusion of market-based instruments in Vietnam's new Environmental Protection Law

Motivation: Dr. Pham Khanh Nam and colleagues at the EfD center in Vietnam have played an instrumental role in the inclusion of market-based instruments in Vietnam's new environmental protection law that came into force in 2021. Building on the significant knowledge within the EfD network on policy instrument design, the team has effectively interacted with the Ministry of Natural Resources and Environment in the drafting of the new law. The team has become a trusted partner in the advisory group for the Law on Environmental Protection and in the development of a carbon market in Vietnam.

Recognition: Prof. Jorge Dresdner, Prof. Carlos Chávez, Dr. Miguel Quiroga, Dr. César Salazar

Initiative: Advancing sustainability in the small fishery and aquaculture sectors in Chile

Prof. Jorge Dresdner is a highly regarded expert who has built up trust with key stakeholders and government representatives over the past 20 years. The EfD Chile team, including Prof. Dresdner, Prof. Carlos Chávez, Dr. Miguel Quiroga, and Dr. César Salazar, are frequently engaged to provide the analytical underpinnings needed for the analyses and evaluations by government and international bodies of the fisheries industry in Chile. They have also played an instrumental role in advancing the dialogue on fisheries in the country. Changes in policy or law are slow-moving, but the team's work has great potential to be very fruitful in terms of fishery quotas and other policy changes.

Recognition: Prof. Wisdom Akpalu

Prof. Wisdom Akpalu is a respected fisheries economist and a successful champion for transparency and novel approaches to address harmful practices in the fisheries sector in Ghana. The results of his research have been frequently featured in the media and he has had an important influence in shifting the policy dialogue within industry and the government. Policy changes to which Prof Akpalu has made important contributions include the use of video monitors on trawlers. His work on these politically sensitive topics, including harmful subsidies, is solidly built on facts and figures, and he has thereby gained the respect and trust of government officials as well as artisanal fisheries organizations.

Highlights through the lens



Course participants: Early-career Fellowship course on Policy Engagement and Science Communication



Gunnar Köhlin, Prof. Edward Bbaale, and VC Prof. Barnabas Nawangwe share a light moment.



LOC: Prof. Edward Bbaale (Second from left) with members of the local organizing committee being recognized for a job well done.



One of the 35 parallel sessions underway.



Place-based trainees in a group photograph.



Fika break for Professors: **L-R-** Eswaran Somanathan, Thomas Sterner and Jan Steckel

More images are [here](#)

Parallel Sessions – Abstracts

Parallel sessions 1B | Fisheries value chain (BlueRforD)

Do Chilean imports lead prices in the EU mussel market?

Leonardo Salazar (University of Concepcion)

One of the main reasons to explain the decrease in the economic performance of the mussel aquaculture sector in the European Union (EU) in the last two decades has been the impact that added competition of imported mussels from Chile might have had on market prices. This hypothesis has not yet been tested. In this article, we empirically test for price leadership and market integration in the EU mussel market. We estimate a cointegrated vector autoregressive (CVAR) model for the French, Italian, and Spanish import mussel markets and test for price leadership. The results indicate that import prices of Chile, Belgium, Spain, Ireland, Italy, and the Netherlands are determined within a fully integrated market so that prices are proportional over time. Furthermore, all countries follow the lead of Chilean mussel prices in the French market, which are on average among the lowest of the main importers in this market. These results provide support to the opinion that added competition from Chilean mussels may have contributed to the low prices in the EU market.

The Welfare Effects of Trade Associations

Manuel Estay (University of Concepcion)

This paper examines the welfare consequences of the existence of a trade association via a case study of the Chilean salmon and trout industries. While trade associations can positively improve welfare through enforcing quality standards and facilitating information sharing among firms, they can also encourage collusion and hurt the sales of non-member firms. Using both reduced form evidence and a structural model of demand, supply, collusion, and entry into the trade association, we find the overall welfare effects to be positive. This is because while the trade association both improves product quality and facilitates collusion according to our models, the product quality welfare effects are larger.

Marine conservation efforts and their effects on industrial fishing activity

Jorge Luis Montero Mestre (University of Los Andes)

This article evaluates the effect of Marine Protected Areas (MPAs) on industrial fishing activity at a global level. Using comprehensive data on global fishing activity and spatial regression discontinuity methods, I estimate the causal effect of MPAs on fishing effort. My main result indicates that protected areas with a stricter protection designation significantly reduce fishing efforts. I find that, on average, fishing efforts have been reduced by 30.5% of the total hours of fishing per km² that were carried out in the world between 2016 - 2020. However, I find a concentration of fishing activity just inside of the border of some protected areas, suggesting predatory behavior by vessels, especially in MPAs with no designation or no clear restriction designation. Additionally, the results suggest that

the design of protected areas with more than one protection designation contributes to the control of fishing efforts on the border MPAs.

Parallel sessions 1D | Agriculture Labor in a Changing Environment (NatCap)

Climate Change, Labor and Farm Productivity: Evidence from Agricultural Households Panel in India.

Nikita Sangwan (Indian Statistical Institute)

Climate change has increased rainfall uncertainty, leading to greater production risks in agriculture. We examine the gender-differentiated labor impacts of droughts using unique individual-level panel data for agricultural households in India over half a decade. Accounting for unobserved heterogeneity across individuals, we find that women's workdays are 19% lower than men's when a drought occurs, driven by the former's lack of diversification to the non-farm sector. Women are less likely to work outside their village and migrate relative to men in response to droughts and are consequently unable to cope fully with the adverse agricultural productivity shock. We find suggestive evidence in support of social costs emanating from gender norms that constrain women's access to non-farm work opportunities. The results highlight the gendered impact of climate shocks, potentially exacerbating extant gender gaps in the labor market.

Labour Outmigration, Farmland Fallowing, Livelihood Diversification and Technology Adoption in Nepal

Randall Bluffstone (Portland State University)

Temporary international labour migration from rural areas of low-income countries is an important international phenomenon, which causes agricultural labour to be diverted from farming to other activities. In labour-intensive agricultural systems, loss of labour can lead to an increase in the opportunity cost of farm labour, which can create incentives to change the mix of livelihood strategies, farm inputs and investments. At the same time, short-term international migration may generate remittances, which can finance agricultural intensification and business investments. Using nationally representative data from Nepal, combined with empirical methods that allow causal inference, we investigate the effect of labour out-migration on farmland fallowing, adoption of agricultural-intensification technologies and livelihood diversification. We find that households with international migrants are over 50% more likely (based on PSM estimates) to have fallow land, compared with households without migrants. The result is robust to alternative specifications and estimation techniques. We also find that temporary international migration promotes adoption of some technologies that intensify agriculture and causes rural households to diversify their livelihoods. Land fallowing may increase food insecurity, while agricultural intensification may improve it, with uncertain net effect. We offer some indicative results on the effect of labour out-migration on food insecurity, especially in the remote rural areas.

Climate Variability, Temporal Migration and Household Welfare among Agricultural Households in Tanzania

Martin Julius Chegere (University of Dar es Salaam)

Climate change has been one of the factors inducing people to migrate internally. As a result of climate change risks, the temporal migration strategy has been linked as an insurance strategy to cope with its impacts. This study analyses whether climate variability is a driving factor for temporal migration among agricultural households; and whether such migration shields farmers from agricultural shocks. The study uses three waves of the Tanzania National Panel Survey data and employs various descriptive and panel-data econometric techniques in the analyses. Results indicate that climate variability has no effect on overall agricultural production but has a significant effect on maize production, a staple food crop in Tanzania. Moreover, high market value from production is associated with a lower chance that climate variability will force a household member to migrate. In cases where climate change leads to temporal migration, the migrants may shield the household from large welfare loss by bringing back their earned income with new skills. More investments in adaptation to climate change can reduce temporal migration. This will facilitate the retaining of productive force thus boost the rural economy where agriculture is commonly practiced.

Parallel sessions 1E | Forestry and Agriculture

Top-down versus bottom-up monitoring in community-based forestry: Experimental evidence in support of third-party oversight.

Francisco Alpizar

Evidence of the impact of community-based forest management (CBFM) on conservation outcomes is mixed and conflicting. Local governance is a key moderating factor, but what constitutes good governance is still up for debate. Desirable institutional features typically arise endogenously, which complicates the analysis of causal effects. We use an experimental design to analyze the impact of alternative monitoring regimes on environmental outcomes of CBFM in Ethiopia, distinguishing between bottom-up and top-down monitoring to improve the accountability of local leaders. Enhanced bottom-up monitoring by community members does not affect forest outcomes, but top-down monitoring promotes forest conservation—regardless of whether it is combined with a reward for the best leaders or punishment for the worst ones. We also identify a mechanism linking top-down monitoring to conservation: Leaders work harder to protect the forest, which “crowds in” effort by community members. Communities struggle to hold their own leaders accountable, and benefit from third party oversight.

Tree planting programs and its Spillover effects on household trees planting for fuelwood: The evidence from forest-dependent households in Tanzania, East Africa.

Yusuph John Kulindwa (Moshi Cooperative University)

Spillover effects from tree-planting programs for fuelwood on forest-dependent households have crucial impacts on the restoration of deforested forests due to the high demand for fuelwood in developing countries. However, few studies have focused on examining the spillover effects of fuelwood tree planting programs on household tree planting for fuelwood. This study aims to identify

determinants of households' decision to plant trees and the type of tree species households' plant for fuelwood. Employing the Propensity Score Matching and surveyed data, we found a positive and significant impact of TPF programs on types of species and the numbers of trees planted for fuelwood. We also found a positive and significant association between TPF spillover effects from non-participants and farm size, tree species, off-farm income, income, and household wealth. Although, we found a high chance of planting more trees by TPF participants compared to TPF non-participants. The limited freedom to harvest and transport tree products to markets and the purpose of the tree planting variables were the main reasons for the spillover effect. The result suggests that non-prohibitive policies that empower households and give them the right to trade in a favorable environment without transport and trade tariffs are likely to affect spillover effects on tree planting for fuelwood. The results suggest a positive influence on tree planting for fuelwood even in non-participants of TPF in villages with active programs.

Effect of Temperature and Precipitation on Rain-Fed and Irrigated Farming Households in Vietnam.

Kiet Nguyen-Tuan (Can Tho University)

The article provides new evidence of the impact of temperature and precipitation on the agricultural land of farmers in Vietnam for the period 2004 - 2016. The results show that the impact of temperature and precipitation on the agricultural land varies between the wet and dry seasons as well as across geographical regions (North, Central, South). In particular, for the rainwater farming system, rainfall in the dry season is non-linearly (Ω) correlated with the revenue, but rainfall in the rainy season has no effect, dry season temperature and rainy season temperature have, respectively, Ω -shaped and U-shaped relationship with the revenue. For irrigated farming systems, the temperature in the dry season and rainy season have a U-shaped association with the profit. The findings show that the irrigated farming systems have been effective in the long term in the face of climate change. Therefore, in preparation for adaptation to climate change, the Vietnamese agricultural sector needs a complete irrigation system at both farm and regional levels.

Parallel sessions 2A | Electrification and Firms (SETI)

Energy and Non-Energy Input Substitution in Kenya's Manufacturing Sector.

Kenneth Kigundu Macharia (University of Nairobi)

Substitution of non-energy inputs for energy is viewed as one of the key approaches to reduce energy consumption. Debate on the direction and extent of substitution has been wide but with little consensus. This research applies the translog cost function at the sub-sector and firm size levels to analyze energy and non-energy input substitution possibilities in Kenya's manufacturing sector. The iterated seemingly unrelated regression technique is applied on a micro panel drawn from the World Bank Enterprise Survey and Energy and Petroleum Regulatory Authority for the years 2007, 2013 and 2018. The sub-sectors of concern are: chemicals, pharmaceuticals and plastics, food, textile and garments and paper and other manufacturing sub-sector while the firm sizes of interest are: small, medium and large. The findings reveal that in general, energy is the highest price-sensitive input across sub-sectors and firm sizes. The Morishima elasticities of substitution reveal that capital and

labour are substitutes for energy across all sub-sectors and firm sizes. Substitutability of capital for energy increases with firm size. However, no consistent pattern is found in the substitution of labour for energy. Findings suggest that energy price policies could be important in reducing energy use and boosting capital and labour intensiveness.

Necessity is the mother of Inventions: Electricity Outages and Firm Innovations in Sub-Saharan Africa

Amin Karimu (University of Cape Town)

A key driver of the productivity gap between developed and developing countries is the differences in the level of innovation. In this paper, we examine whether the low quality of infrastructure, particularly electricity, in Sub-Saharan Africa (SSA) inhibits or spurs innovation among firms in the region. Using recent data from the World Bank Enterprise and Innovation Follow-up Surveys, we apply the instrumental variable approach to estimate the impact of electricity outages on firms' decision to innovate and to invest into R&D. Findings from the paper reveal that exposure to intense electricity outages induce firms to innovate (product and process) as well as increase decision to investment into R&D. There is however, no impact on patent applications by firms. We interpret these results as coping strategies by firms to mitigate the negative impact of outages on their productivity and survival. Moreover, lack of finance constrained firm's ability to innovate.

Productive Electricity Use in the Non-farm Enterprises in Ghana

Isaac Kwamena Nunoo (University of Cape Town)

Energy inputs such as electricity and fuel are essential drivers of enterprise development. The research employs the Ghana Living Standard Survey (GLSS7) data to examine the importance of electricity usage on household enterprise income. This study further shows the relevance of fuel expenditure and other firm characteristics in the enterprise production process. The results obtained from the Least Square (LS) and Instrumental Variable (IV) showed positive effects of electricity and fuel expenditure on enterprise performance. The results revealed fuel energy to be more beneficial compared to electricity. Sub-sample and heterogeneity estimates favoured electricity as the key driver for manufacturing, urban and women-owned enterprises. Robustness checks by the Lewbel IV method revealed similar findings to the standard IV results. Our results have significant policy relevance advancing the need for government electricity for all programs to be enhanced but targeted if the goal is to facilitate household welfare through productive use of electricity and again should as well promote fuel supply to improve household enterprise income in Ghana.

Evaluating the impact of access to electricity on profits of non-farm enterprises beyond connections

Solomon Aboagye (University of Cape Town)

Access to electricity is considered a vital catalyst towards economic growth, poverty alleviation, and provides crucial support for the achievement of many human development goals. Yet, Nigeria has one of the lowest rates of net electricity generation per capita worldwide, with about 44% of its population lacking access to electricity. The situation could be regarded worse in the North West zone of Nigeria, the sample area for the study, as the substantial share of the country's population without access to electricity are located in the zone. It must be disclosed that the recent decades have witnessed some electrification interventions in the country. There are also notable power sector reforms currently underway including major electrification projects. However, many electrification

projects have tended to focus disproportionately on connection. The extent to which access to electricity impact on profits beyond connection is scarcely examined. In attempt to investigate the potential causal effect of access to electricity on the profits of household's non-farm enterprises as a latent poverty reduction pathway, the study therefore shifts emphasis away from connections to actual usage and its attributes which better capture the scope of electricity access. Utilizing the generalized propensity score and inverse probability weighting of treatment methods of matching and estimation, the study found that on the basis of connections access to electricity has limited positive causal effect on the profits of household's non-farm enterprises. However, moving beyond connections and focusing on the attributes of electricity among actual users of electricity the study established a strong positive causal impact of access to electricity on profits even though in most instances, the impact tends to be principally dependent on where an enterprise lies along the profit distribution. To a larger extent the results further demonstrates that access to electricity is not pro-poor as the greater incidence of gains tends to accrue to more profitable enterprises with less profitable enterprises either enjoying nothing or suffering losses in some instances.

Parallel sessions 2C | Fisheries and Marine resources (BlueRforD)

Natural resource management and nutrition outcomes: a quasi-experimental evaluation of fisheries decentralisation in Laos.

Benjamin Chipperfield (Monash University)

We estimate the impact of a national fisheries decentralisation policy on the nutritional status of children in Lao PDR. Using a double robust estimator that combines propensity score and OLS regression, our results show that the causal impacts of this policy are heterogeneous and driven by nutritional gains among younger children living in villages that rely more heavily on natural resources, with girls benefiting more than boys. We identify higher consumption of fish as one mechanism that explains these gains. This change is not accompanied by greater allocation of time to fishing or investment in fishing assets, allaying fears that decentralisation of fisheries management may lead to over-exploitation of local resources. Our findings show that nationally implemented decentralised natural resources management policies can improve welfare.

A Fishing Household Production Model: Understanding Livelihoods of Small-Scale Fishing Communities in Marine Protected Areas.

Jorge Maldonado (University of Los Andes)

Small-scale fishing (SSF) communities typically exhibit high poverty, vulnerability, and a marked dependence on fishing resources in developing countries. Fishing plays a central role as a source of income and food security. Nevertheless, there is no sufficient information about these relationships and their dynamics. This study contributes to understanding SSF livelihoods and identifying how key economic parameters affect fishing household decisions. We develop a fishing household production model, where households make simultaneous decisions about consumption and production, and includes the fact that fishing comes from a common-pool resource. The theoretical model is validated with information from the village of *Barú* (Colombian Caribbean). The calibrated model allows simulating the short and long-run effects of different policies on the SSF management and the fishing

household's wellbeing. Our findings offer insights into the design of policies aimed at both the sustainable use of marine resources and the socio-economic development of these communities.

Analysis of the Cost and Return of Catfish Aquaculture under Plastic Tank, Concrete and Earthen Pond Technologies in Enugu State

Chukwuemeka Chiebonam Onyia (University of Nigeria)

The aim of this study was to analyze cost and return of catfish aquaculture under plastic tank, concrete and earthen pond technologies in Enugu state, Nigeria. The objectives of the study were to estimate the costs and returns of the different pond technologies, estimating the socio-economic attributes that influence the net returns of the fish farmers, compare the costs and returns among the different pond technologies, and ascertain the constraints to sustainable environmental management practices by the respondents. Analysis of data was done using descriptive statistics such as frequency, percentages, mean, and standard deviation; gross margin, multiple regression model and factor analysis. Seventy-five (75) respondents were sampled from the study area using a combination of multistage and proportionate random sampling techniques. Data used for the research was obtained with the aid of well-structured questionnaire. Use of a combination of earthen and concrete pond technologies was found to have the highest return on investment of 10.89 and a combination of earthen and concrete ponds gave highest gross margin of ₦ 3,819,035. The constraints to increased returns from catfish farming were grouped as management, cost of inputs, and water supply financial problems. Government and non-governmental organizations should educate catfish farmers on appropriate technologies in catfish production such as the use earthen and concrete ponds.

Context, Welfare Sensitivity, and Positional Preferences Among Fisherfolks in a Developing Country.

Wisdom Akpalu (GIMPA)

It is well-established in the empirical literature that people care about relative status or positionality, hence any policy that makes someone better off imposes a negative externality on his/her peers. However, the effectiveness of public policy aimed at mitigating positional externality hinges on the measurement of relative concerns, which are individual and context-specific requiring empirical analysis. This study investigates positional concerns among over-exploited natural resource-dependent communities with defined gender roles in a developing country, and the specific role of welfare sensitivity in moderating relative concerns. We found that compared to the women, the men were more positional, on average, and relative concerns are context-dependent for both genders. Next, the men had lower welfare sensitivity than the women, and for both groups, and a specific context, being welfare sensitive over a narrow (broader) income range correlates with a relatively higher (lower) degree of positionality

Parallel sessions 2D | Water Efficiency and Demand (NatCap)

Out of sight out of mind: Household perceptions of “fair” water prices in Nairobi, Kenya.

David Fuente (University of South Carolina)

Providing piped water and sewer services is extremely capital intensive, yet most of this infrastructure is buried, hidden from citizens and ratepayers. Roman emperors built elaborate public fountains to increase the salience of massive infrastructure investments to the public, yet modern households give scarce thought to the network that serves them. At the same time, tariffs are often too low to recover operations and maintenance costs, let alone capital replacement and system expansion. We use a field experiment to investigate whether providing 353 households in Nairobi, Kenya with information about the water infrastructure that serves them changes their perceptions of water and sewer tariffs. Compared to a control group, we find that providing households verbal and visual information (in person) about the capital intensity of water service delivery in Nairobi increased their perceptions of “fair” water bills by 15% to 24% above the control mean of 404 KSH/mo.

Residential Consumers’ Search for Water Bill Information: The Role of Communication Channel and Perceptions on Water Use.

Helena Cardenas (EfD Costa Rica)

Water and electricity utility companies are increasingly looking for ways to communicate and convey information to customers, including issues of scarcity and rationings, resource-saving tips, billing information, among others. Evaluating how residential customers use bill information is relevant to understand biases in consumer behavior, how to improve utility-costumers communication channels, and how to account for heterogeneity in the use of information. This research builds upon previous studies and from attention theory to evaluate the determinants of residential customers’ attention to bill information. Survey data from 850 households is used with a probability model for this purpose. The study takes advantage of a digitalization program of water bills in the city of San Jose, Costa Rica, to evaluate how residential consumers adapted and how they reacted to their bill consultation. Results show that bill consultation depend on several factors: satisfaction and accessibility to the communication channel is an entry point. After this step, there are other key factors, including customers’ expectations on costs and fairness, baseline knowledge of the information provided in the bill, and type of user in relation to how much they consume and how much they spend on water. These variables are better predictors of bill consultation than any socio-demographic variable. In addition, adaptation to new communication channels might be related to those same factors that influence information search as well as to other factors of socio-demographic characteristics, such age, gender, education and income.

Water use in the Kenyan commercial Sector: Coping strategies to deal with unreliability.

Jackson Otieno (Athi Water)

Commercial businesses are vulnerable to shortages or reliability in water supply, particularly those for whom water is a significant input and water prices and quality are likely to be salient. Depending on their ability to substitute to alternative water sources, reliance on unreliable municipal water may result into higher water input costs for firms, which may reduce profits or be partially or fully passed to consumers. In this study we surveyed 400 commercial firms in Nairobi, Kenya that had piped connections to the municipal network to examine their water-related coping mechanisms and related

costs . Only twenty percent receive water for seven days per week, ; 48 percent receive water between one to four days in a week. We find that one quarter of firms buy water was neighbouring piped water sources share water with their neighbours, and nearly all (94 percent) rely on water storage facilities. Six percent of the surveyed firms invested in their own private boreholes, and one quarter rely on water vendors. We valued these costs using information reported by respondents, finding that the average monthly coping costs are approximately US\$300, which are in addition to the \$130 paid monthly to the municipal provider by the average firm. These coping costs were driven by the cost for vended water (\$118.5). The levelized cost of water storage equipment was \$11. We estimate that coping costs are greater than 130 percent of the monthly cost of piped water network in the case where businesses depend on boreholes. A multivariate analysis of total coping costs suggests that the age of business, connection to the piped network, and number of toilet facilities within the premise significantly drive the coping costs.

Determinants of drinking Water source in Nigeria: Evidence from the 2018/2019 Living Standard Survey data

Ebele Amaechina (University of Nigeria)

Water is fundamental to human wellbeing and development. Although water has been recognized as a basic human right, yet access to water globally has not been universally achieved. Infrastructure limitations, poor funding and inadequate policies are some factors that contribute to inability to adequately provide water. Many households source their water by themselves, bearing huge costs and risks in the process. While the sustainable development goal on water advocates for access to safe and affordable drinking water for all by 2030, many nations including Nigeria are not meeting targets. An understanding of socio-economic factors that determine household water source is essential for effective policy making in scaling up access to safe water. Using the new water ladder developed by the Joint Monitoring Program, and nationally collected data, a multinomial logit model was applied to ascertain factors that determine choice of water. The preliminary results show that being in rural or urban sector were major factor determining source of water. Also household size, monthly income and gender were significant. About 53% sourced water from sources that although improved, took them more than 30 minutes to get. More than half of the sampled households paid more than a third of the national minimum wage. Also 23% in urban areas spent more than 40 hours a week fetching water. The paper recommends greater measures to increase water access in Nigeria.

Parallel sessions 2E | EPfD and SETI

Emissions Trading with Consignment Auctioning: A Lab-in-the-Field Experiment.

Zhi Li (Xiamen University)

With a unique opportunity of recruiting hundreds of emissions trading system (ETS) participants in a series of lab-in-the-field experiments, we compare a revenue-neutral consignment auction (CA) with free allocation (grandfathering, GF hereafter) and a uniform price auction (UPA) as alternative permit allocation designs. In our setup, firms first receive

their permits for free. Then, under the two auction mechanisms, they either need to buy back a share of the permits with auction revenues returned to the firms in the primary market (CA) or not returned (UPA), followed by a spot (secondary) market for all mechanisms with the continuous double auction. We find that enforced permit transactions in the primary market induce a higher price, facilitating price discovery with lower volatility and more effective trading in the spot market. Both auctions reduce non-compliance compared with GF, because the auctions reduce both permit hoarding and risky over-selling in the spot market. Both CA and UPA help smaller polluting firms lower their profit risks. CA also helps larger, cleaner firms increase profits. Our results provide insights on permit allocation designs when introducing an ETS, especially for developing countries that are pondering the balance between market efficiency and firms' cost burden.

Distorted Environmental Regulation Enforcement: The Unintended Consequence of Enhanced Pollution Monitoring.

Fan Xia (Nanjing University)

Selective environmental regulation is a potential strategy for local bureaucrats to achieve environmental goals under the target-based performance evaluation system, especially when the performance is evaluated based on incomplete monitoring of environmental quality. We examine the local strategic responses to the enhanced ambient air quality monitoring network in China. Using rich and high-frequency emission data at firm level, we find that firms close to ambient monitoring stations have experienced significantly larger reductions in the concentration of NO_x emission than firms located farther away, since the monitoring stations were put into use in 2015. This provides evidence that local governments are incentivized to target pollution reductions in areas close to monitoring stations to get better air quality readings, leading to a misallocation of regulation enforcement resources. In the first year the monitoring stations were in operation, the discrepancy of emission between firms near monitoring stations and firms far away gets greater on more polluted days. In the following years of 2016 and 2017, the general difference in emission between the two groups become even more substantial than in 2015. But the difference, though consistently significant, is found to narrow down if the day is more polluted. This finding suggests that in response to heavy air pollution, all polluting firms tend to be strictly regulated by local governments to lower the pollution level since the year of 2016, the beginning year of China's 13th five-year plan. We also find that the distortion in environmental enforcement is more significant in cities with slower economic growth.

The Two Energy Transitions and the Hotelling Rule: Exhausting a Resource while Building, Maintaining and Scrapping a Dedicated Capital.

Manh-Hung Nguyen (Toulouse School of Economics)

It is well known that the price and consumption paths of most non renewable resources, including the fossil primary energies, do not follow the paths predicted by the standard Hotelling rule. We develop a model in which a dedicated capital together with the fossil fuel are both required to produce useful energy. Starting from a state of the economy in which the fossil fuel is not yet exploited, we

characterize the optimal path of the double transition: The first transition from the initial renewable energy regime to a mixed or full fossil fuel regime and later the second transition from the fossil fuel regime back to a renewable energy regime when the available stock of the fossil fuel becomes more and more rare. We show that, absent any technical progress, the useful energy price must first decrease, next be constant during the phase of maximum expansion of the fossil fuel energy consumption before entering the phase of decreasing use of the fossil energy. Only this third phase of decreasing fossil fuel consumption looks like a standard Hotelling path.

Natural resource abundance, environmental sustainability, and policy and institutions for environmental sustainability in sub-Saharan Africa.

Eric Fosu Oteng-Abayie (Kwame Nkrumah University of Science and Technology)

This research examines the effect of natural resource abundance on environmental sustainability while considering the mediation role of policies and institutions for environmental sustainability (PIES). We used 29 sub-Saharan African countries, further disaggregated into 11 resource-rich and 18 resource-poor countries over the period 2005-2017. Utilizing the System-Generalized Method of Moments (system-GMM) and Panel-Corrected Standard Error (PCSE), we find that natural resource abundance improves environmental sustainability. We further find that resource-rich countries deteriorate environmental sustainability more than resource-poor economies in SSA. Lastly, we find PIES improve environmental quality or sustainability. We thus conclude that natural resource abundance in SSA enhances environmental sustainability if PIES are strengthened. We call for stringent and appropriate environmental policies and measures towards environmental sustainability.

Parallel sessions 3A | Cooking Fuel Choices & Development Outcomes (SETI)

Collective model of firewood consumption, production and labour supply: Evidence from Malawi.

Raavi Aggarwal (MCC-Berlin)

We develop a collective household model to analyse the non-separable link between firewood consumption, fuel collection, and individuals' labour supply in Malawi. Modelling firewood as a home produced good, we analyse the role of female bargaining power within the house-hold, in determining optimal firewood consumption. We posit labour supply as a potential channel for firewood collection and consumption. Drawing on household and individual-level panel data for 2010-2020, we find a positive effect of fossil fuel prices on firewood consumption, with significant increases in individuals' labour supply for informal work. Greater parity in decision-making between men and women is associated with a reduced likelihood of firewood use, in a context of rising energy prices. The results highlight the labour market effects of energy price increases, and the importance of intra-household dynamics in determining biomass consumption, thus broadening the debate on sustainable development policies in sub-Saharan Africa.

Energy Choice and Consumption in Ugandan Households.

Susan Namirembe Kavuma (Makerere University)

In Uganda, over 80 percent of the people rely on firewood and charcoal for cooking resulting in a tremendous burden of disease from exposure to indoor air pollution. Additionally, fuel wood extraction and collection contribute to deforestation and climate change and places a huge burden on time, particularly for women and children. The overall objective of this study was to identify various factors that determine household fuel choice in Uganda. A panel multinomial logit model was used to model household cooking energy choice in Uganda using a nationally representative four wave rich panel dataset (2009/10-2015/16). Results show that per adult equivalent household expenditure, price of electricity, residing in urban areas, household size, female-headed households and education levels of household head play an important role in determining fuel choice in Uganda. The results also show that households tend to switch to multiple fuels usage as their income increase instead of completely shifting from traditional fuels to modern energy sources. Policy makers could target the identified variables to encourage transition to modern energy sources that will have less adverse environmental, social, and health impacts.

Fuelwood use and household dietary patterns in Uganda.

Florence Lwiza (Makerere University)

Cooking fuel is a basic requirement for households, and it also contributes greatly to the achievement of development objectives of food security, environmental sustainability and rural development. Despite efforts to promote the use of clean fuels, fuelwood remains the dominant energy source for cooking in Uganda and several Sub-Saharan countries. The increased demand for fuelwood has led to a reduction in tree population and forest cover making it less accessible to households. In this research, we research explore the relationship between fuelwood access and household food consumption. The data used for estimation was obtained from the Uganda National Household Survey data for 2018 and 2019. The results show that an increase in the distance travelled to access fuelwood reduced the likelihood of a household having an acceptable food consumption score and the results were significant for distances greater than 5 kilometres and for the households categorized as poor. The findings suggest that access to cooking fuel is an important dimension of food security and therefore efforts should be made to enable households access to affordable fuels and fuel-saving technologies.

Parallel sessions 3B | Forest & Health Nexus, Forest Management

Story behind a success of community forest management in Nepal

Subhrendu Pattanayak (Duke University)

Over the past 25 years, the government of Nepal has implemented one of the most ambitious and comprehensive program of decentralization of forest management in the world. This major institutional change resulted in the transfer of the management of almost 50% of the forests Nepal to

no less than 18,000 Community Forest User Groups (CFUGs). More than one third of the Nepalese population is directly involved in the management of forests, a key natural resource in everyday life, which provide not only firewood or timber, but also fodder for livestock, fruits, nuts and medicinal plants. Thus, in the Hills and Mountains, about 45% of rural households report their first source of firewood as being the community forest.

Forest degradation and health. Evidence from Ethiopia and Uganda

Rebecca Afua Klege (Henry J Austin Health Center)

Ecosystem conservation—a major climate change mitigation strategy can be associated with several health benefits for local communities despite the often skewed economic cost narrative. Growing efforts to understand the health effects of conservation/deterioration of the eco-system is rising (Bauch et al., 2015; Myers et al., 2013; Prüss-Üstün). Specifically, the association between deforestation and malaria prevalence has been of great interest (Buhoff and Busch, 2020, Garg, 2019; MacDonald and Mordecai, 2019; Tucker et al., 2017; Myers et al., 2013; Pattanayak and Yasuoka, 2012; Keesing et al., 2010; Pongsiri et al., 2009; Pattanayak and Pfaff, 2009; Patz et al., 2000; Walsh et al., 1993) with most studies finding that deforestation is positively associated malaria risk factors (Austin, Bellinger, & Rana, 2017; Santos & Almeida, 2018; Wayant, Maldonado, de Arias, Cousino, & Goodin, 2010) or incidence (Fornace et al., 2016; Moreira Chaves, Conn, Mendoza Lopez, & Mureb Sallum, 2018; Olson, Gangnon, Silveira, & Patz, 2010). According to the human and natural system of forest cover model developed by Buhoff and Busch, 2020 in Figure 1: There are multiple channels through which deforestation relates to malaria prevalence justifying higher rates of deforestation may not always increase malaria risk factors.

Protecting Life and Lung: Protected Areas Affect Fine Particulate Matter and Respiratory Hospitalizations in the Brazilian Amazon Biome.

Katrina Mullan (University of Montana)

Emergence of the scientific field of Planetary Health in recognition of the vital link between natural ecosystems and human health (Horton and Lo 2015) raises the question of whether policies that aim to protect ecosystems may also contribute to human wellbeing through beneficial impacts on health. Numerous studies highlight general potential or observed health consequences of ecosystem change (e.g. Keesing et al. 2010, Norris 2004) and specific impacts of loss of tropical forests on exposure to infectious diseases, dietary diversity, and air and water quality (e.g. Galway et al. 2018, Ferraro et al. 2012, Garg 2019, Pattanayak and Wendland 2007). However, this literature typically treats ecosystem change as exogenous. To inform conservation management actions that could mitigate the human health consequences of ecosystem loss additional evidence is needed on whether policies to conserve ecosystems can deliver health benefits in practice (Ferraro et al. 2015).

Parallel sessions 3D | Research Proposals Presentations to EfD Research Committee

Author	Title
Shivani Wadehra (Indian Statistical Institute)	Impact of landfills on health
Razack Lokina (University of Dar es Salaam)	Electric Appliance Adoption and Women's Time Use in Tanzania
Wisdom Akpalu (GIMPA)	Voting Decision on Fishing Fuel Subsidy Reform in An Overexploited Fishery: The Case of Artisanal Fishery in Ghana

Parallel sessions 3E | Health and Environment

Valuing biodiversity conservation fulfilling NOAA requirements in a Mega-biodiverse Country: the case of Manu NPA in Peru

Jose Davila (ESAN Graduate School of Business)

According to NOAA, the results of economic valuation are applicable as public policy if they fulfill: Rationality and Plausibility. We carried out the valuation of biodiversity conservation in Manu, a representative NPAs in Peru, based on three representations: species, habitat and functionality (the latter rarely used). We identified sensitivity to scope at less in part of all attributes except "deforested hectares". When we add socioeconomic characteristics, we identify that gender and salary affect preferences. Our total analysis shows that "number of plants" and "functionality" better fulfill both requirements, however, we believe that there is much work to do.

The impacts of water scarcity on health outcomes: an instrumental variables approach

Bahre Gebru Kiros (SLU, Sweden)

Access to safe drinking water is a basic necessity with no real substitutes (Innes and Cory, 2001; Damania et al., 2020; Hope et al., 2020), and climate change hampers meeting the growing demand for clean water. For example, precipitation variability exacerbates water supplies to be less predictable and more volatile in a changing climate (Russ, 2020). The provision of safe drinking water remains a challenge in water stressed continents like Africa. About 300 million Africans lack basic water access which causes considerable health and economic costs (Hope et al., 2020).

Valuing health damages from polluting energies in Benin

Nassibou Bassongui (Université d'Abomey-Calavi)

This paper estimates the health damages of indoor air pollution-induced by the use of polluting energies in households in Benin. Secondary data from the Harmonized Survey on Household Living Conditions in Benin 2019 were used. Using the health production function approach, direct costs (medical expenses for treatment and preventions) and indirect costs (lost wages) were derived from

a bivariate probit model. The average monthly health damages for a representative household were estimated at 31% of households' monthly consumption expenditures in Benin. These damages were equivalent to 8% of Benin's real gross domestic product. Our results provide a guide to policymakers in implementing interventions for households' energy transition from polluting energies to clean energies and the use of modern cooking technologies. These results could be used as a measure of the willingness to pay or receive from households to switch from polluting energies to clean energy sources.

Parallel sessions 4A | Pollution and Health (SETI)

Household Exposure to the Risk of Cooking Smoke: Evidence from the Sub-Saharan Africa

Anthony Amoah (University of Environment and Sustainable Development)

In sub-Saharan Africa, the place and choice of fuel for cooking have detrimental effects on health due to excessive exposure to smoke. This study explores household-level exposure to cooking smoke risk and its associated determinants. Using a quantitative approach and a regionally representative sample, we pooled the most recent waves of the Demographic Health Survey data set yielding 442,339 households from 33 countries in sub-Saharan Africa. In this study, we first construct disaggregated measures of smoke exposure risk, determine the extent of households' vulnerability to this risk, and investigate the associated determinants. We find evidence that 67% of households cook indoors while 86% use smoke-producing fuels for cooking which implies a high level of vulnerability to smoke exposure. As expected, 53% have a higher risk of smoke exposure, 33% are vulnerable to medium smoke exposure risk, about 14% are at risk of low smoke exposure, and approximately 1% experience very low risk to smoke exposure. We also find factors such as household wealth, size, educational level, and age of household head as the key determinants of the disaggregated smoke exposure risk measures. For robustness of results, we grouped households by their rural-urban geographical classifications, and still establish evidence of the determinants. Again, the smoke exposure risk of income groups as defined by the World Bank are examined in line with standard theories. Further, the study finds that poor households are more likely to be exposed to higher smoke exposure risk than rich households. We recommend the promotion, subsidization, and enforcement of low smoking fuels for households.

Are there synergies in sustainable heating from cleaner stoves and retrofitted houses? Evidence from air pollution reduction policies in Chile

Adolfo Uribe (University of Talca)

We evaluate the interaction between two subsidies-based energy policies in southern Chile: i) the stove replacement of inefficient wood-fired heating stoves with more efficient pellet stoves, and ii) the thermal insulation program to improve the energy efficiency in dwellings. Combining electronic monitors along with household surveys, we estimate the effects on fuel expenditures, indoor temperatures, and indoor air quality (PM2.5). Our research has produced several new results. First, we find that the stove replacement program reduces indoor PM2.5; this reduction increases by combining a pellet stove and an improvement in thermal insulation. Second, households with firewood stoves and with high insulation face on average the highest values of indoor PM2.5. Third, households having better insulation reach higher indoor temperatures regardless of the stove technology, but this additional thermal comfort is even higher combining a pellet stove with better insulation. Fourth, consistent with earlier results, households who adopt the pellet

technology face a higher cost of fuel compared with firewood stove technology; however, this increase in cost is smaller combining pellet stove with the better insulation. This study provides new evidence about the benefits of implementing energy transition policies.

Eliciting preferences to reduce health risk related to air pollution in choice experiments – the effect from survey mode

Henrik Andersson (Toulouse School of Economics)

Ambient air pollution is a major concern. One reason is its negative impact on human health, leading to not only several illnesses but also premature deaths. Governments, therefore, implement policies, or invest in technologies, with the purpose to reduce either air pollution, or negative effects from air pollution, or both. Since these policies and investments come at a cost, it is of importance to relate their costs to their benefits. This requires, though, that costs and benefits are measured in a common metric. Usually, the common metric is money, which means that a good like health that does not have a market price needs to be valued with methods developed to value “non-marketed goods”. There exist, broadly, two approaches to value non-marketed goods. One approach is to use decisions made by individuals in a market, for instance examining the correlation between property prices and air pollution levels. The other approach instead rely on individuals’ decisions in hypothetical choice situations. The former approach is usually referred to as revealed preferences, whereas the latter is referred to as stated preferences (SP). In this study, we employ an SP technique with the purpose to elicit preferences to reduce the risk of being ill or die from air pollution. This study aims to examine whether preferences to reduce the risk of being ill or die from air pollution depend on the elicitation mode. The SP study was conducted in Beijing and split into two subsamples; one running the survey online using a web panel, and one being conducted face to face (f2f). The main objectives are twofold: (1) to compare how survey mode may influence sample demographics, and whether there is any effect from the survey mode under what air-pollution levels responses are obtained, and (2) to examine whether the survey mode affects the estimated monetary values. Regarding the former objective and the effect from survey mode on under what conditions responses are obtained, it is of high relevance since it may be a driving factor between differences in estimates between the modes.

Does Traffic Congestion pose Health Hazards? Evidence from a Highly Congested and Polluted City

Kanishka Kacker (Indian Statistical Institute)

Traffic congestion imposes significant costs on society: longer commutes waste time as people are forced to spend their hours on the road. Engines idle for longer at major road intersections with adverse effects on air-pollution and human health (Currie and Walker 2011; Knittel et al 2016; Barth and Boriboonsomsin 2008). According to the World Health Organization, 9 of the top 10 most polluted cities in 2016 are in India.¹ Three of the top 10 most congested cities in the world are also in India – Hyderabad, Delhi and Mumbai (Numbeo Traffic Index 2019). Private and public forms of transport contribute about 10% to 12% of the emissions of nitrogen oxides and non-methane volatile organic compounds in 2015 in India (Venkatraman et al 2018). At the same time, private ownership of cars in India is projected to increase: more than 85% of respondents in four major metropolitan Indian cities – Bangalore, Delhi, Hyderabad and Mumbai - plan to buy a car in the next five years (Boston Consulting Group 2018).

Yet, there is little rigorous analysis of the effects of traffic congestion in developing countries such as India. Indian cities are not just congested and polluted they are also densely populated implying exposure to pollution is also amongst the highest in the world. Health costs from pollution exposure are thus large but it is unclear how much can be attributed to vehicular congestion. Indeed, recent epidemiological research indicates that the mortality-exposure relationship appears nonlinear and thus flatter at high levels of pollution (Pope et al 2011, Burnett et al 2018): mild reductions in pollution at high-pollution levels are thus unlikely to bring about substantial health gains.

Parallel sessions 4B | Public Goods and Common Resources

Spatiotemporal analysis of technical efficiency in the provision of local public goods: The case of Chilean mining municipalities

Cristobal Vasquez-Quezada (University of Concepcion)

Countries with intensive mineral extraction generate resource windfalls for municipalities to improve population's welfare in mining areas. Nevertheless, this process may be inefficient due to negative incentives presented in their administration, moving away from the actual objective of these resources. This study analyzes the level of technical efficiency over the provision of public goods in Chilean municipalities, namely public education and well-being from a spatiotemporal approach. To study technical efficiency, we obtained information from the National System of Municipal Information and the National Socioeconomic Characterization Survey, between the years 2008-2020 for 342 Chilean municipalities. We use a Stochastic Frontier Analysis in a spatial panel context to control for heteroskedasticity and endogeneity derived by spatial autocorrelation. We rank Chilean municipalities by technical efficiency over the provision of public goods and we study their persistence in space and time. We use two exogenous rules, namely mining municipalities and a classification of municipalities according to their capacity of provision. We compare similar localities and analyze the effects of resource windfalls over efficiency. The results show that technical efficiency is lower in mining areas with high persistence over the period under study. This generates evidence to redesign the compensation mechanism derived from mining industry.

Coordinating on good and bad outcomes in threshold public goods games – evidence from a field experiment in Cambodia

Andries Richter (Wageningen University)

The tendency to cooperate in social dilemma situations strongly depends on how the decision is framed. In particular, cooperation levels are higher in decisions that involve doing something good to others, rather than avoid doing harm. However, this insight mostly comes from linear public goods games carried out as lab experiments. Here, we conduct a threshold public goods game – framed as a public good or public bad – that requires players to coordinate on a contribution threshold. The experiment is carried out as an artefactual field experiment in rural Cambodia with users who frequently cooperate and coordinate on water use, water infrastructure, and fishing, which are activities that link to the mechanisms of the game. We find that the level of cooperation and group success in reaching the threshold are higher in a positive than a negative frame. We find the role of beliefs to be salient, as players hold more optimistic beliefs about contributions of others in the negative frame. Generally, contributions exceed the best-response, but are not sufficient to

close the gap between the too optimistic beliefs and actual contributions in the negative frame. Hence, contributions and group success are lower in the public bad game.

The role of the resource windfalls in welfare from the spatial economy

Mauricio Oyarzo (University of Concepcion)

We investigate how the municipal distribution of mining-induced windfalls affects the welfare of local communities and aggregate outcomes in extractive spatial economies. We study this question using a quantitative spatial economic model (QSEM) that incorporates mining windfalls and environmental externalities applied to the Chilean case. Our results will provide a novel explanation for studying the poor performance of mining windfall to compensate for extractive local economies.

Parallel sessions 4C | Impacts of Weather Variability

The impact of temperature and pollution on worker absenteeism in the Indian manufacturing sector.

Ridhima Gupta (South Asian University)

We use regression analysis on 3 years of daily data on 274 employees across 86 locations over the period 2016-2018 to examine the impact of wet bulb temperature and air pollution on worker absenteeism in India. We find that higher temperatures lead to more absenteeism. But, cooling technologies are adaptive and therefore workers in climate controlled environments respond to higher temperatures by going to work. We do not find a statistically significant impact of contemporaneous particulate pollution on worker absenteeism. Although we uncover significant impacts only for lagged pollution up to a week and for outdoor workers, the estimated impacts are small in magnitude. In this sample, an increase in PM_{2.5} by 10 $\mu\text{g}/\text{m}^3$ increases worker absenteeism by 9% relative to mean absenteeism.

Into the tropics: temperature, mortality and access to health care in Colombia

Juliana Helo Sarmiento (University of Los Andes)

This paper analyzes the relationship between temperature, mortality, and adaptation opportunities in a tropical country. Such countries host almost 40% of the world's population, and face inherently different environmental, demographic, and socio-economic conditions than their counterparts in temperate areas. Using de-tailed data from all Colombian municipalities, I show that even at narrow temperature ranges, which are characteristic of the tropics, anomalously hot or cold days increase mortality. An additional day with mean temperature above 27°C (80.6°F) increases mortality rates by approximately 0.24 deaths per 100,000, equivalent to 0.7% of monthly death rates. Unlike temperate locations, I find that deaths attributed to infectious diseases and respiratory illnesses drive this relationship in the hot part of the distribution, mainly affecting children aged 0-9. These findings uncover new factors and populations at risk, and imply that the average person who dies after a hot temperature shock loses approximately 30 years of life. I also provide evidence that access to health care and quality of services could serve as a mediating factor between temperature and mortality.

Extreme weather events and pro-environmental behavior: Evidence from a climate change vulnerable country

Alejandro Lopez Feldman (Gothenburg University)

Experiencing an extreme weather event and its consequences might make the risks associated with climate change more tangible, easier to evaluate, and more salient. Consequently, those experiences might translate into the adoption of pro-environmental behaviors. Understanding this relationship is fundamental for the successful design of policies aimed towards promoting the adoption of climate change adaptation and mitigation measures. This work contributes to the literature by showing that experiencing an extreme weather event can in fact increase the willingness to take pro-environmental actions. The prevailing available evidence is for developed countries. Our empirical analysis is based on a nationally representative sample of households from Mexico, a developing country that is highly vulnerable to the effects of extreme weather events.

Parallel sessions 4D | Tourism and Conservation (NatCap)

Does conservation farming on boost climate resilience? The case of smallholder farmers in Zambia

Obrian Ndhlovu (University of Cape Town)

This paper employs an econometric approach to investigate the effectiveness of the adoption of conservation farming on mitigating the negative impacts of climate hazards on crop yields and resilience to climate variability. The paper combines a two-wave nationally representative rural agriculture livelihood survey (RALS) data and a high resolution satellite rainfall data, which allows the measurement of the impact of conservation farming at crop-plot level. From the satellite rainfall data, the paper obtains a measure of precipitation extreme at household level, using an objectively measured rainfall shock. The paper finds that the adoption of conservation farming has a positive impact on crop yield, hence contributing to increased yield especially in periods of precipitation deficits. However, when there is sufficient rainfall, the adoption of conservation farming may actually be detrimental to crop yield. In addition, the results show that the adoption of conservation farming is also helpful in preventing weather induced crop failure. The paper finds significant evidence that crops cultivated using conservation farming are more resilient to weather fluctuations, and able to survive harsh weather conditions compared to crops cultivated using conventional methods.

Tourism growth and environmental sustainability: trade-off or convergence?

Beatrice Simo-Kengne (University of Johannesburg)

Besides its socioeconomic benefits, tourism has been documented as one of the leading sectors with deleterious effects on the environment. This study investigates the relationship between tourism dynamics and environmental sustainability using biennial data for 148 countries over the period from 2006 to 2016. The first step develops a tourism growth index that encompasses various dimensions of tourism development and various panel cointegration techniques are then employed to characterize the dynamic association between environment sustainability and tourism growth. Empirical results reveal that tourism growth and environmental sustainability are indeed convergent not only for the full sample countries but also across geographical regions and socioeconomic

clusters. In addition, a negative impact of tourism growth on the environmental welfare is evidenced in the long-term; suggesting a trade-off between tourism activities and environment performance for the full sample over the past decade. At the regional level, similar finding is reported for Asia and Europe against a positive environmental impact for America and an inconclusive output for Africa. The observed difference might be attributed to the heterogeneity in the unsustainability level of regional tourism development with limited exposure for Africa and America. Interestingly, the convergence of tourism growth and environment wellbeing tend to exhibit varied speeds of adjustment across sample panels. The observed differences could be attributed to the country-level switching propensity from environment-harmful tourism practices as well as their socioeconomic characteristics. Consequently, policies geared towards minimizing the adverse environmental effects should be integrated with countries tourism management policies to enable the transition to sustainable tourism sector development. Thus, targeting nature tourism becomes a critical approach to tourism development rather than setting traditional goals such as number of visitors, income stream and employment.

Protected Area Expansions in Low-Income Countries: Economics that reflects the setting can improve conservation outcomes.

Jo Albers (University of Wyoming)

This paper identifies the Dasgupta Review's key points about the role of protected areas (PAs) in conserving nature. Using these factors as a foundation, this paper explores how economists can conduct analyses that improve PA decisions and promote both biodiversity conservation and ecosystem service provision. People's interactions with PAs should be considered when making design, management, and restrictions decisions about PAs because those interactions are critical to determining the threats to biodiversity within PAs and the benefits produced by PAs. More effective PAs arise from making joint decisions about PA design, management, permissible human PA uses, and tourism infrastructure because those decisions influence people's actions – including biodiversity-threatening activities – within PAs.

Valuing Urban Green Spaces and Nature Restoration in a Developing Country: a case of Recreation Parks in Nairobi

Michael Ndwiga (University of Nairobi)

Given the benefits that urban green spaces (UGS) provide to urban dwellers, it is expected that governments/city municipalities should invest in creating new and restoring the existing UGS. Surprisingly, most of the existing UGS have been depleted and neglected. This paper utilized choice experiment to estimate values of different attributes of urban green spaces and nature restoration in Nairobi, Kenya. Results from random parameter logit model with correlations and fixed alternative specific constant shows that residents were willing to pay between US\$35M to 84M for development of neighborhood parks, US\$334M to 476M for a new multi-use parks in each district and US\$449M to 1.2B for a new nature park in the city within a period of five years. US\$9M to 22M and 842M to 1.9B for restoration of Ngong forest and rehabilitation of Nairobi River within a period of five years respectively. These findings provide relevant and timely information that could enable Sub-Saharan Africa governments design appropriate urban policies that incorporate UGS as part of urban ecosystem.

Parallel sessions 4E | Environmental Change and Pollution

Adapting with Technology to the Impact of Heat on Learning? Evidence from Colombia

Laura Villalobos Fiatt (Salisbury University)

High temperatures hinder learning. An effective solution is to control the environment. However, technologies such as air conditioning are seldom adopted in developing countries. An alternative is to reschedule activities for when weather conditions are more favorable. In this paper, we study whether Information and Communication Technologies (ICTs) enable individual adaptation responses, for example by dissociating weather conditions from the learning time, or by increasing class productivity. Using data from Colombia, we confirm that heat affects test scores, and we show that ICTs compensate up to 15 percent of this effect.

Opportunities, Progress and Challenges of Carbon Pricing in Eastern and South African Regions

Anthony Ojonimi Onoja (University of Port Harcourt)

In this study we focus on (i) the relevance of carbon pricing and markets to regional economic growths, climate change mitigation especially in Sub Saharan African context. We then (ii) document progress made in the Southern and Eastern African carbon emission pricing and markets in line with Paris Agreement 2015 as well as recent achievements regarding long expected replenishment of the Green Climate Fund (GCF); (iii) provide some policy designs and pitfalls against effective carbon pricing system in Southern and Eastern Africa. The study used an in-depth review of relevant literature as its method of study. It was found that there are reasonable progress being made in the Eastern and Southern African regions to advance Carbon Pricing with magnitudes surpassing other African regions. South Africa leads in terms of implementing initiatives that will establish carbon pricing. The study found huge opportunities in carbon trading in Africa though not well harnessed. It was however noted that several initiatives on aimed at ensuring green economic growth that can be linked to carbon prices exist in the study region and they mostly include incentives including: carbon taxes, levies and taxes, establishment of trading platforms to sell carbon credits, research funding to deepen knowledge and awareness on carbon trading status among other legislative initiatives. Challenges repressing growth and development of carbon pricing in the regions include poor political will and frameworks on climate change mitigation evidenced in poor number of legislations addressing the issue; poor capacity of the policy makers and countries experts to conceptualize and implement carbon pricing policies and a general lack of financial systems and financial resources to promote climate change mitigation activities. Five relevant recommendations were made based on findings.

Institutions for Sustainable Development: Evidence on collective titling, deforestation, and development

Marcelo Goncalves / Subhrendu Pattanayak (Duke University)

In the last decades, collective property rights (CPR) became one of the primary policies used to avoid deforestation and foster development worldwide. Still, the empirical evidence connecting CPR to improved development and environmental outcomes is scarce and conflicting, requiring further investigation. To address this gap, we evaluate the impact of various programs that granted land titles to Afro-descendant communities in Brazil throughout the last two decades. Contrary to prevalent views, titling is associated with increased deforestation and pasture area (a common sign of land degradation) and reduced land dedicated to agriculture. Additionally, considering that titling programs are essentially an institutional transformation, we explore the interaction of such programs with different institutional backgrounds. We conduct heterogeneity tests to verify whether the results are sensitive to levels of tenure protection and how titling programs interact with broader political institutions. We find that titling programs would only produce the effects mentioned above when the title covers the entire communal territory, so a partial title has no effect. Also, during electoral years, titled communities experience a recovery of part of their forest cover, a reduction in the proportion of land dedicated to agriculture (cultivated land), while pasture area remains unaltered. These findings suggest that collective titling alone does not ensure sustainable development among impoverished communities. For some communities, overcoming poverty while preserving environmental goods will require more comprehensive development policies conformed to the reality of these specific social groups.

Health Effects of Air Pollution Involving Multiple Pollutants: The Impact of Co-Exposure to PM_{2.5} and O₃ on Mortality in China

Fan Xia (Nanjing University)

In recent years, China has made impressive achievements in controlling fine particulate matter (PM_{2.5}) pollution, but the ozone (O₃) pollution level is increasing year by year. However, extant research mainly focused on the health costs of single pollutant exposure dominated by PM_{2.5}; the health risks of co-exposure to PM_{2.5} and O₃ remain understudied. This study explores the causal relationship between simultaneous exposure to the two air pollutants and mortality. Based on the nationwide, daily-frequency, and county-level mortality data from Disease Surveillance Points (DSPs) during 2013-2018, we identify the effects of short-term co-exposure to PM_{2.5} and O₃ on deaths from various cardiovascular and cerebrovascular diseases, and respiratory diseases. To address the potential endogeneity issue of non-random pollution exposure, we use combinations of inversion intensity, wind direction and sunshine duration as instrument variables. Our estimation shows that if the three-day average (the current day and previous two days) PM_{2.5} concentration increases by 10 $\mu\text{g}/\text{m}^3$, the number of non-accidental deaths will rise significantly by 0.62%. Meanwhile, if the three-day average O₃ increases by 10 $\mu\text{g}/\text{m}^3$, the number of non-accidental deaths will increase significantly by 0.98%. A back-of-the-envelope analysis suggests that the reduction in PM_{2.5} level during 2013-2018 (31 $\mu\text{g}/\text{m}^3$) has led to an average decrease of 1.92% in non-accidental deaths. But during the same period, the rise in O₃ level (5.7 $\mu\text{g}/\text{m}^3$) has caused an average increase of 0.56% in non-accidental deaths, *offsetting* a considerable portion of the health benefits brought by PM_{2.5} pollution control. We further evaluate the *interactive effects* of short-term exposure to the two pollutants on the deaths of various chronic diseases, and find evidence that the higher the O₃ concentration gets, the worse the health hazard of PM_{2.5} will be. We also explore the *spatial heterogeneity* in health effects of pollutants co-exposure between northern China and southern China exhibiting different pollution patterns. The marginal health hazard of O₃ is up to 163% higher in

northern China than in southern China; while the negative impact of PM_{2.5} in southern China can get as much as 145% higher than in northern China. Our study reinforces the importance of PM_{2.5} and O₃ co-control empirically, and provides implications for region-differentiated pollution control strategies.

Parallel sessions 5A | Welfare Impact of Energy (SETI)

Evaluating the Impact of Electricity Availability on Household Socio-Economic Indicators in Zambia

Sydney Kabango Chishimba (University of Cape Town)

The International Energy Agency (IEA) estimates that around 580 million individuals in Sub-Saharan African have no access to electricity¹but entirely depend on tradition energy (IEA, 2020). The low access to electricity has contributed to limiting opportunities and increasing energy poverty among households (Blimpo et al., 2020). And trying to avert the consequences of low access to electricity among individuals/households, majority countries in sub-Saharan Africa have implemented electrification programs with the objective of improving people's livelihood so that they contribute effectively to economic development (Torero, 2015). The assumption is that once a household is connected to electricity, they will engage in various socio-economic activities at household and community level to improve their livelihood. Several studies such as Litzowet al.(2019); Lenz et al. (2017); Khandker et al.(2009, 2012); Benschet al.(2011) have evaluated the possible benefits, cost effectiveness and relevance of household electrification programs in developing countries. However, the common phenomenon of attention in most of these studies is the approach to defining electrification (access to electricity service) at household level; taken as a traditional binary approach where a household is either connected or not to available electricity technology source. This approach is deemed narrow way of understanding dynamics of electricity access as issues of quality, capacity, and availability of electricity service provided to a household matter(Bhatia and Angelou, 2015).

The Impact of Household Energy Transition on Household Welfare in Tanzania

Kevin Mutayebwa Rugaimukamu (University of Cape Town)

Household energy transitions are expected to improve household welfare indicators such as health and schooling. This paper looks at the impact of households' use of modern cooking fuels for cooking and electricity for lighting on health and schooling outcomes in Tanzania. The study employs propensity score matching techniques on two survey datasets. The results show a reduction in the incidence of respiratory diseases among children for households using modern cooking fuels, while the use of electricity for lighting was associated with improved evening study hours, examination scores and educational attainment. Moreover, electrification was found to affect household time use (encouraging more non-agricultural activities in rural areas) and reduce fertility (probably due to information access). The study provides the rationale for policies geared towards improving access to modern energy for cooking and lighting and easing the constraints towards full energy transitions by households to achieve several sustainable development goals.

Household electricity consumption inefficiency and poverty: Evidence from Ghana

Daniel K. Twerefou (University of Ghana)

Demand-side management of energy consumption using energy efficiency improvements has the potential to reduce poverty in addition to reducing greenhouse emissions. Unfortunately very little is known about the impact of electrical energy consumption inefficiency on poverty. Using data from a household survey and the Ordinary Least Square estimation technique, we assess the impact of household electricity consumption efficiency obtained from the stochastic energy demand frontier model on multidimensional poverty and the probit model to estimate electricity consumption efficiency on consumption poverty. The results show that a percentage increase in energy efficiency reduces the likelihood of multidimensional poverty by approximately 6.013 percentage points while for lower and upper consumption poverty, the probability reduces by approximately 10.3% and 14.7% respectively. Male-headed households are more likely to experience poverty compared to female-headed households. Multidimensional poverty can be reduced with risk-loving households compared to risk-averse. However, being risk-neutral is enough to reduce the probability of household consumption poverty. Education in both cases is found to significantly improve the probability of being poor. We recommend government to strengthen policy choices on demand-side management of electricity through efficiency improvement such as star rating and appliance rebate systems as well as increasing awareness of energy efficiency as a way of addressing poverty.

Parallel sessions 5B | Agricultural Practices and Fisheries Management

Does cooperative membership influence rice farmers' adoption of green pest control strategies? Evidence from China

Amaka Precious Nnaji (University of Nigeria)

This study explores whether membership in agricultural cooperatives improves smallholder farmers' adoption of green pest control practices, utilizing farm-level data surveyed from rice farmers in China. To enrich our understanding, we also investigate how the adoption of green pest control practices mediates the effects of cooperative membership on chemical pesticide expenditure and rice yield. The endogenous switching probit model, the bootstrapping-based mediation method, and the propensity score matching model are employed to achieve these goals. The empirical results reveal that cooperative membership significantly increases the probabilities of adopting physical pest control practices (e.g., pest-killing lamp or sticky plate 11 trap) and biological pest control practices (e.g., biopesticides) by 6% and 19%, respectively; cooperative membership significantly reduces chemical pesticide expenditure by improving the probability of adopting biological pest control practices; there is a complementary relationship between physical and biological pest control practices in pest management of rice production; adoption of physical and biological pest control practices affects rice yield positively but insignificantly.

Knowledge, Attitudes and Practices of Pesticide Use along River Kuja in Kisii and Migori Counties, Kenya

Richard Mulwa (University of Nairobi)

This study used household level data from the counties of Kisii and Migori to assess knowledge, attitudes and practices of pesticide use amongst farmers along the river Kuja. A total of 705 households (342 in Kisii County and 363 in Migori County) were interviewed. This sample size was

apportioned to the different sub-counties, locations, and villages using proportionate to size sampling. The pesticides considered in the study were; insecticides, herbicides, acaricides, and fungicides. A KAP score was constructed using questions on knowledge attitudes, and practices presented to the respondents. Results shows that knowledge on pesticide use scored the least score (0.35) followed by attitude (0.53), and practices (0.64). The overall KAP score was 0.46. These scores were subjected to Tobit and fractional multivariate regression analysis to assess their determinants from a list of socio-economic and pesticides use variables. Results showed that age of household head had negative effect on KAP and that younger farmers were more likely to embrace knowledge and correct use of pesticides. Education of the household was important for adoption of the correct application practices but not important for acquiring knowledge on pesticide use. High incomes, high wealth index, and larger farm sizes were important for knowledge and adoption of recommended pesticide use practices. Finally, farmers using insecticides, fungicides, and herbicides had more knowledge and had adopted the recommended practices compared to those using acaricides (livestock farmers).

Positional Externality, Ethnicity, and Punishment in a Public Good Game

Mark Senanu Kudzordzi (GIMPA)

When funds earmarked for a public project are embezzled, society bears the costs of the deficit in the provision of the public good and 'positional externality' if the stolen funds are expended on conspicuous consumption. However, the willingness to punish and the intensity of punishment of the perpetrator depends on the co-ethnicity and cross-ethnicity of the victim and the perpetrator. A Public Good experiment with a probabilistic third-party punishment and costly peer-to-peer punishment has been implemented to disentangle the two effects. We found that peer-to-peer costly punishment engendered cooperation, but the third-party enforcement does not affect individual contributions. Next, the likelihood of punishing a free rider is influenced by co-ethnicity and cross-ethnicity, whether (or not) a third-party punishment occurs. While the majority ethnic group members are more likely to punish a free rider from a cross-ethnic than a co-ethnic group, the 'rival' minority group rather punishes the co-ethnic group member more. This implies that in-group and out-group punishment may depend on the relative sizes of the groups. Further, regarding the intensity of punishment, both ethnic groups punished out-group members more when there is no third-party punishment, reflecting evidence of positional externality. On the contrary, however, in-group punishment is rather more severe when the third-party punishes the free rider from the group.

Parallel sessions 5C | Common Pool Resource (Blue R for D)

The Endogenous Formation of Common Pool Resource Coalitions

Carlos Chavez (University of Talca)

We present the results of framed field (lab-in-field) experiments designed to investigate the endogenous formation of common pool resource (CPR) coalitions when the resource is co-defended with costly monitoring by coalition members and sanctions for encroachment imposed by the government. The experiments were conducted with fishers who were members of Chile's territorial use rights fisheries (TURFs). Consistent with theoretical predictions, the subjects frequently formed CPR coalitions, even when they could not deter outsider poaching. They usually formed the grand coalition when the monitoring cost was low, but they formed smaller coalitions when monitoring was more costly. Fishers also invested in monitoring frequently and these investments reduced poaching. When coalitions formed, total harvest effort was curtailed and earnings for coalition members generally increased.

A synthesis study of marine spatial planning

Thong Ho (University of Economics)

This study synthesizes 110 published journal articles and over 50 other documents published by international organizations, which focus on marine spatial planning (MSP) related topics. We categorize these documents based on different criteria, including time trends, research sites and study types. Text mining techniques are also employed to extract keywords from abstracts and titles of the articles and documents. We find that there is great attention to MSP – a transboundary issue in recent years. Most studies with specific research sites were conducted in developed countries, while minimal studies demonstrated this issue in developing countries in Africa and Asia. This poses a threat in solving these global and transboundary problems in many developing countries and international seas. There is a significant concern about management approaches and frameworks that demand decent research work for policy implications.

Time Discounting, Political Affiliation, and COVID-19 Masking Among Artisanal Fisherfolks in Ghana

Kwami Adanu (GIMPA)

Masking is considered a reliable method of preventing COVID-19 infections. Yet, the rate of voluntary compliance with masking remains very low in most parts of the world, especially in developing countries. We hypothesize that the decision to wear a mask entails some benefit-cost analysis which involves time discounting. In addition, we surmise that feel-good benefits from pro-social behavior and from wearing fashionable masks is substantial. Using data from fishing communities in Ghana where the nature of fishing activities puts fishermen and fishmongers in very close proximity with one another daily, we found that masking compliance increases in time discounting for fishmongers, suggesting that private benefits from pro-social behavior or feel-good benefits from wearing a mask is very strong. In addition, those who belong to the ruling political party were more likely to wear a mask. Other factors increasing the likelihood of masking include affiliation with the ruling political party, knowledge of COVID-19, and knowledge of someone who lost his/her job due to COVID-19.

Parallel sessions 5D | Research Proposals Presentations to EfD Research Committee

Author	Title
Uzochukwu Ugochukwu (University of Nigeria)	Health and Economic Burden of Ajali River and Oji Groundwater Pollution from Anthropogenic Activities
Richard Mulwa (University of Nairobi)	Productivity Analysis among Water Service Providers in Kenya
Nicholas Kilimani (Makerere University)	Solar-powered irrigation systems and resilience to climate change: a viability analysis

Parallel sessions 5E | Social Interventions and Health

Technological Changes, Social Norms and Fertility Choices

Nikita Sangwan (Indian Statistical Institute)

This paper examines the issue of “missing women” in the context of a developing country, India, with a highly skewed and worsening sex ratio. In particular, we quantify the impact of a dramatic improvement in agricultural technology (also known as the Green Revolution) interacted with social norms (i.e., patrilocality and son preference), on fertility rates and sex ratio. Using National Family Health Survey data, empirical estimates reveal that increasing HYV adoption from the 25th to the 75th percentile of the distribution reduces fertility rates by 9%, increases the proportion of boys by 6.6%, and reinforces the stopping behavior by 8.6% in rural areas. To shed light on the mechanisms through which technological change can affect fertility behavior, we construct a life-cycle model with an endogenous sequential birth decision, where patrilocality interacts with technological change to increase the returns to having a son relative to having a daughter. Decomposition exercises confirm our empirical findings that gender-neutral technological changes can accentuate the extant gender biases. Our results also point to the importance of a well-established social security system in combating the gender imbalance, especially in developing countries with deeply embedded social norms.

Nutritional and Schooling Impact of a Cash Transfer Program in Ethiopia: A Retrospective

Mengesha Yayo Negasi (Addis Ababa University)

The rate of malnutrition among under-five children in Ethiopia is among the highest in the world and Sub-Saharan Africa. Malnutrition and deprivation have devastating direct effects on children and pregnant women as well as indirect socioeconomic impacts. Since 2005, the Government of Ethiopia has been implementing a large-scale social protection program throughout the country, with the aim to improve nutrition and food security, decrease poverty and, thereby, enhance human capital accumulation.

This paper investigates the direct impact of this program on long-term anthropometric measures of nutritional status and the indirect effects on educational attainment and enrollment delay. Our research design combines differences in program intensity across regions with differences across cohorts induced by the timing of the program. The difference-in-difference estimates suggest that early childhood exposure to the program leads to better nutritional status and hence higher human capital accumulation. Results are robust to different measures of program intensity, estimation samples, empirical models and some placebo tests.

Parallel sessions 6A | Energy Transition (SETI)

Purchase Schemes and Adoption of LPG Cookstoves: Evidence from a Randomised Controlled Trial in Kampala

Aisha Nanyiti (Makerere University)

Biomass is predominantly the energy used for cooking by households and food vendors in Sub-Saharan Africa. Relying on biomass energy leads to deforestation, and is associated with negative health and economic burdens. Deforestation poses a risk to the environment and contributes to climate change. There is therefore need to promote use of cleaner and environmentally friendly energy. Interventions promoting use of mainly biomass saving cookstoves have been undertaken. Recent evidence however, shows that biomass stove models deliver only marginal reductions in emissions. While Liquefied Petroleum Gas stoves yield greater health benefits and reduction in emissions, very few studies have assessed this technology. High initial cost and perceptions regarding safety are identified as major hindrances to adoption of LPG. Purchase and learning schemes offer opportunities to increase adoption. This study examines the effect of hire purchase schemes and economic, health and safety information on adoption of LPG. A Randomized Controlled Trial was conducted in three divisions of Kampala city with a high concentration of chapati vendors. Results show that the hire purchase and learning schemes increase the probability of chapatti vendors deciding to try out, and to finally buy LPG cookstoves.

The role of alternative combustion vehicles and the modal changes on the path to decarbonizing road transport

Santiago Arango-Aramburo (National University of Colombia)

One of the most important challenges of today's cities is more sustainable transport. In this article we develop a system dynamics model that proposes an integrated framework that evaluates two ways of reducing emissions in the transport sector in a region of Colombia: modal changes and the diffusion of vehicles with alternative propulsion sources. The model has four interconnected modules: 1) vehicle/motorcycle stock, 2) use of transport, 4) fueling points infrastructure, 5) electricity consumption, and 6) emissions. We find that by 2050 HEVs could have a 48% share and BEVs 16%. Modal and vehicle fleet changes could lead to the avoidance of 36.4 Mt of CO₂ equivalent between 2016 and 2050 but could also increase electricity demand to 1,530 GWh per year in 2050.

The Role of Social Capital in household's Transition towards Modern Cooking Fuels in Tanzania

Kevin Mutayebwa Rugaimukamu (University of Cape Town)

Tanzanian households rely heavily on wood fuel (firewood and charcoal) for cooking. This has far reaching implications on household and societal welfare due to the associated indoor air pollution and deforestation. Among other measures, social capital could catalyse greater transitions to clean and sustainable cooking fuels such as electricity and LPG. This paper uses panel data econometrics to investigate the role of social capital in households' transition towards modern cooking fuels in Tanzania. A key measure of social capital used for Tanzania is membership in Savings and Credit Co-Operative Societies (SACCOS) or self-help groups. The study found that households with membership in these groups were more likely to adopt modern cooking fuels. SACCOS and other self-help groups serve to spread awareness and technical information about, and bridge liquidity constraints on new

technologies, including modern energy. Given the citizenry's general aversion to command and control by the government and the high levels of trust within SACCOS and other self-help groups, using these groups to drive the adoption of modern energy could be the panacea to the problem of continued unsustainable use of woody fuels in the country.

The Health Benefits of Solar Power Generation: Evidence from Chile

J. Cristobal Ruiz-Tagle (London School of Economics)

Renewable energy is the world's fastest-growing energy source, set to become the leading source of primary energy consumption by 2050 (U.S. Energy Information Administration, 2019). It promises several benefits to society, ranging from reductions in greenhouse gas emissions, lower discharge of local air pollutants, and improved health outcomes, to reduced dependence on imported fuels and the creation of jobs through the manufacturing and installation of these resources (U.S. Environmental Protection Agency, 2019). Yet we still lack a good understanding of the magnitude of some of these benefits, notably those associated with reduced air pollution and health improvements. In this work, we use the rapid adoption of large-scale solar power generation in the desert region of northern Chile to empirically quantify some of the health benefits of solar energy through improvements in air quality.

Parallel sessions 6B | Carbon Pricing and Resource Rents (EPfD)

Beyond progressivity - horizontal and vertical incidence of carbon pricing in Latin America and the Caribbean

Jan Steckel (MCC Berlin)

We compare distributional effects of a USD40/tCO₂ carbon price in 16 Latin American countries. We find carbon pricing to be regressive (progressive) in ten (four) countries, neutral in two. Differences within quintiles are more pronounced than between quintile differences in 12 countries. We show that total household expenditures are a meaningful factor explaining carbon incidence, however exacerbated by variance in car ownership, cooking fuel choices, location of households and socio-demographic factors, such as education and ethnicity. We identify meaningful gaps between households that face high additional cost by carbon pricing and those who are targeted by existing governmental transfer programs.

Policy instruments to address upstream oil and gas methane emissions in developing producer countries

Huong Nguyen (Environmental Defense Fund)

Policy makers around the world are increasingly recognizing the need to drastically reduce methane emissions in parallel with carbon dioxide emissions. More than a hundred countries have signed the Global Methane Pledge and made a collective commitment to reduce global methane emissions by 30% by 2030 from 2020 levels.

Methane emissions in the oil and gas sector are considered particularly promising, not only because of low or even negative net abatement costs for many emission sources, but also

because most of these solutions involve mature existing technologies and work practices. Still, methane-reduction efforts in this sector have not yet been realized extensively due to a combination of informational, structural, financial, and regulatory barriers. This paper therefore lays out regulatory and policy instrument options available to strengthen the incentives to address methane emissions in jurisdictions that produce oil and gas as well as in those that import oil and gas.

The objective of this paper is to give policy makers, regulators, and other stakeholders a description of the main policy and regulatory levers available to realize the significant methane mitigation opportunities in the oil and gas sector. It aims to provide an overview of the differences policy instrument options and thereby help policy makers assess which option is most attractive given regional circumstances and the relevant regulatory and political constraints.

Public support for policy instruments to reduce the use of fossil fuels in Africa: A cross-national study in five East-African countries

Michael Ndwiga (University of Nairobi)

The last decades there has been an increased interest in studying individuals' support and resistance to climate and environmental policy instruments and several factors have been identified as important for people's attitude formation using different types of methods and data. However, as has been pointed out in several reviews, there is an empirical bias in the literature. A large number of studies have been conducted in Europe and North America, but there are very few studies from other parts of the world. Conducting such studies is important. Firstly, to find out whether conclusions from studies in the global north are generalizable to the global south and, secondly, doing studies in other contexts is critical for policy making. In accordance with the Paris Agreement and the commitments that have been made, it is not only the global north that needs to change, but the global south also needs to be part of the climate transition. In this study, we study attitudes to climate and environmental policies in five East African countries (Ethiopia, Tanzania, Kenya, Uganda and Rwanda). The study is unique in its empirical focus and we draw conclusion regarding the generalizability of previous findings.

Rent capture from Mozambican coal mining: Implications for future tax and aid policies

Jesper Stage (Luleå University of Technology)

In this paper we estimate resource rents for Mozambican coal mining using company-level data and compare with the World Bank's estimates of coal rents. World Bank rent estimates are often used in the resource curse literature and also guide the World Bank's policy notes, forming the baseline of their policy advice on resources exploitation. The results show an average unit coal rent of US\$23 per metric ton for the 2011-2020 period while the average World Bank estimate is US\$54 for the same period, meaning that the World Bank overstates coal rents for Mozambique considerably. If World Bank estimates are this error-prone in general this is problematic both for resource curse studies and for the World Bank's policy recommendations. The results suggest that studies employing resource rent estimates should consider sensitivity analysis, and that the World Bank's policy advice should be carefully interpreted to avert high expectations.

Parallel sessions 6C | Gender Analysis (WinEED)

Does Improving Energy Access Improve Gender Outcomes? A Cost-Benefit Analysis from Myanmar

Erin Litzow (University of British Columbia)

Many households in Myanmar lack access to modern energy. This energy poverty affects women and children through many channels, like inadequate light for studying and the burden of collecting and using traditional fuels and appliances. Off-grid solar systems are a potential solution, offering a reliable and affordable light source for studying and working at night, thus improving education, economic, and health outcomes for women and girls, especially in rural settings where expanding the national grid can be prohibitively expensive. In this study, we quantify the costs and benefits of gaining access to electricity via solar in Myanmar. We rely on the World Bank's Multi-Tier Framework (MTF) to form our comparison groups because the MTF goes beyond the binary definition of electrified versus non-electrified (defining 5 tiers of electrification, from no access in tier 0 up to very reliable and affordable access in tier 5, often from a grid connection). Households in tiers 1 and 2 are primarily connected to solar systems. We first assess the private costs and benefits of moving from tier 0 to 1 and find that, over an 11-year time horizon, and conclude that the net present value is negative. Negative values are driven by the costs and maintenance of solar systems, which are greater than the positive fuel savings in both urban and rural areas. We do not find large effects on education or income outcomes, even among women and girls. These results are not sensitive to extreme parameter values. These results imply that a slight movement up the MTF energy access tiers is insufficient from an economic lens, even if there are some benefits to a household gaining some form of electrification. In future analyses we will expand our CBA to cover transitions to higher tiers and include societal costs and benefits.

Gender differences in adaptation strategies to salinity intrusion in the Mekong Delta, Vietnam: An intra-household analysis

Hoa Le Dang (Nong Lam University)

There has been a growing interest in gender differences in adaptation strategies to climate change, due to the significant disparity in both knowledge and access to various resources between male and female farmers. The prominent existing studies on gender differences have mostly examined the adaptation strategies of male-headed and female-headed farm households. Fewer studies have looked at the coping strategies of wives and husbands in response to climate change. This study investigates wives' and husbands' intended adaptive responses to salinity intrusion. Data were collected via a farm household survey in three coastal provinces in the Mekong Delta, Vietnam. The sample includes 117 couples of wives and husbands who have been growing rice for years. The findings indicate that wives and husbands were different in selecting adaptation strategies. Different factors affect wives' and husbands' choices as well as the number of adaptive measures that they are going to take. It is necessary to focus on wives' access to education, participation in formal institutions and trainings on adaptation to salinity intrusion since those factors affect both the number of adaptive measures that wives intend to take and their intention to apply some adaptive measures. Information dissemination regarding adaptation to salinity intrusion should be proceeded in terms of gender-appropriate themes and approaches. Female farmers should be given adequate support, encouraged to join more social activities and associations, and receive equal learning opportunities to males.

Gender differences and roles in the small-scale seaweed aquaculture in Chile

César Salazar (University of Bio-Bio)

Women's participation in small-scale aquaculture is growing, but women producers remain in a disadvantaged position compared to men. Reducing gender gaps is at the core of many development programs, but very little is known regarding the source of these differences. This paper investigates the main drivers of gender gaps in seaweed small-scale aquaculture by making the distinction between sex differences and gender roles in the form of individual preferences. To do so, we use data from a sample of 152 seaweed producers from central-southern Chile and perform a matching procedure to generate a balanced sample of male and female producers. Our results show that female producers are more patient and exhibit higher interpersonal trust. However, the behavior of women is incongruent as they appear to be less patient when their behavior is restricted to their role as aquaculture producers. This supports the notion that opportunity costs and outside options are one of the major drivers of gender gaps and suggests that there are barriers keeping women from exploiting their potentially advantageous individual preferences. Results also support that women's social interactions may be different from those of male producers as women are more willing to exploit the advantages of collaboration in the sector. Relating specific roles to specific activities could provide important insights for the design of support instruments aimed at promoting a more equal participation in and access to the opportunities afforded by the sector.

Gender Dynamics of Farm Households' Resilience to Climate Change-Induced Food Insecurity in Anambra State, Nigeria

Ifeoma Quinette Anugwa (University of Nigeria)

Climate change is development issue that has affected the dynamics of gender roles and behaviour in achieving food security. Though gender is recognized as a significant dimension of climate change and food security, a more nuanced gender analysis of socio-environmental issues still remains understudied, and its incorporation in resilience to food insecurity has received little attention. This study adopted a gender lens to explore how structural inequalities and gendered power relations within a household affects rural farmer's resilience to climate change-induced food insecurity. The study adopted a mixed method approach in collecting both qualitative and quantitative data from 288 respondents. Data for the study were analyzed using percentages, mean scores, Chi-Square, Kappa statistics, Principal Component Analysis and Ordinary Least Square. The couples were vulnerable to climate change-induced food insecurity with the wives being slightly more vulnerable (GVI = 0.36) than their husbands (GVI = 0.34). The overall resilience index estimation showed that 21.7% of the men were resilient to climate change-induced food insecurity in different degrees (moderately resilient (15.4%), resilient (4.2%), and highly resilient (2.1%)). Twenty percent of the women were resilient to climate change-induced food insecurity to varying degrees (moderately resilient (16.8%), resilient (2.1%), and highly resilient (0.7%)). The latent dimensions that significantly contributed to men and women's resilience were; income and food access (men and women ($\beta = 0.766$)), climate change (men ($\beta = -0.471$), women ($\beta = -0.470$)), agricultural practices and technology (men and women ($\beta = -0.417$)), assets (men and women ($\beta = 0.190$)) and livelihood strategy (men and women ($\beta = -0.145$)). Men (87.0%) and women (84.0%) adopted risk management strategies to cushion the effects of climate change-induced food insecurity. Programs that address gender-specific vulnerabilities to climatic shocks and stresses and build on gender-specific capacities, while

understanding that perception, exposure and sensitivity to climatic shocks are gender-differentiated should be established.

Parallel sessions 6D | Household Consumption

Climate aware agrarian households adopt progressive livelihood diversification: Evidence from a consumption mobility survey from Eastern India

Saudamini Das (Institute of Economic Growth)

Poor rural agrarian households engage in multiple activities to maintain their consumption in face of economic hardships or exogenous shocks like climate change. We examine the effectiveness of such livelihood diversification in improving their inter-temporal consumption levels conditional to their climate change awareness. We use a cross sectional survey data of 1200 rural households from central and western parts of Odisha and estimate multiple regression models that include two stage least square estimates assuming the livelihood diversification as an endogenous variable. Results clearly establish that households who take account of their climate change perception in their diversification decision are able to benefit from diversification and maintain or improve their consumption intake over time, whereas those who do not, are not benefiting. In India, offering avenues for diversification has been a prime government policy to bring rural transformation and providing correct climate education can make such policies more effective.

Weather Shocks and Household Consumption in Tanzania Does Crop Diversification Matter?

Laura Barasa (University of Nairobi)

This study investigates whether crop diversification can help farming households in Tanzania cope with weather shocks. We rely on a 5-year panel of household data from the Living Standards Measurement Study - Integrated Surveys in Agriculture (LSMS) to construct a detailed measure of crop diversification. We then explore how variations in farm-level crop diversification affects the relationship between weather fluctuations and household consumption. We find that households with a high degree of crop diversity experienced a larger decline in consumption when exposed to positive precipitation shocks, but a smaller decline when exposed to negative precipitation shocks. The findings suggest that crop diversification may help cushion household consumption in the event of droughts but does not provide any particular protection when facing positive rainfall shocks. These results suggest that the crop diversification involves tradeoffs as it does not provide benefits across the full range of weather conditions. Policies supporting crop diversification as a climate change adaptation strategy should account for these tradeoffs.

Are South African consumers arm-chair environmentalists? Implications for renewable energy

Nomsa Nkosi (University of Witwatersrand)

Discussions among policymakers about renewable energy have gained momentum in recent years, amid growing recognition of the need for more investment in green energy sources. Africa has a huge potential on renewable energy because of the abundance of the renewable

sources. The goal of South Africa is to significantly increase green electricity production from renewable energy sources from the current two percent to 26 percentage by 2030. This plan will impose an extra cost on households; consequently, it is vital to estimate their willingness to pay (WTP) to attain this target or ascertain whether they are simply arm-chair environmentalist. The study uses a bivariate probit model to analyse two decisions that are connected to each other. The decisions are about the likelihood to say yes to paying 20 percent more over and above the current electricity cost paid by the household, for additional renewable energy investments or paying 50 percent more. It is vital that households' determinants of the additional cost burden associated with renewable energy are assessed, to win public acceptance of the introduction of renewable energy. The average US\$966 WTP signals social acceptance of renewable energy. A clear message to policymakers and stakeholders is that they need to do more to communicate the economic and environmental benefits associated with renewable energy.

Parallel sessions 6E | Research Proposals Presentations to EfD Research Committee

Author	Title
Jintao Xu (Peking University)	Allowance Auction Design for China's National Carbon Market
Yuanyuan Yi (Peking University)	Does one size fit all? An examination of China's environmental regulation and firm heterogeneity in cement industry

Parallel sessions 7A | Emission Pricing (EPfD)

Carbon Border Adjustment Mechanism and Free Allowances

Stefan Ambec (Toulouse School of Economics)

Carbon leakage is an obstacle to the implementation of carbon pricing, such as emission permit markets in a world open to trade. The greenhouse gas emission reduction induced domestically can be offset by a growing share of imported products with an higher carbon footprint. We investigate two policy instruments that aim at mitigating carbon leakage: free allowances and the Carbon Border Adjustment Mechanism (CBAM). We show that both instruments impact differently trade, emissions and welfare. Free allowances give a comparative advantage to the domestic firms whose abatement cost is lower than the revenue from their net position in the permit market. As a consequence, those firms are able to export, which reverses the leakage problem. In contrast, the CBAM makes imported products more expensive, which reduces trade. We identify the determinants of the economic outcomes with one of the two instruments or both under perfect and imperfect competition. We also characterize the optimal share of free allowances and optimal carbon price under the CBAM.

Optimal emissions pricing in LMICs accounting for household emissions from traditional cooking

Raavi Aggarwal (MCC-Berlin)

Pricing environmental externalities to reduce fossil fuel emissions might be detrimental to other development targets, such as inclusive health and reduction of poverty. This study asks what would be optimal levels of fuel pricing, taking into account effects on household welfare across the income distribution and differences in energy use, particularly regarding household cooking choices. We aim to i) examine optimal fuel prices for multiple low- and middle-income countries (LMICs) correcting for various externalities; ii) compare energy demand responses to optimal fuel pricing drawing on household survey data for multiple countries; and iii) evaluate planned fuel taxation and social protection schemes, which enables studying the demand responses of probable compensation mechanisms. We draw on micro-scale expenditure and price data for nine developing countries to estimate the exact affine stone index (EASI) demand system, and update existing estimates on externalities by the IMF to include consumer responses to multiple, simultaneous increases in fossil fuel prices. Preliminary results show wide-ranging, country-specific substitution patterns between fossil fuels and biomass across LMICs. Our findings highlight the importance of income effects in determining household fuel choice and energy use in the context of emission pricing for sustainable development.

Can a Carbon Tax Be Beneficial for Sub-Saharan African Economies? Insights from a CGE Analysis for Côte d'Ivoire

Govinda Timilsina (World Bank)

In an economy with substantial informality, a carbon tax can produce fiscal co-benefits that improve economic performance in addition to reducing carbon dioxide emissions. If the carbon tax revenues are used to cut production or labor taxes on formal firms, particularly those not in the energy sector, the cost of imposing the carbon tax is reduced, and there may even be net economic benefits. These tax cuts can also provide an incentive for informal firms to move to formal parts of the economy. This study confirms these hypotheses using a computable general equilibrium model for Côte d'Ivoire. However, the scale and even the sign of overall economic impacts and formal-informal sectoral interactions are sensitive to the scheme and scale of revenue recycling. The largest fiscal co-benefits, in terms of gross domestic product and economic welfare gains, would occur when the entire carbon tax revenue, after keeping the government revenue neutral, is used to cut existing labor or production taxes for non-energy formal firms. Reducing the existing value-added tax also increases gross domestic product and economic welfare, but without reducing the informality. The study also shows that energy producers should be exempted from using the carbon tax revenues to cut their production or labor taxes; otherwise, carbon dioxide reduction decreases due to a rebound effect. Although a carbon tax with lump-sum transfers of revenues is progressive, it would be economically inefficient because of gross domestic product and welfare reduction and lack of incentives to encourage informal activities to move to the formal parts of the economy.

Parallel sessions 7B | Energy and Firms

Peeling the Onion! What are the Drivers and Barriers of Cleaner Production? A Case of the Kenyan Manufacturing SMEs

Simon Wagura Ndiritu (Strathmore University)

Cleaner production is preventive and should be integrated into every production process. Despite its huge contribution to climate change, cleaner production faces many adoption and implementation hurdles which make it harder for organizations to adopt the practice and reap the benefits that come with it. This paper highlights these hindrances, and the various motivations that organizations could take advantage of in their urge to achieve cleaner production. This research assesses the importance of regulations and finances in adopting cleaner production. Also, the research evaluates the role of firms' need to control environmental costs, improve relations with the community, keep up with competitors and achieve a competitive advantage in adopting cleaner technologies. The study uses a probit model to analyze data collected from 852 representative firms in Kenya. This study finds that regulatory constraints and financial resources limit firms. The need to control environmental costs, improve relations with the community, keep up with competitors and achieve a competitive advantage motivate firms to adopt cleaner technologies. These findings are particularly important to policy makers at national and firm levels.

Explaining electricity input and overall firm production costs: Implications of main costs of electricity, power outage and fluctuations on manufacturing firms in Kenya

Helen Osiolo Hoka (Strathmore University)

The study uses survey and key in-depth interviews data from manufacturing firms in Kenya collected in 2019 and estimates a multinomial logit model to analyse the effects of power outages, power fluctuation and electricity cost on overall production costs. While the study is able to distinguish the effects of power outages, power fluctuation and electricity cost on overall production, the combined effects of these factors is also evident. The study found that in general, power outages and power fluctuation in Kenya are uncommon in the recent past years. The frequency of power outage and power fluctuation during working hours varied. For firms that experienced power outage, this was recorded at least once weekly or monthly, but this was also a daily occurrence for firms that experienced power fluctuations. The share of electricity to overall production costs was estimated at less than 10% of the total production for most firms except for some firms that had over 20% of overall production cost. Power outages, power fluctuations and electricity costs had different direct and indirect effects on production cost, quality and quantity of products produced, production schedule, labor hours, and machine efficiency that in turn affected the firm's overall production costs. To address electricity availability, government interventions should focus on continuous diversification of affordable electricity sources and on efficient transmission and distribution power systems. In addition, the view of electricity tariff is critical to ensure tariffs are competitive to attract investments.

Firms' willingness to pay for certification leniency: Evidence from the global wood industry

Johanna Joy Isman (Toulouse School of Economics)

Voluntary third-party certification of quality standards is used in many markets to mitigate inefficiencies caused by asymmetric information, including information on negative production externalities such as deforestation and forest degradation. But where firms choose and pay the third parties that certify their compliance, the efficiency gains from this system are at risk if firms shop for more lenient certifiers. The degree to which private and public regulators of certifiers can improve market outcomes by suspending bad certifiers is limited by firms' option to dropout of certification when it becomes too costly. To assess these risks, I develop a structural model of demand and pricing of certification. To estimate it in the context of forest management certification, I assembled a novel panel dataset of audit results for the forests that were certified according to the FSC-standard between 2015 and 2019, as well as survey data on the fees paid to different certifiers. I find important differences in certifiers' leniency and evidence for shopping for leniency. The estimates suggest that forest firms are willing to pay almost substantially more to a certifier whom they expect not to report a major violation than to a certifier that would report it.

Parallel sessions 7C | Agriculture (NatCap)

Does the uptake of multiple climate smart agriculture practices enhance household savings, food security and household vulnerability to climate change? Insights from Zimbabwe

Boscow Odhiambo Okumu (University of Cape Town)

Globally, climate change and variability poses a significant hindrance on agricultural productivity and agricultural transformation with increased experiences of unpredictable and erratic rainfall and severe temperature that threaten food security and rural livelihoods (see Ching et al.,2011; Williams et al.,2017; Fadairo et al.,2019).The adverse effects are particularly concerning in many African countries that rely more on rain fed subsistence agriculture for livelihood. The predictions of climate models vary from one region to another and depend on the type of economy with cooler temperate regions experiencing mild impacts, but with some benefits, while drier regions such as Sub-Saharan Africa (SSA) suffer severe impacts(Kurukulasuriya and Mendelsohn 2008; Gbetibouo and Hassan 2005).

The trade-off between liquidity and insurance: voucher payments in a lab-in-the-field experiment with Colombian rural workers

Cesar Mantilla (Del Rosario University)

We conduct a lab-in-the-field experiment in which 214 rural workers must choose between a cash or a voucher payment for completing a real-effort task. Participants face a twenty-percent chance of suffering a negative shock that will reduce their cash payment by roughly two-thirds. Opting for the voucher reduces the likelihood of the shock by one-half. We employ a multiple-price list with a varying voucher payment and a fixed cash payment to study this trade-off relevant for expanding the coverage and contributions of rural labor formalization. Voucher take-up rates go

from 32% to 56%, from the least to the more generous voucher. In a sample of undergrad students from the same region, take-up rates went from 17% to 33%. We find that voucher redemption costs explain take-up among students but not among rural workers. Being a rural worker with land, and receiving government subsidies in cash, predict a higher voucher take-up.

Zambia's Farmer Input Support Programme: To what extent have the reforms impacted on the adoption of Crop Diversification and Rotation among smallholder farmers?

Obrian Ndhlovu (University of Cape Town)

This paper evaluates the impact of Zambia's Farmer Input Support Programme reform on the degree of crop diversification and crop rotation. The paper combines a rich two-wave panel of rural household survey data, high-resolution satellite rainfall data, and primary in-depth interviews with Agricultural Extension workers. The paper finds that expanding the number of crops supported beyond just maize positively impacted both the level of crop diversification and the intensity of crop rotation. These results show that reforms are effective in stimulating the adoption of climate-smart farming behaviour. However, the impact is undermined by the absence of functioning markets for alternative crops, the entrenched culture of mono-cropping maize, and the general lack of knowledge and resources necessary to adopt new technologies.

Parallel sessions 7D | Flood Risk and Resource Management

Integrating Vulnerability Assessment in Flood Risk Management Using Gendered and Geospatial Approaches in Kogi State, Nigeria

Chidi Nzeadibe (University of Nigeria)

Floods are the most common environmental hazard in diverse parts of the world and flood risk has been linked to extreme weather events such as increases in the frequency and intensity of heavy rainfall often associated with global climate change. In recent years, flood events have been annual occurrences in Nigeria with the 2012 flooding being the most disastrous, resulting in a loss of physical and durable assets in the twelve most affected states, equivalent to US\$9.5 billion. Over 70% of inhabitants of Kogi state of Nigeria are engaged in small scale crop production or artisanal fishing as a livelihood. These farmers and fisher folks, therefore, remain vulnerable to flood risks as vulnerability remains a complex situation in relation to flood studies in Nigeria. While there has been some awareness about the Sustainable development goals (SDGs), particularly gender-related SDGs, and their linkages with flood risk, empirical work on gendered patterns and determinants of flood risk that could inform and support adaptation policy and action is unfortunately non-existent in Nigeria. More importantly, policy responses aimed at strengthening flood risk adaptation capacity of local communities have paid little attention to the interaction of gender with other social factors while a combined gendered and multi-criteria analysis of vulnerability to flood risk is also lacking. This paper deploys a combination of geospatial and mixed methods analysis to integrate vulnerability assessment in flood risk management in Kogi State in order to inform the formulation of flood risk management policy in Nigeria.

Correlates of Relocation Against Flood Risk in Urban Households: A Case Study of Greater Accra Metropolitan Area in Ghana

Daniel K. Twerefou (University of Ghana)

This paper investigates how these socio-economic, flood-related, community and psychological factors determine relocation against flood risk in the Greater Accra Metropolitan Area of Ghana using the probit model and data from a cross-sectional survey. The results indicate that the likelihood of relocating is non-linear decreasing with age initially but reverses after 55 years, while households that received flood information are more likely to relocate than those who do not. The likelihood of relocating decreases with increased public adaptation measures and increases with increased perception of flood risks. Households that previously lost income and assets from floods are more likely to relocate while household heads with secondary education exhibit a higher probability of relocating compared to those without education. We recommend that policy choices focus on smart engineering solutions while age, formal education, type of occupancies and previous flood experiences drive the designing of flood risk - relocation schemes.

Policy Instruments for the Management of Water and Soil Resources: A Systematic Literature Review

Adrian Saldarriaga (National University of Colombia)

We carried out a systematic review of the literature about the application of policy instruments for management of water and soil resources, worldwide. We provide an explicit and reproducible search protocol. The search was done in the following scientific databases: Web of Science, Springer, ScienceDirect, Academic Search Complete, JSTOR, and Google Scholar. 91 articles were selected and classified according to whether the application of the policy instrument was reports as successful (effectiveness) in meeting the objectives for which they were implemented. The results are analyzed taking into account the type of resource, the geographical area of the studies, the type of instrument used, the study period, distributive aspects, and the type of analytical method employed in this set of studies.

Parallel sessions 7E | Research Proposals Presentations to EfD Research Committee

Author	Title
Xuan Bich Bui (Nha Trang University)	<u>Regulatory Compliance in Small Scale Fisheries in Vietnam and Ghana</u>
Edward Mwavu (Makerere University)	Impact of Conservation Agricultural interventions on farm outcomes among smallholder farmers in Sub-Saharan Africa: A systematic review and meta-analysis
Chizoba Oranu (University of Nigeria)	Gender analysis of impact of armed banditry on agricultural productivity and household food insecurity of smallholder farmers in Nigeria: evidence from Nigeria panel data

Parallel sessions 8A | Energy, Development and Sustainability (SETI)

Why are Connection Charges So High? An Analysis of the Electricity Sector in Sub-Saharan Africa

Shaun McRae (ITAM)

High electricity connection charges and low access rates are common in Sub-Saharan Africa. We estimate a model of household and utility behavior, in which households choose their fuel source and consumption quantity, and profit-maximizing utilities set connection charges. Low regulated tariffs and low household consumption make it difficult for utilities to recover their costs. For each possible tariff, we compute the optimal connection charge for the utility, and show that higher tariffs are associated with lower connection charges and higher electrification rates. Nevertheless, limited willingness to pay for electricity leads to equilibrium electrification rates below 100 percent.

Barriers to Off-Grid Energy Development: Evidence from a Comparative Survey of Private Sector Energy Service Providers in Eastern Africa

Marc Jeuland (Duke University)

Nepal's location in the Himalayas, and commitment to conservation (e.g., twenty percent of its land area is part of protected areas system), draws many thousands of tourists, especially eco-tourists who trek to remote areas. This tourism can create economic opportunities but also create a demand for clean energy in these pristine remote locations, thereby allowing suppliers to scale up energy access in remote parts of the Himalayas where the grid cannot reach. We compile and use a panel data set of adoption of clean energy technologies and ecotourism in roughly 4000 village development committee of Nepal over one and half decades (2001-2015) to examine the relationship between tourism and energy access. Our preliminary result shows that tourism increases installation of micro-hydro capacity. (Analysis of solar home systems and biogas technologies is pending). Achieving Nepal's target to 2 million tourist a year is likely to also promote energy access and therefore reduce poverty in the Hindukush Himalayas.

Ecotourism & Energy Access: Panel data evidence from the high Himalayas

Subhrendu K Pattanayak (Duke University)

In light of recent growth and falling costs of solar photovoltaic technology, this paper examines the barriers and opportunities facing off-grid development in Ethiopia, Kenya, Tanzania and Uganda, four countries whose off-grid sectors vary in maturity. We compare and link the perspectives of nearly 200 private companies to the development of the sector in each country, and measure trade-offs among different institutional designs for regulating and supporting off-grid investment. The survey reveals a set of common challenges but also considerable variation within and across countries. Development of the market is constrained by a lack of market information and technical capacity, insufficiently comprehensive regulation, and in specific countries, informal sector competition (Tanzania), the cost of doing business (Ethiopia), poor tariff policy (Tanzania), and lack of funding (Uganda). Moreover, firm responses emphasize the need for several policy supports: subsidy, financing, access to foreign exchange, technical assistance for regulatory matters, and capacity building. A discrete choice experiment clarifies these policy preferences, but reveals trade-offs as well as country differences. Though the off-grid sector is growing in all four countries, many policy and

regulatory obstacles remain, and these will continue to challenge achievement of SDG7: Sustainable, modern energy for all.

Energy efficiency as a Sustainability Concern in Africa and Financial Development: How much bias is involved?

Philip Kofi Adom (GIMPA)

This study contributes to the literature on whether financial development stimulate technical energy efficiency (TEE) or not, by addressing core biases that creeps into the relationship – reducing the ability to draw causal inference from financial development to TEE. Our approach is based on instrumental stochastic frontier, where biases in the frontier and inefficiency equations are dealt with using external instrumental variables, which we have demonstrated in this study to, largely, satisfy the relevance and valid exclusion restriction criteria. Given these controls, our results raise caution about previous studies estimate of the effect of financial development on TEE. Our results demonstrate substantial bias in income elasticity, estimate of energy efficiency and effect of financial development on energy efficiency. Both income elasticity and energy efficiency suffer from upward bias. The result further shows that financial system development and financial institution development stimulate TEE but these estimates risk downward bias. All aspects of financial institution development stimulates TEE, but more importantly is access to financial institution. We discuss the implications of these findings.

Parallel sessions 8C | Experimental Design for Sustainable Environment (SCOPE)

On the perils of environmentally friendly alternatives

Francisco Alpizar (Wageningen University)

Environmentally friendly alternatives are touted as a key component of a transition towards lowering the impact of human activity on the environment. The environmental costs of these technologies are seldom null; they are simply less environmentally damaging than existing options. In this paper, we investigate consumer behavior when an environmentally friendly alternative is introduced under different decision contexts. Using a carefully constructed field experimental design, we look at the use of plastic bags vis-a vis biodegradable bags, when the later are offered for free versus at a price. Moreover, we explore offering costly biodegradable bags as part of the default choice. We find that giving away the bio-bags for free results in a large behavioral rebound effect, resulting in a large increase in the total number of bags. Setting a small, rather symbolic price offsets this rebound effect completely. Interestingly, when the bio bag is offered as a default, the behavioral rebound remains. The large behavioral rebound effect leads us to conclude against providing these environmentally friendly alternatives for free, and caution against the use of subsidies to promote their uptake.

Environmental educational programs in Chile: Do the characteristics of local governments affect school participation?

Monica Marcela Jaime Torres (University of Concepcion)

Tackling environmental problems is one of the main policy challenges facing governments. The process of forming attitudes starts at a young age, and is mostly shaped by education. Participation in pro-environmental initiatives at schools is mainly voluntary. Local governments can play an important role as the institution that links communities with the environment. In this paper, we examine the role of local governments/municipalities on school participation in an environmental educational program, with a special focus on primary and secondary education. We use data from the Sustainable School Program in Chile. We model schools' participation and level of participation by an ordered probit model with sample selection. Results show that public schools are more likely to participate in the program compared with private schools, and schools with more teachers reveal a higher probability of being part of the program. In addition, while school performance and teachers' perceptions correlate with achieving higher levels of certification, a more intense commitment to the program is more likely in communes whose local authorities have the capacity to promote voluntary financial and environmental initiatives. Thus, in order to promote successful co-management of environmental policy, local governments should take into account the heterogeneity of the school system.

Preferences and willingness to pay for limiting the flow of plastics into the ocean: Evidence from a discrete choice experiment in Coastal Nigeria

Nnaemeka Andegbe Chukwuone (University of Nigeria)

This study applied discrete choice experiment to determine households' preferences and willingness to pay for policy options for managing the problem posed by single-use plastics to limit marine plastic pollution. Six hundred households that were selected through a multi-stage random sampling technique from the coastal city of Lagos, Nigeria, were used for the study. The result of estimations using conditional logit and mixed logit models shows that the respondents expressed a strong preference for waste treatment before disposal (sorting and bagging of waste) of waste and high sensitization to reduce marine plastic pollution. The respondents preferred that single-use plastics should not be banned as the attributes of outright banning, and some single-use plastic banned negatively and significantly influenced their choice. They were willing to give up US\$2.38 and US\$0.79 as an additional waste management fee instead of outright banning or banning some single-use plastics, respectively. Given that the country proposed in its plastic waste policy to ban single-use plastics in the next three years, the study recommends adequate sensitization of the people and all stakeholders before the planned policy implementation to ensure policy effectiveness. Also, the government should put in place an effective waste management system that will involve sorting and separating waste at the source and proper disposal to reduce marine plastic pollution.

Addressing Plastic Bags Consumption Crises through Plastic Bag Levy, Retailer Monetary and Non-monetary Interventions in South Africa.

Babatunde Abimbola Abiola (University of Cape Town)

This research analyses the impact of a plastic bag levy, and retailer interventions focussing on promotion of reusable bags to reduce plastic bag consumption. For this purpose, tax revenue data for the fiscal years 2008 to 2020 and retail outlet data for March 2018 to February 2020 was used. A descriptive arc price elasticity was estimated from the tax revenue data, while the retail outlet data

was analysed by using a panel fixed effects model to evaluate the impact of three treatments on plastic and reusable bag consumption in South Africa. Findings revealed that Treatments 1 (a monetary intervention based on giving reusable bags away for free) and 2 (a non-monetary intervention framed around a plastic-free July campaign) significantly increased reusable bag uptake and reduced plastic bag consumption, while Treatment 3 (a monetary intervention involving a subsidy on reusable bags) increased reusable and plastic bag sales. The findings contribute to the literature on the effectiveness of non-monetary nudges (T2). The latter is more efficient than the monetary incentives (T1 and T3). The results also agree with the literature on the ineffectiveness of subsidies (T3) for the purpose of discouraging the consumption of plastic bags. The results confirmed that plastic bag consumption is habitual in South Africa. Based on these findings, policy recommendations were made that public campaigns and other behavioural nudges should be considered more effective in addressing the consumption of plastic bags than subsidies on reusable bags. In addition, because of the revealed low level of reuse of both plastic and reusable bags, the use of reminders to reuse bags should be considered and researched in order to modify consumer behaviour in South Africa.

Parallel sessions 8D | Water Supply and Behavior (NatCap)

The Impact of Unrestricted Power on Groundwater: A Panel Geographical Regression Discontinuity Approach

Praveen Kumar (Indian Statistical Institute)

Power supply for irrigation is un-metered but rationed in most Indian states. This study estimates the impact of the removal of rationing from 9 hours of supply per day to 24 hours per day on groundwater depletion in Telangana state. This is an extreme kind of policy in semi arid and hard-rock aquifer dominated region like Telangana, where aquifers have limited storage, and are therefore much more rapidly exhaustible. We combine a Difference-in-differences approach with a Geographic Regression Discontinuity design to identify the effect of the policy change at the state boundary. Using a detailed monthly well-level spatial panel dataset from January 2014 to December 2019, we find that the groundwater depth remains unchanged on average in Telangana relative to neighboring states in the two years following the policy change. However, we find that there is increase in power consumption by 12-percent on average in Telangana relative to neighboring states in the two years following the policy change.

Exploring patterns of water bill payment behavior and debt in Nairobi, Kenya

Joseph Cook (Washington State University)

The COVID-19 pandemic has renewed attention to the issue of affordability and debt on households' water and electricity utility bills. Before the pandemic, customer nonpayment and debt was an issue in many cities in the Global South, jeopardizing utilities' ability to recover maintenance and operating costs through tariffs, let alone their ability to finance expansions or improvements. Although a number of cross-sectional studies have examined non-payment, most have relied on survey-based measures. We model the interaction between a customer and the utility, with the customer deciding whether to pay and the utility deciding whether to disconnect a non-paying customer. We then use 12 months of billing records (pre-COVID) for 180,700 households (2.16 million observations) in Nairobi, Kenya to examine dynamic customer payment behavior. We find that a substantial fraction of customers,

including those who skip payments, actually accrue credits on their bills, in part because water and sewer tariffs in Nairobi are low. A large fraction of total water debt arises from a small number of accounts. We use two approaches to develop typologies of customer behavior. In the first, we use intuition about likely behavior patterns to classify customers as “always payers”, “levelpayers”, “intermittent payers” and “never payers”, classifying roughly 80% of customers in our data. In the second, we use a k-medians clustering algorithm to create typologies

Gender perspectives on water availability and quality assessment of drinking water in rural communities in Enugu State, Nigeria

Anthonia Ifeyinwa Achike (University of Nigeria)

The safety, availability and accessibility of fresh water are essential for man’s survival, socioeconomic development and proper operation of ecosystems, communities, and economies. Surface water is becoming increasingly polluted, and the cost of producing groundwater for a variety of uses is prohibitive. Above all, availability and access to safe drinking water for households have gender dimensions that underly effective use. This study aimed to evaluate gender perspectives on water availability and assess the quality of drinking water in rural communities in Enugu State, Nigeria, using Itchi-Agu, a rural town community as a case study. Questionnaires (93) were administered to randomly selected households at Itchi-Agu, gender-based and other demographic questions were asked. The bacteriological quality of 58 water samples collected from different storage containers and sources (in March, August and September 2021) were determined following standards methods. Mothers constituted 64.5 % of the respondents. While the educational status of the breadwinners of three households was unknown, 14.0 % had no formal education, and 82.8 % attained a certain level of formal education: primary education (41.9 %), secondary education (34.4 %), and university education 1.1 %. In the majority of the households (59.3 %), those who participated in fetching water were females; in 12.3 % of the households, anybody could and the least household member responsible for fetching water was the father (11.1 %). Mean total coliform counts (TCC) and faecal coliform counts (FCC) recorded in colony forming units (CFU/100 mL) for drinking water stored in different container types were, respectively, as follows: earthen pots (6.1×10^3 ; 1.5×10^4) and plastic cans (2.9×10^2 ; 6.3×10^3), while the mean TCC (CFU/100 mL) and FCC (CFU/100 mL) for the water sources were respectively as follows: Uja-Anyi spring (8.9×10^3 ; 4.0×10^4); Nwiyi-Odida spring (2.5×10^3 ; 1.2×10^4); Ogede spring (3.0×10^4 ; 8.4×10^4); Iyi-Oka stream (2.7×10^3 ; 5.5×10^4); Iyi-Odu (5.5×10^3 ; 1.6×10^4) and roof-harvested rainwater (5.4×10^2 ; 4.0×10^3) which was the least contaminated. All drinking water sources/types were non-compliant with WHO and NSDWQ drinking water guidelines. The burden associated with water availability and use is on women at Itchi-Agu and the quality of the drinking water sources/types were non-compliant with WHO and NSDWQ standards drinking water guidelines and therefore a public health threat. The findings of the study have implications for government policy on gender dimensions of water access, availability and use in rural communities in Nigeria. It also informs policy on the health of rural dwellers including exposure to water-borne and other diseases, and the appropriate or tailored management strategies.

Parallel sessions 8E | Research Proposals Presentations to EfD Research Committee

Author	Title
Thong Ho (EEPSEA)	<u>Climate security and adaptation: government investment and farmer's adaptation to climate change in coastal communities.</u>
Ibrahim Mike Okumu (Makerere University)	<u>Assessing the Power of Financial Products in advancing adoption of Modern Cooking Technologies</u>
Saudamini Das (Institute of Economic Growth)	Impact of externally funded projects on women empowerment, poverty and climate change adaptability of vulnerable

AKWAABA 2023!

The 17th Annual Meeting

The 17th EfD Annual Meeting will be held in Ghana. This was revealed the EfD Ghana Center Director Prof. Wisdom Akpalu during the recently concluded 16th EfD Annual Meeting in Kampala.



Prof. Wisdom wowed the audience with his presentation about Ghana.

Strong stakeholder networks in government and the media

EfD Ghana maintains a collaborative relationship with relevant government agencies and the media, thanks to our consistency and concerted dedication in addressing natural resource issues. This means the meeting will draw more than a few high-level government officials, and, with it, the attention of the media, both of which portend enduring benefits for EfD Ghana and also EfD Global. –

Prof Akpalu

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